

**DATA AUXILIARY SETS 801A5 AND 801A6
FOR AUTOMATIC CALLING
THEORY OF OPERATION
AND SUPPLEMENTARY INFORMATION**

	PAGE		PAGE
1. GENERAL	1	7. MAINTENANCE AND TESTING INFORMATION	34
2. EQUIPMENT ARRANGEMENTS	2	8. REFERENCES	37
3. DESCRIPTION	3		
A. System Description	3	1. GENERAL	
B. ACU Functional Description	3	1.01 This section is issued to provide additional information on the theory of operation and other supplementary information on Data Auxiliary Sets (DAS) 801A5 and 801A6. 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.	
4. THEORY OF OPERATION	13	1.02 Data Auxiliary Set 801A5 or 801A6 is referred to in this practice as an ACU or by the numerical designation 801A5 or 801A6.	
A. Power Supply	13	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.	
B. Interface Circuits	13	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.	
C. Interface Gates	14	1.05 Data Auxiliary Set 801A5 or 801A6 is shown in Fig. 1. This illustration shows the physical dimensions of the ACU.	
D. Pulse Counter	14		
E. Interdigit Timer and Dial-Pulse Generator	19		
F. ACR Timer	21		
G. Limiter-Detector (DAS 801A6 Only)	22		
H. Monitor Amplifier	23		
I. Supervisory Components	23		
J. Relays	23		
5. DESCRIPTION OF OPTIONS	30		
A. Customer Options	30		
B. Telco Options	31		
6. PERFORMANCE DATA	34		

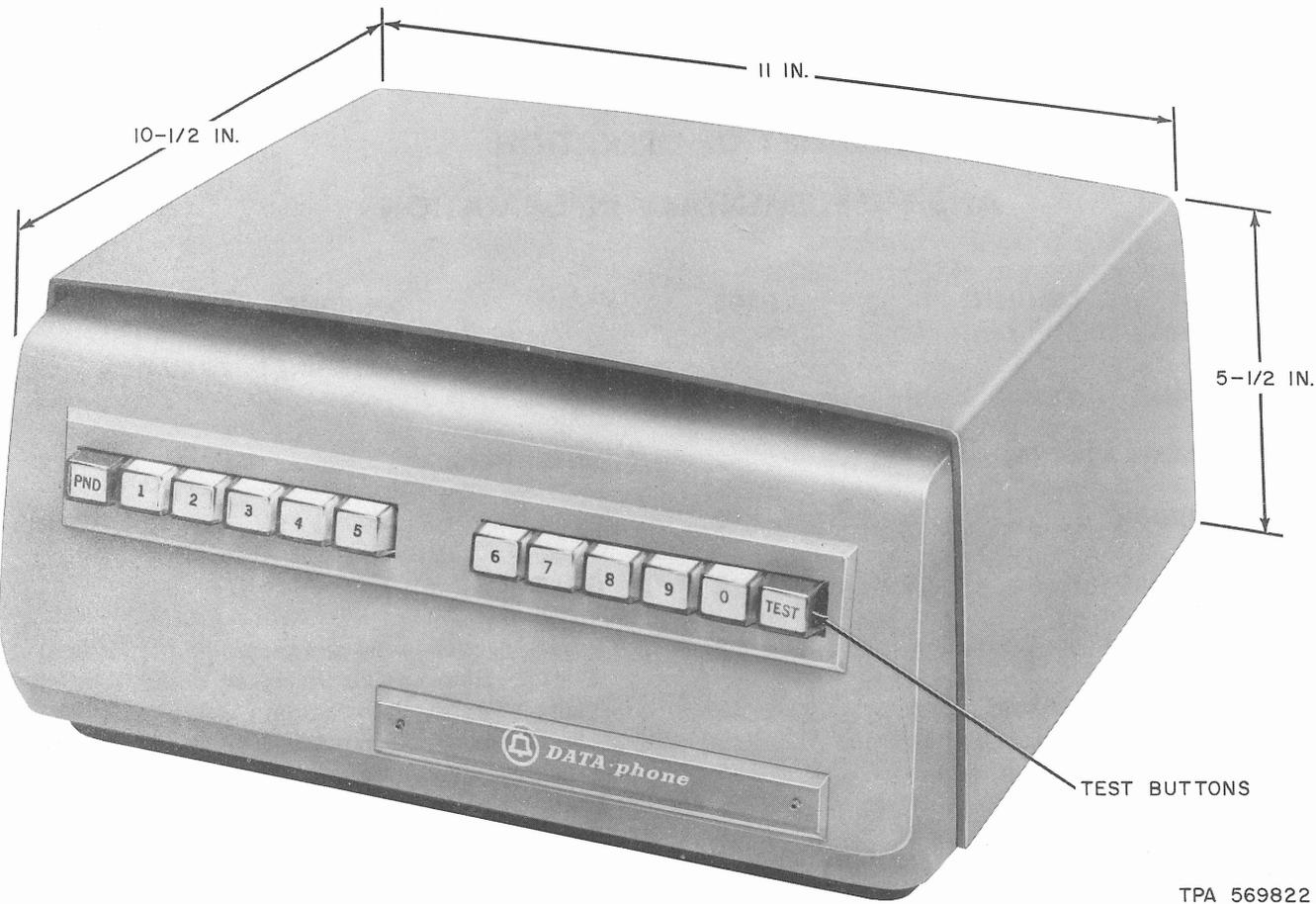


Fig. 1—Data Auxiliary Set 801A-Type, Front View

1.06 The ACU is designed to accept information furnished by a business machine and automatically originate DATA-PHONE® calls by transmitting the required dial pulses necessary to initiate the call. The DAS 801A6 is essentially an 801A5 ACU with a CP AS8 and a CP AS9 added to provide answer detection capabilities.

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 power supply requires an external source of ac power. Series 3 ACUs have a 17A power unit and require 117 volts rms ± 10 percent @ 60 ± 0.1 Hz nominal 15 watts. Series 4 and higher ACUs have a 48A power unit and require 117 volts rms ± 10 percent @ 60 ± 3 Hz nominal 15 watts.

2. EQUIPMENT ARRANGEMENTS

2.01 The ACU is connected directly to the business machine and is under control of the business machine. The ACU is connected to the business machine by a cord which must not exceed 50 ft in length and must be equipped with a plug that mates with a KS-19087-L6 connector. This cord will be supplied by either the business machine manufacturer or the customer.

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

2.03 The ACU can be used with any business machine that furnishes a compatible signal to the ACU. For additional information and specifications on the ACU interface, refer to the Bell System Data Communications Technical Reference on 801A-Type Automatic Calling Unit Interface specifications EIA RS-232-A, EIA RS-366, and the following text.

2.04 Signals between the ACU and business machine are transmitted by one of two optional means: contact interface (option ZE) or voltage interface (option ZF). The signal ranges which are acceptable and which will operate the ACU circuits are given in Table B.

2.05 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.

3. DESCRIPTION

A. System Description

3.01 The ACU is connected directly to the telephone line, the data set, and the business machine. A typical installation showing the connections and the conductor designations is shown in Fig. 2 and 3. Since the ACU is connected across the telephone line, it can call the requested number and transfer the line to the data set. The 801A6 will verify that a connection has been established before it transfers control of the line to the data set.

B. ACU Functional Description

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

Sequence of Operation

3.03 The basic sequential states of the ACU may be summarized as idle, call request (off-hook), ready to dial (line occupied), answer detection (801A6 only), data mode, and call termination (clear). Figures 5 and 6 show the sequence charts for automatic call origination with and without end of

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

TABLE B
INTERFACE SIGNALS

LEAD DESIGNATION	OPTION ZF VOLTAGE INTERFACE		OPTION ZE CONTACT INTERFACE			
	ON (ONE)	OFF (ZERO)	ON (ONE)	OFF (ZERO)		
CRQ	+3 to +25V	-3 to -25V	Contact Closure to Ground	Open Circuit		
DPR	+3 to +25V	-3 to -25V	↓	↓		
NB1	-3 to -25V	+3 to +25V				
NB2	-3 to -25V	+3 to +25V				
NB4	-3 to -25V	+3 to +25V				
NB8	-3 to -25V	+3 to +25V				
PND*	+5 to +20V	-5 to -20V				
DLO*	+5 to +20V	-5 to -20V				
DSS*	+5 to +20V	-5 to -20V				
ACR*	+5 to +20V	-5 to -20V				
PWI*	+5 to +20V	510Ω to Ground			Contact Closure to Ground	Open Circuit

* Assuming a terminator dc load resistance (R_L) in the range between 3000 ohms and 7000 ohms.

TABLE C
NUMBER LEAD CODE

DIGIT	NUMBER			
	NB8	NB4	NB2	NB1
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1
EON	1	1	0	0

number and the test mode operation with and without end of number.

Ground Start Call Origination

3.04 Data Auxiliary Sets 801A5 and 801A6 are designed for ground start operation only; therefore, only ground start telephone lines may be used. An automatic call is originated when the associated business machine presents 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 grounds the ring side of the line. This causes a central office (CO) off-hook relay to operate. A contact on this CO relay closes and grounds the tip of the telephone line. The ACU detects this ground which must be present for 250 milliseconds or longer and turns on the DLO lead. It is assumed that the CO has by this time placed dial tone on tip and ring and is ready to accept digits from the station. The ACU now requests a digit from the business machine by turning on the present next digit (PND) lead. The business

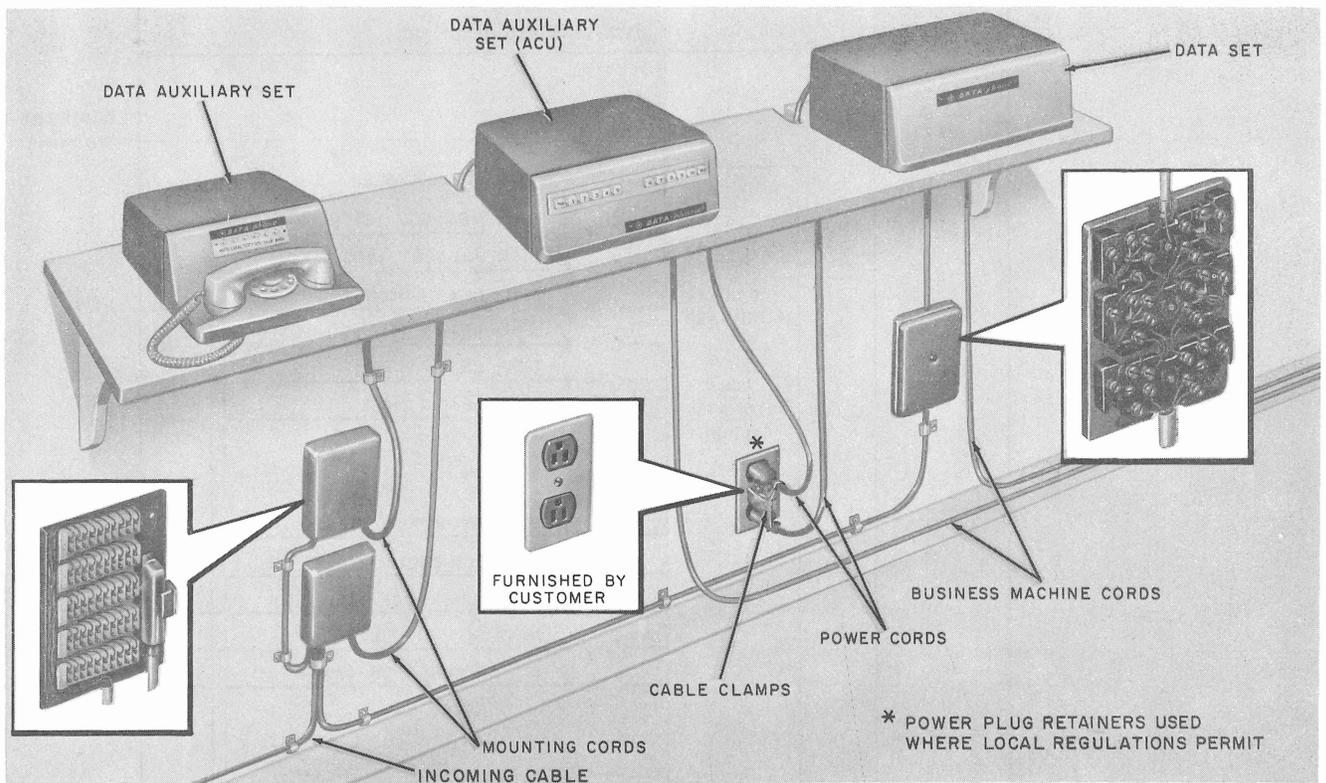


Fig. 2—Main Components of a Typical Installation Using a Single ACU With an Associated Data Auxiliary Set and a Data Set

machine may now present the first digit of the telephone number to be dialed.

3.05 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, and the least significant bit on the NB1 lead. When the number leads have been set, the business machine signals the ACU by turning on the digit present (DPR) lead. In response to the DPR ON, the ACU dial pulses the digit to the central office. After transmission of the dial pulse signal, the ACU turns off the PND lead. The business machine then turns off the DPR lead. The interdigit timer delays the start of the next cycle by at least 600 milliseconds until the central office response time requirements are met and 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. In DASs 801A5 and 801A6, series 5 and higher, progress of the call may be monitored through the ACU speaker if the ACR timer switch is set to the

40-second monitor position (extreme clockwise position).

3.06 A delay by the business machine in turning on the DPR lead, after the interdigit timer turns on the PND lead, reduces the dialing rate. If this delay exceeds the maximum interdigit time allowed by the central office, an incorrect number may be reached. If the delay in turning on the DPR lead exceeds the ACR timer interval, an Abandon Call and Retry signal is given to the business machine via the ACR interface lead.

3.07 The method of detecting an answering signal and conditioning the associated data set for data transmission is a function of the business machine and data set. The business machine may be programmed to generate an end-of-number (EON) code which, with the proper option installed in the ACU, causes the data set to be placed off-hook for answer-tone detection. If the business machine does not send EON, answer-tone detection

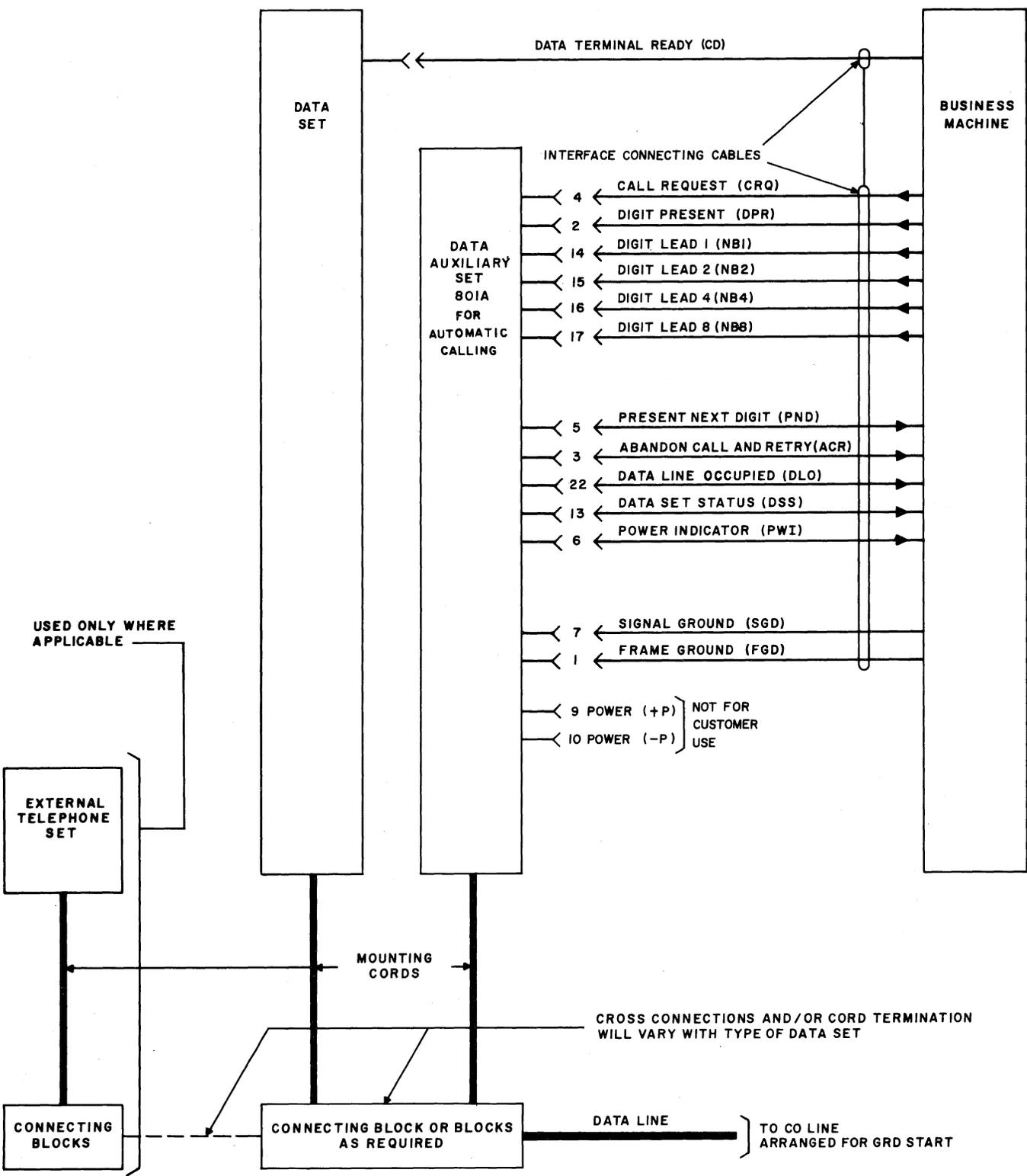


Fig. 3—Block Diagram of a Typical Installation

machine presents the EON code, the data set is placed off-hook and the telephone line is transferred to the associated data set. When this mode of operation is used, the data set must be capable of answer-tone detection. The data set informs the ACU that it has gone into the data mode when an answer tone is detected by placing a ground on the ACU TB2-C lead. This ground causes the ACU DM relay to operate and the ACU then informs the business machine that the data set is in the data mode by turning on the DSS lead. If no EON code is received within the ACR timer interval, or if the data set has not detected the answer tone within the ACR timer interval, the ACR lead is turned "on." This "on" indication is not a command lead, and the business machine must be programmed as to what action to take. An "on" indication is a suggestion to the business machine to abort the call and try again.

