918B MULTISPEED AND CODE CONVERTER

DESCRIPTION AND OPERATION

1. GENERAL

1.01 This section contains the physical and functional description and provides the operating instructions for the 918B multispeed and code converter (MSCC). The 918B MSCC will hereafter be referred to as the converter.

1.02 Whenever this section is reissued, the reason for reissue will be listed in this paragraph.

1.03 The 918B MSCC is a complete replacement for the 918A MSCC. The 918B is functionally the same as the 918A, but is less than one-quarter the size of the 918A (manufacture discontinued).

1.04 The converter permits a single-position teletypewriter (TTY) operating at a single speed and code to communicate with a variety of TTYs operating at various speeds and codes. A block diagram of the system and typical station arrangements are shown in Fig. 1.

1.05 The multispeed and code converter arrangement consists of the following:

- 918B converter unit
- Model 37- or 35-type position TTY
- 918B control unit when used with a 35-type TTY (the 918B control unit is a part of the 37-type TTY).

1.06 The position TTY is installed as part of a No. 2 or No. 9B serviceboard, data observing and testing center (DOTC), or 904G/H/L data test center (DTC). It may be either a special page model 37 M-NTFMA or 35-type keyboard send and receive (KSR) TTY. The receiving speed of the position TTY determines the highest speed TTY which can be connected to the converter. The converter can be optioned to provide either the EIA voltage type of signals required by the 37-type TTY or the 20-mA current required by the 35-type TTY.

1.07 The converter can be used in telegraph circuits at the most commonly used speeds of 45.5, 56.85, and 74.2 baud for 5-element Baudot code and 110 and 150 baud for 8-element American National Standard Code for Information Interchange (ASCII). This is equivalent to 60, 75, and 100 words per minute (WPM) for 5-element Baudot code and 100 and 150 WPM for 8-element ASCII.

1.08 The converter operates duplex or half-duplex. When the converter is used with the 904G/H/L DTC, duplex or half-duplex operation is determined by key selection. When the converter is used with the No. 2 or No. 9B serviceboard or DOTC, duplex or half-duplex is selected by means of the associated cord circuit.

1.09 The internal crystal-controlled oscillators provide the converter with clock frequencies that are 100 times the baud rate.

1.10 The converter has a built-in maintenance circuit which will help in trouble location. It may be determined where a trouble exists by observing two light emitting diodes (LEDs). Test points are located at critical points in the circuit to aid in determining the troubled area. Refer to
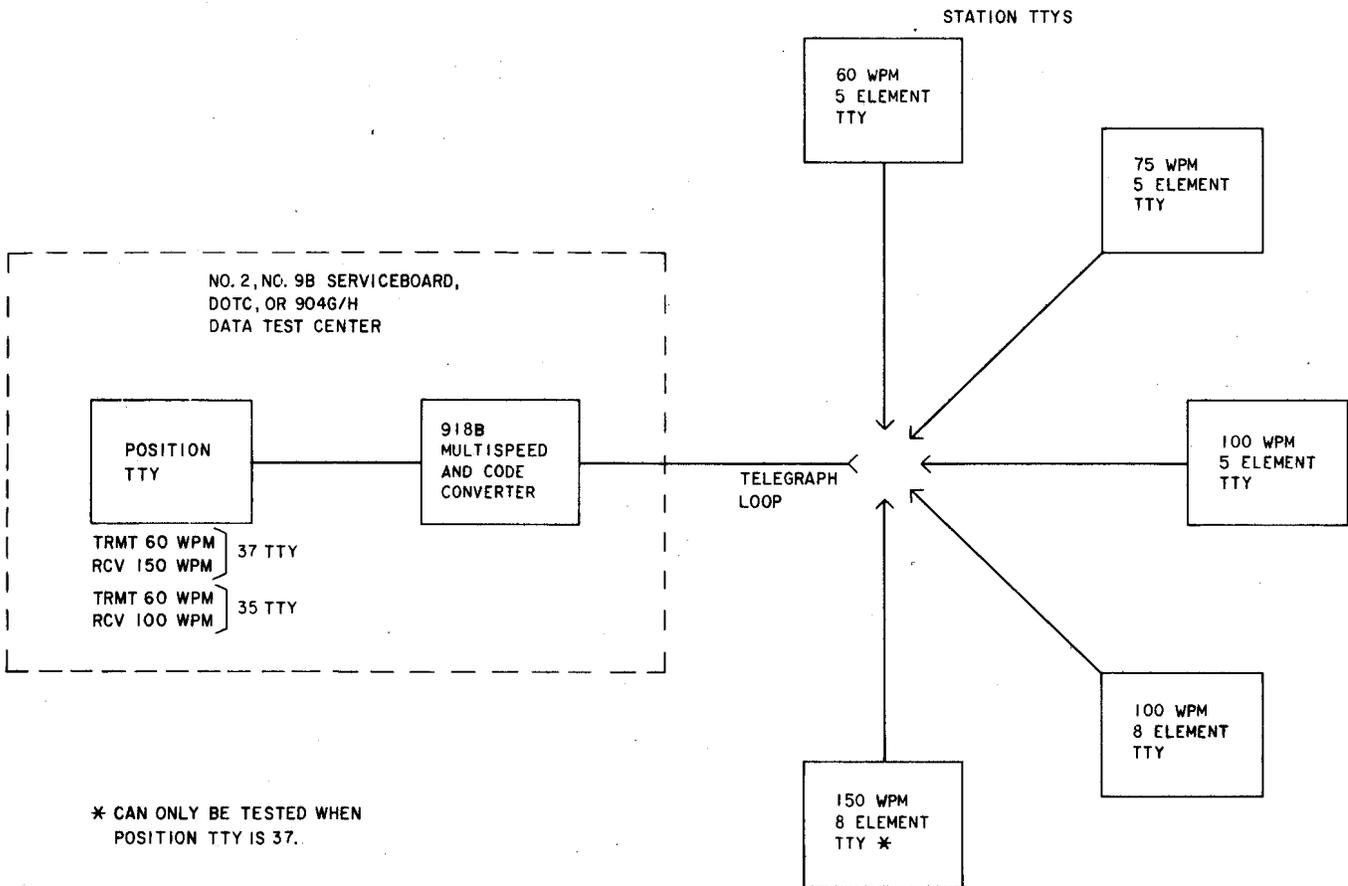
STATION TTYS

