

REPLACING PAGE ADDENDUM

Filing Instructions:

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DATA AUXILIARY SETS 801C3 AND 801C4
FOR AUTOMATIC CALLING
THEORY OF OPERATION AND SUPPLEMENTARY INFORMATION

1. GENERAL

1.001 This addendum supplements Section 598-012-151, Issue 1. The attached pages must be inserted in the section in accordance with the filing instructions above.

1.002 This addendum is issued to add information on the use of the Automatic Calling Unit speaker to monitor normal data calls.

The following changes apply to Part 1 of this section.

(a) 1.08—revised

(b) Fig. 1—revised

3. DESCRIPTION

The following changes apply to Part 3 of this section:

(a) Table C—revised

(b) Fig. 4—revised

(c) 3.15—revised

(d) 3.21—revised

(e) 3.22—revised

(f) 3.23—revised

(g) Fig. 6, Sheets 1 and 2—revised

(h) Fig. 7—revised

(i) Fig. 8—revised

4. PERFORMANCE DATA

The following change applies to Part 4 of this section:

(a) 4.02—revised

Attached:

Pages 1, 2, 7, 8, 9, 10, 13/14, 15/16, 17, 18, 21, 22, 23, 24—revised March 1972

DATA AUXILIARY SETS 801C3 AND 801C4
FOR AUTOMATIC CALLING
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1. GENERAL

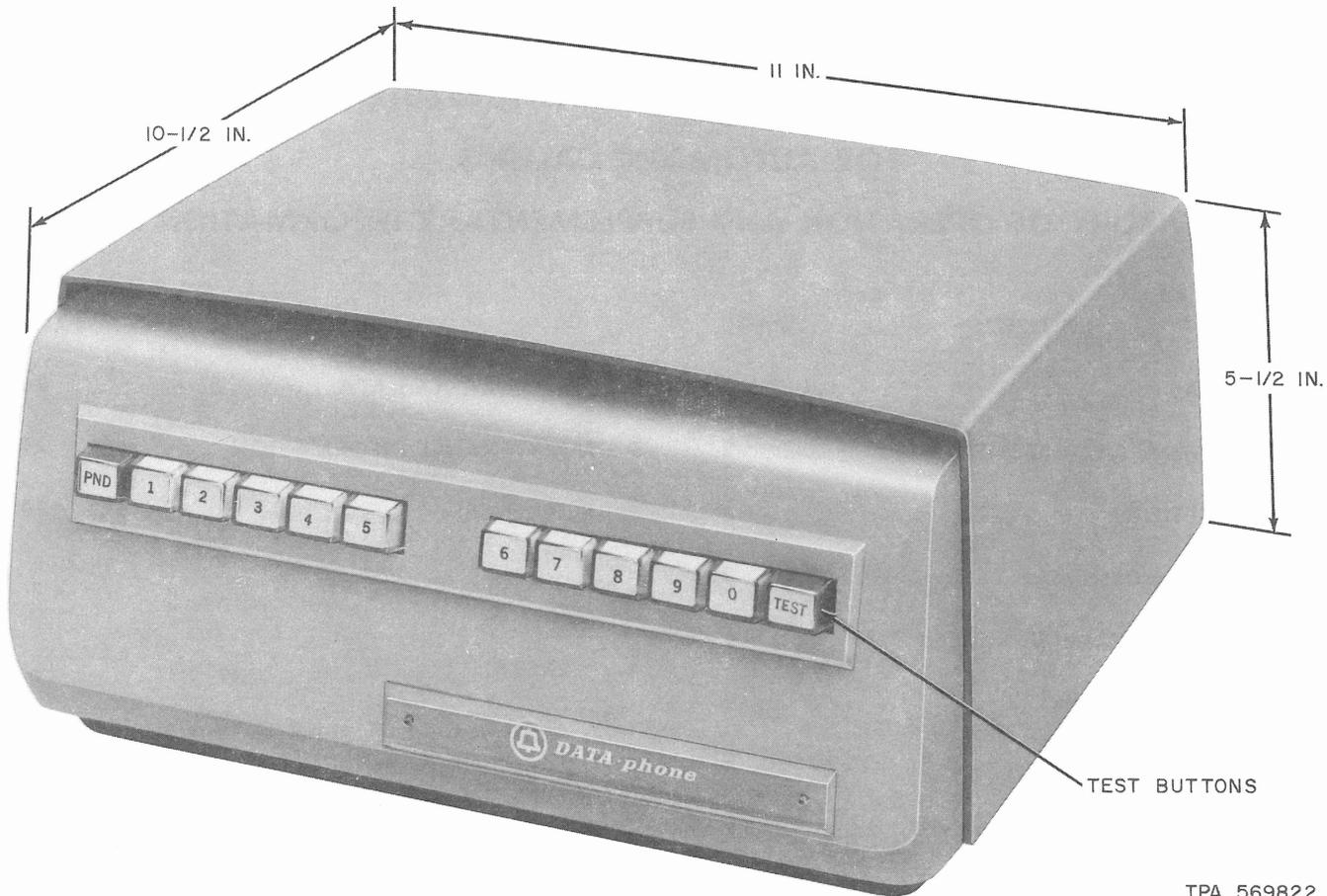
1.01 This section is issued to provide additional information on the theory of operation and other supplementary information on Data Auxiliary Sets 801C3 and 801C4. The information is given in sufficient detail to provide background knowledge of the design and operation of these data auxiliary sets. This section also includes input and output information on the Automatic Calling Unit (ACU). This information will allow qualified personnel to become familiar with this equipment and to perform extensive troubleshooting on the ACU.

1.02 The Data Auxiliary Sets 801C3 and 801C4 are referred to in this practice as an ACU or by the numerical designation 801C3 or 801C4.

1.03 The information contained in this section supplements the information contained in other sections and is not required for installation or servicing of the ACU under normal circumstances.

1.04 Information concerning the business machine is limited to signal characteristics and other general information of this type that is required to determine if the ACU can be used with and is compatible with the equipment in a proposed installation.

1.05 Data Auxiliary Set 801C3 or 801C4 is shown in Fig. 1. This illustration shows the physical dimensions of the ACU.



TPA 569822

Fig. 1—Data Auxiliary Set 801C3 or 801C4—Front View

1.06 The ACU is designed to accept information furnished by a business machine and to originate DATA-PHONE® calls automatically by transmitting the required TOUCH-TONE® frequencies necessary to initiate the call.

1.07 The ACU is designed to operate properly within the environmental limits specified.

(a) Temperature Range: +40 to +120°F

(b) Humidity Range: 20 to 95 percent

Note: The ACU must not be subjected to an environment that will cause condensation inside the cover.

1.08 The ACU requires an external source of ac power: Voltage 117 rms ±10 percent, 60 Hz.

2. EQUIPMENT ARRANGEMENTS

2.01 The ACU is connected directly to and is under control of the business machine. The ACU is connected to the business machine by a cord furnished by either the business machine manufacturer or the customer. A cord to connect the ACU to the associated data set is furnished with the ACU.

2.02 The assignment of the ACU interface lead designation is given in Table A, which also gives the terminal numbers and lead assignment.

2.03 The ACU can be used with any business machine that furnishes a compatible voltage level signal to the ACU. For additional information and specifications on the ACU interface, refer to the Bell System Data Communications Technical

TABLE A
ACU INTERFACE LEAD ASSIGNMENT

NAME	TERMINAL
Frame Ground (FGD)	1
Digit Present (DPR)	2
Abandon Call and Retry (ACR)	3
Call Request (CRQ)	4
Present Next Digit (PND)	5
Power Indication (PWI)	6
Signal Ground (SGD)	7
+Power (+P) } Not for customer	9
-Power (-P) } use	10
Data Set Status (DSS)	13
Data Signal Circuit (Number Bit NB1)	14
Data Signal Circuit (Number Bit NB2)	15
Data Signal Circuit (Number Bit NB4)	16
Data Signal Circuit (Number Bit NB8)	17
Data Line Occupied (DLO)	22

Reference on 801C-Type Automatic Calling Unit Interface Specification and the following text.

2.04 The operation of the ACU is controlled by the binary signals transmitted by the business machine. The voltage levels and polarity of the signals determine the lead status or condition, ie, an "on" condition can be represented by a specific voltage range and an "off" condition by a different range. A change in polarity may also be used to define an "on" or "off" condition. The "1" or "0" condition of a lead is defined in the same way.

2.05 The signal ranges which are acceptable and which will correctly operate the ACU circuits are given in Table B.

2.06 The ACU receives the digits of the number to be called on the NB1, NB2, NB4, and NB8 leads. These four leads are used in parallel for the reception of the binary form of each digit. Table C indicates the binary condition of each lead for any given digit or code and shows the transmitted frequencies for each digit or code.

Note: The ACUs that are series 3 or later have a 12-combination TOUCH-TONE transmitter

instead of the previously supplied 10-combination TOUCH-TONE unit.

3. DESCRIPTION

A. System Description

3.01 The ACU is connected directly to the telephone line, the data set, and the business machine. The connection to the business machine is provided by the customer-furnished mounting cord. These connections and the conductor designations are shown in Fig. 2. The connections to the data set and telephone are provided by an M14C or D10P cord supplied with the ACU. Table D shows the cord connections to the ACU terminal board (TB) 2 (See Fig. 3).

3.02 The output of the ACU is connected directly to the telephone line, thereby allowing the ACU to call the requested number, to verify that the connection has been established, and to transfer the line to the data set.

3.03 The voltage level signals transmitted to the ACU by the business machine are covered in Table B. The output of the ACU consists of TOUCH-TONE frequencies as shown in Table C.

TABLE B
INTERFACE SIGNALS

LEAD DESIGNATION	VOLTS DC			
	ON	OFF	ONE	ZERO
CRQ	+3 to +25	-3 to -25	—	—
DPR	+3 to +25	-3 to -25	—	—
NB1	—	—	-3 to -25	+3 to +25
NB2	—	—	-3 to -25	+3 to +25
NB4	—	—	-3 to -25	+3 to +25
NB8	—	—	-3 to -25	+3 to +25
PND	+5 to +20	-5 to -20	—	—
DLO	+5 to +20	-5 to -20	—	—
DSS	+5 to +20	-5 to -20	—	—
ACR	+5 to +20	-5 to -20	—	—
PWI	+5 to +20	511 Ω to Ground	—	—

*Assuming load is not less than 3000 ohms

B. ACU Functional Description

3.04 A functional block diagram of the ACU is shown in Fig. 4. This shows the various functional circuits that make up the ACU.

Ground Start Call Origination (V or ZK Option)

3.05 Automatic origination of calls can be accomplished by providing an ACU arranged for ground-start or for loop-start operation.

3.06 When the ACU uses a ground-start, a call is originated by the business machine presenting a call request (CRQ) signal on the CRQ lead. If the telephone line is idle, the ACU seizes the line from the data set and appears off-hook by grounding the ring side of the line. In response to the central office ground on the tip side of the line, the ACU removes the ring ground, closes the loop, and turns on the data line occupied (DLO) lead. The oscillator timer now requests a digit from the business machine by turning on the present next digit (PND) lead. The ACU is now ready to dial any number presented by the business machine.

3.07 The business machine presents the binary form of the digit to be dialed (see Table C). The most significant bit is presented on the NB8 number lead, the next significant bit on the NB4

lead, the next bit on the NB2 lead, and the least significant bit on the NB1 lead. For example, the digit 5 would be presented by NB8 = 0, NB4 = 1, NB2 = 0, and NB1 = 1. When the number leads have been set, the business machine signals the ACU by turning on the digit present (DPR) lead. The TOUCH-TONE transmitter then transmits the corresponding dual-frequency signal to the central office. After transmission of the TOUCH-TONE signal, the oscillator timer turns off the PND lead. The business machine turns off the DPR lead and sets the number leads for the next digit. The interdigital delay timers delay the start of the next cycle until the central office response time requirements are met and the oscillator timer then turns on the PND lead. This signals the business machine to set the number leads and turn on the DPR lead, repeating the above sequence.

3.08 A delay by the business machine in turning on the DPR lead, after the oscillator timer turns on the PND lead, reduces the dialing rate. If the delay in turning on the DPR lead exceeds the ACR timer interval, an Abandon Call and Retry signal is given on the ACU lead. If this delay exceeds the maximum interdigit time allowed by the central office, the call will be dropped.

3.09 After the last digit has been dialed, the business machine's response to the PND

NOTE:
CROSS-CONNECTIONS
WILL VARY WITH TYPE
OF DATA SET PROVIDED.

