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TECHNICAL REFERENCE

TYPE 5 DATASPEED® SYSTEM

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Bell System Data Communications

TECHNICAL REFERENCE MANUAL

TYPE 5 DATASPEED® SYSTEM

JUNE, 1970

ENGINEERING DIRECTOR - TRANSMISSION SERVICES

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1. INTRODUCTION

This Technical Reference describes a medium speed, paper tape, parallel data transmission system known as DATASPEED Type 5. The system consists of a Sender terminal containing a paper tape reader and a Receiver terminal containing a paper tape punch. Transmission speed is 750 words per minute. The system is designed to operate with 402-type data sets.

The information presented here is intended to describe:

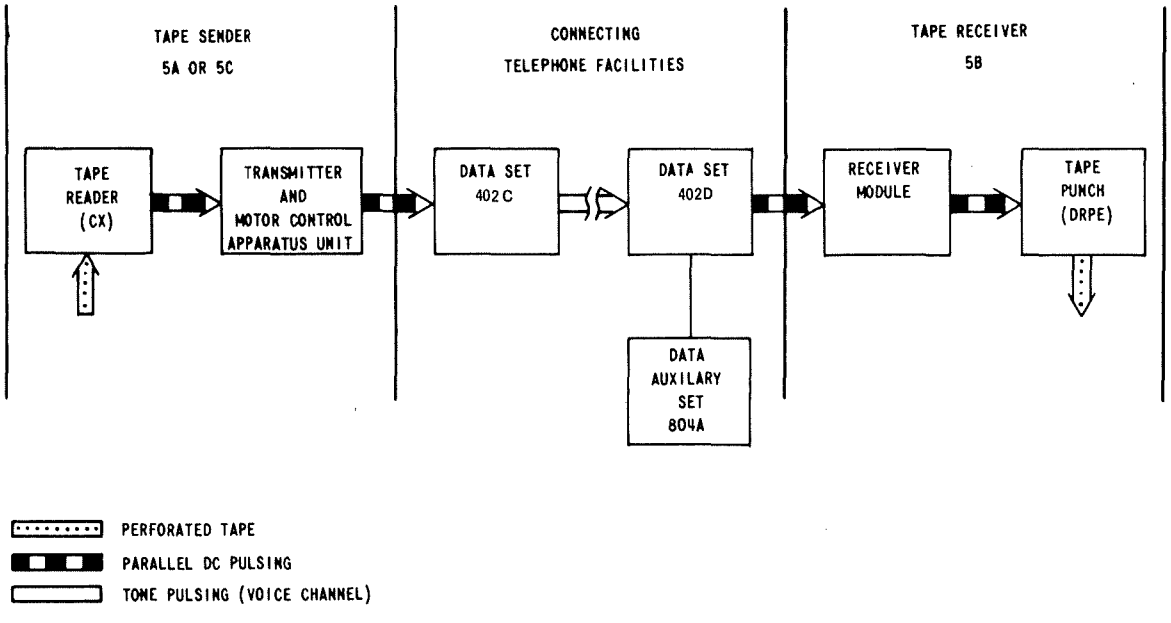
1. The on-line signalling and terminal characteristics which are necessary for the design of other data equipment with which the DATASPEED Type 5 Senders and Receiver terminals will communicate.
2. The DATASPEED Type 5 System operating characteristics with which a user should be acquainted.

1.1 General Description

The DATASPEED Type 5 System provides 75-character per second data communication using either private or conventional telephone lines. Station arrangements permit data transmission or reception. Systems may be arranged for point-to-point data gathering (many Senders with few Receivers) or for data distribution (few Senders to many Receivers). Stations may also be used at outlying points, exchanging data with a data processing terminal such as a computer. It is also possible to connect a Sender and Receiver at a particular site, to a common telephone line. This arrangement constitutes a Send-Receive station.

The primary data medium in this system is punched paper tape having 5, 6, 7 or 8 data levels (hole positions per character). The Sender input tape may be fully perforated or chadless. The Receiver output tape is fully perforated. The equipment is not code sensitive, that is, the particular scheme used to represent data by means of holes in paper tape may be arbitrarily chosen by the user.

The basic DATASPEED Type 5 System provides for transmission and reception under manual control of an operator; however optional features are available which permit unattended operation of a Sender or Receiver.



SYSTEM BLOCK DIAGRAM
Figure 1-1

1.2 Physical and Electrical Characteristics

Feature or Requirement	5A Sender	5C Sender	5B Receiver
Size	Tape Reader Set 6½" wide, 4½" high 14" deep Apparatus Box 13" wide, 16" high 10" deep	16" wide 54" high 24" deep	16" wide 54" high 24" deep
Weight (Less Data Sets)	42 pounds	155 pounds	227 pounds
Mounting	Table and Wall	Floor	Floor
Tape Type and Size	Fully perforated or chadless 11/16", 7/8", 1" wide		
Tape Handling	Optional facilities available separately	800' supply and take-up reels	3,000' supply and 800' take-up reels.
Operating Temperature Range	+ 50°F to + 110°F		
Average AC Power Consumption– Operating (less Data Sets)	100 watts	160 watts	360 watts
Voltage	117 Volts, AC ± 10%		
Frequency	60 ± 0.5 Hertz		
Start Current	5 amperes	6 amperes	8 amperes
Run Current	1.5 amperes	2.6 amperes	3.8 amperes
Signal Interface	Parallel contact closures		
Power Cord	Three wire grounded type of 10' or 25' length		
Speed	750 Words per minute		
Levels of Operation	Variable: 5, 6, 7 or 8		

Table 1A

1.3 Sender and Receiver Description

The 5A Sender is made up of a table mounted reader and a wall mounted apparatus box assembly. A table mounted Data Set 402C completes the terminal equipment. The data set must be located within six feet of the apparatus box. The tape reader is usually placed beside the data set on the same desk or table, but may be located anywhere within 50 feet of the wall mounted apparatus box. The apparatus box assembly contains a rectifier apparatus unit and a motor control relay apparatus unit. Tape handling equipment of various capacities are separately available as options. The 5A Sender is shown in Figure 1-2.

The 5C Sender is a floor mounted version of the 5A Sender. The tape reader and tape handling equipment are mounted on a sliding drawer in the upper half of the cabinet. The apparatus units are mounted in the lower half of the cabinet behind a hinged door. Space is provided near the center of the cabinet for the Data Set 402C. The 5C Sender includes a tape supply reel and a tape winder reel each with a basic capacity of 800 feet of fully perforated tape. The 5C Sender is shown in Figure 1-3.

The 5B Receiver is a floor mounted unit with the same general cabinet design as the 5C Tape Sender. The tape punch and tape handling equipment are mounted on a sliding drawer in the upper half of the cabinet. A receiver module is slide mounted in the lower half of the cabinet behind a hinged door. The receiver module includes the receiver punch driver and power supply circuits. Space is provided to the left of the receiver module to accommodate optional features. Space is also provided at the bottom of the cabinet for the Data Set 402D. A shelf near the center of the cabinet accommodates the Data Auxiliary Set 804A. The 5B Receiver will handle a 3000-foot tape supply reel and an 800-foot take-up reel. The 5B Receiver is shown in Figure 1-4.

1.4 System Operation

Basically, the system operates in the following manner. Punched paper tape is placed in the tape reader at the Sender. The perforations in the tape are converted to parallel direct current pulses by the reader and applied to the transmitter circuit which lengthens each pulse to the required character width. The pulses are then routed from the Sender circuits to a Data Set 402C where they are converted to audio tone signals and applied to the carrier lines. The tone signals are received at the Tape Receiver site, converted from tone to direct current pulsing by a Data Set 402D, amplified, and used to drive the tape punch contained in the Receiver. A simplified block diagram of the system is shown in Figure 1-1.

1.5 Set and Major Component Codes

Listed below is a breakdown of the DATASPEED Type 5 set codes.

1.5.1 BELL CODE

5A DATASPEED Tape Sender which consists of:

- 5A DATASPEED Reader which consists of:
  - 5A DATASPEED Tape Reader Unit
  - 5A DATASPEED Tape Reader Mounting Base and Cover Assembly
  - 28F Motor Unit

and

5A DATASPEED Control Assembly which consists of:

- 5A DATASPEED Apparatus Box
- 5A DATASPEED Power Supply
- 5A DATASPEED Motor Control Assembly
- 5A DATASPEED Transmitter Unit

The 5A-1 DATASPEED Tape Sender is the same as the 5A DATASPEED Tape Sender except for the addition of a Recognizer with Discrete Calling Apparatus Unit.

1.5.2 BELL CODE

5C DATASPEED Tape Sender which consists of:

- 5C DATASPEED Sender Cabinet
- 5A DATASPEED Tape Reader Unit
- 28F Motor Unit
- 5C DATASPEED Control Assembly which consists of:
  - 5C DATASPEED Frame
  - 5A DATASPEED Power Supply
  - 5A DATASPEED Motor Control Assembly
  - 5A DATASPEED Transmitter Unit

The 5C-1 DATASPEED Tape Sender is the same as the 5C DATASPEED Tape Sender except for the addition of a Recognizer with Discrete Calling Apparatus Unit.

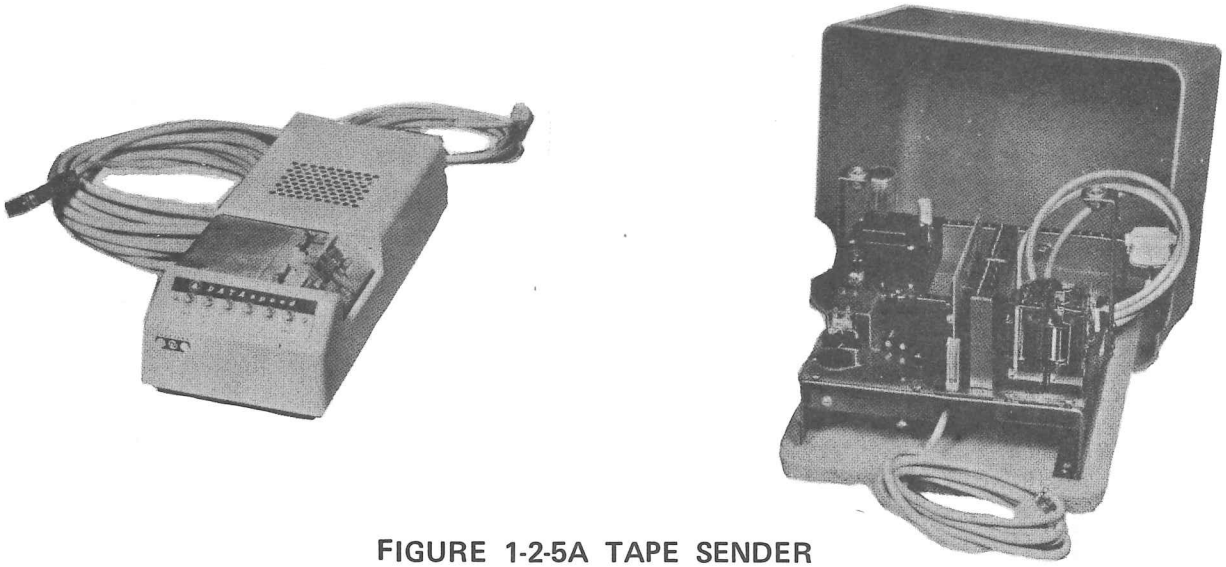


FIGURE 1-2-5A TAPE SENDER

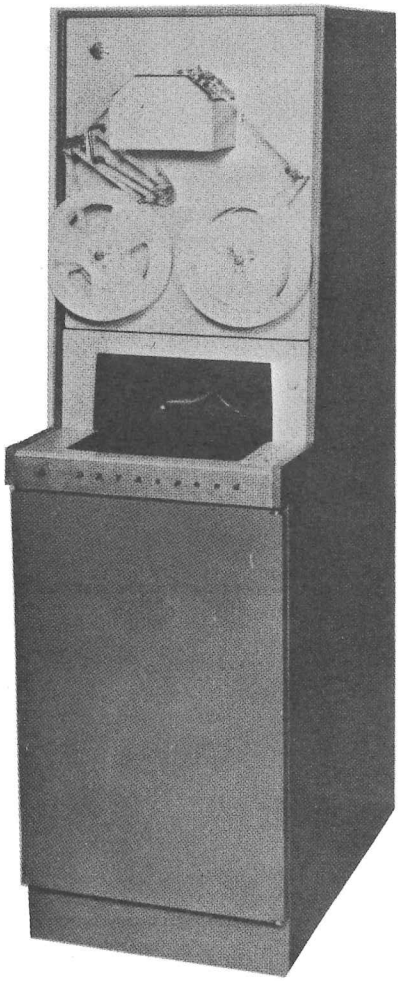


FIGURE 1-3-5C TAPE SENDER

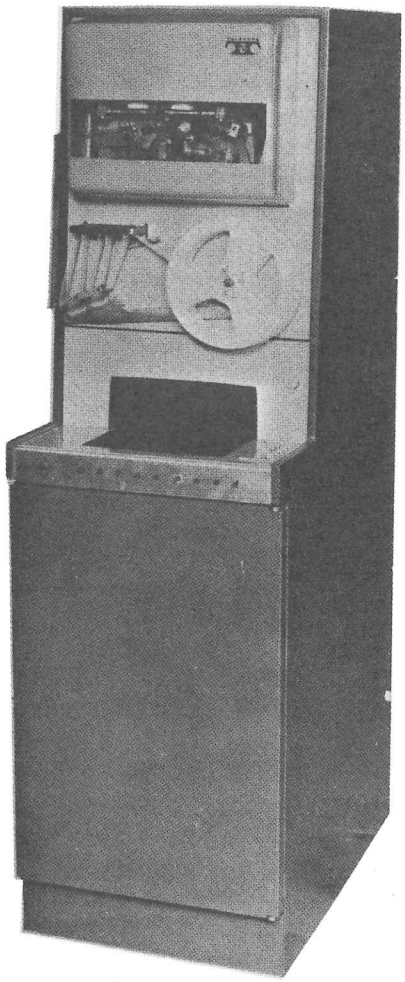


FIGURE 1-4-5B TAPE RECEIVER

1.5.3 BELL CODE

5B DATASPEED Tape Receiver which consists of:

5B DATASPEED Receiver Cabinet

5B DATASPEED Tape Reperforator

5B DATASPEED Control Assembly which consists of:

5B DATASPEED Frame

5B DATSASPEED Driver Module

The 5B-1 DATASPEED Tape Receiver is the same as the 5B DATASPEED Tape Receiver except for the addition of an Identifier Apparatus Unit.

