UCC39 CALL CONTROL UNIT

GENERAL INFORMATION

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1. GENERAL

1.01 This section provides general information on the UCC39 call control unit. This unit permits local or on-line operation of a 33 or 35 teletypewriter and features a data modem (moe′ · dem) which permits operation on the direct distance dialing network without the need for a data set.

1.02 As shown in Figure 1, the basic call control unit consists of a circuit card assembly, a six-button keyswitch assembly, and a power supply, all mounted on a baseplate to form a self-contained unit. The complete unit mounts in the upper right side of the 33 teletypewriter. In a 35 teletypewriter the unit may be mounted in the upper right side (RO or KSR) or in the pedestal (ASR). In all installations it is connected to the adjunct units by cables.

1.03 The pushbutton switches permit mode switching, and the lamps in the pushbuttons indicate the operating modes. An alarm lamp provides an indication of low paper (friction feed sets) or paper out (sprocket feed sets).

1.04 Two circuit cards provide the control and signal conversion required for operation of the terminal. The TP322491 logic

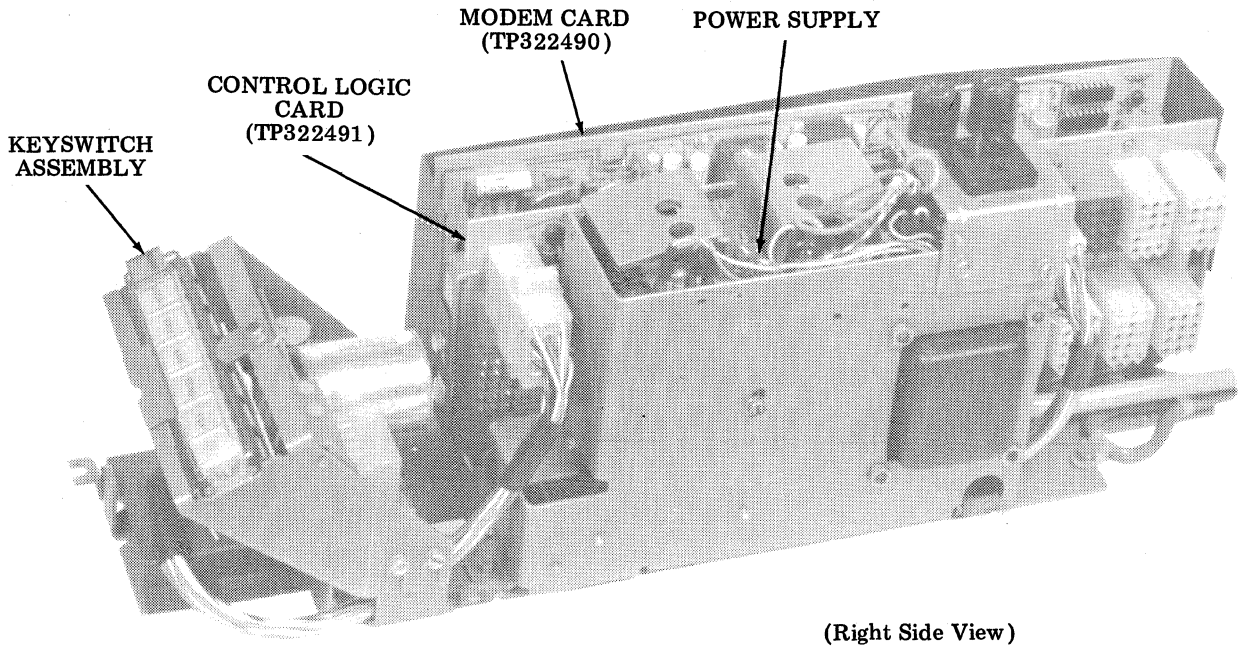

Figure 1 - UCC39 Call Control Unit

card controls the operating modes. The TP322490 modem (modulator/demodulator) card provides analog/digital conversions. The modulator part of this card converts the start-stop digital signals of the teletypewriter distributor to Frequency Shift Keyed (FSK) analog signals suitable for transmission on telephone lines. The demodulator converts FSK signals received from a remote terminal to dc signals suitable for the selector of the teletypewriter.

1.05 The power supply operates from the 115 volt, 50/60 Hz ac line. It provides fused ac and dc operating voltages for the call control unit and adjunct equipment.

1.06 When used with a Data Access Arrangement (DAA) and telephone handset, the call control unit provides all functions required to originate or answer calls and is completely compatible with 100 Series data sets (or equivalents). The system is shown in block diagram form in Figure 2. With a manual DAA (1000A or equivalent) the unit serves as a manual originate, manual answer data set. With an automatic DAA (1001B, 1001D, or equivalent) it serves as a manual originate, auto answer data set. The telephone is a 502A or equivalent with an exclusion key.

1.07 Basic operation of the call control unit is half-duplex. However, it features a full duplex mode selectable by the operator. An echoplex mode is also selectable, whereby the unit returns or "echoes" signals to the remote transmitter so the remote operator can check the accuracy of the data exchange.

1.08 The following operating characteristics apply to the UCC39 call control unit:

Input Voltage
115 volts ac, 50/60 Hz, ±0.75%

Input Current
0.5 amp (nominal) to satisfy 6 v and 24 v load requirements (1 amp each); 2.50 amp (max) to satisfy 33 or 35 motor, plus 0.85 amp (max) for convenience receptacle

Time Base
Asynchronous, start-stop serial code

Modem FSK Carrier Frequencies
Originate
Transmit (F1) — 1070 Hz (space)
1270 Hz (mark)
Receive (F2) — 2025 Hz (space)
2225 Hz (mark)

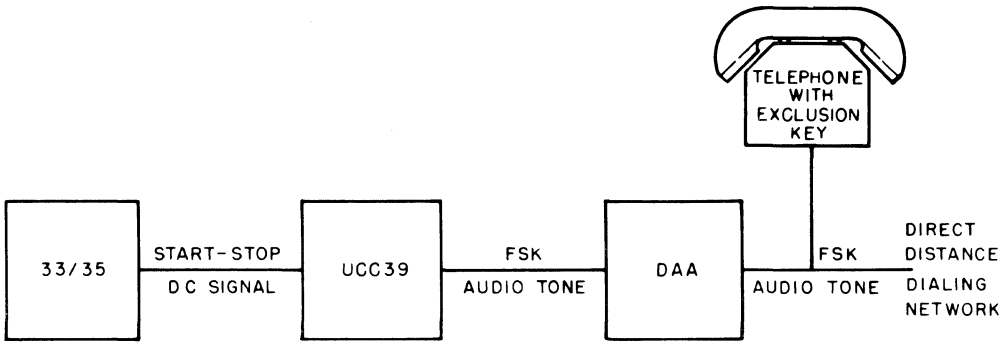

Figure 2 - Interconnection of Call Control Unit and Adjunct Units to Permit Operation on Direct Distance Dialing Network

Answer
Transmit (F2) — 2025 Hz (space)
2225 Hz (mark)
Receive (F1) — 1070 Hz (space)
1270 HZ (mark)

(All frequencies ±1.5 Hz)

Power Supply Outputs
+24 v dc, -24 v dc, +6 v dc, 6 v ac, and 500 ma selector magnet drive

Relative Humidity
To 95%

Altitude
Sea level to 10,000 feet (operating)
Sea level to 50,000 feet (shipping)

Ambient Temperature
+40°F to +110°F (operating)
-40°F to +150°F (storage)

CAUTION: THIS EQUIPMENT IS INTENDED TO BE OPERATED WITHIN THE TEMPERATURE RANGE OF +40°F to +110°F. SERIOUS DAMAGE CAN RESULT IF THIS RANGE IS EXCEEDED. PARTICULAR CAUTION SHOULD BE EXERCISED IN USING ACOUSTICAL OR OTHER ENCLOSURES.

2. OPERATION

2.01 The operator activates the call control unit by means of the six pushbuttons illustrated in Figure 3. The functions of the pushbuttons and the indicator lamps within the buttons are as follows:

CLEAR/ALARM — A momentary pushbutton which lights (red) when depressed and clears the set of its operating mode. The lamp also lights to indicate a paper alarm condition.

LOCAL — A locking pushbutton which lights (green) when depressed and places the set in the local mode.

ORIG — A momentary pushbutton which lights (white) when depressed and conditions the set for on-line operation. The operator then establishes a connection with the remote station to exchange data.

ANS — A momentary pushbutton which lights (white) when depressed, and places the set in the receive mode after a connection is made with a remote station.

ECHO — A locking pushbutton which lights (white) when depressed and conditions the terminal for echoplex operation. Received signals are returned to the remote station to permit a check of transmission accuracy.

FDX — A push on, push off pushbutton which lights (white) when depressed and conditions the set for simultaneous transmission and reception of data (full duplex).

2.02 The UCC39 call control unit can be interfaced directly to a private telephone line or through a DAA to the direct distance dialing network. A manual DAA (1000A or equivalent) permits manual originate, manual answer service. An automatic DAA (1001B, 1001D or equivalent) permits manual originate, auto answer service. Calls are placed or answered through a telephone (502A or equivalent) adjunct to the DAA.

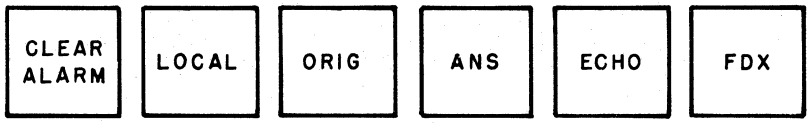

Figure 3 - Pushbutton Switches and Indicator Lamps

ORIGINATING A CALL

2.03 To originate a call, the operator lifts the telephone handset and dials the remote terminal. With an automatic DAA, the exclusion key must be lifted before dialing. If the remote terminal has auto answer capability, its f2 carrier will be heard in the handset. If the remote terminal is arranged for manual answer, it will not send the f2 carrier until the remote operator goes into the answer mode. When the f2 carrier is heard, the local operator depresses the ORIG button and goes on-line by hanging up the handset (auto DAA) or lifting the exclusion key (manual DAA). The teletypewriter motor turns on and the ORIG lamp lights. After a 400 ms delay (to disable the Telephone Company echo suppressors), the local terminal turns on its f1 carrier to complete the data connection.

ANSWERING A CALL (MANUAL ANSWER)

2.04 An incoming call causes ringing at the local terminal. The operator answers the call and agrees to go into the data mode, depresses the ANS button, and goes on-line by lifting the exclusion key on the telephone. The teletypewriter motor turns on and the local terminal sends its f2 carrier to the remote terminal. The remote terminal completes the data link by turning on its f1 carrier. Upon receipt of f1, the ANS lamp lights. If the local terminal is equipped for auto answer-back, it transmits its answer-back to the remote terminal.

ANSWERING A CALL (AUTO ANSWER)

2.05 The call control unit can provide auto answer operation when used with an auto answer DAA. With the call control unit in the clear mode, an incoming call turns on the teletypewriter motor and initiates the answer mode. The local terminal sends its f2 carrier to the remote terminal, which responds by turning on its f1 carrier to the local terminal. This completes the data link and lights the ANS lamp. If equipped for auto answer-back, the local terminal sends its answer-back to the remote terminal.

2.06 If an auto answer terminal is in the local mode, the auto answer operation is inhibited but an incoming call causes the ANS lamp to flash. The operator can then go into the answer mode by depressing the ANS button, or can remain in the local mode and answer the call by lifting the handset. If the ANS button is depressed, the local button unlocks and its lamp goes out, and the f2 carrier is sent to the remote terminal. The remote terminal responds with its f1 carrier. The ANS lamp lights, and if equipped for auto answer-back, the local terminal sends its answer-back to the remote terminal.

