

Hardware [1]

Folder Citation: Collection: Records of the 1976 Campaign Committee to Elect Jimmy Carter;
Series: Noel Sterrett Subject File; Folder: Hardware [1]; Container 83

To See Complete Finding Aid:

http://www.jimmycarterlibrary.gov/library/findingaids/Carter-Mondale%20Campaign_1976.pdf

silent 700

electronic data terminals

silent 700

electronic data terminals

MODELS 743 AND 745 GENERAL SPECIFICATIONS

KEYBOARD

CODE: USASCII: 97 codes generated
CHARACTER SET: 64 printable characters;
33 control characters
NUMERIC KEY PAD: Embedded
calculator-style numeric cluster

PRINTER

METHOD: Non-impact, thermal page
printer; 5 x 7 dot matrix
CHARACTER SET: 69 printable characters
(received lower case translated to upper
case)
CHARACTER SIZE: 0.105 in. x 0.080 in.
LINE LENGTH: 8 inches; 10 characters/
inch; 80 characters/line
LINE SPACING: 6 lines/inch
PRINTING RATE: Switch-selectable 10 or
30 characters/second
PAPER: TI thermographic printing paper,
No. 972603 (white); 8½ in. x 100 ft.; last 10
ft. color coded.

PLATEN: Friction feed

VISIBILITY: At least 50 previous lines,
including current line and last character
printed

CARRIAGE RETURN (CR) AND LINE
FEED (LF): Automatic at column 81; no
code is transmitted

CR TIME: 195 msec. (no filler characters
required after CR)

LF TIME: 33 msec. (one character time)

OPERATOR CONTROLS

SPEED: 10/30 characters/second

DUPLEX: Half/Full

X-MIT LEVEL: Low-High

CONTRAST: Light-Dark

PAPER ADVANCE: 30 lines/second while
depressed

NUM: Activates numeric cluster

STATUS: On line/Local

INDICATORS

CARRIER: Carrier detect

BELL: 250 msec. audible tone

PHYSICAL

SIZE: Model 745: Width: 15.4 in.; Depth: 16.0
in.; Height: 4.6 in.; Model 743: Width: 14.6
in.; Depth: 15.25 in.; Height: 4.25 in.

WEIGHT: Model 745: 13.5 pounds (including
paper); Model 743: 11.2 pounds (including
paper)

POWER REQUIREMENTS

VOLTAGE: 115 volts RMS, + 10%-15%

FREQUENCY: 47-63 Hz.

POWER: 75 watts max.

ENVIRONMENT

TEMPERATURE: Operating: 10°C to 40°C;

Storage: -30°C to 70°C (without paper);

-30°C to 40°C (including paper)

HUMIDITY: Operating: 10% to 90% (no
condensation); Storage: 10% to 95% (no
condensation)

SHOCK: Operating: 0 g.; Storage 20 g. for 11
msec.

VIBRATION: Operating: 0.5 g., 10 to 60 Hz.;

Storage: 1.5 g., 5 to 500 Hz.

DATA TRANSMISSION

METHOD: Asynchronous; serial-by-bit,
serial-by-character

CODE: USASCII: 7-level;

11 bits/character

MODE: Half- or full-duplex

PARITY: Optional odd, even or mark; set at
factory

BUFFER: Character buffering on received
data, permitting true 30 characters/second
operation

COMMUNICATIONS INTERFACE

EIA: RS-232-C compatible (Model 743—
standard; Model 745—auxiliary)

TTY: 20 ma. dc-current loop (Model 743 only)

MODEM: Bell System 103/113 compatible
frequency shift keying; originate mode
(Model 743 only)

ACOUSTIC COUPLER: Bell System
103/113 compatible frequency shift keying;
originate mode (Model 745 only)

For more information, contact your nearest
TI office. Or, write Texas Instruments Incor-
porated, P.O. Box 1444, M/S 784, Houston
77001. Or call Data Terminal Marketing at
(713) 494-5115, extension 2126.

OTHER "SILENT 700" HEAVYWEIGHTS

AUTOMATIC SEND-RECEIVE TERMINALS

The field-proven "Silent 700" ASR
terminals combine the high performance of
magnetic tape cassette off-line storage with
the speed and quietness of the "Silent 700"
family in a totally integrated unit. Available

with a variety of options, including 120
characters-per-second transmission speed,
built-in acoustic coupler, remote device
control and automatic search control, the
"Silent 700" ASR terminals offer users a
powerful replacement for conventional ASR
paper tape teletypewriters.

RECEIVE-ONLY TERMINALS

Compact, fast and quiet, the "Silent 700"
RO terminals are ideal as hard copy devices
for minicomputers, CRT's, special purpose
microprocessors, monitoring systems and
data loggers. The RO terminals are available
with USASCII and Baudot/CCITT codes and
either EIA, TTY or bit parallel line interfaces.

733 ASR



743 KSR



755 RO



Texas Instruments reserves the right to make changes at any time in order to improve design and supply the best product possible.

TEXAS INSTRUMENTS
INCORPORATED

TI 338-50M-1/76

Printed in USA



silent 700

electronic data terminals

silent 700

electronic data terminals

MODELS 743 AND 745 GENERAL SPECIFICATIONS

KEYBOARD

CODE: USASCII: 97 codes generated
CHARACTER SET: 64 printable characters;
33 control characters
NUMERIC KEY PAD: Embedded
calculator-style numeric cluster

PRINTER

METHOD: Non-impact, thermal page
printer; 5 x 7 dot matrix
CHARACTER SET: 69 printable characters
(received lower case translated to upper
case)
CHARACTER SIZE: 0.105 in. x 0.080 in.
LINE LENGTH: 8 inches; 10 characters/
inch; 80 characters/line
LINE SPACING: 6 lines/inch
PRINTING RATE: Switch-selectable 10 or
30 characters/second
PAPER: TI thermographic printing paper,
No. 972603 (white); 8½ in. x 100 ft.; last 10
ft. color coded.

PLATEN: Friction feed

VISIBILITY: At least 50 previous lines,
including current line and last character
printed

CARRIAGE RETURN (CR) AND LINE
FEED (LF): Automatic at column 81; no
code is transmitted

CR TIME: 195 msec. (no filler characters
required after CR)

LF TIME: 33 msec. (one character time)

OPERATOR CONTROLS

SPEED: 10/30 characters/second

DUPLEX: Half/Full

X-MIT LEVEL: Low-High

CONTRAST: Light-Dark

PAPER ADVANCE: 30 lines/second while
depressed

NUM: Activates numeric cluster

STATUS: On line/Local

INDICATORS

CARRIER: Carrier detect

BELL: 250 msec. audible tone

PHYSICAL

SIZE: Model 745: Width: 15.4 in.; Depth: 16.0
in.; Height: 4.6 in.; Model 743: Width: 14.6
in.; Depth: 15.25 in.; Height: 4.25 in.

WEIGHT: Model 745: 13.5 pounds (including
paper); Model 743: 11.2 pounds (including
paper)

POWER REQUIREMENTS

VOLTAGE: 115 volts RMS, + 10%-15%

FREQUENCY: 47-63 Hz.

POWER: 75 watts max.

ENVIRONMENT

TEMPERATURE: Operating: 10°C to 40°C;

Storage: -30°C to 70°C (without paper);

-30°C to 40°C (including paper)

HUMIDITY: Operating: 10% to 90% (no
condensation); Storage: 10% to 95% (no
condensation)

SHOCK: Operating: 0 g.; Storage 20 g. for 11
msec.

VIBRATION: Operating: 0.5 g., 10 to 60 Hz.;

Storage: 1.5 g., 5 to 500 Hz.

DATA TRANSMISSION

METHOD: Asynchronous; serial-by-bit,
serial-by-character

CODE: USASCII: 7-level;

11 bits/character

MODE: Half- or full-duplex

PARITY: Optional odd, even or mark; set at
factory

BUFFER: Character buffering on received
data, permitting true 30 characters/second
operation

COMMUNICATIONS INTERFACE

EIA: RS-232-C compatible (Model 743—
standard; Model 745—auxiliary)

TTY: 20 ma. dc-current loop (Model 743 only)

MODEM: Bell System 103/113 compatible
frequency shift keying; originate mode
(Model 743 only)

ACOUSTIC COUPLER: Bell System
103/113 compatible frequency shift keying;
originate mode (Model 745 only)

For more information, contact your nearest
TI office. Or, write Texas Instruments Incor-
porated, P.O. Box 1444, M/S 784, Houston
77001. Or call Data Terminal Marketing at
(713) 494-5115, extension 2126.

OTHER "SILENT 700" HEAVYWEIGHTS

AUTOMATIC SEND-RECEIVE TERMINALS

The field-proven "Silent 700" ASR
terminals combine the high performance of
magnetic tape cassette off-line storage with
the speed and quietness of the "Silent 700"
family in a totally integrated unit. Available

with a variety of options, including 120
characters-per-second transmission speed,
built-in acoustic coupler, remote device
control and automatic search control, the
"Silent 700" ASR terminals offer users a
powerful replacement for conventional ASR
paper tape teletypewriters.

RECEIVE-ONLY TERMINALS

Compact, fast and quiet, the "Silent 700"
RO terminals are ideal as hard copy devices
for minicomputers, CRT's, special purpose
microprocessors, monitoring systems and
data loggers. The RO terminals are available
with USASCII and Baudot/CCITT codes and
either EIA, TTY or bit parallel line interfaces.

733 ASR



743 KSR



755 RO



Texas Instruments reserves the right to make changes at any time in order to improve design and supply the best product possible.

TEXAS INSTRUMENTS
INCORPORATED

TI 338-50M-1/76

Printed in USA



First Class
PERMIT NO.
6189
Houston, TX

BUSINESS REPLY MAIL
No Postage Necessary if Mailed in the United States

Postage will be paid by

TEXAS INSTRUMENTS INCORPORATED
DIGITAL SYSTEMS DIVISION
P. O. BOX 1444 • HOUSTON, TEXAS 77001



ATTENTION: MANAGER, QUALITY ASSURANCE
M/S 738

SILENT 700® DATA TERMINAL

Model **02745 P**
 S/N **1746**
 Date (Mo./Yr.) **SEP 1976**

Assembly Jm	Test 569	Inspection FINAL IDA INSP 67A
-----------------------	--------------------	---

	Excellent	Satisfactory	Unsatisfactory
Initial Operation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Appearance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Print Quality	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Instruction Material	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments		

This equipment has been thoroughly inspected and tested to assure proper performance and reliable operation. We would appreciate receiving your rating, comments, and information regarding this *Silent 700*® Terminal. Please complete the information below and return this card after the initial operation of your terminal. Thank you.

What directed your attention to the *Silent 700*® Data Terminal?

Print Advertising	<input type="checkbox"/>	Exhibit	<input type="checkbox"/>
Magazine -		Show -	
Direct Mail	<input type="checkbox"/>	User Referral	<input type="checkbox"/>
TI Sales Person	<input type="checkbox"/>	Pass-along Literature	<input type="checkbox"/>
Other		

NAME

PHONE

COMPANY NAME

ADDRESS

First Class
PERMIT NO.
6189
Houston, TX

BUSINESS REPLY MAIL

No Postage Necessary if Mailed in the United States

Postage will be paid by

TEXAS INSTRUMENTS INCORPORATED

DIGITAL SYSTEMS DIVISION

P. O. BOX 1444 • HOUSTON, TEXAS 77001

ATTENTION: MANAGER, QUALITY ASSURANCE

M/S 738

SILENT 700® DATA TERMINAL

Model 02745 P
 S/N 1744
 Date (Mo./Yr.) SEP 1976

Assembly	Test	Inspection
<u>418</u>	<u>mp</u>	<u>67A</u> FINAL 64A INSP

	Excellent	Satisfactory	Unsatisfactory
Initial Operation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Appearance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Print Quality	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Instruction Material	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:		

This equipment has been thoroughly inspected and tested to assure proper performance and reliable operation. We would appreciate receiving your rating, comments, and information regarding this *Silent 700*® Terminal. Please complete the information below and return this card after the initial operation of your terminal. Thank you.

What directed your attention to the *Silent 700*® Data Terminal?

Print Advertising	<input type="checkbox"/>	Exhibit	<input type="checkbox"/>
Magazine —		Show —	
Direct Mail	<input type="checkbox"/>	User Referral	<input type="checkbox"/>
TI Sales Person	<input type="checkbox"/>	Pass-along Literature	<input type="checkbox"/>
Other		

NAME PHONE

COMPANY NAME ADDRESS



how to operate the...



**DATA SET
202S-L1A**



Hazeltine 2000



Operating Manual

HI 1004A
MARCH 1972
REVISED JANUARY 1975

SWITCHCRAFT
INC.

1946 - 1976

DeForest

MARCONI

EDISON

Franklin

76

SHORT
FORM
CATALOG



 **dataspeed** 40

SWITCHED NETWORK

features

Issue 2, September 1974

CATALOG

TELETYPE® MODEL 40/2 DATA TERMINALS
for Switched Network Applications

MAY, 1976 EDITION



TermiNet * DATA
COMMUNICATION
PRODUCTS
**INSTRUCTION
PACKAGE**
44A410543-G30

**THE CONTENTS OF THIS PACKAGE
ARE INTENDED FOR CUSTOMER USE.**

LEAVE THIS MATERIAL ON THE CUSTOMER SITE.

PUBLICATION NUMBER

DESCRIPTION

Envelope
GEZ-5778-30
GEK-36153
GEK-36154
GEJ-2748

Resealing Plastic
Contents Sheet
Installation Manual
Operator's Manual
Supply Ordering Instructions

*Registered trademark of General Electric Company, USA

Data Communication Products Department • General Electric Company

Waynesboro, Virginia 22980

GEK-36154

TermiNet*

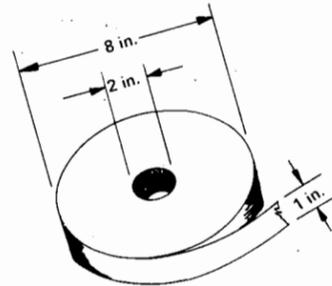
120 LINE PRINTER

**OPERATOR'S
MANUAL**

GENERAL  ELECTRIC

*Trademark, General Electric Company, USA

PUNCH PAPER TAPE



Paper tape used in the ASR Punch is the standard variety used in communications equipment. Consult your local paper supply company to order. Standard or oiled paper having a thickness between 0.003 and 0.0045 inches (nominal) may be used. DO NOT USE TAPE MADE FROM ANY MATERIAL OTHER THAN PAPER.

LAMPS

Replacement lamps may be purchased from your nearest General Electric Supply Company or other electronic supply outlet.

FLUORESCENT LAMPS:

All Model Printers	F6T5/CW	50, 75, 80 Column Printers
All Model Printers	F8T5/CW	118, 120 Column Printers

READER LAMP:

ASR Desk Console	12866	Reader Head
------------------	-------	-------------

PANEL LAMPS:

EQUIPMENT	STOCK NO.	LOCATION
A and B Model Printers	327	Control Panel
C Model and 1200 Printers	7327	Control Panel
ASR Desk Console	327	PUNCH "ON" Pushbutton
TCA Tape Accessory	327	"LOCK SWITCH"
TCA Tape Accessory	7327	All Controls Except "LOCK SWITCH"

MAGNETIC TAPE CASSETTES

Cassettes may be ordered from your local General Electric service organization or Renewal Parts Sales, General Electric Company, Waynesboro, Virginia 22980.

Terminet 30 MTA Data Cassettes, Stock No. 44A 418 396-001, are 300 feet and in accordance with ANSI proposed standard X3B5/11 Feb. 22,

1974 (with or without BOT/EOT Holes).

Terminet 300 and 1200 Tape Cassettes for the TCA are GE Stock No. 44A 417 224-001. These cassettes can also be ordered from TDK Electronics Corp., 755 East Gate Blvd., Garden City, New York 11530 (516)746-0880. Specify computer grade HR300 AW when ordering.

MISCELLANEOUS ITEMS

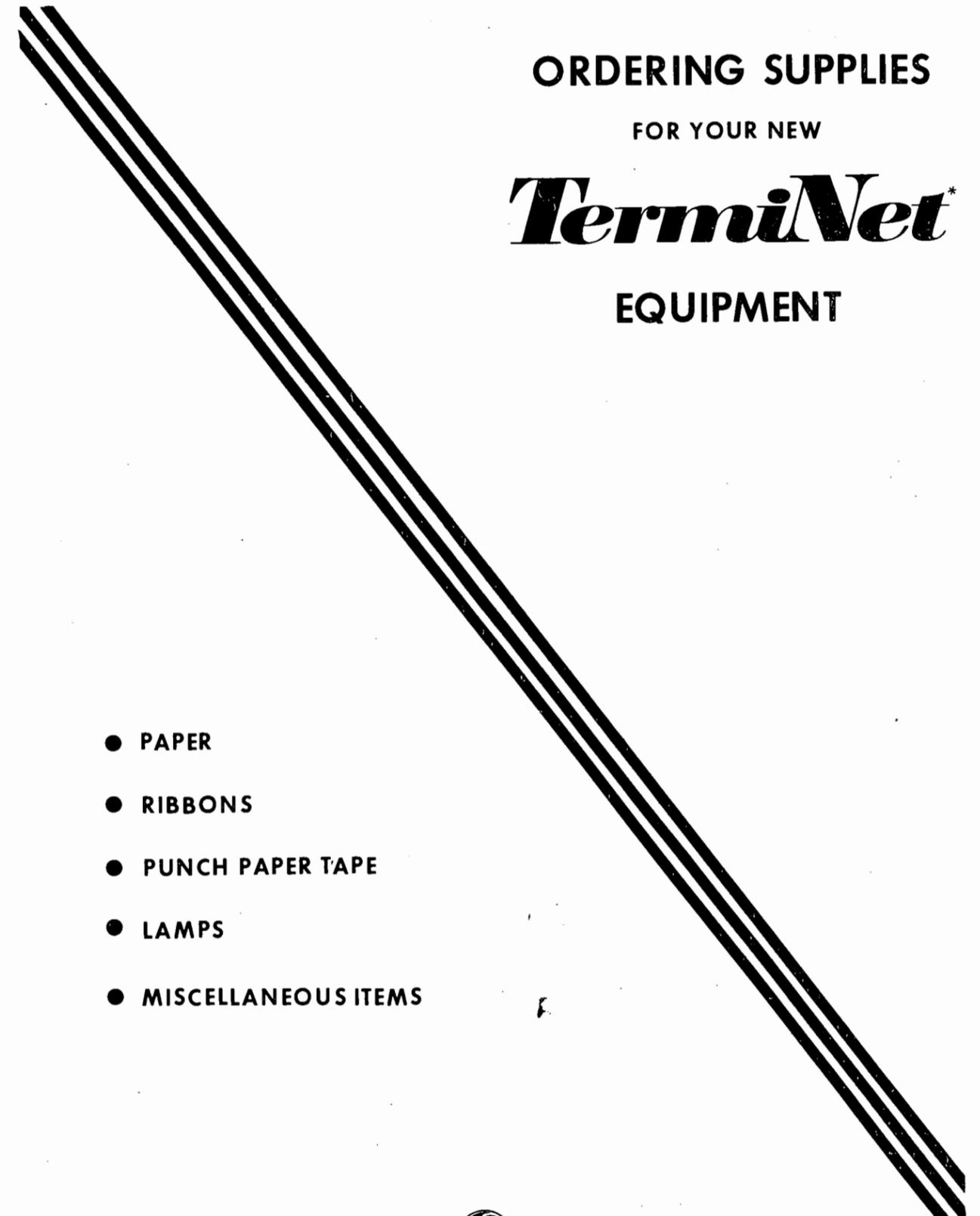
The following list of miscellaneous items may be ordered from your local General Electric service organization or Renewal Parts Sales, General Electric Company, Waynesboro, Virginia 22980.

ITEM NAME	STOCK NO.
Bulb Puller	128A4084P9-150
VTFF Discs (Pkg. of 25), 11" Form	44A417367-001
VTFF Discs (Pkg. of 25), 8" Form	44A417393-001
VTFF Discs (Pkg. of 25) 8 1/2" Form	44A417812-001

ITEM NAME	STOCK NO.
*VFU Editing Punch Kit	44A418630-003
*VFU Editing Punch	44A418630-004
*VFU Editing Slice Tapes (5 Fh)	44A418630-002
*VFU Correction Patches (12)	44A418630-001

*Also available from Computer Accessories Corporation, 211 New York Ave., Huntington, New York 11743.

DATA COMMUNICATION PRODUCTS DEPARTMENT
 GENERAL ELECTRIC COMPANY, WAYNESBORO, VIRGINIA 22980 USA
 (703) 942-8161



ORDERING SUPPLIES

FOR YOUR NEW

Terminet*

EQUIPMENT

- PAPER
- RIBBONS
- PUNCH PAPER TAPE
- LAMPS
- MISCELLANEOUS ITEMS

GENERAL  ELECTRIC

*Trademark, General Electric Company, USA

PAPER

Whether your new Printer uses Continuous Form or paper rolls only, standard commercial sizes will fit. Paper may be obtained from paper supply houses in your area, such as Moore Business Forms Inc., Standard Register Company, or your local General Electric service organization.

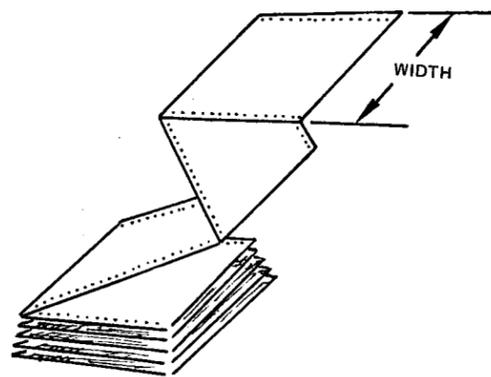
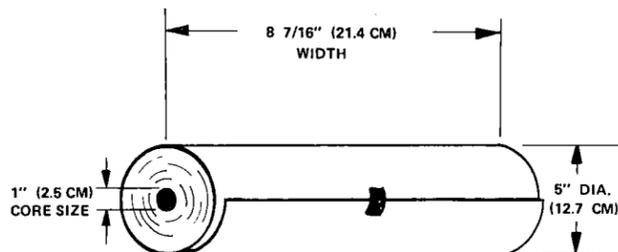
The TermiNet 300 Printer may use either paper rolls, single sheet, or continuous forms, depending on the platen. All other Printers use continuous forms only.

ROLLS

Paper rolls normally used in Printers without the pin feed option fit inside the Printer.

Also, extra wide rolls may be used if the optional paper holder is installed in the rear of your Printer. Use 15 lb. Bond paper.

