37 ELECTRICAL SERVICE UNIT

YESU 823, 825, 827, 829

DESCRIPTION AND OPERATION

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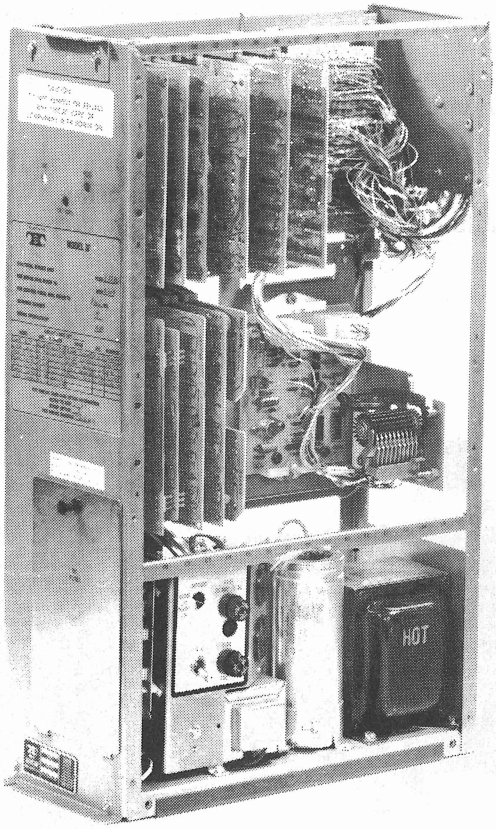

Figure 1 - 37 Electrical Service Unit

Prepared for American Telephone and Telegraph Company by Teletype Corporation

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1. GENERAL

1.01 This section provides the description and operation for the late design 37 electrical service units (Figure 1). For a detailed analysis of this unit, refer to the wiring diagram packages associated with each set. Reference material concerning the set is found in the appropriate sectionalized literature.

1.02 The 37 electrical service unit provides the electrical facilities for the 37 teletypewriter (Figures 2 and 3). The electrical service unit is an assembly that uses the EIA (Electronic Industries Association) Standard interface connections and signal logic. The unit adapts to all classes of data communications, synchronous and asynchronous, which include either 2-wire or 4-wire switched networks. Point-to-point private line service is also available with the standard features.

1.03 The electrical service unit is equipped with the necessary mounting, wiring, and cabling facilities for the various circuit card arrangements available on the 37 teletypewriter. This section also covers a general description and operation for the electrical service unit associated circuit cards (circuit card options, component circuit cards, and circuit cards that provide variable features). Circuit card options are additions to the required circuits for the set.

Figure 2 - 37 Automatic Send-Receive (ASR) Set

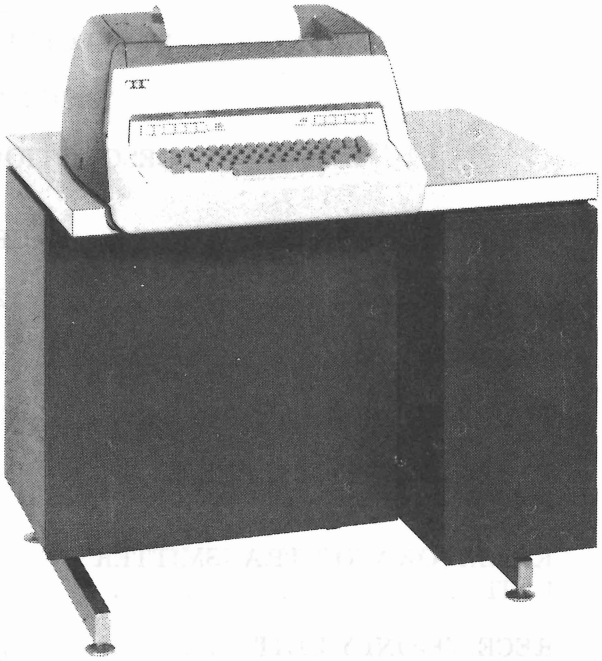

Figure 3 - 37 Keyboard Send-Receive Set

1.04 Components for the 37 set, keyboard, reader, etc, require circuit cards and these cards may have options available. Variable features provide additional capabilities that may be selected to expand upon the basic set.

2. DESCRIPTION

2.01 The electrical service unit for 37 Automatic Send-Receive (ASR) equipment (Figure 2) consists of two electrical assemblies, one for the Keyboard Send-Receive (KSR) Set and one of smaller size for the Reperforator-Transmitter (RT) module. The Receive-Only (RO) Set uses the electrical service unit for the KSR set with a different circuit card arrangement.

2.02 The electrical service unit provides for circuit cards that contain logic for the set controls, component controls, and power supply regulator. Modular design provides a variety of circuit arrangements and the ability to

add variable features. The circuit cards mate with connectors mounted on a frame. Each connector is hard wired to a terminal board. Power supply, wiring, cables, and connectors are provided on the frame of the unit.

2.03 The variations for the different set operations are achieved by the selection of plug-in circuit cards. Integrated circuits have been extensively used on the circuit cards. The control logic circuits interact with the control panel located above the keyboard. Six, twelve, or eighteen nonlocking pushbuttons on the control panel may be used depending upon the set and circuit options. Indicator lamps are associated with each pushbutton and various panel configurations are available.

EIA INTERFACE

2.04 The 37 electrical service unit (ESU) conforms to the EIA Standard RS-232-B for switched network service, and RS-232-C for point-to-point private line services. The EIA Standard defines the control signals and binary serialized data signals between an input/output device and the data set or processing terminal (communications equipment).

2.05 This standard also defines the type of connector and the lead designations on the interface cable. Refer to Table A for information concerning the EIA signal logic and Table B for information about the interface connector lead designations.

Note 1: Except for the two ground leads, all interface leads use bipolar signal voltages.

Note 2: This 25-pin connector has pin assignments that are not required in the 37 set equipment.

Note 3: Unassigned pin numbers 11, 18, and 25 may be assigned by mutual agreement. If additional pins are required, pins from other unused circuits may be used, but extreme caution should be taken in their selection.

KEYBOARD SEND-RECEIVE UNIT

2.06 The 37 Keyboard Send-Receive (KSR) electrical service unit is mounted in the lower left portion of the KSR cabinet (Figure 3). The standard components and circuit card arrangements of a typical KSR unit are shown in Figure 4. The electrical service unit is wired to provide a variety of input/output requirements.

TABLE A

EIA SIGNAL LOGIC

DESCRIPTION	LOW	HIGH
Binary State	1	0
Signal Condition	Mark	Space
ESU Input Voltages	-3v dc to -25v dc	+3v dc to +25v dc
ESU Output Voltages	-12.5v dc	+12.5v dc
Paper Tape	Hole	No Hole
Control Function	Off	On

TABLE B

EIA INTERFACE WITH CONTROLLER UNIT PIN ASSIGNMENTS (P303 Connector)

DESCRIPTION	PIN NUMBER	CIRCUIT
Data Set Ready	6	(CC)
Data Terminal Ready	20	CD
Selected to Receive	19	-
Request to Send	4	(CA)
Clear to Send	5	(CB)
Ring Indicator	22	(CE)
Transmitted Data	2	(BA) Send Data
Data Carrier Detector	8	(CF)
Received Data	3	(BB)
Protective Ground	1	(AA) Frame Ground
Signal Ground	7	(AB) Circuit Ground

Set requirements are achieved by the arrangement of circuit cards. This unit provides the necessary facilities, power supply wiring and cabling, to convert the KSR set to an Automatic Send-Receive Set.

2.07 Circuit cards for the ESU provide the set logic and component logic for the KSR set. Options and variable features for the circuit cards are outlined in Table C and Table D.

