1C DISCRETE CALLING GENERATOR

DESCRIPTION AND OPERATION

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1. GENERAL

1.01 This section provides the description and operation of the discrete calling generator. It has been reissued to include the latest engineering changes, to change format, and to remove the preliminary designation. Since this is a general revision, marginal arrows normally used to indicate changes and additions have been omitted.

1.02 The discrete calling generator (Figure 1) enables a data processing terminal to gather data from unattended high speed tape senders that are protected against sending to unauthorized callers.

2. DESCRIPTION

FUNCTION AND CONFIGURATION

2.01 The discrete calling generator permits a data processing terminal to transmit a 14-bit code discrete code signal which is recognized by a sender and causes it to begin transmission.

2.02 In a typical data gathering operation, the data processing terminal will contact a tape sending terminal through normal telephone facilities. Upon completion of initial contact, the data processing terminal can identify itself as a proper receiver by transmitting the discrete code. When the discrete code is

Figure 1 - Discrete Calling Generator

Prepared for American Telephone and Telegraph Company by Teletype Corporation

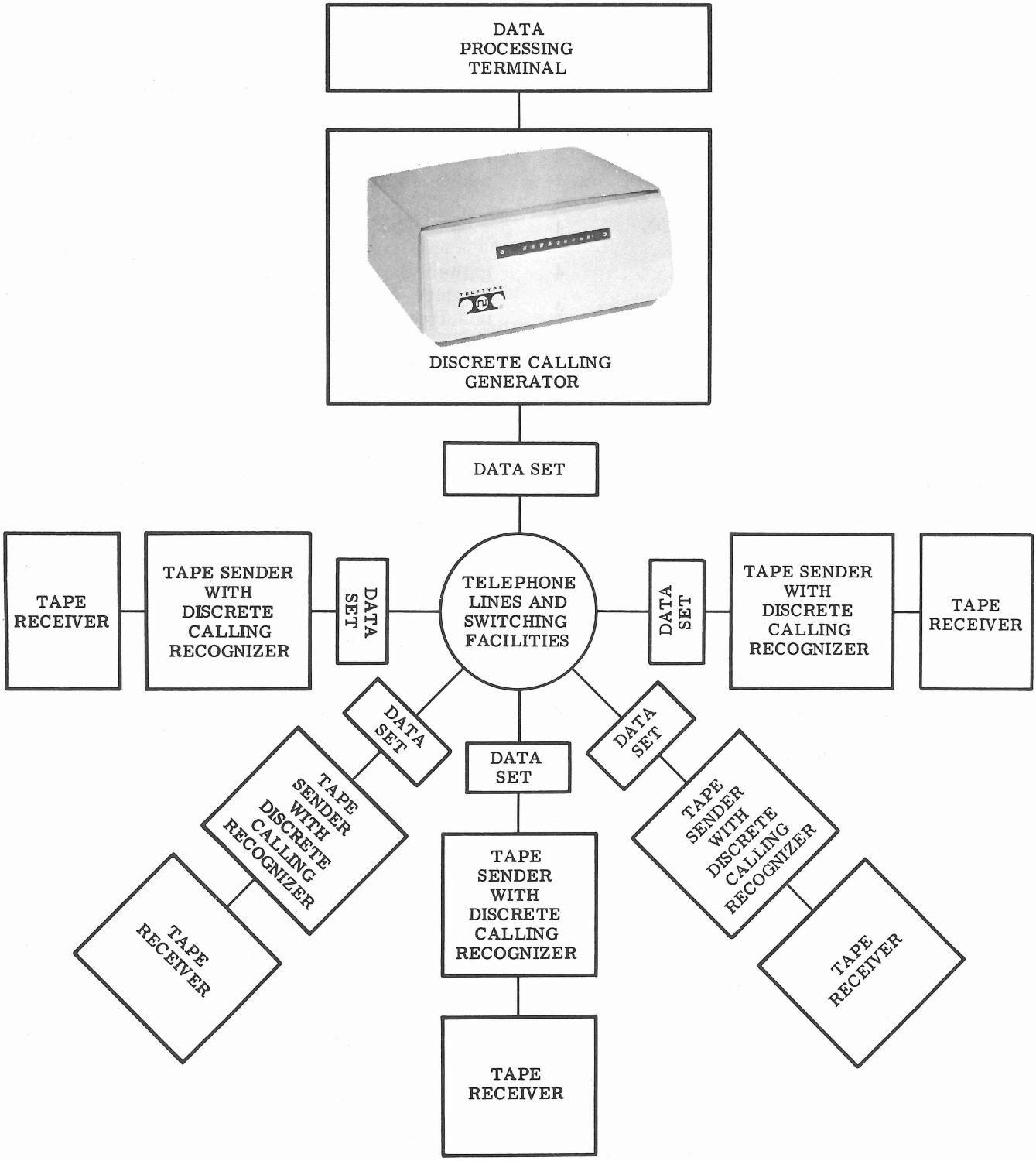


Figure 2 - Typical Data Processing System Using Discrete Calling

recognized, the sending terminal will start tape transmission to the data processing terminal. All terminals within a given system are encoded with the same discrete code.

2.03 The discrete calling generator is located at the interface between the data processing terminal and the terminal's data set (Figure 2). Only one unit is required per system. The sending terminals are equipped with compatible recoginizer units which compare and recognize the 14-bit code.

2.04 A discrete calling code is required to start high speed sending terminals to prevent data from being lost to wrong numbers or unauthorized calls. To provide security for a system, the code and speed are intentionally difficult for ordinary business equipment to generate. When the unit is not generating the code, it is "transparent" and has no effect on signaling between the terminal and data set.

2.05 The interface connector panel of the discrete calling generator is shown in Figure 3. The generator may be used for serial type data set operation (data set Types 201A, 201B, 202A, 202B, 202C, and 202D) or parallel type data set operation (data set Type 402D) but not both at the same time. It has three service options:

(a) Option A - Automatic Operation; terminal and data set connections only.

(b) Option R - Remote Control; terminal, data set, and auxiliary control connections.

(c) Option RD - Remote Control through available data set circuits (for serial data set operation only); terminal and data set connections only.

2.06 The major components of the discrete calling generator consist of the generator logic elements, signal generator, and power supply (Figure 4). A service option (Paragraph 2.05) is readily obtainable by rearranging the straps on the service option terminal block. The cover is held in place by four retainers; two are located in the rear, and one is located on each side of the cover base.

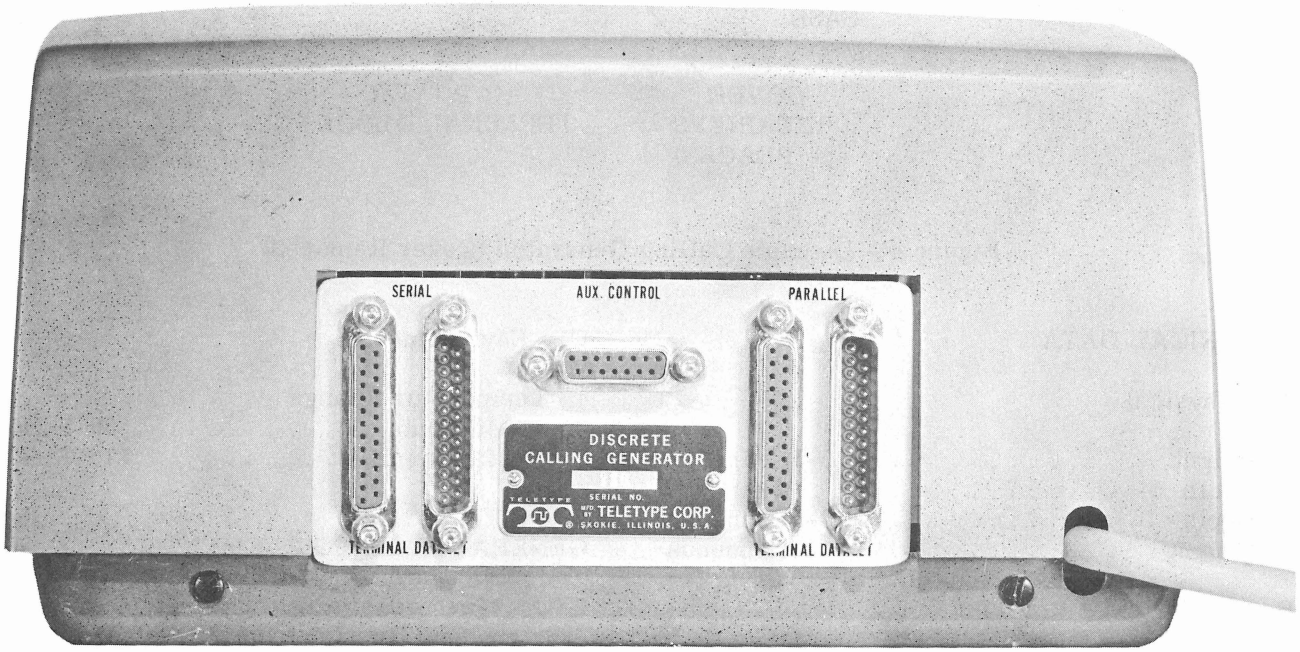


Figure 3 - Interface Connector Panel (Rear View of Discrete Calling Generator)