The 5B-2 DATASPEED Tape Receiver is the same as the 5B DATASPEED Tape Receiver except for the addition of an Unattended Send-Receive Apparatus Unit.

The 5B-3 DATASPEED Tape Receiver is the same as the 5B DATASPEED Tape Receiver except for the addition of an Identifier Apparatus Unit and an Unattended Send-Receive Apparatus Unit.

1.6 Optional Features

1.6.1 5A and 5C Sender

a. Circuit Assurance and Break Option

The circuit assurance and break feature is built into all Senders, requiring only the removal of a strap. This option will shut down the Sender automatically if a line break occurs. It will also permit the Receiver operator to stop the Sender should it be necessary to do so. In either case, a signal lamp at the Sender will light, and an auxiliary signal circuit will be closed to advise the Sender operator of the shutdown. Note that this option can be employed only when the data set has the reverse channel feature.

b. Recognizer Without Discrete Calling Apparatus Unit Option

This recognizer option allows an unattended Sender to answer incoming calls automatically, transmit a tape message, and disconnect automatically at the end of transmission. The feature uses the automatic answer and answer-back features of the Data Set 402C. The recognizer without discrete calling should only be used when sender security is not important.

c. Recognizer With Discrete Calling Apparatus Unit Option

This recognizer option enables an unattended Sender to answer incoming calls automatically, transmit a tape message, and disconnect automatically at the end of transmission. The feature provides a recognizer circuit which will cause the Sender to transmit only in response to a coded signal. In this way, data will be transmitted only to authorized Receivers.

d. Cable Options

The 5A Sender is normally equipped with a 10-foot power cable and a 10-foot apparatus unit cable. Where it is necessary to place the tape reader farther away from the apparatus box assembly, a 25-foot apparatus unit cable and 25-foot three-wire power cable are available as options.

1.6.2. 5B Receiver

a. Unattended Answering Option

The unattended answering option is built into the Receiver, requiring only the connection of a wire. With the connection made and the AUTO ANSWER switch in the AUTO position, the Receiver will accept data on an unattended basis.

b. Receive-Only Hunting Group Option

This option is built into the Receiver, requiring only the proper jumper connection. The option permits Tape Reeceiver service as part of a receive-only rotary hunting group, and provides that the set shall appear busy when it is not prepared to answer automatically.

c. ZE Wiring Option

This option is built into the Receiver and requires only proper jumper connections. When the ZE option is installed, a Receiver can place a call to an unattended Sender equipped with the recognizer without discrete calling.

d. Station Identifier Apparatus Unit Optioı

The station identifier is used in Receivers which call unattended Senders equipped with the recognizer with discrete calling option. The identifier allows a Receiver to generate a coded signal which is recognized by the called sending station only if it agrees with a signal pattern stored in the recognizer unit in the Sender.

e. Blank Panel Option

When a Sender and Receiver are connected as a send-receive station, the Data Auxiliary Set 804A, normally mounted in the Receiver is not required. A blank panel can then be installed in place of the normally supplied control panel and cover panels which accommodate the data auxiliary set in the standard Receiver. The replacement panel has no opening for the data auxiliary set.

f. Unattended Send-Receive Apparatus Unit Option

When a Sender and Receiver at a common location are connected to a common telephone line, the Receiver may be equipped with an unattended send-receive option. The option allows a distant station to call an unattended send-receive station and direct it to send or receive as many times as desired during a single call. Either recognizer apparatus unit option is required to operate the sender portion of the unattended send-receive apparatus unit.

1.7 Station Arrangements

The following table summarizes in a general manner the equipment required for various types of station arrangements. The use of suffixes in the coding scheme permits initial ordering of the systems needed. The addition of apparatus unit options to existing standard sets can provide the same arrangements.

Service Arrangements
Table 1B

Service	Sender Station	Receiver Station
Attended at both stations	5A or 5C Sender, Data Set 402C	5B Receiver Data Set 402D, Data Auxiliary Set 804A
Sender attended Receiver unattended	5A or 5C Sender, Data Set 402C	5B Receiver use auto answer feature in Data Set 402D, Data Auxiliary Set 804A
Sender attended Receiver unattended	5A-1 or 5C-1 Sender, use auto answer feature in Data Set 402C	5B-1 Receiver, Data set 402D, Data Auxiliary Set 804A
Unattended Send-Receive	5A-1 or 5C-1 Sender, use auto answer feature in Data Set 402C	5B-2 Receiver, use auto answer and send-receive features in Data Set 402D
Unattended Send-Receive stations, Receive in manual condition capable of calling unattended Sender	5A-1 or 5C-1 Sender, use auto answer feature in Data Set 402C	5B-3 Receiver, use auto answer and send-receive features in Data Set 402D

For unattended Sender operation, either recognizer apparatus unit option, can be used depending on station security requirements.

An unattended Send-Receive station consists of a Sender arranged for unattended service and a Receiver containing an unattended send-receive apparatus unit option. The send-receive station will automatically arrange itself to send or receive as appropriate to the calling station type. A send-receive station used to place a call can be manually switched to function as a sender or receiver; and a remote unattended send-receive station will follow these switching operations.

1.8 Individual Terminal Arrangements

Tables 1C, 1D and 1E list the various kinds and optional modes of operation possible for the three basic terminal types.

Receiver-Only Terminal
Table 1C

Type of Operation	Receiver Code
Manual	5B
Unattended (automatic)	5B
Manual and capable of calling an unattended Sender (without discrete calling feature)	5B
Manual and capable of calling an unattended Sender (with discrete calling feature)	5B-1
Unattended with an out of service feature when a low tape condition exists	5B
Manual with automatic answering permanently disabled	5B

Send-Only Terminal
Table 1D

Type of Operation	Sender Code
Manual without circuit assurance and break feature	5A or 5C
Manual with circuit assurance and break feature	5A or 5C
Unattended without discrete calling and without circuit assurance and break feature	5A or 5C and Recognizer without Discrete Calling
Unattended with discrete calling and without circuit assurance and break feature	5A-1 or 5C-1
Unattended with discrete calling and with circuit assurance and break feature	5A-1 or 5C-1

All the unattended Sender terminals are factory wired to answer calls automatically when there is no tape in the reader. An all-space signal will be transmitted indicating no tape. This mode of operation can be optionally changed to provide no answer when there is no tape in the reader.