2.08 The KSR electrical service unit interfaces with a data set or auxiliary set by an EIA interface cable and connector provided

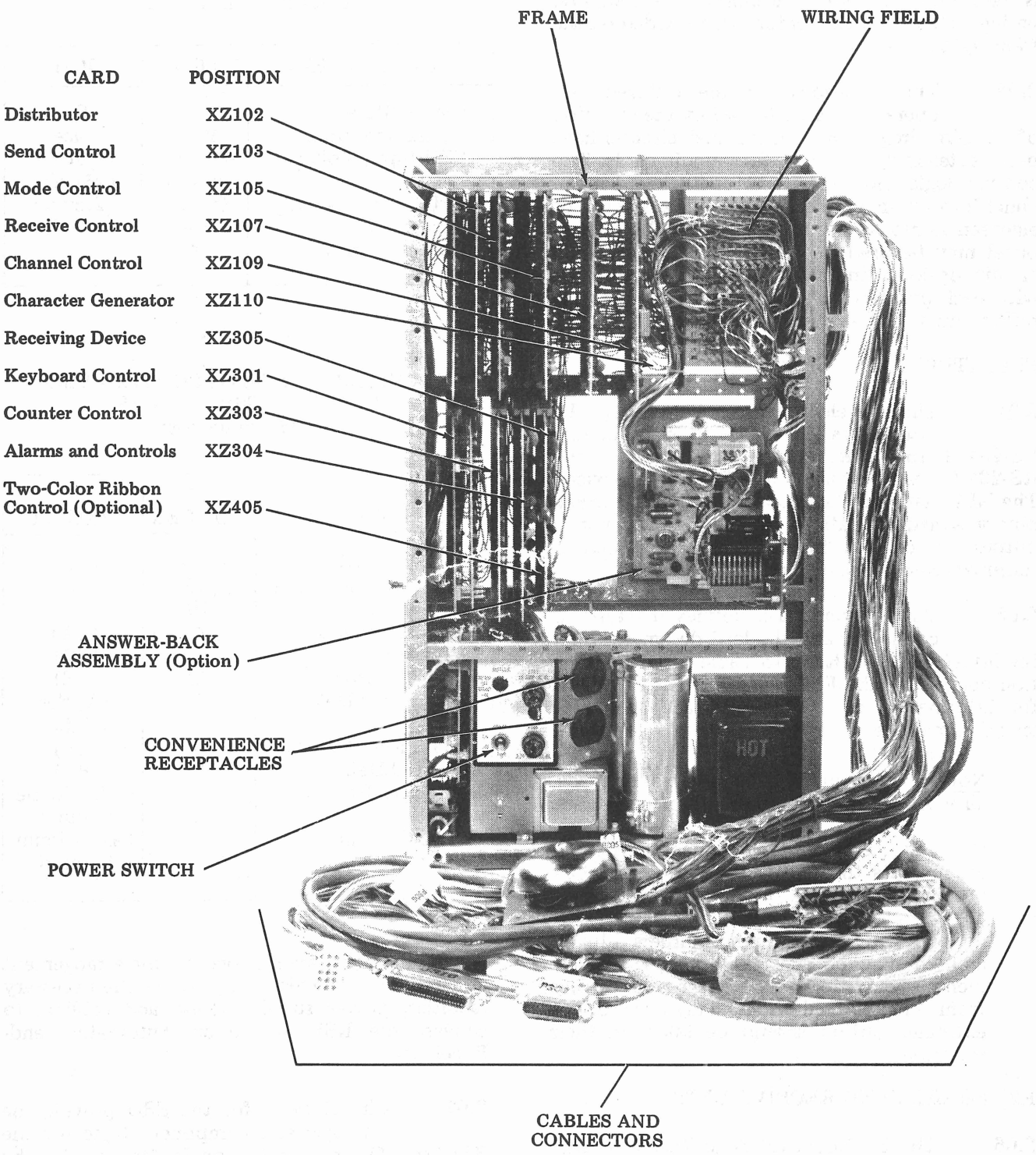

Figure 4 - 37 KSR Electrical Service Unit

TABLE C

37 KSR/ASR FEATURES AND OPTIONS

FEATURE	CARD OR MECHANISM	OPTION
150 wpm operation with 10- or 11-unit code	Mode control	10-unit code
		11-unit code
Full or half-duplex operation or full and half-duplex with line control	Receive control	Dedicated half-duplex
		Dedicated full duplex
		Line control operation
		Receiver status alarm (ASR only)
Data set control of motor. Disconnect on either EOT or alarm condition	Channel control	Motor control, EOT, and alarm disconnect

TABLE D

37 KSR/ASR VARIABLE FEATURES

FEATURE	CARD OR MECHANISM	OPTION
Programmable answer-back message	Answer-back assembly and circuit card	Answer-back at beginning of call or on HERE IS or ENQ
Two-color printing	Two-color ribbon control	Two-color ribbon
Automatic turn-on and turn-off of punch and reader in response to line signals*	Alarms and automatic control	On-line punch and reader control
Counts the number of forward-spacing characters generated by the keyboard*	Keyboard control with character counter and counter control	Character counter and programmable counter control to count up to 255 keyboard generated characters

*Featured on ASR sets only

with the unit. The EIA connector provides the necessary wiring for the receipt of data signals and on-line control signals for the KSR set.

2.09 The standard EIA connector, P303, on ESU will mate with any data communication equipment or interface equipment that conforms to the EIA Standard RS-232-B or RS-232-C. The P303 connector extends all related power, control, and signal line circuits to the appropriate data set or auxiliary set. The location of the data set is in the right pedestal of the KSR table, or external to the table if the narrow table is used.

REPERFORATOR-TRANSMITTER UNIT

2.10 The electrical service unit for the reperforator-transmitter (RT) module (Figure 5) provides the control logic circuit cards, motor control relay, and internal wiring (Figure 6) for the punch and reader. These electrical facilities for the RT module are contained in a metal frame and mounted into the RT module.

This unit contains the necessary interconnecting cabling and power cord to interface with the KSR set to form an Automatic Send-Receive Set (Figure 2).

2.11 The control circuits required for the RT module are the reader driver and control logic and the receiving device logic cards. The reader control circuit contains the reader driver, alarms, and control circuits. The receiving device logic card contains the selector magnet driver for the punch and the motor control circuit for the punch and reader. This circuit is also used in the electrical service unit for the KSR set. (For information concerning the descriptions and operation of the receiving device logic card, refer to 2.44 and 3.28). The punch feed-out circuit card is optional for the RT module.

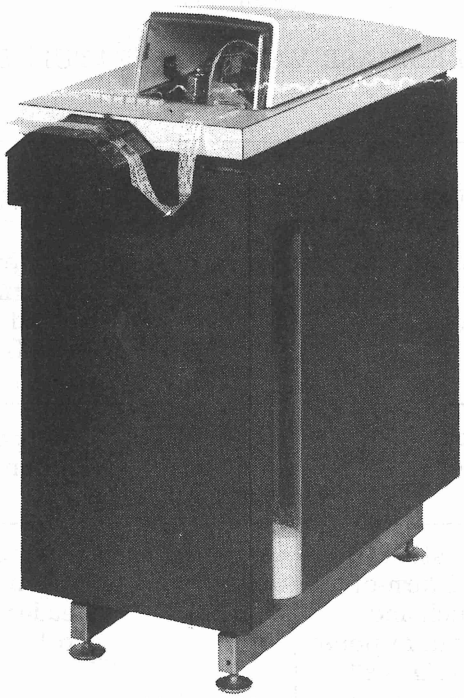

Figure 5 - 37 RT Module

RECEIVE-ONLY UNIT

2.12 The electrical service unit for the Receive-Only (RO) Set has the same basic arrangement as the unit for the KSR electrical service unit. The circuit card requirement for the RO unit contains the standard equipment (circuit cards) to receive data and also contains the frame wiring and power supply required for converting the set to a KSR. Variable features, two-color printing and the answer-back, are available on the RO set with the option of end-of-transmission and alarm disconnect circuits.

POWER SUPPLY AND REGULATOR

2.13 The power supply for the 37 KSR and ASR Sets is contained in the lower portion of the electrical service unit chassis (Figure 4). This power supply and regulator provides power for the electrical service unit, copylights, printer motor, reperforator and the reader motors, and for the optional tape handling equipment.