DISCONNECTING A CALL

2.07 Disconnect in the originate or answer mode occurs upon receipt of an EOT character, upon loss of carrier, or upon depression of the CLEAR button. With a manual DAA, the handset must be placed on-hook to complete the disconnect.

FULL DUPLEX OPERATION

2.08 The call control unit provides simultaneous transmission and reception of data (full duplex operation) when the FDX button is depressed in the originate or answer mode. The FDX lamp lights when the button is depressed. Received data is printed out by the teletypewriter, but transmitted data does not provide a printout. To restore half-duplex operation the FDX button is depressed a second time.

Note: Full duplex operation is not possible with an RO unit.

ECHO OPERATION

2.09 When the ECHO button is depressed, incoming data is returned to the remote sender for verification of accuracy. The sender must be operating full duplex to receive the echo. The ECHO button is a locking pushbutton which lights when depressed. To release the button, the operator depresses the CLEAR or LOCAL button.

LOCAL OPERATION

2.10 Local operation permits preparation of printed copy (33 or 35 KSR or ASR) and punched tape (33 or 35 ASR) without on-line operation. When the LOCAL button is depressed, the button locks and the lamp lights (green). All local functions can be performed, but on-line transmission or reception is inhibited. The operator can place or answer calls via the DAA, but must manually initiate on-line operation by depressing the ORIG or ANS button. This unlocks the LOCAL button and enables on-line operation.

OPTIONS

2.11 Option screws on the TP322491 logic card permit the following features in the operation of the call control unit:

Send Inhibit — When this option screw is installed, it prevents the keyboard (KSR or ASR) and reader (ASR) from transmitting to the remote terminal in the echo mode. With the screw omitted, the keyboard and reader transmit in the echo mode.

Paper Alarm — When the option screw is installed, a low paper (friction feed) or paper out (sprocket feed) condition, lights the ALARM lamp (red) but has no effect on the send and receive functions of the terminal. With the screw omitted, a paper alarm lights the lamp and also prevents call connection with a remote station. On TP322491 cards previous to Issue 4, disconnect also occurs on existing calls.

Answer-back Trip — Witn this screw installed, the answer-back is tripped automatically when the answer mode has been established. With the screw omitted, the answer-back is not automatically sent upon call connection.

3. CIRCUIT DESCRIPTIONS

3.01 The circuitry of the UCC39 call control unit is contained on two circuit cards: the TP322491 logic card and TP322490 modem card. Operating voltages and currents are provided by the TP188865 power supply. The functions of the circuits are outlined in the following circuit descriptions. Complete schematic diagrams and detailed circuit descriptions are contained in Wiring Diagram Package WDP0341.

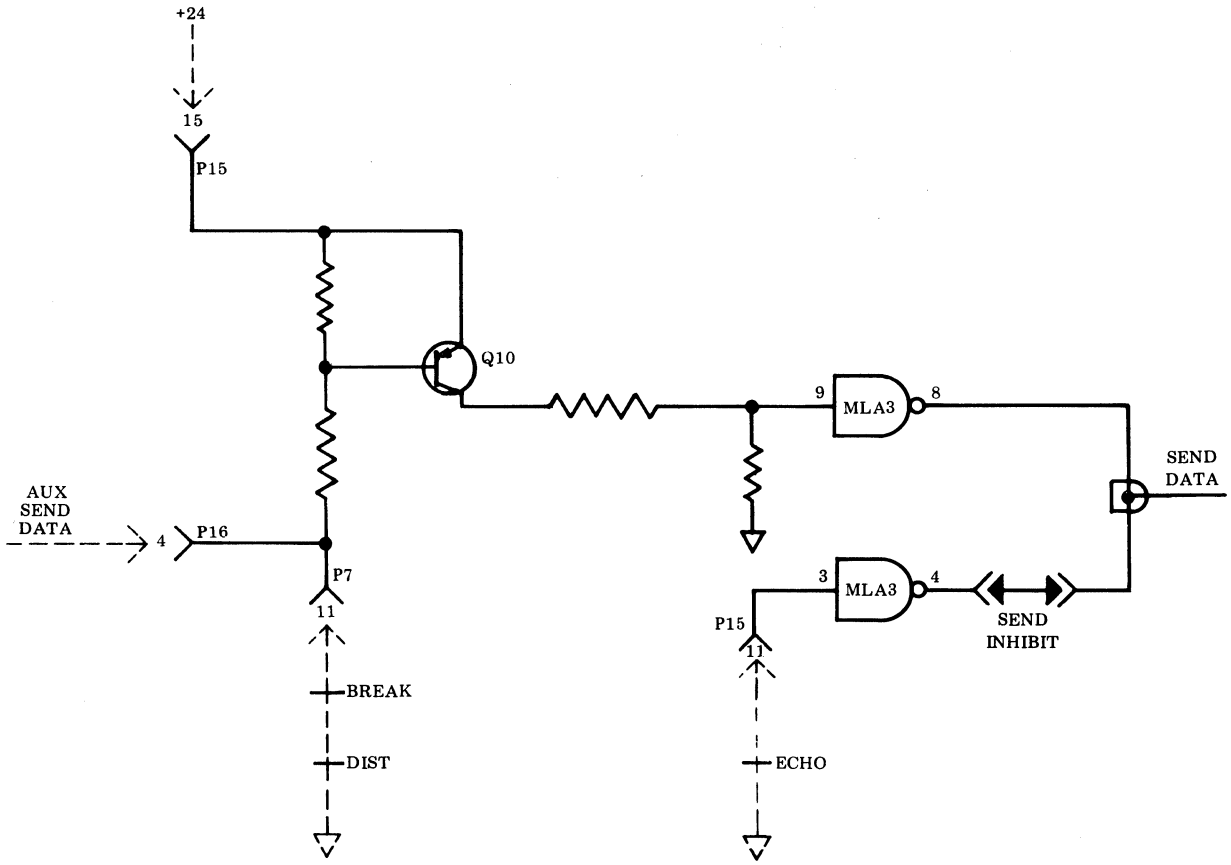

Figure 4 - Send Data Circuits

CONTROL LOGIC CARD (TP322491)

3.02 The TP322491 circuit card provides the control logic and interface between the teletypewriter and the telephone line. A Data Access Arrangement (DAA) with telephone set is required to place and answer calls on the direct distance dialing network.

A. Send Data Circuits

3.03 The send data circuits of the control logic card are shown schematically in Figure 4. The distributor contacts are connected through the normally closed Break contacts and P7-11 to the base of Q10. With a mark (closed contact) in the distributor, Q10 is on and produces a high at MLA3-9. This drives MLA3-8 low, producing a low on the Send Data lead. An Aux Send Data input is provided at P16-4, and a mark (low) applied at this point will also produce a low on the Send Data lead.

3.04 A space (open distributor contact or +24 v on Aux Send Data lead) causes Q10 to turn off, producing a low at MLA3-9 and a high on the Send Data lead.

3.05 The Send Inhibit option screw prevents data from being sent on-line when the ECHO button is depressed. With this option enabled, the Send Data lead is blinded by a low at MLA3-4 when the ECHO button is depressed. With the option disabled, the ECHO contacts have no effect on the Send Data lead.

3.06 An open Break contact disconnects the distributor contacts from Q10, and thus prevents the Send Data lead from following the changes in the distributor.

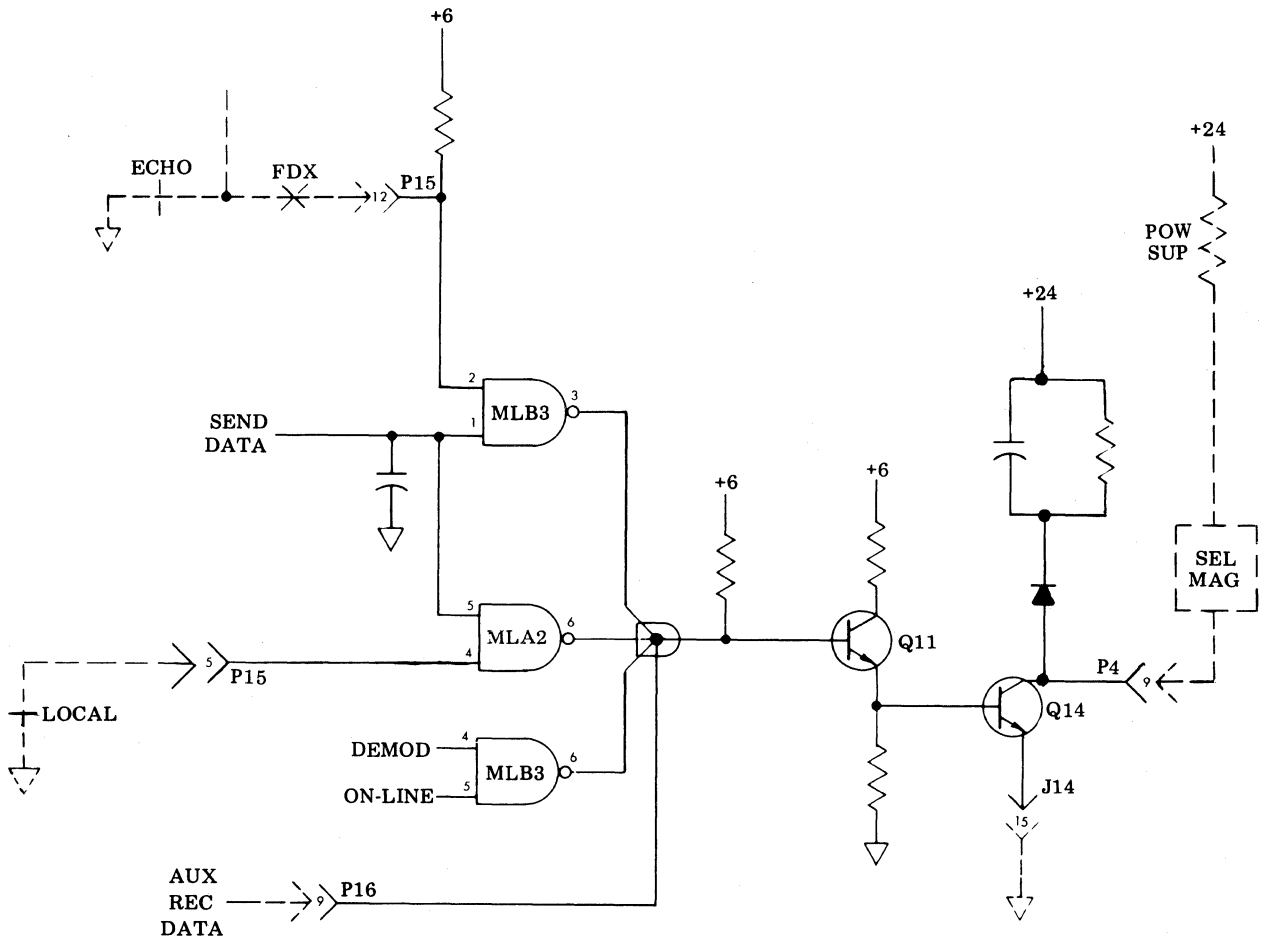

Figure 5 - Selector Magnet Driver Circuits

B. Selector Magnet Driver

3.07 The selector magnet driver is shown in Figure 5. Transistors Q11 and Q14, which drive the selector magnet, are controlled by a set of gates (and the Aux Rec Data input) wired-OR to the base of Q11. A high at MLB3-3, MLA2-6, MLB3-6, and the Aux Rec Data lead represents a mark, which turns on Q11 and Q14 and energizes the selector magnet. A low at any of the above points places a low (space) on Q11, turning Q11 and Q14 off to de-energize the selector magnet.