3.10 With the option, data set answer-tone detection without EON, installed (option E), the data set is placed off-hook when the ACU detects a valid tip ground (see 3.04). When the ACU presents the first PND "on" to the business machine and the business machine turns on DPR, the ACU ANS relay operates; line interrupts are thus avoided when the ACU transfers control of the telephone line to the data set. When the ACU has dialed the digits of the telephone number, the distant station detects ringing, goes off-hook, and sends back an answer tone. The local data set detects this tone and presents a ground on the ACU TB2-C lead. The ACU DM relay operates and the DSS lead is turned on. The LT relay then releases and the ANS relay releases. If a valid answer signal is not received within the ACR timer interval, the ACR lead is turned on.

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; that is, the ACU TK relay is operated. The ACU presents a DLO signal to the business machine. With DLO "on," the ACU inhibits the call request circuit, thereby preventing the business machine from originating a call. The ACU responds to an off-hook signal from the data set by seizing the telephone line and grounding the ring which presents an off-hook condition to the central office. When the central office has recognized the off-hook condition

by grounding the tip, the telephone line is returned to the data set. 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 and the DLO lead is turned "off," the call request circuit is enabled.

3.12 A button on the associated telephone set or DAS is available so that, in the event of a local ac power failure, depressing this button will gain access to the telephone line.

Incoming Call

3.13 When not in the calling process, the ACU monitors the tip and ring of the telephone line and, upon detecting an incoming call, turns on DLO. This signal, an indication to the business machine that the data line is occupied, is held on until the telephone line is idle. When DLO is on, a call request cannot be processed.

Test Mode

3.14 The 12 pushbuttons on the front panel are used to test the ACU without external test equipment. A call origination may be made using these buttons to do the operations normally done by the business machine. 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 transferred from the business machine to the ACU.

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 In the test mode, when the central office applies dial tone, it is audible from a front-mounted speaker and the lamp behind the PND button will light. This indicates readiness to transmit the first digit of the telephone number. A digit is outpulsed by depressing the button corresponding to that digit. When the digit has been outpulsed, the PND lamp turns off and remains off until the digit button is released and the interdigit timer completes its cycle. With the PND lamp again illuminated, the ACU is ready for the next digit. This is a repetitive procedure until the complete number is outpulsed. If the test is to include the data set, the data set DTR

TPA 518094

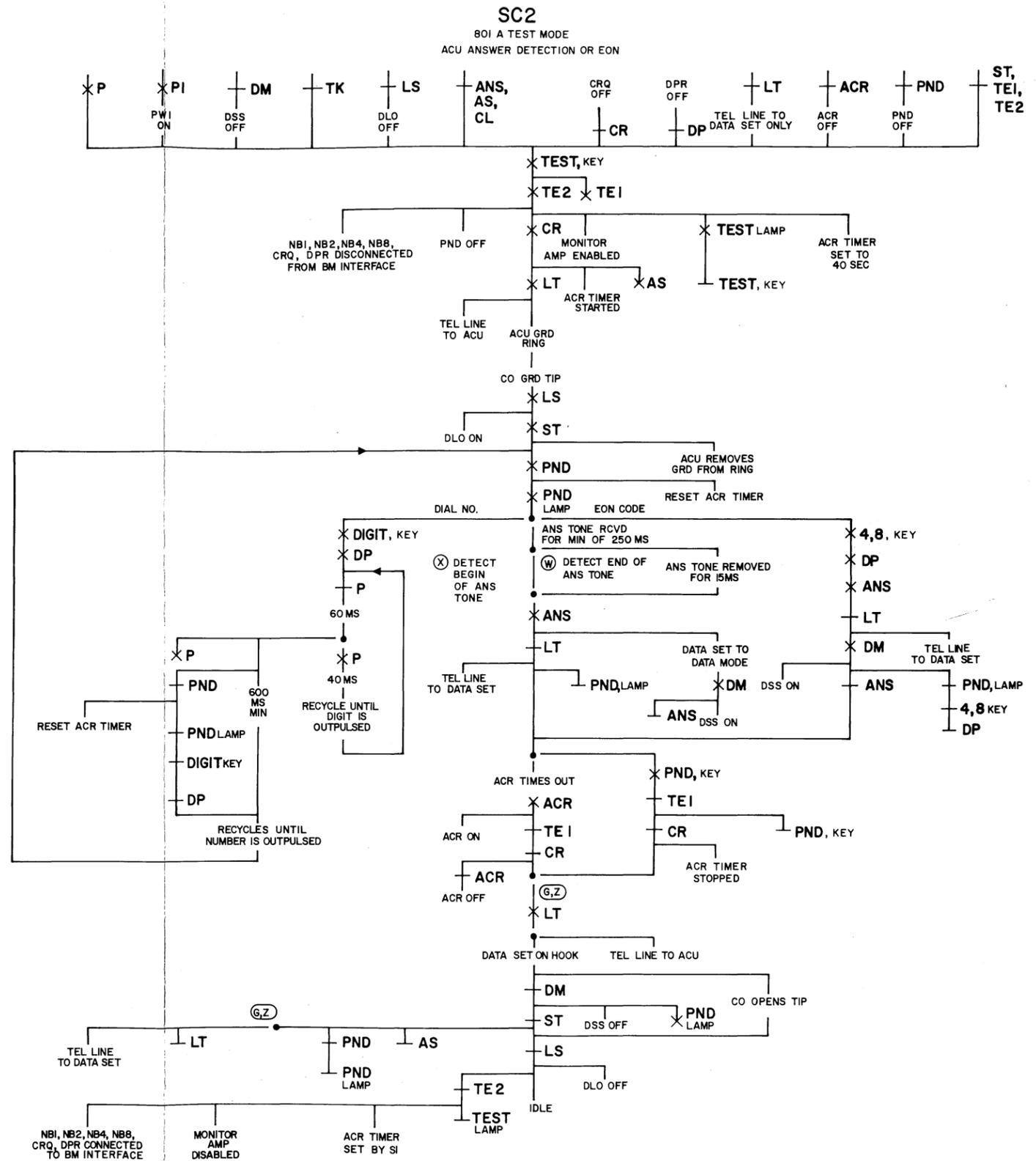
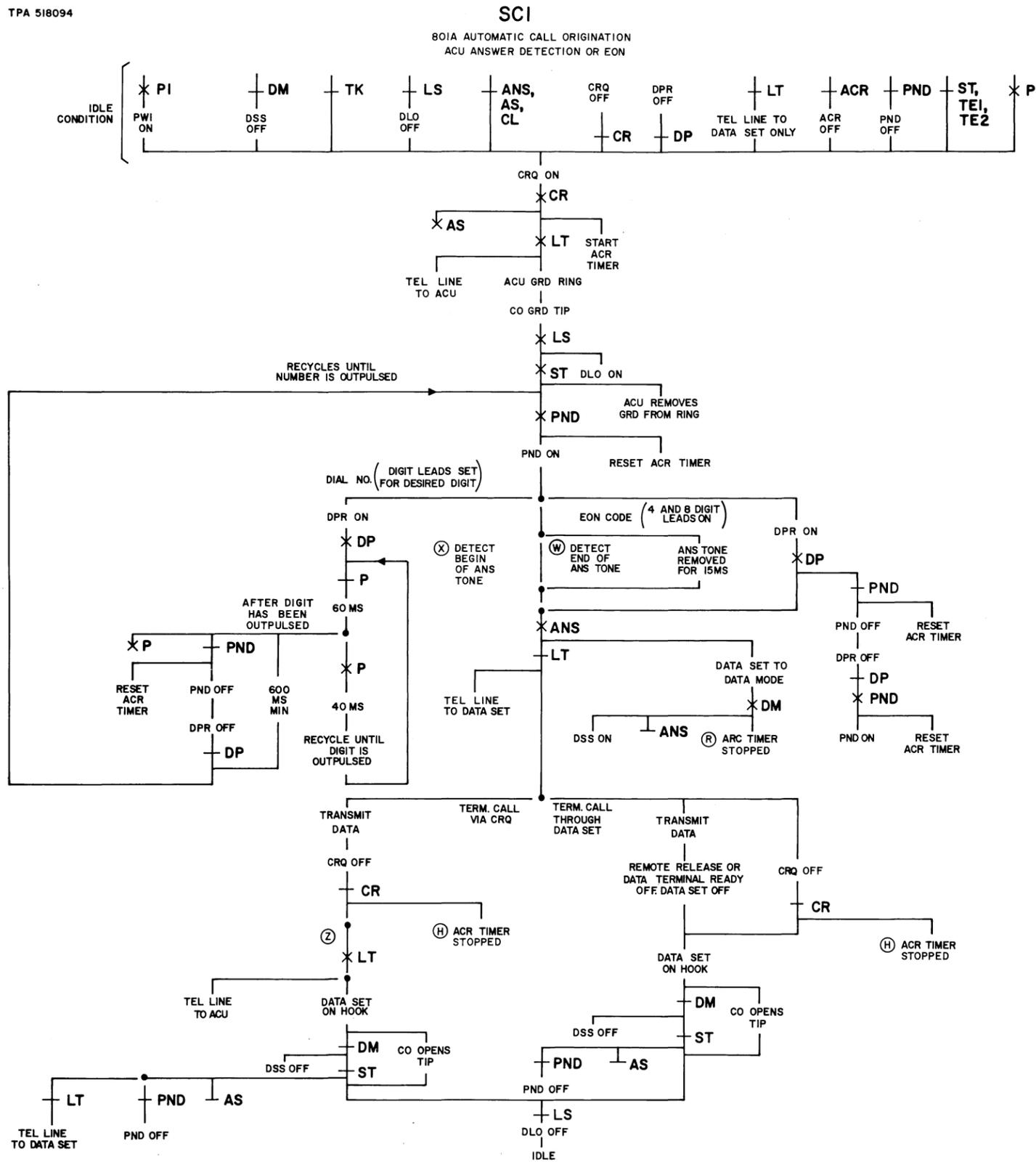


