

33 CALL CONTROL UNIT

GENERAL DESCRIPTION

AND OPERATION

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1. GENERAL

1.01 This section provides a general description and operation of the 33 call control units. It is reissued to add environmental temperature circuits and information on the call control unit for Computer Input/Output Sets. Marginal arrows indicate changes and additions.

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

- (1) Call Control Unit for Circuit Switching Service
- (2) Call Control Unit for Switched Network Service
- (3) Call Control Unit for Private Wire Service
- (4) Call Control Unit for Computer Input/Output Sets

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 CIRCUIT SWITCHING SERVICE (Figure 1)

2.01 The call control unit for Circuit Switching Service utilizes two types of signals in its operation. Over short and intermediate length telegraph loops it operates on neutral signals; over longer loops with excessive distortion it operates on polar signals. A polar adapter attached to the call control unit enables it to operate on polar signals. Paragraphs 2.02 through 2.14 describe the neutral operation. Paragraphs 2.15 through 2.20 describe the polar operation.

A. Neutral Operation

Controls

2.02 The controls on the call control unit used to originate and handle calls consists of a set of push-buttons and dialer. In certain applications the pushbutton designations are, from left to right, as follows: START, DIAL, LOCAL, and CONN(STOP). In other applications the pushbutton designations are, from left to right: REQUEST, CONN, LCL, and DISCONN.

Dialer

2.03 The dialer is a conventional telephone type which operates normally closed pulsing contacts. These contacts open and close to send dialing pulses during the dial run-down interval. The pulses are produced at a rate of ten per second with the contacts open for 0.006 + 0.003 second during each pulse interval. A pair of normally open off-normal contacts close when the dial wheel is rotated from its idle position. These contacts provide a steady mark current

