

37 RECEIVE-ONLY (RO) TELETYPEWRITER SET
FOR "DATA-PHONE®" SERVICE
GENERAL DESCRIPTION AND OPERATION

CONTENTS	PAGE	CONTENTS	PAGE
1. GENERAL	1	CHANNEL TERMINATION	15
2. DESCRIPTION	2	5. REFERENCES	15
STANDARD FEATURES	2		
VARIABLE FEATURES	2	1. GENERAL	
COMPONENTS	3	1.01 This section provides a general description and operation of 37 Receive-Only (RO) Teletypewriter (TTY) Sets which are used in switched network service (Figure 1).	
A. Typing Unit	3	1.02 A 37 RO TTY Set is a heavy-duty terminal that functions with the ASCII (American National Standard Code for Information Interchange) and has EIA (Electronics Industries Association) Standard RS-232-B interfacing. The sets operate at a speed of 150 words per minute (wpm).	
B. Base	4		
C. Control Panel	5		
D. Motor Unit	5		
E. Typing Unit Cover and Pan	5		
F. Table	5		
G. Electrical Service Unit	5		
H. Data and Attendant Set	8		
ACCESSORIES	9		
A. Answer-Back Unit	9		
B. Paper Handling Accessories	9		
3. TECHNICAL DATA	9		
4. OPERATION	11		
GENERAL	11		
PERIPHERAL INTERFACE	11		
CHANNEL INTERFACE	11		
ORIGINATING AND ANSWERING	14		
LOCAL OPERATION	14		
A. Device Selection	14		
B. Motor Control	14		
LINE OPERATION	14		
A. Device Selection	14		
B. Channel Establishment	14		
C. Message Exchange	15		



Figure 1 - 37 RO Teletypewriter Set

SECTION 574-300-100

1.03 The styling and equipment are designed to complement modern office furnishings. The printed copy and equipment noise are comparable to that of an office typewriter.

1.04 References to left or right, front or rear, top or bottom, etc, apply to the set in its normal position with the operator facing the control panel.

1.05 The 37 RO TTY Station receives data in the form of voice frequency tones that are converted into voltage signals by a data set. The voltage signals are used by the RO set to copy the data on page size copy paper or business forms.

1.06 Figure 2 is a block diagram illustrating the use of 37 TTY equipment in a switched network application. It should help in understanding the overall capabilities of a 37 TTY set.

1.07 A data station with sending facilities may call another data station through their common central office. If Station A is a Keyboard Send-Receive (KSR) or an Automatic Send-Receive (ASR) TTY Set, it may send to Station B through their common central office. It may also call Station C using the switched network facilities between the two central offices.

1.08 A 37 RO TTY data station may be used to receive calls from a customer-provided computer D. The switched network permits the computer to call any of the data stations and transmit or request data.

2. DESCRIPTION

2.01 A typical RO TTY set (Figure 1) consists of the equipment listed under COMPONENTS.

STANDARD FEATURES

2.02 The following features are standard on RO sets:

- Modern modular design.
- Interfacing which conforms with EIA Standard RS-232-B.
- Receives at the speed of 150 wpm (15 characters per second) with a 10-unit code transmission pattern.

- Receives all 128 ASCII characters — prints 94 graphics including upper and lower case alphabet.

- Seventy-two characters on a line (10 per inch). Craftsman adjustable for shorter or longer lengths up to 80 characters.

- On-line backspace.

- On-line carriage return and line feed.

- Local carriage return.

- Local paper feed-out.

- Single color printing.

- Operator control of multiple copy.

- Operator control of vertical spacing.

- (a) 3 lines per inch.

- (b) 6 lines per inch.

- Roll paper (friction feed sets) or flat-folded, form-feed paper with marginal perforations (sprocket feed sets).

- Print position indicator (next character indicator).

- Print position scale.

VARIABLE FEATURES

2.03 In addition to the above standard features, certain options and accessories can be obtained which provide the following variable features:

- Two-color ribbon.

- Printed graphics extension (prints symbols for all 128 ASCII characters).

- Horizontal tabulation, on-line control.

- Vertical tabulation, on-line control.

- Half-forward, half-reverse, and reverse line feed.

- Nonrepeat form feed.

- Carriage return on receipt of NEW LINE, VT, or FF characters.