3.08 Gate MLA2-6 provides the selector drive signals in the local mode. With the LOCAL button depressed, a high applied through P15-5 to MLA2-4 enables this gate. Marks and spaces on the Send Data lead are applied to MLA2-5 to produce change at MLA2-6.

3.09 In the send mode, MLB3-3 provides the selector drive signals which provide local copy of the transmitted data. Assuming the FDX button is not depressed, a high at MLB3-2 enables this gate so it follows the signals on the Send Data lead (output of Figure 4). If the FDX button is depressed, a low is applied to MLB3-2 and the gate is disabled. However, if the ECHO button is depressed, the low is blocked from MLB3-2 and the returned signals are printed out.

3.10 Local printout in the receive mode is controlled by MLB3-6. This gate is enabled by the On-Line signal at MLB3-5. The signals received from the demodulator (modem card TP322490) then provide variations at MLB3-4, resulting in mark and space variations at MLB3-6.

3.11 The Aux Rec Data lead permits operation from user-supplied equipment connected to P16-9.

C. Originate/Answer Mode Control

3.12 The originate or answer mode selection is provided by the circuitry of Figure 6. The state of dc flip-flop MLA2-8/MLA2-11 provides alternate highs or lows on the Ans Mode and Orig Mode leads. The reset state of this flip-flop is MLA2-8 high and MLA2-11 low (answer mode). Reset is provided by a low at MLA2-9.

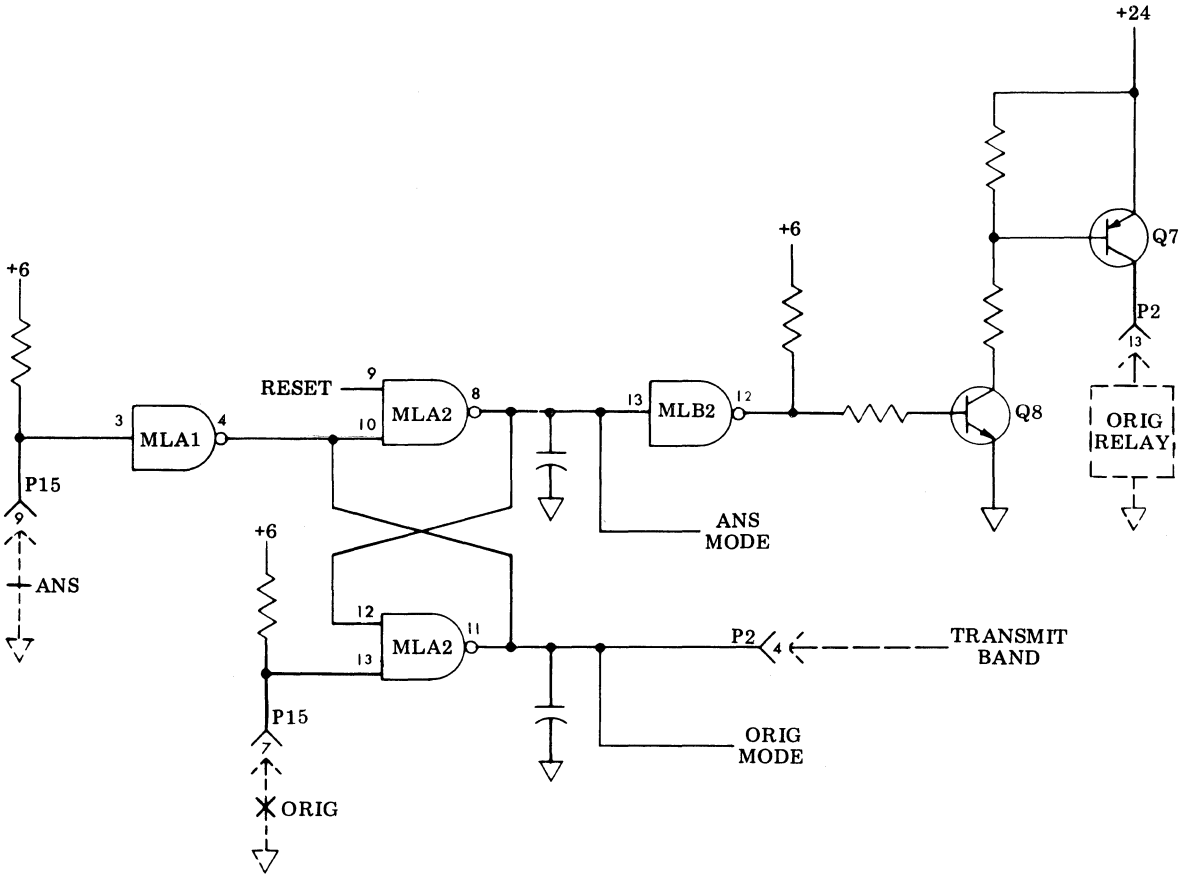

Figure 6 - Originate/Answer Mode Control Circuits

3.13 To place the circuit in the originate mode, the ORIG button is depressed. This places a low on MLA2-13, setting the flip-flop so that MLA2-11 is high and MLA2-8 is low. The low at MLA2-8, applied to MLB2-13, causes MLB2-12 to go high, turning on Q8 and Q7. This energizes the originate relay. The circuit remains in this state until a reset is applied to MLA2-9 or the ANS button is depressed to produce a high at MLA1-3. A high at MLA1-3 drives MLA1-4 and MLA2-10 low, resetting the flip-flop to the answer state and thus de-energizing the originate relay.

D. On-Line Control

3.14 The circuitry of Figure 7 initiates on-line operation in response to manual originate, manual answer, or auto answer control signals. In the off-line or reset state, this circuit provides a low at MLC3-3 and a high at MLC3-6.

3.15 Assuming the ANS button is not depressed, a low is applied through P15-9 to MLA1-13. This places a high at MLA1-12, and this high applied to MLC3-2 has no effect on the on-line flip-flop. If the ANS button is depressed, MLA1-13 goes high. This forces MLA1-12 and MLC3-2 low, setting the flip-flop to the on-line state (MLC3-3 high and MLC3-6 low).

3.16 Auto answer is provided by the R.I. contacts of an automatic DAA. Incoming ring pulses on the R.I. lead are integrated by C8 and after approximately a 200 ms delay, present a low at MLC3-1. This low sets the flip-flop to the on-line state.

3.17 The Orig Mode lead from the originate/answer flip-flop is monitored by MLA1-2. When the ORIG button is depressed (Figure 6), the resulting high on the Orig Mode lead forces MLA1-2 low. This low, applied to MLC3-2, sets the on-line flip-flop to the on-line state.

3.18 A high on the On-Line output of the flip-flop serves as an enabling signal on MLB3-9. The signals at the Send Data lead (MLB3-10) produce variations at MLB3-8 which are inverted by MLA3-6 and applied to the modulator of modem card TP322490.

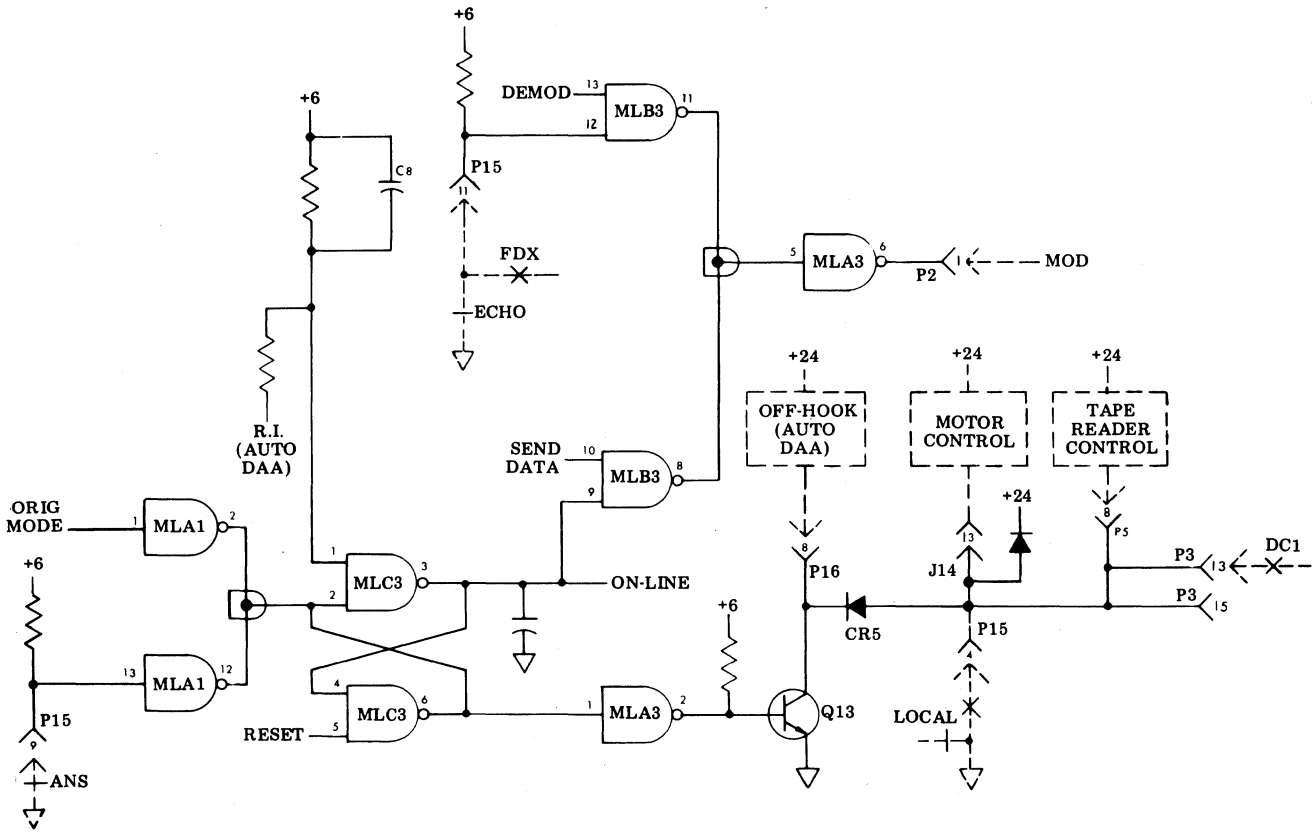

Figure 7 - On-Line and Motor Control Circuits

3.19 Gate MLB3-11 is used to couple the demodulator output to the modulator when the echo mode is selected. In their normal position the ECHO switch contacts disable this gate by applying a low to MLB3-12. When the ECHO button is depressed the contacts open and the gate is enabled. The demodulated signal at MLB3-13 is gated through MLB3-11 and MLA3-6 to the modulator, where it is transmitted to the remote terminal.

E. Motor Control

3.20 The circuits controlling the motor control relay and the off-hook and tape reader control relays are also shown in Figure 7. In the on-line mode, the low at MLC3-6 is inverted to produce a high at MLA3-2. This turns on Q13, energizing the off-hook, motor control, and tape reader control relays. In the clear mode MLC3-6 is high and MLA3-2 is low to turn off Q13. This de-energizes all three relays. In the local mode transistor Q13 is again turned off by a high at MLA3-2. However, the normally open contacts of the LOCAL switch close and energize the motor control and tape reader control relays. The off-hook relay is not energized in this mode because it is blocked from the local contacts by CR5.

3.21 A DC1 signal can be used to energize the tape reader relay. As shown in Figure 7, the DC1 provides a stunt box contact closure to ground which energizes the tape reader control relay. The off-hook relay is blocked by CR5 as explained for local operation.

F. Carrier Control, Originate/Answer Lamps

3.22 The circuit of Figure 8 monitors the carrier received by modem card TP322490 and the state of the originate/answer flip-flop (Figure 6) to light the ORIG or ANS lamp and to control the local carrier supplied to the remote terminal by the modem.

