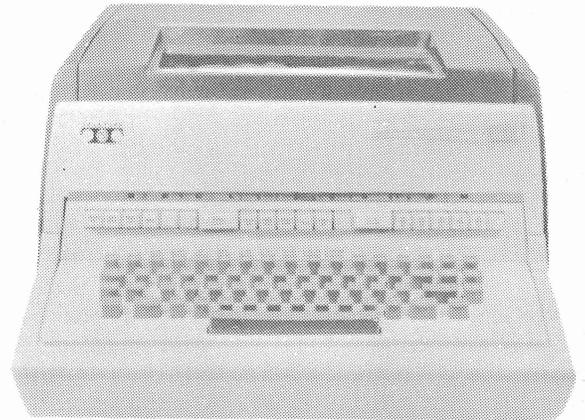


37 KEYBOARD SEND-RECEIVE (KSR) TELETYPEWRITER SET  
USED IN TELEGRAPH TEST BOARDS AND SERVICE BOARDS  
GENERAL DESCRIPTION AND OPERATION

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1. GENERAL

1.01 This section provides a general description and operation of 37 KSR (Keyboard Send-Receive) TTY (teletypewriter) Sets (Figure 1) which are used in test board service in either a 904G/H Data Test Center, No. 2 or No. 9B service board or DOTC (Data Observing and Testing Center). The KSR set may be used in conjunction with a 918A Multispeed and Code Converter. The set generates data from a keyboard and converts received data into printed copy. Since the previous issue was not available for general distribution, marginal arrows normally used to indicate changes and additions have been omitted.

1.02 A 37 KSR TTY Set is a heavy-duty terminal that functions with the ASCII (American National Standard Code for Information Interchange) and has EIA (Electronics Industries Association) Standard RS-232-B interfacing.

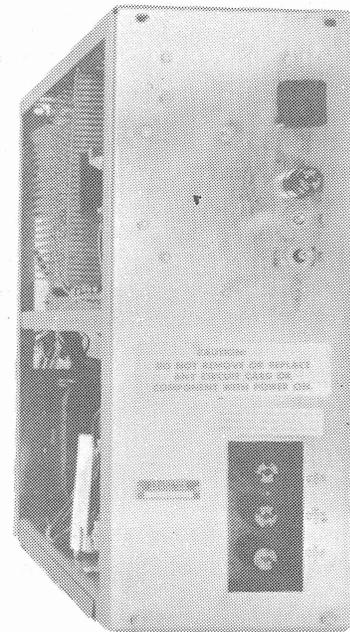


Figure 1 - 37 KSR Teletypewriter Set  
Used in Test Board Service

1.03 The styling and equipment are designed to complement modern office furnishings. The operator interface including keyboard layout and touch, quality of printed copy and equipment noise is comparable to that of an office typewriter. The console and typing unit are mounted in the teletypewriter position of the Data Test Center or service board, and the electrical service unit is mounted separately up to 10 feet away.

1.04 References to left or right, front or rear, top or bottom, etc, apply to the set in its normal position as viewed by the operator.

1.05 The 37 KSR TTY Set originates data in the form of voltage signals, ie, positive (+) voltage for spacing signals and negative (-) voltage for marking signals. The voltage signals are used by the 37 KSR TTY Set to produce printed data transmission from the set by serial signals.

1.06 Figure 2 is a block diagram illustrating the use of 37 TTY equipment in a test board application. It should help in understanding the overall capabilities of a 37 KSR TTY Set. The 37 KSR TTY Set is connected through a 918A Multispeed and Code Converter, and an interface unit to a hub for communication with stations of various speeds and signal codes. The typing unit operates at 150 wpm which is one of the outputs of the 918A Code Converter. The keyboard reset mechanism has gears that limit the resetting of the keyboard to 59 wpm, slightly slower than the lowest speed station capable of communicating with the 918A Converter. The converter can accept and transmit 5- and 8-level signals at 60, 75, 100, and 150 wpm. The 37 KSR TTY Set can also be used without the 918A Multispeed and Code Converter, if desired.