Fig. 1—918B Multispeed and Code Converter—System Block Diagram

Section 103-814-501 for complete troubleshooting tests.

2. PHYSICAL DESCRIPTION

2.01 The converter consists of five AR-size circuit boards and a power supply mounted in a standard 59C apparatus mounting (Fig. 2). The unit can be mounted in a 19- or 23-inch bay using 6 vertical inches of frame space. Two units may be mounted horizontally in a 23-inch bay using 6 vertical inches of frame space. The converter operates in conjunction with a position TTY mounted on the position TTY shelf of a No. 2 or 9B serviceboard, 904G/H/L DTC, or in the position TTY well of a DOTC console.

The distance between the position TTY and the converter should not exceed 150 feet.

2.02 The special page model 37 M-NTFMA TTY uses the standard 4-row keyboard and the 918B control unit panel (Fig. 3). When the Model 35-type TTY is used as the position TTY, the 918B control unit panel is physically separate from the TTY and is located in one of the following positions:

● In the jack field of the No. 2 serviceboard

● On the 19-inch relay rack directly behind the TTY in the No. 9B serviceboard

● To the right side of the TTY in the shape of a stile strip in the 904G/H/L DTC (Fig. 4).

Since the 150 speed is not used with the 35-type TTY and a BREAK key is located on the keyboard of the TTY, these key positions are left as spares. The rest of the control panel is identical to the one used with the 37-type TTY. Lamp, key location, and designations on the control panel are shown
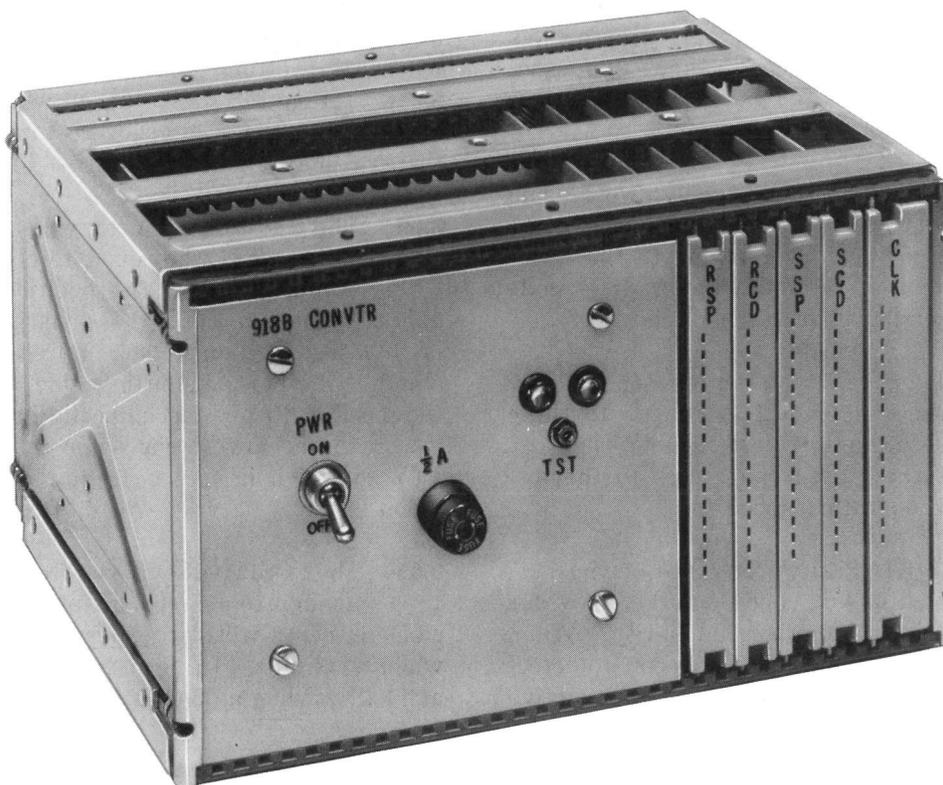
Fig. 2—918B Multispeed and Code Converter—Front View

