37 ELECTRICAL SERVICE UNIT

YESU803, 806, 814, 815, 823, AND 826

DESCRIPTION AND OPERATION

CONTENTS PAGE

1. GENERAL

1.01 This section provides the description and operation for the 37 electrical service units (Figure 1) that are used in 85A2, 86A2, and 86B2 data selective calling applications. 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.

Prepared for American Telephone and Telegraph Company by Teletype Corporation

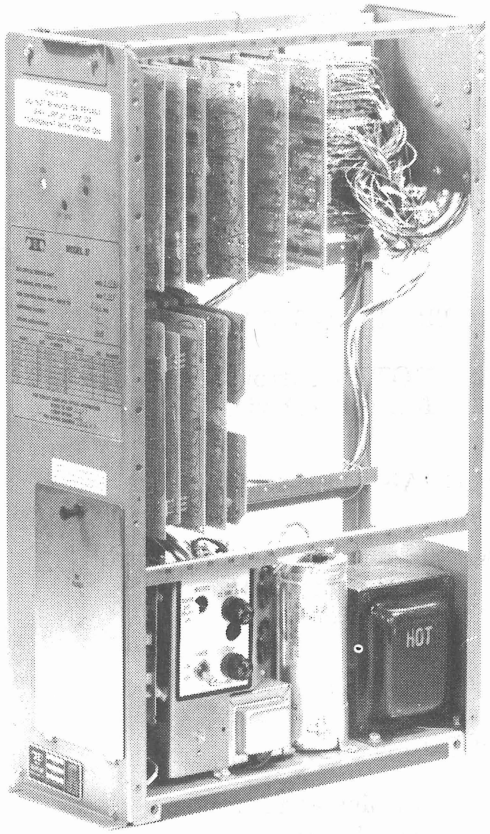

Figure 1 - 37 Electrical Service Unit (YESU826)

1.02 The 37 electrical service unit provides the electrical facilities for the 37 teletypewriters (Figures 2, 3, and 4), that were designed to operate in the full and half-duplex data selective calling service.

1.03 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 the 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 and the Receive-Only Typing Reperforator (ROTR) use different electrical service units.

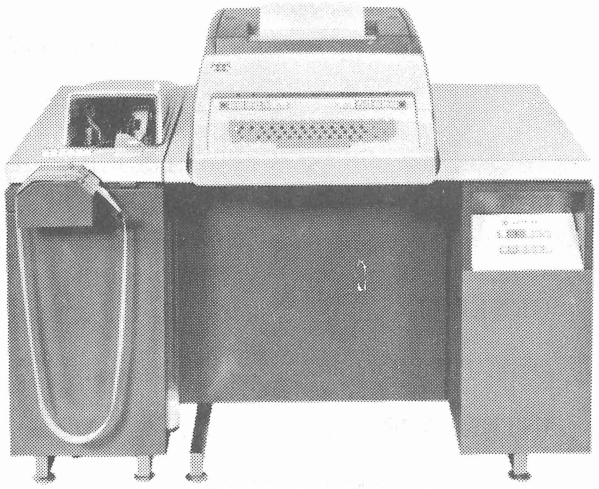

Figure 2 - 37 Primary ASR Set

Figure 3 - 37 Primary RO Set

2.02 The electrical service unit (ESU) provides for circuit cards that contain logic for the set controls, component controls, and power supply regulator. 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.

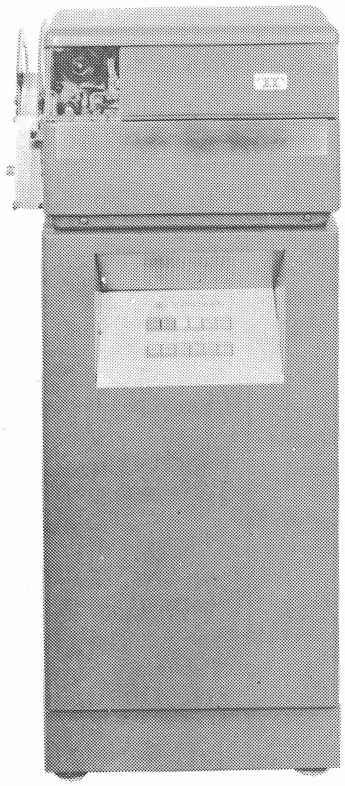

Figure 4 - 37 Primary ROTR Set

2.03 The variations for the different set operations are achieved by the selection of plug-in circuit cards. Integrated circuits have been used extensively on the circuit cards. The control logic circuits interact with the control panel located above the keyboard. Indicator lamps are associated with the pushbuttons on the control panel.

INTERFACE

2.04 The ASR, RO, and ROTR electrical service units have a cable terminated in a plug, P303, for connecting to the station controller and its associated equipment. The interface lead designations are shown in Table A. Except for the two ground leads, all interface signals are voltage levels having the specifications shown in Table B. The ASR electrical service unit also has a cable terminated in a 50-pin plug, P310, connecting it to the RT module. The interface lead designations for this cable are shown in Table C.

AUTOMATIC SEND-RECEIVE UNIT

2.05 The 37 Automatic Send-Receive (ASR) electrical service unit is mounted in the lower left portion of the main cabinet. The standard components and circuit cards of a typical ASR unit are shown in Figure 5. A variation of the ASR electrical service unit, utilizing a separate utility strip, is shown in Figure 6. The utility strip contains the power cord, circuit breaker, convenience receptacles, motor control relay, and copylight transformer. The electrical service unit in Figure 5 (YESU826) contains these features in the main frame, and does not need a utility strip. YESU806 (Figure 6), and YESU826 (Figure 5) are interchangeable.