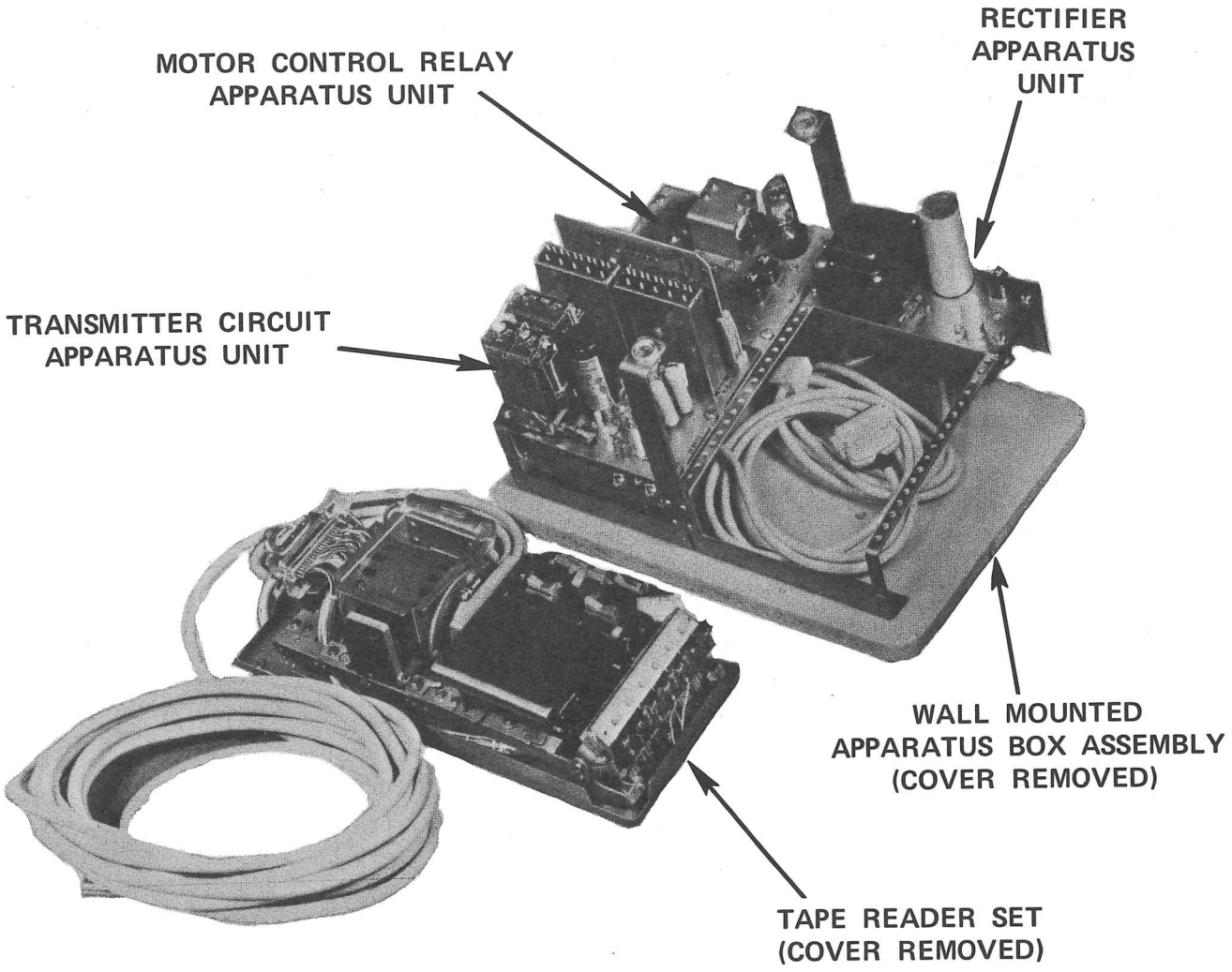


FIGURE 1-5-5A TAPE SENDER, COMPONENTS

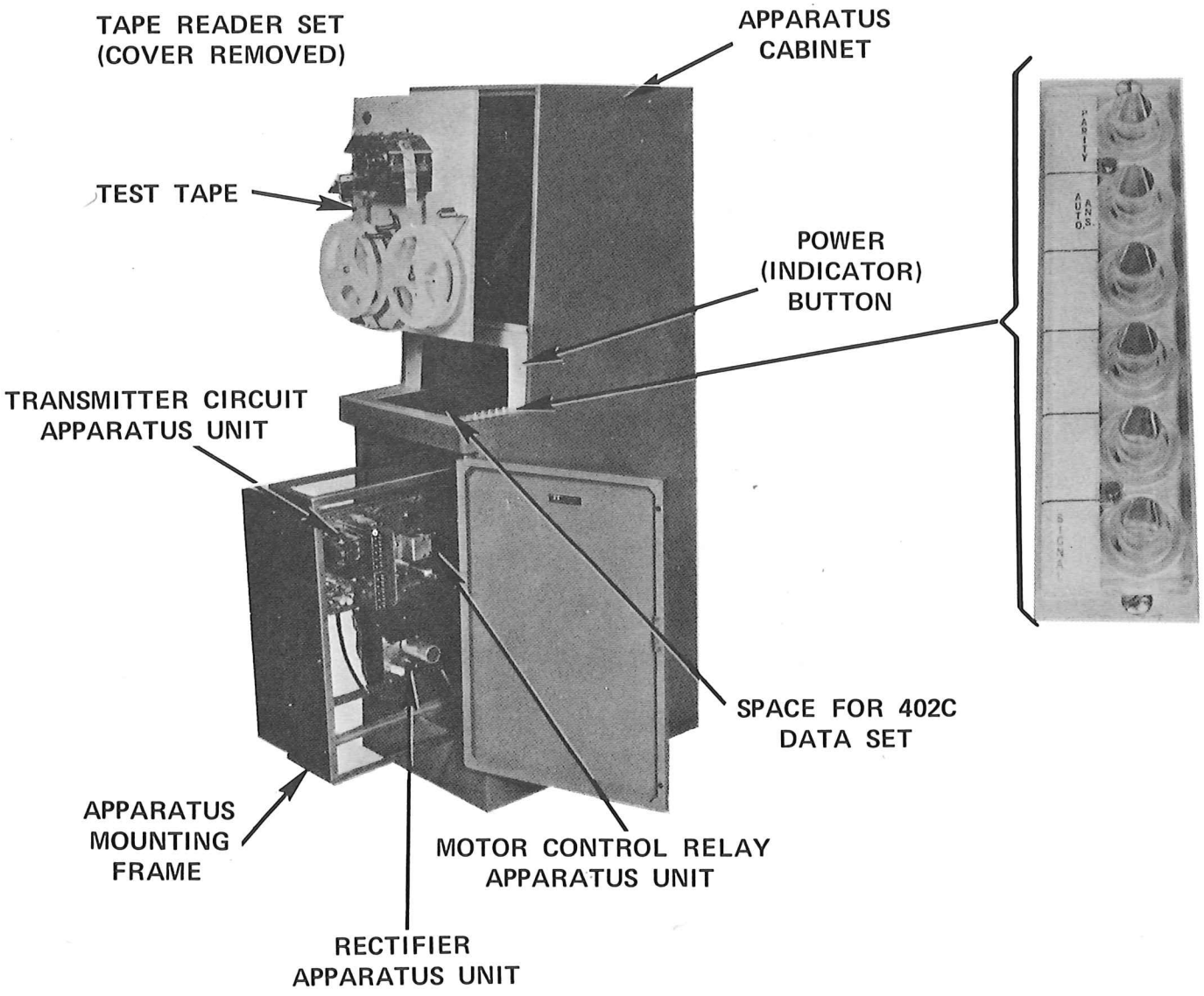


FIGURE 1-6-5C TAPE SENDER COMPONENTS

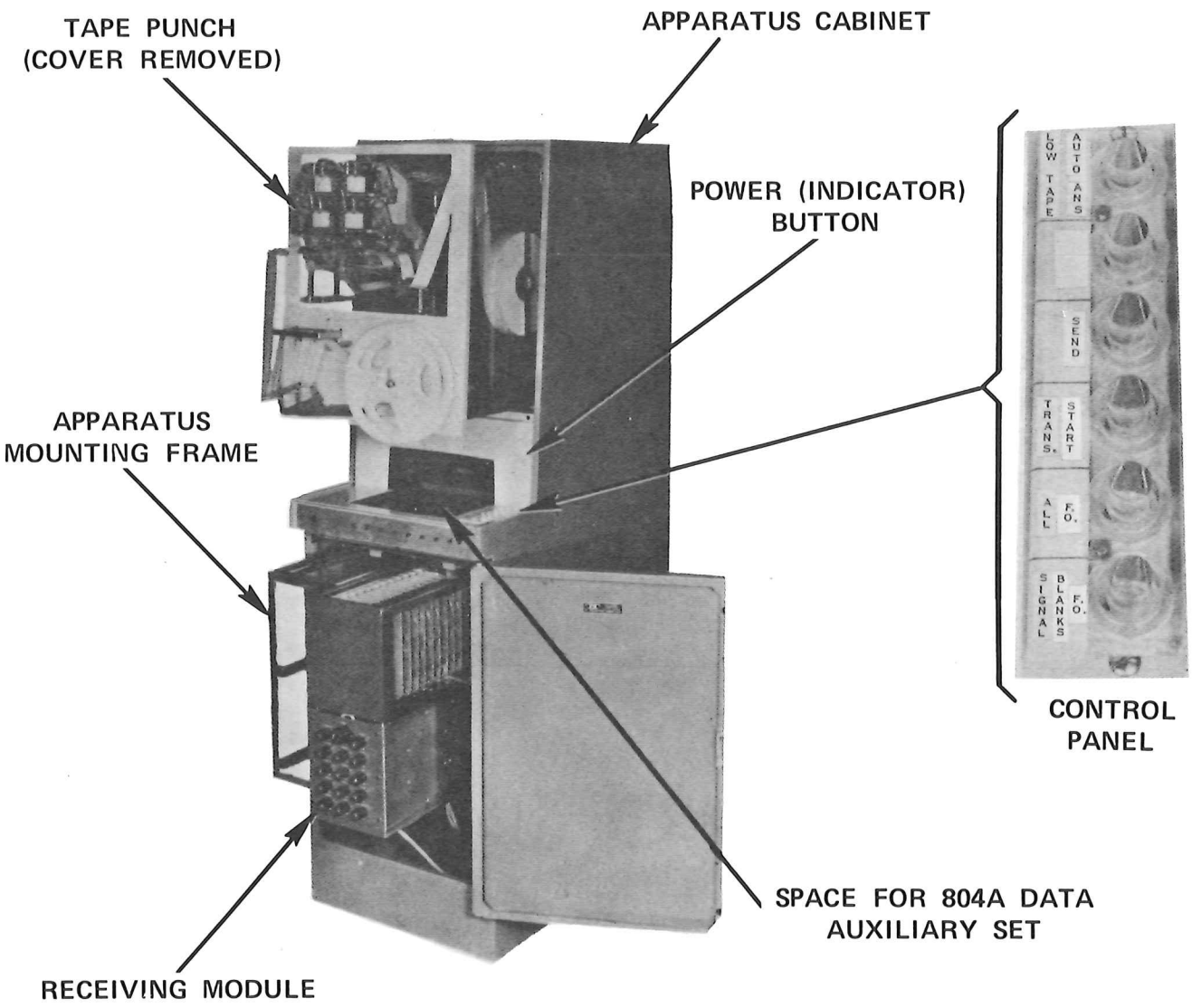


FIGURE 1-7-5B TAPE RECEIVER, COMPONENTS

Unattended Send-Receive Terminal
Table 1E

Additional Types of Operation	
Unattended send-receive service using all three answer-backs; to indicate no tape, low tape or both. (Answer-backs: A = low tape in Receiver, B = no tape in Sender, AB = both)	5A or 5C with Recognizer without Discrete Calling and 5B-2 or 5A-1 or 5C-1 and 5B-2
Unattended send-receive service using two answer-backs (A or B) to indicate a low tape in Receiver or no tape in Sender. Station will not answer automatically with a low tape – no tape condition.	5A or 5C with Recognizer without Discrete Calling and 5B-2 or 5A-1 or 5C-1 and 5B-2
Unattended send-receive service using answer-back A to indicate low tape in the Receiver. Station will not answer automatically with a low tape-no tape condition.	5A or 5C with Recognizer without Discrete Calling and 5B-2 or 5A-1 or 5C-1 and 5B-2
Unattended send-receive service, with Receiver in manual condition, capable of calling unattended Sender.	5A or 5C with Recognizer without Discrete Calling and 5B-2 or 5A-1 or 5C-1 and 5B-3

In addition to the types of operation listed above, any send or receive type of operation listed under Sender-only and Receiver-only terminals, may also be used at a send-receive terminal.

2. TAPE HANDLING

2.1 5A Sender

2.1.1 Tape handling equipment for the table mounted Sender is not provided with the basic set and must be ordered separately. In this manner a customer can select from a variety of winders, unwinders, reels and associated equipment a tape handling scheme suited for his particular application. A set of parts is available which provides facilities for mounting tape handling equipment.

2.1.2 A tape handling facility set of parts provides a mounting base and mounting hardware with which various tape handling arrangements and the table mounted Sender can be conveniently located. The use of the mounting base also insures proper tape rounting. No tape handling equipment is included with the set of parts. The facility is designed to mount standard tape winders and unwinders.

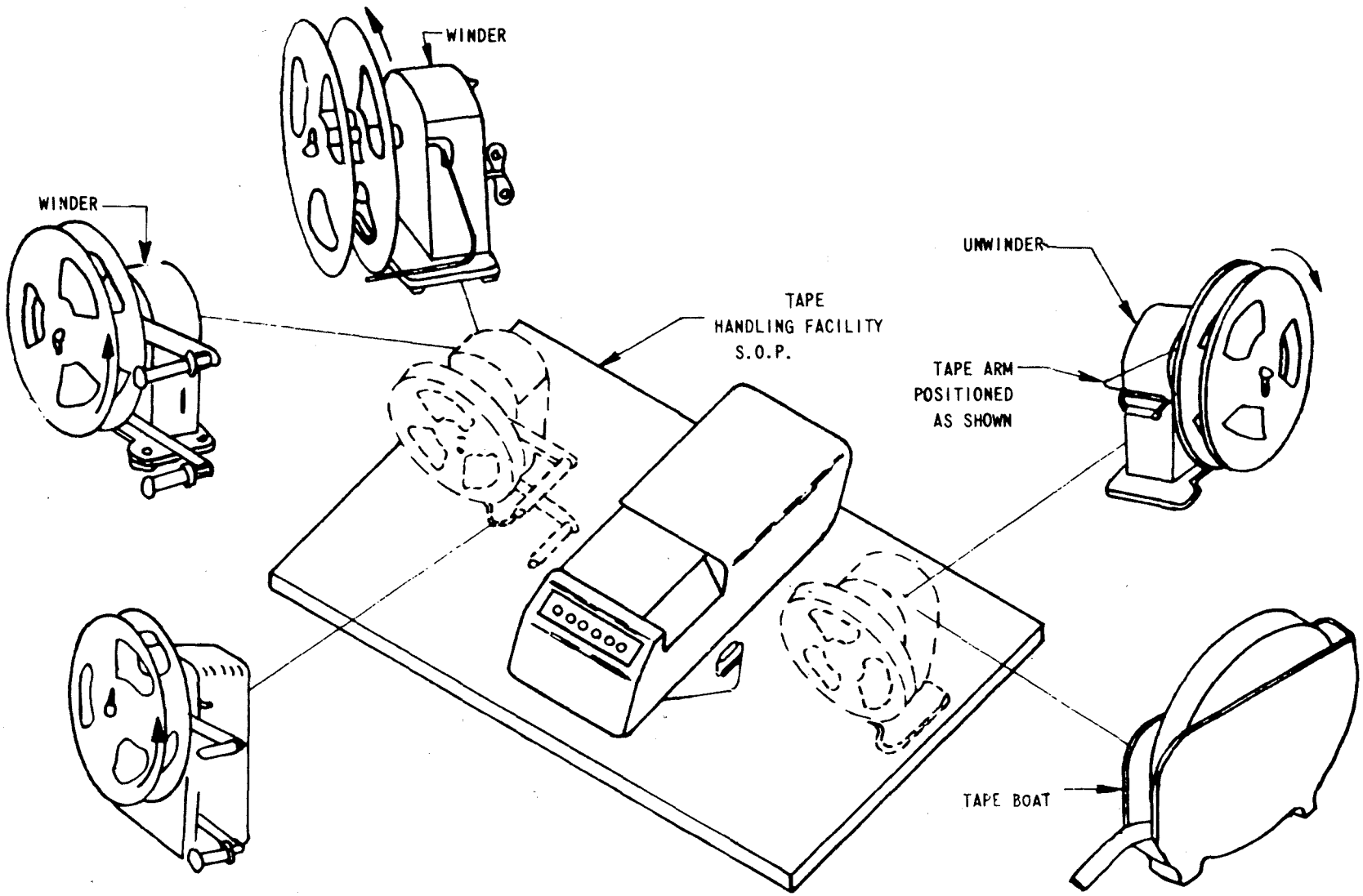
2.1.3 The tape handling facility is packed unassembled because its assembly is dependent upon the type of tape handling scheme desired. The weight of the set of parts is 12 pounds. The dimensions of the mounting base are 28 inches long, 16 inches wide, and 13/16 inches thick.

2.1.4 Larger capacity tape handling equipment is available which does not use the tape handling set of parts. A winder unwinder, or tape feeder (center unwinder) can be located on the same table top which supports the Sender.

