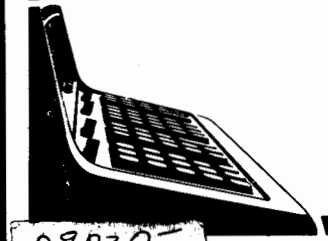
C8

9830A
CALCULATOR
SERVICE MANUAL

HEWLETT hp PACKARD



09830-90030

9830A CALCULATOR

SERVICE MANUAL

09830-90030

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Chapter 1
INTRODUCTION

THE 9830A CALCULATOR

The 9830A Calculator is a member of the family of 9800 series desk-top calculators, and, although different in most respects, has some of the 9800 calculator-family physical characteristics. (The 9830A Calculator is described in a later section of this chapter.)

The 9830A uses a program language (HP BASIC) that is new to -hp- calculators, and requires that the Field Service Engineer become familiar with some new programming techniques which satisfy the new language. Therefore, personnel who expect to be servicing the 9830A should become familiar with the reference manuals listed in Table 1-1.

Manual Title	-hp- Part Number
9830A Simplified Operating	09830-90000
9830A Operating and Programming	09830-90001

Table 1-1. 9830A Reference Manuals

SERVICE CONCEPT

The recommended procedure for servicing the 9830A Calculator is as follows:

A. With the exceptions given in sections B. and C. of this procedure, the 9830A Calculator should be serviced by on-site, assembly exchange utilizing the assemblies in 11290A Service Repair Kit (described in a later section of this chapter). The defective calculator assembly should be returned Customer Service Center (CSC) [or Parts Center Europe (PCE) in Europe] via the -hp- Blue Stripe Exchange Program for credit.

B. The internal cassette memory, ROM Buffer, and power supply assemblies (except as noted in Procedure C.) may be serviced by either replacing the defective component at the customers location or exchanging the defective assembly with the corresponding service kit assembly, then replacing the defective component at the service office. Since the -hp- part number for these assemblies is provided in this manual, the defective

assembly may be replaced by ordering a new assembly from CSC.

C. The cassette control logic (A62) and R/W memory (A63) are also on the -hp- Red Stripe Program and, if defective, may be returned to the factory for evaluation. The power supply assembly is also on the -hp- Blue Stripe Exchange Program.

Chapter V, VI, and VII of this manual provides detailed information for servicing each of the calculator assemblies.

THE MANUAL IN BRIEF

This service manual, together with a thorough knowledge of the reference manuals (see Table 1-1), provides complete documentation for servicing the 9830A Calculator.

A BRIEF DESCRIPTION OF THE 9830A

The 9830A Calculator is referred to as the 'Model 30" of the 9800 series of instruments. The Model 30, at first glance, somewhat resembles a Model 20 Calculator. However, the differences greatly outnumber the similarities. Table 1-2 shows a few of the major differences.

	MODEL 20	MODEL 30
LANGUAGE	ALGEBRAIC	HP BASIC
KEYBOARD	CALCULATOR	TYPEWRITER-TYPE
DISPLAY	16 CHARACTER (5X7 matrix)	32 CHARACTER (5X7 matrix)
RECORDING	MAGNETIC CARD	TAPE CASSETTE
ROM'S	3 MAXIMUM	*8 MAXIMUM

Table 1-2. Model 30 - Model 20 Differences

The basic Model 30 consists of a 1760 word memory (one word consists of 16 bits). Various options (see Table 2-2) are available that provide additional memory or an

*5 external and 3 internal ROM's may be added at one time.

assortment of ROM assemblies. ROM assemblies are optional Read-Only-Memories which are similar to the 9820A ROM Blocks except they are added to slots that are accessable only by removing part of the calculator chassis and are not enclosed in the protective (plastic) box. THESE ROM'S ARE INTENDED TO BE INSTALLED AND REMOVED BY -HP- PERSONNEL. Three connectors are provided for ROM assemblies.

A door in the left side of the calculator provides access to the 'Plug-in' ROM block slots. These ROM Blocks are similiar to other 9800 series calculator ROM Blocks in that they enable the calculator to perform specific types of operations. These ROM's may be installed by the user and require no installation by -hp- personel.

Some of the Model 30 Read-Only-Memories may be purchased, either as an option or accessory, as ROM assemblies. If the ROM's are ordered as options, they are factory installed; ROM's ordered as accessories are installed by the Field Service Engineer. The 'Plug-in' ROM Blocks may also be purchased as an accessory, thus allowing the customer to purchase either of the three types of ROM's after the purchase of a Model 30 Calculator. Table 2-2 lists the ROM's available at the time of this printing,either as an option or an accessory. (See the 'ROM Connections' section of Chapter 2.)

9830A SERVICE KIT - 11290A

11290A Service Kit Exchange Assemblies

-hp- Part Number	Description	Quantity
09830-69551	Power Supply (A51)	1
*09830-69584	2K R/W Memory (A84)	1
11275-69584	4K R/W Memory (OPT275)	1
09830-69530	Keyboard (A30)	1
09830-69541	Display (A41)	1
09830-69961	Xport Cassette	1
09830-69521	ROM Basic I(A21)	1
*09830-69582	M Register (A82)	1
*09830-69583	T Register (A83)	1
09830-69542	Display Logic (A42)	1
09830-69526	ROM Basic II (A26)	1
11270-69520	Matrix ROM Ass'y	1
11270-69920	Matrix ROM Block	1
11271-69520	Plotter ROM Ass'y	1
11271-69920	Plotter ROM Block	1
11272-69520	I/O ROM Ass'y	1
11272-69920	I/O ROM Block	1
11274-69520	String ROM Ass'y	1
11274-69920	String ROM Block	1
11277-69520	Terminal ROM Assembly	1
11277-69920	Terminal ROM Block	1

*These assemblies are the 'standard' memory configuration (see page 6-1).

9830A SERVICE KIT - 11290A

11290A Service Kit Non-Exchange Assemblies

-hp- Part Number	Description	Quantity
09830-66502	I/O Ass'y (AØ2)	1
09830-66501	Mother Board (AØ1)	1
09830-66503	ROM Mother Ass'y (AØ3)	1
09865-69562	Logic Ass'y (A62) (Red Stripe)	1
09865-69563	R/W Ass'y (A63) (Red Stripe)	1
09865-66564	Motor Ass'y (A64)	1
09830-66561	Interface Ass'y (A61)	1
09830-66525	Bfr Ass'y (A25)	1
	Miscellaneous Calculator Chassis Parts	1
09830-90030	Service Manual	2
09830-90000	Manual, Simplified Operating	2
09830-90001	Manual, Operating and Programming	2
8500-1251	Head Cleaning Solution	1
9162-0050	Cassettes	2
09830-90035 62	System Test Cassette	
09830-90016	Programming Pad	1
98300A	Math Pac Vol I	1
4040-0978	Dust Cover	1
5040-7437	ROM Keys	2
2110-0002	Fuse 2ANB (115V Operation)	2
2110-0001	Fuse 1ANB (230V Operation)	2
2110-0056	Fuse 6ANB	2
8120-1378	Cbl - AC Power	1
8520-0023	Cotton Applicators	

Chapter 2
INSTALLATION

POWER REQUIREMENTS

Two line-voltage selector switches located on the rear panel of the calculator (see Figure 2-1), when correctly positioned (See Figure 2-2), enable the calculator to be operated on a line voltage of either 100, 120, 220, or 240Vac (+5, -10%). The line frequency must be within a range of 48 Hz to 66 Hz (inclusive). A maximum power of 150 voltamps is required for calculator operation.

Two convenience power outlets are provided which give a maximum total of 6 amps of current for two Model 30 peripherals. These power outlets are not connected to the calculator LINE ON/OFF switch. Instead, they provide ac power, at the line frequency and voltage applied to the calculator, whenever ac power is applied to the calculator power receptacle.

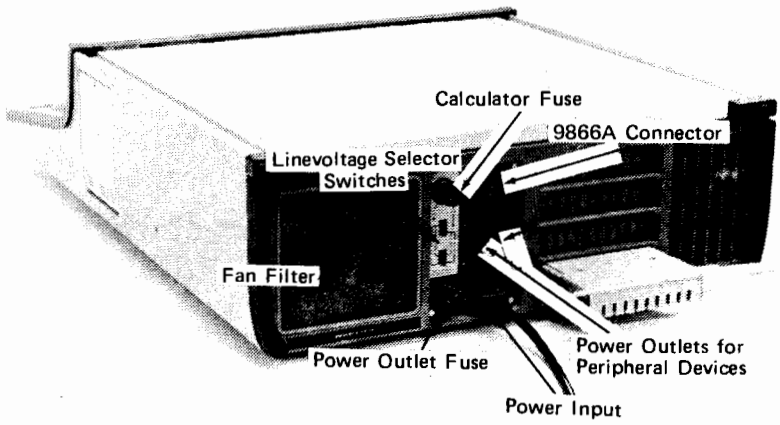


Figure 2-1. The Calculator Rear Panel.

GROUNDING REQUIREMENTS

To protect personnel operating the Model 30, the 'National Electrical Manufacturer's Association (NEMA)' recommends that the calculator chassis be grounded. The calculator is equipped with a three conductor power cable and receptacle which, when connected to an appropriate power outlet, grounds the calculator chassis. The center pin of the power receptacle is the ground connection.

LINE VOLTAGE SELECTION

> CAUTION
>
> DAMAGE TO THE MODEL 30 CALCULATOR MAY OCCUR IF THE CALCULATOR IS OPERATED ON A LINE VOLTAGE IN EXCESS OF +5% OF THE SELECTED LINE VOLTAGE OR IF THE CORRECT FUSE, FOR THE SELECTED LINE VOLTAGE, IS NOT INSTALLED.

Line-Voltage Selector Switches

The following procedure should be followed when setting the line-voltage selector switches:

1. Disconnect the calculator from any ac power source.
2. Switch the LINE switch OFF.
3. Switch the two selector switches (located on the rear panel) for the local line voltage. DO NOT SET THE SWITCHES FOR A SEASONAL LOW-LINE CONDITION. Figure 2-2 shows the four possible voltage setting.

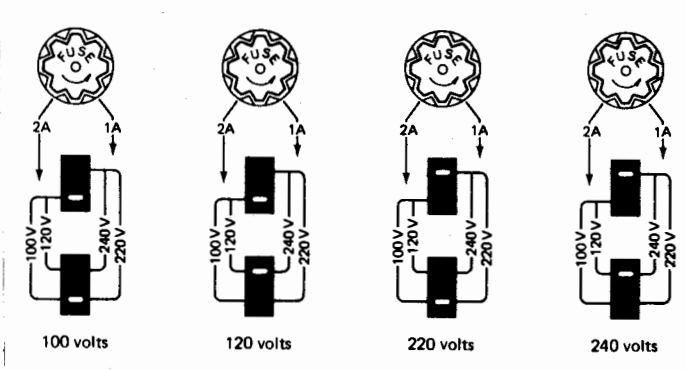


Figure 2-2. Switch Settings for the Various Nominal Powerline Voltages.

WARNING
BEFORE CHANGING A FUSE, ENSURE THAT THE CALCULATOR IS DISCONNECTED FROM ANY POWER SOURCE.

Fuses

The calculator has two fuses located on the rear panel (See Figure 2-1). The convenience outlet fuse is a 6-amp fuse. The calculator fuse is either a 2-amp fuse for 100/120 Vac operation, or a 1-amp for 220/240 Vac operation.

To remove a fuse, press in on the cap of the fuse holder, while at the same time twisting the cap in the direction indicated by the arrow on the cap. Pull the cap free and remove the fuse. The fuse may be installed by reversing this procedure.

TABLE 2-1, FUSES

Nominal Voltage	Operating Range (+5, -10%)	Fuse
100V	90 to 105V	2-ampNB
120V	108 to 126V	2-ampNB
220V	198 to 231V	1-ampNB
240V	216 to 252V	1-ampNB

PERIPHERAL CONNECTIONS

9866A Thermal Printer Installation

> NOTE
> The 9866A Thermal Printer Service Manual (-hp- Part number 09866-90030) provides detailed information for installing the printer.

The Thermal Printer is constructed so it can be placed on top of the calculator ('piggyback' style) or on a flat surface adjacent to the calculator.

The cannon connector on the rear of the calculator is intended to be used for printer connections. This connector does not require the use of an I/O card.

If the printer ac power cord is connected to one of the calculator convenience outlets, 3-amps (of the 6-amps total convenience outlet current) is required for printer operation on 100 Vac or 120 Vac power lines.

READ-ONLY-MEMORY CONNECTIONS

Ordering ROM's

Read-Only-Memory (ROM) cards may be ordered by the customer in any one of three ways:

1. The ROM may be ordered as an option which is factory installed in one of the three internal ROM assembly connectors. The option, when installed, should be considered as an integral part of the system. The option number

uses the last three numbers of the associated ROM accessory (described in 2 and 3.)
Example:
Accessory Number 11270 = Opt. 270

2. The ROM may be ordered as a traditional 'plug-in ROM Block' by using the accessory number with a 'B' suffix. (These ROM's are installed by the customer.
Example: 11270B is the matrix plug in ROM Block accessory number.

3. The ROM may be ordered as an (internal) ROM assembly using the accessory number with a 'F' suffix. (These ROM's are installed in the field.)
Example: 11270F is the matrix ROM assembly accessory number.

Table 2-2 lists all of the ROM's available at the time of this printing.

OPTION NUMBER (or) -hp- ACCESSORY NUMBER		ROM DESCRIPTION
270	11270B or F	Matrix ROM
271	11271	Plotter Control ROM
272	11272	Extended I/O ROM
274	11274	Alpha String ROM
275	11275	R/W Memory Accessory
276	11276	Unassigned
277	11277	Terminal ROM

Table 2-2. The 9830A ROM's.

Plug-in ROM Block's

Plug-in ROM's Block's are ROM PC assemblies which are contained in plastic boxes and may externally be added to the calculator memory by the user. These ROM's are installed by the customer.

ROM's Assemblies

Unlike previous 9800 series calculators, the 9830A contains provisions for permanently adding up to three ROM's to the calculator memory. It is not intended that these ROM's be accessible by the customer. Instead, the ROM Assemblies should be installed at the factory if ordered as an option, or by the local Field Service engineer if they are ordered as an accessory.

Because the ROM Assemblies are not accessible by the customer, the ROM should be considered to be a permanent feature of the 9830A System.

The ROM Assemblies may be installed by removing the calculator top cover and installing the assembly into any unused ROM connector (See Figure 6-2). Before returning the top cover and the two retainer plates to the customers calculator, perform the 9830A System Test Program to verify proper ROM operation.

MEMORY OPTIONS

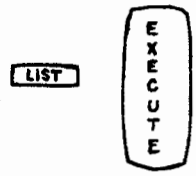
The 9830A may have two (2) memory configurations. The basic calculator contains 1760 words, whereas option 275 (accessory number 11275F) contain 3808 words (one word is equal to 16 bits).

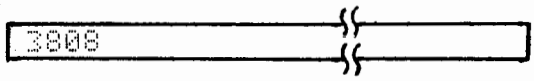
Option 275 may be installed into the calculator by performing the following prodedure:

1. Switch the calculator OFF and remove any ac power.
2. Remove the calculator top cover and the two PC board retainer plates.

3. Remove the A84 (09830-69584) assembly from the PC slot immediately forward of the power supply (A51) assembly (see Figure 6-3.) And replace it with the Opt. 275 (11275-69584) assembly. There will be an empty PC slot just forward of the presently used R/W memory slot. The empty slot is for the possibility of future R/W memory options.

4. To verify that the installed option is operating correctly:
Remove all previously installed ROM's and switch the calculator on.

PRESS: 

DISPLAY: 

If the display is incorrect, the option 275 assembly is defective or improperly installed. Refer to chapter VI for the correct replacement procedure.

5. When the display is the same as the one shown in step 5, reinstall all of the assemblies that were removed in steps 2 and 5. Then, perform the 9830A System Test Cassette program.

9830A SYSTEM TEST CASSETTE

A tape cassette which contains prerecorded programs for the testing of the Model 30, Model 30 ROM's and (if selected) Model 30 peripherals is included in each 11290A Service Kit. Before the cassette programs can be loaded into the calculator memory where it can be used to perform a test, the Cassette Memory, Processor, and some Memory assemblies must be functioning correctly.

Some of the programs which are prerecorded on the test cassette tape are written in a binary (machine) language and cannot be listed. The remaining test cassette programs are secured and only a line number followed by an asterisk (*) can be either displayed or listed.

Because some ROM's and peripherals may be added to the 9800 Series of instruments, a periodic updating of the test cassette, by the Field Service Engineer, may be necessary. Instructions for the addition of new programs to the existing test programs will be provided as the new programs become necessary to provide a complete system test.

TEST CASSETTE INSTRUCTIONS

1. To Load Cassette:
   Press: Scratch A execute
   Press: List 9999 execute (display should be either 1760 or 3808)
   Press: Load Bin Ø execute

2. Make decision regarding what to test:

   A. If you want to test the calculator one time, press "test execute". The program will test the calculator and ROM's. Basically, the test tests some RWM, then all the ROM's, more RWM, and then all the ROM's. When all the RWM has been tested (the ROM's 18 times) the calculator will display "9830A

TEST CASSETTE INSTRUCTIONS (cont'd)

test satisfactory". If a basic ROM error is detected, the calculator will display "Basic ROM failure". Similar messages are displayed for other failures. If the calculator has a bad ROM (either add-on or basic) the program will stop each time the bad ROM is detected. To ensure full testing of the machine, continue to press execute each time the program stops. When the beeper has beeped 18 times the entire R/W memory has been checked.

B. The calculator may be placed in a "continuous test mode" (useful for intermittent troubles). To do this, type in "CTEST" Execute. The calculator screen will blank and the calculator will begin beeping. After 18 "beeps" (test cycle complete), the calculator will flash "9830A test satisfactory N". Where N is the number of times the test loop has been successfully completed. Failure to complete test loop will cause calculator to stop and display message as described in 1A. To stop the test, press STOP. When the display returns, the program will stop.

C. If you wish to test peripherals, type "PTEST" execute. The next message that appears on the display will request the model number of the peripheral you wish to test. Type this in and press execute. Another message will appear asking for the select code. If you wish to specify the factory set select code, type in "Ø". The next request is for the number of times you wish to test the peripheral. Type this in and press execute. The test routine will be loaded into the calculator and executed.

D. Tests may easily be combined. For example, assume you wished to test the calculator and one peripheral, say the 9861A.

TEST CASSETTE INSTRUCTIONS (cont'd)

To do this, press:
SCRATCH A Execute
LOAD BIN Ø Execute
TEST Execute
After calcultor test completed press PTEST execute.
From there on follow instructions given in 2C.

3. The peripheral tests.

A. 9860A
Requires that a special test card be entered into the reader when the calculator display requests it.

B. The typewriter will type out a group of symbols and perform functions similar to all previous exerciser typeouts.

C. 9862A
The plotter will require that the lower left and upper right limits be set. The form plotted is identical to the form shown on page C-2 of the Model 20 electrical inspection booklet.

D. 9863A
Follow the switch and pin configuration described in the Model 20 electrical inspection booklet. If you have the "older" test tape, be sure to load the tape so that the first group of punches are missed.

E. 9864A
The 9864A test is simply reading of the x and y coordinates from the digitizer. To test the Model 64 use the instructions contained in the Model 20 electrical inspection booklet.

TEST CASSETTE INSTRUCTIONS (cont'd)

To terminate the test, press STOP. When the program stops, you may either test the calculator by typing in TEST or CTEST execute or, if you want to test other peripherals, type in RUN execute.

F. 9865A

Follow instructions contained in calculator display when Model 65 test routine is called. You can test the internal cassette by specifying a select code of "10". Be sure to remove the systems test cassette and replace it with a scratch tape. Failure to do this will cause the system test cassette to be destroyed if it is not protected. All test cassettes should be protected.

G. 9866A

This program will print a test pattern on the Model 66. Wild results are obtained if 61 and 66 are both connected to calculator and both select codes are set to 15.

4. Peripheral Test Special Cases

Two of the peripherals test programs have special cases. These are the Model 61 and Model 66 tests.

On the 9861A test you can continuously test one line of the type-out. To do this, specify the number of times to run program as "Ø". When Calculator display returns it will ask which line. Give it the line number you want repeated. The program will continuously repeat the line until you press stop. To get back to test other peripheral, type in RUN execute. CONTinue execute may be used to continue the test.

TEST CASSETTE INSTRUCTIONS (cont'd)

On the 9866A giving a Ø for the number of repetitions will cause the test pattern "IH#" to be continuously typed. To stop printing, press STOP. CONTinue EXECUTE will cause the test to be continued, whereas RUN EXECUTE will allow you to escape the test.

Chapter 3
INSTRUMENT MAINTENANCE

CLEANING THE TAPE HEAD

As with most precision recording equipment, the cassette memory can be expected to provide trouble-free operation only if the user adheres to a scheme of regular preventative maintenance. The following tape-head cleaning procedure should be performed after every eight hours of cassette operation. Also, this procedure should be performed prior to making a 'permanent' cassette memory recording.

> CAUTION
> READ ALL OF THE FOLLOWING PROCEDURE AND INFORMATION SUPPLIED WITH THE TAPE HEAD CLEANER BEFORE PERFORMING THE CLEANING PROCEDURE.

To clean the tape head:

1. Rewind and remove the tape cassette, then switch the calculator OFF.
2. Remove any dust or other material that has accumulated in the vicinity of the tape head. (See Figure 3-1).
3. The tape head should be cleaned with a cotton applicator which has been dampened with head cleaning solution (-hp- P/N 8500-1251) or denatured alcohol. It is sufficient to gently wipe the top of the head a few times, and then repeat wiping of the head with a clean applicator.

> CAUTION
> DO NOT ALLOW THE CLEANING SOLUTION TO TOUCH THE TAPE-TRANSPORT DOOR OR THE LIGHT-SENSING ASSEMBLY.

4. Close the tape-transport door after cleaning the tape head. A good practice is to close the door whenever the cassette memory is not in use.

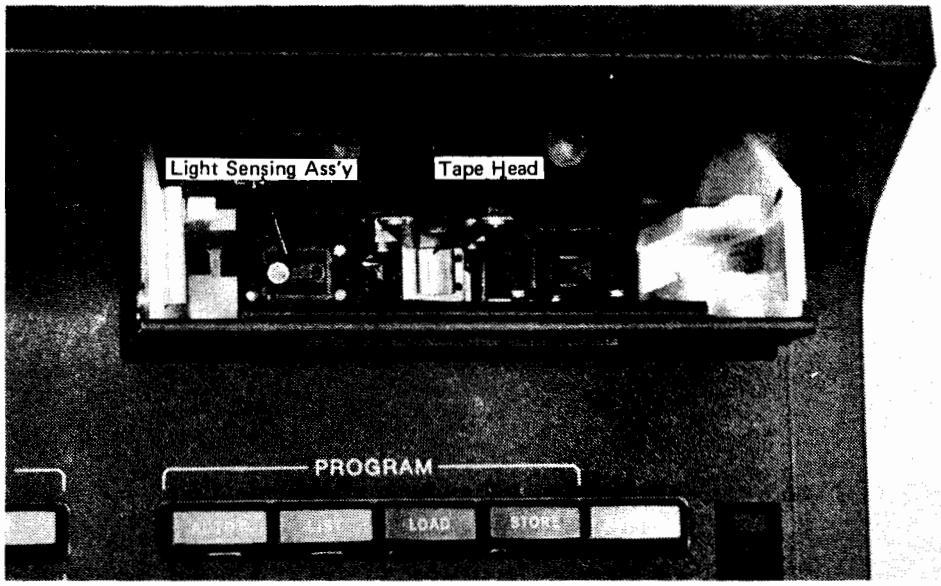


Figure 3-1. The Tape Head and Light Sensing Assembly.

IMPORTANT NOTE

The reliability of the cassette Memory can be directly related to periodic cleaning of the tape head It is STRONGLY RECOMMENDED that the tape head be cleaned each time a service call is made on a Model 30 calculator system.

THE TAPE CASSETTE

The tape cassette recommended for use in the cassette memory is shown in Figure 3-2. This cassette is a precision unit and contains three-hundred feet of digital-quality, magnetic recording tape. These and other important characteristics make this tape cassette ideally suited for use in the Model 30.

The -hp- cassette is available in single quantities and in multiple quantities at a reduced price. When ordering the tape cassette, specify -hp- Part No. 9162-0050. (Available through CSC only.)

Although other available tape cassettes will initially work in the cassette memory, many of these products will not provide reliable cassette recordings. Also, since the use of colored tape cassettes (any color other than white) will actually damage the Calculator Transport Assembly, -hp- cannot ensure calculator operation if it is used with a tape cassette not indicated above. Furthermore, -hp- will not warranty any damage to a calculator that is caused by the use of tape cassettes other than the one recommended.

Since a vast amount of information can be stored on a single tape cassette, loss of the cassette's contents (e.g., normal tape wear, physical damage, exposure to a strong magnetic field, or instrument failure) could be extremely expensive to the user...both in time and resources lost. One method of preventing such a loss is to make a duplicate recording of each often-used or valuable tape, and then storing these 'master tapes' in a safe place. The practice of making master tapes (or making master recordings on magnetic cards) should be considered manditory when the application requires that the tape be used on a daily basis.

THE TAPE CASSETTE

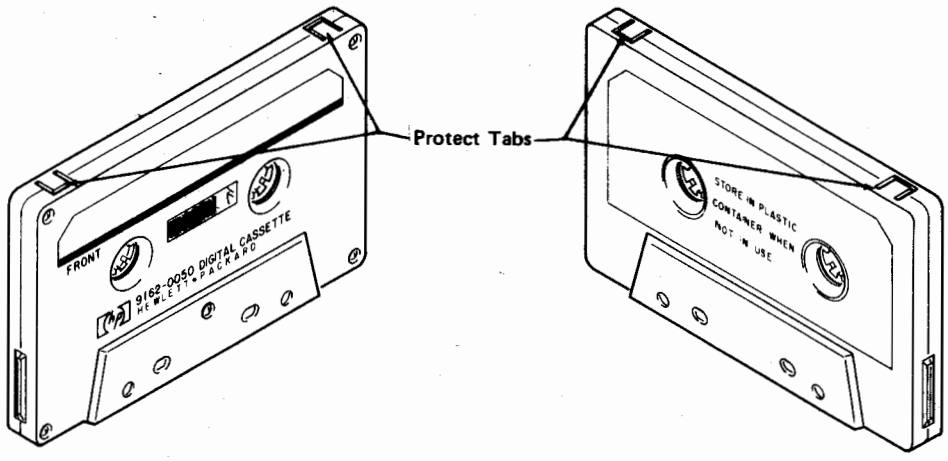


Figure 3-2. The Tape Cassette.

THE TAPE CASSETTE

The Protect Tabs

The information recorded on a tape cassette can be protected from loss due to subsequent recording operations by removing both protect tabs on top of the cassette (see Figure 3-2). The calculator will terminate any record operation on a cassette which has the protect tabs removed.

Storing Tape Cassettes

Each tape cassette is supplied with a plastic case, which should be used when storing the cassette, as the magnetic tape is delicate and can be easily damaged. Also, the tape should be fully rewound before it is removed from the cassette memory.

As with most magnetic tape products, the information stored in the tape cassette can be altered or destroyed by exposing the tape to a stroung magnetic field, such as is produced by a bluk tape eraser, a toy magnet, or some metal-detection devices (e.g., equipment used at many airports). In some cases, the use of a steel container, such as an index box, will protect the tapes from magnetic fields.

CLEANING THE CALCULATOR AND FAN-FILTER

Clean the calculator with a soft cloth, dampened in clean water or in water containing a soft soap or mild detergent. Do not use an excessively wet cloth or allow water to penetrate inside the calculator. In particular, do not use any abrasive materials, expecially on the display window.

The fan-filter (located on the rear of the calculator) should normally be cleaned about every three months. Clean it by holding it under a running water-faucet or by washing it in warm soapy water and then rinsing it in clean water. Dry the filter thoroughly before re-installing it.

CLEANING THE CALCULATOR AND FAN-FILTER (cont'd)

The filter can be easily removed by using a small blunt instrument such as a screwdriver, a paper-knife or a nail file. Insert the instrument into one of the slots located on either side of the filter; the filter can then be snapped out by applying pressure toward the center of the filter and, at the same time, toward the back of the calculator. To replace the filter, snap in first one side and then the other.

Chapter 4
PSEUDO-HARDWARE

INTRODUCTION

Pseudo-hardware problems are problems which may occur because of an anomaly in the calculator itself. These problems require that the user observe some special considerations when a program is being written, edited, or run.

UNUSUAL CASSETTE MEMORY OPERATIONS

The 'Rewind' operation will result in no error note if a tape cassette is not installed, the tape is on the clear leader, or the wrong select code is given for an externally connected 9865A. A'Rewind' or 'Find File' operation which is executed from a program statement must be followed by a 'WAIT' statement; failure to observe this rule may result in the termination of the cassette operation.

When storing or loading and renumbering programs with the cassette memory (e.g., LOAD Ø,11-), the operator must ensure that the program does not contain a GO TO (LINE) statement in which the line number is less than the beginning line number. Example:

Original Program		Stored Program
10	PRESS	50
20	STORE Ø,50	60
30		70
.		.
.		.
.		.
999		

If line 60 originally contained a GO TO 10, it would be renumbered GO TO (illegial line number). The program could be loaded into the calculator memory, but not run.

EDITING

Step Program

When the operator is stepping through a program which contains a progarm line with a recoverable error, the error note is displayed in place of the program line following the error line. The next program line which may be displayed is, then, two lines after the error line.

Trace

When the calculator is in the 'Trace Mode' of operation, any line number which contains a 'WAIT' statement is displayed during the execution of the 'WAIT' statement.

Typing Aid Keys

'Delete Line' operations cannot be performed on typing aid keys.

Auto Mode

When a program is being run in the 'Auto Mode' and the program calls an undefined key, ERROR 10 IN LINE (N) is displayed, but auto mode is not cleared.

Print All Mode

When the calculator is in the 'Print All' mode of operation, the execution of very large numbers to large powers may result in more than one error note being printed.

INPUT STATEMENTS

Pressing 'CLEAR' while the calculator is executing an 'input statement' and is in the 'Print All' mode of operation will result with a ? being printed by the 9866A.

COMMON STATEMENTS

Linking into a key (e.g., LINK f Ø) must be followed by 'INIT EXECUTE' if 'common' data is to be used.

The 'common' symbol table memory allotments remain in the calculator if a program which uses no 'common' data is loaded over a program which used 'common' data. This would decrease the amount of user-available memory for the new program.

DEFINED FUNCTIONS or KEYS

If a single line function is called from the keyboard and results in an ERROR note, 'continue' cannot be used to exit the program. (RUN EXECUTE must be pressed.)