2.06 Circuit cards for the ESU provide the set logic and component logic for the ASR set. Variable features for the circuit cards are outlined in Table D.

REPERFORATOR-TRANSMITTER UNIT

2.07 The electrical service unit for the reperforator-transmitter (RT) module provides the control logic circuit cards, motor control relay, and internal wiring (Figure 7) 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 cabling and power cord to interface with the main table containing the keyboard and typing unit to form an automatic send-receive set (Figure 2).

2.08 The control circuits required for the RT module are the reader driver and control logic and the receiving device logic cards. The reader driver circuit card adapts the reader to asynchronous operation. The card contains the reader controls, alarms, and storage-sample logic circuitry. The receiving device logic card contains the selector magnet driver for the punch and the motor control circuit for the punch and reader. For information concerning the description and operation of the receiving device logic card, refer to 2.33.

2.09 A variation of the electrical service unit for the RT module is shown in Figure 8. Only the physical configuration of the two electrical service units differs. YESU823 (Figure 7) and YESU803 (Figure 8) are interchangeable.

TABLE A

DATA AUXILIARY SET INTERFACE LEAD DESIGNATIONS (P303)

PIN NO.	KSR/ASR	RO	ROTR
1,2,3	Circuit Ground	Circuit Ground	Circuit Ground
11	Spare	Spare	Manual Tape Feed-Out Control
12	Selected to Receive	Spare	Spare
14	Character Detected	Character Detected	Character Detected
16	Send Data	Ground at RO Terminates Data Auxiliary Set (DAS) Logic	ROTR Does Not Terminate DAS Logic
24	Motor Control	Motor Control	Motor Control
25	Spare	Space	Automatic Tape Feed-Out Control
27	Form Feed or Tabulation in Process	Form Feed or Tabulation in Process	Tape Feed-Out in Process
29	EOT Punched	Spare	Spare
30	Reader Status	Vcc at RO Terminates DAS Logic	Vcc at ROTR Terminates DAS Logic
31	Paper Alarm	Paper Alarm	Low Tape
33	Unattended	Ground at RO Terminates DAS Logic	Ground at ROTR Terminates DAS Logic
34	Off-Line	Vcc at RO Terminates DAS Logic	Vcc at ROTR Terminates DAS Logic
36	Taut Tape	Spare	Spare
37	Tape Available	Ground at RO Terminates DAS Logic	Ground at ROTR Terminates DAS Logic
40	Reader On	Spare	Spare
42	Unattended	Ground at RO Terminates DAS Logic	Ground at ROTR Terminates DAS Logic
43	Receive Data	Receive Data	Receive Data
44	Form Feed Detected	Form Feed Detected	Spare
49	Tape Reader Control	Spare	Spare
50	Frame Ground	Frame Ground	Frame Ground

TABLE B

INTERFACE VOLTAGE LEVELS

DESCRIPTION	LOW	HIGH
TTY to Data Auxiliary Set	0.0 volt Min +0.5 volt Max	+3.2 volts Min +5.5 volts Max
Data Auxiliary Set to TTY	-0.7 volt Min +0.95 volt Max	+2.0 volts Min +8.0 volts Max
Receive Data Lead	-25 volts Min +0.5 volt Max	+3.0 volts Min +25 volts Max

TABLE C

RT MODULE INTERFACE

LEAD DESIGNATIONS

PIN NO.	LEAD DESIGNATION
2	Punch Motor
4	Punch Data
15,16	-12 Volt Buss
17,18	+12 Volt Buss
19	Message Available
21	Reader Status
22	Present Character
23	Character Available
24-31	Parallel Data Bits
32	Taut Tape
33	Reader On
34	Tape Available
35,36	Circuit Ground
40,41	Vcc

TABLE D

37 SET VARIABLE FEATURES

FEATURE	CIRCUIT CARD	OPTION
Two-color printing	Two-color ribbon control	Two-color ribbon
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