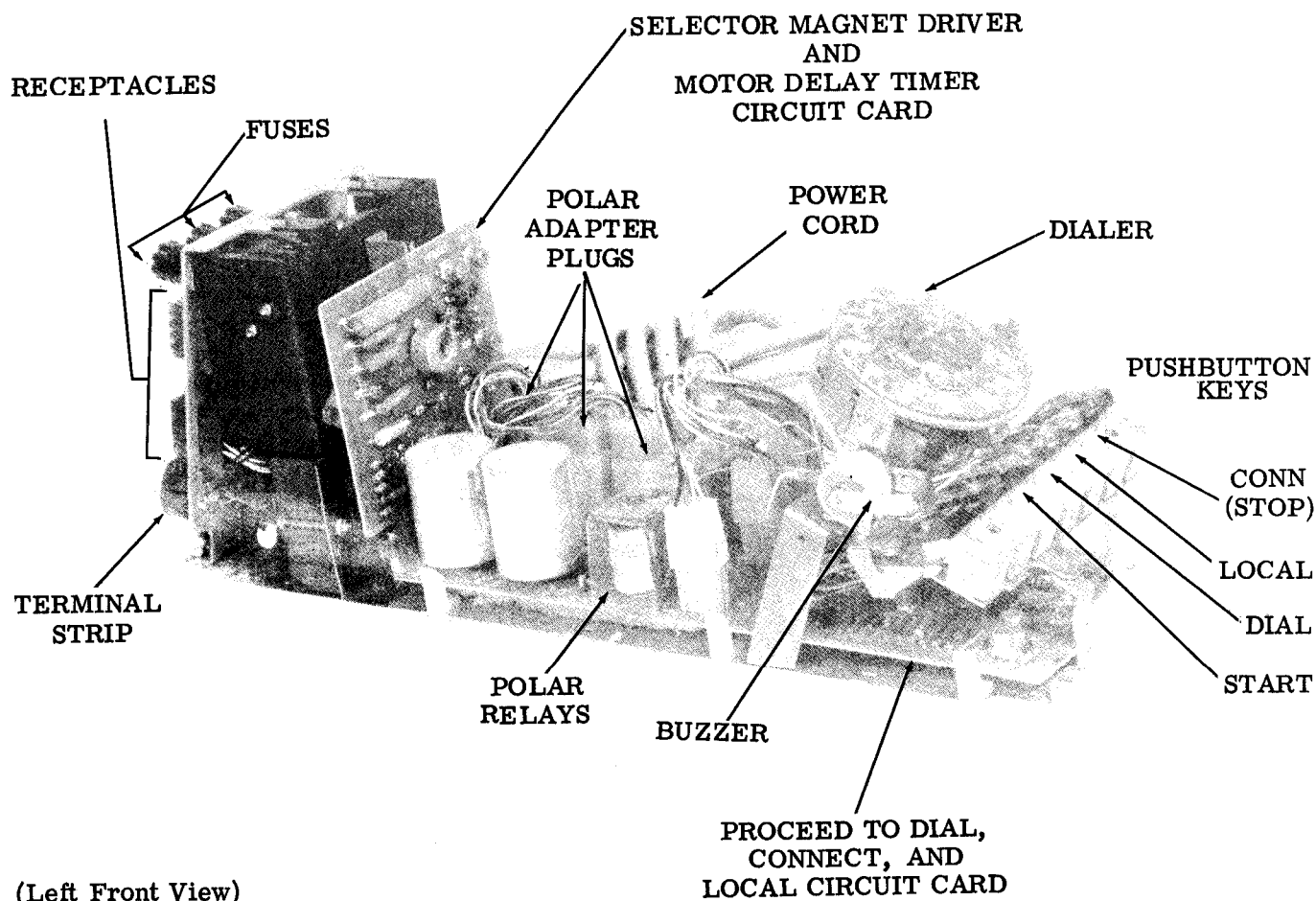


Figure 1 - Call Control Unit for Circuit Switching Service

to "blind" the selector when dialing is undertaken. This prevents the printing of spurious characters if dialing is necessary when in the connected condition as in multiaddress calling.

Start

2.04 In the idle condition, with the motor and typing unit stopped and visual indicators de-energized, there is a positive current of 0.005 ampere in the telegraph loop. When the calling station operator depresses the START pushbutton, it causes the shunting of a major portion of the loop resistance, and the loop current increases to 0.060 ampere. The START pushbutton must be held in the depressed position, while switching apparatus in the telegraph exchange is made available. When the circuit is ready, the telegraph exchange interrupts the 0.060 ampere loop current for about 0.025 second. This "proceed-to-dial" signal causes the DIAL lamp to be illuminated at the calling station, and it locks in the shunt to the loop resistance so that the operator may now release the START pushbutton and proceed to dial

the number of the called station. Rotation of the dial transmits signals consisting of no current for 0.06 second followed by full current (0.060 ampere) for 0.04 second during each dial pulse interval. When dialing is completed, the exchange furnishes the connection and signifies this by reversing the telegraph loop current from positive to negative which causes the typing unit motor to start and the CONN lamp to light. Message transmission can now be exchanged between the connected teletypewriters. The line signals are 0.060 ampere marking and zero current spacing.

2.05 If the distant called station is busy or disabled at the time of a call, the local telegraph exchange reverses the local loop current from positive to negative for about 0.2 second and then causes it to revert to positive current again. This causes the local motor to start and the CONN lamp to light momentarily, but they then both turn off. The teletypewriter returns to the idle condition as the positive current is detected.

Connect

2.06 The local telegraph exchange responds to an incoming call by reversing the idle signal loop from positive to negative current. At the local station, the CONN lamp is illuminated, and the motor is turned on as the shunt to the loop resistance is applied in response to the current change. Message transmission can now take place with unattended service at the receiving station.

Stop

2.07 Following completion of traffic a disconnect can be originated from either the calling or the called station. Holding the STOP pushbutton depressed causes the line to go open (zero current). In approximately 3 seconds the local exchange causes the connection to the distant station to be broken, and it reverses the current in the local loop so that positive current flows — limited by the local station loop resistance. This turns off the motor and extinguishes the CONN lamp. The STOP pushbutton is released after the CONN lamp goes out. The original idle condition is now restored. When a disconnect is initiated from a remote station, the local exchange recognizes the open line interval and breaks the connection. The loop current is reversed back to positive, and the local station is returned to the idle condition as stated above.

Local

2.08 Local Operation is provided by depressing the LOCAL pushbutton until the LOCAL lamp is turned on. This places the teletypewriter in an off-line operating condition for copy preparation, practice, or maintenance purposes. To return to the idle condition, the STOP pushbutton is held operated until the lamp is extinguished, or a call can be initiated by depressing the START pushbutton directly. If a call is received while the teletypewriter is in the local condition, the buzzer will sound for an interval of 2.6 seconds, and the teletypewriter will automatically shift over to the call-connected condition with the CONN lamp illuminated.

Fuse Protection

2.09 Three fuses protect the components in the call control unit from accidental shorts or overloads. The selector magnet driver fuse is 0.375 amp, slow blowing, protecting the SMD circuit; the typing unit motor fuse is a 3.2 amp, slow blowing; the third fuse is the ac line fuse, 3.2 amp, slow blowing.