Fig. 5—Data Auxiliary Set 801A-Type Sequence Chart

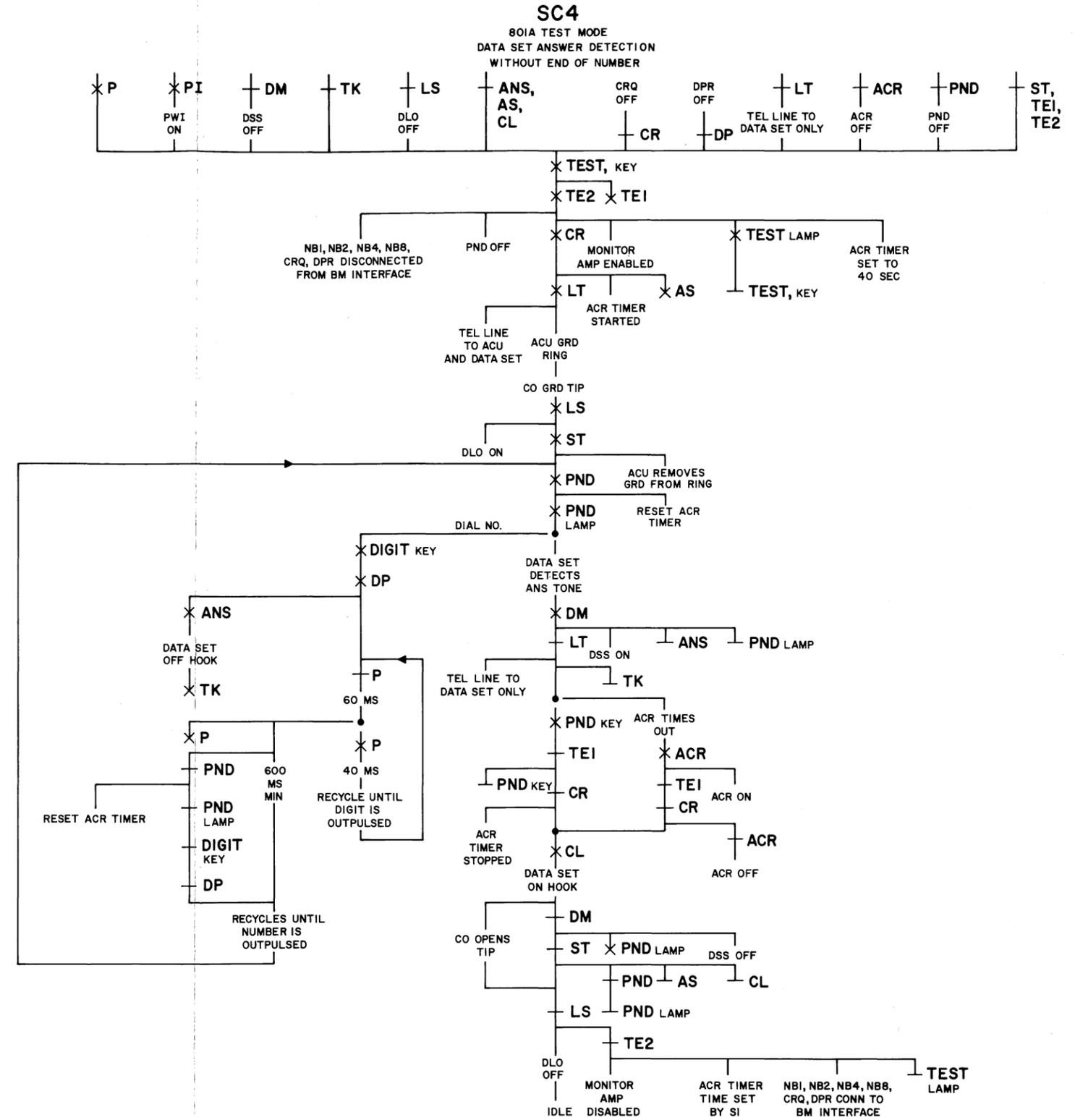
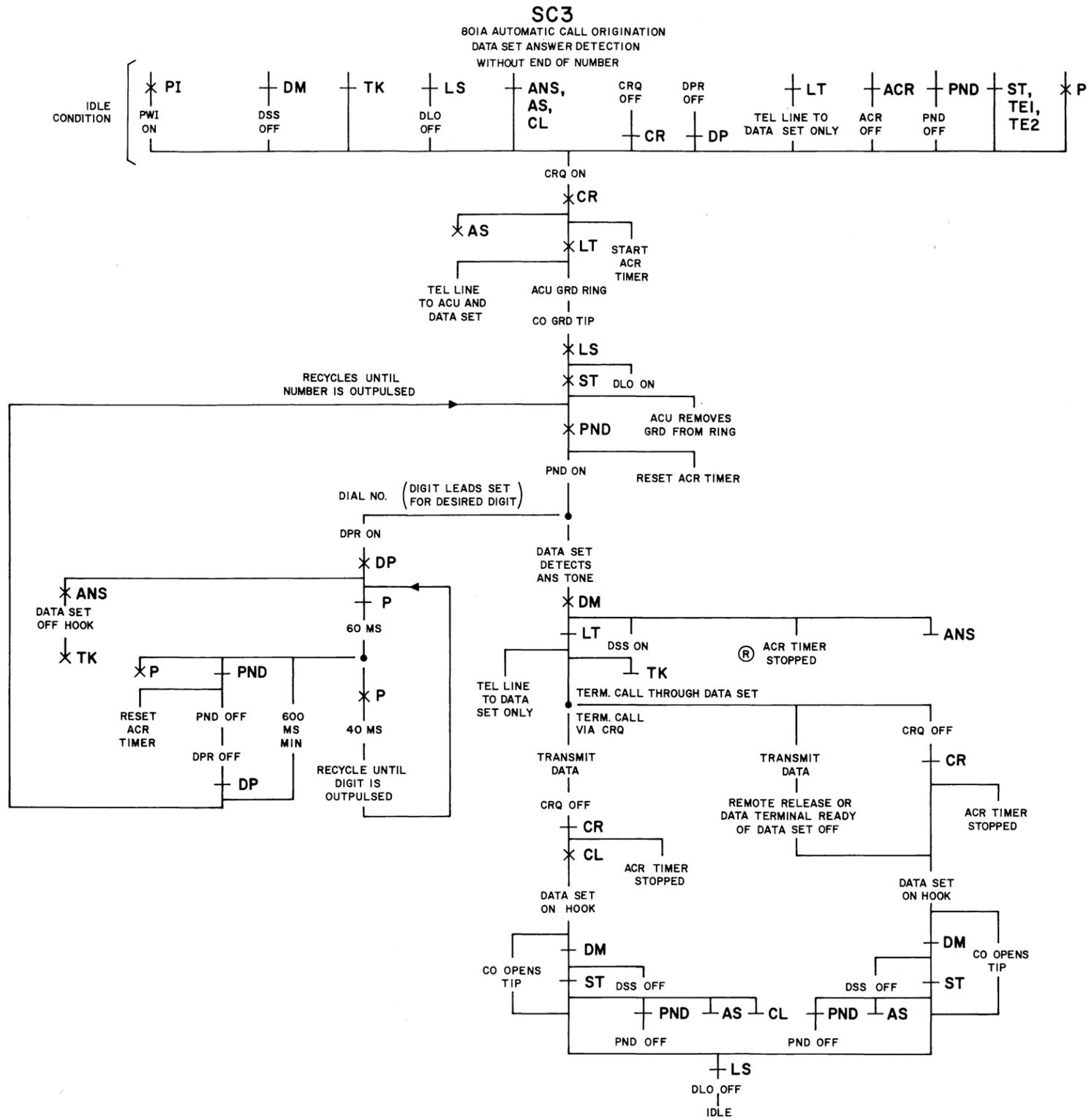


Fig. 6—Data Auxiliary Set 801A-Type Sequence Chart

lead must be turned "on." If the associated business machine normally presents an end-of-number (EON) code, the 4 and 8 buttons may be pushed simultaneously to manually generate this code. This code is used to transfer the telephone line to the data set. When the data set detects answer tone, the PND lamp will extinguish.

3.16 Automatic Time-Out: When the ACU enters the test mode, a 40-second timer is started. Each time a digit button is depressed, this timer is reset. If the timer is allowed to reach 40 seconds, the ACU will drop out of the test mode and return to the idle condition. The ACU may also be taken out of the test mode at any time by pushing the PND button.

Call Termination

3.17 A call may be terminated by either of two optional means: turning off CRQ or termination by the data set. If the call is to be terminated by turning off CRQ (option Z or A), two methods of directing the data station to go on-hook are used. Line transfer (option Z) is used with data sets that go on-hook if telephone line current is interrupted. The call is terminated by transferring the telephone line from the data set until the data set goes on-hook, then the ACU goes to its idle state. With the CL contact method (option A), the ACU signals the data set to go on-hook via a contact closure. This signal is held until the data set is on-hook, then the ACU returns to the idle condition.

3.18 If the call is to be terminated by the data set (option G or ZD), the business machine will have turned off CRQ some time after DSS is on. The business machine will terminate the call by turning off the data terminal ready function to the data set. The ACU will revert to the idle state upon removal of the data mode indication (ground on ACU TB2-C lead) by the data set. Dropping CRQ before the system is in the data mode (before DSS is on), will cause the call to be aborted.

3.19 In order to satisfy central office requirements, an intercall timer is incorporated into the LS relay driver circuit located on CP AS9. This timer delays DLO from turning off by a minimum of 500 milliseconds after the call is terminated.

4. THEORY OF OPERATION

4.01 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. 7).

A. Power Supply

4.02 The ACU may have either a 17A or a 48A power supply. The 17A power supply converts 117 volts ± 10 percent, 60 ± 0.1 Hz ac into two regulated dc supplies. The positive supply may vary from 17.5 to 20.3 volts, and the negative supply from -17.5 to -20.3 volts. Maximum acceptable ripple is 115 millivolts peak-to-peak.

4.03 The 48A power supply supersedes the 17A power supply. ACUs having the 48A supply will be marked Series 4 and higher to indicate this change. The 48A power supply converts 117 volts ± 10 percent, 60 ± 3 Hz ac into two regulated dc supplies. The positive supply may vary from 18.3 to 20.4 volts, and the negative supply from -18.3 to -20.5 volts. Maximum acceptable ripple is 115 millivolts peak-to-peak. The larger frequency tolerance of the 48A power supply permits use of an emergency power source in the event of a local power failure.

B. Interface Circuits

4.04 The interface circuits are located on CP AS14. Figure 8 illustrates a schematic diagram. This circuit pack contains five interface circuits, a transistor switch, and miscellaneous components. The interface circuits provide a business machine with either a contact interface or a voltage interface.

4.05 The interface circuits are arranged for EIA voltage interface by tightening screw terminals 1 through 4 and 6 through 12 and loosening 14 through 18.

4.06 A contact interface may be obtained by tightening screw terminals 14 through 18 and loosening 1 through 4 and 6 through 12. Screw terminals 5 and 13 are not internally connected

and, therefore, do not provide any useful function. The contact closures are grounded on one side and protected by a 0.5 μ fd capacitor in series with a 120-ohm resistor.

4.07 The transistor switch, Q1, is used only in the test mode when manually dialing a number. A ground is applied to the base of Q1 when a number key is pushed. Q1 will saturate, thus making both the emitter and collector approximately ground potential. These two signals are processed by CP AS13.

C. Interface Gates

4.08 The interface gates are located on CP AS13.

Figure 9 illustrates a working schematic diagram. This circuit accepts an EIA or a contact interface from an associated business machine. The business machine sets the digit to be dial-pulsed in binary form on interface leads NB1, NB2, NB4, and NB8. The least significant digit is set on NB1; the next in significance is set on NB2, and so on through NB8. Each interface circuit, NB1, NB2, NB4, and NB8, goes through a TE2 contact which is external to CP AS13 and is designated D1, D2, D4, and D8 (the inputs to the interface gates).

4.09 In the steady state condition, transistors Q3, Q4, Q5, and Q6 are turned off by the saturation of Q1. Collector current of Q1 flows through the parallel paths of R8 and CR7, R11 and CR11, R14 and CR15, and R17 and CR18, thus taking the base current away from Q3, Q4, Q5, and Q6 and turning them off. Capacitor C1 is charged to 15 volts. When the DP11-13 contact opens, C1 will discharge through R2 and R3 which turns Q1 off for approximately 5 ms. During this 5 ms, no current flows through CR7, CR11, CR15, and CR18, thus giving control of Q3, Q4, Q5, and Q6 to the interface leads. If any of the inputs are 1s, as defined in Table B, the current in R5 will flow into the interface lead through CR2, CR3, CR4, or CR5. This deprives Q2 of base current which turns Q2 off. The positive potential on the collector of Q2 in a cut-off condition reverse biases CR12 and CR19. A 1 on D1 holds Q3 off; a 0, as defined in Table B, reverse biases CR6 and Q3 and turns Q3 on. A 1 on D2 holds Q4 off; a 0 causes it to saturate. A 1 on D4 holds Q5 off; a 0 causes it to saturate. A 1 on D8 holds Q6 off; a 0 causes it to saturate. If all four inputs are 0s, CR2, CR3, CR4, and CR5 are reverse-biased

and Q2 will saturate. When Q2 is on, CR12 and CR19 are forward biased which holds both Q4 and Q6 on. A binary 0 has been translated into a binary 10. Zeros on the input leads become negative-going pulses on the respective outputs when the gate is opened. The only exception is that 0s on all inputs become negative pulses only on NB4 and NB8. The four output leads are used to set 0s into a binary counter which is capacitively coupled and sensitive only to negative-going pulses.

4.10 Resistors R4, R6, R9, R12, R14, and R18 provide a path for collector current to flow which gives high temperature stabilization. Diodes CR8, CR9, CR13, CR16, and CR20 protect their associated transistors from large negative voltages on the interface leads and increase the threshold voltage required to turn the transistor on. Diode CR1 prevents breakdown of the Q1 base-to-emitter junction.

D. Pulse Counter

4.11 The pulse counter is located on CP AS10.

A schematic diagram is shown in Fig. 10. The counter is composed of four identical flip-flop stages which are initially set to 1111 via the reset (RS) lead to ground. When the DP relay operates, any 0s in the number to be dialed are set into the counter by negative pulses on the corresponding N leads. The counter is then counted down utilizing trigger pulses coming from the dial-pulse generator. When the number of trigger pulses equals the binary number set into the counter, the 0000 state is reached which reverse-biases CR4, CR5, CR6, and CR7. This forces Q3 to turn off making its collector go positive. This positive step starts the interdigit timer by energizing the end-of-count lead which turns off the PND relay. The release of PND relay stops the dial-pulse generator and resets the counter to 1111.

4.12 Since all four flip-flop circuits operate identically, the following descriptive information may be applied to all. Initially, RS is grounded while CR8 conducts, making the collector of Q2 low. This state swings the base of Q1 negative, thus turning it off. With Q1 off, Q2 draws base current through R1 and R2 which holds the collector of Q2 low when the ground on R5 is removed. The first negative pulse on TR coupled through C3 and CR2 will turn Q2 off. Q1 will then draw current through R5 and R6 and will again turn on. When the collector of Q1 drops in positive potential,

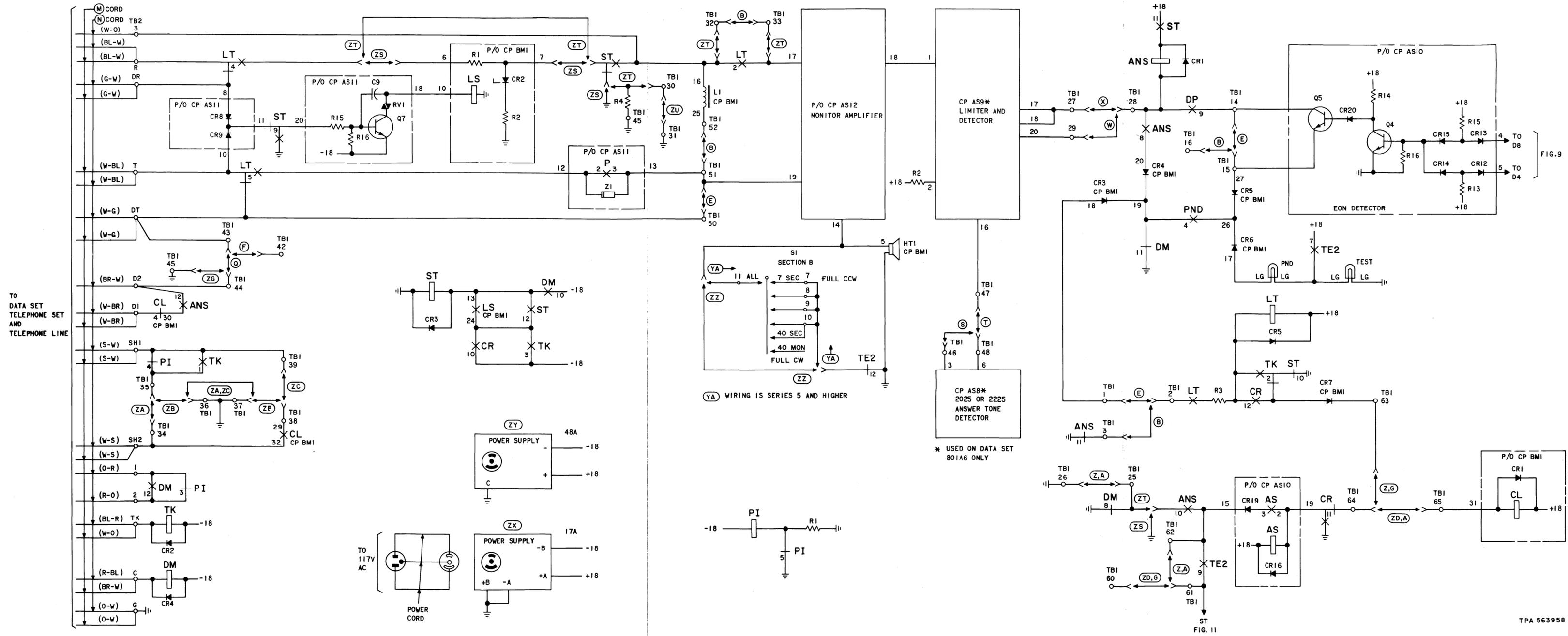


Fig. 7—Data Auxiliary Set 801A5 and 801A6 Schematic Diagram (Sheet 1 of 2)