When defining or editing a key (e.g., fØ), then 'INIT EXECUTE' must be pressed before 'common' data may be accessed.

If a program calls an undefined variable when the program is in a function, an ERROR is not displayed and the program line-counter is stepped the next line number. The next line is not, however, executed.

If FETCH fØ(TYPING AID KEY) is pressed and followed by LIST EXECUTE, the list operation will not be performed.

STOP KEY

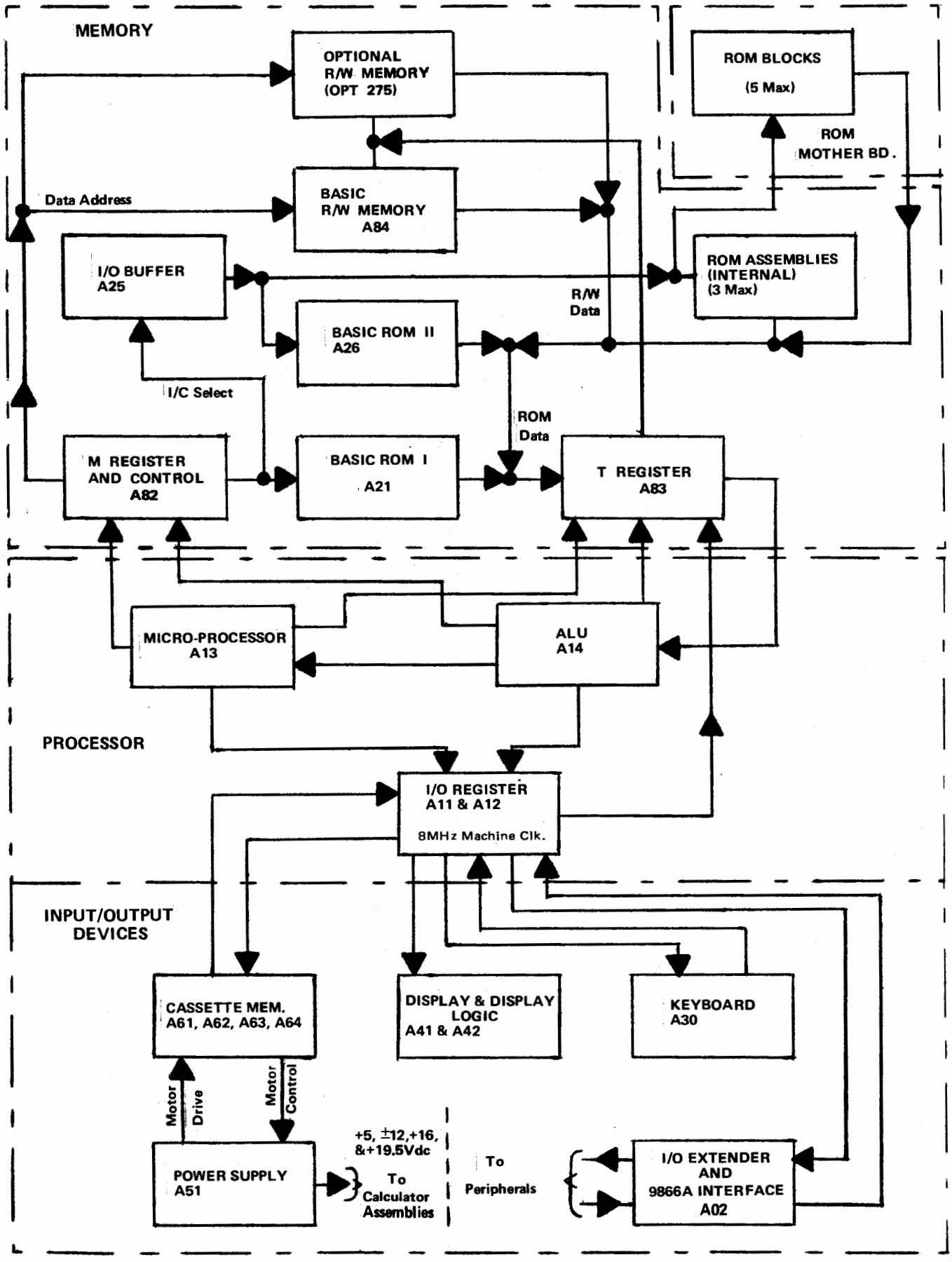
The 'STOP' key should always be held pressed until STOP appears in the display.

FORMAT STATEMENTS (9866A)

If a FORMAT statement is used to suppress a printer carriage return / line feed, then the printer may or may not perform a CR/LF when the program stops. Thus, to clear the printer a CR/LF must be given before the printer is used again.

See Pages 5-2 & 5-3

9830A BLOCK DIAGRAM



ASSEMBLY	ASSEMBLY PART NO.	FUNCTION
+Power Supply (A51)	09830-66551	Provides ±12V, +5V, +16V, and +19.5V dc power for calculator assemblies.
2K R/W MEMORY (A84) 4K R/W MEMORY (OPT275)	09830-69584 11275-69584	User data and program storage and machine bookkeeping (e.g., plug-in ROM addresses) area.
Keyboard (A30)	09830-69530	User data and program input area. Contains logic for inputting key codes into calculator I/O reg.
Display (A41)	09830-69541	Display and LED drive logic.
Display (A42)	09830-69542	Display control logic.
Basic ROM I (A21)	09830-69521	9830A Control and BASIC language storage area.
Basic ROM II (A26)	09830-69526	Extension of ROM I memory.
M-REGISTER (A82)	09830-69582	Memory Control logic.
T-REGISTER (A83)	09830-69583	Controls transfer of data into and out of all memory assemblies.
I/O Assembly (AØ2)	09830-69502	Data is output to peripherals from I/O Ass'y. Also contains some logic for 9866A Printer.
ROM Ass'y or Block	*	Defines special calculator operations (e.g., peripheral control).
+Buffer Assembly (A25)	09830-66525	These assemblies are described in their individual theory of Operations in thi chapter.
+Cassette Assemblies	*	

ASSEMBLY	ASSEMBLY PART NO.	FUNCTION
I/O Register (A11)	09810-69511	Controls inputs and outputs of calculator memory including cassette, keyboards, display, and peripheral data.
I/O Control Assembly (A12)	09810-69512	Controls I/O register (A11). Also contains 9830A clock.
Micro Processor (A13)	09810-69513	Controls M-register operations.
Arithmetic-Logic Unit (A14)	09810-69514	Controls arithmetic functions. Also contains temporary storage register.
Mother Board (AØ1)	09830-69501	Provides connections to all calculator assemblies.
ROM Mother Board (AØ3)	09830-69503	Provides connections from plug-in ROM's to the calculator.

\+ Detailed Theory of Operation descriptions provided in this manual.

* More than one assembly, see replacable parts lists.

+5V POWER SUPPLY

Refer to the +5V Schematic, Figure 5-1, a simplified drawing of the +5V power supply, and Figure 5-2, a representation of the significant power supply waveforms, during the following presentation.

The +5V power supply utilizes a switching regulator technique to provide maximum output current with minimum heat dissipation by the series pass transistor. Since Q1 only draws current when saturated, power dissipation in Q1 is minimized. The +12V power supply provides the reference voltage for the +5V supply.

> CAUTION
> THE +5V POWER SUPPLY MAY BE DAMAGED IF THE SUPPLY IS OPERATED WITHOUT BEING PROPERLY HEAT SUNK.

Q1 is switched by a small voltage difference between U1 pin 2 and U1 pin 3 (inputs to the IC operational amplifier). A +5V reference is established on the amplifier non-inverting input (pin 3) by voltage divider R8 and R9. C14 ensures that the +5V reference does not appear on U1 pin 3 before the +5V sense voltage (E out) appears on U1 pin 2. If the +5V reference should appear first, Q3 switches ON and disables the supply. (An example of this is when a 9800 Calculator is switched OFF then ON very quickly.) When the supply output is less than the reference voltage, U1 switches ON. The +19V Q1 collector voltage, divided by R6 and R36, establishes a higher reference voltage, (See Figure 5-1). When the supply output increases to the higher reference voltage, U1 switches Q1 OFF and the previous reference decreases to the level originally extablished by R8 and R9. Q1 is switched ON when the voltage output is again equal to the reference voltage.

Functional Description

The Q1 output is a 20V square wave, which is filtered by L1, C6, and C27. The output of the filter (+5V) is the average of the Q1 collector signal. CR9 provides a continuous path for inductor (L1) current when Q1 is OFF. L2 isolates the capacitance of C6 and C27 from external filter capacitance, couples the ripple voltage to the +5V sense line and provides additional +5V filtering.

+5V Protection

The +5V supply is short-circuit protected by Q3. Q3 is switched ON if either of two conditions occur:

1. If the +5V reference appears on U1 pin 3 before the sense voltage is +5V.
2. If the sense voltage is more than .6V below the reference voltage (+5V output shorted to ground or a negative supply).

Q3 switching on clamps the operational amplifier output to the sense voltage (e.g., ground), thus Q1 is switched OFF.

Over-Voltage protection is provided by Q11, CR11 and Q3. (An over-voltage condition will occur if either Q1 is shorted or the +5V supply should become shorted to a more positive supply.) When the +5V supply exceeds approximately 5.2V, CR11 begins conducting and switches Q11 ON. Q11, then, clamps the +5V Bus to ground, which switches Q3 ON, thus switching the supply OFF. (Q11 remains conducting until the instrument power is switched OFF.)

> **CAUTION**
> THE +5V POWER SUPPLY IS NOT CURRENT LIMITED. A FAILURE WHICH RESULTS IN EXCESSIVE +5V CURRENT MAY CAUSE DAMAGE TO THE INSTRUMENT.

Power On Preset (NPOP)

The one-shot (U5) is triggered as the +5V supply output is rising from Ø to +5V. The one-shot Q output switches Q8 ON, thus generating the (low) 'power on preset' (NPOP) pulse.

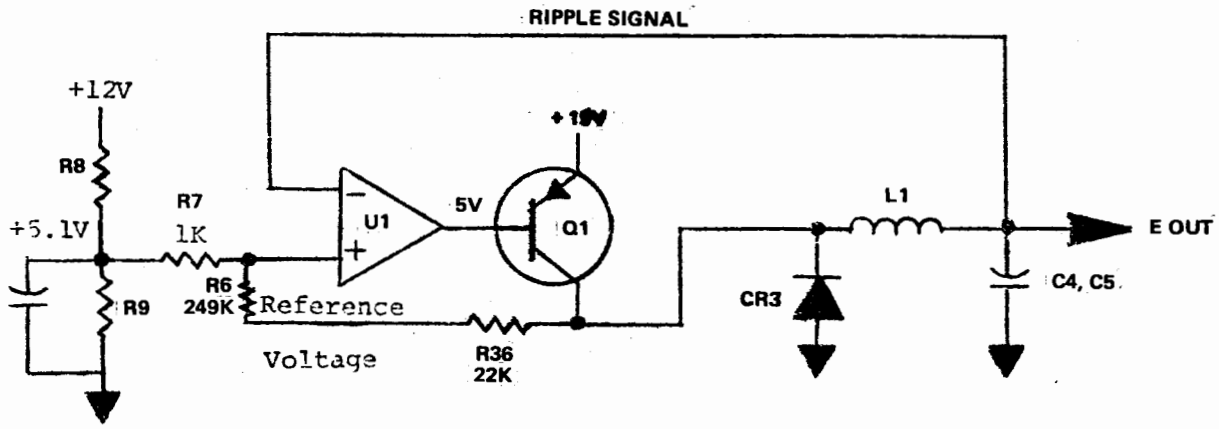
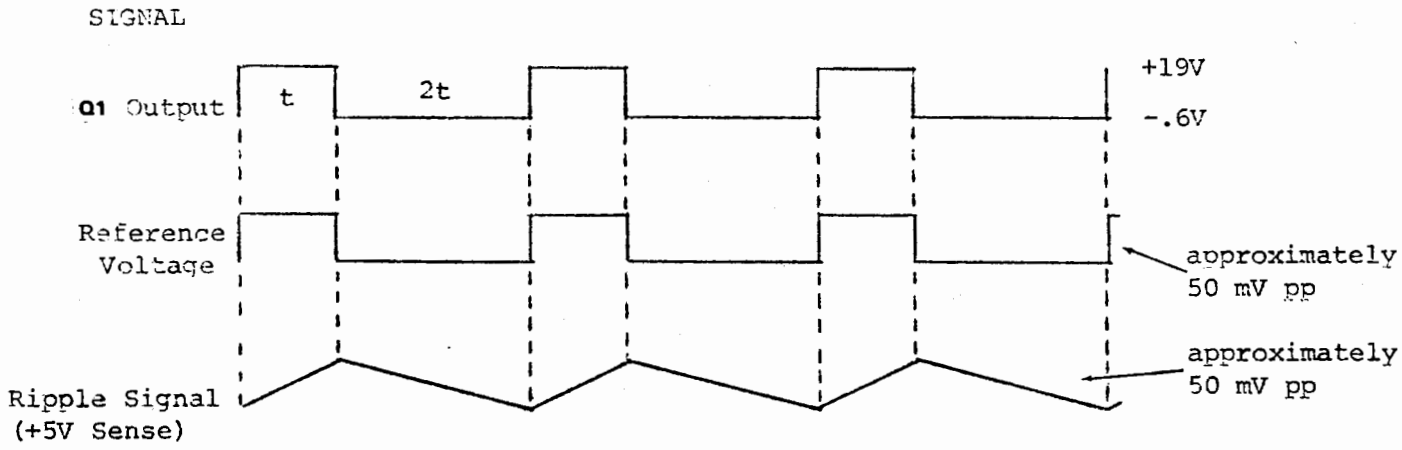


Figure 5-1. +5V Simplified Schematic.



NOTE: When the reference voltage and the ripple signal are approximately equal, Q1 switches conduction states.

NOTE

When the reference voltage and the ripple signal are approximately equal, Q1 switches conduction states.

Figure 5-2. Power Supply Waveforms.

+12V POWER SUPPLY

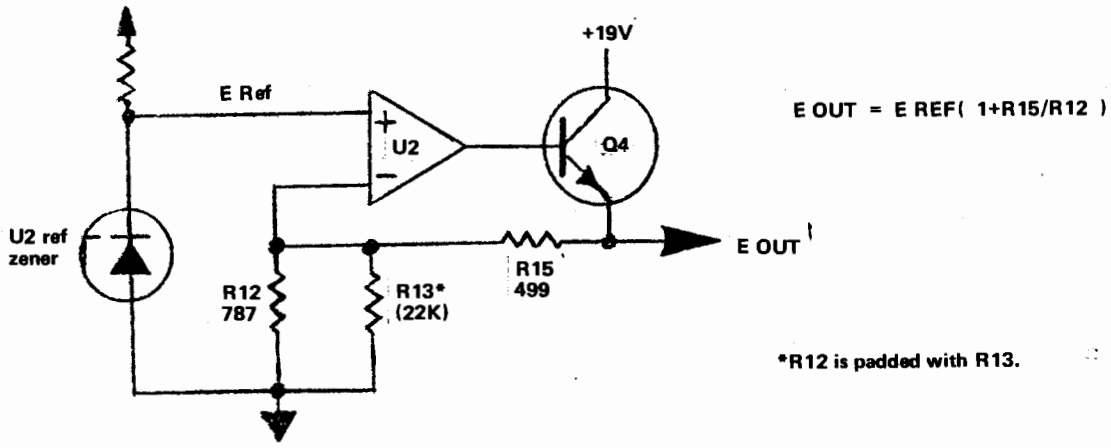


Figure 5-3. +12V Power Supply Simplified Schematic

Figure 5-3 is a simplified drawing of the +12V power supply and should be referred to during the following presentation.

> NOTE
> The +12V power supply is the reference for all other power supplies, and must be operative before any other supply will switch on.

The U2 internal reference zener diode provides a +7.15V reference for the (U2) operation amplifier. The +12V supply functions as a non-inverting amplifier which amplifies the zener reference voltage. The gain of the amplifier is determined by the ratio of R15 to R12. Since the feedback through R15 and R12 regulates the supply output, varying R12 (by changing R13) varies the supply output.

+12V Protection

R4 (in conjunction with U1) provides current limiting for Q4.

Q12 and CR15 provide 'over-voltage' protection. When the supply output increases to +13V, CR15 begins conducting and switches Q12 ON. Q12, then, clamps the supply output to ground.

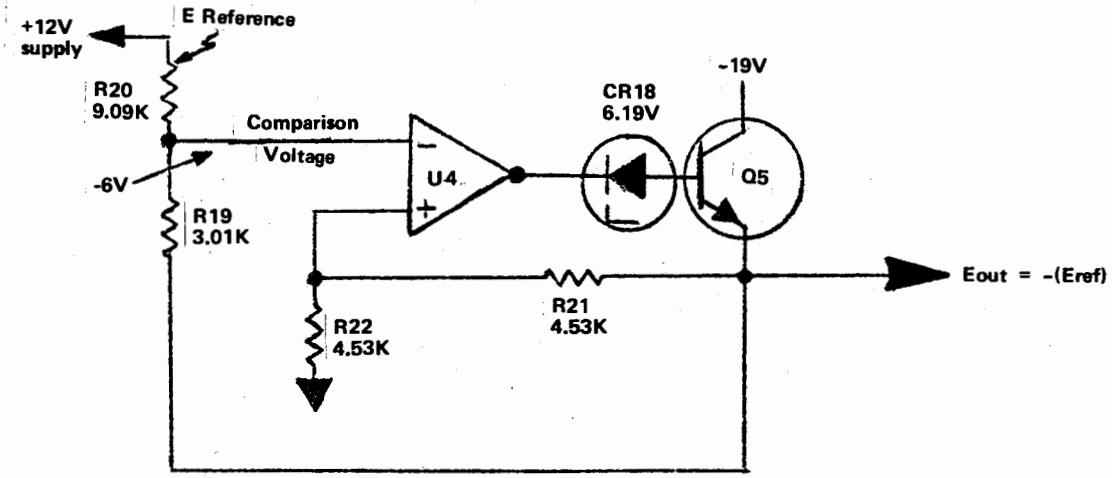


Figure 5-4. -12V Power Supply Simplified Schematic.

-12V POWER SUPPLY

Figure 5-4 is a simplified drawing of the -12V power supply, and should be referred to during the following presentation.

The -12V power supply reference voltage is determined by the +12V and -12V outputs through R19 and R20. If the +12V supply increases, U4 senses the +12V increase and increases the Q5 output an equal amount. When the -12V supply is of equal magnitude to the +12V supply, the

-12V POWER SUPPLY (cont'd)

reference voltage will, again be -6V. In this manner, the -12V supply is forced to precisely 'track' the supply. Thus, changing the value of R13* changes the output of both the +12V and -12V power supplies.

R22 and R21 provide feedback to stabilize the -12V supply and, in conjunction with R19 and R20, determines the supply output. (See the +12V supply presentation.)

CR18 shifts the level of the U4 output by 6.19V to provide proper biasing for Q5.

-12V Protection

R17, with U4, provides current limiting for Q5.

Q13 and CR19 protects 'downstream' devices should the -12V supply become more negative than -13V.

9830A +16V POWER SUPPLY

Figure 5-5 is a simplified drawing of the +16V power supply and should be referred to during the following presentation.

9830A +16V Power Supply (cont'd)

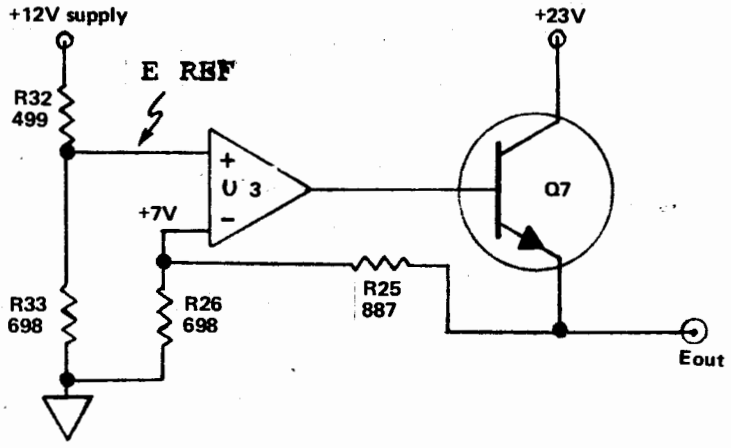


Figure 5-5. +16V Power Supply Simplified Schematic.

The +16V power supply functions as a non-inverting amplifier which amplifies the reference voltage (+7V) by an amount proportional to one plus the ratio of R25/R26.

The reference voltage is determined by the ratio of R32/R33 and the +12V supply output. This provides a reference voltage of +7V that follows the +12V supply.

+16V Protection

R23 (in conjunction with U3) provides current limiting for Q7.

Q14 and CR21 provide 'over-voltage' protection. Q14 is switched ON by CR21 if the -16V output increases to a voltage greater than -18.2V; thus, the supply output is clamped to ground.

19.5V POWER SUPPLY

The +19.5V power supply consists of pass transistor Q10, biasing diodes CR23 and CR24, and half-wave rectifier CR8. The power supply output voltage is related to the ac voltage on the secondary of the power transformer, T1.

+19.5V Protection

CR22 prevents the power supply from exceeding +20V dc. If the +16V power supply output is less than +16V, or if the +16V supply is not ON, the +19.5V power supply is clamped to the +16V output by CR22.

THE INTERNAL CASSETTE MEMORY

This section provides the principles of the operation of the internal cassette memory. It is presumed that the reader is thoroughly familiar with normal cassette memory operation, and has had some experience with calculator and cassette memory operations.

Logic Definitions

Except where otherwise noted, the following logic conventions are used when describing cassette memory signals:

A. Logic levels are nominally Ø volts or +5 volts; ØV is referred to as the 'low' state and +5V is referred to as the 'high' state.

B. Logic signals are given three character mnemonics as listed in Table 5-1. The mnemonics are of two types:

1) Those preceded by the letter 'N' (not); these signals are low when true and may be seen on the schematics as a three-character mnemonic with a bar over all three characters; i.e., NFTC = $\overline{\text{FTC}}$ = a low-true, fast-tape command.

2) Those signals preceded by the letter 'Y' (yes); these signals are high when true and may be shown on the schematics as a three-character mnemonic. For example, a high LEADER signal would be either YLDR or LDR.

References

Located at the beginning of the Theory of Operation for each assembly, are various illustrations that should be referred to while that description is being read.

TABLE 5-1(a)
MNEMONIC LIST FOR THE CASSETTE MEMORY

AGD	Analog Ground
ARA	Analog Read A
ARB	Analog Read B
BFD	Blank Film Detect
CEO	Calculator Ready
CGD	Chassis Ground
CIN	Cassette In Place
CFI	Calculator Flag Input
CNT	Control (I/O card to 9865A)
CO (Ø-3)	Select Code (from Calculator)
DI (Ø-7)	Data Input (to Calculator)
DO (Ø-7)	Data Output (from Calculator)
FLG	Flag (from 9865A to I/O)
FTC	Fast Command
ID (Ø-7)	Input Data (9865A to I/O)
INT	Interrrupt
IS (Ø-3)	Input Status (9865A to I/O)
LDR	Clear Leader
LGD	Logic Ground
MCM	Motor Common
MCT	Motor Control
MFR	Motor Forward
MGD	Motor Ground
MLS	Mini-Loudspeaker Signal
MRV	Motor Reverse
OD (Ø-7)	Output Data (I/O to 9865A)
OS (Ø-3)	Output Status (I/O to 9865A)
POP	Power ON Preset
RCL	Read Clock
RDT	Read Data

TABLE 5-1(b)
MNEMONIC LIST FOR THE CASSETTE MEMORY (cont'd)

RMK	Read Mark
RNC	Run Command
RVC	Reverse Command
RWD	Rewind
SCD	Select Code
SI (Ø-3)	Status Input (I/O to Calculator)
SIH	Service Interrupt Inhibit
SO (Ø-3)	Status Output (Calculator to I/O)
SFR	Solenoid Forward
SRV	Solenoid Reverse
SSI	Service Interrupt Request (to Calculator)
STP	STOP (internal in 9865A logic)
THA	Threshold A
THB	Threshold B
WCL	Write Clock
WDA	Write Data A
WDB	Write Data B
WDT	Write Data
WEN	Write Enable
WMK	Write Mark
WPT	Write Permit (from light sensors when tabs are removed)
WTC	Write Command

INTRODUCTION

General Description

The following discussion refers to Figure 5-6.

The cassette memory adds to the basic memory storage capability of a Model 30 Calculator. Control of the internal cassette memory is accomplished by internal calculator circuits. Thus, the internal cassette memory does not require the use of an additional ROM assembly.

The function of the I/O Card (A61) is to provide the cassette memory select code and to coordinate and buffer the data exchange between the cassette memory and the calculator. The I/O Card also contains the 'Tone Generator' one-shot, U14. When the sending device has data to be transferred, the I/O accepts the data, performs any necessary buffering and logic operations, and outputs the data when the receiving device is ready. Power for the I/O Card is provided by the calculator.

The Control Logic Board (A62) decodes the ASCII and STATUS outputs from the I/O Card (A61) when the cassette memory is receiving data from the calculator and compiles the ASCII data when the cassette memory is sending data to the calculator. The Control Logic Board determines the sequence of events which occurs in either a read or write operation. The control logic also responds to transport and system status conditions and translates the (read/write) data signals going to and from the Read/Write Board (A63).

The Read/Write (R/W) Board has two major functions:

A. In the write mode, it encodes bit serial data into two-channel Bit-Mark Sequence (BMS) data to be stored on the magnetic tape.

B. In the read mode, it decodes the two-channel, analog, BMS data from the tape into clock, mark, and bit-serial pulses.

General Description (cont'd)

The Motor Control Board (A64) determines and monitors the speed of the tape-drive motors. Outputs of the Motor Control Board provide high and low-speed bidirectional tape movement through two drive motors that are located in the transport assembly.

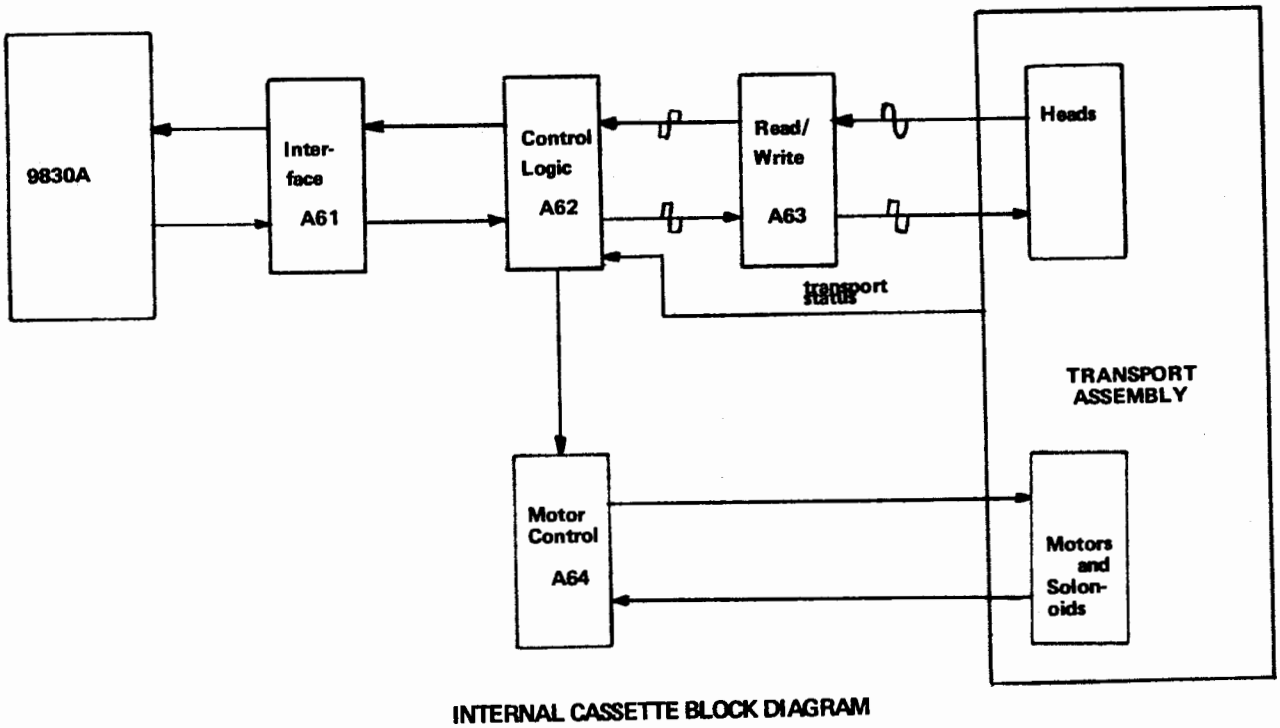


Figure 5-6. Cassette Memory Block Diagram.

FILE MARKING FORMAT

The format shown below is used when each file is marked. Each file consists of a file-header, a file-body, and a length of slack tape. The length of each file is determined by the file-size specification.

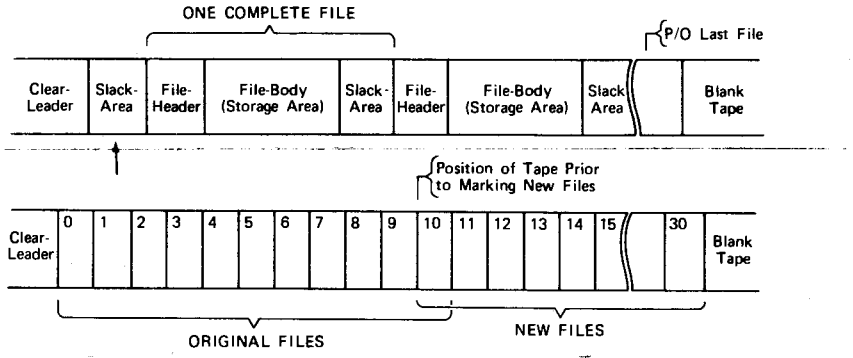


Figure 5-7. The File Marking Format.

The file-header contains information such as the beginning of file mark, the file number, type (data, program, or unused), absolute size, and current size (number of registers currently in use). The file-body contains space for storing a specified number of data (registers). The slack-tape, which is at the end of each file, provides an area within which the tape stops after each cassette control operation (see arrow in Figure 5-7). When the tape is stopped within the slack-tape area of one file, the cassette memory is ready to record into, load from, or identify, the next file on the tape.

The 'Beginning of File mark' (BOF) is the only CONTROL (or INTERRUPTING) character that is marked on the magnetic tape. The BOF is written at the beginning of each File Header. The File Header is used to determine the location of the tape during 'FIND FILE' operations.

CASSETTE MEMORY I/O CARD (A61)

Refer to Interface (A61) Schematics

Cassette Memory Operations

Each cassette memory operation begins by the calculator checking the cassette memory status. This is accomplished by the calculator addressing the peripheral and holding the CALCULATOR READY (NCEO) signal high. The peripheral address (select code) is decoded by U7a,b, and c, and, when the select code is correct, U5c is enabled; thus U1 is enabled and outputs cassette memory status to the calculator.