Electrical Interconnections

2.10 There are eight nylon terminal blocks at the rear which serve to interconnect the set components to the call control unit. Also located at the rear is a terminal strip for the signal line and ac power connections.

Circuits

2.11 There are three basic and two auxiliary circuits in the call control unit. The three basic circuits are: The proceed to dial circuit; the connect circuit; and the local circuit. The two auxiliary circuits are: the selector magnet driver circuit and the motor delay timer circuit.

2.12 The three basic circuits are essentially binaries (flip-flops) that have been modified to perform a specific function. They are protected with a diode arc suppressor against transients and voltage pulses generated by their associated relays and coils. They are protected from transient noise induced into them from leads in the cable to the dial, pushbutton keys, and lamp assembly. A low-pass filter or delay network of the RC type is placed in the feedback loop in each binary. The delay network slows the response time of the associated binary (0.001 second in the proceed to dial circuit; 0.02 second in the connect circuit). This reduces its susceptibility to noise. The signal line inputs are filtered against spurious noise occurring on the signal line.

2.13 The selector magnet driver circuit delivers marking signals of 0.500 ampere and spacing signals of essentially 0 ampere to the typing unit selector magnet. The signals trigger the selector magnet driver circuit at about half the current level for normal (0.060 ampere mark) neutral input signals. In teletypewriters modified for polar operation, the signal is applied to polar-to-neutral converting circuits and then to the selector magnet driver. The selector magnet driver circuit thus functions as an amplifying relay which improves the margin of operation over either neutral or polar line circuit.

2.14 The motor delay timer circuit provides a means to delay motor turn-off in the set. This allows the set to complete its printing cycle and come to rest before the motor begins to stop. This circuit is mounted on the same circuit card assembly with the selector magnet driver, but the circuit is electrically independent of it. At 25 degrees C with 390 ohm output load, the delay of the motor delay timer is from 0.475 second to 0.675 second when the supply voltages are within 3 percent of their nominal values.

B. Polar Operation

2.15 Call control units that are modified for polar operation respond to and transmit polar telegraph signals on separate receiving and sending legs extending to the telegraph exchange facilities. The operating conditions and sequence are similar to that for neutral signaling.

2.16 In the idle condition the sending and receiving legs each have from 0.015 to 0.040 ampere positive current flowing. The sending leg current is supplied by the call control unit, and the receiving leg current is supplied by the central exchange. At the local station the polar adapter

interconnects the legs with the neutral signaling control and teletypewriter circuitry. Operation of the START pushbutton causes the current in the sending leg to reverse to a negative polarity with a value equal to the positive current formerly applied (0.015 to 0.040 ampere). The telegraph exchange responds by reversing the current to negative on the receiving leg for 0.025 second. This causes illumination of the DIAL lamp at which time the START pushbutton should be released. The dialing signals go out over the sending leg in polar form with each pulse interval consisting of 0.06 second of positive current followed by 0.04 second of negative current. When the connection is completed, the exchange reverses the polarity of the receiving leg from positive to negative current. After 0.08 second of this reversal, the call control unit causes the motor to turn on, and the CONN lamp to be illuminated. Traffic can now be exchanged. Each station is arranged to record its transmitted copy. Transmitted and received signals consist of positive current for space and negative current for mark on both signal legs.

2.17 When receiving an incoming call, the local exchange reverses the receiving leg current from positive to negative. The local call control unit, after 0.08 second of negative current, turns on the motor and the CONN light and causes the sending leg current to be reversed from positive to negative.

2.18 If the distant station that is called is busy, it will result in the momentary application of negative current to the local receiving leg followed by a return to a continuous positive current. The motor may run briefly, but the teletypewriter will be quickly placed back into the idle condition.

2.19 In effecting a disconnect, operation of the STOP pushbutton causes the transmission of positive current on the sending leg. The exchange will then reverse the current on the receiving leg to positive as it breaks connection to the distant station. The call control unit detects the positive current. After 1.3 seconds it turns the motor and CONN lamp off as it applies a steady positive current to the sending leg and restores the teletypewriter to the idle condition. If the disconnect is initiated at the distant teletypewriter, the positive current disconnect signal, when applied to the local receiving leg, causes the local teletypewriter to go into the idle condition after 1.3 seconds, and the sending loop becomes positive again.

2.20 For local operation the interval conditions are the same as for neutral signaling. Externally, the signal legs remain on positive current unless a call is received. When a call is received, a negative current on the receiving leg for 0.08 second causes the buzzer to sound for 2.6 seconds. Following the buzzer sound, teletypewriter shifts to the call-connected condition.