## 2. DESCRIPTION

2.01 Figure 3 and Chart show the TTY set which consists of the following components:

Typing Unit  
Keyboard  
Control Panel  
Motor Unit  
Typing Unit Cover and Pan  
Electrical Service Unit

## CHART

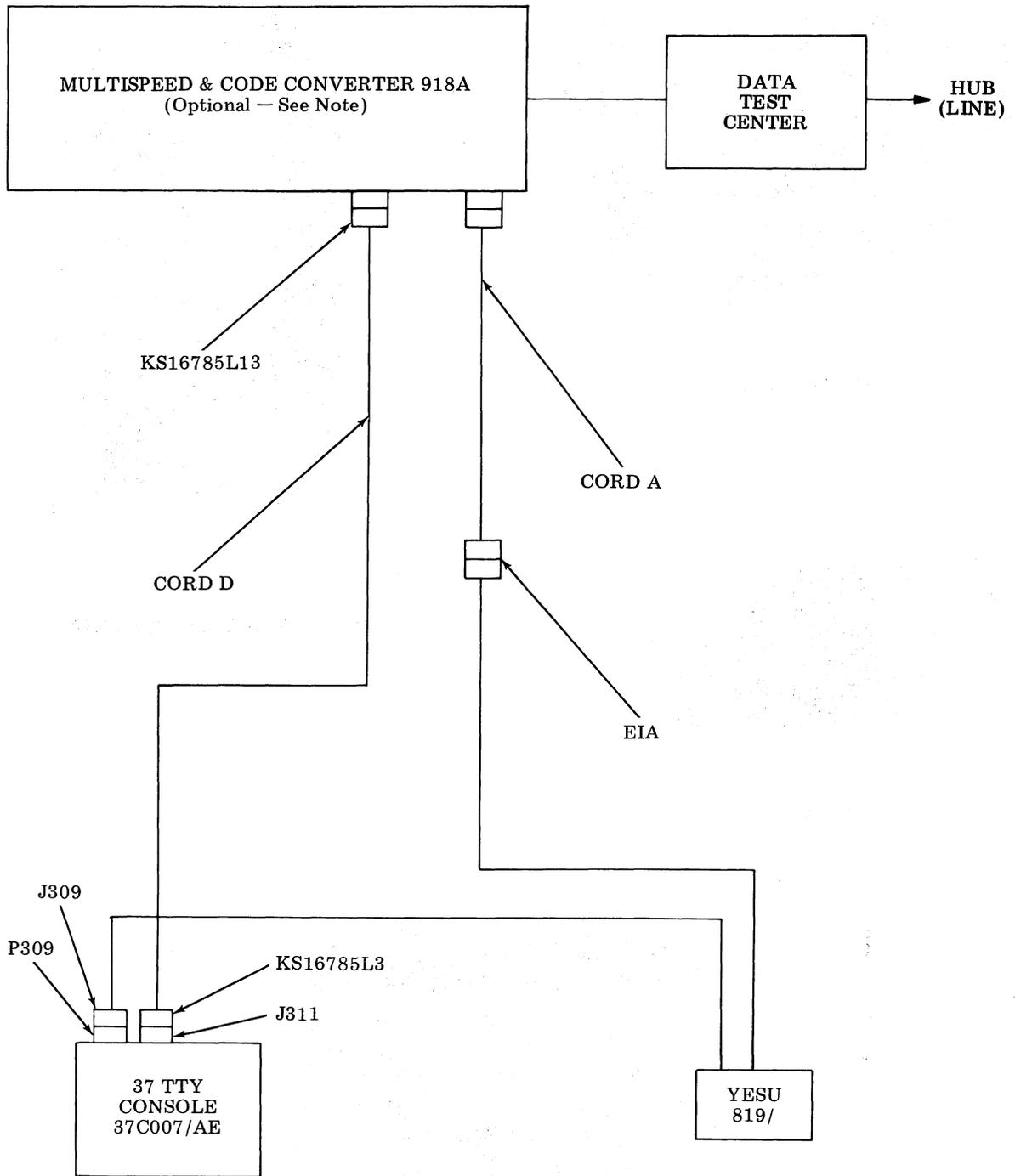
### TELETYPEWRITER SET DIMENSIONS

CONSOLE		YESU819	
DIMENSIONS		DIMENSIONS	
Width	17-1/2"	Width	14-3/4"
Height	11-1/2"	Height	5-3/4"
Depth	19-1/2"	Depth	12-1/2"