ROLL TYPE	WIDTH (W)	DIA. (D)	CORE SIZE (C)
Standard	8 7/16"	5 in.	1 in.
Extra Wide	12 27/32"	4" (max.)	7/16"



Continuous Form Paper

SINGLE SHEETS

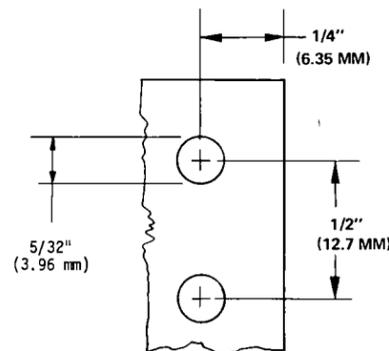
Single sheets up to 12 27/32 in. wide (minimum length - 5 in.) may be used in Printers normally using paper rolls. Sheets should be 15 lb. Bond.

CONTINUOUS FORM

Your Printer may have a pin feed option which consists of either a platen having a row of pins around each end or a forms feed tractor mounted on top of the Printer. In either case, your Printer will use Continuous Form paper in one of the sizes shown in the table. You can determine the size your Printer uses by measuring the distance across the width of the platen between pins. Use "overall" size when ordering. Multiple copy paper consisting of an original and up to five copies not exceeding 0.025 in. thick may be used.

For single part forms, use 15 lb. Bond; for 2, 3, and 4 part forms, use 13.5 lb. Bond, 8 lb. carbon; for 5 and 6 part forms, use 12 lb. Bond, 8 lb. carbon. Multipart forms should be well crimped along both edges and not glued or stapled.

PAPER WIDTHS (in inches)	
Pin-to-Pin	Overall
5 1/2	6
8	8 1/2
8 1/2	9
9	9 1/2
12 11/32	12 27/32

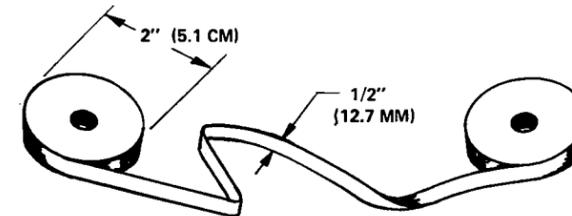


Paper Hole Dimensions

RIBBONS

TermiNet 300 and 1200 Printers and 120 Line Printer

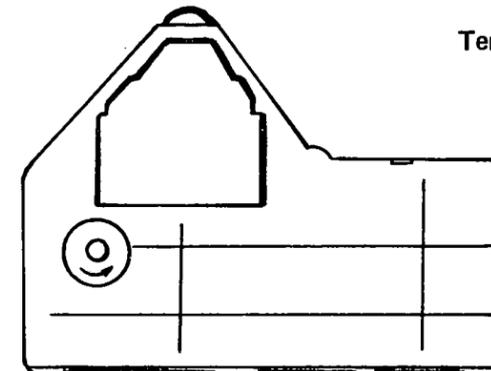
Replacement ribbons, available from your local General Electric service organization or office supply dealers in your area must have 150 FS Underwood type double spools. The following ribbon brands are suited for use on TermiNet Printers.



- Columbia #3202-20005
- Curtis Young DUO PAK, Nylon 44, Black Med. #4
- Labelon Underwood Scriptor Duet, Black Medium, #430 Nylon
- Buckeye #130-2070-115 Paquette, Black Rec. #5
- General Ribbon, G.E. TermiNet 300, Silk, Computer Black, Heavy
- General Ribbon Miralon, G.E. TermiNet 300, Computer Black, Maximum Heavy
- General Ribbon, Miralon T411, Black/Red, Maximum Heavy (for printers equipped with the Red/Black Ribbon Option Only)

RIBBON CARTRIDGE

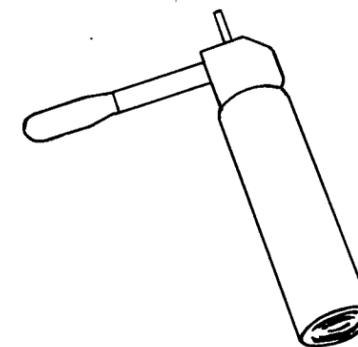
TermiNet 30 Printer



Replace your TermiNet 30 Printer ribbon cartridge only with General Electric Cartridge 44A411800-G01. Replacement cartridges are available from your local General Electric service center or agent servicing your Printer.

INK CARTRIDGE

TermiNet 120 Line Printer



Replacement cartridges, Part Number 44A418349, are available from General Electric Company, Data Communication Products Department.

HAZELTINE 2000																	
MODEL 33, MODEL 35 DN-730		PRESSING KEY(S) SHOWN GENER- ATES CODE SHOWN IN ASCII COLUMN			PRINTS WHEN	ASCII	MODEL 33, MODEL 35 DN-730		PRESSING KEY(S) SHOWN GENER- ATES CODE SHOWN IN ASCII COLUMN			PRINTS WHEN	ASCII				
PRINTS	S	C	C/S	DECIMAL CODE	CHARACTER	PRINTS	S	C	C/S	DECIMAL CODE	CHARACTER	PRINTS	S	C	C/S	DECIMAL CODE	CHARACTER
SP				0	NUL	SP				0	NUL	SP				0	NUL
AB				1	SOH	AB				1	SOH	AB				1	SOH
CD				2	STX	CD				2	STX	CD				2	STX
ETX				3	ETX	ETX				3	ETX	ETX				3	ETX
EOT				4	EOT	EOT				4	EOT	EOT				4	EOT
ENQ				5	ENQ	ENQ				5	ENQ	ENQ				5	ENQ
ACK				6	ACK	ACK				6	ACK	ACK				6	ACK
BEL				7	BEL	BEL				7	BEL	BEL				7	BEL
BS				8	BS	BS				8	BS	BS				8	BS
HT				9	HT	HT				9	HT	HT				9	HT
LF				10	LF	LF				10	LF	LF				10	LF
VT				11	VT	VT				11	VT	VT				11	VT
FF				12	FF	FF				12	FF	FF				12	FF
CR				13	CR	CR				13	CR	CR				13	CR
S0				14	S0	S0				14	S0	S0				14	S0
S1				15	S1	S1				15	S1	S1				15	S1
DLE				16	DLE	DLE				16	DLE	DLE				16	DLE
DC1				17	DC1	DC1				17	DC1	DC1				17	DC1
DC2				18	DC2	DC2				18	DC2	DC2				18	DC2
DC3				19	DC3	DC3				19	DC3	DC3				19	DC3
DC4				20	DC4	DC4				20	DC4	DC4				20	DC4
NAK				21	NAK	NAK				21	NAK	NAK				21	NAK
SYN				22	SYN	SYN				22	SYN	SYN				22	SYN
ETB				23	ETB	ETB				23	ETB	ETB				23	ETB
CAN				24	CAN	CAN				24	CAN	CAN				24	CAN
EM				25	EM	EM				25	EM	EM				25	EM
SUB				26	SUB	SUB				26	SUB	SUB				26	SUB
ESC				27	ESC	ESC				27	ESC	ESC				27	ESC
FS				28	FS	FS				28	FS	FS				28	FS
GS				29	GS	GS				29	GS	GS				29	GS
RS				30	RS	RS				30	RS	RS				30	RS
US				31	US	US				31	US	US				31	US
SP				32	SP	SP				32	SP	SP				32	SP
! " # \$ % & ' () * + , - . / 0 1 2 3 4 5 6 7 8 9 : ; < = > ?				33	!	!				33	!	!				33	!
				34	"	"				34	"	"				34	"
				35	#	#				35	#	#				35	#
				36	\$	\$				36	\$	\$				36	\$
				37	%	%				37	%	%				37	%
				38	&	&				38	&	&				38	&
				39	'	'				39	'	'				39	'
				40	((40	((40	(
				41))				41))				41)
				42	*	*				42	*	*				42	*
				43	+	+				43	+	+				43	+
				44	,	,				44	,	,				44	,
				45	-	-				45	-	-				45	-
				46	.	.				46	.	.				46	.
				47	/	/				47	/	/				47	/
				48	0	0				48	0	0				48	0
				49	1	1				49	1	1				49	1
				50	2	2				50	2	2				50	2
				51	3	3				51	3	3				51	3
				52	4	4				52	4	4				52	4
				53	5	5				53	5	5				53	5
				54	6	6				54	6	6				54	6
				55	7	7				55	7	7				55	7
				56	8	8				56	8	8				56	8
				57	9	9				57	9	9				57	9
				58	:	:				58	:	:				58	:
				59	;	;				59	;	;				59	;
				60	<	<				60	<	<				60	<
				61	=	=				61	=	=				61	=
				62	>	>				62	>	>				62	>
				63	?	?				63	?	?				63	?

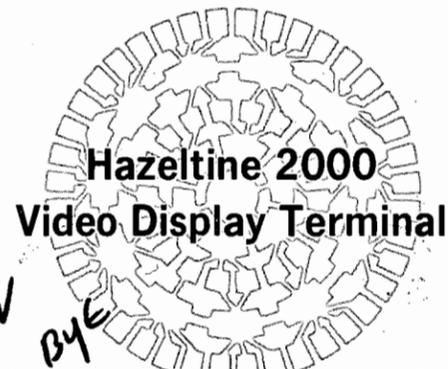
NOTES: S = "SHIFT" Key Depressed.
 C = "CTL" Key Depressed.
 Shaded Area -- Areas of commonality with documentation and Model 33, Model 35, and DATANET 730 characters.
 Backspace key; produces decimal code 8 in all modes.
 In Hazeltine 2000 "To Generate ASCII Code Press" column, the subcolumns show codes generated by individual keys, keys plus SHIFT(S), keys plus CTRL(C), and keys plus SHIFT plus CTRL(C/S), respectively.
 ASCII Decimal Code -- 33, exclamation point; 39, apostrophe; 44, comma; 45, hyphen-minus; 95, underline; 96, grave accent; 124, broken vertical line.

Corresponding
 ASCII codes
 cannot be gener-
 ated, but
 terminal will
 print characters
 at right if code
 is received, ex-
 cept that the
 DN-730 will not
 print a character
 when it receives
 ASCII decimal
 codes 124, 125,
 and 126.

RUBOUT

875-0611
 800-282-4536

WSR 92000, CR
 EIKSUM
 NJSIS
 FIV
 BYE



1201.01C
 MARK III
 TERMINAL OPERATIONS
 AUGUST 1974

The contents of this card are distributed on an "as is" basis and is for information only. This card neither expresses nor implies any warranty including but not limited to a warranty of merchantability or fitness for use for a particular purpose, nor does GE warrant the availability of the interfacing software.

This card contains two sets of instructions for accessing the system; the first is for low-speed service users (300 baud sign-on) and the second for 1200 baud service users signing on at 1200 baud. There are also some different modem requirements for low-speed users than for 1200 baud service users, as well as a special terminal modifications for 1200 baud service users. These are defined under "Modem Requirements" and "Terminal Requirement for 1200 Baud Use."

ACCESSING THE SYSTEM (300 BAUD USERS)

- Become acquainted with contents of the MARK III Command System reference manual (GE publication 3501.01).
- Turn terminal power switch to ON position. Set mode to HALF DUPLEX and baud rate switch to 300. Be certain the RECEIVE button signal light is activated.
- Dial MARK III access number; connect terminal to system (in consonance with terminal/coupler/dataset instructions from manufacturer).
- Within 5 seconds after connection, press the H key and then the CR key in immediate succession.
- Enter your user number in response to U# =.

ACCESSING THE SYSTEM (1200 BAUD USERS)

- Become acquainted with the contents of the MARK III Command System reference manual (GE publication 3501.01)
- On the control panel located in front of the CRT, make the following switch settings:

Switch	Setting
ON/OFF	ON
EOT/CR	CR ✓
PARITY	EVEN ✓
CONTRAST	Set according to individual preference
FULL/HALF/BATCH	HALF (Half duplex)
BAUD	1200 ✓
CA	AUTO ✓

E 21-22
 S2 3 5 6 X
 S3 7 9

- Press "TALK" on the dataset.
- Dial the 1200 baud access number.
- Upon hearing the audible tone, depress the DATA button on the data set (Note: only Bell 202C data sets with reverse channel option can be used to access the system at 1200 baud).
- When the RECV light goes out, type one or more H characters followed by a Control/D (EOT). If Control/D does not turn the line around, use Control/C (ETX).
- At this point, the RECV lamp should light and the system will issue a request for U# =.
- Enter your user number, a carriage return, and a Control/D.

4028921: WININ76
 301 657 1626

USING THE DOCUMENTATION

NOTE: GE Time-Sharing documentation employs Model 33, Model 35, or DN-730 character sets for illustrative purposes.

Documentation Shows	On This Device Press	Function	ASCII Decimal Code
←	S ϕ	Character delete	95
↑	S N	Exponentiation	94
C S L	C S L	For Filenames and Passwords	28 29 30
C S M	C S M		
C S N	C S N		
C S ϕ	C S ϕ	Line Delete	31
C X	C X	Line Delete	24
BREAK	BREAK	Stop Execute	(None)

Character Printing Restrictions

The following characters elicit terminal responses (turn punch on, turn reader off, turn reader on, etc.) and you should not attempt to have your program print them:

DC1 Control/R
DC2 Control/S
DC3 Control/T
DC4 Control/U

An ESC character followed by any of the following:

0
:
:
:
H
J

FF Control/J (unless followed by rubout characters having a duration of 300 milliseconds plus 27 milliseconds for each line spaced. At 1200 baud, each character consumes 8.3 milliseconds.)

ENQ Control/E
NAK Control/U
DLE followed by any of the following:
EOT
?

Note:

Programs currently running at 300 baud which use form-feed or vertical tabs may have to be modified by adding more rubout characters in order to run at 1200 baud.

The following characters turn the line around and cannot be used for output:

EOT Control/D
ETX Control/C
ACK Control/P
NAK Control/U
ENQ Control/E

NOTES AND HINTS

- Control/D (EOT) must follow a CR for all system commands when operating at 1200 baud, as well as a CR after line-at-a-time input to running BASIC or FIV programs.
- A chart of ASCII coding and a comparison with Models 33/35 and DN-730 appear on the reverse side of this card. The Hazeltine 2000 is similar in operation to these terminals except that it is capable of generating the entire ASCII code set.
- Standard character delete (decimal code 95), line delete (decimal code 24), and Stop Execute codes are changed by use of the SET command (see publication 3501.01).
- The Hazeltine Printer Unit and the Hazeltine Tape Cassette System are compatible with MARK III.
- See manufacturer's operating instructions for terminal responses to codes received.
- Control/S/K will generate a decimal code 27 (ESC).
- At 1200 baud the "DELETED" message will not print in response to a Control/X (line delete).

MODEM REQUIREMENTS

- Low-speed (300 baud) users must use this terminal with a Bell 103E modem.
- 1200 baud service users must use this terminal with a Bell 202C modem.

TERMINAL REQUIREMENT FOR 1200 BAUD USE

This terminal must contain a manufacturer's "1200 baud compatibility" modification in order to be used for 1200 baud service. One of the following dash numbers will identify the terminal's baud rate package:

- 261 Includes 110, 150, 300, 600, 1200 baud rates.
- 262 Includes 110, 300, 1200, 2400, 9600 baud rates.
- 263 Includes 110, 1200, 2400, 4800, 9600 baud rates.



Bell System
**TECHNICAL
REFERENCE**



Southern Bell
125 Perimeter Center-West
Atlanta, Georgia 30346
Phone (404) 391-2338
Res.: (404) 971-4002

Rex Andrews
Data Systems Specialist

See inside cover →

DATA SET **103A3**

DATA SET 103E

DATA SET 103G

DATA SET 103H

INTERFACE

SPECIFICATION

OCTOBER 1973





Southern Bell
125 Perimeter Center-West
Atlanta, Georgia 30346
Phone (404) 391-2338
Res.: (404) 971-4002

Rex Andrews

Data Systems Specialist

PRELIMINARY

**Bell System Data Communications
TECHNICAL REFERENCE**

**DATA SETS 202S AND 202T
INTERFACE
SPECIFICATION**

AUGUST 1974

MANAGER - DATA SYSTEMS



NOTICE

This Technical Reference is published by American Telephone and Telegraph Company as a guide for the designers, manufacturers, consultants and suppliers of customer-provided systems and equipment which connect with Bell System communications systems or equipment. American Telephone and Telegraph Company reserves the right to revise this Technical Reference for any reason, including, but not limited to, conformity with standards promulgated by ANSI, EIA, CCITT, or similar agencies, utilization of new advances in the state of the technical arts, or to reflect changes in the design of equipment or services described herein. The limits of responsibility and liability of the Bell System with respect to the use of customer-provided systems or equipment are set forth in the appropriate tariff regulations.

If further information is required, please contact:

Manager - Data Systems
American Telephone and Telegraph Company
195 Broadway
New York, New York 10007

TABLE OF CONTENTS

	<u>Page</u>
TECHNICAL SPECIFICATION SUMMARY	I
1. GENERAL	1
1.1 Data Sets 202S and 202T	1
1.2 Compatibility	1
1.2.1 Customer Interface	1
1.2.2 Data Set	2
1.3 Bit Rates	2
1.4 Physical Description	2
1.5 Power Requirements	3
1.6 Grounding	3
1.7 Location and Mounting of the Data Set	3
1.8 Test Switches and Self-Testing Features	4
1.9 Status Lamps	4
2. OPTIONAL CUSTOMER FEATURES AND SERVICES	5
2.1 Options Common to All Data Sets	6
2.1.1 Received Data Squelch	6
2.1.2 Clear-to-Send Delay	6
2.1.3 Fast Carrier Detection	7
2.1.4 Soft Turn-Off	8
2.1.5 Local Copy of the Primary Channel	8
2.1.6 Reverse Channel	9
2.1.7 Local Copy of the Reverse Channel	9
2.1.8 Grounding	9
2.2 Automatic Answer Option for Data Set 202S	9
2.3 Automatic Calling Service With Data Set 202S	9
2.4 Line Hunting With Data Set 202S Multiple Arrangements.....	9
2.5 Private Line Options With Data Set 202T	10
2.5.1 Two-Wire or Four-Wire	10
2.5.2 Carrier Detector Reset	10
2.5.3 Continuous Carrier	10
2.5.4 Received Data Clamp	11
2.6 Additional Services Available with Data Set 202T	11
2.6.1 Alternate-Voice Service	11
2.6.2 Dial Back-Up	11
3. INTERFACE	11
3.1 Electrical Considerations	12
3.1.1 Signal States	12
3.1.2 Impedances of Terminator	12
3.1.3 Rise and Fall Times	12
3.1.4 Open Circuit Voltages	13
3.2 Purpose and Use of Interface Circuits	13
3.2.1 Protective Ground (AA) - Circuit 1	13
3.2.2 Transmitted Data (BA) - Circuit 2	13
3.2.3 Received Data (BB) - Circuit 3	13
3.2.4 Request-to-Send (CA) - Circuit 4	14
3.2.5 Clear-to-Send (CB) - Circuit 5	14
3.2.6 Data Set Ready (CC) - Circuit 6	15

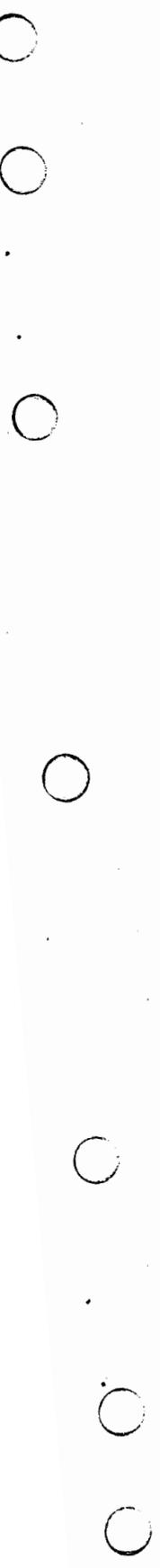
	<u>Page</u>
3.2.7 Signal Ground (AB) - Circuit 7	15
3.2.8 Received Line Signal Detector (CF) - Circuit 8 ...	15
3.2.9 Circuits 9 and 10	16
3.2.10 Secondary Request-to-Send (SCA) - Circuits 11 and 19	16
3.2.11 Secondary Received Line Signal Detector (SCF) - Circuit 12	16
3.2.12 Data Terminal Ready (CD) - Circuit 20	16
3.2.13 Ring Indicator (CE) - Circuit 22	16
3.2.14 Carrier Detector Reset (CR) - Circuit 25	17
4. OPERATION WITH DATA TERMINAL EQUIPMENT	17
4.1 Switched Network Operation With Data Set 202S	17
4.1.1 General Call Set Up Procedures	17
4.1.2 Automatic Answer and Data Mode Transfer	18
4.1.3 Call Termination Procedures	19
4.1.4 Data Transmission Procedures	19
4.2 Private Line Operation With Data Set 202T	19
4.2.1 Two-Wire Point-to-Point Operation	20
4.2.2 Four-Wire Point-to-Point Operation	20
4.2.3 Four-Wire Multipoint Operation	21
5. TESTING OF THE DATA SETS 202S AND 202T	22
5.1 Local Self-Test (LT) - Data Sets 202S and 202T	22
5.2 Analog Loopback Test (AL) - Data Sets 202S and 202T	22
5.3 Remote Test (RT) - Data Set 202S	23
5.4 Four-Wire Remote Test (RT) - Data Set 202T Four-Wire Operation	23
5.5 Telephone Company Remote Test Procedures	24
5.5.1 Two-Wire Remote Test	24
5.5.2 Four-Wire Remote Test	24
6. PERFORMANCE	25
6.1 Switched Network Service - Data Set 202S	25
6.2 Private Line Service - Data Set 202T	25

LIST OF TABLES

Table 1 - Option Summary Table	27
Table 2 - Recommended Customer Options for Switched Network Service Using Data Set 202S	28
Table 3 - Recommended Customer Options for Two-Wire Private Line and Four-Wire Private Line With Talkback Using Data Set 202T	29
Table 4 - Recommended Customer Options for Four-Wire Point- to-Point and Multipoint Without Talkback Using Data Set 202T	30

LIST OF FIGURES

	<u>Page</u>
Figure 1 - Data Set 202S with Key Telephone Set	31
Figure 2 - Front View of Data Set 202T	32
Figure 3 - Rear View of Data Set	33
Figure 4A - Rack Mounting for Data Set 202S	34
Figure 4B - Rack Mounting for Data Set 202T	35
Figure 4C - Typical Cabinet for Data Sets 202S and 202T	36
Figure 5 - Customer Interface Circuit Designation and Pin Assignments	37
Figure 6 - Call Set-Up and Termination Procedures for DATAPHONE Service with Automatic or Manual Calling and Automatic Answering	38
Figure 7 - Call Set-Up and Termination Procedures for DATAPHONE Service with Manual Calling and Answering	39
Figure 8 - Half-Duplex Operation of Data Sets 202S or 202T	40
Figure 9 - Four-Wire Private Line Multipoint Arrangement with One Master Station and Several Remote Stations	41
Figure 10 - Multipoint Polling Operation of Data Set 202T on 4-Wire Private Lines (Continuous Carrier Option in Master Data Set)	42
Figure 11 - Four-Wire Multipoint Arrangement with Each Data Set Able to Communicate with Each Other Data Set	43
Figure 12 - Analog Loopback Test using the Data Terminal	44
Figure 13 - Two-Wire Remote Test for Data Set 202S	44
Figure 14 - Far-End Remote Test Using Local Data Terminal (4-Wire only)	44
Figure 15 - Telephone Company Remote Test Arrangements	45
Figure 16A - Bit Error Rate Distributions by Mileage Strata at 1200 bps	46
Figure 16B - Bit and Block Error Rate Distributions at 1200 bps	47



TECHNICAL SPECIFICATION SUMMARY FOR DATA SETS 202S AND 202T

Operation: Asynchronous, Binary, Serial

Operating Modes: 202S - Simplex, half-duplex
202T - Simplex, half-duplex, duplex

Data Set Compatibility: 202S - 202C, 202D with 804, 202E, 202R (Manual Operation, without Reverse Channel)
202T - 202D, 202C, 202E, 202R (Without Reverse Channel)

Interface Voltages: EIA Standard RS-232-C

Line Requirements: 202S 2-wire Switched Network
202T 2-wire Private Line with Reverse Channel
-Up to 1200 bps on Basic 3002 Channel
-Between 1200 and 1800 bps on 3002 Channel with C2 conditioning
4-wire Private Line and 2-wire private Line without Reverse Channel
-Up to 1400 bps on Basic 3002 Channel
-Between 1400 and 1800 bps on 3002 Channel with C2 Conditioning

Interface Control Functions:

Receiver Squelch:
156 \pm 9, 8.7 \pm 3 or 0 milliseconds
Clear-to-Send Delay:
180 \pm 9, 60 \pm 3, 30 \pm 1 or 8 \pm .3 milliseconds
Received Line Signal Detector:
Operate: 23 \pm 5 or 6.9 \pm .4 milliseconds
Release: 10 \pm 1 or 5 \pm .5 milliseconds
Carrier Turn-Off:
Soft Turn-Off: 24 \pm 1 or 8 \pm .4 milliseconds
Quick Turn-Off: Less than 1 millisecond

Interface Connector and Cable:

Business machine must provide a 25-pin Cinch or Cannon Type DB-19604-432 (male) connector plug with Cinch Type DB-51226-1 hood (or equivalents). Interface cable provided by customer must be less than 50 feet long per EIA Standard RS-232-C

AC Power:

117 volts \pm 10%, 60 Hz \pm 5% power source.
Data Sets consume about 7 watts maximum. Power outlet should be a conventional three-wire type not under switch control.