2.21 Technical Data

Dimensions (Approximate)

Width 5 inches
Length 17 inches
Height 6 inches

Input 115 v ac + 10%, 60 Hz + ½%
Polar adapter input 115 v ac + 10%, 60 Hz

Power consumption

Neutral operation . . . not exceeding 22.5 watts
Polar operation not exceeding 52.5 watts

Environmental conditions 40° F to 110° F
ambient temperature

CALL CONTROL UNIT FOR SWITCHED NETWORK SERVICE

2.22 The call control unit for switched Network Service (Figure 2) 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 paragraph 2.23 briefly describes the data set.

2.23 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.

2.24 The call control unit used with the data set operates with conventional telephone central offices that have the necessary routing and accounting facilities.

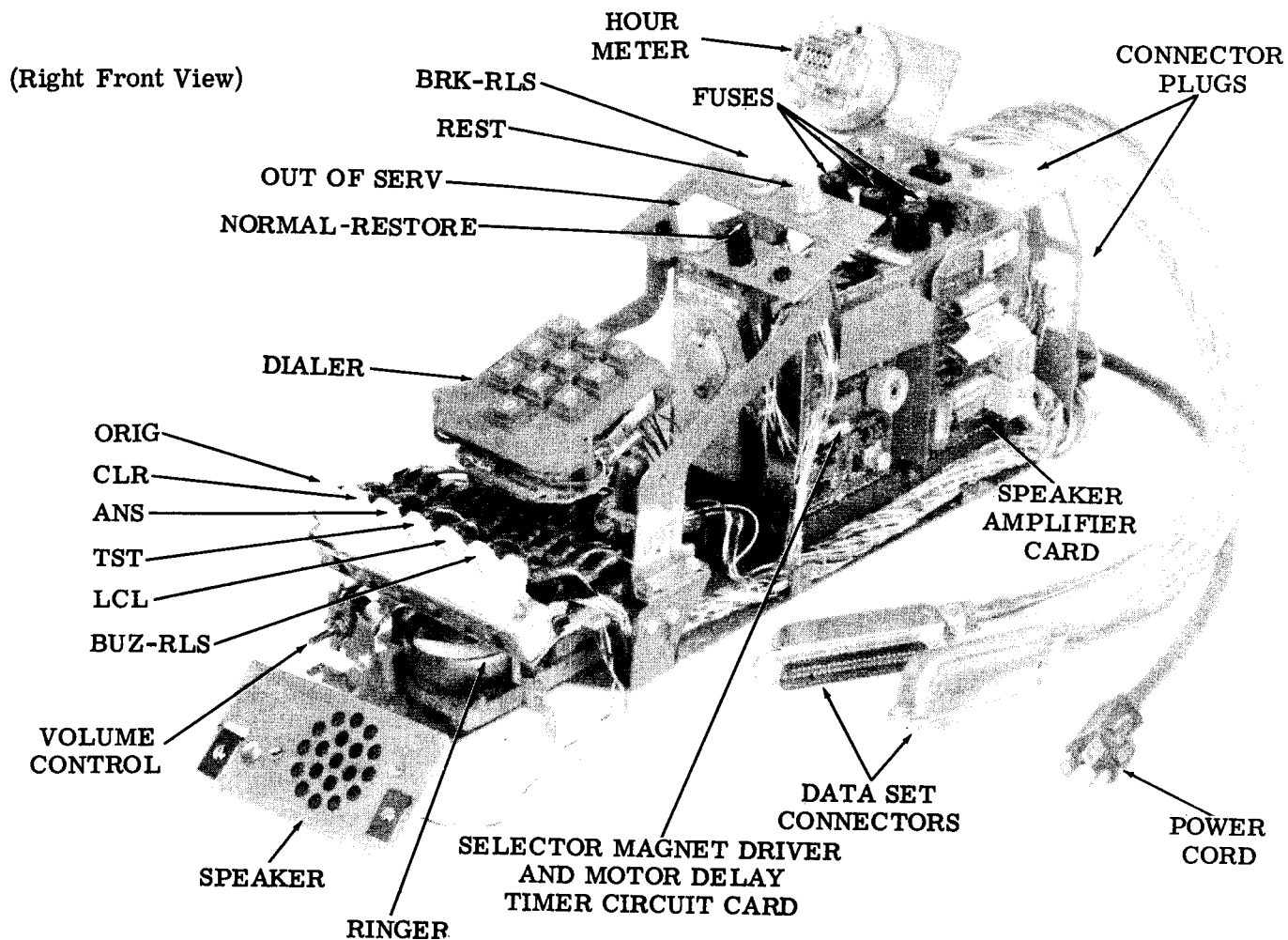
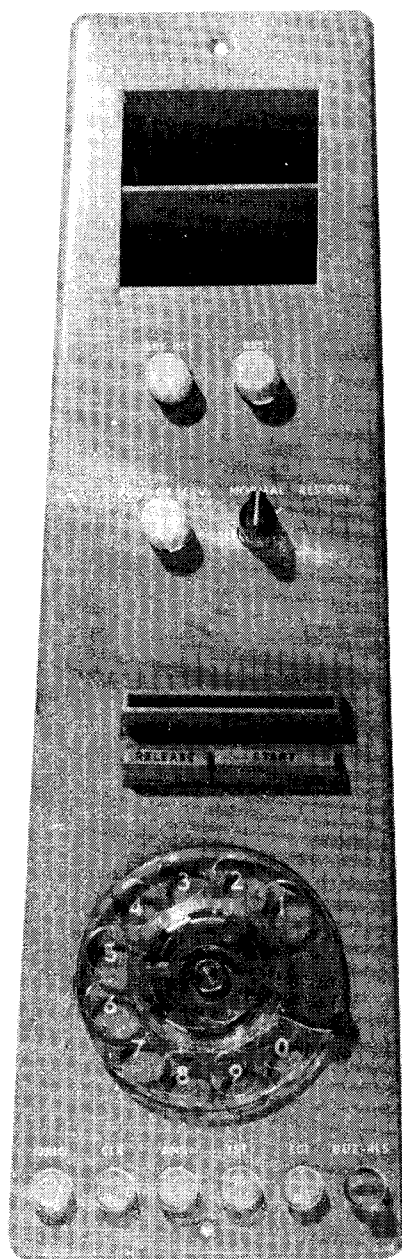