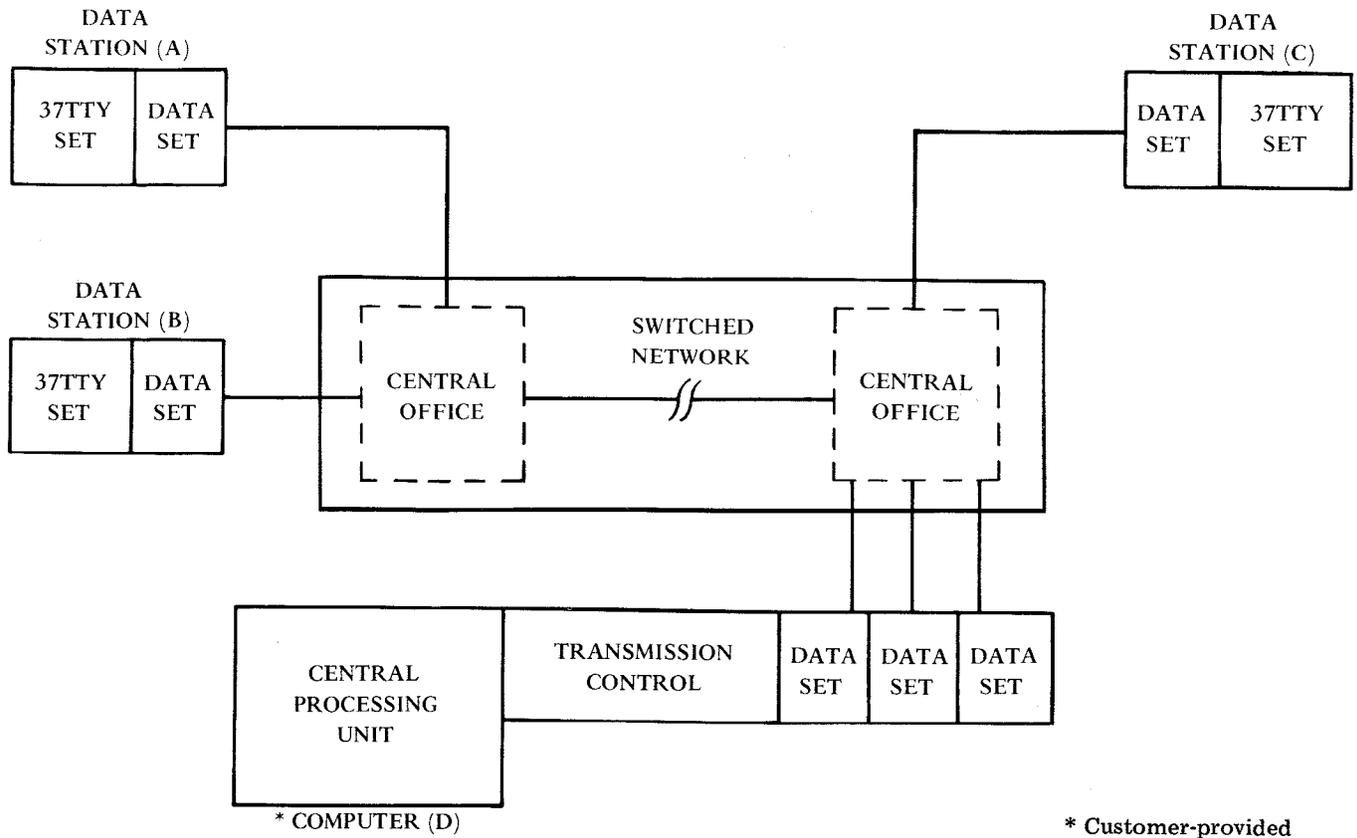


Figure 2 - Switched Network Application Using 37 Teletypewriter Equipment

- Optional operating speed of 100 wpm (10 characters per second) with an 11-unit code pattern.
- Front or rear loading of forms.
- Form accumulation shelf.
- Eighty-six characters on a line (12 per inch).
- Vertical tabulation (craftsman adjustable).
- Horizontal tabulation (craftsman adjustable).
- Shift-in, shift-out feature.
- Alarm indication for low-paper (friction feed sets) or paper-out condition (sprocket feed sets).
- Wide platen (132 character line) typing unit and cabinetry.
- Incorrect vertical parity indication.
- Answer-back triggered either automatically from data set, upon receipt of ENQ character, or manually with HERE IS pushbutton.
- Disconnect capability on EOT character.

COMPONENTS

A. Typing Unit

2.04 The typing unit (Figure 3) receives information serially by means of a single magnet (two coils) type of selector. A function box is provided for character and character sequence recognition.

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

2.06 The typing unit is capable of printing symbols for all 128 ASCII characters. Normally, however, it will be arranged to print the 94 graphic, numeric, and alpha characters of ASCII.

sprocket feed paper 14-7/8 inches wide. One-half inch is needed on each side of a page to allow for sprocket holes. The typing unit is capable of providing multiple copies consisting of one original and up to five carbons.

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

2.11 Optional paper positioning controls are provided for either friction feed or sprocket feed typing units:

(a) Form-Feed — When the typing unit detects the form-feed character, it will position the paper for printing on the first line of the next page. Pages up to 15 inches in length, adjustable by a craftsman, may be accommodated. The typing unit form feeds three lines during one character interval. Two successive form feeds are prevented unless there has been an intervening line feed.

(b) Horizontal Tabulation — This feature is a fixed tabulator stop type. The fixed stops are set by a craftsman to customer specifications.

(c) Vertical Tabulation — This feature is a fixed tabulator stop type. The fixed stops are set by a craftsman to customer specifications.