Environmental Requirements:

Ambient temperature range: from 40 to 120°F
Relative humidity: from 20 to 95 percent

Dimensions of Single Data Set Housing:

Height 2.2 inches

Width 5.8 inches

Depth 10.8 inches

Weight:

Data Set 202T - 4.5 lbs; 5 lbs with reverse channel

Data Set 202S - 5.5 lbs; 6 lbs with reverse channel

1. GENERAL

This document contains technical information that is applicable to the following data set list codes:

202S-L1, L1/2, L1/3, L1/2/3
202T-L1, L1/2, L1/3, L1/2/3

A subsequent issue of this Technical Reference will describe additional features and improvements that will be identified by new data set list codes.

1.1 Data Sets 202S and 202T

Data Sets 202S and 202T provide for the transmission and reception of medium speed, binary, serial data in Switched Network and Private Line services, respectively. The data sets, which employ frequency shift keying modulation, provide the following basic design features:

- a. Data Set 202S - asynchronous data transmission at speeds up to 1200 bps. (Data Set 202S up to 1200 bps in Switched Network service.)
- b. Data Set 202T - asynchronous data transmission at speeds up to 1800 bps.

Data Set 202S provides simplex (one-way) or half-duplex (two-way nonsimultaneous) transmission for Switched Network service, while Data Set 202T provides simplex, half-duplex or duplex (two-way simultaneous) transmission in private line point-to-point or multipoint applications.

The data sets place no restriction as to the code used or the number of consecutive marks or spaces for either Switched Network or Private Line applications. No timing is provided by the data sets.

Among the standard features provided in these data sets are the local self-test, analog loopback, and remote test capabilities that are controlled by test switches located on the front panel. These features permit isolation of data transmission troubles by either the customer or Telephone Company personnel. The data set also feature status lamps on the front panel to aid in trouble diagnosis.

Data Set 202S is provided with a standard six-button key telephone set as shown in Figure 1. Data Set 202S can be optioned for unattended automatic answer, and for automatic calling with an 801-Type Data Auxiliary Set. For Data Set 202T, dial backup and alternate voice are available with auxiliary equipment. Other optional features which may be specified by the customer when ordering the data service are described in Section 2.

1.2 Compatibility

1.2.1 Customer Interface

The interface signals exchanged between the data terminal and the data sets conform to the Electronics Industries Association Standard RS-232-C.

1.2.2 Data Set

Data Set 202T can communicate over private line facilities with another Data Set 202T or with Data Sets 202R, 202E, 202C and 202D. Data Set 202S can communicate over the switched telecommunication network with another Data Set 202S or with Data Set 202C, Data Set 202E, Data Set 202D in combination with a Data Auxiliary Set 804A, or Data Set 202R where Data Set 202S is equipped for manual origination of calls. Data Set 202R does not provide the optional reverse channel features available with Data Sets 202S, 202T, 202C, 202E and 202D. See section 4.1.1 for call setup procedures.

1.3 Bit Rates

The operating bit rate of the data set is a function of both the data set design and the network over which the data set operates. The recommended maximum bit rate for Data Set 202S on the switched telecommunication network (DDD) is 1200 bits per second. This limit is a statistically derived value based on the overall distribution of network connections. Although on selected connections it may be possible to operate at bit speeds in excess of 1200 bps, no performance statements can be made at higher speeds.

In private line service, where the parameters of the transmission facility are more controlled, the maximum recommended bit rate for Data Set 202T is given below.

Two-Wire Private Line with Reverse Channel

- Up to 1200 bps on Basic (unconditioned) 3002 Channel

- Between 1200 and 1800 bps on 3002 channel with C2 Conditioning

Four-Wire Private Line and two-wire Private Line without Reverse Channel

- Up to 1400 bps on Basic 3002 Channel

- Between 1400 and 1800 bps on 3002 channel with C2 conditioning

(See Section 6.2)

The maximum bit rate possible on a given channel is a function of how well the receiving data terminal can maintain synchronization in the presence of signal distortion. A discussion of the transmission characteristics of voiceband private line channels is contained in the Bell System Technical Reference "Data Communications Using Voiceband Private Line Channels" (PUB 41004).

1.4 Physical Description

Pictorial views of Data Sets 202S and 202T are shown in Figures 1, 2, and 3. The data sets in their housings measure 5.8 inches wide, 2.2 inches high, and 10.8 inches deep, and will operate normally over a temperature range from 40° to 120°F with relative humidity in the range from 20 to 95 percent. The weight of the data sets is approximately 5 pounds. For switched network operation using Data Set 202S a standard six-button key telephone set shown in Figure 1 is normally provided to serve up to five data sets on five DDD lines.

In addition, multiple data set arrangements shown in Figures 4A and 4B are available for up to eight Data Sets 202S or 16 Data Sets 202T. These arrangements measure 19" wide, 7" high and 13" deep and may be used in a standard 19 or 23" relay rack or a cabinet mounting. A cabinet shown in Figure 4C is also available which mounts up to 24 Data Sets 202S or 48 Data Sets 202T.

A CALL DIRECTOR[®] shown in Figure 4C is also available for Data Set 202S multiple data set arrangements.

1.5 Power Requirements

Electrical power is supplied to single data set installations by an external transformer which mounts on the customer-provided 105 to 129 volt, 60 \pm 3 Hertz nonswitched three-prong outlet. The transformer is protected internally against overload and conforms to the Underwriters Laboratories Class 2 power transformer requirements. Multiple data set installations (rack or cabinet) are powered by an ac power supply in the data mounting which connects to the customer-provided nonswitched three-prong outlet.

1.6 Grounding

The Protective Ground circuit on the interface of Data Sets 202S and 202T is established through the ground wire of the power cord. This also provides grounding of the data set housing and chassis to the local building power ground. It is recommended that the Protective Ground of the data terminal equipment be tied to the same building power ground to avoid differences in ground potentials which may cause poor performance or cause damage to the electronic circuitry. The Signal Ground circuit on the interface is the common reference potential for all other circuits on the interface. The Protective and Signal Ground circuits are normally tied together by means of a strap in the data set as provided from the factory. This arrangement is intended to provide additional margin to longitudinal power line noise. The strap may, however, be disconnected at the request of the customer with due consideration given to possible noise conditions, ground potential differences, safety conditions, local electrical codes, and the data terminal manufacturer's recommendations.

The Protective Ground Interface circuit (AA) is not provided in multiple data set arrangements. Absence of Circuit (AA) is in agreement with the optional nature of this circuit in EIA Standard RS-232-C. If bonding of the data terminal equipment frame ground to the data set frame ground is necessary, the Telephone Company can connect a ground wire between the data terminal and the frame of the multiple arrangement which is tied to the ground wire of the power cord. The option (one per data mounting) to connect the signal ground (Circuit AB) to frame ground is provided.

1.7 Location and Mounting of the Data Set

Data Sets 202S and 202T should be located in the vicinity of the data terminal equipment on a nearby desk, table, stand; and in Bell System provided data set cabinets or equipment racks for multiple arrangements. The customer-provided interface cable from the data terminal should not exceed 50 feet in length, in accordance with recommendations of EIA Standard RS-232-C. This recommendation is intended to minimize cross-talk coupling among the unbalanced interface circuits and noise pickup from outside sources. The data set will be installed in a location to permit compliance with this recommendation. The data set should be located at least one foot from any apparatus which may produce stray radiation.

[®] Registered Trademark of AT&T Co.

1.8 Test Switches and Self-Testing Features

Data Sets 202S and 202T are equipped with three test switches which are accessible at the front cover which permit local and remote testing of the data sets and facilities. The functions of these test switches, [Analog Loopback (AL), Local Self-Test (LT) and Remote Test (RT)] are discussed in detail in Section 5, and are summarized below:

1. AL (Analog Loopback): Connects the transmitter output to the receiver input and disconnects the telephone line to permit testing of the data set by the data terminal or independent test set.
2. LT (Local Self-Test): Connects the transmitter output to the receiver input, disconnects the customer interface, and conditions the data set to operate with a built-in word generator and word comparator circuit.
- 3a. RT (Remote Test - 2-Wire): Conditions the data set for 2-wire testing from a Telephone Company Data Test Center using the data set's built-in word generator. The Remote Test of Data Set 202S also may be used by the customer to determine if a connection can be established to the data set.
- 3b. RT (Remote Test - 4-Wire): Connects the output of the demodulator to the input of the modulator so that the data set operates as a repeater* for testing on 4-wire facilities from a remote location.

1.9 Status Lamps

Data Set 202T is provided with six LED status lamps on the front cover; whereas, Data Set 202S is provided with an additional lamp that indicates the Data Terminal Ready status. The lamp names and their functions are described below:

- ON Indicates that power is applied to the data set.
- TR Terminal Ready - Data Set 202S only: Indicates the status of the Data Terminal Ready (CD) signal from the customer interface.
- MR Modem Ready: Indicates the status of the Data Set Ready (CC) signal.

*The data set in 4-wire remote test does not regenerate the received data signal. If the received signal has 20 percent distortion, it is retransmitted with 20 percent distortion.

- RS Request-to-Send: Indicates the status of Request-to-Send (CA) from the customer interface.
- CS Clear-to-Send: Indicates the status of Clear-to-Send (CB) from the data set.
- CO Carrier On: Indicates the status of Received Line Signal Detector (CF) from the data set.
- TM Test Mode: Indicates that the data set is in a test mode.

The lamps operate as follows. The ON lamp will light when ac power is supplied to the data set. In the DATA mode the TR, MR, RS, CS, and CO lamps light in accordance with the ON condition of the respective interface circuits CD, CC, CA, CB, and CF (see Section 3 for description of these circuits and Section 5 for the status of the interface circuit indicator lamps in the TEST mode).

The TM lamp will light when the data set is placed in the TEST mode by use of the AL, LT or RT test switches. For the Analog Loopback Test and Remote Test the lamp will go OFF only if the data set is removed from the TEST mode by releasing the appropriate test switch. For the Local Self Test the TM lamp will go OFF before the test is ended if an error is made (see Section 5). As a test that the lamps are working, all the lamps will go ON in the Local Self Test and two-wire Remote Test irrespective of the status of the interface circuits.

2. OPTIONAL CUSTOMER FEATURES AND SERVICES

Data Sets 202S and 202T are provided with optional features which must be specified by the customer when the data service is ordered. Table 1 provides a summary of these options. Several of the options listed in the table depend on a different option in the distant data set. For example, the Clear-to-Send Delay in the local data set depends on the Receive Line Signal Detector acquisition time in the distant data set. Therefore, care must be taken in choosing the option to be compatible with the distant data set. Note that the distant data set may be a Data Set 202C, 202D, 202R or 202E as well as a Data Set 202S or 202T. Tables 2, 3 and 4 give the recommended options for the Switched Network service and various Private Line applications assuming that the distant Data Set 202-Type is employing its recommended options.

The recommended options given in Tables 2, 3 and 4 are engineered to maximize protections against interfering phenomena. Other option combinations are possible which may optimize a particular system taking into account the calling pattern and terminal insensitivity to various kinds of interfering phenomena (noise hits, echoes, etc.). These combinations may include the removal of the Received Data Clamp (202T only) and Squelch options in the data set and using a shorter Clear-to-Send Delay than recommended. The Telephone Company will install customer engineered options. However, successful operations of such systems and interface trouble analysis is the responsibility of the customer.

A detailed description of the optional customer features and services is provided below.

2.1 Options Common to All Data Sets

2.1.1 Received Data Squelch

When a station that has been transmitting, in half-duplex operation on 2-wire facilities, turns its Request-to-Send circuit turned OFF, the telephone line may reflect signals (echoes) back to the transmitting station for a period up to the round-trip delay of the circuit (maximum round-trip delay within continental U.S.A. is less than 100 msec.). The squelch option prevents the demodulator (receiver) of the station that has been transmitting from delivering these reflections as data to the Received Data circuit.

Data Sets 202S and 202T provide for either 156 msec., 9 msec., or No Squelch options. The 156 msec. option is recommended for Switched Network service, 2-wire private line facilities, and on 4-wire private lines with talkback. The 9 msec. option may be used in customer engineered applications on 2-wire facilities, less than 50 miles in length. On these facilities the duration of the echoes should be less than 9 msec. On facilities of greater distance, the 9 msec. option should be used only if the data terminal is able to ignore echoes, (e.g., by using a start of message code). The No Squelch option should be used on 4-wire facilities and may be used on customer engineered applications over 2-wire facilities if the data terminal is able to ignore echoes.

For Switched Network service, if the data terminal is unable to ignore echoes, it is impractical to attempt to optimize the turnaround time by using the 9 msec. or No Squelch option in conjunction with the 60, 30, or 8 millisecond Clear-to-Send Delay options because the propagation time and, therefore, echo delay is widely variable. Propagation time may vary significantly between two calls between the same points because of the alternate routing capability and the mix of facilities in the Switched Telephone Network. It is impractical to optimize the turnaround time for Switched Network service, even if the data terminal can ignore echoes, because echo suppressors may be employed in the connection. The turnaround time of an echo suppressor may be as long as 100 milliseconds. The customer can optimize the turnaround time of his system by using the 9 millisecond or No Squelch option in conjunction with the 60, 30 or 8 millisecond Clear-to-Send Delay only if his terminal can ignore echoes, has provisions to keep echo suppressors disabled (using the reverse channel of the data set), and the data sets have compatible options.

2.1.2 Clear-to-Send Delay

The ON condition of the Clear-to-Send circuit from the data set is a response to an ON condition on the Request-to-Send circuit delayed by a time interval which permits the data set to establish operations with the remote data set. Data Sets 202S and 202T provide Clear-to-Send Delay options of 180 msec., 60 msec., 30 msec. and 8 msec.

The Clear-to-Send Delay option must be chosen to be compatible with the remote data set's squelch and Receive Line Signal Detector acquisition timing and for soft carrier turn-off options on 2-wire applications.

1. 180 Milliseconds

This option is recommended for Switched Network Service, 4-wire private line facilities with talkback and 2-wire private line facilities. It is required when the remote data set has the 156 msec. Squelch option installed. For Switched Network service the 180 millisecond delay insures that the echo suppressors are turned around before data is transmitted.

2. 60 and 30 Milliseconds

The 60 and 30 millisecond options should be used on 4-wire point-to-point and multipoint facilities requiring fast start-up. The 60 millisecond option is compatible with the turn-on time of the Received Line Signal Detector of Data Sets 202C, 202D3, and 202D4, and the 40 millisecond Receive Line Signal Detector option of Data Sets 202D5, 202D6, and 202R. The 30 millisecond option is compatible with the 20 millisecond Receive Line Signal Detector option of Data Sets 202D5, 202D6, and 202R and with Fast Carrier Detection OUT (normal mode) of the Received Line Signal Detector of Data Sets 202S and 202T.

3. 8 Milliseconds

This option is recommended for use in Data Set 202T for duplex multipoint systems requiring fast startup of the data set. It is only compatible with a Data Set 202S or 202T at the distant end. The data terminal, with this option must maintain the Transmitted Data circuit in the Mark State when Request-to-Send is ON and until the Clear-to-Send indication is given. The remote data set must be optioned for the Fast Carrier Detection option IN.

2.1.3 Fast Carrier Detection

Data Sets 202S and 202T provide either a normal or a fast response time for the Received Line Signal Detector.

1. IN (Fast Mode - 7 msec.)

With this option the Received Line Signal Detector circuit turns ON in approximately 7 msec. when a Marking signal is received. The circuit turns OFF in approximately 5 msec. when it detects the soft carrier turn-off frequency. If the data set is optioned for the Fast Mode but does not receive the Marking carrier or the soft carrier turn-off frequency, the Normal Mode response times will occur. This option must be used when the distant data set uses the 8 msec. Clear-to-Send Delay option.

2. OUT (Normal Mode - 23 msec.)

With this option the Received Line Signal Detector turns ON in approximately 23 msec. when data signals are received and turns OFF in approximately 10 msec. if data signals are not received. This option is compatible with the Clear-to-Send Delay options in Data Sets 202C, 202D, 202E and 202R and is recommended when the distant data set has either the 180, 60 or 30 millisecond Clear-to-Send Delays.

2.1.4 Soft Turn-Off

1. IN (8 Milliseconds or 24 Milliseconds)

When a data terminal turns Request-to-Send OFF at the end of a message, transients occur which may cause spurious spacing signals to be received at a distant station. With the Soft Carrier Turn-Off Option, the data set transmits a soft carrier frequency for a period of either 8 or 24 milliseconds after the Request-to-Send circuit is turned OFF. This option should be used in conjunction with the Received Data Clamp option and results in a steady MARK on the Received Data circuit of the distant data set.

The 8 ms option should be used when the distant data set is a Data Set 202S or 202T and has the Fast Mode Carrier Detection option, while the 24 msec. option should be used when the remote data set is a 202C, 202D, 202R or 202S and 202T with the Normal Mode Carrier Detection option. In 2-wire applications the soft carrier turn-off option influences the Clear-to-Send delay option needed at the distant data set.

2. OUT (Quick Turn-Off)

With this option, carrier is turned off in less than 1 millisecond after the Request-to-Send circuit is turned OFF. This option is recommended only when the Carrier Detector Reset option is used in the distant data set in applications requiring fast start-up. When the Carrier Detector Reset option is not used, the Quick Turn-Off option may be used in customer engineered applications where the distant data set is insensitive to spurious signals at the end of transmission.

2.1.5 Local Copy of the Primary Channel

With this option, on 2-wire facilities, the receiver continuously monitors the transmitted line signals while the data set is in the DATA mode and provides a local copy on the Received Data circuit. The local copy signal is delayed less than 2 msec. by the data set.

2.1.6 Reverse Channel

An optional 5 baud reverse channel is available for operation on 2-wire facilities. This feature may be used to provide a break feature, circuit assurance, or a feedback signal for error detection and retransmission systems. The Reverse Channel may also be used to hold echo suppressors disabled on switched network applications. The Secondary Request-to-Send (SCA) circuit and the Secondary Line Reserved Signal Detector (SCF) circuit are used for the transmission and reception of the Reverse Channel data, respectively. The Request-to-Send circuit must be ON to permit reception of a signal on the Secondary Received Line Signal Detector circuit.

2.1.7 Local Copy of the Reverse Channel

This option provides for the local copy of the reverse channel. The local copy signal is delayed less than 50 msec.

2.1.8 Grounding

The signal ground (AB) circuit, as discussed in Section 1.6, is normally tied to the protective ground (AA) circuit. This option allows the connection between these circuits to be removed.

2.2 Automatic Answer Option for Data Set 202S

The Automatic Answer Option allows the data terminal to receive calls while unattended provided the Data Terminal Ready circuit is ON.

2.3 Automatic Calling Service With Data Set 202S

Call originations may be performed with unattended automatic data terminals by using an optional Data Auxiliary Set 801-Type Automatic Calling Unit. These units are described in two Technical References. The 801-Type used for dial pulse signaling is described in AT&T publication PUB 41601. The 801C-Type used for TOUCH-TONE® signaling is described in AT&T publication PUB 41602.

2.4 Line Hunting with Data Set 202S Multiple Arrangement

Line hunting is an available option in switched network service. Any number or all of the data sets housed in a multiple arrangement can be arranged for line hunting. The multiple mounting arrangement for Data Set 202S provides means for remote testing data sets that are associated with a line hunting arrangement and provides make-busy capabilities so that incoming calls may be caused to skip one or more of these data sets.

A separate service line is provided for remote testing any of the data sets served by a line hunting arrangement. The service line may also be used by the customer for telephone service. Operation of the RT button transfers that data set to the service line, disconnects the service line from the telephone set, and provides a busy indication to the telephone central office on the line associated with that data set.

® Registered Service Mark of AT&T Co.

Only one data set should be placed in remote test at a given time since only one data set can access the service line at a time. If a second data set is placed in remote test, it may or may not disconnect the first data set from the service line and access the line itself, depending on its location in the data mounting. The data set that is in remote test but is not connected to the service line is still able to answer calls. Upon answering a call in remote test, the data set will transmit an internally generated test sequence instead of responding to signals on the Transmitted Data Circuit.

Manual make-busy keys, shown in Figure 4A, are provided for use in line hunting arrangements when the customer desires to make one or more lines busy for any reason other than for remote test, such as during analog loop-back test, self-test or if the data terminal equipment associated with a data set is taken out of service. The make-busy feature is not provided for data sets not associated with the line hunting arrangement.