### STANDARD FEATURES

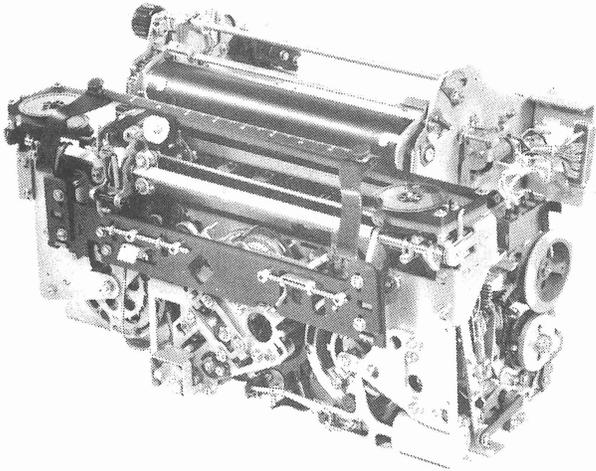
2.02 The following features are standard on this KSR TTY set:

- Modern modular design.
- Interfacing which conforms with EIA Standard RS-232-B except for motor control and shift to red leads.
- Printer receives at the speed of 150 wpm (15 characters a second) 10-unit code.
- Transmits from keyboard at 59.5 wpm.
- Generates all 128 ASCII characters with even parity.
- Receives all 128 ASCII characters — prints 94 common graphics including upper and lower case alphabet. Also prints and spaces for all control characters.
- Eighty-six characters on a line (12 per inch).
- Keyboard end-of-line indication (lamp).
- On-line carriage return and line feed.
- Local carriage return.
- Local paper feed-out.
- Two color printing.
- Operator control of multiple copy.
- Operator control of vertical spacing.
  - (a) 3 lines per inch.
  - (b) 6 lines per inch.
- Roll paper (friction feed sets).
- Print position indicator (next character indicator).
- Print position scale.
- Character repeat feature.
- Full duplex operation on-line with provision for typing unit to copy keyboard signals in local mode of operation.
- NEW LINE function (carriage return and line feed) in response to Carriage Return, Line Feed, Vertical Tabulation and/or Form Feed Characters.
- Automatic carriage return and line feed after 86 characters.
- Paper winder is used with the console. It is not part of the console.

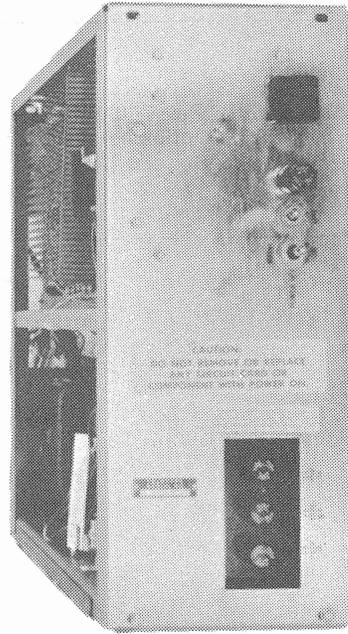


Note: If the Multispeed and Code Converter 918A is not used, plug the EIA connector from the YESU819 into the Data Test Center outlet panel. Cord A and cord D are not used.

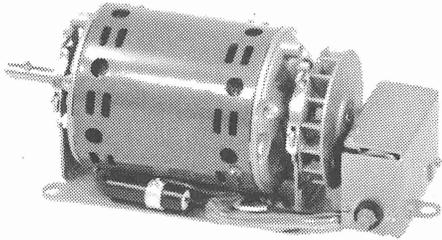
Figure 2 - Test Board Application Using 37 Teletypewriter Equipment



