



HEWLETT-PACKARD CALCULATOR

09861-90001

HEWLETT-PACKARD COMPANY

SERVICE MANUAL

9861A/11212A

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APPENDIX A
LIST OF FACIT SERVICE CENTERS

The 9861A Output Typewriter Peripheral consists of an input/output (I/O) card, interconnecting cables, 11201A Typewriter Interface, and a Facit Model 3841-4 Output Typewriter. This system, together with an appropriate typewriter control block (e.g. the 11212A Typewriter Control Block), gives the user the capability of typing a listing of the program in a 9800 series calculator, a message, or data in the calculator. (The latter two may be programmed into the calculator.)

NOTE

The 9861A requires that the correct control block is installed. Installation of a control block with the calculator ON is not recommended. If you inadvertently do so, switch the calculator OFF, wait a few seconds, and then turn it back ON.

CAUTION

CARE SHOULD BE TAKEN TO ENSURE THAT THE 11201A INTERFACE IS SET FOR THE LOCAL NORMAL LINE VOLTAGES. THE 3841 REQUIRES A GEAR CHANGE TO SET IT TO THE LOCAL LINE FREQUENCY (50 OR 60 HZ). CHANGING THE 11201A LINE VOLTAGE SELECTOR SWITCHES DOES NOT CHANGE THE LINE VOLTAGE TO THE 3841 TYPEWRITER. THE 9861A SYSTEM MAY BE DAMAGED IF BOTH UNITS DO NOT MATCH AVAILABLE LINE POWER. THE 9861A PERIPHERAL MANUAL EXPLAINS, IN DETAIL, THE TURN-ON PROCEDURES.

This manual is intended to assist in the repair of a 9861A. It contains sections on Maintenance, Theory of Operation, Schematics, Replaceable Parts List, a list of Facit Service Facilities, and Troubleshooting Guides.

The responsibility for the maintenance and repair of the 9861A belongs to Hewlett-Packard, except that Facit and their service facilities will install the 9861A and will maintain the 3841-4 Typewriter when notified by you or your customer. Appendix A contains a list of all Facit Service Centers.

The troubleshooting guides in Section 4 have been constructed to aid you in a quick location of the defective component. If the failure cannot be located by using the guides, the Theory of Operation and schematics give more detailed information to assist in the repair.

Section 4 also contains information on basic operation of the typewriter/calculator system, pseudo-hardware problems, and exerciser programs.

9861A GENERAL THEORY OF OPERATION

When installed with the correct control block, the 9861A gives the user the capability of typing information from the calculator.

The output of the control block is ASCII coded data which appears at the I/O card input lines. The I/O card converts the ASCII code to a code which can be used to drive the Facit typewriter, and transfers the converted Facit code the Typewriter Interface.

The 11201A Typewriter Interface provides the logic, timing and power necessary to drive the electro-mechanical decoder in the typewriter. The sequence of information from the control block to the typewriter is gated in the interface by a sync pulse from the typewriter.

9861A BLOCK DIAGRAM

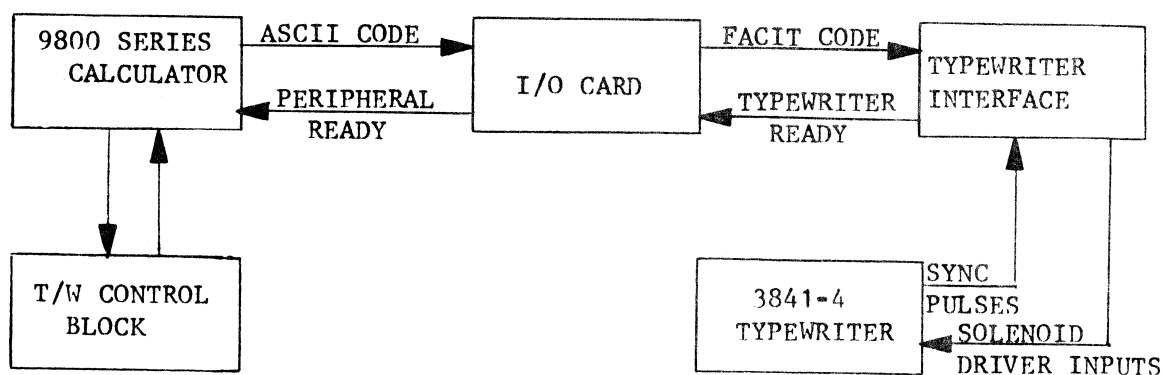


FIGURE 3-1

FACIT MODEL 3841-4 OUTPUT TYPEWRITER

THE FOLLOWING DISCUSSION REFERS TO FIGURE 3-2.

The data output of the 11201A is synchronized with the typewriter by a sync pulse generator, which is attached to the motor drive shaft in the typewriter. The sync pulse generator consists of a spoked sync-wheel and a sensing device. The spokes pass between a light source and a photo-transistor. The photo-transistor has a series of sync pulse outputs which are transmitted to the typewriter interface. Six sync pulse times (14 mSec each) are equal to the time required for one average print cycle (84 mSec), giving a speed of 12 characters per second. Non-repeating numerals can be typed at 14.5 characters per second.

The typewriter is also equipped with an electro-mechanical decoder, consisting mainly of a set of solenoids which are activated by coded instructions from the 11201A. These solenoids (see figure 3-2) control both typing and operational functions (such as TAB, SPACE, etc.). The solenoids in the decoder are: six program solenoids; eight function solenoids; two trip-lever reset solenoids; one color shift solenoid and one keyboard lockout solenoid. Each of the solenoids is the load for an 11201A driver.

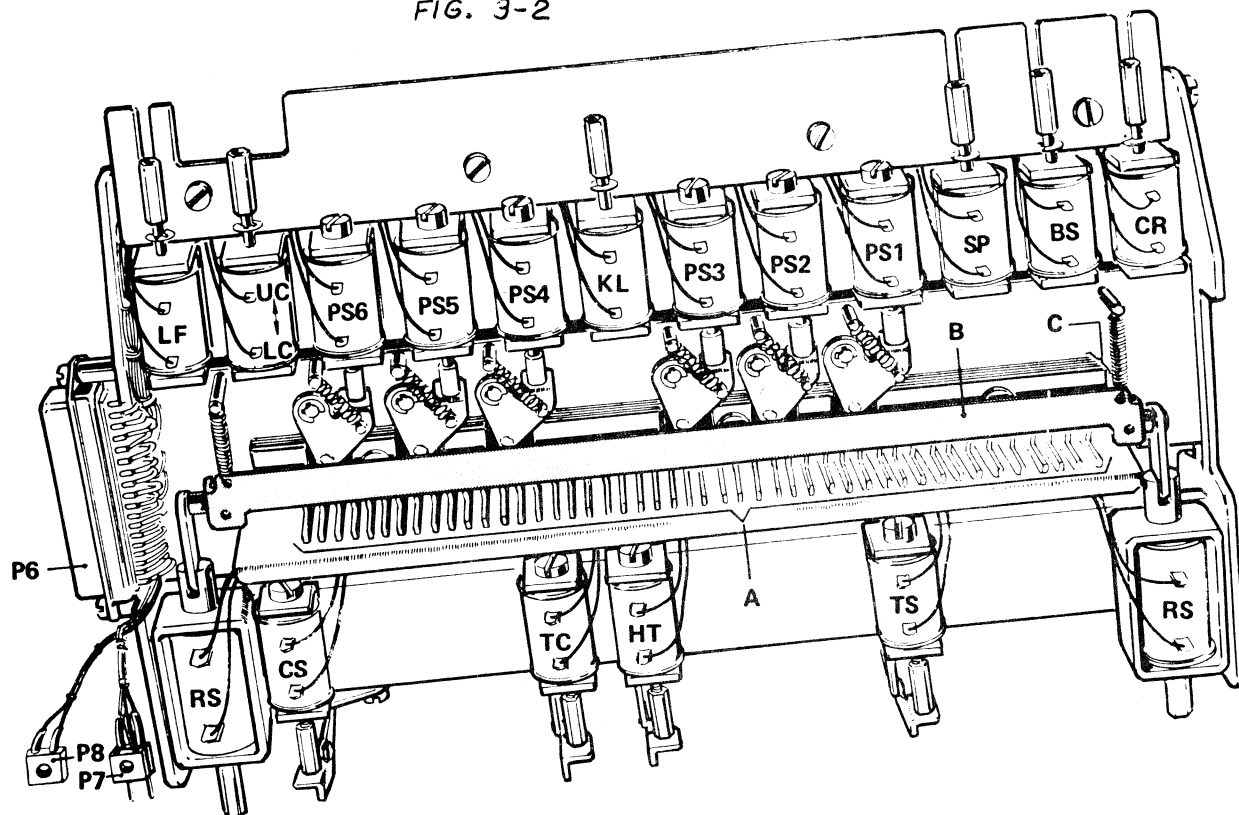
FACIT MODEL 3841-4 OUTPUT TYPEWRITER

The movement of a program function solenoid triggers the selected function. If a function solenoid is defective or not properly activated, that function cannot occur.

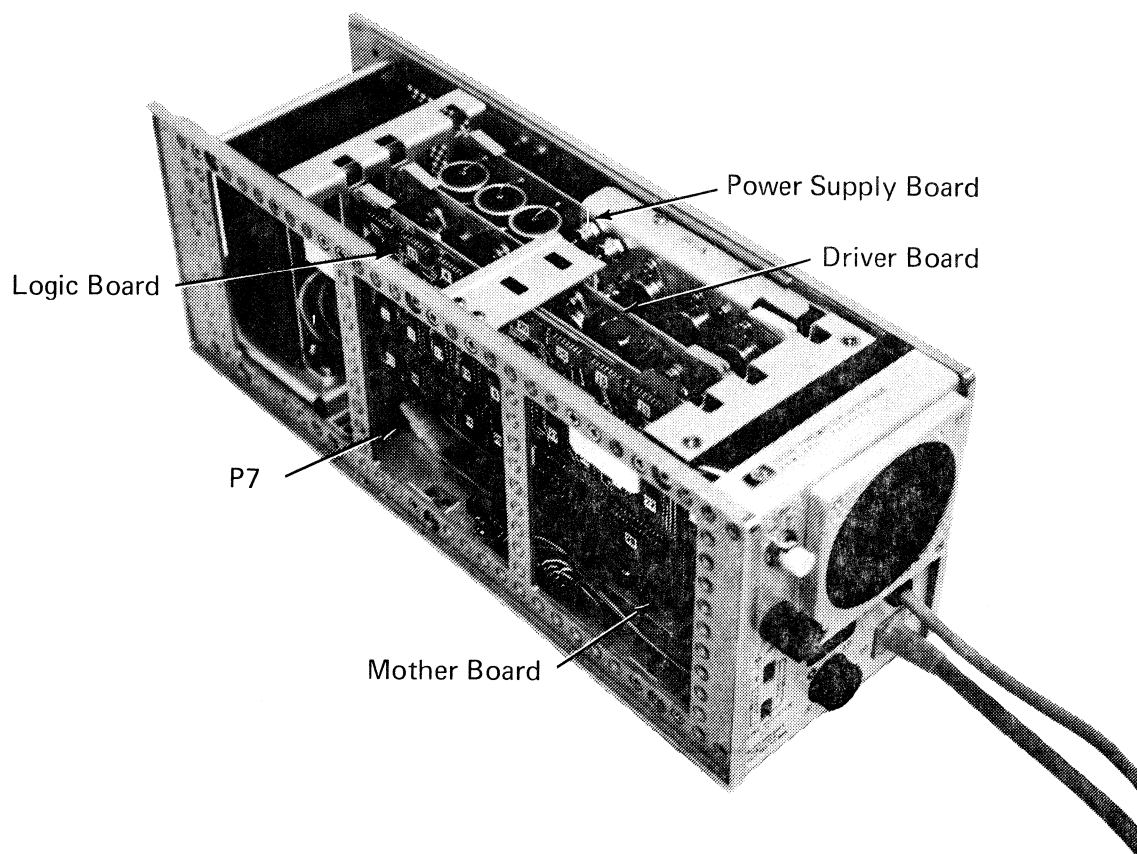
The program solenoids (PS-1 through PS-6) each control one program bar that is moved sideways when the solenoid is energized. Typing is triggered when one of 46 trip-levers drops into the gap which, for the character in question, is common to all six program bars. After each typing operation, the actuated trip-lever is moved back to its initial position by the reset bar; the reset bar is driven by the two trip-lever reset solenoids. If one or more of the program solenoids is defective or not properly activated, an incorrect character will be typed. If either of the trip-lever reset solenoids is defective or not actuated properly, the decoder will not be cleared and the previous character will be typed again.

The color shift solenoid changes the ribbon to red when activated. It should be noted, however, that the typewriter color selector control must be in the position (blue) for a black ribbon.

FIG. 3-2



- | | | | | | |
|-----|------------------------|-------|--------------------------|----|----------------------------|
| A | Trip levers | PS3 | Program solenoid No. 3 | LF | Line feed solenoid |
| B | Trip lever reset bar | PS4 | Program solenoid No. 4 | TS | Tab.set solenoid |
| C | Program bars | PS5 | Program solenoid No. 5 | HT | Tabulator solenoid |
| P6 | CANNON connector | PS6 | Program solenoid No. 6 | TC | Tab.clear solenoid |
| P7 | Sync connector | CR | Carriage return solenoid | CS | Colour shift solenoid |
| P8 | Line end connector | BS | Back-space solenoid | KL | Keyboard locking solenoid |
| PS1 | Program solenoid No. 1 | SP | Space solenoid | RS | Trip lever reset solenoids |
| PS2 | Program solenoid No. 2 | UC/LC | Segment shift solenoid | | |



I/O ASSEMBLY

THE FOLLOWING DISCUSSION REFERS TO FIGURE 4-1 AND TABLE 4-1.

Communication between the calculator and typewriter interface, are provided by the I/O assembly (11201-66591). The ASCII coded outputs of the calculator are recoded into FACIT codes for the interface. The I/O also provides system status signals for the calculator and a control signal for the interface.

When the I/O assembly is not processing data from the calculator, the two flip-flops (U7a and U7b) and the two ROM's (U1 and U3) are disabled. Latch U4 is enabled and its outputs follows the data inputs DO-0 through DO-7. The calculator may, at this time, address the I/O on channel select lines CO-0 through CO-3, and give a SIH (prevent interrupt) instruction. The channel select code and SIH enables the I/O to see CEO (control) as a command to begin processing the new ASCII code. SIH input enables U1b. The CO-0 and U1b output (high) enables U6c. The U6c output (high) and CO-1 through CO-3 (high) enables U1a. The inverted U1a output (high) partially enables U2a and U2c.

U2a is fully enabled if P2 pin 2 (EOL) is also high. U2a is normally disabled by U6b, which is normally low. U2c is enabled if U6b is high. U6b is normally low, disabling U2a. The U2a (SI-3 or end of line) and U2c (SIØ or status) outputs (high) are used as peripheral ready flags for the calculator.

When the peripheral ready conditions have been met, the calculator addresses the I/O and gives SIH and CEO instructions.

I/O ASSEMBLY

The inverted CEO (P1 - pin 21) enables U6a. The U6a output (high) is the clock input for U7b. The U7b Q output enables U8b. The U8b output (low) is a control output (P2 pin 5) to the typewriter interface.

U8a is enabled by a FLAG from the interface (P2 pin 3). The output of U8a (low) enables U6b. The U6b output (low) enables ROM's U3 and U11. The inverted U6b output (high) disables the latch U4.

The end of the FLAG input clocks U7a. The $\overline{Q}$ output (low) is the ACKNOWLEDGE FLAG (CFI) to the calculator.

11201A TYPEWRITER INTERFACE

The Typewriter Interface couples the Facit model 3841-4 output typewriter to HP model 9800 series calculators. Communications with the calculator, are made through a cable; the cable is terminated by the I/O card, which contains a PC assembly used for buffering and some logic.

Characters from the calculator appear on data lines as ASCII codes. These codes are recoded by the I/O into and eight bit Facit code. Six bits are used for the 46 type bars, one bit for upper/lower case shift, and one bit to differentiate between functions or characters and numbers. Most functions and programs are easily recognized in the interface since they are driven by seperate bit lines.

A data latch on the data input lines holds the codes for processing. If new data arrives during processing, the two codes are compared to determine if they will drive the same type bars, if they are the same numbers, or if they require a case or color shift. Non-repeating numbers can be typed at 14.5 characters per second, otherwise the maximum typing speed is 12 characters per second.

Codes in the latch are gated to the function or program solenoids by the control logic.

The control logic regulates a sequence of events which may occur during eight states. Each state transition occurs at the time of a sync pulse from the typewriter.

POWER SUPPLIES

THE FOLLOWING DISCUSSION REFERS TO FIGURE 4-2 AND TABLE 4-1

The 11201A uses three positive power supplies. Two are +5V regulated supplies for the integrated circuits and logic. The third is a +29V regulated supply for the typewriter solenoid drivers.

+5V SUPPLIES

The two +5V dc supplies are reasonably straightforward. IC1 and IC2 are regulators. With pins 3 at ground and approximately 9.5V dc (filtered) on pin 1, they give a +5V (+/- 5%) output.

+29V SUPPLIES

Q1 - Q3 is the +29V regulator. CR9 and CR12 provide the regulator reference (TP-2). Q5 - Q8 is the current shut-down circuit. R11 is the current sensing resistor. When the voltage on Q8 base turns Q8 on, SCR Q5 fires. This turns off Q6 and turns on Q7. That removes the drive to Q3 and shuts off the +29V supply.

C4, CR7, and Q4 provide the +29V supply with a slow turn-on time and fast turn-off time. The slow turn-on time ensures +5V is present for the logic first, whereas the fast turn-off time prevents the typewriter solenoids from chattering by turning off the driver circuits first.

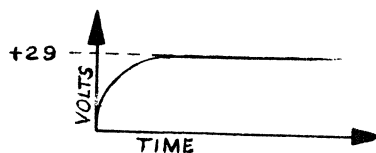


FIGURE 3-2 TP-1 VOLTAGE AT TURN-ON

DRIVER CIRCUITS

REFER TO FIGURE 4-3 AND TABLE 4-1

The driver circuits are Darlington power drive circuits. A detailed theory of operation is not given here.

The drivers for the case (UC/LC), keyboard lockout (KL) and color shift (CS) solenoids employ a 28 msec, 42 msec, and 84 msec one-shot in their respective circuits. These one-shots act as delay mechanisms, as the driver outputs are reduced from +1V (driver fully turned on) to +12V or +8V when the one-shots reset to their original states. This prevents overheating of the typewriter solenoids. (The case and keyboard lockout drivers reduce to +12V, and the color shift driver reduces to +8V). The troubleshooting section of this manual (CHAPTER 4) contains detailed diagrams of the driver outputs.

CONTROL LOGIC ASSEMBLY

THIS DISCUSSION REFERS TO FIGURE 4-4 AND TABLE 4-1

The 11201A Typewriter Interface logic assembly consists of five basic blocks: Inputs, Latch, Comparitors, Control Logic, and Outputs.

The input circuits consist of the sync pulse shaping circuit (Q1, Q2, and U30), a three bit binary counter and its decoder (U1 and U9), a 5 msec one-shot (U14a), and a 37 msec one-shot (U14b).

INPUT
CIRCUITS

The sync pulse shaping circuits match the impedance of the logic sync input to the typewriter sync generator, and shape the sync pulses into 8.2 microsec square waves. The 8.2 microsec square waves provide the sync timing for the control logic assembly.

The counter and decoder determine which one of the eight 14 msec states the control logic is in.

The 5 msec and 37 msec one-shots provide delays when required. The 37 msec delay allows the logic to continue sequencing for 37 msec after the end of the sync pulse generator output, e.g., when the typewriter is turned OFF.

The end of the 37 msec delay strobes the logic to state 6.

The latch (U29) transfers data codes from its input to its output when enabled by the control logic. When disabled, the latch may have new input codes without affecting the codes

LATCH

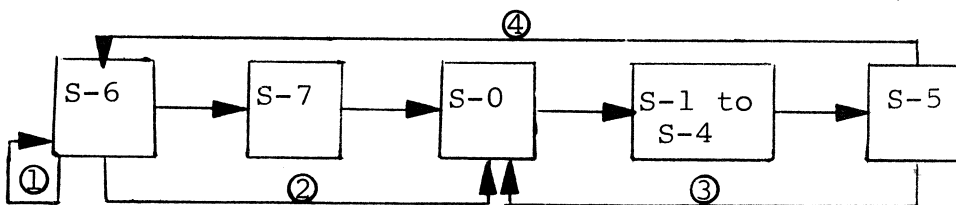
on its output.

NOTE

The Control Logic Theory of Operation discussions are oriented around the decoder (U9) outputs, which are essentially eight conditions or states. Each state is discussed separately, but the logic operations which take place during that state, if any, are dependent upon logic operations that have taken place during preceding states and the FACIT code that is on the latch (U29).

Although each state is discussed separately, the logic has several possible loops which may bypass some states to conserve time and, therefore, increase the maximum typing speed. Because of these loops, it is necessary, at times, to make the statement; 'if a condition exists'. This is due to conditions that were determined in two or more previous states depending upon the typewriter operation that is taking place.

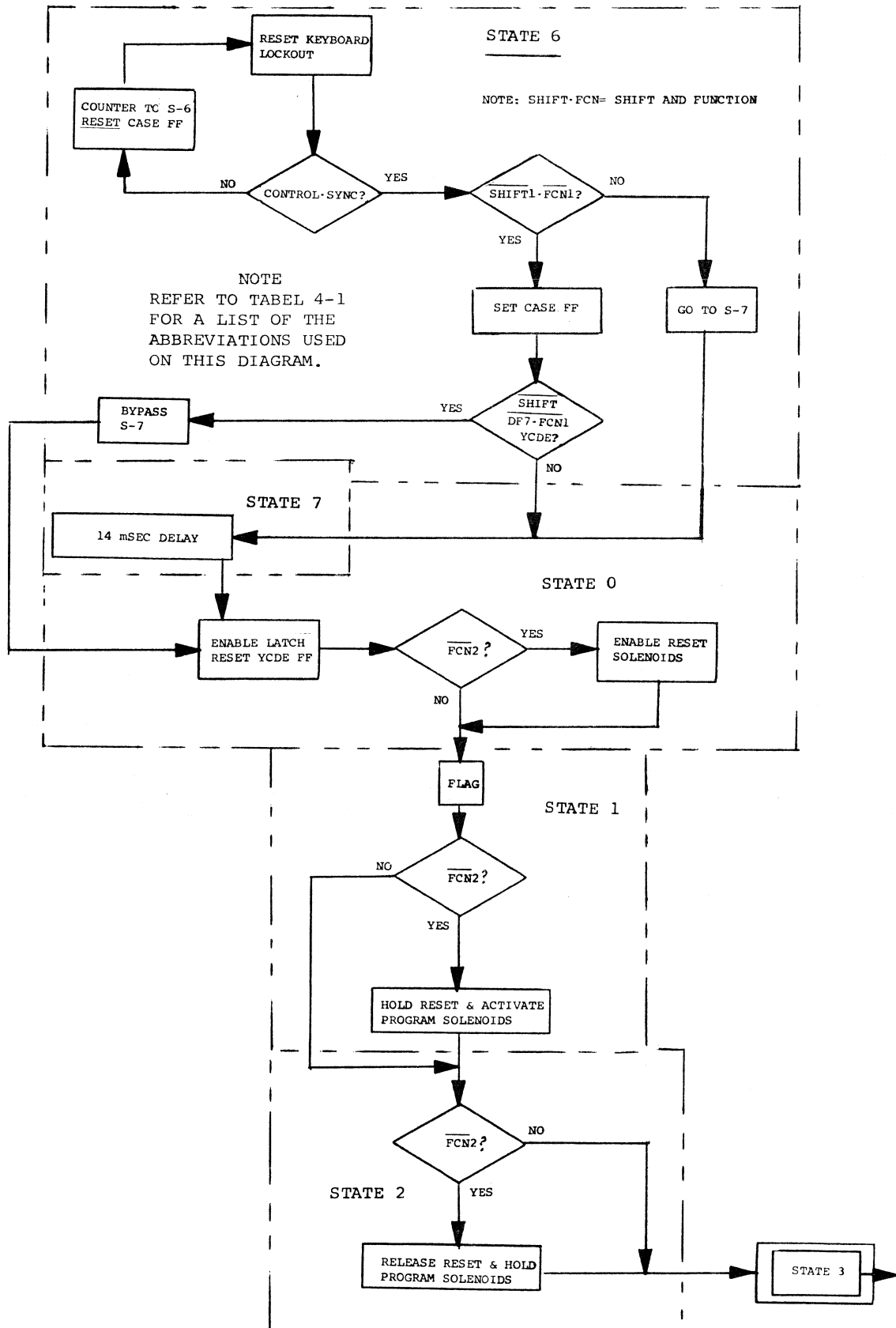
Below is a block diagram of the logic states and the loops that interconnect them. You may also wish to refer to the CONTROL LOGIC FLOW DIAGRAM FIGURE 3-3a and b.



1. T/W TURN OFF OR NO NEW CODES FROM THE I/O
2. UNSHIFTED CHARACTERS THAT ARE NOT NUMERALS
3. NON-REPETITIVE NUMERALS
4. NORMAL OPERATION

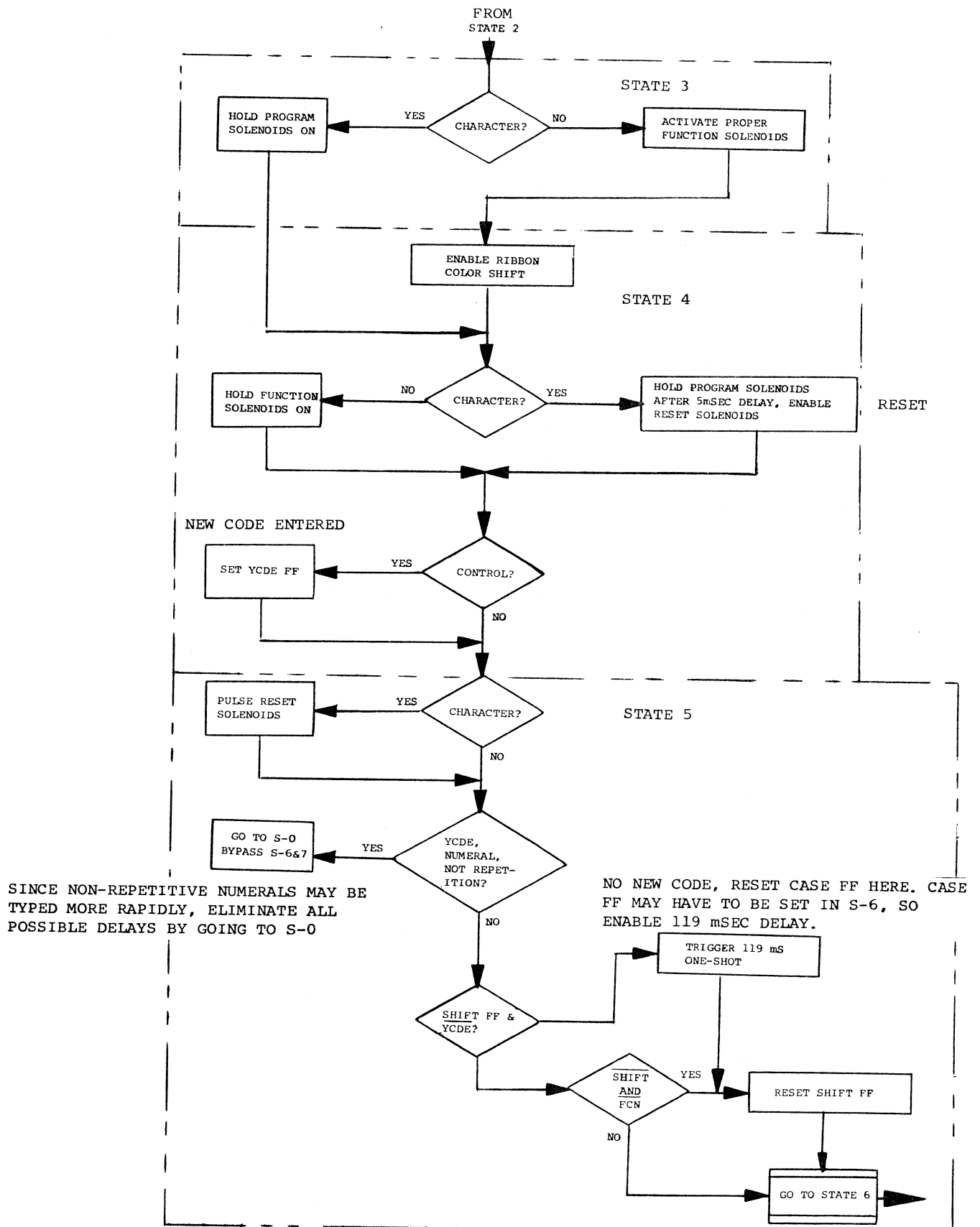
STATE CONTROL LOGIC FLOW DIGRAM

FIGURE 3-3a



STATE CONTROL LOGIC
FLOW DIAGRAM (cont'd)

FIGURE 3-3b



THEORY OF OPERATION

CONTROL LOGIC ASSEMBLY

Two comparitors in the logic compare the data codes currently on the latch input and output. They give a high output if the input and output bits being compared are the same, i.e. repetition. COMPARITORS

The control logic determines which typewriter solenoid drivers are enabled. It also correlates the timing with respect to the decoder output and the time required for a specified typewriter operation. CONTROL
LOGIC

The output power gates are enabled by the control logic and the input data codes. The power gates provide the proper outputs to the I/O and interface driver assemblies. OUTPUTS

INITIALIZATION

NOTE

The following discussions are oriented around the decoder (U9) outputs, which are essentially eight 14 msec states or conditions. Frequent reference to the state control block diagram at the beginning of each discussion will assist in a more clear understanding of what occurs during each state.