(d) Horizontal Tabulation On-Line Control — This is an on-line feature used to set and clear tabulation stops in the typing unit horizontal tabulation mechanism. The characters ESC 1 are used to set tabulator stops and the characters ESC 2 are used to clear the stops.

(e) Vertical Tabulation On-Line Control — This is an on-line feature used to set and clear the tabulation stops in the typing unit vertical tabulation mechanism. The characters ESC 5 are used to set the tabulator stops and the characters ESC 6 are used to clear the stops.

B. Base

2.12 The base provides mounting facilities for the typing unit, motor unit, and intermediate gear assembly.

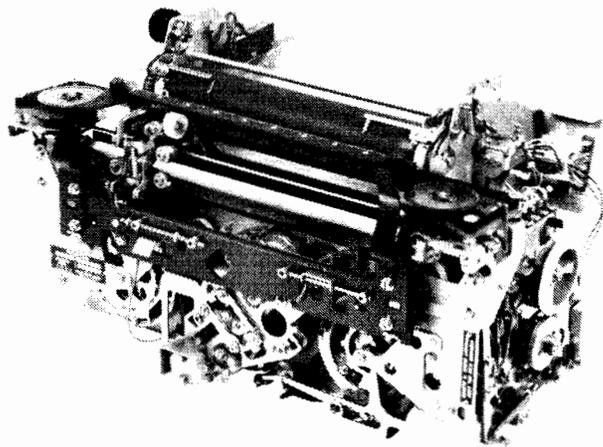


Figure 3 - 37 Typing Unit

2.07 Normally the typing unit will print ten characters per inch allowing 72 characters on an 8-1/2 inch platen with normal margins on the paper. Optionally, other typing units may be arranged to print 12 characters per inch allowing 86 characters on an 8-1/2 inch platen with normal margins on the paper. Line feed provides for spacing six lines of type per vertical inch.

2.08 Two types of paper feed options are available:

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

(b) A typing unit arranged with sprocket feed is capable of handling sprocket feed paper 11 inches long and 9-1/2 inches wide. One-half inch is needed on each side of a page to allow for sprocket holes. The typing unit is capable of providing multiple copies consisting of one original and up to five carbons.

2.09 An optional wide platen typing unit will print 132 characters per line at 10 characters per inch. The typing unit is available in sprocket feed only, and is capable of handling

C. Control Panel

2.13 The control panel (Figure 4), which is located on the front of the typing unit cover, contains a number of nonlocking push-buttons. In addition, there are two mechanical pushbuttons designated PAPER ADVANCE and LOCAL RETURN. A typical arrangement is shown in Figure 4. Functional descriptions of the different controls are given in Table A.

D. Motor Unit

2.14 The function of the motor is to provide mechanical rotating motion for operating the typing unit.

2.15 The motor is a synchronous type, rated at 1/20 horsepower, and is operated from a 117 volt ± 10 percent ac, single phase, 60 hertz ± 0.45 Hz source of commercial power. It consists of a 2-pole wound stator with two windings (a main running winding and a start winding), and a ball bearing rotor. The start winding is in series with a start relay, capacitor, and thermal cutout switch which are mounted in a compartment of the motor mounting cradle.

E. Typing Unit Cover and Pan

2.16 The typing unit cover and pan includes copylights and provides the housing for the typing unit, base, motor and control panel. The cover and pan with assembled components normally mount onto a table.

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

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

F. Table

2.19 The table provides a mounting surface for the typing unit cover and pan and the other components which the cover and pan houses. In addition, a compartment of the table provides facilities for mounting the electrical service unit. The power for the set components is obtained from the electrical service unit when its ac power cord is plugged into a commercial source of power.

2.20 A double-compartment table is available for both standard and wide platen units. Also available are two single-compartment tables for standard platen and one single-compartment table for wide platen units. Their dimensions are given in Figure 5.

