918A MULTISPEED AND CODE CONVERTER DESCRIPTION AND OPERATION

1. GENERAL

1.01 This section provides the physical and functional description and operating instructions for the 918A Multispeed and Code Converter. To simplify this section, the 918A Multispeed and Code Converter will hereafter be referred to as the converter.

1.02 The converter allows a single position teletypewriter (TTY) operating at a single speed and code, and installed as part of a No. 2 or No. 9B Serviceboard, Data Observing and Testing Center (DOTC), or 904G/H Data Test Center (DTC), to communicate with a variety of TTYs operating at various speeds and codes. Refer to Fig. 1 for a block diagram of the system and typical station arrangements.

1.03 The position TTY may be either a special model 35 or 37-type Keyboard Send and Receive (KSR) TTY. The receiving speed of the position TTY determines the highest speed TTY which can be attached to the converter. When the model 35-type TTY is used as the position TTY, an option-selected circuit in the converter provides conversion between 20-mA loop signals and Electronics Industries Association (EIA) voltages on the send side and EIA voltages and 20-mA loop signals on the receive side.

1.04 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 or 150 baud for 8-element American National Standard Code for Information Interchange ASCII).

1.05 The converter operates full duplex (FDX), and when used in a No. 2 or No. 9B Serviceboard or DOTC, the TTY cord circuit must be modified in accordance with J70100H-L6 which is shown in Schematic Drawing (SD) 70559-01. The cord circuit provides for either full- or half-duplex operation. When the converter is used with the 904G/H DTC, full- or half-duplex operation is determined by key selection.

1.06 The converter must be provided with clock frequencies that are 100 times the baud rate. The clock frequencies are provided by an internal crystal-controlled oscillator but may be provided by an external oscillator if the crystals are removed and internal connections are made in the set.

2. PHYSICAL DESCRIPTION

2.01 The converter consists of a bay-mounted power supply, relays, and a series of printed wiring boards (Fig. 2). The unit occupies a vertical mounting space of 13 inches on a 23-inch relay rack. A card extender board, which provides for in-service testing of the printed wiring boards, may be provided. The converter operates in conjunction with a position TTY mounted on the position TTY shelf of a No. 2 or 9B Serviceboard, 904G/H 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 model 37-type TTY uses the standard 4-row keyboard and a panel of function control keys and lamps (Fig. 3). When the model 35-type TTY is used as the position TTY, the function control panel is physically separated from the TTY and is located in one of the following positions:

(1) In the jack field of the No. 2 Serviceboard.

(2) On the 19-inch relay rack directly behind the TTY in the No. 9B Serviceboard.

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

Since the 150 speed is not used and a BREAK key is located on the keyboard of the machine, these