Before any typewriter operation can occur, three conditions must be met. The logic must be turned on and must have received the signals SYNC and CONTROL.

CONTROL LOGIC ASSEMBLY

INITIALIZATION

When the interface is initially turned ON, C6 is not charged. C6 charging disables U4d. The U4d output (high) enables U12d and the U12d output (low) resets the YCDE flip-flop. The U4d output, inverted by U26b, forces U1 to the count of 6 and resets the color shift flip-flop (black ribbon). Because the signal $\overline{\text{CONTROL}}$ is missing, the U28c output (low) clears U11a and b. The U11b output (low) and the U9 $\overline{6}$ output (low) disables U2c. The inverted (low) U2c output enables U8d. The U8d output (high) enables U12c and resets the case flip-flop (lower case). The U11b $\overline{Q}$ output (high) disables U6d. The U6d output (low) resets the tab clear all flip-flop. The $\overline{6}$ output (low) of U9 resets the keyboard lockout flip-flop.

When the T/W is turned ON, 14 mSec. SYNC pulses begin triggering the 8.2 uSec. one-shot U30 through an impedance matching circuit Q1 and Q2. The Q output of U30 (8.2 uSec square waves) triggers U14a, a 5 mSec one-shot. The rising (SYNC-8.2 uSec) Q output of U30 triggers U14b, a 37 mSec one-shot.

5 mSec after a SYNC input, U14a Q output goes low and resets the reset flip-flop. The $\overline{Q}$ output of U14a has no effect at this time, as U4a is not enabled until state 4.

CONTROL LOGIC ASSEMBLY

INITIALIZATION
(CONT'D)

The positive going $\overline{Q}$ output of U30 triggers U14b every 14 mSec.. The Q output of U14b will, therefore, remain high until 37 mSec. after the end of SYNC inputs (T/W OFF), and holds U4d enabled. U4d must be disabled (see previous interface turn-on discussion) to have an effect. When U14b Q output goes low, U4d resets the logic as in the previous turn-on discussion.

U11b is still cleared and continues to disable U28d through U2c and U10d. The U30 outputs to U11b and U28d cannot have an effect on the logic. The counter U1 remains at six, the idling condition of the logic, until a CONTROL input removes the cleared condition of U11b.

When the signal CONTROL is received from the I/O, it partially enables U28c. U28c is fully enabled if the T/W carriage return and tab reeds are not closed. The output (high) of U28c removes the clear (low) inputs for U11a and b. Since the CONTROL signal arrived simultaneously with data on the DF-0 through DF-7 lines, the control logic now begins to process the data for a typewriter operation, beginning with state 6.

CONTROL LOGIC ASSEMBLY

STATE 6

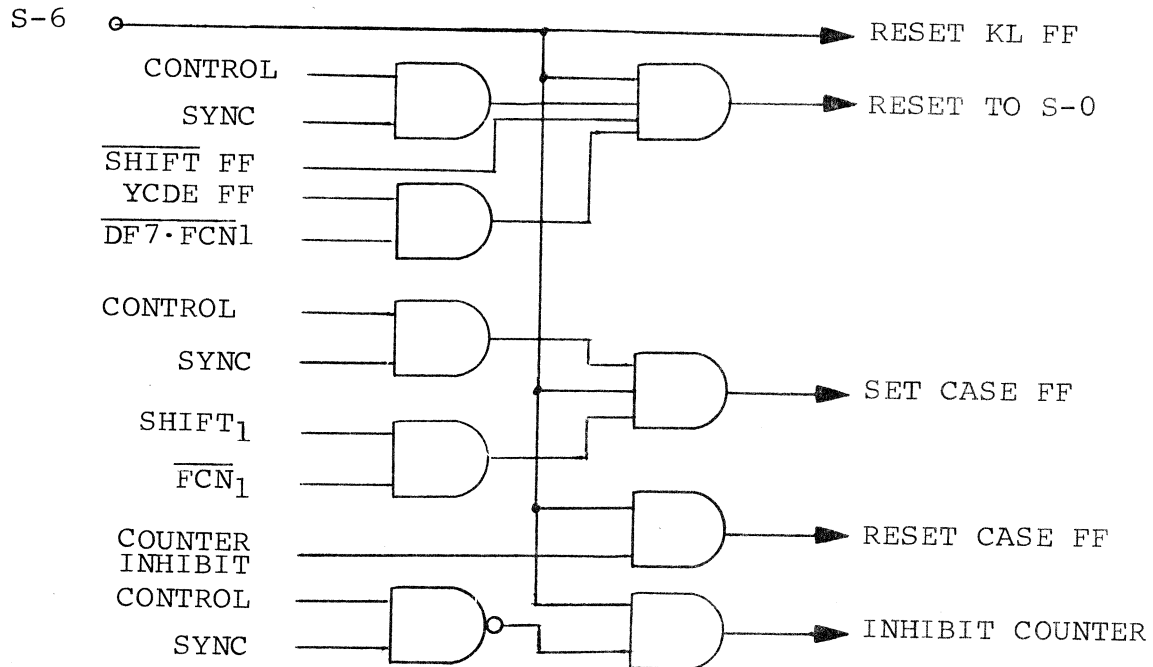
NOTE

EACH OF THE FOLLOWING STATES ARE DISCUSSED INDEPENDENTLY OF EACH OTHER. AT TIMES, CERTAIN FLIP-FLOP CONDITIONS ARE ASSUMED EVEN THOUGH THEY ARE NOT EXPLAINED AT THAT TIME. THESE FLIP-FLOP CONDITIONS ARE EXPLAINED, IN DETAIL, DURING LATER STATE DISCUSSIONS. FIGURE 3-3a AND 3-3b IS AN OVER-ALL LOGIC FLOW DIAGRAM AND MAY HELP IN THE UNDERSTANDING OF THE GENERAL LOGIC PHILOSOPHY.

CONTROL LOGIC ASSEMBLY

STATE 6

GENERAL DESCRIPTION

FIGURE 3-4
STATE 6

STATE 6 CONTROL LOGIC BLOCK

State 6 is the idling state of the logic. Sync and $\overline{\text{control}}$ inputs starts state sequencing.

During state 6, the typewriter keyboard is locked out to prevent interference with the automatic typing operation. The case flip-flop is set, if necessary, before the typing operation occurs. If no new code has been entered, the case flip-flop is reset and the counter inhibited. If the new code is not a time consuming operation, e.g. a tab clear, the logic will be reset to S-0, bypassing S-7.

CONTROL LOGIC ASSEMBLY

STATE 6
(continued)

DETAILED DESCRIPTION

During State 6, the keyboard lockout flip-flop, U21c and U32b, is set by the $\overline{Q}$ (CONTROL) output of U11b.

U2b is enabled by the $\overline{Q}$ output of U11b. U2b partially enables U8c and U13d. If a shift $\overline{FCN}$ is required (U19c high), U8c is enabled. U8c (low) sets the case flip-flop U21a and b.

If the shift flip-flop U25a and U13a is set (shift), U13d is enabled. U13d (low) enables U8b. U3d is partially enabled by U8b. U6c fully enables U3d. If the YCDE flip-flop is set, U6c is partially enabled. U6c is enabled if the 'dot and' gate is low. This can occur only when both inputs are low (DF7·FCN). The U3d output (low) sets the reset flip-flop, U4b and c. When U4c is low, the counter (U1) is reset to $\emptyset$.

If the Q output of U11b is low (no CONTROL or SYNC), U2c inhibits the counter by disabling U28d. The inverted output (low) of U2c disables U8d. U8d high enables U12c.

U12c resets the case flip-flop (U21b high)

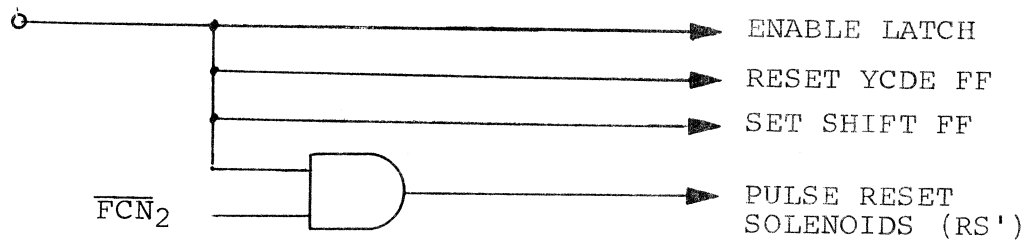
State seven is used as a delay and no detailed description is necessary.

STATE 7

CONTROL LOGIC ASSEMBLY

GENERAL DESCRIPTION

STATE 0

FIGURE 3-5
STATE 0

STATE 0 CONTROL LOGIC BLOCK DIAGRAM

State 0 enables the data latch U29, allowing the Facit data code to be transferred to its output. The YCDE flip-flop is reset and the shift flip-flop is set. They can now be reconditioned by a new code input from the I/O. If the present code is that of a character ($\overline{FCN}_2$), the reset solenoids are energized to clear any previous typing operation.

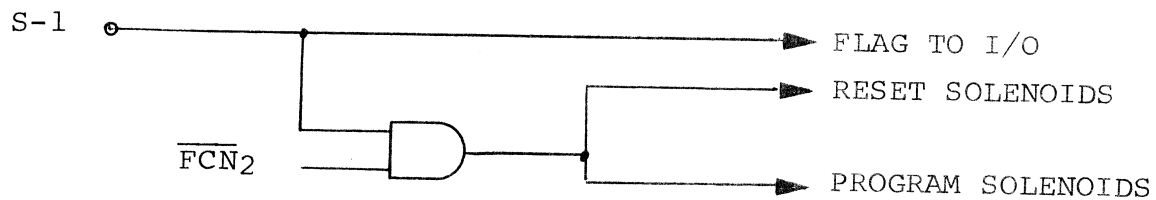
DETAILED DESCRIPTION

The $\overline{0}$ output (low) of U9 pin 12 enables the latch. The Facit data codes are transferred to the latch output. The inverted $\overline{0}$ (high) enables U12d. The U12d output (low) resets the YCDE flip-flop. $\overline{0}$ enables U25a and 18b. Enabling of U25a sets the shift flip-flop. The U18b output (high) partially enables U28b. U28b is enabled when the inverted output of U7c is high. U7c is enabled if data bits DF4 and DF5 are low ($\overline{FCN}_2$). If the code is $\overline{FCN}_2$, U28b enables and the typewriter reset solenoid drivers are enabled.

CONTROL LOGIC ASSEMBLY

GENERAL DESCRIPTION

STATE 1

FIGURE 3-6
STATE 1

STATE 1 CONTROL LOGIC BLOCK DIAGRAM

The state 1 output of the decoder initializes a FLAG to the I/O. This is an indicator to the I/O that the interface is ready for a new code. If the present operation is a typing operation ($\overline{\text{FCN2}}$), the reset solenoids are held energized. The program solenoids are energized to begin the typing sequence.

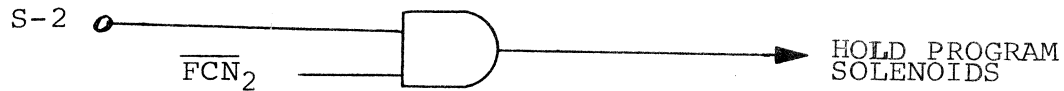
DETAILED DESCRIPTION

The decoder pin 11 $\overline{1}$ output enables U18b, U6a, and U3a. The U6a output (high) clocks U11a, a D flip-flop. The twice inverted output of U11a (high) is a FLAG for the I/O. The U3a output (high) enables U6b. The U6b output (low) partially enables U7d. If the operation is a character ($\overline{\text{FCN2}}$), U7c enables U7d. The U7d output (high) partially enables the power gates U24a,b,c, and d and U23c and d. These power gates are enabled by the data bits on DF-0 through DF-4. (A high bit enables the gate.) This enables the program drivers for the character to be typed.

CONTROL LOGIC ASSEMBLY

GENERAL DESCRIPTION

STATE 2

FIGURE 3-7
STATE 2

STATE 2 CONTROL LOGIC BLOCK DIAGRAM

State 2 releases the reset solenoids and allows the typing operation from state 1 to continue. The typewriter now mechanically decodes the driver outputs and selects the proper character to be typed

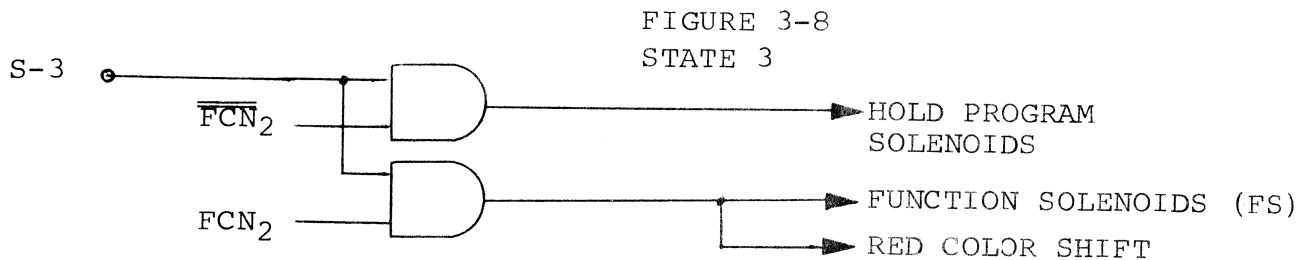
DETAILED DESCRIPTION

The decoder $\overline{2}$ output (pin 10) enables U3a and U6b. U6b partially enables U7d. U7d is enabled by the $\overline{FCN}_2$ output (low) of U7c. U7d partially enables the program solenoids as in state 1. U18b is no longer enabled. Its output (low) disables U28b, releasing the reset solenoids

CONTROL LOGIC ASSEMBLY

GENERAL DESCRIPTION

STATE 3



STATE 3 CONTROL LOGIC BLOCK DIAGRAM

During state 3, the program solenoids remain energized if a character is being typed. If the operation is a function, the proper function solenoids are energized. (A color shift to a black ribbon cannot occur until state 4.)

DETAILED DESCRIPTION

The decoder $\bar{3}$ output (pin 9) enables U3b and U12b, and partially enables U2d. The inverted $\bar{3}$ signal partially enables U4a.

The output of U3b (high) enables U6b. The program solenoids remain energized. U3b also partially enables U25c. U25c is enabled if U7c is high (FCN2). The U25c output (low) partially enables U7b and U7a. The inverted U25c output partially enables U23a.

When data bit DF-1 is high, U23a is enabled. U23a enables the carriage return driver.

If the code is a function (FCN2), DF-7 enables U7b or is inverted to enable U7a. (This allows one data bit to enable two different functions.) If U-7b is enabled (DF-7 low),

power gates U23b, U27b, U27c, and U27d are partially

enabled. A high data bit (DF0-DF3 or DF-6) fully enables

CONTROL LOGIC ASSEMBLY

STATE 3
(continued)

one of the power gates for the function indicated by
the Facit Data Code.

The inverted U7b output (low) partially enables U19b. U19b is fully enabled when data bit DF-0 is low. The U19b output (high) enables U12a. The U12a output (low) sets a 119 msec 'hold off' one-shot, U33. This occurs for all functions except space, tab set, tab clear, and color shift.

U7a is enabled when data bit DF-7 is high. The U7a output (high) partially enables U21d, U20a, U5b, and 32a. U21d is fully enabled by a high data bit DF-3. The U21d output (low) sets the color shift flip-flop U25b and U32c. (A red ribbon is selected.)

U5b is enabled by a high data bit DF-6. The U5b output (high) enables U19d. The inverted U19d output (high) enables the tab clear driver.

U20a is fully enabled by a high data bit DF-1. The U20a output (low) sets the 119 msec 'hold off' one-shot, and sets the tab clear all flip-flop U20b and U20c. The U20c output (high) enables the tab clear driver. The tab clear all operation will not end until the flip-flop is reset. This occurs when U6d or U2a is disabled by the end of the 119 msec 'hold off' and the de-energizing of the carriage return reed. The U33 Q output (low) disables U2a. The U2a output (high) disables U6a. U6a is also disabled by the

CONTROL LOGIC ASSEMBLY

STATE 3
(continued)

de-energizing of the carriage return reed.

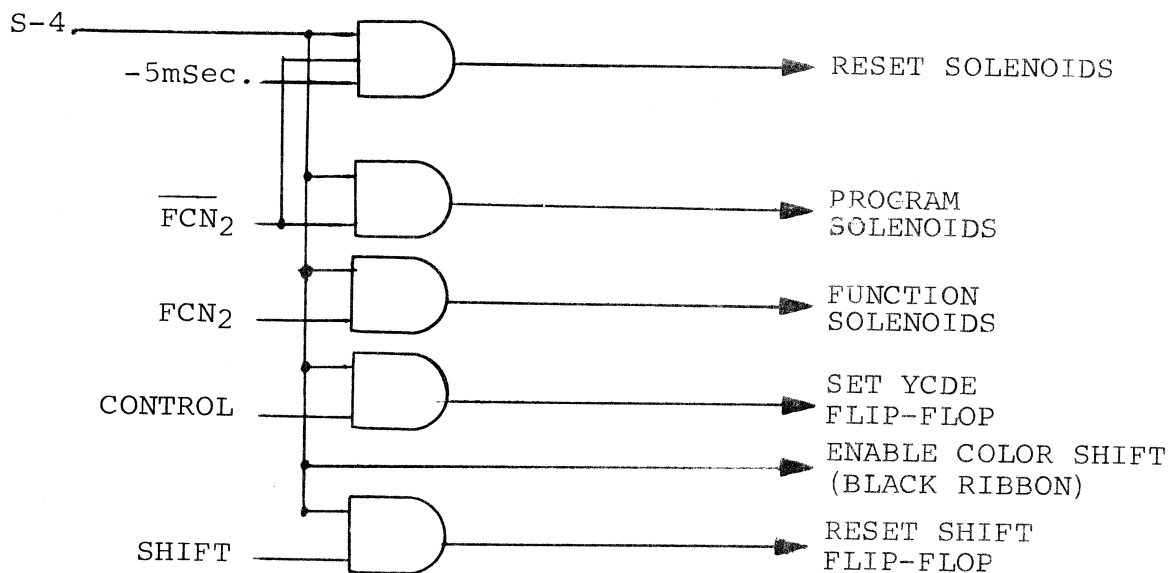
NOTE

For a tab clear all, the calculator first gives a continuous space command until end of line is reached. It then gives a tab clear and carriage return. The 119 msec hold off is activated because of an 80 msec delay between the carriage return command and typewriter execution. When the carriage has returned to the left margin, the carriage return reed opens and the typewriter operation is complete.

CONTROL LOGIC ASSEMBLY

GENERAL DESCRIPTION

STATE 4

FIGURE 3-9
STATE 4

STATE 4 CONTROL LOGIC BLOCK DIAGRAM

The selected function or program operations described in state 3 continue in state 4. A black ribbon selection can occur in state 4. If a new control signal is present, the YCDE flip-flop is set. If a new code requires a shift, the shift flip-flop is set. (The two flip-flops are set for logic operations that occur in state 5.) 5 msec after the beginning of state 4, the reset solenoids are again energized.

DETAILED DESCRIPTION

The $\overline{4}$ decoder output (pin 8) partially enables U32a. If data bit DF-2 is high, a black ribbon shift occurs, as U32a is fully enabled.

The function and program solenoids remain energized as described in the state 3 description.

CONTROL LOGIC ASSEMBLY

STATE 4
(continued)

U4a is partially enabled by the inverted $\overline{4}$ input. U4a is enabled when the $\overline{Q}$ output of U14 is high; this occurs 5 msec after SYNC. The output of U4 (low) enables U18b. If the operation is a character ($\overline{FCN2}$), U28 enables the reset solenoid driver.

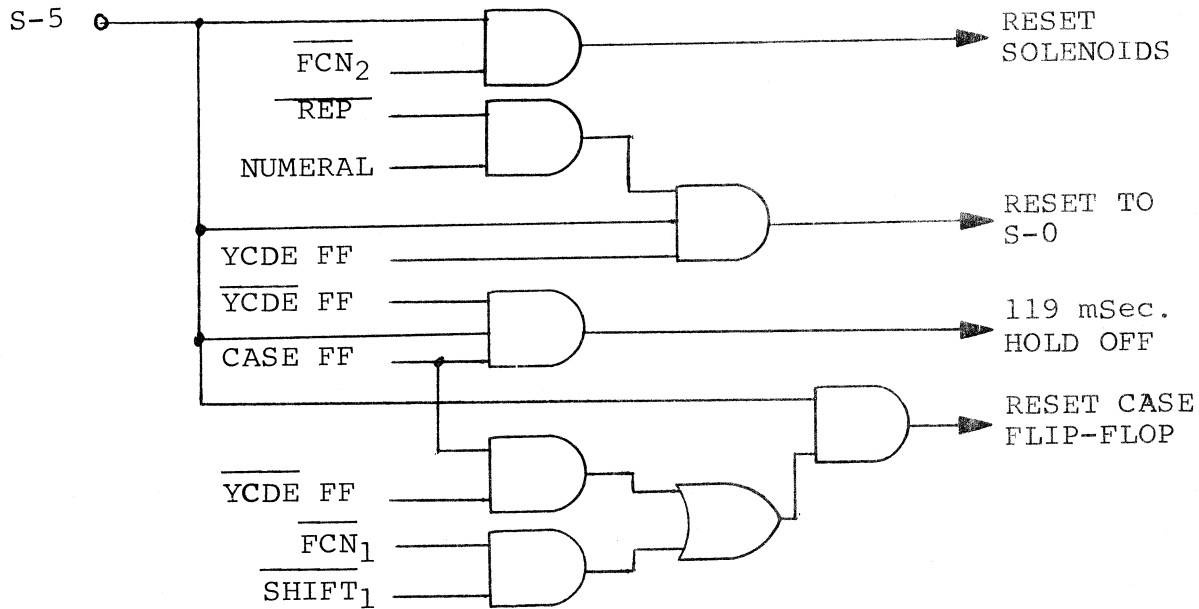
The $\overline{4}$ signal partially enables U2d. The $\overline{\text{CONTROL}}$ input is inverted twice and enables U2d. The U2d inverted output (low) sets the YCDE flip-flop.

U12b is partially enabled by $\overline{4}$. If the new data code is $\overline{FCN1}$, U19a is low. The U19a output enables U12b. The U12b output (high) partially enables U3c. U3c is fully enabled when U15 pin 10 is low (shift required). The output of U3c (low) resets the shift flip-flop U25a and U13a (high).

CONTROL LOGIC ASSEMBLY

GENERAL DESCRIPTION

STATE 5



STATE 5 CONTROL LOGIC BLOCK DIAGRAM

During state 5, the logic determines how much time is required to complete the present operation. It also decides if the next operation can be accomplished without the use of states 6 and 7. If no new code is present ($\overline{\text{YCDE}} \cdot \overline{\text{CONTROL}}$), the case flip-flop is set.

If the present code is a character ($\overline{\text{FCN2}}$), the reset solenoids remain energized. If the new code is a non-repetitive numeral, the counter is reset to 0. If the YCDE flip-flop is not set and the case flip-flop is reset, a 119 msec 'hold off' occurs. If the new code is an upper case character, the case flip-flop is reset.

DETAILED DESCRIPTION

The $\overline{5}$ decoder output (pin 7) enables U31b, U31d, and U18b.

CONTROL LOGIC ASSEMBLY

STATE 5
(continued)

The output of U18b (high) enables U28b. The output of U28b (high) holds the reset solenoids energized if the code is a character.

The inverted $\overline{5}$ partially enables U8a. U8a is enabled by U31a. If the new code is a non-repetitive numeral, U31a output is high. The low output of U8a enables U8b. The U8b output (high) partially enables U3d. U3d is enabled by U6c. U6c is enabled if the YCDE flip-flop is set, and the 'dot and' gate has a low output (both U10a and U15 pin 11 low). The U3d output (low) sets the reset flip-flop. Setting the reset flip-flop resets the counter to 0.

The YCDE flip-flop output enables U20d if no new code has been entered. If the YCDE flip-flop is not set and the case flip-flop is set (U21a low), the U20d output (high) enables U31b. U31b enables U12a and U12c. Enabling U12a sets the 119 msec one-shot U33. U12c resets the case flip-flop if the YCDE flip-flop is not set and case flip-flop is set, or if U8d is low. U8d is enabled by U31d. If the new input code is FCN·SHIFT, U25d enables U31d.

TABLE 4- 1
9861A LIST OF ABBREVIATIONS

FCN1	A FACIT data code on the latch input for a non-typing operation.	11201A
FCN2	A FACIT data code on the latch output for a non-typing operation.	
<u>FCN</u>	A character to be typed (either a letter or numeral)	
YCDE	Yes code; a new code on the data latch input from the I/O assembly.	
CONTROL	(CEO) Signal from the I/O assembly which tells the 11201A control logic that a new code is present.	
SHIFT1	FACIT data code on the latch input which requires a shifted typewriter keyboard.	
CASE	Upper (shifted) or lower (unshifted) typewriter keyboard.	9861A
FLAG	Signal to I/O assembly from the 11201A that a new code can be processed.	
CR REED TAB REED	Typewriter reeds which provide a low (gnd) when the carriage is moving for a carriage return or tab(reeds closed)	
EOL	(End of Line) Typewriter is a right margine.	
PS	program solenoid - used for typing operation.	
CS	color shift - red or black ribbon.	
CS'	color shift - output of logic assembly to the driver assembly	
TC	tab clear - clears tab at the present carriage position.	