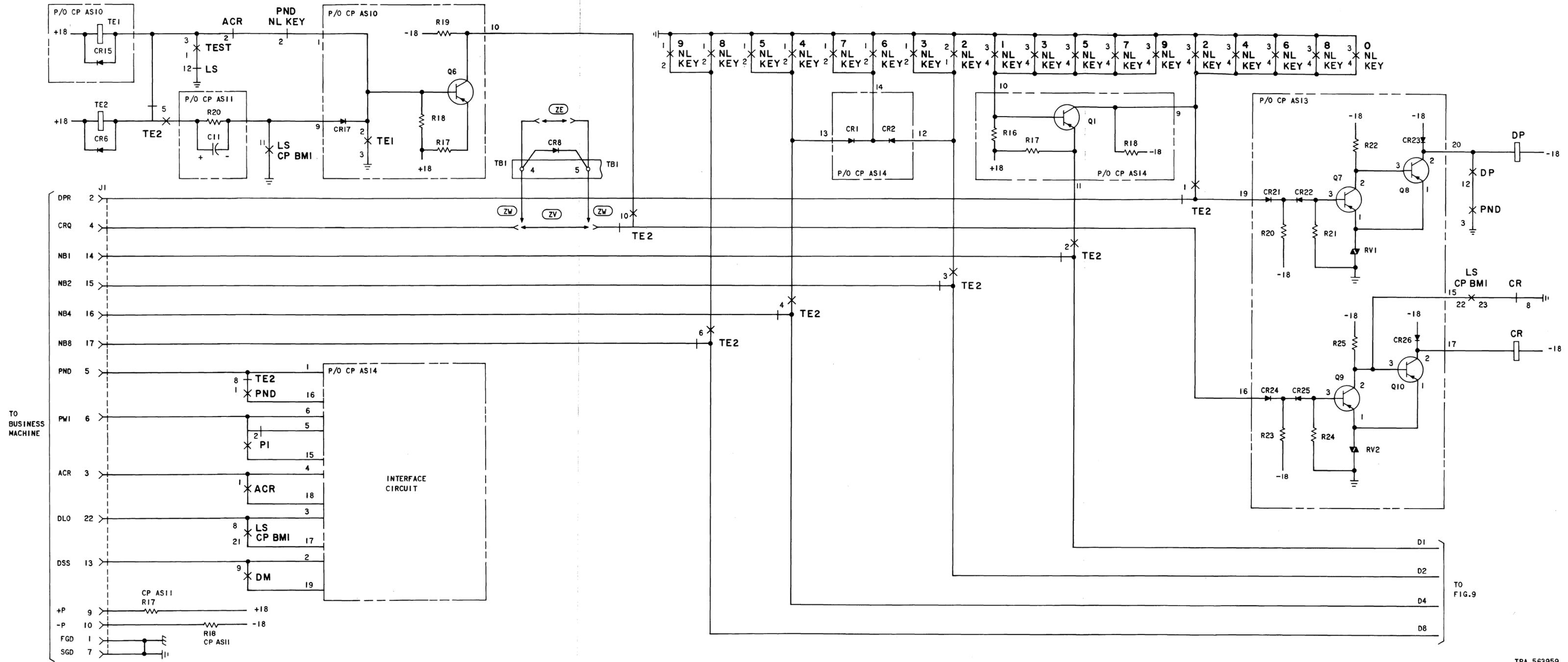


Fig. 7—Data Auxiliary Sets 801A5 and 801A6 Schematic Diagram (Sheet 2 of 2)

TPA 563959

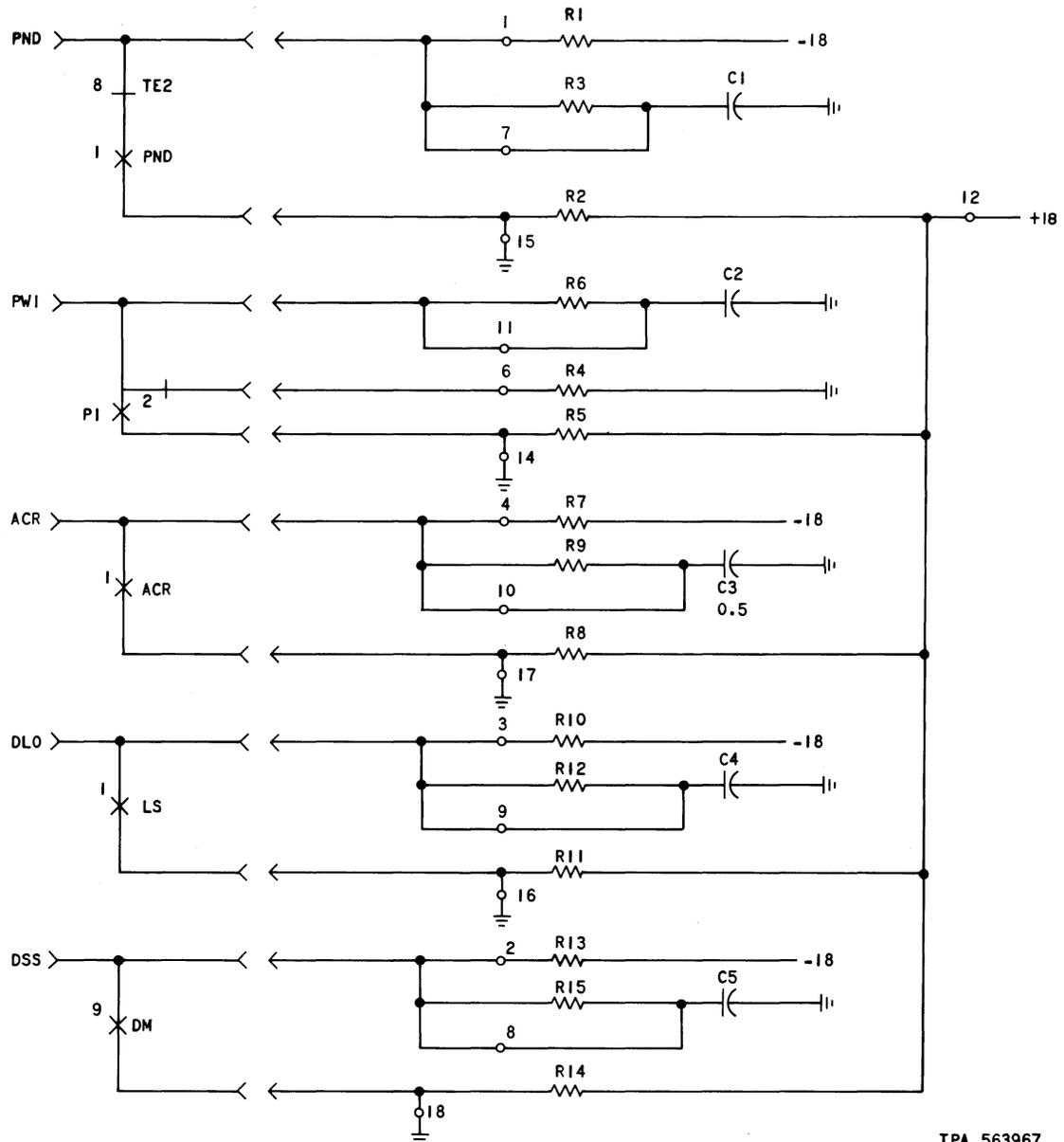


Fig. 8—Interface Circuits—Schematic Diagram

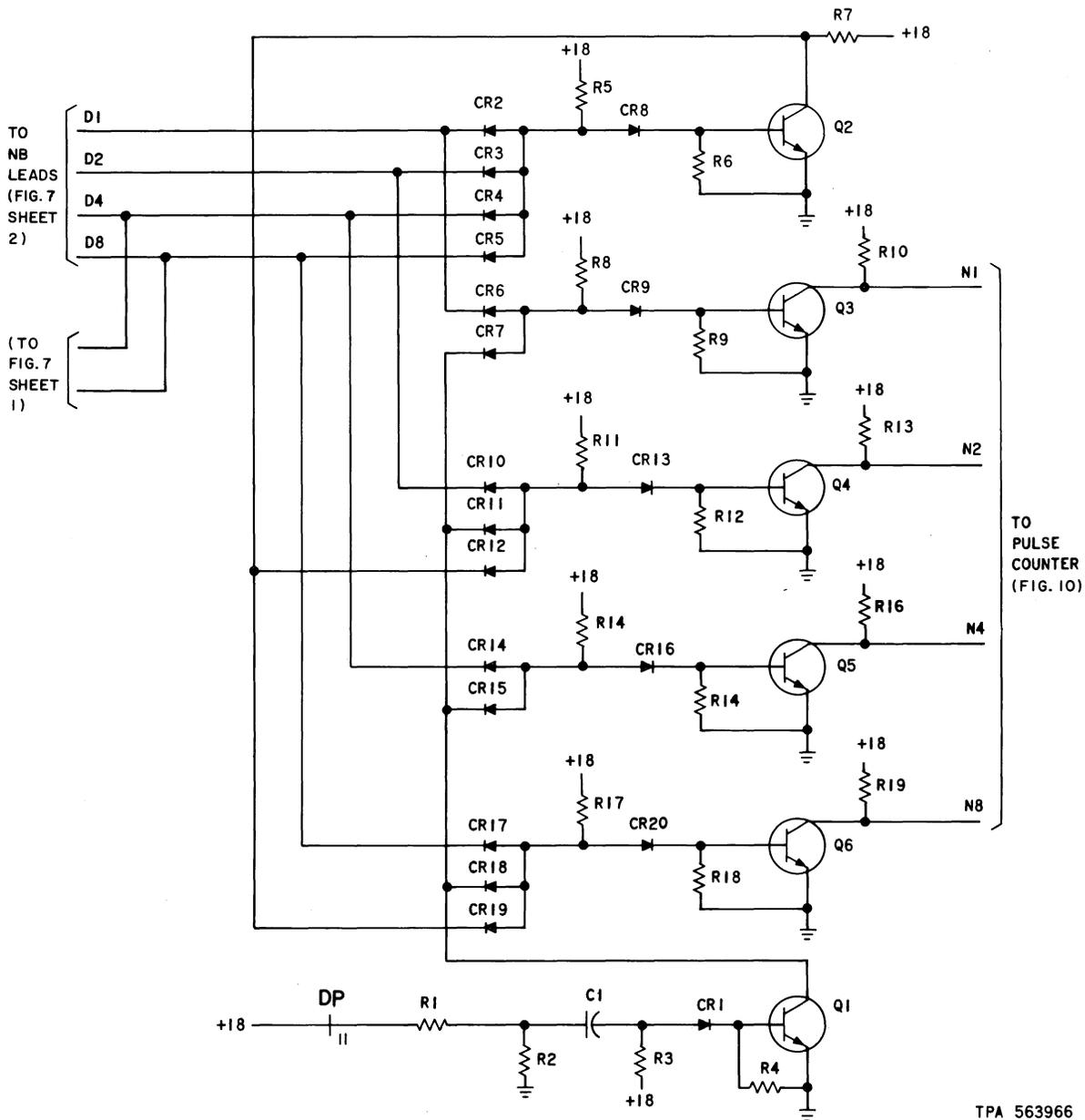
it holds Q2 off. Since the next flip-flop stage is sensitive only to negative-going transitions, there is no change of state. The next negative-going pulse on TR will turn Q1 off, which in turn causes Q2 to turn on. This negative-going step causes the next flip-flop to change state. Capacitor C1 filters noise to prevent false triggering.

E. Interdigit Timer and Dial-Pulse Generator

4.13 The interdigit timer and dial-pulse generator share the circuitry of CP AS11. Figure 11

is the schematic diagram of the interdigit timer, while Fig. 12 illustrates the dial-pulse generator.

4.14 The interdigit timer consists of a monopulser which will turn off an external relay (PND) connected between pin 16 and the +18 volt supply for at least a 600-ms time period. A cycle of operation will begin with the appearance of a positive trigger signal applied to pin 17. With the emitter of Q2 at ground potential, the steady state of Q2 is "on" and the PND relay is operated. When Q2 is on, Q1 is held off by R3. A positive pulse



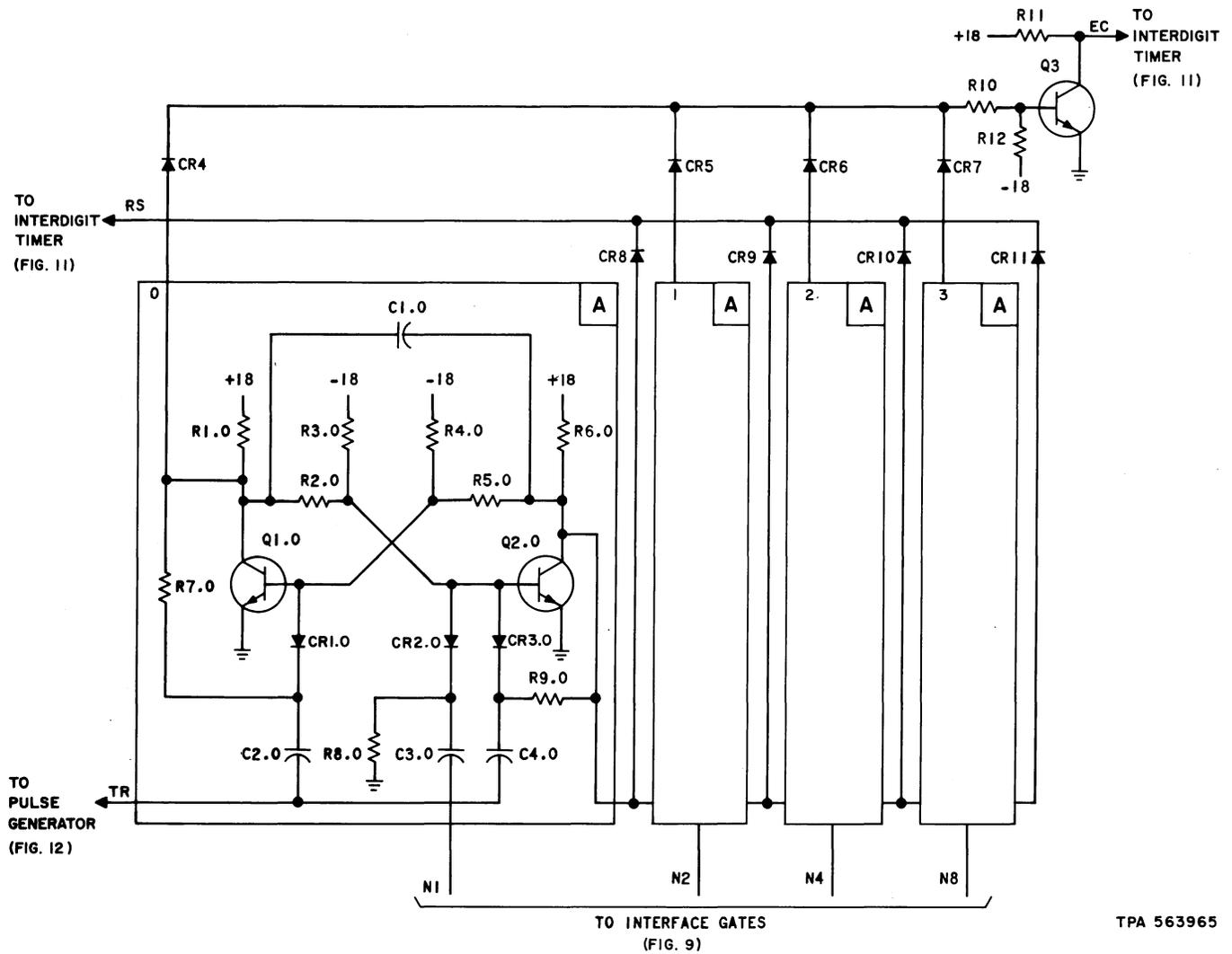
TPA 563966

Fig. 9—Interface Gates—Schematic Diagram

applied on pin 17 will turn Q1 on. When Q1 turns on, the collector drops from +18 to near 0, thus reverse biasing CR4. R21 enables Q2 to turn off even at higher than normal operating conditions. Transistor Q2 will hold PND off until C3 and C4 have discharged through R2 sufficiently to turn Q2 back on. This is the 600-ms interdigit time generated by this circuit.

4.15 The dial-pulse generator consists of a 10-pps multivibrator which drives the pulsing relay

with a make time of 39 ms and break time of 61 ms. A contact on relay PND provides a ground which drives Q4 into saturation. With Q4 saturated, Q3 is held off. Q5 and Q6 draw sufficient base current through R5 to remain on. When Q6 is conducting, the pulsing relay (P) is operated and the circuit is in idle condition. When pin 3 of Q3 is removed from ground, Q4 will turn off thus allowing Q3 and Q5 to operate as a free-running multivibrator. As Q3 draws sufficient base current through R18 to turn on, the negative step on the



TPA 563965

Fig. 10—Pulse Counter—Schematic Diagram

collector of Q3 turns both Q5 and Q6 off. C6 will begin to discharge through R5 to allow Q5 and Q6 to turn back on. This is the period of break time on the P relay. As Q5 turns on again, the negative step on its collector will turn Q3 off until C7 discharges through R6 to allow Q3 to again turn on. This is the period of make time on the P relay. Each time Q6 turns off, the P relay will open the telephone line, thus imposing a dial pulse.