If the calculator finds the status conditions satisfactory for further operations (the leader status bit, SI2, is ignored) the CALCULATOR READY (NCEO) is forced low disabling U5c and enabling U5b. U5b enables U2 and U3. In this condition, the I/O card is set for mutual data exchange between the calculator and the cassette memory.

When U5b is enabled, its output is seen by the Control Logic Assembly (A62) as a control (YCNT) signal which causes the control logic to begin processing the calculator output data.

The U5b output is also the D input to U10a, and, when the signal FLAG (YFLG) is received from the control logic, U10a is clocked and U4d is enabled. U4d, when enabled, outputs the signal CALCULATOR FLAG INPUT (NCFI), which informs the calculator that the cassette memory has begun processing the calculator output data and has data for the calculator on the I/O card output lines (DIØ-D17).

If the cassette memory is performing an operation (correct select code and NFLG low) and the cassette door is opened, U10a is preset causing U4d to output the high signal CALCULATOR FLAG INPUT (NCFI). The calculator then checks the cassette memory status (as previously described)

Cassette Memory Operations (cont'd)

and the operation is aborted.

Interrupt Operation

When used with the MODEL 30 calculator the cassette memory can request calculator service if U13c is enabled by any one of the following conditions occurring:

A. If the cassette door is opened.
B. If the cassette runs onto the clear leader.
C. If the cassette memory reads an interrupting character on the tape. (The only interrupting character is the beginning-of-file mark.)

The U12b output clocks U13, and, if the D input of U13 is high, U4b and U4c are partially enabled. The D input of U13 is high if the cassette memory is in the CONTROL MODE (ISØ high), NPOP is high, NCEO is low, and the select code is correct.

U4b and U4c are enabled by U13 if the signal SERVICE INTERRUPT INHIBIT (NSIH) is high, and output the peripheral SELECT CODE (NSCD) and SERVICE INTERRUPT REQUEST (NSSI) to the calculator.

CONTROL LOGIC ASSEMBLY (A62)

Refer to Control Logic Schematics

Power ON Preset

A 'POP' circuit is included on the Control Logic Board to ensure that the cassette memory powers up in the proper mode. The 'POP' circuit consists of Q1, CR2, and C1.

When the cassette memory is initially switched ON, +5V is applied to the input of inverter U2 and C1 begins charging to +5V through R1. A charge on C1 of approximately 2.7V causes the Zener diode CR2 to break down. CR2 conducting through R3 switches Q1 on. Q1 conducting through R2 forces the input of U2 to a logical Ø.

The initial high U2 input is inverted to make a NPOP pulse. This pulse ensures that U10c is disabled. The low U10c output clears the data latch (U20), disables U1b and U16d, and clears flip-flops U15a and b.

When Q1 is switched on, the NPOP pulse is removed from the logic circuits and the control logic is ready to begin processing data from the I/O Card.

Status Data Processing

Table 5-2
INPUTS

Operation	FAST OSØ	REVERSE OS1	WRITE OS2
Forward	low	low	low
Fast Forward	high	low	low
Reverse	low	high	low
Fast Reverse	high	high	low
Write	low	low	high

The status data outputs of the I/O Card appear on data lines OSØ-OS3 as control logic command inputs. These commands are used as inputs to U10 (a one-of-ten bit decoder) and U20 (a data latch).

Data lines OSØ - OS2 input data to U10. A fourth input to U10 comes from the control one-shot (U7) $\overline{Q}$ output. U7 has a 300nS output when triggered by the positive edge of the control (YCNT) input from the I/O Card.

When the calculator STOP key is pressed, the decoder's B and D inputs go low and the A and C inputs go high, causing the pin 6 output to go low. This low is the signal STOP (NSTP) that disables U10c, presetting the control logic as described in the 'POP' section.

The 300nS Q output of U7 partially enables U16a. U16a is fully enabled if the latch, U20, shows the cassette memory to be in the write mode (pin 12 high). The U16a output is the LOAD signal for the 9-bit shift register, which causes the shift register to store the data from the I/O assembly.

Status Data Processing (cont'd)

The output of the decoder cannot be low unless the D input is low. The D input is low only when U7 has a 300nS output, at which time the inputs are decoded and one low input forces the output(s) low. The low decoder output clocks the data latch (U20), presets the Run flip-flop, and the trailing edge of the decoder output clocks the Rewind flip-flop.

When the clock input of U20 is low, the outputs of the data latch follow the inputs. The data is latched at the trailing edge of the 300nS decoder output.

The low preset input to the Run flip-flop forces the Q output high, thereby enabling U17c (which enables the motor drive circuits on the Motor Control Board), and partially enabling U16b. The Q output is also the signal RUN ENABLE for the Divide-by-ten logic circuits which are described later in this section.

A high signal on data line OS2 (when latched by U20) fully enables U16b. The high U16b output is seen by the R/W Memory Board as a WRITE COMMAND (YWTC) signal. The WRITE COMMAND (YWTC) signal also goes to U2, U14, U8a, U8b, U17d and the 3 KHz Clock. Each of these logic operations are described in the Control Logic ASCII Translation section of this chapter.

U15a is the Rewind flip-flop and is preset by a (low) REWIND (NRWD) signal when the REWIND button is pressed. If the cassette memory is not performing a calculator command, U15b is cleared, enabling U16c, and a RUN-FAST-REVERSE command is initiated to the Motor Control Board. The rewind operation is terminated by either the tape running onto the clear leader (which clears U15a) or a new calculator command presetting U15b.

Control Logic Operation Commands

The outputs of the data latch (U20) enables the proper gate U17a,b and c. (U16b) was described in the Status Data Processing section.) The combined outputs of these three gates and U16b, determines the operation which the cassette memory is performing. See Table 5-3.

Table 5-3.
OUTPUTS

	U17a	U17b	U17c	U16b
OPERATION	FTC	RVC	WTC	RNC
Forward	1	1	0	0
Fast Forward	0	1	0	0
Reverse	1	0	0	0
Fast Reverse	0	0	1	0
Write	1	1	1	0

The Operation Command outputs are seen by the R/W Board or Motor Control Board as commands to perform the operation(s) indicated by the combination of all four commands. The outputs are also used in other control logic operations, and frequent reference to them is made throughout the remainder of the Control Logic Assembly description.

Status Outputs

The Control logic four status signals to the I/O Card. These outputs are:

Table 5-4

ISØ. . . . . Mode (high=control; low=data mode)
IS1. . . . . WRITE PERMIT (NWPT)
IS2. . . . . CLEAR LEADER (YLDR)
IS3. . . . . CASSETTE IN (NCIN)

Status Outputs (cont'd)

Each calculator command contains a (Control/Data) MODE signal on data line SO3. The I/O Card outputs this signal to the control logic (OS3) where it is latched by U20. The output of U20 pin 10 is buffered by U10a and serves as one input of U4. The U10a output appears on data line ISØ, and is one input to U18a. U18a and U4 are described later in this section.

The signal WRITE PERMIT (YWPT) comes from the tape transport assembly, and is high if the tape cassette is not protected. The WRITE PERMIT signal is inverted and appears as a NWPT signal on data line IS1.

The control logic monitors and outputs the two tape transport status signals LEADER (YLDR) and CASSETTE IN (NCIN).

The LEADER (YLDR) signal enables U1a. (U1a is a Schmitt-trigger input gate, and serves as a filter on the LEADER [YLDR] input line to prevent line noise interferrence with cassette memory operations.) The U1a output is inverted and clocks the RUN flip-flop which disables U17c. The U1a output is also inverted and appears on data line IS2.

U1b is partially enabled by the CASSETTE IN (NCIN) signal, which is an output on the IS3 data line. A high U10c output, and a high INTERRUPT (NINT) signal from the I/O Card fully enables U1b. The low U1b output enables U9c and U9c partially enables U16d. U16d is fully enabled by a high LEADER (NLDR) input signal. The U16d output is the 'clear' input to U15a. Both U15a and b require a low 'clear' input, and if an input to U1b is low, or if the LEADER (NLDR) signal is low, the two flip-flop outputs disableU16c and U17c to abort the operation. The cassette must be in place before any further operations can be performed. However, the tape can be moved off of clear leader to perform new operations whenever necessary.

ASCII Data Translation

U3e, U4, U5b, U12a, and U12b comprise a nine-bit shift register. During write operations, the shift register is loaded parallel by the LOAD signal from U16a. The ASCII data is then translated and shifted to U3 pin 10 to be written on the tape. During a read operation, the data from the R/W Board is clocked (by a clock signal from the tape) serially from the D input of U5b into the shift register and loaded parallel onto the output lines. When U9b outputs a FLAG signal, the I/O inputs the parallel data.

During write operations, WRITE CLOCK (YWCL), WRITE DATA (YWDT), and WRITE MARK (YWMK) signals are control logic outputs to the R/W Board. During read operations, the signals are inputs to the control logic from the R/W Board as READ CLOCK (NRCL), READ DATA (YRDT), and READ MARK (YRMK) signals. When the 'read' signals are properly sequenced, they constitute a character. The sequence of data is 9 data bits per character; each character separated by a mark. (This sequence, called a Bit Mark Sequence, is described, in detail, in the READ/WRITE Assembly Theory of Operation.

The center bit of the 9-bit character is called a CONTROL bit. If the center bit is a logical 1 the character is a control character; a logical Ø constitutes a data character.

3 KHz Write Clock

One-shots U6 and U13 make up an asymmetrical 3 KHz clock. U6 has a high output for 133uS and a low output for 200uS (R9 is padded by R10 to give a 3 KHz rate at TP1).

3 KHz Write Clock (cont'd)

The trailing edge of the U6 Q output clocks U13. A high U6Q output partially enables U18d and U10b. The U6 $\overline{Q}$ output enables U12d, and the U12d output clocks the divide-by-ten- counter U14. U14 is also clocked through U12 by a low NRCL signal.

The clock is enabled by the WRITE COMMAND (YWTC) signal (from U16b) on U13 pin 5. The end of the YWTC signal inhibits the clock.

Divide-by-ten Counter (U14)

The Divide-by-ten logic circuits determine the sequence that data is written on the magnetic tape. This data must then be read by the cassette memory in that sequence before it will be recognized by the decade counter outputs a high signal to enable U18c one of every ten 3 KHz clock outputs. (High inputs on pin 2 and 3 force the counter to Ø; high inputs on pins 6 and 7 force the counter to 9.) The output of U18c is high nine counts (0-8) for every 10 clock outputs. The U18c output enables U18d (when the clock is high) for 9 of 10 counts; the low output (9) is inverted to fully enable U10b at a count of 9, when the clock output (TP1) is high.

The output of U18d (enabled 9 of 10 clock outputs) is inverted and seen by the R/W board as a WRITE CLOCK (YWCL) signal. The low output of U18d or a low READ CLOCK (NRCL) signal from the R/W board enables U18b. U18b partially enables U10d. U10d is fully enabled by the RUN ENABLE signal from the Run flip-flop. The output of U10d causes the 9-bit shift register to right-shift during read or write operations.

The output of U10b is high one of ten (9) clock outputs. The U10b output is seen by the R/W Board as a WRITE MARK (YWMK) signal, partially enables U12c, and is inverted to clear U8b.

Divide-by-ten Counter U14) (cont'd)

U12c is fully enabled by the high $\overline{Q}$ output of U8a. The U8a output is low when WRITE COMMAND (YWTC) clocks the flip-flop, thus disabling U12c until the counter reaches the first count. At the first count of 9, U18d clears U8a forcing the $\overline{Q}$ output high. The high U8a output together with a high U10b output enables U9b and generates a FLAG each time a character is written.

Flag

The previous discussion described how a FLAG is generated during write operations. U9a, when enabled, also enables U9b to output a FLAG during Read operations. This occurs when a character is read in the data Mode, or when a control character is read in the control Mode. (A control character, or BOF, has been read when pin 5 of U11 is high.)

A STOP signal (from the ROM) also enables the Flag gate U9b, which outputs a FLAG to the I/O Card.

Counter Presetting

U8b, together with a high WRITE COMMAND (YWTC) signal, forces the counter to 9 when the signal WTC first goes high. This forces the first bit written to be a MARK. (U8a prevents a FLAG from being generated at this MARK.) U8b is cleared as soon as this first mark is written.

U5a, together with a high WRITE COMMAND (NWTC) signal, forces the counter to Ø when the logic is in the Read mode and U5a is either preset by a false RUN ENABLE signal (no operations being performed) or clocked (by YRMK) when a Mark has been read.

CASSETTE READ/WRITE MEMORY ASSEMBLY (A63)

Refer to Read/Write Memory Schematics (A63) and Figure 5-8.

General Description

The R/W Memory Board encodes bit-serial data into two-channel, Bit-Mark-Sequence (BMS) data during a Write operation, and decodes the two-channel BMS data (from the tape-head preamplifiers) into clock, mark, and bit-serial data during a Read operation.

During a Read operation, the R/W Board must also determine high or low tape speed and shapes the analog signal from the tape head into a digital signal of the same time duration.

Threshold Detector

The analog signals from the tape-head preamplifiers are proportional in amplitude to the tape speed. The Threshold Detector (U6a and U6b), together with the Tape-Speed detector (Q1 and Q2), converts the tape-head analog signals into digital signals.

> NOTE
> The A- and B- channel Threshold Detectors function in the same manner; therefore, only the A-channel (ARA bit with U6a) is described here.

The signal YARA is the input data from the tape-head preamps to the + input of the operational amplifier (U6a). When the analog signal reaches a large enough voltage level, the U6a output switches from one saturated state to another. The U6a + input and output are of the same polarity; however, the output switches from one saturated state to the opposite state, thus outputting a ±10V square-wave for each ac input signal.

CASSETTE READ/WRITE MEMORY ASSEMBLY (A63)

Threshold Detector (cont'd)

Assuming the YARA input to initially be positive-going, the positive output of U6a is coupled by R14 to the bases of Q3 and Q4. Q3, then switches on, clamping its collector to ground (along with any signal from Q1). Q4 switches off, and the U6a-input senses the voltage present between R8 and R9.

> NOTE
> The voltage levels between R4-R5 and R8-R9 are dependent upon tape speed and are described in the Tape-Speed Detector section of this description.

The negative voltage now present on the - input of U6a determines how far negative the YARA signal must go before U6a switches to the negative output state. When the YARA signal is of a sufficient negative value, U6a switches states, turning Q3 off and Q4 on. The voltage (from Q2) on the collector of Q4 is now clamped to ground and the positive voltage between R4 and R5 references U6a for the next positive input signal.

Threshold Detector Output Shaping

The U6a output is positive limited to approximately +5V by CR3. CR4 clamps the negative portion of the U6a output to ground. The output of CR3 and CR4 is the signal YTHA and is one input of U1a. (The signal YARB, squared by U6b and shaped by CR9 and CR10, is the signal YTHB and one input to U1b.)

Tape-Speed Detector

The signals YARA nad YARB are proportional in amplitude to the tape speed. To prevent tape noise from switching the Threshold Detector,

CASSETTE READ/WRITE MEMORY ASSEMBLY (A63)

Tape-Speed Detector (cont'd)

when operating at high speed, the Tape-Speed Detector outputs a greater dc voltage (proportional to tape speed) to decrease the sensitivity of U6a and U6b. The - input of U6a and U6b is, therefore, polarity switched by Q3 -Q6, and desensitized by Q1 and Q2 increasing the voltage level of the Q3 -Q6 polarity outputs.

A low NFTC (low = FAST TAPE COMMAND) signal switches Q1 and Q2 off. Both transisitors being off allows current to flow through R6 and R7, thus causing an increase in both the positive voltage between R4 and R5 and the negative voltage between R8 and R9 (more negative). Depending upon the Q3-Q4 and Q5-Q6 switching states, the increase in voltage levels is sensed by the - input of U6a and U6b. (When Q3 and Q4 switch states, the opposite polarity is sensed by U6a.) The increase in reference voltage increases the threshold of U6a and b, thus decreasing the sensitivity of the Threshold Detector.

When the NFTC signal is high, Q1 and Q2 are switched on, and R6 and R7 are clamped to ground. This decreases the voltage sensed by Q6a and b and increases the sensitivity of the Threshold Detector.

Read Logic

A low WRITE COMMAND (YWTC) signal enables U1a and U1b, thus enabling the Read logic circuits.

When a MARK is read, both threshold bits (YTHA and YTHB) are high enabling U3c, and U9a is cleared. The high $\overline{Q}$ output of U9a is the signal READ MARK (YRMK), and also disables U5b forcing the READ CLOCK (NRCL) high.

CASSETTE READ/WRITE MEMORY ASSEMBLY (A63)

Read Logic (cont'd)

U5a is enabled when either threshold bit is high and the trailing edge of the U5b output triggers the .5uS one-shot (U8) each time a data bit is read. The U8 output clocks U9a and (with the, now, clocked U9a low $\overline{Q}$ output) enables U5b to generate the .5uS READ CLOCK (NRCL) signal. U9a continues to have a high Q and low $\overline{Q}$ output until the next time a mark is read.

When threshold bit B(YTHB) is high U9b is preset by U5c unless U9a is cleared by a mark. This forces the READ DATA (YTDT) signal low each time YTHB is low.

U9b is cleared each time the YTHA bit is high except when a mark is read, thus generating the signal READ DATA (YRDT) each high channel A bit except for a mark.

Write Logic

The write logic is enabled by both the WRITE PERMIT (YWPT) and WRITE COMMAND (YWTC) signals going high and enabling U1c. The output of U1c switches Q7 on, thus generating the WRITE ENABLE (YWEN) signal.

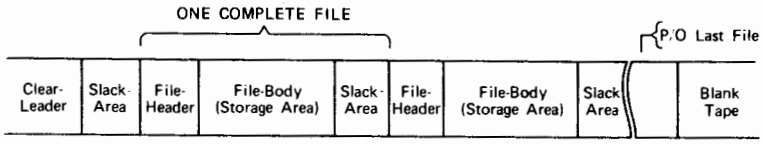
A high WRITE MARK (YWMK) signal enables U3a and U3b, and forces the signals WRITE DATA A and B (WDA and WDB) high for the duration of the WRITE CLOCK (YWCL) signal.

Data is written on the tape when the WRITE DATA (YWDT) signal goes high, forcing the YWDA signal high and the YWDB signal low for the duration of the WRITE CLOCK signal. A low WRITE DATA (YWDT) signal reverses the YWDA and YWDB output levels.

CASSETTE READ/WRITE MEMORY ASSEMBLY (A63)

File Marking Format

The format shown below is used when each file is marked. Each file consists of a file-header, a file-body, and a length of slack tape. The length of each file is determined by the file-size specification.



The File Marking Format

The file-header contains information such as the Beginning of file mark, the file number, type (data, program, or unused), absolute size, and current size (number of registers currently in use). The file-body contains space for storing a specified number of data (registers). The slack-tape, which is at the end of each file, provides an area within which the tape stops after each cassette control operation (see arrow in the above Figure). When the tape is stopped within the slack-tape area of one file, the cassette memory is ready to record into, load from, or identify, the next file on the tape.

The 'Beginning of File mark' (BOF) is the only CONTROL (or INTERRUPTING) character that is marked on the magnetic tape. The BOF is written at the beginning of each File Header. The File Header is used to determine the location of the tape during 'FIND FILE' operations.

MODEL 30 'FIND FILE' operations are similar, except that the cassette memory stops (although it may not be noticable) at each file header between the current and specified files. The calculator then outputs

CASSETTE READ/WRITE MEMORY ASSEMBLY (A63)

File Marking Format (cont'd)

another 'FIND FILE' command until the desired file is located.

Every character that is written on the magnetic tape must be present in a predetermined sequence called a Bit Mark Sequence (BMS). This sequence is a marker bit followed by the nine bit character. The cassette memory does not recognize characters which are not read in the BMS sequence.

Each nine bit character is composed of: four bits-a control bit-four bits. The control bit determines if the character is a control or data character (BOF is the only control character). Each bit of a character uses channels A and B of the magnetic tape as shown in the Table below.

	Channel	A	B
	logical Ø	Ø	1
WDT	logical 1	1	Ø
WMK	marker	1	1

The control bit is a logical 1 for a control character and a logical Ø for a data character.

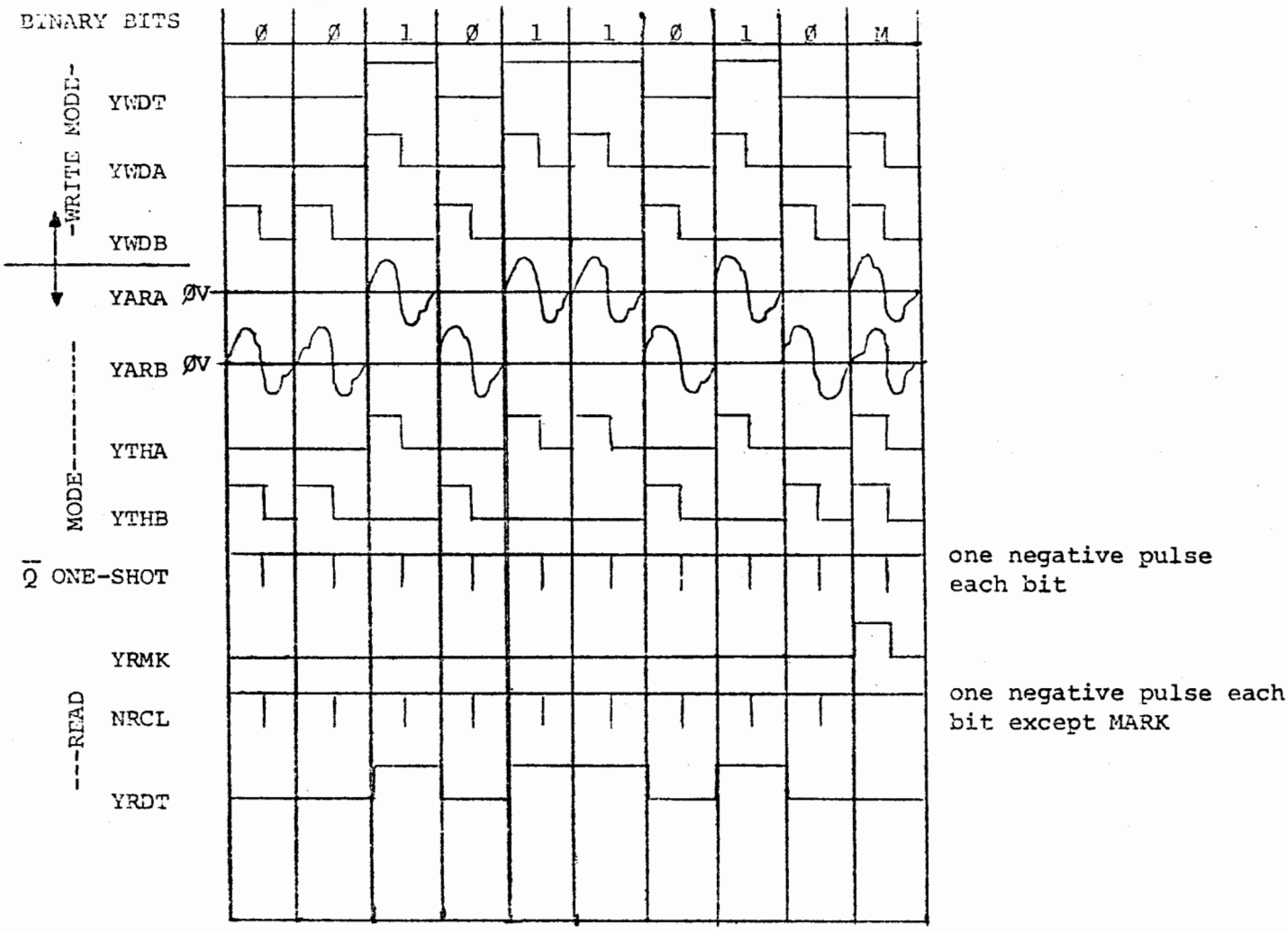


Figure 5-8. Cassette R/W Assembly Waveforms.

MOTOR CONTROL ASSEMBLY (A64)

Refer to the Motor Control Schematics and Figure 5-9.

General Description

The Motor Control Board controls the current (to the transport ass'y) that gives high-low motor speeds and energizes the forward-reverse solenoids. It also regulates the motor speeds, and drive-motor torque is reduced when the Tape Cassette is on the clear leader, thus preventing excessive wear of the transport's tape-drive mechanism.

Motor and Solenoid Drive Circuits

U2 enables either the forward (Q6, Q7, and Q9) or reverse (Q4, Q5, and Q8) driver circuits. Each circuit energizes the solenoid and drive motor that is the collector load for the output transistor.

Motor Drive voltage is applied through the drive motor to the drive transitors. As the motor turns, it generates a back-EMF voltage which is proportional to the speed of the drive motor.

Motor-Speed Detector

The current used by the drive motor must pass through sensing resistor R9. R9, along with R10 - R14 input the motor terminal voltage and a voltage proportional to the total motor current. The signal at the output of U4 is proportional to the drive-motor speed. The U4 output goes to the motor-speed control circuits.

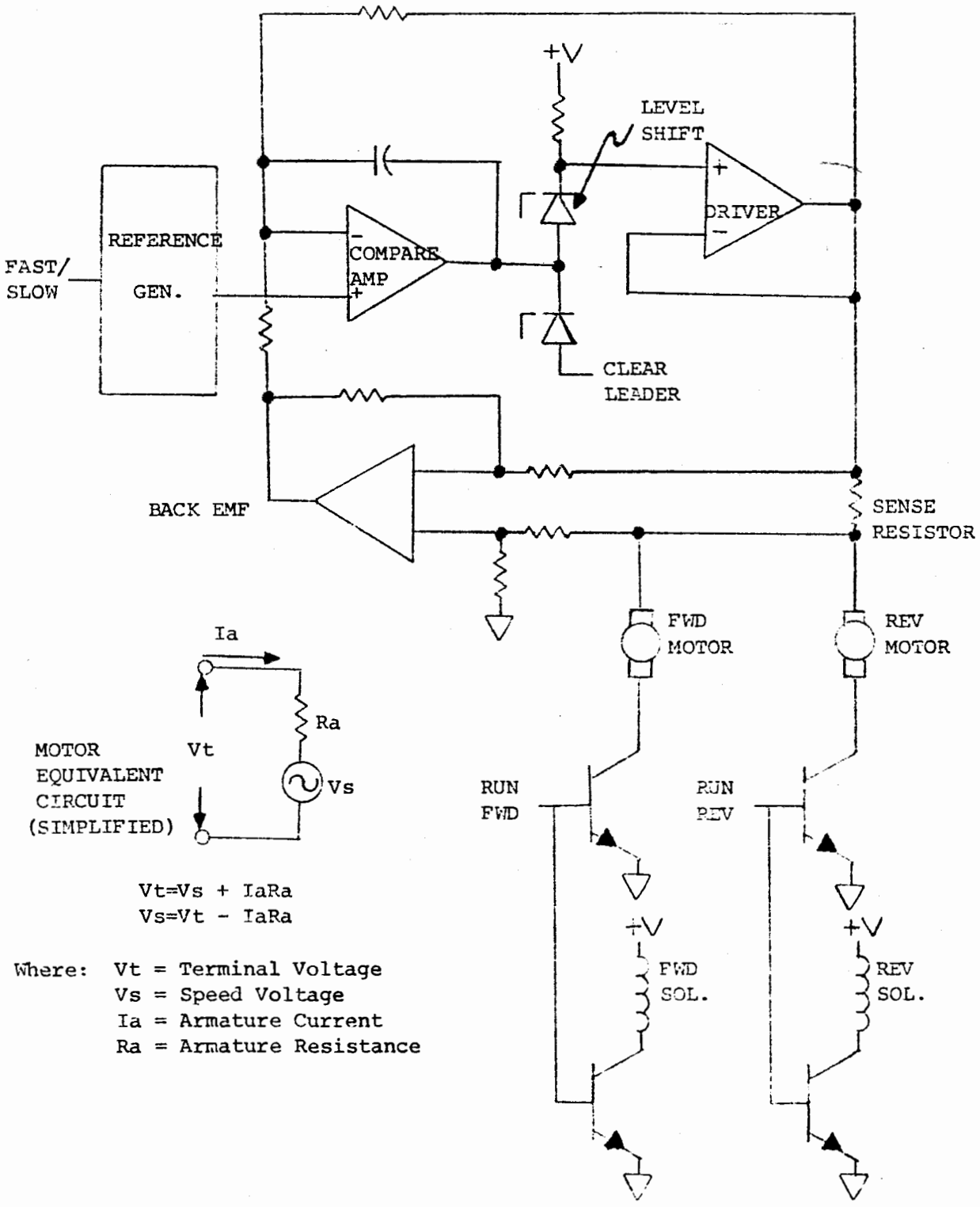
MOTOR CONTROL ASSEMBLY (A64)

Motor-Speed Control

The inputs to U3 are the high-low speed command (NFTC) and motor speed. U3 outputs the difference of the inputs to Q2 through Q1. The (Q2) current through R7 changes the biase on the 'motor pass' transistor (on the A51 Board) and regulates the current available to the drive motors, thus the speed of the motors.

When the tape cassette runs onto the clear leader, Q3 is switched on and reduces the current to the drive motor. The effect of this is to reduce the drive-motor torque to the tape cassette, and reduces wear on the friction-drive mechanism in the transport ass'y. A full torque condition cannot be regained until the end of the high YLDR signal.

Figure 5-9. Cassette Motor Control Assembly Block Diagram.



ROM BUFFER ASSEMBLY (A25)

The ROM Buffer Assembly provides the following:

A. Buffering for the calculator 'ROM ADDRESS' signals.

B. The calculator ROM-Chip Select lines (M9, M10, M11, M12, $\overline{M13}$, and M14+$\overline{DEN}$) are decoded to provide 16 signals which select one of two pairs of ROM IC's within a ROM assembly.

U1, U2, U3e, and U3f buffer the calculator 'ROM ADDRESS' signals which are used to select one specific word in one pair of ROM IC's within a selected ROM assembly. The ROM ADDRESS is seen on all ten output lines.

U6 decodes the calculator outputs to enable one of the sixteen output lines. Enabling a specific 'Rom-chip select' line causes one ROM pair to be addressed (enabled). If a ROM is changed from slot to slot, a different chip select line must be enabled to select the same ROM pair. (This is accomplished by internal calculator 'bookkeeping'.)

The output of the decoder is inverted, then changed to a +12V logic level by the associated 'pull-up' transistor. The 'Rom-chip select' outputs select one pair of ROM IC's in the desired ROM assembly.

