

33 CALL CONTROL UNIT

GENERAL DESCRIPTION

AND OPERATION

CONTENTS	PAGE
1. GENERAL . . . . .	1
2. DESCRIPTION AND OPERATION . . . . .	1
CALL CONTROL UNIT FOR SWITCHED NETWORK SERVICE . . . . .	1
CALL CONTROL UNIT FOR PRIVATE WIRE SERVICE . . . . .	8

1. GENERAL

1.01 This section provides a general description and operation of the 33 call control units. It is reissued to consolidate 33 information. Marginal arrows are not used to indicate changes.

1.02 This section describes two call control units which may be considered basic units. They are:

- (1) Call Control Unit for Switched Network Service
- (2) Call Control Unit for Private Wire Service.

1.03 The call control unit is the electrical link which joins the various components of the set to one another, and the set to the transmission facilities.

1.04 References to left, right, front, or rear consider the call control unit as viewed by the operator.

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

2. DESCRIPTION AND OPERATION

CALL CONTROL UNIT FOR SWITCHED NETWORK SERVICE

2.01 The call control unit for Switched Network Service (Figure 1) supplies dc signals to a data set. The data set modulates these signals into tone frequencies which are transmitted over the telephone lines. A data set at the receiving station demodulates the tone frequencies back to dc signals which are then handled by the call control unit for operation of the teletypewriter set. For a better understanding of the call control unit, 2.02 briefly describes the data set.

2.02 Start-stop dc signal pulses form essentially a square wave which cannot readily be transmitted over telephone lines. The data set is basically a converter which changes the dc signals from the sending or calling station into frequency-shifted tones for transmission over the telephone network. A marking pulse from a sending station is converted to a 1270-hertz marking signal (F1 mark) and a spacing pulse becomes a 1070-hertz spacing signal (F1 space). The data set at the receiving or called station sends a 2225-hertz marking signal (F2 mark) and a 2025-hertz spacing signal (F2 space). During transmission of a message, the calling station sends a mark and space tones (F1 mark and space) while the called station sends a continuous mark tone (F2 mark). In this way the telephone facilities are operated on a full duplex basis. If the signal received at either station (F1 mark and space at the called station and F2 mark at the calling station) shifts to a space tone for more than one second, or if the received signal is lost for one second, the data set will cause the station to be disconnected. This provides assurance that the connection is maintained for the entire period of message transmission.

2.03 The call control unit used with the data set operates with conventional telephone central offices that have the necessary