TABLE 4-1 (CONT'D)
9861A LIST OF ABBREVIATIONS

TS	tab set - sets a tab at the present carriage position.	9861A CONT'D
HT	tabulation - carriage moves right to the next position where a tab has been set or to the right margin.	
BS	back space - carriage moves right-to-left one space.	
LF	line feed - carriage advances to the next line.	
CR	carriage return - carriage returns to the left margin.	
SP	space - carriage moves left-to-right one space.	
DF	data, FACIT code - 8 bit code from the I/O assembly that is used by 11201A.	
D0	data, ASCII code - 8 bit code from the control block to the I/O assembly.	
SYNC	synchronous - timing pulses from the typewriter that are used to correlate the timing in the 9861A.	
SIH	prevent interrupt - signal from the I/O assembly to the control block that indicates that a typing operation is occurring.	
CO-3	One of four (CO-0 - CO-3) channel select lines.	
SI-0	Peripheral status - peripheral ready flag to the control block from the I/O assembly.	
SI-3	EOL flag to the control block.	
CFI	Acknowledge flag to the control block.	
T/W	Typewriter	

TABLE 4-1

lower case	FACIT CODE (DF)				UPPER CASE	FACIT CODE (DF)			
	76	543	210	octal		76	543	210	octal
ø	10	010	000 *	220	!	01	010	000	120
1	10	010	001	221	"	01	010	001	121
2	10	010	010	222	#	01	010	010	122
3	10	010	011	223	\$	01	010	011	123
4	10	010	100	224	%	01	010	100	124
5	10	010	101	225	&	01	010	101 *	125
6	10	010	110	226	'	01	010	110	126
7	10	010	111	227	(	01	010	111	127
8	10	011	000	230	)	01	011	000	130
9	10	011	001	231	*	01	011	001	131
:	10	011	010	232	+	01	011	010	132
;	00	011	011	033	<	01	011	011	133
,	00	011	100	034	=	01	011	100	134
-	10	011	101	235	>	01	011	101	135
.	00	011	110	036	?	01	011	110	136
/	00	011	111	037	,	01	011	111	137
@	00	100	000 *	040	{	01	100	000	140
[	00	111	011	073	}	01	111	011	173
]	00	111	101	075	~	01	111	101	175
^	00	111	110	076		01	111	110	176
a	00	100	001	041	A	01	100	001	141
b	00	100	010	042	B	01	100	010	142
c	00	100	011	043	C	01	100	011	143
d	00	100	100	044	D	01	100	100	144
e	00	100	101	045	E	01	100	101	145
f	00	100	110	046	F	01	100	110	146
g	00	100	111	047	G	01	100	111	147
h	00	101	000	050	H	01	101	000	150
i	00	101	001	051	I	01	101	001	151
j	00	101	010	052	J	01	101	010 *	152
k	00	101	011	053	K	01	101	011	153
l	00	101	100	054	L	01	101	100	154
m	00	101	101	055	M	01	101	101	155
n	00	101	110	056	N	01	101	110	156
o	00	101	111	057	O	01	101	111	157
p	00	110	000	060	P	01	110	000	160
q	00	110	001	061	Q	01	110	001	161
r	00	110	010	062	R	01	110	010	162
s	00	110	011 *	063	S	01	110	011	163
t	00	110	100	064	T	01	110	100	164
u	00	110	101	065	U	01	110	101	165
v	00	110	110	066	V	01	110	110	166
w	00	110	111	067	W	01	110	111	167
x	00	111	000	070	X	01	111	000	170
y	00	111	001	071	Y	01	111	001	171
z	00	111	010	072	Z	01	111	010	172
					FUNCTIONS				
tab set	10	000	001	201	line fd	00	000	100 *	004
red rib.	10	001	000	210	tab C. A.	10	000	010	202
blk rib.	10	000	100	204	tab clr	11	000	000	300
bck spc	00	001	000 *	010	car rtn	00	000	010 *	002
tab	01	000	000 *	100	space	00	000	001 *	001

9810/11212/9861
PSUEDO-HARDWARE PROBLEMS

Some operating characteristics of the 9861A GENERAL
could be interpreted as instrument failures.

The Psuedo-Hardware section of this manual
deals with those failures, and will assist you
in their identification.

If the 11201A has not been set for the correct INSTALLATION
line voltages, it may be damaged or may operate
intermittently. If the typewriter is not matched
to the normal local line frequency, it may type
too slow or too fast. If it should type too
rapidly, mechanical binding can occur. See the
9861A OUTPUT TYPEWRITER PERIPHERAL MANUAL
(09861-90000) for the correct installation
proceedures.

If the typewriter is locked in the shifted key- NO UNSHIFTED
board condition, an unshifted keyboard cannot KEYBOARD
be selected from the calculator.

If the typewriter ribbon selector is set in the NO BLACK
red ribbon position, a black ribbon cannot be RIBBON
selected from the calculator.

TROUBLESHOOTING

9810/11212/9861

PSUEDO-HARDWARE PROBLEMS

If the typewriter carriage reaches the right margin while typing a message, the calculator address to the peripheral (FMT 2 FMT) will be terminated and the calculator keyboard will revert to the normal mode of operation. Therefore, the typewriter margins must be set in conformance with the message which is to be typed.

LOSS OF ADDRESS
TO PERIPHERAL

The program in the calculator memory will be lost and the calculator keyboard locked out if the instruction FMT 2 LIST is given in excess of six times without first depressing STOP two consecutive times. When listing a program, a STOP command will stop the listing. A CONTINUE or FMT 2 LIST will cause the listing to continue. However, continue may be used any number of times, whereas FMT 2 LIST cannot be used in excess of six times unless STOP is pressed a second time each time the listing is stopped. A listing can begin at any program step by pressing STOP STOP GOTO (step) FMT 2 LIST. STOP END FMT 2 LIST will cause the listing to begin at program step 0000.

LOSS OF PROGRAM
WHILE LISTING

The following equipment is necessary to trouble-shoot the 9861A:

hp 180A Oscilloscope

hp 427A Voltmeter

hp 10525A Logic Probe

hp 9861A Service Repair Kit

Various options are left to you as to the level of repair of the 9861A. The customers system may be repaired by the exchange of a service repair kit assembly with the defective assembly in the customers 9861A. The defective assembly is, then, returned to the factory for evaluation. The defective assembly may also be repaired on site to a component level. We do not recommend attempting to repair a defective assembly at the service center unless a FACIT Model 3841-4 Typewriter is available to you there.

SYSTEM REPAIR

The oscilloscope should be used to verify that calculator, control block, typewriter interface, and the I/A assembly are functioning correctly using the Oscilloscope Checkout Procedure at the end of this chapter. The use of this procedure prior to calling a FACIT service repairman will save you and the customer unnecessary delays in the repair of the defective 9861A.

OSCILLOSCOPE
USAGE

EXCHANGING 9861A ASSEMBLIES

CAUTION

INSURE THAT ALL POWER SWITCHES ARE
OFF BEFORE INSERTING OR REMOVING
ANY ASSEMBLY. FAILURE TO DO SO
CAN RESULT IN DAMAGED ASSEMBLIES

The recommended procedure for the exchanging of assemblies when troubleshooting the 9861A is to first replace the 9810 Calculator and typewriter control block. If the typewriter exerciser still will not run properly, exchange the four 9861A assemblies with those in your service kit. If the failure was corrected, return the customers assemblies to his system one at a time until the defective assembly has been isolated.

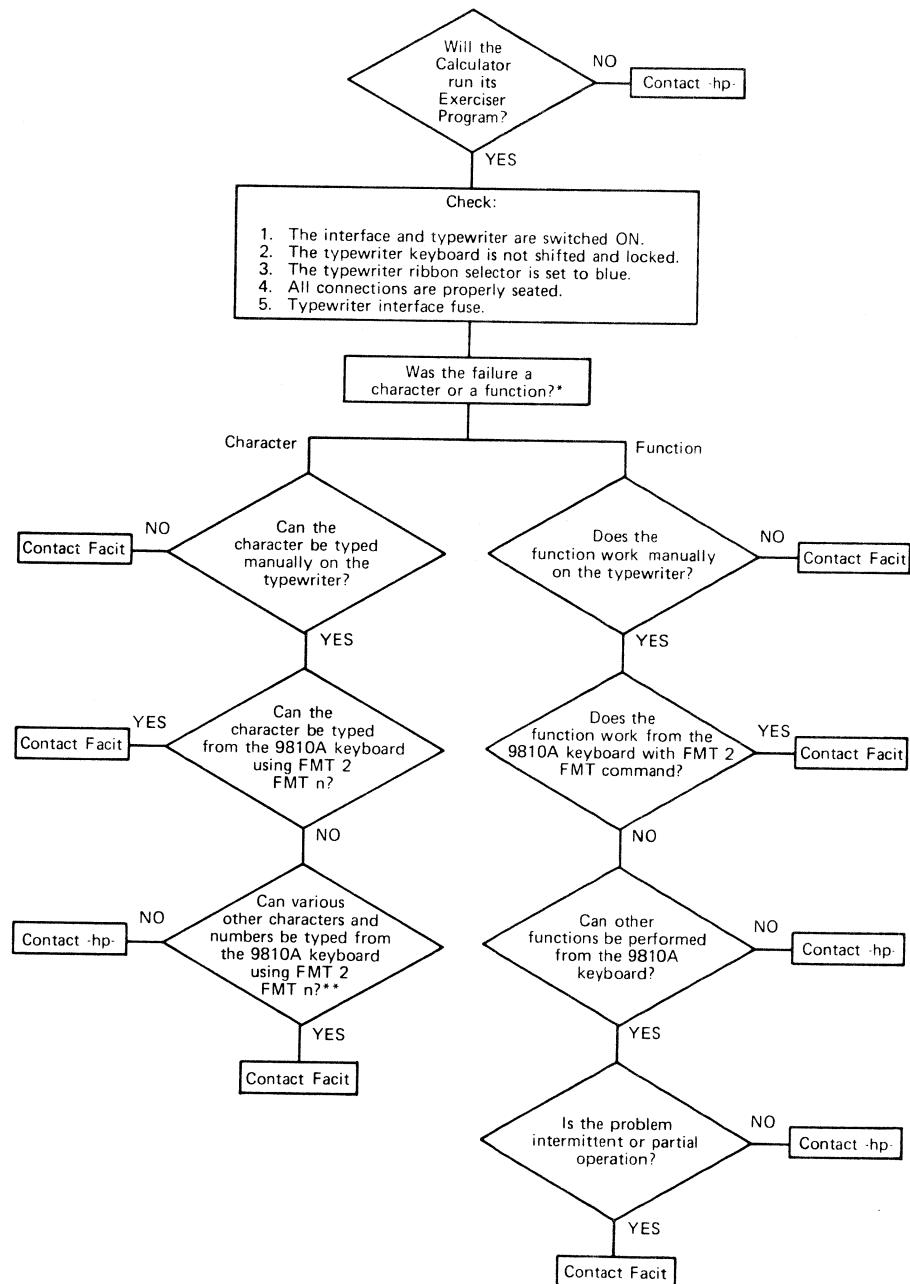
CAUTION

WHEN SERVICING THE I/O ASSEMBLY, TAKE
CARE NOT TO SHORT THE ASSEMBLY TO THE
CALCULATOR CHASSIS. FAILURE TO DO SO
MAY RESULT IN A DAMAGED CALCULATOR

9861A GENERAL TROUBLESHOOTING TREE

The following troubleshooting tree will help you determine which device in the 9861A is defective, the typewriter or the remainder of the system.

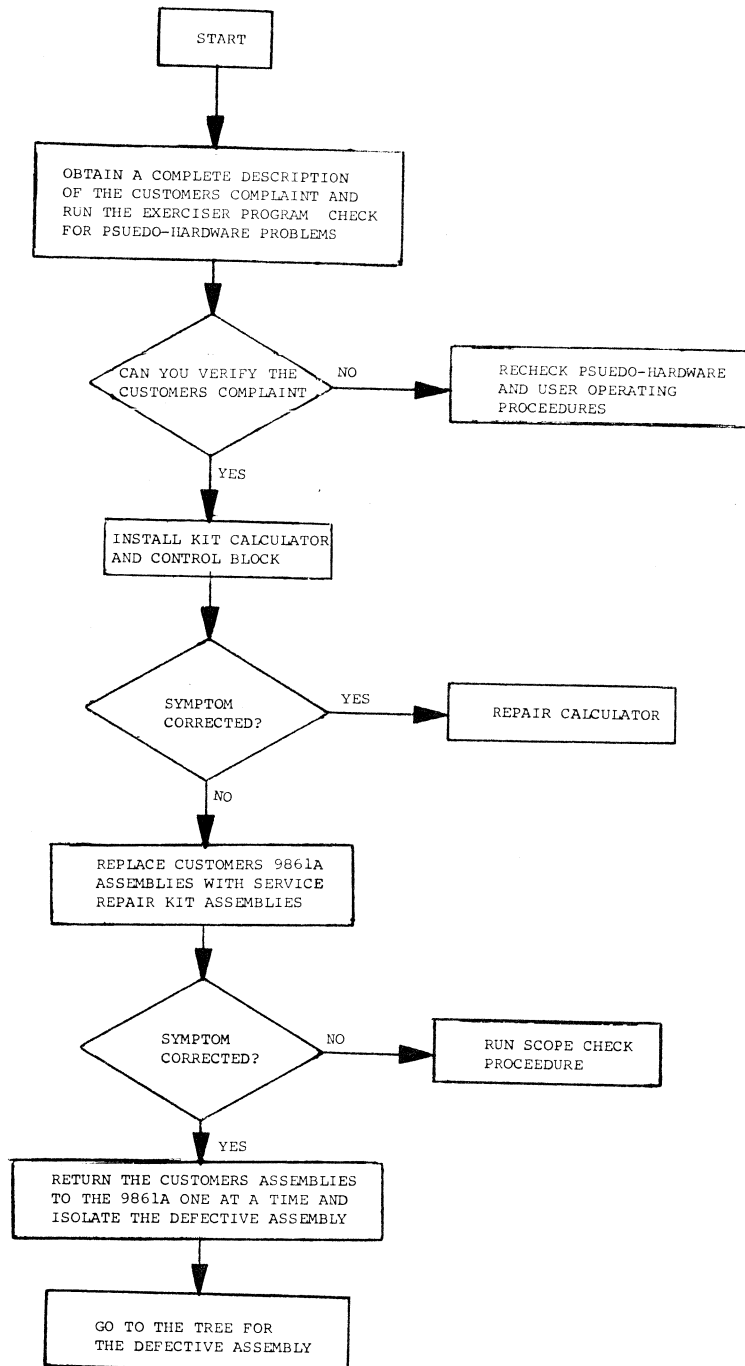
If the typewriter does not operate properly while the calculator is running the exerciser program, use the following troubleshooting tree.



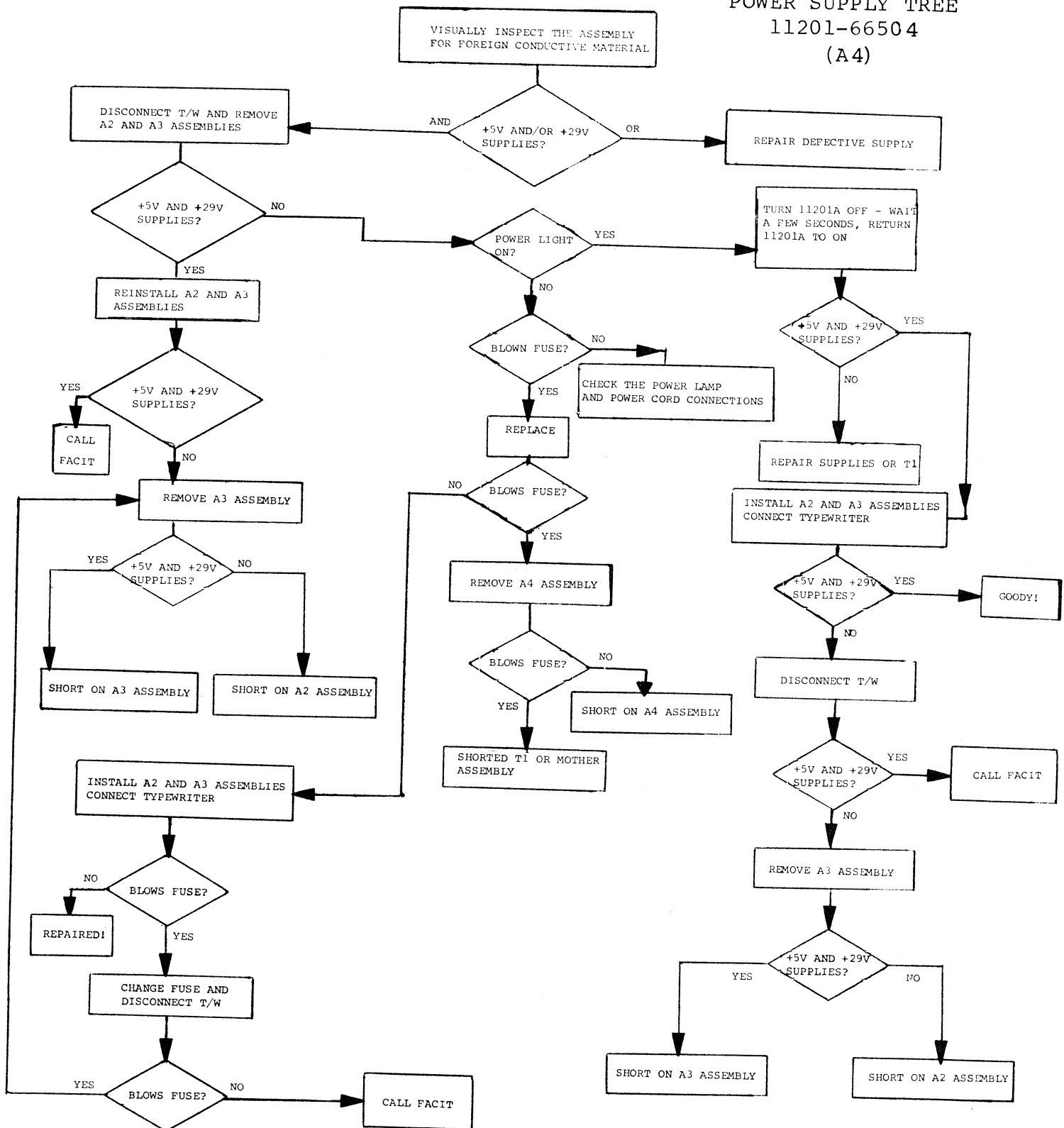
*A function is a typewriter operation which does not involve typing. An example of a function would be "TAB".

** n is the character in question.

9861A TROUBLESHOOTING TREE



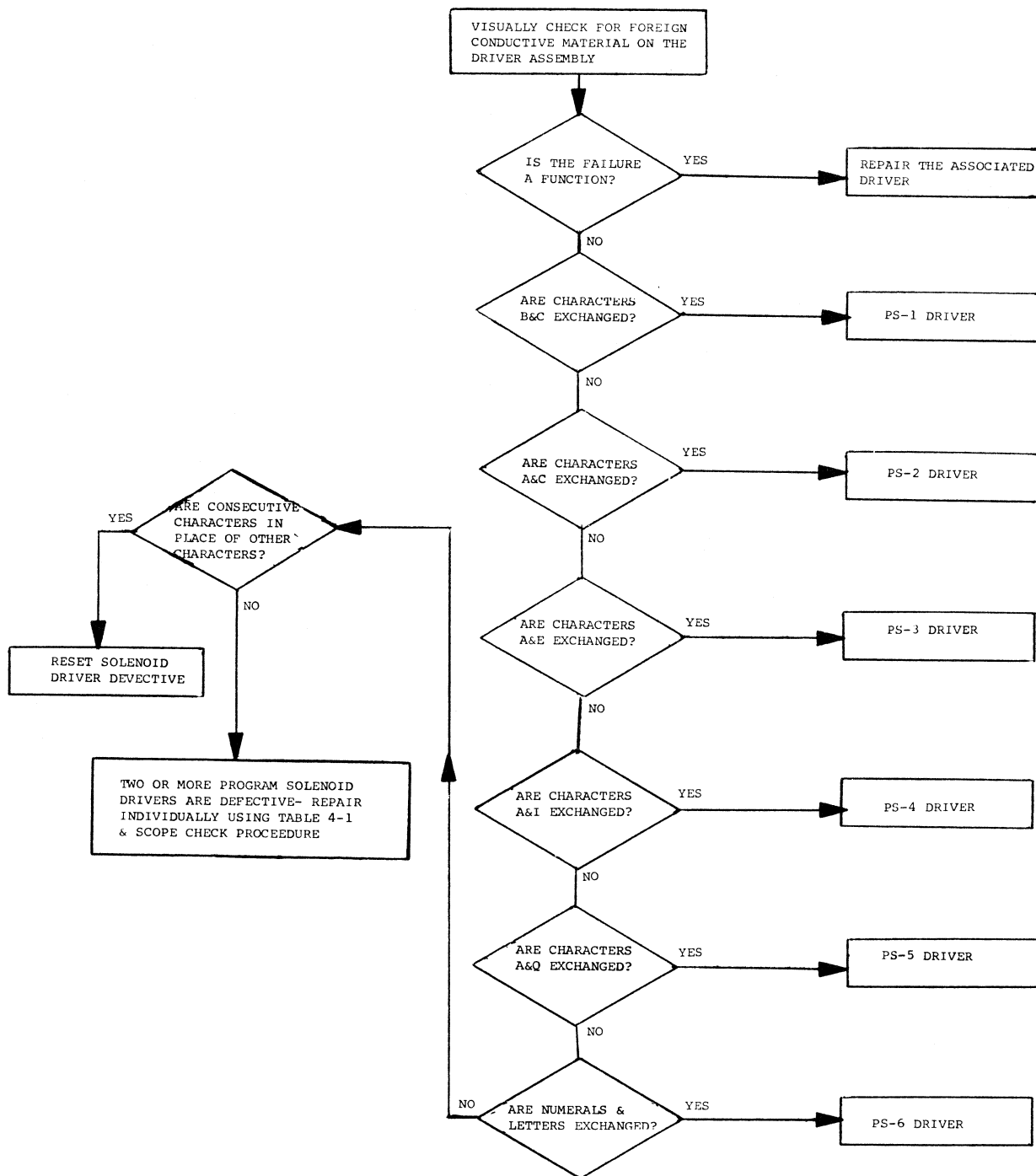
POWER SUPPLY TREE
11201-66504
(A4)



SOLENOID DRIVER TREE
11201-66503 (A3)

CAUTION

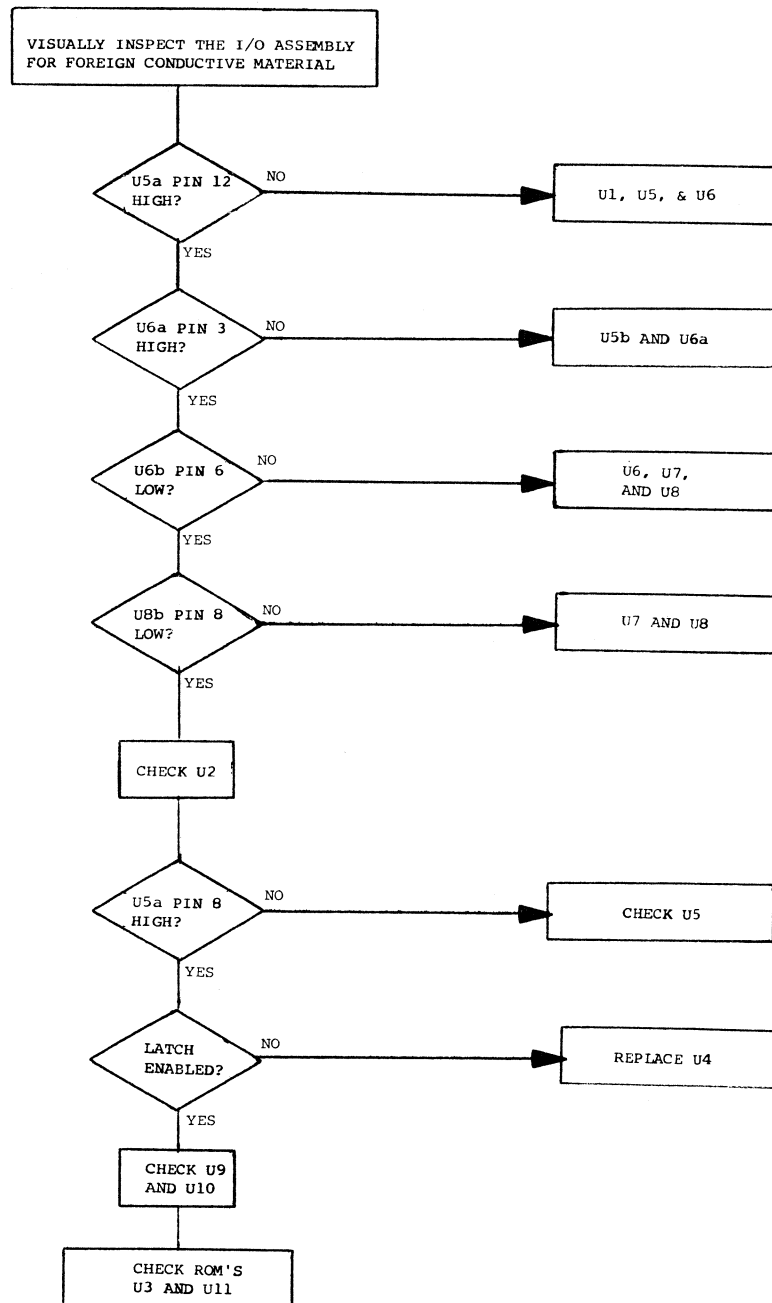
DO NOT SHORT THE DRIVER ASSEMBLY, AS
IT MAY BE DAMAGED



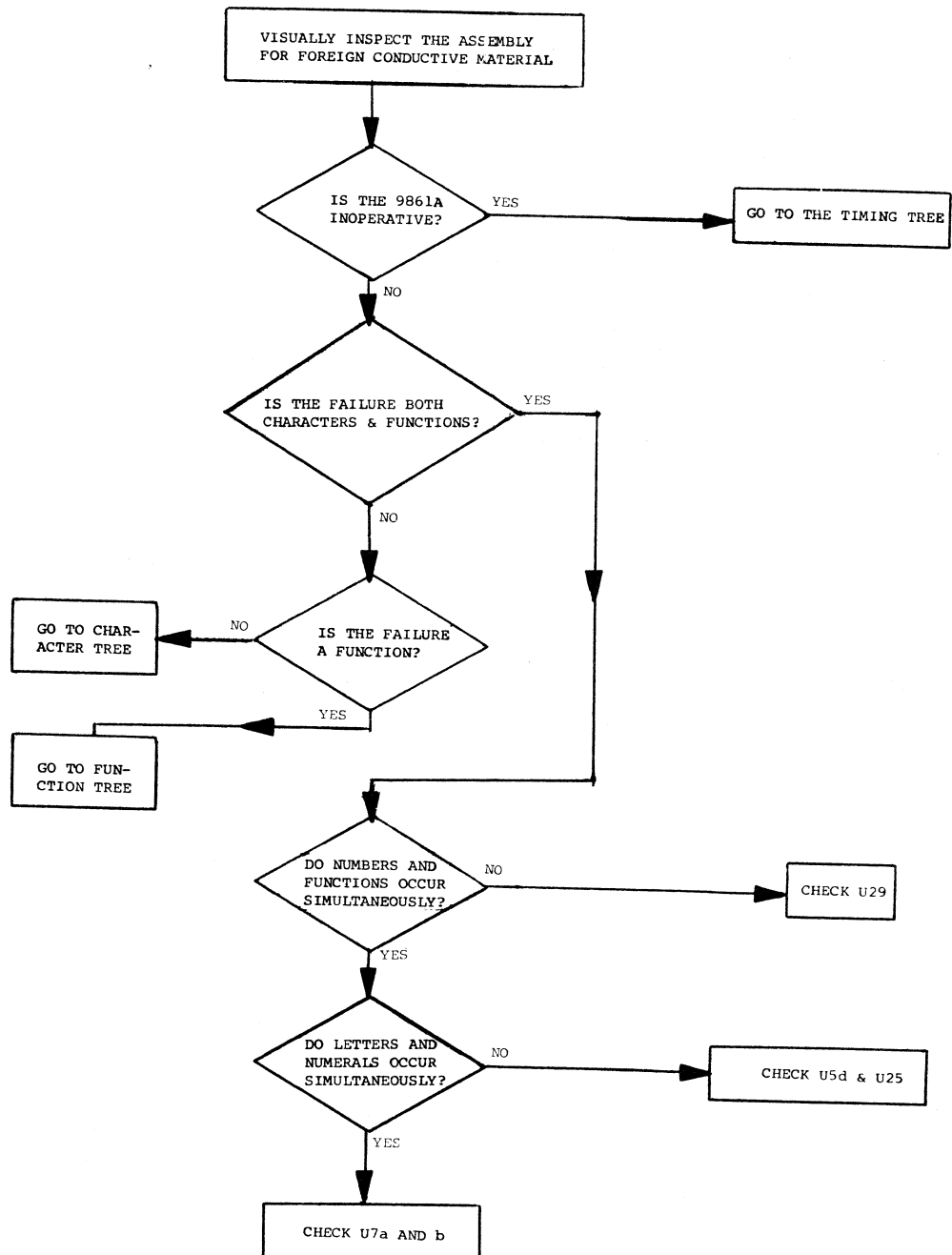
I/O ASSEMBLY TREE
(11201-66591) A5

CAUTION
THE 9810 CALCULATOR MAY BE DAMAGED IF
THIS ASSEMBLY IS SHORTED. TAKE CARE
NOT TO SHORT THIS ASSEMBLY TO THE CAL-
CULATOR CHASSIS.