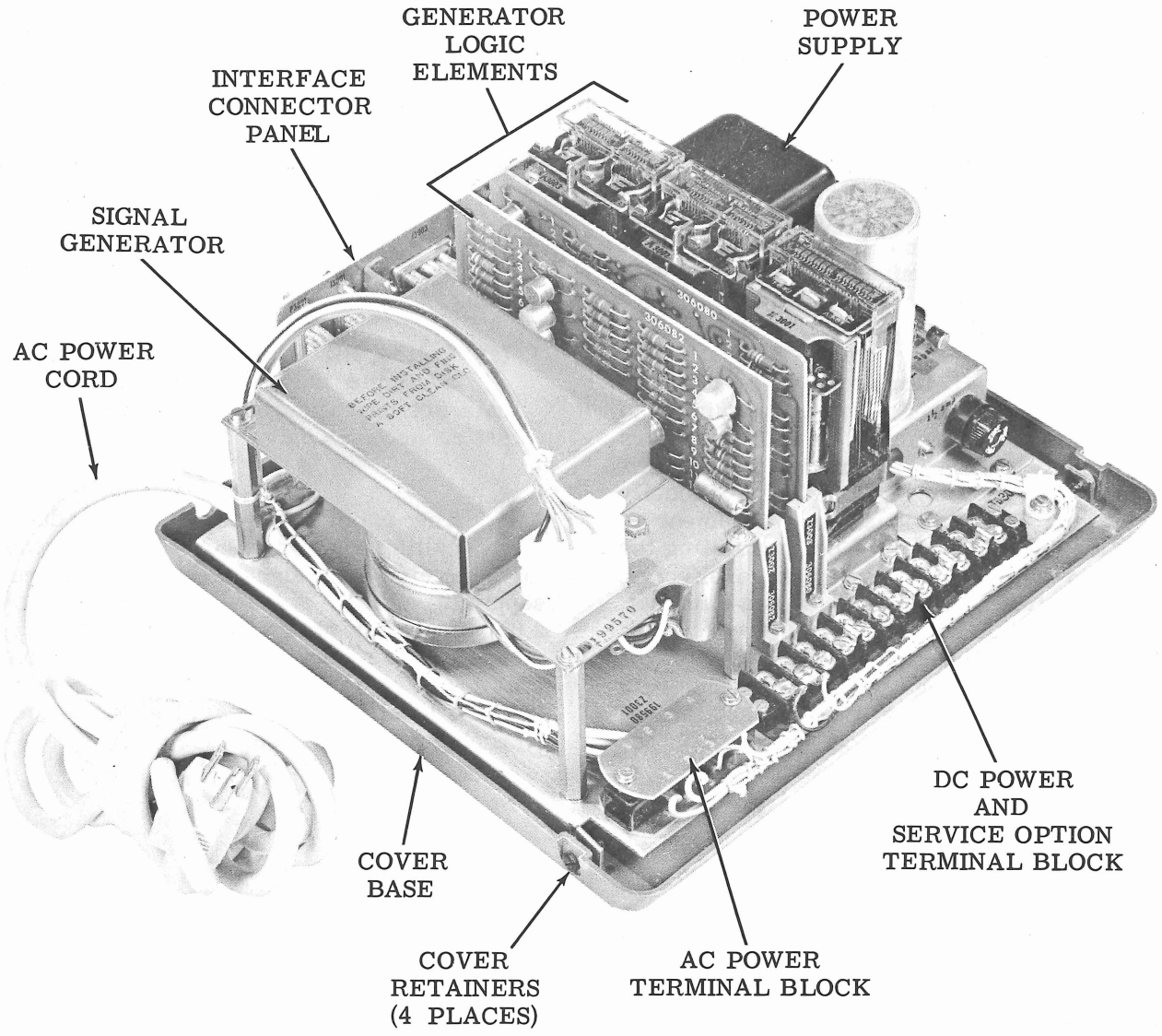


Figure 4 - Discrete Calling Generator (Cover Removed)

TECHNICAL DATA

A. Physical

Height	5-1/2 inches
Width	11 inches
Depth	10-1/4 inches
Weight	13.2 pounds

B. Electrical

Voltage Requirements	115 volts ac, 60 cps
Power Consumption	
Idle	28 watts
Operating	36-1/2 watts

C. Environmental

Temperature Range	
Minimum	59°F (15°C)
Maximum	113°F (45°C)

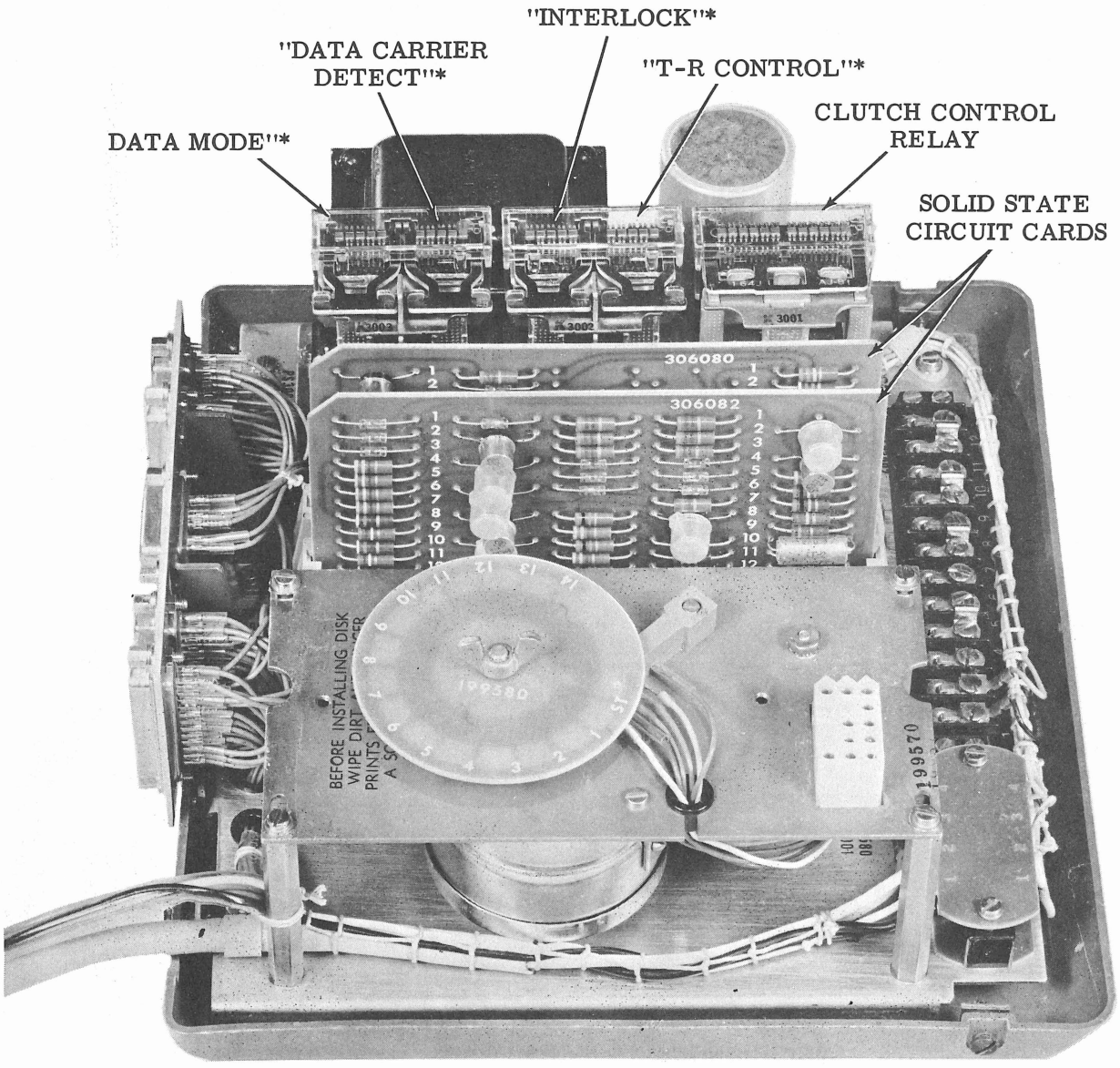
GENERATOR LOGIC ELEMENTS

2.07 The generator logic elements accept signal inputs from the external interface and auxiliary control (when used) circuits. When conditions for operation are detected by the appropriate logic elements, the signal generator will distribute the 14-bit discrete code on the appropriate interface circuit. The logic

elements convert the input-output signals as required for compatibility of the discrete calling generator with serial or parallel type data set circuits.

2.08 The generator logic elements (Figure 5) include three wire spring relays and two solid state circuit cards. Two of the three wire spring relays are active for parallel data set applications only; their four separate relay coils are energized from circuit conditions (through parallel data set connectors) on Data Mode, Data Carrier Detect, Interlock, and T-R Control. The clutch control relay will respond when the required logical input occurs in the internal logic circuits.

2.09 The solid state circuit cards contain logic elements for the serial interface circuits (through serial data set connectors), remote control circuits (through auxiliary control connector), internal clutch control circuit, and output signal generating circuits. Voltage divider circuits are also included.