Chapter 6
EXCHANGING CALCULATOR ASSEMBLIES

9830A MEMORY CONFIGURATIONS

Two entirely different memory configurations exist for the Model 30 Calculator. Each type of configuration is unique unto itself and cannot be serviced with assemblies from the other type of configuration. The first two hundred instruments (Serial No's 1233A-00101 through 1233A-00300) contain the 'original' memory configuration; all other calculators contain the final or 'standard' configuration.

Units which contain the 'original' memory configuration can be identified by the decal (shown below) and the color of the board extractors on the memory assemblies. The decal may be found on the PC board retainer plate just under the top cover; the memory assemblies' board extractors (on the right side) are red on the original configuration or gray on the standard configuration.

CAUTION

This unit contains the original 9830A Memory Configuration.

M-register	09830-69522
T-register	09830-69523
2K R/W memory	09830-69524

It cannot be serviced with a standard Memory Configuration.

M-register	09830-69582
T-register	09830-69583
2K R/W memory	09830-69584
4K R/W memory	11275-69584

To avoid massive instrument damage refer to Service Note 9830A-1 for servicing instructions.

'Original Memory' Decal

Updating 11290A Service Kits

The initial 11290A Service Kits contain the 'original' memory configuration and can only be used to service calculators which utilize an 'original' memory (Serial No's 1233A-00101 through 00300). Calculator Products Division (CPD) will automatically provide (free of charge) the assemblies necessary for field installation of the 'standard' memory in each kit (see page 6-11) as calculators which utilize the 'standard' configuration are sold in that region. The original configuration assemblies, from the kit, should be returned to CPD.

Repairing Memory Ass'ys in Calculators Serial No's 1233A-00101 through 00300

If the 11240A Kit has not been updated to a 'standard' configuration, the defective 'original' assembly should be replaced with the corresponding kit assembly and returned to CSC (or PCE) as a Blue Stripe assembly. After the kit has been updated, defective 'original' memories should be retrofitted with the 'standard' kit configuration (see page 6-11 for the correct procedure). The 'original' calculator memory assemblies should be returned to CPD, at which time new assemblies will be provided (free of charge), for the kit, by CPD.

IMPORTANT NOTE

DO NOT RETROFIT AN 'ORIGINAL' MEMORY CONFIGURATION TO A 'STANDARD' CONFIGURATION UNLESS THE 'ORIGINAL' MEMORY IS DEFECTIVE.

ASSEMBLY ACCESS

WARNING

SOME OF THE ASSEMBLY ACCESS INFORMATION PROVIDED HEREIN PROVIDES ACCESS TO THE AC INPUT POWER ASSEMBLIES. THE AC POWER CORD MUST BE DISCONNECTED BEFORE ACCESSING THESE ASSEMBLIES.

The following procedure should be used to obtain access to a calculator assembly. Figures 6-1 through 6-11 show the various assemblies as they are removed.

1. Remove the top cover by removing the six screws that secure the cover to the chassis, then lift the cover out of the calculator.
2. Remove the screw which holds the top retainer plate in position, thus allowing the removal of both retainer plates.

ASSEMBLY ACCESS

Steps 1 and 2 provide access to most calculator assemblies. The remainder of this procedure provides assembly access information for the power supply (A51), rear panel components, keyboard (A34), display (A41), display logic (A42), cassette transport (A65), and mother board (A1).

3. To remove the keyboard, remove the four screws in the bottom of the calculator which hold the keyboard to the chassis. Next, pull the keyboard forward approximately three inches. (See Figure 6-5.)

> CAUTION
> DAMAGE TO THE KEYBOARD SIGNAL CABLE MAY OCCUR IF THE KEYBOARD IS PULLED TOO FAR FORWARD.

Moving the keyboard forward three inches provides access to the display logic (A42) and the keyboard signal-cable connector.

4. The keyboard signal-cable connector is approximately in the center of the calculator, and just forward of the display assembly (A41) (See Figure 6-5). Once the signal cable is disconnected from the calculator, the keyboard may be removed and the ac power connector (See Figure 6-6) may be disconnected. The display (A41) assembly may be removed after the screw in center of the pc board is first removed.
5. To remove the cassette transport, remove the two screws which hold the transport in place. Then, lift the transport out of the calculator. (See Figure 6-7.)

ASSEMBLY ACCESS

> NOTE
> When the transport assembly is installed into the calculator, the transport door must be aligned with the calculator keyboard and must open only when the 'OPEN' lever is pulled. This is accomplished by loosening the two transport adjustment screw (See Figure 6-5) and making the proper adjustments. Then, tighten the two screws and check the transport door for alignment and proper operation. The door 'OPEN' mechanism (See Figure 6-6) must then be checked and, if necessary, adjusted using the two screws which secure the lever to the chassis.

6. The rear panel components may be accessed by laying the calculator on it's top and removing the three screws (in the bottom). Then place the calculator upright and loosen the two 11/32" nuts which hold the top of the rear panel to the chassis. DO NOT REMOVE THE TWO 11/32" NUTS. Next, remove the I/O Assembly (See Figure 6-10). Pull the rear panel free of the calculator chassis (See Figure 6-9).
7. The calculator mother board may be removed (after first removing all of the pc assemblies, mother board screws, door open lever, and ROM cage) by sliding the board out the front of the calculator.
8. The calculator assemblies may be installed by reversing steps 1 through 7.

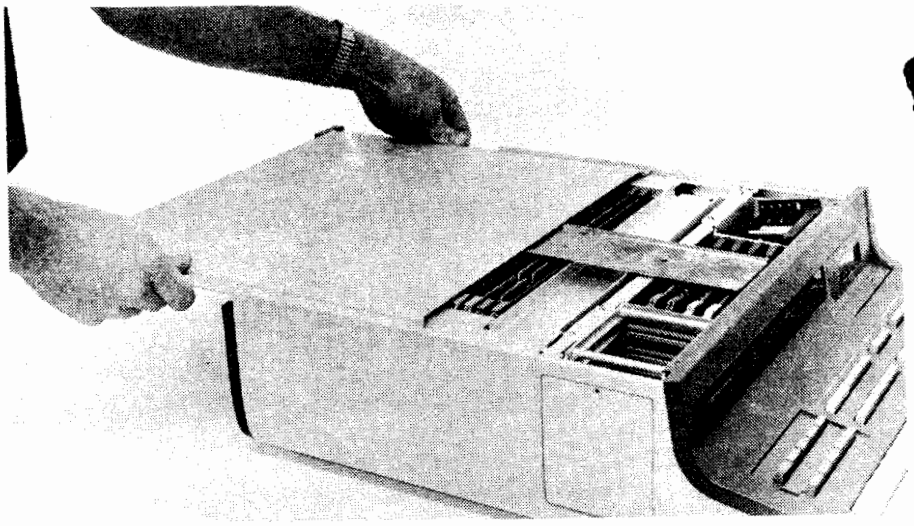


Figure 6-1. Removing the Calculator Top Cover.

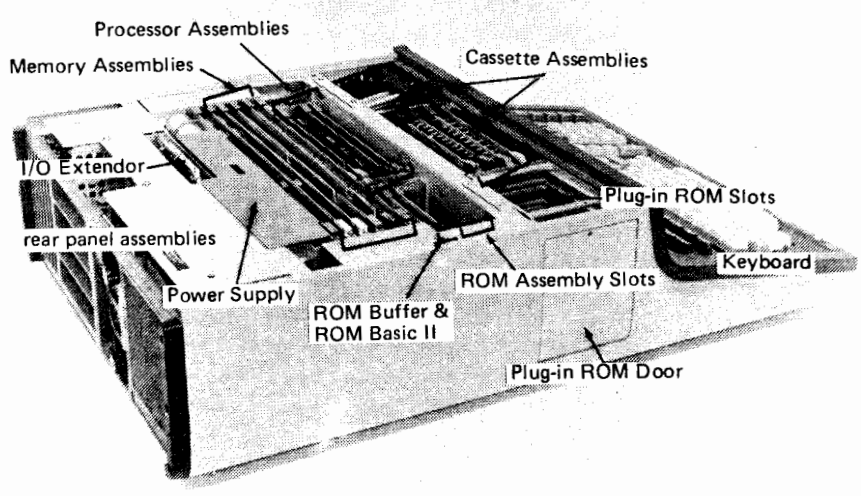


Figure 6-2. The Calculator Assemblies.

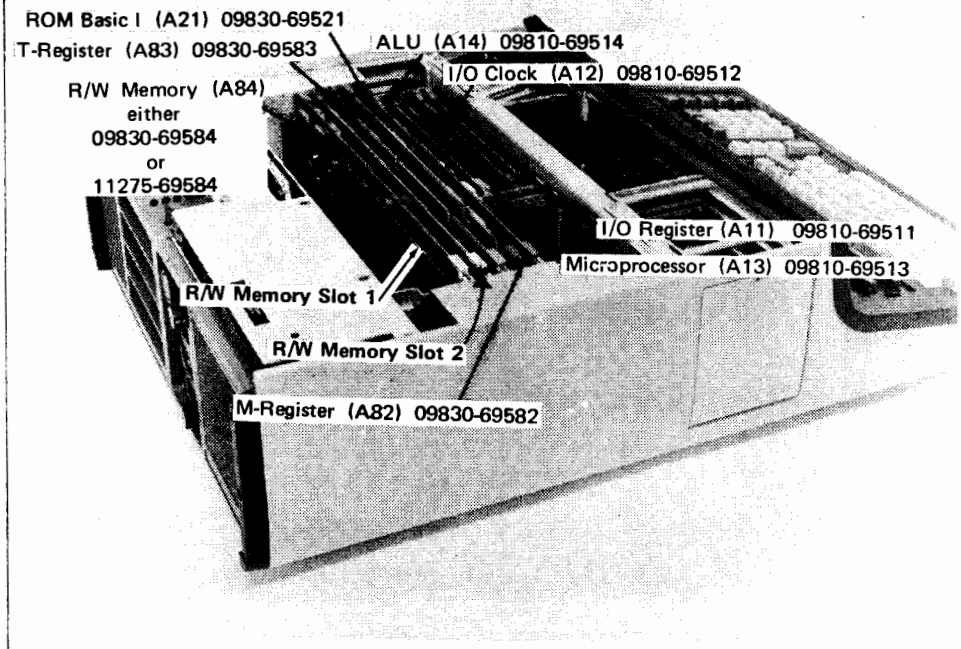


Figure 6-3. The Processor and Memory Assemblies.

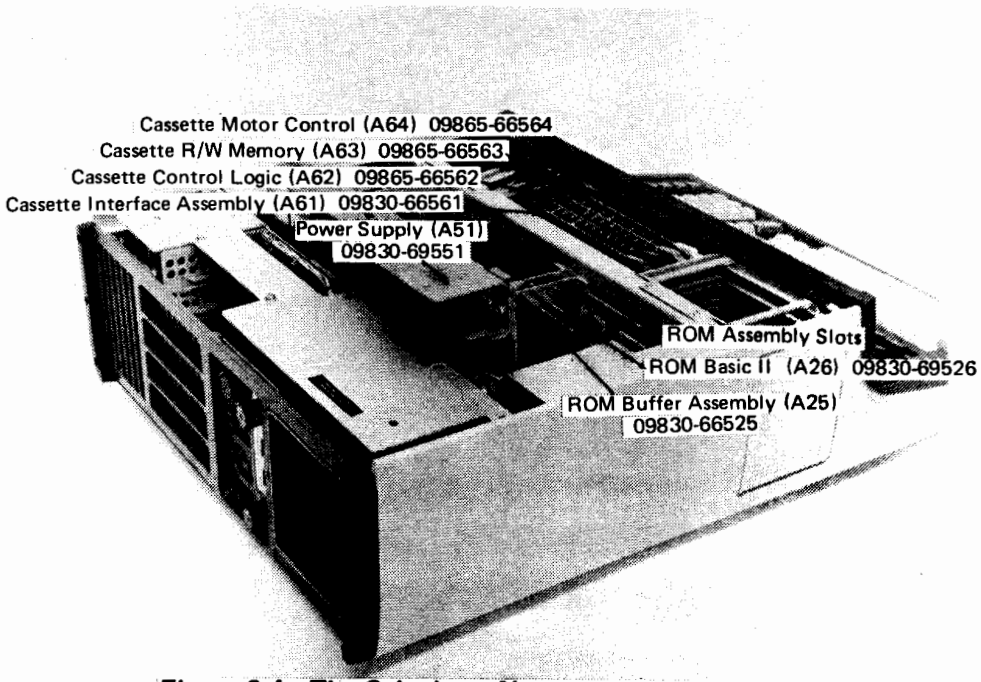


Figure 6-4. The Calculator Non-memory Assemblies.

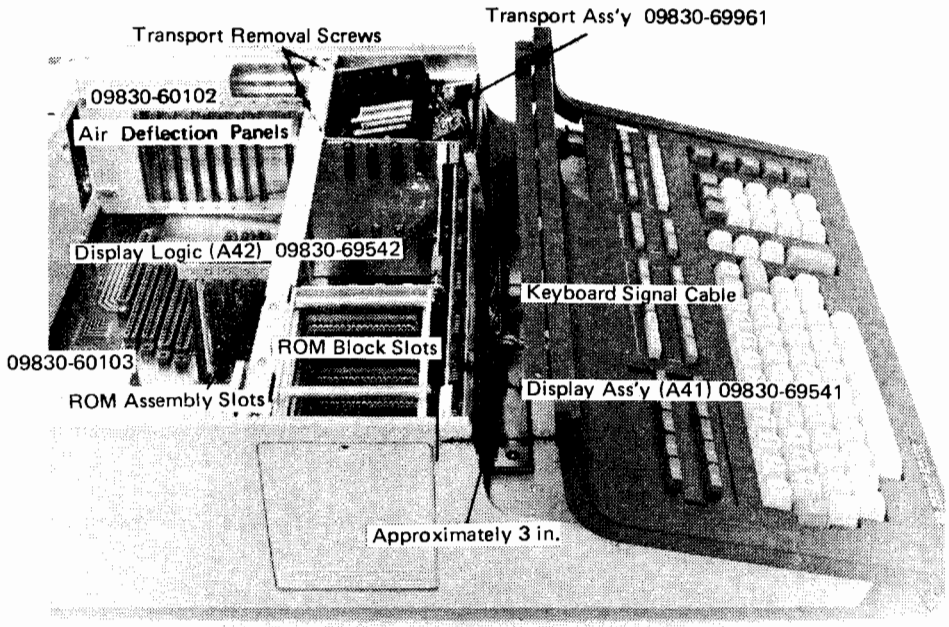


Figure 6-5. Removing the Keyboard.

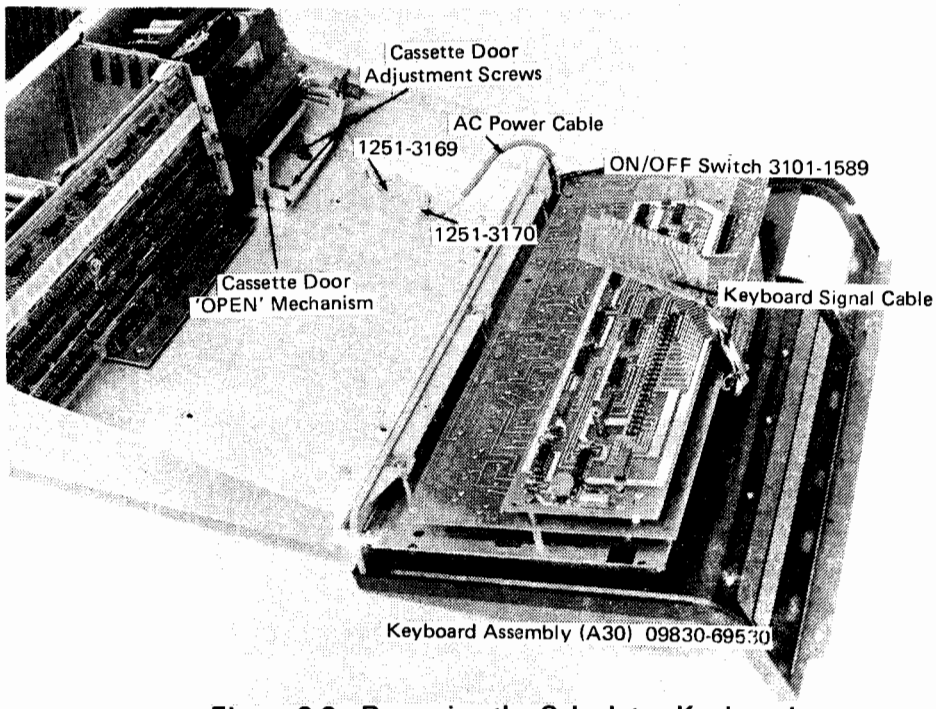


Figure 6-6. Removing the Calculator Keyboard.

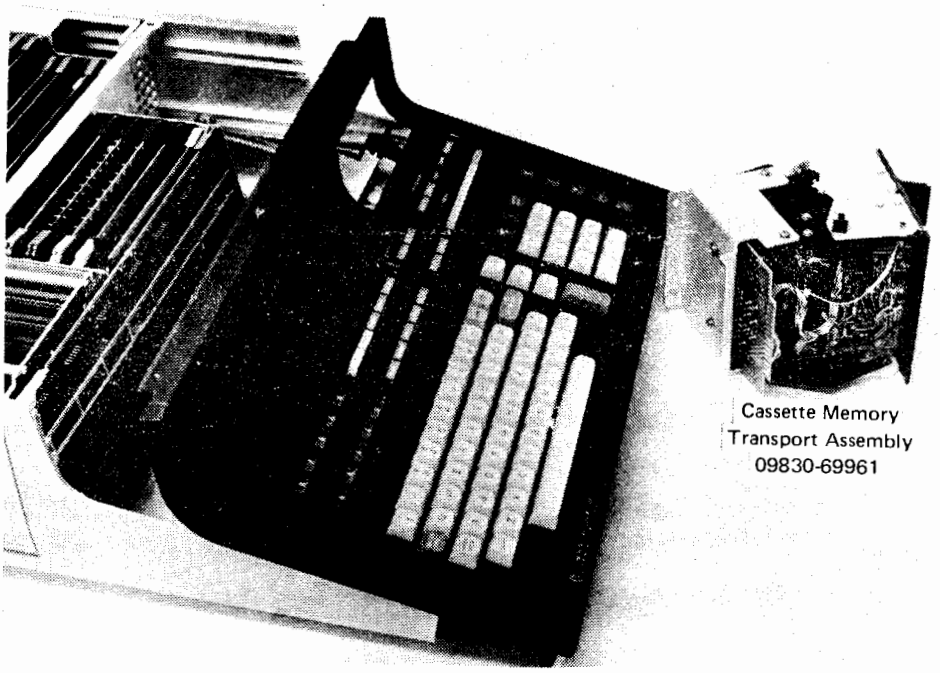


Figure 6-7. The Cassette Memory Transport Assembly.

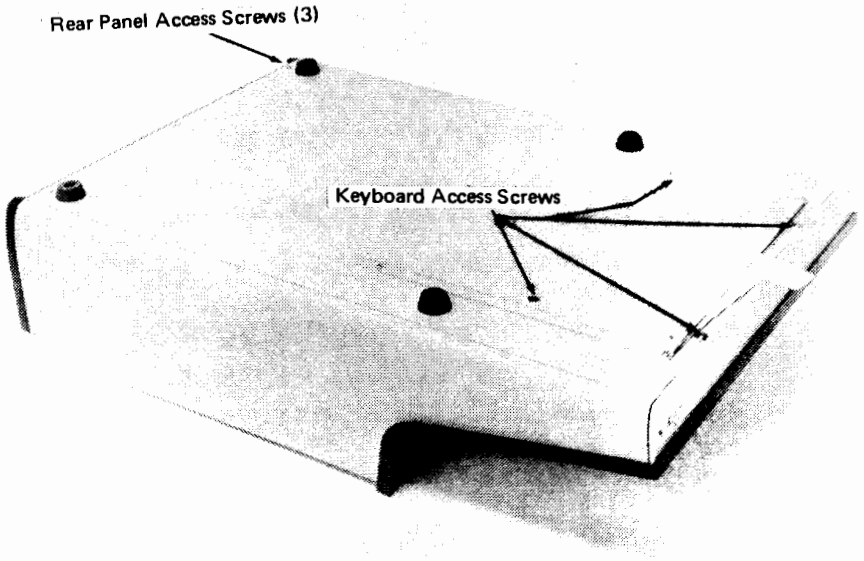


Figure 6-8. The Calculator Access Screws.

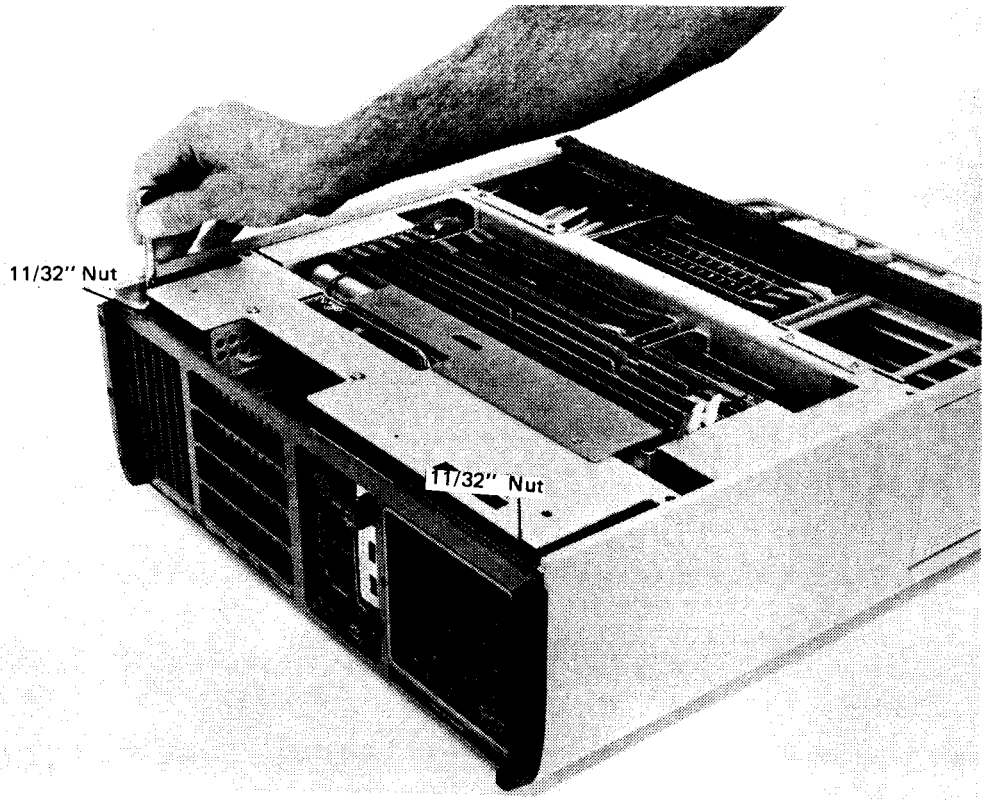


Figure 6-9. Removing the Rear Panel.

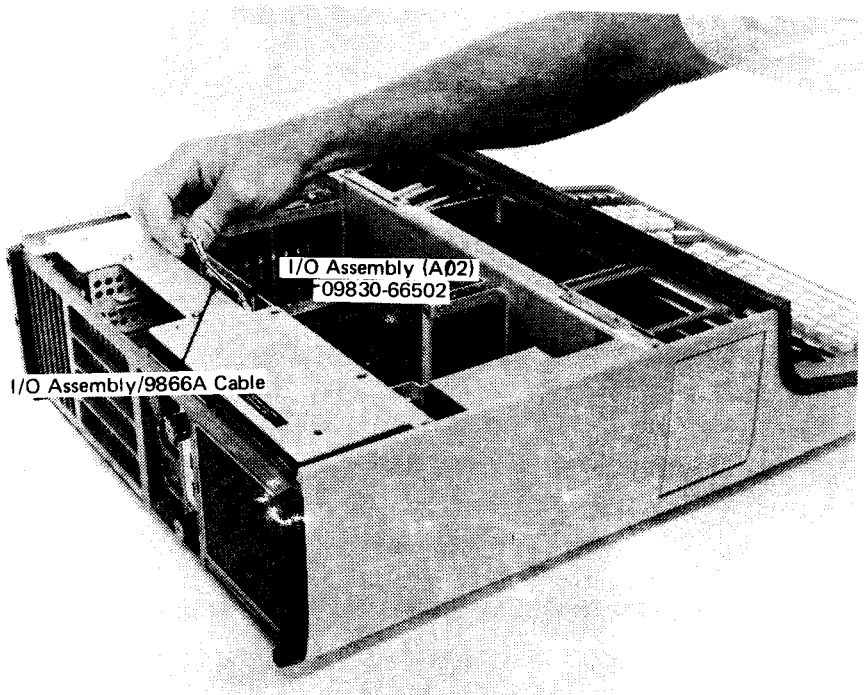


Figure 6-10. Removing the I/O Assembly.

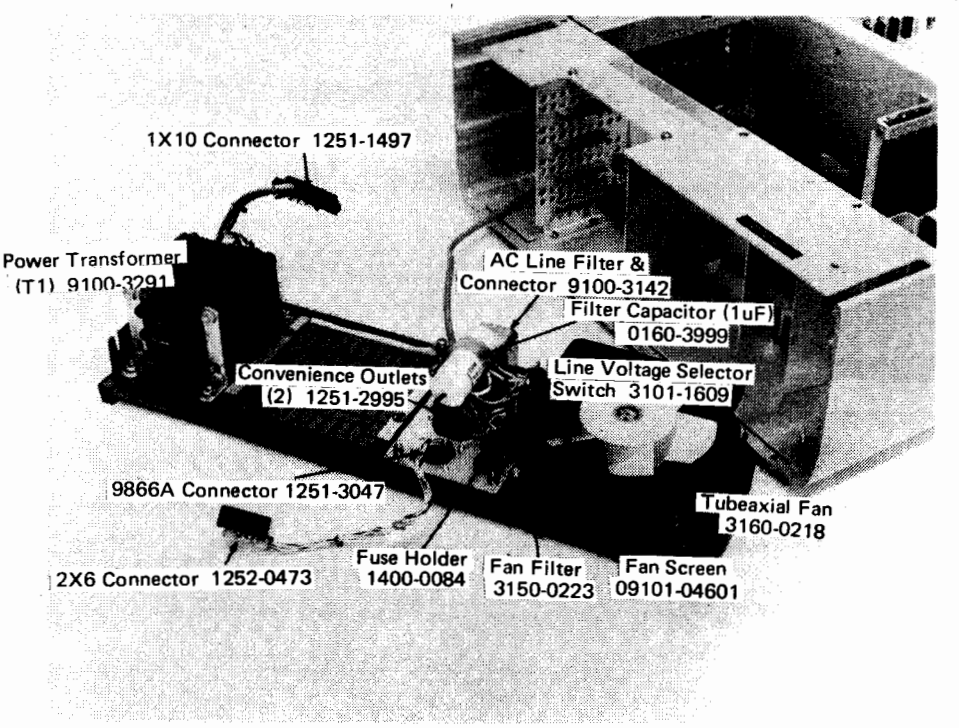


Figure 6-11. The Rear Panel Assemblies.

9830A MEMORY RECONFIGURATION PROCEDURE

The following procedure provides information for replacing an 'original' calculator memory (see page 6-1) with a 'standard' memory.

Equipment Required:

Item		Quantity
1.	11/32" open-end wrench	1
2.	POZIDRIVE phillips driver	1
3.	M-Register Assembly (09830-66582)	1
4.	T-Register Assembly (09830-66583)	1
5.	*2K R/W Memory Assembly (09830-66584)	1
6.	*4K R/W Memory Assembly (11275-66584)	1
7.	Right guide panel (09830-60102)	1
8.	Left air deflector panel (09830-60103)	1

*Items 5 and 6 are mutually exclusive. Only install an equivelant amount of R/W memory into the calculator.

1. Switch the calculator OFF and remove any ac power.
2. Remove the top cover. Then, remove the Memory, Processer, and ROM Assemblies (see figure 6-2).
3. Remove the back panel (see step 7 on page 6-4).
4. Remove the two screws in each of the two panels which contain the memory PC board guides. (The screws can be accessed from the back of the calculator.) Lift the two panels out of the calculator and replace them with the two new panels (gray PC board guides should be on the right side of the instrument) and replace the four screws.

9830A MEMORY RECONFIGURATION PROCEDURE

5. Return all of the assemblies that were removed in **STEPS 2 & 3** except the M- register (09830-69522), T-register (09830-69523) and R/W Memory (09830-69524) to the calculator.
6. Install the new M-register (09830-69582), T-register (09830-69583), and either a 2K (09830-69584) or 4K (11275-69584) memory in PC slot 1 (see figure 6-3). If the original R/W memory was 1760 words, use the 2K assembly. If the original memory was 3808 words, use the 4K assembly. DO NOT attempt to use two 2K boards to obtain a 4K memory, as only the assembly in R/W memory slot 1 will be recognized. If 4K (11275-69584) and 2K (09830-69584) R/W memory assemblies happen to be installed in the same calculator, the 4K assembly must be in slot 1 to provide more than 1760 words of memory.
7. Remove the decal from the PC board retainer plate and use the 9830A System Test Cassette to verify that the new memory is operating correctly.

Chapter 7
TROUBLESHOOTING

ASSEMBLY EXCHANGE PROCEDURE

NOTE

This procedure assumes that a 9810A or 9820A Service Kit (11209A or 11229A) Processor Assembly is available for use with the 11290A Service Kit.

1. Verify the customers complaint and check for user errors.
2. If the calculator appears to be totally inoperative, check the calculator fuse. If the fuse is okay, remove the top cover and check the power supply outputs (+19.5V, +16V, ±12V, and +5V) with an -hp- 427A or an equivelant voltmeter. Improper calculator operation will result if any of the power supplies is defective.
3. The internal cassette memory must be functioning correctly before programs can be loaded from tape cassettes. If data and programs can be entered from the keyboard but not from tape cassettes, exchange all of the cassette assemblies. If the exchange of the cassette assemblies corrects the problem, isolate then repair the defective assembly. Otherwise, proceed with step 4.
4. Exchange the four processor assemblies. If the kit processor does not correct the failure, then exchange the four memory assemblies. If replacing either the processor or memory assemblies corrects the failure, then exchange the individual assemblies until the defective assembly is isolated. Replace the defective assembly with the associated kit assembly. If neither assembly appears to be defective, proceed with step 5. *See Chapter 6 (page 6-1) for the orignal memory retrofitting procedures.*

ASSEMBLY EXCHANGE PROCEDURE

5. If running the '9830A System Test Cassette' program indicates that a 'Plug-in' ROM Block or ROM Assembly is defective, or if you suspect one of the ROM's of being defective, exchange the ROM.
6. If, while running the '9830A System Test Cassette' program, an audible tone (beep) is heard every four seconds but no display is seen after 90 seconds, or if the display is obviously incorrect, exchange the display (A41) and display logic (A42). (Each assembly must be returned individually). Then replace the assemblies one at a time until the defective assembly is found.
7. If one or more keys on the keyboard is defective, exchange the keyboard.