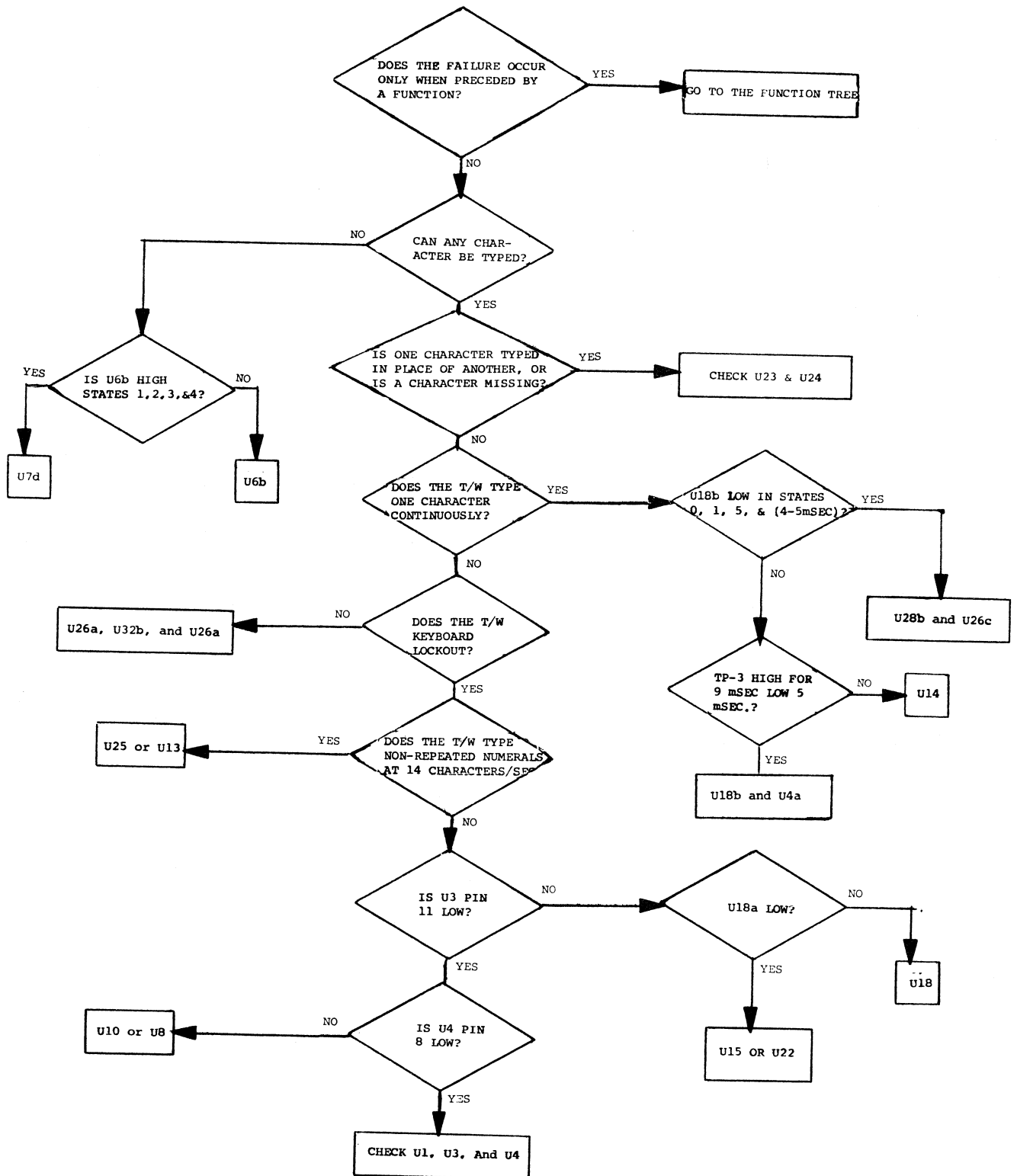
NOTE
CHECKS ON THE I/O SHOULD
BE MADE DURING DATA PROCESSING



CONTROL LOGIC TREE
11201-66502 (A2)



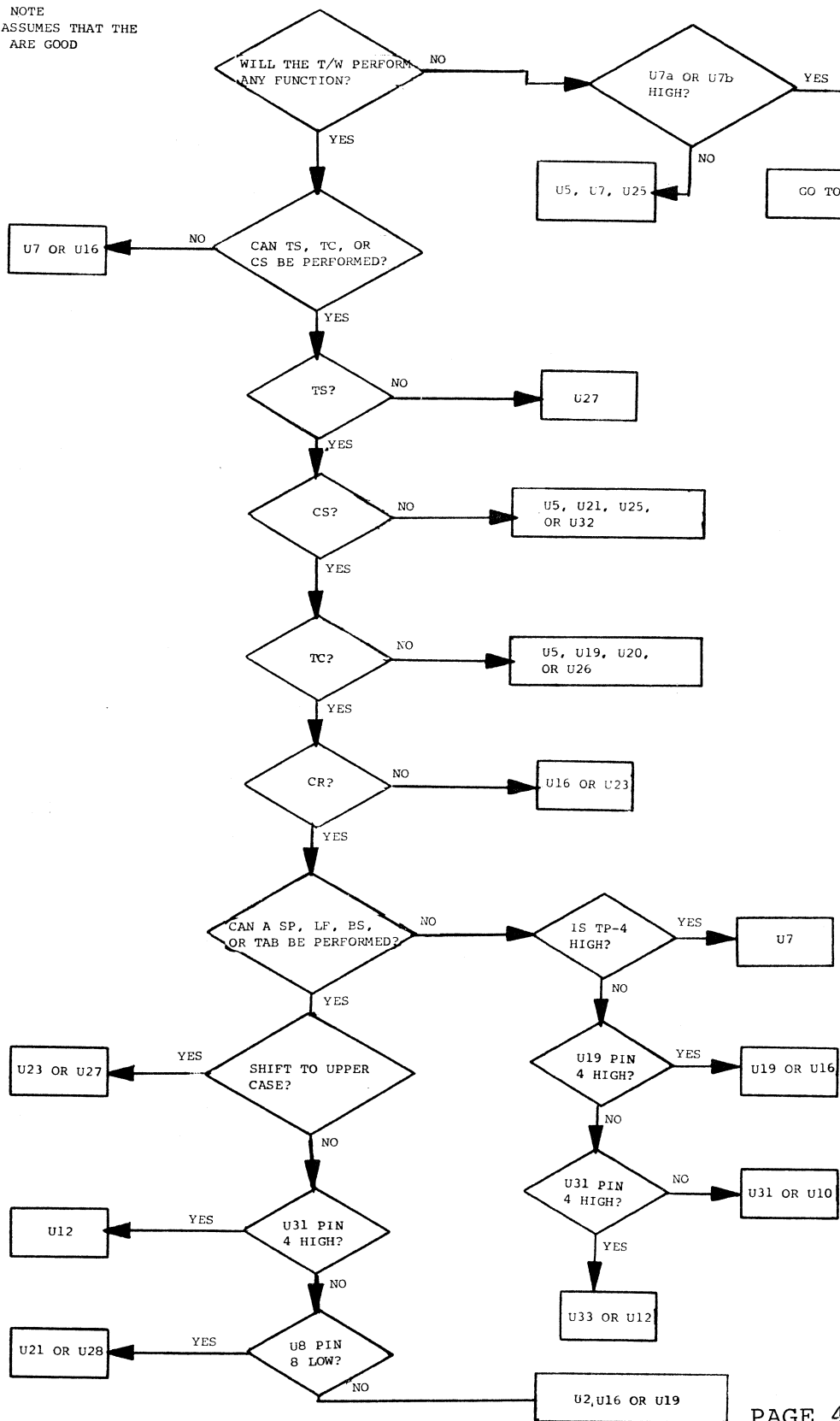
CONTROL LOGIC CHARACTER TREE
 11201-66502 (A2)
 THIS TREE ASSUMES THAT FUNCTIONS ARE GOOD



CONTROL LOGIC FUNCTION TREE

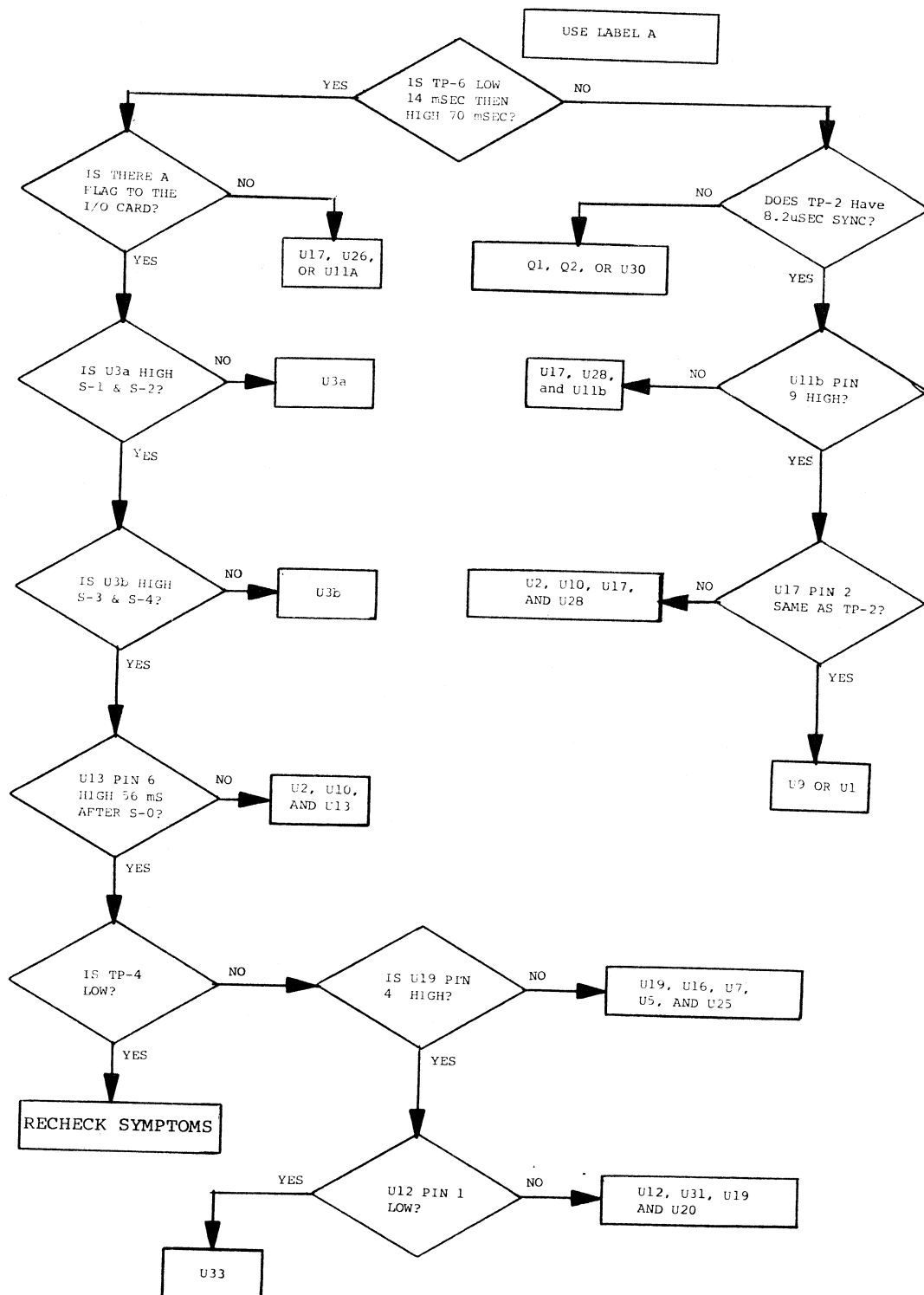
11201-66502 (A2)

NOTE
THIS TREE ASSUMES THAT THE
CHARACTERS ARE GOOD



CONTROL LOGIC TIMING TREE

11201-66502 (A2)



The 9861A Oscilloscope Checkout Proceedure is intended to assist you in determining if the 11201A Typewriter Interface is providing the correct solenoid drive signals for the Model 3841-4 FACIT Typewriter.

The proceedure requires the use of the 9861A Scope Check Program (S/N 09810-90028), hp 180A Dual Channel Oscilloscope, and the pulse diagrams shown in figures 4- through 4- in this manual.

EQUIPMENT
REQUIRED

The 9861A Scope Check Program has been arranged so that a particular solenoid driver output may be checked by the use of a program subroutine which repeatedly uses that particular driver. Each subroutine is addressed by the use of a label (LBL A through LBL I). A list of the subroutines, their label addresses, and the associated driver is provided in TABEL 4- .

9861A SCOPE
CHECK PROGRAM

To check a 11201A solenoid driver output signal, first load the 9861A Scope Check Program into the calculator memory. Then set the hp 180A oscilloscope controls as follows:

TEST
PROCEEDURE

TRIGGER: ext; - slope; ACF; 20 or
50 mSec/div.

MODE: norm.

DISPLAY: chop; B trigger

CHANNEL A: .2v/div; DC; connect 10:1
test probe to TP-2 (SYNC)

CHANNEL B: 10v/div; DC; connect test
lead to driver under test

EXTERNAL TRIGGER: connect to TP-6 (Ø)

TEST
PROCEEDURE
(cont'd)

- 1.) Check TABLE 4- for the subroutine address for the driver in question.
- 2.) PRESS: STOP END GoTo LBL (A-I) or STOP END for LBL A
- 3.) Recheck the test probe connections.
- 4.) Adjust the scope for the desired presentation.
- 5.) Compare the scope presentation to the ideal presentation in figures 4- through 4- . Take care to note the wave form on-off times, voltage levels, and the general waveform comparison.
- 7.) If the presentation in step no. 6 is the same, the driver output is acceptable and the next driver output may be checked.
- 8.) If the presentation in step no. 6 is not the same, refer to the troubleshooting tree in this chapter.
- 9.) Repeat this prodeedure for each solenoid driver until all of the drivers have been thoroughly checked.

NOTE

IT IS POSSIBLE FOR TYPEWRITER FAILURES TO APPEAR TO BE 11201A FAILURES. PRIOR TO TROUBLESHOOTING THE 11201A, MAKE THE FOLLOWING CHECKS:

1. If a driver output is 0V, check to see if the associated typewriter solenoid is open.
2. If a driver output is always +29V, check to see if the associated typewriter solenoid is shorted.

THE TYPEWRITER WIRING DIAGRAM AND MOTHER BOARD PIN CONNECTIONS WILL PROVIDE ACCESS TO THE TYPEWRITER SOLENOIDS FOR DC RESISTANCE MEASUREMENTS.

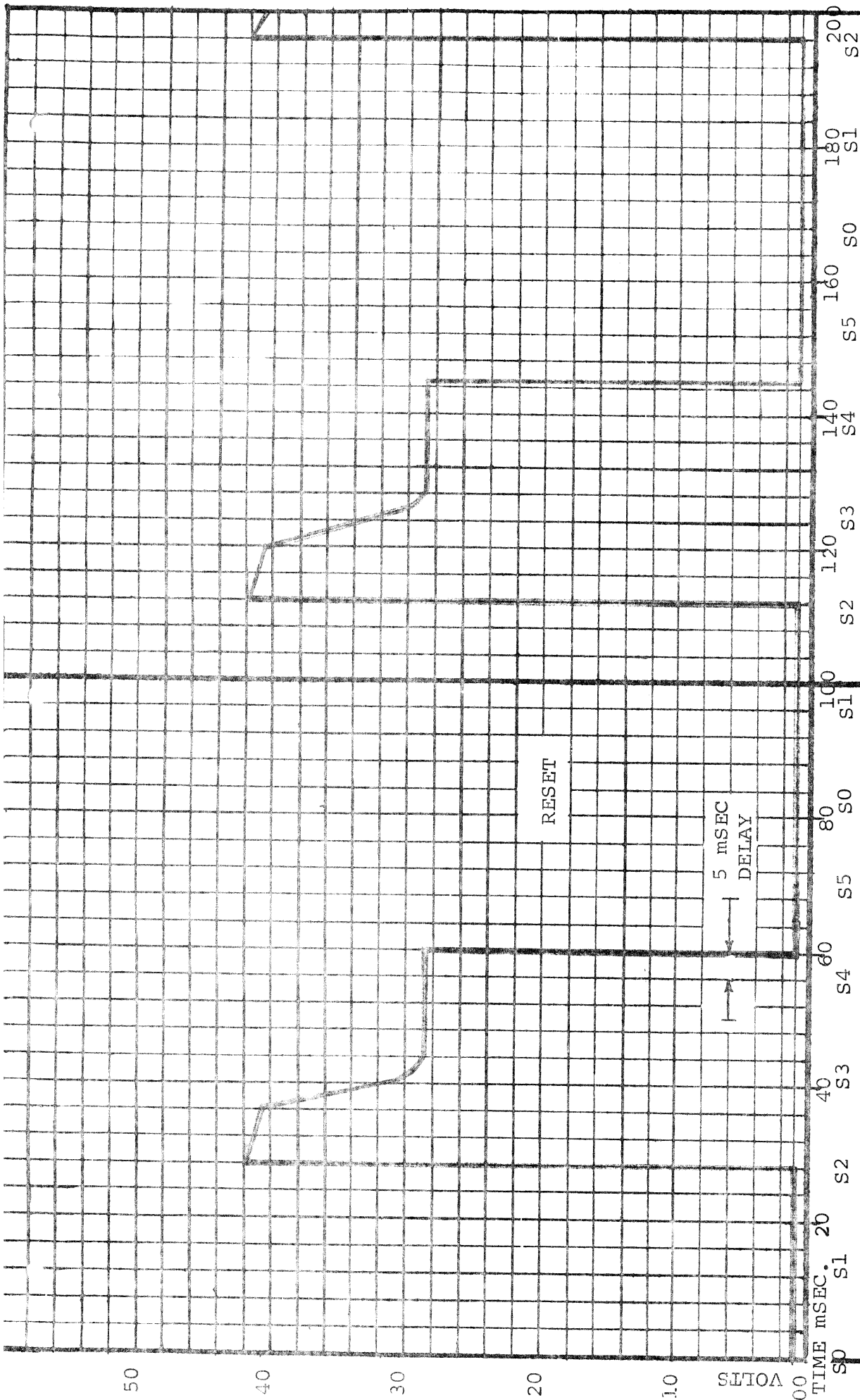
TABLE 4-2

TEST LOOP ADDRESSES

OPERATION	TYPING	ADDRESS	DRIVER
NON-REPEATING CHARACTERS-- [] [] []	----	LABEL A	----- Q31, 33, 35, 37, Q39, & Q41
NON-REPEATING NUMERALS -- 0123456789	----	LABEL B	----- Q15 & Q39
SPACE - TAB SET	-----	LABEL C	----- Q17 & Q29
SPACE - TAB CLEAR	-----	LABEL D	----- Q19 & Q29
TAB	-----	LABEL E	----- Q21
COLOR SHIFT	----- [cs{red) cs{blk)-]	LABEL F	----- Q4
KEYBOARD LOCKOUT	-----	LABEL G	----- Q8
CASE SHIFT - BACK SPACE- CARRIAGE RETURN/LINE FEED	-----	LABEL H	----- Q12, Q23, & Q27
REPEATING CHARACTERS	----- AA AA AA --	LABEL I	----- Q31, Q33, Q35, Q37 Q39, & Q41

NOTE

- 1.) EACH OF THE SUBROUTINES MAY BE USED INDIVIDUALLY. IT IS NOT NECESSARY TO RUN THE COMPLETE PROGRAM TO MAKE A SPECIFIC CHECK ON ONE DRIVER.
- 2.) TO ADDRESS TO A SPECIFIC SUBROUTINE, SEE THE ABOVE TABLE FOR THE ADDRESS OF THE SUBROUTINE OR OPERATION WHICH YOU DESIRE TO PERFORM. PRESS: STOP END GOTO LBL (A-I). WHEN YOU ARE PREPARED TO MAKE THE SPECIFIC CHECK AND THE TEST PROBES ARE PROPERLY CONNECTED, PRESS: CONTINUE.

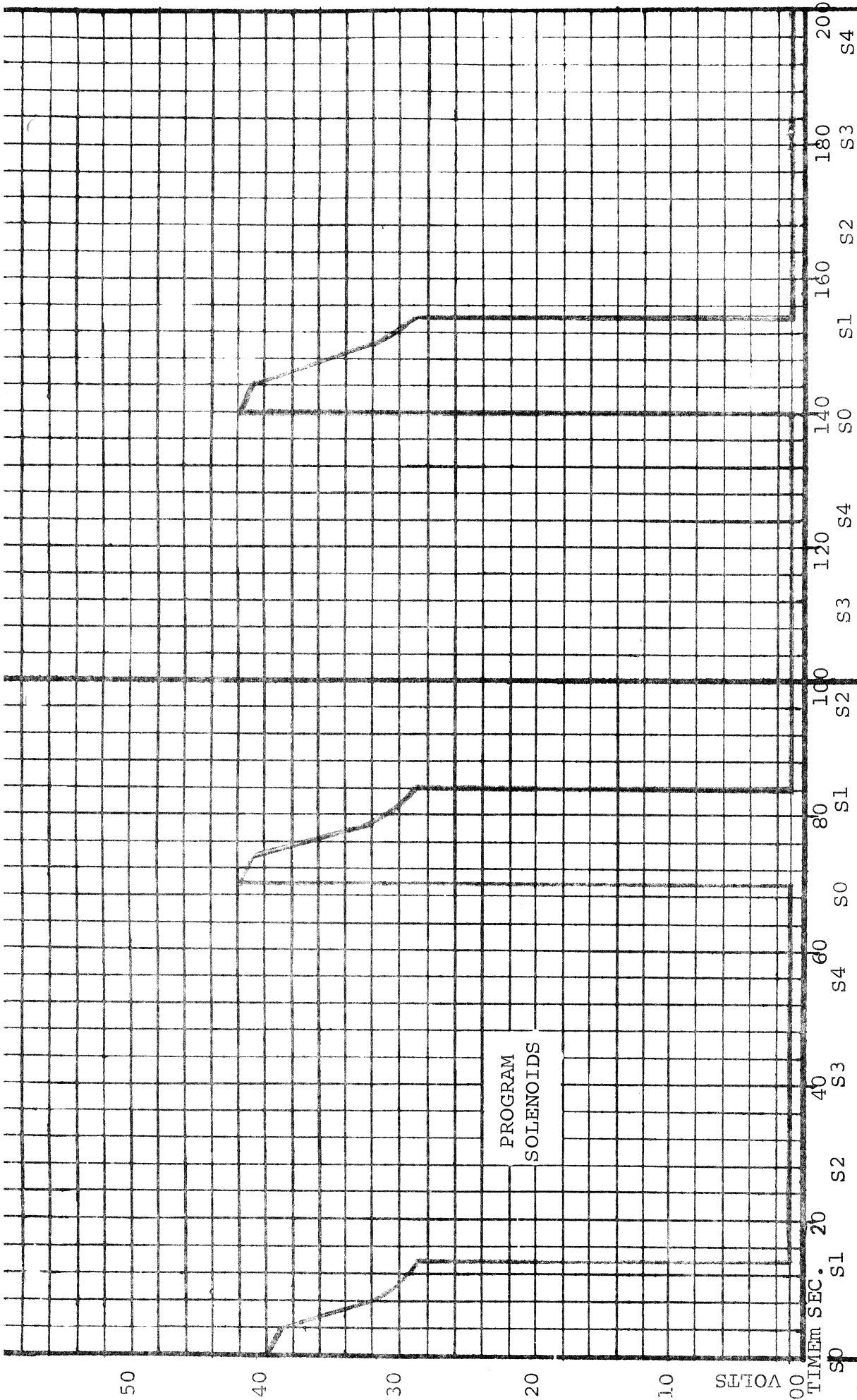


NOTE
OBSERVE THE 5 mSEC. DELAY AFTER STATE 4 TO THE
ENERGIZING OF THE RS DRIVER.