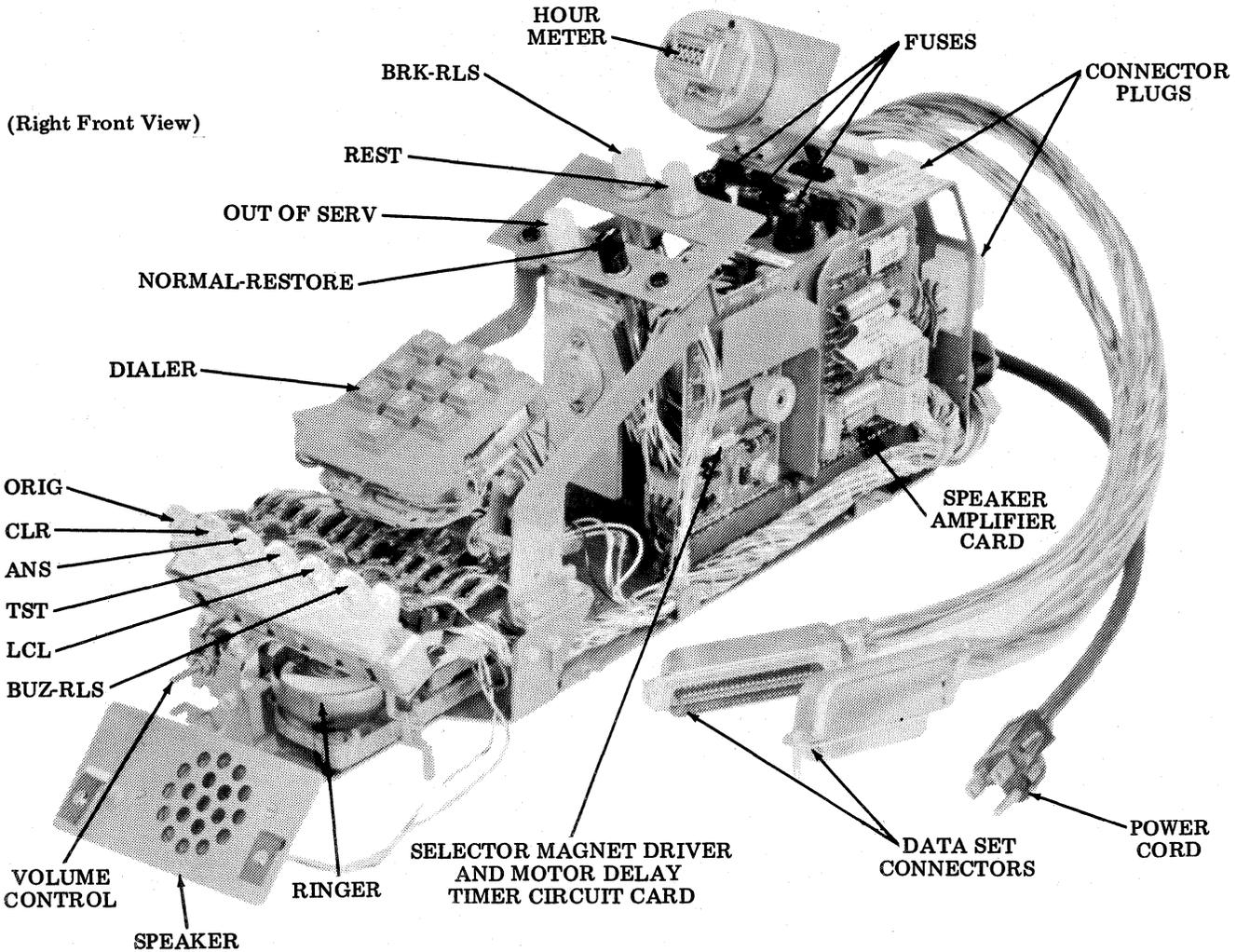
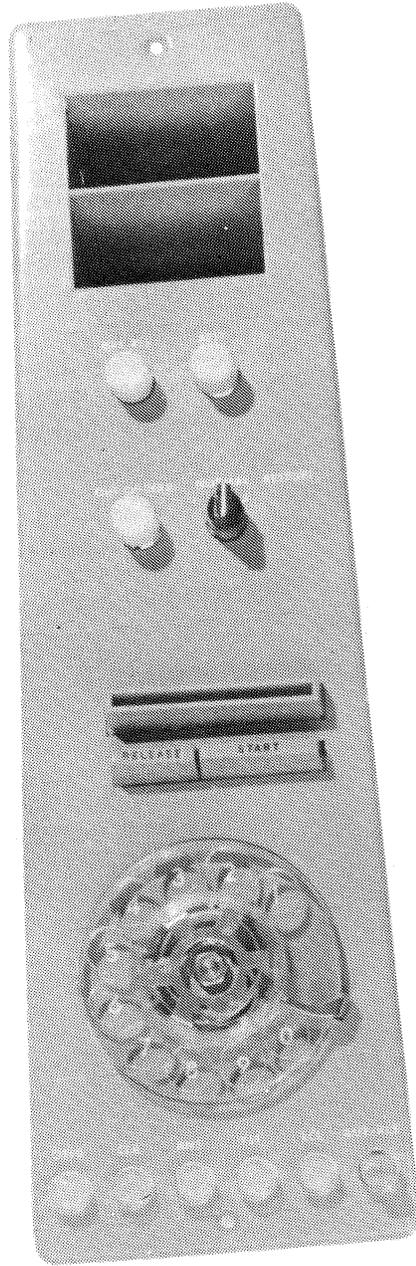