When the defective assembly is isolated and replaced with a Service Kit assembly, return the remaining customers assemblies to the calculator. Then, run the '9830A System Test Cassette' program(s) to verify correct calculator and peripheral operation. Then, perform the procedures required for cleaning the cassette tapeheads described in the Instrument Maintenance Chapter.

8. Always verify the failure by reinstalling the defective pc board into the calculator and ensuring that the failure still occurs. Intermitten problems may cause the symptom to dissappear when power is removed or during the exchange of assemblies, then reappears at a later time. Thus, necessitating two service calls to repair one failure.

+5V POWER SUPPLY

The switching frequency of Q1 should be between 18 KHz (period = 55.6uS) and 30 KHz (period = 33.3uS) and is controlled by the values of C6, C27, and R6. The only recommended values are listed below; if one of these values does not bring the frequency within the specifications indicated above, C6 may be leaky or R6 may have to be changed to some value larger than 150K.

TABLE 7-1.

+5V Frequency Adjustment.

Component	-hp- Part Number	Comments
C6 or C27	180uF; 0180-1702	May lower the frequency if DC leakage occurs.
R6	150K; 0684-1541	May be selected to a value not less than 150K.

It may be necessary to remove Q3 to troubleshoot the +5V supply as most failures will cause Q3 to be switched ON. Removing Q3 may, however, cause R1 to open. Therefore, it is recommended that a spare R1 (22 ohm -hp- Part Number 0684-2201) be available when servicing the calculator.

Common +5V power supply failures are, a defective regulator IC (U1) or the case (collector) of Q1 becoming shorted to the heat sink (ground).

+5V SPECIFICATION:

+5V ±2%

±12V SUPPLIES

The most common failures in the ±12V power supplies are the two IC regulators U2 or U4. However, if U2 is changed the reference zener may be slightly different, necessitating a change in the value of R13. (Eout = 12V ±2%)

±12V SUPPLIES

To determine the correct value of R13 perform the following procedure:

1. Switch the calculator OFF and remove the A51 Assembly.
2. Remove R13.
3. Connect a 10-turn 100K pot in parallel with R7. (Adjust the pot for 100K)
4. Install the A83 assembly and switch the calculator ON.
5. Slowly decrease the pot to give +12.1V output at TP1.
6. Remove the pot and measure the value of the resistance used in step 5.
7. Use the padding list (below) to select the resistor nearest the resistance measured in step 6. Install the selected resistor.
8. Check TP1 and TP2 for ±12V ±2%.

Table 7-2. R13 Padding List

Value	-hp- Part No.	Value	-hp- Part No.	Value	-hp- Part No.
221K	0757-0473	8.87K	0698-4202	4.32K	0757-0436
56.2K	0757-0459	7.87K	0698-3259	4.12K	0698-3493
32.4K	0698-4492	6.98K	0698-4470	3.83K	0698-3153
22.6K	0757-0349	6.34K	0698-3516	3.65K	0757-0434
17.4K	0698-4482	5.90K	0698-3515	3.40K	0698-4440
14.0K	0698-4479	5.36K	0698-3258	3.24K	0698-4439
11.5K	0698-3268	4.99K	0698-3279	3.09K	0698-4438
10.0K	0757-0442	4.64K	0698-3155		

POWER SUPPLY	NOMINAL VOLTAGE	TOLERANCE IN VOLTS	HIGH	LOW
−12	−11.86	±.36	−12.22	−11.5
+12	+12.10	±.12	12.22	11.98
+16	+16.00	±.32	16.32	15.68
+20	+19.50	±.59	20.09	18.91
+ 5	+ 5.17	±.10	5.27	5.07

CASSETTE MEMORY

INTRODUCTION

This section contains test procedures and troubleshooting hints that will assist the Field Service Engineer in the service and repair of a defective Cassette Memory. It is assumed, however, that the Field Service Engineer is familiar with normal Cassette Memory and calculator operation.

TEST EQUIPMENT RECOMMENDED

Below is a complete list of the test equipment that is required to effeciently service and repair a cassette memory.

1.) POZIDRIVE phillips driver
2.) Solder iron and solder
3.) -hp- 427A
4.) -hp- 10525A Logic Probe
5.) 3-12" jumpers, with mini-alligator clips on each end.
6.) Premarked and protected tape cassette.

Two items which are sometimes useful are:

1.) -hp- 180A Oscilloscope
2.) -hp- 3440A or its equivelant

> NOTE
>
> Item number 6 (above) is not provided in the 11290A Service Kit. It is recommended that the Field Service Engineer mark a tape with at least 100 2-register files and remove the cassette tabs. This is useful in determining if the Cassette Memory will read information on a known good cassette. Should you wish to write on the tape after the protect tabs have been removed, simply cover the holes with cellophane tape.

NOTE

The reliability of the Cassette Memory can be directly related to periodic cleaning of the tape head (See the Instrument Maintenance Chapter). It is strongly recommended that the tape head be cleaned each time a service call is made on a Model 30 calculator system.

I/O CARD TEST PROCEDURE (A61)

If exchanging the I/O Card correct the failure, perform the following procedure; use procedure A if the Cassette Memory performs some operations correctly, and procedure B if the Cassette Memory is inoperative or fails following the first operation.

> NOTE
> Perform each step in procedure A and B. DO NOT skip steps.

PROCEDURE A

1.) If the Cassette Memory does not detect the clear leader, an open door, or removed protect tabs, check U1.
If operations are aborted as soon as the instructions are given(on the keyboard), check U1 pins 3, 6, and 11 with the tape off of the clear leader, the door closed, and both protect tabs still in the cassette. The U1 outputs should be +5V.

2.) If the interrupt mode is defunct, check U5, U7d, U13, U4d, and U12.

PROCEDURE B

1.) If a FIND FILE, BACK SPACE, or FORWARD SPACE command is given (using a previously marked tape) and the Cassette Memory cannot find the file or space one file, (i.e., the tape slowly runs to clear leader), check A62 TP2.
If A62 TP2 is high (+5V), check U11, U4d, and U10a.
If A62 TP2 is low (ØV), check U7, U6, U4, and U5.

2.) If the Cassette Memory does not read previously recorded data or programs correctly, check U2 and U3.

3.) If the Cassette Memory will not perform any operation and an error note is displayed, check U1.

CONTROL LOGIC ASSEMBLY (A62) TEST PROCEDURE

The following procedure will assist you in finding control logic failures. However, the control logic is somewhat sophisticated, and to truely troubleshoot the logic circuits that make the control logic function requires the use of special troubleshooting techniques and equipment. The following procedure is designed to assist in the repair of most failures, but it will not necessarily point out every failure that may occur. For this reason, the Control Logic Assembly is on the -hp- Red Stripe Program and may be returned to the factory for evaluation.

If, when a keyboard command is given, the cassette memory fails to drive the tape, consult the following table:

SYMPTOM	CHECK	PROBABLE CAUSE
Inoperative except for REWIND	300 nS Decoder output	U20, U19, U7
REWIND only inoperative	Rewind FF	U15a, U15b, U16c
No Fast Tape Speed Except REWIND	U20	U20
No Fast Tape Speed	U17a	U17a
No reverse operation except REWIND	U20	U20
No Reverse operation	U17b	U17b

Motors Will Not Turn:.....Check should be:	...If not:
U17 pins 8 or 9 low?	U17c
U2 pin 12 high	'POP' circuit
U10 pin 8 high?	U10c, U19, U7
U9 pin 8 high?	U1b, U9c
U16 pin 11 high?	U1a, U16d
Check U15b	U15b

CONTROL LOGIC ASSEMBLY (A62) TEST PROCEDURE (cont'd)

If the motors drive the tape, but the A62 ass'y is known to be defective, perform the following tests:

Use a logic probe to check the below test points.
WRITE MODE:

TP1 - 3 KHz Clock	should be	DIM
TP3 - WTC	should be	HIGH
TP4 - FLG	should be	DIM
TP6 - 1 of 10 CLK	should be	DIM
TP9 - WDT	should be	FLASHING (slow)
TP10 - WCL	should be	DIM
TP11 - WMK	should be	DIM

READ MODE:
After performing the write mode checks,

TP1 - 3 KHz Clock	should be	OUT
TP3 - WTC	should be	OUT
TP4 - FLG	should be	FLASHING (rapidly)
TP6 - 1 or 10 RCL	should be	DIM
TP9 - WDT	should be	FLASHING (rapidly)
TP10 - WCL	should be	OUT
TP11 - WMK	should be otu	OUT

CONTROL LOGIC ASSEMBLY (A62) TEST PROCEDURE (cont'd)

TEST	SYMPTOM	PROBABLE CAUSE
TP1	High	3 KHz Write Clock
TP1	Low	3 KHz Clock, U16b
TP4	TP4 bad*	
	TP6 OK	U5a, U8a, U11, U9a, U12c
TP4	TP4 bad, TP6 bad	
	TP1 OK, TP10 fad	U18c, U14, U5a, U8
TP3	bad	U16b, U20
TP6	bad, TP1 OK	U18c, U14, U5a, U8a
TP10	bad, TP1 OK,	
	TP6 OK	U18d, U11
TP11	bad, TP6 OK	
	TP1 OK	U10b
TP9	bad	Shift Register or U16a

If all tests are apparently good, but the Cassette Memory does not function properly, the problem may be:

a.) Defective Shift Register
b.) Defective 3 KHz Clock
c.) Defective 1 of 10 bit Decoder

*A symptom indication is bad if the test for that test failed, and good or OK if the test on that test point was satisfactory.

R/W MEMORY BOARD (A63) TEST PROCEDURE

1.) Remove the calculator top cover.
2.) Switch the calculator ON.
3.) Measure the voltage on U16 pins 5 and 9. The polarity of the voltages on U6 pins 5 and 9 is dependant upon the condition states of Q3-Q6. Both voltages must be ±.5V ±10%. If not, Q1 - Q6 has failed. (This test simulates a slow tape speed.)
4.) Switch the calculator power OFF.
5.) Remove the Transport Ass'y by removing the four screws on the top of the transport and lifting the ass'y out of the Cassette Memory.

> CAUTION
> IF THE REMAINDER OF THIS PROCEDURE IS PERFORMED WITH THE TRANSPORT ASSEMBLY STILL INSTALLED IN THE CALCULATOR, THE CASSETTE MEMORY WILL BE DAMAGED!

6.) Switch the calculator power ON.
7.) Temporarily short TP5 to the + (top) side of C19 (+12V)
8.) Measure the voltage on TP6 and pin 5 of U6a.
TP6 = (approx.) +11V
pin 5 = -.95V ±10%
9.) Short TP5 to the - (bottom) side of C20 and check TP6 and pin 5 of U6 as in step number 8. The voltages should be the same, but the polarity of the voltages must be reversed.
10.) Perform steps 7 - 9 by shorting the ±12V supplies to TP8 and check TP7 and pin 9 or U6b.
11.) Switch the calculator power OFF, then ON (presets U9a).
12.) Temporarily short TP5 and TP8 to +12V.
13.) TP6 and TP7 must be +11V, if not repeat step 12.
14.) Check TP9 for a logical 1 (+5V). If TP9 is ØV, repeat steps 12 and 13. If TP9 remains low, check U9a.

R/W MEMORY BOARD (A63) TEST PROCEDURE (cont'd)

15.) TP4 should be ØV. If not, U5c or U9b may be defective.
16.) Temporarily short TP8 to the -12V supply. TP7 must be -11V and TP6 +11V. If not repeat steps 12 and 16.
17.) TP4 should be +4 to ±4 to +5V. If not repeat steps 11 and 16. If TP4 remains low, check U9a, U8, and U3d.
18.) Repeat steps 11, 12, and 14.
19.) Temporarily short TP5 to the -12V supply. TP9 should be ØV. (This checks the .5 4S one-shot.) If TP9 is not ØV, check U8 and U9.
20.) Switch the power OFF, remove the A62 Ass'y, then switch the power ON.
21.) U1c pin 8 should be +5V; Q7 collector should be +5V; TP2 & TP3 should be +5V.
22.) Switch the power OFF, remove the A63 Ass'y, and use a mini-alligator clip to jumper pins 2 & 4 of U2 to ground (do not worry about pins 1 and 5). Reinstall the A63 Ass'y and switch the power ON.
23.) The voltage on the collector of Q7 should be +5V; the voltage on TP2 and TP3 should be ØV. If not replace U2.
24.) Switch the power OFF and remove the jumpers from step 22. Reinstall the A62 and A63 Ass'ies and switch the power back ON.
25.) TP2, TP3, and the collector of Q7 should be ØV.
26.) When the Cassette Memory has been repaired, return all of the customers assemblies to his calculator and run the Cassette Memory Exerciser Program.

NOTE

The R/W Memory Board is also on the -hp- Red Stripe Program and may be returned to the factory for evaluation.

MOTOR CONTROL (A64) TEST PROCEDURE

If exchanging the A64 assembly corrects the failure, proceed with the following tests:

1. Switch the calculator OFF, remove the A62 assembly. then switch the calculator ON.
2. Connect a jumper from ground to A64 TP1.
3. Check the following test point voltages:

TEST POINT	VOLTAGE	PROBABLE FAILURE
2	6.0V to 9.0V	CR1, CR2, Q1, Q2
3	6.0V to 9.0V	SHORT ON A4 ASS'Y
4	4.5V to 7.5V	U4
5	6.0V to 9.0V	U2, Q6, Q7
8	6.0V to 9.0V	U2, Q4, Q5

4. Remove the jumper that was installed in step 2.
5. Measure the voltage on TP64. It should be 2.5 to 3.5V. If not U1 or U3 has probably failed.
6. Switch the calculator OFF, reinstall the A62 assembly. and remove the A63 assembly.
7. Switch the calculator ON.
8. Press the key sequence for a SEARCH or FIND FILE operation. The solenoids should energize (click) and the tape should run (slow) forward to the trailing clear leader. (It is not necessary for the motors to turn to perform the following tests).

   Using the 427A, check the following voltages on the defective A64 assembly:

MOTOR CONTROL (A64) TEST PROCEDURE (cont'd)

TEST POINT	VOLTAGE	PROBABLE FAILURE
2	3.0 to 6.0V	Q1, Q2
5	3.0 to 6.0V	U2, Q6, Q7
6	11.0 to 13.0V	U2, Q6, Q9
7	0 to .5V	U2, Q4, Q8
8	0 to .5V	U2, Q4, Q5

9. Press STOP.
10. Press the REWIND button and measure the following voltages with a 427A.

TEST POINT	VOLTAGE	PROBABLE FAILURE
2	9.0 to 13.0V	U1
5	0 to .5V	Q6, Q7, U2
6	0 to .5V	Q6, Q9, U2
7	at least +11V	Q4, Q8, U2
8	at least +9V	Q4, Q5, U2

11. Position the tape on the beginning clear leader. Hold the REWIND button in and measure the voltage on TP2: 3.5 to 4.5V (Checks CR2 and Q3).

When the Motor Control Board has been repaired, return all of the customer's assemblies to his calculator and run the Cassette Memory Exerciser Program.

MOTHERBOARD CONNECTIONS

Table 7-3

MNEMONIC	A64 ASS'Y P2	A63 ASS'Y P3	A62 ASS'Y P4
+12U			
CGD			
LGD	1,A,18,V	1,A,18,V	1,A,24, BB
+5V	2,B	2,B	2,B
MRV	3,C		
MCM	5,E		
MFR	4,D		
SFR	6,F		
SRV	7,H		
YWDB		4	
ARB		E	
YWDA		3	
ARA		D	
AGD	12,N	6,F	
YLDR	13		D
YWPT		5	C
YWEN		C	
YCIN			3
+12V	17	17	
-12V	U	U	
+17U	8,J		
MGD	9,K		
NRNC	15		12
NFTC	16	12	13
NRVC	T		P
YWTC		13	14
NPOP		P	R
YRMK		14	15
YRDT		R	S
NRCL		15	16
YWMK		S	T
YWDT		16	17
YWCL		T	U
+12P			
+12N			
+5P			
+5N			
-12P			
-12N			
MCT	10,L		
MDR	11,M		
NRWD			N
YTHA		8	
YTHB		9	

I/O CONNECTIONS

Tabel 7-3

MNEMONIC	A62 ASS'Y P2
YCNT	11
YOSØ	22
YOS1	Z
YOS2	23
YOS3	AA
YODØ	18
YOD1	V
YOD2	19
YOD3	W
YOD4	20
YOD5	X
YOD6	21
YOD7	Y
YIDØ	7
YID1	H
YID2	8
YID3	J
YID4	9
YID5	K
YID6	10
YID7	L
YFLG	M
YISØ	5
YIS1	E
YIS2	6
YIS3	F
LGD	
CGD	
NINT	4
+5V	-

ROM BUFFER ASSEMBLY (A25)

If a particular ROM Assemlby or ROM Block will function correctly in one ROM slot but not in another or if one (known good) ROM cannot be used but another ROM appears to be okay, then the defective component is either the decoder (u6) or components on one of the decoder output lines.

If all of the plug-in ROM's are inoperative, the one (or more) of the components on the 'ROM ADDRESS' lines is defective. This symptom would also be an indication of a totally inoperative decoder (U6).

Table 7-4
Decoder (U16) Inputs = Outputs

INPUTS						OUTPUTS															
G1	G2	D	C	B	A	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
L	L	L	L	L	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H
L	L	L	L	H	L	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H
L	L	L	L	H	H	H	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H
L	L	L	H	L	L	H	H	H	H	L	H	H	H	H	H	H	H	H	H	H	H
L	L	L	H	L	H	H	H	H	H	H	L	H	H	H	H	H	H	H	H	H	H
L	L	L	H	H	L	H	H	H	H	H	H	L	H	H	H	H	H	H	H	H	H
L	L	L	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H	H	H	H	H
L	L	H	L	L	L	H	H	H	H	H	H	H	H	L	H	H	H	H	H	H	H
L	L	H	L	L	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H	H	H
L	L	H	L	H	L	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H	H
L	L	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H
L	L	H	H	L	L	H	H	H	H	H	H	H	H	H	H	H	H	L	H	H	H
L	L	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L	H	H
L	L	H	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L	H
L	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L
L	H	X	X	X	X	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
H	L	X	X	X	X	H	H	H	H	H	H	H	H	L	H	H	H	H	H	H	H
H	H	X	X	X	X	H	H	H	H	H	H	H	H	H	L	H	H	H	H	H	H

H = high, L = low, X = irrelevant

REFERENCE DESIGNATOR		-hp- PART NO.	TQ	DESCRIPTION		
A25		09830-66525	1	PC BUFFER ASSEMBLY		
		0180-1701	1	C-F: 6.8UF, 6V		
		0180-1746	1	C-F: 15UF, 20V		
		1901-0040	16	Diode: Si, .05A, 30V		
		0403-0220	1	Extracter: PC BD, Grn		
		4040-0712	1	Extracter: PC BD, Red		
		1820-0495	1	IC: SN74154N		
		1820-0577	3	IC: SN7416N		
		1820-0618	2	IC: Dgtl, SN7417N		
		09830-26525	1	PC BD: ROM Bfr (P)		
		0684-2211	10	R-F: 220 OHM, .1		
		0684-3321	16	R-F: 3300 OHM, .1		
		1854-0404	16	XSTR: Si, NPN		
A51		09830-66551	1	PC POWER SUPPLY ASSEMBLY		
	C1, C2	0180-2405	2	C-F: 6400UF, 25V		
	C3	0180-1985	1	C-F: 500UF, 30V		
	C4	0180-2407	1	C-F: 1000UF, 25V		
	C5	0180-2567	1	C-F: 1500UF, 40V		
	C7 thru C12	0180-1714	6	C-F: 330UF, .1		
	C13	0150-0073	3	C-F: 100PF, 1000V		
	C14	0180-1701	3	C-F: 6.8UF, 6V		
	C15	0150-0073		C-F: 100PF, 1000V		
	C16	0180-0387	3	C-F: 47UF, 20V		
	C17	0160-0127	1	C-F: 1UF, 25V		
	C18	0150-0071	1	C-F: 400PF, 500V		
	C19	0180-1779	1	C-F: 18UF, 35V		
	C20	0180-0387		C-F: 47UF, 20V		
	C21	0150-0073		C-F: 100PF, 1000V		
	C22	0180-0387		C-F: 47UF, 20V		
	C23	0150-0035	1	C-F: 20PF, 600V		
	C24, C25	0180-1701		C-F: 6.8UF, 6V		
	C26	0180-0106	1	C-F: 60uF, 6V		
	C6, C27	0180-0159	2	C-F: 220UF, 10V		
	CR1, CR2	1901-0200	2	Diode: Si, 3A, 100V		
	CR3 thru CR8	1901-0045	8	Diode: Si, .75A, 100V		
	CR9	1901-0678	1	Rect: Silicon		
	CR11	1902-3094	1	Diode: Breakdown, 5.11V		
	CR12	1901-0045		Diode: Si, .75A, 100V		
	CR13	1901-0040		Diode: Si, .05A, 30V		

REFERENCE DESIGNATOR		-hp- PART NO.	TQ	DESCRIPTION		
A51				PC POWER SUPPLY ASS'Y (continued)		
	CR15	1902-3190	2	Diode: Breakdown, 13V		
	CR16	1902-0049	1	Diode: Breakdown, 6.19V		
	CR17	1901-0045		Diode: Si, .75A, 100V		
	CR19	1902-3190		Diode: Breakdown, 13V		
	CR22	1902- 3054	1	Diode: Breakdown, 3.92V		
	CR23 thru CR25	1901-0040		Diode: Si, .05A, 30V		
		0403-0211	1	Extr: PC BD Brn		
		0403-0215	1	Extr: PC BD Grn		
		1205-0033	2	Heat Sink: Semicon		
		09830-01151	1	Heat Sink		
	IC 1 thru IC 4	1820-0196	4	IC: U5R7723393		
	IC5	1820-0261	1	IC: 74121N		
	L1	9100-3297	1	Choke: 132UH		
	L2	9100-3298	1	Choke: 40UH		
	Q14	1884-0082	1	Thyristor		
	Q1	1853-0310	1	XSTR: 2N4398		
	Q2	1853-0052	1	XSTR: 2N3740		
	Q3	1854-0354	2	XSTR: Si, NPN		
	Q4	1854-0063	2	XSTR: 2N3055		
	Q5	1853-0063	1	XSTR		
	Q6	1853-0010	2	XSTR: Si, PNP		
	Q7	1854-0063	2	XSTR: 2N3055		
	Q8	1854-0354		XSTR: Si, NPN		
	Q9	1854-0072	1	XSTR: 2N3054		
	Q10	1853-0010		XSTR: Si, PNP		
	Q11 thru Q13	1884-0068	4	Thyristor		
	R1	0684-2201	1	R-F: 22 OHM, .1		
	R2	0684-2211	1	R-F: 220 OHM, .1		
	R3	0811-3069	2	R-F: 1 OHM		
	R4	0684-1011	4	R-F: 100 OHM, .1		
	R5	0684-1001	1	R-F: 10 OHM, .1		
	R6	0757-0270	1	R-F: 249K, .01		
	R7	0684-1021	1	R-F: 100 OHM, .1		
	R8	0698-4461	2	R-F: 698 OHM, .01		
	R9	0757-0416	1	R-F: 511 OHM, .01		
	R10	0811-3050	1	R-F: .75 OHM, .05		
	R11	0684-1011		R-F: 100 OHM, .1		
	R12	0698-4014	1	R-F: 787 OHM, .01		
	R14	0698-4448	1	R-F: 294 OHM, .01		
	R15	0698-4123	2	R-F: 499 OHM, .01		
	R16	0684-6811	1	R-F: 680 OHM, .1		

REFERENCE DESIGNATOR		-hp- PART NO.	TQ	DESCRIPTION		
A51				PC POWER SUPPLY ASS'Y (continued)		
	R17	0699-0001	1	R-F: 2.7 OHM, .1		
	R18	0684-1011		R-F: 100 OHM, .1		
	R19	0757-0273	1	R-F: 3010 OHM, .01		
	R20	0757-0288	1	R-F: 9090 OHM, .01		
	R21, R22	0698-4443	2	R-F: 4530 OHM, .01		
	R23	0812-0066	1	R-F: .47 OHM, 1%		
	R24	0684-1011		R-F: 100 OHM, .1		
	R25	0698-4464	1	R-F: 887 OHM, .01		
	R26	0698-4461		R-F: 698 OHM, .01		
	R27	0683-3305	1	R-F: 33 OHM, .05		
	R28	0684-3321	1	R-F: 3300 OHM, .1		
	R29	0684-2731	1	R-F: 27K, .1, 1/4W		
	R30	0684-3311	1	R-F: 330 OHM, .1		
	R31	0684-4701	1	R-F: 47 OHM, .1		
	R32	0698-4123		R-F: 499 OHM, .01		
	R33	0757-0419	1	R-F: 681 OHM, .01		
	R34	0684-4721	1	R-F: 4700 OHM, .10		
	R35	0811-3069		R-F: 1 OHM		
	R36	0684-2231	1	R-F: 22K, .1, 1/4W		
		09830-26551	1	PC BD: Power Supply		
		2200-0778	2	Screw Machine		
		3050-0803	1	Washer- Flat		
A61		09830-66561	1	PC INTERFACE ASSEMBLY		
	C1	0180-0106	1	C-F: 60UF, 6V		
	C2 thru C5	0150-0093	4	C-F: .01UF, 100V		
	C6	0180-1746	1	C-F: 15UF, 20V		
	C7	0180-0116	1	C-F: 6.8UF, 35V		
	C8	0180-0376	1	C-F: .47UF, 35V		
	C9	0180-0228	1	C-F: 22UF, 15V		
	CR1, CR2	1901-0040	2	Diode: Si, .05A, 30V		
		4040-0711	1	Extr: PC BD Brn		
		4040-0715	1	Extr: PC BD Blue		
	IC1 thru IC4	1820-0269	4	IC: SN7403N		
	IC5	1820-0511	2	IC: SN7408N		
	IC6	1820-0174	2	IC: SN7404N		
	IC7	1820-0511		IC: SN7408N		
	IC8	1820-0054	2	IC: SN7400N		
	IC9	1820-0207	1	IC: V1A960159X		
	IC10	1820-0077	2	IC: SN7474N		
	IC11	1820-0174		IC: SN7404N		
	IC12	1820-0587	1	IC: Dgtl, DM74L10N		

REFERENCE DESIGNATOR		-hp- PART NO.	TQ	DESCRIPTION		
A61				PC INTERFACE ASS'Y (continued)		
	IC13	1820-0077		IC: SN7474N		
	IC14	1820-0207		IC: V1A960159X		
	IC15	1820-0054		IC: SN7400N		
	LS1	*9160-0246*	*1*	*SPKR - 8 ohm*		
		2190-0773	*3*	*Fiber washers*		
	Q1, Q2	1854-0071	2	XSTR: Si, NPN		
	R8	0683-0825	1	R-F: 8.2 ohm(for 8 ohm speaker)		
	R1	0684-1021	2	R-F: 100 OHM, .1		
	R2	0698-4483	1	R-F: 18.7K, .01		
	R3	0684-4731	1	R-F: 47K, .1, 1/4W		
	R4	0684-2211	1	R-F: 220 OHM, .1		
	R5	0684-4711	2	R-F: 470 OHM, .1		
	R6	0684-3921	1	R-F: 3900 OHM, .1		
	R7	0684-4711		R-F: 470 OHM, .1		
	R9	0684-1021		R-F: 100 OHM, .1		
A62		09865-69562	1	CONTROL LOGIC PC ASSEMBLY		
	C1	0180-0106	1	C: 60UF, 6V		
	C2	0160-3165	2	C: .047UF, 50V		
	C3, C4	0180-0291	2	C: 1UF, 35V		
	C5	0180-1743	1	C: .1UF, 35V		
	C6	0150-0093	6	C: .01UF, 100V		
	C7	0140-0176	1	C: 100PF, 300V		
	C8, C9	0150-0093		C: .01UF, 100V		
	C10	0160-3165		C: .047UF, 50V		
	C11, C12	0150-0093		C: .01UF, 100V		
	C14	0150-0093		C: .01UF, 100V		
	CR1	1901-0040	1	Diode: Si, .05A, 30V		
	CR2	1902-0126	1	Diode: Bkdn, 2.61V		
	Q1	1854-0071	1	XSTR: Si, NPN		
	R1	0684-1031	1	R: fxd, 10K, 10%, 1/4W		
	R2	0684-1021	4	R: fxd, 1K, 10%, 1/4W		
	R3	0684-1041	1	R: fxd, 100K, 10%, 1/4W		
	R4	0698-3493	1	R: fxd, 4.12K, 10%		
	R5 thru R7	0684-1011	4	R: fxd, 100 OHMS, 10%, 1/4W		
	R8	0757-0436	1	R: fxd, MF, 4.32K, 1%		
	R9	0698-3226	1	R: fxd, MF, 6.49K, 1%		
	R10*			Padded Resistor		
	R11	0684-1021		R: fxd, 1K, 10%, 1/4W		
	R12	0684-1011		R: fxd, 100 OHMS, 10%, 1/4W		
	R13, R14	0684-1021		R: fxd, 1K, 10%, 1/4W		

REFERENCE DESIGNATOR		-hp- PART NO.	TQ	DESCRIPTION		
A62				CONTROL LOGIC PC ASS'Y (continued)		
	U1	1820-0537	1	IC: SN7413N		
	U2	1820-0174	2	IC: SN7404N		
	U3, U4	1820-0367	2	IC: SN7495N		
	U5	1820-0077	3	IC: SN7474N		
	U6, U7	1820-0261	3	IC: SN74121N		
	U8	1820-0077		IC: SN7474N		
	U9	1820-0068	1	IC: SN7410N		
	U10	1820-0511	2	IC: SN7408N		
	U11	1820-0174		IC: SN7404N		
	U12	1820-0054		IC: SN7400N		
	U13	1820-0261		IC: SN74121N		
	U14	1820-0055	1	IC: SN7490N		
	U15	1820-0077		IC: SN7474N		
	U16	1820-0511		IC: SN7408N		
	U17	1820-0328	1	IC: SN7402N		
	U18	1820-0054		IC: SN7400N		
	U19	1820-0491	1	IC: SN74145N		
	U20	1820-0701	1	IC: Dgtl		
		4040-0712	1	Extr: PC BD, Red		
		4040-0715	1	Extr: PC BD, Blue		
A63		09865-69563	1	PCBD: CASSETTE R/W MEMORY ASS'Y		
	C1	0150-0093	10	C: .01UF, 100V		
	C4	0160-0938	2	C: 1000PF, 100V		
	C5	0160-0356	2	C: 18PF, 300V		
	C7	0150-0093	2	C: .01UF, 100V		
	C8	0160-0170	2	C: .22UF, 25V		
	C10	0160-0938		C: 1000PF, 100V		
	C11	0160-0356	2	C: 18PF, 300V		
	C13	0160-0170		C: .22UF, 25V		
	C16	0180-1743	1	C: .1UF, 35V		
	C17, C18	0150-0093		C: .01UF, 100V		
	C19, C20	0180-0301	2	C: 5UF, 50V		
	C21	0140-0176	1	C: 100PF, 300V		
	C22 thru C27	0150-0093		C: .01UF, 100V		
	CR1	1902-3036	1	DIO: BKDN, 3.16V		
	CR3, CR4 CR9, CR10	1901-0040	4	Diode: Si, .05A, 30V		
	Q1	1854-0071	3	XSTR: Si, NPN		
	Q2	1853-0020	4	XSTR: Si, PNP		
	Q3	1854-0071		XSTR: Si, NPN		
	Q4	1853-0020		XSTR: Si, PNP		
	Q5	1854-0071		XSTR: Si, NPN		
	Q6, Q7	1853-0020		XSTR: Si, PNP		