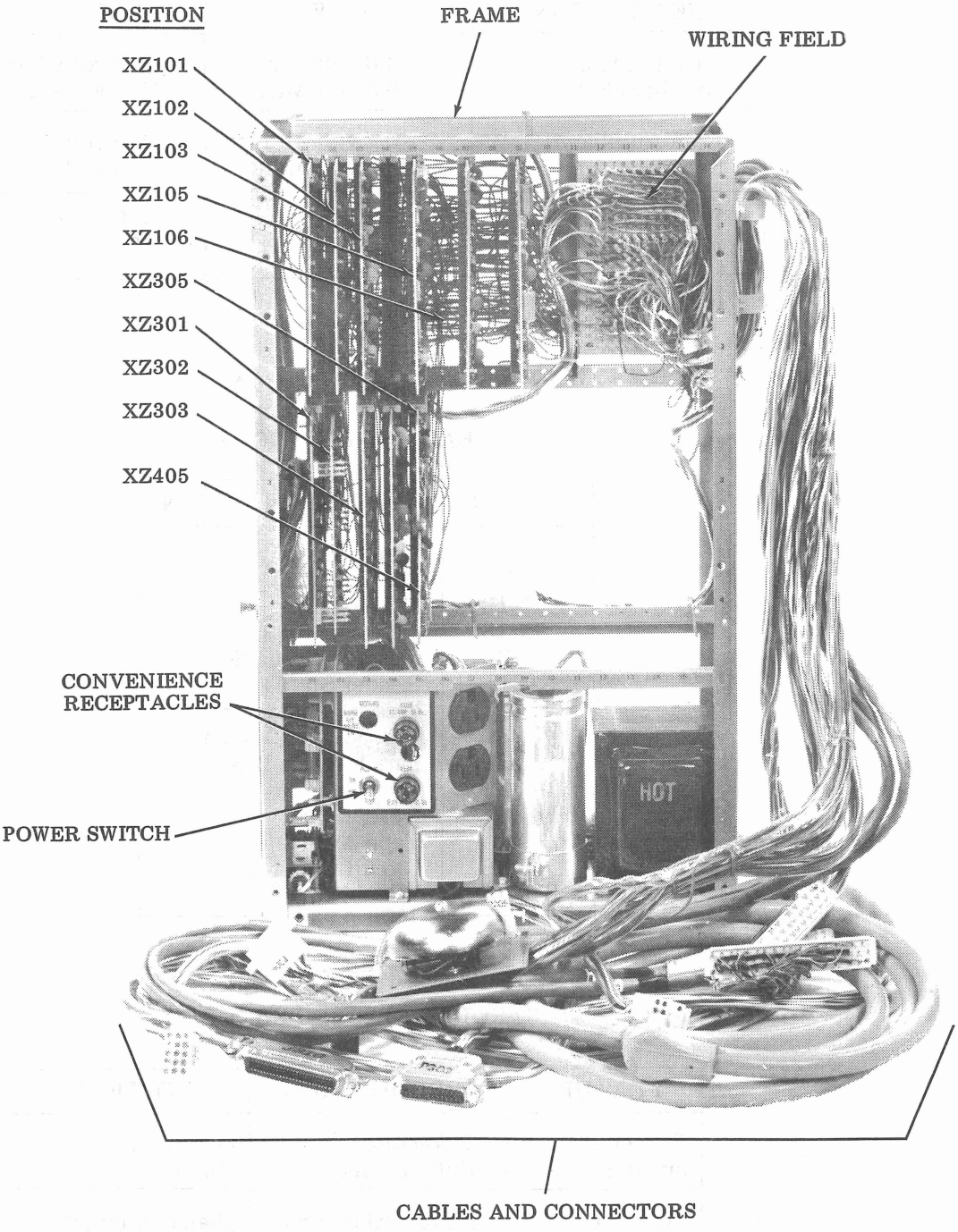

Figure 5 - 37 Electrical Service Unit (YESU826)

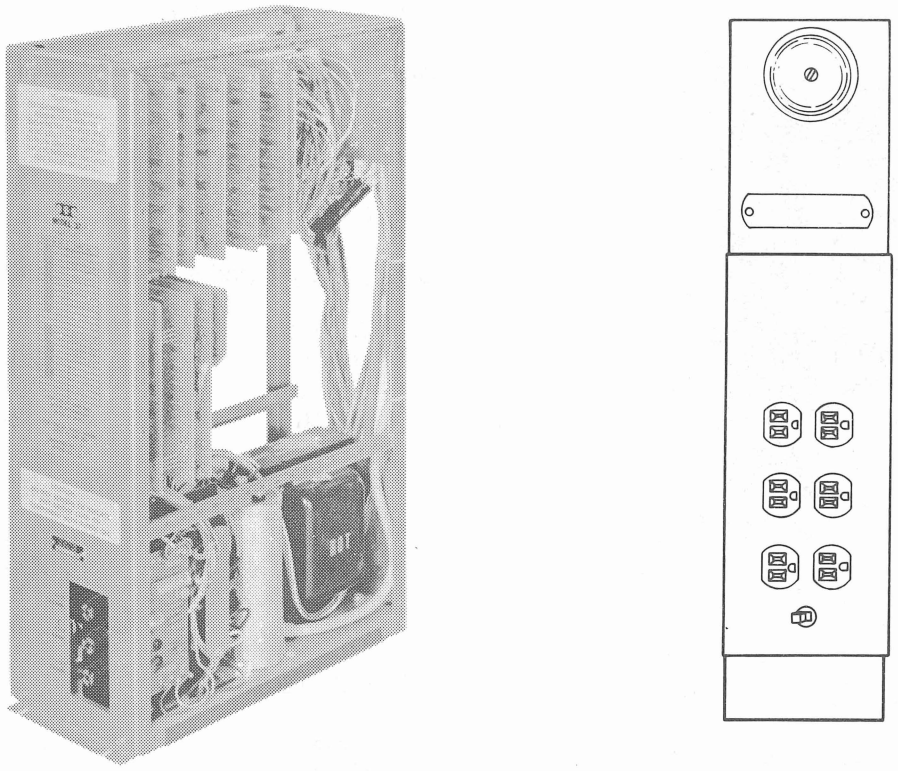

Figure 6 - 37 Electrical Service Unit Variation (YESU806 With Utility Strip)

RECEIVE-ONLY UNIT

2.10 The electrical service unit for the RO set controls the equipment needed for the set to receive data either as a primary receiver using a data auxiliary set, or as an auxiliary to another teletypewriter set by direct connection to the primary set.

2.11 The receive-only electrical service unit is equipped with a power supply, receiving device logic card, RO control card, associated wiring, and interface cables for a printer, motor, control panel, and data auxiliary set.

RECEIVE-ONLY TYPING REPERFORATOR

2.12 The electrical service unit for the receive-only typing reperforator, like the RO unit, contains the equipment needed for the set to receive data either as a primary receiver using a station controller or as an auxiliary to another teletypewriter set by direct connection to the primary set.