2.5 Private Line Options With Data Set 202T

2.5.1 Two-Wire or Four-Wire

The application of Data Set 202T determines the type of line interface that must be specified. The 2-wire arrangement for private line service permits simplex or half-duplex operation of the data set. The 4-wire arrangement for private line service permits duplex as well as half-duplex operation.

2.5.2 Carrier Detector Reset

This option is provided in Data Set 202T. It is intended to be used in a 202T receiver at a master station of a 4-wire multipoint system to permit rapid acquisition of incoming signals from different remote transmitters. A 0.2 millisecond (or more) ON condition should be applied by the data terminal on the Carrier Detector Reset interface circuit after the end of message has been detected. This causes the Received Line Signal Detector Circuit within the data set to reset for rapid acquisition of a new data signal when the next message arrives. This circuit should be held OFF at all other times. If this circuit is not implemented in the data terminal equipment, the option should not be installed since noise may turn the circuit ON.

2.5.3 Continuous Carrier

1. IN

This option may be used on 4-wire facilities and in Transmit-Only service over 2-wire facilities. An internal ON condition is applied to the Request-to-Send circuit which causes the carrier to be continuously transmitted. The Clear-to-Send circuit is also permanently held ON.

2. OUT (Carrier Under Control of Request to Send Circuit)

This option is required to control the direction of data transmission in half-duplex operation over 2-wire facilities. It may also be used in duplex services to provide a means of signaling the remote terminal (e.g., carrier OFF could be used as an out-of-service indication). Carrier is transmitted in less than one millisecond after the Request-to-Send circuit is turned ON.

2.5.4 Received Data Clamp

1. IN

The clamp circuit clamps to Mark the Received Data circuit when the Received Line Signal Detector is OFF. It is recommended that this option always be used.

2. OUT

If desired by the customer, the clamp circuitry associated with the Received Line Signal Detector may be disabled. With this option, noise may cause spurious signals on the Received Data circuit when a transmitted signal from the distant end is not present and the Received Line Signal Detector is OFF.

2.6 Additional Services Available with Data Set 202T

2.6.1 Alternate-Voice Service

Four-wire or 2-wire private lines may be equipped with a telephone set for alternate-voice private line service. The telephone set is connected to the line through channel terminating equipment at the station when this service is ordered. The customer should contact the telephone company to determine how this option is provided.

2.6.2 Dial Back-Up

Dial Back-Up is available with 4-wire or 2-wire private line circuits using data auxiliary equipment. The customer should contact the telephone company to determine how this option is provided.

3. INTERFACE

The interface is the point of connection between the data set and the data terminal. Each data set is equipped with a 25-pin (female) connector. The user must supply the plug and necessary cable to connect his equipment to the data set. For the male connector, a plug such as the DB-19604-432 plug manufactured by Cannon* or Cinch+ (or equivalent) is required. This type

*ITT - Cannon Electric, Division of IT&T Corporation, 3208 Humboldt St., Los Angeles, California 90031.

+Cinch Manufacturing Company, 1026 S. Homan Avenue, Chicago, Illinois 60624.

plug provides a reliable, low-resistance contact. In addition, a DB-51226-1 Hood Manufactured by Cinch (or equivalent) is recommended to protect the connections, anchor the cable to the plug, provide a finger grip for easy insertion or removal, and provide a positive screw-in locking arrangement to prevent the connector from being pulled out inadvertently.

3.1 Electrical Considerations

Data Sets 202S and 202T are equipped to follow the recommendations of Electronic Industries Association Standard RS-232-C.

3.1.1 Signal States

The Transmitted and Received Data signals are considered in the marking condition when the voltage on the circuit is more negative than minus three volts with respect to Signal Ground, and in the spacing condition when the voltage on the circuit is more positive than three volts with respect to Signal Ground.

All control functions are considered ON when the voltage on the circuit is more positive than plus three volts with respect to Signal Ground, and is considered OFF when the voltage on the circuit is more negative than minus three volts with respect to Signal Ground. The Request-to-Send (CA), Data Terminal Ready (CD), and Secondary Request-to-Send (SCA) control circuits are "Fail Safe" in that a power-off condition or a disconnection of the interconnecting cable is interpreted as an OFF condition by the data set.

The data and control circuit interface functions are defined below:

Voltage	Negative	Positive
Binary State	ONE	ZERO
Signal Condition	Mark	Space
Control Function	OFF	ON

3.1.2 Impedances of Terminator

The terminating impedance of the receiving end of interchange circuits has a dc resistance of not less than 3000 ohms nor more than 7000 ohms over the range of voltages for which the signal is defined. When the interface plug is disconnected, the interface voltage on terminator circuits is less than +2 volts.

3.1.3 Rise and Fall Times

The operation of the circuitry that receives signals from an interchange circuit is dependent only on the signal voltage. The operation of the circuitry that transmits signals to an interchange circuit conforms to RS-232-C with regard to the rise and fall time. For Control Interchange circuits, the time required for the signal to pass through the transition region (-3 volts to +3 volts) during a change in state does not exceed one millisecond. For the circuit, the rise time and the fall time does not exceed 15 microseconds through the six-volt range (-3 volts to +3 volts) in which the signal condition is not defined.

3.1.4 Open Circuit Voltages

The open circuit driver voltage with respect to Signal Ground on any interchange circuit does not exceed ± 18 volts. The driver design is such that when the terminating impedance is in the proper range (3000 ohms to 7000 ohms) and the terminator open circuit voltage is zero, the potential at the point of interface is not less than ± 5 volts or more than ± 15 volts. The terminator on an interchange circuit is designed to withstand any input signal within the ± 25 volt limit.

3.2 Purpose and Use of Interface Circuits

Data Sets 202S and 202T are provided with interface circuits shown in Figure 5 for connections to the customer's data terminal equipment. Circuit names and their designations are in accordance with EIA Standard RS-232-C except as noted. Circuit numbers correspond to pin assignments on the 25-pin receptacle. A description of the operation of each circuit and the signals appearing on them follows.

3.2.1 Protective Ground (AA) - Circuit 1

This conductor is electrically bonded to the equipment frame. It is further connected to external grounds through the power cord. The protective ground interface circuit (AA) is not provided in multiple data set arrangements (see Section 1.6.)

3.2.2 Transmitted Data (BA) - Circuit 2

Direction: TO Data Set

Signals on this circuit are generated by the transmitting data terminal and are transferred to the modulator of the data set for transmission to the remote data terminal equipment. A positive signal is a binary "0" or SPACE and a negative signal is a binary "1" or MARK.

The data terminal should not transmit data unless an ON condition is present on the Clear-to-Send and Data Set Ready interface circuits (except for Analog Loopback Test, described in Section 5).

The transmitting data terminal equipment should hold Transmitted Data in the Marking condition when no data is to be transmitted. With zero volts on the Transmitted Data circuit and with the Request-to-Send and Data Set Ready circuit ON, the transmitted Data circuit is in an indeterminate state and either a Marking or Spacing data signal will be transmitted.

3.2.3 Received Data (BB) - Circuit 3

Direction: FROM Data Set

Signals on this circuit are generated by the receiving data set in response

to data signals received from the distant data set. With the Local Copy option installed in half-duplex operation on 2-wire facilities, the Received Data circuit follows the Transmitted Data circuit delayed by less than two milliseconds, and may be used to monitor transmitted signals.

3.2.4 Request-to-Send (CA) - Circuit 4

Direction: TO Data Set

Signals on this circuit are generated by the data terminal equipment to condition the local data set to transmit data. With the Data Set Ready circuit ON, the carrier signal is transmitted in less than one millisecond after the Request-to-Send circuit turns ON. The ON condition must be maintained whenever the data terminal equipment has information ready for transmission. The data set transmits all signals on the Transmitted Data circuit while the ON condition is maintained on the Request-to-Send and Data Set Ready circuit.

If local copy is being received from the demodulator of the set that is transmitting and a Squelch option is installed, it is necessary to delay the OFF signal on the Request-to-Send Circuit 2 milliseconds after the last bit is applied to the Transmitted Data circuit. This is to allow the last bit to clear the local demodulator before the squelch circuit clamps the Received Data circuit when Request-to-Send circuit is turned OFF.

In half-duplex operation, the OFF condition of the Request-to-Send circuit holds the data set in the receive-data condition, and the ON condition holds the data set in the transmit-data condition. The above conditions are established without regard to signals on the Transmitted Data and Received Data circuits.

Data terminal equipment designed for either transmit-only or duplex operation may continuously hold Request-to-Send in the ON condition. The Continuous Carrier option may be selected on Data Set 202T which internally holds Request-to-Send in the ON condition.

On a multipoint communication channel which may successively carry data signals transmitted by one of several data communication equipment stations, Request-to-Send must be used by each data processing terminal equipment to condition its local data set to transmit.

3.2.5 Clear-to-Send (CB) - Circuit 5

Direction: FROM Data Set

The ON condition of the Clear-to-Send circuit is a response to an ON condition on the Request-to-Send interface circuit CA, delayed by 180, 60, 30, or 8 milliseconds depending on the option selected. The ON state of the Clear-to-Send circuit indicates to the data terminal equipment that signals presented on the Transmitted Data circuit will be transmitted to the communication channel.

The OFF condition is an indication to the data terminal equipment that it should not transfer data on the Transmitted Data circuit. When Request-to-Send is turned OFF, Clear-to-Send is turned OFF in less than one millisecond.

3.2.6 Data Set Ready (CC) - Circuit 6

Direction: FROM Data Set

Signals on this interface circuit indicate the mode of the data set. The ON condition indicates that the data set is in the DATA mode and is capable of transmitting and receiving data signals. The ON condition is required in conjunction with an ON condition on the Request-to-Send and Clear-to-Send circuits when transmitting data. The OFF condition indicates that the data set is in the TEST, TALK, call setup, or on-hook modes. The ON condition of this circuit alone should not be interpreted that a communication channel has been established to a remote data station or used to determine the status of any remote terminal equipment.

An ON condition on this circuit is a response to an ON condition of Data Terminal Ready in switched service applications. For non-switched data-only private line service, Data Set Ready is controlled by the state of the test switches on the data set and associated channel terminating equipment. It is ON when the data set is in the DATA mode and OFF when the data set or channel terminating equipment is in a TEST mode.

3.2.7 Signal Ground (AB) - Circuit 7

This circuit establishes the common ground reference potential for all interface circuits except Protective (Frame) Ground. It is normally connected to the Protective Ground circuit to minimize the introduction of longitudinal power line noise into electronic circuitry through the power transformer. Depending on local procedures and conditions, this connection may be disconnected by the telephone company installer.

3.2.8 Received Line Signal Detector (CF) - Circuit 8

Direction: FROM Data Set

The ON condition on this circuit indicates that the data carrier is being received and has been received for at least 23 milliseconds (or optionally 7 milliseconds with Fast Mode Timing option, see Section 2.1.3). This circuit will not normally turn on in the presence of noise, out of band signals, or other non-FSK signals even when the Fast Mode Carrier Detection option is selected.

When the data carrier is lost due to an end of transmission or to a telephone line interruption, the OFF condition follows after a 10 millisecond time delay. The OFF condition on this circuit causes the Received Data circuit to be clamped to the MARK condition. An option is provided in Data Set 202T only, that removes this clamp. However, this option is not recommended unless the terminal can ignore noise hits. With the Fast Mode Timing option, the OFF condition follows 5 ms after receiving soft turn-off tone.

The Received Line Signal Detector responds to carrier signals from either the local or remote transmitting data set when optioned for Local Copy of the Primary Channel. Additionally, the Received Line Signal Detector circuit is OFF during the squelch interval when the Squelch option is employed.

3.2.9 Circuits 9 and 10

These circuits are used for testing purposes by telephone company personnel. The data terminal must not be connected to these circuits.

3.2.10 Secondary Request-to-Send (SCA) - Circuits 11 and 19

Direction: TO Data Set

This circuit is provided only on data sets equipped with the reverse channel and is used to provide communication from the receiving data set to the transmitting data set simultaneous with the normal data channel. This channel can only be used when Request-to-Send (CA) is OFF. An option to provide local copy of the reverse channel is available on the Secondary Received Line Signal Detector circuit. SCA appears on two pins of the interface connector to conform with both EIA Standard RS-232C and the interface of older 202-type data sets.

3.2.11 Secondary Received Line Signal Detector (SCF) - Circuit 12

Direction: FROM Data Set

This circuit is provided only on data sets equipped with the reverse channel to inform the data set transmitting on the primary channel of conditions at the receiving data set simultaneous with the transmission on the primary data channel. With the Local Copy option for the Reverse Channel, Circuit SCF responds to Reverse Channel carrier from either the local or remote data set.

3.2.12 Data Terminal Ready (CD) - Circuit 20

Direction: TO Data Set

This circuit is provided in Data Set 202S to control the connection of the data set to the communication channel. The ON condition permits the data set to be connected to the communication channel upon auto answer or TALK to DATA transfer. When the station is arranged for automatic answer the data set goes OFF-hook in response to a ringing signal when circuit CD is turned ON. Data Terminal Ready must be held ON or turned ON before transferring to the DATA mode for stations optioned for manual answer.

When the data set is in the DATA mode, the ON condition serves to maintain the connection, while the OFF condition removes the data set from the communication channel by causing the data set to go on-hook.

The OFF condition does not disable the operation of Circuit CE (Ring Indicator).

3.2.13 Ring Indicator (CE) - Circuit 22

Direction: FROM Data Set

This circuit is provided in Data Set 202S to permit automatic answering of incoming calls.

The ON condition of this circuit in Data Set 202S indicates that a "ringing" signal is being received. The OFF condition is maintained at all other times. Operation of this circuit is not disabled by an OFF condition on Data Terminal

Ready. The Ring Indicator circuit turns ON and OFF with the ring and silent intervals of "ringing".

3.2.14 Carrier Detector Reset (CR) - Circuit 25

Direction: TO Data Set

This circuit may be used on an optional basis with Data Set 202T on private lines to reset the Received Line Signal Detector at the end of a message. This feature should be used in conjunction with the Quick Trun-Off option in the distant data set in fast turnaround applications such as at the master station of a 4-wire multipoint system. An ON condition should be applied to this circuit for .2 millisecond or more following detection of an end of message. At all other times the OFF condition should be applied by the data terminal. If this circuit is not implemented by the data terminal, this option should not be used since noise may turn the circuit ON. This circuit is not designed by EIA Standard AS-232C.

4. OPERATION WITH DATA TERMINAL EQUIPMENT

4.1 Switched Network Operation With Data Set 202S

4.1.1 General Call Set Up Procedures

A call may be initiated manually or by using an automatic calling unit. Either manual or unattended automatic answering may be used to receive a call. A sequence diagram of call set up and termination procedures for automatic and manual arrangements between two 202S data sets is given in Figures 6 and 7, respectively.

In the case of manual originate and answer, the calling attendant picks up the handset on the telephone set, depresses the line button corresponding to the line on which the data set operates, and dials the number of the distant data set. After the call is answered by the attendant at the called station and voice contact is made, the two attendants agree to go into the DATA mode by momentarily depressing the nonlocking "DATA" button until the line lamp lights. Before either station is transferred to the DATA mode, the Data Terminal Ready interface circuit of both data terminals must be ON.

After the data set is transferred to the DATA mode, the handset may be placed on-hook. The lamp under the button corresponding to the telephone line to which the data set is connected will stay ON while the data set is in the DATA mode.

If the call is answered automatically, the calling party will hear a high pitched answer tone after the call is answered. Upon hearing this tone the attendant should momentarily depress the nonlocking "DATA" button on the telephone set to transfer to the DATA mode and then place the handset on-hook. Again, both data terminals must provide an ON condition to the Data Terminal Ready circuit to prepare the data sets for data transmission and to hold the connection. If the call is originated by an ACU, the ACU will detect the answer tone and place the data set in the DATA mode.

Figures 6 and 7 show that the call set up procedures for Data Set 202S are such that, except when ACUs are used, the answer tone is transmitted when both data sets enter the DATA mode, irrespective of which was the calling or called party. Data sets working with automatic calling units do not transmit answer tone when they go into the DATA mode. If the data set that is to receive first goes into the DATA mode first, then the answer tone from the remote data set could be interpreted as a Spacing signal at the receiver and result in spurious Spacing signals on the Received Data circuit. To prevent this, the carrier detectors of 202S data sets are inhibited until they receive at least 3 milliseconds of Marking signal at the start of a call. Thus the Received Data circuit is clamped to Mark until the answer tone is completed and Mark is received. The Received Line Signal Detector circuit turns ON in 23 milliseconds once the Marking frequency is detected. Since the data set transmits whatever signal is on the Transmitted Data circuit when the Data Set Ready and the Request-to-Send circuits are ON, (regardless of whether the Clear-to-Send timing delay has expired), the data terminal transmitting to a distant Data Set 202S must hold its Transmitted Data circuit in the Mark state for at least 3 milliseconds after the data terminal turns its Request-to-Send circuit ON and the Data Set Ready circuit (CC) is ON.

The above procedure is not identical with the procedure for Data Set 202C and 202D, when operating with Data Auxiliary Set 804, which require that the called party go into the DATA mode first and transmit answer tone. The calling party enters the DATA mode at the end of answer tone and does not transmit answer tone. As a result, a problem may occur when a Data Set 202S with manual call origination calls one of these data sets. In this case, spurious Space signals may occur on the Received Data Circuit of the previous 202-type data sets due to Data Set 202S's answer tone if these data sets are placed in the DATA mode first.

If Data Set 202S calls Data Set 202C, 202D, or 202R with manual answer, it is recommended that the attendants should agree that Data Set 202S should go into the DATA mode first to avoid the above problem. If Data Set 202S calls Data Set 202C or 202D with automatic answer, then the attendant should go into the DATA mode at the beginning of the answer tone.

4.1.2 Automatic Answer and Data Mode Transfer

With automatic answer Data Set 202S answers an incoming call at the end of the first ringing cycle as detected by the Ring Indicator circuit if the Data Terminal Ready (CD) circuit is ON. The data set will respond after the call is answered with an answer sequence consisting of a 1.3 second silent interval and 1.9 seconds of answer tone. This is followed by an ON condition of the Data Set Ready (CC) circuit. The data set is now in the DATA mode and can be used for data transmission as a transmitter or receiver under the control of the Request-to-Send (CA) circuit. Circuit CD must be kept ON for the duration of the call to hold the connection.

After the answer sequence is over, it is possible to transfer to the TALK mode by lifting the handset and depressing the lighted button on the telephone set corresponding to the line with which the data set is associated. The lamp will be OFF while in the TALK mode. The DATA mode can be re-established by having the attendants at each data set momentarily depress the "DATA" button on the telephone set until the lamp lights, and hang up the handset. During the TALK mode the Data Set Ready circuit will be OFF.

4.1.3 Call Termination Procedures

Switched network connections must be terminated by taking positive action at both data stations. A call may be terminated manually by lifting the handset, depressing the button on the telephone set corresponding to the line with which the data set is associated (to go to TALK mode), and then replacing the handset on-hook.

With unattended call termination, a call is terminated by turning OFF the Data Terminal Ready circuit for at least 50 milliseconds. The lamp under the line button will extinguish and the Data Set Ready circuit will go to an OFF condition.

4.1.4 Data Transmission Procedures

Transmission of data on a DATAPHONE call must follow the basic procedures of half-duplex operation on 2-wire point-to-point private lines (see Section 4.2.1). The 180 millisecond Clear-to-Send delay and 156 millisecond squelch duration (see Section 2.1.1) are recommended to insure that echoes on the line have subsided or echo suppressors have been turned around (if they are not disabled).

If echo suppressors are in the circuit, they are disabled during the call set-up procedure by the answer tone. Echo suppressors will become enabled again if there is a period as long as 100 milliseconds without any signal on the line. This last requirement must be met by the data terminal and may be accomplished using the reverse channel by insuring that either the reverse channel transmitter or data transmitter is ON at all times after echo suppressors are disabled. If the remote data terminal is able to ignore echoes and the reverse channel is used to keep echo suppressors disabled, then the No Squelch option and the shorter Clear-to-Send Delays may be used.

4.2 Private Line Operation With Data Set 202T

In (nonswitched) private line operation the line facilities are dedicated between the data set locations. With power applied, the data set is either in the DATA or TEST modes (or TALK mode if alternate-voice service is used). The Data Terminal Ready and Ring Indicator circuits are not used. In the DATA mode, the Data Set Ready (CC) circuit will be ON, and transmission is initiated by the data terminal by control of the Request-to-Send circuit.

4.2.1 Two-Wire Point-to-Point Operation

With 2-wire point-to-point operation, the data set may be operated either half-duplex (alternately in each direction) or simplex (Receive-Only or Transmit-Only).

In half-duplex operation, the Request-to-Send circuit is turned ON by the station desiring to transmit. After a delay of nominally 180, 60, 30, or 8 milliseconds (depending on which Clear-to-Send Delay option is selected), the Clear-to-Send circuit turns ON, indicating that the data terminal may begin transmission. Note that the Clear-to-Send Delay option chosen must be compatible with the options used in the distant data set. The procedure for reversing the direction of transmission are given in Figure 8.

It is recommended that the 180 millisecond Clear-to-Send Delay option and the 156 millisecond Squelch option be used. This is to prevent the demodulator of the station that has been transmitting from receiving line reflections when the station turns its Request-to-Send circuit OFF.

The 9 millisecond squelch option and a shorter Clear-to-Send Delay option may be used in customer engineered systems on facilities less than 50 miles in length. Also, the No Squelch and the shorter Clear-to-Send Delay options may be used (see Section 2.1.1), if the local data terminal is able to ignore the line reflections (e.g., by using a start of message code such as STX or SOH to unblind the receiving data terminal at the beginning of a message). However, the telephone company is not responsible for satisfactory operation or trouble analysis of these customer engineered application. In addition, with the Local Copy option when line reflections are present, the Received Line Signal Detector circuit of both the local and remote data sets may be ON all the time. This will occur when the data terminal of the remote data set turns Request-to-Send ON before the Received Line Signal Detector circuit (of the remote data set) turns OFF. In this case, the transmitted message (from the local to the remote data set) should be longer than the round-trip propagation delay (maximum round-trip delay within continental U.S.A. is less than 100 milliseconds) or distinct start codes should be used at each end so that the echo of the local start code is not interpreted as a start code from the remote data set.

When Data Set 202T is on a line with Data Sets 202C, 202D or 202R, the 180 millisecond Clear-to-Send Timing option must be used when these data sets have the Squelch option installed.