Figure 1 - Call Control Unit for Switched Network Service

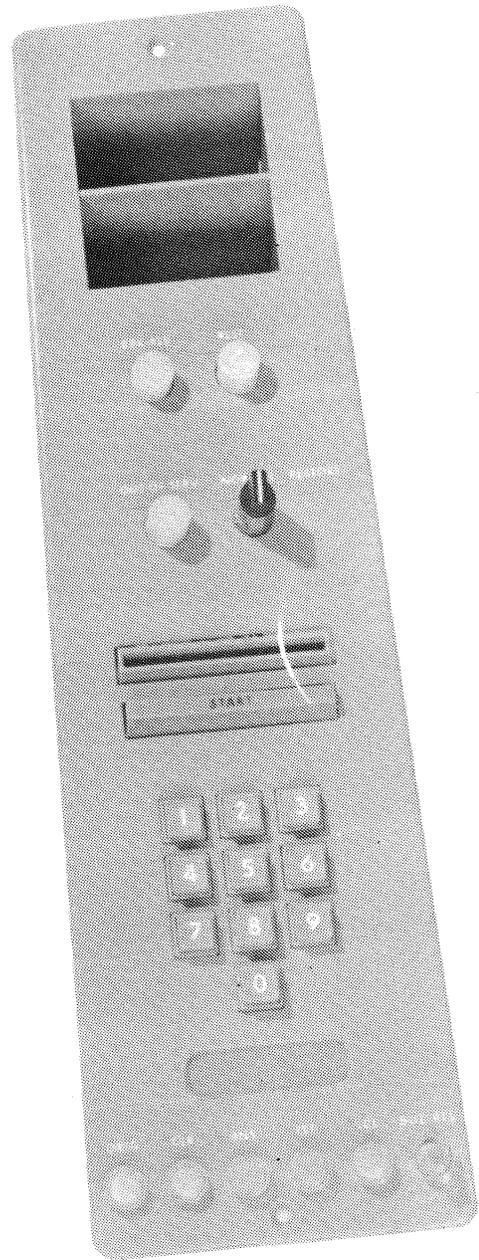
routing and accounting facilities. In operation, a call is originated by depressing the ORIG pushbutton (Figure 2). A lamp illuminates the pushbutton, and the dial tone will be heard through a loudspeaker. If the line is busy, a busy signal will be heard and the clear (CLR) pushbutton (non-locking) should be depressed. If the line is not busy, the operator dials the number of desired station. This causes the called station to go into connect condition. If the teletypewriter is manually operated, the called station operator presses the answer (ANS) pushbutton (non-locking). Following a short interval, about 1-1/2 seconds, in which telephone facilities are connected, the called station transmits a mark tone (F2) and receives a mark tone (F1) from the calling station. Receiving the continuous F2 mark tone from the called station for 1 second causes the calling station to go into connect condition,

and its motor is turned on. Likewise, the continuous F1 mark tone from the calling station for 1 second causes the called station to go into connect condition, and its motor is turned on. Either station can now transmit.

2.04 At the end of the message, either station may originate a disconnect by depressing the CLR pushbutton, (Figure 2) at which time each station goes back to its idle condition, ready to receive or originate other calls. For keyboard practice, maintenance purposes, or preparation of copy, the local mode (LCL) pushbutton (locking) is depressed. This turns on the motor and disables automatic answering facilities, if present. In the event of an incoming call during local operation, the call control unit responds to ringing signals and the ANS pushbutton must be operated manually.



ROTARY CARD DIALER



TOUCH-TONE\* CARD DIALER

Figure 2 - Call Control Panels

\*Registered Service Mark of AT&TCo.

Operation of the test (TST) pushbutton (locking) causes received signals to be retransmitted to the test center for maintenance purposes. A lamp, associated with each pushbutton, illuminates the pushbutton whenever that pushbutton has been operated and the operating condition exists. The ANS lamp is pulsed in response to ringing signals of an incoming call, and lights continuously when the call is answered. The CLR lamp is automatically extinguished 1.5 seconds after the pushbutton has been depressed, and disconnect is completed.

2.05 A steady mark signal blinds the associated teletypewriter during all intervals, except when in the connect condition. This prevents spurious characters from being printed except when due to loss of signals, circuit noise, or deliberate break or space-disconnect signals.

#### Progress of a Call

2.06 To originate a call, the ORIG pushbutton (Figure 2) is momentarily depressed. This connects the station to the line and lights the ORIG lamp. During the period of time in which connection is being made, the telephone central office makes no time measurements. When the ORIG pushbutton is closed, the call control unit is connected to the telephone line through the data set and an off-hook condition is set up. The amplifier is connected into the circuit so that the dial tone from the central office is heard. The called station is dialed while the amplifier monitors the progress.