2.13 The receive-only typing reperforator electrical service unit is equipped with a power supply, receiving device logic card, ROTR control card, associated wiring, and interface cables for a punch, motor, control panel, and station controller.

TECHNICAL DATA

A. Code and Signal Characteristics

2.14 The 37 electrical service unit is designed to process the ASCII (American National Standard Code for Information Interchange) combinations. The ASCII is an 8-level code. Seven information bits plus one parity bit are transmitted by the Model 37 System. The code is 10 units at 150 wpm. The keyboard has parallel 11-wire output with even code parity which is translated to a serial 8-level code by the system logic for transmission.

2.15 The set interfacing conforms to the lead designations shown in Table A and Table C.

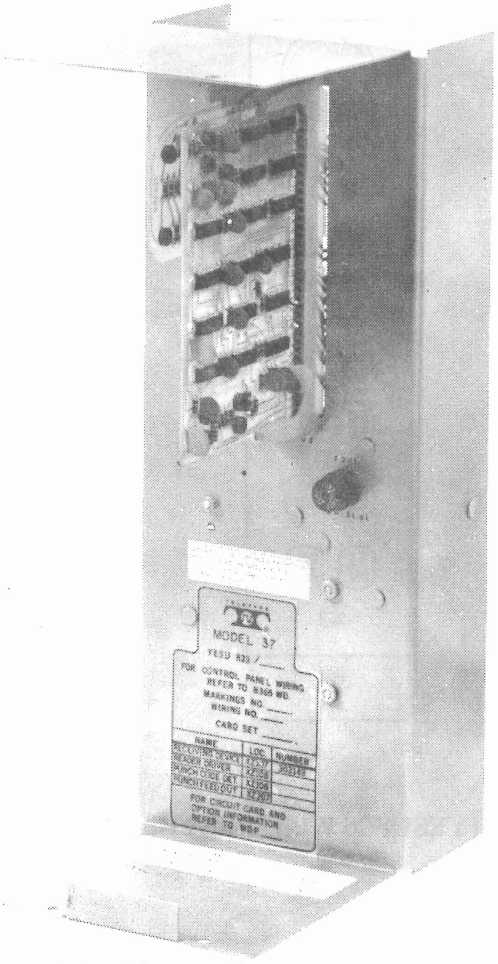

Figure 7 - 37 RT Electrical Service Unit (YESU823)

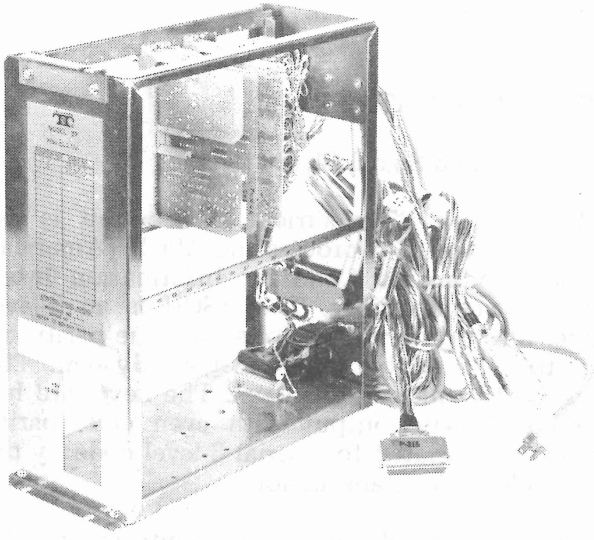

Figure 8 - 37 RT Electrical Service Unit Variation (YESU803)

B. Physical Characteristics

ASR Unit (YESU806, YESU826)

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

Utility Strip (used with YESU806)

Weight	.9 pounds
Height	.20-1/2 inches
Width	5 inches
Depth	2-1/2 inches

RT Unit (YESU823)

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

RT Unit (YESU803)

Weight	13 pounds
Height	.14-1/2 inches
Width	5-3/4 inches
Depth	.13 inches

RO Unit (YESU815)

Weight	22 pounds
Height	.20 inches
Width	5-3/4 inches
Depth	.13 inches

ROTR Unit (YESU814)

Weight	22 pounds
Height	.15 inches
Width	5-3/4 inches
Depth	.13 inches

C. Power Requirements

115 volt $\pm$10%, 50 to 60 hertz $\pm$1% (YESU806, ASR variation is 60 hertz, $\pm$0.75%), single-phase 15 amp, fused circuit. Cable — 3-wire, grounded plug

ASR (including RT module)	.300 volt-amperes
RO Set	.100 volt-amperes
ROTR Set	.100 volt-amperes

D. Heat Load

RO	350 BTU/HR (maximum)
ROTR	350 BTU/HR (maximum)
ASR	1050 BTU/HR (maximum)

E. Environment

Temperature Ranges —

This equipment is intended to be operated in a room environment within the temperature range of 40°F to 110°F. Serious damage to it could result if this range is exceeded. In this connection, particular caution should be exercised in using acoustical or other enclosures.

Ambient Storage Temperature

Minimum	-40°F
Maximum	+150°F

Relative Humidity

Minimum	0%
Maximum	95%

ASR CIRCUIT CARDS

2.16 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

2.17 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 "piggyback" mounting of the character counter logic card for specific ASR applications.

2.18 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. Character Counter

2.19 The character counter is a 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.

2.20 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.

2.21 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.

2.22 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, 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.