2.14 This multivoltage power supply converts ac to dc appropriate for the operation of the solenoids, integrated logic circuits, and discrete semiconductor logic. The

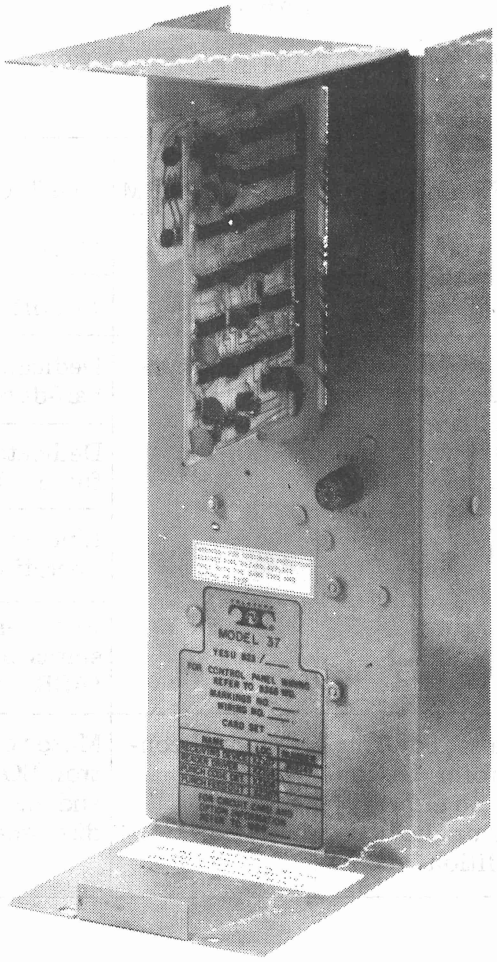

Figure 6 - RT Electrical Service Unit

power supply includes a transformer, filter capacitors, diode bridge rectifier, power transistors, resistors, and the regulator circuit card. The power supply regulator circuit card has three fuses: one 4 ampere to the +12.5 volt line, one 3 ampere to the 5.25 volt line, and a 3 ampere fuse to the -12.5 volt line. These fuses protect the power transistors and the bridge rectifier in the power supply. The regulator circuit card maintains a regulated 5.25 volts and governs the power supply by keeping the output voltages constant when fluctuations occur in the ac line voltages and dc load. The power supply and regulator provides voltages required for the Diode Transistor Logic (DTL) and EIA signal circuits.

2.15 The power supply also contains two convenience receptacles, the fuses for the electrical service unit ac circuitry, main power switch, motor control relay, and copylight transformer.

TECHNICAL DATA

A. Code and Signal Characteristics

2.16 The 37 electrical service unit is designed to process the 128 ASCII (American National Standard Code For Information Interchange) combinations. The ASCII is an eight level code. Seven information bits are transmitted by the Model 37 System plus one parity bit (8 bits total). The code is either 10- or 11-units at 150 or 100 wpm. The transmission speed is 15 characters per second at 150 wpm. The keyboard has parallel 11-wire output with even code parity which is translated to 8-wire output by the system logic for transmission.

2.17 Set interface conforms to the EIA Standard as defined in 2.04 and 2.05. Refer to Table A for the EIA signal logic.

B. Physical Characteristics

KSR Unit

Weight	37 pounds
Height	20 inches
Width	5-3/4 inches
Depth	13 inches

RT Unit

Weight	8-1/2 pounds
Height	14-3/4 inches
Width	5-3/4 inches
Depth	8-1/8 inches

C. Power Requirements

117 Volts ±10%, 60 Hertz ±0.45% Hertz

Single Phase 15 amp, Fused Circuit

Cable - Three Wire, Grounded Plug

RO Set	200 Watts
KSR Set	300 Watts
ASR (RT and KSR) Set	550 Watts

D. Heat Load (Maximum)

RO Set	700 BTU/Hr
KSR Set	1000 BTU/Hr
ASR (RT and KSR) Set	1800 BTU/Hr

E. Environment

Ambient Temperature

Minimum	40°F
Maximum	110°F

Relative Humidity

Minimum	0%
Maximum	95%

CIRCUIT CARDS

2.18 The interaction of the circuit cards with the components and the data set are outlined in Figure 8.

2.19 Most circuit card inputs are positive NAND type integrated circuits that consist of Diode Transistor Logic (DTL). The DTL inputs are approximately a 1.4 ma load. A logic one (high) draws no current from the input of the logic element.

A. Keyboard Control

2.20 The keyboard control circuit converts the parallel output from the contacts on the keyboard to eight parallel output information levels (bits) representing all 128 ASCII characters (Figure 10). This card is capable of accepting 128 distinct characters: these include 95 graphic characters, 32 control characters and the delete character. Provisions are made for "piggy back" mounting of the character counter logic card for specific ASR applications.

2.21 The keyboard control circuit operates with inputs from the keyboard contacts referenced to circuit ground. These data inputs, bits 1 through 8, consist of marks or spaces. Keyboard control, shift inhibit, and shift inputs are defined by using negative logic. A mark is a logic voltage level between circuit ground and +0.5 volts (low). A space is a logic voltage level between +5.0 volts and +6.6 volts (high). A closed contact is referenced to circuit ground and is

considered a logical one. An open contact is referred to the nominal 5.25 volt supply through a pull-up resistor and is considered a logical zero.

B. Reader Driver

2.22 The reader driver circuit adapts the reader to asynchronous operation. The circuit contains control alarm features that monitor the tape-out, tight-tape, and run-stop conditions. Additional circuits provide a single step feature that causes the reader to send one character upon the operation of an externally mounted switch. An automatic reader control portion controls the input and output control signals for the reader through interface leads to the alarms and automatic control card, send control card, mode control card, and the control panel. This circuit contains eight data bit latches for bit storage. These latches may retain a character when the automatic stop condition exists. Manual control of this circuit is provided when the alarms and automatic control card is not used (a strapping option on the card).

C. Distributor

2.23 The electronic transmitting distributor circuit card converts parallel input signals to serial output signals of either 10- or 11-unit code. The parallel input consists of eight information levels (bits). The serial output consists of a start bit, eight information bits, and one or two stop bits. The telegraphic speed is determined by an external oscillator.

2.24 In addition to the basic functions of conversion and transmission of data bits, the electronic transmitting distributor performs the following functions.

(a) Responds to a character suppress signal (blind) to inhibit transmission of a character.

(b) Recognizes ASCII control characters (6th and 7th level spacing) and electronically delays the transmission of the next character. The delay is a one character interval, plus one to three extra bits, depending upon the character unit code.

(c) Provides an output signal which indicates that a character is stored in the register and can be decoded.

(d) Provides an output signal which is used to sample conditions prior to the parallel data input sample.

(e) Provides an output signal which indicates that another character may be distributed.

D. Send Control, ASR/KSR

2.25 The send control card is designed to coordinate the three sending devices (keyboard, reader, and answer-back) for operation with the line or local transmitting distributor. The send control circuit interacts with the three sending devices by five peripheral interface control leads for each sending device. The five interface leads (Message Available, Send Message, Send Ready, Present Character, and Character Available) and the associated signals control the operation of the on-line and local transmitting distributors. Internal control of the distributors by the send control circuit is governed by Diode Transistor Logic (DTL) signals. The DTL signal logic is described in Table E.

2.26 The data bits are converted to EIA signal voltages by a portion of the send control circuit. Transmission control information is related from the data set via the channel control circuit to the send control.

E. Mode Control, ASR/KSR

2.27 The 37 teletypewriter mode control circuit has two states, local or on-line. Depending on the set, ASR or KSR, the mode control provides either local or on-line condition for the keyboard, printer, punch, and reader. The mode control circuit contains a set clock for sets operating at 150 wpm with 10-unit code (150 baud), or 100 wpm with 11-unit code (110 baud).

TABLE E

DIODE TRANSISTOR LOGIC (DTL)

DESCRIPTION	HIGH	LOW (GROUND)
VCC (Input/Output Voltages)	+5.0 to +6.6v dc	0 to +0.5v dc
Binary State	1 = VCC	0
Signal Condition	Mark	Space
Signal Not Inverted (Keyboard/Reader Input)	Space	Mark

The set clock is a crystal controlled, astable multivibrator composed of two transistors operating at 128 times the bit rate.