REFERENCE DESIGNATOR		-hp- PART NO.	TQ	DESCRIPTION		
A63				PC BD R/W MEMORY ASS'Y (continued)		
	R1	0684-2221	4	R: fxd, 2.2K, 10%, 1/4W		
	R2	0684-2721	1	R: fxd, 2.7K, 10%, 1/4W		
	R3	0684-1531	1	R: fxd, 15K, 10%, 1/4W		
	R4	0698-3151	2	R: fxd, MF, 2.87K, 1%, 1/8W		
	R5	0698-3512	2	R: fxd, MF, 1.18K, 1%, 1/8W		
	R6, R7	0698-3179	2	R: fxd, MF, 2.55K, 1%, 1/8W		
	R8	0698-3512		R: fxd, MF, 1.18K, 1%, 1/8W		
	R9	0698-3151		R: fxd, MF, 2.87K, 1%, 1/8W		
	R10	0698-3228	4	R: fxd, MF, 49.9K, 1%, 1/8W		
	R11	0757=0442	4	R: fxd, MF, 10K, 1%, 1/8W		
	R12	0698-3228		R: fxd, FM, 49.9K, 1%, 1/8W		
	R13	0757-0442		R: fxd, MF, 10K, 1%, 1/8W		
	R14	0684-1031	4	R: fxd, 10K, 10%, 1/4W		
	R15	0684-4701	2	R: fxd, 47 OHMS, 10%, 1/4W		
	R19	0684-3321	2	R: fxd, 3.3K, 10%, 1/4W		
	R20	0684-1031		R: fxd, 10K, 10%, 1/4W		
	R21	0684-2231	2	R: fxd, 22K, 10%, 1/4W		
	R22	0698-3228		R: fxd, MF, 49.9K, 1%, 1/8W		
	R23	0757-0442		R: fxd, MF, 10K, 1%, 1/8W		
	R27	0684-4701		R: fxd, 47 OHMS, 10%, 1/4W		
	R28	0684-1031		R: fxd, 10K, 10%, 1/4W		
	R29	0684-3321		R: fxd, 3.3K, 10%, 1/4W		
	R30	0698-3228		R: fxd, MF, 49.9K, 1%, 1/8W		
	R31	0757-0442		R: fxd, MF, 10K, 1%, 1/8W		
	R32	0684-1031		R: fxd, 10K, 10%, 1/4W		
	R33	0684-2231		R: fxd, 22K, 10%, 1/4W		
	R36	0684-2221		R: fxd, 2.2K, 10%, 1/4W		
	R34	0683-3915	1	R: fxd 390 ohm, 5%		
	R37	0684-6821	1	R: fxd, 6.8K, 10%, 1/4W		
	R35	0683-2015	1	R: fxd, 200 ohm, 5%		
	U1	1820-0511	1	IC: SN7408N		
	U2	1820-0068	1	IC: SN7410N		
	U3	1820-0054	1	IC: SN7400N		
	U4	1820-0174	1	IC: SN7404N		
	U5	1820-0328	1	IC: SN7402N		
	U6	1826-0019	1	IC: Op amp		
	U8	1820-0261	1	IC: SN74121N		
	U9	1820-0077	1	IC: SN7474N		
		4040-0713	1	Extr: PC BD, Orange		
		4040-0715	1	Extr: PC BD, Blue		
A64		09865-66564	1	MOTOR CONTROL ASSEMBLY		
	C1	0160-0160	1	C: .008UF, 200V		
	C2	0150-0121	2	C: .1UF, 50V		
	C3, C4	0150-0093	2	C: .01UF, 100V		
	C5	0150-0121		C: .1UF, 50V		

REFERENCE DESIGNATOR		-hp- PART NO.	TQ	DESCRIPTION		
A64				MOTOR CONTROL ASS'Y (continued)		
	CR1	1902-0048	1	Diode: Bkdn, 6.81V		
	CR2	1901-0040	1	Diode: Si, .05A, 30V		
	CR3	1902-0041	1	Diode: Bkdn, 5.11V		
	L1	9140-0018	1	Coil: RF Choke, 1uH		
	Q1	1853-0010	1	XSTR: Si, PNP		
	Q2	1854-0039	1	XSTR: Si, NPN		
	Q3, Q4	1853-0027	3	XSTR: Si, PNP		
	Q5	1854-0556	4	XSTR: Si, NPN		
	Q6	1853-0027		XSTR: Si, PNP		
	Q7, Q8, Q9	1854-0556		XSTR: Si, NPN		
	R1	0698-0083	1	R: fxd, MF, 1.96K, 1%		
	R2	0698-3279	1	R: fxd, MF, 4.99K, 1%		
	R3	0757-0442	1	R: fxd, MF, 10K, 1%		
	R4	0684-5611	1	R: fxd, 560 OHMS, 10%		
	R5	0684-2231	1	R: fxd, 22K, 10%		
	R6	0687-1521	1	R: fxd, 1.5K, 10%		
	R7	0684-2211	1	R: fxd, 220 OHMS, 10%		
	R8	0757-0472	1	R: fxd, MF, 200K, 1%		
	R9	0811-3142	1	R: fxd, 10 OHMS, 1%		
	R10	0698-7313	1	R: fxd, MF, 19.8K, .1%		
	R11	0698-7398	1	R: fxd, MF, 6.124K, .1%		
	R12	0698-7861	1	R: fxd, MF, 25.42K, .1%		
	R13	0698-7681	1	R: fxd, MF, 15.33K, .1%		
	R14	0698-6378	1	R: fxd, MF, 14.9K, .1%		
	R15	0698-4473	1	R: fxd, MF, 8.06K, 1%		
	R16, R17	0684-8211	2	R: fxd, 820 OHMS, 10%		
	R18	0687-6801	4	R: fxd, 68 OHMS, 10%		
	R19	0684-1021	2	R: fxd, 1K, 10%		
	R20, R21	0687-6801		R: fxd, 68 OHMS, 10%		
	R22	0684-1021		R: fxd, 1K, 10%		
	R23	0687-6801		R: fxd, 68 OHMS, 10%		
	U1	1820-0471	1	IC: SN7406N		
	U2	1820-0094	1	IC: Dgtl, Quad 2		
	U3, U4	1820-0203	2	IC: Opr Ampl		
		4040-0714	1	Extr: PC BD, Yellow		
		4040-0715	1	Extr: PC BD, Blue		
				CHASSIS MOUNTED PARTS		
		09830-00601	1	Shield-Inst		
		09830-01202	1	Clamp-Board		
		09830-01210	1	Retainer-Board		
		09830-04101	1	Cover-Top		
		09830-01203	1	Arm-Swing		

REFERENCE DESIGNATOR	-hp- PART NO.	TQ	DESCRIPTION		
			CHASSIS MOUNTED PARTS (continued)		
	09830-01205	1	Brkt- Lower		
	09830-01208	1	Brkt- ROM Door		
	09830-01209	1	Latch- ROM Door		
	09830-23702	1	Rod- Pivot		
	09830-24701	1	Spacer- Board Guide		
	09830-24702	1	Spacer- ROM		
	09830-60102	1	Chassis Ass'y - Right		
	09830-60103	1	Chassis Ass'y - Left		
	09830-60301	1	Panel Ass'y - Conn		
	1251-2995	2	Connector-AC: Power, Convenience		
	1400-0084	2	Fuseholder		
	1251-3047	1	Connector: Cannor		
	3101-1609	1	Slide-Switch		
	9100-3142	1	Filter-Line: (includes conn)		
	1400-0003	1	Cable-Clamp: 7/8"		
	09830-60302	1	Panel Ass'y - Rear		
	2190-0915		Lockwasher: #6		
	2360-0192		Screw-Mach: 6-32, Pozidrive		
	2580-0003		Nut-Hex: 8-32		
	3150-0223		Filter Foam		
	09101-04601		Fan Screen		
	0470-00039		Adhesive-Kit		
	3160-0218		Fan-Tubeaxial		
	0360-1610		Terminal-Solder Lug: #6, 90°		
	2190-0008		Lockwasher: #6, Ext		
	2190-0918		Lockwasher: #6, Helical		
	2940-0094		Screw-Mach: 6-32 x .625, Hex		
	5040-5831		Foot-Left Rear		
	2190-0105		Lockwasher: #6, Helical		
	2360-0317		Screw-Mach: 6-32 x .250, Pan, Pozidrive, Blk		
	3050-0121		Washer-Flat: #6		
	5040-5832		Foot-Right Rear		
T1	9100-3291		XFMR		
	2190-0087		Lockwasher: #6, Helical		
	2510-0107		Screw-Mach: 8-32, Pan, Pozi		
	2580-0004		Nut-Hex: 8-32		
	3050-0139		Washer-Flat: #8		
C1	0160-3999		C: 1UF		
	09830-60304	1	Panel Ass'y - Label		
	0360-1610		Terminal-Solder Lug: #6		
	0380-0003		Spacer-Post: #4		
	1400-0017		Clamp-Cable: Red		
	2190-0008		Lockwasher: #6, Ext		
	2190-0918		Lockwasher: #6, Helical		
	2420-0003		Nut-Hex: 6-32		

REFERENCE DESIGNATOR	-hp- PART NO.	TQ	DESCRIPTION		
			CHASSIS MOUNTED PARTS (continued)		
	09830-60304		Panel Ass'y - Label (continued)		
	3050-0016		Washer-Flat: #6		
	09830-60401	1	Chassis Ass'y - Rear		
	09830-00101		Chassis-Rear		
	0590-0721		Nut-Retainer: 4-40, Floating		
	09830-01201		Brkt- Left		
	09830-04105		Baffle		
	09830-60402	1	Chassis Ass'y - Front		
	09830-00102		Chassis-Front		
	0510-0137		Nut-Retainer: #4, Pem		
	0590-0721		Nut-Retainer: 4-40, Floating		
	09830-01201		Brkt- Left		
	09830-01206		Latch-Chassis Mtg		
	09830-66601		Board Guide-Front Right		
	09830-66602		Board Guide-Front Right		
	09830-66603		Guide Ass'y-Center		
	09830-61602	1	Cable Ass'y - Power		
	09830-64401	1	Cabinet Ass'y		
	0403-0004		Bumper-Rubber		
	09830-60104		Deck Ass'y - Calc		
	09830-66501	1	PC Ass'y - Mother Board		
	2360-0115		Screw-Mach: 6-32, Pan, Pozi Ext		
	2360-0312		Screw-Mach: 6-32, Pan, Pozi		
	2360-0315		Screw-Mach: 6-32, Pan, Pozi		
	09830-66502	1	PC Ass'y - I/O		
	4330-0496		Bead-Glass		
	09830-66605	1	Brkt-Display		
	09830-68501	1	Guide Ass'y - ROM		
	2200-0105		Screw-Mach: 4-40, Pozi		
	09830-68501	1	Housing - I/O Left		
	0400-0018		Grommet-Nyl: 12.75 lg, 1/21 part per instr		
	09830-68502	1	Housing - I/O Right		
	5040-7012		ROM Door		
	3050-0437		Spring Washer-Curved: .128 ID, .230 OD, .008 thk		

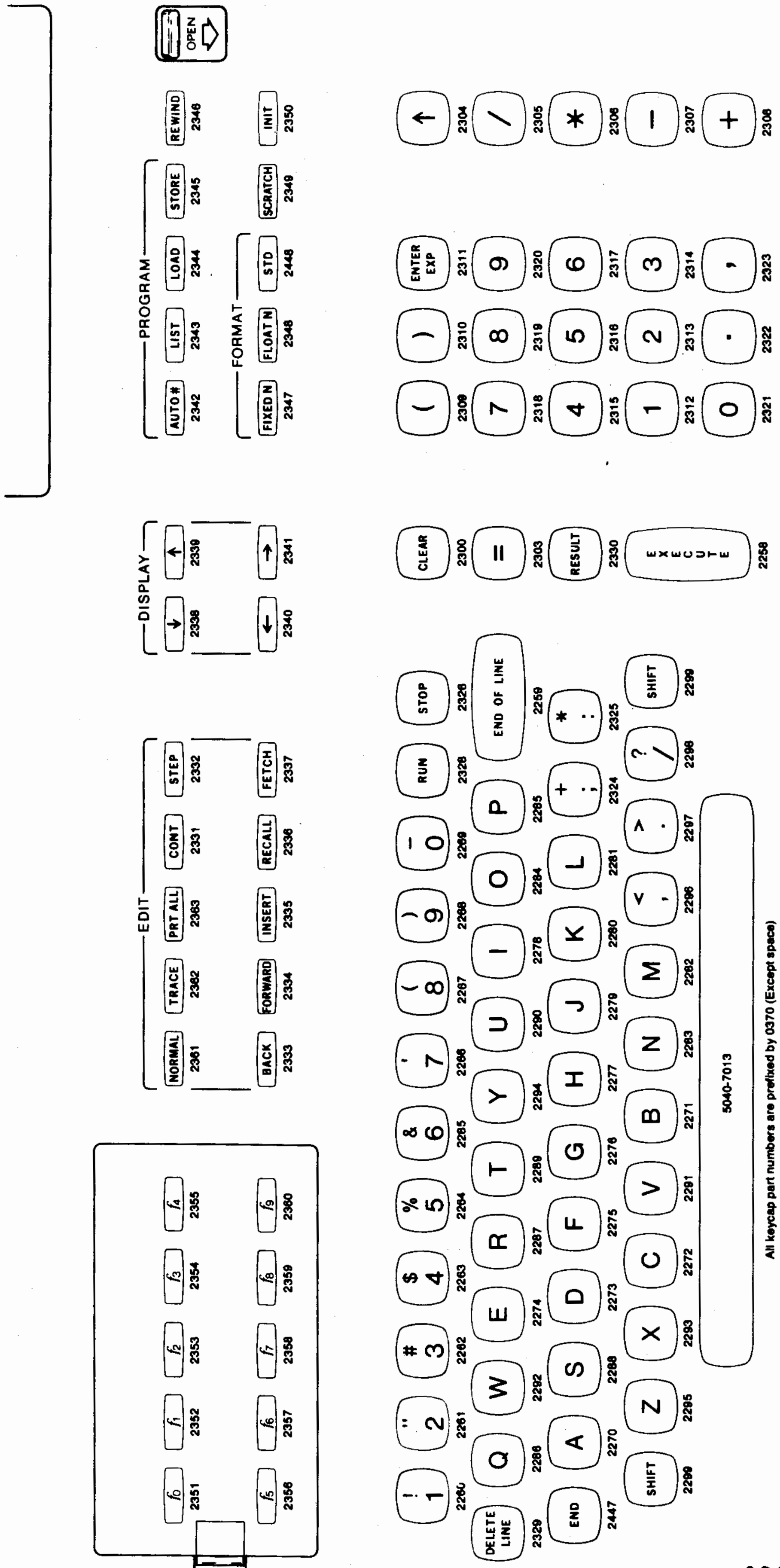
REFERENCE DESIGNATOR	-hp- PART NO.	TQ	DESCRIPTION		
			CHASSIS MOUNTED PARTS (continued)		
	09830-67920	1	Memory Ass'y		
	4330-0496		Bead-Glass		
	09830-67930	1	Keyboard Ass'y		
	09820-61632	1	Cable Ass'y - SW		
	0362-0004		Terminal-Cable		
	0362-0005		Caps-Terminal-Cable		
	0890-0103		Tubing-Heat Shrinkable: 1.25 in, White		
	1251-2989		Contact-R & P Conn: Male		
	3101-1589		SW - Rocker		
	2200-0770		Screw-Mach: 4-40, Pozi		
R1	0683-3945	1	R:fxd,390k 1/4w 10%		
	09830-61631	1	Cable Ass'y - KB		
	09830-66531	1	PC Ass'y - SW		
	09830-66532	1	PC Ass'y - Logic		
	4330-0496		Bead-Glass		
	5040-5869	1	Panel - Front		
	5040-5989	1	Panel - Keyboard		
	5040-7005	1	Window - Display		
	0520-0128		Screw-Mach: 2-56, Pan, Pozi		
	2190-0112		Lockwasher: #2, Helical		
	3050-0432		Washer-Flat: #2		
	5040-7009	1	Guide Torsion		
	2200-0778		Screw-Mach: 4-40, Pozi		
	2260-0001		Nut-Hex: 4-40		
	09830-67940	1	Display Assembly		
	4330-0496		Bead-Glass		
	09830-67961	1	XPort Ass'y		
	2200-0105		Screw-Mach: 4-40, Pan, Pozi		
	3050-0105		Washer-Flat: #4		
	09830-66561	1	PC Ass'y - Interface		
	2200-0167		Screw-Mach: 4-40		
	2260-0001		Nut-Hex: 4-40		
	3050-0716		Washer-Flat: #4		
	3050-0460		Washer-Conical		
	09830-01261	1	Brkt - Mounting		

REFERENCE DESIGNATOR	-hp- PART NO.	TQ	DESCRIPTION		
			CHASSIS MOUNTED PARTS (continued)		
	09830-20261	1	Cassett-Door		
	09830-66565	1	Ass'y - Cassette		
	09865-66566	1	PC Ass'y - Head		
	09865-26524	1	PC BD - Head Pins		
	0360-0124		Terminal - Round		
	1400-0249		Ty-Rap		
	2190-0004		Lockwasher: #4, Int Star		
	2200-0123		Screw-Mach: 4-40, Pan		
	2200-0151		Screw-Mach: 4-40, Pan, Pozi		
	3050-0716		Washer-Flat: #4		
	09865-66562	1	PC Ass'y - Logic		
	09865-69563	1	PC Ass'y - R/W		
	09865-66564	1	PC Ass'y - Motor		
	09830-67900	1	Chassis Ass'y		
	7120-2938	1	Plate-Serial		
	7120-3053	1	Plate-Legend		
	7120-3054	1	Plate-Legend		
	7120-3055	1	Plate-Legend		
	7120-3218	1	Label-Options		
	7120-3210	1	Label-Opt Matrix		
	7120-3211	1	Label-Opt Plotter		
	7120-3214	1	Label-Opt String		
	2110-0001		Fuse: 1-amp, 250V		
	2110-0002		Fuse: 2-amp, 250V		
	2110-0056		Fuse: 6-amp, 250V		
	1251-2035		Conn: PC 2 x 15		
	1251-2048		Conn: PC 2 x 22		
	1251-2134		Conn: PC 2 x 18		
	1251-2025		Conn: PC 2 x 24		
	1251-1631		Conn: PC 10		
	1251-0478		Conn: PC 12		
	8120-1378		Cable: AC power*		
	9211-0046	1	Carton: Corr		
	9211-1806	1	Carton: Corr		
	9220-1956	1	Post: Polyeth		
	9162-0050		Cassette		
	9320-1671	1	Card: Instr		
	8500-1251		Cleaner: Head		

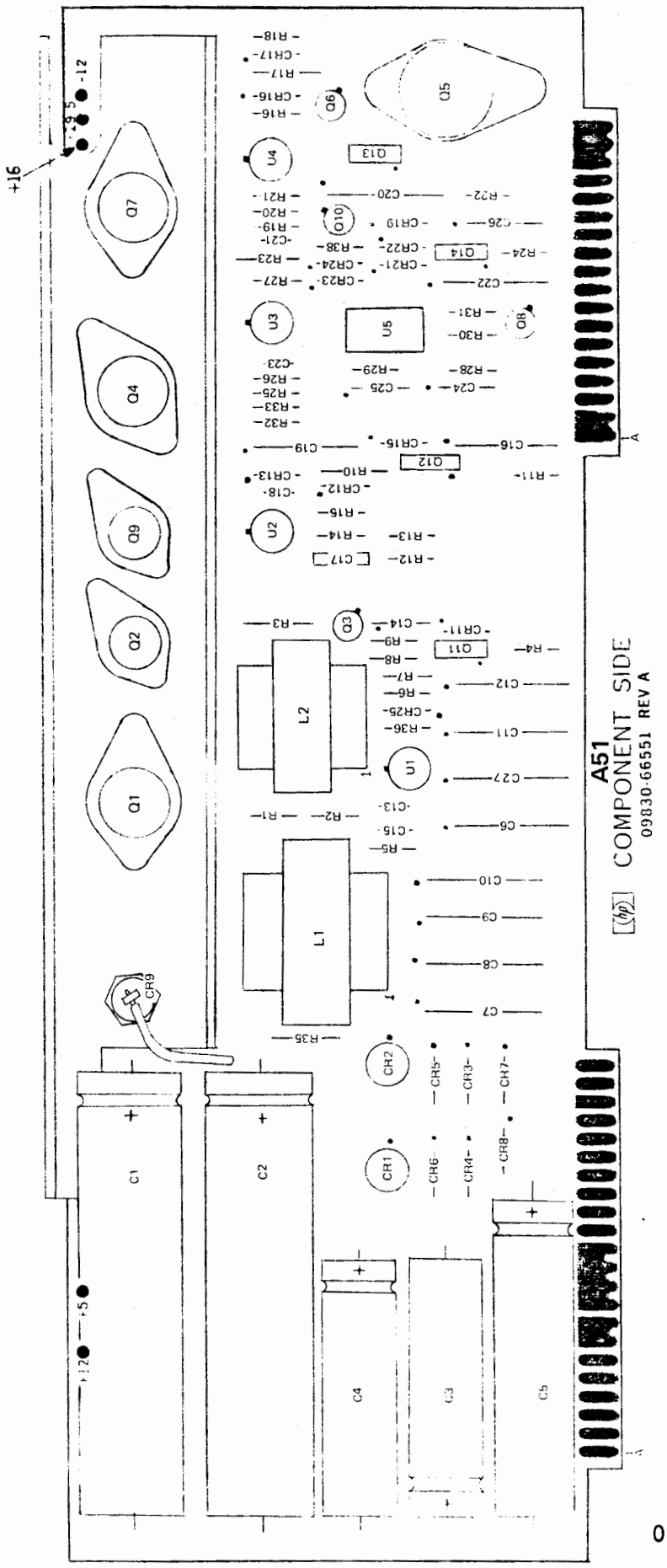
* Standard in U.S., other types of connectors are available on order.

REFERENCE DESIGNATOR		-hp- PART NO.	TQ	DESCRIPTION		
				CHASSIS MOUNTED PARTS (continued)		
		11270-66520	1	PC Ass'y - Matrix ROM		
		11271-66520	1	PC Ass'y - Plotter ROM		
		11274-66520	1	PC Ass'y - String ROM		
		11275-66584	1	4K R/W MEMORY		
		09830-90000		Manual-Simplified		
		09830-90001		Manual-Operating		
		09830-90002		Manual-String ROM		
		09830-90003		Manual-Plotter ROM		
		09830-90004		Manual-Matrix ROM		
		09830-90030		Manual-Service		
		09830-90035		Cassette Test		
A2		09830-66502		I/O EXTENDER BD		
	C1	0150-0093		C: FXD, .01 µF		
	R1,R2	0684-2221		R: FXD, 2.2K 10%		
	U1	1820-0619		74H22		
	U2	1820-0328		SN7402N		
	U3	1820-0077		SN7474N		
	U4,U5	1820-0301		SN7475N		
	J1-J4	1251-2915		CONNECTOR, PC BD		

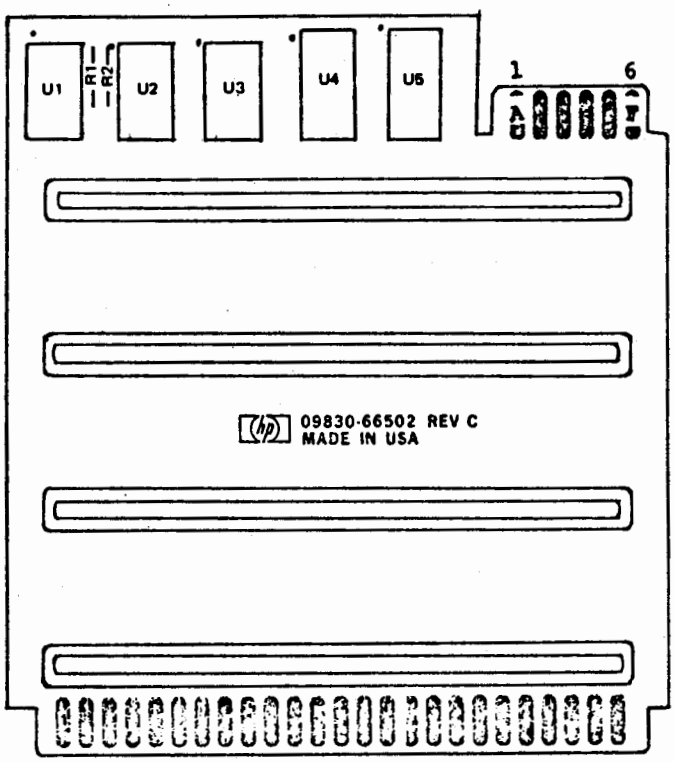
9830A KEYCAP PART NUMBERS



09830A-6-(7-30)

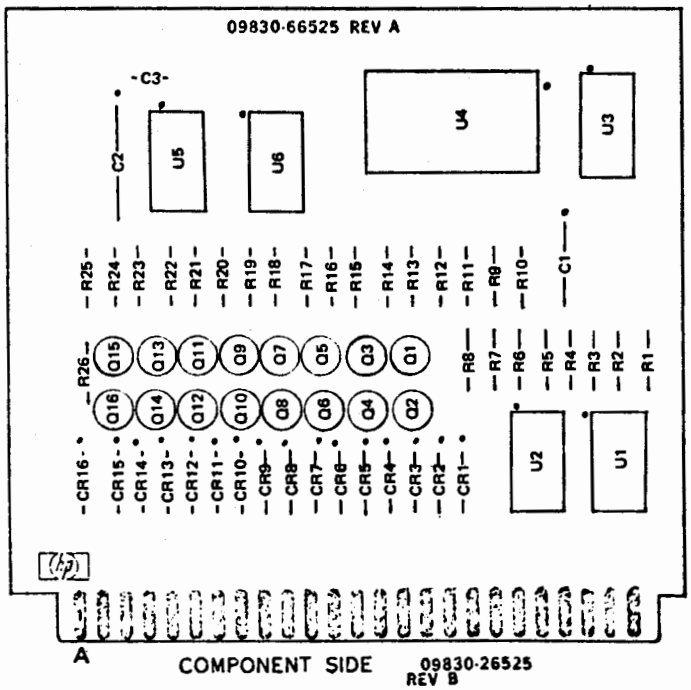

A51
COMPONENT SIDE
09830-66551 REV A
+16
-12
+5
+12
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
Q10
Q11
Q12
Q13
Q14
U1
U2
U3
U4
U5
L1
L2
CR1
CR2
CR9
C1
C2
C3
C4
C5

09830A-6-(7-31)