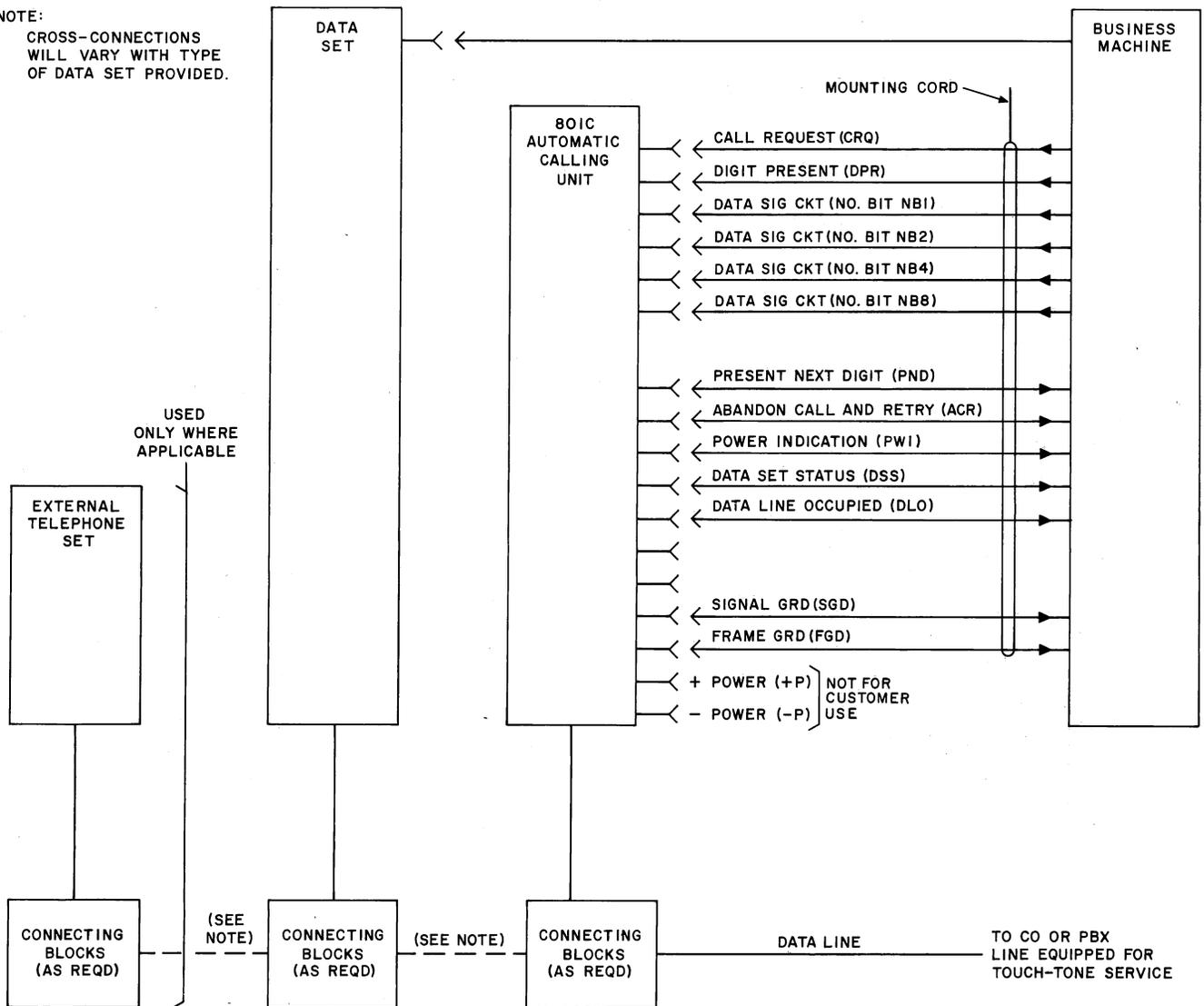


Fig. 2—Data Auxiliary Set 801C3 and 801C4—Typical Interconnecting Block Diagram

signal determines the action of the ACU. When the business machine presents the end-of-number (EON) code on the number leads while the DPR lead is on, the telephone line is transferred to the associated data set and the data set is placed in an off-hook condition. When this mode of operation is used, the data set must be capable of answer-tone detection. When an answer tone is received, the data set informs the ACU that it has gone into the data mode. When the data set enters the data mode, the ACU informs the business machine by turning on the DSS lead. When the ACU is equipped with answer-tone detection, the EON code is not used. The PND lead is turned on after

the last digit has been dialed; however, the DPR lead is held off by the business machine. Upon the detection of a valid answer signal, the ACU transfers the telephone line to the associated data set and places the data set in the off-hook condition. When neither an EON indication nor a valid answer signal is received within the ACR timer interval, the ACR lead is turned on.

Loop-Start Call Origination (Y Option)

3.10 If the ACU is equipped for loop-start operation, the sequence of operation is similar to ground-start operation. In response to a call

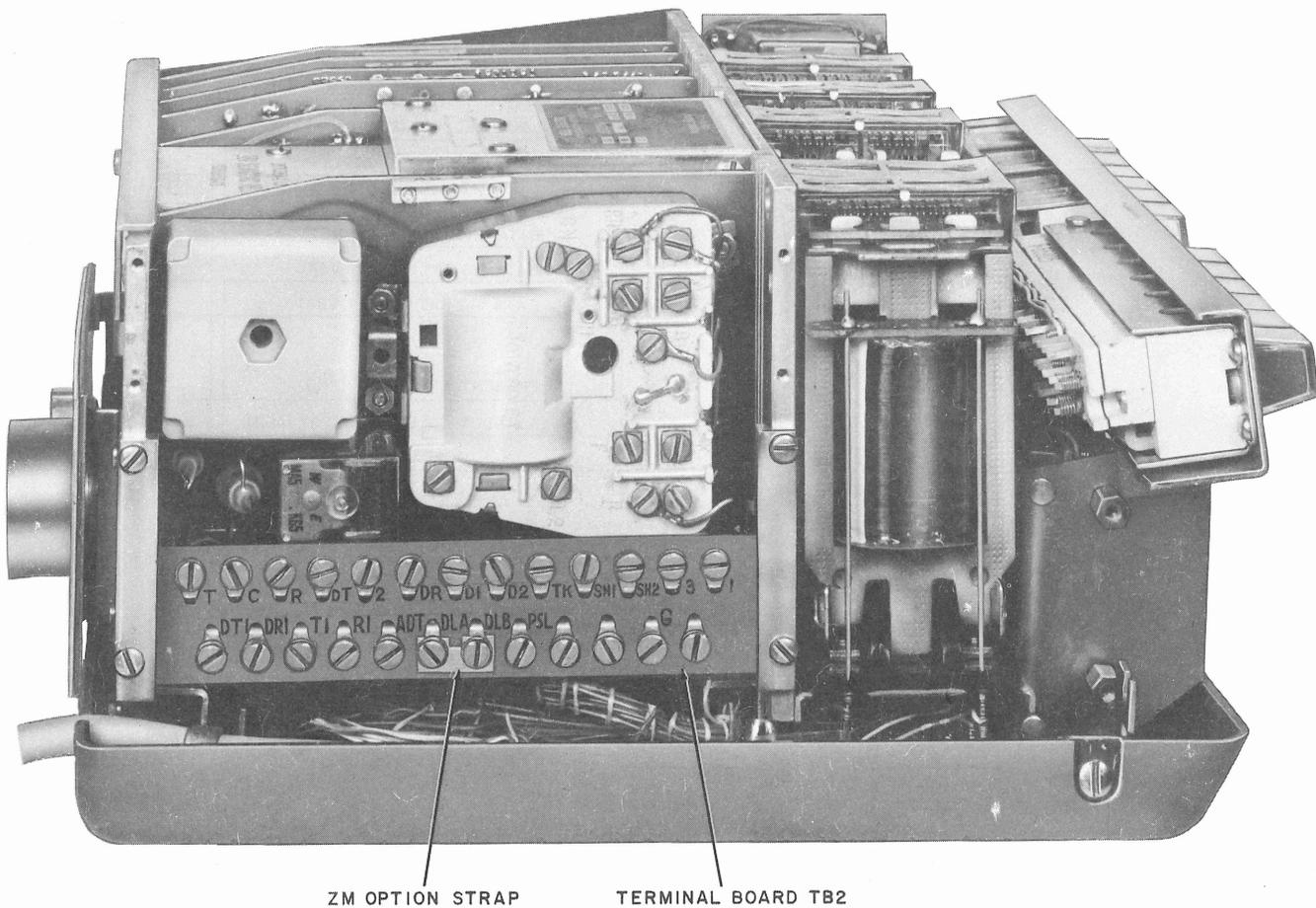


Fig. 3—Data Auxiliary Set 801C3 or 801C4—Covers Removed Showing the Location of Terminal Board TB 2

request signal from the business machine, the ACU seizes the telephone line from the data set and goes off-hook by placing the telephone network across the line. When the TOUCH-TONE dual-frequency dial tone is received and detected, the ACU signals the business machine that the data line is occupied by turning on the DLO lead. A digit is requested from the business machine by the oscillator timer turning on the PND lead. From this point of procedure, call origination is identical to the previously described ground-start call origination sequence.

Manual Origination of Calls

3.11 A call may be originated manually by using the telephone associated with the data set. When the data set is in the talk mode, an off-hook indication is presented to the ACU. The ACU

presents a DLO signal to the business machine to inhibit the call request circuit, thereby preventing the business machine from originating a call. When a loop-start telephone line is used, the ACU plays no further part in originating the call. When the call is terminated, the data set presents an on-hook indication to the ACU, and the DLO lead is turned off. The intercall timer is then activated, preventing the ACU from recognizing a call request "on" signal from the business machine for a period of one second.

3.12 When a ground-start line is used, the ACU responds to an off-hook signal from the data set by seizing the telephone line and presenting an off-hook condition to the central office. When the central office has recognized the off-hook condition, the telephone line is returned to the data set. The call request circuit is disabled and

TABLE C

DIGIT	NB8	NB4	NB2	NB1	TRANSMITTED FREQUENCIES
0	0	0	0	0	941,1336
1	0	0	0	1	697,1209
2	0	0	1	0	697,1336
3	0	0	1	1	697,1477
4	0	1	0	0	770,1209
5	0	1	0	1	770,1336
6	0	1	1	0	770,1477
7	0	1	1	1	852,1209
8	1	0	0	0	852,1336
9	1	0	0	1	852,1477
*	1	0	1	0	941,1209
#	1	0	1	1	941,1477
EON (See Note)	1	1	0	0	— —

Note: The EON code is used to indicate when the business machine has completed dialing and is a signal to the ACU that the telephone line is to be transferred back to the data set. A TOUCH-TONE digit is also transmitted when the EON code is presented. The CP AS28 card transmits a 7-digit tone and the CP AS64 card simultaneously transmits a 5-digit tone. These tones are not part of the called number but are spurious tones generated as a result of the DAS 801C digit logic. Since they are in addition to the called number, they are not accepted by the central office equipment.

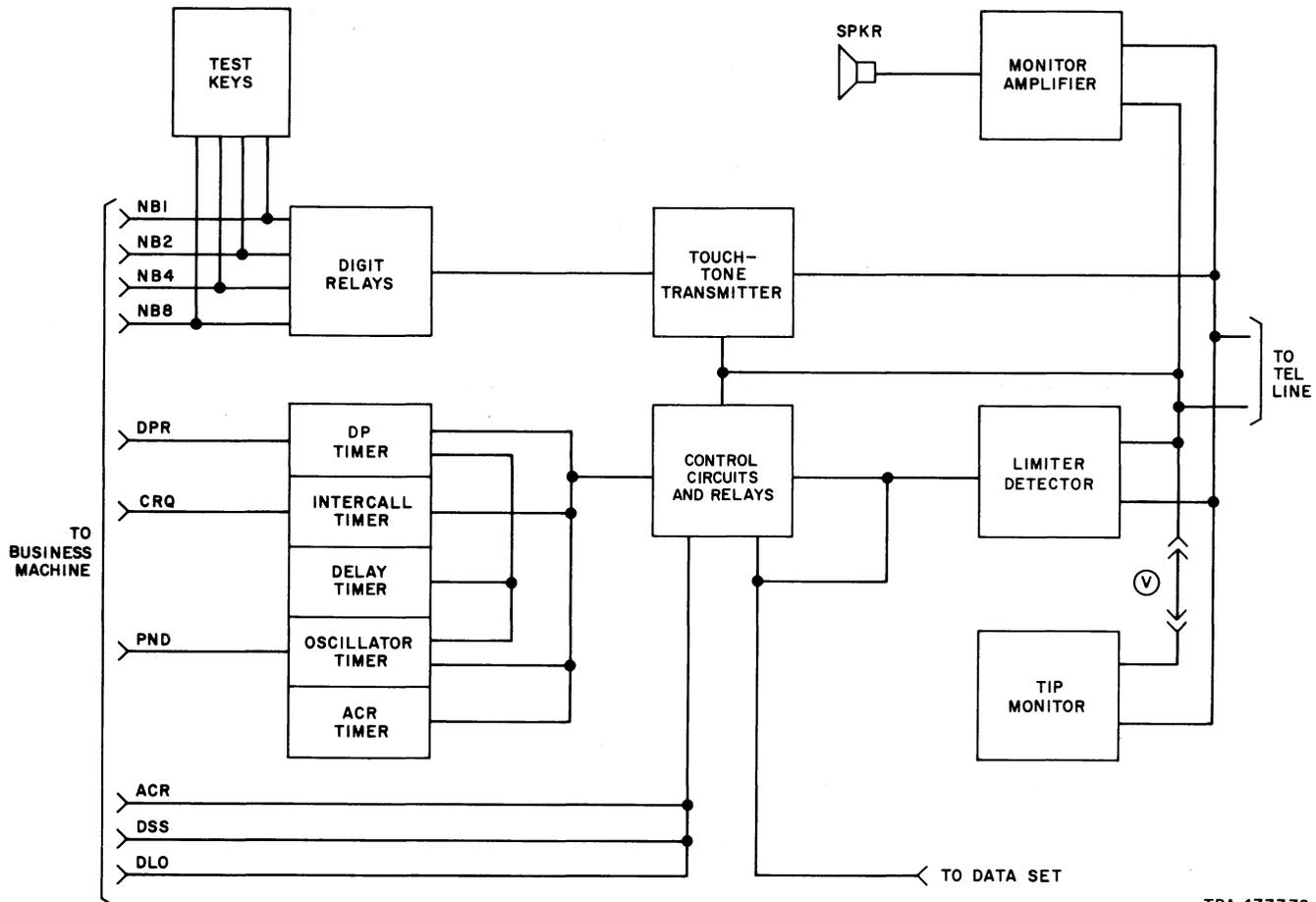
TABLE D

TB2 TERMINAL	M14C CORD	D10P CORD
T	W-BL	W-BL
C	R-BL	BR-W
R	BL-W	BL-W
2	R-O	—
DR	G-W	G-W
D1	W-BR	W-BR
D2	BR-W	—
TK	BL-R	W-O
SH1	S-W	S-W
SH2	W-S	W-S
3	W-O	—
1	O-R	—
DT	W-G	W-G
G	O-W	O-W

a DLO "on" signal is presented to the business machine. When an on-hook indication is received from the data set, the ACU monitors the telephone line for an idle condition. When the connection is dropped, the call request circuit is enabled and the DLO lead is turned off.

Incoming Calls

3.13 Incoming calls are handled in the following manner. For loop-start operation, the ACU presents a DLO "on" signal to the business machine when the data set answers an incoming call. If the data set presents a data mode indication to the ACU, the business machine is informed via the DSS lead. When a ground-start line is used, an incoming call results in a DLO "on" signal before the call is answered.



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Fig. 4—Data Auxiliary Set 801C3 or 801C4—Functional Block Diagram

Test Mode

3.14 The ACU is equipped with a test mode. This feature allows the ACU to be tested without the use of external test equipment. The ACU has 12 test keys which are used to originate test calls manually (refer to Fig. 1). Keys 1 through 9 and 0 can be used to generate the frequency pairs corresponding to these digits. The 11th and 12th frequency combinations cannot be generated by the use of the test keys; however, all seven single frequencies are generated and tested by testing the other digits. To use the test circuit, the attendant must depress and hold the TEST button until the TEST lamp lights. This signifies that the ACU is in the test mode and that the control of the interface leads has been removed from the business machine.