2.28 The mode control interacts with the control panel located above the keyboard by light indicator switches. When the set is in the local mode the switch is illuminated on the control panel.

2.29 The output of the mode control circuit is a clock pulse of 32 times the bit rate and is capable of driving ten logic loads. The clock pulse is a result of the set clock frequency that is divided by four using a pair of flip-flops. The output of the flip-flop network associated with the mode control circuit is used to control other circuitry in the set. In the ASR, individual device control is provided for the keyboard, printer, punch, and reader by means of transmitter control and associated flip-flop circuitry on the mode control circuit. The RO set is normally in the on-line mode and the motor of the set is under the control of the data set.

F. Channel Control

2.30 The channel control circuit monitors and responds to line control signals from the data set. The send, receive, and mode control circuits interact with the channel control circuit to govern the on-line mode of the set. The channel control contains the following features:

(a) On-line motor start control for switched or nonswitched service

(b) Timed send interrupt generation

(c) Timed receive interrupt detection

(d) On-line transmission control

(e) Out-of-service, "do not answer" signal (option).

G. Character Generator

2.31 The character generator circuit is used in point-to-point private line service and mounts directly onto the channel control circuit card.

2.32 The character generator card provides the logic necessary for individually transmitting the characters ENQ, ACK, and the two character sequence DLE-EOT. Characters ENQ and ACK regulate the communications channel by assigning one station as the master and the other as the slave. The first station to receive an ACK reply to a transmitted ENQ assumes master status, while the other station which received the ENQ and responded with an ACK assumes slave status. The two character sequence DLE-EOT serves as a call termination code, which causes motor turn-off when this sequence is detected in the printer function box.

H. Alarms and Control

2.33 The alarms and control circuit card is used on the RO and KSR sets to supply power for the signal bell and to provide control logic for the paper alarm. The circuit contains an amplifier to drive the bell magnet and an amplifier for the paper alarm lamp. The controlled paper alarm circuit has the necessary control logic to switch the paper alarm lamp in response to a paper alarm "do not answer" or disconnect signal. Control of the printer is by the control logic circuit that responds to a Printer Ready and Printer Receive message signal.

2.34 The paper alarm is used when a signal from the printer indicates a low paper condition. When this condition exists, the ALARM lamp on the control panel goes on and causes the Printer Selectable lead to go nonselectable after the completed message. The printer is then in the nonselectable state and will not accept an incoming call. The data transmission during this state will not be received until the alarm condition is removed and the printer becomes selectable.

2.35 On an incoming call an alarm in the data set signals the operator, who switches the set to the desired mode.

I. Alarms and Automatic Control (ASR)

2.36 The alarms and automatic control card contains an automatic reader control, automatic punch control, paper alarm logic, and bell driver that are basic independent logic systems. The alarms and automatic control card provides a circuit to drive the signal bell and a logically controlled paper alarm circuit. This circuit has an automatic control which allows the punch and reader to be turned on or off by a signal pulse from a printer stunt box contact closure. This automatic feature enables a remote station to seize the 37 set and transmit the data.

J. Receive Control

2.37 The receive control card directs and controls line data signals to the appropriate receiving device. The circuit receives EIA serial input signals and provides DTL output signals. The EIA input amplifier receives incoming on-line signals and data signals that are generated locally are received directly from the sending distributors.

2.38 The receive control card functions as a signal regeneration circuit which changes input line data signals that have 40 percent or less distortion to output signals with less than 3 percent distortion. The signal regenerator portion of the receive control circuit maintains a minimum character length of 9.8 units at 150 baud (150 wpm) and 10.6 units of 110 baud (100 wpm).

2.39 The printer is designed to meet the following receiving margins when operating at 150 wpm:

25% Marking Bias

25% Spacing Bias

25% Marking End Distortion

25% Spacing End Distortion

25% Switched Combination Distortion

At 100 wpm (110 baud) the receiving margins are:

35% Marking Bias

35% Spacing Bias

35% Marking End Distortion

35% Spacing End Distortion

35% Switched Combination Distortion

2.40 When equipped with the regenerator, the equipment will meet the following minimum receiving margins:

40% Marking Bias

40% Spacing Bias

40% Marking End Distortion

40% Spacing End Distortion

40% Switched Combination Distortion

2.41 The receive control circuit detects a received signal with improper parity and provides power to an external parity error detection indicator lamp on the control panel. Half or full duplex transmission mode is controlled by the internal logic of the card. The line or local tabulation function of the circuit locks (holds all sending signals) all signals during the tabbing operation. The output indicator of the receiving device in the alarm circuit indicates an alarm condition for the receiver control circuit.

2.42 The receive control circuit contains the following features and subcircuits:

Regenerator

Bit Counter

Data Flip-Flop

Parity Flip-Flop

Timer Control Latch Reset

Parity Count Inhibit Gate

Receive Control

Receive Data Logic

Receive Alarms

Tabbing Control

Full Duplex

Parity Error Display Logic

2.43 Parity errors are displayed on a lamp, located on the control panel. Parity error circuitry is part of the regenerator.

K. Receiving Device

2.44 The receiving device logic card performs the function of a selector magnet and motor control relay driver. The selector magnet driver circuit is a 3-stage amplifier and designed to operate full on or off without intermediate levels. The motor control relay driver is a 2-stage amplifier designed to operate

full on or off without intermediate levels. These circuits receive integrated circuit logic levels (DTL signals and serial data) and convert the output to current levels appropriate for operation of the magnets.

VARIABLE FEATURES

A. Answer-Back Control

2.45 The answer-back control card is associated with an electromechanical answer-back unit (Figure 7) mounted in the electrical service unit. This unit is an 8-level self-contained transmitting device designed to generate a precoded message of 20 characters or less. The character sequence, usually a station identification sequence, is programmed into and stored in a code drum. For mechanical information about the answer-back unit, refer to the Description and Principles of Operation Section 574-325-101. Answer-back drum coding information is given in Answer-Back Adjustments Section 574-325-703.

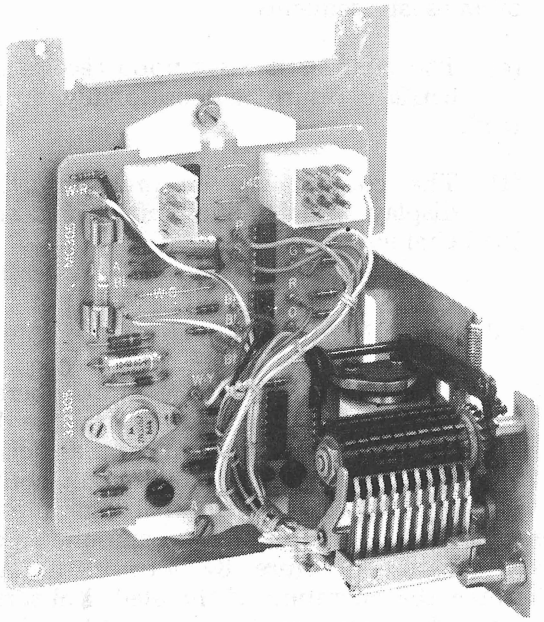

Figure 7 - Answer-Back Unit

2.46 The answer-back control circuit consists of a stepping motor driver and an output gating register that provides a parallel read-out for the contacts. The combination of a filter network and a NAND gate passes a clock pulse to drive the flip-flop circuit that starts the stepping motor driver. The output register contains eight bits of information and the output is in parallel form. This circuit is designed to send and receive the following signals:

(a) Receives a start command to begin operation.

(b) Sends a Message Available (Sender Selectable) indication when the answer-back moves to the first position and the STOP switch operates.

(c) Receives a Present Character command that provides a read-out from the output register and initiates the next cycle.

(d) Sends a Character Available indication, informs the send control that a character is present and should be taken.