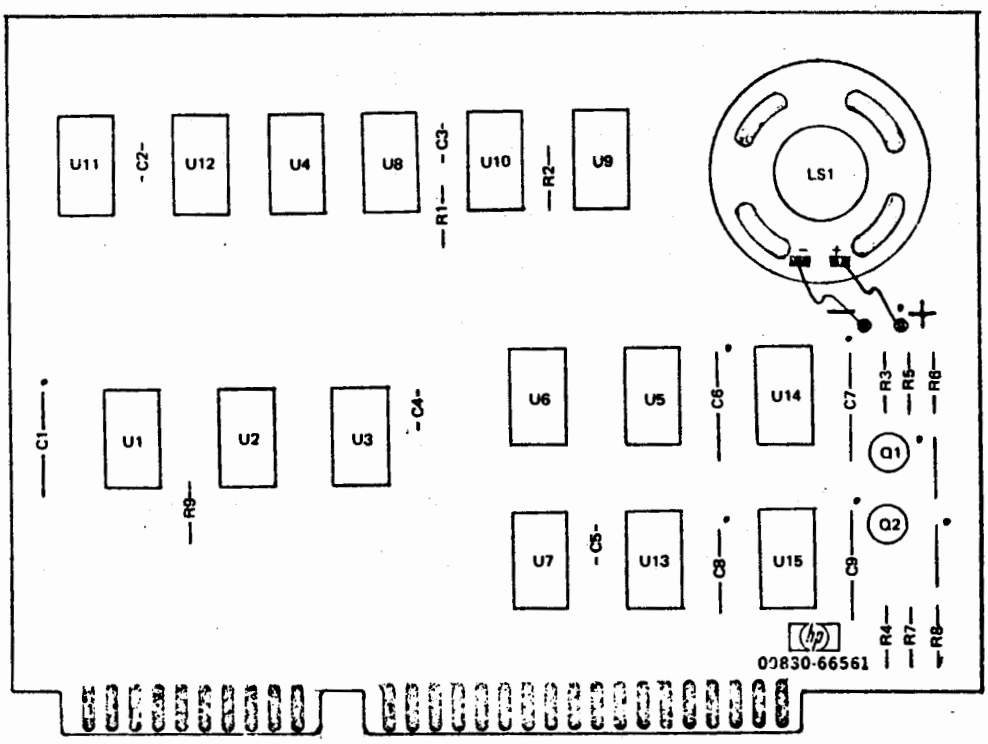
COMPONENT SIDE
REV C

A2

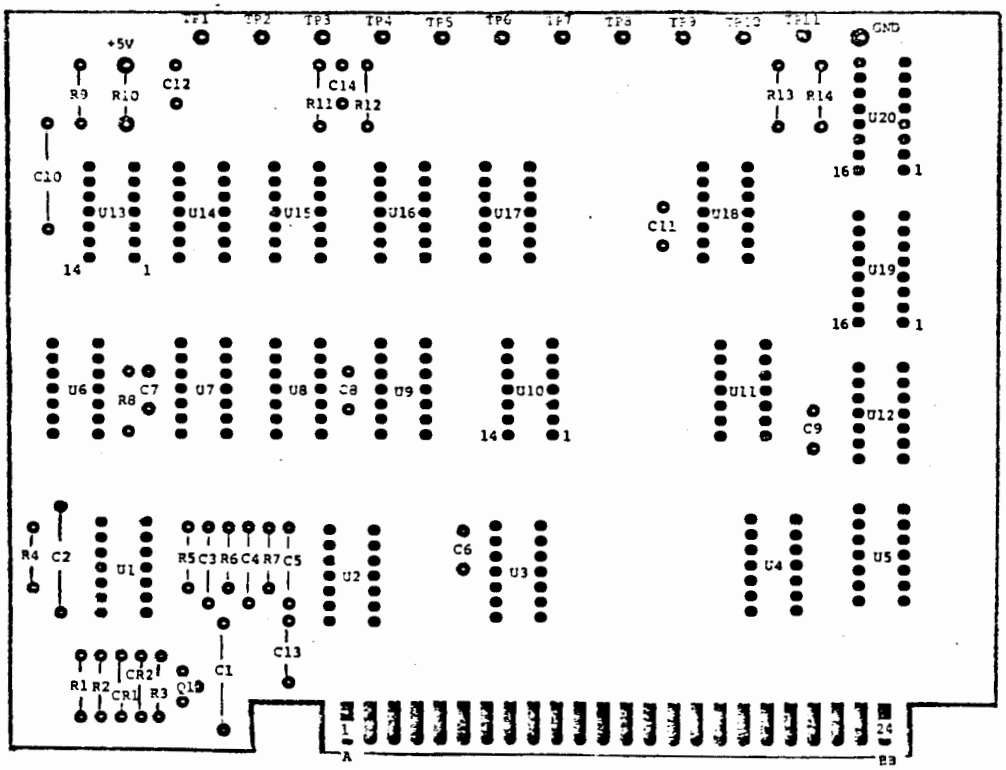


COMPONENT SIDE 09830-26525
REV B

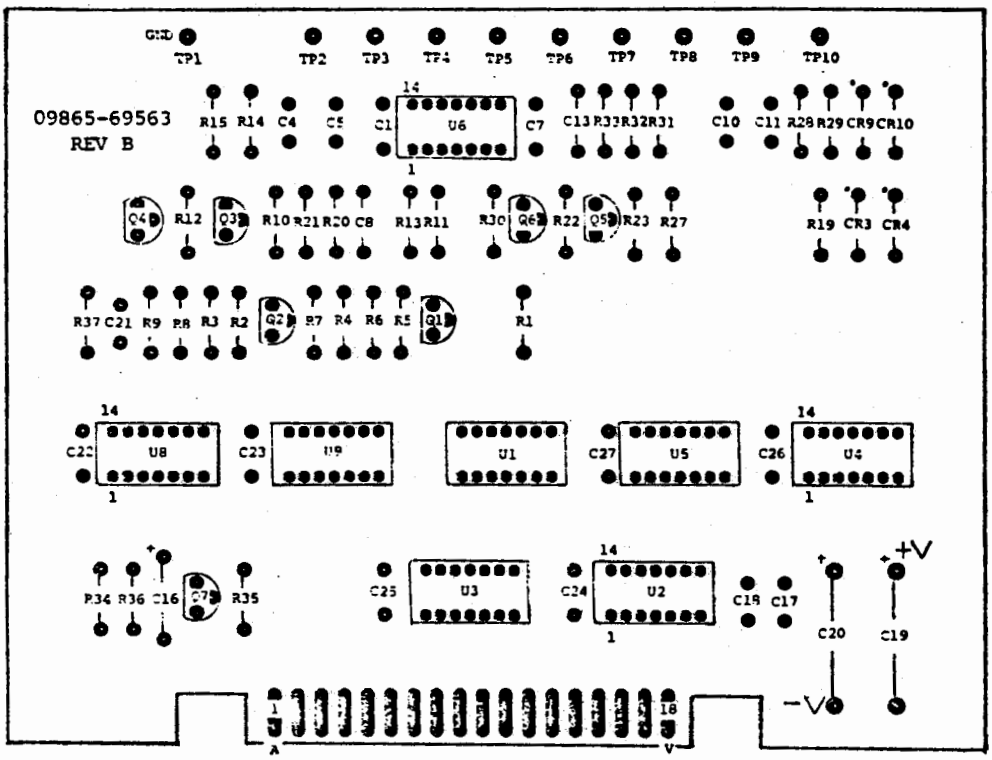
A25



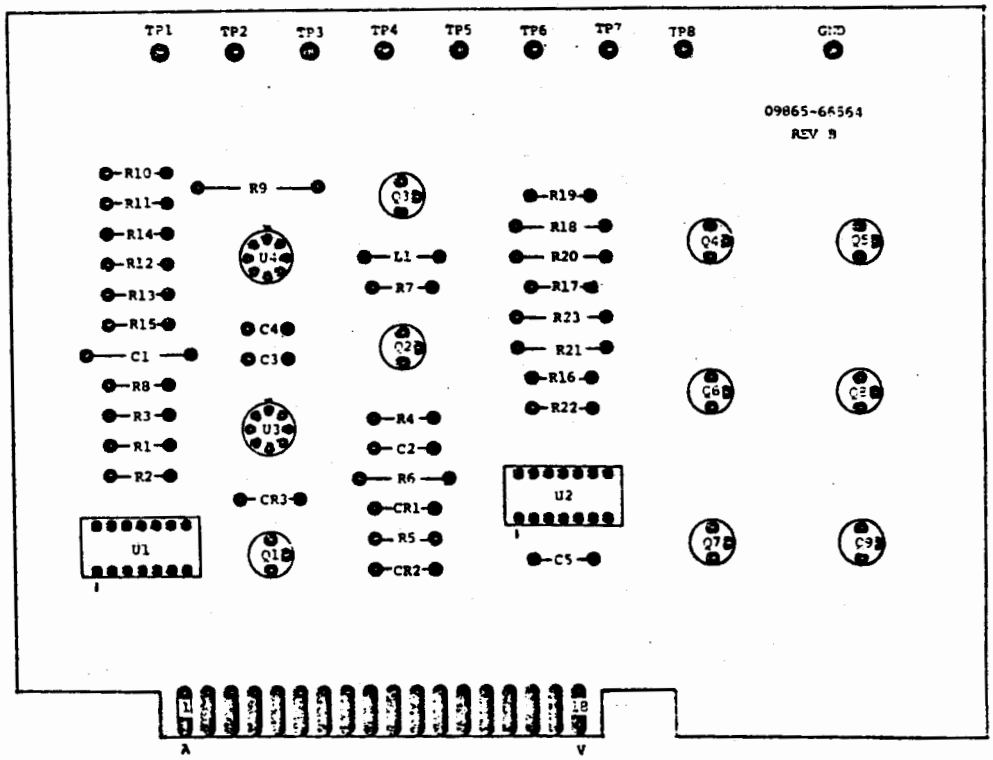
COMPONENT SIDE A61
09830-26561 REV A



CONTROL LOGIC ASSEMBLY A62

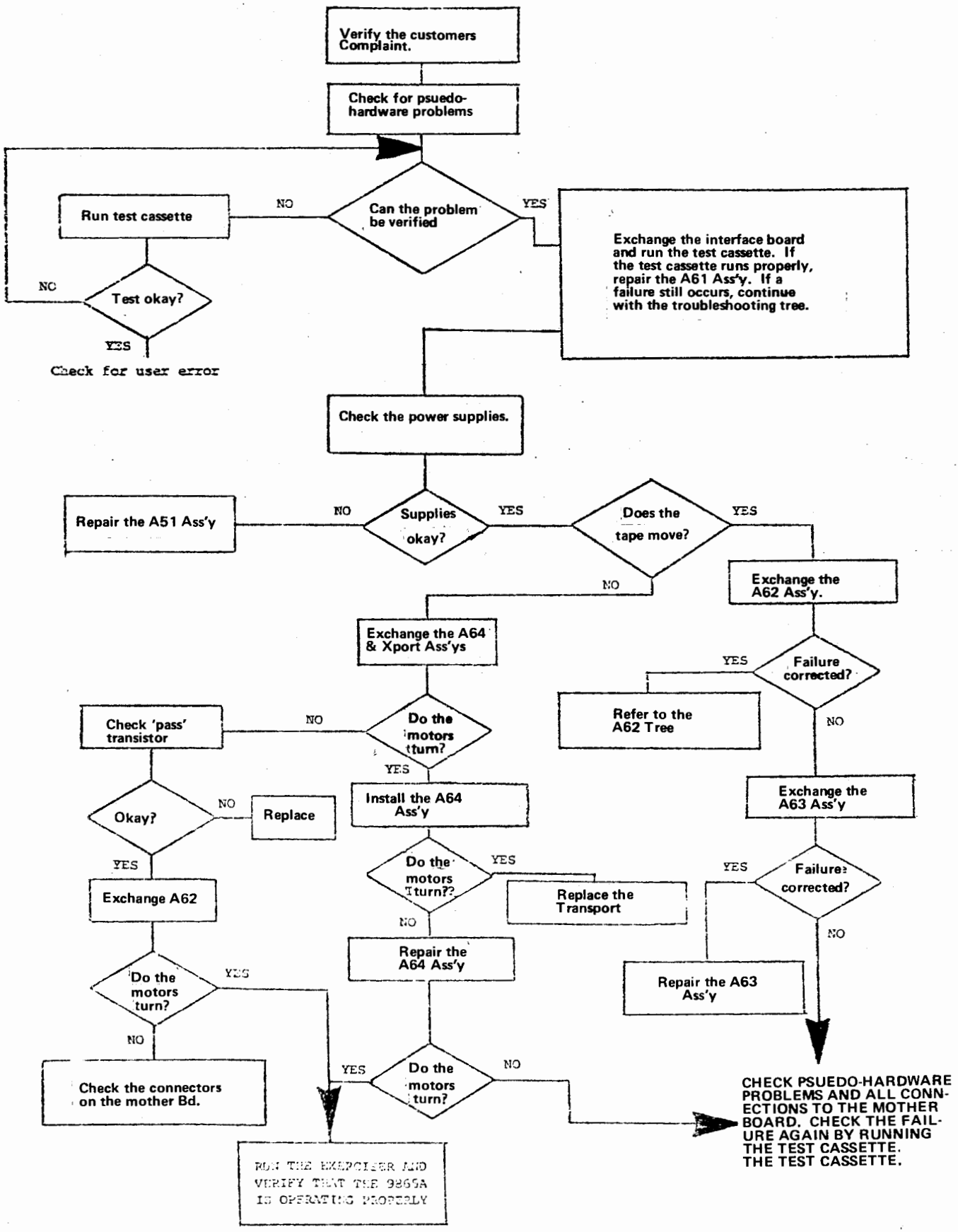


READ/WRITE MEMORY **A63**



MOTOR CONTROL **A64**

INTERNAL CASSETTE MEMORY TROUBLESHOOTING TREE



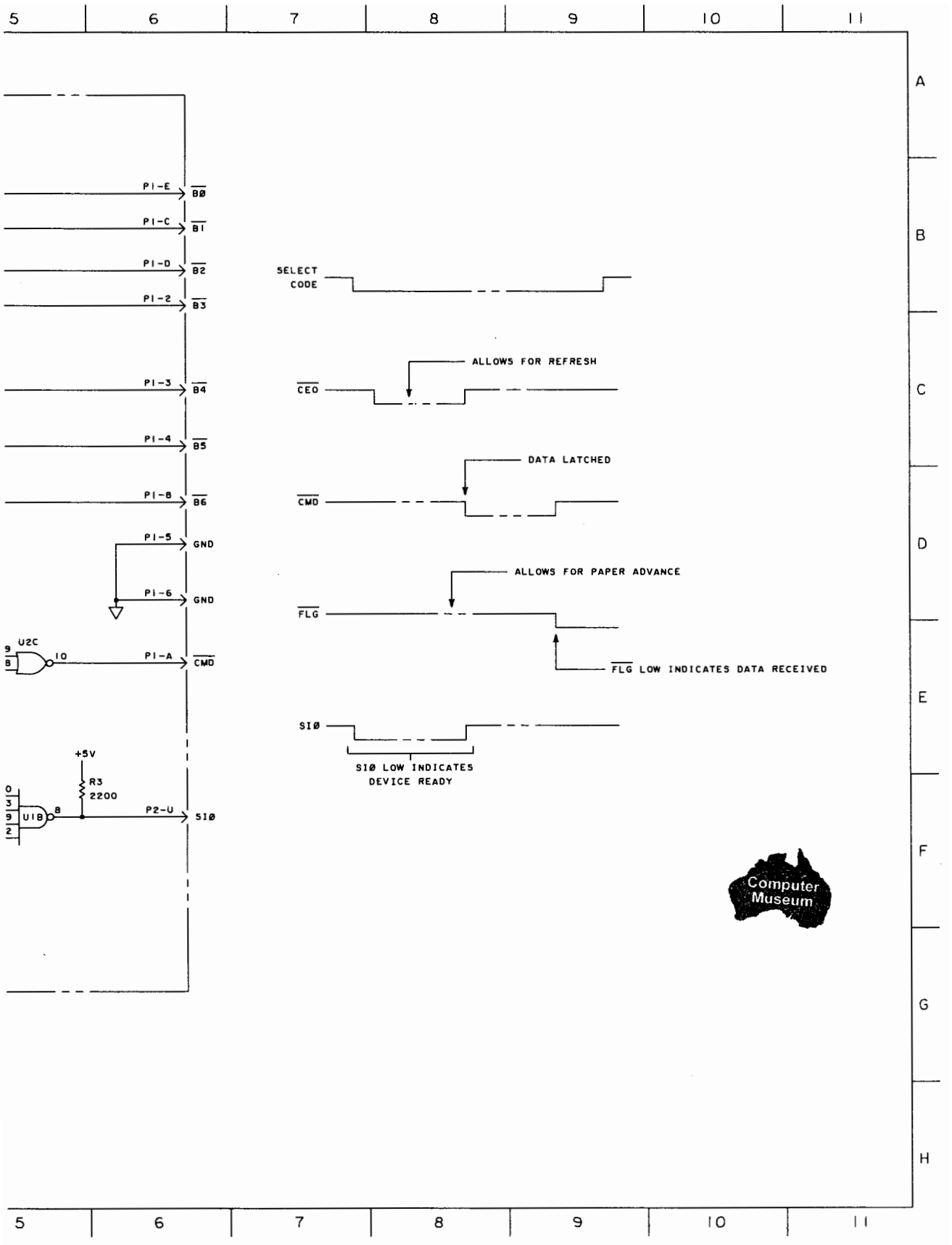
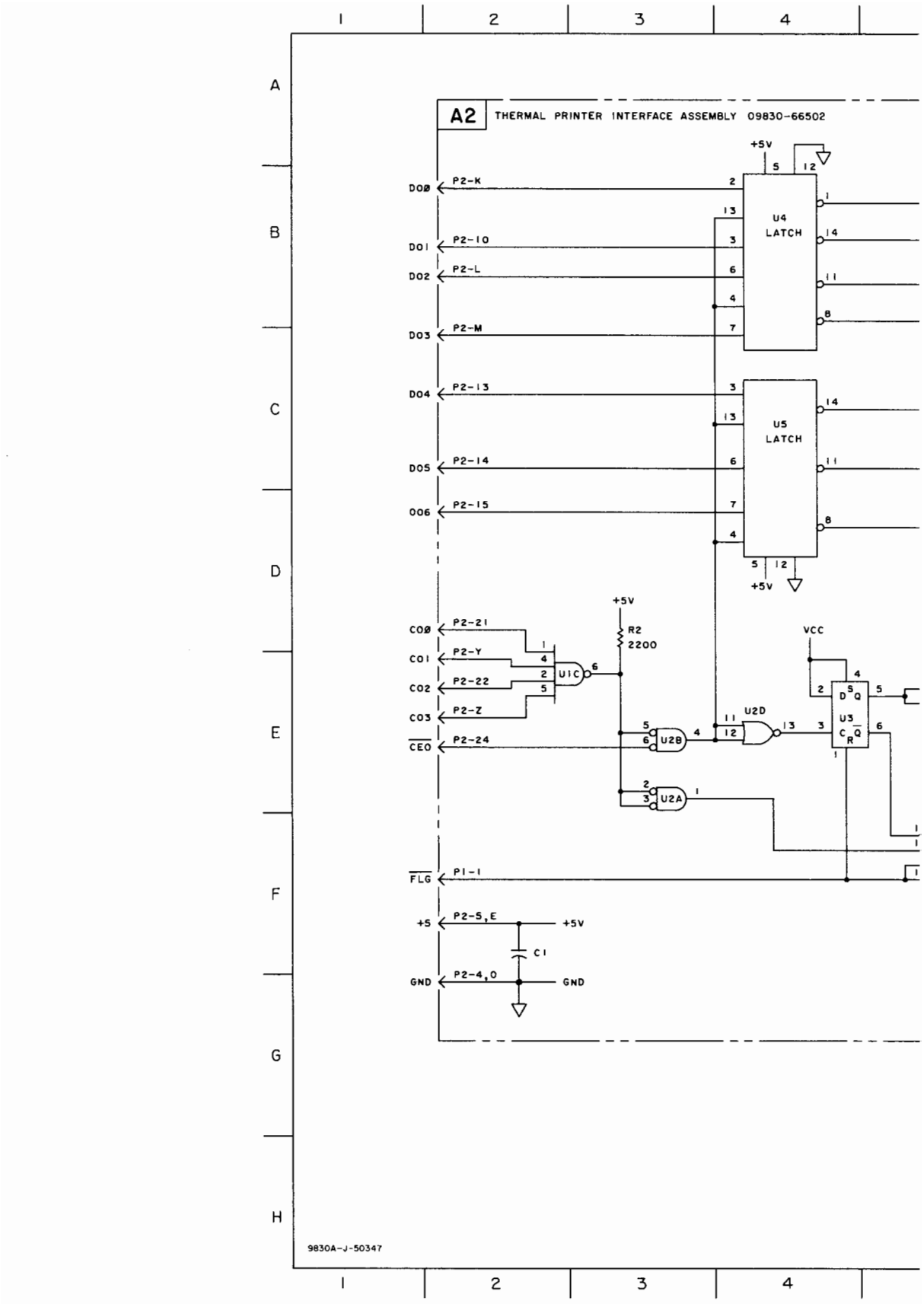


Figure 7-1. I/O Extender & 9866A Interface A2


A2
THERMAL PRINTER INTERFACE ASSEMBLY 09830-66502
+5V
U4
LATCH
U5
LATCH
DO0
DO1
DO2
DO3
DO4
DO5
DO6
P2-K
P2-10
P2-L
P2-M
P2-13
P2-14
P2-15
CO0
CO1
CO2
CO3
CEO
P2-21
P2-Y
P2-22
P2-Z
P2-24
U1C
R2
2200
U2B
U2A
U2D
VCC
U3
FLG
P1-1
+5
P2-5,E
C1
GND
P2-4,0
9830A-J-50347

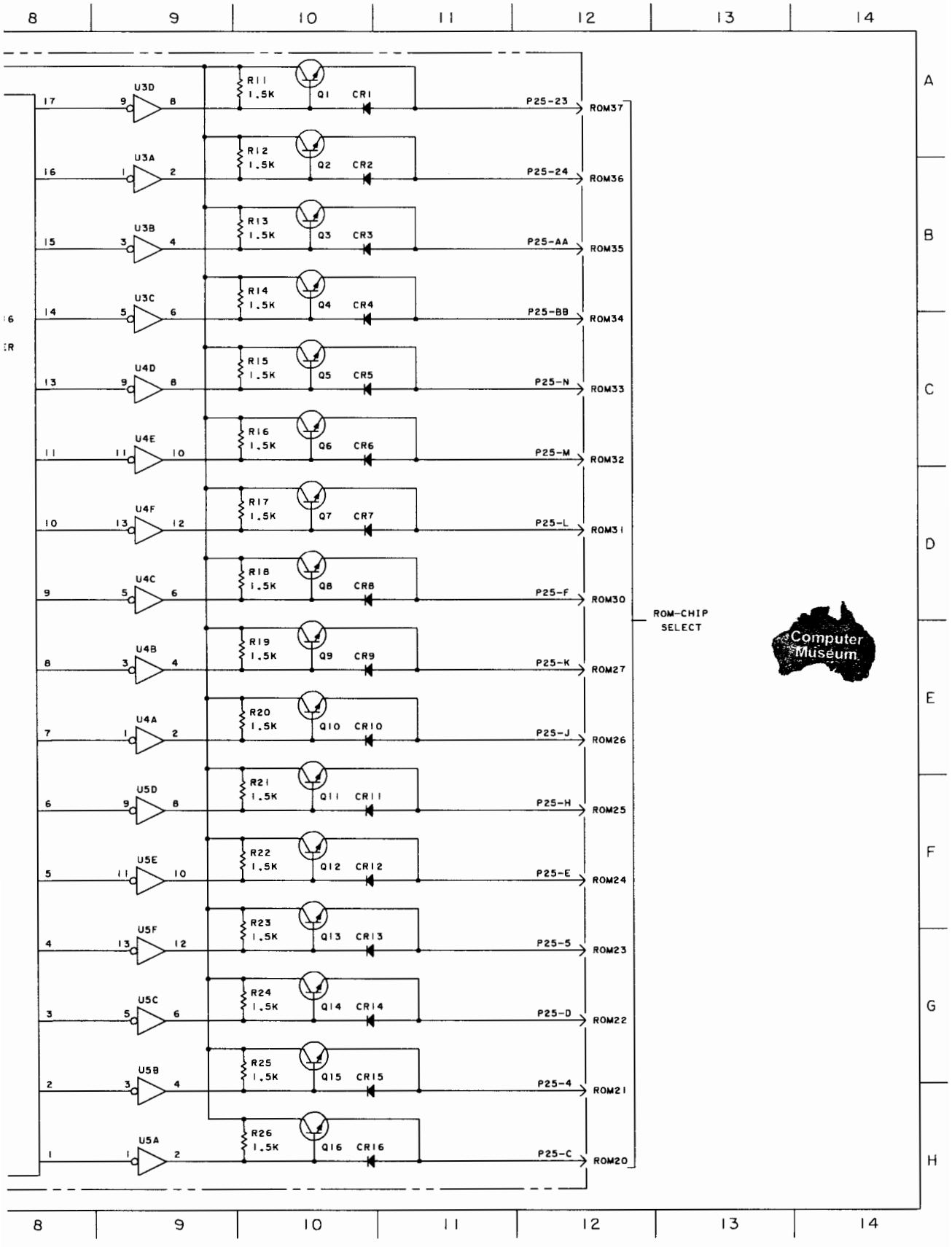
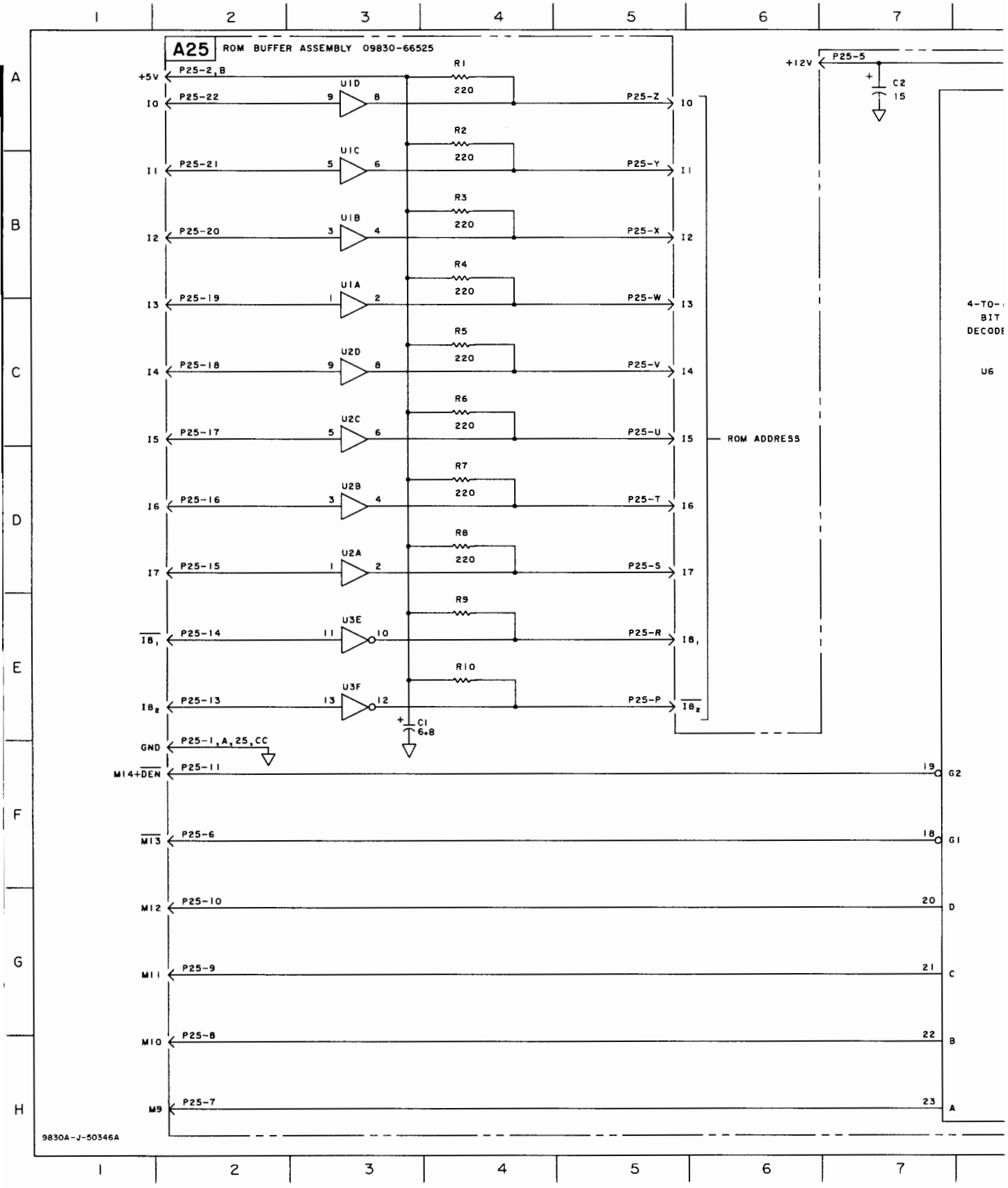


Figure 7-2. ROM Buffer Assembly A25


A25 ROM BUFFER ASSEMBLY 09830-66525
+5V
P25-2,8
I0
P25-22
U1D
9
8
R1
220
P25-Z
I0
I1
P25-21
U1C
5
6
R2
220
P25-Y
I1
I2
P25-20
U1B
3
4
R3
220
P25-X
I2
I3
P25-19
U1A
1
2
R4
220
P25-W
I3
I4
P25-18
U2D
9
8
R5
220
P25-V
I4
I5
P25-17
U2C
5
6
R6
220
P25-U
I5
ROM ADDRESS
I6
P25-16
U2B
3
4
R7
220
P25-T
I6
I7
P25-15
U2A
1
2
R8
220
P25-S
I7
I8,
P25-14
U3E
11
10
R9
P25-R
I8,
I8z
P25-13
U3F
13
12
R10
P25-P
I8z
C1
6.8
GND
P25-1,A,25,CC
M14+DEN
P25-11
19
G2
M13
P25-6
18
G1
M12
P25-10
20
D
M11
P25-9
21
C
M10
P25-8
22
B
M9
P25-7
23
A
+12V
P25-5
C2
15
4-TO-
BIT
DECODE
U6
9830A-J-50346A