Note: The ACU may be placed in the test mode only when it is in the idle condition. The operation of any button at any other time will be ignored by the ACU.

3.15 When the ACU enters the test mode, it automatically initiates a call request using the same circuits used by the business machine. The ACR timer is set automatically to the maximum timer interval. The PND lead is clamped in the "off" condition, and the DLO lead is clamped in the "on" condition. When dial tone is received, the signal tones are made audible by the monitor amplifier and speaker in the ACU. This monitor amplifier circuit is activated when the ACU is in the test and monitor modes. When the PND button lights, a digit may be dialed by depressing the corresponding number button and holding this

button until the PND lamp goes off. The button is then released and the next digit dialed when the PND lamp is again turned on. If the ACU uses the EON control, it can be tested by operating the number 4 and 8 buttons simultaneously. When the number 4 and 8 buttons are released, the PND lamp should remain off, thereby signifying that the data set is in the data mode. If at any time it is desirable to interrupt the test, the ACU can be released from the test mode by operation of the PND button.

Call Termination (Ground-Start)

3.16 When used with data sets utilizing a line holding relay, an automatically originated call may be terminated in two ways. If the call is to be terminated by means of turning off CRQ (Z option), the ACU will seize the line, then return it to the data set as soon as the data mode indication is released by the data set. At this point, the ACU is idle and ready to process another call. If the call is to be terminated through the data set after the data mode indication has been presented to the business machine (G option), the on-hook indication must be presented to the central office by opening the loop within the data set. When the data mode indication is removed from the ACU, the ACU reverts to the idle state, turning off the DSS, DLO, and PND leads.

Note: The A and Z options are referred to as the one lead control options. The G and ZD options are referred to as the two lead control options.

3.17 If a data set without a line holding relay is used or if for some other reason a command to go on-hook is required by the data set, and if the call is to be terminated by means of turning off CRQ, the ACU presents a "clear" indication to the data set via a contact closure when CRQ is turned off. The data set then goes through its call termination procedure, finally removing the data mode indication from the ACU and allowing the ACU to become idle. If the call is to be terminated through the data set, CRQ will have been turned off prior to transmitting the data. In this mode, an option in the ACU prevents the "clear" signal from being given to the data set upon turning off CRQ if the DM indication has already been given to the ACU. The ACU reverts to the idle state upon removal of the data mode indication by the data set.

Call Termination (Loop-Start)

3.18 When a loop-start line is used, call termination differs from that for a ground-start line in the following manner. At the end of each call, a 1-second intercall time interval is imposed by the ACU to assure that the CO has recognized the on-hook condition and has dropped the connection.

Sequence of Operation

3.19 The basic sequential states of the ACU may be conveniently summarized as idle, call request (off-hook), ready to dial (line occupied), answer detection, data mode, and call termination (clear). Figure 5 shows the sequence charts for automatic call origination with and without end of number and the test mode operation with and without end of number.

C. Circuit Analysis

3.20 Circuit analysis for the ACU has been divided into sections by function or circuit board. Two of the circuit boards are optional, therefore an ACU may not contain all of the circuit packs contained in this text. A schematic diagram is used in conjunction with the explanation of these circuits. The interconnections between the circuit boards or functional circuits is shown by the schematic diagram of the ACU (refer to Fig. 6).

D. Power Supply

3.21 The ACU may have either a 17A or a 48A power supply. The 17A power supply (DAS 801C3 or C4, series 3 and below) or the 48A power supply (series 4 and above) converts 117 volts 60 Hz ac into two regulated 18-volt outputs. The 17A power unit requires 60 ± 0.1 Hz and the 48A power unit required 60 ± 3 Hz. These outputs are designed to deliver a positive 18 volts dc or a negative 18 volts dc relative to the supply ground.

E. ACR Timer

3.22 The ACR timer is a 7- to 40-second timer that is adjustable in five steps to give time intervals of 7, 10, 15, 25, and 40 seconds. DAS 801C3 and 801C4 series 5 and above contain an additional (40 MON) timer switch position. When in the 40 MON position (monitor mode), the timer is set to 40 seconds and progress of a normal call may be monitored in the ACU speaker. At the

expiration of the selected time interval, the ACR relay is operated (refer to Fig. 7). Switch S1, resistors R3 through R7, and capacitors C1 through C3 make up the timing elements of this circuit. Initially, the ACR relay is not operated due to a negative 18 volts applied to the base of Q1 through R8 resulting in Q4 being held off. The timer interval is started when the negative 18 volts connected through R25 is removed and the capacitors charge through the selected timing resistors toward a positive 18 volts. Switch S1 is used to select the resistor(s) unless the TEST relay is operated. When the capacitors have charged to a voltage that exceeds the emitter voltage of Q1, diode CR1 conducts and Q1 turns on. Transistor Q3 turns off, causing the emitter voltage to decrease, which turns on Q4. This provides a ground for the ACR relay. The subsequent operation of the ACR relay provides a ground through R2, thereby increasing the base current to Q1. The schematic diagram for the ACR timer and the timer controlling relay contacts is shown in Fig. 7. The timer is reset by applying a negative 18 volts through the relay contacts and R25 to recharge the capacitors.

F. Monitor Amplifier

3.23 The monitor amplifier uses a line coupling isolation transformer (T1). The input to the monitor amplifier is capacitively coupled by C6 to the base of the emitter follower Q5. Transistor Q7, which is dc coupled to Q5, has its ac gain controlled by R21 and C9. Transistor Q6 drives the externally mounted HT1 receiver. Figure 8 shows a schematic diagram of the monitor amplifier. ♦On later model sets (series 4 and above), the ACU is placed in the monitor mode by removing the short across the monitor speaker HT1 by a breaking contact on the ACR timer select switch.♦

G. Telephone Network, Line Coupler, and Line Holding Inductor

3.24 The telephone network and line coupler connect the tip and ring to the TOUCH-TONE oscillator and provide protection from lightning surges. The line coupler consists of four diodes, CR3 through CR6, that insure proper current polarity. Surge protection is provided by diode CR1. A separate line holding inductor (L1) is provided for a low dc impedance path without attenuating a superimposed ac signal. This inductor holds the line when the telephone network and TOUCH-TONE oscillator are not drawing current.

Figure 9 gives the schematic diagram of these circuits and shows the connections to the other circuits of the ACU.

H. Tip Monitor

3.25 Figure 10 is a schematic diagram for the tip monitor circuit. The tip monitor circuit is composed of a diode gate (CR8 and CR9) and relay driver Q1. If a voltage more positive than -18 volts (ie, a voltage near ground potential) is applied to either terminal 9 or 10, Q1 is turned on and the TM relay is operated. An external relay contact that provides a ground to pin 11 can also be used as an override means of operating the relay. Capacitor C1 prevents operation of the TM relay on short ground pulses and prevents release of the relay during very brief ground interruptions. Capacitor C2 suppresses parasitic oscillations.

I. 10-Combination TOUCH-TONE Transmitter and Controls

3.26 The TOUCH-TONE transmitter is controlled by the operation of four relay drivers and their associated relays. The relay drivers receive a number in binary form from either the test keys or the business machine (Fig. 11). When the ACU is in the test mode, the TE relay is operated and the test keys are connected to the relay driver circuits. When the ACU is not in the test mode, the TE relay provides a set of contacts that connect the business machine leads to the relay drivers. The operation of the relay drivers is identical, whether the signals are supplied by the test keys or by the business machine. The digits are presented to the relay drivers in binary form on terminals 5, 8, 10, and 4. Since the operation of all the relay drivers is identical, only Q1 will be described.

3.27 The relay windings are connected to a -18 volt source through terminal 3 and a CR relay contact (Fig. 11). Reverse bias supplied to Q1 by R3 is limited by CR5, and the transistor is normally off. Resistor R2 limits the base current of Q1 when a negative voltage is applied to operate the D1 relay. Diode CR1 limits the induced voltage across the relay winding when the relay releases. Contacts on the digit relays, which are controlled by the relay drivers, control the frequencies of the TOUCH-TONE oscillator Z1. This is accomplished by the digit relays D1, D2, D4, and D8 connecting the two capacitors to the appropriate taps on the

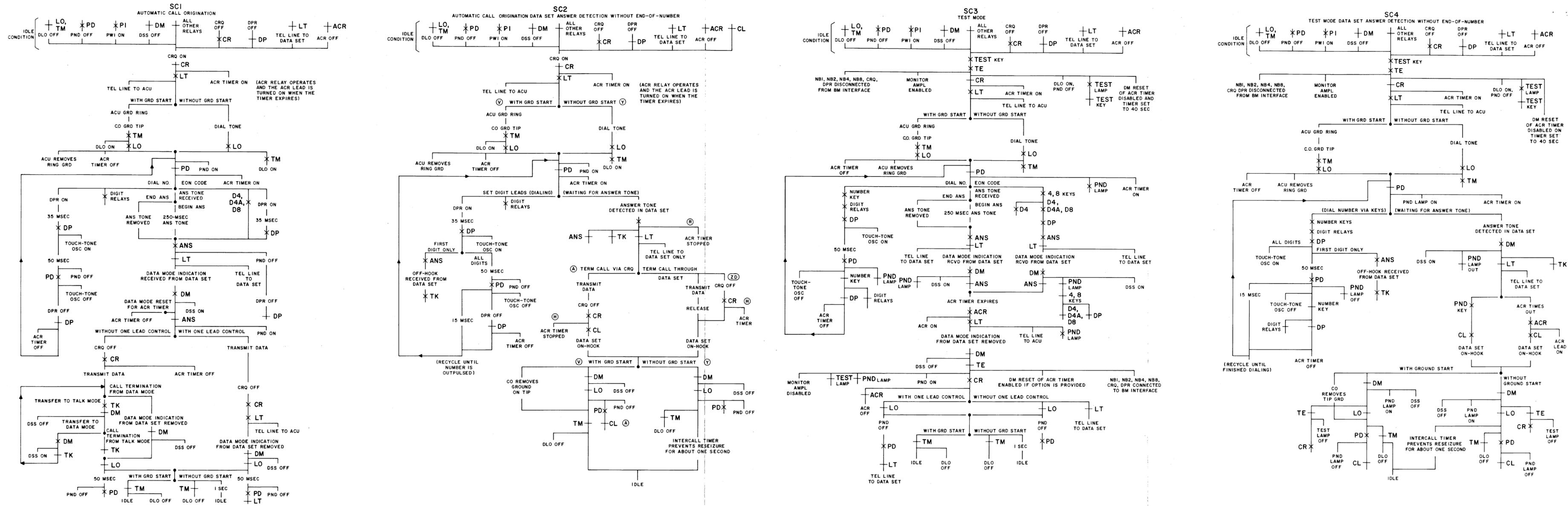
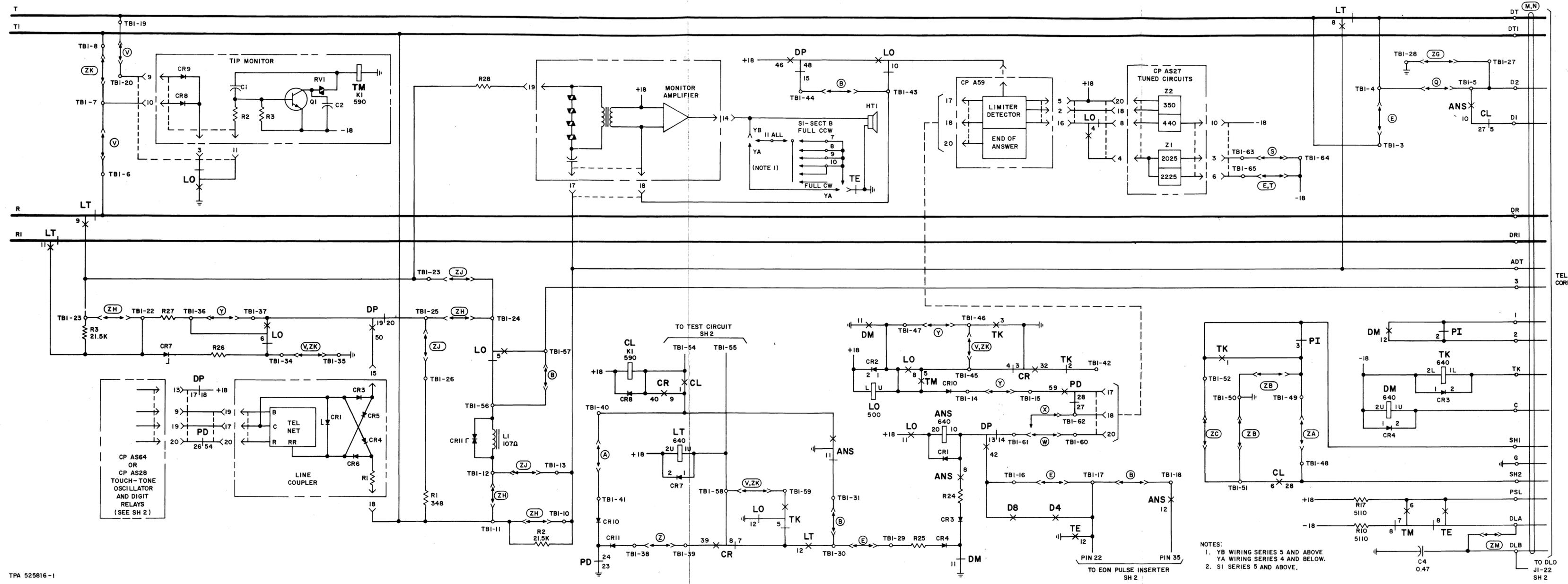