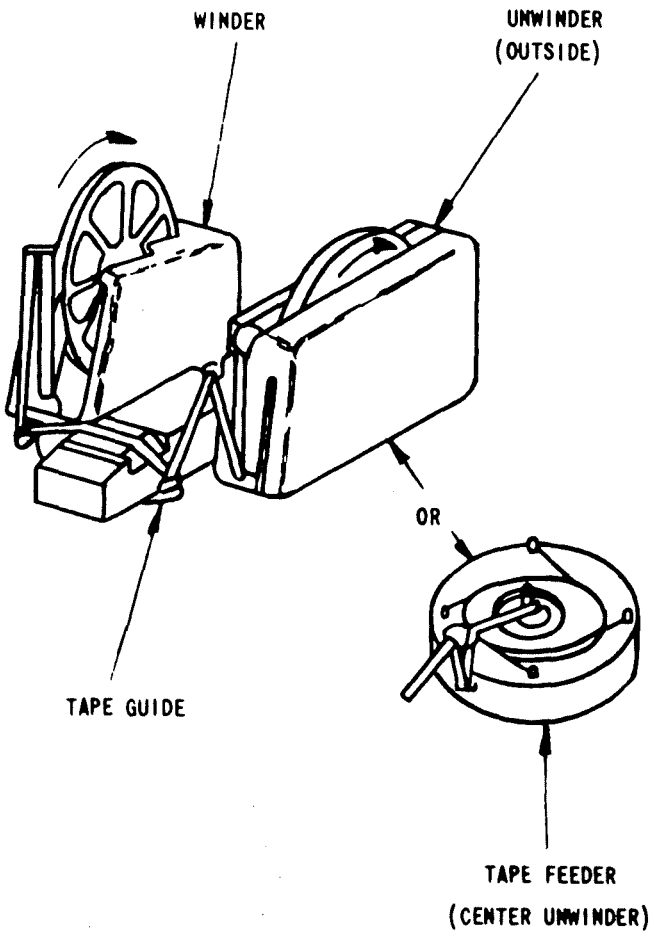
2.2 5B Receiver and 5C Sender

2.2.1 Standard capacity tape handling equipment for the 5B Receiver and 5C Sender are provided with the basic sets. The 5C Sender uses the same tape reel in both wind and unwind positions. This reel has a capacity of 800 feet of fully perforated tape or 500 feet of chadless tape when used without an adapter. The 5B Receiver uses the same reel in the wind position and a high capacity 3000-foot supply reel in the unwind position.

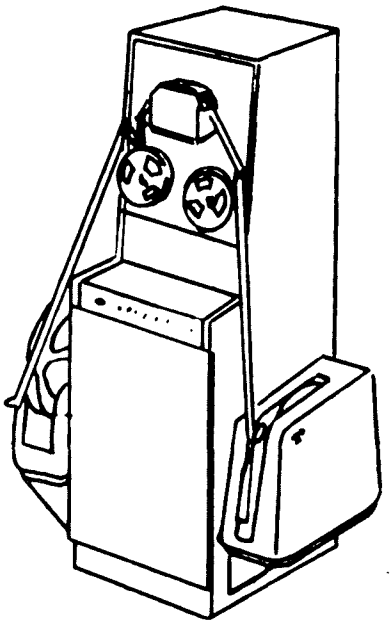
2.2.2 Optional high capacity tape handling equipment and associated accessories are available for use with the floor mounted cabinets. Various tape handling schemes are shown in the figure section.



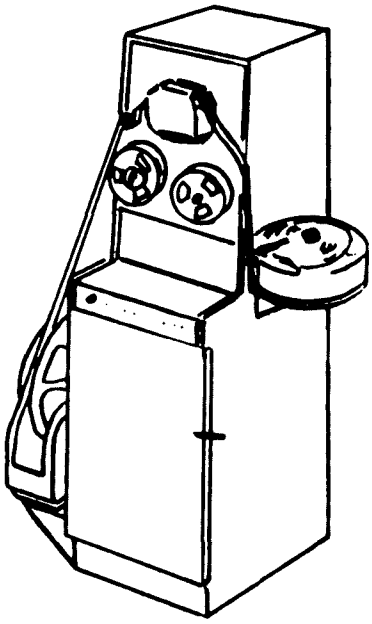
5A SENDER TAPE HANDLING ARRANGEMENTS
Figure 2-1



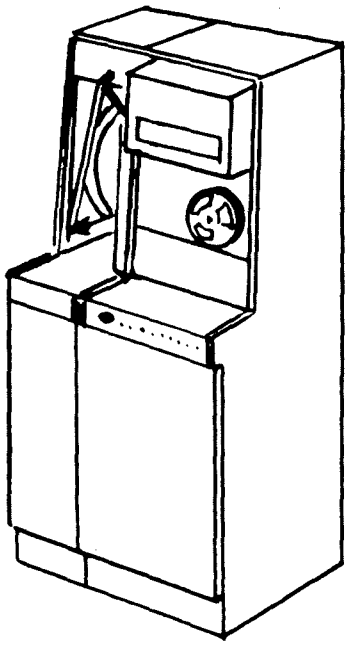
5A SENDER LARGE CAPACITY TAPE HANDLING ARRANGEMENTS
Figure 2-2



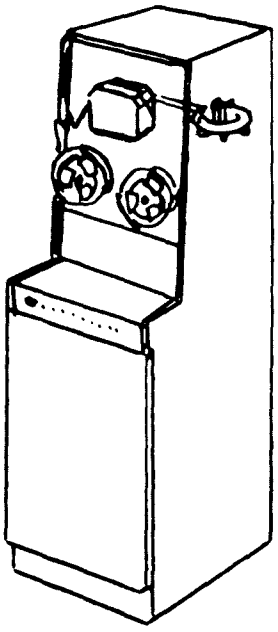
5C SENDER WITH SIDE MOUNTED WINDER AND UNWINDER
Figure 2-3



5C SENDER WITH SIDE MOUNTED WINDER AND TAPE FEEDER
Figure 2-4



5B RECEIVER WITH CABINET AND WINDER
Figure 2-5



5C SENDER WITH CENTER UNWINDER MODIFICATION KIT
Figure 2-6

3. INTERFACE

The Type 5 System is designed to interface with Bell System 402-type data sets. 5A or 5C Sender uses Data Set 402C and 5B Receiver uses Data Set 402D. The 402C provides alternate voice or data only operation on the direct distant dialing (DDD) network or a private line. The 402D provides data only operation on a private line. Data Auxiliary Set 804A is required to provide alternate voice and DDD network service when a Data Set 402D is used by itself. For additional data set information refer to Bell System Data Communications, Technical Reference Manual Data Sets 402C and 402D Interface Specification.

3.1 5A and 5C Sender

The interconnecting diagram for a send-only station is shown in Figure 3-1. Connection from connector J752 on either Sender to the data set is made with the six-foot cable assembly. An optional ten-foot cable assembly is available for use with the 5A Sender when additional cable length is required. Figure 3-2 shows the lead designations and control location of the twenty-five conductor interface cable. A functional description of each lead follows.

LEAD 1, FRAME GROUND. This conductor is connected to the cabinet frames and to the protective ground terminals on all AC power connectors and the power cords.

LEADS 2, 3, 4, 5, 7, 8, 9, 10: DATA. These conductors provide the data output from a Sender to the data set. The data output consists of eight contacts which are open (space) or closed (mark) to Data Ground for the duration of a character, 13.3 milliseconds ±1 millisecond. Changes of state on any Data lead occur within ±1.5 milliseconds of a change of state of the timing lead.

LEAD 6, TIMING. The Sender changes the condition of a timing contact at the beginning of a character alternately opening or grounding the timing lead. The contact remains constant for the duration of the character. If the timing lead is marking (closed to DATA GROUND) for one character, it is spacing (open) for the next. The data set uses the timing changes to determine when the Data Level leads should be sampled.

LEAD 11, DATA GROUND. This conductor establishes the common ground reference for all signals from the Sender to the data set. It is connected to the Frame Ground lead in the data set. This arrangement minimizes the introduction of noise into the data set. The Data Ground lead is also connected to the control Common lead within the Sender.

LEADS 12, 23; SPARES. These conductors are not used. The unconnected taped ends of the wires are located behind the connector J752 mounting plate.

LEAD 13, INTERLOCK. The data set closes the Interlock lead to the Control Common lead to indicate that it is in the data mode (prepared to transmit data or receive answer-back or reverse channel signals), is connected to a working telephone circuit, and has an operating power supply.

LEAD 14, REMOTE RELEASE. This conductor is normally connected to Data Ground by the Sender and is used to hold the data set in the data mode. When a Sender recognizer (unattended operation option) is present, the recognizer opens the Remote Release lead to terminate a call.

LEAD 15, REMOTE OPERATE. This conductor (Data Set Option N) is used when an optional recognizer unit is present in the Sender. The recognizer holds a contact closed between the Remote Operate lead and Data Ground to allow the data set to answer calls unattended.

LEAD 16, REVERSE CHANNEL RECEIVE. This conductor is grounded by the data set to the Control Common lead to indicate that Reverse Channel signals are being received. The Reverse Channel Receive lead is not used when the optional reverse channel receiver is absent from the data set. Reverse channel is used to provide a circuit assurance and break feature.

LEADS 17, 19; ANSWER-BACKS AB, B. The data set closes the appropriate Answer-Back lead to the Control Common lead when asnwer-back signals are being received. Only one Answer-Back lead will be closed at a time. Opening the Data Send lead prepares the data set to receive answer-backs. The data set contacts associated with the Answer-Back AB and B leads perform no electrical functions in the Sender. Refer to unattended Send-Receive Station operating procedure section for audio frequency use of answer-backs on the telephone line.

LEAD 18, ANSWER-BACK A. The description given for leads 17 and 19 also applies to lead 18 with one exception. This conductor is used when an optional recognizer unit is present in the Sender. Closure of the data set Answer-Back A contact provides a recognition signal to the Sender which is used to establish the proper calling sequence.

LEAD 20, DATA SEND. The Sender closes the Data Send lead to the Data Ground lead to allow transmission of data. The Sender opens this conductor to allow Answer-Back signals to be received.

LEAD 21, SPARE (RING INDICATOR). This conductor is not used but is strapped within the Sender to the Ring Indicator lead.

LEAD 22, RING INDICATOR. The data set closes the Ring Indicator lead to the Control Common lead to indicate that a ringing signal is being received on the telephone line. If the Receiver has the Remote Operate lead grounded a call will be answered automatically approximately 150 milliseconds after the Ring Indicator lead is grounded. The Ring Indicator lead closures follow the ringing of the telephone lines which is typically 2 seconds ON and 4 seconds OFF.

LEAD 24, CONTROL COMMON. This conductor establishes the common ground reference for all signals from the data set to the Sender. It is not grounded in the data set but is connected to the Data Ground lead within the Sender.

LEAD 25, −18 VOLTS. This conductor (Data Set Option M) is not used by the Sender and is used for telephone company test purposes only.

3.2 5B Receiver

The interconnecting diagram for a receive-only station is shown in Figure 3-3. Figure 3-4 shows the lead designations and control contact locations of the twenty-four conductor interface cable. A functional description of each lead follows.

LEAD 1, FRAME GROUND. This conductor is connected to the cabinet frames and to the protective ground terminals on all AC power input connectors and the power cords.

LEADS 2, 3, 4, 5, 7, 8, 9, 10; DATA. The data set closes the Data leads to the Data Common lead for mark and holds them open for space. The condition of the data leads remains unchanged for the duration of a character. A change in the condition of the Data leads occurs prior to the closure of the timing lead. The character duration must be 13.3 milliseconds ±1 millisecond. Up to 0.5 millisecond contact bounce is allowable between characters.

LEAD 6, TIMING. The data set closes the Timing lead to the Timing Common lead for approximately 5 milliseconds at the beginning of each character. The Receiver samples the Data leads during the timing closures.

LEAD 11, DATA COMMON. This conductor establishes the common reference for all signals from the data set to the Receiver. It is connected within the Receiver to the Timing Common and Control Ground leads.

LEAD 12, TIMING COMMON. This conductor is the lead to which the data set closes the Timing lead. It is connected within the Receiver to the Data Common and Control Ground leads.

LEAD 13, INTERLOCK. The data set closes the Interlock lead to the Data Common lead to indicate that it is in the data mode (prepared to receive data or transmit answer-back or reverse channel signals), is connected to a working telephone circuit, and has an operating power supply.

LEAD 14, REMOTE RELEASE. The Receiver normally maintains a closure between the Remote Release lead and the Control Ground lead to allow the data set to be held in the data mode. The Receiver opens the Remote Release lead to terminate a call.

LEAD 15, REMOTE OPERATE. The Receiver maintains a closure between the Remote operate lead (data set option N) and the Control Ground lead to allow the data set to answer calls unattended.

LEAD 16, REVERSE CHANNEL SEND. This conductor is normally grounded by the Receiver to the Control Ground lead to cause the data set to transmit a reverse channel signal. The Reverse Channel Send lead opens when the Carrier On lead opens after being grounded during a call. The lead is not used when the optional reverse channel transmitter is absent from the data set.

LEAD 17, TRANSMITTER-RECEIVER CONTROL. When a Sender and Receiver are connected to a common telephone line at the same location (a Send-Receive Station), the T-R Control lead controls which data set is connected to the line. With this conductor closed to the Control Ground lead, the Receiver data set is connected to the telephone line. The Sender is connected to the telephone line when the T-R Control lead is opened by the Receiver. At Receive-Only Stations, the T-R Control lead is normally closed to the Control Ground lead.

LEADS 18, 19; ANSWER-BACKS A, B. The Receiver closes the Answer-Back A lead to the Control Ground lead to enable the data set to transmit Answer-Back A. Similarly the Answer-Back B lead is closed to the Control Ground lead to transmit Answer-Back B. When the Answer-Back A and Answer-Back B leads are closed to the Control Ground lead, Answer-Back AB is transmitted by the data set. These answer-back signals are used only when optional features are installed in the Receiver otherwise the Answer-Back A and B leads are open. When the identifier option is present, only the Answer-Back A lead is used. When the unattended send-receive option is present, both answer-back leads are used.