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

2.25 The send control card is designed to coordinate the sending devices (keyboard and reader) for operation with the line or local transmitting distributor. The send control circuit interacts with the 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 from the power supply and regulator circuit. The DTL signal logic is described in Table E.

TABLE E

DIODE TRANSISTOR LOGIC (DTL)

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

2.26 The data bits are converted to interface voltage levels by a portion of the send control circuit. Transmission control information is related to the send control from the station controller.

E. Mode Control I

2.27 The mode control circuit has three states, off-line, on-line, or unattended. The connection of the transmitting and receiving devices in each of these modes is shown in Table F.

2.28 The mode control circuit contains a set clock for units operating at 150 wpm with 10-unit code. The set clock is a crystal controlled, astable multivibrator operating at 128 times the bit rate.

2.29 The mode control circuit interacts with the control panel located above the keyboard. When the desired mode control switch on the control panel is depressed, the indicator lamp in the switch lights and the unit enters that mode.

2.30 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.

F. Receive Control

2.31 The receive control card directs receive signals to the appropriate receiving devices. The circuit receives serial input signals

TABLE F

MODE CONTROL ARRANGEMENTS

Mode	Printer	Punch	Reader	Keyboard	PUNCH ON
	Connected To				Control
On-Line	Line	Local Ckt	Line	Local Ckt	Always ON (ineffective)
Off-Line	Local Ckt	Local Ckt	Local Ckt	Local Ckt	Effective
Unattended	Line	Disconnected (See Note)	Line	Disconnected	Always OFF (See Note) (ineffective)

Note: In addition to the modes described above, Mode Control II circuit card provides for variations described in 2.47.

and provides serial output signals. An input amplifier receives incoming on-line signals. Signals generated locally are received directly from the sending distributors.

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

Paper Alarm Indication
Bell Driver
Form Feed Detection
Tabulation
Character Detected

G. Receiving Device

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

H. Counter Control

2.34 The counter control circuit card assembly is intended to be used in conjunction with the character counter circuit card. The counter control 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.

2.35 The circuit is capable of counting up to 255 keyboard generated characters. On the 256th character, the counter is reset to 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 or optional new line character is detected. The circuit is programmable to any line length up to 256 by proper strapping on the card. When the counter is at zero, further down counting is prevented by the zero stop control.

2.36 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.

I. Reader Driver

2.37 The reader driver circuit adapts the reader to asynchronous operation. The card contains the reader controls, alarms, and storage-sample logic circuitry. An additional circuit provides a single step feature that allows the reader to send one character per operation of an externally mounted switch.

2.38 The logic inputs of the circuit card assembly are DTL inputs. The logic outputs of the circuit card assembly are either DTL outputs for driving integrated circuit logic, or transistor driver outputs for driving either lamps or the reader magnet.

RO CIRCUIT CARDS

A. RO Control

2.39 The RO control circuit card assembly provides an interface between the printer and the station controller. Contact closures by the printer utilize the circuit card logic to provide controller interface signals, initiate electrically operated functions, operate a signal device, and control an auxiliary receiver.

2.40 The logic inputs of the circuit card assembly are DTL inputs. The logic outputs of the circuit card assembly are either DTL outputs for driving integrated circuit logic, or transistor driver outputs for driving either lamps or magnets.

B. Receiving Device

2.41 The receiving device in the RO electrical service unit is the same as the receiving device described for the ASR in 2.33.

ROTR CIRCUIT CARDS

A. ROTR Control

2.42 The ROTR control circuit card assembly provides an interface between the punch and the station controller. Circuits included on this card are tape feed-out control, tape feed-out driver, print suppression driver, backspace driver, character detected amplifier, and tape alarm.

2.43 The logic inputs of the circuit card assembly are DTL inputs. The logic outputs of the circuit card assembly are either DTL outputs for driving integrated circuit logic, or transistor driver outputs for driving either lamps or magnets.

B. Receiving Device

2.44 The receiving device in the ROTR electrical service unit is the same as the receiving device described for the ASR in 2.33.

VARIABLE FEATURES

A. Two-Color Ribbon Control

2.45 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.

2.46 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 integrated circuit logic inputs to current levels appropriate for the operation of the ribbon magnet.

B. Mode Control II

2.47 The Mode Control II circuit card assembly allows the addition of an auxiliary receiver. In addition to the mode control arrangements described in Table F, Mode Control II provides for the following:

(1) An auxiliary receiver, either RO or ROTR, may be added to a RO or ASR terminal by adding interconnecting cables and circuit cards. The auxiliary unit will respond to:

(a) Local control by a pushbutton switch on the control panel and/or

(b) Remote control using the device control codes DC2 (on) and DC4 or ETX (off), ETX being the terminate code of a received message.

(2) The reperforator in the RT portion of the ASR can also be used (in the Unattended mode only) as a auxiliary receiver.

(3) The reperforator in the RT portion of the ASR can also be connected as a monitor to the printer of the ASR. In this arrangement (in the Unattended mode only) the reperforator will make a tape of the data received by the printer. This function is control panel initiated and is incompatible with (2) above. Its associated control panel switch is labeled RECV ON PUNCH.

(4) For the control of an auxiliary ROTR by a primary ASR, feed-out options are available after:

(a) Manual disconnect

(b) DC4 disconnect

(c) ETX disconnect

C. Oscillator

2.48 The oscillator circuit card assembly is designed to be used in conjunction with the Mode Control II circuit card. The oscillator attaches piggyback style to the mode control card and provides set timing (clock pulses) for the electrical service unit operation.