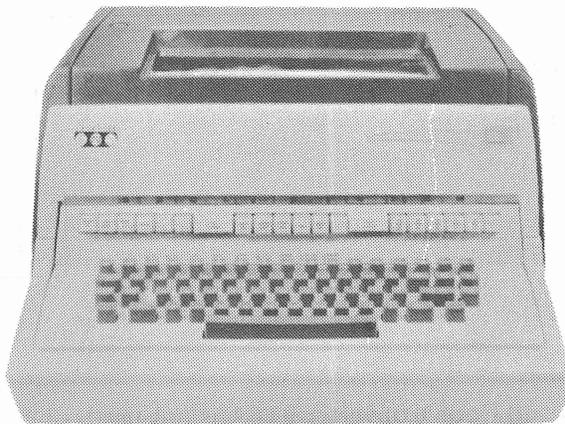
**TYPING UNIT**



**ELECTRICAL SERVICE UNIT**



**MOTOR UNIT**



**Figure 3 - 37 KSR Teletypewriter Set and Components**

COMPONENTS

A. Typing Unit

2.03 The typing unit receives information serially by means of a single magnet (two coils) type of selector. A function box is provided for character recognition.

2.04 Page copy is provided by the typing unit which prints both upper and lower case characters utilizing a typebox positioned by an aggregate motion mechanism. The typebox is moved from character to character and is retracted when reception stops, thus, making all characters visible when the machine is idle.

2.05 The typing unit is capable of printing symbols for 127 ASCII characters. Space character is not printed. An eight row typebox is provided with pallets in the upper two rows for 32 control characters.

2.06 Typing unit will print 12 characters per inch allowing 86 characters on an 8-1/2 inch platen with normal margins on the paper. Line feed provides for spacing six lines per vertical inch. The suppression latch (TP306176) and spring (TP90054) have been removed from the printer to provide spacing on every character including functions.

2.07 A typing unit arranged for friction feed is capable of accommodating roll paper in widths of 3 to 8-1/2 inches and capable of providing multiple copies of one original and two carbons.

2.08 All typing units are equipped with line feed and carriage return (both on-line and local), and serviceman adjustable margins.

B. Keyboard

2.09 A standard 4-row keyboard configuration (Figure 4) is used. The keytop arrangement is consistent with a standard office typewriter.

2.10 The keyboard is an electromechanical device for generating ASCII code combinations. It converts the mechanical depression of a key into electrical code paths. Keys move codebars which control electrical contacts. The electrical contacts present an even vertical parity parallel wire output to a keyboard control logic card in the electrical service unit which converts the signals into ASCII.

2.11 It is possible to generate all 128 code combinations of ASCII. Upper and lower case alpha characters, numerics, and special graphic characters are designated on the keytops. Control characters are designated on the keyboard in two ways. The most often used controls appear on separate keys and are active in both the shifted and unshifted modes without use of the CONTRL key. Another group of controls appear on the same keytop with a graphic. To generate these code combinations, it is necessary to depress the CONTRL key while the particular key is struck. All control character designations requiring the depression of the CONTRL key, as well as the individual key, appear on the keyboard in charcoal grey.

2.12 A repeat feature is provided on every key. Further depression of the key beyond its normal stop position will cause the associated character to be generated repetitively at the maximum character rate of 59.02 wpm. The repeat feature can be enabled or disabled by a serviceman.

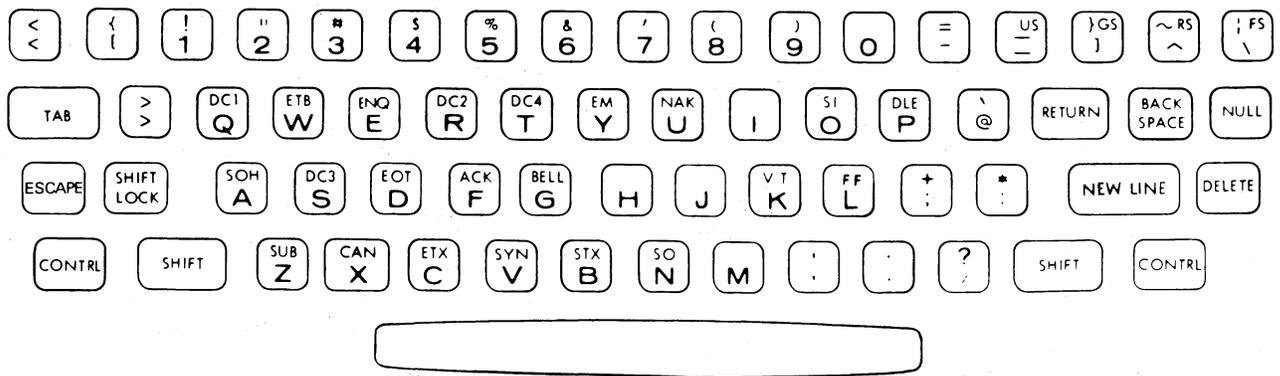


Figure 4 - Keyboard Arrangement

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### C. Base

2.13 The base provides mounting facilities for the typing unit, motor unit, and intermediate gear assembly. Holes are also provided on the base for mounting the keyboard reset mechanism and margin indicator switch.