4.2.2 Four-Wire Point-to-Point Operation

In 4-wire point-to-point operation, simultaneous transmission in both directions is possible. The carrier signal is transmitted only when the Request-to-Send circuit is ON or when the Continuous Carrier option is used. The data terminal should wait for Clear-to-Send to go ON before data is transmitted. The receiving data set will provide an ON indication on the Received Line Signal Detector (CF) circuit after detecting carrier signal. Four-wire circuits can also be operated half-duplex as described in Section 4.2.1. It is recommended that the Request-to-Send circuit be held ON all the time or the Continuous Carrier option be used in both directions to obtain maximum utilization of the 4-wire facility.

4.2.3 Four-Wire Multipoint Operation

For broadcast polling applications on multipoint private lines a split bridge technique is employed. The bridge is arranged such that a signal input from any station on the bridge is not transmitted back to the originating station. Figure 9 shows this type of multipoint private line arrangement which is attractive where all transmissions are between a master station and associated remote stations (i.e., remote stations cannot intercommunicate directly).

This system permits the master station to operate with the Continuous Carrier option or the Request-to-Send Circuit permanently held ON thereby eliminating the startup delay each time a new transmission is initiated by the master station. For remote stations the data set turnaround time is controlled by the switched carrier Clear-to-Send Delay option of the data set and the compatible Received Line Signal Detector timing of the master data set. For fast turnaround, the 8 msec. option should be used when a Data Set 202T is at the master station.

Furthermore, to minimize the turnaround time in this multipoint arrangement the master station may use the Carrier Detector Reset option and the Fast Mode Carrier Detection option, while the remote stations should use the 8 msec. Clear-to-Send Delay and the Quick Carrier Turn-Off options. If the master station cannot implement the Carrier Detector Reset circuit, then the remote stations should use the 8 msec. Soft Carrier Turn-Off option to turn the Receive Line Signal Detector in the master station OFF within 5 msec. A sequence of interface control circuit operations at the master and remote data sets is shown in Figure 10 for this type of polling operation. This sequence indicates when the Circuit CR should be used.

If the remote data set is a Data Set 202R, 202C or 202D and the master station (202T) uses the Carrier Detector Reset option, then the remote data set should use the Quick Turn-Off option and may transmit data after sending 8 milliseconds of Mark after Request-to-Send is turned ON. If the master station does not use the Carrier Detector Reset option, the remote station should use the Soft Turn-Off option. For this case the interval between messages from any two remote stations must be greater than the Soft Turn-Off interval (maximum of 40 milliseconds for Data Set 202R and 60 milliseconds for Data Sets 202C and 202D).

Figure 11 shows another private line arrangement which permits any station to transmit and receive from any other station nonsimultaneously (conference multipoint). Where the customer desires to obtain local copy through the receive leg, a "talk-back" feature may be added to the bridge. When the "talk-back" feature is provided, the 156 msec Squelch option is recommended to prevent line reflections from being interpreted as valid data after the Request-to-Send circuit is turned OFF.

With this Squelch option installed, the remote data sets should use the 180 milliseconds Clear-to-Send Delay option. If the "talk-back" feature is not employed, the remote data sets should use the 60, 30, or 8 milliseconds Clear-to-Send Delay option.

It is possible, when the "talk-back" feature is not provided, for any two stations to transmit and receive simultaneously. However, a disadvantage of this system is that all of the other stations on this circuit receive an unintelligible combination of both transmitted signals.

5. TESTING OF THE DATA SETS 202S AND 202T

As indicated in Section 1.8, Data Sets 202S and 202T have test capabilities which can be used by a customer to expedite the isolation of transmission problems to either the data set, the transmission facilities, or the customer's data terminal equipment. These test features may be used either prior to calling the Telephone Company Repair Service or when the Telephone Company Test Center requests assistance with certain remote tests. The use of the test buttons and status lamps on Data Sets 202S and 202T is described in this section. Before proceeding with the following tests, the data terminal equipment associated with the data set under test should be in the idle mode so that data transmission is not interrupted by these tests.

5.1 Local Self-Test (LT) - Data Sets 202S and 202T

The Local Self-Test may be used to determine whether the data set is performing properly. The attendant depresses the nonlocking LT button on the data set housing to initiate the test, and must manually keep the button depressed for the duration of the test. An OFF indication is given on the Data Set Ready circuit, while other data set interface drivers are either in the Mark or OFF state and the interface terminators are isolated from the data terminal equipment.

All lamps are turned ON regardless of the status of the interface circuits, upon entering the Local Self-Test, to check the operating condition of the lamps. If a single error occurs during the test, the TM (Test Mode) lamp turns OFF and remains OFF until the LT button is released and depressed again. If an error occurs during a 15 second test, the test should be repeated. The data set should pass (TM lamp does not go OFF) 4 of 5, 15 second tests. The release of the LT button returns the data set to normal operation.

5.2 Analog Loopback Test (AL) - Data Sets 202S and 202T

In the Analog Loopback Test the output of the transmitter is connected to the input of the receiver to permit testing of the data set and data terminal by the data terminal. This loopback also permits the testing of the data set by test sets. Figure 12 shows the configurations of the data set and data terminal for this test. To enter the Analog Loopback Test, the attendant depresses the locking AL button. The Data Set Ready (CC) circuit turns OFF, but the other interface circuits perform as in normal operation.* The Data Terminal Ready (on Data Set 202S) and Request-to-Send circuits must be turned ON by the customer's equipment for

*EIA Standard RS-232-C presently requires CC to be OFF when the data set is in the TEST mode. It also recommends that the data terminal ignore all other interface circuits when CC is OFF. Data Terminals following this recommendation cannot perform this test.

testing to begin. The Power ON and Test Mode status lamps remain ON while the other indications follow the status of the interface circuits. The delay through the data set in the Analog Loopback mode is less than 2 msec.

Each time the Analog Loopback mode is entered by Data Set 202S, the data set cycles through the answer tone sequence consisting of a nominal 1.3 second quiet interval followed by the transmission of 1.9 seconds of answer tone.

For Data Set 202S, if the attendant answers a call or goes off-hook on the line, while in Analog Test mode, the Clear-to-Send circuit turns OFF. If the test procedure does not require this circuit to be ON, the test may continue. However, should the attendant hang up the phone, the data set reinitiates the answer sequence, which interferes with the data set test.

The automatic answer feature is disabled in the analog loopback test mode. The line is disconnected if the attendant answers a call and attempts to go into the DATA mode by depressing the DATA button on the telephone and hanging up the telephone. The AL button must be released before depressing the DATA button on the telephone when entering the DATA mode.

5.3 Remote Test (RT) - Data Set 202S

A 2-wire Remote Test shown in Figure 13 may be used by the customer to determine if a connection can be established to a remote data set. Any convenient telephone handset may be used in performing this test. However, if the telephone handset of the calling data set is used, the entire telephone connection can be tested. A Data Set 202S in Remote Test will automatically answer an incoming call and go through the call set up procedure shown in Figure 6 for the called data set. The data set will trip ringing, go through a quiet interval of 1.3 seconds, transmit answer tone for 1.9 seconds and then transmit a random data signal. The customer can monitor this sequence with the telephone set to determine if the data set and link from the data set to the calling station are in working order. For data sets with reverse channel, a low frequency beeping tone will also be heard. If the above sequence does not occur, the customer should report the problem to the Telephone Company. It should be noted that during this test noise or speech picked up by the mouth piece of the telephone hand set may cause the remote data set to transmit a steady tone instead of the random data.

5.4 Four-Wire Remote Test (RT) - Data Set 202T Four-Wire Operation

The 4-wire Remote Test shown in Figure 14 may be used in the isolation of a trouble condition on four-wire facilities. The output of the demodulator is connected to the input of the modulator so that the data set operates as a repeater. As a repeater, a distorted signal entering the demodulator will be distorted when it enters the modulator. The return signal may be highly distorted and produce a high error rate although the channel may be within specification. Consequently, use of this remote test should be limited to operation at 1200 bps and below. At these data rates the percent distortion is reduced and satisfactory error performance is expected.

To initiate the loopback the attendant at the remote data set depresses the locking RT button. The Data Set Ready circuit turns OFF while the other interface circuits are isolated from the remote data terminal. In this test mode the Power ON and TM lamps are the only lamps turn ON.

To initiate the test, the local data set which is in the DATA mode may transmit a test sequence to the remote data set. The remote data set demodulates the sequence and then transmits it back to the local data set which checks for errors. Note that the local data terminal must be able to operate duplex to perform this test.

To return the remote data set to normal operation, the RT button should be released.

5.5 Telephone Company Remote Test Procedures

In addition to the tests which can be conducted by the customer's attendant, remote tests can be conducted by the Telephone Company Test Center with the assistance of the customer's attendant at each data set (see Figure 15). The Telephone Company Repair Service should be notified only of problems which have been isolated to the data set or transmission facility. When the Test Center calls in response to a trouble report, the customer personnel will be requested to assist with the remote test features of the data set and the channel. The customer may also be asked to make a Local Self-Test of the data set. The procedure for remote testing the two-wire (Data Set 202S or 202T) and four-wire nonswitched private line services (Data Set 202T) are described in items 5.5.1 and 5.5.2.

5.5.1 Two-Wire Remote Test

The two-wire remote test is entered by depressing the RT button. All the lamps are conditioned to go ON to verify this operation. The Test Center can then call the Data Set 202S and the data set will automatically answer. The Test Center then sends a series of transmissions to the local data set designed to isolate possible problems. After completing the transmissions, the Test Center calls the customer location and requests the data set be removed from the TEST mode by pushing the RT button. The lamps, except for the power on lamp, should go OFF if CA and CD are held OFF by the data terminal. Results of the test and any further action by the Telephone Company will be indicated by Test Center personnel.

5.5.2 Four-Wire Remote Test

The remote test for four-wire private line data sets, consists of a loop-back test of the data set. This requires the customer personnel to depress the RT button on the data set (which is in the DATA mode) to place it in the proper TEST Mode. In this test mode the power ON and TM lamps are the only lamps that are ON. The Test Center then sends data over the looped back path and observes the performance for a prearranged interval of time. Following

this test the Test Center personnel will discuss the results with the customer personnel and indicate any further action which should be taken. The customer personnel should then restore the data set to normal by releasing the RT button.

6. PERFORMANCE

This section is included to provide the data terminal designer with some insight into the performance that can be expected from systems employing the Data Sets 202-type.

6.1 Switched Network Service - Data Set 202S

Results of Data Sets 202-type performance at 1200 bps on the Switched Telecommunication Network are given in an article by Balkovic, Klancer, Klare, and McGruther, entitled "1969-70 Connection Survey: High-Speed Voiceband Data Transmission Performance on the Switched Telecommunications Network", Bell System Technical Journal, 50, No. 4 (April, 1971), p.p 1349-1384 and reprinted in Technical Reference PUB 41007. Figures 16A and 16B show the bit and block error rates for Data Sets 202-type based on data from that survey report. The performance data was obtained using Data Set 202D. However, the performance of Data Set 202S is comparable to the performance of Data Set 202D on the Switched Network. Note that this data is taken from a number of calls from a number of locations. Performance from any one location may deviate substantially from that shown in the figures.

6.2 Private Line Service - Data Set 202T

The performance of asynchronous data sets depends on the signals presented on the transmitted data circuit and timing recovery circuit of the data terminal as well as the characteristics of the data channel. Most asynchronous data sets are used in start-stop systems in which a group of bits corresponding to a character is preceded by a start element which serves to prepare the receiving data terminal for the reception of the characters, and is followed by a stop element during which the receiving data terminal comes to rest in preparation for the reception of the next character. For Data Set 202T operating in start-stop systems in which the timing for sampling the received data is obtained only from the start element, a long term average of 1 character (10 bits per character including start and stop bits) in error per 10,000 characters transmitted or better is to be expected for data rates up to that specified in Section 1.3 for the recommended conditioning. However, for systems with character length greater than 10 bits, poorer performance can be expected.

For Data Set 202T operating on 4-wire private lines or 2-wire private lines without reverse channel in which the sending data processing terminal transmits data continuously to a receiving data processing terminal that is operating at the same frequency as the transmitter and maintained in phase by means of phase lock loops or equivalent, the data set will provide satisfactory performance (long time average of 1 bit in error per 100,000 bits

transmitted or better on working circuits) on a high percentage of basic support the above error performance requirements for data sets operating at data rates greater than that specified in Section 1.3 for the recommended conditioning.

Furthermore, since the performance of asynchronous data sets depends on the signals presented on the transmitted data circuit and timing recovery circuit of the data terminal, it is recommended that the data terminal use crystal controlled timers at the transmitter and receiver for operation at data rates of 1200 bps and above.

When Data Set 202T is used on the Switched Network with Dial Back-Up service, it is expected to have an error rate at 1200 bps comparable to that of Data Set 202S (see Section 6.1). It is expected that the performance of the data set at data rates greater than 1200 bps will be degraded. Therefore, operation at these data rates is not recommended.

TABLE 1
OPTION SUMMARY TABLE

FEATURE	OPTIONS		
LINE INTERFACE	SWITCHED NETWORK	PRIVATE LINE 2-WIRE	PRIVATE LINE 4-WIRE
RECEIVED DATA SQUELCH	156 MSEC		
	9 MSEC*		
	0 MSEC		
CLEAR-TO-SEND DELAY	180 MSEC		
	60 MSEC		
	30 MSEC		
	8 MSEC		
FAST CARRIER DETECTION	IN (TURN ON - 7 MSEC; TURN-OFF - 5 MSEC)		
	OUT (TURN ON - 23 MSEC; TURN OFF - 10 MSEC)		
SOFT CARRIER TURN-OFF	24 MSEC*		
	8 MSEC		
	OUT (QUICK TURN-OFF)		
RECEIVED DATA CLAMP	NOT APPLICABLE	IN (BB CLAMPED MARK WHENEVER CF IS OFF)	
		OUT	
LOCAL COPY OF THE PRIMARY CHANNEL	IN	NOT APPLICABLE	
	OUT		
REVERSE CHANNEL	IN	NOT APPLICABLE	
	OUT		
LOCAL COPY OF THE REVERSE CHANNEL	IN	NOT APPLICABLE	
	OUT		
GROUNDINGS	AB CONNECTED TO AA		
	AB NOT CONNECTED TO AA		
AUTOMATIC CALLING UNIT	NO	NOT APPLICABLE	
	YES		
AUTOMATIC ANSWER	IN (CONTROLLED BY CD)	NOT APPLICABLE	
	OUT		
ALTERNATE VOICE	NOT APPLICABLE	NO	
		YES	
DIAL BACKUP	NOT APPLICABLE	NO	
		YES	
CARRIER DETECTOR RESET	NOT APPLICABLE	IN	
		OUT	
CONTINUOUS CARRIER	NOT APPLICABLE	IN (CARRIER TRANSMITTED CONTINUOUSLY)	
		OUT (CARRIER UNDER CONTROL OF CA)	

*THE COMBINATION OF 9 MSEC RECEIVED DATA SQUELCH AND 24 MSEC SOFT CARRIER TURN-OFF IS NOT AVAILABLE

TABLE 2
 RECOMMENDED CUSTOMER OPTIONS
 for
 SWITCHED NETWORK SERVICE
 with
 DATA SET 202S*

Received Data Squelch	156 msec.
Clear-to-Send Delay	180 msec.
Fast Carrier Detection - (Received Line Signal Detector Timing)	Out (Normal - 23 msec.)
Soft Carrier Turn-off	24 msec.
Received Data Clamp	Always In
Reverse Channel	Optional**
Local Copy-Primary Channel	Optional
Local Copy-Reverse Channel	Optional**
Automatic Calling Unit	Optional**
Automatic Answer	Optional
Grounding	AB Connected to AA

*It is assumed that the remote data set; 202C, 202D with 804 Data Auxiliary Set, 202R or 202S uses the recommended options shown below:

	<u>202C and D</u>	<u>202R</u>	<u>202S</u>
Squelch	In	In	156 msec.
Clear-to-Send	200 msec	200 msec.	180 msec.
Receive Line Signal Detector Timing (Fast Carrier Detection)	40 msec. (Note 1 for 202C)	40	Out (Normal - 23 msec.)
Soft Carrier Turn-off	In	In	24 msec.
Received Data Clamp	In	In	In
Reverse Channel	Optional	Not Avail.	Optional
Local Copy-Primary Channel	In (Note 1)	In (Note 1)	Optional
Local Copy-Reverse Channel	In (Note 1)	Not Avail.	Optional
Automatic Calling Unit	Optional (Note 2)	Not Avail.	Optional
Automatic Answer	Optional	Not Avail.	Optional

**The Reverse Channel and Automatic Calling Unit Options should not be used with a remote 202R Data Set.

Note 1: Standard Arrangement - not a customer option.
 Note 2: Not available with 202D.

TABLE 3

RECOMMENDED CUSTOMER OPTIONS
for
DATA SET 202T*
with
TWO-WIRE AND FOUR-WIRE PRIVATE
LINES WITH TALK BACK

Line Interface	2-wire or 2-wire
Received Data Squelch	156 msec
Clear-to-Send Delay	180 msec.
Fast Carrier Detection - (Received Line Signal Detector Timing)	Out (Normal - 23 msec.)
Soft Carrier Turnoff	24 msec.
Received Data Clamp	In
Reverse Channel	Optional in two-wire private lines
Carrier Detector Reset	Out (Not Used)
Continuous Carrier	Out (Carrier Under Control of CA)
Local Copy-Primary Channel	Optional in Two-wire Private Line
Local Copy-Reverse Channel	Optional
Alternate Voice	Optional
Dial Back-Up	Optional
Grounding	AB Connected toAA

*It is assumed that the remote data set; 202C, 202D, 202R, or 202T uses the recommended options shown below:

	<u>202C and D</u>	<u>202R</u>	<u>202T</u>
Squelch	In	In	156 msec.
Clear-to-Send	200 msec.	200 msec.	180 msec.
Receive Line Signal Detector Timing (Fast Carrier Detection)	40 msec.	40 msec.	Out (Normal - 23 msec)
Soft Carrier Turn-off	In	In	24 msec.
Received Data Clamp	In	In	In
Dial Back-up	Optional	Optional	Optional
Reverse Channel	Optional for 2-wire	Not Available	Optional for 2-wire
Carrier Detector Reset	Not Avail.	Not Avail.	Out (Not Used)
Local Copy-Primary Channel	In for 2-wire	In for 2-wire	Optional 2- wire
Local Copy-Reverse Channel	In for 2-wire	Not Avail.	Optional
Continuous Carrier	Not Avail.	Out	Out

TABLE 4

Recommended Options for Four-Wire Point-to-Point and Multipoint without Talkback Using Data Set 202T:

Line Interface	4-wire
Received Data Squelch	Out
Clear-to-Send Delay	8 milliseconds if remote data set is a 202T with Fast Mode Carrier Detection. 30 milliseconds if remote data set is Data Set 202T with Normal Mode Carrier Detection or Data Sets 202R, 202-D5 and 6 with 20 millisecond carrier detector timing. 60 milliseconds if remote data set is Data Sets 202C, 202-D3 and 4, or Data Sets 202R, 202-D5 and 6 with 40 millisecond carrier detector timing.
Fast Carrier Detection (Received Line Signal Detector Timing)	In (Fast Mode) if remote data set is Data Set 202T with 8 millisecond Clear-to-Send Delay. Out (Normal Mode) if remote data set is optioned for 30, 60, 180 or 200 millisecond Clear-to-Send Delay.
Soft Carrier Turn-Off	24 milliseconds if remote data set is Data Set 202C, 202-D3, 4, 5 and 6, 202R or 202T with Normal Mode Carrier Detection. 8 milliseconds if remote data set is Data Set 202T with Fast Carrier Detection option installed. Quick Turn-Off if remote data set uses Carrier Detector Reset option.
Received Data Clamp	In
Carrier Detector Reset	In-at master station of Broadcast Polling or Bridge Multipoint System when remote data sets use the Quick Carrier Turn-Off and master station is able to implement this circuit. Out - All other times
Continuous Carrier	In for Point-to-Point applications and for data set as Master Station of Split Bridge Multipoint Systems. Out - May be used for above applications and should be used for data set at the Remote Station of Split Bridge Multipoint System and all stations on conference multipoint facilities.
Alternate Voice	Optional
Dial Back-Up	Optional
Grounding	AB Connected to AA.