in Fig. 3. The lamp and key functions are as follows:

- MOTOR OFF—Locking key. Depressing this key turns the TTY motor off. Not available on 35-Type TTY.

- CONT'L BLACK (Control Black)—Locking key. Depressing this key causes control characters to be printed in black. When key is released, the control characters are printed in red. Operation of this key does not affect parity errors, which are always printed in red. This key should be depressed during monitor situations to quickly detect parity errors. Not available on 35-type TTY.

- KYBD EOL (Keyboard End of Line)—Lamp. Lights on 68th character to indicate end of line is approaching. Extinguishes automatically on the RETURN character. Not available on 35-type TTY.

- BREAK—Nonlocking key. Depressing this key transmits a spacing signal to the line. There is less than 1/2-second delay before the spacing signal is initiated. Not available on 35-type TTY.

- PAPER ADVANCE—Nonlocking key. Depressing this key feeds paper out of the local TTY. A signal is not sent to the line. Not available on 35-type TTY.

- PARITY GEN (Parity Generate)—Locking key and lamp. Depressing this key conditions the converter to generate odd parity. When the key is released, the converter generates even parity. Key is active only in 8-element ASCII operation. Lamp lights when key is depressed.

- ERROR RESET—Nonlocking key and lamp. The lamp lights when a parity error has been detected. Depressing the key extinguishes the lamp. Key is active only in 8-element ASCII operation.

- UNSHIFT SPACE—Locking key. Depressing this key conditions the case memory in the converter so it will not revert to the lower case mode if it is in the upper case mode and a space bar character is received.

- HOLD—Locking key. Depressing this key enables the converter to store up to three 5-element characters. Releasing this key transmits the stored characters to the line at the line operating speed.

- PARITY DET (Parity Detect)—Locking key. Depressing this key conditions the converter to detect and recognize odd parity. When released, it conditions the converter to detect and recognize even parity. Key is active only in 8-element operation.

- LOCAL RETURN—Nonlocking key. Depressing this key performs a carriage return on the local TTY. A signal is not sent to the line. Not available on 35-type TTY.

- 60 WPM (5), 75 WPM (5), 100 WPM (5), 100 WPM (8), and 150 WPM (8)—Speed and code keys. Five locking and mechanically interlocked keys used to condition the converter to the line transmission speed and code, 5-element or 8-element, in use. (Figures after WPM indicate code element.)

- Spare key—May be used to select an additional speed when an additional crystal-controlled oscillator is provided. To activate this additional speed (5- or 8-element), a crystal of the desired frequency must be installed.