### D. Control Panel

2.14 The control panel which is located above the keyboard contains 18 push-buttons (keys). In addition, there are two mechanical pushbuttons (keys) designated PAPER ADVANCE and LOCAL RETURN. The control panel arrangements are shown in Figure 5. Functional descriptions of the different controls, and the locations of controls within each arrangement, are given in Table A.

### E. Motor Unit

2.15 The function of the motor is to provide electromechanical rotating motion for operating the typing unit and keyboard reset mechanism.

2.16 The motor is a synchronous-type, rated at 1/20 horsepower, and is operated from a 115 volt  $\pm 10$  percent ac, single phase, 60 hertz  $\pm 0.75$  percent source of commercial power. It consists of a 2-pole wound stator with two windings (a main running winding and a start winding), and a ball bearing rotor. A start relay, capacitor, and thermal cutout switch are mounted in a compartment of the motor mounting cradle.

### F. Typing Unit Cover and Pan

2.17 The typing unit cover and pan includes copylights and provides the housing for the typing unit, keyboard and base, motor, and control panel. The cover and pan with assembled components mount onto a shelf in the Data Test Center.

2.18 The cover is hinged to the pan and can be easily removed, or it may be raised and extended over interior components while maintenance is being performed.

2.19 Two lids at the top of the cover provide access to the typing unit for ribbon changing, replenishing paper supply, and adjusting print hammer for multiple copy, etc.

2.20 Two connectors are provided at the rear of the console. P309 connects to the YESU819 connector J309. J311 connects to the 918A Multispeed and Code Converter.

### G. Electrical Service Unit

2.21 The electrical service unit is a chassis assembly which mounts into the Data Test Center. The chassis assembly has a multi-voltage power supply, a wiring field, and is equipped with five card connectors. A set of circuit cards provides the logical operations for the set (Table B). The cards mount into the card connectors.

2.22 Wiring from the card connectors terminates at the wiring field which provides a centralized wiring location for the set. Two cables terminate at the wiring field. One plug (J309) connects to the console. The other connector provides a signal interchange point that connects to the 918A Converter which generally conforms with the EIA-232-B Standard.

2.23 A power cord from the electrical service unit plugs into an ac power receptacle. The ac power for the set is provided over a single ac power cord which terminates at one of the two terminal boards, and is fused with a 3.2 ampere, slow blow fuse.

2.24 A copylight transformer and motor control relay are also a part of the YESU819 and derive their power from the multivoltage power supply in the chassis. Copy lamps go on when the motor goes on.

2.25 The multivoltage power supply converts ac power into appropriate dc power which is used for internal set operation.

2.26 A circuit card extender board, mounted in the electrical service unit is provided as a circuit card troubleshooting tool.

### ACCESSORIES

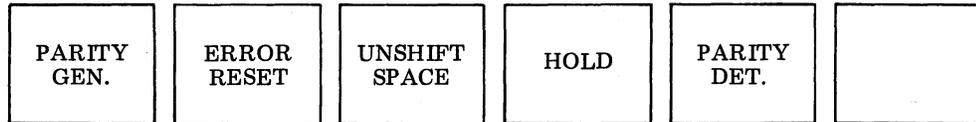
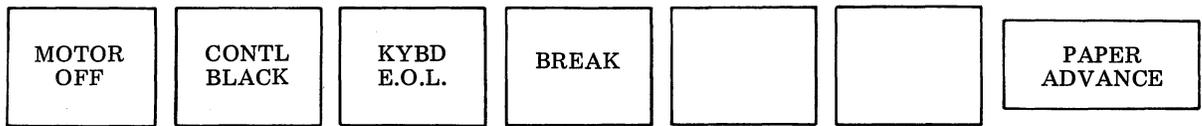
#### Paper Winder

2.27 The paper winder is mounted in back of the console and will accommodate paper widths from 4-1/2 to 8-1/2 inches. It will wind 400 feet of single copy paper. It will not handle multicopy paper.