4.16 A line status circuit consisting of a one-stage relay driver is located on CP AS11. The LS relay is operated by Q7 whenever the voltage on pin 20 is approximately ground potential for a time interval of about 240 ms. This time delay is provided by capacitor C9. A drop in line impedance would appear across R15, resulting in an off-hook

condition. Although this circuit is normally monitoring the tip, CR9 will provide ring monitoring for times when the central office reverses the battery.

F. ACR Timer

4.17 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. Series 5 and higher ACUs contain a 6-position switch that provides for monitoring the progress of normal calls placed by the associated business machine. The sixth position (fully clockwise) removes the short across the monitor speaker (HT-1). In the monitor mode, the ACR timer is automatically set to 40 seconds. At the expiration of the selected

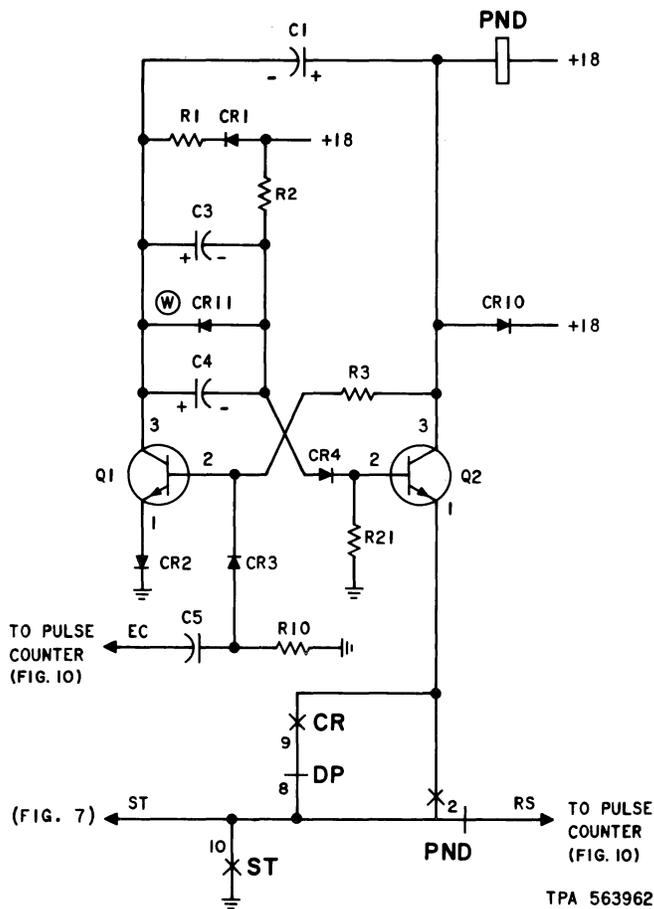


Fig. 11—Interdigit Timer—Schematic Diagram

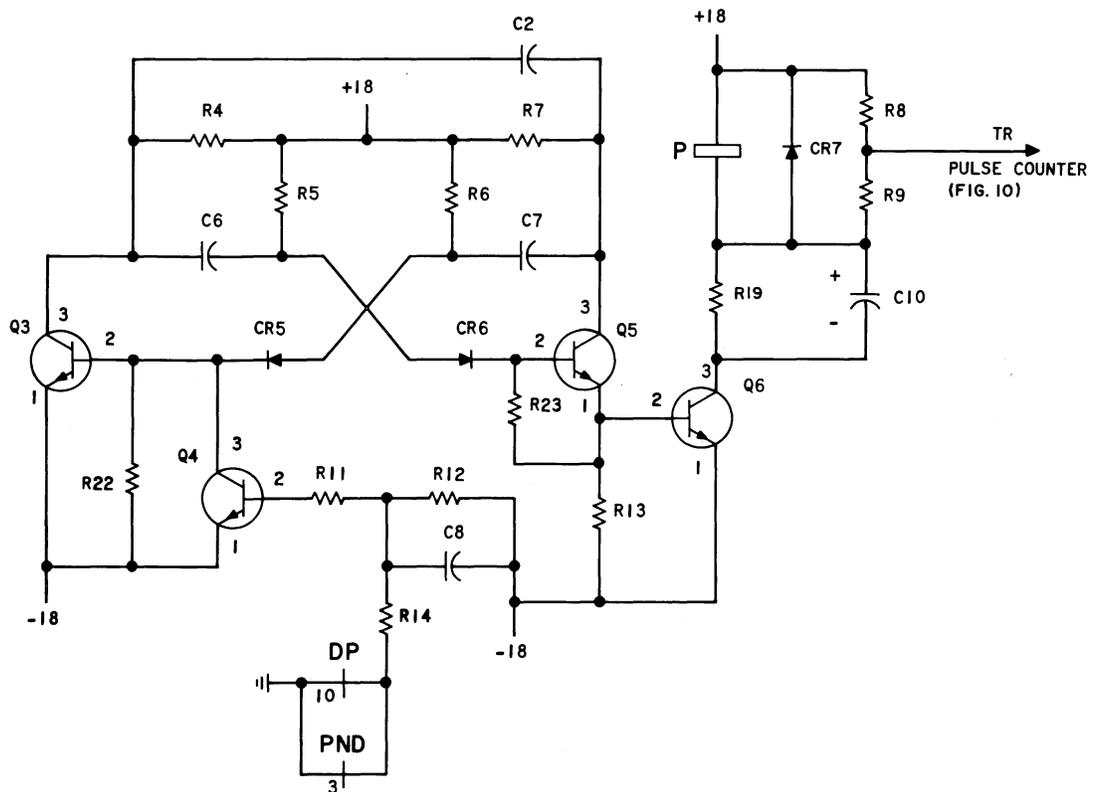
time interval, the ACR relay is operated. Switch S1, resistors R3 through R7, and capacitors C1 through C3 make up the timing elements of this circuit.

4.18 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 R1 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. 13. The timer is reset when PND is turned on by momentarily applying a negative 18 volts through the PND relay early make-break contacts and R1 which causes the capacitors to immediately discharge. This, in effect, turns off Q4 and releases the ACR relay.

G. Limiter-Detector (DAS 801A6 Only)

4.19 The limiter-detector circuits are not included in the DAS 801A5. This circuit provides ACU answer-tone detection which is an exclusive feature of the DAS 801A6. Limiter and detector circuits are located on CP AS9, while the tuned circuits are located on CP AS8. Figure 14 shows this relationship schematically. The limiter consists of transistors Q1, Q2, Q3, and its associated components. T1 and C8 of CP AS12 couple the limiter to the telephone line. Signals from the monitor amplifier input are coupled to the base of Q1 through capacitor C1. The input impedance of 900 ohms is determined by R1 and R2 which also provide bias to operate Q1 as a linear amplifier. The gain and dc operating point is set by an external resistor, R2, in series from +18 volts to the emitter of Q1. 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,



TPA 563963

Fig. 12—Dial-Pulse Generator—Schematic Diagram

the collector of Q4 becomes more 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 (detect beginning of answer tone) 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. If option W (detect end of answer tone) is used, this base current will turn on Q8 for at least 50 msec, operating the ANS relay.

H. Monitor Amplifier

4.20 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 emitter follower Q5. Transistor Q7, which is dc-coupled to Q5, has its gain controlled by R21 and C9. Transistor Q6 drives the externally mounted HT1 receiver. Figure 15 shows a schematic diagram of the monitor amplifier.

I. Supervisory Components

4.21 The supervisory components are located on CP BM1 and illustrated schematically in Fig. 16. This circuit contains a receiver, an inductor, and two relays.

J. Relays

Call Request (CR)

4.22 The operated state indicates that the ACU is originating a call. If the station is in the idle mode, then the call request relay is operated when the associated business machine turns on the CRQ interface lead. An on condition on the

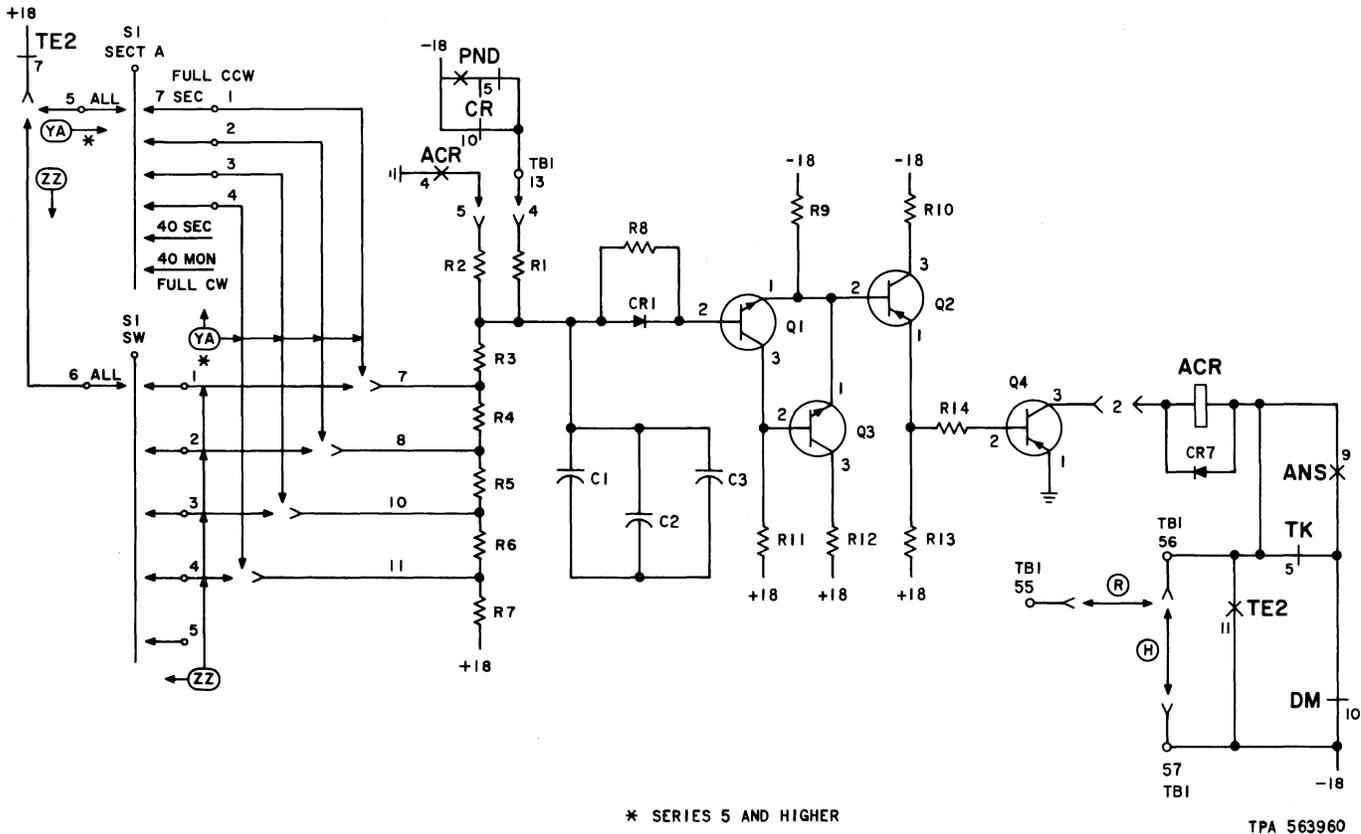


Fig. 13—ACR Timer—Schematic Diagram

CRQ lead causes CR24 on CP AS13 to conduct, which takes the base current from Q9, thus turning it off. If the telephone line is idle, Q10 will turn on, which operates the CR relay. If the telephone line had been in use, Q10 would have been reverse-biased through LS, thus preventing Q10 from turning on the CR relay. With voltage interface operation, diode CR8, which is series connected with the CRQ input lead, prevents a ground from turning on CRQ. With contact interface operation, diode CR8 is strapped out with option ZE.

4.23 Operation of the CR relay causes the following:

- The AS relay operates through CR-11M.
- The LT relay operates through CR-12M, TK-2B, and ST-10B to ground.
- The ACR timer starts by the opening of CR-10B.

Line Status (LS)

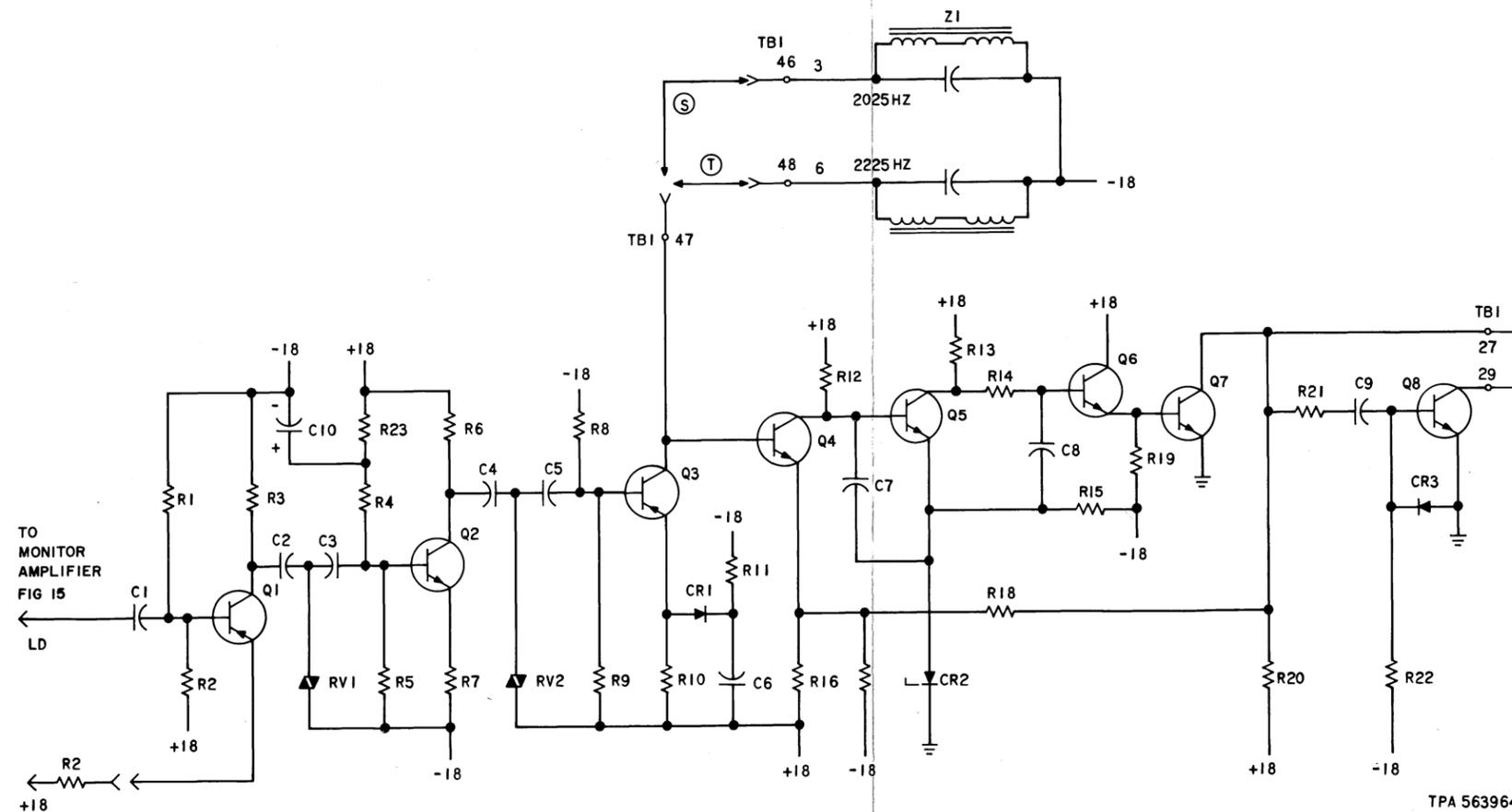
4.24 The operated state indicates the communications channel is in use. When the LS relay operates, it causes the following:

- The ST relay operates through CR10 and LS mode.
- The TE1 relay is prevented from operating by opening the operate path to ground.
- The interface lead DLO turns on by the LS make contact connected between terminals 8 and 21 on CP BM1.