LBL A

OPERATION REPEATING CHARACTERS

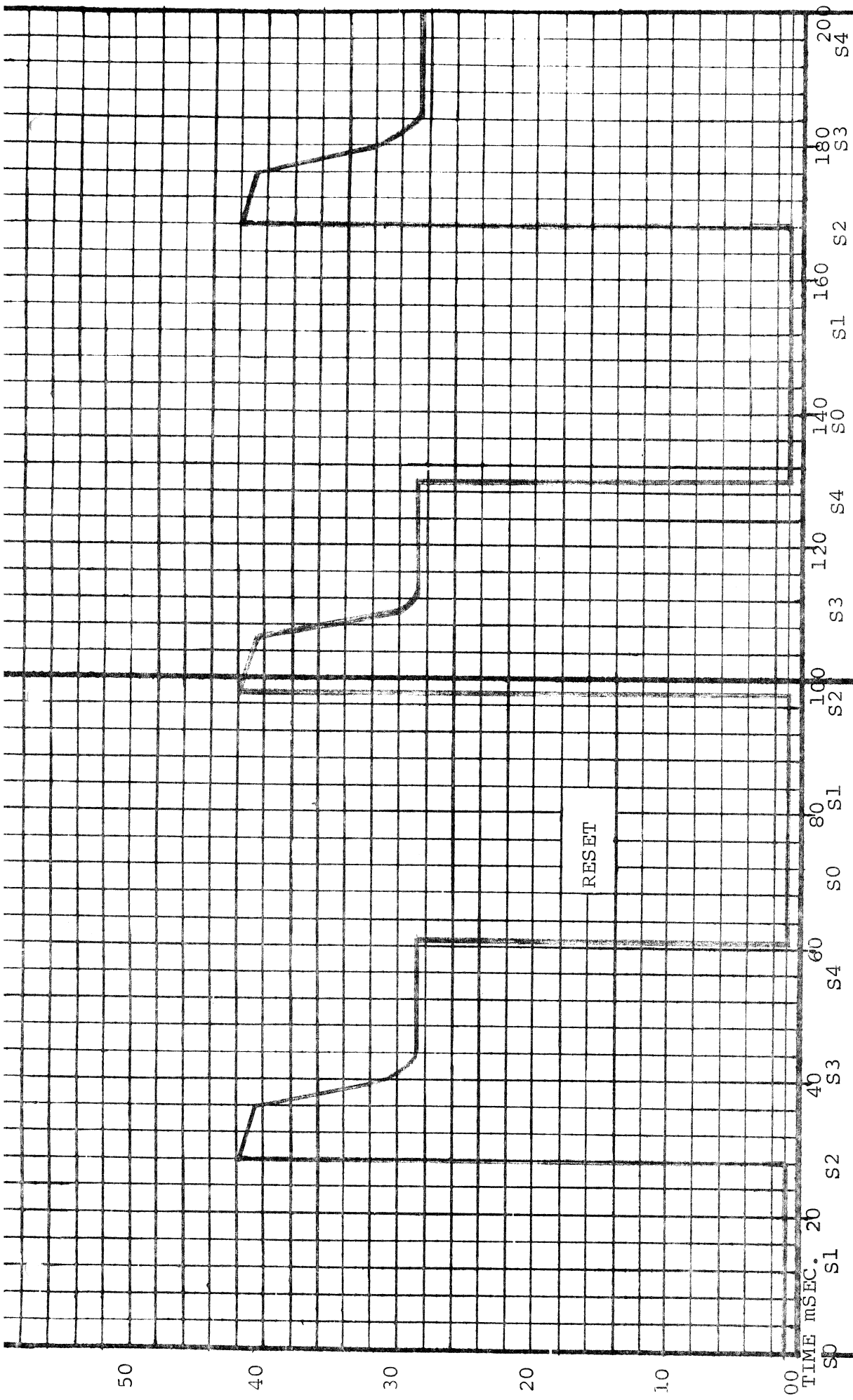
CHECK RS & 5 mSEC. DELAY



PROGRAM
SOLENOIDS

LBL B

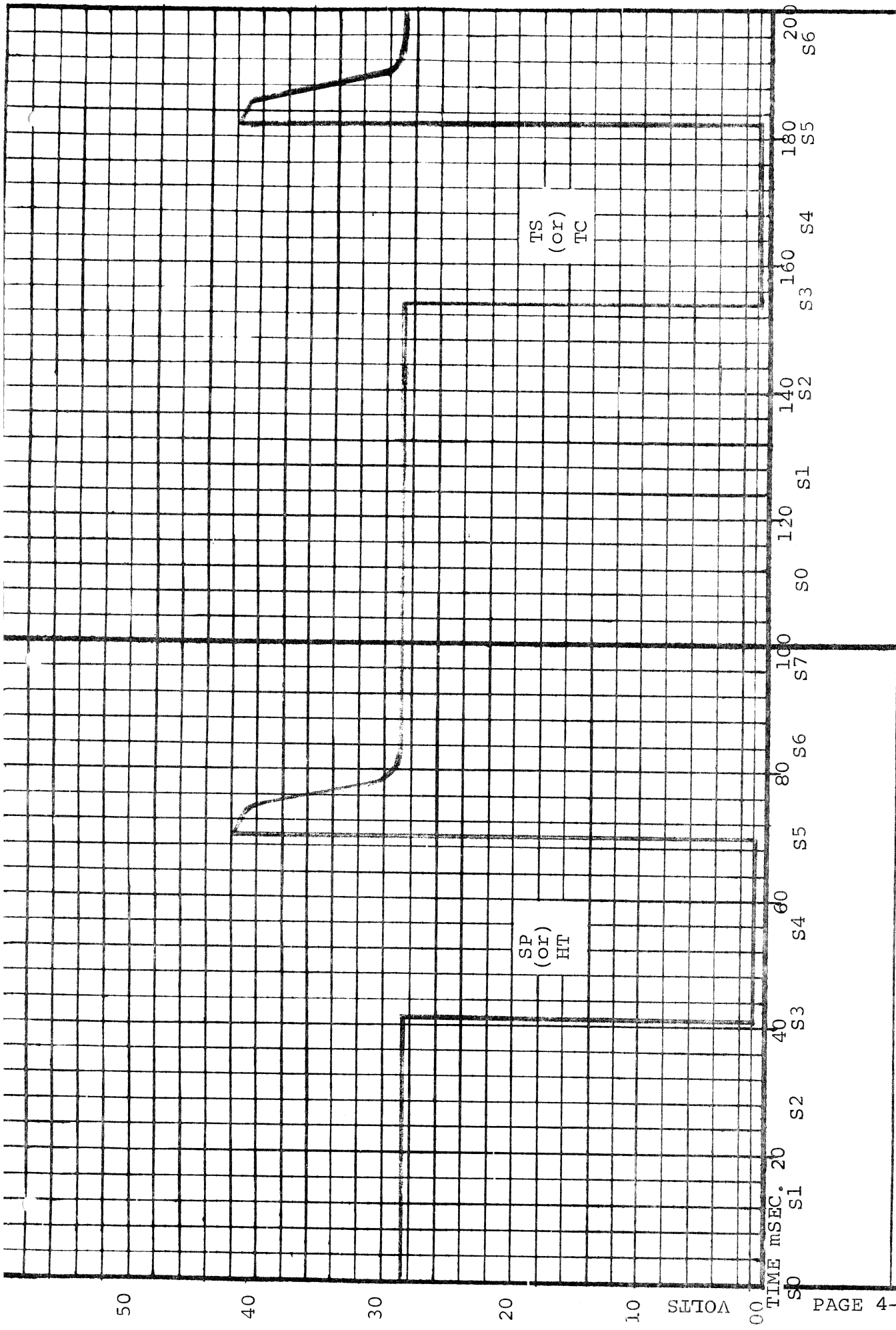
OPERATION NON-REPEATING NUMERALS (slow speed)
CHECK PS (slow speed)



LBL B

OPERATION NON-REPEATING NUMERALS

CHECK RS (high speed)



LBL C-SP&TS; D-SP&TC; E-HT
 OPERATION SP-TS-(pause, pause); SP-TC-(pause, pause); HT (LBL E) MAY BE RUN , USE SP GRAPH
 CHECK SP, TS, TC, & HT

50

40

30

20

10

SLTIOA

00

TIME mSEC.

PAGE 4-23

S0 S1 S2 S3 S4 S5 S6

40

60

80

100

120

140

160

180

200

BLACK
RIBBON

84 mS
+/-
13

REDUCED
POWER

RED
RIBBON

LBL F

OPERATION CS (red) - CS (black) - (pause, pause)
CHECK COLOR SHIFT

50

40

30

20

VOLTS

10

00

TIME msec.

S6

S7

S0

S1

S2

S3

S4

S5

S6

S7

S0

S1

S2

S3

S4

S5

S6

S7

S0

S1

S2

S3

S4

S5

S6

S7

S0

S1

S2

S3

S4

S5

S6

S7

S0

S1

S2

S3

S4

S5

S6

S7

S0

S1

S2

S3

S4

S5

S6

S7

S0

S1

S2

S3

S4

S5

S6

S7

S0

S1

S2

S3

S4

S5

S6

S7

S0

S1

S2

S3

S4

S5

S6

S7

S0

S1

S2

S3

S4

S5

S6

S7

S0

S1

S2

S3

S4

S5

S6

S7

S0

S1

S2

S3

S4

S5

S6

S7

S0

S1

S2

S3

S4

S5

S6

S7

S0

S1

S2

S3

S4

S5

S6

S7

S0

S1

S2

S3

S4

S5

S6

S7

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S1

S2

S3

S4

S5

S6

S7

S0

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S4

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S6

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S6

S7

S0

S1

S2

S3

S4

S5

S6

S7

S0

S1

S2

S3

S4

S5

S6

S7

S0

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S3

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S6

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S0

S1

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S1

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S3

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S6

S7

S0

S1

S2

S3

S4

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S6

S7

S0

S1

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S4

S5

S6

S7

S0

S1

S2

S3

S4

S5

S6

S7

S0

S1

S2

S3

S4

S5

S6

S7

S0

S1

S2

S3

S4

S5

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S7

S0

S1

S2

S3

S4

S5

S6

S7

S0

S1

S2

S3

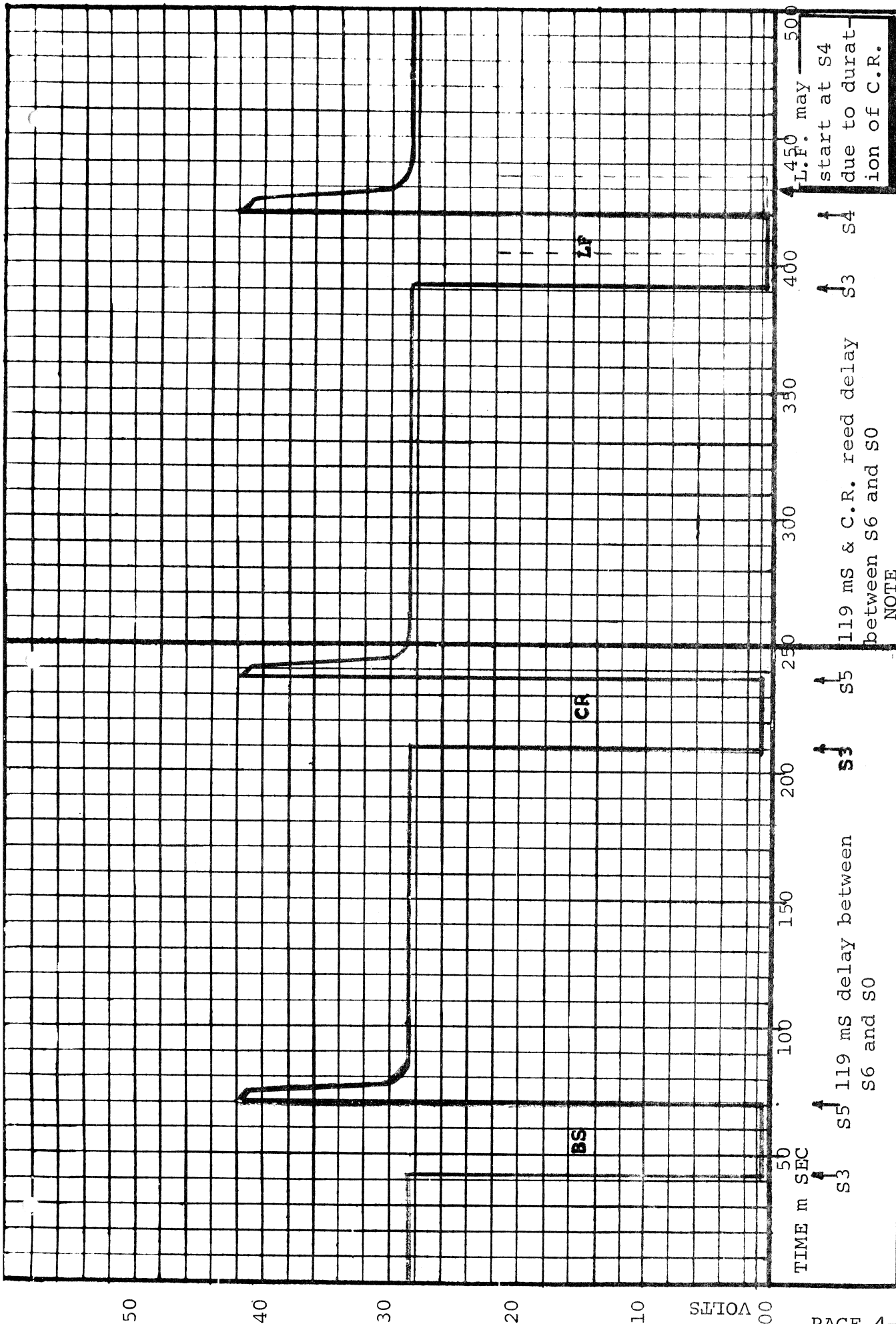
S4

S5

S6

S7

S0



NOTE
 119 mS & C.R. reed delay between S6 and S0
 8.2 u SEC. sync pulses occur approximately every 14 m Sec, but will vary with the T/W motor speed
 Sync pulses that are important to the timing of this graph are noted by arrows.

LBL H
 OPERATION BS - CR - LF (pause, pause)
 CHECK NOTE THESE OPERATIONS REQUIRE A 119 m SEC. DELAY. SEE 11201A Control Logic THEORY OF OPERATION

50

40

30

20

10

VOLTS

00

TIME m SEC

50

100

150

200

250

300

350

400

450

500

S0

S5

S6

S0

S5

LOWER
CASE28 mS
+
5 mSREDUCED
POWERUPPER
CASE

NOTE

8.2 u SEC. sync pulses occur approximately every 14 m Sec, but will vary with the T/W motor speed. Sync pulses that are important to the timing of this graph are noted by arrows.

LBL I

OPERATION AA-(pause) - AA-(pause, pause)

CHECK UC/LC SHIFT

9861A OSCILLOSCOPE CHECKCUT PROGRAM

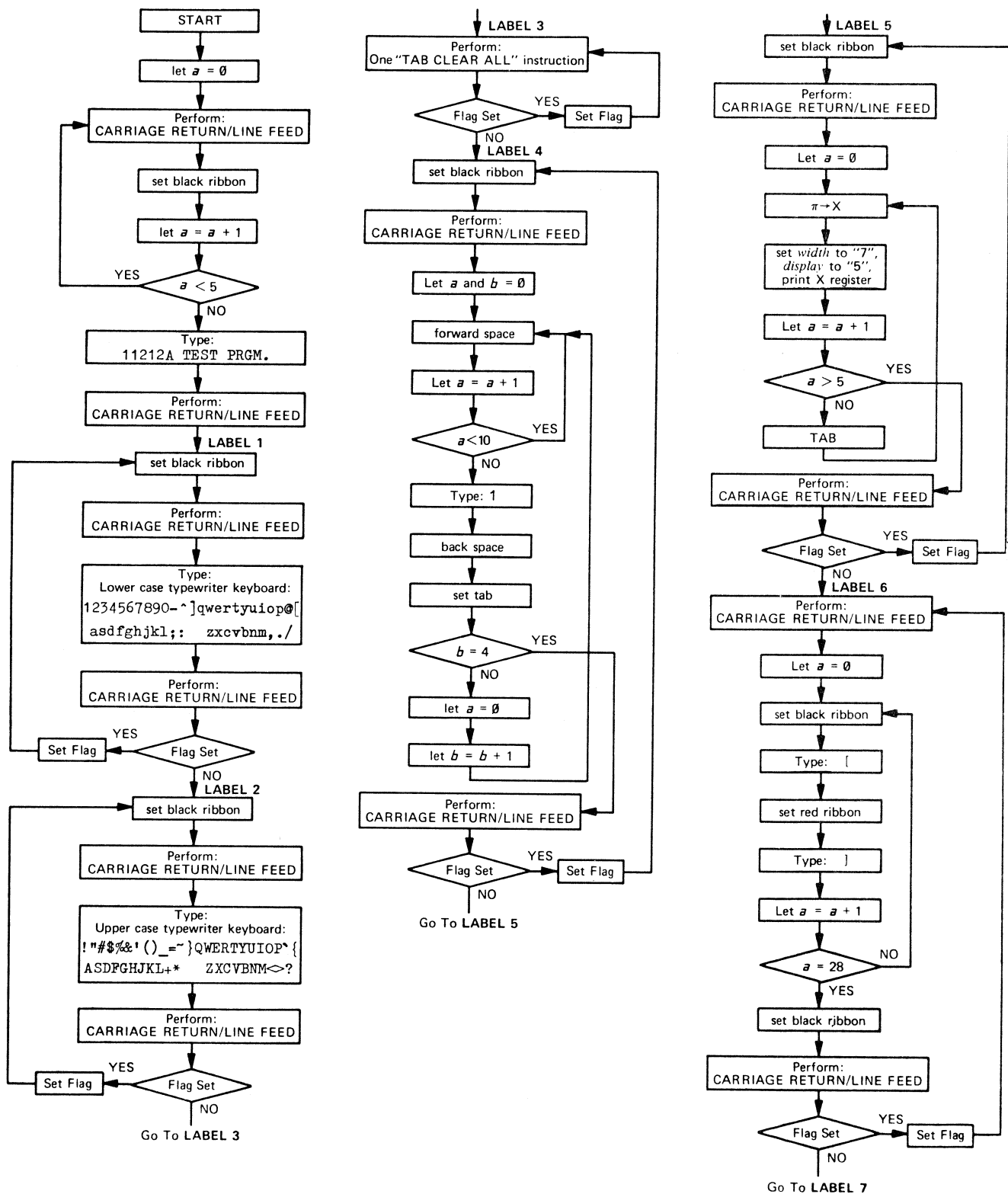
* 0000--LBL---51	0050--KEY---30	0100--FMT---42	0150--PSE---57
0001-- A ---62	0051--FMT---42	0101--FMT---42	0151--FMT---42
0002--FMT---42	0052--PSE---57	0102-- 2 ---02	0152-- 2 ---02
0003-- 2 ---02	0053--PSE---57	0103--FMT---42	0153--FMT---42
0004--FMT---42	0054--GTO---44	0104--UP ---27	0154-- A ---62
0005--UP ---27	0055--S/R---77	0105--S/R---77	0155-- A ---62
0006--SQT---76	0056-- 0 ---00	0106--UP ---27	0156--FMT---42
0007--CHS---32	0057-- 1 ---01	0107--S/R---77	0157--PSE---57
0008--FMT---42	0058-- 7 ---07	0108--FMT---42	0158--PSE---57
0009--GTO---44	0059-- 0 ---00	0109--PSE---57	0159--GTO---44
0010--S/R---77	0060--GTO---44	0110--PSE---57	0160--S/R---77
0011-- 0 ---00	0061--LBL---51	0111--GTO---44	0161-- 0 ---00
0012-- 1 ---01	* 0062-- C ---61	0112-- 0 ---00	0162-- 2 ---02
0013-- 7 ---07	0063--LBL---51	0113-- 1 ---01	0163-- 2 ---02
0014-- 0 ---00	0064-- D ---63	0114-- 0 ---00	0164-- 0 ---00
0015--GTO---44	0065--FMT---42	0115-- 1 ---01	0165--GTO---44
0016--LBL---51	0066-- 2 ---02	* 0116--LBL---51	0166--LBL---51
0017-- A ---62	0067--FMT---42	0117-- G ---15	0167-- I ---65
* 0018--LBL---51	0068--CNT---47	0118--FMT---42	0168--CNT---47
0019-- B ---66	0069--DN ---25	0119-- 2 ---02	0169--CNT---47
0020--FMT---42	0070--FMT---42	0120--FMT---42	0170--CNT---47
0021-- 2 ---02	0071--PSE---57	0121--S/R---77	0171--CNT---47
0022--FMT---42	0072--PSE---57	0122--FMT---42	0172-- a ---13
0023-- 0 ---00	0073--GTO---44	0123--PSE---57	0173--UP ---27
0024-- 1 ---01	0074--S/R---77	0124--PSE---57	0174-- 1 ---01
0025-- 2 ---02	0075-- 0 ---00	0125--GTO---44	0175-- + ---33
0026-- 3 ---03	0076-- 1 ---01	0126--LBL---51	0176--YTO---40
0027-- 4 ---04	0077-- 7 ---07	0127-- G ---15	0177-- a ---13
0028-- 5 ---05	0078-- 0 ---00	* 0128--LBL---51	0178-- 0 ---00
0029-- 6 ---06	0079--GTO---44	0129-- H ---74	0179-- 5 ---05
0030-- 7 ---07	0080--LBL---51	0130--FMT---42	0180-- 0 ---00
0031-- 8 ---10	* 0081-- D ---63	0131-- 2 ---02	0181--X>Y---53
0032-- 9 ---11	0082--LBL---51	0132--FMT---42	0182--CNT---47
0033--FMT---42	0083-- E ---60	0133--UP ---27	0183--S/R---77
0034--GTO---44	0084--FMT---42	0134--GTO---44	0184--CNT---47
0035--S/R---77	0085-- 2 ---02	0135--CLR---20	0185--CNT---47
0036-- 0 ---00	0086--FMT---42	0136--FMT---42	0186--FMT---42
0037-- 1 ---01	0087--KEY---30	0137--PSE---57	0187-- 2 ---02
0038-- 9 ---11	0088--FMT---42	0138--PSE---57	0188--FMT---42
0039-- 5 ---05	0089--PSE---57	0139--GTO---44	0189--CLR---20
0040--GTO---44	0090--PSE---57	0140--LBL---51	0190--FMT---42
0041--LBL---51	0091--GTO---44	0141-- H ---74	0191-- 0 ---00
0042-- B ---66	0092--LBL---51	* 0142--LBL---51	0192--XTO---23
* 0043--LBL---51	* 0093-- E ---60	0143-- I ---65	0193-- a ---13
0044-- C ---61	0094--LBL---51	0144--FMT---42	0194--S/R---77
0045--FMT---42	0095-- F ---16	0145-- 2 ---02	0195--CNT---47
0046-- 2 ---02	0096--FMT---42	0146--FMT---42	0196--CNT---47
0047--FMT---42	0097-- 2 ---02	0147-- A ---62	0197-- a ---13
0048--UP ---27	0098--FMT---42	0148-- B ---66	0198--UP ---27
0049--CNT---47	0099--CLR---20	0149--FMT---42	0199-- 1 ---01

NOTE: * Denotes LABEL addresses of the subroutines

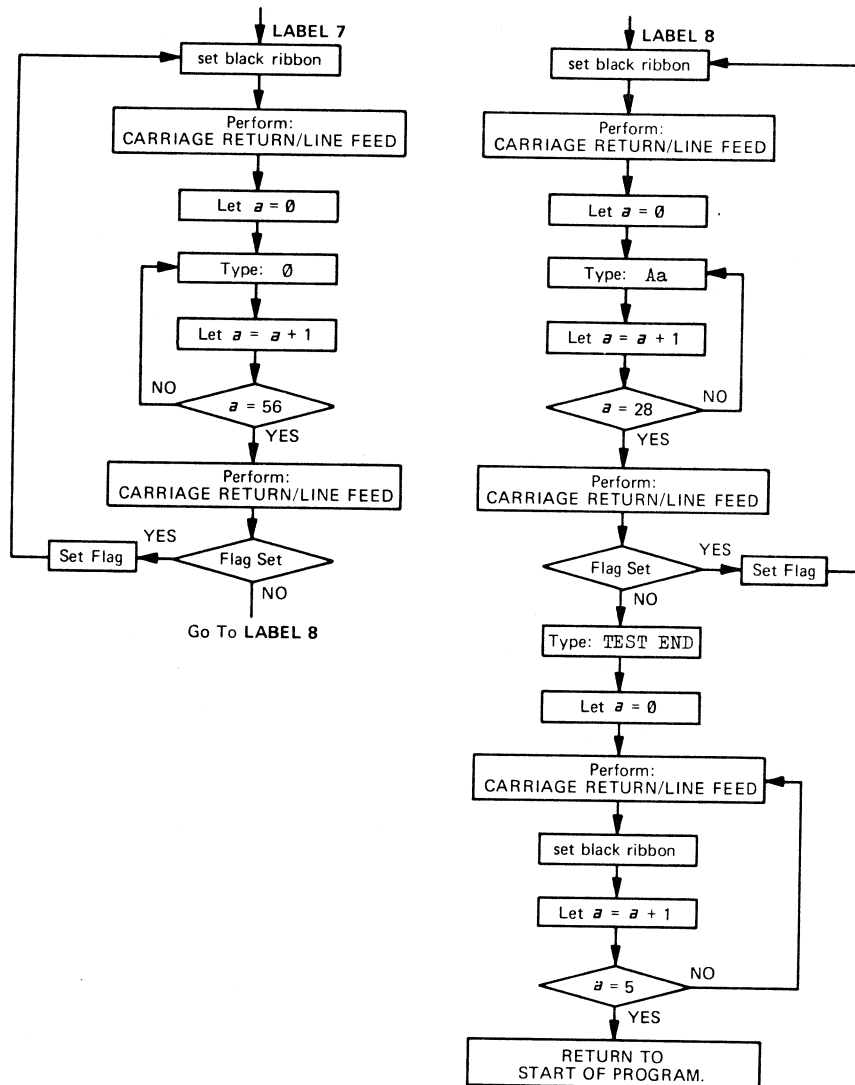
0200-- + ---33	0250--UP ---27	0300--S/R---77	0350--S/R---77
0201--YTO---40	0251--SQT---76	0301-- 0 ---00	0351--UP ---27
0202-- a ---13	0252--CHS---32	0302-- 1 ---01	0352--S/R---77
0203-- 0 ---00	0253--FMT---42	0303-- 7 ---07	0353--FMT---42
0204-- 1 ---01	0254--GTO---44	0304-- 0 ---00	0354--PSE---57
0205-- 0 ---00	0255--S/R---77	0305--GTO---44	0355--PSE---57
0206--X>Y---53	0256-- 0 ---00	0306--LBL---51	0356--GTO---44
0207--CNT---47	0257-- 1 ---01	0307-- C ---61	0357-- 0 ---00
0208--S/R---77	0258-- 7 ---07	0308--LBL---51	0358-- 1 ---01
0209--CNT---47	0259-- 0 ---00	0309-- D ---63	0359-- 0 ---00
0210--CNT---47	0260--GTO---44	0310--FMT---42	0360-- 1 ---01
0211--FMT---42	0261--LBL---51	0311-- 2 ---02	0361--LBL---51
0212-- 2 ---02	0262-- A ---62	0312--FMT---42	0362-- G ---15
0213--FMT---42	0263--LBL---51	0313--CNT---47	0363--FMT---42
0214--CLR---20	0264-- B ---66	0314--DN ---25	0364-- 2 ---02
0215--FMT---42	0265--FMT---42	0315--FMT---42	0365--FMT---42
0216-- 0 ---00	0266-- 2 ---02	0316--PSE---57	0366--S/R---77
0217--XTO---23	0267--FMT---42	0317--PSE---57	0367--FMT---42
0218-- a ---13	0268-- 0 ---00	0318--GTO---44	0368--PSE---57
0219--S/R---77	0269-- 1 ---01	0319--S/R---77	0369--PSE---57
0220--CNT---47	0270-- 2 ---02	0320-- 0 ---00	0370--GTO---44
0221--CNT---47	0271-- 3 ---03	0321-- 1 ---01	0371--LBL---51
0222-- a ---13	0272-- 4 ---04	0322-- 7 ---07	0372-- G ---15
0223--UP ---27	0273-- 5 ---05	0323-- 0 ---00	0373--LBL---51
0224-- 1 ---01	0274-- 6 ---06	0324--GTO---44	0374-- H ---74
0225-- + ---33	0275-- 7 ---07	0325--LBL---51	0375--FMT---42
0226--YTO---40	0276-- 8 ---10	0326-- D ---63	0376-- 2 ---02
0227-- a ---13	0277-- 9 ---11	0327--LBL---51	0377--FMT---42
0228-- 0 ---00	0278--FMT---42	0328-- E ---60	0378--UP ---27
0229-- 2 ---02	0279--GTO---44	0329--FMT---42	0379--GTO---44
0230-- 5 ---05	0280--S/R---77	0330-- 2 ---02	0380--CLR---20
0231--X>Y---53	0281-- 0 ---00	0331--FMT---42	0381--FMT---42
0232--CNT---47	0282-- 1 ---01	0332--XEY---30	0382--PSE---57
0233--S/R---77	0283-- 9 ---11	0333--FMT---42	0383--PSE---57
0234--CNT---47	0284-- 5 ---05	0334--PSE---57	0384--GTO---44
0235--CNT---47	0285--GTO---44	0335--PSE---57	0385--LBL---51
0236--FMT---42	0286--LBL---51	0336--GTO---44	0386-- H ---74
0237-- 2 ---02	0287-- B ---66	0337--LBL---51	0387--LBL---51
0238--FMT---42	0288--LBL---51	0338-- E ---60	0388-- I ---65
0239--CLR---20	0289-- C ---61	0339--LBL---51	0389--FMT---42
0240--FMT---42	0290--FMT---42	0340-- F ---16	0390-- 2 ---02
0241-- 0 ---00	0291-- 2 ---02	0341--FMT---42	0391--FMT---42
0242--XTO---23	0292--FMT---42	0342-- 2 ---02	0392-- A ---62
0243-- a ---13	0293--UP ---27	0343--FMT---42	0393-- A ---62
0244--S/R---77	0294--CNT---47	0344--CLR---20	0394--FMT---42
0245--LBL---51	0295--XEY---30	0345--FMT---42	0395--PSE---57
0246-- A ---62	0296--FMT---42	0346--FMT---42	0396--FMT---42
0247--FMT---42	0297--PSE---57	0347-- 2 ---02	0397-- 2 ---02
0248-- 2 ---02	0298--PSE---57	0348--FMT---42	0398--FMT---42
0249--FMT---42	0299--GTO---44	0349--UP ---27	0399-- A ---62