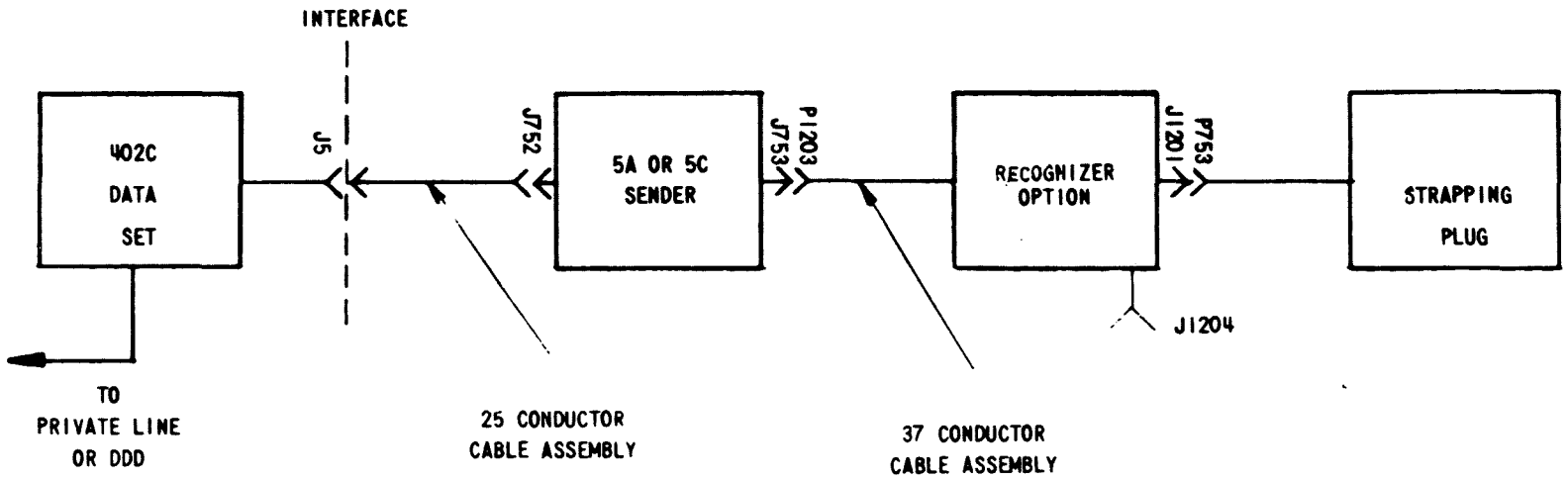
LEAD 20, DATA RECEIVE. This conductor is closed by the Receiver to the Control Ground lead to allow reception of data. The Receiver opens the Data Receive lead to permit transmission of answer-back signals. When answer-back transmission is not required, that is no optional features present, the Data Receive lead is always closed to Control Ground.

LEAD 21, CARRIER ON. The data set closes the Carrier On lead to the Data Common lead when the all space signal has been received and continues to maintain the closure so long as the data set continues to receive carrier. The data set will open the Carrier On lead from the Data Common lead within 30 milliseconds after carrier is no longer received. Once the Carrier On lead opens from the Data Common lead, the all space signal must be received for the data set to again operate the Carrier On circuit. The Receiver does not sample the Data leads until the Carrier On lead is closed.

LEAD 22, RING INDICATOR. The data set closes this conductor to the Data Common lead to indicate that a ringing signal is being received on the telephone line. If the Receiver has the Remote Operate lead closed to the Data Ground lead, the call will be answered automatically (but not ready to receive data) approximately 150 milliseconds after the Ring Indicator lead closes. The Ring Indicator lead closures follow the ringing of the telephone lines which is typically 2 seconds ON and 4 seconds OFF.

LEAD 23, OUT OF SERVICE. This conductor (data set V option) when closed by the Receiver to the Control Ground lead makes the telephone line appear busy. The busy condition will occur when the Receiver cabinet power is off or a low tape supply condition exists.

LEAD 24, CONTROL GROUND. This conductor establishes the common ground reference for all signals from the Receiver to the data set. It is connected to the data set frame and to the Frame Ground lead to minimize the introduction of noise into the data set. The Control Ground lead is connected within the Receiver to the Data Common and Timing Common leads.

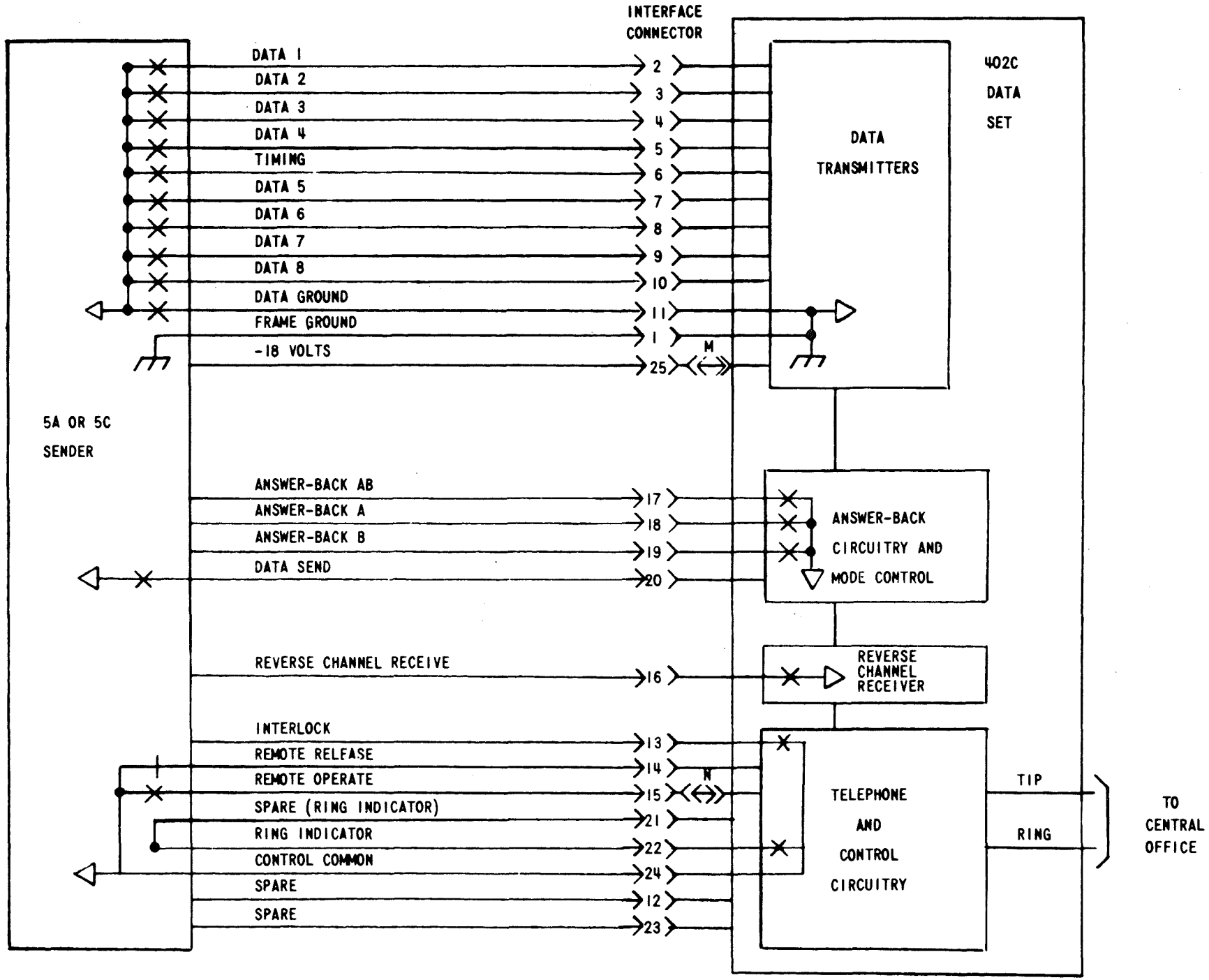


NOTES: J = CONNECTOR ATTACHED TO EQUIPMENT

P = STRAPPING PLUG OR CONNECTOR ATTACHED TO CABLE

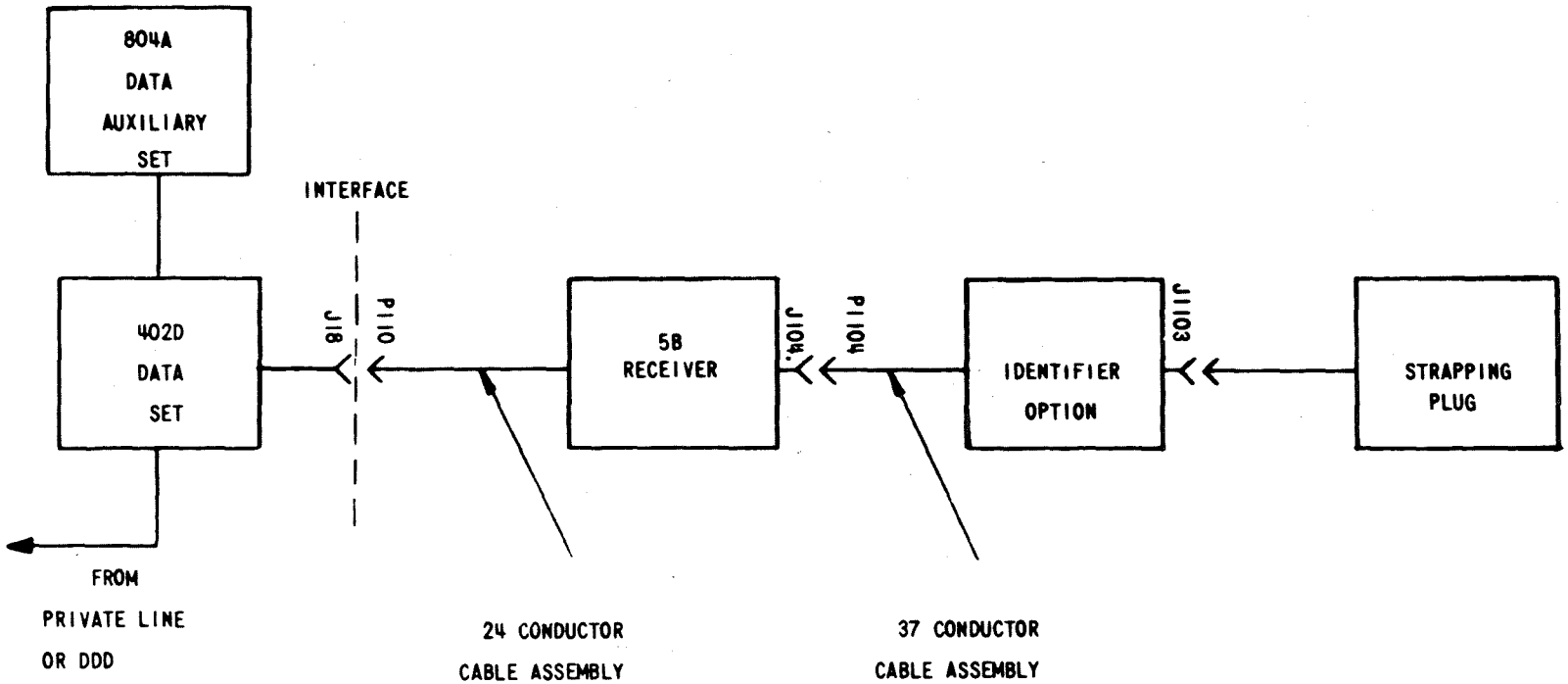
REPRESENTS MULTIPLE CONNECTOR.