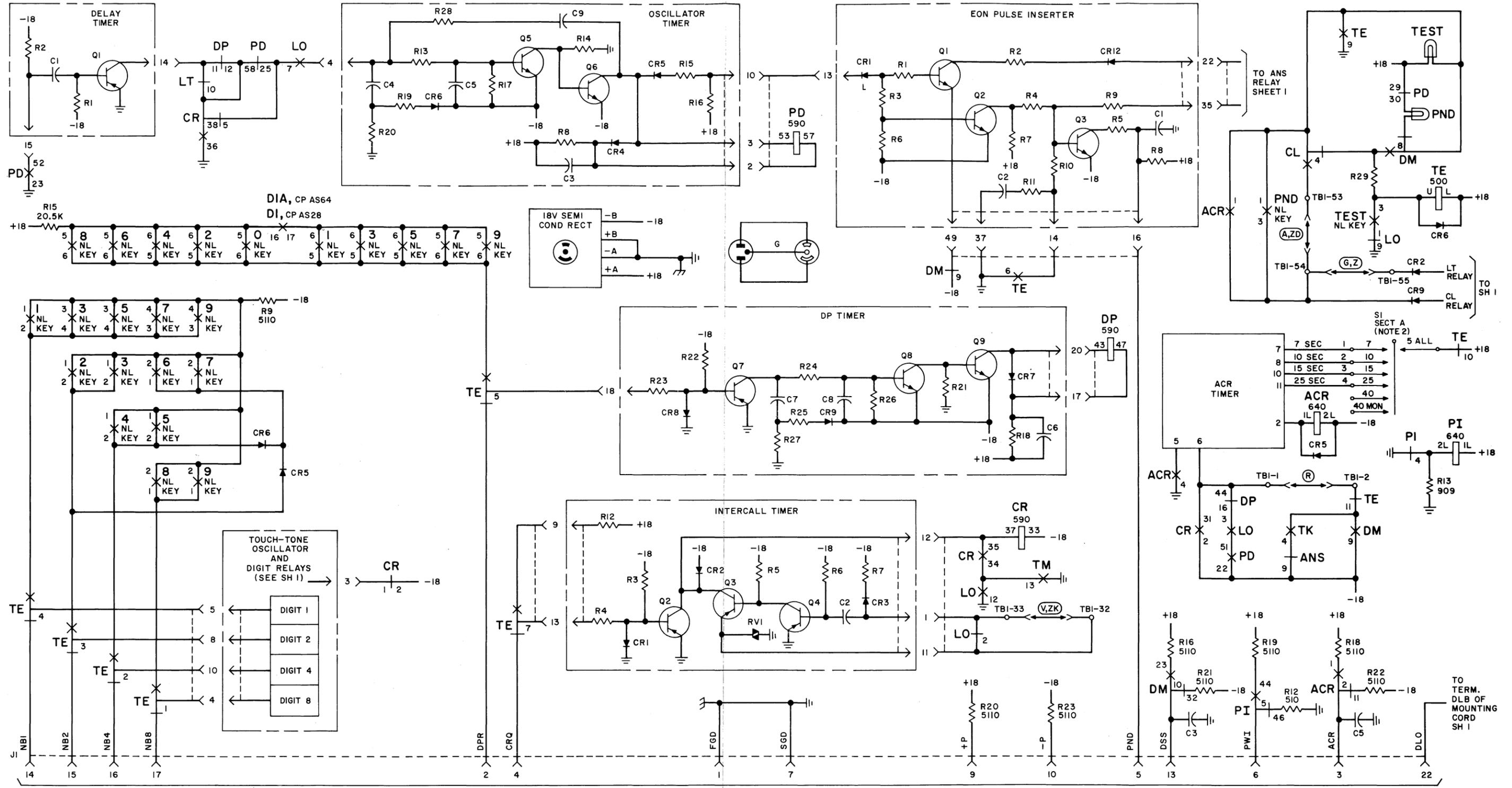
Fig. 5—Data Auxiliary Set 801C3 and 801C4—Sequence Charts



TPA 525816-1

- NOTES:
1. YB WIRING SERIES 5 AND ABOVE
YA WIRING SERIES 4 AND BELOW.
 2. S1 SERIES 5 AND ABOVE.

Fig. 6 Data Auxiliary Set 801C3 and 801C4—Schematic Diagram (Sheet 1 of 2)



BUSINESS MACHINE INTERFACE

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Fig. 6 Data Auxiliary Set 801C3 and 801C4—Schematic Diagram (Sheet 2 of 2)

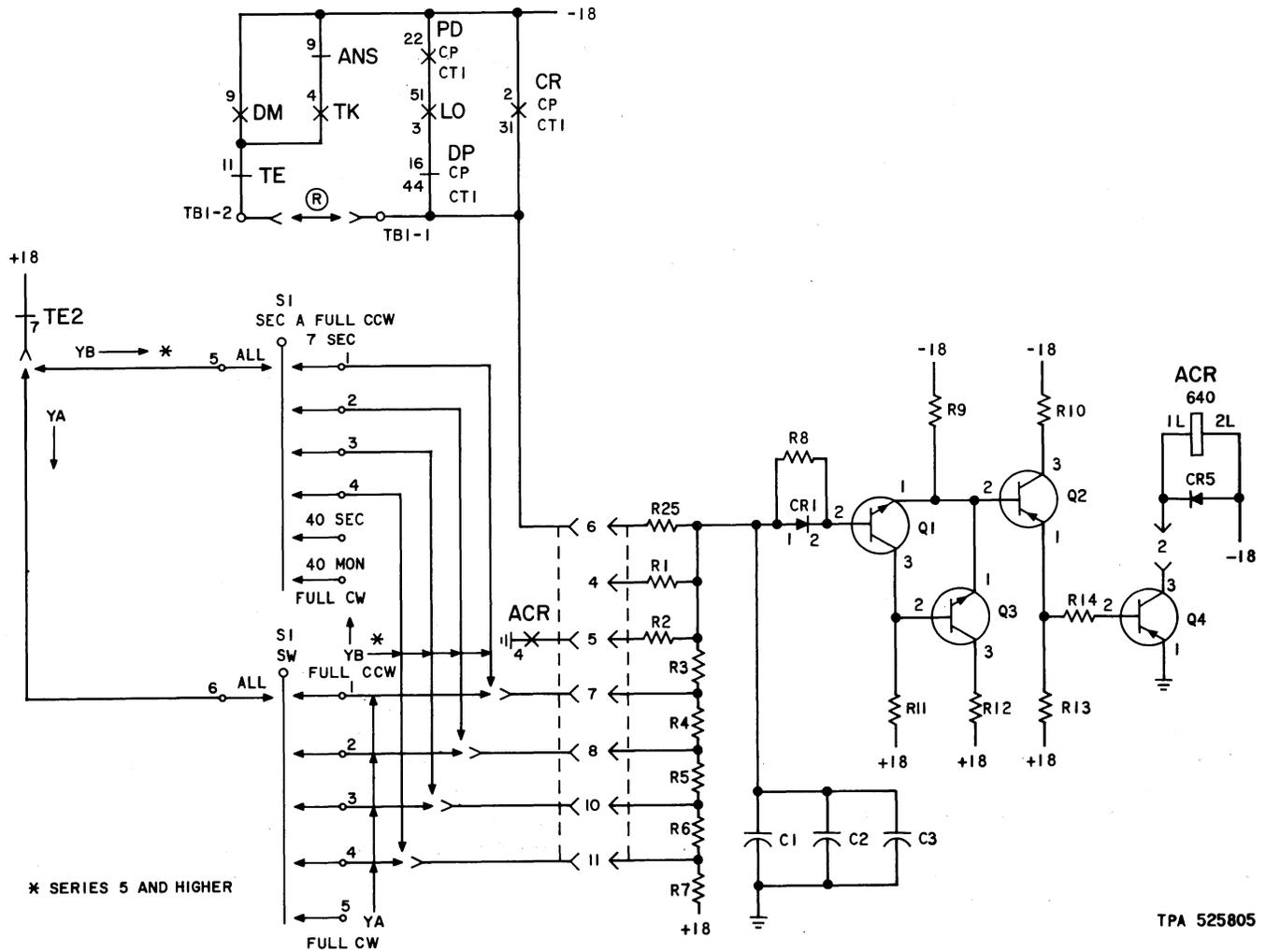


Fig. 7—ACR Timer—Schematic Diagram

NOTE:

YB WIRING IS USED IN SERIES 5 AND ABOVE. YA WIRING IS USED IN SERIES 4 AND BELOW.

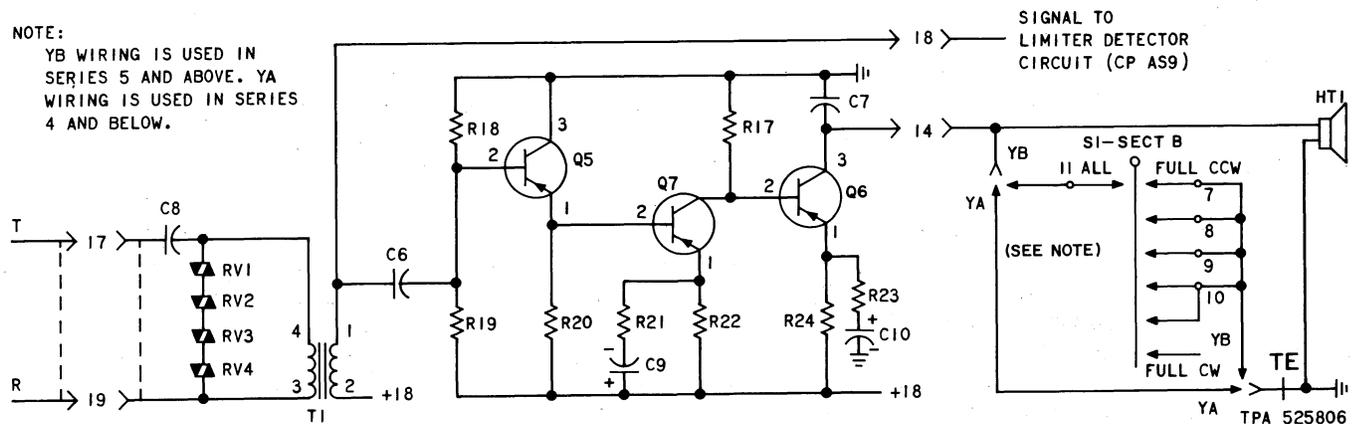


Fig. 8—Monitor Amplifier—Schematic Diagram

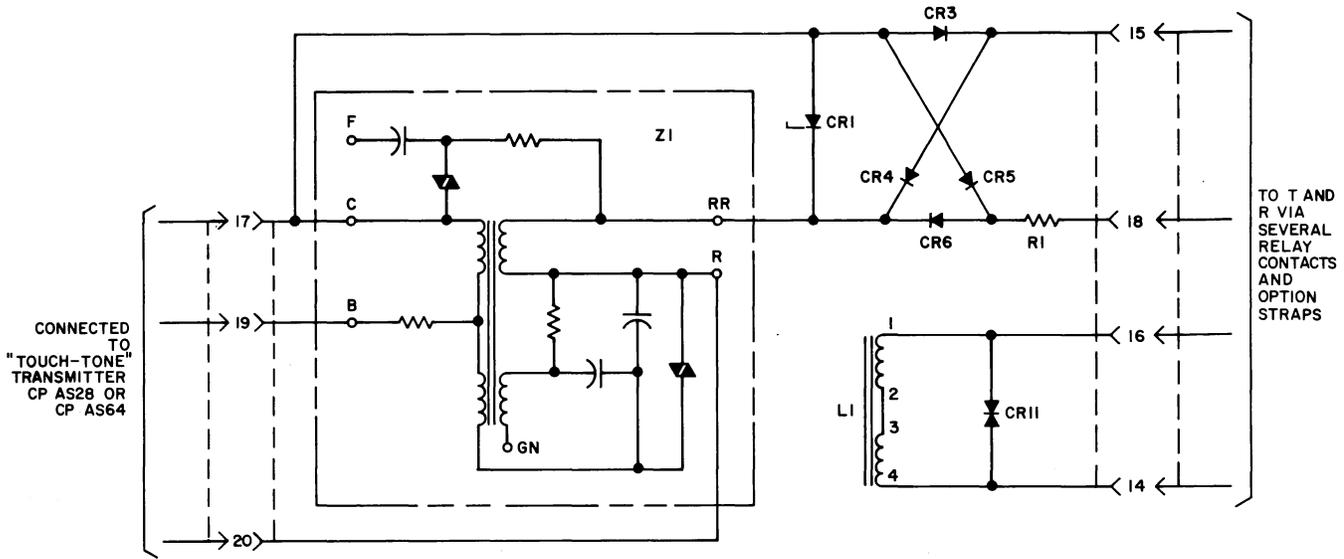


Fig. 9—Telephone Network Line Coupler and Line Holding Inductor—Schematic Diagram

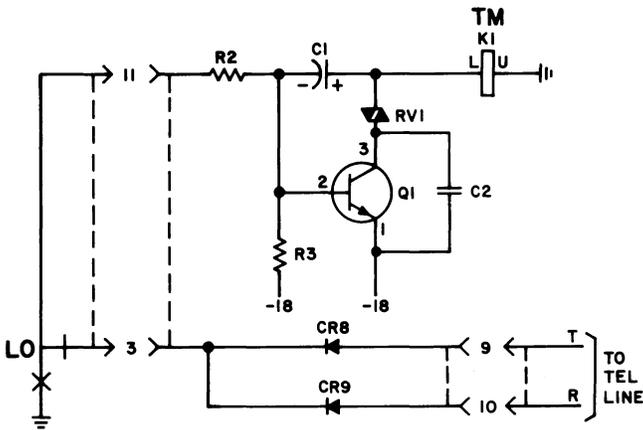


Fig. 10—Tip Monitor—Schematic Diagram

tuning inductor. R1 limits the dc current through the tuning inductor. Interruption of the dc current by operation of a DP relay contact shock excites the oscillator to full amplitude in a minimum number of cycles. The output of the oscillator is connected to the telephone line by a telephone network where the power required for the oscillator is derived. Operation of the CR relay removes the -18 volts from the digit relay windings. When the EON option is used, operation of the D4 and D8 relays provide an operate path for the ANS relay.

J. 12-Combination TOUCH-TONE Transmitter and Controls

3.28 Figure 12 shows the schematic diagram for a 12-combination TOUCH-TONE transmitter. This transmitter is almost identical to the 10-combination transmitter previously described, with the exception of the contact arrangement of the TOUCH-TONE transmitter and other minor changes which provide for the generation of 12-tone combinations instead of 10 (refer to Fig. 12). Operation of the relay drivers controlling the TOUCH-TONE oscillator is the same as described in the preceding text (see 3.27).