Figure 1
Data Set 202S with Key Telephone Set

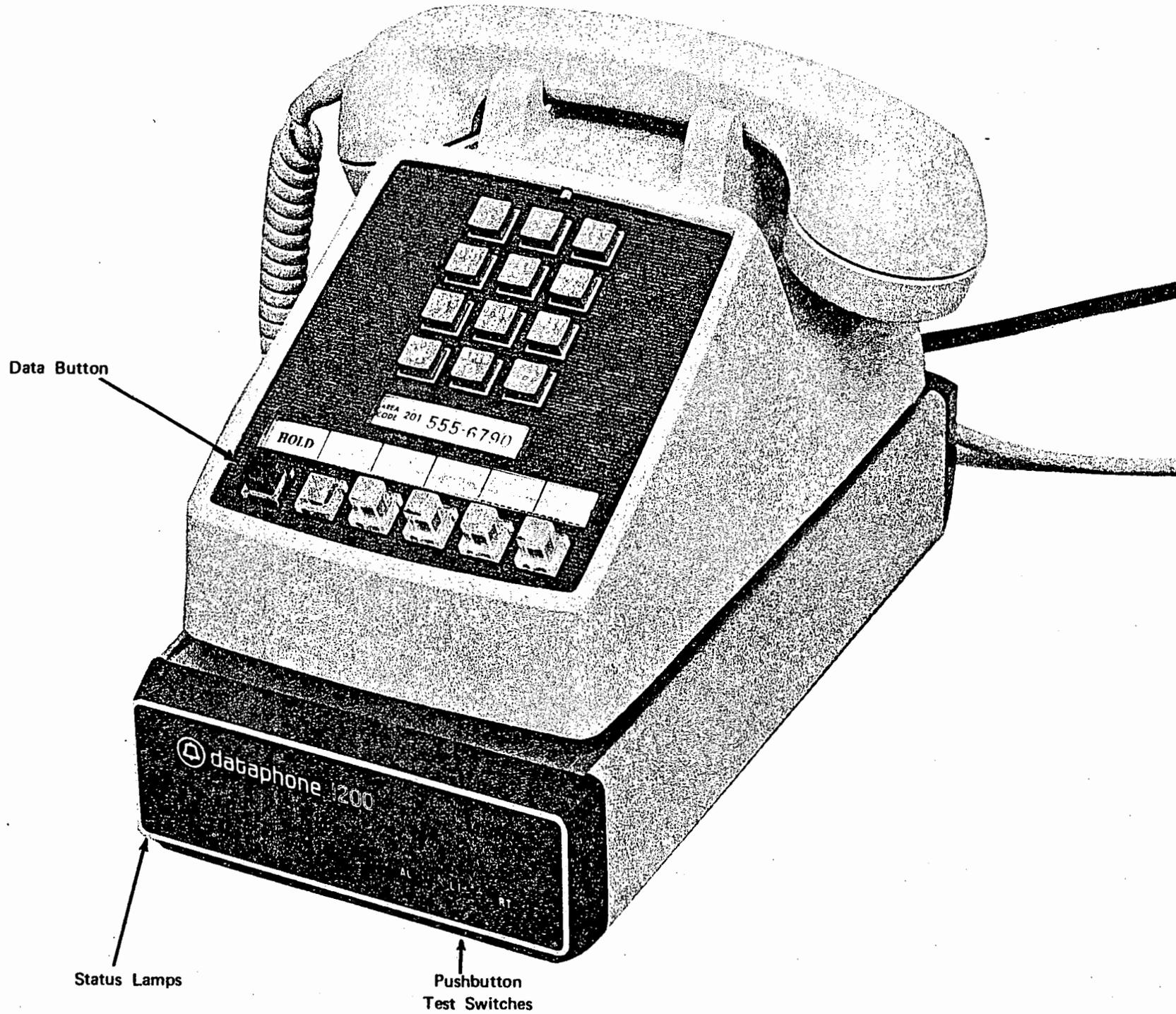
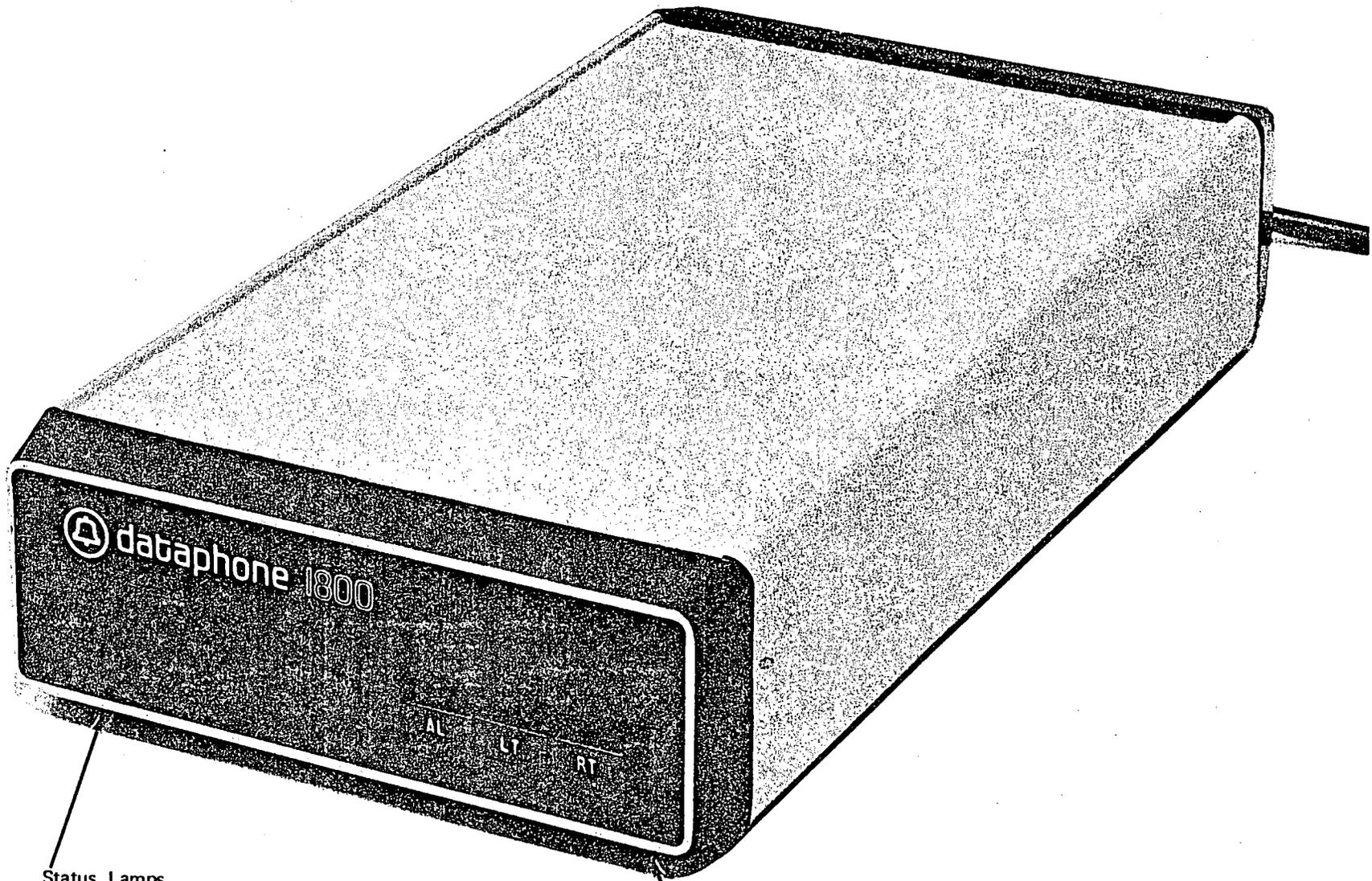


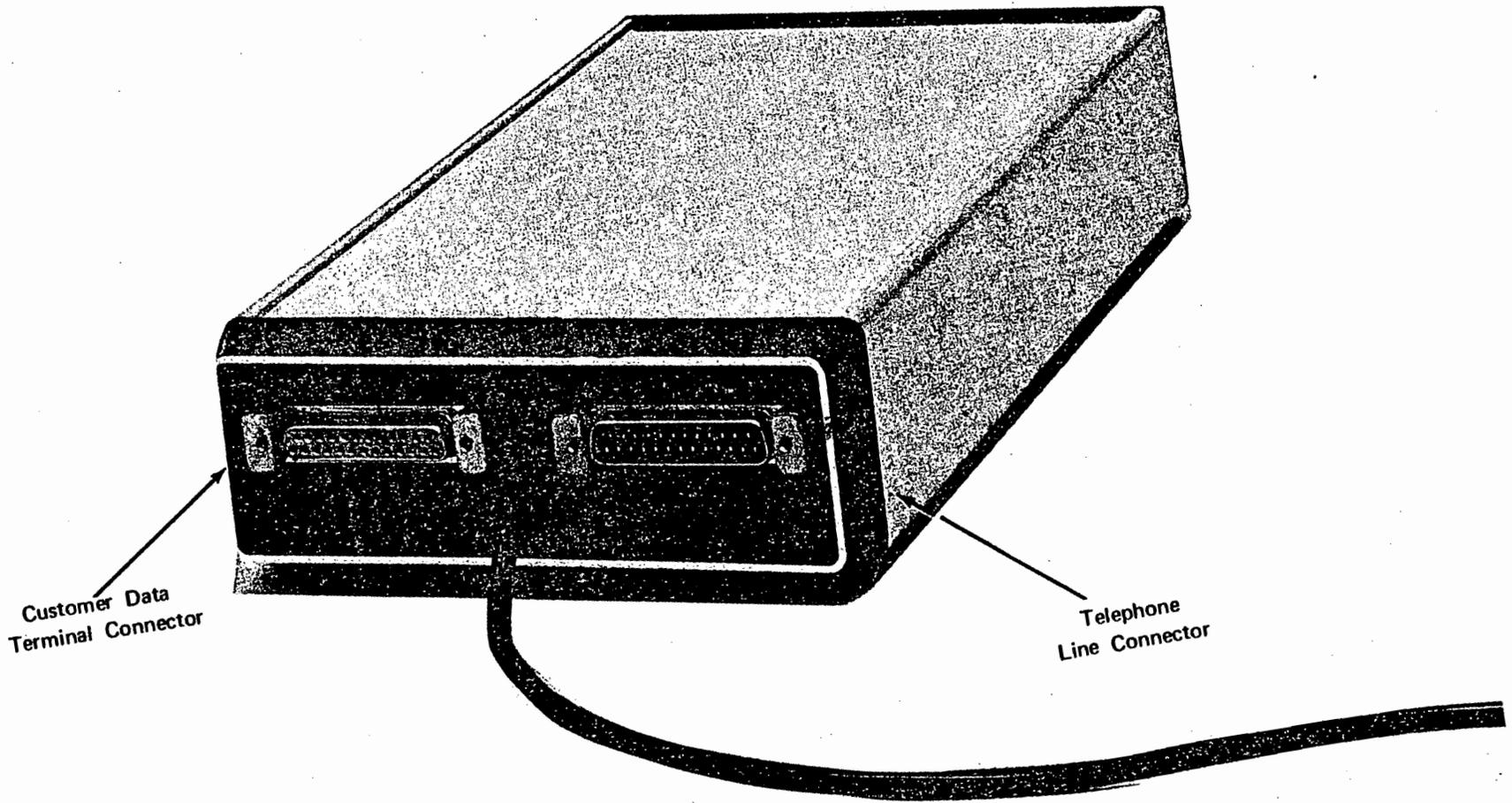
Figure 2
Front View of Data Set 202T



Status Lamps

Pushbutton
Test Switches

Figure 3
Rear View of Data Set



Customer Data
Terminal Connector

Telephone
Line Connector

Figure 4A
Rack Mounting of Data Set 202S

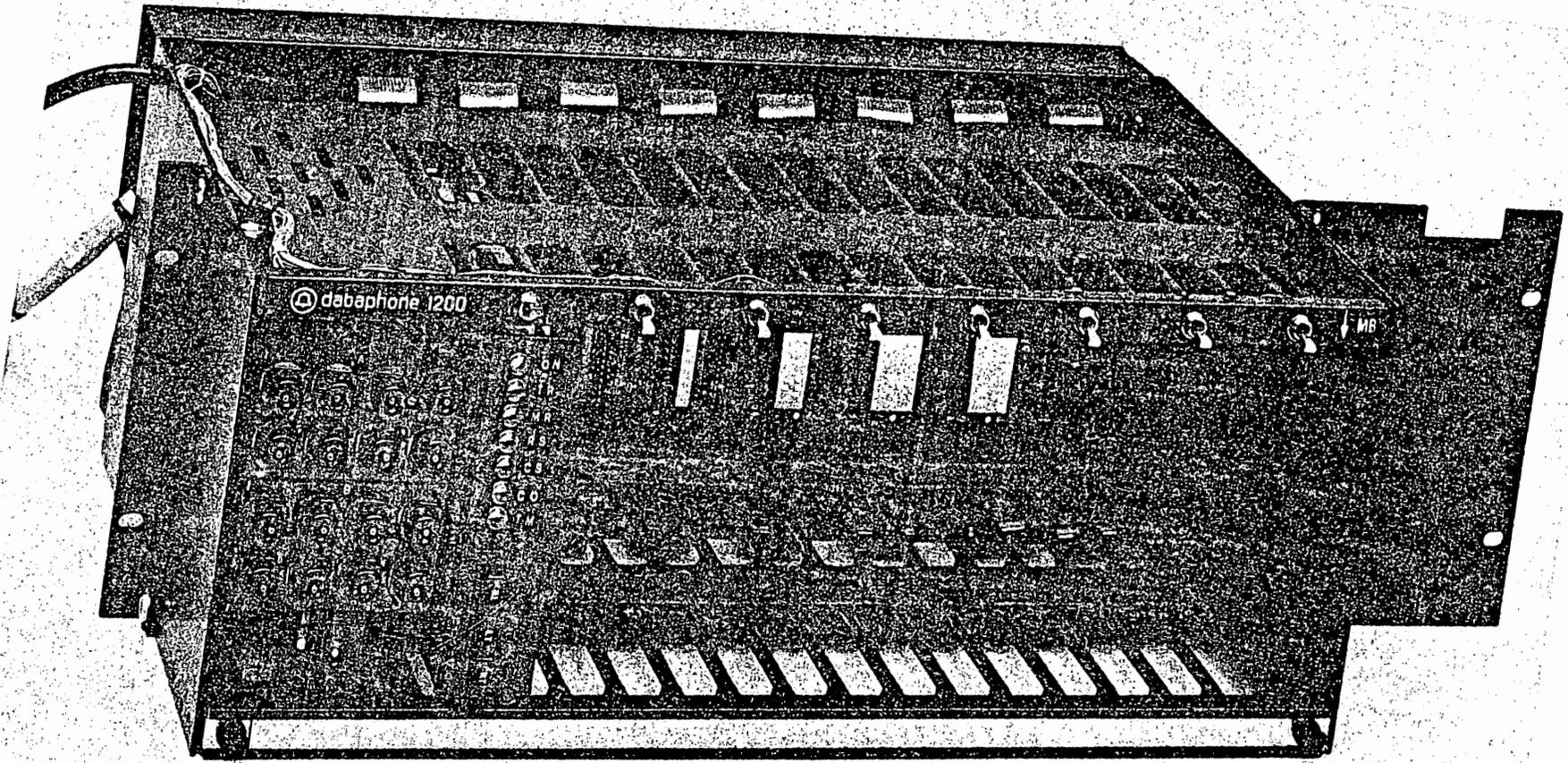


Figure 4B
Rack Mounting for Data Set 202T

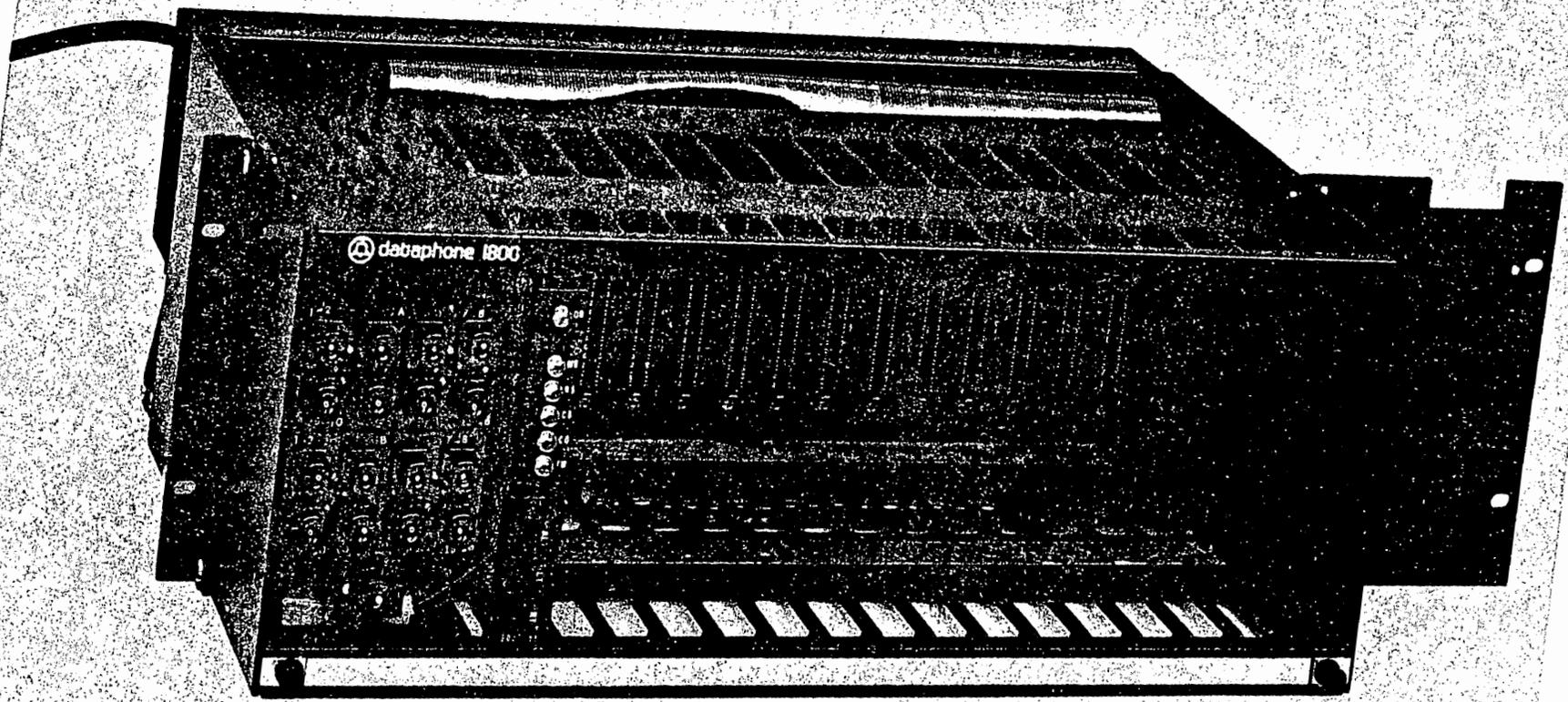
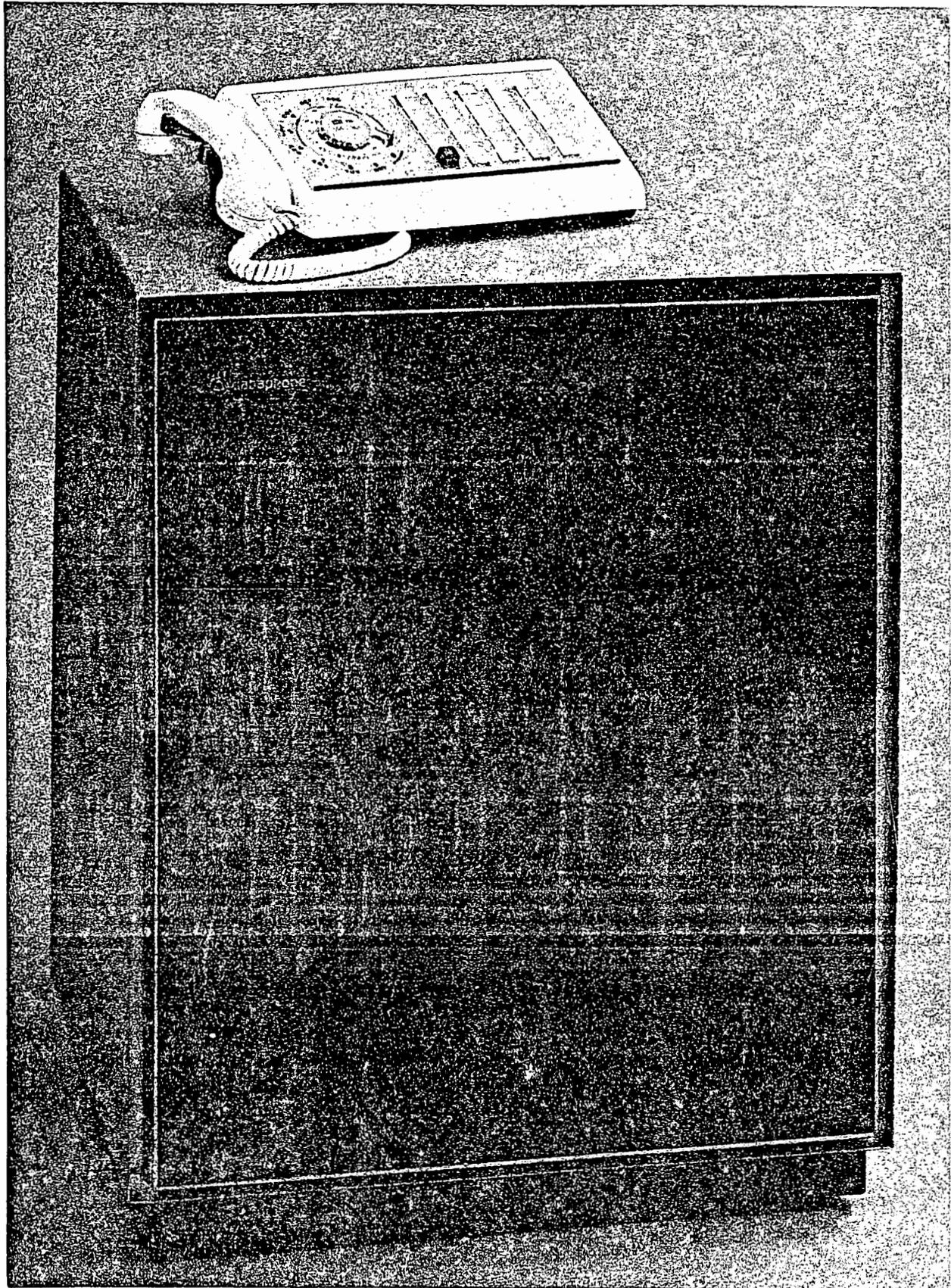


Figure 4C
Cabinet for Data Sets 202S and 202T



Customer Interface Circuit Designations,
Pin Assignments, and Applications

Pin No.	Circuit Designation Using EIA RS-232-C Nomenclature
1	Protective Ground (AA)
2	Transmitted Data (BA)
3	Received Data (BB)
4	Request-to-Send (CA)
5	Clear-to-Send (CB)
6	Data Set Ready (CC)
7	Signal Ground (AB)
8	Received Line Signal Detector (CF)
9	Reserved for Data Set Testing
10	Reserved for Data Set Testing
11	Secondary Request-to-Send (SCA)**
12	Secondary Received Line Signal Detector (SCF)
13-18	Not Used
19	Secondary Request-to-Send (SCA)**
20	Data Terminal Ready (CD)*
21	Not Used
22	Ring Indicator (CE)*
23-24	Not Used
25	Carrier Detector Reset (CR)+

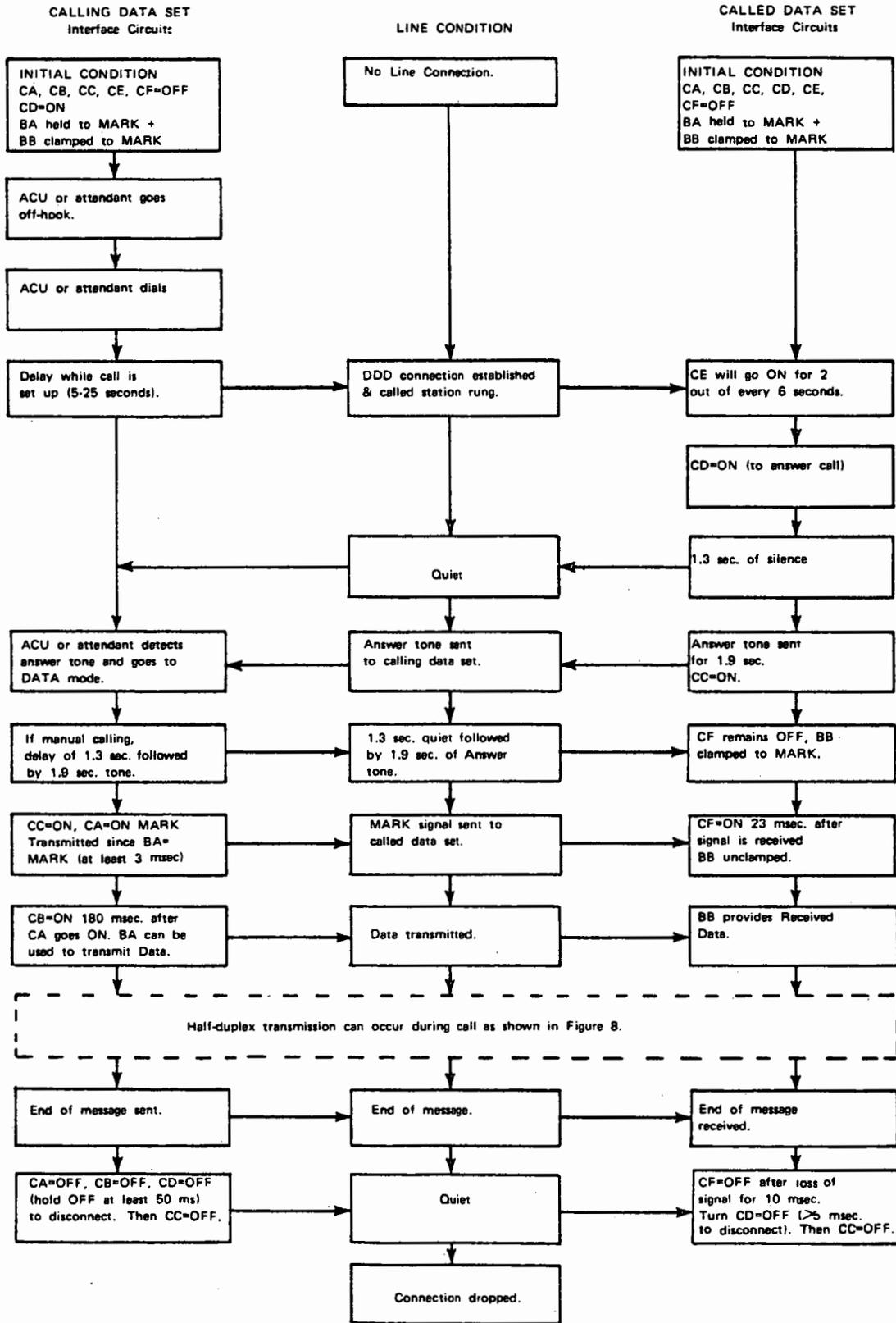
*These circuits are provided for switched network service only.