Figure 2 - Call Control Unit for
Switched Network Service

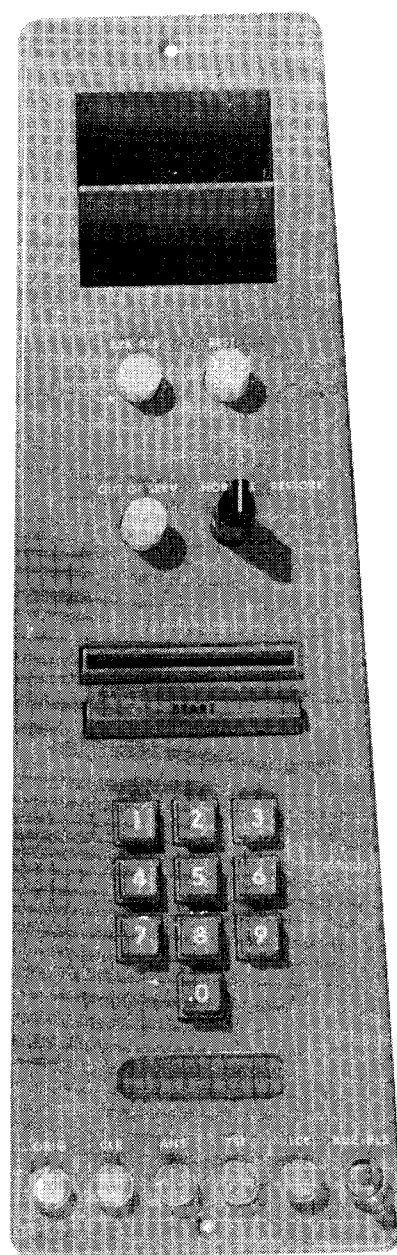
In operation, a call is originated by depressing the ORIG pushbutton (Figure 3). A lamp illuminates the pushbutton and the dial tone will be heard through a loudspeaker. If the line is busy, a busy signal will be heard and the clear (CLR) pushbutton (nonlocking) should be depressed. If the line is not busy, the operator dials the number of the 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 (nonlocking). 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.

2.25 At the end of the message, either station may originate a disconnect by depressing the CLR pushbutton, (Figure 3) 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



ROTARY DIALER



TOUCH-TONE® DIALER

Figure 3 - Call Control Panels

call during local operation, the call control unit responds to ringing signals and the ANS pushbutton must be operated manually. 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.

2.26 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

2.27 To originate a call, the ORIG pushbutton (Figure 3) 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.

2.28 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

2.29 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 3). 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

2.30 To answer a call manually, momentarily depress the ANS pushbutton (Figure 3). 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.