K. Intercall Timer

3.29 The intercall timer is shown in Fig. 13. It is composed of a transistor switch Q2 which can be delayed for 1 second by the timer circuit composed of Q3 and Q4. The transistor switch Q2 controls the operation of the CR relay. When the CR relay is operated, operation of the TM or LO relay provides a holding path. Diode CR2 protects the transistor by limiting the collector voltage. Q2 is biased in the "on" condition by R3 and can be turned off by applying a positive voltage through R4 to the base of the transistor. When the ACU is in the test mode, +18 volts is applied through resistor R12 to the base of Q2. When the ACU is not in the test mode, the CRQ lead

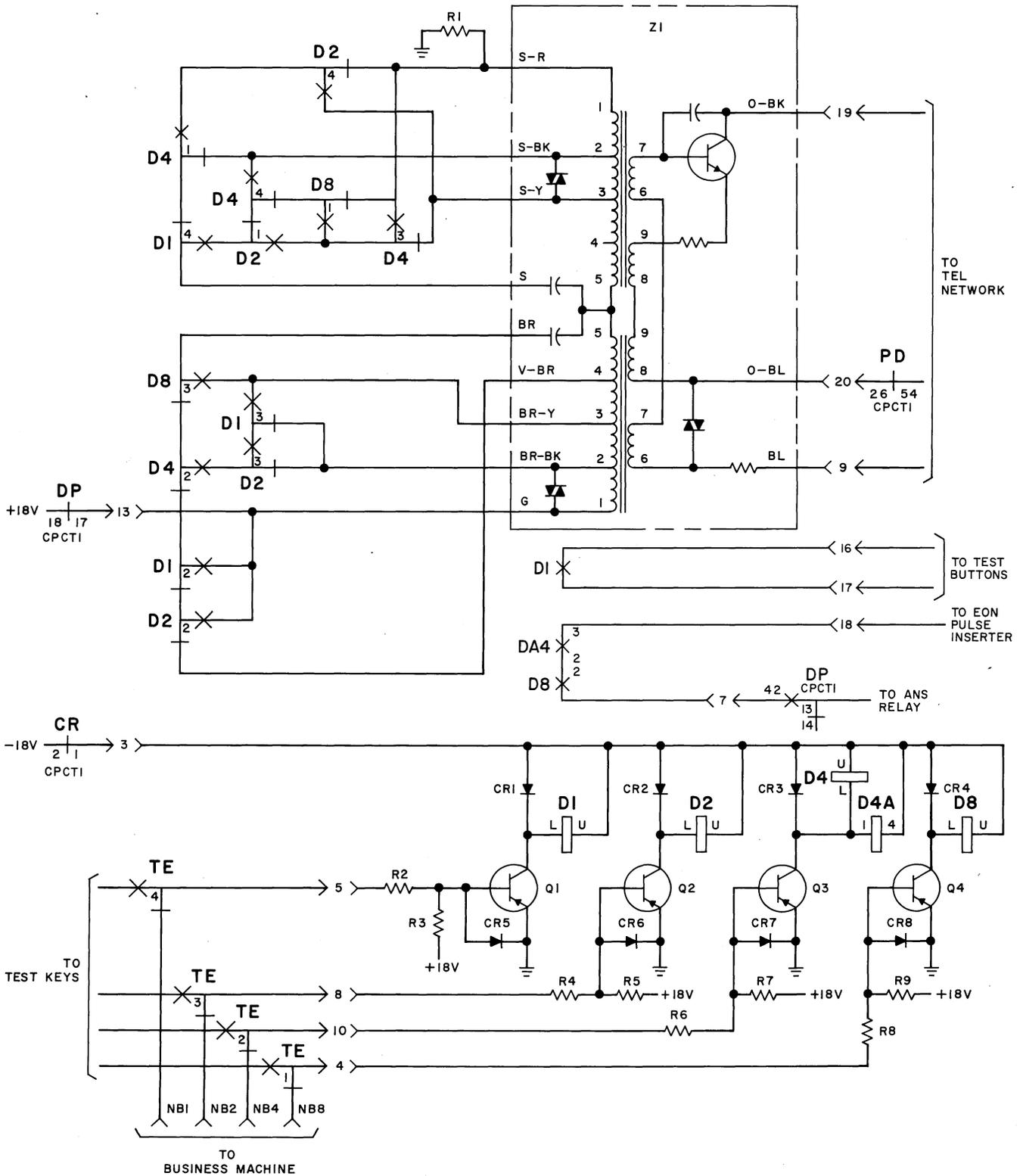


Fig. 11—10-Combination TOUCH-TONE Transmitter and Control Circuits—Schematic Diagram

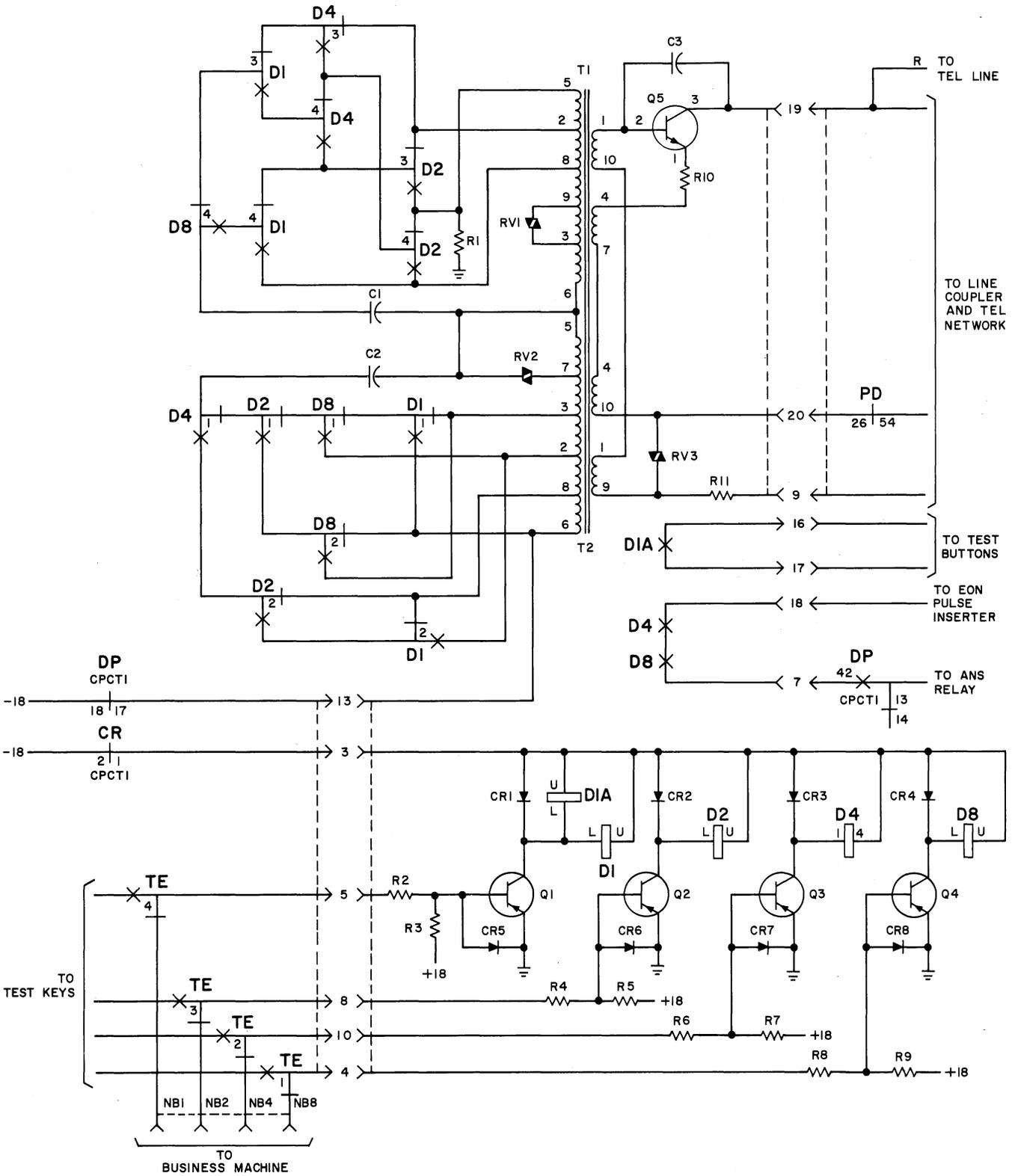


Fig. 12—12-Combination TOUCH-TONE Transmitter and Control Circuit—Schematic Diagram

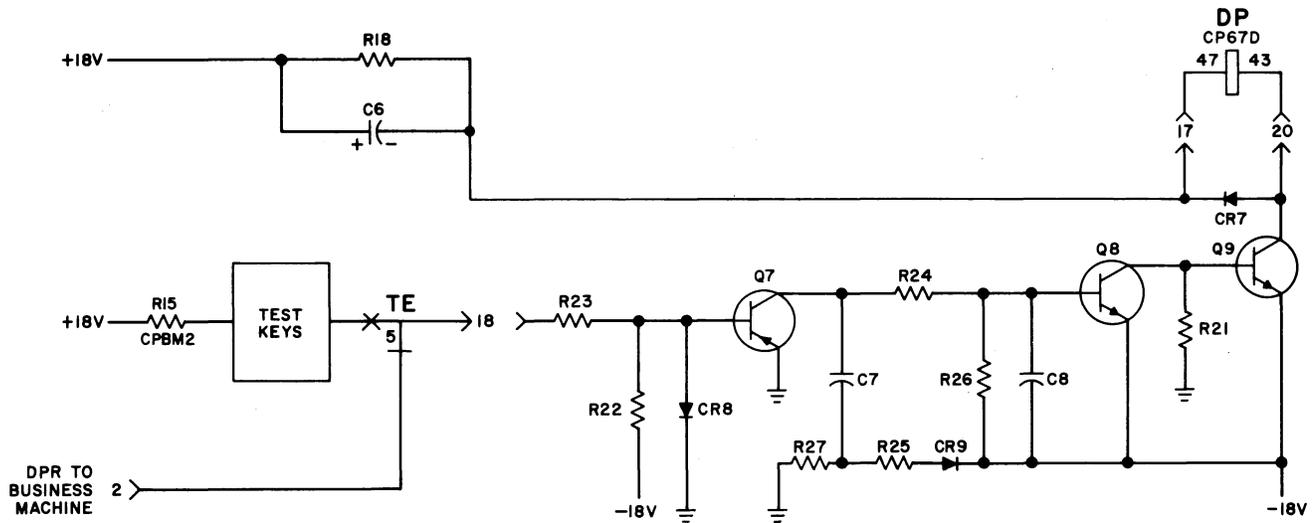


Fig. 14—DP Timer—Schematic Diagram

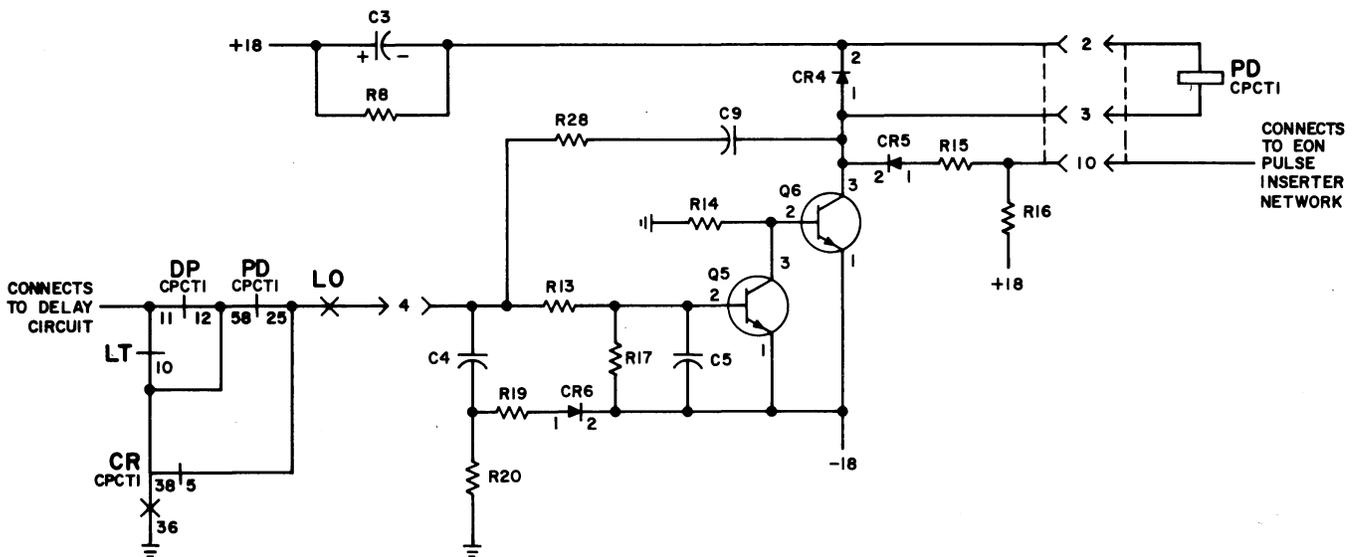


Fig. 15—Oscillator Timer—Schematic Diagram

voltage at terminal 10 is controlled by resistor R16 and the external load that is connected to the terminal. With Q6 turned on, the voltage at terminal 10 is negative, ie, it exceeds -5 volts when the load is greater than 3000 ohms. The timer interval for this timer is 42 msec.