2.07 At the called station audible and visible signaling devices are operated. The called station goes off hook and into the connect condition upon operation of the ANS pushbutton circuit, by manual or automatic means, at the distant point. At this time, there is a nonsignaling interval of 1.225 seconds during which accounting and toll recording facilities at the telephone exchange will be cleared. Following the nonsignaling interval, the called station transmits its F2 mark tone and sets its monitoring timer to respond to the F1 mark tone from the calling station. When the continuous F2 mark tone is received at the calling station for a period of 1 second, indicating that a station has answered, it will go into the connect condition and turn on its motor. When the continuous F1 mark tone is received at the called station for an interval of 1 second, it will go into the connect condition. The station may now acknowledge the call either by operator keyboarding, or by automatic answer-back message transmission. The monitoring timers

at both stations are set to respond to reception of a space tone from the distant station. Traffic can now be exchanged from either station on a half-duplex basis.

#### Disconnecting a Call

2.08 During the time the two stations are connected (traffic interval), either station can initiate a disconnect as follows:

(a) A call is normally terminated by the end-of-transmission (EOT) code combination which provides fast disconnect without introducing hit characters. This is accomplished by the data set in response to EOT contact closures in function boxes of both the sending and receiving teletypewriters.

(b) A call connection can also be cleared manually by momentarily depressing the CLR pushbutton (Figure 2). Operation of the CLR pushbutton at either station will cause transmission of a spacing signal of 1.5-seconds duration, after which the station originating the disconnect will discontinue its tone transmission and go back on hook. The other station, after receiving the spacing signal for 1 second, will automatically transmit its 1.5-second spacing signal and then go on hook. Both stations will then be back in their original idle condition in which calls can be either originated or accepted.

#### Answering a Call

2.09 To answer a call manually, momentarily depress the ANS pushbutton (Figure 2). This connects the station to the line and lights the ANS lamp. The lamp remains lighted until the answer mode is terminated. Manual answering is necessary only when the automatic answer-back circuit is disabled. The automatic answer-back circuit is disabled by low-paper contacts, data set relay contacts (when in local mode), and the OUT OF SERV. key.

2.10 Call control units equipped with automatic answering facilities will respond to received ringing signals, turning the teletypewriter on at the end of the ringing interval and proceeding through to the connect condition. Automatic message answer-back is a part of this feature. The presence of an operator is required in order to complete disconnect and return the teletypewriter to idle condition. For unattended service, an automatic disconnect timing device

(optional) actuated when a call is answered, will cause the teletypewriter to go through the connect condition, send the 1.5-second spacing tone, and go back on hook if the F1 mark tone is not received within 8 seconds after the called station answered. This is designed to prevent the unattended station from being made busy by (telephone) calls that fail to cause a full connection to be set up. This feature does not affect normal automatic disconnect upon receiving the 1-second spacing tone or loss of tones due to a dropoff.

#### Local Mode

2.11 The local mode (LCL) provides off-line operation of the teletypewriter. The operator selects the local mode by depressing the LCL pushbutton (Figure 2). This lights the LCL lamp and operates the motor control relay (MCR) to energize the motor. The data set connects the sending circuit to the receiving circuit and enables the keyboard and answer-back to transmit. In this condition the teletypewriter can be used for preparing copy, for operator practice, or for maintenance purposes. If an incoming signal is received during this time, ringing signals are received and manual operation of the ANS pushbutton is required in order to receive the message. If the teletypewriter is in a terminal hunting group, the operator must turn the out-of-service (OUT-OF-SERV.) knob to the RESTORE position momentarily and then to NORMAL.

#### OUT OF SERV. Switch

2.12 The OUT OF SERV. switch (Figure 2) prevents the automatic answering of incoming calls. In its NORMAL position (arrow on knob upright), it has no effect or function; in the OUT OF SERV. position (knob rotated counterclockwise and detented) it sets the following conditions:

- (a) A contact is closed that causes the OUT OF SERV. lamp to light.
- (b) A contact is closed that shorts the ringer coils. This makes the ringer inoperative. As an option the contact can be located to shunt both the ringer and series capacitor (ie, the telephone line). This makes the station appear to be in an off-hook condition or busy to the central office.
- (c) A contact is opened that breaks the automatic answer circuit to the answer relay. This prevents the relay from operating

in response to the ring-up relay and thus the teletypewriter will not answer.