2.31 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

2.32 The local mode (LCL) provides off-line operation of the teletypewriter. The operator selects the local mode by depressing the LCL pushbutton (Figure 3). 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

2.33 The OUT OF SERV. switch (Figure 3) 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.

2.34 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

2.35 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 3) 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.

2.36 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.

2.37 To restore the teletypewriter to service after the paper has been inserted, depress the CLR pushbutton and return the OUT OF SERV. knob (Figure 3) 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

2.38 This high intensity restrain (REST) lamp (Figure 3) 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

2.39 If the TST pushbutton (Figure 3) 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

2.40 The teletypewriter can send by operating the keyboard, answer-back mechanism, or BREAK key (Figure 3). 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

2.41 **Pulsing Rotary Dialer:** For rotary dialer applications a pulsing contact of the rotary dialer is inserted into the telephone line. The rotary dialer (Figure 3) 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.

2.42 **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.

2.43 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.

2.44 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.

2.45 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.

2.46 **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.

2.47 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.

2.48 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.

2.49 **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.

2.50 The TOUCH-TONE MF signal generated is a 1-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	Dial Digits
770	4	5	6	
851	7	8	9	
941		10		

2.51 The frequencies above 1900 hertz are generated at a somewhat higher level to compensate for greater line loss at those frequencies. There is also a variation or amplitude for various digits.

2.52 TOUCH-TONE and Card Dialer (Figure 3): 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.

2.53 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.

2.54 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

2.55 Three fuses protect the components in the call control unit from accidental shorts or overloads. The selector magnet driver fuse is 0.5 amp slow blowing; the motor delay timer fuse is 2.25 amp slow blowing; the ac line fuse is 3.2 amp, slow blowing.

Electrical Interconnections

2.56 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

2.57 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 500ma 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.

2.58 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.

2.59 Technical Data

Dimensions (Approximate)

Width	5 inches
Length	.17 inches
Height	6 inches

→ Input	115 v ac + 10%, 60 Hz
Environmental conditions	.40 F to 110 F ambient temperature

CALL CONTROL UNIT FOR PRIVATE WIRE SERVICE (Figure 4)

2.60 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 the signal line(s) into the teletypewriter set.

↗ Note: Call control units used in 3300 Series Coded Sets have the tape reader power pack mounted on them. The power pack consists of a circuit card which is located to the right of the capacitor. In other sets the power pack mounts within the stand underneath the base.

2.61 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

2.62 Two fuses protect the components in the call control unit from accidental shorts and overloads. The selector magnet driver fuse is 0.8 amp, slow blowing; the ac power line fuse is 2.8 amp, slow blowing.