3.23 The Carrier Detect signal (high) from the modem is applied through P2-8 to MLB2-3, producing a low at MLB2-4. This low is inverted by MLB2-10 to produce a high at MLA2-2 and MLB1-2. Depending on the state of the originate/answer flip-flop, MLA2-3 or MLB1-3 will go low. If the ANS button is depressed the flip-flop will be in the answer mode and a high at MLB1-1 will cause MLB1-3 to go low. This low, applied to MLB1-12, forces MLB1-11 high and turns on Q1 to energize the ANS lamp. The high on the Ans Mode lead is also applied to MLB1-10. With a high on the On-Line lead (MLB1-9), MLB1-8 goes low and forces MLB1-6 high to turn on the Carrier Control lead. The Carrier Control signal, fed to the modem, turns on the carrier to the remote terminal. In the answer mode, a low on the Orig Mode lead disables MLA2-3 to prevent the ORIG lamp from turning on.

3.24 If the auto answer option is enabled, R.I. signals from an auto DAA are applied through P16-11 to MLB1-13. Each ring pulse places a low on MLB1-13, forcing MLB1-11 high to turn on Q1 and energize the ANS lamp. Thus, the lamp flashes to indicate the call. The operator can answer the call or depress the ANS button to place the terminal in the answer mode.

3.25 If the ORIG button is depressed, the originate/answer flip-flop places a high on MLA2-1 to enable this gate. A Carrier Detect signal from the modem results in a high on MLA2-2, forcing MLA2-3 low. Transistor Q9 is normally on, and turns off when MLA2-3 goes low. Monostable multivibrator MLC1 times-out in approximately 450 ms, determined by the C5R6 charge time, and MLC1-6 then goes high to turn on Q2 and energize the ORIG lamp. MLC1-8 goes low when MLC1 times-out, and this low serves as a clock pulse to flip MLC2. The resulting low at MLC2-8 is applied to MLB1-4, forcing MLB1-6 high. This high is applied through P2-7 to the modem, where it is used to produce the carrier to the remote terminal.

3.26 If the terminal is switched out of the originate mode, or if the carrier is lost, the resulting low at MLA2-1 or MLA2-2 forces MLA2-3 high to turn on Q9. This causes MLC1 to revert to its initial state, and the low at MLC1-6 turns off Q2 to de-energize the ORIG lamp. However, the high at MLC1-8 has no effect on MLC2. This flip-flop does not reset and turn off the Carrier Control lead until the on-line flip-flop is reset to place a low on MLC2-10.

3.27 The Demod (P2-14) and Remote Carr Aux Control (P16-10) leads provide normal and inverted equivalents of the Carrier Detect signal for customer-provided equipment and for demodulator data receive circuits.

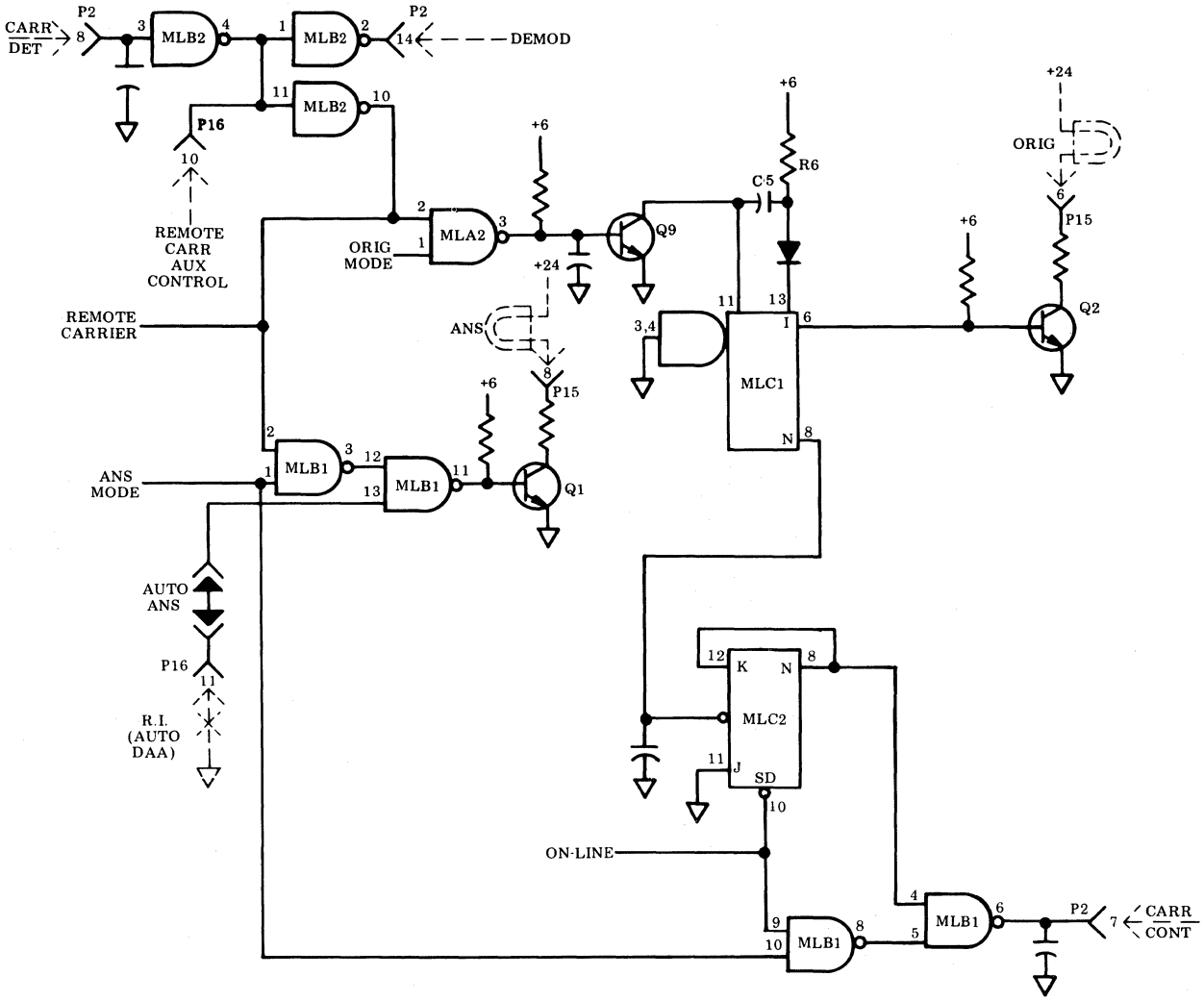

Figure 8 - Carrier Control and Originate/Answer Lamp Control Circuits

G. Answer-back Control

3.28 Figure 9 shows the circuits that control the answer-back. The inputs to this circuit are obtained from the carrier control, originate/answer circuits of Figure 8. The input at MLB2-9 is the gated Ans Mode and On-Line signal from MLB1-8 in Figure 8. The input at MLB2-5 is the inverted Carrier Detect signal from MLB2-4 in Figure 8. The outputs at MLB2-8 and MLB2-6 are wired-OR to control the state of the answer-back flip-flop.

3.29 With no carrier from the remote terminal, and with the local terminal in other than the answer mode, MLB2-9 and MLB2-5 are both high. This places a low on the K and SD inputs of the flip-flop, and at MLC3-10. The low on MLC3-10 holds MLC3-8 high, forcing MLC3-11 low to turn off Q12 and prevent the answer-back from being tripped. In this state the answer-back can be operated only by depressing the HERE IS key.

3.30 When the carrier is received from the remote terminal, MLB2-5 goes low and MLB2-6 attempts to go high. If the terminal is in the answer mode, (a low at MLB2-9), the wired-OR is permitted to go high because of the highs at both MLB2-8 and MLB2-6. This high is applied to MLC3-10. The flip-flop is initially in its set state, so MLC2-6 is high, placing a high on MLC3-9. Thus, the high on MLC3-10 forces MLC3-8 low. MLC3-11 goes high, turning on Q12 and energizing the answer-back trip magnet.

3.31 The Send Data lead is connected to the clock pulse input of the flip-flop. Once the answer-back cycle is initiated, the first space-to-mark transition of the answer-back message clocks the flip-flop and switches MLC2-6 low. This low, applied to MLC3-9, forces MLC3-8 high and MLC3-11 low to turn off Q12 and de-energize the trip magnet. The flip-flop remains in this state until MLB2-8 or MLB2-6 goes low to set it back to its initial state for the next call. Thus, a call in the answer mode triggers a cycle of the answer-back, and the answer-back message itself turns off the trigger circuit.

H. Reset Circuits

3.32 The manual and automatic reset circuits of Figure 10 are used to reset the various control circuits on the TP322491 logic card. A power-on reset is provided by capacitor C6 whenever the terminal is turned on. The initial low across C6 provides a high at MLA1-10 and a low at MLA1-6 which serves as a reset pulse for the logic circuits. C6 charges in approximately 200 ms, effectively removing the reset pulse to permit circuit operation. Diode CR2 limits the voltage across C6 to about 6.5 v. Diode CR1 discharges C6 rapidly when the power is turned off.

3.33 Reset is also produced by closure of the EOT contacts or by depressing the CLEAR button, either of which places a low directly on the wired-OR which forms the Reset lead. Depressing the LOCAL button provides a reset by placing a high on MLA3-11 and thereby forcing MLA3-10 low.

3.34 If the Paper Alarm option screw is omitted, reset is also produced by a paper alarm condition. When the alarm occurs, the normally closed contacts open to place a high on MLA1-9. This forces MLA1-8 low, providing a reset which inhibits answering any further calls. The normally open contacts close to energize the ALARM lamp. If the paper alarm option screw is installed, a permanent low is placed on MLA1-9. The only effect of the alarm condition is then to light the ALARM lamp.

3.35 Absence of remote carrier also produces a reset. When the terminal goes on-line, the on-line flip-flop (Figure 7) places a high on MLA3-13. This forces MLA3-12 low, turning off Q4, Q6, and Q3. With Q3 off, C7 charges toward +6 v through R10. When the charge reaches about -0.5 v (nominally 25 seconds), Q5 turns on. If the remote carrier is not present at the drain when Q5 turns on, a low is coupled to the source to provide a reset. Loss of carrier during transmission has the same effect. The timer is disabled when the on-line flip-flop is reset.

MODEM CARD (TP322490)

3.36 The TP322490 circuit card operates as a modulator/demodulator (modem) to provide signal conversion between the teletypewriter and telephone line. The modulator receives start-stop dc signals from the teletypewriter distributor and produces Frequency Shift Keying (FSK) signals suitable for transmission on the telephone line. The demodulator receives FSK signals from a remote terminal and converts them to dc signals suitable for operation of the teletypewriter. When used with the TP322491 logic card and a Data Access Arrangement (DAA), the modem provides all functions of a low speed FSK data set.