3. FUNCTIONAL DESCRIPTION

3.01 A block diagram of the converter is shown in Fig. 5. Also shown are the relationships between the five AR circuit boards. Since the converter operates duplex, two parallel paths are provided, one for the transmit side and the other for the receive side. The transmit and receive sides are similar, the only difference being that the transmit side contains a 3-character store to insert FIGS (figures) and LTRS (letters) automatically when transmitting from a 4-row position TTY to a 3-row station TTY. The 3-character store can also store up to three characters and then transmit them at line speed to the station TTY.
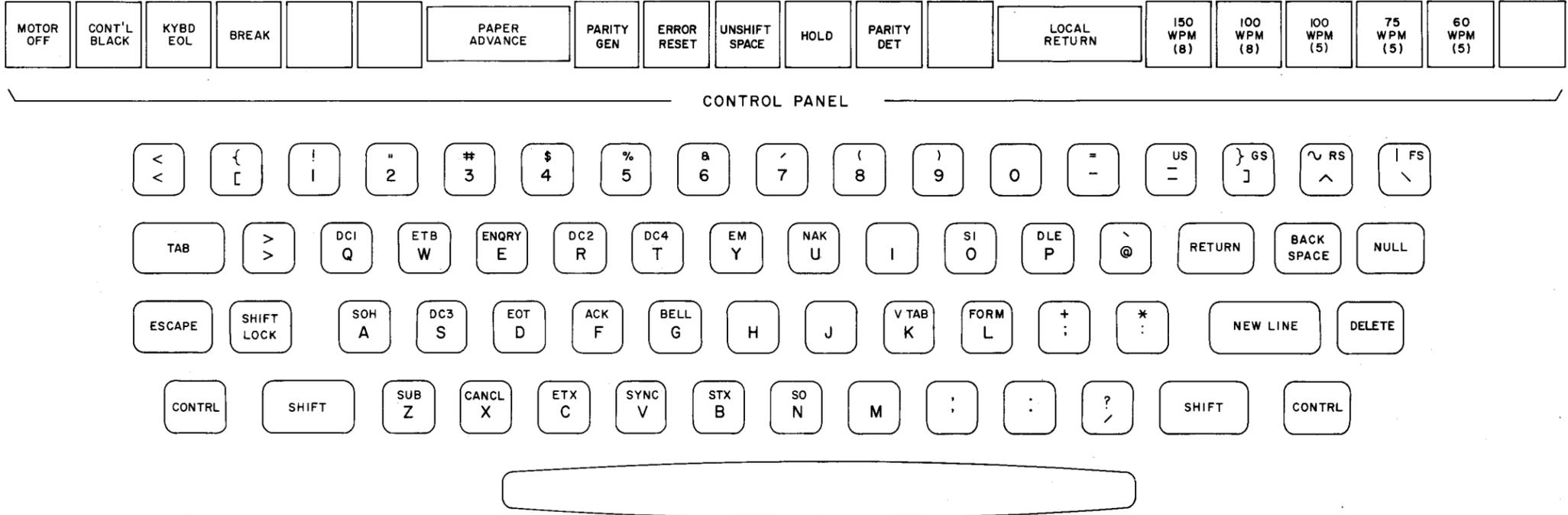
3.02 The position TTY may be either a 35- or 37-type TTY; however, to eliminate the need for unlimited storage, the position TTY must be able to receive at the highest character rate (speed) of any service it may be required to monitor (150 wpm). On the transmitting side, the keyboard of the position TTY is mechanically hobbled to slightly less than the lowest character rate of any station TTY to which it may be required to transmit (60 wpm).

3.03 The POSITION OSC is a free-running oscillator associated with the position TTY. This clock is strap-wired to operate at either 15 kHz when a 37-type TTY is used as a position TTY or at 11 kHz when a 35-type machine is used.

Sending

3.04 When the mark-to-space transition of the start pulse provided by the position TTY occurs, the position clock starts and the read-in into the input shift register is made at the midpoint of every bit of the character being read. A true representation of the character is read into the shift register so long as the distortion in the input pulse does not exceed 49 percent. When the speed and code key is set to an 8-element code position, parity generation occurs during the eighth bit. The parity generator generates a mark in the eighth bit position if the character has an odd number of marking information bits and the PARITY GEN key is *not* depressed. The parity generator generates a space in the eighth bit position if the character has an odd number of marking information bits and the PARITY GEN key is depressed. Parity generation, therefore, is completely independent of the position TTY.

3.05 When the last bit of a character is read into the input shift register, a read-in pulse is generated by the input shift register. This pulse is used to place the complete character into the output shift register if translation is not required (8-element), or to trigger the core logic read if translation is required (5-level).

| MOTOR OFF | CONT'L BLACK | KYBD EOL | BREAK | | | PAPER ADVANCE | PARITY GEN | ERROR RESET | UNSHIFT SPACE | HOLD | PARITY DET | | LOCAL RETURN | 150 WPM (8) | 100 WPM (8) | 100 WPM (5) | 75 WPM (5) | 60 WPM (5) | |