2.13 For stations that are not in terminal hunting groups, the operator may return the teletypewriter to service by turning the OUT OF SERV. knob to the NORMAL position. For terminal hunting stations, however, the operator must turn the knob to the RESTORE position and hold it until a dial tone is heard. In this position:

- (a) A contact is closed that shorts the tip to ring (off-hook condition). This condition is detected by the central office which then releases the teletypewriter from lockout and applies the dial tone.
- (b) A contact is closed that completes a path from the speaker amplifier to ground. This permits the amplifier to pass the line signals (dial tone).

The OUT OF SERV. switch is then restored to NORMAL.

#### Low-Paper Alarm

2.14 A low-paper alarm is provided in the teletypewriter. When a low-paper condition occurs, make contacts in the low-paper switch provide ground to the low-paper buzzer, permitting it to operate. Depressing the buzzer-release (BUZ-RLS) pushbutton (locking) in the call control unit (Figure 2) silences the buzzer and causes the BUZ-RLS lamp to light. Attempting to release the pushbutton without replenishing the paper supply will result in the buzzer operating. When the paper has been replenished, the teletypewriter is returned to normal by releasing the BUZ-RLS pushbutton.

2.15 Break contacts on the low-paper switch disable the automatic answer-back circuit. The operator can override this condition by answering manually. If the low-paper alarm occurs during a call, the operator has the option of completing the call before changing the paper, or interrupting the call. To interrupt the call, the operator stops transmission by depressing the keyboard BREAK key, and then depressing the BRK-RLS pushbutton to notify the distant station of the problem. The connection is cleared by simultaneously operating the control (CTRL) and EOT keys on the keyboard. Turning the OUT OF SERV. knob to the detent position insures that the teletypewriter will not automatically answer a call while paper is being replenished.

2.16 To restore the teletypewriter to service after the paper has been inserted, depress the CLR pushbutton and return the OUT OF SERV. knob (Figure 2) to its NORMAL position. (For teletypewriters in terminal hunting groups, turn the knob to its RESTORE position and hold it there. When dial tone is heard, release the knob.) The teletypewriter is now in a normal idle operating position.

#### Restrain Lamp

2.17 This high intensity restrain (REST) lamp (Figure 2) lights when a restraining signal is received from an 8-level to a 5-level converter used in transmission to 5-level TWX stations on the DDD switching plan. The lamp remains lighted until the restraining signal is removed. The purpose of this feature is to limit the sending speed from 8-level teletypewriter transmitting at 100 wpm to 5-level teletypewriters receiving at 60 wpm.

#### Test Mode

2.18 If the TST pushbutton (Figure 2) is operated while the teletypewriter is connected to a test center, the message sent by the test center will be recorded on the teletypewriter and turned around and sent back for analysis. This is accomplished by connecting the teletypewriter to the data set through a set of transfer contacts and a break contact to ground. This type of operation can be terminated by momentarily operating any of the nonlocking pushbuttons which will then release the TST locking pushbutton.

#### Signal Generation

2.19 The teletypewriter can send by operating the keyboard, answer-back mechanism, or BREAK key (Figure 2). The keyboard signal generator contacts and answer-back contacts are in parallel with the signal generator (distributor) which is, in turn, connected to the data set. The BREAK key connects to the data set via separate leads.

#### Dialers

2.20 Pulsing Rotary Dialer: For rotary dialer applications, a pulsing contact of the rotary dialer is inserted into the telephone line. The rotary dialer (Figure 2) is equipped with a normally closed pulsing contact and a normally opened off-normal contact. The pulsing contact is inserted into the telephone line when the station

originates a call. When answering the call, a short circuit is applied across the pulsing contact. The off-normal contact is placed across the output of the amplifier and silences the speaker whenever the dialing disc is moved.