G. Electrical Service Unit

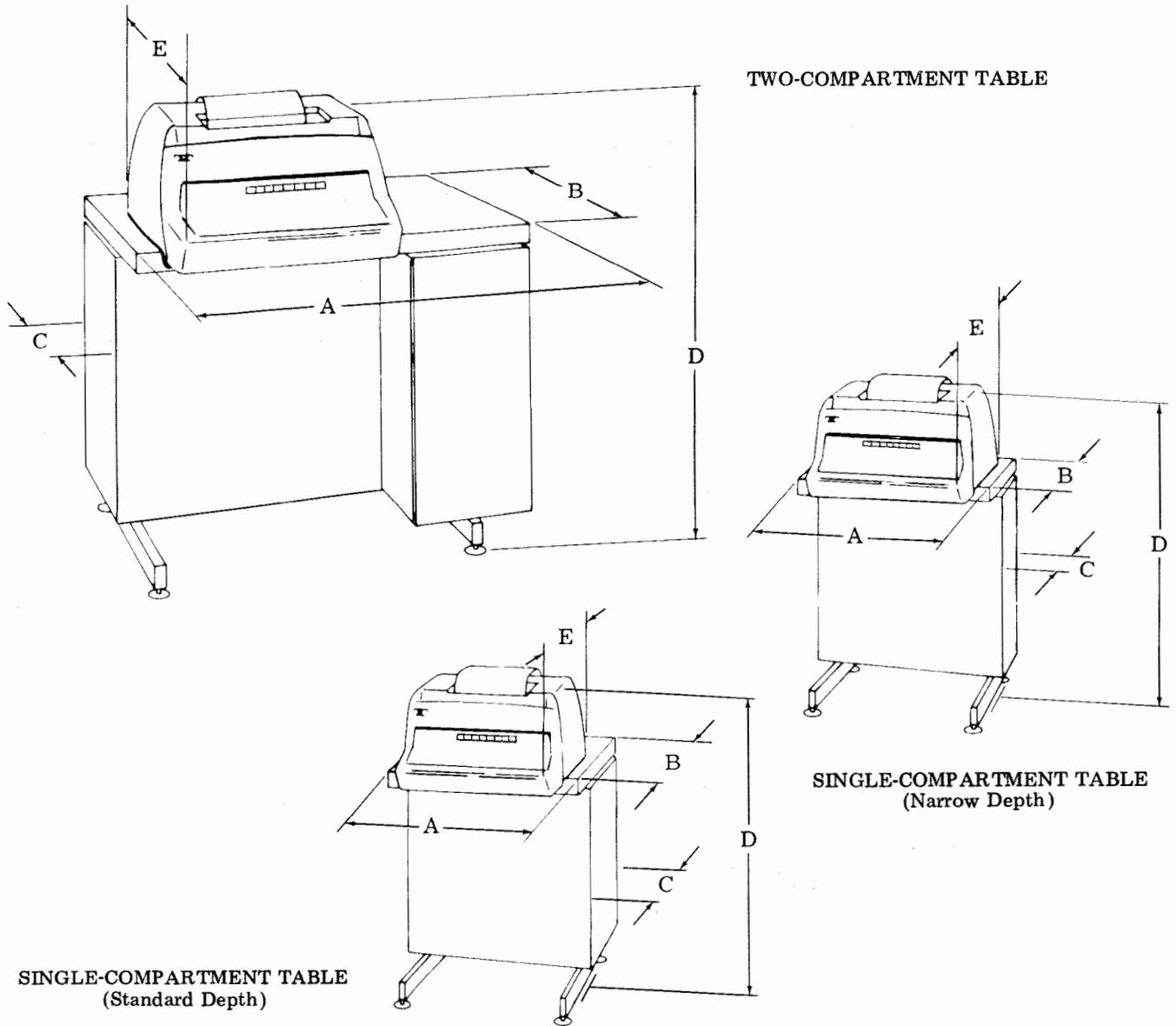
2.21 The electrical service unit (Figure 6) consists of a chassis assembly which mounts into the lower part of the knee well of the table. The chassis assembly has a multivoltage power supply, copylight transformer, motor control relay, fuses, duplex ac receptacle, a wiring field, and circuit card connectors. A set of circuit cards selected for a given arrangement provides the set logic (Table B). The cards mount into the card connectors.

PAPER ADVANCE	INTRPT	OFF LINE	HERE IS	OUT OF SERVICE	PAPER ALARM	ERROR	LOCAL RETURN
------------------	--------	----------	---------	-------------------	----------------	-------	-----------------

Figure 4 - Typical Control Panel Arrangement

TABLE A
CONTROLS DESCRIPTION

CONTROL (Figure 4)	FUNCTION
PAPER ADVANCE	Paper is fed out of the typing unit for as long as this pushbutton is held depressed. This is a local function only, and has no effect on the distant station.
INTRPT (interrupt)	When momentarily depressed, this pushbutton causes a timed (500 milli-second) spacing signal (break) to be sent on-line. It is used by the receiving station to interrupt transmission from the sending station.
OFF LINE	Depressing this pushbutton lights the associated indicator and activates the teletypewriter for use in the off-line (local) mode. A second operation of the pushbutton extinguishes the light and conditions the equipment for incoming calls. If this pushbutton is depressed while a data call is in progress, a disconnect will result.
HERE IS	When momentarily depressed, this pushbutton starts the local answer-back mechanism which causes a stored series of characters (such as station identification) to be sent. The answer-back only operates on-line.
OUT OF SERVICE	When this pushbutton is depressed, the associated lamp lights and the terminal will not respond to a data call. If the pushbutton is depressed while a data call is in progress, the out of service condition is effective immediately. Optionally wired, the out of service condition may be deferred until the end of the call. This mode is used for servicing the terminal, such as replacing the ribbon or replenishing the paper supply. Depressing the pushbutton again clears the lamp.
PAPER ALARM	When lighted, this lamp may indicate a low-paper supply condition. The lamp also optionally lights when a character is received with incorrect vertical parity. The lamp will be turned off by depressing the PAPER ALARM pushbutton if a parity error was received. When lighted by a low-paper condition, the lamp turns off only after the paper supply is replenished.
ERROR	Lamp turns on for a received parity error. Operation of the associated pushbutton clears the lamp.
LOCAL RETURN	When this pushbutton is depressed, the typing unit carriage returns to the left margin. This is a local function only, and has no effect on the distant station.