CONTROL PANEL

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│ < │ │ { │ │ ! │ │ " │ │ # │ │ $ │ │ % │ │ a │ │ ' │ │ ( │ │ ) │ │ 0 │ │ = │ │ US│ │}GS│ │~RS│ ││FS│
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 │TAB │ │ > │ │DCI│ │ETB│ │ENQRY│ │DC2│ │DC4│ │ EM│ │NAK│ │   │ │ SI│ │DLE│ │ ` │ │RETURN│ │ BACK │ │ NULL │
 │    │ │ > │ │ Q │ │ W │ │  E  │ │ R │ │ T │ │ Y │ │ U │ │ I │ │ O │ │ P │ │ @ │ │      │ │SPACE │ │      │
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 │ESCAPE│ │SHIFT│ │SOH│ │DC3│ │EOT│ │ACK│ │BELL│ │ H │ │ J │ │VTAB│ │FORM│ │ + │ │ * │ │NEW LINE│ │DELETE│
 │      │ │LOCK │ │ A │ │ S │ │ D │ │ F │ │ G  │ │   │ │   │ │ K  │ │ L  │ │ ; │ │ : │ │        │ │      │
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 │CONTRL│ │SHIFT│ │SUB│ │CANCL│ │ETX│ │SYNC│ │STX│ │ SO│ │ M │ │ ; │ │ : │ │ ? │ │SHIFT│ │CONTRL│
 │      │ │     │ │ Z │ │ X  │ │ C │ │ V  │ │ B │ │ N │ │   │ │ , │ │ . │ │ / │ │     │ │      │
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MODEL 37−TYPE TTY KEYBOARD

Fig. 3—Model 37-Type Teletypewriter Keyboard and 918B Control Panel
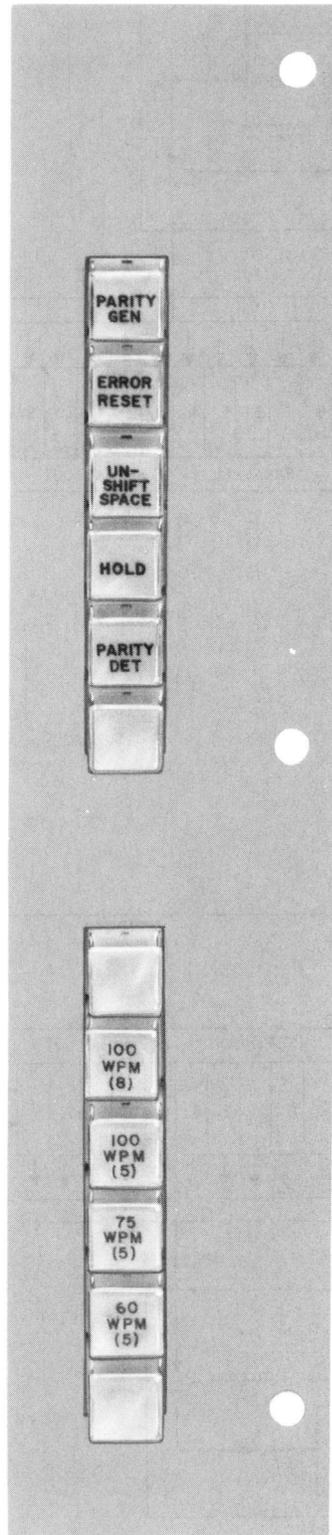
Fig. 4—Control Panel Used with 35-Type Teletypewriter and 904G/H/L Data Test Center

3.06 When translation is required, the 8-element character is translated to the corresponding 5-element character by the read only memories (ROM). After passing through the amplifiers, the character is held in the 3-character store before transfer to the output shift register.

3.07 Additional characters required by the use of 5-element codes are generated by the ROM and are inserted as fill characters in the 3-character store. These additional characters, FIGS and LTRS, are required to provide upper case or lower case characters in the 5-element code. Under certain conditions it is necessary to test 5-element selective calling systems at line transmission speeds rather than at the slower keyboard speed. The HOLD key provides this function by allowing the 3-character store to store a maximum of three characters and then release them at the line speed.

3.08 The output shift register receives characters from either the translated or nontranslated path. The characters are shifted through the output shift register under control of the customer clock. The CUSTOMER OSC is a free running crystal-controlled oscillator operating under control of the speed and code key. The customer clock can be arranged to operate at the following frequencies:

4.55 kHz for a 60 wpm, 5-element TTY

5.685 kHz for a 75 wpm, 5-element TTY

7.423 kHz for a 100 wpm, 5-element TTY

11.000 kHz for a 100 wpm, 8-element TTY

15.000 kHz for a 150 wpm, 8-element TTY.

From the output shift register the characters are sent serially to the hub through the interface.