0400-- A ---62	0450-- 0 ---00
0401--FMT---42	0451--X>Y---53
0402--PSE---57	0452--CNT---47
0403--PSE---57	0453--S/R---77
0404--GTO---44	0454--CNT---47
0405--S/R---77	0455--CNT---47
0406-- 0 ---00	0456--FMT---42
0407-- 2 ---02	0457-- 2 ---02
0408-- 2 ---02	0458--FMT---42
0409-- 0 ---00	0459--CLR---20
0410--GTO---44	0460--FMT---42
0411--LBL---51	0461-- 0 ---00
0412-- I ---65	0462--XTO---23
0413--CNT---47	0463-- a ---13
0414--CNT---47	0464--S/R---77
0415--CNT---47	0465--CNT---47
0416--CNT---47	0466--CNT---47
0417-- a ---13	0467-- a ---13
0418--UP ---27	0468--UP ---27
0419-- 1 ---01	0469-- 1 ---01
0420-- + ---33	0470-- + ---33
0421--YTO---40	0471--YTO---40
0422-- a ---13	0472-- a ---13
0423-- 0 ---00	0473-- 0 ---00
0424-- 5 ---05	0474-- 2 ---02
0425-- 0 ---00	0475-- 5 ---05
0426--X>Y---53	0476--X>Y---53
0427--CNT---47	0477--CNT---47
0428--S/R---77	0478--S/R---77
0429--CNT---47	0479--CNT---47
0430--CNT---47	0480--CNT---47
0431--FMT---42	0481--FMT---42
0432-- 2 ---02	0482-- 2 ---02
0433--FMT---42	0483--FMT---42
0434--CLR---20	0484--CLR---20
0435--FMT---42	0485--FMT---42
0436-- 0 ---00	0486-- 0 ---00
0437--XTO---23	0487--XTO---23
0438-- a ---13	0488-- a ---13
0439--S/R---77	0489--S/R---77
0440--CNT---47	0490--END---46
0441--CNT---47	
0442-- a ---13	
0443--UP ---27	
0444-- 1 ---01	
0445-- + ---33	
0446--YTO---40	
0447-- a ---13	
0448-- 0 ---00	
0449-- 1 ---01	

11212A EXERCISER PROGRAM FLOWCHART



11212A EXERCISER PROGRAM FLOWCHART



11212A EXERCISER PROGRAM

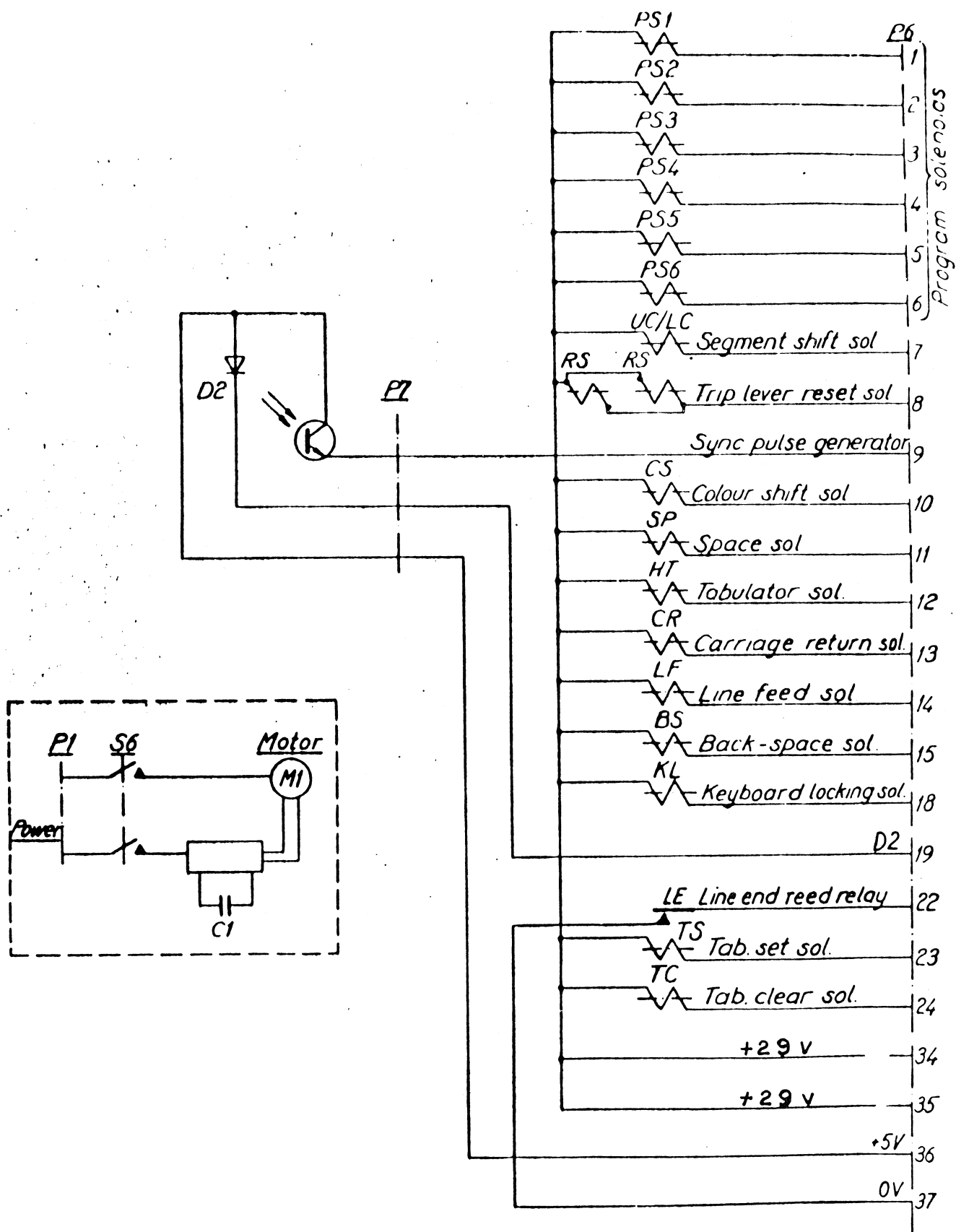
STEP	KEY	CODE	STEP	KEY	CODE	STEP	KEY	CODE	STEP	KEY	CODE
0000	--CLR---	20	0050	-- 3 ---	03	0100	-- B ---	66	0150	--RUP---	22
0001	--FMT---	42	0051	-- 4 ---	04	0101	-- N ---	73	0151	-- UP---	27
0002	-- 2 ---	02	0052	-- 5 ---	05	0102	-- M ---	70	0152	-- r ---	76
0003	--FMT---	42	0053	-- 6 ---	06	0103	-- UP---	27	0153	--CNT---	47
0004	--CLR---	20	0054	-- 7 ---	07	0104	--CLX---	37	0154	--CNT---	47
0005	--S/R---	77	0055	-- 8 ---	10	0105	-- . ---	21	0155	--CNT---	47
0006	--FMT---	42	0056	-- 9 ---	11	0106	--DIV---	35	0156	-- A ---	62
0007	-- 1 ---	01	0057	-- 0 ---	00	0107	--CLR---	20	0157	--YTO---	40
0008	--XTO---	23	0058	-- - ---	34	0108	--FMT---	42	0158	-- D ---	63
0009	-- + ---	33	0059	-- UP---	27	0109	--IFG---	43	0159	-- F ---	16
0010	-- a ---	13	0060	--EEX---	26	0110	--SFL---	54	0160	-- G ---	15
0011	-- a ---	13	0061	--CHS---	32	0111	--GTO---	44	0161	-- H ---	74
0012	-- UP---	27	0062	--CNT---	47	0112	--LBL---	51	0162	-- J ---	75
0013	-- 5 ---	05	0063	--CNT---	47	0113	-- 1 ---	01	0163	-- K ---	55
0014	--X>Y---	53	0064	--CNT---	47	0114	--LBL---	51	0164	-- L ---	72
0015	-- 0 ---	00	0065	-- b ---	14	0115	-- 2 ---	02	0165	-- + ---	33
0016	-- 0 ---	00	0066	--IND---	31	0116	--FMT---	42	0166	-- X ---	36
0017	-- 0 ---	00	0067	-- E ---	60	0117	-- 2 ---	02	0167	--CNT---	47
0018	-- 1 ---	01	0068	-- a ---	13	0118	--FMT---	42	0168	--CNT---	47
0019	--FMT---	42	0069	--XTO---	23	0119	--S/R---	77	0169	--CNT---	47
0020	-- 2 ---	02	0070	--XFR---	67	0120	--CLR---	20	0170	--XSQ---	12
0021	--FMT---	42	0071	--1/X---	17	0121	-- UP---	27	0171	-- YE---	24
0022	-- 1 ---	01	0072	-- I ---	65	0122	-- 1 ---	01	0172	-- C ---	61
0023	-- 1 ---	01	0073	-- 0 ---	71	0123	-- 2 ---	02	0173	--INT---	64
0024	-- 2 ---	02	0074	-- π ---	56	0124	-- 3 ---	03	0174	-- B ---	66
0025	-- 1 ---	01	0075	-- UP---	27	0125	-- 4 ---	04	0175	-- N ---	73
0026	-- 2 ---	02	0076	--RUP---	22	0126	-- 5 ---	05	0176	-- M ---	70
0027	-- A ---	62	0077	-- UP---	27	0127	-- 6 ---	06	0177	-- UP---	27
0028	--CNT---	47	0078	-- r ---	76	0128	-- 7 ---	07	0178	--CLX---	37
0029	--XTO---	23	0079	--CNT---	47	0129	-- 8 ---	10	0179	-- . ---	21
0030	-- E ---	60	0080	--CNT---	47	0130	-- 9 ---	11	0180	--DIV---	35
0031	--YTO---	40	0081	--CNT---	47	0131	-- 0 ---	00	0181	--CLR---	20
0032	--XTO---	23	0082	-- A ---	62	0132	-- - ---	34	0182	--FMT---	42
0033	--CNT---	47	0083	--YTO---	40	0133	-- UP---	27	0183	--IFG---	43
0034	-- π ---	56	0084	-- D ---	63	0134	--EEX---	26	0184	--SFL---	54
0035	-- a ---	13	0085	-- F ---	16	0135	--CHS---	32	0185	--GTO---	44
0036	-- G ---	15	0086	-- G ---	15	0136	--CNT---	47	0186	--LBL---	51
0037	-- M ---	70	0087	-- H ---	74	0137	--CNT---	47	0187	-- 2 ---	02
0038	-- . ---	21	0088	-- J ---	75	0138	--CNT---	47	0188	--LBL---	51
0039	--CLR---	20	0089	-- K ---	55	0139	-- b ---	14	0189	-- 3 ---	03
0040	--FMT---	42	0090	-- L ---	72	0140	--IND---	31	0190	--FMT---	42
0041	--LBL---	51	0091	-- + ---	33	0141	-- E ---	60	0191	-- 2 ---	02
0042	-- 1 ---	01	0092	-- X ---	36	0142	-- a ---	13	0192	--FMT---	42
0043	--FMT---	42	0093	--CNT---	47	0143	--XTO---	23	0193	-- UP---	27
0044	-- 2 ---	02	0094	--CNT---	47	0144	--XFR---	67	0194	-- DN---	25
0045	--FMT---	42	0095	--CNT---	47	0145	--1/X---	17	0195	--FMT---	42
0046	--S/R---	77	0096	--XSQ---	12	0146	-- I ---	65	0196	--IFG---	43
0047	--CLR---	20	0097	-- YE---	24	0147	-- 0 ---	71	0197	--SFL---	54
0048	-- 1 ---	01	0098	-- C ---	61	0148	-- π ---	56	0198	--GTO---	44
0049	-- 2 ---	02	0099	--INT---	64	0149	-- UP---	27	0199	--LBL---	51

11212A EXERCISER PROGRAM

STEP	KEY	CODE	STEP	KEY	CODE	STEP	KEY	CODE	STEP	KEY	CODE
0200--	3	---03	0250--	a	---13	0300--	2	---02	0350--	GTO	---44
0201--	LBL	---51	0251--	1	---01	0301--	FMT	---42	0351--	3	---03
0202--	4	---04	0252--	XTO	---23	0302--	XEY	---30	0352--	2	---02
0203--	FMT	---42	0253--	+	---33	0303--	FMT	---42	0353--	8	---10
0204--	2	---02	0254--	b	---14	0304--	GTO	---44	0354--	FMT	---42
0205--	FMT	---42	0255--	GTO	---44	0305--	2	---02	0355--	2	---02
0206--	S/R	---77	0256--	2	---02	0306--	8	---10	0356--	FMT	---42
0207--	CLR	---20	0257--	1	---01	0307--	0	---00	0357--	S/R	---77
0208--	FMT	---42	0258--	4	---04	0308--	FMT	---42	0358--	CLR	---20
0209--	CLX	---37	0259--	FMT	---42	0309--	2	---02	0359--	FMT	---42
0210--	XTO	---23	0260--	2	---02	0310--	FMT	---42	0360--	IFG	---43
0211--	a	---13	0261--	FMT	---42	0311--	CLR	---20	0361--	SFL	---54
0212--	XTO	---23	0262--	CLR	---20	0312--	FMT	---42	0362--	GTO	---44
0213--	b	---14	0263--	FMT	---42	0313--	IFG	---43	0363--	LBL	---51
0214--	FMT	---42	0264--	IFG	---43	0314--	SFL	---54	0364--	6	---06
0215--	2	---02	0265--	SFL	---54	0315--	GTO	---44	0365--	LBL	---51
0216--	FMT	---42	0266--	GTO	---44	0316--	LBL	---51	0366--	7	---07
0217--	CNT	---47	0267--	LBL	---51	0317--	5	---05	0367--	FMT	---42
0218--	FMT	---42	0268--	4	---04	0318--	LBL	---51	0368--	2	---02
0219--	1	---01	0269--	LBL	---51	0319--	6	---06	0369--	FMT	---42
0220--	XTO	---23	0270--	5	---05	0320--	FMT	---42	0370--	S/R	---77
0221--	+	---33	0271--	FMT	---42	0321--	2	---02	0371--	CLR	---20
0222--	a	---13	0272--	2	---02	0322--	FMT	---42	0372--	FMT	---42
0223--	a	---13	0273--	FMT	---42	0323--	CLR	---20	0373--	CLX	---37
0224--	UP	---27	0274--	S/R	---77	0324--	FMT	---42	0374--	XTO	---23
0225--	1	---01	0275--	CLR	---20	0325--	CLX	---37	0375--	a	---13
0226--	0	---00	0276--	FMT	---42	0326--	XTO	---23	0376--	FMT	---42
0227--	X>Y	---53	0277--	CLX	---37	0327--	a	---13	0377--	2	---02
0228--	0	---00	0278--	XTO	---23	0328--	FMT	---42	0378--	FMT	---42
0229--	2	---02	0279--	a	---13	0329--	2	---02	0379--	0	---00
0230--	1	---01	0280--	n	---56	0330--	FMT	---42	0380--	FMT	---42
0231--	4	---04	0281--	FMT	---42	0331--	S/R	---77	0381--	1	---01
0232--	FMT	---42	0282--	2	---02	0332--	UP	---27	0382--	XTO	---23
0233--	2	---02	0283--	7	---07	0333--	r	---76	0383--	+	---33
0234--	FMT	---42	0284--	.	---21	0334--	S/R	---77	0384--	a	---13
0235--	1	---01	0285--	5	---05	0335--	CHS	---32	0385--	a	---13
0236--	UP	---27	0286--	PNT	---45	0336--	FMT	---42	0386--	UP	---27
0237--	GTO	---44	0287--	1	---01	0337--	1	---01	0387--	5	---05
0238--	XEY	---30	0288--	XTO	---23	0338--	XTO	---23	0388--	6	---06
0239--	FMT	---42	0289--	+	---33	0339--	+	---33	0389--	X=Y	---50
0240--	b	---14	0290--	a	---13	0340--	a	---13	0390--	0	---00
0241--	UP	---27	0291--	a	---13	0341--	a	---13	0391--	3	---03
0242--	4	---04	0292--	UP	---27	0342--	UP	---27	0392--	9	---11
0243--	X=Y	---50	0293--	5	---05	0343--	2	---02	0393--	8	---10
0244--	0	---00	0294--	X<Y	---52	0344--	8	---10	0394--	GTO	---44
0245--	2	---02	0295--	0	---00	0345--	X=Y	---50	0395--	3	---03
0246--	5	---05	0296--	3	---03	0346--	0	---00	0396--	7	---07
0247--	9	---11	0297--	0	---00	0347--	3	---03	0397--	6	---06
0248--	CLX	---37	0298--	8	---10	0348--	5	---05	0398--	FMT	---42
0249--	XTO	---23	0299--	FMT	---42	0349--	1	---01	0399--	3	---03

11212A EXERCISER PROGRAM

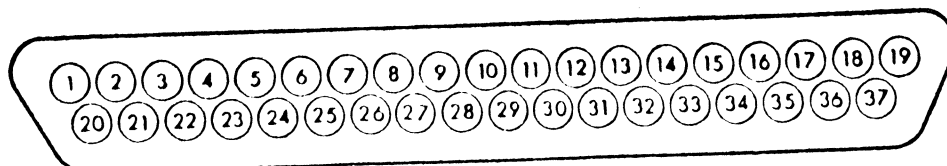
STEP	KEY	CODE	STEP	KEY	CODE
0400	--FMT---	42	0450	--GTO---	44
0401	--CLR---	20	0451	--LBL---	51
0402	--FMT---	42	0452	-- 8 ---	10
0403	--IFG---	43	0453	--FMT---	42
0404	--SFL---	54	0454	-- 2 ---	02
0405	--GTO---	44	0455	--FMT---	42
0406	--LBL---	51	0456	--XTO---	23
0407	-- 7 ---	07	0457	-- E ---	60
0408	--LBL---	51	0458	--YTO---	40
0409	-- 8 ---	10	0459	--XTO---	23
0410	--FMT---	42	0460	--CNT---	47
0411	-- 2 ---	02	0461	-- E ---	60
0412	--FMT---	42	0462	-- N ---	73
0413	--S/R---	77	0463	-- D ---	63
0414	--CLR---	20	0464	--FMT---	42
0415	--FMT---	42	0465	--CLR---	20
0416	--CLX---	37	0466	--FMT---	42
0417	--XTO---	23	0467	-- 2 ---	02
0418	-- a ---	13	0468	--FMT---	42
0419	--FMT---	42	0469	--CLR---	20
0420	-- 2 ---	02	0470	--S/R---	77
0421	--FMT---	42	0471	--FMT---	42
0422	-- A ---	62	0472	-- 1 ---	01
0423	-- UP---	27	0473	--XTO---	23
0424	-- A ---	62	0474	-- + ---	33
0425	--FMT---	42	0475	-- a ---	13
0426	-- 1 ---	01	0476	-- a ---	13
0427	--XTO---	23	0477	-- UP---	27
0428	-- + ---	33	0478	-- 5 ---	05
0429	-- a ---	13	0479	--X>Y---	53
0430	-- a ---	13	0480	-- 0 ---	00
0431	-- UP---	27	0481	-- 4 ---	04
0432	-- 2 ---	02	0482	-- 6 ---	06
0433	-- 8 ---	10	0483	-- 6 ---	06
0434	--X=Y---	50	0484	--GTO---	44
0435	-- 0 ---	00	0485	-- 0 ---	00
0436	-- 4 ---	04	0486	--END---	46
0437	-- 4 ---	04			
0438	-- 3 ---	03			
0439	--GTO---	44			
0440	-- 4 ---	04			
0441	-- 1 ---	01			
0442	-- 9 ---	11			
0443	--FMT---	42			
0444	-- 2 ---	02			
0445	--FMT---	42			
0446	--CLR---	20			
0447	--FMT---	42			
0448	--IFG---	43			
0449	--SFL---	54			



Cannon connector P6

1. Program solenoid 1
2. Program solenoid 2
3. Program solenoid 3
4. Program solenoid 4
5. Program solenoid 5
6. Program solenoid 6
7. Segment shift solenoid (UC/LC)
8. Trip lever reset solenoids (RS)
9. Sync pulse generator
10. Colour shift solenoid (CS)
11. Space solenoid (SP)
12. Tabulator solenoid (HT)
13. Carriage return solenoid (CR)
14. Line feed solenoid (LF)
15. Back-space solenoid (BS)
16. -
17. -
18. Keyboard locking solenoid (KL)
19. D2
20. -
21. -
22. Line end reed relay (LE)
23. Tab.set solenoid (TS)
24. Tab.clear solenoid (TC)
25. -
26. -
27. -
28. -
29. -
30. -
31. -
32. -
33. -
34. +29 V
35. +29 V
36. +5 V to sync pulse generator
37. 0 V

CANNON CONNECTOR P6



The circled numbers are pin connections as seen from outside of connector.

REFERENCE DESIGNATOR	PART NO.	TQ	DESCRIPTION	MFR.	MFR. PART NO.
	0950-1360	1	Out - Typewriter		
	11201-61602	1	Cbl Assy - Output		
	T-97667	1	Hood - Conn		
	T-97668	2	Latch - Conn		
	1251-0159	1	Conn - P.C. 30(2 x 15)		
	1251-1029	1	Lock Assy - Slide		
	1251-3089	1	Conn - Female 37		
	5040-5949	1	Cbl - TM		
	11201-61603	1	Cbl Assy - Int		
	09860-27121	1	Collet		
A1	11201-66501 ✓	1	P.C. Assembly - Mother		
	11201-26501 ✓	1	P.C. Board - Mother		
	1251-1887 ✓	2	Conn - P.C. 44(2 x 22)		
	1251-2917 ✓	1	Conn - P.C. 24(2 x 12)		
A2	11201-66502	1	P.C. Assembly - Logic		
C1	0160-3847 ✓	15	C - Fixed .01uf 25V		
C2	0180-0373 ✓	1	C - Fixed .68uf 35V		
C3	0160-0153 ✓	1	C - Fixed .001uf 200V		
C4	0180-0210 ✓	1	C - Fixed 3.3uf 15V		
C5	0160-0161 ✓	1	C - Fixed .01uf 200V		
C6	0180-1701 ✓	1	C - Fixed 6.8uf 6V		
C7	0180-1954 ✓	1	C - Fixed 4.7uf .05V		
C8	0180-0100 ✓	1	C - Fixed 4.7uf 35V		
C9	0160-3847 ✓	1	C - Fixed .01uf 25V		
C10	0180-0228 ✓	2	C - Fixed 22uf 15V		
C11	0160-3847 ✓		C - Fixed .01uf 25V		
C12	0180-0228 ✓		C - Fixed 22uf 15V		
C13-24	0160-3847 ✓		C - Fixed .01uf 25V		
Q1, 2	1854-0023	2	TSTR - Si NPN		
R1	0684-4701 ✓	2	R - Fixed 47ohm .1		
R2-9	0684-2221 ✓	9	R - Fixed 2200ohm .1		
R10	0698-4487	1	R - Fixed 25.5K .01		
R11	0698-3264	1	R - Fixed 11.8K .01		
R12	0684-3931 ✓	1	R - Fixed 39K .1 1/4W		
R13	0684-1021 ✓	4	R - Fixed 1000ohm .1		
R14	0684-4731 ✓	1	R - Fixed 47K .1 1/4W		
R15	0684-1031 ✓	2	R - Fixed 10K .1 1/4W		
R16	0684-1011 ✓	2	R - Fixed 100ohm .1		
R17	0684-1021 ✓		R - Fixed 1000ohm .1		
R18	0684-2731 ✓	1	R - Fixed 27K .1 1/4W		
R19	0684-2221 ✓		R - Fixed 2200ohm .1		
R20, 21	0684-4721 ✓	4	R - Fixed 4700ohm .10		
R22, 23	0684-3911 ✓	2	R - Fixed 390ohm .1		
R24	0684-5611	12	R - Fixed 560ohm .1		
R25-28	0684-5611		R - Fixed 560ohm .1		
R29, 30	0684-1021 ✓		R - Fixed 1000ohm .1		
R31-36	0684-5611		R - Fixed 560ohm .1		
R37	0757-0455	1	R - Fixed 36.5K .01		
R38	0684-5611		R - Fixed 560ohm .1		
R39	0684-4701 ✓		R - Fixed 47ohm .1		
R40	0684-1031 ✓		R - Fixed 10K .1 1/4W		
R41	0684-1521 ✓	1	R - Fixed 1500ohm .1		
R42, 43	0684-4721 ✓		R - Fixed 4700ohm .10		
R44	0684-1011 ✓		R - Fixed 100ohm .1		
R45	0684-1811 ✓	1	R - Fixed 180ohm .1		