(e) Data Outputs

Mark - high (+4 v dc to +6.6 v dc)

Space - low (0 v dc to +0.5 v dc)

Suppress - low (0 v dc to +0.5 v dc)

B. Two-Color Ribbon Control

2.47 The two-color ribbon control card is a variable feature that enables the operator to select the red or black portion of the typing ribbon. This circuit has the following features:

(a) Solenoid driver to operate the ribbon magnet.

(b) Auxiliary driver to operate a lamp for SHIFT IN or SHIFT OUT applications.

(c) An integrated circuit latch that reads the logic state of the stunt box contacts.

(d) A reset mechanism to select the black ribbon at the end of the message (on-line mode).

2.48 The two-color ribbon control card plugs into a prewired printed circuit card connector and does not require field assembly or adjustment. The ribbon magnet driver converts the intergrated circuit logic inputs to current levels appropriate for the operation of the ribbon magnet.

C. Counter Control

2.49 The counter control circuit card assembly is designed to be used in conjunction with the character counter circuit (2.52). This circuit is a variable feature that performs a binary up-down counting function and indicates the programmed End-of-Line (EOL) character. The EOL condition is indicated by an EOL lamp on the control panel.

2.50 This circuit is capable of counting up to 255 keyboard generated characters. On the 256 character, the counter is reset of zero. Each time a backspace character is generated, the counter down counts by one. The counter control card resets to zero each time a carriage return character is detected and is programmable to any line length up to 256 by strapping on the card. When the counter is at zero, further down counting is prevented by the zero stop control.

2.51 The inputs are obtained from the character counter circuit. These inputs are count-up, count-down, and reset. The output of the counter control is used to drive the EOL lamp.

D. Character Counter

2.52 The character counter is a variable feature used with the 37 ASR Set to count the number of forward spacing characters generated by the keyboard or punched by the reperforator. This card is mounted to the keyboard control card and is designed to operate with the counter control card. The character counter controls the binary counting circuit of the counter control card.

2.53 The inputs for the character counter are direct from the keyboard control and consist of eight parallel information levels. The outputs provide count-up, count-down, reset, and control signals for the counter control card. This 3-card arrangement controls a lamp indicator on the control panel to indicate an end-of-line condition. This feature is required when punching tape without a printer monitor, to indicate when a carriage return or new line (carriage return and line feed) signal is required.

2.54 An escape (ESC) sequence recognition (control character code extension) is provided in the character counter card. The code extension enables the operator to deviate from one routine and perform another operation and come back into the original routine. Characters, normally "spacing" characters, when part of an escape sequence, lose their normal sense and therefore are not counted.

2.55 The character counter, counter control, and keyboard circuit card assemblies have the following characteristics in relation to the counting function.

(a) The character counter counts all characters appearing in columns 2 through 7 of the ASCII code, except for the delete character, and except where these characters appear as part of an escape sequence.

(b) Characters appearing in columns 0 and 1 are not counted.

(c) There are no provisions for tabulation.

(d) The counter counts down on backspace unless this is the terminating character of an escape sequence.

(e) The counter is reset upon receipt of a carriage return and optionally on line feed.

(f) The counter can be programmed to display "end-of-line" after any specified character count.

3. OPERATION

3.01 The electronic service unit operates with the set components and the data set (Figure 9). Each component has an associated logic circuit that interfaces with the set control logic (Figure 10). The set control logic circuits coordinate the operation of the components and variable features (Figure 8). For information concerning the operation of the electrical service unit with the components, refer to the appropriate set literature.

3.02 Information related to the circuit cards is covered in the wiring diagram package shipped with the circuit card set. Electrical service unit information is included in the wiring diagram package shipped with the electrical service unit. The following operations require the associated wiring diagrams for detailed analysis.