*PARALLEL INTERFACE RELAYS

Figure 5 - Generator Logic Elements

SIGNAL GENERATOR

2.10 The signal generator includes a 20 rpm synchronous motor, clutch solenoid, code disc, and pickup brushes (Figure 6). When operated, the signal generator will (1) generate the 14-bit discrete code and (2) maintain energizing current to the clutch control relay for the duration of one disc revolution.

2.11 The 20 rpm synchronous motor operates continuously as long as 115 volt ac power is available to the discrete calling generator. The clutch solenoid is energized when the clutch control relay (Figure 5) is operated. The clutch engages the code disc with the motor drive, and the code disc starts rotating. After the disc is displaced from the homing position (Figure 7), the generator homing brush will maintain energizing current to the clutch control relay. Meanwhile, the signal brush originates the 14-bit discrete code, preceded by one spacing and one marking bit. The common brush provides source voltage to the code disc.

POWER SUPPLY

2.12 The power supply (Figure 8) includes a capacitor, fuse, two resistors, four silicon diodes, and a transformer. The resistors and silicon diodes are contained within the

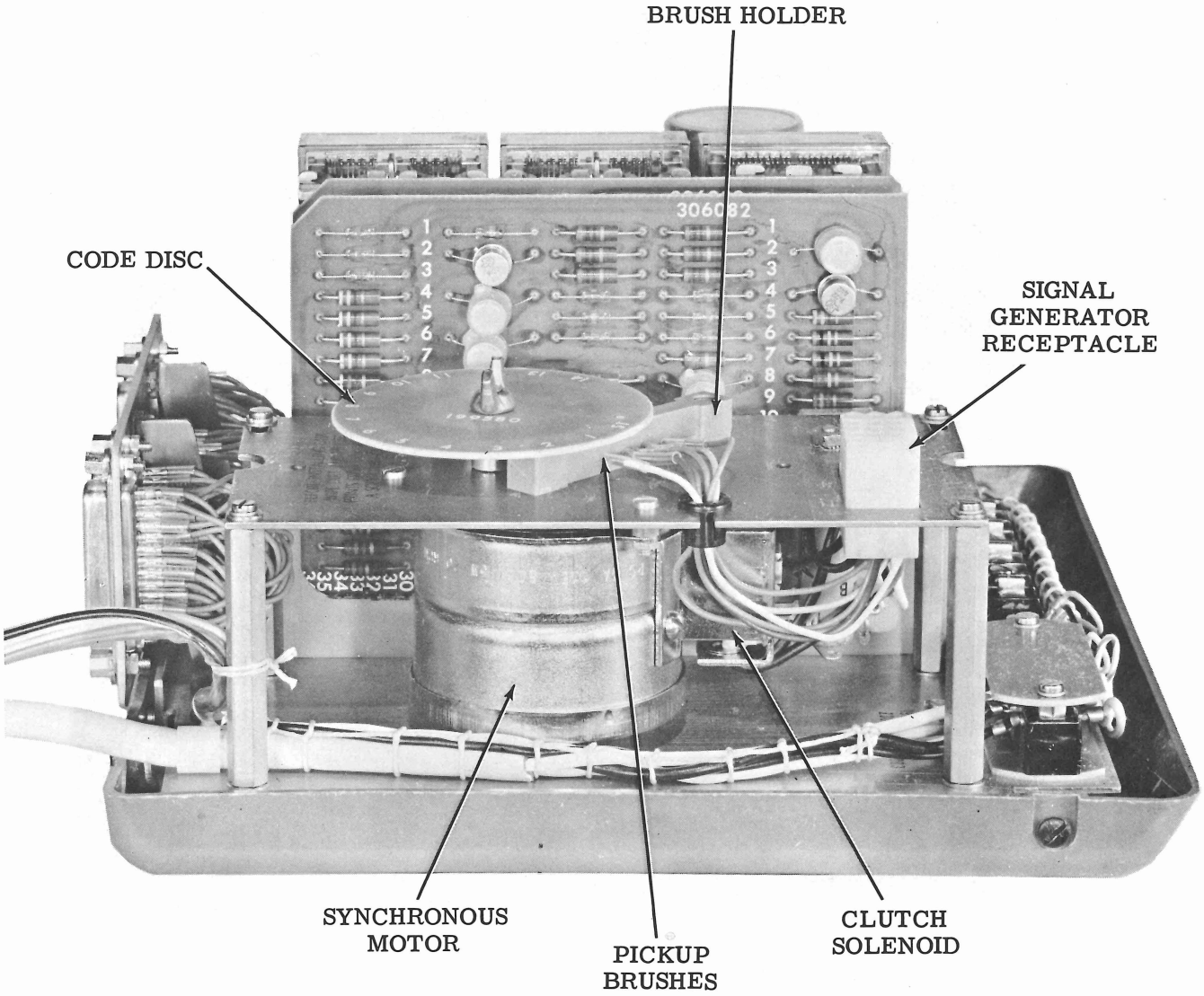


Figure 6 - Signal Generator (Metal Cover Removed)