+This circuit is provided in Data Set 202T. It is not defined in EIA Standard RS-232-C.

**The data terminal may control the Secondary Request-to-Send Circuit from either pin 11 or pin 19; these pins are physically connected together in the data set.

FIGURE 6

CALL SETUP AND TERMINATION PROCEDURES FOR SWITCH NETWORK SERVICE
WITH AUTOMATIC OR MANUAL CALLING AND AUTOMATIC ANSWERING*



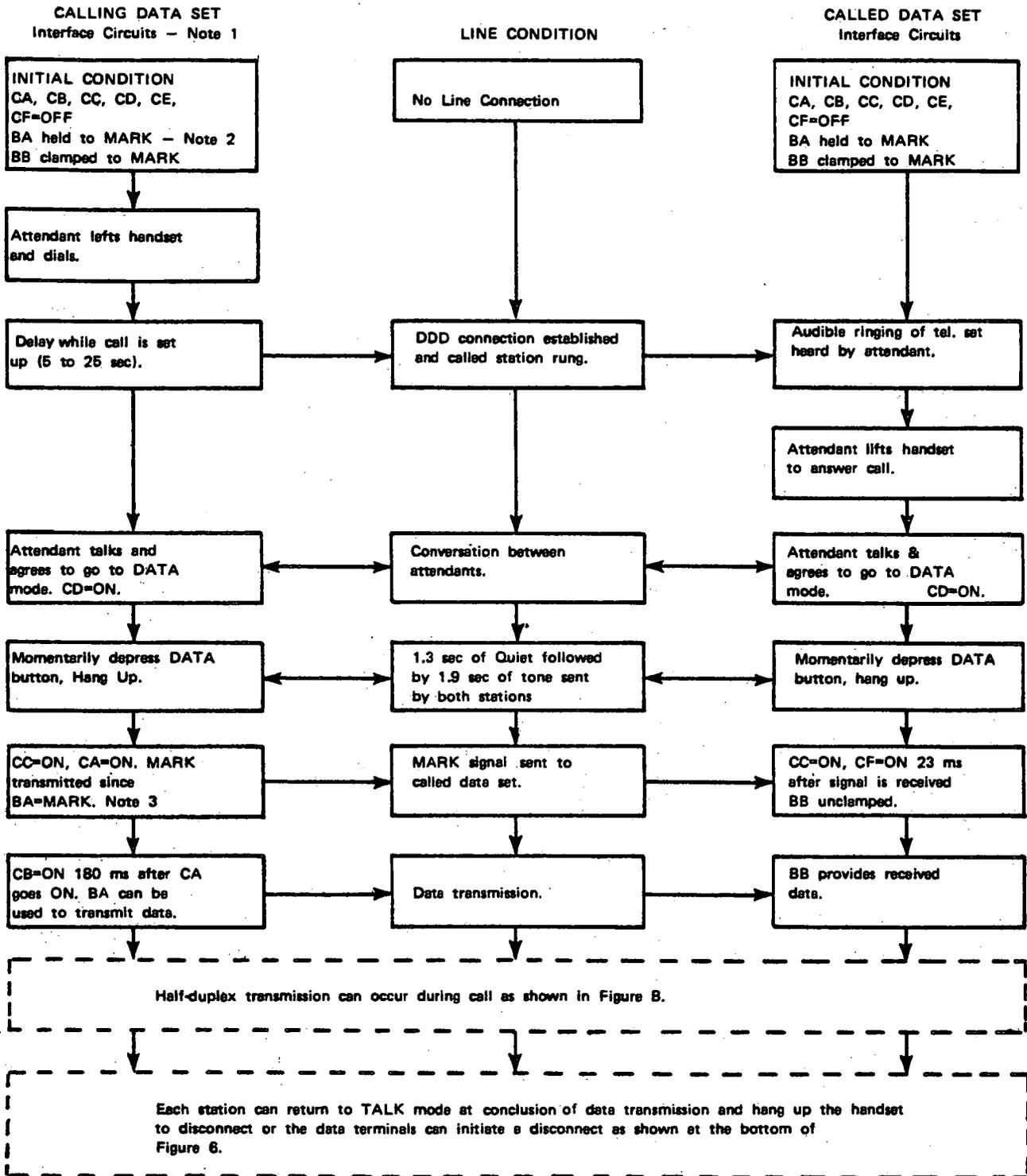
NOTES: *Calling station assumed to transmit first.

**For manual call origination, if the called station is to transmit first, it should wait several seconds for the calling station to enter the DATA mode.

+At both stations, BA must be MARK when CA turns ON for at least 3 msec. at the beginning of its first transmission.

FIGURE 7

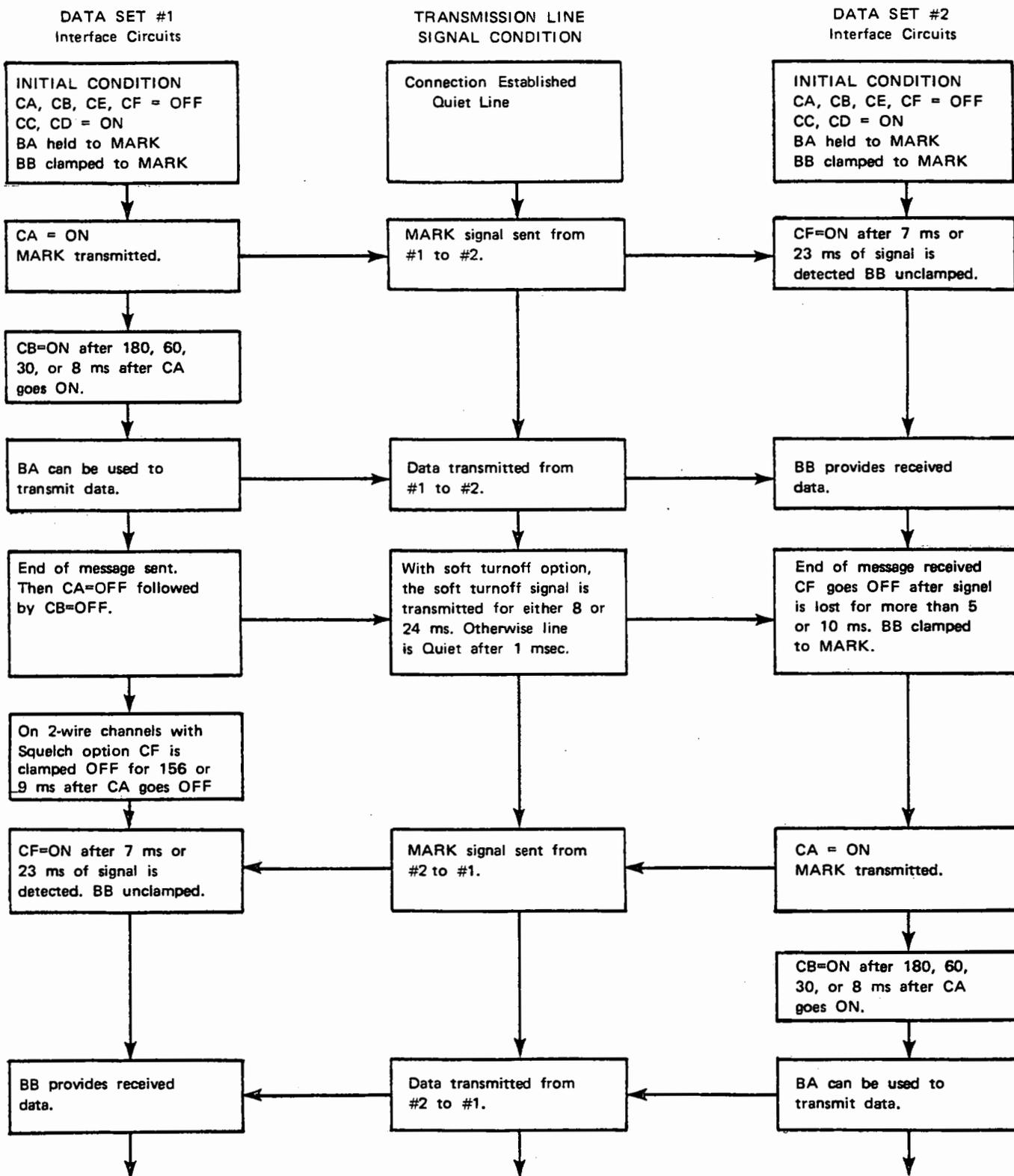
CALL SETUP AND TERMINATION PROCEDURES FOR SWITCHED NETWORK SERVICE WITH MANUAL CALLING AND ANSWERING



- NOTE: 1 - Calling station assumed to transmit first.
- 2 - At both stations, BA must be MARK when CA turns ON for at least 3 msec at the beginning of its first transmission.
- 3 - The first station to transmit should wait a few seconds to ensure that the distant end is in the DATA mode.

FIGURE 8

HALF-DUPLEX OPERATION OF DATA SETS 202S AND 202T
(Carrier under the control of Request to Send)*



*With the Continuous Carrier option on 4-wire private lines CB and CF are ON and BB is unclamped on both data sets all the time.

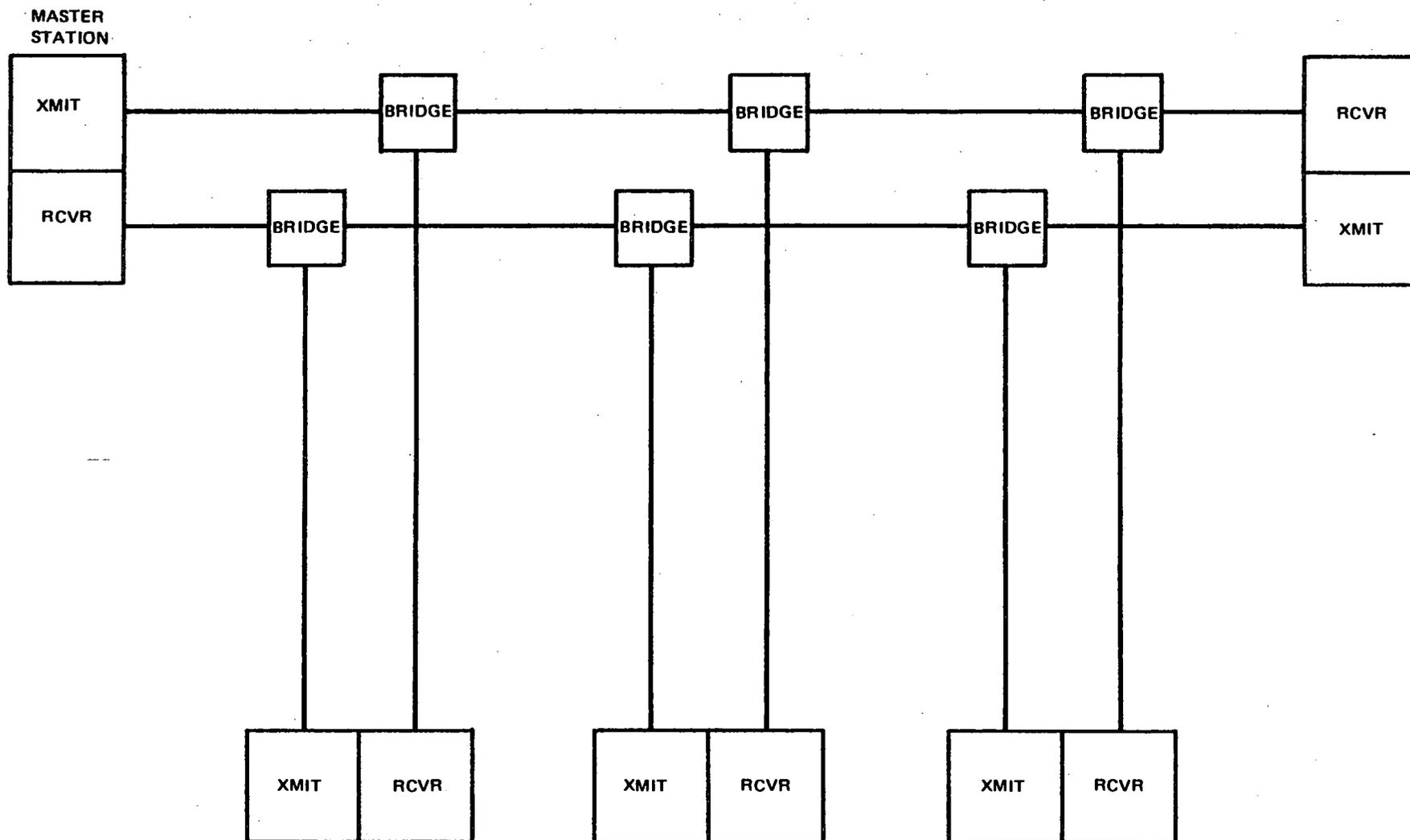
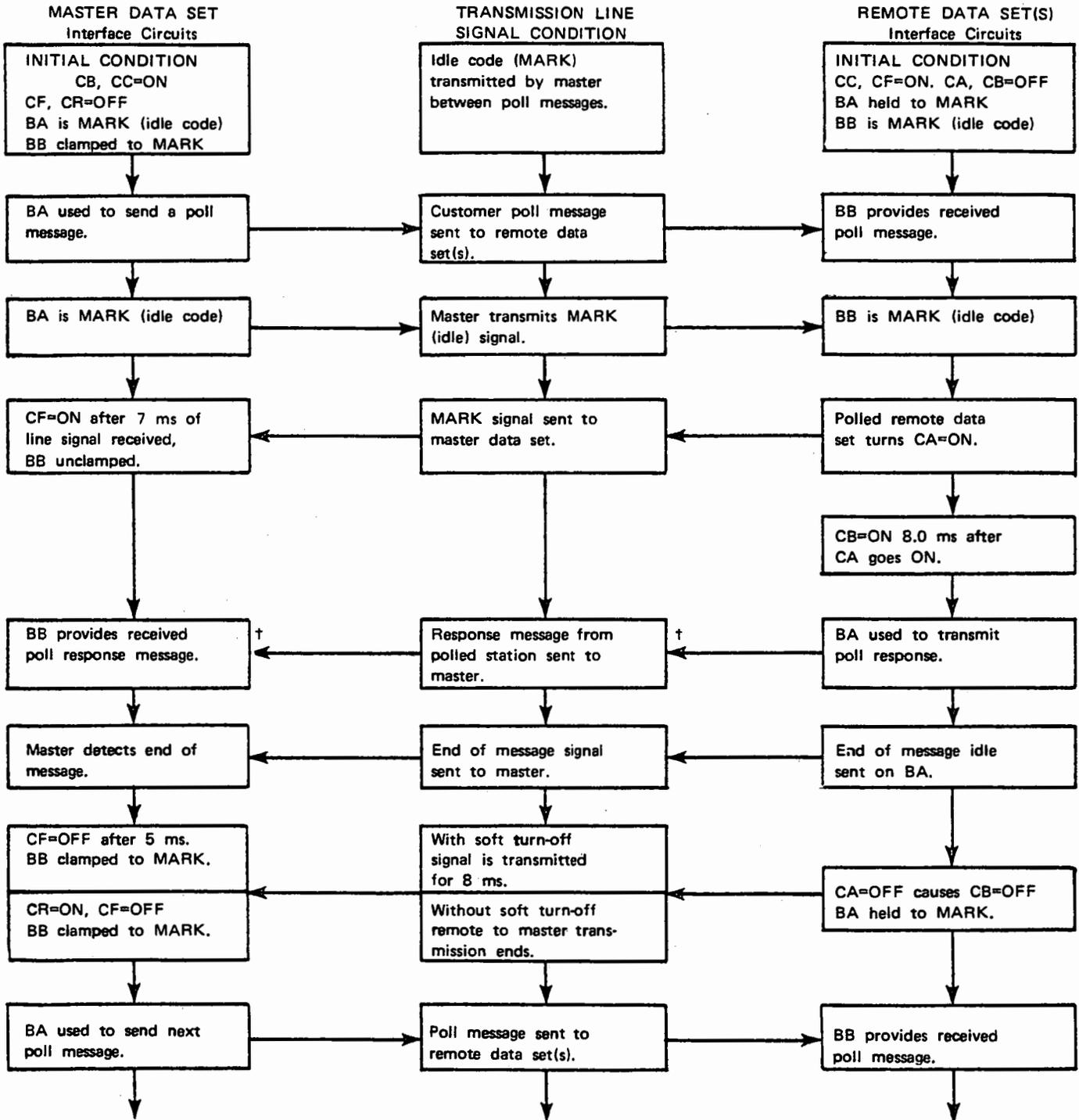


FIGURE 9 — 4-WIRE MULTIPOINT PRIVATE LINE SERVICE WITH ONE MASTER STATION AND SEVERAL REMOTE STATIONS

MULTIPOINT POLLING OPERATION OF 202T ON 4-WIRE PRIVATE LINES
 (CONTINUOUS CARRIER OPTION IN MASTER DATA SET)*



*If Continuous Carrier option is not used, then CA may be kept ON at all times.

†If the data terminal is able to operate duplex, the master station may transmit messages to another remote station while it is receiving a response from a poll.

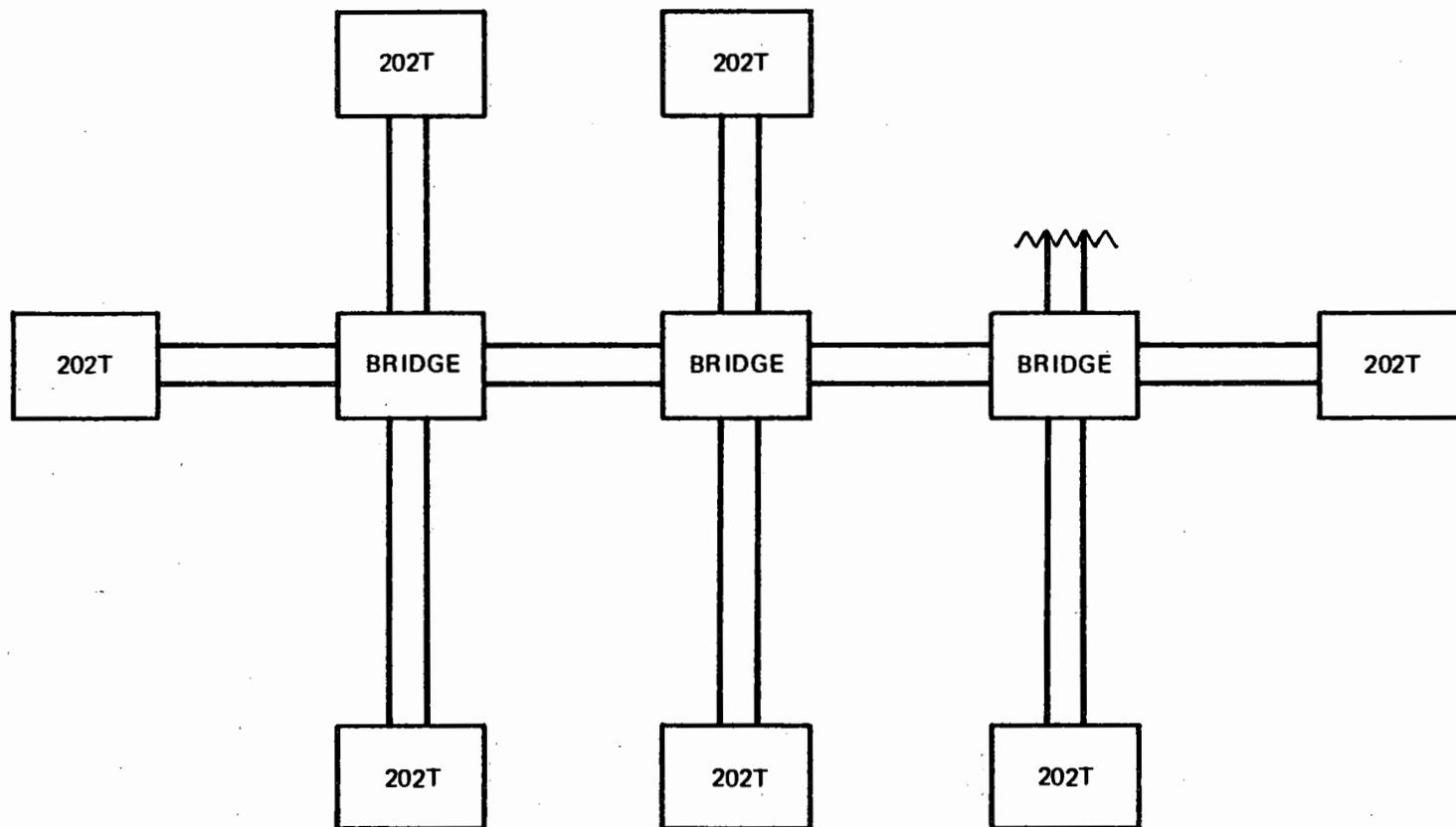
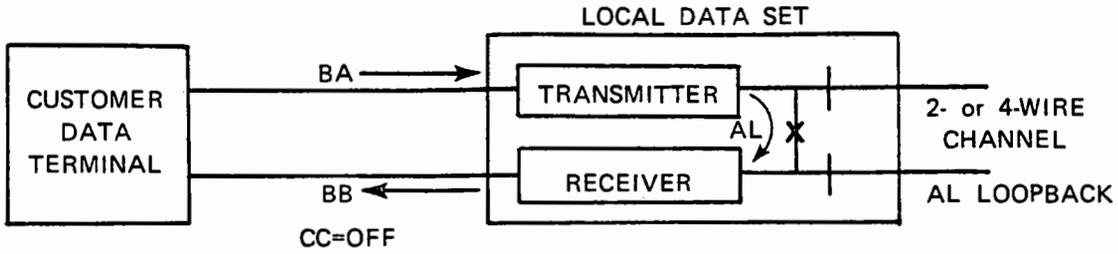


FIGURE 11 - 4-WIRE MULTIPOINT ARRANGEMENT WITH EACH DATA SET
ABLE TO COMMUNICATE WITH EACH OTHER DATA SET.