INTERCONNECTING DIAGRAM FOR SEND-ONLY STATION
Figure 3-1



SENDER INTERFACE AND CONTROL CONTACT LOCATIONS

Fig 3-2



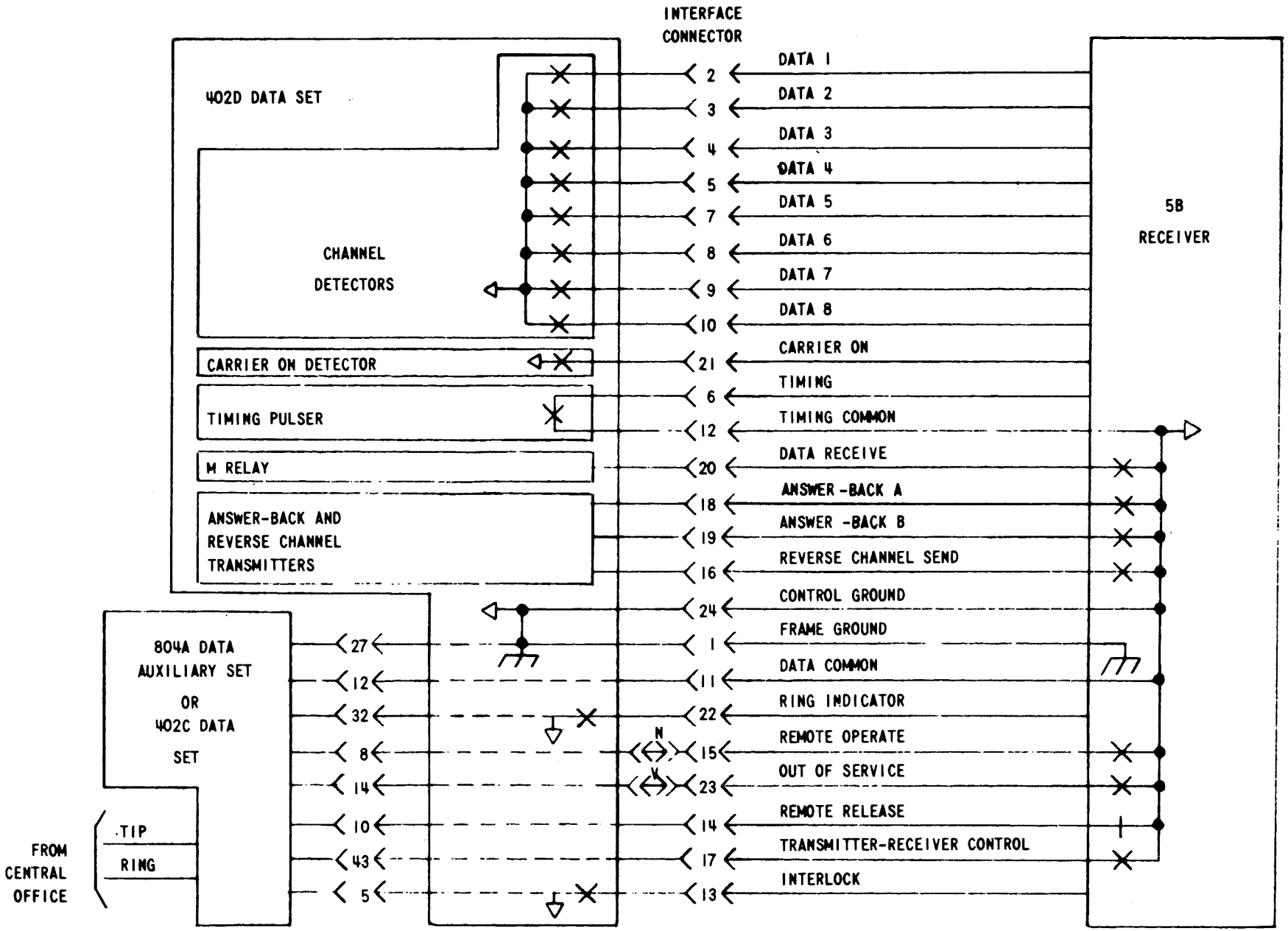
NOTES: J = CONNECTOR ATTACHED TO EQUIPMENT

P = STRAPPING PLUG OR CONNECTOR ATTACHED TO CABLE

REPRESENTS MULTIPLE CONNECTOR

INTERCONNECTING DIAGRAM FOR RECEIVE-ONLY STATION

Figure 3-3



RECEIVER INTERFACE AND CONTROL CONTACT LOCATIONS

Figure 3-4

4. GENERAL OPERATING PROCEDURES

4.1 Indicating Lamps and Control Buttons

4.1.1 5C Sender (Figure 1-6)

Control Button/Lamp and Function

POWER

Controls AC power to the terminal. When depressed, AC power is supplied and the lamp will illuminate.

PARITY

This control button and lamp are not used.

AUTO ANS

Controls optional automatic answering equipment in the Sender. When depressed, the set will answer calls automatically. The lamp will illuminate if tape is not present in the reader or the reader control lever is not in the run position.

SPARES

These three undesignated control buttons are not used. The upper and middle SPARE lamp sockets are wired for customer use while the lower one is not. Wires are present on the single make contact associated with each SPARE control button.

SIGNAL

Provides visual indication of transmission failure and has no control function (its contact is not wired). The SIGNAL lamp indication is used only with reverse channel option data sets otherwise the lamp is removed. The lamp will illuminate, if during transmission, the reverse channel circuit is opened.

The control/lamp descriptions given for the 5C Sender also apply to the 5A Sender with one exception. The 5A Sender has no power control key and is energized by plugging its power cord into an AC outlet.

4.1.2 5B Receiver (Figure 1-7)

Control Button/Lamp and Function

POWER

Controls AC power to the terminal. When depressed AC power is supplied and the lamp will illuminate. The POWER lamp flashes when the low tape switch is operated.

LOW TAPE (lamp) – AUTO ANS (button)

The LOW TAPE lamp illuminates when the low tape switch is operated. The AUTO ANS key controls automatic answering in the Receiver. When depressed the set will answer calls automatically.

SPARE (lamp) – AUTO TRANS (button)

The undesignated lamp is not used but is wired. The undesignated button is used only with the ZE wiring option which allows a Receiver to call an unattended Sender without the discrete calling feature. The key can then be designated AUTO TRANS which denotes automatic transmitter operation. When depressed the answer-back A circuit is grounded, the initial step in calling an unattended Sender.

SEND

The SEND lamp is not used nor is it wired. The SEND button is used only with a manual Send-Receive station and controls which data set is connected to the transmission line. When depressed the Sender and its Data Set 402C are connected to the line otherwise the Receiver is connected.

TRANS START

The TRANS START button is used when placing a call to an unattended Sender. Two types of operation are possible depending on the option used by the Receiver to provide this capability. Identifier option: The TRANS START lamp is not connected when this option is present. The button is depressed to start the unattended Sender transmitting after the Receiver data set is placed in the data mode. ZE wiring option: The TRANS START lamp illuminates when the interlock circuit closes, a step in the call establishment procedure. After the lamp illuminates the button is depressed which starts the unattended Sender transmitting.

ALL FO

The ALL FO (feed out) lamp though wired is not used. When the button is depressed, an all levels marking tape will be perforated by the Receiver.

SIGNAL (lamp) – BLANKS FO (button)

The SIGNAL lamp illuminates when a Sender ends transmission and opens the carrier circuit. When the button is depressed, an all levels spacing tape will be perforated by the Receiver.

4.2 Send Station Operating Procedures

4.2.1 Attended Operation Without Variable Features

Either the send station or the receive station of a system may originate a call. Before a call can be made, the set POWER button must be depressed, a message tape placed in the reader, and the reader control lever moved to the RUN position. To place a call to an attended Receiver, both the Sender and the Receiver data sets must be in the Talk mode which is controlled by a button on the data sets.

The receive station's number is dialed in the normal manner of placing a telephone call. The telephone of the recieve station rings until answered at which time conversation may take place. When both operators are ready to begin data transmission, the receive station operator depresses the Data button of the data set. When the Data button is operated, a 2025 Hertz tone is transmitted to the sending station. The send station operator waits until the tone stops and then places the sending data set in the Data mode. This action causes the reader motor to start in approximately five seconds followed in a few seconds by message transmission.

The send station operator may stop the reader at any time and then resume transmission by using the RUN-STOP lever of the tape reader. When transmission has ended, the send station operator may depress the Talk button and go on-hook or remain in the Talk mode. Either of these actions illuminates the SIGNAL lamp and closes an auxiliary circuit at the Receiver to advise the receive station operator that transmission has ended. If the Receiver is in the Data mode and the Sender goes to the Talk mode or ends the call, the Receiver will usually punch several random characters in the tape because of line noise in the absence of carrier. For this reason, it is advisable to prepare the tape with a short trailer to separate these random characters from the text of the message.

4.2.2 Attended Operation With Circuit Assurance And Break Feature

Operation proceeds as described for the Sender without variable features except that the send station operator will hear a low constant tone (reverse channel) in addition to the brief, high 2025 Hertz tone. The operator is to ignore the low tone, and depress the Data button on the data set at the conclusion of the high tone. If a circuit failure occurs during transmission or the receive station operator interrupts transmission, the Sender will stop, the SIGNAL lamp will light, and an auxiliary circuit closes at the Sender to advise the operator that a trouble stop has occurred. The Sender will not restart until the sending and receiving data sets are returned to the Talk mode and then placed in the Data mode as is done when originating a call. A trouble stop usually involves some loss of data which requires partial or complete message tape retransmission.

4.2.3 Unattended Operation

An operator prepares the Sender for unattended operation by placing a message tape in the reader, positioning the reader control lever to RUN, and depressing the AUTO ANS (automatic answer) button. The AUTO ANS lamp will illuminate if the reader control lever is not properly positioned or tape is absent from the reader. When conditioned as described, the set will answer incoming calls automatically, regardless of the position of the data set mode control keys, returning a 2025 Hertz tone to the receiving station. The receive station operator switches to the Data mode at the conclusion of the high, 2025 Hertz tone. The receive station operator next depresses the TRANS START (transmitter start) button which causes a character or identification code to be transmitted. Recognition of the character or code, depending on which recognizer is being used by the unattended Sender, causes transmission to start and continue until the end of the message tape is reached. The unattended Sender will not answer additional incoming calls or optionally return a no traffic signal if there is no tape to send.

4.2.4 Unattended Operation With Circuit Assurance And Break Feature

In this form of operation, the reverse channel signal

must be received in addition to the character or identification code, before the Sender will start. Loss of reverse channel signal will stop the Sender and begin a thrity second timer after which the call is disconnected. If an operator in the area sees the Sender's SIGNAL light go on, the Talk key on the data set may be depressed to keep the call on line. After performing some prearranged traffic operation or talking to the receive station operator, data transmission can be resumed using manual operating procedures.

4.2.5 Calling An Unattended Receiver

A Sender can call an unattended Receiver in the same manner as if the receiving station was attended. The Receiver returns a 2025 Hertz tone to the Sender immediately after answering and is ready to receive when the tone stops. A Receiver which is not able to receive will ignore incoming calls.

4.3 Receive Station Operating Procedures

4.3.1 Attended Operation Without Variable Features

Either the receive station or the send station of a system may originate a call. Before a call can be made, the tape supply should be checked, the set POWER button depressed, and tape threaded through the punch. To place a call to an attended Sender, both the Receiver and Sender data sets must be in the Talk mode which is controlled by a button on the data sets.

The send station's number is dialed in the normal manner of placing a telephone call. The telephone of the send station rings until answered at which time conversation may take place. When both operators are ready to begin transmission, the receive station operator depresses the Data button of the data set. This action causes a 2025 Hertz tone to be transmitted to the sending station. The send station operator waits until the tone stops and then operates the Data button on the sending data set. The reader motor starts approximately five seconds after the sending station is placed in the Data mode. Message transmission begins a few seconds later. No further action is required by the receive station operator until the SIGNAL lamp illuminates, indicating that the sending station operator has returned to the Talk mode. The receive station operator then can also return to the Talk mode and resume conversation or place the data set on-hook which terminates the call.

4.3.2 Attended Operation With Circuit Assurance And Break Feature

Operation proceeds as described for the Receiver without variable features. Any interruption of the telephone circuit will stop the Sender and illuminate its SIGNAL lamp. The operators must return their data sets to the Talk mode and prepare to rerun the message tape, since circuit interruptions usually introduce errors. The receive station operator can intentionally interrupt data transmission because of a trouble condition such as torn tape or tape supply depletion. This is accomplished by depressing the Talk button which returns the receiving data set to the Talk mode. The receive station operator then listens for the send station operator to also go into the Talk mode so that the difficulty can be corrected and data transmission resumed. A trouble stop usually involves some loss of data which requires partial or complete message retransmission. Data transmission is resumed by having the receive station operator return to the Data mode and following the procedure described when originating a call.

4.3.3 Unattended Operation

An operator prepares the Receiver for unattended operation by checking the tape supply reel, depressing the set POWER button, threading tape through the punch and depressing the AUTO ANS (automatic answer) button. The Receiver will now answer incoming calls automatically regardless of the position of the data set mode control keys. The Receiver returns a 2025 Hertz tone to the Sender immediately after answering and is ready to receive when the tone stops. A Receiver which is not able to receive will ignore incoming calls.

4.3.4 Unattended Operation With Circuit Assurance And Break Feature

In this form of operation, the reverse channel signal must be transmitted before the Sender will start. Reverse channel signal transmission is automatically performed by the receiving data set. Loss of reverse channel signal will stop the Sender and begin a thrity second timer which will drop the call unless both data sets are returned to the Talk mode. The call originating procedure otherwise is the same as described for unattended operation.

4.3.5 Calling An Unattended Sender Equipped With The Recognizer Without Discrete Calling

Before a call can be placed, the tape supply reel should be checked, the set POWER button depressed, tape threaded through the punch, and the SPARE (undesignated) button depressed. This SPARE button is adjacent to the AUTO ANS button on the Receiver control panel. The telephone call to the unattended Sender can now be made. At the conclusion of the 2025 Hertz tone from the Sender, the Data button on the Receiver data set is depressed. After a few seconds, the TRANS START (transmitter start) lamp illuminates. At this signal the receive station operator depresses the TRANS START button which releases the previously depressed SPARE button. Data transmission will begin after the TRANS START button is operated. After the transmission is completed, the sending station will remove carrier causing the Receiver SIGNAL lamp to illuminate. The operator can now depress the data set Talk button and go on-hook. When the circuit assurance and break feature is present, the preceding operating procedure does not change.

4.3.6 Calling An Unattended Sender Equipped With the Recognizer With Discrete Calling

This form of operation follows the procedure given for calling an unattended Sender equipped with the recognizer without discrete calling except for the following. The SPARE button is not depressed nor does the TRANS START lamp illuminate. Neither the button nor lamp are functional in this form of operation. These differences require the TRANS START button to be depressed after the Data button is depressed on the Receiver data set. The other procedures and descriptions are identical. When the circuit assurance and break feature is present the preceding operating procedure does not change.

4.4 Send-Receive Station Operating Procedures

4.4.1 Attended Operation

The operating procedures required for an attended send-receive station are identical to those given for the individual send and receive stations.