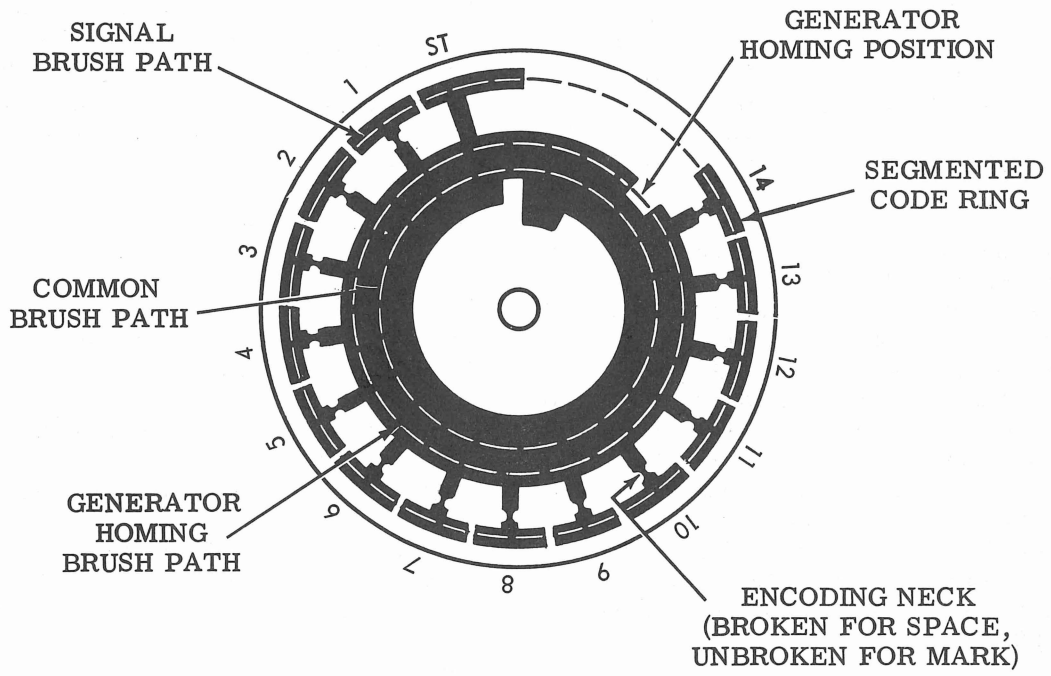


Figure 7 - Generator Code Disc and Brush Paths

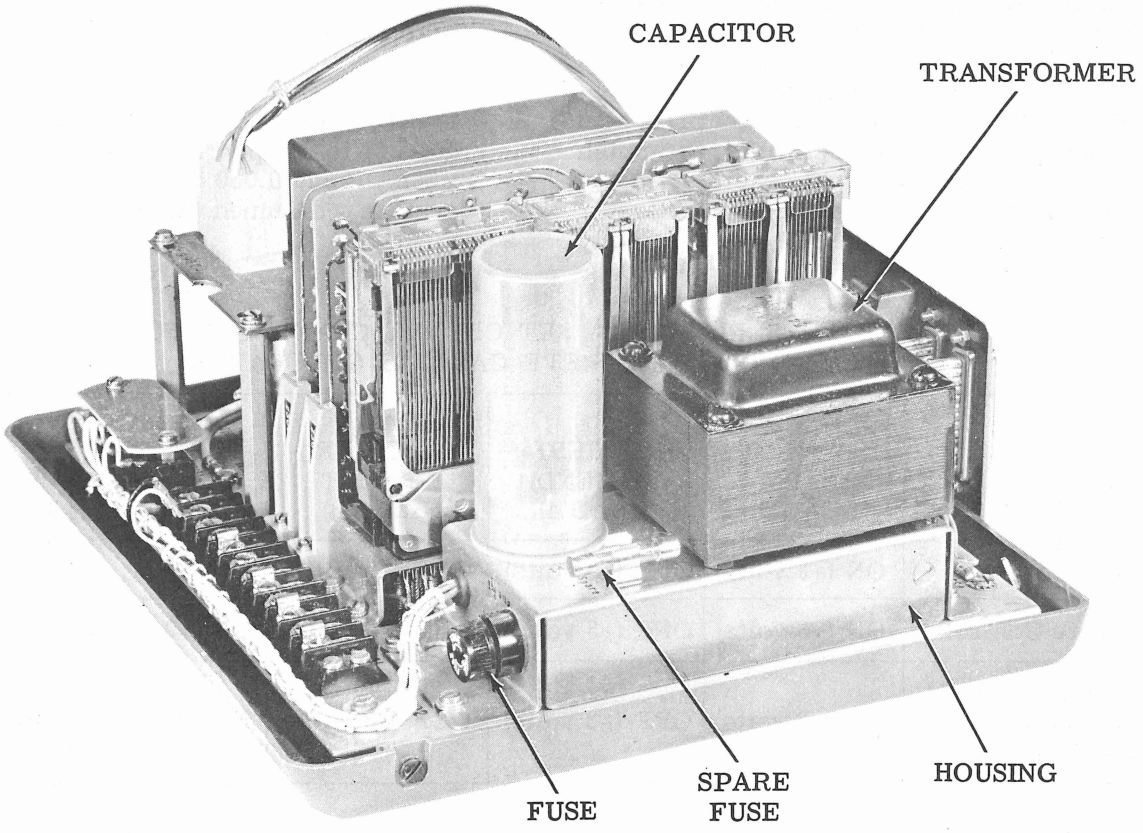


Figure 8 - Power Supply

power supply housing. The power supply accepts 115 volts ac from the ac terminal block, converts ac to dc, and delivers 48 volts dc to the dc terminal block (Figure 4). A 24 volt ac output (not used by the discrete calling generator) is returned and attached to the ac terminal block.

2.13 The dc voltage is accepted by voltage divider circuits which are located on a solid state circuit card. Four resistors and three zener diodes are arranged to provide voltage increments suitable for the electronic logic. A ground reference point is selected to place the positive voltage level at +36 volts and the negative voltage level at -12 volts. Voltage levels of -12 volts, -6 volts, ground, and +6 volts (established and regulated by the three zener diodes) are required for the solid state logic elements. The total potential of 48 volts (+36 volts and -12 volts) is required for energizing the relays.

3. MODULE OPERATION

3.01 The discrete calling generator contains the logic circuits for operation with either a serial or parallel type data set but not both at the same time. A block diagram representing the major logic groups of the discrete calling generator is shown in Figure 9. When the conditions for operation are presented on the appropriate interface circuits, the clutch control logic causes the signal generator to deliver the 14-bit discrete code. The generator may be initiated automatically or remotely through either a data set circuit (for serial data set application only) or the auxiliary control circuit. A detailed circuit description is given in the section covering the schematic wiring diagrams for the discrete calling generator.

INTERFACE CIRCUITS

A. Serial Data Set

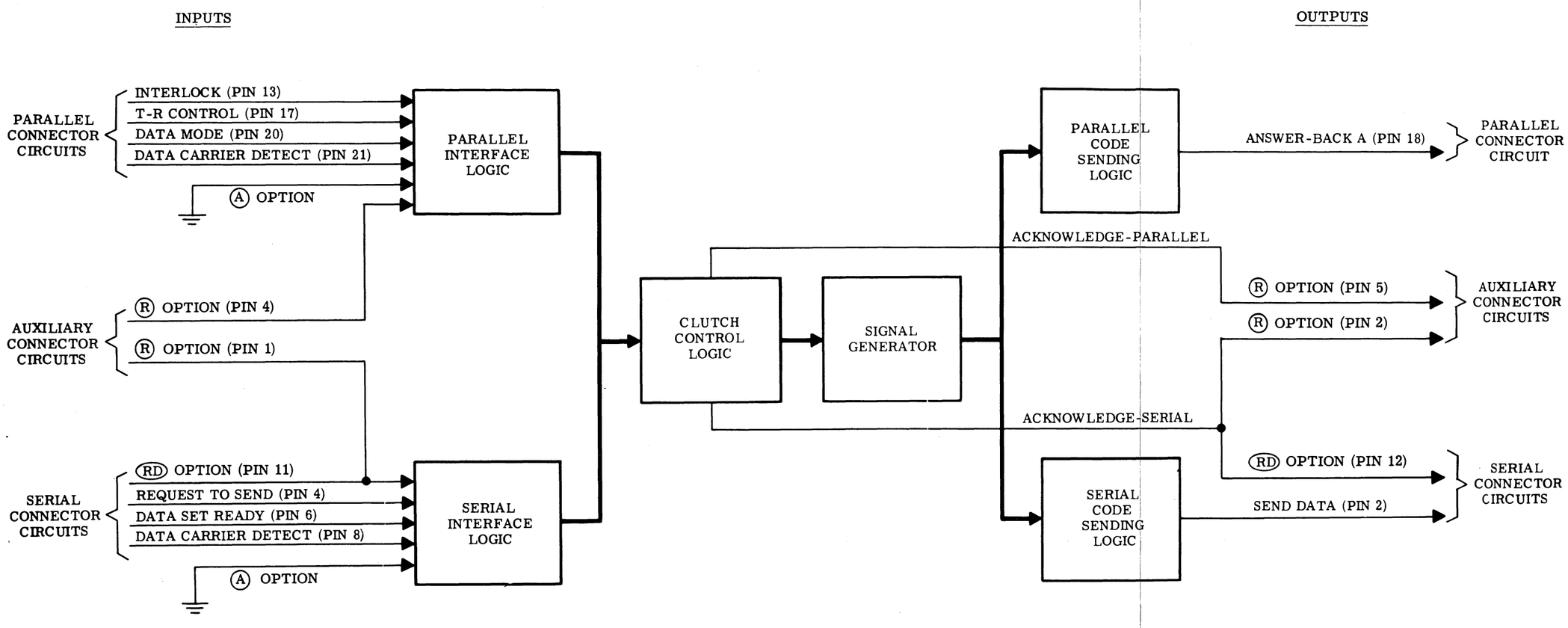
3.02 For serial data set application, the circuit conditions for operation of the discrete calling generator are shown in Table 1. The disposition of the serial data set circuits through the discrete calling generator are listed in Table 2. When the signal generator is not in operation, all leads have a one-to-one correspondence between the input and the output. The input and the output interfaces, therefore, are the same; the data processing terminal will not detect the presence of the discrete calling generator between itself and the data set. The interfaces conform to EIA Standard RS-232-A for serial operation, so the discrete calling generator will operate with any data set built to this standard.

Note: Data Set Ready (Pin 6) and Data Carrier Detect (Pin 8) circuits are partially loaded when the discrete calling generator is not in operation. Each circuit will be required to supply approximately 0.228 ma when ON and 0.030 ma when OFF. The current is consumed by the input logic elements.

TABLE 1 - SERIAL DATA SET CIRCUIT CONDITIONS FOR OPERATION OF DISCRETE CALLING GENERATOR

SERVICE OPTION	DATA SET READY (LEAD 6)	REQUEST TO SEND (LEAD 4)	DATA CARRIER DETECT (LEAD 8)	AUXILIARY CONTROL (PIN 1)	DATA SET INTERFACE
A (Automatic)	ON (+3 volts)	OFF (-3 volts)	OFF (-3 volts)	Not Used	Not Used
R (Remote Control)	ON (+3 volts)	OFF (-3 volts)	OFF (-3 volts)	ON (+3 volts)	Not Used
RD (Remote Control through Data Set Connector)	ON (+3 volts)	OFF (-3 volts)	OFF (-3 volts)	Not Used	ON (+3 volts)

Note: Voltages shown for serial operation are minimum voltages; maximum voltages are +25 volts for ON and -25 volts for OFF. Option R uses the auxiliary control connector; option RD uses the data set connector in place of the auxiliary connector.



NOTE 1: DISCRETE CALLING GENERATOR MAY BE USED WITH EITHER SERIAL OR PARALLEL TYPE DATA SET BUT NOT BOTH AT THE SAME TIME.

NOTE 2: SERVICE OPERATION Ⓐ, Ⓡ, OR ⓇⒹ IS ESTABLISHED THROUGH INTERNAL STRAPPING ARRANGEMENT.

Ⓐ - AUTOMATIC OPERATION.

Ⓡ - REMOTE CONTROL THROUGH AUXILIARY CONNECTOR.

ⓇⒹ - REMOTE CONTROL THROUGH DATA SET CONNECTOR.

Figure 9 - Block Diagram of Discrete Calling Generator

TABLE 2 - DISPOSITION OF SERIAL TYPE DATA SET CIRCUITS THROUGH DISCRETE CALLING GENERATOR

INTERFACE		SIGNALS BYPASSED	SIGNALS USED	SIGNALS CONTROLLED
PIN	CIRCUIT			
1	Frame Ground	X	X	
2	Send Data			X
3	Receive Data			X
4	Request to Send		X	X
5	Clear to Send			X
6	Data Set Ready	X	X	
7	Signal Ground	X	X	
8	Data Carrier Detect		X	X
9	+17.5 Volts	X		
10	-17.5 Volts	X		
11*	Reverse Channel Send	X	X	
12*	Reverse Channel Receive	X	X	
13	Not Used	X		
14	New Sync.	X		
15	Transmit Clock	X		
16	Dibit Transmit Clock	X		
17	Not Used	X		
18	Dibit Receive Clock	X		
19	Not Used	X		
20	Data Terminal Ready	X		
21	Not Used	X		
22	Ring Indicator	X		
23	Not Used	X		
24	External Clock	X		
25	Remote Test	X		

*RD Option - Remote control through data set.