3. OPERATION

3.01 The electrical service unit operates with the set components and the station controller (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.

3.02 Information related to the circuit cards is covered in the wiring diagram package shipped with the equipment. The wiring diagram package includes the circuit descriptions and associated wiring diagrams for the set. The following operations require the associated wiring diagrams when a detailed analysis of the circuits is desired.

SENDING

3.03 The keyboard and reader logic circuits operate through common leads with the distributors (Figure 11). Control of these sending circuits is accomplished by the send control circuit. The condition for sending is met when the set is on, keyboard is idle, and bits 1 through 8 are marking. When a code pattern is generated by the keyboard, the data bits are presented to the keyboard logic circuit. The keyboard control logic converts the keyboard parallel input information levels to eight parallel output information levels representing ASCII characters. The send control card generates a Present Character (PC) signal which gates bits 1 through 4 to the output pins of the keyboard logic card. The PC input remains low for one bit duration. The bit latches are now primed 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 the 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

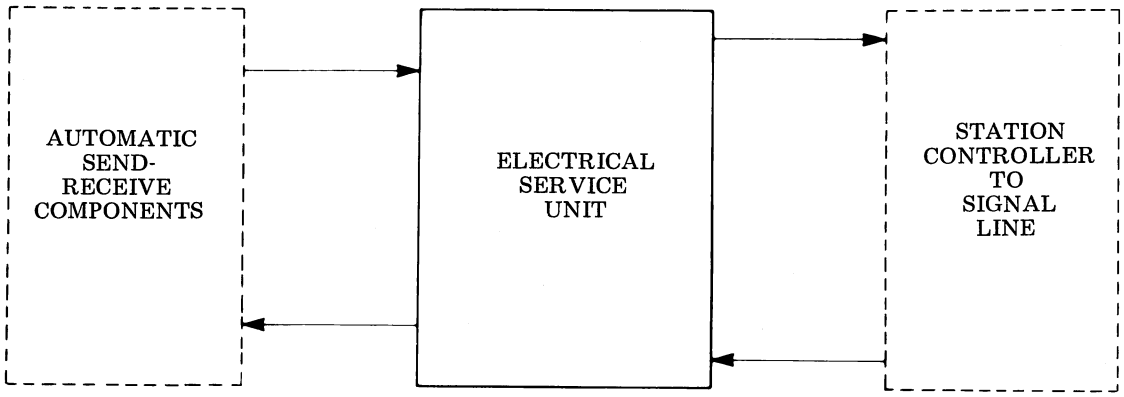

Figure 9 - 37 Automatic Send-Receive Flow Chart

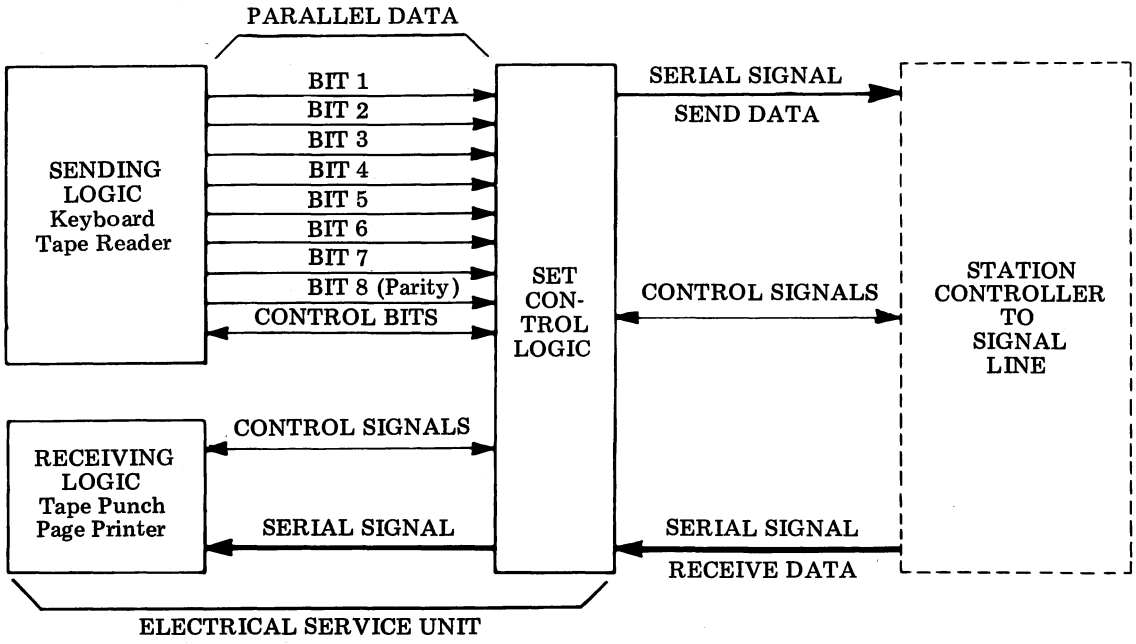

Figure 10 - Electrical Service Unit With Data Flow Chart

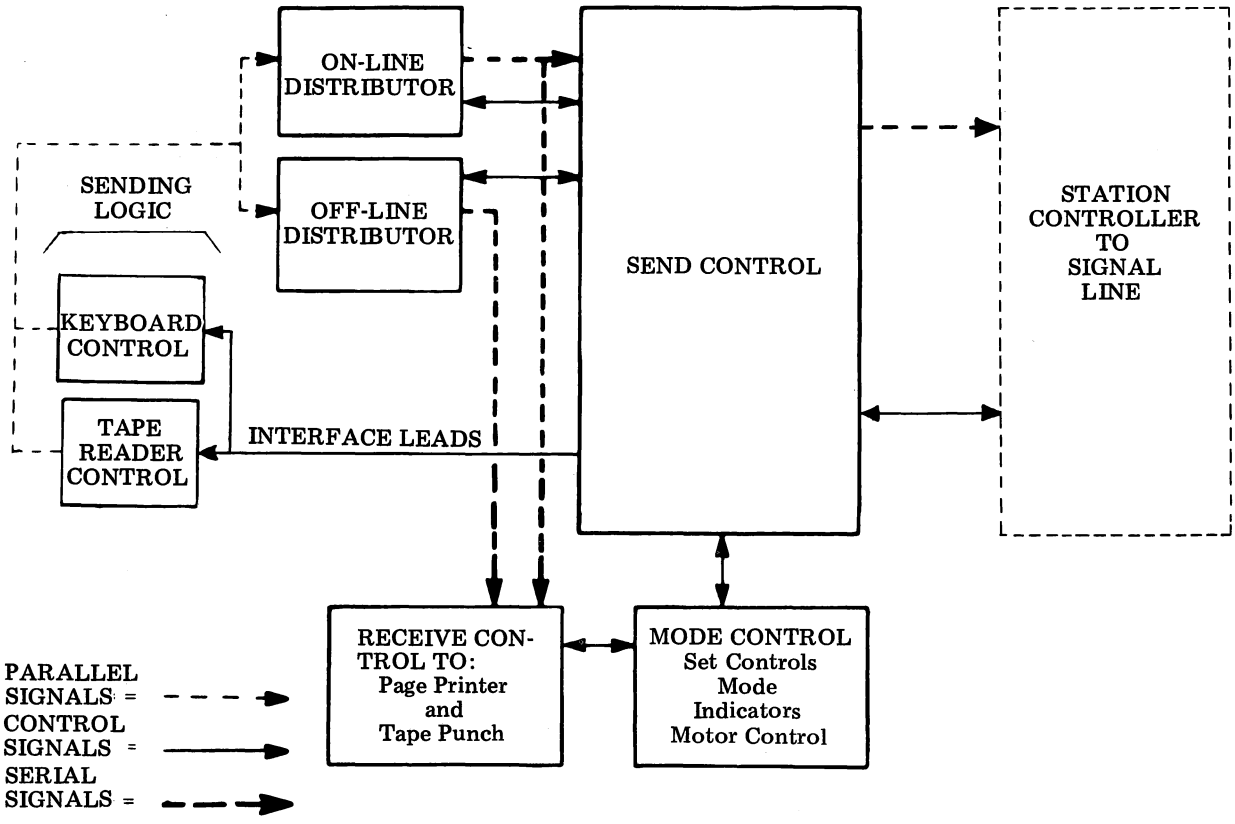

Figure 11 - 37 ASR Sending Signal Flow Chart

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 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, at which time the register will have all spaces stored in it. The distribution cycle will be complete at this time.

3.09 The inverted output of the TC 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 signal exchange between the keyboard, send control, and distributor, during local operation of the keyboard, occurs in the following manner. It is dependent upon keyboard Message Available (MA) and keyboard Present Character exchange between the keyboard and send control, and the local Take Character and local Present Next Character exchanged between the send control and the distributor.