DIMENSION	TWO-COMPARTMENT (STANDARD AND WIDE PLATEN) (INCHES)	SINGLE-COMPARTMENT (STD DEPTH) (STANDARD PLATEN) (INCHES)	SINGLE-COMPARTMENT (NARROW DEPTH) (STANDARD PLATEN) (INCHES)	SINGLE-COMPARTMENT (WIDE PLATEN) (INCHES)
A	32-1/2	22-1/2	22-1/2	29
B	23	23	17-1/8	23
C	14-1/2	14-1/2	8-5/8	14-1/2
D	36	36	36	36
E	24-1/2	24-1/2	18-5/8	24-1/2

Figure 5 - 37 RO Sets — Dimensions

2.22 Wiring from the card connectors terminates at the wiring field which provides a centralized wiring location for the set. Cable assemblies with several plugs also terminate at the wiring field. The plugs connect to the typing unit, base, control panel, copylights, etc. An interface connector provides a signal interchange point which conforms with the EIA Standard RS-232-B.

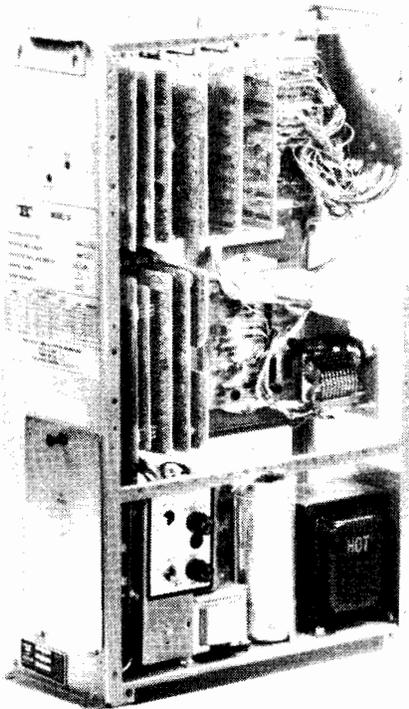


Figure 6 - Electrical Service Unit

TABLE B
CIRCUIT CARDS

Cards in Receive-Only Unit	Quantity
Mode Control	1
Receive Device Control	1
Receive Control	1
Alarms and Controls	1
Distributor	1
Send Control	1
Channel Control	1

2.23 An electrical service unit variation utilizes a utility strip (Figure 7). The utility strip is a separate chassis containing some of the components normally contained in the main chassis. These components are the copyright transformer, motor control relay, ac receptacles, a circuit breaker instead of a fuse, and the signal bell which is normally mounted separate from the main chassis.

2.24 The ac power for the set is provided over a single ac power cord which terminates at the electrical service unit main chassis. If the electrical service unit utilizes the utility strip, the ac power cord from the utility strip plugs into an externally provided ac receptacle, and the ac power cord from the electrical service unit main chassis plugs into an ac receptacle on the utility strip.

2.25 The multivoltage power supply converts ac power into appropriate dc power which is used for internal set operation, ie, the regulator, solenoids, lamp driver amplifiers, motor control relay, bell, integrated and discrete semiconductor circuits, etc.

H. Data and Attendant Set

2.26 The standard data set for 37 TTY DATA-PHONE service is Data Set 103H (Figure 8). This data set is a general purpose, full duplex, frequency shift keyed, serial

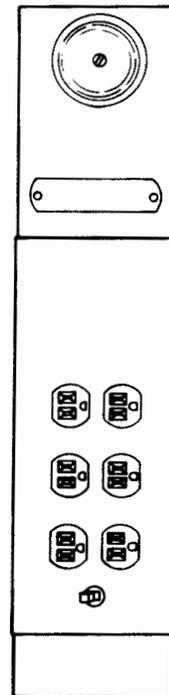


Figure 7 - Utility Strip

data transmission set that accepts voltage signals from the teletypewriter logic, and converts these signals into voice frequency tones. These tones are transmitted over the telephone transmission facilities to the receiving terminal, where a compatible data set converts the voice frequency tones into voltage signals.

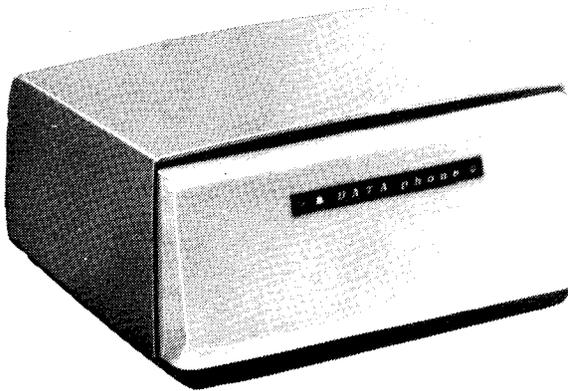


Figure 8 - Data Set 103H

2.27 The Data Auxiliary Set DAS804P-type (Figure 9) is available with the following dialing features:

- (a) Rotary dial
- (b) "TOUCH-TONE®" dial
- (c) Rotary and card dialer
- (d) TOUCH-TONE and card dialer.