3.03 The auxiliary connector provides an additional input for remote control (option R) operation of the discrete calling generator. The connector pins and circuits are listed in Table 3. The auxiliary connector also passes a signal that acknowledges the operation of the generator.

Note: If remote control operation (option R or D) is selected, the input from either the auxiliary connector, pin 1, or the data set connector, pin 11, must be maintained for 200 ms minimum while the conditions for operation are present on the Request to Send, pin 4, Data Set Ready, pin 6, and Data Carrier Detect, pin 8, circuits.

B. Parallel Data Set

3.04 For parallel data set operation, the circuit conditions for operation of the discrete calling generator are shown in Table 4. The disposition of the parallel data set circuits through the discrete calling generator are listed in Table 5. When the signal generator is not in operation, all leads have a one-to-one correspondence between the input and the output, except the Data Common lead, pin 11, and the Control Common lead, pin 24, which are connected together within the generator. Signals on some leads will be repeated through relay logic. The interfaces conform to the interface of data set Type 402D.

3.05 The auxiliary connector provides for remote control operation as specified in Paragraph 3.03 and Table 3.

4. SYSTEM OPERATION AND TIMING DIAGRAMS

4.01 The operation of a system using the discrete calling generator depends on whether data transmission is serial or parallel

TABLE 3 - AUXILIARY CONTROL CONNECTOR CIRCUITS

CONNECTOR		SERIAL DATA SET APPLICATION	PARALLEL DATA SET APPLICATION
PIN	CIRCUIT		
1	Remote Control	X	
2	Acknowledge Signal	X	
4	Remote Control		X
5	Acknowledge Signal		X
7	Signal Ground	X	X
14	Signal Ground	X	X
15	Test	X	X

TABLE 4 - PARALLEL DATA SET CIRCUIT CONDITIONS FOR OPERATION OF DISCRETE CALLING GENERATOR

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 option RD cannot be used with parallel type data set.

TABLE 5 - DISPOSITION OF PARALLEL TYPE DATA SET CIRCUITS THROUGH DISCRETE CALLING GENERATOR

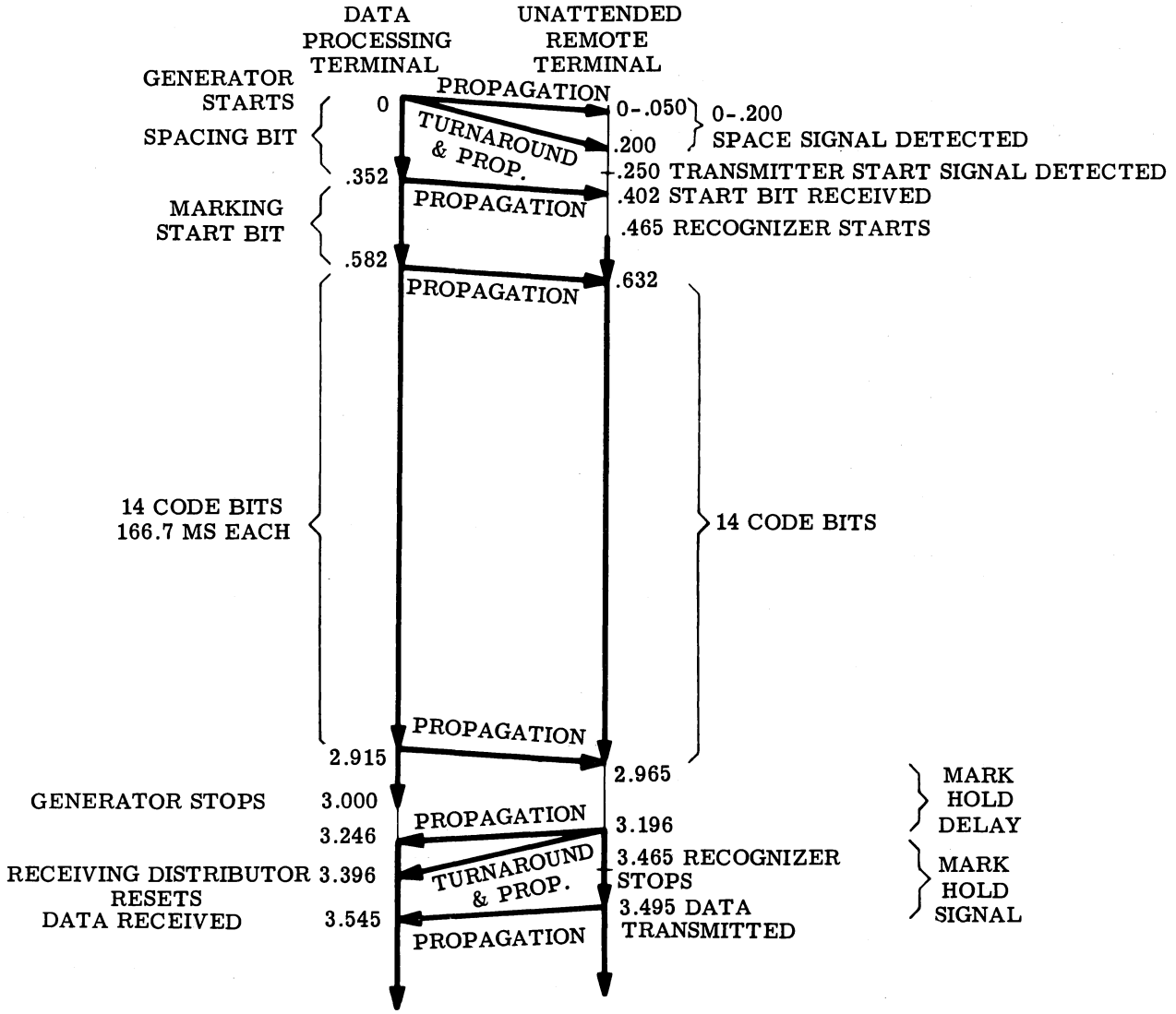
INTERFACE		SIGNALS BYPASSED	SIGNALS USED	SIGNALS CONTROLLED
PIN	CIRCUIT			
1	Frame Ground	X	X	
2	Data 1	X		
3	Data 2	X		
4	Data 3	X		
5	Data 4	X		
6	Timing	X		
7	Data 5	X		
8	Data 6	X		
9	Data 7	X		
10	Data 8	X		
11	Data Common	X	X	
12	Timing Common	X		
13	Interlock		X	
14	Release	X		
15	Operate	X		
16	Reverse Channel Send	X		
17	T-R Control		X	
18	Answer-Back A			X
19	Answer-Back B			X
20	Data Mode		X	
21	Data Carrier Detect		X	
22	Ring Indicator	X		
23	Out of Service	X		
24	Control Common	X	X	
25	Not Used	X		

and 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.

4.02 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 signal delay of up to 200 ms (when the generator starts and when the mark hold is sent) to turn them around. This time delay 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.

SERIAL TRANSMISSION

4.03 The generator and recognizer events of the discrete calling code are shown in Figure 10. The recognizer, located at the unattended remote terminal, compares the input



NOTE: MAXIMUM ECHO SUPPRESSOR TURNAROUND TIME (150 MS) AND PROPAGATION TIME (50 MS) ARE ASSUMED. IF ECHO SUPPRESSORS ARE NOT PRESENT OR ARE DISABLED, TURNAROUND TIME IS ABSENT.

Figure 10 - System Timing Diagram for Discrete Calling Feature (Serial Type Transmission)

discrete code with a locally generated discrete code. The data processing terminal is assumed to be separated from the remote terminal by a line distance equivalent to a propagation time of 50 milliseconds. The assumed number of echo suppressors (if present) between the sending and receiving terminals is equivalent to a turnaround time of 150 milliseconds.

4.04 The code disc of the generator and the recognizer are identical in appearance. However, the effective brush paths and starting point of the generator code disc (Figure 7) are different from their counterparts on the recognizer code disc (Figure 11). The necessary delay at the remote sending terminal, before the recognizer unit can start, is compensated for by starting the recognizer code disc at a later point (recognizer homing position vs generator homing position). Therefore, when the code bits are generated at the data processing terminal, the sampling periods at the remote sending terminal will occur as both the generator code signals and the local code signals are in phase.

4.05 The timing diagrams, Figures 12 and 13, in the following discussion show serial operation using the 202C or 202D data set. The 202C and 202D data sets generate a 2025 cps recognition tone which will disable the echo suppressors. For 201A, 201B, 202A, and 202B data sets, the only difference is that the recognition tone is 1200 cps and the echo suppressors are not disabled.

A. Receive-Only or Receive-Send Operating Format

4.06 The operational events of a serial type processing terminal receives-only or receives before transmitting, are shown in Figure 12. Dialing, call setup, ringing, the delays for the data set to enter the data mode and to transmit the disabling and recognition tone, and the duration of the tone transmission are the same for both send-only and send-receive remote terminals.