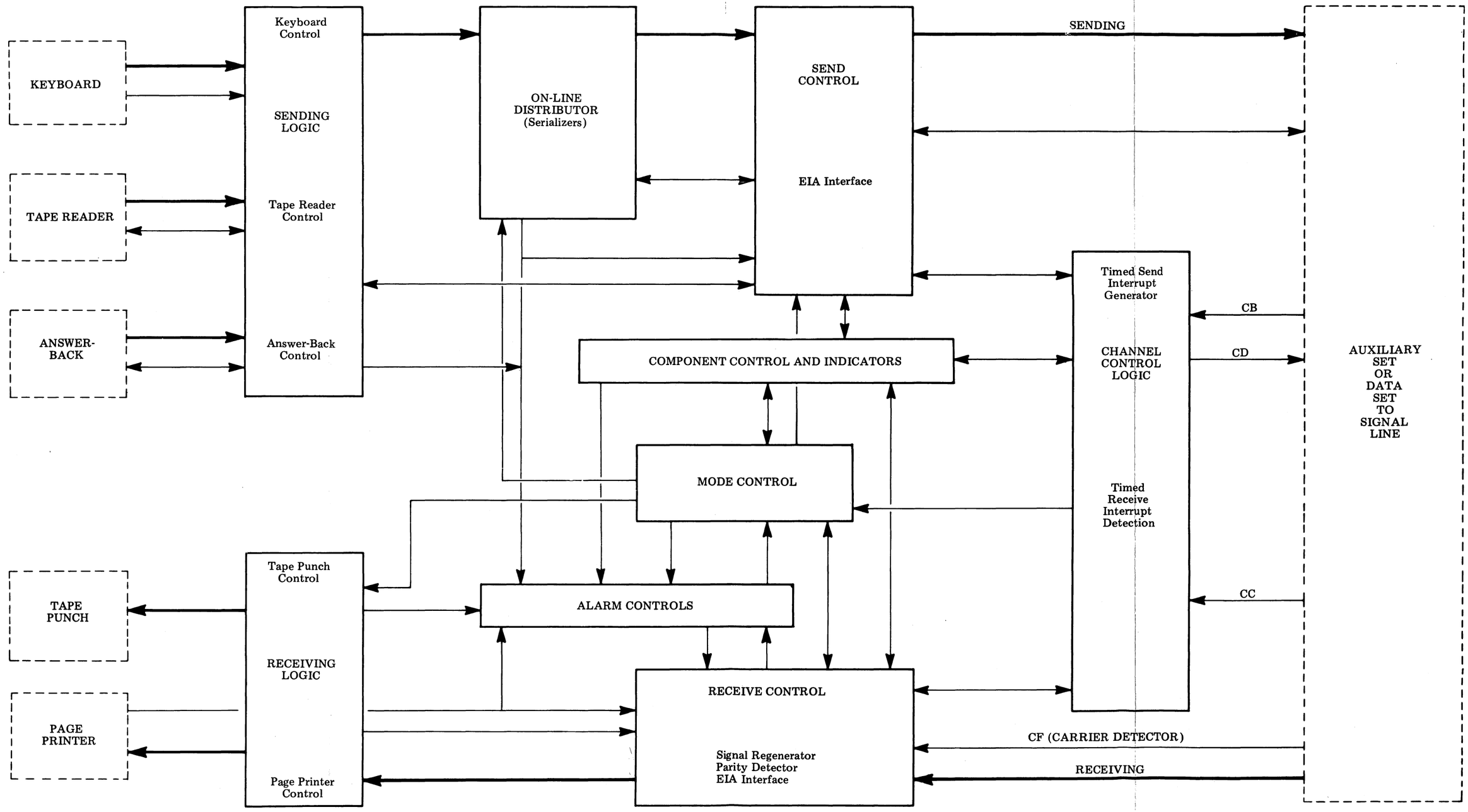

Figure 8 - Typical 37 ASR Electrical Service Unit, Block Diagram

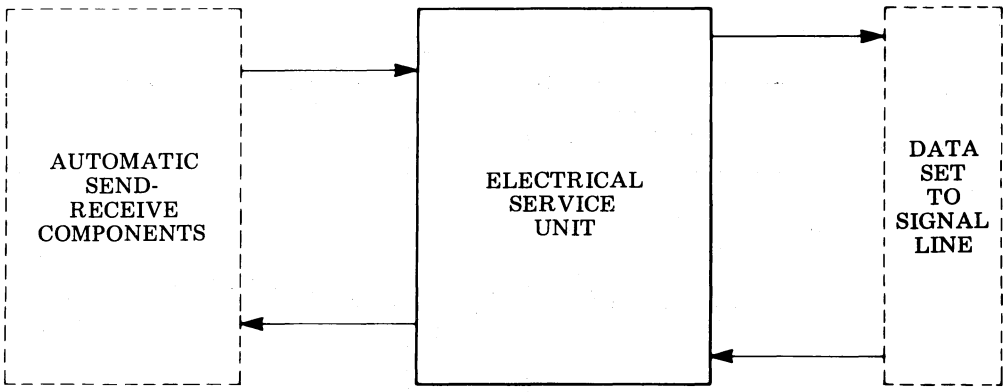

Figure 9 - 37 Automatic Send-Receive Flow Chart

SENDING

3.03 The keyboard, reader, and answer-back logic circuits operate through common leads with the distributors (Figure 11). Control of these sending circuits is accomplished by the send control circuit. When a bit sequence is generated by the keyboard, the data bits are presented to the keyboard logic circuit. A bit sequence and Present Character (PC) signal is generated by the send control card and when the keyboard auxiliary contact closes, the Present Character signal gates bits 1 through 4 to the output pins; the PC input remains low for one bit duration. The result of this action primes the bit latches for a Shift Control Sample (SCS) input.

3.04 The SCS input goes low for a 0.25 bit duration after the PC signal and remains low for 0.25 bit. During this period the keyboard logic card reads the first four bits, the Control Shift Inhibit, and Shift signals and determines if the character is upper or lower case. After the 0.25 bit duration, the latch drivers are enabled and bits 5 through 8 appear at the output pins. At this time, bits 1 through 8 are available to be transmitted to the shift register of the distributor. This cycle is repeated for every data character and control signal.

A. On-Line and Local Distributor

3.05 The operation of the electronic distributor starts when the distributor is idle (no character is being processed) and issues a Present Next Character command (PNC in 0-state). This signal indicates to the set logic (send control) that a character can be presented for distribution. The distribution cycle begins when the Take Character (TC) signal is presented to the distributor from the send control (TC in 0-state). If the TC signal is in the 1-state, nothing happens. If it is in the 0-state, the frequency dividers are released.

3.06 The TC input is now monitored for 0.25 bit duration. If TC goes back high any time prior to 0.25 of a bit, the frequency dividers are recycled to the 0-count. Assuming TC remains low, the distributor will now complete one distribution cycle. The 0.25 bit time out provides integration that will reject noise pulses at the TC input.

3.07 At 0.5 of a bit, all data input gates are primed. A 1-state on any data input lead during this time causes a mark to be set in the corresponding data flip-flop. When 0.75 of a bit is reached, the character sample period terminates. After this time the data input leads have no effect on the distributor. The character sample period is terminated if the TC condition is removed prematurely. The 0-state at TC should remain for a 1-bit duration.

3.08 At approximately 0.87 of a bit, the clock pulse changes to the 1-state. This primes the data flip-flop. At exactly 1-bit time (0.13 bits later) the clock pulse reverts to the 0-state. At this time each data bit stored in the distributor is shifted one position. The data shifted from the line flip-flop becomes the output signal. This will continue for nine more clock pulses (10 for an 11-unit code), at which time the register will have all spaces stored in it. The distribution cycle will be complete at this time.