Start (ST)

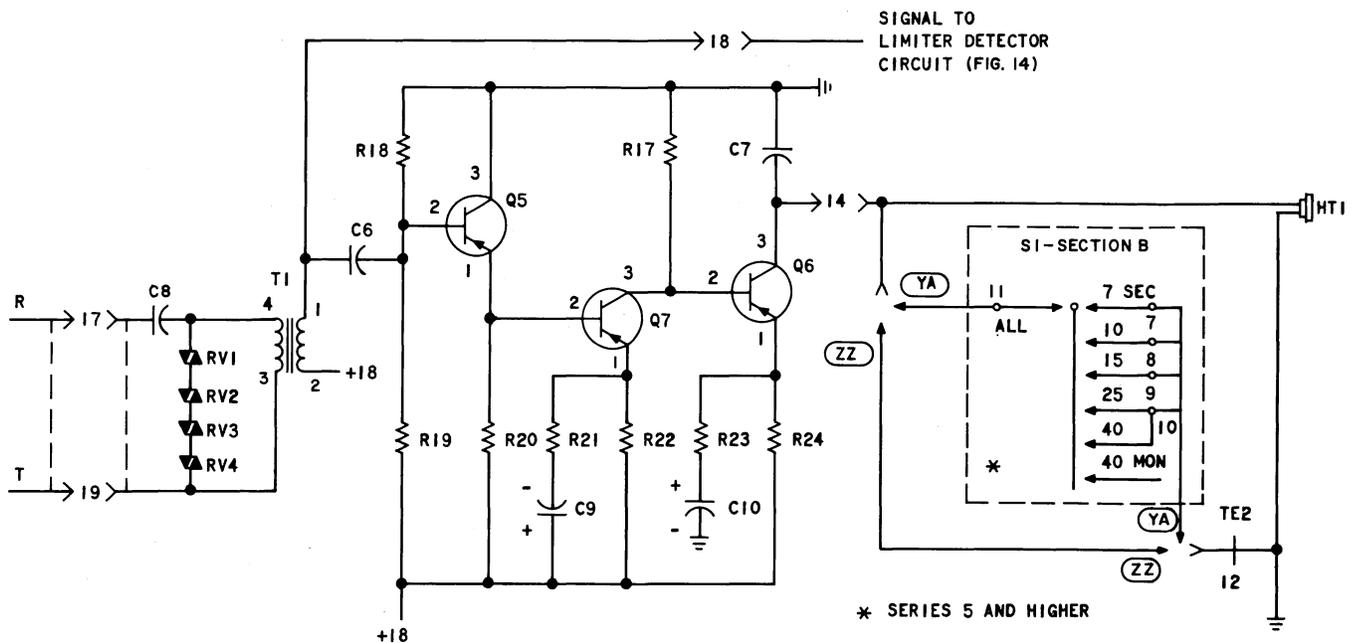
4.25 The operated state may indicate either of two conditions:

- A ground on tip has been detected by the ACU tip monitor circuit after a call request or talk indication was presented to the ACU by the data set.
- The data set is off-hook.



TPA 563964

Fig. 14—Limiter-Detector—Schematic Diagram



TPA 563961

Fig. 15—Monitor Amplifier—Schematic Diagram

4.26 Operation of the ST relay causes the following:

- The tip monitor circuit is removed from the telephone line. The LS relay is held operated by ST-9M.
- The PND relay operates through CR-9M, DP-8B, ST-10M, and Q2 of CP AS11.
- A hold path for the ST relay is established through ST-12M and CR-10M.
- The ground imposed on the ring is removed, and a dc path from tip to ring through ST-8M is completed. With option B, this path is through LT-4M, ST-8M, L1 on CP BM1, option strap B, P relay make contact, and LT-5M. With option E, this path is through LT-4M, ST-8M to terminal TB2-3, through the data set line-holding coil to terminal TB2-DT, option strap E, P relay make contact, and LT-5M.
- The pulse counter on CP AS10 is reset to 1s through PND-2B and ST-10M to ground.
- A hold path is formed for the AS relay through the AS make contact CR19 on CP

AS10, option strap (Z, A), (TB1-62 to TB1-61), and ST-10M to ground.

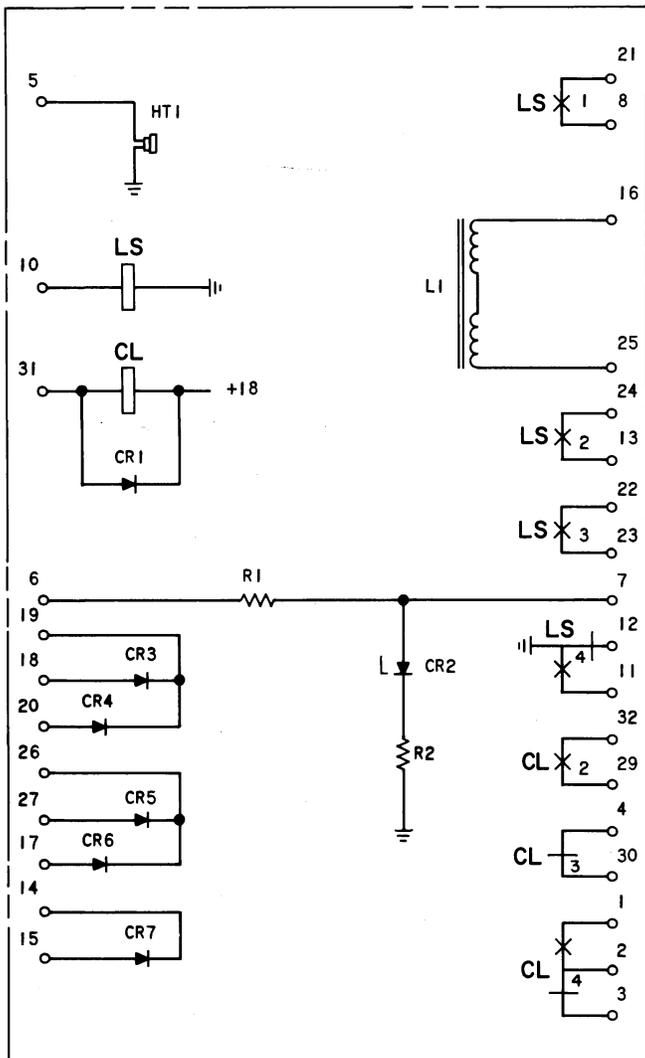
Automatic Seizure (AS)

4.27 The operated state indicates the telephone line has been seized by the ACU.

Line Transfer (LT)

4.28 The operated state transfers the telephone line to the ACU circuits. When the LT relay operates, it causes the following:

- The telephone line, which comes in on tip (T) and ring (R) of TB2, is switched from data tip (DT) and data ring (DR) to the ACU circuits through LT-4 and LT-5. The ring is grounded through LT-4 and ST-8 (and R4 if ZU is not used) and appears off-hook to the central office. The tip goes to CP AS11 through the base of Q7, CR9, ST-9, and R15. When the central office applies a ground on tip, Q7 turns on which operates the LS relay.
- A hold path is provided for the LT relay through CR-12M, R3, LT-1M, and either



TPA 563968

Fig. 16—Supervisory Components—Schematic Diagram

ANS-11M (option B) or DM-11B, and (option E) CR3 of CP BM1.

(c) Input to the monitor amplifier is switched through LT-2M if option E is installed. Monitor mode is enabled only in the test mode or, as in this case, with ACU Series 5 and later when ACR timer select switch is in position 6.

Abandon Call and Retry (ACR)

4.29 The operated state indicates a preset time has elapsed and signals the business machine suggesting it remove the call request and try again

at a later time. Operation of ACR in the test mode restores the data station to on-hook.

Present Next Digit (PND)

4.30 The PND relay operates through a path to ground formed by ST-10M, DP-8B, CR-9M, and Q2 of CP AS11. When the present next digit relay operates, it causes the following:

- The PND interface lead turns on through PND-1M.
- The ACR timer is reset to zero through PND-5M.
- A hold path for the PND relay is completed through Q2 on CP AS11, PND-2M, and ST-10M. The operated state indicates the ACU is ready to accept a digit to be dialed.

4.31 When the present next digit relay releases, it causes the following:

- The dial-pulse generator is stopped by completing a ground path through PND-3B.
- A hold path for the DP relay through PND-3M is broken.
- The PND interface lead is turned off by PND-1M.
- The PND relay hold path through PND-2M is broken, thus preventing the PND relay from reoperating until the DP relay releases. When the DP relay releases the path to ground through ST-10M, CR-9M, and DP-8B, a path is established allowing the PND relay to operate as soon as the interdigit timer has timed out.
- The pulse counter is reset to all 1s through PND-2B and ST-10M to ground.
- The ACR timer is reset to zero through PND-5.

Digit Present (DP)

4.32 In response to the PND interface lead turned on, the business machine sets the four number interface leads to the digit to be dialed and then turns the DPR interface lead on. A positive voltage or ground through TE2-1B causes

CR21 on CP AS13 to conduct, which turns Q7 off. Transistor Q8 will then operate the DP relay.

4.33 Operation of the DP relay causes the following:

(a) The hold path for relay DP is completed through DP-12M and PND-3M contacts. This will prevent a wrong number from being dialed if the DP relay is turned off prematurely.

(b) The digit code, which is set on the number interface leads, is sampled and the pulse counter is set to that number through DP-11B.

(c) The dial-pulse generator is started by removing the ground from pin 3 of CP AS11 through DP-10B. This causes the normally operated P relay to release and reoperate at 10 pulses per second (pps). The P contact between pins 12 and 13 of CP AS11 interrupts the dc telephone line current at the 10-pps rate, which dial pulses the digit to the central office. For each dial pulse, a trigger pulse is sent to the counter on CP AS10. When the number of dial pulses is equal to the number previously set into the counter, an end-of-count signal on pin 16 of CP AS10 turns Q2 off, which releases the PND relay and starts the interdigit timer on CP AS11 for 600 ms.

(d) With the E option installed, the ANS relay operates through ST-11M, DP-9M, E option strap, CR5 on CP BM1, PND-4M, and DM-11B. This puts the associated data set off-hook through ANS-12M.

4.34 When the PND relay turns off, the business machine will respond by turning the DPR lead off. Q7 of CP AS13 draws base current away from Q8 which turns off and releases the DP relay. As a result of DP releasing, pin 14 of CP AS11 is grounded through CR-9, DP-8, and ST-10. Expiration of the interdigit timer cycle then allows the PND relay to reoperate.

Pulsing (P)

4.35 This relay is normally operated. It releases and reoperates at 10 pps to dial pulse a digit to the central office.

Answer (ANS)

4.36 Operation of the answer relay signals the data set to go either off-hook or into the data mode. With the DPR on in DAS 801A6, the ANS relay is operated by an answer tone or an end-of-number code. In DAS 801A5, the ANS relay is operated by an end-of-number code with the DPR on when using option B. When option E is used, the ANS relay is operated by the first DPR on.

Talk (TK)

4.37 The operated state indicates either the telephone set or data set is off-hook. It is controlled by both the data set and the telephone set.

Data Mode (DM)

4.38 The operated state indicates either the data set is off-hook or both off-hook and in the data mode. It is controlled by the data set.

Clear (CL)

4.39 The operated state indicates the ACU is signaling the data set to go on-hook.

Test 1 and Test 2 (TE1 and TE2)

4.40 The operated condition of either indicates the ACU is in the test mode. Depressing the TEST key will operate both the TE1 and TE2 relays through LS-12B to ground. If the data station is off-hook, the LS relay will be in the operated mode, and the ACU can therefore not be placed into the test mode. The TE1 make contact provides a hold path for the TE1 relay through the PND key and ACR-2B. The TE2 relay is held operated through TE2-5M, R20 of CP AS11, CR17 of CP AS10, and the TE1 make contact. Operation of the TE2 relay disconnects CRQ, DPR, PND, NB1, NB2, NB4, and NB8 from the business machine. The ACR timer is activated through TE2-7B to time for 40 seconds. Monitor amplifier output is switched on through TE2-12B. A CRQ on indication is accomplished via a ground through the TE1 make contact that saturates Q6 of CP AS10 which drives its collector to approximately ground potential. This ground through TE2-10 draws the base current from Q9 of CP AS13 which turns it off. Transistor Q10 then draws base current through R25 and

operates the CR relay. At the end of the test, TE2 will remain operated through an LS-11M contact until the LS relay releases, indicating that the data station is on-hook and the telephone line is idle.

Power Indication (PI)

4.41 The operated state indicates dc voltage is available in the ACU. It is operated from -18 volts through PI-5B to ground and is held operated through R1 to ground.

5. DESCRIPTION OF OPTIONS

5.01 This part describes the options which are available in DASs 801A5 and A6 and gives additional information to aid the user in determining which options are required under specific conditions. These options are generally divided into two categories: (a) Customer options—options which are selected based on customer requirements, (b) Telco options—options which are selected based on compatibility with the telephone facility. The following paragraphs provide detailed information on customer options listed in Table D.

**TABLE D
CUSTOMER OPTIONS**

OPTION	DESIGNATION
EIA Voltage Interface. Contact Interface.	ZF ZE
Call terminated through ACU after DSS on. Call terminated through data set after DSS on.	Z or A G or ZD
ACR timer stopped after DSS on. ACR timer not stopped after DSS on.	R H
End-of-number signal from customer terminal. No end-of-number signal from customer terminal.	B
ACU answer-tone detection (DAS 801A6 only). Data set answer-tone detection without EON signal (DAS 801A5 only).	B E

A. Customer Options

Voltage or Contact Interface

5.02 EIA Voltage Interface (Option ZF): This is an option used with all business machines generating voltage signals. Signals are passed between the ACU and business machine via bipolar voltages conforming to EIA Standard RS-232-A. (See Table B.)

5.03 Contact Interface (Option ZE): This option is specified when the ACU is used with business machines designed for a contact interface. Signals are passed between the ACU and the business machine via contact closures to signal ground. (See Table B.)

Call Terminated Either Through ACU or Data Set After Data Set Status (DSS) On

5.04 Through ACU (Option Z or A): The business machine can, through the ACU, terminate calls originated by the ACU if the call request (CRQ) lead is held on for the duration of the call. With option Z installed, the data station is placed on-hook by turning CRQ off. The ACU causes the data set to go on-hook by transferring the telephone line away from the data set. With option A installed, the data station is also placed on-hook by turning CRQ off. The ACU signals the data set to go on-hook by a CL contact closure presented to the data set via ACU option ZB or ZC.

5.05 Through Data Set (Option G or ZD): The business machine can terminate ACU-originated calls through the data set should the programmer wish to drop CRQ after receipt of DSS on. With option G or ZD installed, the customer must turn off the data terminal ready lead (CD) if he wishes to abort a call. When the data set removes the ground on TB2-C lead of the ACU, the DM relay releases which causes the ST relay to release. The releasing of ST breaks the hold path for the LS relay. After approximately 1.5 seconds, the LS relay releases which turns DLO off. The data station is now idle.

ACR Timer Stopped or Not Stopped After DSS On

5.06 Stop ACR Timer (Option R): With this option, the ACR timer, which is adjustable

from 7 to 40 seconds, is stopped or disabled when DSS turns on. The ACR interface lead is held off whenever the DM relay has been operated by the data set. This option is not normally used with the end-of-number (EON) mode since in this case the DM relay operation means only the data set is off-hook and not necessarily in the data mode.

5.07 Continue ACR Timer (Option H): With this option, the ACR timer continues to run for its specified time even though the associated data set has signaled the ACU that it is off-hook or in the data mode.

Customer Terminal Generates EON Code to ACU or No EON Code Generated

5.08 EON Code (Option B): This mode is used when the data set is to be placed off-hook upon receipt of an EON code from the business machine. A DAS 801A6 will also transfer the telephone line to the data set and signal the data set to go into the data mode on detection of a valid answer tone. Presentation of the EON code causes the ACU ANS relay to operate and gives the data set an operate path for its off-hook relay. The ACU also disconnects from the telephone at this time. When the data set off-hook relay operates, its line-holding coil is connected across tip and ring. This transferring of the telephone line from the ACU to the data set causes loop interrupts, and the EON option is therefore not recommended with the 101-type and 103-type data sets.