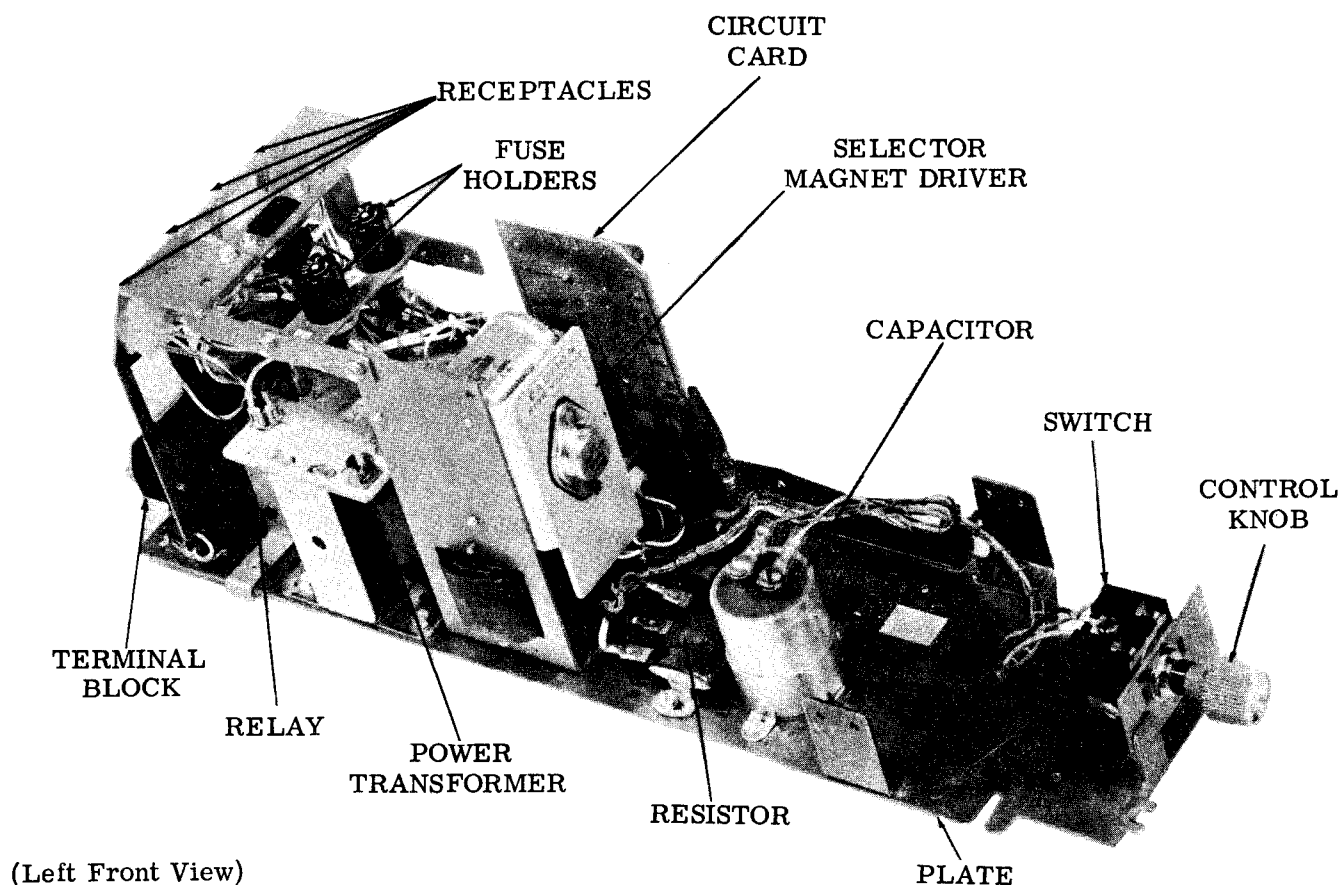


Figure 4 - Typical Call Control Unit for Private Wire Service

Electrical Interconnections

2.63 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

2.64 When the switch is in the LINE position, the teletypewriter can be 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 line, and 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

2.65 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

2.66 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.

2.67 Technical Data

Dimensions (Approximate)

Length 15 inches
 Width 4 ½ inches
 Height 6 inches

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

CALL CONTROL UNIT FOR COMPUTER INPUT/OUTPUT
 SETS (Figure 5)

2.68 The call control unit for Computer Input/Output Sets provides the electrical interconnection of the various set components, the interface, and control circuits. The call control unit consists of a circuit board, a power supply, operator control keys, a terminal strip, and plugs to

interconnect the various set components as well as the power source.

2.69 The 20 pin interface connector has the following pin assignment:

A - Send Data (Out)	P - Punch Off
B - Receive Data (In)	R - Printer Available
C - Remote	T - Reader Available
F - Circuit Common	U - Motor Off
H - Reader Off	W - Keyboard Off
J - E.O.M. (End of Message)	D - Spare
K - Spare Wire	E - Spare
L - Request	S - Spare
M - Printer Off	V - Spare
N - Punch Available	X - Spare