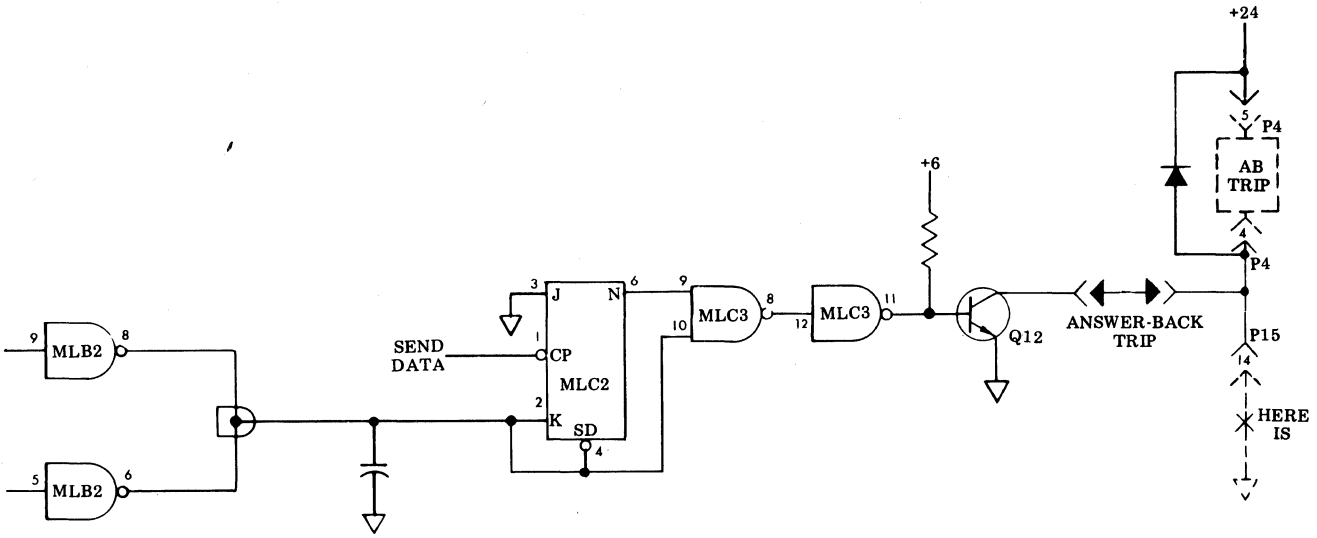

Figure 9 - Answer-back Control Circuits

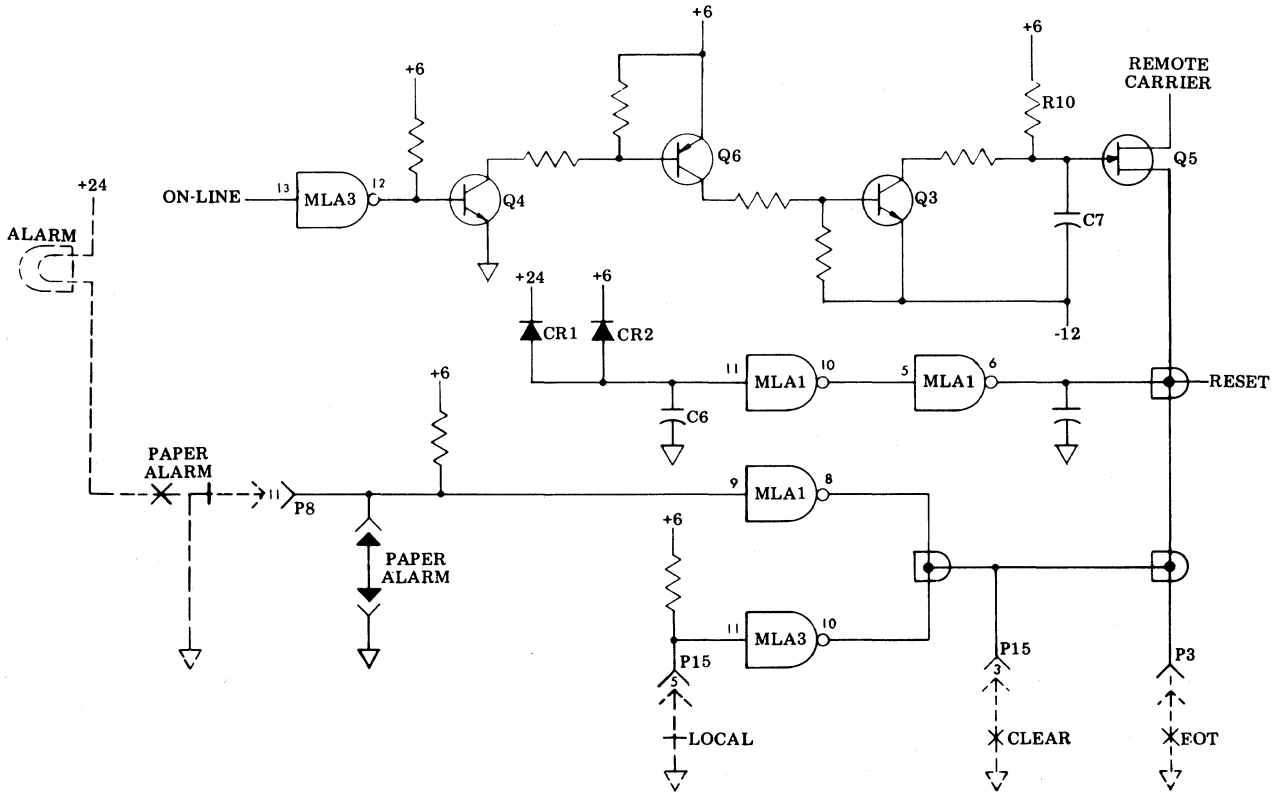

Figure 10 - Reset Circuits

3.37 The circuits on the modem card are illustrated in Figures 11 through 15. These circuits are shown in their entirety in wiring diagram 1216SD. They are broken-up and simplified in this section to emphasize the basic elements of the modem, which are described in the following paragraphs.

A. Tone Input/Output Circuits

3.38 The circuits of Figure 11 select and filter the marking and spacing tones fed from the modulator to the DAA and from the DAA to the demodulator. Switching is provided by relay K1, which responds to the Transmit Band signal from the originate/answer flip-flop on logic card TP322491. Filtering is provided by a low-pass filter (Z3, Z4, C19, C22, and C23) and a high-pass filter (Z1, Z2, C17, C20, and C21). Transformer T1 provides impedance matching between the DAA or telephone line and the filter circuits.

3.39 In the answer mode, the Transmit Band signal applied through J2-13 is low and relay K1 is de-energized. The K1 contacts are in the normal states shown in Figure 11. Incoming carrier signals applied between J2-12 and J2-15 are stepped up by T1 and applied to the filters. Low frequency tones (1070 Hz = F1 space; 1270 Hz = F1 mark) are passed through the low-pass filter and contacts 8, 9 of K1 to the demodulator amplifier. High frequency tones (2025 Hz = F2 space; 2225 Hz = F2 mark) are passed from the modulator through contacts 5, 6 of K1 and through the high-pass filter to T1, where they are coupled to the DAA or telephone line for transmission to the remote terminal.

3.40 In the originate mode, the originate/answer flip-flop applies a +24 v Transmit Band signal to J2-13, energizing relay K1. The K1 contacts change states, so the output of the high-pass filter is connected through contacts 10, 9 to the demodulator, and the modulator is connected through contacts 6, 7 to the input of the low-pass filter. Thus, low frequency tones from the modulator (1070 Hz = F1 space; 1270 Hz = F1 mark) are passed through the low-pass filter to Tl, and are coupled to the DAA or telephone line. High frequency tones from the remote terminal (2025 Hz = F2 space; 2225 Hz = F2 mark) are passed through the filter to the demodulator.

3.41 As a result of this switching action, the demodulator receives high band signals (F2s and F2m) in the originate mode and low band signals (F1s and F1m) in the answer mode, and the modulator supplies low band signals (F1s and F1m) in the originate mode and high band signals (F2s and F2m) in the answer mode. The filters prevent unwanted frequency conponents from interfering with the operation of the circuits.

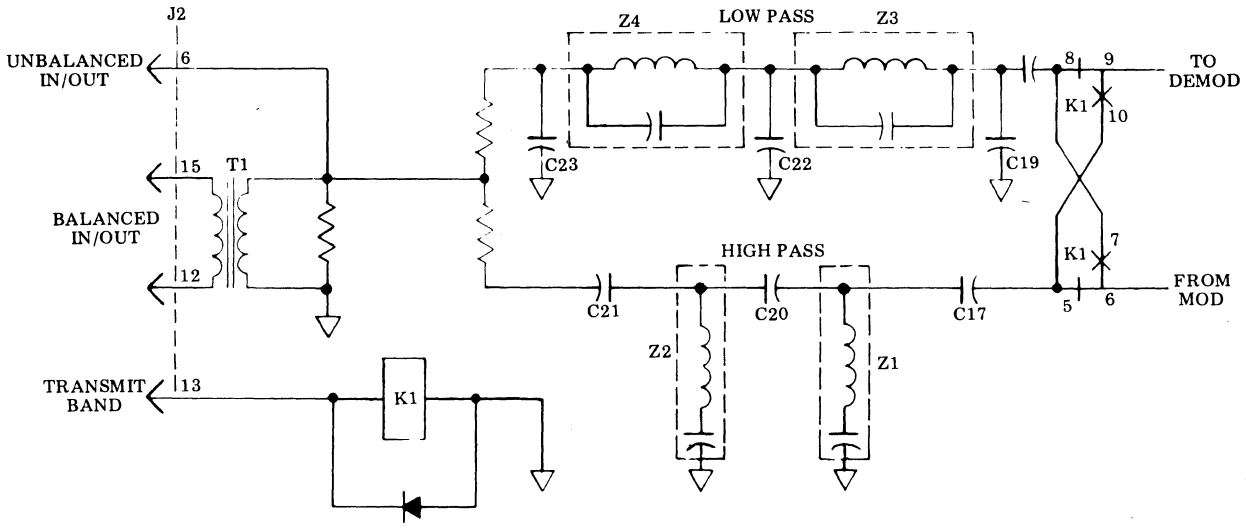

Figure 11 - Tone Input/Output Circuits

B. Demodulator Amplifier/Limiter and Discriminator Driver

3.42 Received tones are fed from the filter circuit through the K1 relay contacts to linear operational amplifier and limiter (OP1) as shown in Figure 12. The output of amplifier/limiter OP1 is applied to phase inverter Q4 and push-pull output transistors Q2 and Q3, which drive the primaries of discriminator transformers T2 and T3.

3.43 Transformer T2 is tuned to a frequency above the marking tone frequency (1270 or 2225 Hz), and T3 is tuned to a frequency below the spacing tone frequency (1070 or 2025 Hz). Thus, the voltage across T2 is high for marking tones and the voltage across T3 is high for spacing tones, and because of the push-pull operation the two voltages are out of phase. This results in the conventional S-shaped response curve for discriminator operation.

C. Discriminator Circuits

3.44 The discriminator circuits are shown in Figure 13. The tapped secondaries of T2 and T3 provide full-wave detection. The secondaries are tuned by capacitors C11 and C1 (plus C12 and C13 through the normally closed K1 contacts) in the answer mode. This provides detection of the 1070 Hz spacing tones (F1s) and 1270 Hz marking tones (F1m) received in the answer mode. In the originate mode the K1 contacts open to remove C12 and C13 from the secondary circuits. This reduces the capacitance and thereby raises the resonant frequencies of the T2 and T3 secondaries to detect the 2025 Hz spacing tones (F2s) and 2225 Hz marking tones (F2m) in the originate mode.

3.45 The mark and space outputs appear across R1C2 and R4C3, respectively. These dc voltages are series opposing so the spacing tones produce a negative output (the negative voltage across R4C3 exceeds the positive voltage across R1C2) and the marking tones produce a positive output (the positive voltage across R1C2 exceeds the negative voltage across R4C3).