2.21 Pulsing Card Dialer (40A Dialer): The 40A dialer operates on direct current furnished from the central office. To use the card dialer, the ORIG pushbutton is depressed. After a dial tone has been received, a card with the telephone number punched in it is firmly inserted in the slot. This operation winds a spring which later pushes the card out of the slot as dialing proceeds.

2.22 The card dialer is started by momentarily depressing the START bar. This operates the card dialer start contact and establishes a path from the ring side to the tip side of the telephone line. Sending of the dial pulse means interruptions of the current in the telephone line.

2.23 A scanning drum makes sixteen revolutions: ten for transmitting the digits and six for interdigital time. At the completion of the revolutions, an escapement is tripped which permits the next row of holes on the card to be placed in position for sensing.

2.24 This sequence is repeated at each row as the card advances out of the card dialer. If no "stop" code is punched in the card, the card dialer will continue to advance the card (even if no number code is punched) until the card is released. If the "stop" code is sensed, the card dialer stop contacts operate. The card can be released by operating the RELEASE bar. No attempt should be made to release the card by reoperating the START bar, as this will trigger the card dialer mechanism and place a short circuit across the output of the data set. This shunt will prevent the station from receiving or sending until the card is disengaged. If this condition persists, the data set will disconnect.

2.25 Pulsing Card Dialer (41A Dialer): In locations with 60-hertz ac power, the 41A card dialer is used. In this dialer the power to operate the commutator disc is derived from a synchronous motor powered by the 14 v ac source in the teletypewriter. The power to advance the card in the dialer is derived from a spring wound by inserting the card in the slot. The switching functions and the motor control are independent of the signal path. These features result in a superior performance as compared with the 40A dialer.

2.26 To operate the dialer, the card is inserted and the START bar is momentarily operated. The commutator disc begins rotating, and the dial pulses are sent to the line.

2.27 When all the punched codes are sent, the disc stops. A mechanical linkage then permits the spring, wound by inserting the card, to advance the card for the next digit to be read and dialed. As the "stop" code is read, the dialing stops. The card can then (as also at any other time) be released by operating the RELEASE bar.

2.28 TOUCH-TONE Dialer: For multifrequency (MF) dialing applications, the dialing frequencies generated by the TOUCH-TONE dialer are fed through the loudspeaker amplifier and into the telephone line via the sending amplifier in the data set. As the station connects, the output of the TOUCH-TONE dialer is disconnected from the data set so that there is no hazard connected with improper operation of the TOUCH-TONE dialer at that time.

2.29 The TOUCH-TONE MF signal generated is a one-transistor oscillator generating two frequencies any time a single pushbutton is operated. Seven frequencies are provided, with each dial digit corresponding to two frequencies according to the table below:

#### TOUCH-TONE

##### Frequencies

cps →	1209	1336	1477	
697	1	2	3	
770	4	5	6	Dial
851	7	8	9	Digits
941		10		

2.30 The frequencies above 1000 hertz are generated at a somewhat higher level to compensate for greater line loss at those frequencies. There is also a variation of amplitude for various digits.

2.31 TOUCH-TONE and Card Dialer (Figure 2): To use the automatic card dialer, the ORIG pushbutton is depressed. After the dial tone has been received, a punched card is inserted into the slot and pushed down. The START bar is

then momentarily operated. The card dialer proceeds with dialing under power of a spring motor wound by insertion of the card. When a "stop" code is read, the dialing stops. The card should then be released by reoperating the START bar.

2.32 The sensing contacts in the card dialer are in parallel with the frequency-determining contacts in the associated TOUCH-TONE dialer. As the card advances out of the slot, the sensing contacts sense the holes punched in the card and thus determine the proper frequencies to be transmitted. This occurs for every row on the card.

2.33 Since the card advances out of the slot very rapidly, there is no need for a separate RELEASE bar. When the station connects, relay contacts in the data set disconnect the MF signal input and remove any hazard connected with false operation of the TOUCH-TONE dialer.

##### Fuse Protection

2.34 Three fuses protect the components in the call control unit from accidental shorts or overloads. They are the selector magnet driver fuse, the motor delay timer fuse, and the ac line fuse.