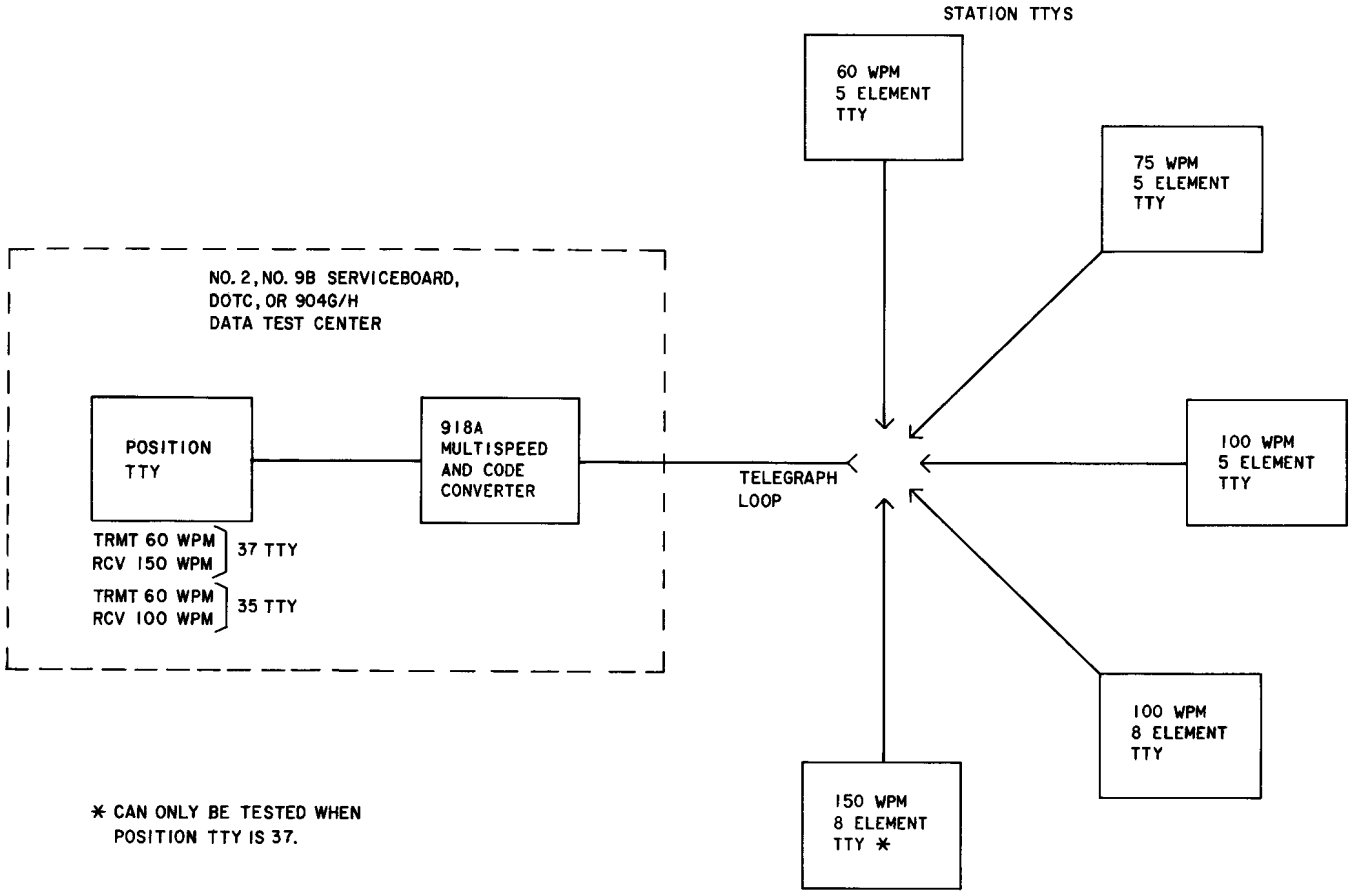


Fig. 1—918A Multispeed and Code Converter—System Block Diagram

key positions are left as spares. The rest of the control panel is identical to the one used with the 37-type TTY. Refer to Fig. 3 for lamp and key location and designations. The lamp and key functions are as follows.

MOTOR OFF—Locking key. Depressing this key turns the TTY off.

CONT'L BLACK (Control Black)—Locking key. Depressing this key causes control characters to be printed in black. When key is released, 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 monitoring situations to quickly detect parity errors.

KYBD EOL (Keyboard End of Line)—Lamp. Lights on 68th character to indicate end of line is approaching. Extinguishes automatically on the RETURN character.

BREAK—Nonlocking key. Depressing this key transmits a spacing signal to the line. There is an initial waiting period of less than half a second before the spacing signal is initiated.

PAPER ADVANCE—Nonlocking key. Depressing this key feeds paper out of the machine. A signal is not sent to the line.

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-level operation.

ERROR RESET (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-level operation.

UNSHIFT SPACE—Locking key. Depressing this key conditions the case memory in the converter

Fig. 2—918A Multispeed and Code Converter—Front View

so it will not revert to the lower case mode if it is in the upper case mode and a space character is received.

HOLD—Locking key. Depressing this key enables the converter to store up to three 5-level 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-level operation.