REFERENCE DESIGNATOR	-hp- PART NO.		TQ	DESCRIPTION	MFR.	MFR. PART NO.
A2	11201-66502		1	P. C. Assembly - Logic (continued)		
U1	1820-0400		1	IC - MC8281 (SIGNETICS)		
U2	1820-0584		4	IC - DM74L02N		
U3,4	1820-0583		7	IC - DM74L00		
U5	1820-0511		2	IC - SN7408N		
U6	1820-0584			IC - DM74L02N		
U7	1820-0328		2	IC - SN7402N		
U8	1820-0583			IC - DM74L00		
U9	1820-0786		1	IC - DGTL N8250A		
U10	1820-0586		3	IC - DGTL DM74L04N		
U11	1820-0596		1	IC - DGTL DM74L74N		
U12	1820-0584			IC - DM74L02N		
U13	1820-0583			IC - DM74L00		
U14	1820-0579		1	IC - DGTL SN74123N		
U15	1820-0787		2	IC - DGTL N8242A		
U16,17	1820-0586			IC - DGTL DM 74L04N		
U18	1820-0588		1	IC - DGTL DM74L20N		
U19	1820-0584			IC - DM74L02N		
U20,21	1820-0583			IC - DM74L00		
U22	1820-0787			IC - DGTL N8242A		
U23,24	1820-0513		3	IC - DGTL SN7409N		
U25	1820-0583			IC - DM74L00		
U26	1820-0175		1	IC - SN7405N		
U27	1820-0513			IC - DGTL SN7409N		
U28	1820-0511			IC - SN7408N		
U29	1820-0742		1	IC - DGTL SL17869		
U30	1820-0261		2	IC - 74121N		
U31	1820-0328		2	IC - SN7402N		
U32	1820-0587		1	IC - DGTL DM74L10N		
U33	1820-0261			IC - 74121N		
CR1-3	1901-0040		3	Diode - Si .05A 30V		
	4040-0710		1	Extr - P. C. black		
A3	11201-66503		1	P. C. Assembly - Driver		
C1	0180-0100		1	C - Fixed 4.7uf 35V		
C2,3	0180-0197		2	C - Fixed 2.2uf 20V		
C4-6	0160-3847		3	C - Fixed .01uf 25V		
C7	0180-0309		1	C - Fixed 4.7uf 10V		
R1	0684-5611		22	R - Fixed 560ohm .1		
R2	0811-3115		1	R - Fixed 35ohm .0		
R3	0684-5611			R - Fixed 560ohm .1		
R4	0698-3159		1	R - Fixed 26.1K .01		
R5	0684-1021		3	R - Fixed 1000ohm .1		
R6	0684-3911		1	R - Fixed 390ohm .1		
R7	0684-1011		4	R - Fixed 100ohm .1		
R8,9	0684-5611			R - Fixed 560ohm .1		
R10	0811-3116		1	R - Fixed 35ohm .03 5W		
R11	0757-0452		1	R - Fixed 27.4K .01		
R12	0684-5611			R - Fixed 560ohm .1		
R13	0684-1021			R - Fixed 1000ohm .1		
R14,15	0684-5611			R - Fixed 560ohm .1		
R16	0811-3114		1	R - Fixed 75ohm .03 5W		
R17	0698-4483		1	R - Fixed 18.7K .01		
R18	0684-1021			R - Fixed 1000ohm .1		
R19,20	0684-5611			R - Fixed 560ohm .1		
R21	0684-2721		2	R - Fixed 2700ohm .10		
R22	0684-1511		1	R - Fixed 150ohm .1		
R23	0684-2721			R - Fixed 2700ohm .10		
R24	0684-1011			R - Fixed 100ohm .1		
R25	0684-1031		13	R - Fixed 10K .1 1/4W		
R26	0684-1011			R - Fixed 100ohm .1		
R27	0684-1031			R - Fixed 10K .1 1/4W		
R28	0684-1011			R - Fixed 100ohm .1		

REFERENCE DESIGNATOR	-mp- PART NO.	TQ	DESCRIPTION	MFR.	MFR. PART NO.
A3	11201-66503		P. C. Assembly - Driver (continued)		
R29	0684-1031		R - Fixed 10K .1 1/4W		
R30	0684-5611		R - Fixed 560ohm .1		
R31	0684-1031		R - Fixed 10K .1 1/4W		
R32	0684-5611		R - Fixed 560ohm .1		
R33	0684-1031		R - Fixed 10K .1 1/4W		
R34	0684-5611		R - Fixed 560ohm .1		
R35	0684-1031		R - Fixed 10K .1 1/4W		
R36	0684-5611		R - Fixed 560ohm .1		
R37	0684-1031		R - Fixed 10K .1 1/4W		
R38	0684-5611		R - Fixed 560ohm .1		
R39	0684-1031		R - Fixed 10K .1 1/4W		
R40	0684-5611		R - Fixed 560ohm .1		
R41	0684-1031		R - Fixed 10K .1 1/4W		
R42	0684-5611		R - Fixed 560ohm .1		
R43	0684-1031		R - Fixed 10K .1 1/4W		
R44	0684-5611		R - Fixed 560ohm .1		
R45	0684-1031		R - Fixed 10K .1 1/4W		
R46	0684-5611		R - Fixed 560ohm .1		
R47	0684-1031		R - Fixed 10K .1 1/4W		
R48	0684-5611		R - Fixed 560ohm .1		
R49	0684-1031		R - Fixed 10K .1 1/4W		
R50, 51, 52	0684-5611		R - Fixed 560ohm .1		
Q1-3	1854-0547	36	TSTR - 2N3725		
Q4	1854-0063	4	TSTR - 2N3055		
Q5-12	1854-0547		TSTR - 2N3725		
Q13	1853-0010	1	TSTR - Si PNP		
Q14	1854-0547		TSTR - 2N3725		
Q15	1854-0063		TSTR - 2N3055		
Q16	1854-0547		TSTR - 2N3725		
Q17	1854-0063		TSTR - 2N3055		
Q18	1854-0547		TSTR - 2N3725		
Q19	1854-0063		TSTR - 2N3055		
Q20-24	1854-0547		TSTR - 2N3725		
U1-3	1820-0261	3	IC - 74121N		
U4	1820-0175	1	IC - SN7405N		
CR1	1901-0158	4	Diode - Si .75A 200V		
CR2,3	1901-0050	13	Diode - Si		
CR4	1902-1285	1	Diode - Zener		
CR5,6, 7	1901-0158	4	Diode - Si .75A 200V		
CR8-18	1901-0050		Diode - Si		
	1205-0011	16	Heat Sink - TSTR		
	1205-0208	4	Heat Sink - Semicon		
	1205-0210	4	Heat Sink - Semicon		
	4040-0710	1	Extr - P. C. Black		
A4	11201-66504		P. C. Assembly - Power Supply		
C1	0180-1731	1	C - Fixed 4.7uf .001		
C2,3	0180-2406	2	C - Fixed 5000uf 40V		
C4	0180-0197	1	C - Fixed 2.2uf 20V		
C5	0150-0093	1	C - Fixed .01uf 100V		
C6	0180-0229	3	C - Fixed 33uf 10V		
C7	0180-2093	1	C - Fixed 8000uf 15V		
C8,9	0180-0229		C - Fixed 33uf 10V		
R1	0698-3640	1	R - Fixed 1.8K .05		
R2	0684-1821	1	R - Fixed 1800ohm .1		
R3	0684-2221	1	R - Fixed 2200ohm .1		
R4	0684-1021	1	R - Fixed 1000ohm .1		
R5	0684-1011	4	R - Fixed 100ohm .1		
R6	0687-5621	1	R - Fixed 5600ohm .1		
R7	0698-3637	1	R - Fixed 820ohm		

REFERENCE DESIGNATOR	-hp- PART NO.		TQ	DESCRIPTION	MFR.	MFR. PART NO.
A4	11201-66504		4	P. C. Assembly - Power Supply (continued)		
R8-10	0684-1011			R - Fixed 100ohm .1		
R11	0811-2490		1	R - Fixed .1ohm 5W		
R12	0816-0001		1	R - Fixed 250ohm .05		
R13	0698-4517-3582		1	R - Fixed 127K-01 41.2K 1%		
R14	0757-0454-1124		1	R - Fixed 33-2K-01 39.2K 1%		
R15	0684-0271		1	R - Fixed 2.7ohm .1		
Q1	1854-0458		1	TSTR		
Q2	1853-0052		1	TSTR - 2N3740		
Q3	1854-0547		3	TSTR - 2N3725		
Q4	1853-0010		2	TSTR - Si PNP		
Q5	1884-0052		1	Thyristor - Scr		
Q6,7	1854-0547			TSTR - 2N3725		
Q8	1853-0010			TSTR - Si PNP		
U1,2	1820-0430		2	IC - Linear		
CR1-4	1901-0496		4	Diode - Rect Si		
CR5,6	1901-0045		3	Diode - Si .75A 100V		
CR7	1901-0050		2	Diode - Si		
CR8	1902-0041		1	Diode - Bkdn 5.11V		
CR9	1902-0078		2	Diode - Bkdn 14.7V		
CR10	1901-0050			Diode - Si		
CR11	1901-0045			Diode - Si .75A 100V		
CR12	1902-0078			Diode - Bkdn 14.7V		
CR13	1901-0044		1	Diode - Si		
CR14-17	1901-0200		4	Diode - Si 3A 100V		
	11201-01244		1	Plate - Heat Sink		
	11201-26504		1	P. C. Bd - Power Supply		
	1200-0043		3	Insul - TSTR Mtg		
	1200-0080		4	Insulator - Diode		
	1205-0033		4	Heat Sink - Semicon		
	4040-0710		1	Extractor - P. C. Black		
A5	11201-66591		1	P. C. Assembly - I/O Int		
C1	0180-0228		1	C - Fixed 22uf 15V		
C2-5	0160-3847		4	C - Fixed .01uf 25V		
R1	0684-2221		1	R - Fixed 2200ohm .1		
R2-4	0684-1021		3	R - Fixed 1000ohm .1		
U1	1820-0588		1	IC - DGTL DM74L20N		
U2	1820-0269		1	IC - SN7403N		
U3	1816-0001		1	ROM - Bipolar IO		
U4	1820-0614		1	IC - Digital		
U5	1820-0174		3	IC - SN7404N		
U6	1820-0511		1	IC - SN7408N		
U7	1820-0596		1	IC - DGTL DM74L74N		
U8	1820-0537		1	IC - SN7413N		
U9,10	1820-0174			IC - SN7404N		
U11	1816-0002		1	ROM - Bipolar 11		
CR1	1901-0040		1	Diode - Si .05A 30V		
	11200-04101		1	Cover - I/O		
	0590-0993		4	Standoff - Press		
	11201-26591		1	P. C. Bd - I/O Int		
	1251-2138		1	Conn - P. C. 36(2 x 18)		
	1251-3048		1	Conn - Circular		
	1530-1695		1	Strain - Relief		
	5040-5911		1	Boot - Btn		
	5040-5950		1	Cbl - Interface		
	7120-2831		1	Label - I/O Cbl		
PEC1	1810-0041		1	Ntwk - Encap Res		

REFERENCE DESIGNATOR	-hp- PART NO.		TQ	DESCRIPTION	MFR.	MFR. PART NO.
	11201A		1	Typewriter - Interface		
	0684-2731		1	R - Fixed 27K .1 1/4W		
	09101-01208		1	Clamp - Cbl		
	11201-01101		1	Plate - Heat Sink		
	11201-01201		1	Brkt - Xfmr L		
	11201-01202		1	Brkt - Xfmr R		
	11201-01246		1	Brkt - Support		
	11201-04102		1	Cover - Top		
	11201-04103		1	Cover - Btm		
	11201-04104		2	Cover - Side		
	11201-06601		1	Guide - Fr Bd		
	11201-06602		1	Guide - R Bd		
	11201-21201		1	Bar - Heat Sink		
	11201-21202		1	Bar - Brkt Support		
	11201-24702		1	Spacer - Btm Sprt		
	7208-0108	.420'	1	Al - Rect Bar		
	11201-60101		1	Deck Assembly		
	11201-01210		4	Brkt - Deck		
	11201-61601		1	Cbl - Assembly - Input		
	1251-0159		1	Conn - P. C. 30(2 x 15)		
	1251-3047		1	Conn - Circular		
	11201-61604		1	Cbl Assembly - Power		
	1251-2987		1	Conn		
	11201-64101		1	Panel Assembly - Fr		
	11201-24701		4	Support - Fan		
	7186-0001	.080'	1	Brs Hex .312 AF		
	3101-1609		1	Sw - Slide		
	9100-3121		1	Xfmr - Filter Line		
	11201-67901		1	Xfmr Assembly		
	1251-0198		1	Conn - P. C. 12(2 x 6)		
	1251-2988		1	Body R & P 5 Conn		
	9100-3254		1	Xfmr - Power		
	11201-87901		1	Kit - Misc Mtl		
	09861-90000		2	Manual		
	2110-0002		1	Fuse - 2Amps NB		
	2110-0055		1	Fuse - 4Amps NB		
	8120-1378		1	Cbl - AC Power		
	8120-1766		1	Cbl - AC Power		
	1400-0084		1	Holder Fuse		
	1400-0847		4	Clip - Cable		
	2110-0002		1	Fuse - 2Amps NB		
	2110-0055		1	Fuse - 4Amps NB		
	3101-1394		1	Sw - Pushbutton		
	2140-0244		1	Lamp, Neon AIH		
	3150-0232		1	Filter - Screen		
	3150-0233		1	Filter - Foam		
	3160-0209		1	Fan		
	5020-0700		6	Spacer - Mod Cab		
	5040-5951		1	Fan Filter		
	5060-0704		2	Frame Assembly (P)		
	7120-1254		1	Plate Ident		
	7122-0058		1	Plate - Serial		
	8120-1764		1	Cbl - TW Power		
	09810-90028		1	Prerecorded Card		

TYPEWRITER INTERFACE MOTHER
BOARD PIN CONNECTIONS
11201-66501 (A1)

P1 from the I/O			
1	GND	A	GND
2	+5V (BUSS 2)	B	+5V
3	GND	C	GND
4	GND	D	
5	EOL	E	
6	CONTROL	F	
7	FLAG	H	
8	DF-0	J	
9	DF-1	K	
10	DF-2	L	
11	DF-3	M	
12	DF-4	N	
13	DF-5	P	
14	DF-6	R	
15	DF-7	S	GND

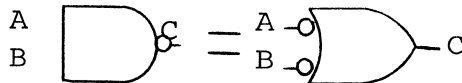
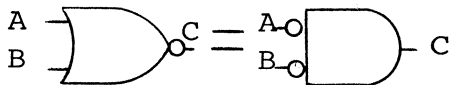
P2 to the typewriter			
1	GND	A	GND
2	CR & TAB REED	B	SYNC PULSES
3	D2	C	LINE END
4	+5V (BUSS 1)	D	+ 5V (BUSS 2)
5	PS-2	E	PS-1
6	PS-4	F	PS-3
7	PS-6	H	PS-5
8	KL	J	RS
9	UC/LC	K	SP
10	CR	L	LF
11	BS	M	TS
12	HT	N	TC
13	CS	P	CS
14	GND	R	+29V GND
15	+29V	S	+29V

XA2 LOGIC ASSEMBLY			
1	GND	A	GND
2	+5V BUSS 1	B	+5V
3	NC	C	PS-1
4	D2	D	PS-2
5	LINE END	E	PS-3
6	CR REED	F	PS-4
7	TAB REED	H	PS-5
8	SYNC	J	PS-6
9	EOL	K	CS
10	CONTROL	L	TC
11	FLAG	M	TS
12	DF-0	N	HT
13	DF-1	P	BS
14	DF-2	R	LF
15	DF-3	S	CR
16	DF-4	T	SP
17	DF-5	U	UC/LC
18	DF-6	V	RS
19	DF-7	W	KL
20	NC	X	NC
21	GND	Y	GND
22	GND	Z	GND

XA3 DRIVER ASSEMBLY	
1	GND
2	+5V BUSS 1
3	PS-1
4	PS-2
5	PS-3
6	PS-4
7	PS-5
8	PS-6
9	CS
10	TC
11	TS
12	HT
13	BS
14	LF
15	CR
16	SP
17	UC/LC
18	RS
19	KL
20	+29V
21	GND
22	GND

XA4 POWER SUPPLY	
1	NC
2	NC
3	+29V
4	+29V
5	+29V
6	+29V
7	+5V BUSS 2
8	+5V BUSS 2
9	+5V BUSS 1
10	+5V BUSS 1
11	GND
12	GND
NOTE	
XA4 CONNECTIONS	
A THROUGH N ARE	
GROUND.	

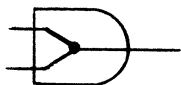
11201A CONTROL LOGIC
DRAWING EXPLANATIONS AND TRUTH TABLES



A	B	C
0	0	1
0	1	0
1	0	0
1	1	0

TRUTH TABLES
HIGH = 1
LOW = 0

A	B	C
0	0	1
0	1	1
1	0	1
1	1	0

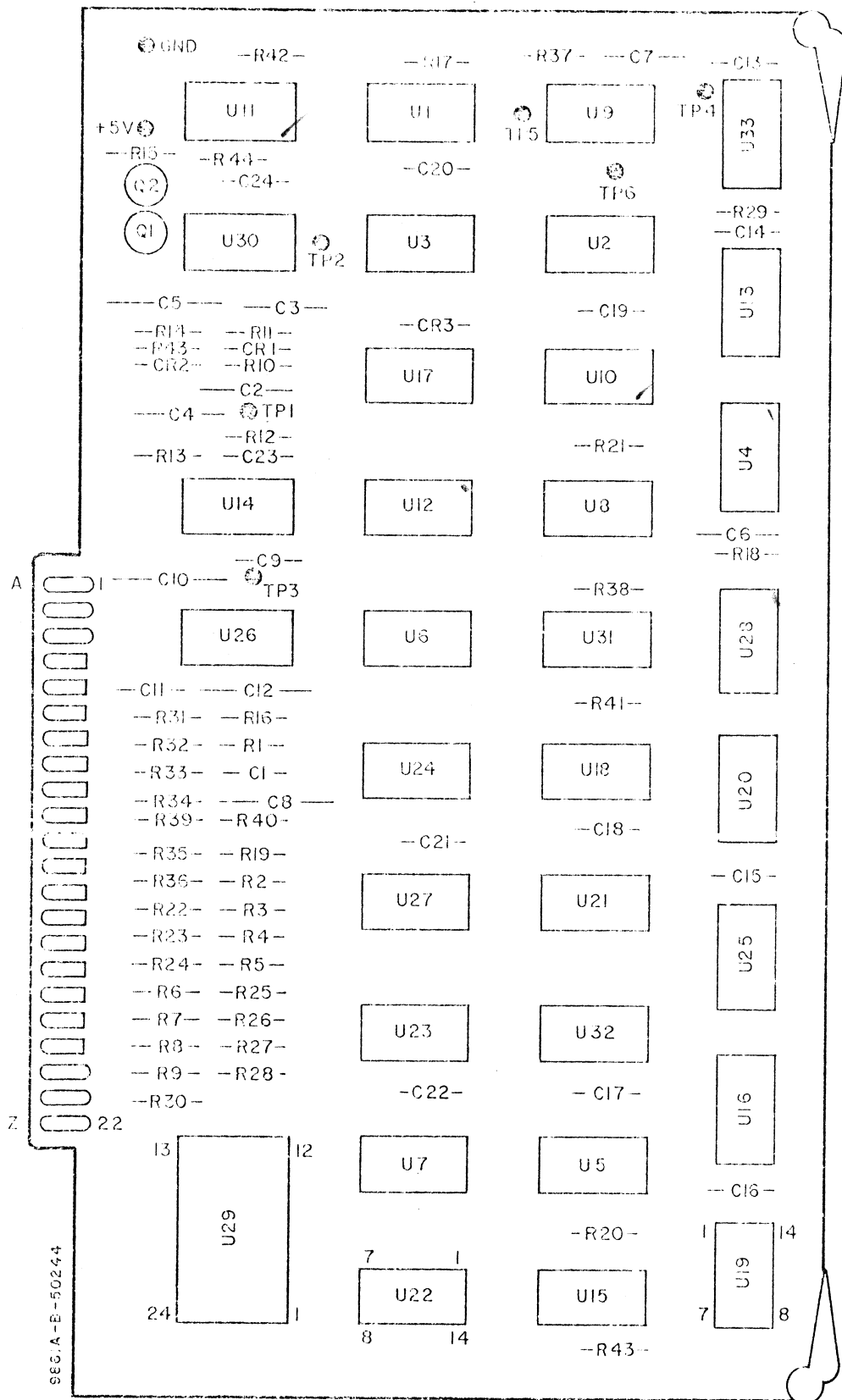


DRAWING OF
DOT 'AND'

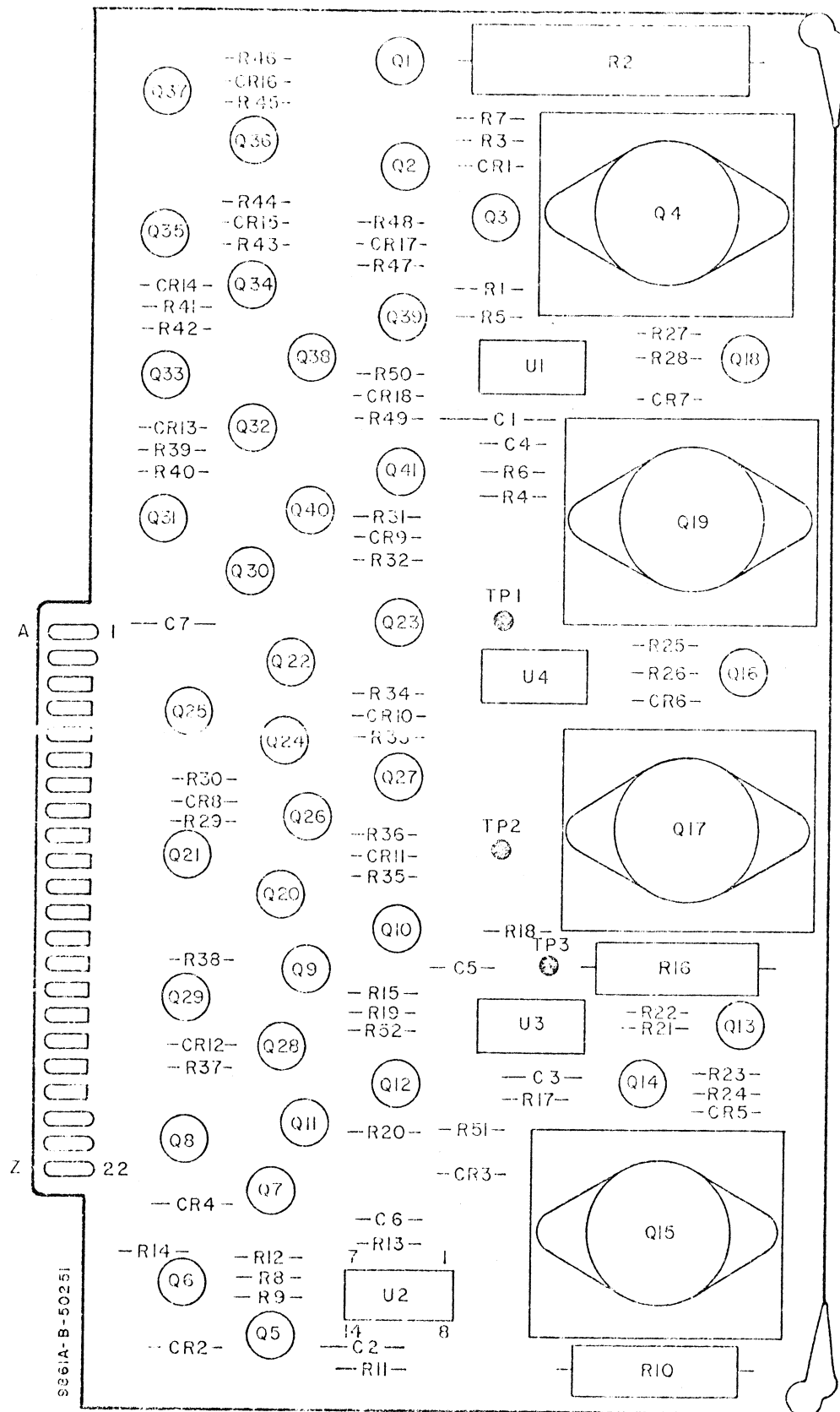
DOT 'AND' - The dot 'and' gate shown at the right is a wire junction which performs the same function as a 'AND' gate. (Refer to MIL-STD 806B) If either input A or B is 0 (low), the output will be 0.