4.07 The automatic calling unit transfers the line to the data set approximately 100 ± 25 ms after it detects the end of the disabling and recognition tone. Reverse Channel (if used)

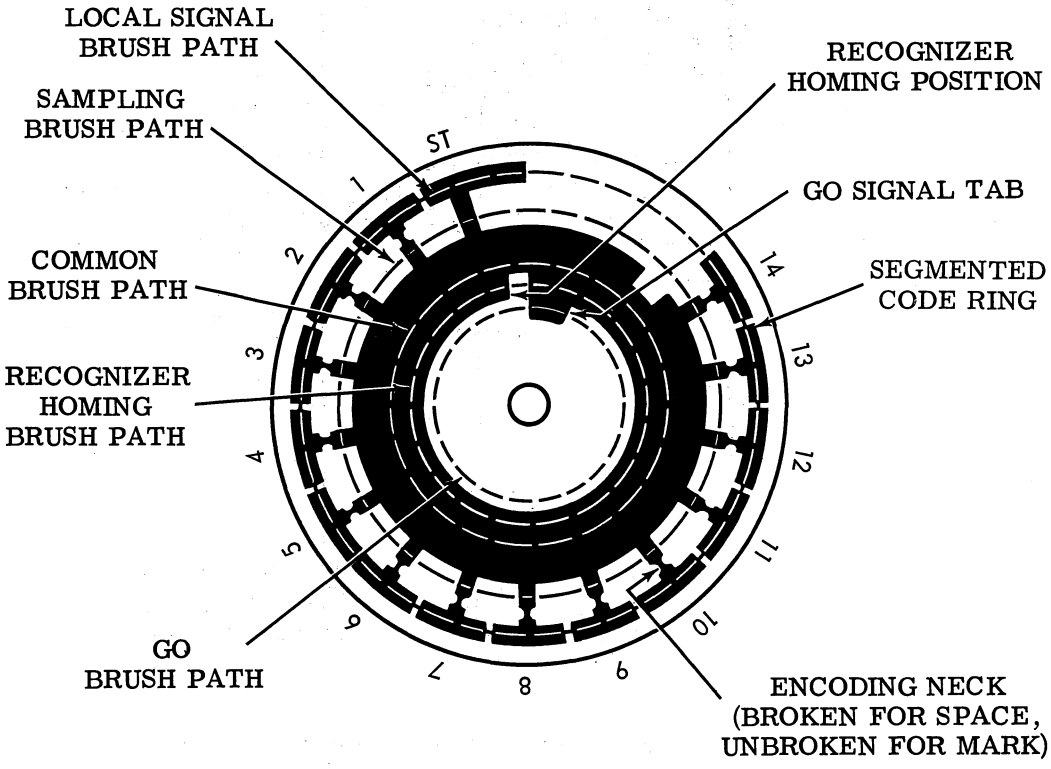
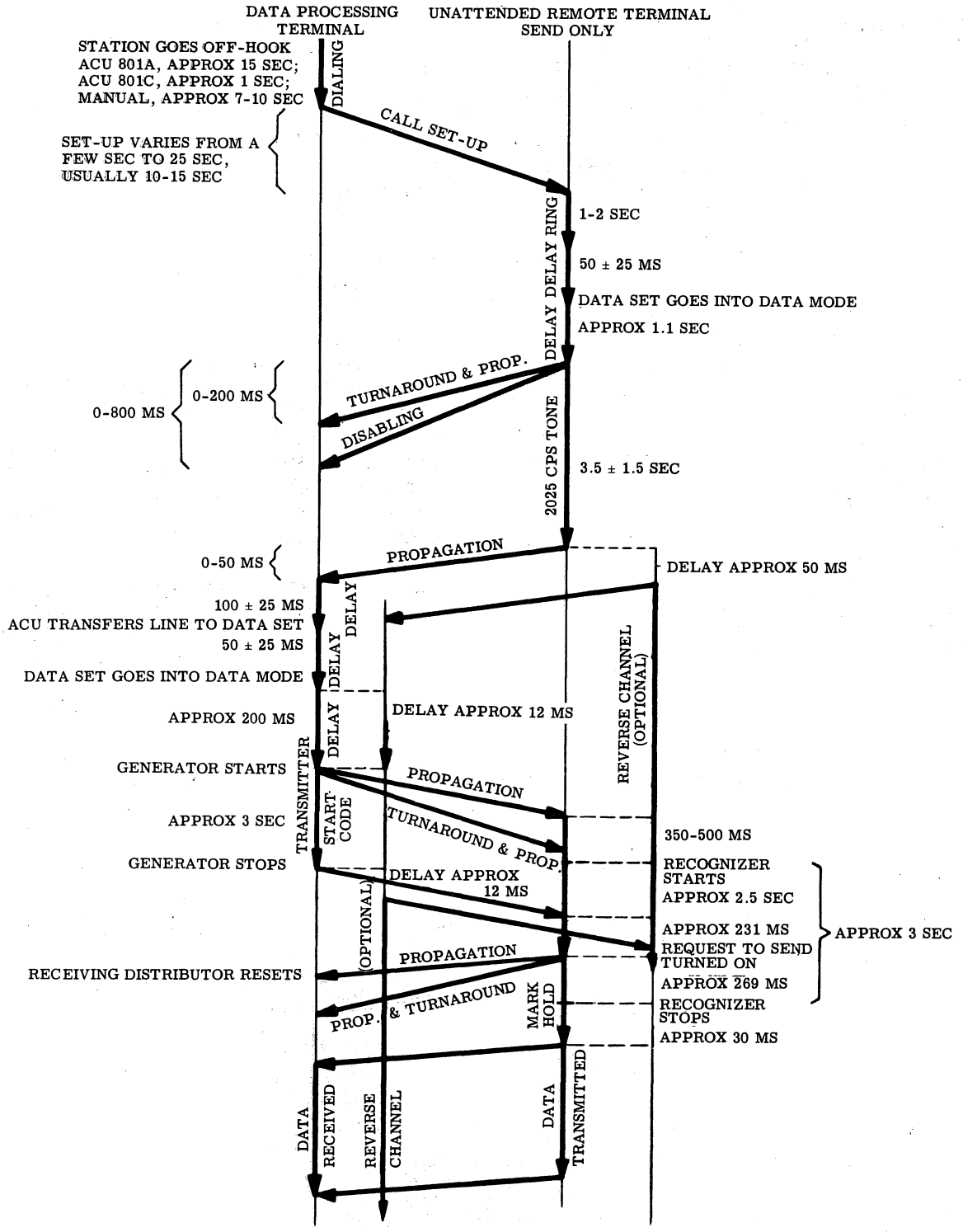
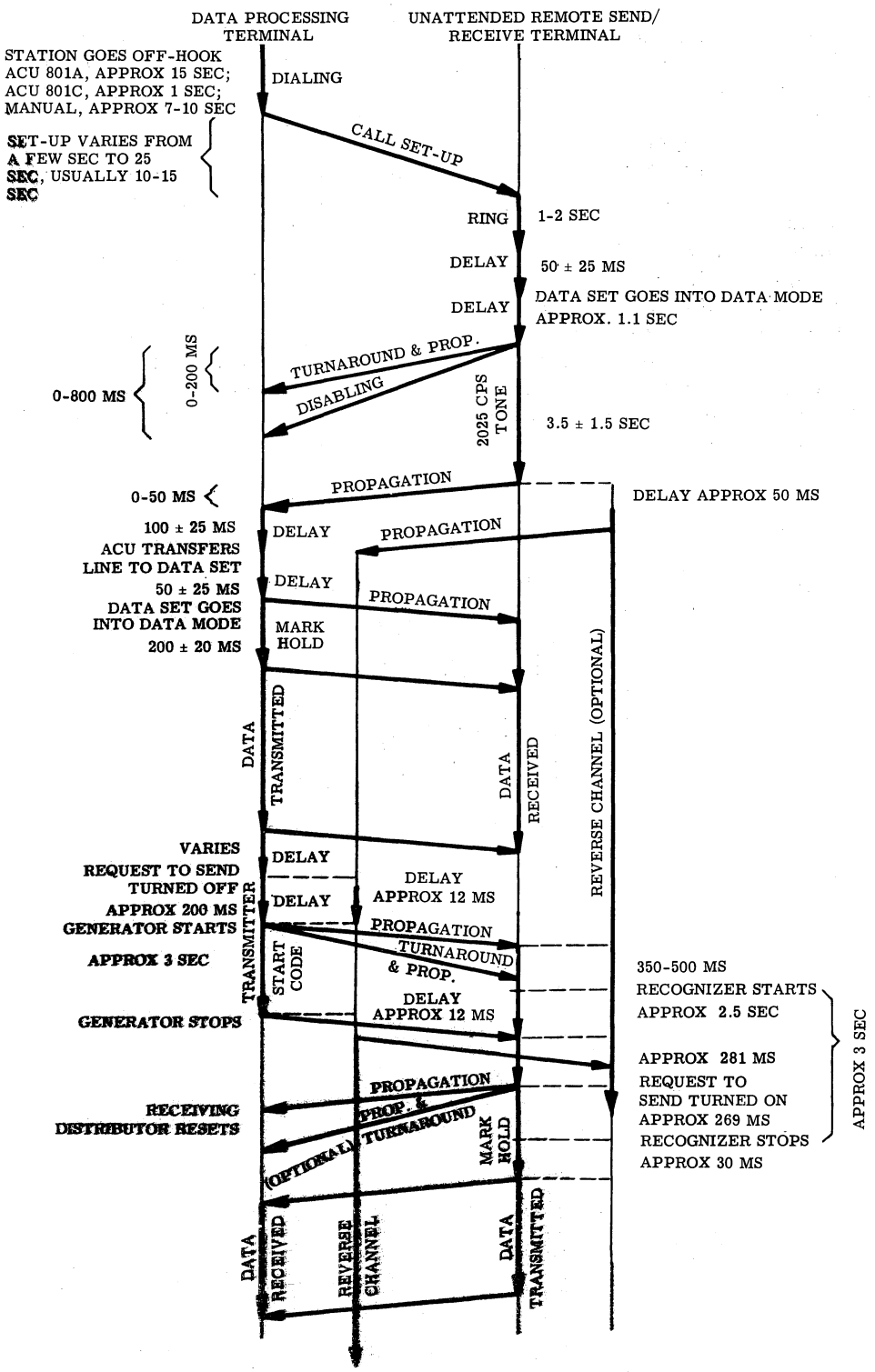