3.46 The output of the discriminator is fed through low-pass filter R2C4, which attenuates any remaining carrier frequencies, to the gate of buffer amplifier Q1. This FET saturates when the carrier is marking (positive voltage on the gate), producing a low Receive Data Out at J2-14. The FET cuts off when the

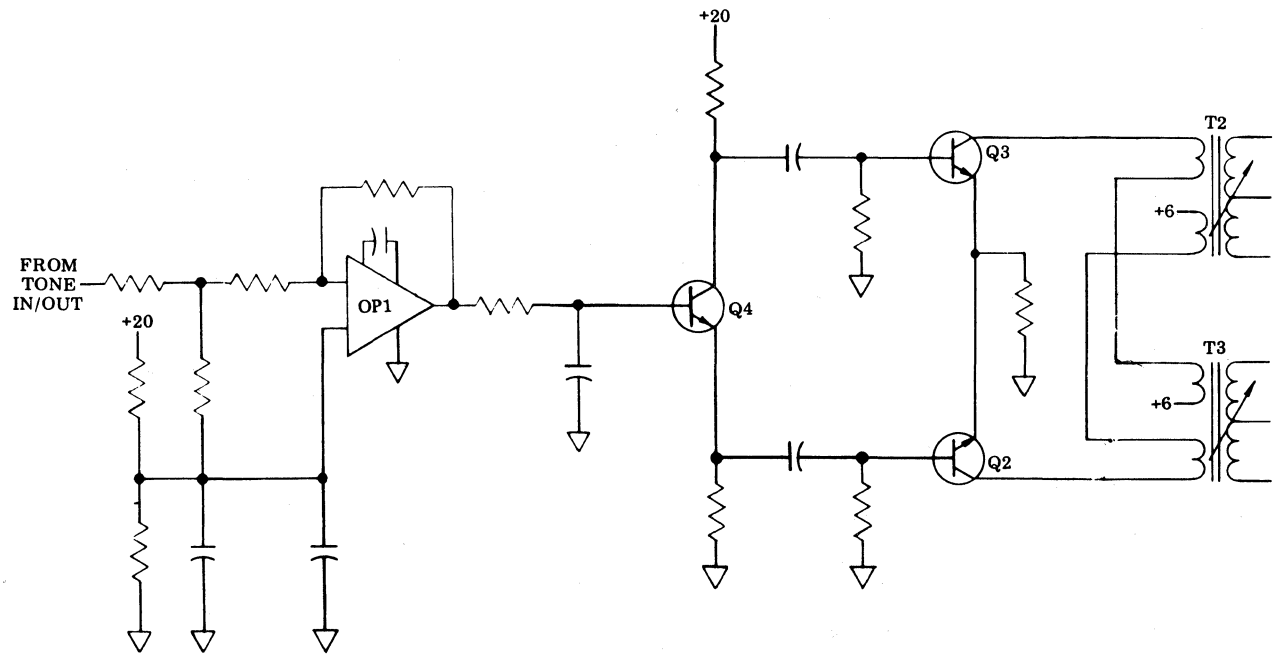

Figure 12 - Demodulator Amplifier/Limiter and Discriminator Driver Circuits

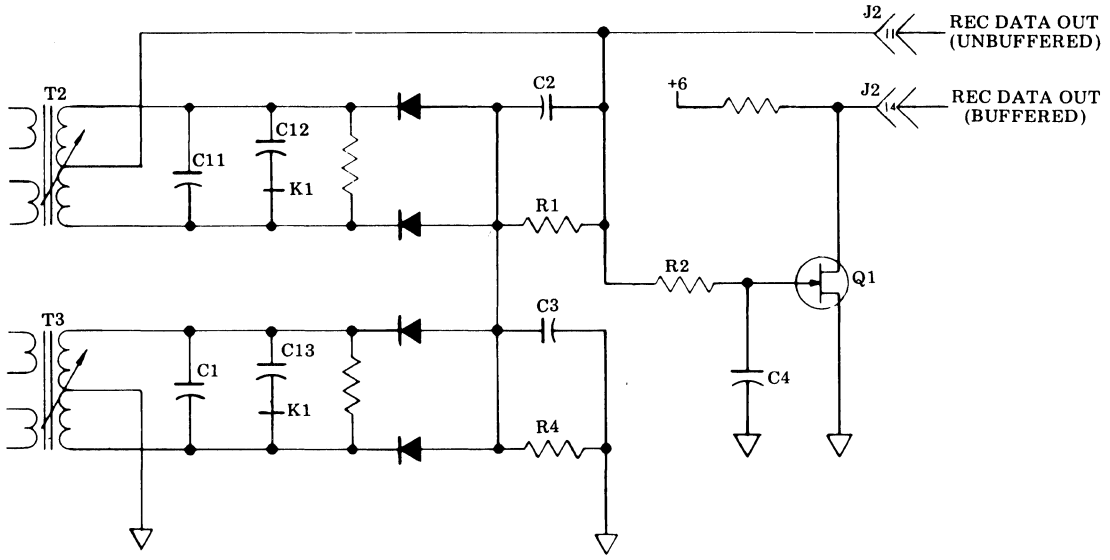

Figure 13 - Discriminator Circuits

carrier is spacing (negative voltage on the gate), producing a high Receive Data Out. An unbuffered Receive Data Out signal is applied directly from the discriminator output to J2-11 for customer use.

D. Carrier Detect Circuit

3.47 The Carrier Detect signal is produced by the circuit of Figure 14. This circuit samples the signal voltages across discriminator transformers T2 and T3 and produces an output only if adequate carrier is received. The carrier signals are coupled through C36 or C35 to C6. The pulses are rectified by CR7 in the base circuit of Q5. The output of Q5 is amplified and inverted by Q6 to produce a high at J2-8 when carrier is present and a low when no carrier or insufficient carrier is present. Capacitor C16 introduces a delay of approximately 0.2 second between the time carrier is present and the time the Carrier Detect signal appears at J2-8.

E. Modulator Circuit

3.48 The modulator produces the marking and spacing tones to be transmitted to the remote terminal. As shown in Figure 15, the clock pulses provided by a crystal-controlled oscillator are used to drive a nine-stage binary counter. The outputs of the counter stages are connected to four decoders which establish the high and low frequency marking and spacing tones.

3.49 The oscillator supplies a 1.00064 MHz clock signal to the first stage of the counter, which serves as a frequency divider. Each decoder receives inputs from all nine counter stages. The normal or inverted leads from the counter are selected so that all nine inputs to a given decoder are high on the following counts:

F1s - 467	F2s - 247
F1m - 394	F2m - 225

3.50 The clock pulse (CK) is also applied to each decoder. This negative pulse inhibits the decoders so the outputs cannot change until the clock pulse ends. This gives the counter stages time to switch to their new states and insures that the correct count will be decoded.

3.51 The Transmit Band and D.C. Data signals are also used to control the decoders. The Transmit Band signal is an indication of whether the terminal is in the originate or answer mode, and therefore selects either the low band (F1) or high band (F2) decoders. In the originate mode this signal is high to enable the two F1 decoders, and is inverted by MLA4-3 to disable the two F2 decoders. In the answer mode it is low to disable the F1 decoders and enable the F2 decoders.

3.52 The remaining control signal, D.C. Data, enables or disables spacing decoders F1s and F2s. As indicated in Figure 15, this signal is high for a space (enable) and low for a mark (disable).

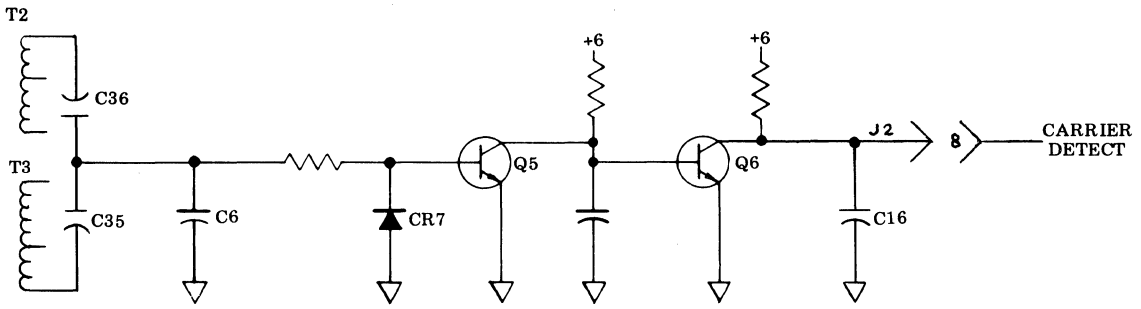

Figure 14 - Carrier Detect Circuits

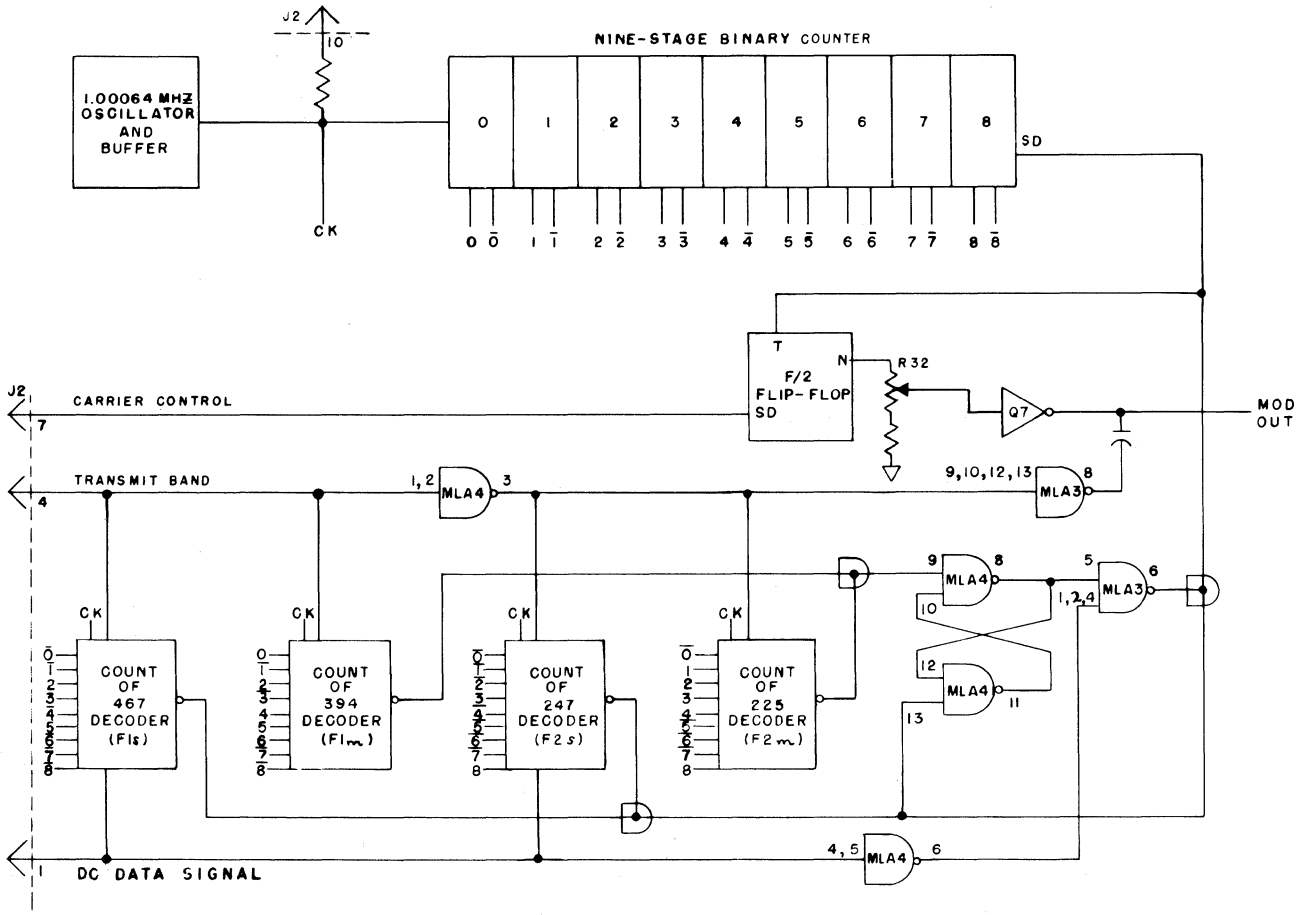

Figure 15 - Modulator Circuits

3.53 To see how the modulator generates the desired tone frequencies, assume the terminal is in the originate mode. The high Transmit Band signal enables F1s and F1m and disables F2s and F2m. The F1s and F1m carriers will therefore be produced by marking and spacing signals on the D.C. Data lead.