Receiving

3.09 Reception from the hub (line side) is accomplished in basically the same manner as transmission to the hub. The incoming characters are shifted through an input shift register under control of the CUSTOMER CLOCK and are sent to the output shift register or to the ROM if translation is required. After being translated, the characters are shifted through the output shift
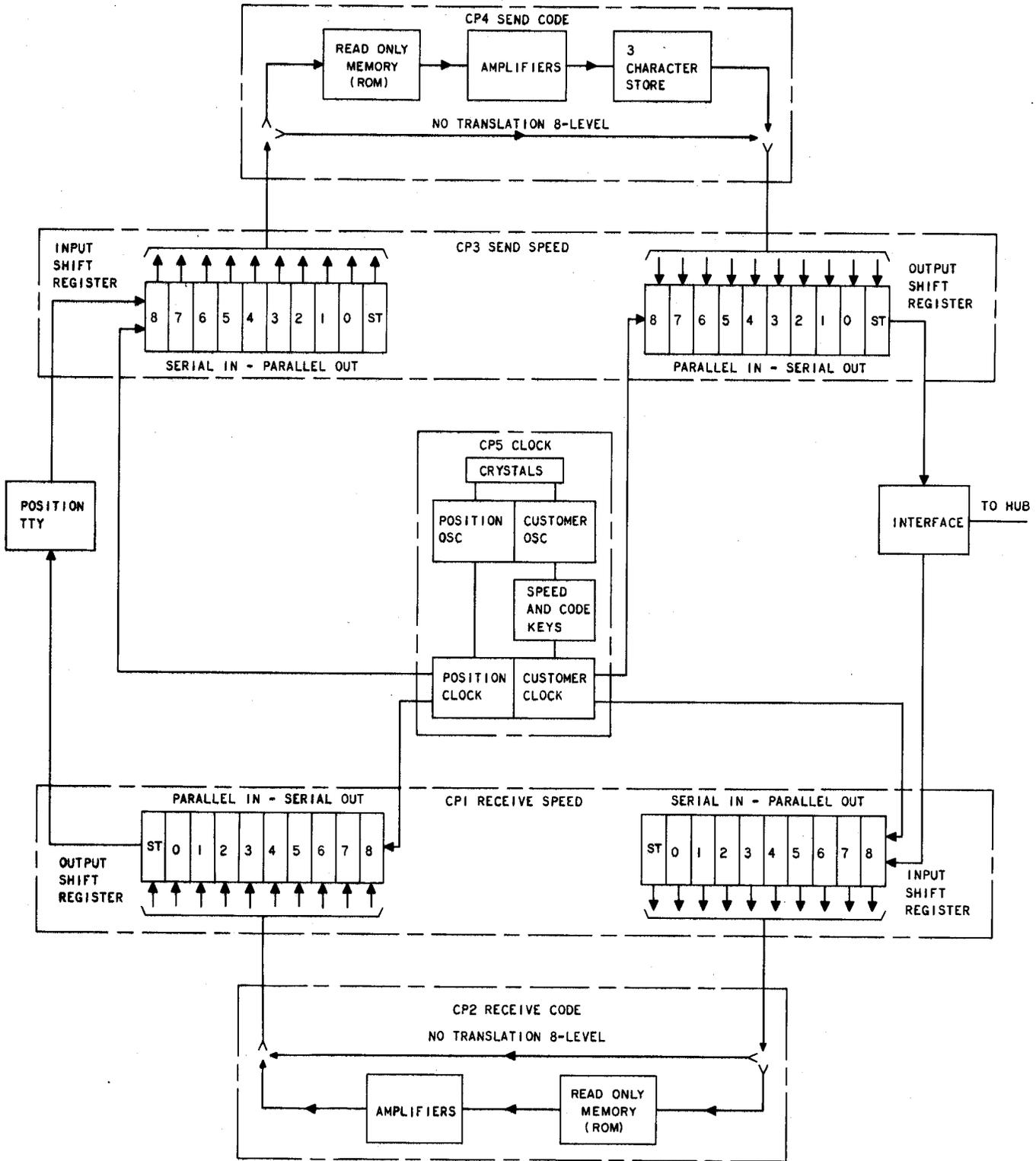
Fig. 5—918B Multispeed and Code Converter—Block Diagram

register, which is under control of the POSITION CLOCK, and sent to the position TTY.

4. OPERATION

4.01 The following paragraphs outline the operations required to communicate with the various TTY stations using the position TTY. Operational notes and translation characteristics of the converter are summarized in Table A.

4.02 Operation of the converter in the half-duplex or duplex mode is selected by means of the associated cord circuit in the No. 2 or No. 9B serviceboard or DOTC, or by means of a key on the 904 G/H/L DTC. When the converter is operating in the half-duplex mode, a slight delay will be observed between the time a key is depressed and the character is printed on the position TTY. This delay is due to the character being translated, looped back through the converter and then retranslated.

4.03 A character will not be sent to the line or printed on the position TTY if a key representing a nontranslatable character (eg, %) is depressed while the converter is operating in a mode requiring code translation.

4.04 Before connecting the converter to the circuit, the test board attendant must operate the proper key for the code and speed shown on the line card of the circuit to be tested.

A. 150-WPM (8) Operation

4.05 With the 150 WPM (8) key on the position TTY depressed, transmission proceeds directly between the line and the position TTY. The only restriction is the mechanically hobbled speed of the keyboard. The converter generates even parity in the 8-element mode; if odd parity is desired, the PARITY GEN and PARITY DET keys must be depressed.