N. EON Pulse Inserter

3.32 The EON pulse inserter shown in Fig. 16 consists of two transistors and their associated components. The pulse inserter provides a negative going pulse on the PND lead when the EON code

is presented and the DP relay is operated. The PND lead is turned on when the oscillator timer places a positive voltage on terminal 13. This causes transistors Q1 and Q2 to be turned on and Q3 to be off. The PND lead is on, but no collector current flows in Q1 because the relay contacts connected to pins 22 and 35 are all open. When the business machine turns on the NB4 and NB8 leads (EON code) and the DPR lead is on, the ANS relay operates since -18 volts is applied (when B option is installed) through the D4, D8, and DP contacts, saturated Q1, and a closed DM relay contact. A voltage that is more positive than -18

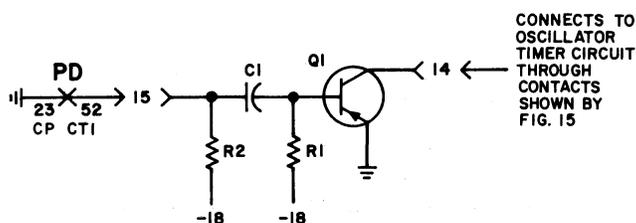


Fig. 17—Delay Circuit—Schematic Diagram

With the LO relay operated, the 2025-Hz or 2225-Hz network is selected by installation of the required option, thereby providing answer-tone detection. Signals from the monitor amplifier input are coupled to the base of Q1 through capacitor C1. Resistors R1 and R2 determine the bias for the operation of Q1 as a linear amplifier. The gain and dc operating point are determined by the resistance of the network from pin 2 to +18 volts. When this circuit is used for dial tone detection, this network which is resonant at 350 Hz acts as a trap for the 350-Hz portion of the standard dial tone. Although Q1 does not saturate or cut off in normal operation, RV1 will clip large signals on the collector of Q1 to approximately ± 0.6 volt dc. This determines the maximum signal to the base of Q2. Transistor Q2 also operates in the linear region, and its output is clipped by RV2 in a similar manner to the first stage. Transistor Q3 is biased so that the emitter is approximately 0 volt dc. The current in R10 therefore divides equally between R11 and the collector current in Q3. When the base is driven slightly negative by an ac signal, CR1 stops conducting, and all the current in R10 goes through the collector (twice steady state). When the base is driven slightly positive by an ac signal, the transistor cuts off, and the collector current goes to 0. This square wave of collector current flows through the parallel resonant tank on pin 16, producing a sine-wave voltage across it. When this signal frequency is in a narrow band around resonance, the amplitude of the sine wave is sufficient to cause Q4, which is normally off, to conduct during a portion of the positive half cycle. The threshold for conduction or detection is determined by the voltage divider of R16, R17, and R18. Transistor Q5 is normally on. Its emitter is held at approximately -6 volts by CR2 and R15. After a few cycles of conduction, the collector of Q4 becomes less positive than the emitter of Q5

turning it off. Capacitor C7 holds off Q5 between cycles of the signal. With Q5 off, C8 is charging through R13 and R14. In about 250 msec, the base of Q6 will go positive, and Q6 and Q7 will turn on. Capacitor C9 discharges through CR3, R21, and the collector to the emitter of Q7. The detector threshold is lowered slightly so that there will not be chatter on marginal signals via R18. If option X is installed, the answer relay will operate. After the signal is removed for at least 10 msec, C7 discharges to the point where Q5 turns on. This turns off Q6 and Q7, and C9 charges through R20, R21, and base to the emitter of Q8. This base current will turn on Q8 for at least 50 msec, operating the ANS relay if option W is installed.

Q. Tuned Circuits

3.35 The tuned circuits which are used in conjunction with the limiter circuits are shown in Fig. 18. They consist of two networks, each network having two resonant circuits. The 350-Hz resonant circuit is used to reduce the gain of the input stage of the limiter to the 350-Hz portion of the new standard dial tone because it would interfere with the 440-Hz detection. The 440-Hz resonant circuit sets the frequency to which the output of the dial tone detector is sensitive. When answer-tone detection is provided, network Z1 provides two parallel resonant circuits which allow for the detection of either 2025-Hz or 2225-Hz tones. Option straps are used to select the tuned circuit required.

4. PERFORMANCE DATA

4.01 The input signals to the ACU are furnished by a compatible business machine and consist of voltage level signals. The range and polarity of these signals are given in 2.04 and Table B.

4.02 In addition to the signals furnished by the business machine, the ACU requires the following ac input with third wire grounding: series 4 or later, single phase, 60 ± 3 Hz 117 volts rms ± 10 percent; series 3 and earlier ACUs, single phase, 60 ± 0.1 Hz 117 volts rms ± 10 percent.

4.03 The output of the ACU consists of TOUCH-TONE signals required to dial a number. The TOUCH-TONE frequencies are given in Table C.

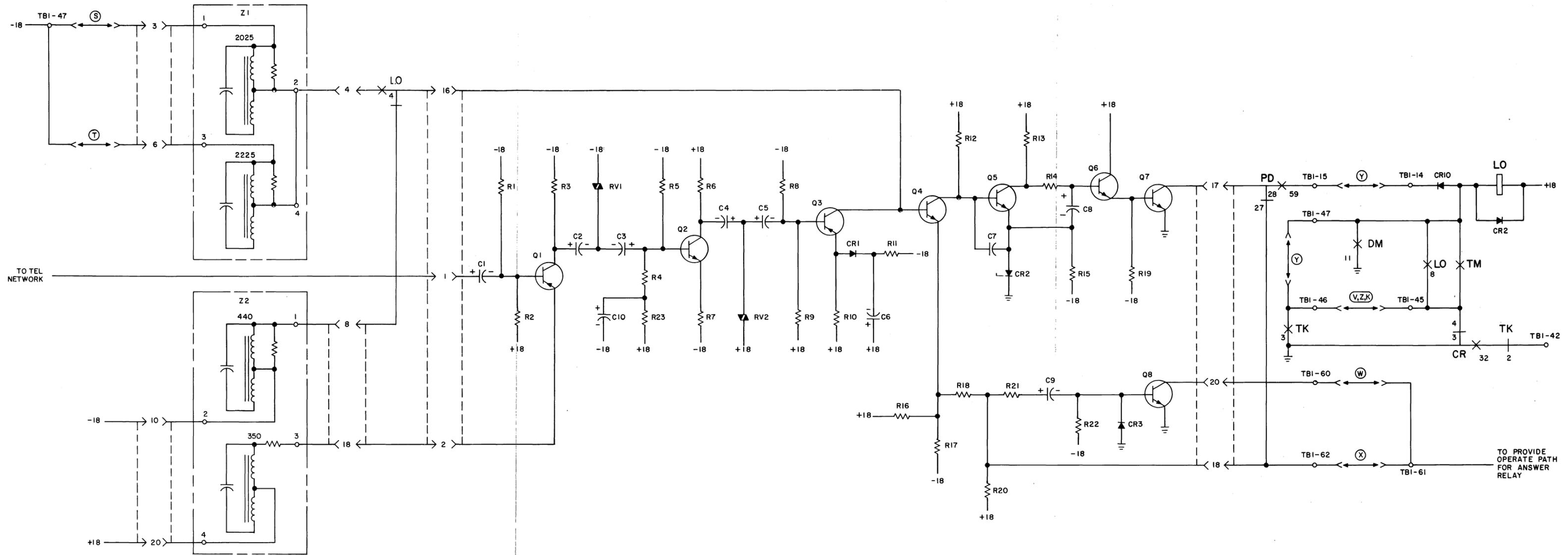


Fig. 18—Limiter Detector and Tuned Circuits—Schematic Diagram

4.04 Circuit characteristics or parameters for the circuit packs are given in the following tables. These tables cover CP AS9, CP AS12, CP AS26, CP AS27, CP AS28, CP AS29, CP CT1, CP BM2, and CP AS64.

CP AS9

CIRCUIT	FUNCTION OR TYPE
Limiter Detector	This circuit limits the input signal and provides for dial tone or answer-tone detection.

CP AS12

CIRCUIT	FUNCTION OR TYPE
ACR (7 to 40 seconds) Timer	Provides timer circuit for the operation of the ACR relay after expiration of the preset timer interval.
Monitor Amplifier	This 3-stage audio amplifier is used to drive the associated speaker used to monitor call progress tones.

CP AS26

CIRCUIT	FUNCTION OR TYPE
Telephone Network and Tip Monitor	This circuit pack provides a telephone network and line status monitoring circuit to be used in conjunction with a ground-start line. The K1 relay is operated when the line is being used and released when the line is idle.

CP AS27

CIRCUIT	FUNCTION OR TYPE
Tuned Circuit Z1	<p>2 Sections</p> <p>Terminals 3 and 4 connect to the 2025-Hz tuned circuit.</p> <p>Terminals 4 and 6 connect to the 2225-Hz tuned circuit.</p>
Tuned Circuit Z2	<p>2 Sections</p> <p>Terminals 8 and 10 connect to the 440-Hz tuned circuit.</p> <p>Terminals 18 and 20 connect to the 350-Hz tuned circuit.</p>

CP AS28

CIRCUIT	FUNCTION OR TYPE
Digit Relays	This circuit translates the binary number signals into contact closures for the TOUCH-TONE oscillator.
10-combination TOUCH-TONE Oscillator	The input to this circuit is provided as contact closures by the 4-digit relays. The output consists of TOUCH-TONE frequency signals.

CP AS29

CIRCUIT	FUNCTION OR TYPE
Digit Delay Timer	Timer started by ground applied to terminal 15. The time delay is 15 msec.
Intercall Timer	This transistor switch controls the CR relay and can be delayed for 1 second by the intercall timer.
Oscillator Timer	Timer is started by removing ground from terminal 4 which provides a 42-msec delay. The PD relay is operated at the expiration of the 42-msec interval.
DP Timer	The timer is started when the business machine turns on the DPR lead. The DP relay is then activated after a 27-msec delay time.

CP CT1

CIRCUIT	FUNCTION OR TYPE
Relays	This circuit pack provides three relays for circuit control.

CP BM2

CIRCUIT	FUNCTION OR TYPE
Miscellaneous Components	—
Pulse Inserter Network	The pulse inserter network causes the PND relay to operate on an EON signal.

CP AS64

CIRCUIT	FUNCTION OR TYPE
Digit relays	This circuit translates the binary number signals into contact closures required for the TOUCH-TONE oscillator.
12-combination TOUCH-TONE Oscillator	The input to this circuit is provided as contact closures by the digit relays. The output consists of TOUCH-TONE frequency signals.

4.05 Component placement on the circuit pack assemblies is shown in Fig. 19 through Fig. 27.

5. MAINTENANCE INFORMATION

5.01 The ACU does not require any routine maintenance. It is assumed that the Serving Test Center (STC) has checked with the customer and verified that attempts by the customer to complete calls manually (by using the test buttons) have failed.

5.02 The ACU does not have fuses in the power supply circuit; therefore, if power is available at the customer-furnished receptacle, a check of the power cord should be made prior to any other testing. After verifying that power has been

supplied to the ACU, the unit should be tested as outlined in the section entitled Data Auxiliary Sets 801C3 and 801C4, Test Procedures (598-012-501) to verify that the ACU is operating properly. If the test procedure indicates trouble with a specific circuit, refer to the preceding circuit pack tables for information on locating the circuit pack that contains the circuit in question. A known good circuit pack can be substituted for the circuit pack suspected of being in trouble as a method of clearing trouble. For information on substitution and replacement of circuit packs, refer to the section entitled Data Auxiliary Sets 801C3 and 801C4, Maintenance (598-012-301).

5.03 For additional detailed information on repairing the ACU, refer to the Bell System Repair Specification (BSRS) 480.077.

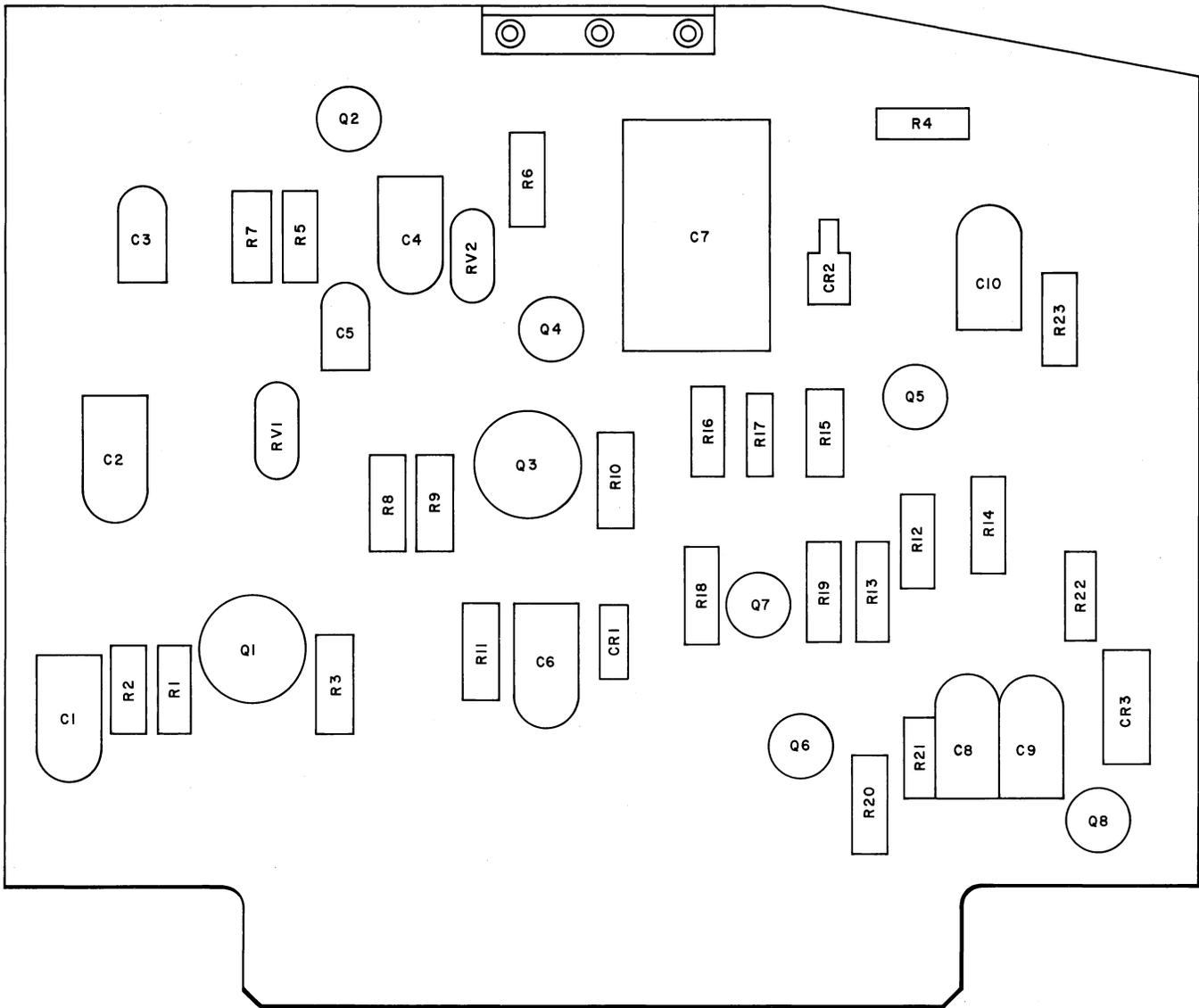


Fig. 19—CP AS9 Component Placement

6. REFERENCES

6.01 For additional information on the ACU, refer to the following schematic drawing (SD) and circuit description (CD):

- SD- & CD-1D103-01.