3.54 A mark (low) on the D.C. Data lead disables the F1s decoder, and is also inverted by MLA4-6 to place an enabling signal (high) on MLA3-1, 2, 4. When the count reaches 394, the output of the F1m decoder goes low. This low, applied to MLA4-9, sets MLA4-8 high to place a high on MLA3-5. Since MLA3-1, 2, 4 is held high by the marking signal, the high at MLA3-5 forces MLA3-6 low. This low is applied to the set direct leads of all counter stages, resetting the counter. It is also applied to the trigger input of a divide-by-2 flip-flop to toggle the flip-flop, and it is applied to MLA4-13 to reset the dc flip-flop and remove the high from MLA3-5. The reset on the counter clears the counter stages and thereby removes the reset pulse. The duration of the reset pulse is less than 100 ns, the nominal switching time of the logic.

3.55 The counter continues to cycle to the count of 394 as long as the mark is present on the D.C. Data lead. Each reset pulse at MLA3-6 is used to trigger the divide-by-2 flip-flop, and the output of the flip-flop changes for every reset pulse at its trigger input. The result is a square wave applied through R32 to amplifier Q7, which inverts the signal and applies it to the Mod Output lead.

3.56 At the clock frequency of 1.00064 MHz, the count of 394 produces a pulse frequency of approximately 2540 Hz at the output of the F1m decoder. Since the flip-flop toggles on every input pulse, the frequency of the rectangular wave at the modulator output is 1270 Hz, which is the desired marking tone frequency in the originate mode.

3.57 A space (high) on the D.C. Signal lead enables the F1s decoder and, inverted by MLA4-6, places a disabling signal (low) on MLA3-1, 2, 4. Although the output of F1m goes low at a count of 394, this change cannot be transferred to MLA3-6 as it was in 3.54. The count therefore continues to 467, which forces the F1s output low to provide counter reset and toggle the divide-by-2 flip-flop. The next count of 467 toggles the flip-flop as explained in 3.54, and the Mod Output is a rectangular wave at the desired spacing tone frequency (1070 Hz) as long as the spacing signal is present on the D.C. Data lead.

3.58 Notice that flip-flop MLA4-8, MLA4-11 is set by a low from the output of the F1m decoder every count of 394, even though this action has no effect on the output when a space is present. If a space-to-mark transition occurs between the count of 394 and 467, MLA3-6 goes low to produce a reset and trigger the divide-by-2 flip-flop.

POWER SUPPLY (TP188865)

3.59 The TP188865 power supply provides the dc operating voltages for the control and modem circuits of the call control unit. It also provides fused and switched ac operating voltages for the related equipment. The power supply circuitry is represented in the simplified diagram of Figure 16. More detailed circuitry is presented in wiring diagram 1195SD.

3.60 The 115 v ac obtained through the power cord is applied through power on/off switch S1 to the convenience outlet. This voltage can be used to operate equipment with a maximum power rating of 100 watts.

3.61 The Line Side (LS) of the line voltage is fused by F1 and applied to one of the normally open contacts of the motor control relay (K1). The LS line is connected through fuse F2 to one end of the power transformer primary. The Ground Side (GS) of the line is connected to the convenience outlet, to P14-11, and to the other side of the power transformer primary.

3.62 The secondary of power transformer T1 is tapped to provide the various operating voltages required by the call control unit. The full secondary voltage is applied to two full-wave rectifiers and filters which provide +24 v and -24 v dc outputs at P14-6 and P14-9, respectively. A portion of the secondary voltage is applied to a full wave rectifier and filter to provide +6 v dc which is fused and regulated to provide a regulated +6 v dc output at P14-10. A 6 v ac is applied from the secondary of T1 to P14-3. The common lead for each of these voltages terminates at P14-14 and P14-15.

3.63 The +24 v output is applied through current-limiting resistor R3 to P14-2. This output provides current for the selector magnet of the teletypewriter (Figure 5). The +24 v output is also applied to motor control relay K1, which connects through P14-13 to the motor control circuitry (Figure 7).

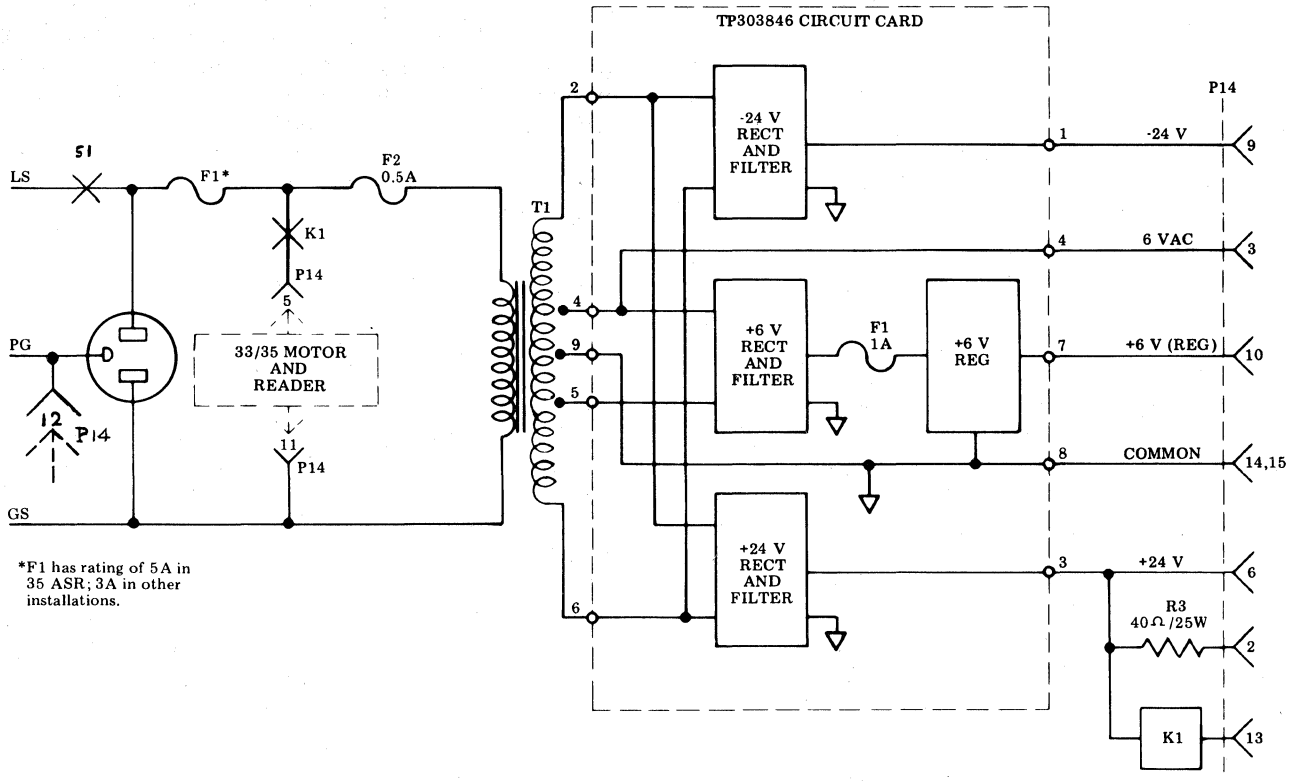

Figure 16 - Power Supply Circuits

3.64 As indicated by the broken line in Figure 16, the rectifier, filter, and regulator circuits are a part of circuit card TP303846. The card connector terminals are indicated by the numbered circles in the diagram.

4. INSTALLATION

4.01 The UCC39 call control unit is usually shipped assembled in the cabinet and connected to the teletypewriter. In this case the installer is required only to provide the signal and ac power connections and to check for any options or adjustments that may be necessary. If the call control unit is supplied separately, the installer must mount it in the cabinet and provide the necessary connections.

INSTALLING THE CALL CONTROL UNIT

4.02 The following instructions cover the various types of installation. Select the appropriate set of instructions and disregard those that do not apply.

A. Assembling the UCC39 Into a 33 RO, KSR, or ASR

4.03 With the cover of the teletypewriter open, position the call control unit so its mounting tabs align with the mounting holes on the right side of the teletypewriter base pan. Secure the unit to the base pan with the four mounting screws supplied with the unit. When the unit is properly mounted and adjusted, the pushbuttons on the keyswitch assembly will extend through the opening when the cover is closed.

4.04 Connect the cables from the teletypewriter to connectors 3 through 8 at the rear of the call control unit. (The connectors are numbered for identification.) Attach the ground lead at the rear of the UCC39 base to the corresponding tab on the 33 base pan.

4.05 Proceed with the interface cable connections, option check, and signal level adjustment in 4.30 through 4.33.

B. Assembling the UCC39 Into a 35 RO or KSR

4.06 With the cover of the teletypewriter open, position the call control circuit so its mounting tabs align with the mounting holes on the right side of the teletypewriter cabinet base. Secure the unit to the base pan with the four mounting screws supplied with the unit.

4.07 Remove the keyswitch assembly from its mounting bracket by loosening the four mounting screws and lockwashers (two each side; Figure 17). Remount the keyswitch assembly on adjustable bracket TP192270 of the teletypewriter cabinet base (front of call control unit) using the four TP181242 screws and TP125015 lockwashers supplied in the TP344395 set of parts.

Note: The answer-back relay and mounting hardware referred to in the following instructions are supplied with the TP344395 set of parts.

4.08 Assemble the TP178306 answer-back relay to the TP344353 bracket with two TP181242 screws inserted from the underside of the relay (Figure 18).

4.09 Connect the TP344355 cable leads to the relay terminals as indicated in Table A.

4.10 Mount the TP344354 insulator over the relay and bracket as shown in Figure 18. Secure the assembly with two TP7002 flat washers and TP3598 nuts on the TP181242 screws installed previously (Figure 18).

4.11 Mount the relay on the brackets from which the keyswitch assembly was removed. Secure the relay assembly by tightening the four mounting screws.

4.12 Connect the TP344355 cable leads to the terminals of the "T" power terminal block at the rear of the electrical service assembly as indicated in Table A.

4.13 Connect the cables from the electrical service assembly to connectors 3 through 8 at the rear of the call control unit. The connectors are numbered for identification.

4.14 Place a TP121249 cable clamp (TP344395 set of parts) on the TP344355 cable and secure the clamp to the LESU frame with a TP153841 screw, TP7002 flat washer, and TP3598 nut.