Each type has associated with it, a hand telephone set, a loudspeaker, amplifier, loudspeaker control, ringer, and a set of combination push-button indicators (Table C). The pushbutton indicators are used to control calls, or test the data set.

ACCESSORIES

A. Answer-Back Unit

2.28 The answer-back unit provides for automatically transmitting a maximum of 20 characters for set identification. The unit consists of a mechanical device, an electronic circuit, and a mounting arrangement.

2.29 The mechanical device has a magnet which, each time it is pulsed and released, moves a 20-character codeable drum. Contacts ride tines of the drum. The electronic

circuit (answer-back driver card) drives the magnet and provides readout for the contacts.

B. Paper Handling Accessories

2.30 A number of paper handling accessories are available for sets with sprocket feed typing units. Modification kits are available for either front or rear loading of a standard box of paper forms. Front loading of forms can be used for forms up to 14 inches in length. Forms up to 15 inches long can be loaded from the rear of the table. A form accumulator is also available as an accessory.

3. TECHNICAL DATA

3.01 Electrical and Environmental Characteristics

- (a) Power 117 volts ac $\pm 10\%$,
60 Hz ± 0.45 Hz,
15 ampere fused circuits,
single phase (3-wire)
- (b) 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.
- (c) Ambient relative humidity . . . From 0 to 95 percent
- (d) Power consumption 300 watts

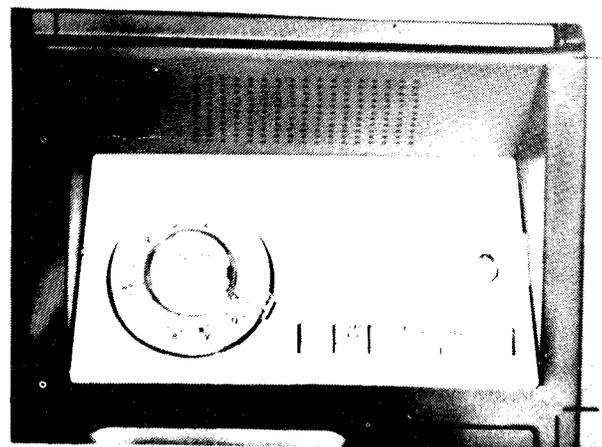


Figure 9 - Attendant Set Controls (Rotary Dialer) (DAS 804P5)

TABLE C
ATTENDANT SET CONTROLS

CONTROL (Figure 10)	FUNCTION
DATA	When this pushbutton is depressed, the associated lamp lights indicating that the station is in the data mode. In this condition, the telephone mode will not operate (even if the handset is not on the switch hook).
CLEAR/TALK	When depressed, this pushbutton clears (disconnects) a data call. The associated lamp lights for the duration of the clearing cycle. The station disconnects after the data portion of the call is cleared unless the handset is off its switch hook, in which case the call is placed in the telephone mode. This pushbutton (when depressed) also stops any actions initiated by a previously depressed DATA or TEST pushbutton, and turns off their associated lamp.
TEST	When this pushbutton is depressed, the associated lamp lights and the data set is conditioned for remote testing from a data test center.
AUTO	This pushbutton operates independently from the other pushbuttons. When the pushbutton is depressed, the associated lamp lights and the station is placed in condition for automatic answering. The AUTO answer mode is effective only when the station is ready to receive a call; for example, when paper supply is adequate.
LOUDSPEAKER	Call progress tones (dial tone, busy tone, etc.) are heard in this speaker when "hands free" calls are made.
VOLUME CONTROL	This control regulates speaker volume.

3.02 Physical Characteristics

- (a) Dimensions See Figure 5
- (b) Weight
 - Standard platen approximately 220 pounds
 - Wide platen approximately 245 pounds
- (c) Power cord
 - Purpose Provides ac power for entire set
 - Type Single 3-pin polarized cord
 - Length 8 feet from back of cabinet

(d) Interface cord

- Purpose Provides the EIA (Electronics Industries Association) interface
- Type 25-conductor plug
- Length6 feet

3.03

Set Internal Power Supply

(a) Multivoltage power supply

- Output voltages (dc) . . (nominal), +12.5 volts maximum 4 amperes
- (nominal), -12.5 volts maximum 3 amperes
- (nominal), +5.25 volts maximum 3 amperes