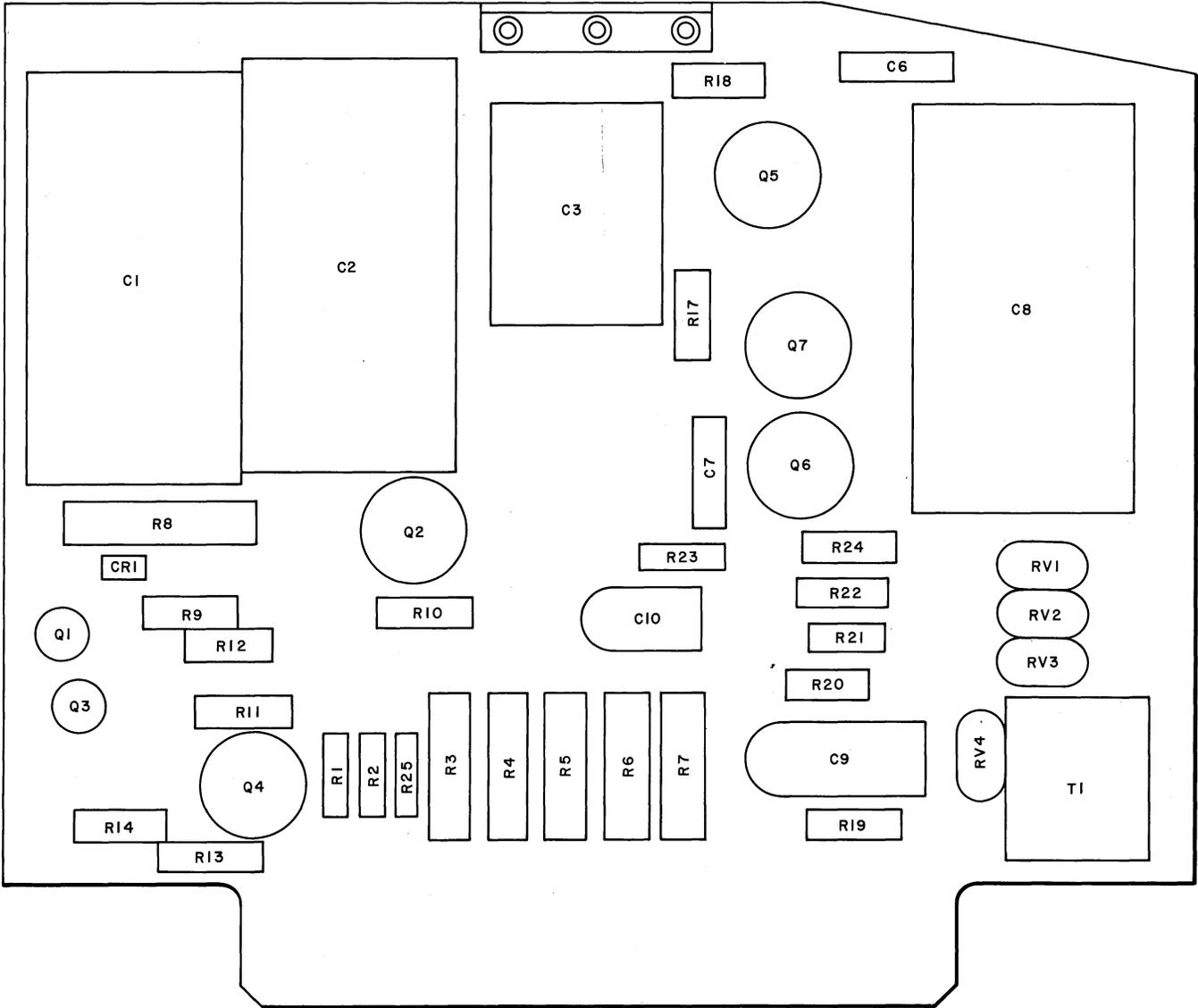


Fig. 20—CP AS12 Component Placement

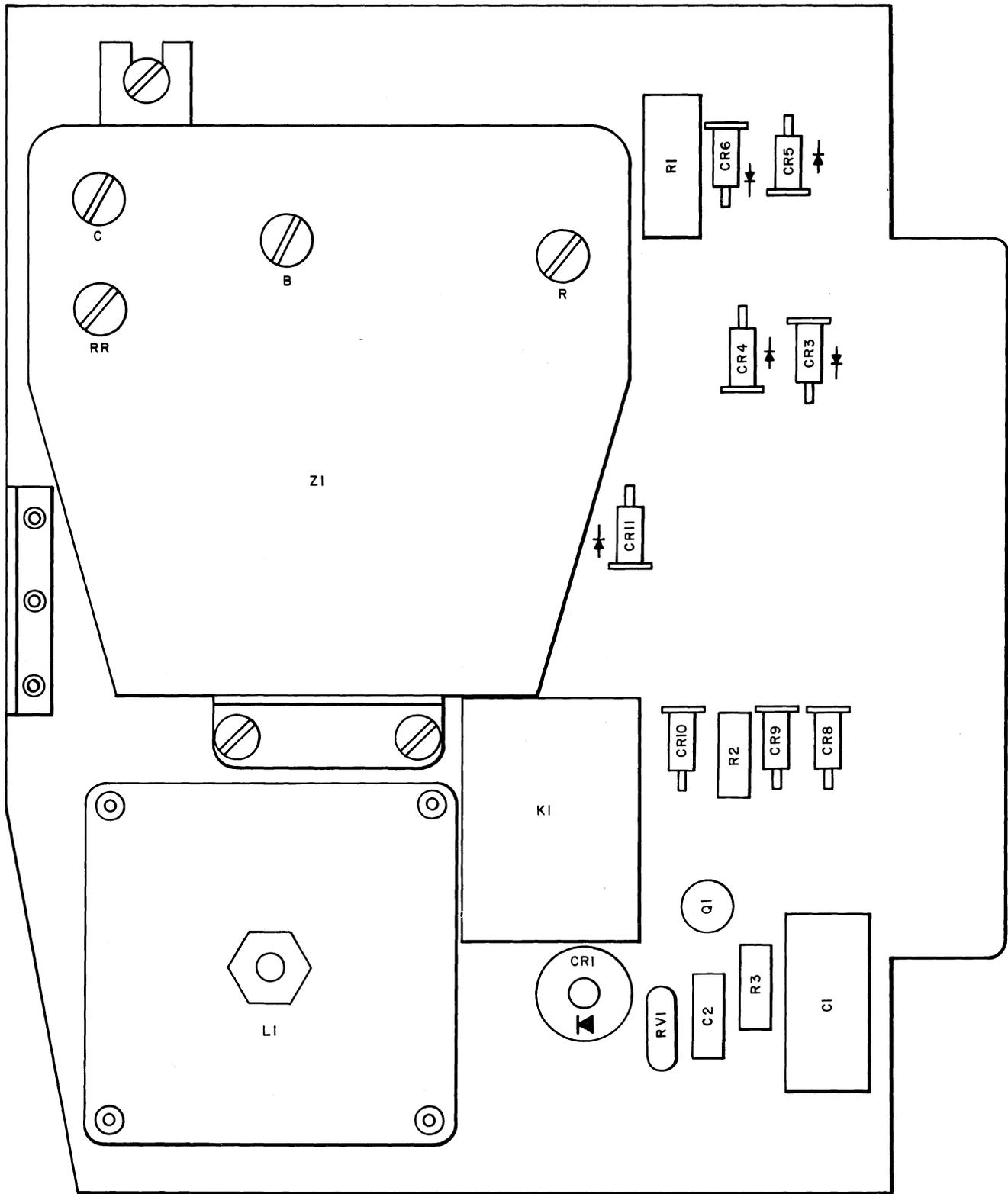


Fig. 21—CP AS26 Component Placement

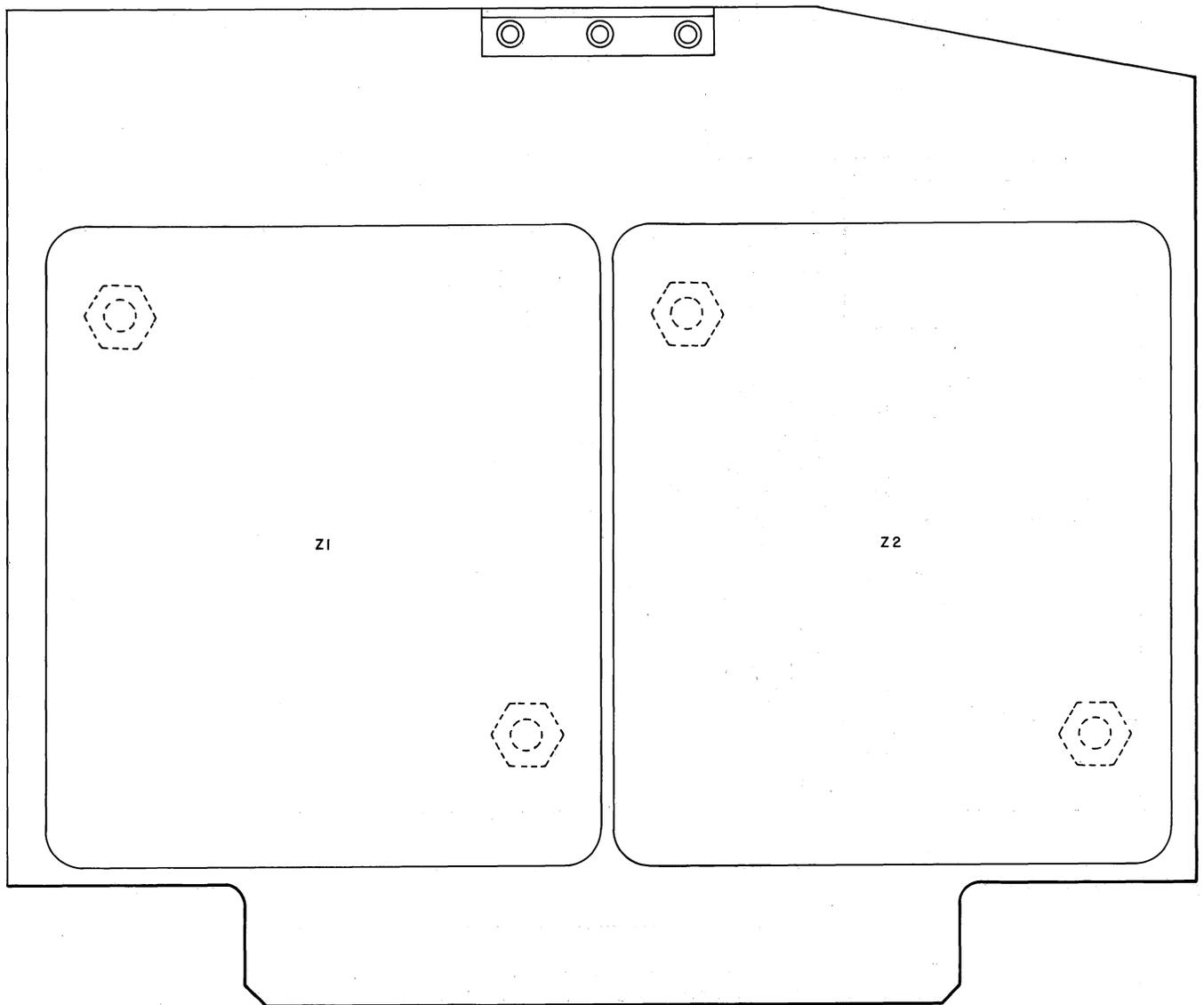


Fig. 22—CP AS27 Component Placement

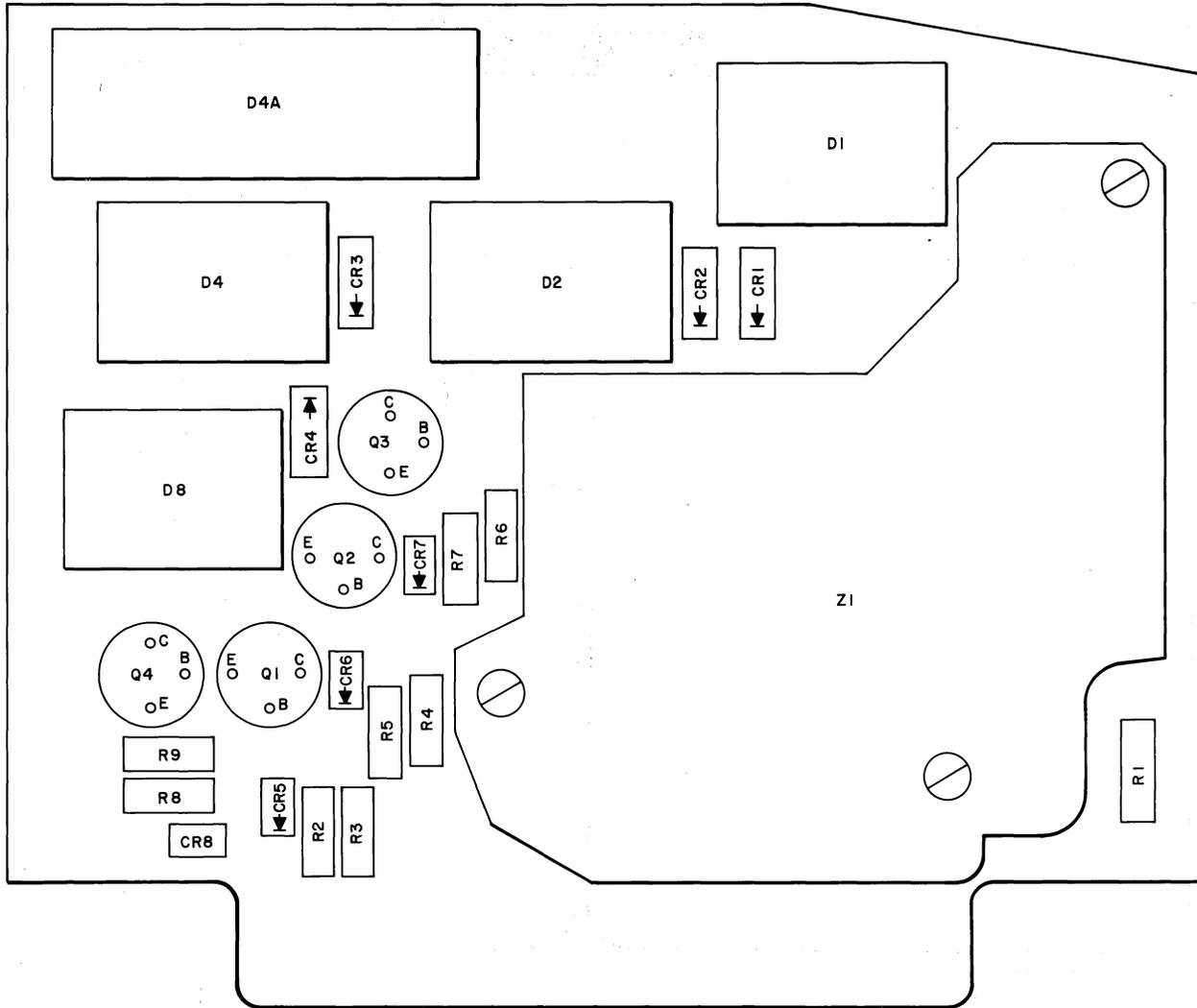


Fig. 23—CP AS28 Component Placement