If the PARITY GEN and PARITY DET keys are not in the same mode of operation, the next character received by the converter will cause the lamp under the ERROR RESET key to light and the character to be printed in red, indicating a parity error has been received.

Operation of the CONT'L BLACK key will cause the control characters to be printed in black. Only parity errors will be printed in red.

B. 100-WPM (8) Operation

4.06 Operation in the 100 WPM (8) mode requires speed conversion and in some cases control characters conversion. Operation of the PARITY GEN, PARITY DET, and CONT'L BLACK keys are identical to the 150 wpm (8) mode.

4.07 Operation with 35-type TTYs at 100 wpm (8) presents some problems with translation. Since the 35-type TTY does not print lower-case characters, the 37-type position TTY must be conditioned to transmit all alphabetic characters in upper case. The SHIFT LOCK key must be operated unless numeric characters are to be transmitted.

4.08 When using a 37-type position TTY and sending to a 35-type station TTY at 100 wpm (8), certain control characters must be transmitted differently. Figure 6 shows the keys to be depressed on the 37-type TTY to obtain the equivalent control characters when transmitting to a 35-type TTY. It is suggested that a system using colored tape be used to identify the correct key to depress on the 37-type TTY (in addition to the CNTRL key) to obtain the equivalent control function on the 35-type TTY.

> *Example:* To transmit CONTROL SHIFT L to a 35-type TTY station, the testboard attendant should depress the CNTRL key, note the color of the tape associated with the L key, and depress the other key having the same colored tape (the FS key).

To transmit CONTROL SHIFT K, the testboard attendant need only depress the ESCAPE key.

C. 60-WPM (5), 75-WPM (5) and 100-WPM (5) Operation

4.09 Operation on 5-element circuits requires both translation and speed conversion. Before starting a test with a 5-element circuit, information on the station arrangement should be obtained from the line card.

TABLE A

OPERATIONAL NOTES AND TRANSLATION CHARACTERISTICS OF THE
918B MULTISPEED AND CODE CONVERTER

I.   OPERATIONAL NOTES

(1) Normalize by depressing DELETE key. This transmits LTRS (letters) to 3-row stations.

(2) The character Λ (circumflex) will generate FIGS (figures) to 3-row stations.

(3) Depress UNSHIFT SPACE key if the 3-row station will not unshift on space.

(4) Depress CONT'L BLACK key to cause control characters to be printed in black rather
     than in red. This will not affect parity errors being printed in red when a 37-type is used
     as the position machine.

(5) Depress PARITY GEN and PARITY DET keys for odd parity, if required, when in the
     8-element (4-row) mode of operation.

(6) Depress SHIFT LOCK key when transmitting alphabetical characters to 35-type TTYs.

II. EQUIVALENT CONTROL FUNCTIONS BETWEEN 37-TYPE AND 35-TYPE TTYS

37-TYPE TTY	35-TYPE TTY
ESCAPE	CTRL SHIFT K
CONTROL FS	CTRL SHIFT L
CONTROL GS	CTRL SHIFT M
CONTROL RS	CTRL SHIFT N
CONTROL US	CTRL SHIFT O

III. TYPE ARRANGEMENT A (3-ROW TTY)

LOWER CASE (LTRs)	UPPER CASE (FIGs)	LOWER CASE (LTRs)	UPPER CASE (FIGs)
A	-	K	(
B	?	L	)
C	:	M	.
D	$	N	,
F	!	S	BELL
G	&	V	;
H	#	X	/
J	'	Z	"