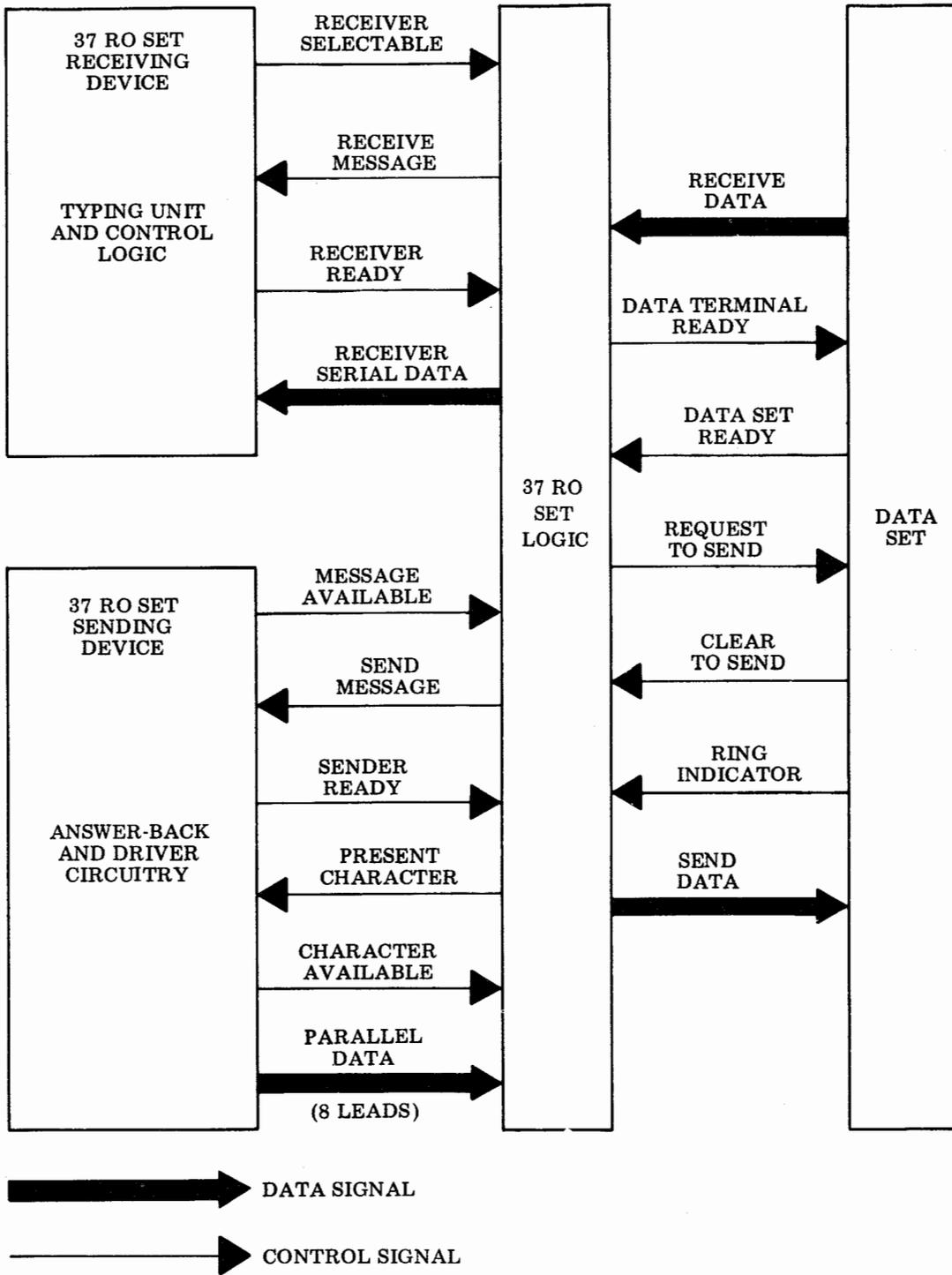


Figure 10 - 37 RO Set Peripheral and Channel Interface

TABLE D
EIA INTERFACE LEADS

DESIGNATION	NAME	PIN NO.	PURPOSE
AA	Protective Ground	1	To connect ac power service ground to equipment chassis. It is electrically isolated from signal ground.
AB	Signal Ground	7	To provide ground for all signal circuits.
BA	Transmitted Data	2	To carry set output data when the set is in the on-line mode and to remain "marking" when set is in the off-line (local) mode. <u>Note:</u> When equipped with an INTRPT pushbutton, this lead will carry a timed "spacing" signal of nominally 500 ms duration each time the pushbutton is operated.
BB	Received Data	3	To present incoming data to the set when the set is in the on-line mode. <u>Note:</u> If this lead is grounded at the interface, the set will act as if it were in the "marking" condition.
CA	Request to Send	4	To condition local line interface unit to transmit. This lead is connected permanently on by a strap in the set.
CB	Clear to Send	5	To inform terminal that local data set is ready to transmit any data presented on BA lead. <u>Note:</u> This lead controls the starting of the answer-back, if so equipped.
CC	Data Set Ready	6	To inform set that local data set is connected to the transmission facility. <u>Note:</u> When this lead is on, it causes set motors to start running.
CD	Data Terminal Ready	20	To inform data set that the set is ready to receive data messages. <u>Note:</u> The set is prepared to receive when: (a) No alarms are present. (b) Set is not in "do not answer" mode. (c) At least one receiving device is in on-line mode.