5.09 No EON Code: With this mode, the data set or ACU detects the answer-tone signal.

ACU Answer Detection or Data Set Answer Detection Without EON Code

5.10 ACU Answer Detection (Option B): This mode is recommended for Data Sets 103A

and all 200, 400, and 600 series. When this option is used, the frequency of the answer-tone detector circuit must be selected and the choice made whether to transfer the telephone line to the data set at the beginning or end of the answer tone. Some typical installations are given. With Data Set 103A2, the ACU uses the 2225-Hz detector; with most other data sets, the ACU uses the 2025-Hz detector. Data Set 103A-type uses beginning of tone; most others use end of tone.

5.11 Data Set Answer Detection Without EON (Option E): This option is used with data

sets that cannot tolerate loop interrupts. Therefore, to avoid possible loop interrupts when transferring the telephone line from the ACU to the data set, the data set line-holding coil is used to hold the telephone line as soon as the ACU goes off-hook. When the customer turns DPR on, the ANS relay in the ACU operates. A set of ANS make contacts (option E or ZG) presented to the data set will close and form a path to ground to operate the data set off-hook relay. After all the digits of a telephone number have been dialed, the distant station goes off-hook and returns an answer tone. The local data set detects this answer tone and signals the ACU by grounding the ACU TB2-C lead. This causes the DM relay to operate (DSS is turned on); the ACU LT relay then releases.

5.12 Option E was designed for certain data sets that "handshake." Therefore, it should be specified for installations using Data Sets 101 (with DAS 811B), 103E, and 103G.

B. Telco Options

5.13 The following paragraphs provide additional information on the Telco options listed in Table E.

TABLE E
TELCO ENGINEERING OPTIONS

OPTION	DESIGNATION
<u>Mounting Cord</u> 10-conductor, D10P-61 14-conductor, M14C-61	M N
<u>Data Mode</u> Data set to data mode by contact to DT Data set to data mode by grounded contact Data set to data mode by isolated contact	Q ZG F
<u>Contact</u> Isolated TK contact Isolated CL contact Grounded TK and CL contacts	ZA ZC ZB
<u>Call Termination</u> Terminate call via data set — line XFER Terminate call via CRQ — line XFER Terminate call via data set — clear contact Terminate call via CRQ — clear contact	G Z ZD A
<u>Answer Tone (DAS 801A6 only)</u> Detect 2025-Hz answer tone Detect 2225-Hz answer tone Detect beginning of answer tone Detect end of answer tone	S T X W
<u>Contact Protection</u> Subscriber loop resistance more than 400 ohms	ZU

Note: Leave factory-wired options installed unless service order specifies other options in the above groups.

5.14 10-Conductor or 14-Conductor Mounting

Cord: The 10-conductor mounting cord, D10P-61, (option M) is supplied with both the 801A5 and 801A6 ACUs. A 14-conductor mounting cord (option N) must be ordered separately if needed. Some typical installations are as follows:

DATA SET	MOUNTING CORD
101-type	M14D-61
103A-type	M14C-61 with D25C-61 D10P-61 with D35C-61
103E-type	D10P-61
103G-type	D10P-61
200-type	D10P-61
400-type	D10P-61
600-type	D10P-61

Data Set to Data Mode by Contact to DT or by Isolated Contact or by Grounded Contact

5.15 By Contact to DT (Option Q): With this option, a contact of the ANS relay in the ACU is connected to the DT lead. This provides a path for the line hold (H) relay in the data set to operate and start the sequence which places the data set on-line. This option is required for Data Sets 103A (with D35C cord) and all 200, 400, and 600 series.

5.16 By Isolated Contact (Option E): This option provides an isolated contact of the ANS relay to transfer the telephone line to the data set. It should be specified for Data Sets 101 (with DAS 811B) and 103A (with D25C cord).

5.17 *By Grounded Contact (Option ZG):* This option provides a grounded contact of the ANS relay to transfer the telephone line to the data set. It should be specified for installations using Data Sets 103E and 103G.

Grounded TK and CL Contacts or Isolated TK Contact or Isolated CL Contact

5.18 *Grounded TK and CL Contacts (Option ZB):* This option provides a grounded contact of the CL and TK relays. It should be specified for DS 103E and DS 103G. The grounded TK contact is not used with Data Sets 103E-type and 103G-type. The grounded CL contact is used to clear (disconnect) these specific data sets.

5.19 *Isolated TK Contact (Option ZA):* This option provides a contact closure which may be used to give an off-hook indication to the data set. Option ZA is required when the ACU is used with a Data Set 103A.

5.20 *Isolated CL Contact (Option ZC):* This option provides a contact closure which may be used by the data set to clear the data station and return to idle mode. Option ZC is used with Data Set 101 (with DAS 811B).

Terminate Call by ACU (CRQ) or by Data Set

5.21 *Terminate Call by Line Transfer Method (via Data Set, Option G, or CRQ, Option Z) or by CL Contact Method (via Data Set, Option ZD, or CRQ, Option A):* The business machine can terminate ACU-originated calls via the ACU if the CRQ lead is held on for the duration of the call, or via the data set if the programmer wishes to drop CRQ after receipt of DSS on.

5.22 *Via CRQ After DSS On (Option Z or A):*

This mode requires the business machine to maintain the CRQ lead in an on condition for the duration of the call. With option Z, the business machine initiates clearing by turning CRQ off. The ACU opens the line and holds it open until the data set goes on-hook (line transfer method) or, with option A, the ACU notifies the data set to go on-hook via a contact closure (CL contact method). Data line occupied (DLO) is turned off after the data set goes on-hook, notifying the business machine that the line is free for another

call. If this option is desired, specify one of the following:

- ***Option Z*** for Data Sets 103A and all 200, 400, and 600 series
- ***Option A*** for Data Sets 101 (with DAS 811B), 103E, and 103G.

5.23 *Via Data Set After DSS On (Option G or ZD):*

This option is available if the business machine programmer wishes to transfer control of the call from the ACU to the data set after DSS goes on. In this case, CRQ is turned off at any time after receipt of DSS on, and it must be held off until DLO is turned off at the termination of the call. The call is terminated by the customer turning data terminal ready (DTR) off. It must be used if Data Set 103A is operated with the long space disconnect option. If this option is desired, specify one of the following:

- ***Option G*** for Data Sets 103A and all 200, 400, and 600 series
- ***Option ZD*** for Data Sets 101 (with DAS 811B), 103E, and 103G.

Detect 2025- or 2225-Hz Answer Tone (DAS 801A6 Only)

5.24 *2025-Hz Answer Tone (Option S):* This option conditions the ACU answer detector to respond to 2025 Hz. It is normally used for Data Sets 103A1 and all 200, 400, and 600 series.

5.25 *2225-Hz Answer Tone (Option T):* This option conditions the ACU answer detector to respond to 2225 Hz. It is normally used with Data Set 103A2.

Detect Beginning or End of Answer Tone (DAS 801A6 Only)

5.26 *Beginning of Answer Tone (Option X):*

This option causes the ACU to transfer the line to the data set after receipt of approximately 200 milliseconds of valid answer tone. It is normally specified for Data Set 103A-type.

5.27 *End of Answer Tone (Option W):* This option causes the ACU to transfer the line to the data set after completion of a valid answer

SECTION 598-010-151

tone. This option is normally specified for 200, 400, and 600 series data sets.

Relay Contact Protection

5.28 Option ZU: The network previously used in CP BM1 for contact protection of ST-8 relay is removed by ZT wiring because it caused false tip party indications at some central offices. ZT wiring also provided a resistor (R4) to ground for contact protection on short loops (less than 400 ohms). The ST-8B contact is used to provide the ring ground when a call is initiated. On long loops, option ZU straps out the resistance.

6. PERFORMANCE DATA

6.01 The inputs to the ACU are furnished by a compatible business machine and consist of voltage level signals. The characteristics of these signals are given in Table B.

6.02 In addition to the signals furnished by the business machine, the ACU requires the following ac input: series 4 or later, single phase, 60 ±3 Hz, 117 volts rms ±10 percent nominal 15 watts with third wire grounding; series 3 and earlier ACUs, single phase 60 ±0.1 Hz, 117 volts rms ±10 percent, nominal 15 watts.

6.03 Circuit characteristics or parameters for the circuit packs are given in tables which cover

CP AS8, CP AS9, CP AS10, CP AS11, CP AS12, CP AS13, CP AS14, and CP BM1.

6.04 Component placement on the circuit pack assemblies is shown in Fig. 17 through Fig. 24.

7. MAINTENANCE AND TESTING INFORMATION

7.01 The ACU does not require any routine maintenance. When a trouble is reported, it should be verified with the customer that attempts to complete calls manually (by using the test buttons) have failed.

7.02 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 801A5 and 801A6, For Automatic Calling, Test Procedures (598-010-501) to verify that the ACU is operating properly.

7.03 The test procedures in Section 598-010-501 include tests that may be performed using Data Test Sets 901A, 901B, and 914B. The 914B Data Test Set in particular has features which make it useful in troubleshooting problems that cannot be detected in routine testing. The 914B

CP AS8

CIRCUIT	FUNCTION OR TYPE
Tuned Circuit Z1	2 Sections Terminals 3 and 4 connect to the 2025-Hz tuned circuit. Terminals 4 and 6 connect to the 2225-Hz tuned circuit.

CP AS9

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

CP AS10

CIRCUIT	FUNCTION OR TYPE
Pulse Counter	The pulse counter counts the number of dial pulses corresponding to the binary number which has been set into the counter on the N leads.
EON Detector	This circuit starts the sequence to transfer control of the telephone line to the data set.

CP AS11

CIRCUIT	FUNCTION OR TYPE
Dial-Pulse Generator	This circuit consists of a multivibrator which drives a relay used to dial pulse.
Interdigit Timer	A positive trigger signal applied to pin 17 will start the timer and also turn PND off. After a 600-millisecond delay, PND will reoperate.

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 AS13

CIRCUIT	FUNCTION OR TYPE
Interface Gates	This circuit accepts an EIA or a contact interface from an associated business machine.

CP AS14

CIRCUIT	FUNCTION OR TYPE
Interface Circuits	This circuit provides an associated business machine with either a contact closure or EIA voltage signal.

CP BM1

CIRCUIT	FUNCTION OR TYPE
Supervisory Components	Miscellaneous

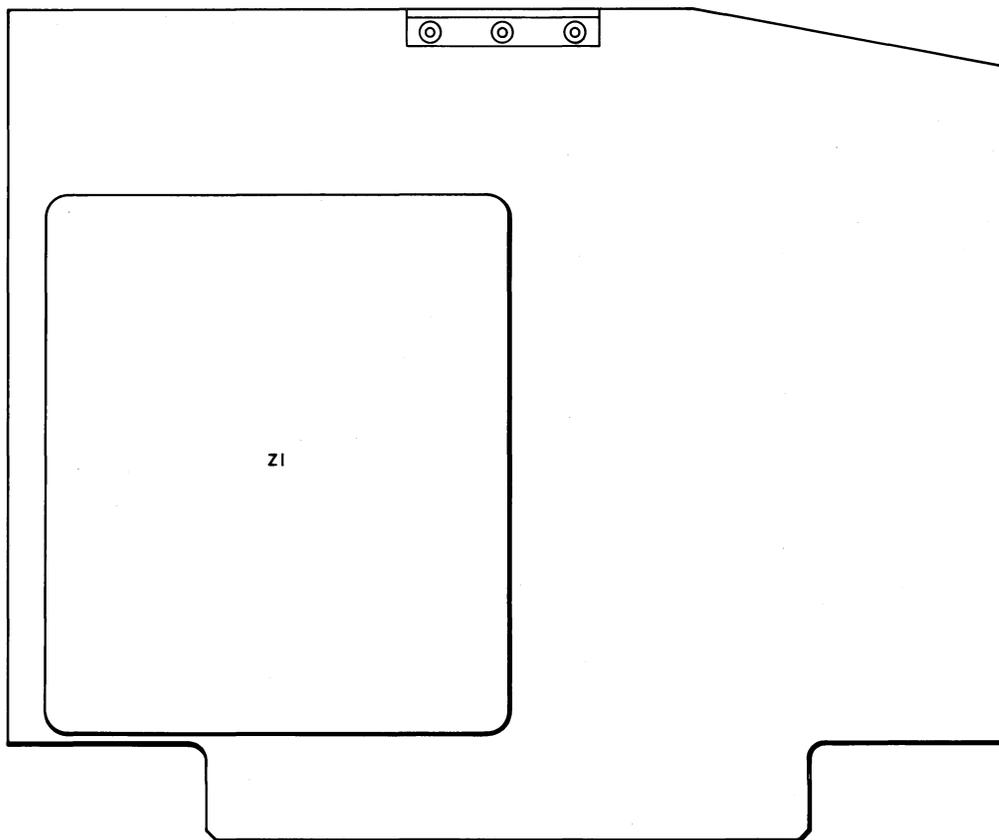
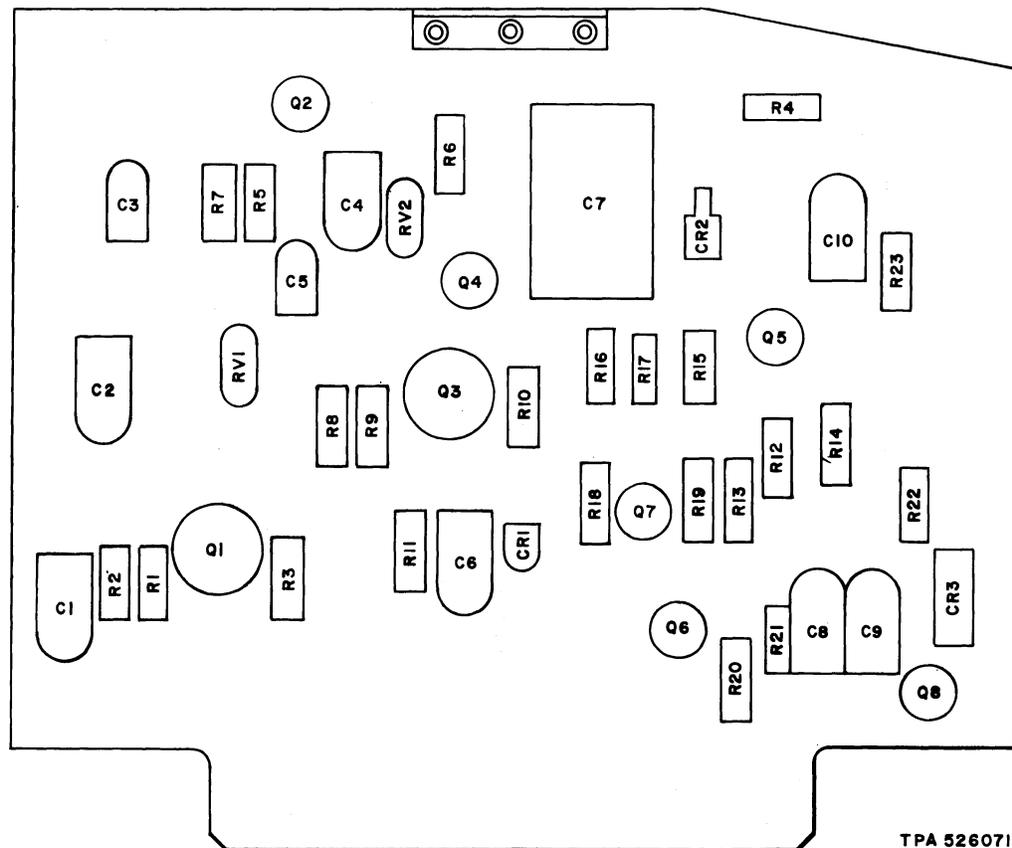


Fig. 17—CP AS8 Component Placement



TPA 526071

Fig. 18—CP AS9 Component Placement

may be used to simulate the customer's business machine in a static mode by supplying control functions and dialing information to the ACU. When problems are encountered and service is critical, consideration should be given to a request for technical support to aid in locating troubles. This support takes the form of assistance from staff engineering data personnel and could ultimately lead to the data design and development personnel of Bell Telephone Laboratories where more sophisticated troubleshooting aids are available.