2.70 Voltages and impedances for control and data leads are listed in Figure 6.

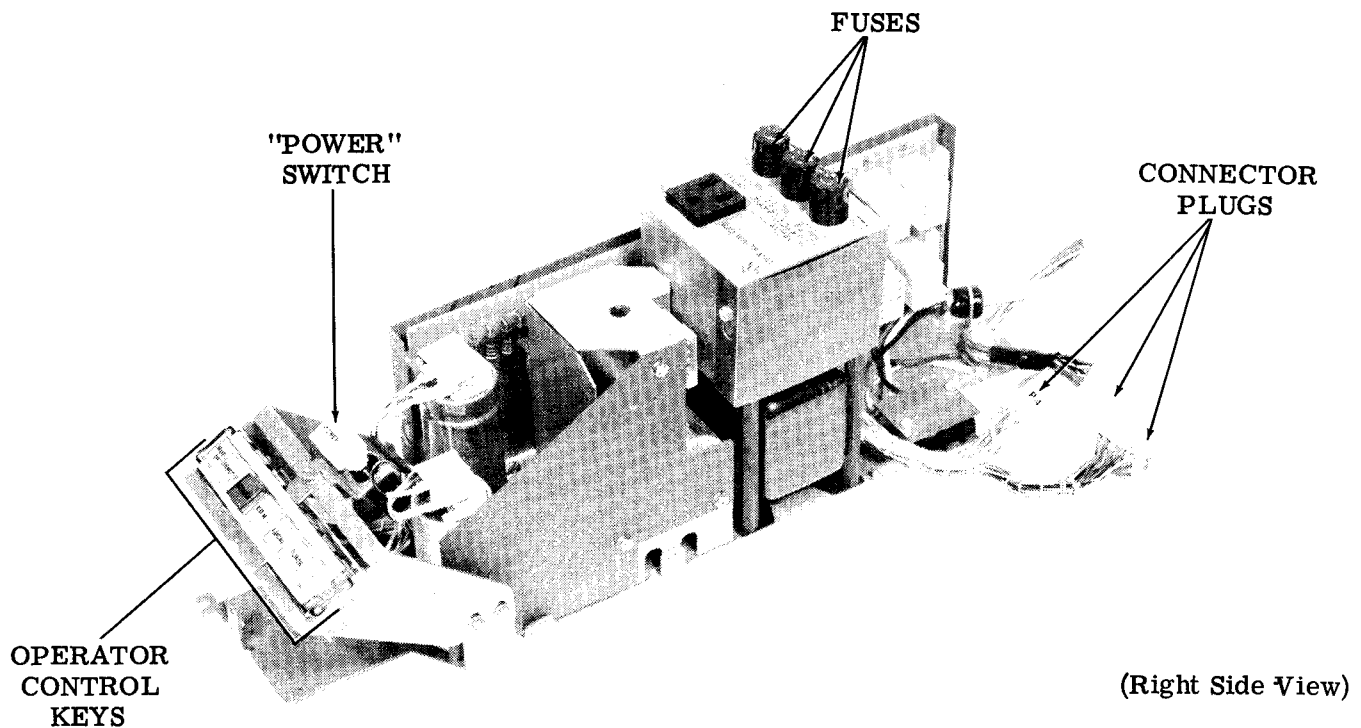


Figure 5 - Call Control Unit for Computer Input/Output Sets

	INPUT				OUTPUT			
	TTY On State		TTY Off State		TTY On State		TTY Off State	
	<u>Max</u>	<u>Least</u>	<u>Max</u>	<u>Least</u>	<u>Max</u>	<u>Least</u>	<u>Max</u>	<u>Least</u>
	(Mark)		(Space)		(Mark)		(Space)	
	+7.0 V	+3.5 V	+1.5 V	-0.5 V	+7.0 V	+3.5 V	+1.0 V	-0.5 V
Computer Impedance to Ground (ohms)	R > 50K		R < 125		450 < R < 550		450 < R < 550	

Figure 6 - Voltages and Impedances for Control and Data Leads

2.71 Operator Controls:

(a) **POWER** – Push on, push off key is illuminated red when power is on. Operation of this key closes both sides of the power line activating the 48 v dc and 24 v dc power supplies. Operation of this key also activates the interface leads.

(b) **MOTOR OFF** – Locking* key, not illuminated.

(c) **REMOTE** – Locking*, white illuminated key whose operation places the set in the remote mode of operation. When in remote mode the teletypewriter communicates with the computer and is capable of receiving serial information with the computer selecting the teletypewriter components for printing only, paper tape operation only, or simultaneous printing and tape perforating. The teletypewriter is also capable, in remote mode, of sending serial information with the computer selecting the tape (reader) sender, while locking the keyboard, or permitting manual entry from the keyboard. The sending line is wrapped to the receiving line to provide local copy in the local mode.

(d) **REQUEST** – Momentary, green illuminated key. This key is operated when the teletypewriter is in the remote mode and requesting transmission with the computer.

(e) **E.O.M. (End of Message)** – Momentary, white, not illuminated key. The operator depresses this key at the end of the message indicating to the computer that the transmission is complete.

(f) **LOCAL** – Locking*, white illuminated key. Operation of this key places the teletypewriter in the local mode for preparation of message tapes and other off-line activities.

(g) **PUNCH** – Push on, push off, white illuminated key. This key is operated when the set is in local mode to turn the tape punch on and off. During remote operation this key is not used because the punch responds to on and off signals from the computer.

2.72 Technical Data:

Input 115 v ac $\pm$ 10% 50 or 60 Hz $\pm$ 0.75 Hz
 Running Current Less than 3 amperes
 Starting Surge 12 amperes, maximum

Environmental Temperature range – 40° F to 110° F

Relative Humidity – 2% to 95%

Altitude – Sea level to 10,000 Ft.

Storage Temperature – (-) 40° F to 150° F with altitudes up to 50,000 Ft.

*Note: The three locking keys are mutually exclusive.