TABLE D
EIA INTERFACE LEADS (Continued)

DESIGNATION	NAME	PIN NO.	PURPOSE
CE	Ring Indicator	22	To inform set that ringing current is being received, ie, the start of a received call. <u>Note:</u> This lead primes the answer-back, if so equipped. When CB goes on, the answer-back will start sending automatically.

ORIGINATING AND ANSWERING

4.07 Data communication is started with the set in the idle condition — Request to Send (CA lead) permanently on, copylights off, and motor not running. Data Terminal Ready (CD lead) must be on, ie, an alarm condition must not exist and the receiving device is in the on-line mode. Under these conditions a data call can be answered.

4.08 While establishing a connection, the line interface unit at both the originating and answering sets should turn on the Data Set Ready (CC lead), remove the mark hold from Received Data (BB lead), turn on Clear to Send (CB lead). After Clear to Send, the set enables the Transmitted Data (BA lead). In addition, at the answering set, Ring Indicator (CE lead) is turned on after ringing occurs.

4.09 Ring Indicator (CE lead) at the answering set conditions the answer-back start logic circuitry so that when Clear to Send (CB lead) is turned on, a pulse is generated which starts the answer-back cycle, if so equipped.

4.10 When Data Set Ready (CC lead) at a set is turned on, the motor starts, and copylights go on. The reception of data by the RO set can now take place.

LOCAL OPERATION

A. Device Selection

4.11 The typing unit may be placed in the off-line condition by depressing the OFF LINE pushbutton on the control panel. The selected pushbutton lamp will light to indicate the selection of local operation.

B. Motor Control

4.12 The typing unit motor is started by selection of the OFF LINE pushbutton. A second depression of the OFF LINE pushbutton turns off the motor and returns the typing unit to the on-line mode.

LINE OPERATION

A. Device Selection

4.13 The receiving device is placed on-line by depressing the OFF LINE pushbutton on the control panel. A nonlighted pushbutton indication means line operation has been selected.

4.14 The typing unit must be selected for line operation if a call is to be received.

B. Channel Establishment

4.15 For stations equipped with telephone facilities, a call is placed and a connection between two stations is established before any teletypewriter data is transmitted. To answer the call, the called station must be in service and have no alarm conditions.

4.16 The calling station dials the called station, which turns on Ring Indicator. This primes the called station answer-back. Since the Data Terminal Ready lead is normally on (no alarms present), Data Set Ready turns on. This results in Clear to Send turning on and an indication that the connection is established.

C. Message Exchange

4.17 With Clear to Send on, messages may be transmitted from the sending terminal to the receiving terminal.

4.18 Data transmission can be stopped on receipt of an interrupt signal. Depressing the INTRPT pushbutton on the control panel (Figure 4) interrupts transmission from the sending terminal. Depressing the INTRPT pushbutton again clears the interrupt condition.

4.19 Data is exchanged between the transmitting and receiving sets at different stations using the line distributor for serialization.

CHANNEL TERMINATION

4.20 The sending terminal will be disabled (blinded) for further data transmission whenever either the on condition of Clear to Send (CB lead) is lost, the NAK character is received, or the interrupt signal is received. If Clear to Send (CB lead) is on, transmission from the sending terminal can be enabled again either manually by operating the INTRPT pushbutton or automatically by receipt of the ACK character.

4.21 The set will disconnect and data transmission will be automatically stopped upon receipt or transmission of the EOT character. The EOT signal causes Data Terminal Ready (CD lead) to momentarily turn off. With Data Set Ready (CC lead) on, the data set recognizes this condition as a request to disconnect and should cause disconnect to take place.

5. REFERENCES

5.01 The following sectionalized literature pertains to the 37 RO Sets:

<u>TITLE</u>	<u>NUMBER</u>
<u>RO SET</u>	
Installation	574-300-200
Removal and Replacement of Components	574-300-702

<u>TITLE</u>	<u>NUMBER</u>
<u>MOTOR UNIT</u>	
Description and Principles of Operation	570-220-100
Adjustments	570-220-700
Lubrication	570-220-701
Disassembly and Reassembly	570-220-702

<u>TYPING UNIT</u>	
Description and Principles of Operation	574-320-101
Adjustments	574-320-703
Lubrication	574-320-704
Disassembly and Reassembly	574-320-705

<u>TYPING UNIT BASE</u>	
Description and Operation, Adjustments, and Lubrication	574-331-100

<u>ELECTRICAL SERVICE UNIT</u>	
Description and Operation	574-322-102

<u>TABLE</u>	
Description and Operation	574-323-101
Adjustments	574-323-703

<u>TYPING UNIT COVER AND PAN</u>	
Description and Operation	574-326-101
Adjustments	574-326-703
Lubrication	574-326-704

<u>ANSWER-BACK UNIT</u>	
Description and Principles of Operation	574-325-101
Adjustments	574-325-703
Lubrication	574-325-704