COMPONENT LOCATOR
CONTROL LOGIC ASS. 11201-66502 (A2)

COMP	LOC.	COMP	LOC.	COMP	LOC.	COMP	LOC.
C1	L3	R25	E21	U8a	F10	U21c	J17
C2	H4	R26	E21	U8b	F13	U21d	B14
C3	H4	R27	D21	U8c	J12	U22	C6
C4	J4	R28	D21	U8d	J14	U23a	D20
C5	H2	R29	J16	U9	H7	U23b	D20
C6	K5	R30	J20	U10a	F5	U23c	B20
C7	J16	R31	A21	U10b	K12	U23d	B20
C8	L3	R32	B21	U10c	F10	U24a	B20
C9	B3	R33	B21	U10d	E9	U24b	C20
C10	B3	R34	C21	U10e	L3	U24c	C20
C11	C3	R35	C21	U10f	K9	U24d	C20
C12	C3	R36	C21	U11a	K7	U25a	E17
C13		R37	J16	U11b	K7	U25b	B16
through		R38	H20	U12a	F12	U25c	B10
C27	B3	R39	L2	U12b	J10	U25d	F7
		R40	L3	U12c	K15	U26a	J20
CR1	H3	R41	L3	U12d	K9	U26b	J6
CR2	J4	R42	J6	U13a	F17	U26c	L19
CR3	K3	R43	B8	U13b	K13	U26d	H20
		R44	H3	U13c	K13	U26e	C7
Q1	H3	R45	H3	U13d	K12	U26f	F20
Q2	H3			U14a	H4	U27a	F20
		U1	H6	U14b	J4	U27b	E20
R1	L2	U2a	H16	U15	A6	U27c	E20
R2	D2	U2b	J9	U16a	B11	U27d	E20
R3	D2	U2c	K9	U16b	J9	U28a	K18
R4	D2	U2d	J10	U16c	C13	U28b	H19
R5	D2	U3a	J12	U16d	B14	U28c	K6
R6	E2	U3b	J9	U16e	F4	U28d	H6
R7	E2	U3c	F16	U16f	A15	U29	D6
R8	E2	U3d	F14	U17a	H6	U30	H4
R9	E2	U4a	F12	U17b	K3	U31a	F7
R10	F3	U4b	K14	U17c	K8	U31b	F10
R11	H4	U4c	K14	U17d	J13	U31c	J21
R12	J4	U4d	J6	U17e	L19	U31d	F9
R13	J4	U5a	A20	U18a	F7	U32a	C14
R14	H2	U5b	D14	U18b	H13	U32b	J17
R15	H3	U5c	J20	U19a	F4	U32c	C16
R16	C3	U5d	B11	U19b	B16	U33	J16
R17	J7	U6a	K10	U19c	F5	TP-1	J5
R18	K5	U6b	B13	U19d	C17	TP-2	H4
R19	K3	U6c	J13	U20a	C14	TP-3	F5
R20	B5	U6d	F16	U20b	D16	TP-4	J16
R21	B7	U7a	B13	U20c	C16	TP-5	J8
R22	F21	U7b	B13	U20d	F9	TP-6	H8
R23	F21	U7c	A9	U21a	K16	GND	B3
R24	E21	U7d	A14	U21b	K16		



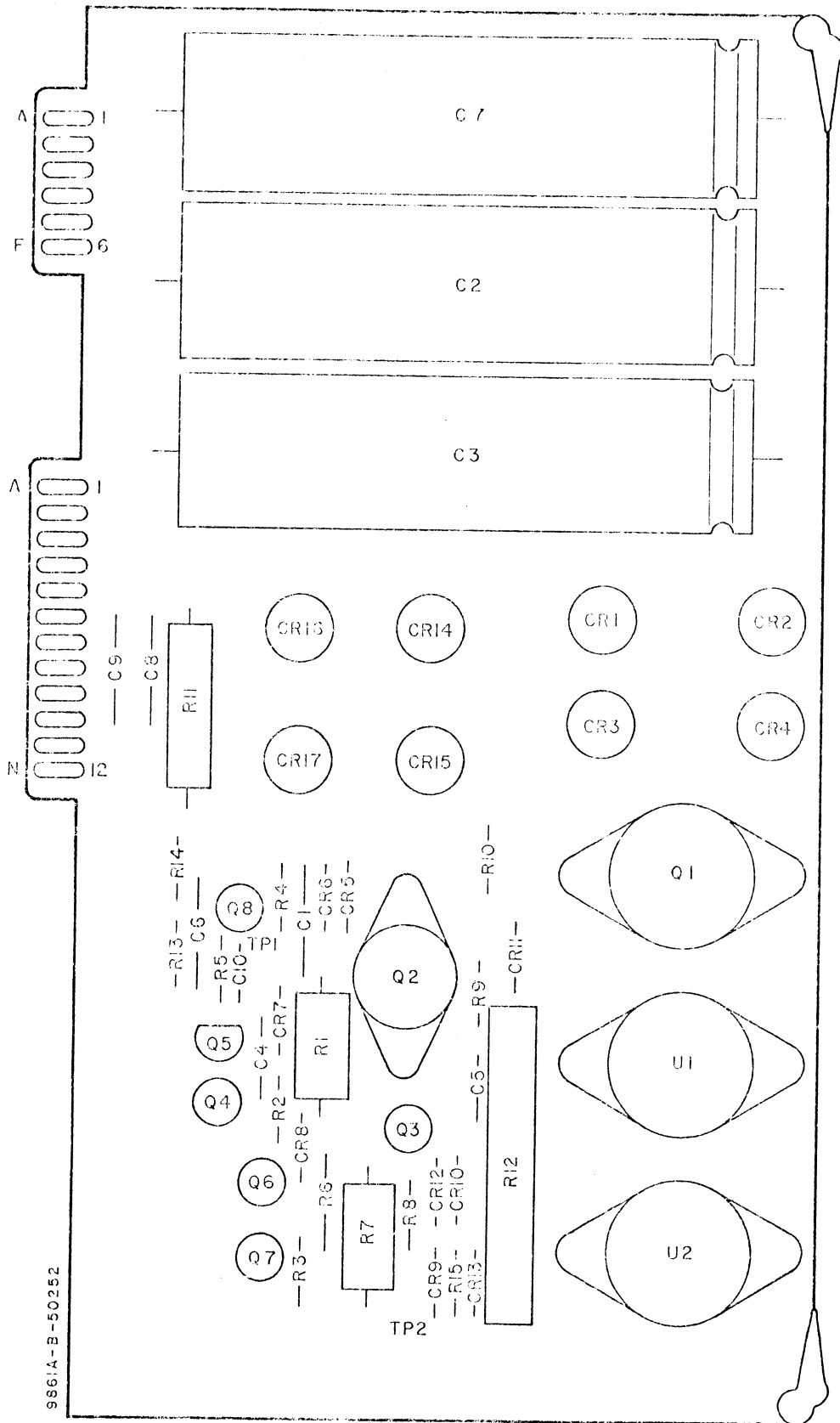
A2
 hp Part No. II201-66502
 REV A



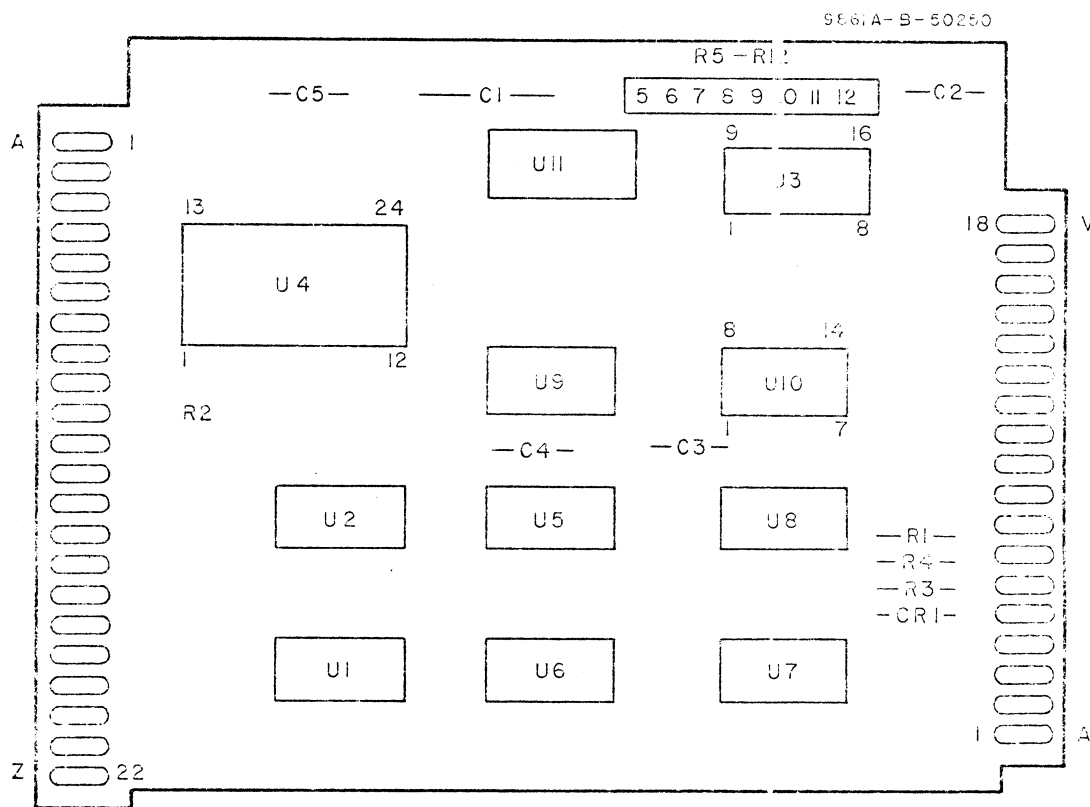
A3

hp Part No 11201-66503

REV A

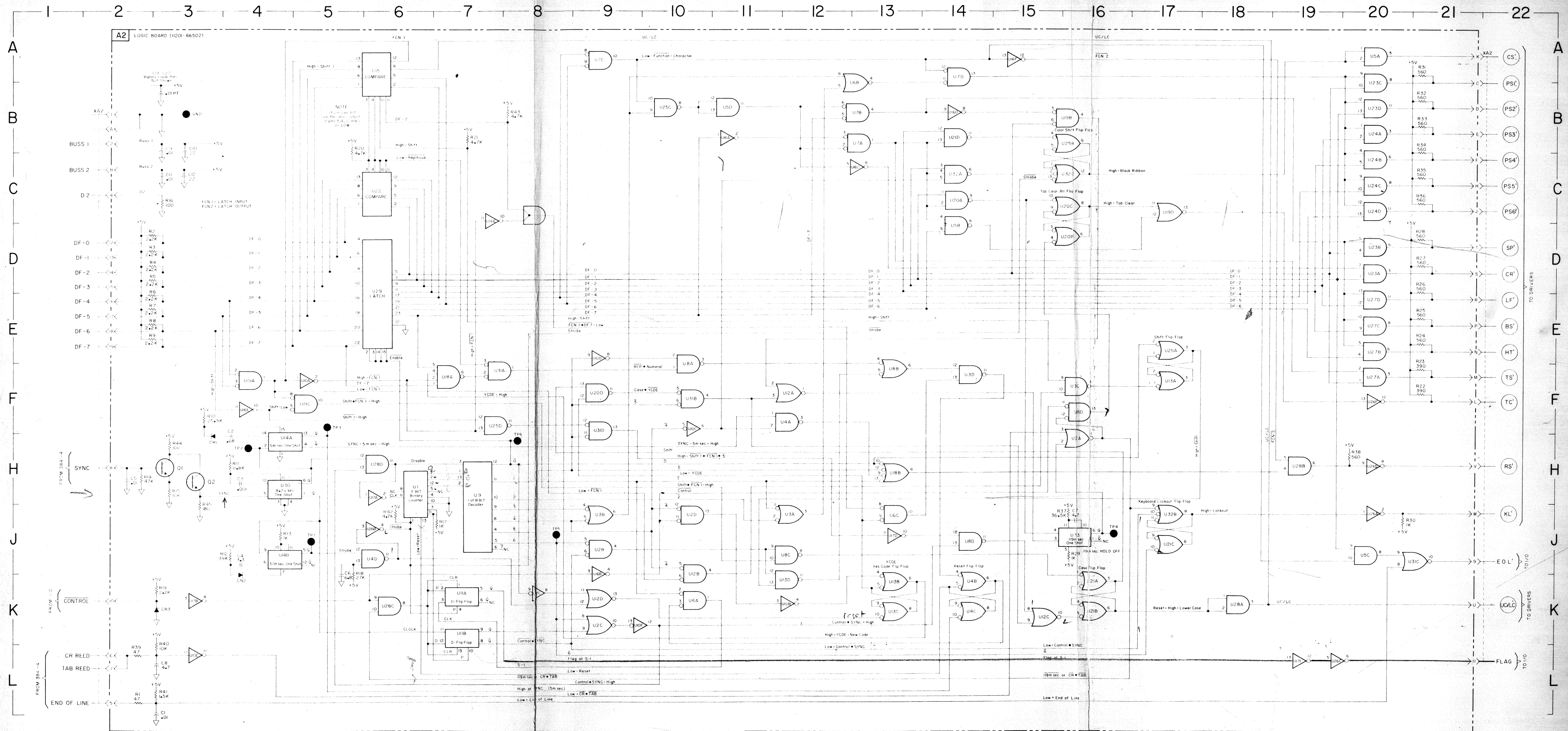


hp **A4** Part No 11201-66504
REV B

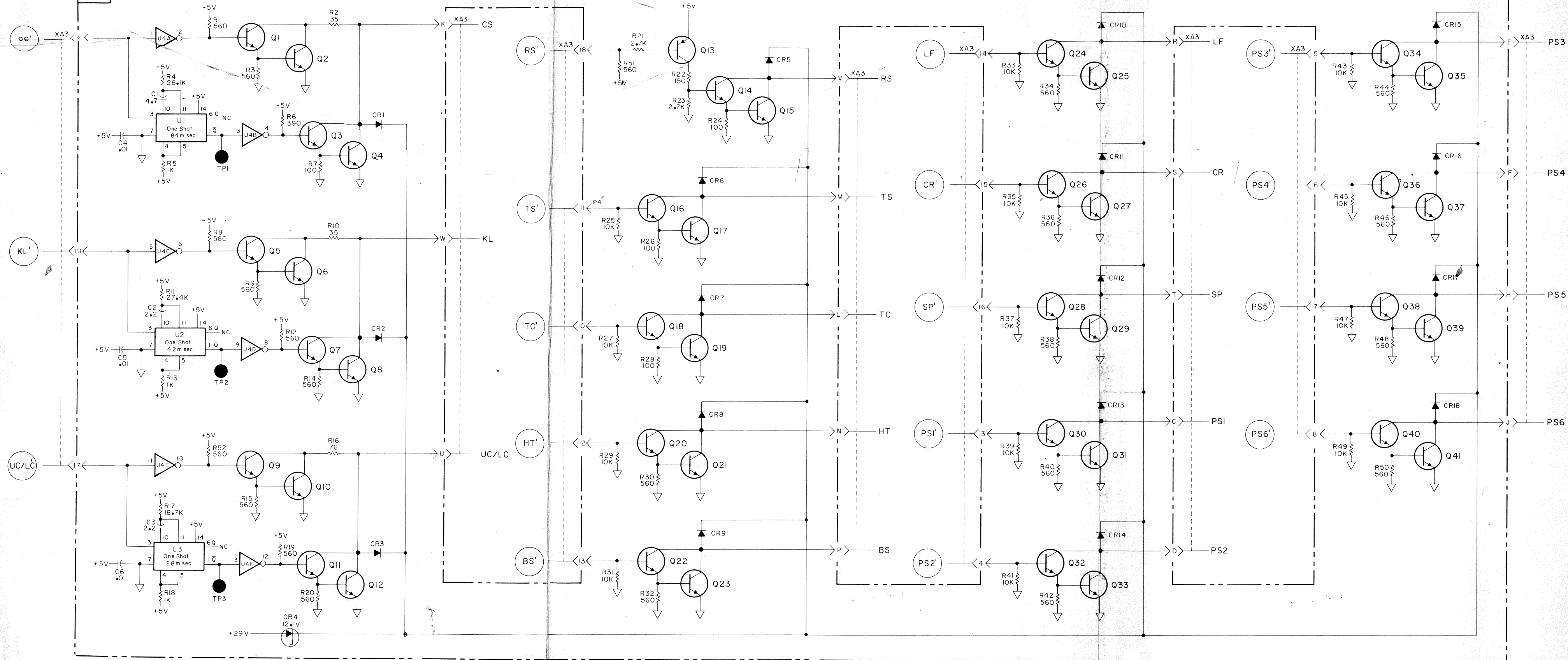


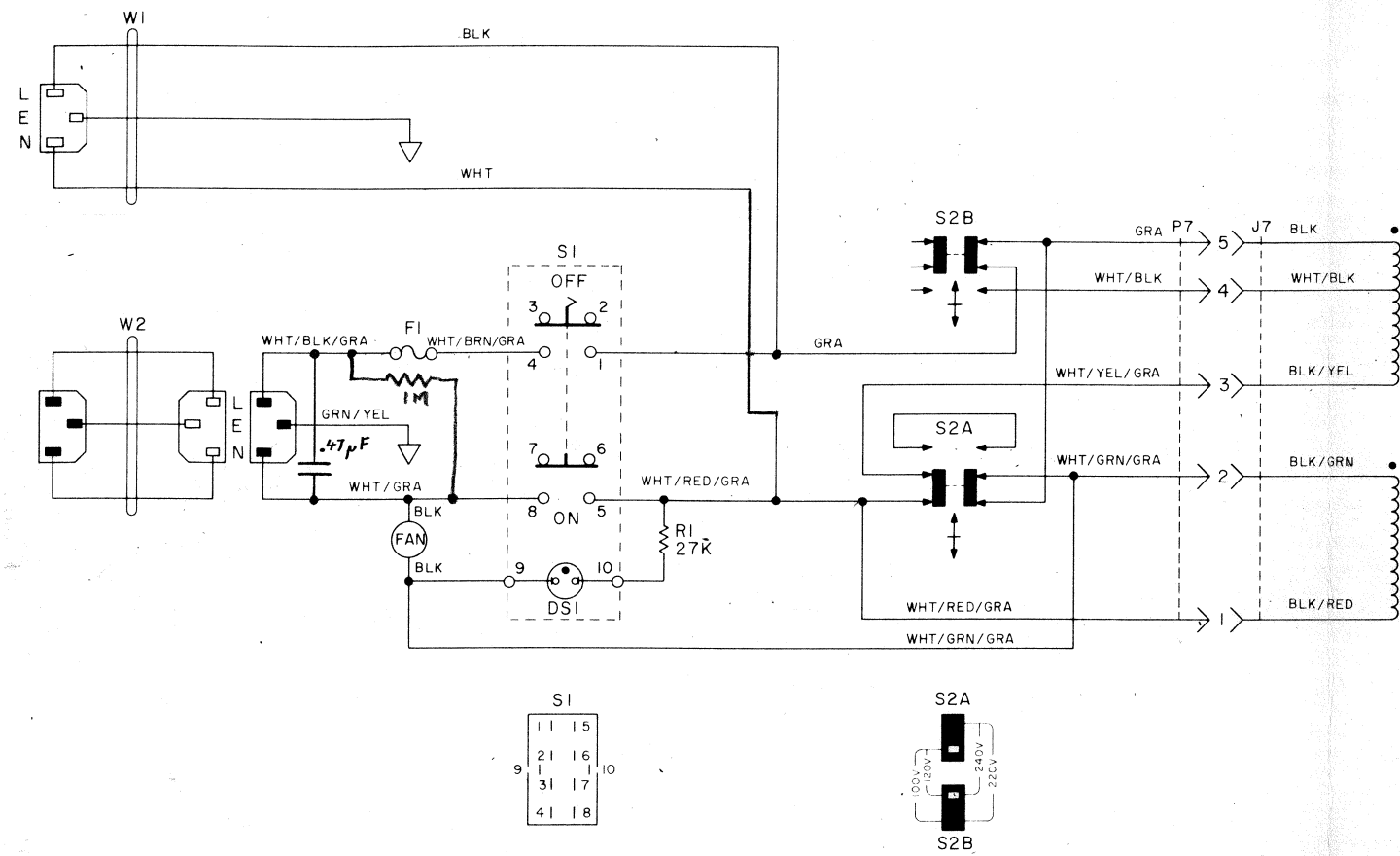
A5
hp Part No 11201-66591

AT THE TIME OF THIS PRINTING, A COMPLETE LIST OF THE FACIT SERVICE CENTERS WAS NOT AVAILABLE. AS SOON AS SUCH A LISTING IS AVAILABLE A COPY WILL BE FORWARDED TO YOU.

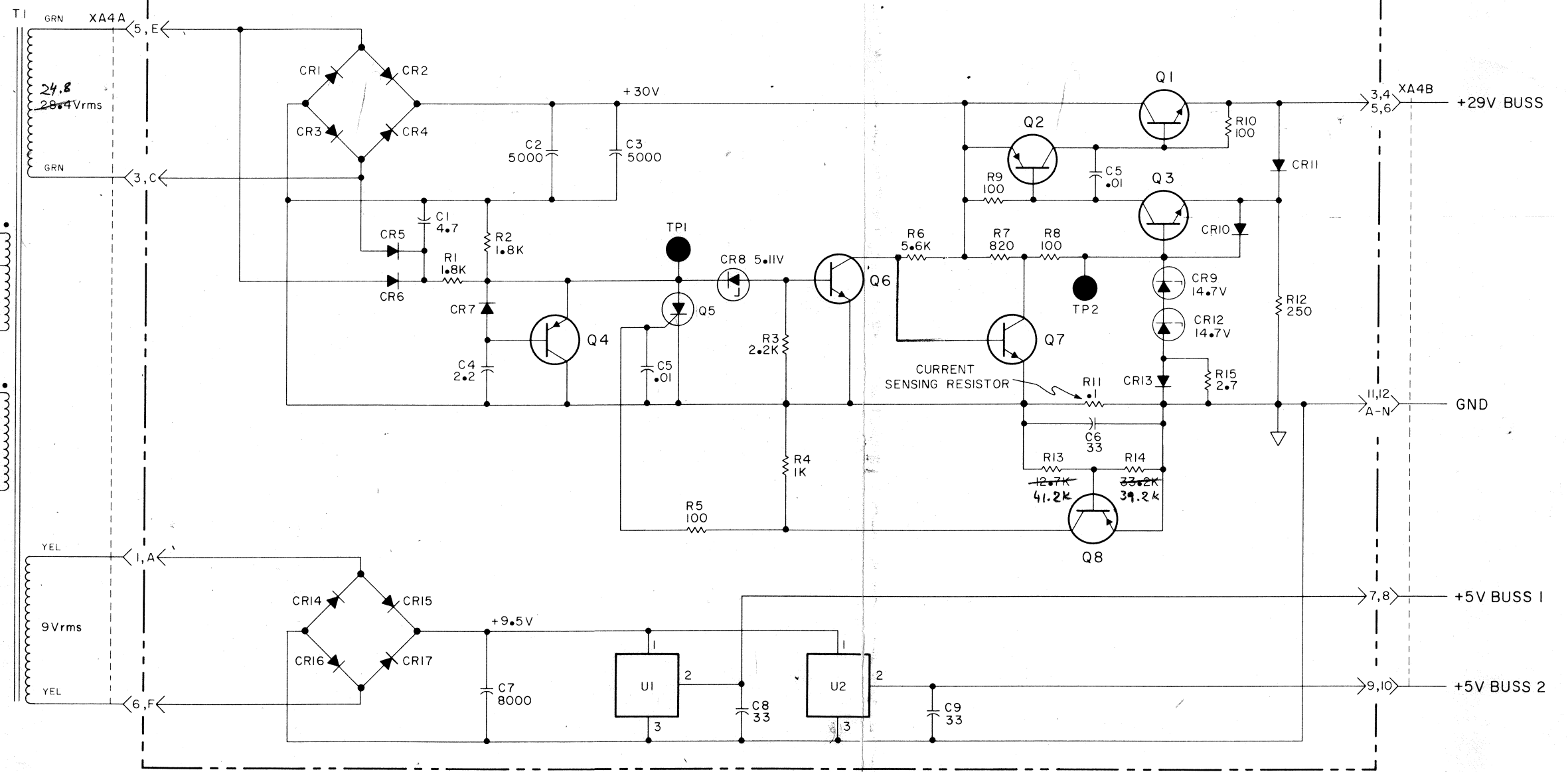


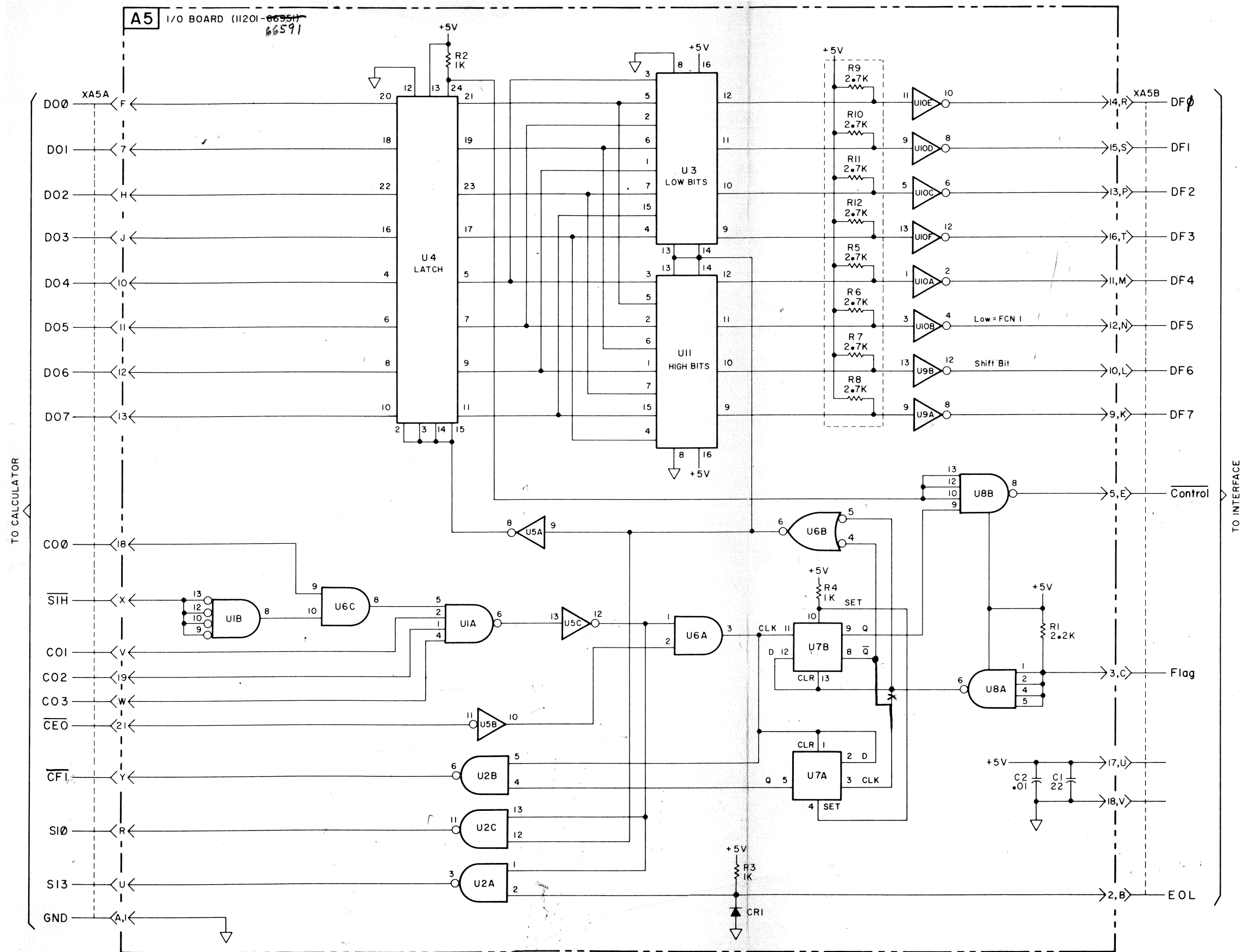
A3 DRIVER BOARD (11201-66503)

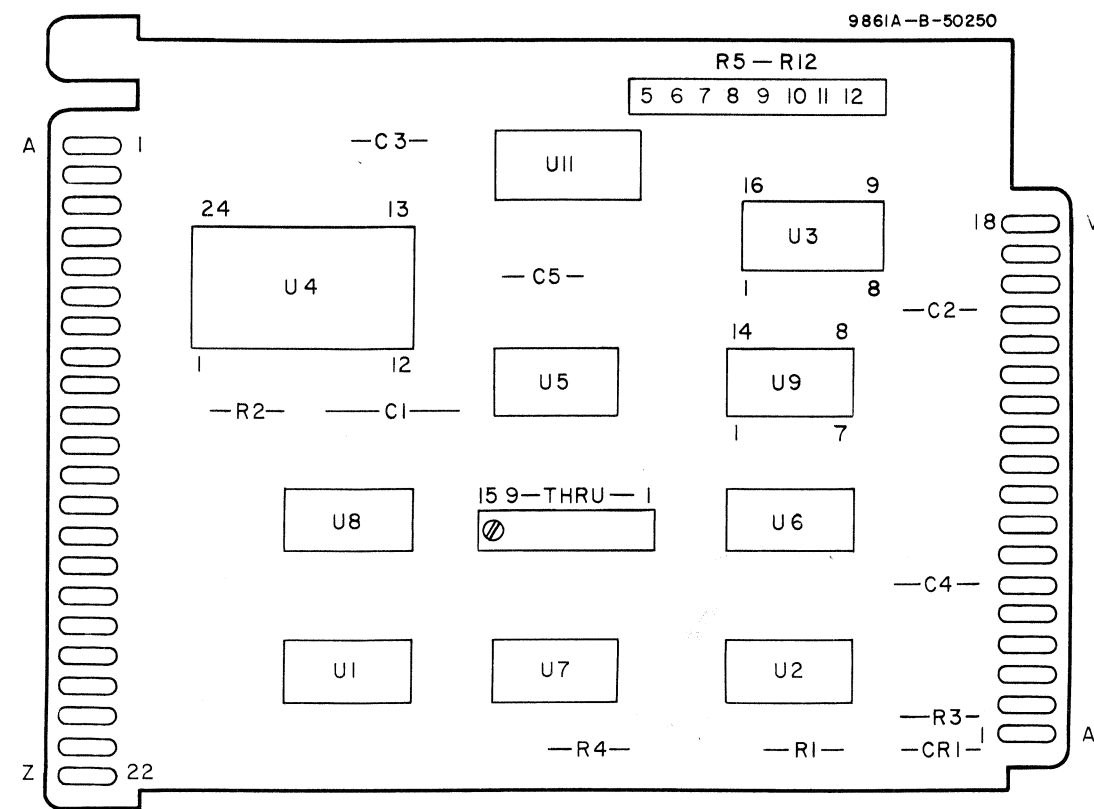




A4 POWER SUPPLY BOARD (11201-66504)







A5
hp Part No II20I-6659I
 REV B