Figure 11 - Recognizer Code Disc and Brush Paths



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 SENDS PERMANENTLY TURNED ON.

Figure 12 - System Timing Diagram for High Speed Type 1 and Type 2 Data Transmission with Discrete Calling Feature (Data Processing Terminal Receives Data Only)

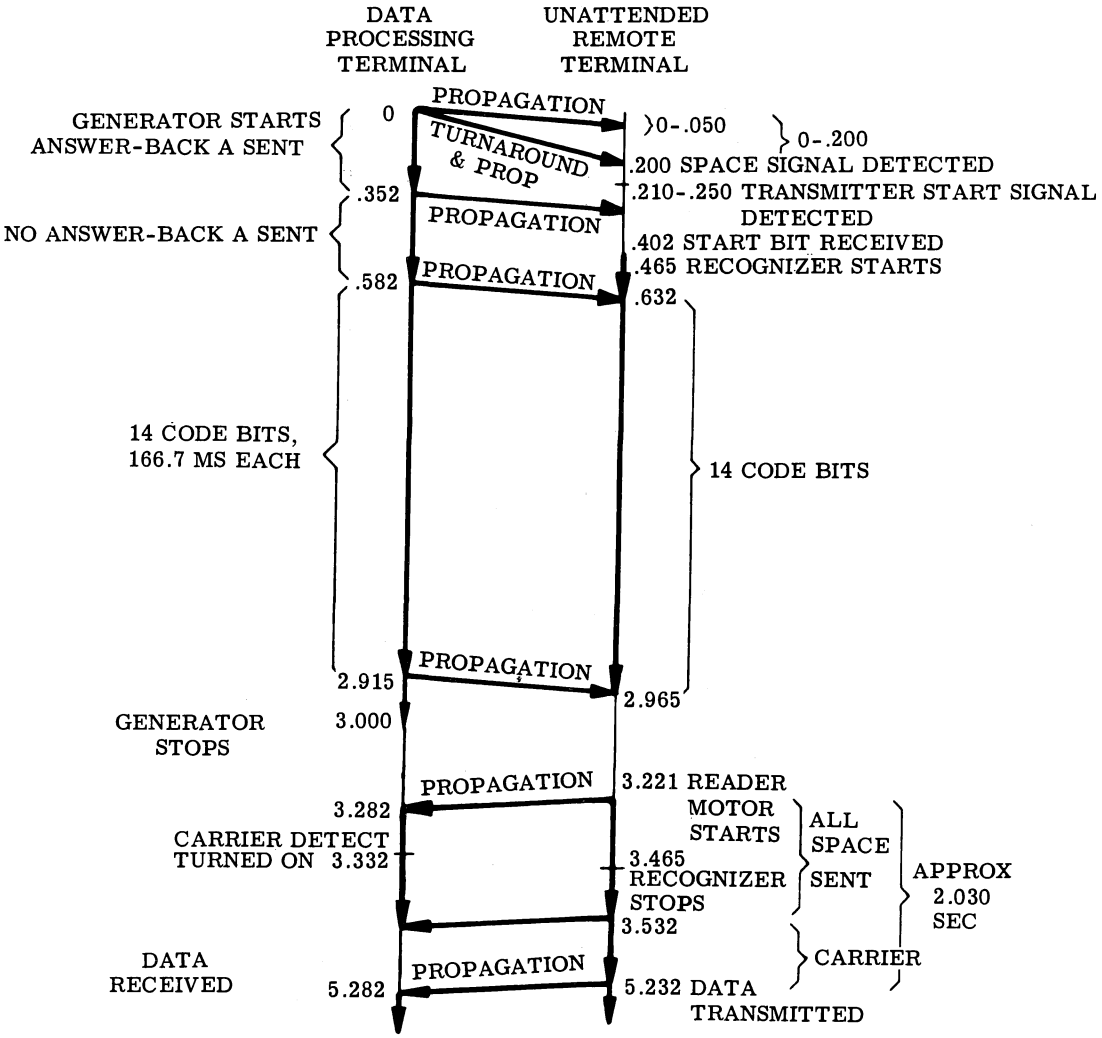


NOTE: TURNAROUND AND DISABLING TIMES APPLY TO ECHO SUPPRESSORS WHICH MAY APPEAR ON THE SWITCHED NETWORK FACILITIES. IF ECHO SUPPRESSORS ARE NOT PRESENT OR ARE DISABLED, TURNAROUND TIME IS ABSENT. OPTIONAL REVERSE CHANNEL TIMING IS SHOWN WITH REVERSE CHANNEL SENDS PERMANENTLY TURNED ON.

Figure 13 - System Timing Diagram for High Speed Type 1 and Type 2 Data Transmission with Discrete Calling Feature (Data Processing Terminal Sends First, Then Receives)

is turned ON by the remote terminal approximately 50 ms after sending the disabling and recognition tone. After a 50 ± 25 ms delay, the processing terminal data set enters the data mode, presenting the operate conditions for the discrete calling generator. At this time Reverse Channel (if used) is also turned ON and is transmitted after a 12 ms delay. After a further delay of 200 ms (to allow the integrator pulse shaper in the discrete calling generator to time out and the signal generator clutch to engage), the discrete calling code is sent (Figure 10). Reverse Channel (again, if used) goes OFF at the data processing terminal when the code starts and comes ON again approximately 12 ms after the code stops.

4.08 After the last code bit is received by the remote sending terminal, there is a 207 ms delay before a relay is triggered, and, after an additional 24 ms (231 ms total), the mark hold signal is sent by the remote terminal. Reverse Channel (if used) goes OFF at the remote terminal when the mark hold signal comes ON. The receiving distributor at the processing terminal is reset when the mark is detected. Meanwhile, at the remote sending terminal, the discrete calling recognizer unit will stop approximately 269 ms after the mark hold signal was started. The mark hold continues for another 30 ms as a relay pulls in. Data transmission then begins from the remote sending terminal.



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.

Figure 14 - System Timing Diagram for Discrete Calling Feature (Parallel Type Transmission)

B. Send-Receive Operating Format

4.09 The operational events of a serial type data processing system in which the data processing terminal sends first and then receives, is shown in Figure 13. Dialing, call setup, ringing, the delays for the data set to enter the data mode and to transmit the disabling and recognition tone, and the duration of the tone transmission would be the same for both send-only and send-receive remote terminals.

4.10 The automatic calling unit transfers the line to the processing terminal data set approximately 100 ± 25 ms after it detects the end of the disabling and recognition tone. Reverse Channel, if used, is turned ON by the remote terminal approximately 50 ms after sending the disabling and recognition tone. After a 50 ± 25 ms delay, the processing terminal data set enters the data mode, sending the mark hold signal for 200 ± 20 ms. Data is then transmitted from the data processing terminal. When data transmission is completed, Request to Send goes OFF (after a delay), presenting the operate conditions for the discrete calling generator. At this time, Reverse Channel (if used) is also turned ON and is transmitted after a 12 ms delay. After a further delay of 200 ms (to allow the integrator pulse shaper in the discrete calling generator to time out and the signal generator clutch to engage), the discrete calling code is sent (Figure 10). Reverse Channel (again, if used) goes OFF at the data processing terminal when the code starts and comes ON again approximately 12 ms after the code stops. The remaining operation is given in Paragraph 4.08.

PARALLEL TRANSMISSION

4.11 The generator and recognizer events of the discrete calling generator are shown in Figure 14. The recognizer, located at the unattended remote terminal, compares the input discrete code with a locally generated discrete code. The assumed line distance between the data processing terminal and the remote terminal is equivalent to a propagation time of 50 ms. The assumed number of echo suppressors (if present) between the sending and receiving terminals is equivalent to a turnaround time of 150 milliseconds. Refer to Paragraph 4.04 for operational details of the generator and recognizer code discs.