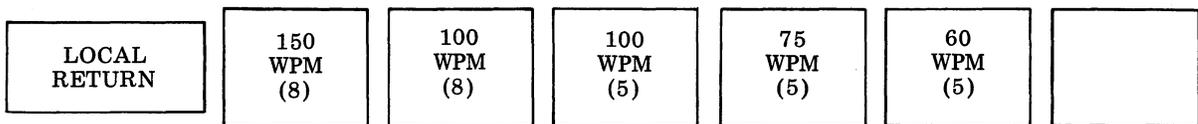
2.28 The winder has its own motor, fused for 5 amps and is controlled by a power switch and a mercury switch. When the paper from the typing unit goes slack due to paper feed-out, the slack paper bail drops, the mercury switch is operated to turn on the motor. The paper is wound up, the slack bail rises and the mercury switch turns off the motor.

2.29 A paper display rack is used to elevate the paper off the console to facilitate reading the copy.

(Left Side of Panel)



(Center of Panel)



(Right Side of Panel)

Figure 5 - Control Panel

TABLE A  
CONTROL PANEL SWITCHES AND LAMPS

DESIGNATION	SWITCH	LAMP	DESCRIPTION
MOTOR OFF	L		Turns off motor in on-line operation. All characters printed in black. Illuminated at end of 80-character line. Turns off when character counter is reset.
CONTL BLACK	L	X	
KYBD E.O.L.			
BREAK	N		Mechanically causes paper feed-out by printer.
PAPER ADVANCE			
PARITY GEN.	L	X	*
ERROR RESET	N	X	*
UNSHIFT SPACE	L		*
HOLD	L		*
PARITY DET.	L		*
LOCAL RETURN			Mechanically causes printer to return carriage.
150 WPM (8)	L		
100 WPM (8)	L		
100 WPM (5)	L		
75 WPM (5)	L		
60 WPM (5)	L		

Note: L designates locking, N nonlocking.

\*Wiring of switches and lamps are brought out "dry" through 36-pin connector for use by the 918A Converter.

TABLE B  
CIRCUIT CARDS

CIRCUIT CARD	PURPOSE
Keyboard Control Card (Piggyback on Character Counter-Z10)	<ol style="list-style-type: none"> <li>1. Receives output of keyboard contacts and converts the output to ASCII signals with even parity in 8th code level.</li> <li>2. Establishes proper parity before a character is read using the shift control sample signal. This prevents parity errors if the SHIFT or CONTL keys are operated before the character key.</li> </ol>
Distributor Card (Z09)	Serializes the parallel data input from the keyboard. Serialized characters from the Distributor card are fed to the Timer and Interface card. Take Character, a control signal from the keyboard auxiliary contact (closes when a character is generated) is a command to start serialization.
Receiving Device (Z07-Bottom)	<ol style="list-style-type: none"> <li>1. Drives the motor control relay in response to command from Timer and Interface card.</li> <li>2. Converts logic voltage level signals to power levels suitable for typing unit selector magnets.</li> </ol>
Character Counter (Z10)	Scans every character generated by the keyboard and presents a count-up (function and control characters omitted) signal to the counter control circuit. The counter is reset on RETURN or NEW LINE. It counts down on BACKSPACE characters from the keyboard only.
Counter Control (Z06)	Records count up, count down, and reset signals from the Character Counter card. At a preselected count it turns on EOL lamp. Card is programmed for 80 characters, but may be reprogrammed.
Ribbon Control (Z07-Top)	Controls the function of ribbon color selection upon receipt of signal from Timer and Interface card for red and from control panel and stunt box for black.
Timer and Interface (Z08)	<ol style="list-style-type: none"> <li>1. Converts the Distributor card DTL signals to EIA Send Data output of set.</li> <li>2. Converts the EIA received data to DTL level signals for Receiving Device card.</li> <li>3. Contains a crystal controlled bit timer to provide timing signals to the Distributor card.</li> <li>4. Contains resistors for interface contact closures with their related control circuits for motor control operations.</li> <li>5. Provides signals to Ribbon Control card to shift ribbon to red.</li> <li>6. Permanently holds EIA leads Request To Send and Data Terminal Ready to high and Ring Indicator and Clear To Send to low state.</li> </ol>