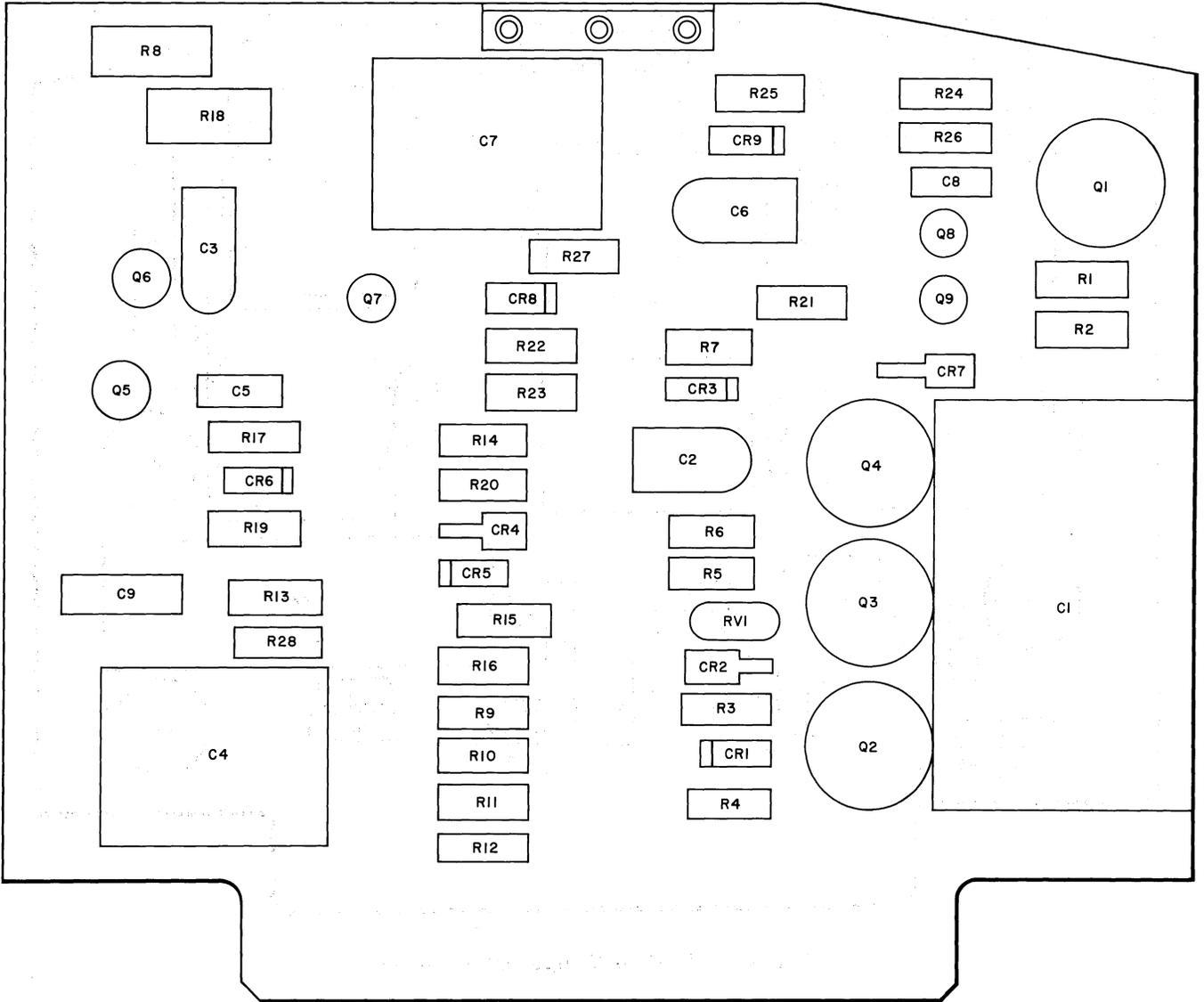


Fig. 24—CP AS29 Component Placement

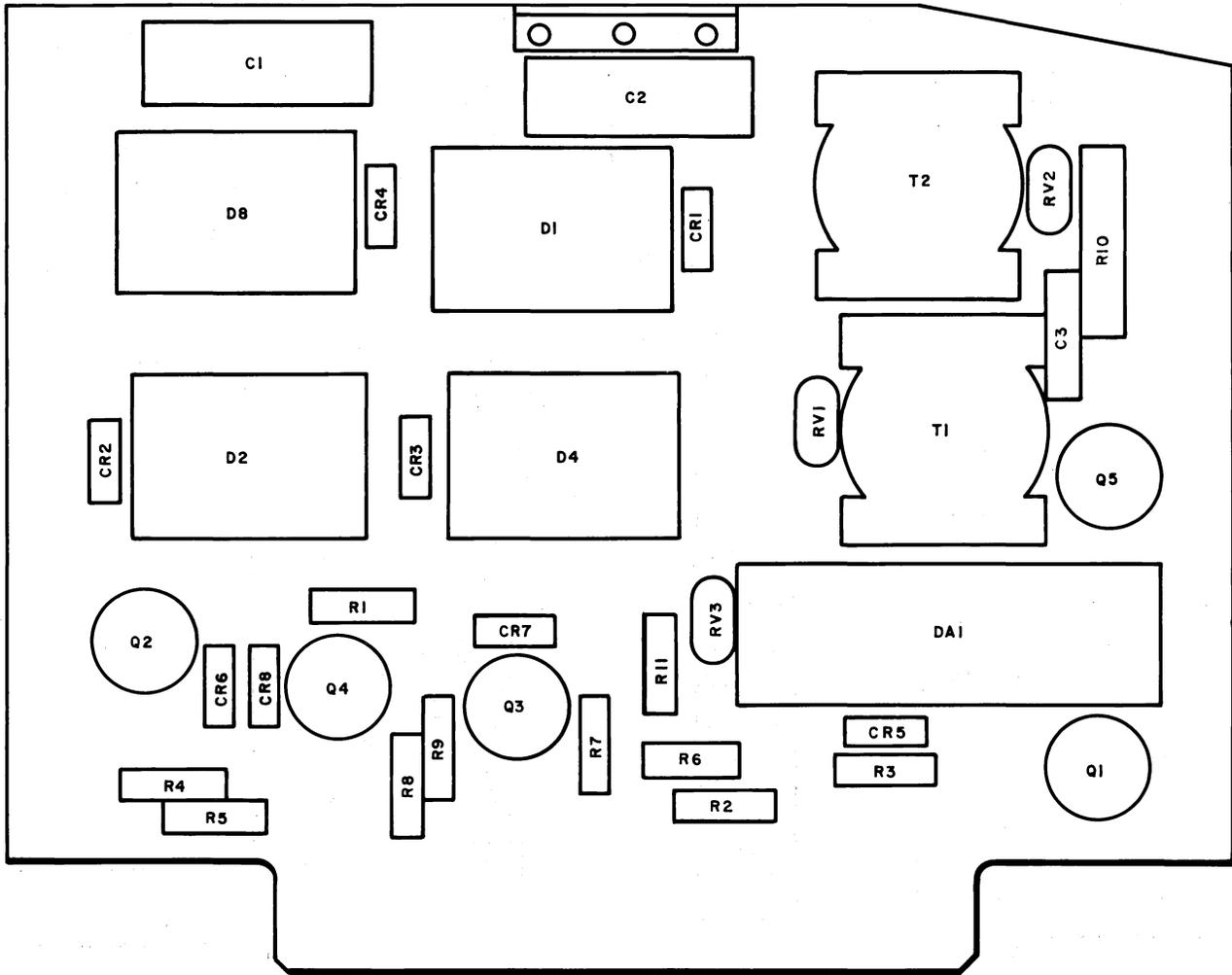


Fig. 25—CP AS64 Component Placement

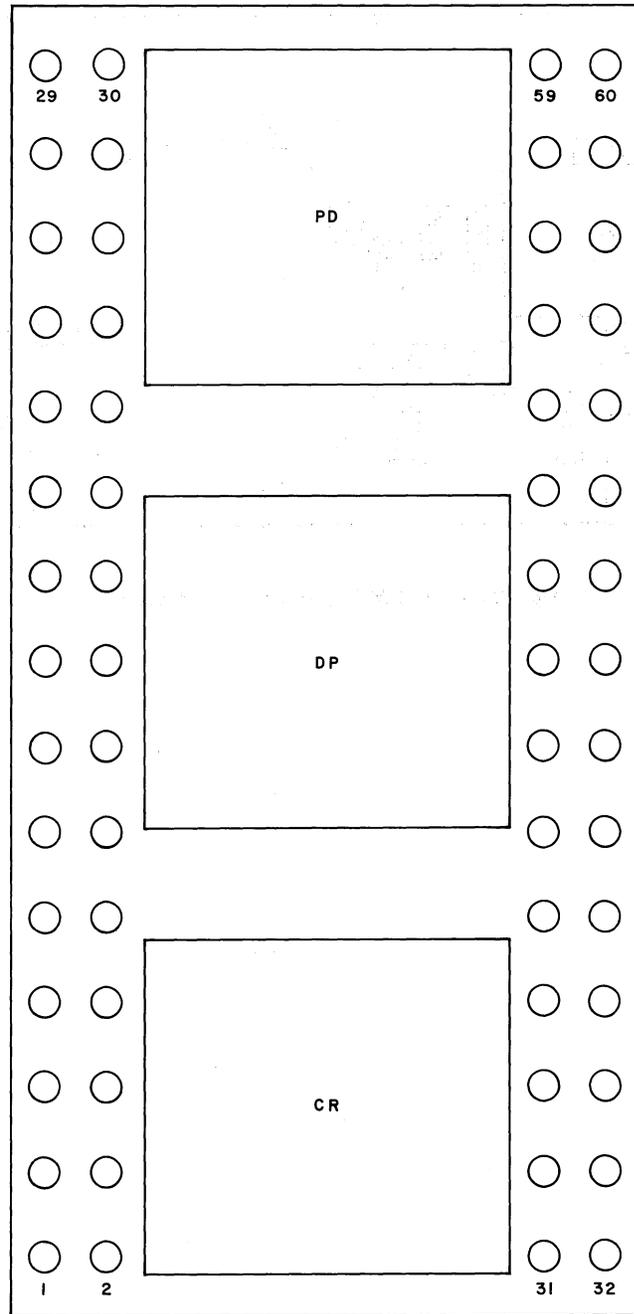


Fig. 26—CP CT1 Component Placement

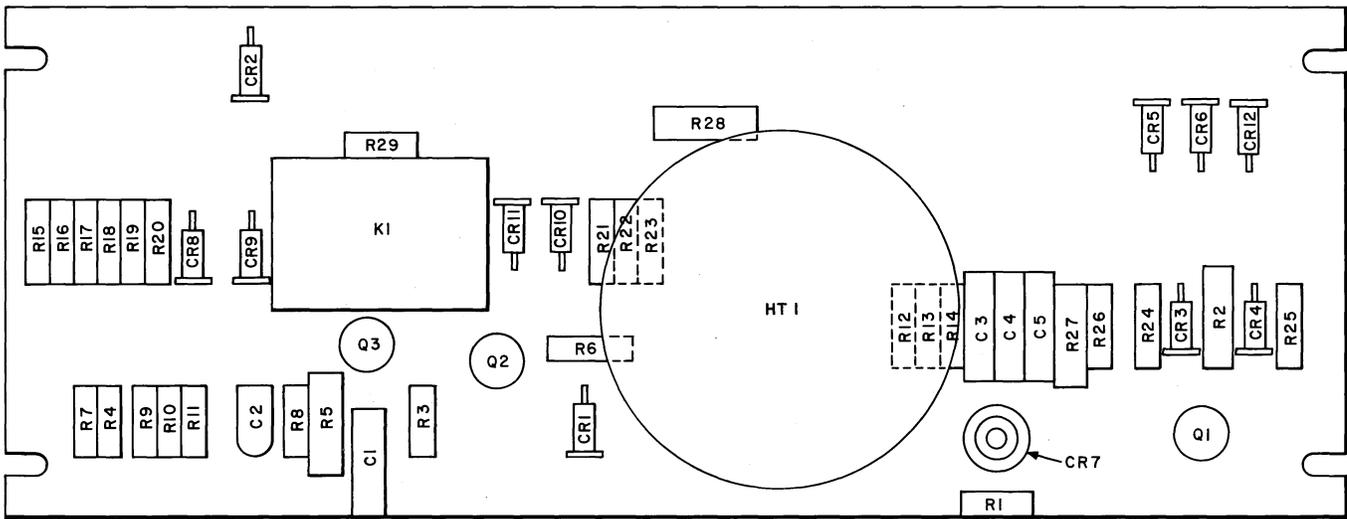


Fig. 27—CP BM2 Component Placement