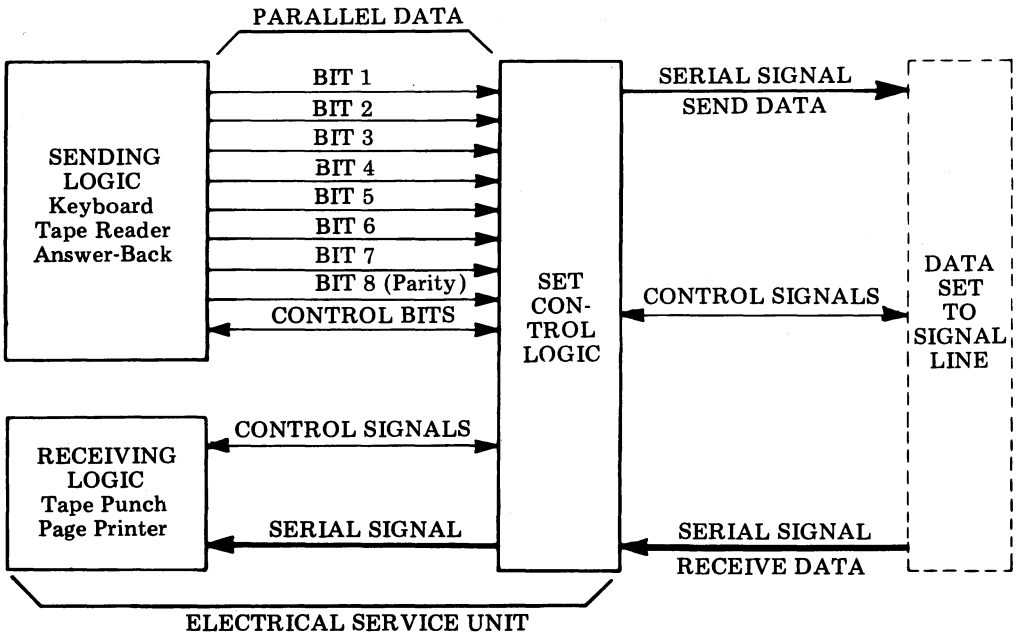

Figure 10 - Electrical Service Unit With Data Set Flow Chart

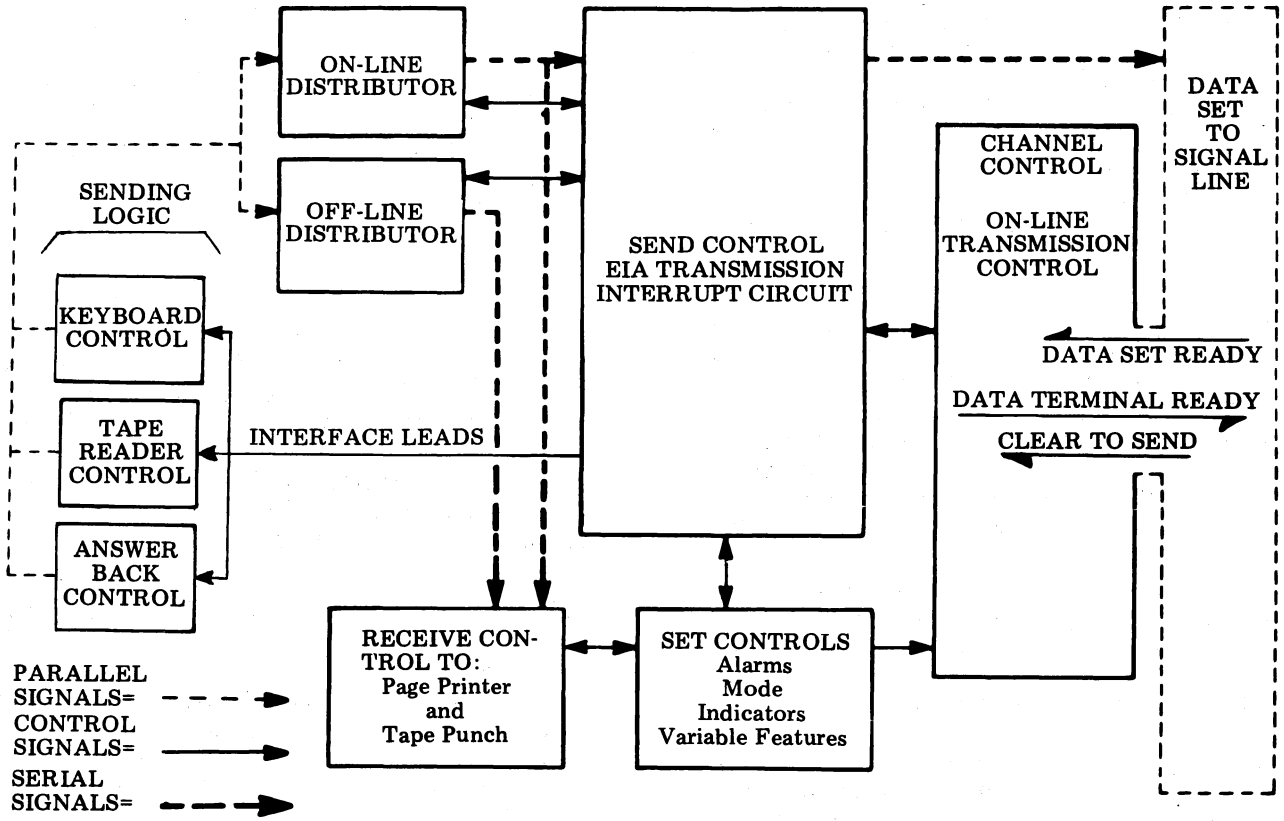

Figure 11 - 37 ASR Sending Signal Flow Chart

3.09 The inverted output of the Take Character latch is used to hold the data and start (ST) positions of the register in a spacing condition and to set a mark in the line and stop (SP) positions. The inverted output of the SP position drives the PNC gate. During most of the distribution cycle this output is low, keeping PNC's output high. When a mark is set in SP, PNC output reverts to the 0-state. It will remain in this state until one bit after the start of distribution, at which time a space is shifted into the SP flip-flop.

3.10 When a control character is the character being sent, a PNC signal will not be issued. After the stop bit of the control character is sent, the frequency dividers are kept running. When this occurs, the distributor cycles itself for the duration of another character. In this blinded character cycle, another mark rather than a space is shifted into the SP flip-flop at the first clock pulse, causing an extra stop bit to be generated. The remaining distribution cycle continues as previously described. Since the transmission of the control character is 11 bits in length, the extra stop bit combines with the second distribution cycle in making the control character 23 bits long in total time duration. This time is necessary to insure that the printer function box response has been completed before another character is transmitted. When the register is all spacing, PNC reverts low, signaling external logic that another character may be transmitted.

B. Send Control

3.11 The send control interacts with the transmitter for the sending devices directly through the interface control leads (Figure 11). Operation of the send control circuit is initiated by a Message Available (MA) signal from a transmitter. The MA signal is necessary before a sending device can transmit character bits to one of the distributors. The send control receives the MA signal from one or more sending devices and assigns a priority to the device that presented an MA first. The send control returns a Send Message signal to the sending device that has established a priority. The condition of a priority is an indication to the sending device that either a line or local distributor has been seized.

3.12 A Send Ready signal informs the send control that the device has performed all necessary internal operations and is ready to start sending a message. The return of a Present Character signal is an indication to the sending device that the distributor's shift register is empty and ready to accept a character for distribution. The sending device returns a Character Available signal to the send control which is relayed to the distributor to indicate that a character has been sent and the distributor can start its cycle. This sequence of five interface signals either remains on or is repeated for each character.

3.13 The Shift Control Sample signal from the distributor enters the send control circuit after the keyboard Present Character lead has gone low (on). The Shift Control Sample (SCS) lead is used to transfer the parallel input data bits 5 through 8 to the output prior to being sampled by the distributor for the bits 1 through 4. (The first four data bits are sampled prior to the last four to determine upper or lower case.) The local Present Next Character lead remains high until the character has been shifted out of the register; at this time it will revert low and wait for the beginning of the next character.

3.14 When serialized information bits leave the line distributor, the signals are received by the send and receive control card (Figure 11). The mixing of data bits when two devices are transmitting simultaneously is prevented by the Character Available signal from the on-line device. This signal inhibits the local present character and the character available from the local device and inhibits a line Present Character signal. The Character Available signal and the inhibited signals prevent the parallel input of the line or local distributors from being sampled at the same time. The data from all sending devices appears on the data leads but are sequentially gated to prevent simultaneous presentation of parallel data on these leads. Sending Contention Latches (CNL Line and CNL Local) on the send control assign priority to devices in the on-line and local modes.

Answer-Back

3.15 The operation of the answer-back is started by a start pulse from the stunt box of a printer through the send control circuit to the answer-back control circuit. This start pulse is filtered and gated to provide a clock pulse to drive a flip-flop circuit, which commences the initial answer-back step. The drive circuitry provides a timed current pulse to the answer-back coil, attracting the armature. At the end of the pulse, the coil releases the armature, which pulls the answer-back drum to its first position.

3.16 When the drum moves to its first position, the normally closed STOP switch opens, providing a Message Available indication and disabling the effect of the start input on the circuit. Control of the answer-back is now under the direction of the Present Character input. The terminal logic takes the Message Available indication from the answer-back logic and issues a Present Character command, which performs three functions: data bits are presented at the data output gates for the duration of PC, the drive flip-flop is set, and a Character Available is issued. Setting the drive flip-flop initiates the process of advancing the answer-back drum to the next position as discussed previously.

3.17 The Present Character command is normally one bit in length, and must be removed before the armature is fully attracted to allow sufficient time to read the character before the drum is advanced.

3.18 Reading and advancing the answer-back drum occurs with each PC command. When the drum advances to the home position, the STOP switch closes, causing removal of the MA indication and priming the synchronous input of the drive flip-flop. The terminal logic does not issue further PC commands when MA has been removed. The answer-back circuit is now in an idle state.

Character Counter

3.19 The operation of the character counter circuit assembly depends upon signals from the keyboard control card. At the beginning of each character distribution cycle, a sample pulse time occurs between 0.5 bit and the end of the distribution cycle. The step forward output is normally high and goes low for a 0.5 bit duration each time a space or printed character is detected. The step reverse output is high at all times except when a backspace is detected. The counter control recognizes these conditions on separate leads from the character counter card. Each time the counter recognizes a low state the counter counts up or down by one depending on the signal lead receiving a low signal.

3.20 The reset output operates on a signal when the carriage return or new line character is generated (depending on the strapping). The escape sequence is generated from the keyboard by the ESCAPE key. When an escape sequence is started, the normal functions of the character generating signals are in the inhibiting mode; the step-forward signal is inhibited until the final character of the code is generated. At this time the on-line terminal performs the control function and reverts to normal operation.

Counter Control

3.21 The operation of the counter control card depends upon input from the character counter card. The following outline describes a brief operational sequence for the basic functions of the circuit.

(a) Count-Up (Step Forward):

(1) The count-up input is normally high (the off state) when the keyboard is idle.

(2) When a printed character or space signal is generated by the keyboard, the count-up input goes low (the on state) for a 0.5 bit time duration. This time duration is entered into the character distribution cycle.

(3) The count-up input reverts to a high state at the end of the distribution cycle.

(4) Each high-low-high transition of the count-up input generates a clock pulse which adds a binary one to the contents of the binary counter.

(b) Count-Down (Step Reverse):

(1) The count-down input is normally high while the keyboard is idle.

(2) When a backspace character is generated by the keyboard, the count-down input goes low for a 0.5 bit time duration. This time period is entered into the character distribution cycle.

(3) The count-down input reverts to a high state at the end of the distribution cycle.

(4) Each high-low-high transition generates a clock pulse which subtracts a binary one from the contents of the binary counter.

(c) Reset:

(1) The reset input is high at all times except when a carriage return or line feed character is generated by the keyboard.

(2) When a carriage return or line feed character is generated, the reset input goes low for a 0.5 bit time duration. This time period is entered into the character distribution cycle.

(3) At one bit time period, the reset input reverts to a high state.

(4) Any high-low transition of this input resets all the normal (N) counter outputs to a low state and all the inverted (I) counter outputs to a high state. This sequence resets all the counters to zero.

(5) The 256th clock pulse resets all normal (N) outputs to a logic zero and the counting cycle starts again.

(d) Zero-Stop:

(1) Zero-Stop inputs monitor the eight inverted (I) flip-flop outputs.

(2) With the counter cleared to zero, the inputs are high.