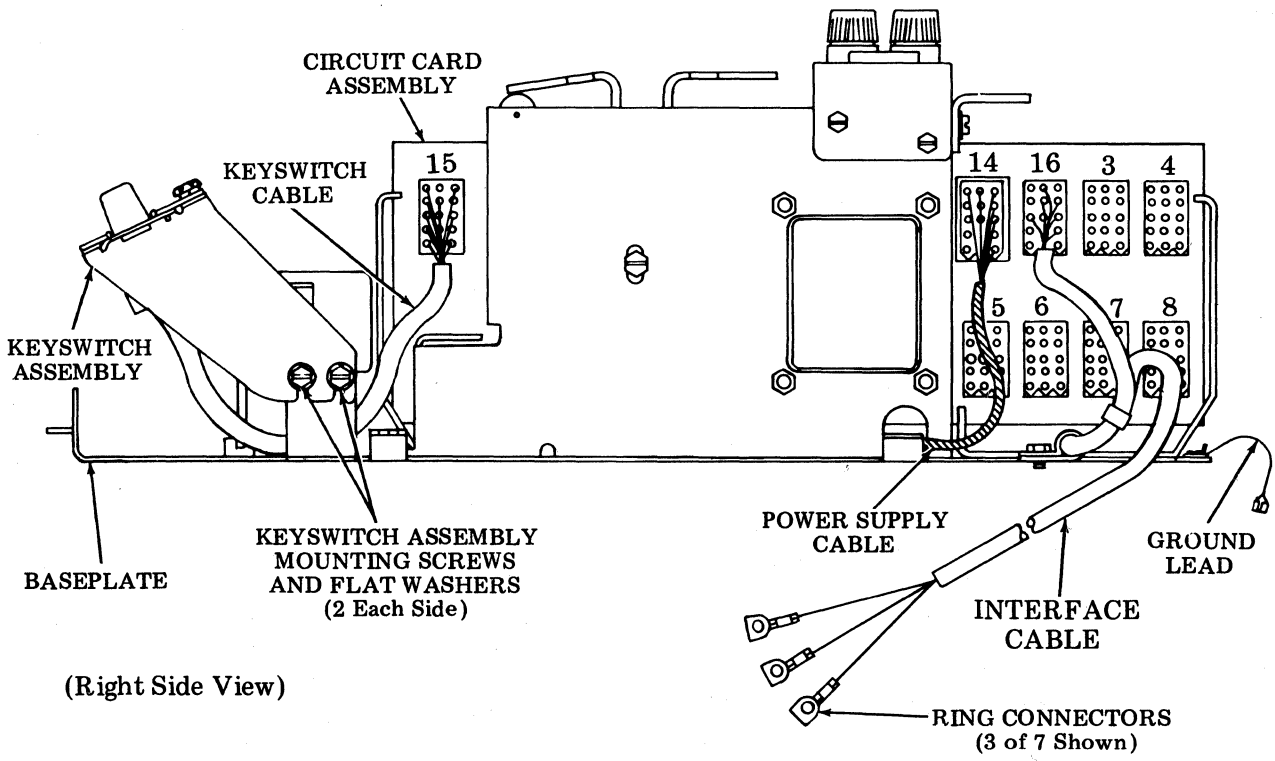

Figure 17 - UCC39 Call Control Unit Assembly

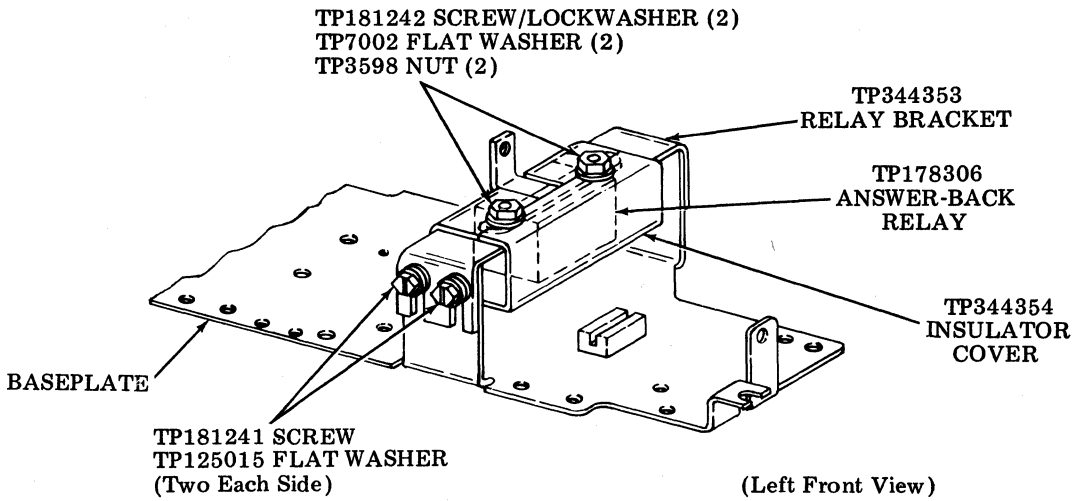

Figure 18 - Answer-back Relay Assembled to UCC39 Baseplate

4.15 Insert the TP186164 strap (TP344395 set of parts) in holes 8 and 9 of the "E" connector of the LESU.

4.16 Proceed with the interface cable connections, option check, and signal level adjustment in 4.30 through 4.33.

C. Assembling the UCC39 Into a 35 ASR

4.17 Remove cable connector 15 from its connector on the UCC39.

4.18 Remove the keyswitch assembly from its mounting bracket by loosening the four mounting screws and lockwashers (two each side; Figure 17). Remount the keyswitch assembly on adjustable bracket TP192270 of the cabinet base using the four TP181242 screws and TP125015 lockwashers supplied in the TP344395 set of parts.

Note: The answer-back relay and mounting hardware referred to in the following instructions are supplied with the TP344395 set of parts.

4.19 Assemble the TP178306 answer-back relay to the TP344353 bracket with two TP181242 screws inserted from the underside of the relay (Figure 18).

4.20 Connect the TP344603 cable leads to the relay terminals as indicated in Table A.

4.21 Mount the TP344354 insulator over the relay and bracket as shown in Figure 18. Secure the assembly with two TP7002 flat washers and TP3598 nuts on the TP181242 screws installed previously (Figure 18).

4.22 Mount the relay on the brackets from which the keyswitch assembly was removed. Secure the relay assembly by tightening the four mounting screws.

4.23 Mount the call control unit near the right end of the lower shelf on the pedestal of the teletypewriter. Use the two TP153441 mounting screws, TP3639 lockwashers, and TP125231 nuts supplied with the call control unit. Insert the screws, with lockwashers, through the UCC39 baseplate into the pedestal shelf, and mount the nuts from the underside of the shelf.

4.24 Connect the TP344603 cable leads to the terminal of the "T" power terminal block at the rear of the electrical service assembly as indicated in Table A.

4.25 Connect the cables from the electrical service assembly to connectors 3 through 8 at the rear of the call control unit. The connectors are numbered for identification.

4.26 Connect the male plug end of the TP344602 extension cable to connector 15 of the cable from the keyswitch assembly. Connect the other end of the extension cable to connector 15 of the call control unit.

4.27 Place a TP121249 cable clamp (TP344395 set of parts) on the TP344603 cable and secure the clamp to the LESU frame with a TP153841 screw, TP7002 flat washer, and TP3598 nut.

TABLE A

TP344355 OR TP344603 CABLE CONNECTIONS

CABLE LEAD	TP178306 RELAY TERMINAL	"T" POWER TERMINAL BLOCK	"C" WIRING FIELD	
			LESU381 (35 ASR)	LESU382 (35 RO/KSR)
Black	1			
Red	3			
Slate*	4		C6K	C1F
Brown*	5		C5D	C2C
Blue		5		
Green		6		
White		7		
White/Brown		8		
White*			C3N	C4G
Yellow*			C3M	C3G
Orange			C8A	C5F
White/Black			C3A	C5D
White/Red			C6G	C5E
White/Green			C4A	C2D
Black/Yellow			C7A	C4F

*Wires so indicated are 18 AWG. All others are 24 AWG.

4.28 Insert the TP186164 strap (TP344395 set of parts) in holes 6 and 8 of the "E" connector of the LESU.

4.29 Proceed with the interface cable connections, option check, and signal level adjustments in 4.30 through 4.33.

CONNECTING THE INTERFACE CABLE

4.30 The interface cable (connector 16) must be connected to the DAA. The cable leads are connected by ring terminals to the corresponding DAA connection points as indicated in Table B. All leads are used for an auto DAA. Only the DT (orange) and DR (red) leads are used for a manual DAA, and the remaining leads may be cut or taped.

TABLE B

INTERFACE CABLE CONNECTIONS

COLOR OF WIRE	CONNECTION	
	AUTO DAA	MANUAL DAA
White	+24 v	NR
Blue	Common	NR
Black	Data Transmission (DA)	NR
Green	Off-Hook (OH)	NR
Yellow	Ring Indicator (RI)	NR
Orange	Data Tip (DT)	Data Tip (DT)
Red	Data Ring (DR)	Data Ring (DR)

NR = Not required. Lead may be cut or taped.

OPTIONS

4.31 Three screw options are provided on the TP322491 logic card. Sets are usually shipped with the options preprogrammed to the customer's order. The installer should check and, if necessary, program the options as shown in Table C. The screws are labeled on the circuit card.

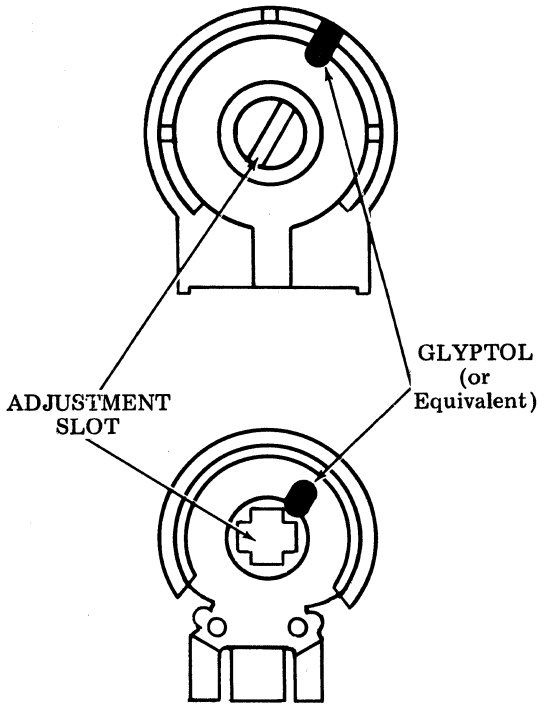

Figure 19 - Application of Glyptol to Secure Potentiometer Adjustment (Two Types of Potentiometers Shown)

SIGNAL LEVEL ADJUSTMENT

4.32 The level of the modulator output signal is set by potentiometer R32 on the TP322490 card. This level is preset before the call control circuit is shipped, but may require some adjustment at the time of installation.

4.33 The output level is factory adjusted to -6 ±1/2 dBm. If the specified input to the DAA is -6 dBm, as determined by the installer of the DAA, no further adjustment is required. If the specified maximum level to the DAA is other than -6 dBm, the level should be adjusted accordingly. This is done by connecting a 600 ohm noninductive resistor across the DT and DR leads of the interface cable and, with a voltmeter across the resistor, adjusting R32 to the following voltage level:

0 dBm — 0.8 v	- 8 dBm — 0.3 v
-2 dBm — 0.6 v	-10 dBm — 0.25 v
-4 dBm — 0.5 v	-12 dBm — 0.2 v
-6 dBm — 0.4 v	

After the adjustment is complete, cement R32 with a drop of glyptol as shown in Figure 19.

TABLE C

OPTION SCREWS ON TP322491 CONTROL LOGIC CARD

OPTION SCREW	OPTION	EFFECT ON OPERATION	
		SCREW IN	SCREW OUT
OPT 1	Send Inhibit	Keyboard and tape reader do not transmit to remote terminal in echo mode.	Keyboard and tape reader can transmit to remote terminal in echo mode.
OPT 2	Low Paper (Friction Feed) Paper Out (Sprocket Feed)	Low paper or paper out lights alarm lamp, but does not affect operation of terminal.	Low paper or paper out lights alarm lamp and prevents subsequent call connection with remote station. If TP322491 logic card has issue number 3 or lower, disconnect will occur during existing call.
OPT 4	Answer-back Trip	Answer-back is tripped upon call connection when remote carrier is received in answer mode.	Answer-back is not tripped by completion of call in answer mode.

Note: There is no option screw OPT 3 on the circuit card.