LOCAL RETURN—Nonlocking key. Depressing this key performs a carriage return. A signal is not sent to the line

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 rate and code in use.

Spare key—May be used for an additional speed and 5- or 8-level code key. To activate this key, a crystal of the proper frequency must be installed and internal connections made in the converter.

3. FUNCTIONAL DESCRIPTION

3.01 Refer to Fig. 5 for a block diagram of the converter. Since the converter operates FDX, two parallel paths are provided, one for the transmit side and the other for the receive side,

the only difference being that the transmit side contains a 3-character store to automatically insert FIGS and LTRS when transmitting from a 4-row position TTY to a 3-row station TTY and to store up to 3 characters.

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 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 machine or 11 kHz when a 35-type machine is used.

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 does not exceed 49 percent. When the SPEED AND CODE SWITCH is set to an 8-level 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 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-level) or to trigger the CORE LOGIC read if translation is required (5-level).

3.06 When translation is required, the 8-level character is translated to the corresponding 5-level character by the CORE LOGIC matrices. 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-level codes are generated by the CORE LOGIC and are inserted as fill characters in the 3-CHARACTER STORE. These additional characters are FIGS and LTRS required to provide upper case or lower case characters in the 5-level code. Under certain conditions it is necessary to test 5-level selective calling systems at line transmission speeds rather than at the slower keyboard rate. The HOLD key provides this function 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 SWITCH. The CUSTOMER CLOCK can be arranged to operate at the following frequencies:

4.55 kHz for a 60 WPM, 5-level TTY

5.685 kHz for a 75 WPM, 5-level TTY

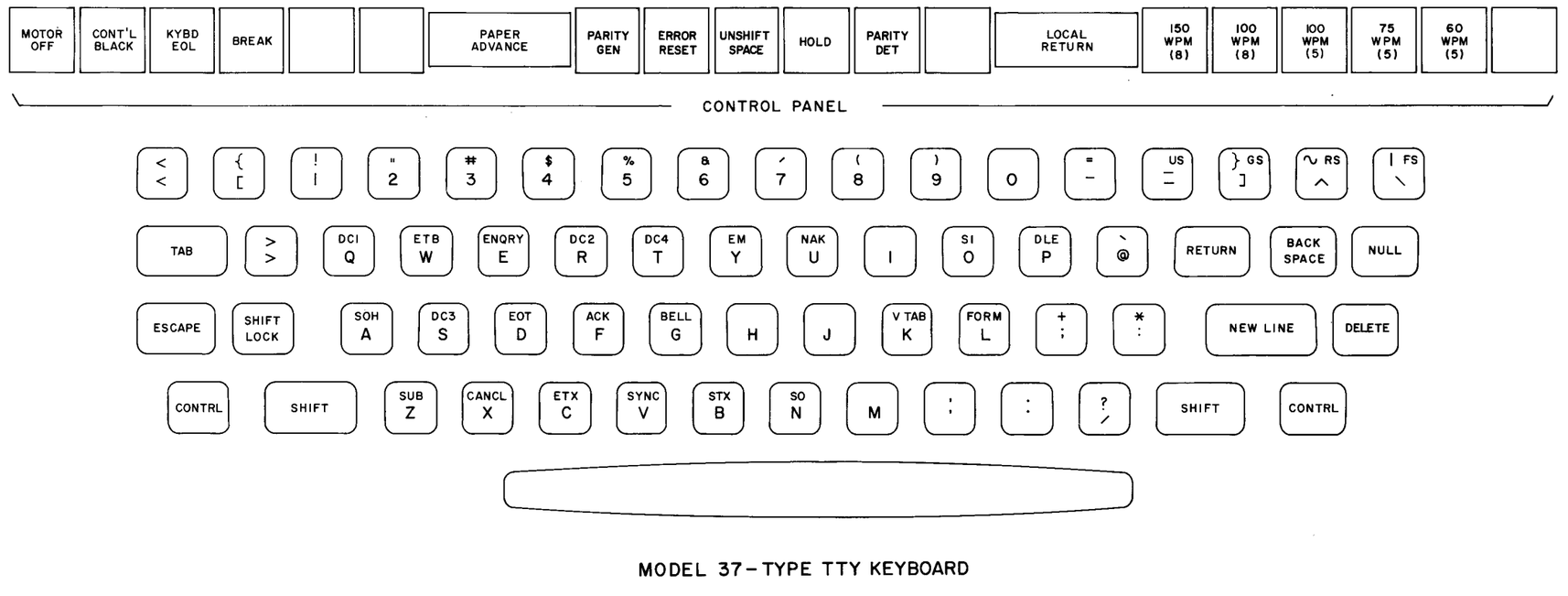
7.423 kHz for a 100 WPM, 5-level TTY

11.000 kHz for a 100 WPM, 8-level TTY

15.000 kHz for a 150 WPM, 8-level TTY

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

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 CORE LOGIC if translation is required. After being translated, the characters are shifted through the output shift register which is under control of the POSITION CLOCK, and sent to the POSITION TTY.



MODEL 37-TYPE TTY KEYBOARD

Fig. 3—Model 37-Type Teletypewriter Keyboard and Control Panel

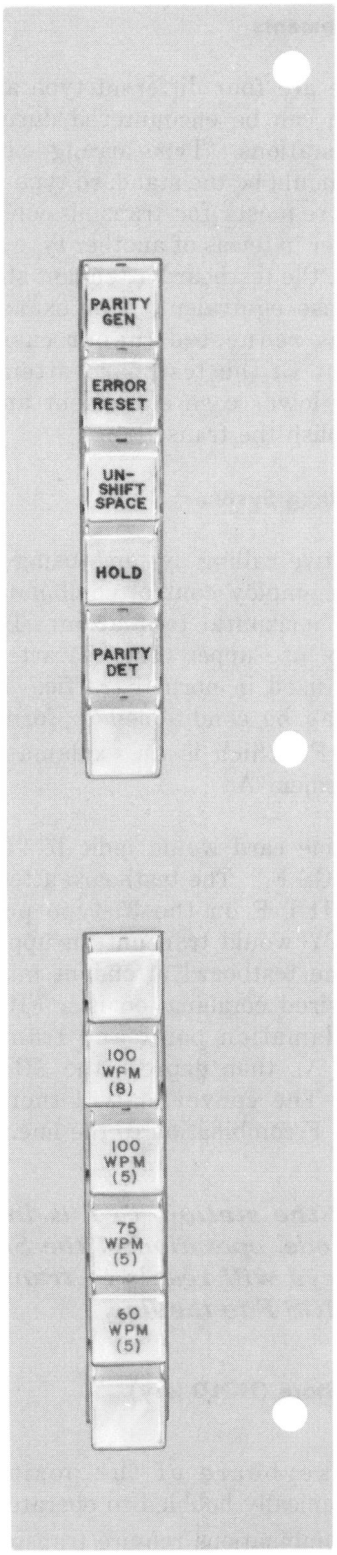


Fig. 4—Control Panel Used With 35-Type Teletypewriter and 904G/H Data Test Center

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 have been summarized in Table A.

4.02 Operation of the converter in the half- or full-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 904G/H 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 to be tested, the test board attendant should operate the proper key for the code and speed shown on the line card.

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-level mode of operation; if odd parity is desired, the PARITY GEN and PARITY DET keys should be depressed.

If the PARITY GEN and PARITY DET keys are not in the same mode of operation, the next character received by the 918A 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 and 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 character 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. In addition, certain control characters are transmitted differently with the 35-type TTY and further translation is required. Refer to Fig. 6 for the 35-type control characters and their equivalents on the 37-type position 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.

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

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 L key, and depress the other key having the same colored tape.

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

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

The DELETE key should be depressed to normalize the position and station TTYs.

Type Arrangements

4.09 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 and 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

4.10 Selective calling systems using 5-level 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.

4.11 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)

4.12 The keyboard of the position TTY is mechanically hobbled to operate at 60 WPM. If 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.