##### Electrical Interconnections

2.35 A number of nylon plugs and a terminal strip located at the rear serve to interconnect the set components to the call control unit. A six foot power cord connects the call control unit to the ac power source.

##### Circuits

2.36 Selector Magnet Driver Circuits: The data set supplies a 20-mA dc signal to the selector magnet driver associated with the teletypewriter. The selector magnet driver amplifies the signal to 500 mA to operate the selector on the teletypewriter. The selector magnet driver is a two-stage triggering regenerative amplifier (or flip-flop) capable of switching high output currents of 0.500 ampere at very closely controlled input current levels. The output of the selector magnet driver is automatically regulated and is essentially independent of normal variations in power supply voltage, and of selector-magnet and current-limiting resistance values.

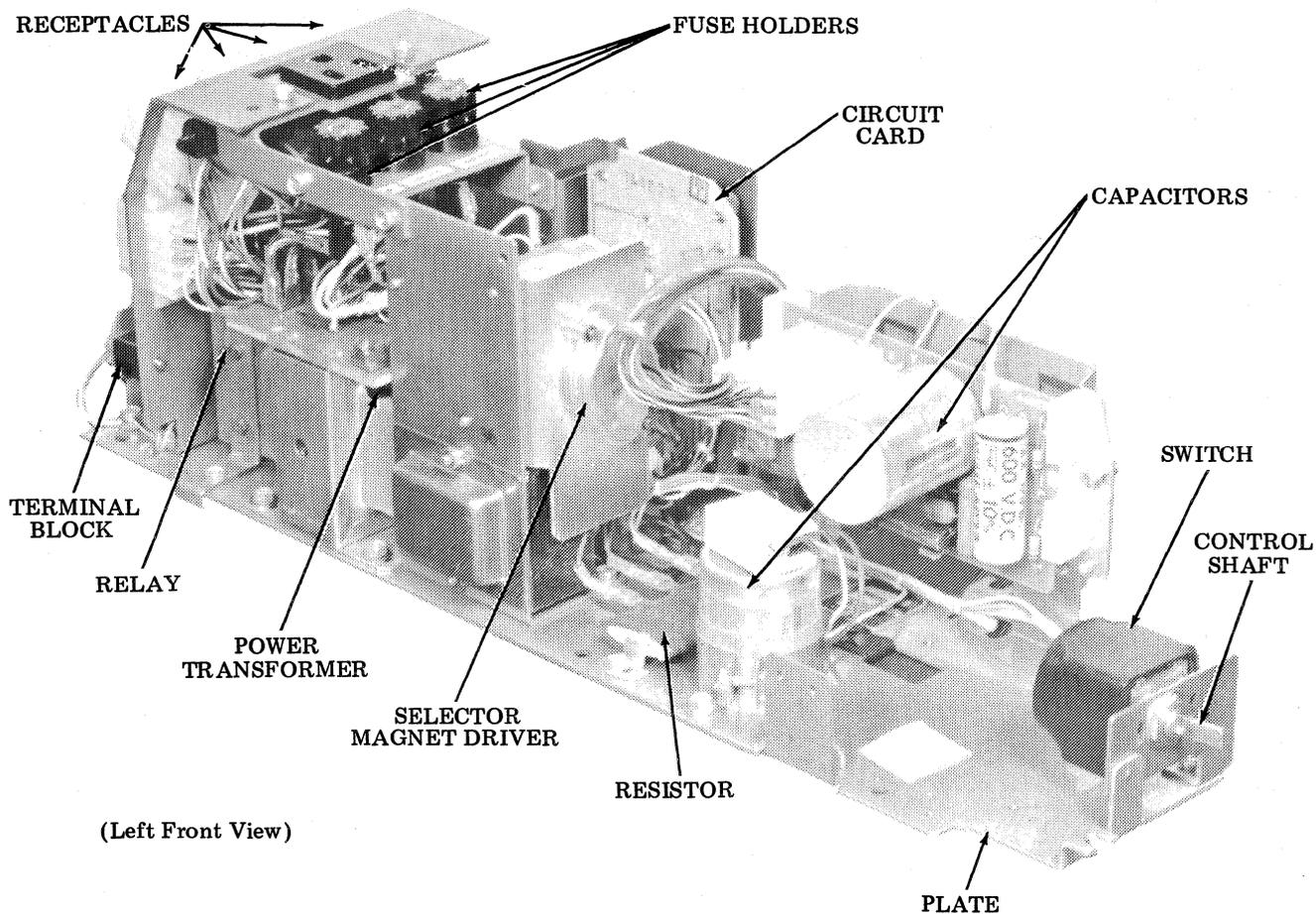


Figure 3 - Typical Call Control Unit for Private Wire Service

2.37 **Speaker Amplifier Circuit:** The speaker amplifier is powered only after the ORIG key is operated and is quieted when the station connects. It has two inputs, one from the telephone line via the buffer amplifier in the data set limiter and the other from the multifrequency (MF) tone dialer. Three outputs are provided: (1) into the speaker or optional hand-held receiver, (2) into the telephone line through the sending amplifier in the data set, and (3) an auxiliary output into the data set. The line-to-speaker connection permits monitoring of supervisory signals when originating a call. The TOUCH-TONE dial-to-line and TOUCH-TONE dial-to-speaker connection provides for amplification of the outgoing MF dialing signals and for monitoring them during outpulsing. The line-to-second-output connection is provided for the dial tone detector (when furnished). The various connections mentioned are established by switching in the data set and by the common switch in the TOUCH-TONE dialer.

2.38 **Technical Data**

Dimensions (Approximate)

Width . . . . .	5 inches
Length . . . . .	.17 inches
Height . . . . .	6 inches

Input . . . . .	115 v ac $\pm$ 10%, 60 Hz
Environmental conditions . . . . .	40° F to 110° F ambient temperature

**CALL CONTROL UNIT FOR PRIVATE WIRE SERVICE, (Figure 3)**

2.39 Power for the motor, selector magnet driver, local power supply, and tape reader power pack, is supplied from fused 115 volt ac, 50 to 60 hertz power. Direct current of either 0.020 or 0.060 ampere is required for the signal line(s) and for operation in the local mode. The dc power for the signal line(s) is supplied by