37-TYPE TTY   35-TYPE TTY

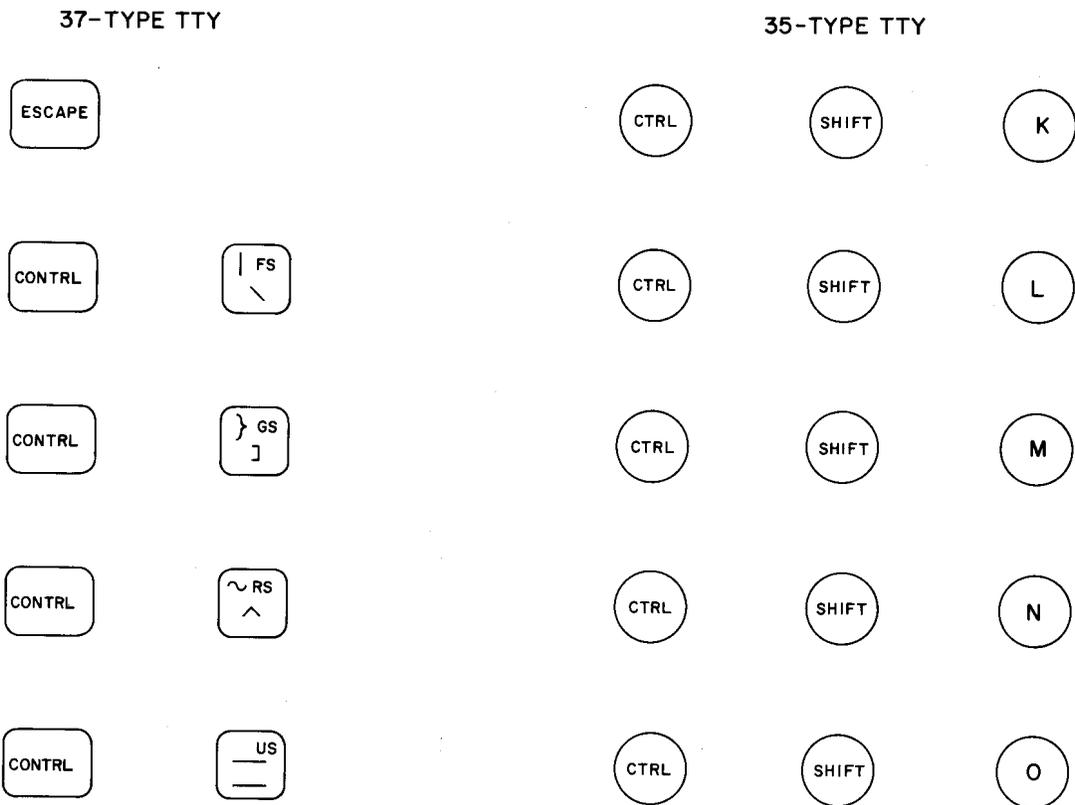| ESCAPE | | CTRL | SHIFT | K |
CONTRL	| FS \	CTRL	SHIFT	L
CONTRL	} GS]	CTRL	SHIFT	M
CONTRL	~ RS ^	CTRL	SHIFT	N
CONTRL	US —	CTRL	SHIFT	O

Fig. 6—Equivalent Control Characters

The DELETE key should be depressed to normalize the position and station TTYs. (This transmits LTRS to 3-row stations.)

Type Arrangements

4.10 There are four different type arrangements which can be encountered during operation with 3-row stations. Type arrangement A shown in Table A should be the standard type arrangement used. If requests for transmission of an upper case character, in terms of another type arrangement are received, the testboard attendant should request the lower case equivalent. For example, if a 1/4 character is requested (upper case F in type arrangement C) the testboard attendant should request the lower case equivalent and use Table A to accomplish the translation.

Selective Calling Systems

4.11 Selective calling systems using 5-element codes often employ control combinations such as vertical or horizontal tabulation. These control combinations use upper case characters which are not usually used in normal traffic. For example, the TTY may be conditioned to form feedout on upper case F, which is an exclamation point in type arrangement A.

4.12 The line card would indicate "form feedout on FIGS F." The testboard attendant cannot depress SHIFT F on the 37-type position TTY, since the TTY would transmit an upper case F to the line. The testboard attendant must recognize that the desired combination is a FIGS character and an exclamation point and transmit first a circumflex (Λ), then depress the SHIFT key and the 1 key. The converter will then transmit a 5-level FIGS F combination to the line.

If the station TTY is in the LTRS mode, operation of the SHIFT and 1 keys will result in transmission of FIGS F to the line.

3-Character Store (HOLD key)

4.13 The keyboard of the position TTY is mechanically hobbled to operate at 60 wpm. If 5-level control combinations require transmission at line speed, the testboard attendant should depress the HOLD key, generate the required characters and depress the HOLD key again. The control combination will be transmitted at the line speed.

81-Type Systems

4.14 Transmitter start patterns for 81-type systems are in the form BLANK pause transmitter start code LTRS. This combination can be generated by the converter.

5. REFERENCES

5.01 The following documents provide additional information concerning the 918B multispeed and code converter and associated equipment.

SECTION	TITLE
103-814-301	918B Multispeed and Code Converter—Maintenance

SECTION	TITLE
103-814-501	918B Multispeed and Code Converter—Test Procedures
574-2YY-ZZZ	35-Type Teletypewriter
574-3YY-ZZZ	37-Type Teletypewriter
666-101-100	No. 2 Telegraph Serviceboard—Description and Operating Principles
666-102-100	No. 9B Telegraph Serviceboard Hub Operation
666-198-900	LL Data Observing and Testing Center—Description
668-400-100	Data Test Center 904G/H Type—Description
668-400-500	Data Test Center 904G/H Type—Tests

NUMBER	TITLE
SD-73107-01	Multispeed and Code Converter No. 981B