FIGURE 12

ANALOG LOOPBACK TEST USING THE DATA TERMINAL



NOTE: CUSTOMER DATA TERMINAL MUST PROVIDE A TEST WORD GENERATOR AND COMPARATOR FUNCTION TO CHECK FOR ERRORS. DATA TERMINAL MUST BE ABLE TO OPERATE FULL DUPLEX WITH CC = OFF.

FIGURE 13

TWO-WIRE REMOTE TEST FOR DATA SET 202S

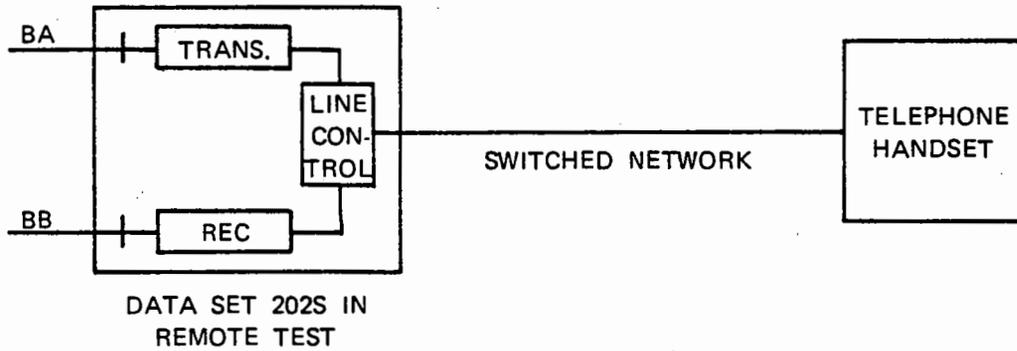
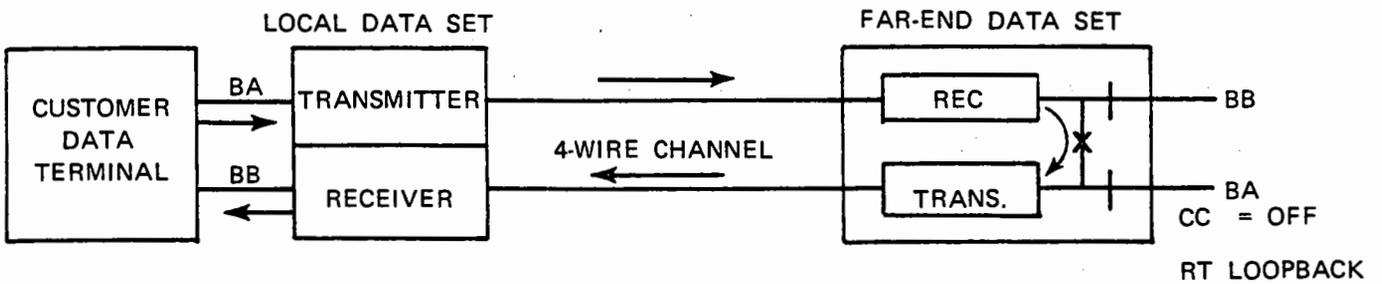


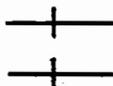
FIGURE 14

FAR-END REMOTE TEST USING LOCAL DATA TERMINAL (4-WIRE ONLY)



SEE NOTE ABOVE

SWITCH SYMBOLS:



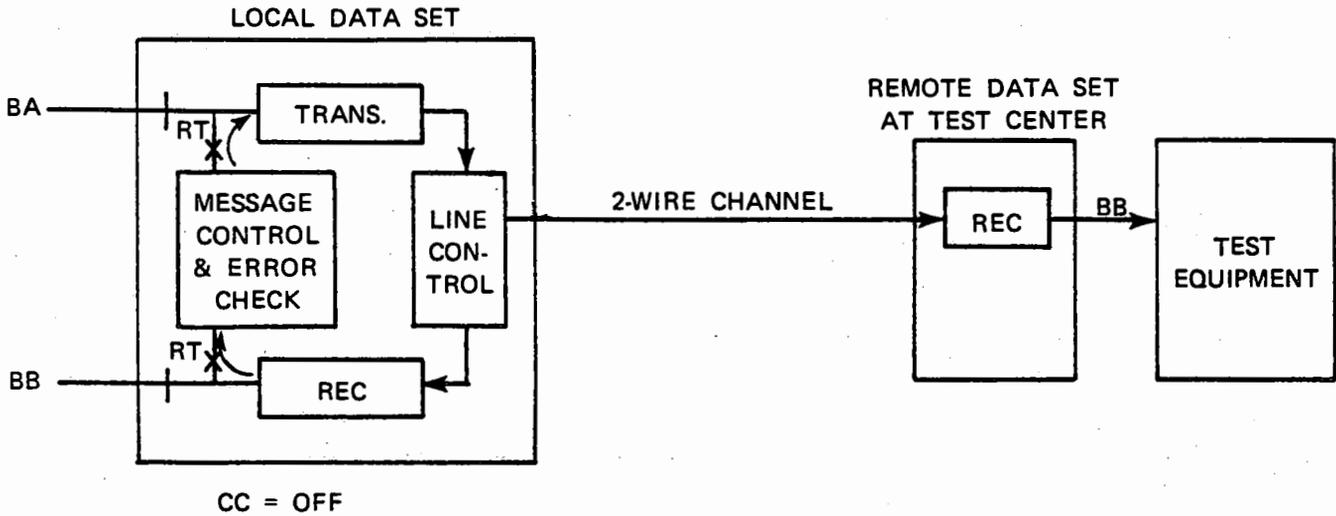
Normally Closed (Open when switch depressed).

Normally Open (Closed when switch depressed).

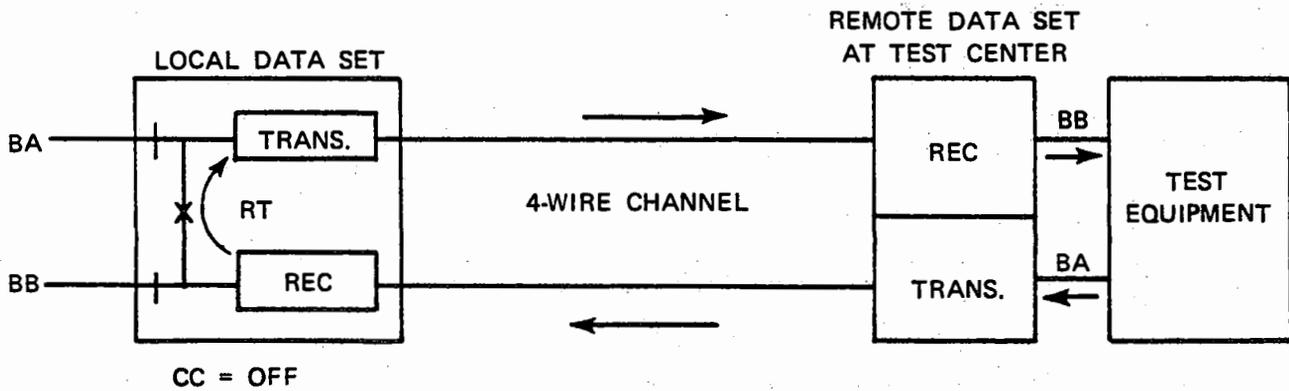
FIGURE 15

TELEPHONE COMPANY REMOTE TEST ARRANGEMENTS

2-WIRE REMOTE TEST



4-WIRE REMOTE TEST



SWITCH SYMBOLS:



Normally Closed (Open when switch depressed).

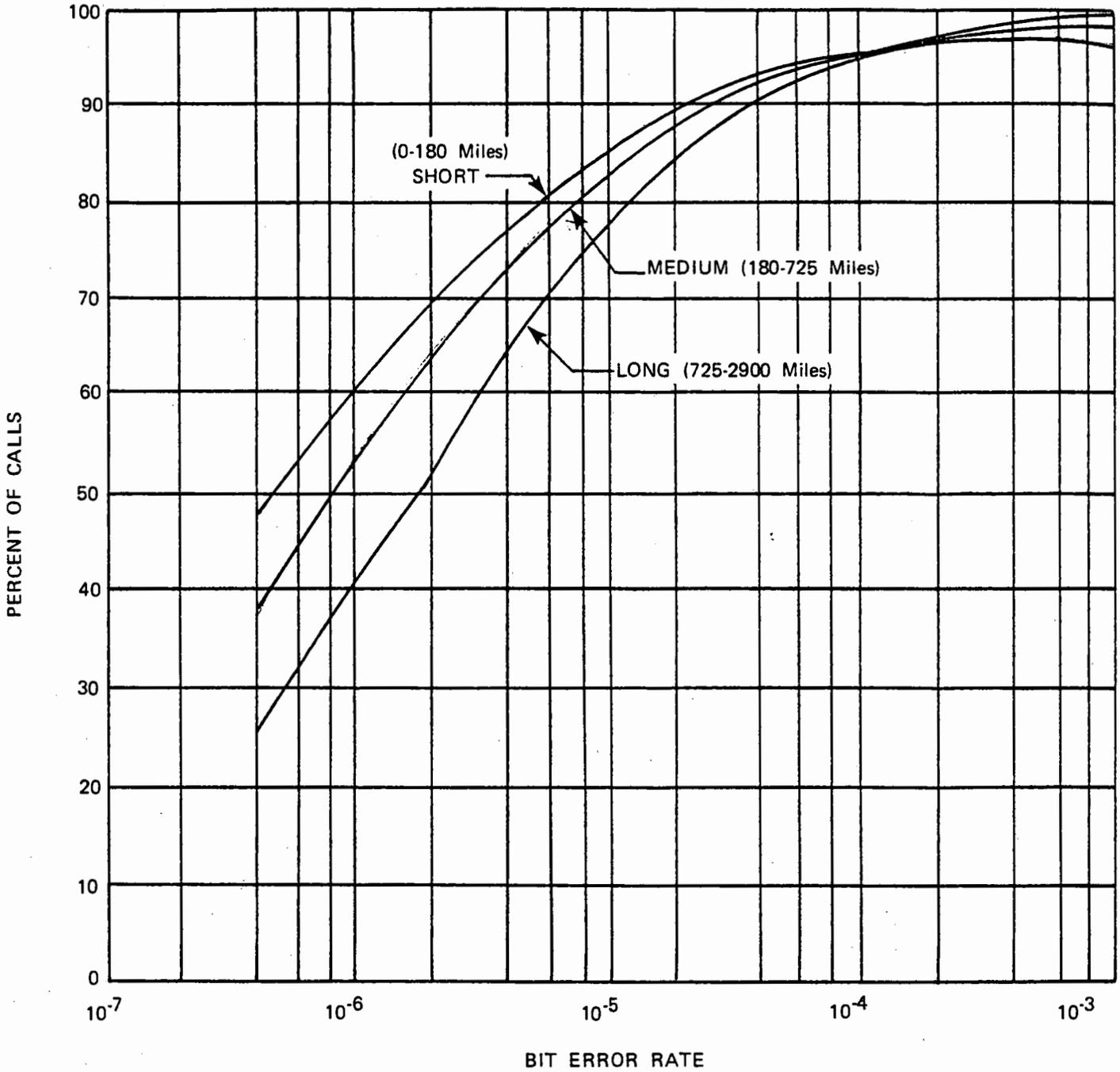


Normally Open (Closed when switch depressed).

FIGURE 16A

Switched Telecommunication Network

Bit Error Rate Distributions by Mileage Strata at 1200 BPS



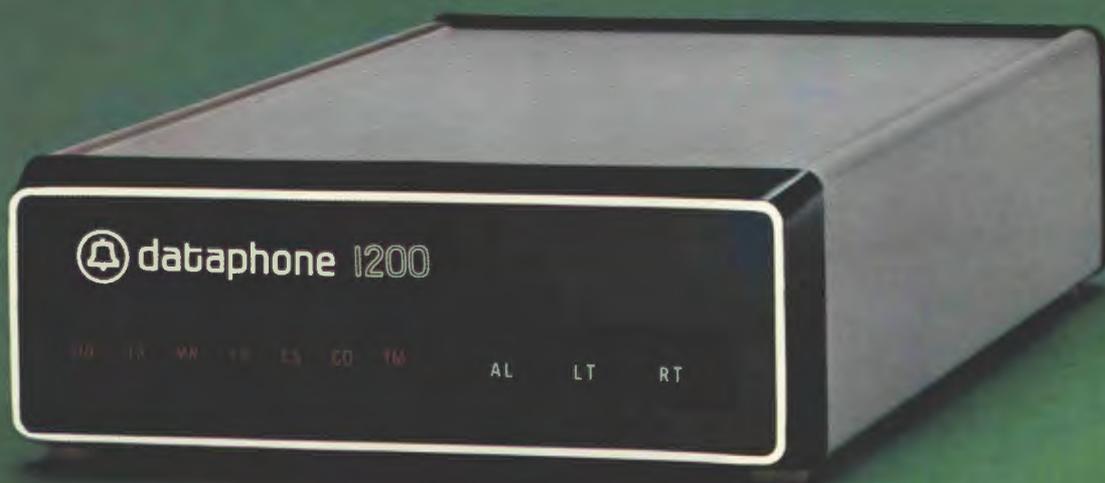
dataphone 1200

TRANSMITTER-RECEIVER FOR SWITCHED NETWORK APPLICATIONS

The Dataphone® 1200 data set (202S) is a nonsynchronous, serial binary transmitter-receiver incorporating large scale integrated (LSI) circuit technology.

It provides simplex or half-duplex transmission on DATAPHONE service over the switched telephone network at speeds up to 1200 bps.

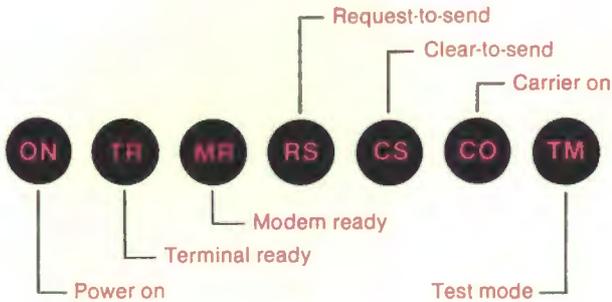
Incorporated into this model are comprehensive testing features coupled with long life light emitting diode (LED) monitoring lamps to permit rapid isolation of data system problems and monitoring of important interface circuits.





dataphone 1200

TRANSMITTER-RECEIVER FOR SWITCHED NETWORK APPLICATIONS



*Your 202's
ARE OPTIONED*

FEATURES

TELEPHONE EQUIPPED: Equipped with a standard six button key telephone for operation over the switched telephone network.

AUTOMATIC OPTIONS: Can be optioned for automatic answering. Can also provide for automatic calling when operated in conjunction with 801-Type Data Auxiliary Set.

CODE INSENSITIVE: Places no restrictions on the coding used by the data terminal.

STATUS LAMPS: Provide quick visual check of both modem and communications facility status through the use of latest LED technology.

ADVANCED TECHNOLOGY: Compact, solid state design incorporating a printed circuit board. Requires minimum space.

MOUNTING ARRANGEMENTS

For single set operation the set is enclosed in a brushed aluminum cabinet with black molded plastic front and back covers. For multi-data set operation, it can be housed in the new Bell System multi-station cabinets which accommodate 16, 24 or 64 data sets.

TECHNICAL SPECIFICATIONS

DATA RATE: 0 to 1200 bps

MODULATION: Frequency shift keyed

OPERATION: Nonsynchronous

LINE REQUIREMENTS: 2-wire switched network

INTERFACE: EIA RS 232C

OPERATING MODES: Simplex, half-duplex

AC POWER: 117 volts \pm 10%, 60 Hz \pm 5% power service

AMBIENT TEMPERATURE: 40° to 120°F

RELATIVE HUMIDITY: 20% to 90%

DIMENSIONS: 2.2 inches high, 5.8 inches wide, 10.8 inches deep

WEIGHT: 5.5 lbs; 6 lbs with reverse channel

OPTIONAL CUSTOMER FEATURES

FEATURE	OPTION
Received Data Squelch	*156 MSEC 9 MSEC 0 MSEC
Clear-to-send Delay	*180 MSEC 60 MSEC 30 MSEC 8 MSEC
Fast Carrier Detection	IN (Turn on—7 MSEC; Turn off—5 MSEC) *OUT (Turn on—23 MSEC; Turn off—10 MSEC)
Soft Carrier Turn-off	* 24 MSEC 8 MSEC OUT (Quick Turn-off)
Local Copy of the Primary Channel	IN OUT
Reverse Channel	IN OUT
Local Copy of the Reverse Channel	IN OUT
Groundings	! Signal Ground connected to Protective Ground Signal Ground not connected to Protective Ground
Automatic Calling Unit	NO YES
Automatic Answer	IN (Controlled by CD) OUT

* Recommended and supported for general application.

For more information, please call your Bell System Account Representative and ask for the DATAPHONE 1200 Data Set Technical Guide.



dataphone 1200

TRANSMITTER-RECEIVER FOR SWITCHED NETWORK APPLICATIONS

GENERAL INFORMATION

The Dataphone® 1200 data set (202S) is designed for the transmission and reception of nonsynchronous, half-duplex data, at speeds up to 1200 bits per second over the switched telephone network.

Where required, the data set can be optioned for automatic answering and can also operate in conjunction with an 801-Type Data Auxiliary Set for automatic calling. The data set features three operational push-button test switches for rapid isolation of data transmission troubles by either customer or Telephone Company personnel. Visual indication of the status of various

interface leads and operating modes is given by seven status lamps which utilize long-life light emitting diodes. Both the buttons and the lamps are located on the front panel.

It is code insensitive and places no restrictions on the coding used by the data terminal.

This model is a compact, solid state data set employing large scale integrated (LSI) circuit technology. It can communicate over the switched telephone network with another Dataphone 1200 or with Data Sets 202C, 202E, 202D or 202R providing they are properly optioned for compatibility.



dataphone 1200

TRANSMITTER-RECEIVER FOR SWITCHED NETWORK APPLICATIONS

The Dataphone® 1200 data set (202S) is a nonsynchronous, serial binary transmitter-receiver incorporating large scale integrated (LSI) circuit technology.

It provides simplex or half-duplex transmission on DATAPHONE service over the switched telephone network at speeds up to 1200 bps.

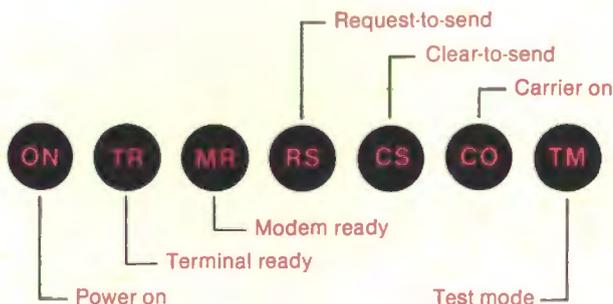
Incorporated into this model are comprehensive testing features coupled with long life light emitting diode (LED) monitoring lamps to permit rapid isolation of data system problems and monitoring of important interface circuits.





dataphone 1200

TRANSMITTER-RECEIVER FOR SWITCHED NETWORK APPLICATIONS



FEATURES

TELEPHONE EQUIPPED: Equipped with a standard six button key telephone for operation over the switched telephone network.

AUTOMATIC OPTIONS: Can be optioned for automatic answering. Can also provide for automatic calling when operated in conjunction with 801-Type Data Auxiliary Set.

CODE INSENSITIVE: Places no restrictions on the coding used by the data terminal.

STATUS LAMPS: Provide quick visual check of both modem and communications facility status through the use of latest LED technology.

ADVANCED TECHNOLOGY: Compact, solid state design incorporating a printed circuit board. Requires minimum space.

MOUNTING ARRANGEMENTS

For single set operation the set is enclosed in a brushed aluminum cabinet with black molded plastic front and back covers. For multi-data set operation, it can be housed in the new Bell System multi-station cabinets which accommodate 16, 24 or 64 data sets.

TECHNICAL SPECIFICATIONS

DATA RATE: 0 to 1200 bps

MODULATION: Frequency shift keyed

OPERATION: Nonsynchronous

LINE REQUIREMENTS: 2-wire switched network

INTERFACE: EIA RS 232C

OPERATING MODES: Simplex, half-duplex

AC POWER: 117 volts \pm 10%, 60 Hz \pm 5% power service

AMBIENT TEMPERATURE: 40° to 120°F

RELATIVE HUMIDITY: 20% to 90%

DIMENSIONS: 2.2 inches high, 5.8 inches wide, 10.8 inches deep

WEIGHT: 5.5 lbs; 6 lbs with reverse channel

OPTIONAL CUSTOMER FEATURES

FEATURE	OPTION
Received Data Squelch	*156 MSEC 9 MSEC 0 MSEC
Clear-to-send Delay	*180 MSEC 60 MSEC 30 MSEC 8 MSEC
Fast Carrier Detection	IN (Turn on—7 MSEC; Turn off—5 MSEC) *OUT (Turn on—23 MSEC; Turn off—10 MSEC)
Soft Carrier Turn-off	* 24 MSEC 8 MSEC OUT (Quick Turn-off)
Local Copy of the Primary Channel	IN OUT
Reverse Channel	IN OUT
Local Copy of the Reverse Channel	IN OUT
Groundings	Signal Ground connected to Protective Ground Signal Ground not connected to Protective Ground
Automatic Calling Unit	NO YES
Automatic Answer	IN (Controlled by CD) OUT

*Recommended and supported for general application.

For more information, please call your Bell System Account Representative and ask for the DATAPHONE 1200 Data Set Technical Guide.

SILENT 700

electronic data terminals

Model 745 Portable Data Terminal Operating Instructions



MANUAL NO. 984024-9701

ISSUED 15 DECEMBER 1975



TEXAS INSTRUMENTS
INCORPORATED