3. TECHNICAL DATA

3.01 Electrical and Environmental Characteristics

- (a) Power . . . . . 115 v  $\pm$ 10% ac  
60 Hz  $\pm$ 0.75 Hz
- (b) Ambient temperature . . . . . From 40<sup>o</sup>F to 110<sup>o</sup>F
- (c) Ambient relative humidity . . . . . From 0 to 95 percent
- (d) Power consumption . . . . . 250 watts

3.02 Physical Characteristics

- (a) Dimensions . . . . . See Chart
- (b) Weight . . . . . 115 pounds
- (c) Power cord
  - Purpose . . . . . Provides ac power for entire set
  - Type . . . . . Single 3-pin polarized cord
  - Length . . . . . 8 feet from electrical service unit.
- (d) Interface cord
  - Purpose . . . . . Provides the Electronic Industries Association (EIA) interface
  - Type . . . . . 25-conductor plug
  - Length . . . . . 10 feet

3.03 Set Internal Power Supply

- (a) Multivoltage power supply
  - Output voltages . . . . . +12.5 volts dc  $\pm$ 7% maximum current 5 amperes
  - 12.5 volts dc  $\pm$ 5% maximum current 3 amperes
  - +5.25 volts dc  $\pm$ 5% maximum current 3 amperes
  - 12 volts ac
- (b) Other outputs
  - Output voltages . . . . . 115 volts ac  
5.5 volts ac

- 3.04 Convenience outlet . . . . . maximum load  
10 amps at 130 v ac

4. OPERATION

4.01 The KSR set interface leads originate at the electrical service unit. The interface signals conform to EIA Standard RS-232-B. The interface leads which have designations beginning with A (ie, AA) are ground leads. The interface leads which have designations beginning with B (ie, BA) are data leads. The data leads are positive (+) or high for spacing signals and negative (-) or low for marking signals. The interface leads which have designations beginning with C (ie, CB) are control leads. A positive (high) voltage on a control lead means it is on, and a negative (low) voltage means it is off. The interface leads are listed, by designation, in Table C along with the name and purpose of each lead.

Note: At the interface, EIA signals are converted into diode transistor logic (DTL) signals and vice versa. DTL data signals are high (+5.5 volts) for marking signals and low (zero volts or ground) for spacing signals. DTL control signals are high when a lead is off and low when a lead is on. Thus, there is a logic inversion when signals pass through the interface.

Figure 6 is a block diagram which shows the mutual relationship between the various set logic cards of a 37 KSR TTY Set and identifies the EIA interface leads. The following functional description of set operation is based upon Figure 6.

4.02 The normal operation has the set in the on-line mode under the control of other portions of the Data Test Center. The set will be in full duplex operation where the keyboard and the printer are independent of each other.

4.03 Data communication is started with the set in the idle condition, Request To Send, Clear To Send, Data Terminal Ready, and Ring Indicator are all permanently on. This indicates the KSR and the interface unit are ready to communicate.

4.04 The motor will start when the Data Test Center supplies a ground to the Motor Control lead to pull up the motor control relay. The copy lamps will go on. The motor will stay on until the ground is removed.

TABLE C  
EIA INTERFACE LEADS

DESIGNATION	NAME	PIN NO.	PURPOSE
AA	Protective Ground	1	To connect ac power service ground to equipment chassis. It is electrically isolated from signal ground.
AB	Signal Ground	7	To provide ground for all signal circuits.
BA	Send Data	2	To carry set output data when the set is in the on-line mode.
BB	Received Data	3	To present incoming data to the set when the set is in the on-line mode.
CA	Request to Send	4	To condition local line interface unit to transmit. This lead is connected permanently on by the Timer and Interface card in the set.
CB	Clear to Send	5	To inform set that local data set is ready to transmit any data presented on BA lead.  <u>Note:</u> This lead is connected permanently on by the Timer and Interface card in the set.
CE	Ring Indicator	22	To inform set of the start of a received call. This lead is permanently connected on in the Timer and Interface card.
CD	Data Terminal Ready	20	To inform data set that the set is ready to receive data messages. This lead is permanently connected on by the Timer and Interface card in the set.
	Motor Control	6	To provide on-line control of the motor. If connected to ground, motor will go on. If open, motor will turn off.
	Ribbon Shift to Red	25	To control on-line printing in red color. If connected to ground by code converter, characters will be printed in red. If lead is opened characters will be printed in black.