3.12 When the terminal is in the Off-Line mode with the reader idle, the keyboard may be operated. Depressing a key switches keyboard MA low, simultaneously causing keyboard PC and local TC to turn on. Keyboard PC is latched on until reset by local PNC switching high. At 0.25 of a bit after local TC has switched low, starting the local distributor, a 0.25 bit long local SCS is generated. Local SCS together with keyboard PC allow the keyboard control circuit card to transfer parallel bits 1 through 8, set up in the keyboard contacts, on to the parallel data buss, where they will be sampled by the distributor for 0.25 of a bit, after keyboard SCS reverts high. At 0.25 of a bit after the sample period, the first clock pulse within the distributor causes local PNC to switch high, turning off keyboard PC and local TC. Local PNC remains high for 9 bits, the time required to serially shift a character

out of the distributor shift register. After this period, the distributor resets itself, switching PNC low, indicating its readiness to accept another character for distribution.

3.13 In reader local operation, the signal exchange starts when reader MA signal switches low, turning on reader PNC, providing tab is not in effect and no line TC is in progress. The reader recognizing PC on, with a character in storage, responds by turning on reader Character Available, which results in a local TC signal. From this point on, the sequence is identical to that described for keyboard local operation. Reader parallel data bits 1 through 8 are moved directly into a positive buffer storage; Shift Control Sample is not utilized and no extra gating such as that utilized on the keyboard control card is required. Reader MA switches low at the beginning of a message, and remains low for the duration of a message.

3.14 On-line operation is identical to local operation, except the signal exchange between the send control and the line distributor is enabled by the line PNC and line TC signals. The tape reader control lead from the station controller must be on (low) to enable the line PC gate. Reader PC assures that PC, once started, cannot be interrupted any sooner than 1 bit, should Message Available or reader tape control turn off within that time.

3.15 Since the line and local distributors share the same parallel data buss, garbling is prevented whenever the two transmitters are operating simultaneously, by using line TC to inhibit keyboard PC and local TC to inhibit reader PC, preventing any overlap of line and local distributor sampling periods.