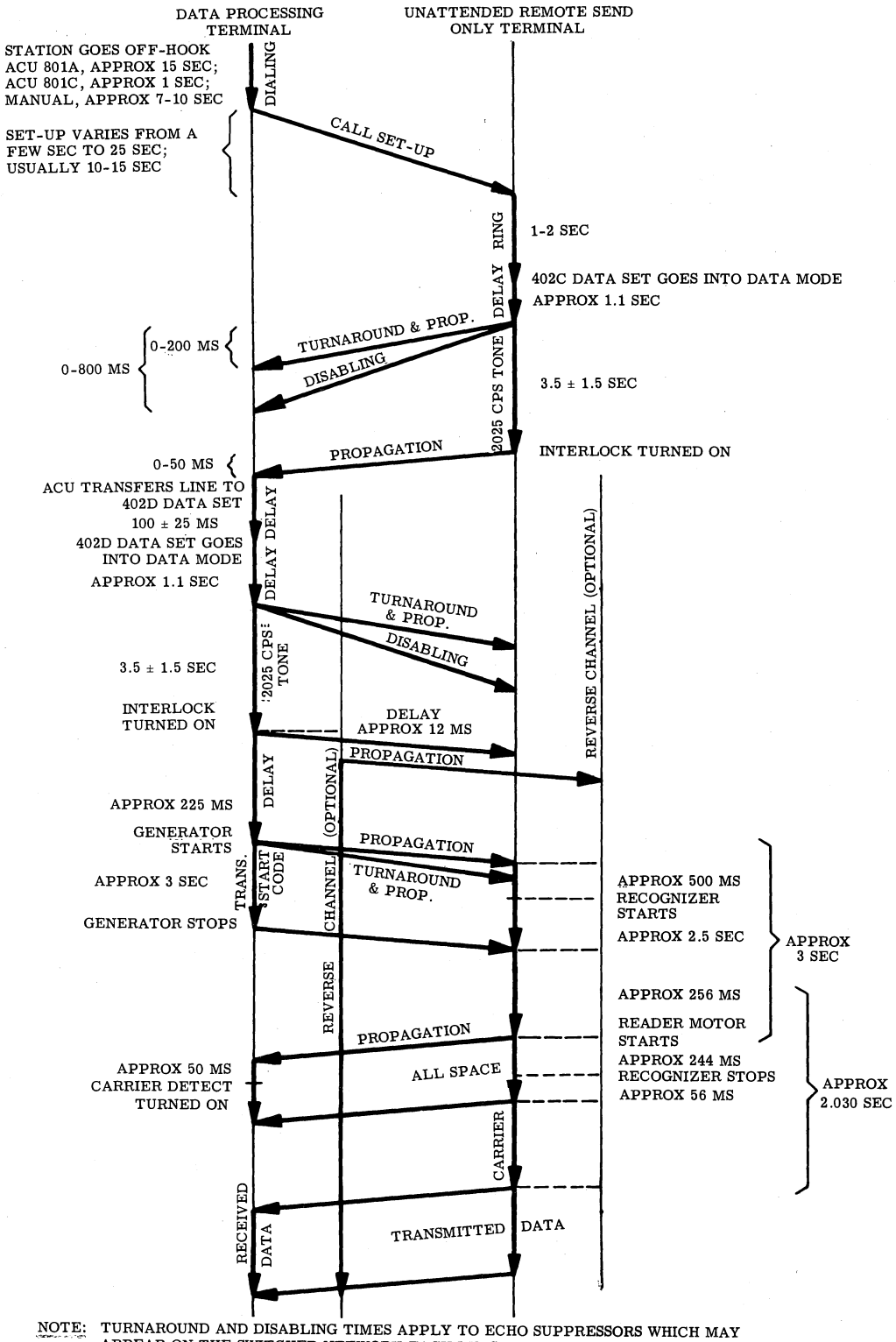
4.12 The timing diagrams (Figures 15 and 16) for parallel operation are based upon using 402C (send) and 402D (receive) data sets. Special answer-back signals, not discussed, may be used in the system.

A. Receive-Only or Receive-Send Operating Format

4.13 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 15. Dialing, call setup, and ringing are the same for both send-only and send-receive remote terminals.

4.14 When the remote data set (402C) enters the data mode, and after a 1.1 second delay, the 2025 cps 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 402D data set enters the data mode. Approximately 1.1 seconds later, the 402D data set transmits the 2025 cps 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, the Reverse Channel tone 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 (Figure 14).

4.15 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 207 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 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.



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 15 - System Timing Diagram for High Speed Type 5 Data Transmission with Discrete Calling Feature (Data Processing Terminal Receives Data Only)

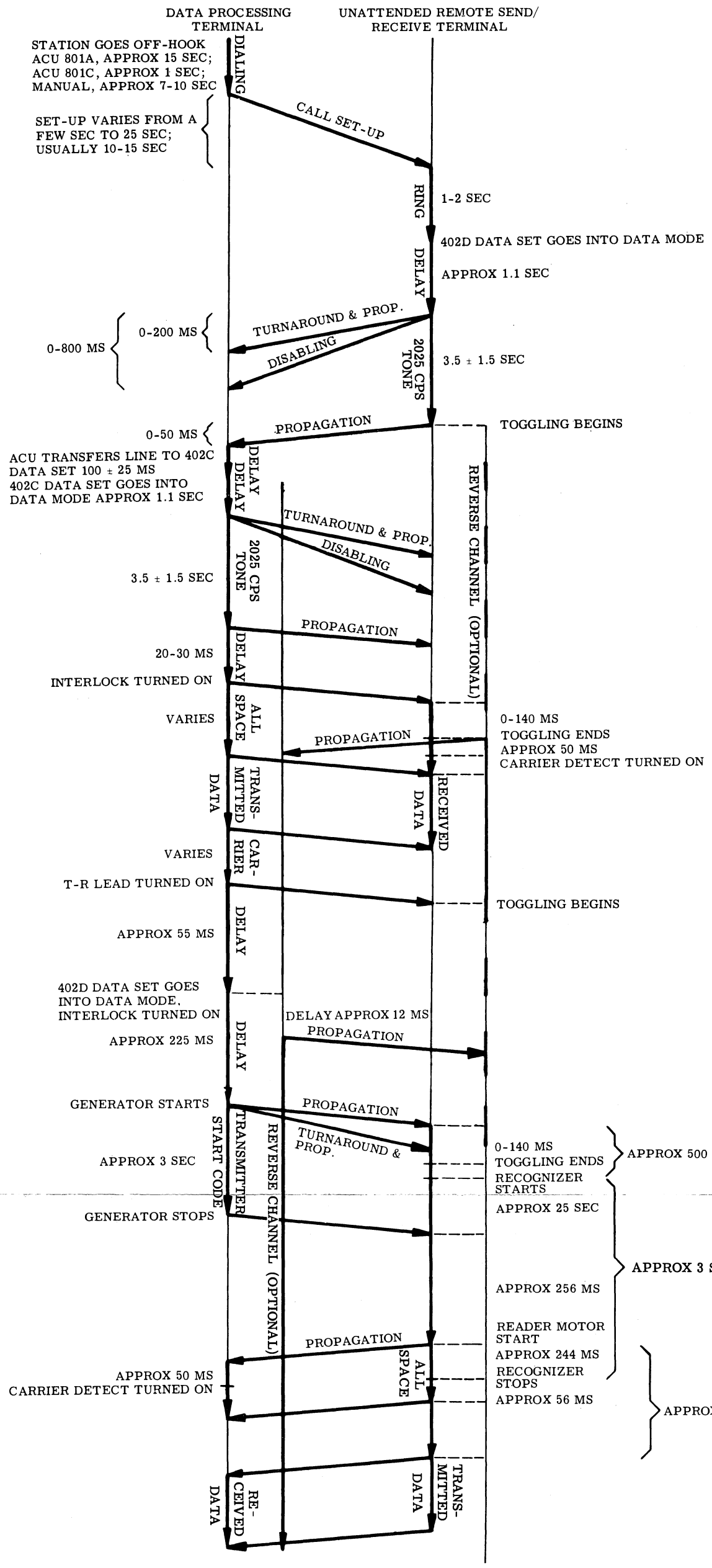


Figure 16 - System Timing Diagram for High Speed Data Transmission with Discrete Calling Feature (Data Processing Terminal Sends First, Then Receives)

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 SENDS PERMANENTLY TURNED ON.

B. Send-Receive Operating Format

4.16 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 16. Dialing, call setup, and ringing are the same for both send-only and send-receive remote terminals.

4.17 When the remote data set (402D) enters the data mode, and after a 1.1 second delay, the 2025 cps disabling and recognition tone is sent for 3.5 ± 1.5 seconds. At the end of the tone, the remote station begins switching from the 402C to the 402D data set 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.

4.18 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 402C data set 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).

4.19 After propagating to the remote terminal, the ALL SPACE will be detected immediately or after a delay up to 140 ms, depending upon the switching status of the remote data sets (402C and 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 switching ends. Approximately 50 ms after switching stops, Carrier Detect comes ON in data set 402D.

4.20 When the 402C data set 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 (Figure 5) 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 402D data set. 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 (Figure 14). The remaining operation is given in Paragraph 4.15.