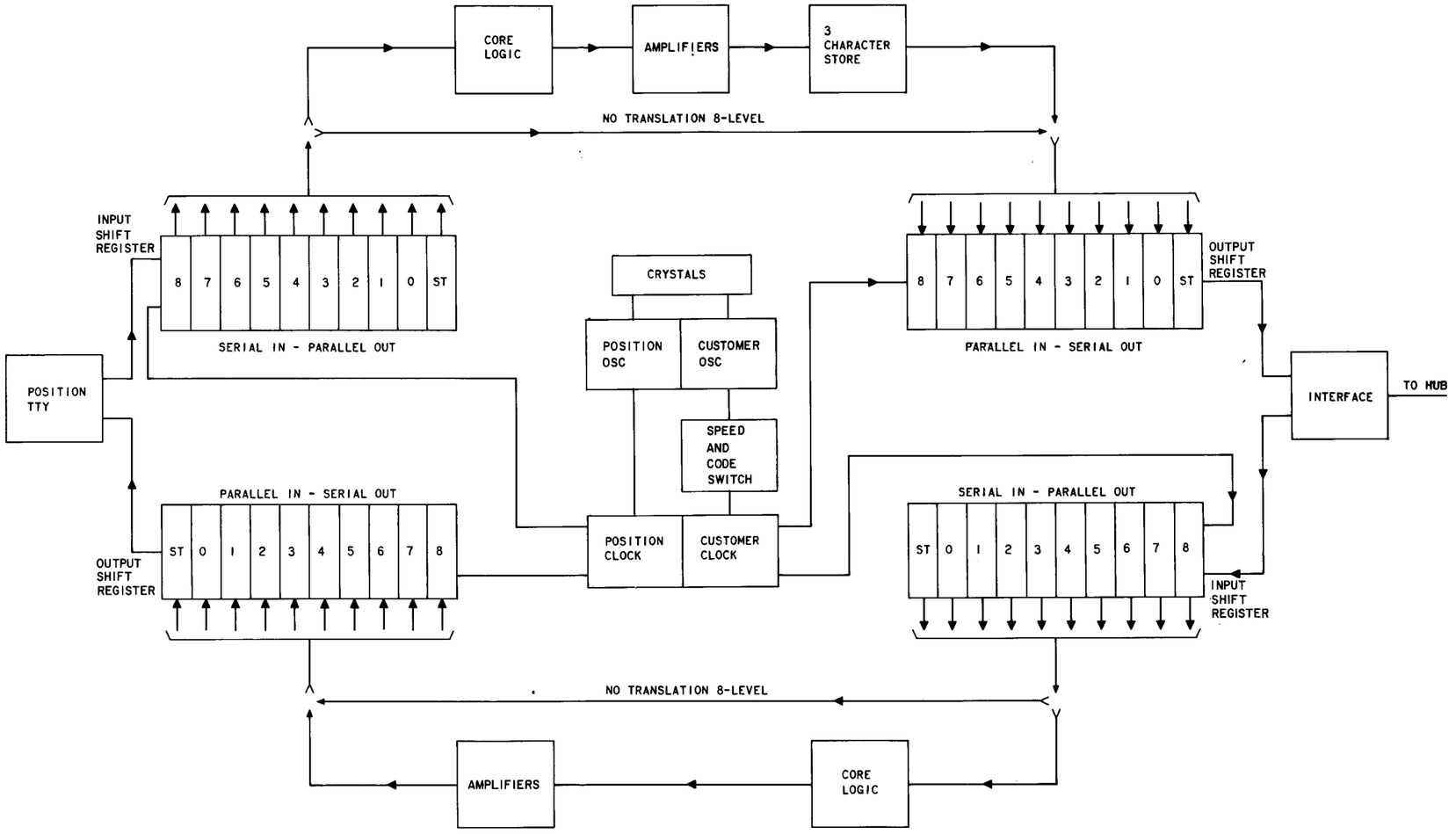


Fig. 5—918A Multispeed and Code Converter—Block Diagram

TABLE A

I. OPERATIONAL NOTES

1. Normalize by depressing DELETE key. This transmits LTRS to 3-row stations.
2. The character Λ (circumflex) will generate FIGS 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 stop control characters being printed in red. This will not affect parity errors being printed 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.
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
CONTRL FS	CTRL SHIFT L
CONTRL GS	CTRL SHIFT M
CONTRL RS	CTRL SHIFT N
CONTRL US	CTRL SHIFT O