4.4.2 Unattended Operation

The operator prepares the station for unattended operation by following the preparation procedures given for the individual, unattended send and receive stations. The calling station follows normal procedures for sending to or receiving from an unattended send-receive station with one exception. At the conclusion of the 2025 Hertz tone on answering, the unattended station may transmit one of three answer-back tones for ten seconds to indicate various tape supply conditions. The calling operator or business machine can then decide to proceed or disconnect the call based on the absence or presence of these answer-back tones. The unattended station will transmit answer-back A, 1017 Hertz, if the Receiver has low tape, answer-back B, 2025 Hertz, if the Sender has no tape, or answer-back AB, 1785 Hertz, if simultaneously the Receiver has low tape and the Sender has no tape. If disconnecting action is required it should be done after the conclusion of the answer-back tone as the unattended station cannot respond to commands while transmitting the answer-back signal. The call can be disconnected by having the calling station go on-hook. If no answer-back tone is received, the procedures previously described are followed depending on the type of calling station.

5. DISCRETE CALLING GENERATOR

5.1 General Description

5.1.1 The Discrete Calling Generator (Figure 5-1) is a selfcontained module which enables a data processing terminal with no DATASPEED set at the same location to gather data from a remote, unattended DATASPEED terminal. The remote, DATASPEED terminal can be a Send-Only or Send-Receive Terminal. The data processing terminal, which can be a computer, and remote terminal are initially connected through conventional telephone facilities. Upon completion of initial contact, the data processing terminal identifies itself as an authorized receiver by transmitting a discrete code with the Discrete Calling Generator. When the discrete code is recognized, typically a Sender will begin tape transmission to the data processing terminal. All terminals within a given system are encoded with the same discrete code. The Bell System code for the Discrete Calling Generator is 1C.

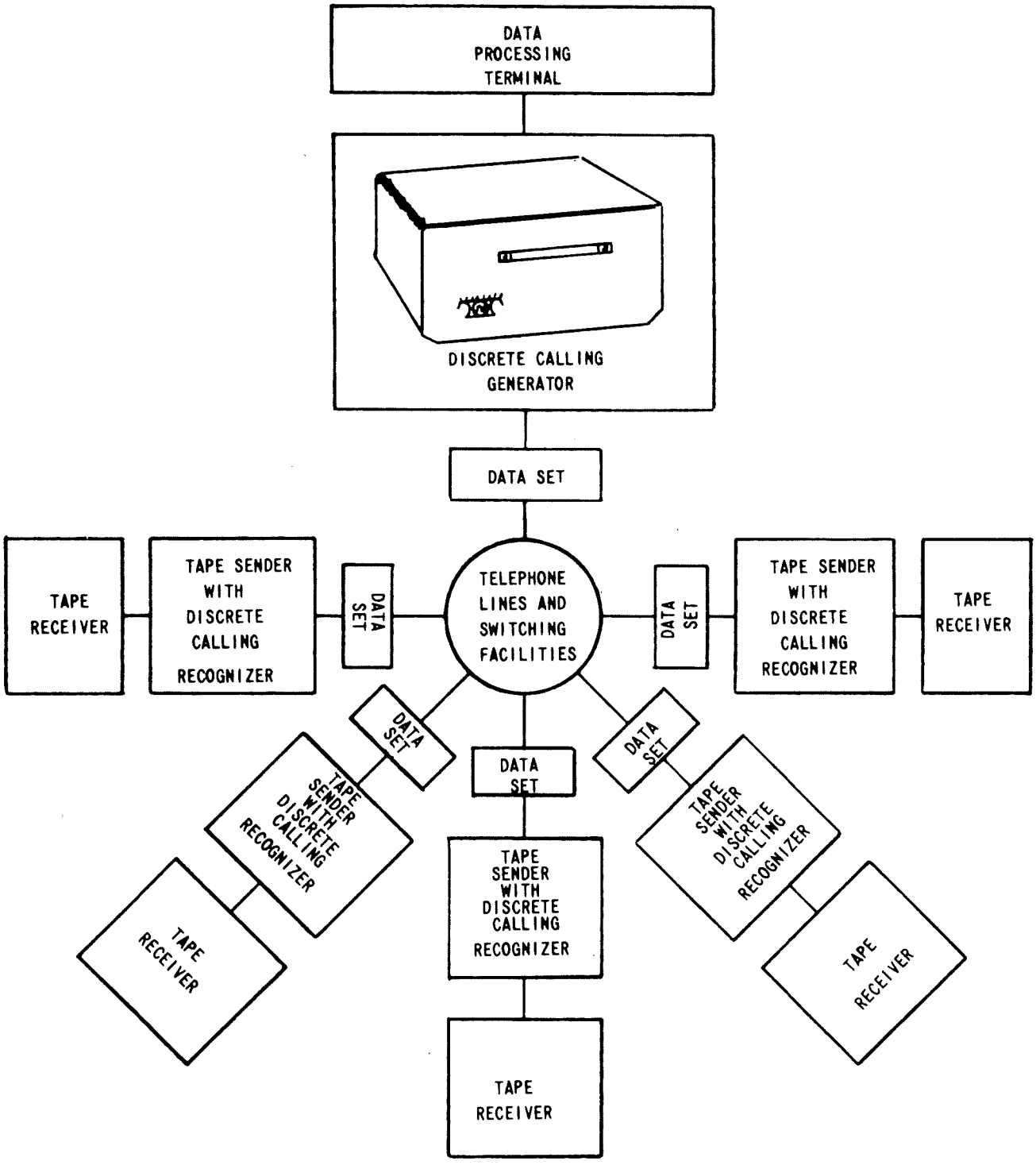
5.1.2 The 1C Generator is located at the interface between the data processing terminal and its

data set. A typical system is shown in Figure 5-1. Only one 1C Generator is required per system. The DATASPEED Senders must be equipped with recognizer units which compare and recognize the 14-bit code. The discrete calling code is required to start unattended DATASPEED terminals to prevent data from being lost to wrong numbers or unauthorized calls. System security is provided by having the code and speed intentionally difficult for ordinary business equipment to generate. When the Discrete Calling Generator is not generating the identification code, it is "transparent" and has no effect on signalling. The 1C Generator has two installation options which can be used with the Data Set 402D. Option A provides automatic operation and Option R provides remote control operation.

5.1.3 The physical and electrical characteristics of the Discrete Calling Generator are as follows:

Physical and Electrical Characteristics of the 1C Generator
Table 5A

Feature or Requirement	Discrete Calling Generator
Size	11" wide, 5.5" high, 10.25" deep
Weight	13.2 pounds
Operating Temperature Range	+40°F to +110°F
Average AC Power Consumption-Operating	36.5 watts
Voltage	117 volts AC ± 10%
Frequency	60 ± 0.5 Hertz
Current	0.31 Amperes
Interface	Contact Closures
Power Cord	Three wire grounded type of 10' length



TYPICAL DATA PROCESSING SYSTEM UTILIZING DISCRETE CALLING
Figure 5-1

5.2 Interface

5.2.1 For Data Set 402D operation, the disposition of the data set circuits through the 1C Generator are listed in Table 5B. The circuit conditions for operation of the 1C Generator are shown in Table 5C. When the 1C Generator is not in operation, all leads have a one-to-one correspondence between the input and the output with the exception that the Data Common lead, pin 11, and the Control Common lead, pin 24, are connected together within the generator. Signals on some leads are repeated through the relay logic. The interface conforms to the interface of the Data Set 402D.

5.2.2 The auxiliary connector provides an additional input for remote control (Option R) operation of the 1C Generator. The connector pins and circuits are listed in Table 5D. The auxiliary connector also passes a signal that acknowledges the operation of the generator.

PARALLEL TYPE DATA SET OPERATION

Table 5B

Discrete Calling Generator (1C) Interface	Signals Connected Straight Through	Signals Used by 1C	Signals Controlled by 1C	State of Interface Leads when 1C is Operated	
				Input	Output
1. Frame Ground	X			–	–
2. Data 1	X			0	0
3. Data 2	X			0	0
4. Data 3	X			0	0
5. Data 4	X			0	0
6. Timing	X			0	0
7. Data 5	X			0	0
8. Data 6	X			0	0
9. Data 7	X			0	0
10. Data 8	X			0	0
11. Data Common	X	X		–	–
12. Timing Common	X			–	–
13. Interlock		X		1	1
14. Release	X			1	1
15. Operate	X			–	–
16. Reverse Channel Send	X			–	–
17. T-R Control		X		1	1
18. Answer-Back A			X	–	M
19. Answer-Back B			X	–	0
20. Data Mode		X	X	1	0
21. Carrier Detect		X		0	0
22. Ring Indicator	X			0	0
23. Out of Service	X			0	0
24. Control Common	X	X		–	–
25. Not Used	X			–	–

Leads 11 and 24 are connected together by the Discrete Calling Generator.

0 – Off State or Marking
1 – On State or Spacing
M – Modulated

TABLE 5C CIRCUIT CONDITIONS FOR OPERATION OF DISCRETE CALLING GENERATOR WITH PARALLELL DATA SET

SERVICE OPTION	DATA CARRIER DETECT (LEAD 21)	T-R CONTROL (LEAD 17)	DATA MODE (LEAD 20)	INTERLOCK (LEAD 13)	AUXILIARY CONTROL (PIN 4)
A (AUTOMATIC)	OFF (OPEN)	ON (CLOSED)	ON (CLOSED)	ON (CLOSED)	NOT USED
R (REMOTE CONTROL)	OFF (OPEN)	ON (CLOSED)	ON (CLOSED)	ON (CLOSED)	ON (CLOSED)

NOTE: REMOTE CONTROL THROUGH DATA SET INTERFACE CANNOT BE USED WITH PARALLEL TYPE DATA SET.

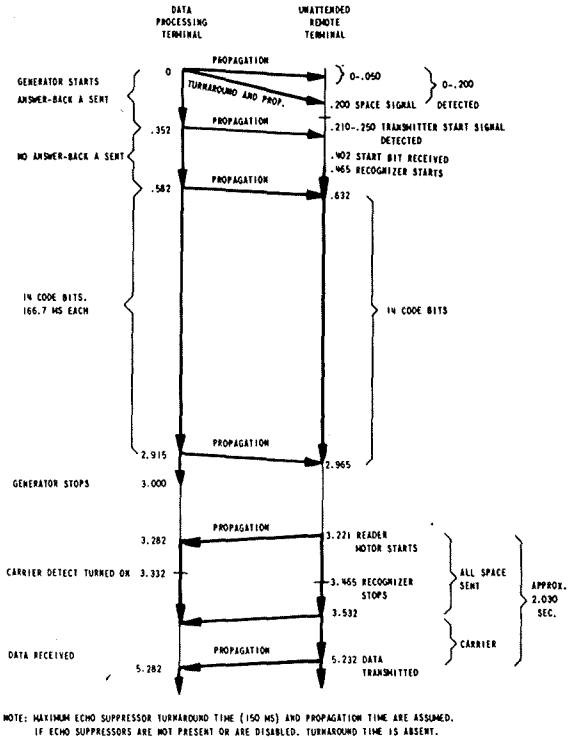
Table 5D - AUXILIARY CONTROL CONNECTOR CIRCUITS

CONNECTOR		PARALLEL DATA SET APPLICATION
PIN	CIRCUIT	
1	REMOTE CONTROL	
2	ACKNOWLEDGE SIGNAL	
4	REMOTE CONTROL	X
5	ACKNOWLEDGE SIGNAL	X
7	SIGNAL GROUND	X
14	SIGNAL GROUND	X
15	TEST	X

5.3 System Operation and Timing Diagrams

5.3.1 The operation of a system using the 1C Generator depends on whether the data processing terminal is a receive-only or send-receive station. Unattended operation only is discussed though attended operation (manual dialing) is possible.

If no echo suppressors are present in the system, or if they have been held disabled by Reverse Channel signals, the only transmission delay will be the time required for the signal to propagate from one terminal to the other. If echo suppressors are present, there will be a loss of signal of up to 200 ms (when the generator starts and when the mark hold is sent) to turn them around. This loss has no effect on any other part of the operation. The absence or presence of echo suppressors are represented by separate vectors at these points on the timing diagrams. All diagrams give time in seconds.



NOTE: MAXIMUM ECHO SUPPRESSOR TURNAROUND TIME (150 MS) AND PROPAGATION TIME ARE ASSUMED. IF ECHO SUPPRESSORS ARE NOT PRESENT OR ARE DISABLED, TURNAROUND TIME IS ABSENT.

SYSTEM TIMING DIAGRAM FOR DISCRETE CALLING GENERATOR-PARALLEL TYPE TRANSMISSION
Figure 5-2

5.3.2 The generator and recognizer events of the 1C Generator are shown in Figure 5-2. The assumed line distance between the data processing terminal and the remote terminal is equivalent to a propagation time of 50 milliseconds (ms). The assumed number of echo suppressors (if present) between the sending and receiving terminals is equivalent to a turnaround time of 150 ms.

5.3.3 The timing diagrams (Figure 5-3 and 5-4) for parallel operation are based upon using Data Sets 402C (send) and 402D (receive).