C. Character Counter

3.16 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 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 one depending on the signal lead receiving a low signal.

3.17 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.

D. Counter Control

3.18 The operation of the counter control card depends upon input from the character counter card. The following outline describes a sequence of operations 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 0.5 bit time duration.

(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.

(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.

(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.

MODE CONTROL

3.19 The set control logic is contained in the mode control circuit card. The mode control selects line or local operation of each device in the set in response to the operation of the pushbuttons located on the control panel. The modes arrangements provided on this circuit are On-Line, Off-Line, and Unattended.

3.20 Selection of the On-Line mode latches the Off-Line and Unattended lamp driver inputs high. The On-Line lamp driver input latches low, turning on the ON-LINE lamp. The PUNCH ON lamp on the RT control panel lights and unblinds the punch, allowing the operator to keyboard data to the punch locally while receiving data on-line.

3.21 When Off-Line is selected, the On-Line and Unattended lamp driver inputs are latched high. The Off-Line lamp driver input latches low, turning on the OFF-LINE lamp. The Off-Line mode allows the operator to manually select the punch as a receiver by depressing the PUNCH ON pushbutton on the RT module.

3.22 In the Unattended mode, the Off-Line and On-Line lamp driver inputs are latched high. The Unattended lamp driver input latches low, turning on the UNATTENDED lamp. Unattended operation blinds the keyboard and punch from operation.

3.23 The mode control circuitry provides automatic mode selection upon application of power to the terminal. A time delay is provided so that the ON-LINE and OFF-LINE lamps remain off, latching the UNATTENDED lamp on.

3.24 The motor of a receiving printer is controlled by the maintenance switch located on the power supply or by the motor control lead from the data auxiliary set. When in the ON position the switch places a permanent ground on the motor control input logic which turns on the printer and punch motors. In the NORMAL position, motor control reverts back to the data auxiliary set via the motor control lead. The amplifier associated with this input controls the application of ac power to the motors by means of a dc controlled relay.

RECEIVING

A. ASR Units

3.25 The receive control circuit interfaces with the set control logic and the data set. An input amplifier receives incoming on-line signals. Signals generated locally are received directly from the sending distributors.

3.26 The receive control circuit can direct receive signals to the local printer, local punch, or an auxiliary receiver. The data gating circuit for each of the three receivers is identical. The gates are controlled by a common blind input and the mode control signal for the particular receiving device.

3.27 The Paper Alarm lamp driver is activated by the paper alarm transfer switch located on the printer.

3.28 The output of the bell driver is connected to the bell magnet coil through an inductive suppression network. When the normally open bell contacts close, the driver is pulsed on, energizing the magnet and producing a single ring of the bell.

3.29 The form feed detection circuit generates a form feed indication upon activation of the form feed transfer contacts located in the printer stunt box.

3.30 The Tabulation Latch is operated by the activation of the tab transfer contacts during a tabulation or form feed function. This results in simultaneous indications on the Tab Control and Tab Form Feed in Progress outputs.

3.31 The character detected circuit is used in conjunction with a typing unit equipped with character detected contacts. The contact output is processed through an active integrator and gated to produce a positive output pulse.

B. RO Units

3.32 The RO control logic circuit card interfaces between the controller and receiving device logic card. An input amplifier receives incoming on-line signals and inverts the signals before sending them to the receiving device logic card. An additional inverter provides a data signal for auxiliary receiver use.

3.33 The RO control logic card also contains a lamp driver circuit, bell magnet and print suppress magnet drivers, form feed indication, tabulation indication, motor start signal, paper alarm, character detected amplifier, and print suppression and auxiliary feed-out for an auxiliary punch device.

C. ROTR Units

3.34 The ROTR control logic circuit card interfaces between the controller and the receiving device logic card, and provides tape feed-out control and feed-out driver, print suppression driver, backspace driver, character detected amplifier, and tape alarm.

3.35 Serial input data is received by an inverting amplifier, which interfaces the signal line with the receiving device logic card. The tape feed-out will be interrupted if data is received while tape feed-out is in progress.

3.36 The tape feed-out is either initiated by a pushbutton or by the feed-out input from the controller. This permits a timed feed-out once for each message, provided that the motor start input is switched between messages. A tape feed-out cycle will be initiated at the end of a motor start cycle provided a tape feed-out command was not received during the motor start cycle. An adjustable resistor is provided to permit increasing (clockwise adjustment) or decreasing (counterclockwise adjustment) the length of the tape feed-out cycle.

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 and circuit descriptions for data selective calling electrical service units:

ASR Electrical Service Units:

WDP0209	Circuit Card Set ASR
WDP0211	Circuit Card Set RT
1010CD	Circuit Description — Electrical Service Unit ASR (YESU806)
1021CD	Circuit Description — Electrical Service Unit ASR (YESU826)
1011CD	Circuit Description — Electrical Service Unit RT (YESU803)
1025CD	Circuit Description — Electrical Service Unit RT (YESU823)

RO Electrical Service Units:

WDP0213	Circuit Card Set RO
1012CD	Circuit Description — Electrical Service Unit RO (YESU815)

ROTR Electrical Service Units:

WDP0216	Circuit Card Set ROTR
1013CD	Circuit Description — Electrical Service Unit ROTR (YESU814)

Data Selective Calling Service BSPs:

581-131-101	85A2 — 150 WPM Half-Duplex Operation — Description and Operation
581-136-101	86A2 — 150 WPM Data Station — Description and Operation
581-136-103	86B2 — 150 WPM Data Station — Description and Operation