(3) Further down counting is inhibited by the resulting low on the zero-stop control.

SET CONTROL LOGIC

3.22 The set control logic circuits consist of the channel control, mode control, and alarms and controls. The channel control operates the on-line motor start control. The mode control selects line or local operation of each device in the set in response to the operation of the switches located on the control panel. The alarms and controls provides a means of monitoring the paper supply of the printer and on-line punch and reader control.

3.23 For detailed descriptions of the set control logic, see the circuit descriptions in the appropriate wiring diagram packages.

Mode Control

3.24 The mode control and its associated switch and lamp on the control panel places the printer and keyboard in off-line or on-line modes. The motor control start indicator from the channel control circuit turns on the set motors upon a signal from the printer Receive Message lead.

3.25 The output of the mode control is a set clock frequency (2.27 and 2.29) used to gate data through the distributors and the receive control signal regenerator. The mode control interfaces with the alarms and control or alarms and automatic control circuit by the printer, punch, reader, and receive message leads. These leads control the components when the set is in the local mode, and signals an alarm condition to the operator that one of these components is being used or the set is not in the sending mode. When the set is in the on-line mode and the alarms and automatic control circuit is used, the seizure of the component may be accomplished by remote control.

RECEIVING

3.26 The receive control circuit interfaces with the set control, tape punch control, printer control, channel control, and the data set. (Refer to Figure 11 and 2.39 through 2.43) Information bits (data) can be received from three sources: receiving data from the data set via the regenerator, sending data from the on-line distributor, and local data from the local distributor. The receive control receives half or full duplex signaling and accepts an EIA data signal (pin 20) from the signal line via the data set and regenerator.

3.27 Receiving voltages are marking between -3 volts to -25 volts and spacing between +3 volts to +25 volts. Spacing signals greater than 0.5 bit in length forces the regenerator to cycle and monitor the line for the duration of one character.

Receiving Device

3.28 The selector magnet driver circuit receives one input, serial data, which is amplified to power the selector magnet on the page printer unit and tape reader. This driver circuit is under the control of the set logic (Figure 12) and the input is supplied with mark and space signals corresponding to received data. A logical one signal (mark) will cause the selector magnet to be energized and a logical zero signal (space) will de-energize the selector magnet.

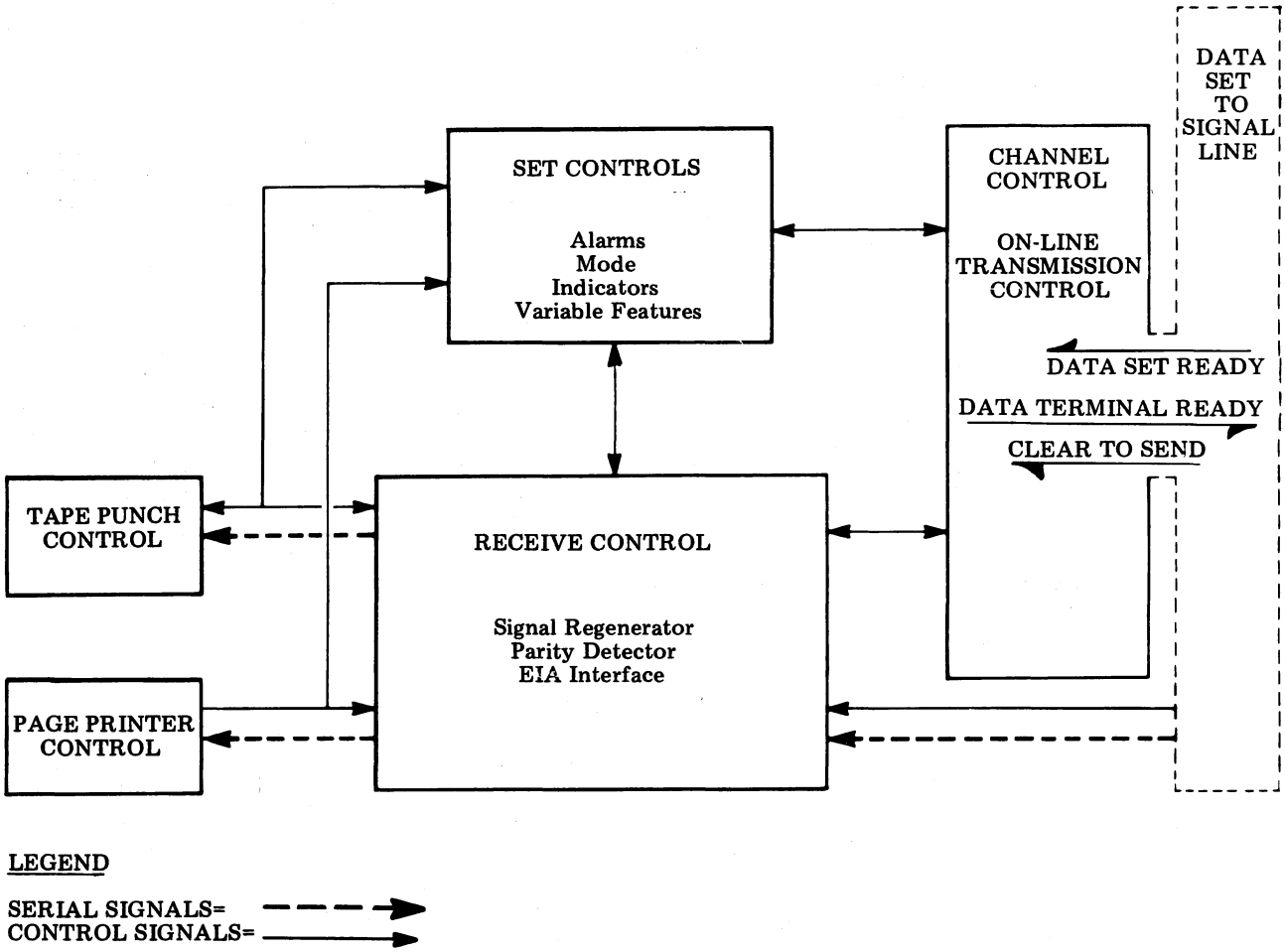

Figure 12 - 37 ASR Receiving Signal Flow Chart

3.29 The motor control relay driver receives two inputs, Receive Message and Motor Start signals. These inputs are connected together in a logical or configuration. A logic zero input will energize the motor control relay and be released on a logic one input.

Two-Color Ribbon (Optional)

3.30 The operation of the two-color ribbon option depends upon stunt box recognition of control character sequences ESC3 (red ribbon) and ESC4 (black ribbon). This results in a low level input to the ribbon magnet driver, energizing the ribbon magnet assembly and causing the printer to print the data in red.

3.31 The ribbon magnet will remain energized until the end of the transmitted message (EOT signal) at which time a normalize pulse resets the ribbon control latch. The operation of this latch de-energizes the ribbon magnet and the next characters are printed in black. Black printing can be re-initiated during a message by a black ribbon bit sequence generated from the keyboard. This sequence, ESCAPE followed

by the character 4, is detected by the stunt box which causes the ribbon control latch to reset. The ribbon amplifier is switched off and the ribbon magnet is de-energized.

4. REFERENCES

Associated Wiring Diagrams

4.01 The wiring diagram package is packed and shipped with the equipment. The wiring diagram package includes all the associated circuit descriptions and wiring diagrams for the circuit cards.

4.02 The following is a list of wiring diagram package (WDP) numbers for the 37 sets:

Switched Network:

WDP0309 Wiring Diagrams for RO, KSR, ASR Sets
WDP0125 Circuit Card Set RO
WDP0126 Circuit Card Set KSR
WDP0127 Circuit Card Set ASR
WDP0128 Circuit Card Set RT
WDP0306 Wiring Diagrams for RT

Point-to-Point Private Line:

WDP0318 Wiring Diagrams for RO, KSR, ASR Sets
WDP0243 Circuit Card Set ASR
WDP0244 Circuit Card Set KSR
WDP0245 Circuit Card Set RO
WDP0128 Circuit Card Set RT