4.05 The keyboard is connected to the Send Data lead. When the keytop is depressed the keyboard contacts will close, the reset mechanism clutch will be released. As the keyboard is reset its auxiliary contact will close to command the Distributor card to take the character from the contacts. The distributor will serialize the character and feed it through the Timer and Interface card to the Send Data lead. The character counter will count the spacing characters transmitted and light the EOL (End-of-Line) lamp after 80 spacing characters are in one line.

4.06 Incoming signals are received on the Received Data lead and go through the Timer and Interface card to the Receiving Device card and the printer selector magnets. The operator must personally monitor the supply of paper since the low paper switch is not wired to indicate low-paper condition.

4.07 The 918A Converter in the Data Test Center will provide a ground signal to the KSR set, on the Ribbon Shift To Red lead for red printing of all characters to indicate a parity error or another condition. When the CONTL BLACK switch on the control panel is depressed the printer will print all characters in black. This switch does not override the Ribbon Shift To Red signal from the 918A Converter. If CONTL BLACK switch is not depressed the typing unit will print all characters in black except for control and delete characters. The stunt box contacts will control the red printing in this mode of operation.

4.08 The typing unit will print all usual characters and special graphics for all control characters except space. The typing unit will space on all characters, including control characters. After the 86th character the automatic carriage return-line feed modification kit will cause a NEW LINE (CR-LF) operation on the printer at the 87th character received.

4.09 For maintenance of the test board KSR operation and for local testing, the ON-LINE/LOCAL switch on the electrical service unit is at LOCAL and the Send Data lead and Receive Data lead are disconnected from the 918A Converter. Instead the Send Data lead is connected to the Receive Data lead so that the typing unit monitors the keyboard transmission.

4.10 When the power switch in the electrical service unit is at MAINTENANCE ON position, the motor is turned on. When the switch

is at the NORMAL ON position, the motor is under the external control of the Data Test Center. When the switch is at the POWER OFF position all power to the set is off except for the convenience receptacle. Depressing the MOTOR OFF switch on the control panel will turn off the motor in on-line mode of operation.

## 5. REFERENCES

5.01 The following sectionalized literature pertains to the 37 KSR Set:

<u>TITLE</u>	<u>NUMBER</u>
<u>KSR SET</u>	
General Description and Operation	574-304-100
Installation	574-304-200
Troubleshooting	574-304-300
<u>MOTOR UNIT</u>	
Description and Principles of Operation	570-220-100
Adjustments	570-220-700
Lubrication	570-220-701
Parts	570-220-800
<u>TYPING UNIT</u>	
Description and Principles of Operation	574-320-101
Disassembly and Reassembly	574-320-702
Adjustments	574-320-703
Lubrication	574-320-704
Parts	574-320-801
<u>KEYBOARD UNIT</u>	
Description and Principles of Operation	574-321-101
Adjustments	574-321-703
Lubrication	574-321-704
Disassembly and Reassembly	574-321-705
Parts	574-321-801
<u>ELECTRICAL SERVICE UNIT</u>	
Parts	574-322-801

**SECTION 574-304-100**

**BASE**

Description and Principles  
of Operation,  
Adjustments and  
Lubrication  
Parts

574-331-100  
574-331-800

**PAPER WINDER**

Description, Installation,  
Adjustments and  
Lubrication  
Parts

574-332-100  
574-332-800

**TYPING UNIT COVER AND PAN**

Description and Principles  
of Operation  
Adjustments  
Lubrication  
Parts

574-326-101  
574-326-703  
574-326-704  
574-326-801

**WIRING DIAGRAMS AND  
CIRCUIT DESCRIPTIONS**

KSR Set — WD Package

WDP0283