external facilities, while local dc current for operation in the local mode is furnished through the operation of the local power supply circuit in the call control unit. At the rear of the call control unit is a terminal strip which provides the point of entry for the ac power and signal line(s) into the teletypewriter set.

Note: Normally the tape reader power pack comes from the factory installed in the call control unit; optionally the power pack may be mounted in the stand. See Section 574-100-201TC.

2.40 A 3-position rotary power switch is the only manual control on the call control unit. Its three positions are: OFF, LOCAL, and LINE.

Fuse Protection

2.41 Two fuses protect the components in the call control unit from accidental shorts and overloads. They are the selector magnet driver fuse and the ac power line fuse.

Electrical Interconnections

2.42 Connector plugs at the rear of the call control unit serve to interconnect the set components to the call control unit. A terminal strip, also located at the rear, serves to connect the ac power to the call control unit and offers a convenient terminating area for other accessories and external connections.

Line Mode

2.43 When the switch is in the LINE position, the teletypewriter is placed in the external signal line loop for communication with other teletypewriters. The external signal line

loop is united with the selector magnet driver. With dc power on the signal lines, transmission from the keyboard or tape reader will cause the typing distributor to send start-stop signals to other teletypewriters in the external signal loop. Also, the local teletypewriter is able to receive, through the typing unit selector, the start-stop signals transmitted from other teletypewriters in the signal line loop.

Local Mode

2.44 When the switch is in the LOCAL position, (1) the local battery is supplied to the selector magnet driver and the send circuit, (2) the external signal line loop is divorced from the selector magnet driver, and (3) the external signal line loop is shunted so that other teletypewriters in that loop can communicate without being affected by the operation of the local teletypewriter.

Off Mode

2.45 When the switch is in the OFF position, the signal line is diverted around the local teletypewriter. Other teletypewriters can communicate in the signal loop without interference. All power in the call control unit, except the ac power to the selector magnet driver, is off.

2.46 Technical Data

Dimensions (Approximate)

Length . . . . . 15 inches  
 Width . . . . . 4-1/2 inches  
 Height . . . . . 6 inches

Input . . . . . 115 v ac, 50-60 Hz  
 Environmental conditions . . . . 40° F to  
 110° F ambient temperature