III. TYPE ARRANGEMENT A (3-ROW TTY)

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

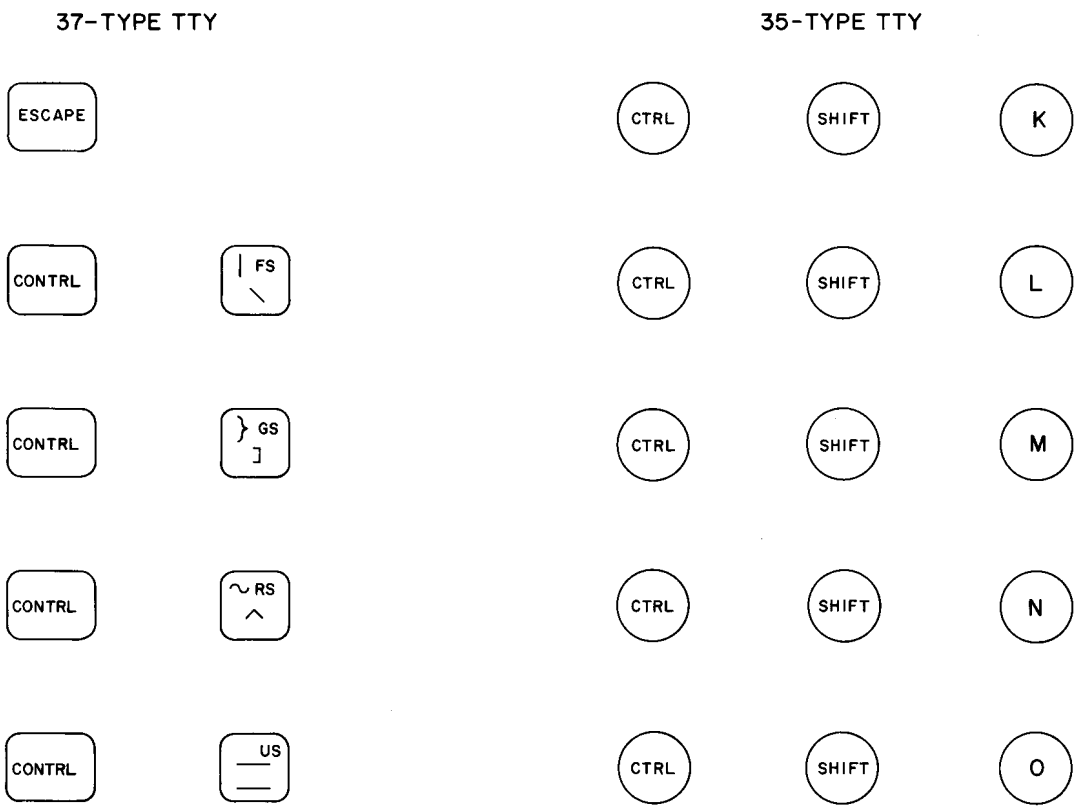


Fig. 6—Equivalent Control Characters

81-Type Systems

4.13 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 references provide additional information on the 918A Multispeed and Code Converter.

(a) CD and SD-73063-01

(b) Section 666-101-100—No. 2 Telegraph Serviceboard—Description and Operating Principles

(c) Section 666-102-100—No. 9B Telegraph Serviceboard Hub Operation

(d) Section 668-400-100—Data Test Center 904G/H Type—Description and Operation

(e) Section 666-198-900 LL Data Observing and Testing Center—Description