7.04 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 801A5 and 801A6 For Automatic Calling, Maintenance (598-010-301). For additional detailed information on repairing the ACU, refer to the Bell System Repair Specification (BSRS) 480.072 (Issue 2).

8. REFERENCES

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

- SD-1D082-01
- CD-1D082-01.

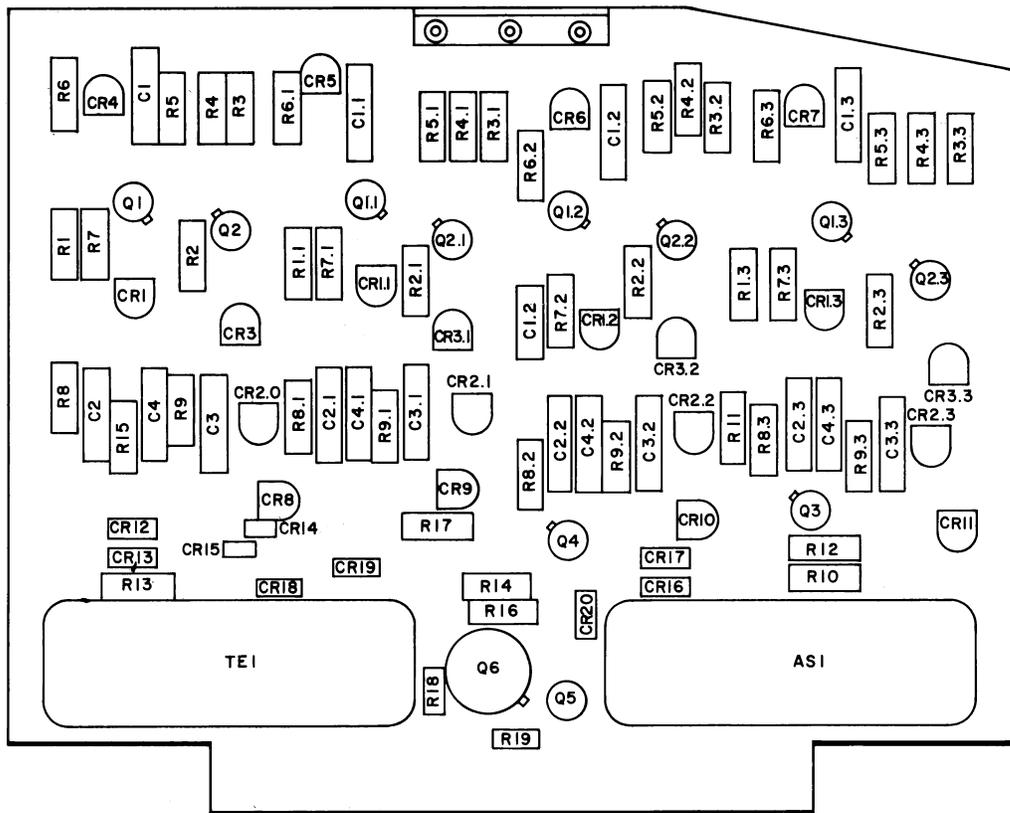


Fig. 19—CP AS10 Component Placement

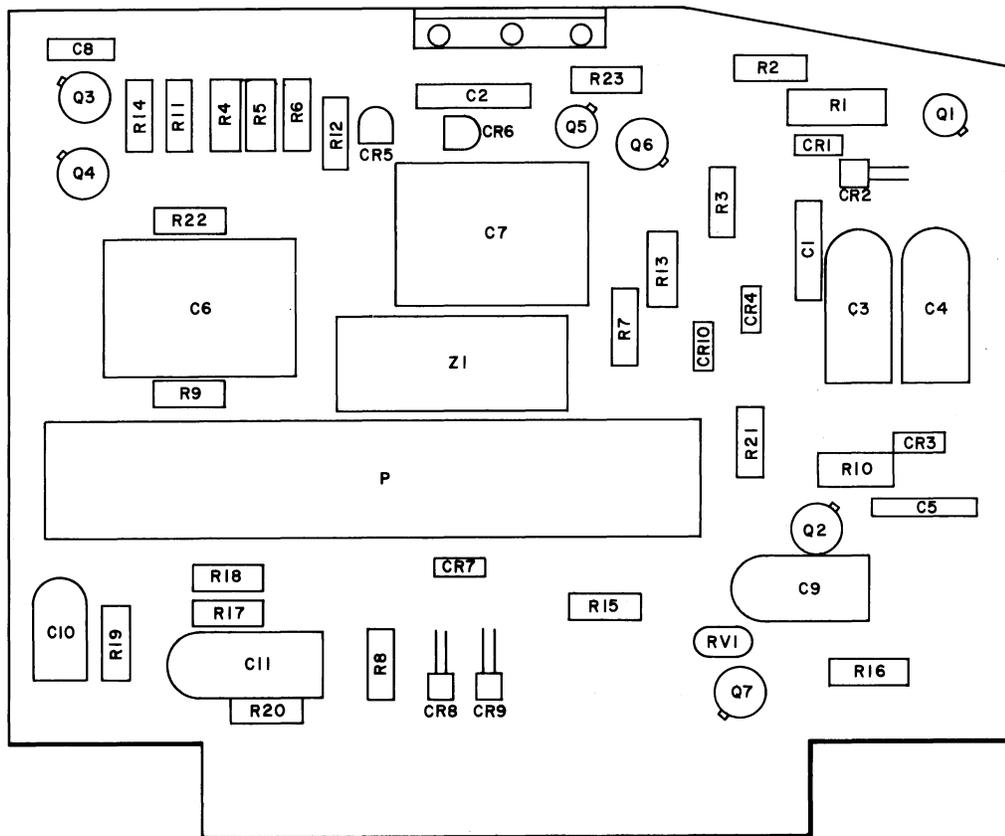


Fig. 20—CP AS11 Component Placement

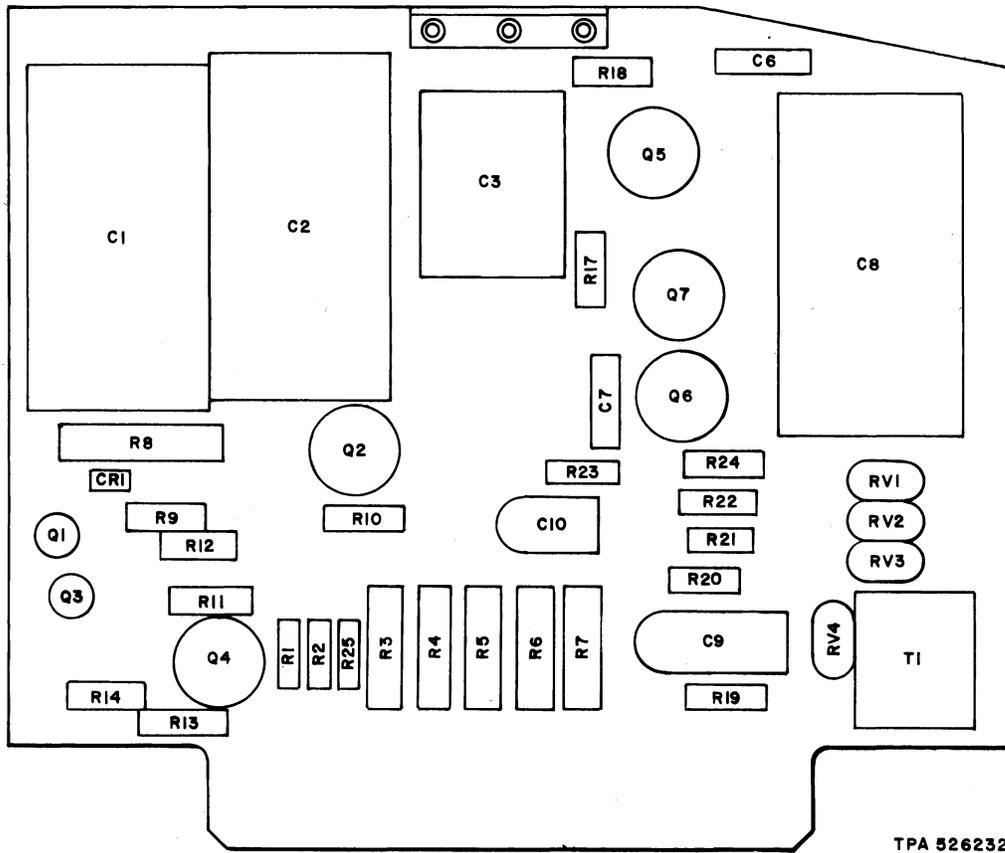


Fig. 21—CP AS12 Component Placement

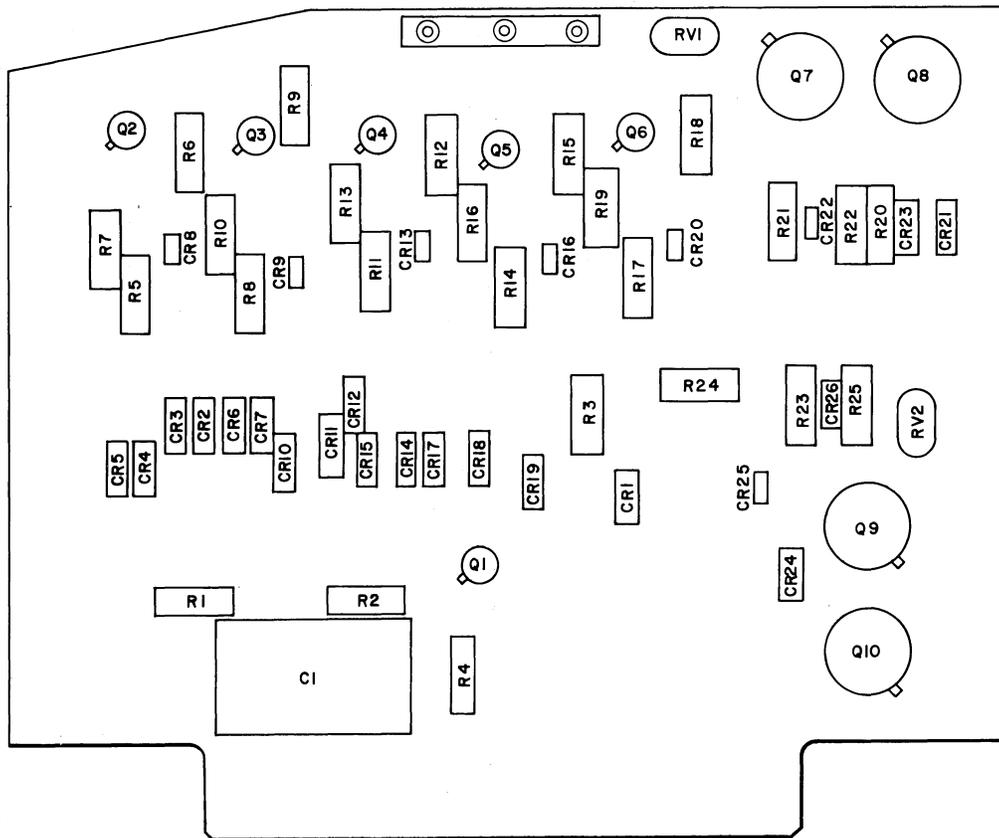


Fig. 22—CP AS13 Component Placement

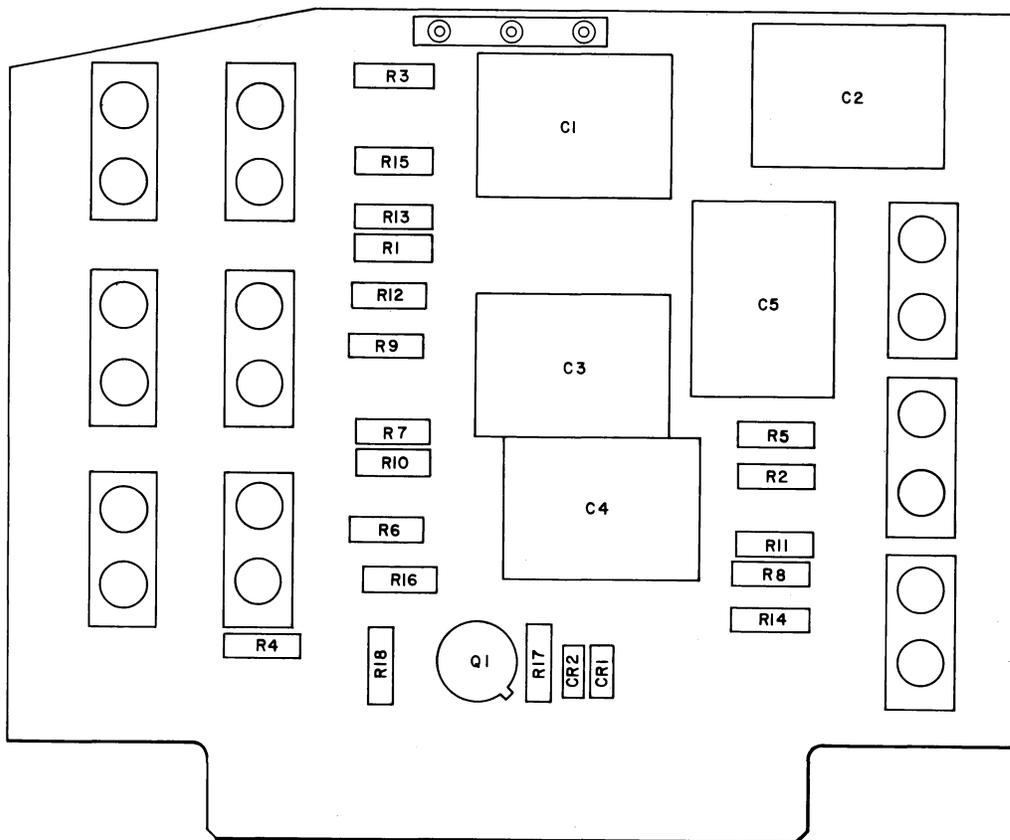


Fig. 23—CP AS14 Component Placement

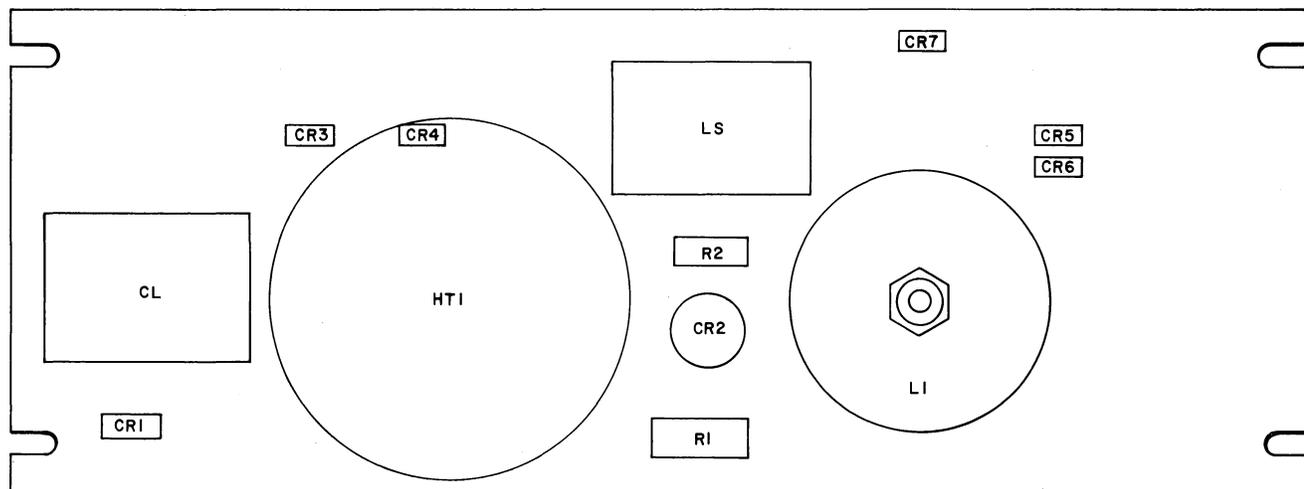


Fig. 24—CP BM1 Component Placement