5.3.4 The operational events of a parallel type data processing system in which the data processing terminal receives-only or receives before transmitting, are shown in Figure 5-3. Dialing, call set-up, and ringing are the same for both send-only and send-receive remote terminals.

5.3.5 When the remote data set (402C) enters the data mode, and after a 1.1 second delay, the 2025 Hertz disabling and recognition tone is sent for 3.5 ± 1.5 seconds. When the automatic calling unit detects the end of the disabling and recognition tone, it transfers the line to the receiving data set (402D). Following a delay of 100 ± 25 ms, the Data Set 402D enters the data mode. Approximately 1.1 seconds later, the Data Set 402D transmits the 2025 Hertz disabling and recognition tone to the remote data set for 3.5 ± 1.5 seconds. Following the tone, the Interlock circuit is turned ON. At this time, Reverse Channel (if used) is turned ON, and, after a delay of 12 ms, is transmitted. The operate conditions of the Discrete Calling Generator are then present. After a further delay of 225 ms (200 ms to allow the integrator pulse shaper to time out and the signal generator clutch to engage), the discrete calling code is sent (as shown in Figure 5-2).

5.3.6 Answer-back A corresponds to a spacing bit, and absence of Answer-back A corresponds to a marking bit in serial transmission. After the last code bit is received by the remote sending terminal, there is a 208 ms delay following

which the GO relay is triggered. During the remaining 48 ms delay, the following events take place: (1) The GO relay operates; (2) the reader motor starts; (3) the ALL SPACE signal starts; and (4) the two-second delay tube for the reader clutch, is triggered. The ALL SPACE signal continues for 300 ms and then stops. However, the carrier remains ON LINE as the first character in the reader (although idle) is transmitted during the remainder of the two-second delay. At the end of the two-second delay, the reader motor is up to speed; the reader clutch engages, and data transmission begins.

5.3.7 The operational events of a parallel type data processing system in which the data processing terminal sends first and then receives, is shown in Figure 5-4. Dialing, call set-up, and ringing are the same for both send-only and send-receive remote terminals.

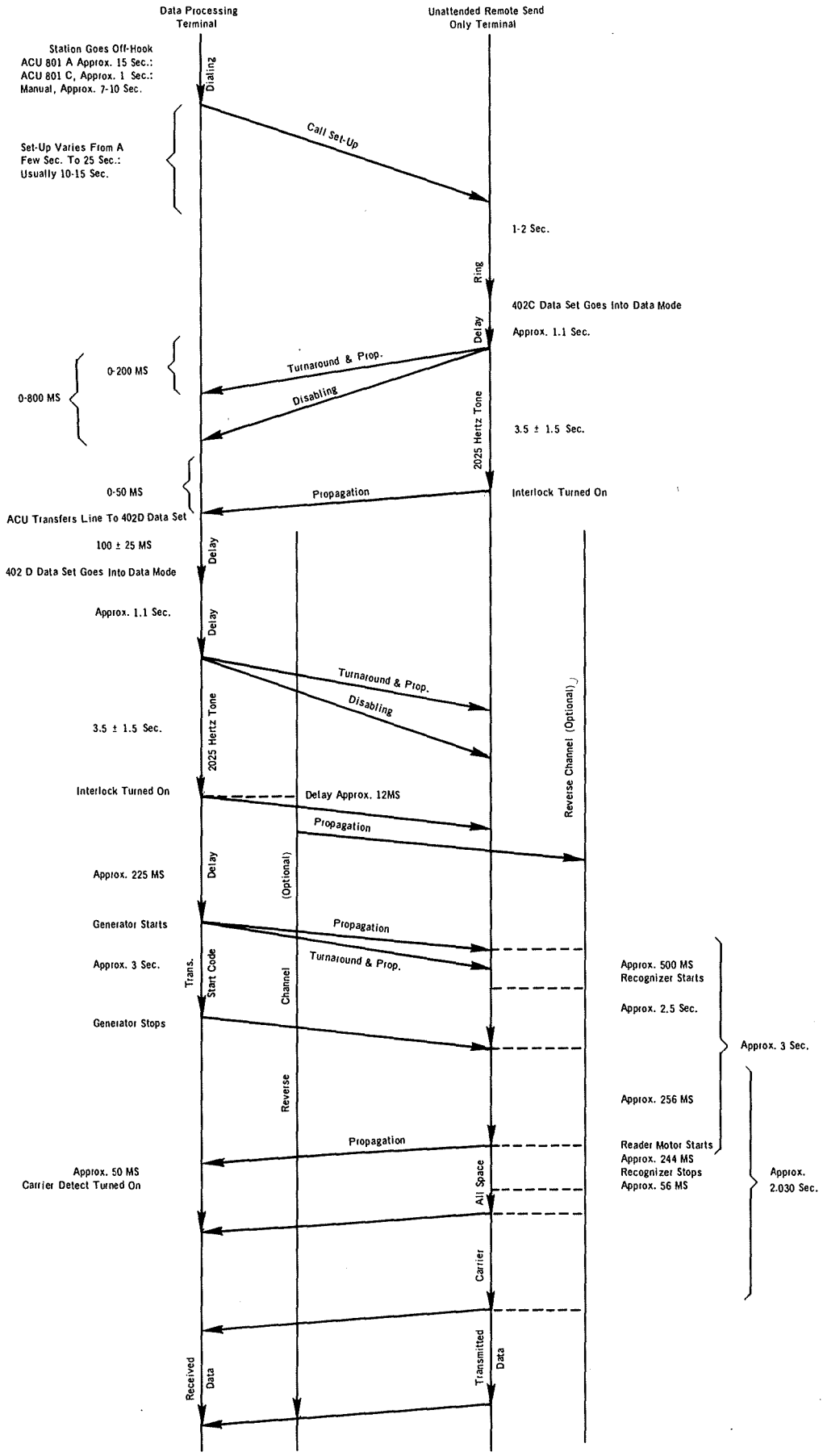
5.3.8 When the remote data set (402D) enters the data mode, and after a 1.1 second delay, the 2025 Hertz disabling and recognition tone is sent for 3.5 ± 1.5 seconds. At the end of the tone, the remote station begins toggling from the Data Set 402C to the Data Set 402D and vice versa. Each data set is ON for alternating periods of 140 ms. Reverse Channel (if used) is turned ON approximately 12 ms after the disabling and recognition tone stops.

5.3.9 When the automatic calling unit detects the end of the disabling and recognition tone, it transfers the line to Data Set 402C at the data processing terminal. After a 100 ± 25 ms delay, the Data Set 402C enters the data mode, and, after 1.1 seconds, it transmits the 2025 disabling and recognition tone for 3.5 ± 1.5 seconds. Following a 20 to 30 ms delay, Interlock is turned ON, and the ALL SPACE is sent (to switch on the remote receiver).

5.3.10 After propagating to the remote terminal, the ALL SPACE will be detected immediately or after a delay up to 140 ms, depending upon the toggling status of the remote data sets (402C & 402D). If Data Set 402D is ON, there will be no delay; but if Data Set 402C is ON, there will be a delay of up to 140 ms before Data Set 402D comes ON and toggling ends. Approximately 50 ms after toggling stops, Carrier Detect comes ON in Data Set 402D.

5.3.11 When the Data Set 402C at the data processing terminal is finished sending the ALL SPACE, it begins sending data. After data transmission (and perhaps a delay for data processing), the T-R Control relay in the Discrete Calling Generator, is triggered by the data processing terminal's act of switching from the transmit mode to the receive mode. This relay closes after a delay of 25 ms, triggering the T-R relay in the Data Set 402D. After an additional delay of 30 ms, the T-R relay closes, switching the station from Data Set 402C to Data Set 402D. Data Set 402D is in the Data Mode when it is switched ON, so the Data Mode relay in the Discrete Calling Generator, is triggered. When the Data Mode relay closes, the conditions for operation of the Discrete Calling Generator are present. Reverse Channel (if used) is also triggered when Data Set 402D is switched ON, and goes ON after a delay of 12 ms. After the delay of 225 ms (200 ms to allow the integrator pulse shaper to time out and the signal generator clutch to engage), the discrete calling code is sent (as shown in Figure 5-2). The remaining operation is as previously described.

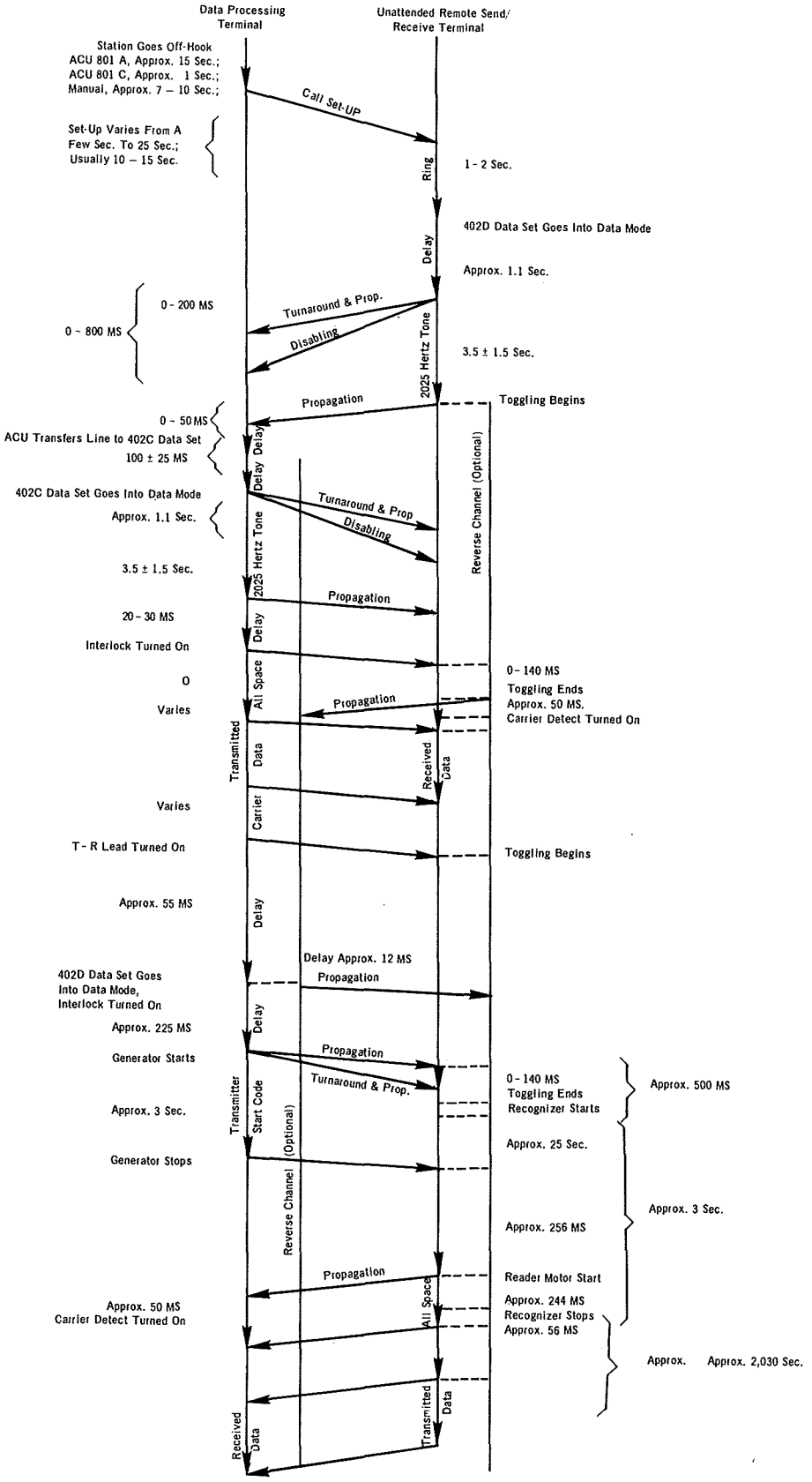
SYSTEM TIMING DIAGRAM FOR TYPE 5 DATASPEED TRANSMISSION WITH DISCRETE CALLING FEATURE, DATA PROCESSING TERMINAL RECEIVES DATA ONLY



Note: Turnaround And Disabling Times Apply To Echo Suppressors Which May Appear On The Switched Network Facilities If Echo Suppressors Are Not Present Or Are Disabled, Turnaround Time Is Absent. Optional Reverse Channel Timing Is Shown With Reverse Channel Send Permanently Turned On.

FIGURE 5-3

SYSTEM TIMING DIAGRAM FOR TYPE 5 DATASPEED TRANSMISSION WITH DISCRETE CALLING FEATURE, DATA PROCESSING TERMINAL SENDS FIRST AND THEN RECEIVES



Note: Turnaround and Disabling Time Apply to Echo Suppressors Which May Appear on the Switched Network Facilities. If Echo Suppressors Are Not Present Or Are Disabled, Turnaround Time Is Absent. Optional Reverse Channel Timing Is Shown With Reverse Channel Sends Permanently Turned On.

FIGURE 5-4

PROCEDURES FOR OBTAINING COPIES OF REFERENCED ARTICLES AND ADDITIONAL COPIES OF TECHNICAL REFERENCES

I. Bell System Technical Journals (BSTJ), Institute of Electrical and Electronics Engineers (IEEE), American Institute of Electrical Engineers (AIEE) and most other material from technical journals may be ordered from:

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