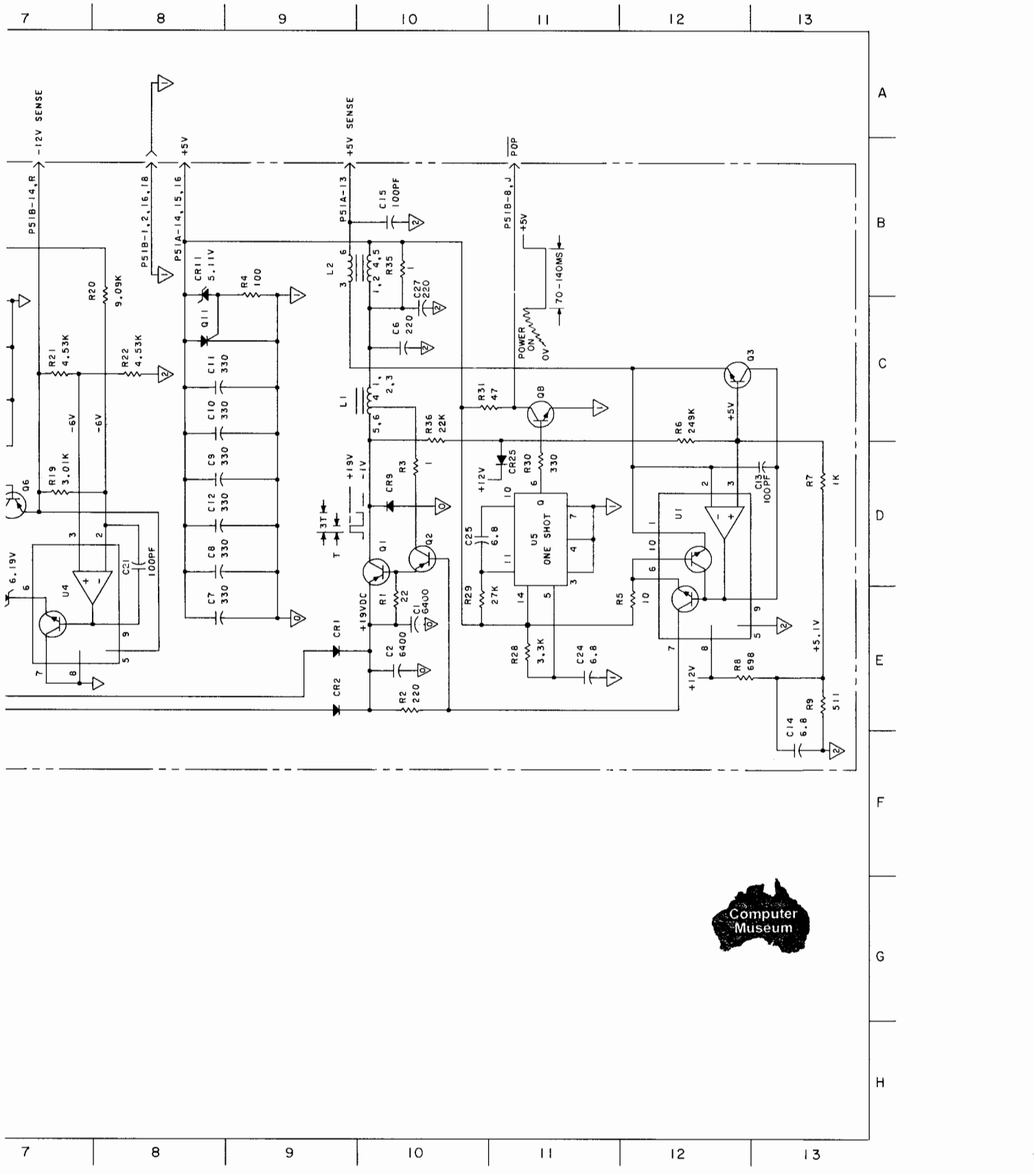
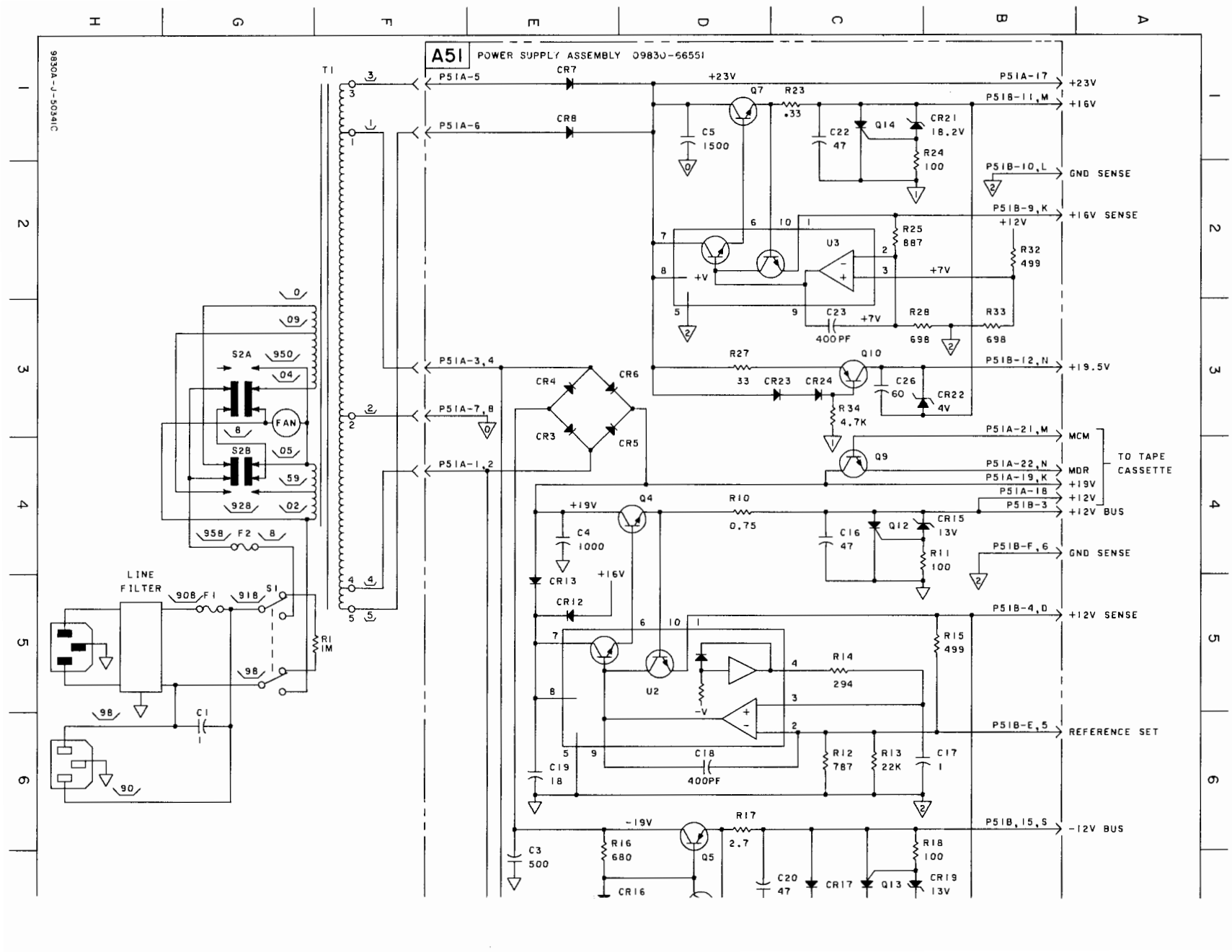


Figure 7-3. Power Supply Assembly A51


A51 POWER SUPPLY ASSEMBLY 09830-66551
98S0A-J-5034IC
T1
P51A-5
P51A-6
P51A-3,4
P51A-7,8
P51A-1,2
CR7
CR8
CR4
CR6
CR3
CR5
+23V
P51A-17
+23V
P51B-11,M
+16V
P51B-10,L
GND SENSE
P51B-9,K
+16V SENSE
P51B-12,N
+19.5V
P51A-21,M
MCM
P51A-22,N
MDR
P51A-19,K
+19V
P51A-18
+12V
P51B-3
+12V BUS
P51B-F,6
GND SENSE
P51B-4,D
+12V SENSE
P51B-E,5
REFERENCE SET
P51B,15,S
-12V BUS
TO TAPE CASSETTE
Q7
R23
.33
C5
1500
C22
47
Q14
CR21
18.2V
R24
100
U3
R25
887
R32
499
+12V
+7V
+V
C23
400PF
R28
698
R33
698
R27
33
CR23
CR24
Q10
C26
60
CR22
4V
R34
4.7K
Q9
Q4
R10
0.75
C4
1000
CR13
+16V
CR12
C16
47
Q12
CR15
13V
R11
100
U2
R14
294
R15
499
-V
C18
400PF
C19
18
R12
787
R13
22K
C17
1
-19V
R17
2.7
R16
680
CR16
Q5
C3
500
C20
47
CR17
Q13
CR19
13V
R18
100
S2A
S2B
FAN
950
04
05
59
928
02
0
09
8
958
F2
8
LINE FILTER
908
F1
918
S1
98
R1
1M
C1
90

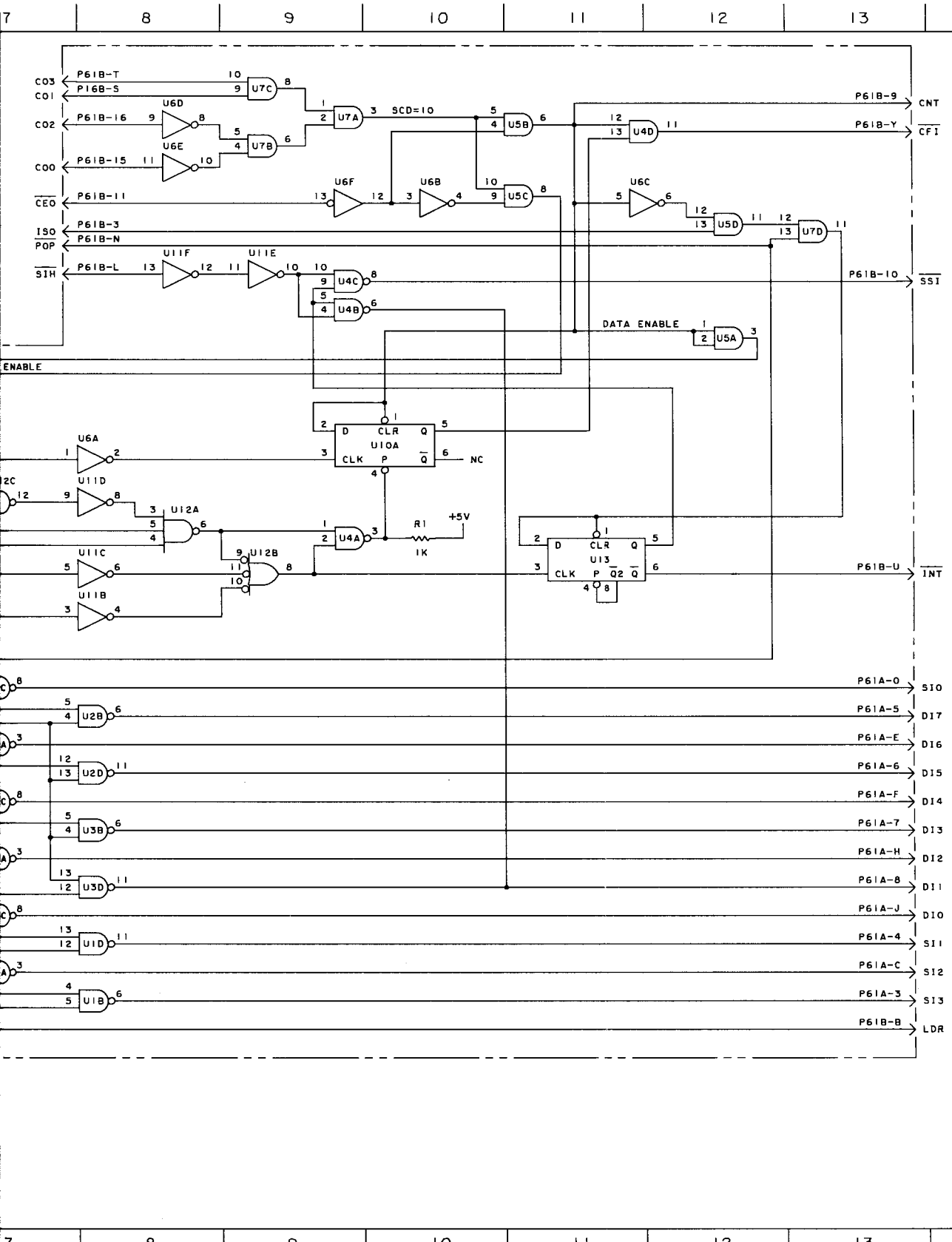
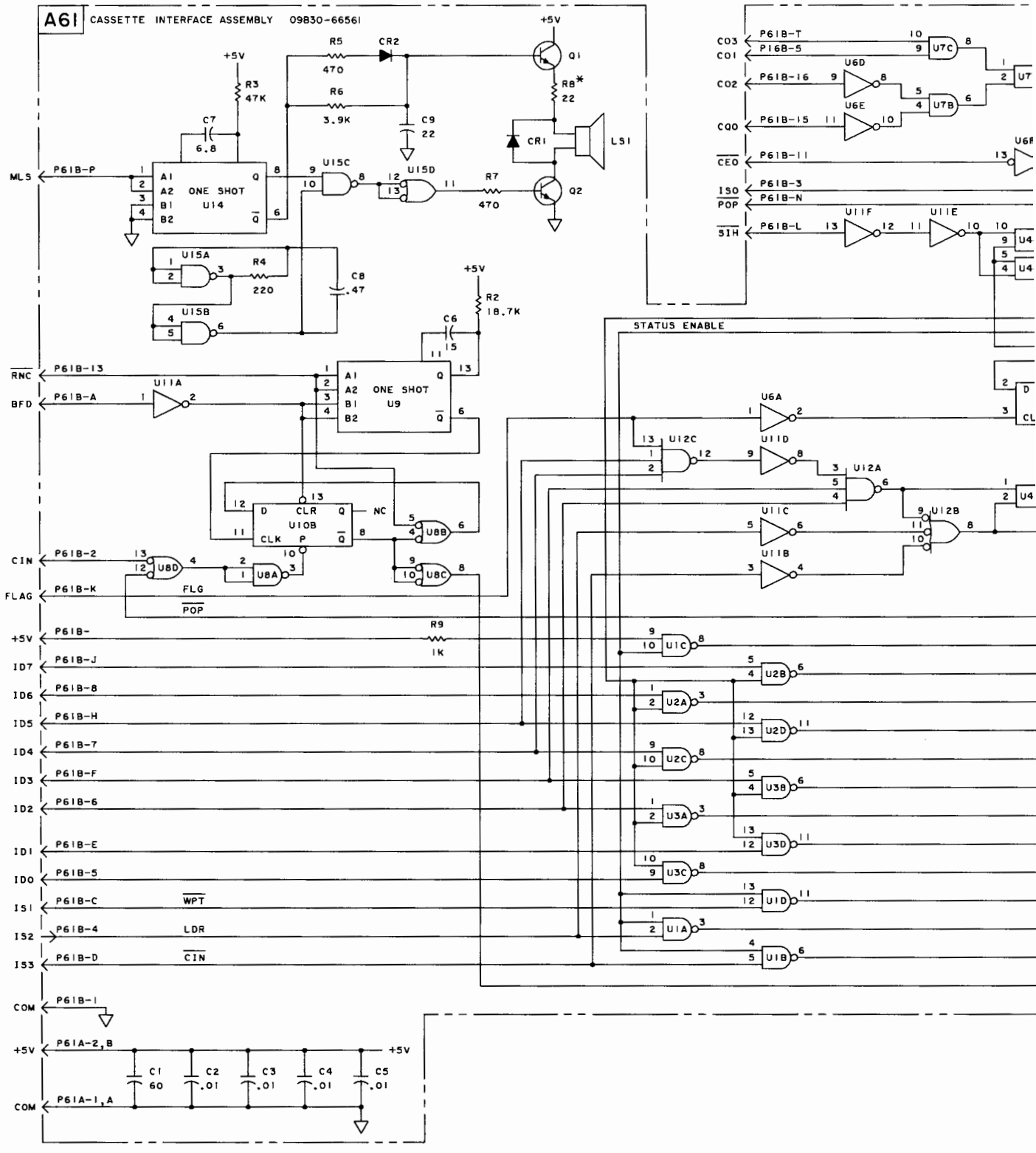


Figure 7-4. Cassette Interface Assemb
A61


A61 CASSETTE INTERFACE ASSEMBLY 09830-66561
+5V
R5 470
CR2
Q1
R3 47K
R6 3.9K
C7 6.8
C9 22
R8* 22
CR1
LS1
MLS
P61B-P
U14 ONE SHOT
U15C
U15D
R7 470
Q2
U15A
U15B
R4 220
C8 .47
R2 18.7K
C6 .15
RNC
P61B-13
BFD
P61B-A
U11A
U9 ONE SHOT
U10B
NC
CIN
P61B-2
FLAG
P61B-K
FLG
POP
U8A
U8B
U8C
U8D
+5V
P61B-
R9 1K
ID7
P61B-J
ID6
P61B-8
ID5
P61B-H
ID4
P61B-7
ID3
P61B-F
ID2
P61B-6
ID1
P61B-E
ID0
P61B-5
IS1
P61B-C
WPT
IS2
P61B-4
LDR
IS3
P61B-D
CIN
COM
P61B-1
+5V
P61A-2,8
C1 60
C2 .01
C3 .01
C4 .01
C5 .01
COM
P61A-1,A
CO3
P61B-T
CO1
P16B-5
U7C
CO2
P61B-16
U6D
U7B
CO0
P61B-15
U6E
CEO
P61B-11
ISO
POP
P61B-3
P61B-N
31H
P61B-L
U11F
U11E
STATUS ENABLE
U6A
U12C
U11D
U12A
U11C
U12B
U11B
U1C
U2B
U2A
U2D
U2C
U3B
U3A
U3D
U3C
U1D
U1A
U1B

J-50342A

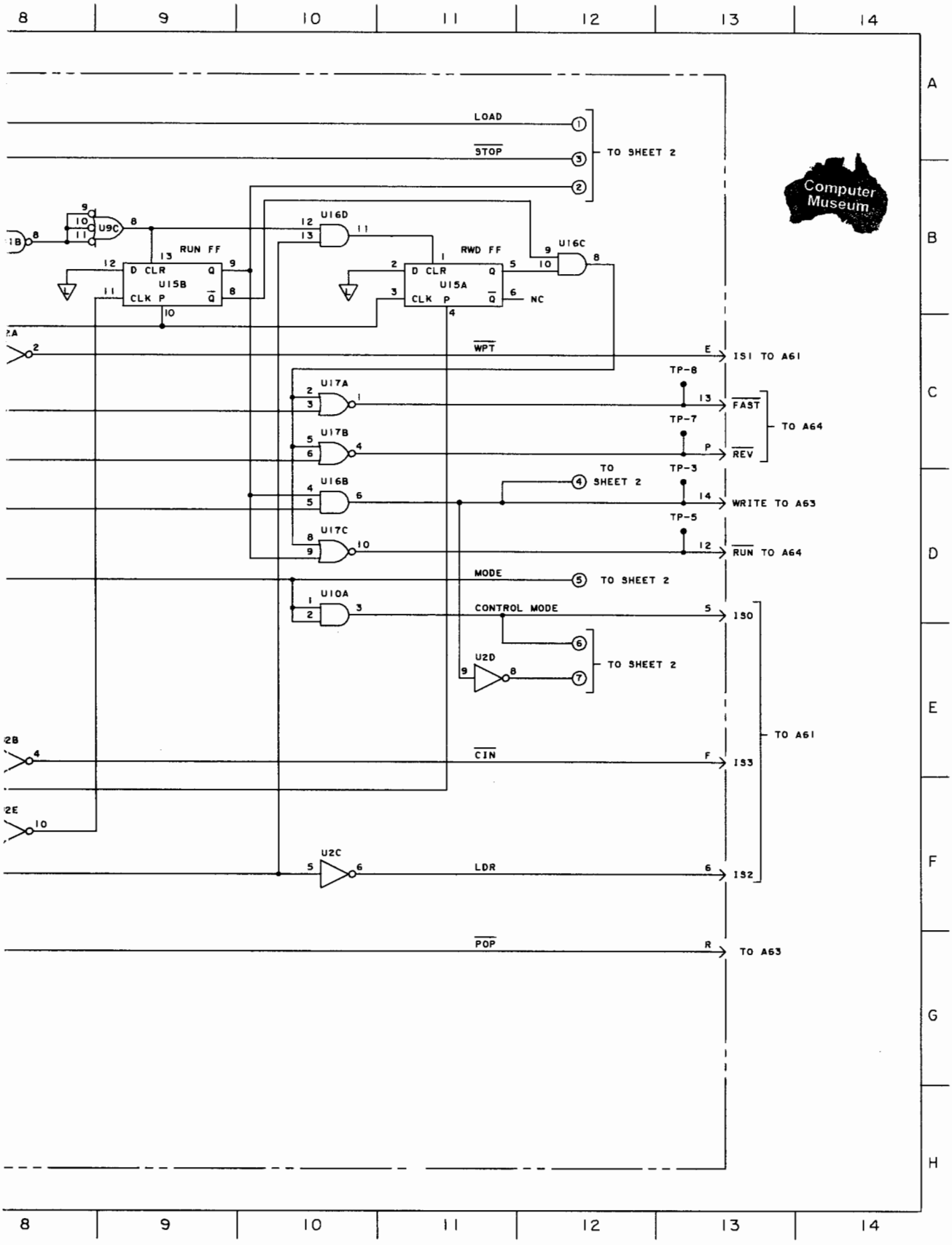
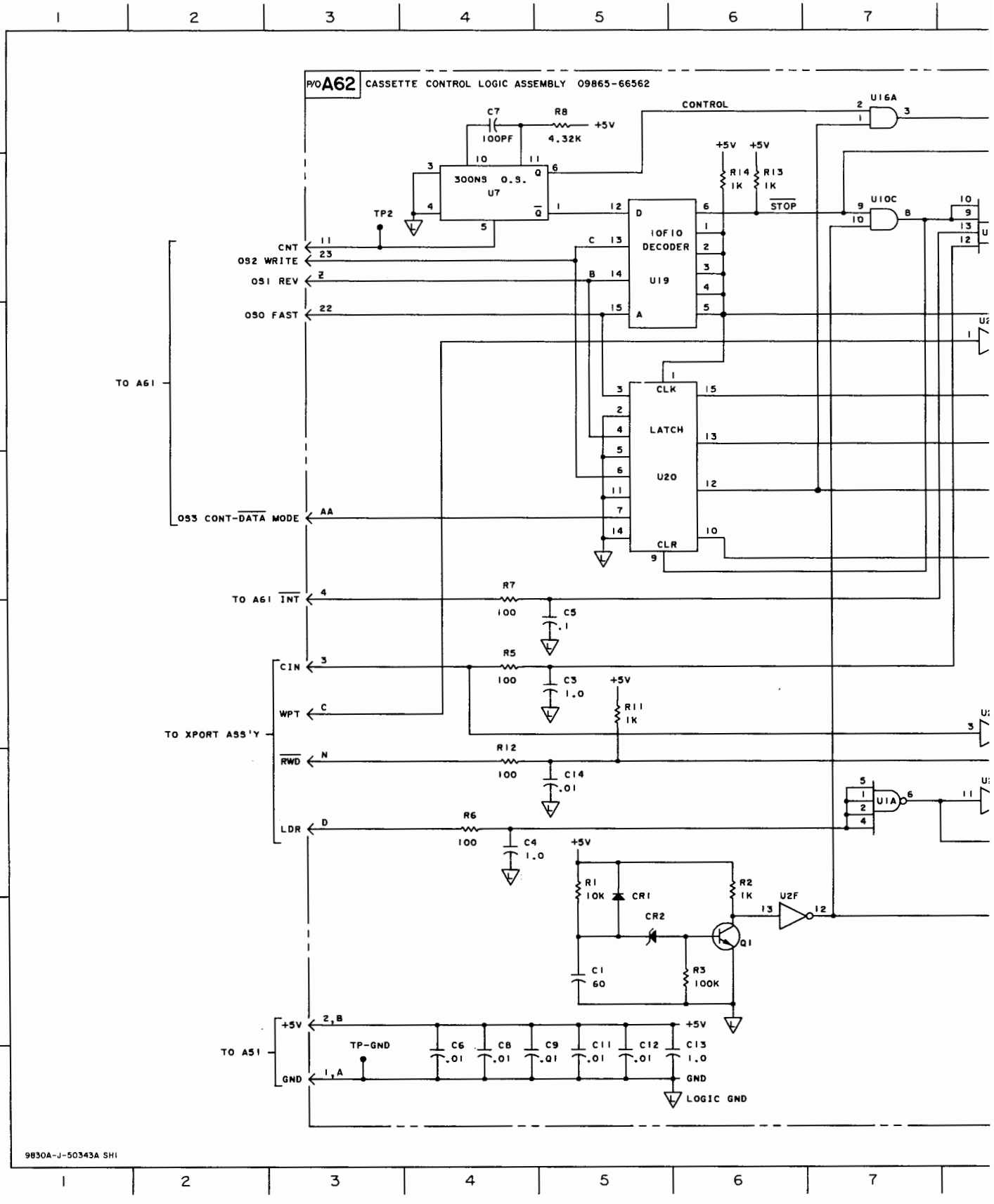


Figure 7-5. Cassette Control Logic A62 (Sheet 1 of 2)


P/O A62 CASSETTE CONTROL LOGIC ASSEMBLY 09865-66562
C7 100PF
R8 4.32K
+5V
CONTROL
U16A
300NS 0.S. U7
TP2
+5V +5V
R14 1K
R13 1K
STOP
U10C
1OF10 DECODER U19
CNT
OS2 WRITE
OS1 REV
OS0 FAST
TO A61
CLK
LATCH U20
CLR
OS3 CONT-DATA MODE
TO A61 INT
R7 100
C5 .1
CIN
R5 100
C3 1.0
R11 1K
WPT
TO XPORT ASS'Y
RWD
R12 100
C14 .01
U1A
LDR
R6 100
C4 1.0
R1 10K
CR1
CR2
R2 1K
U2F
Q1
C1 60
R3 100K
TO A51
TP-GND
C6 .01
C8 .01
C9 .01
C11 .01
C12 .01
C13 1.0
GND
LOGIC GND
9830A-J-50343A SHI

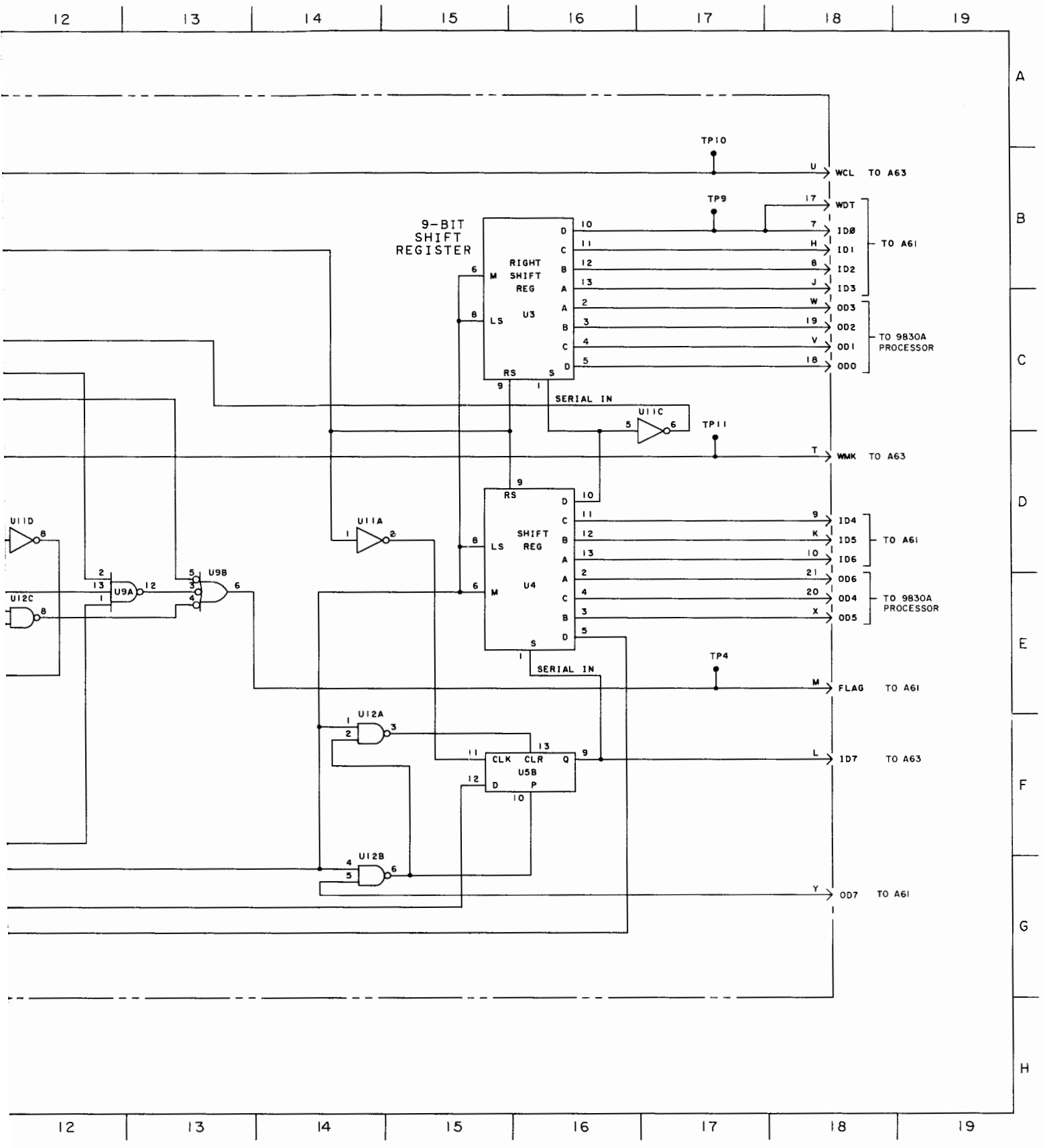
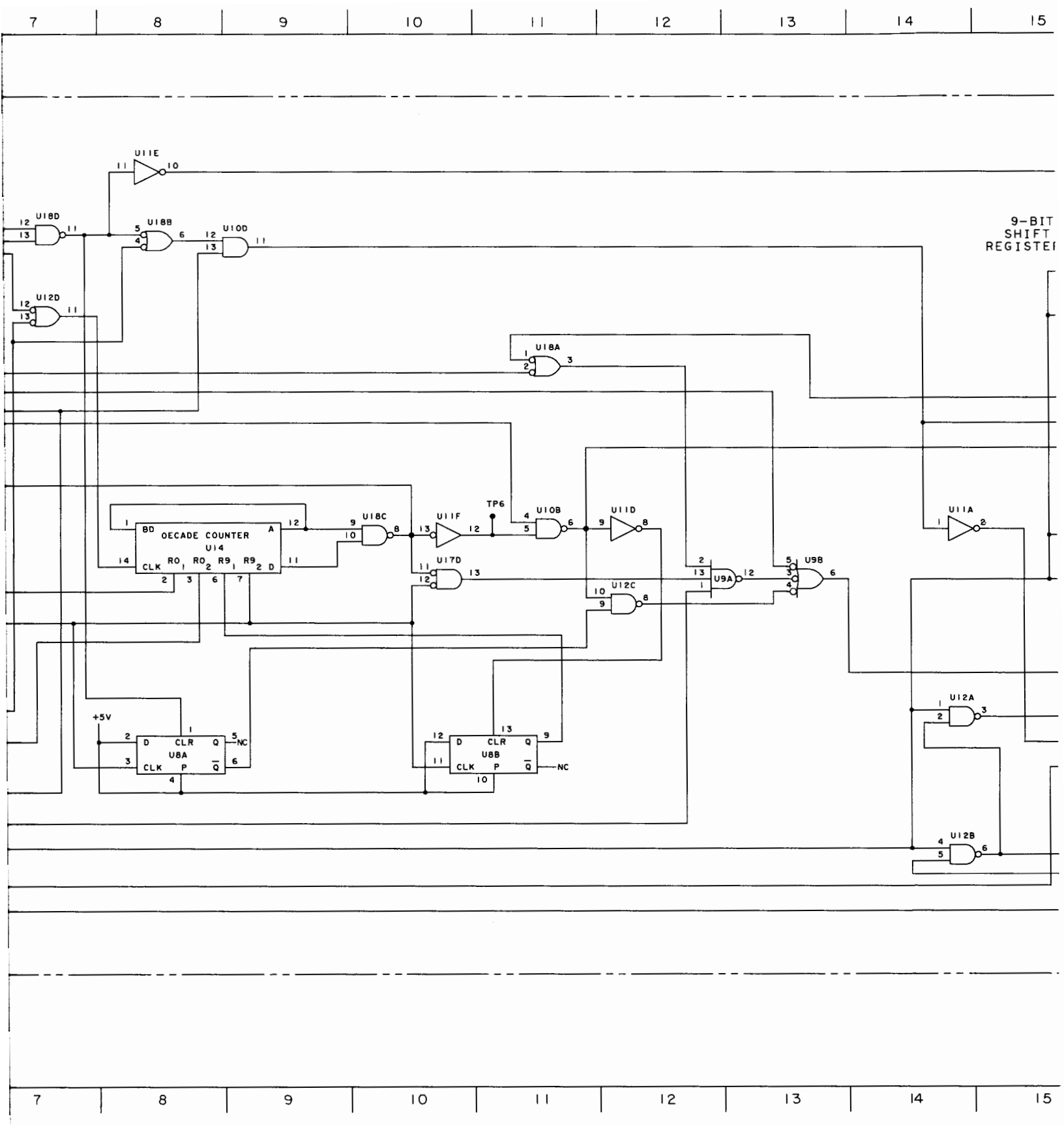
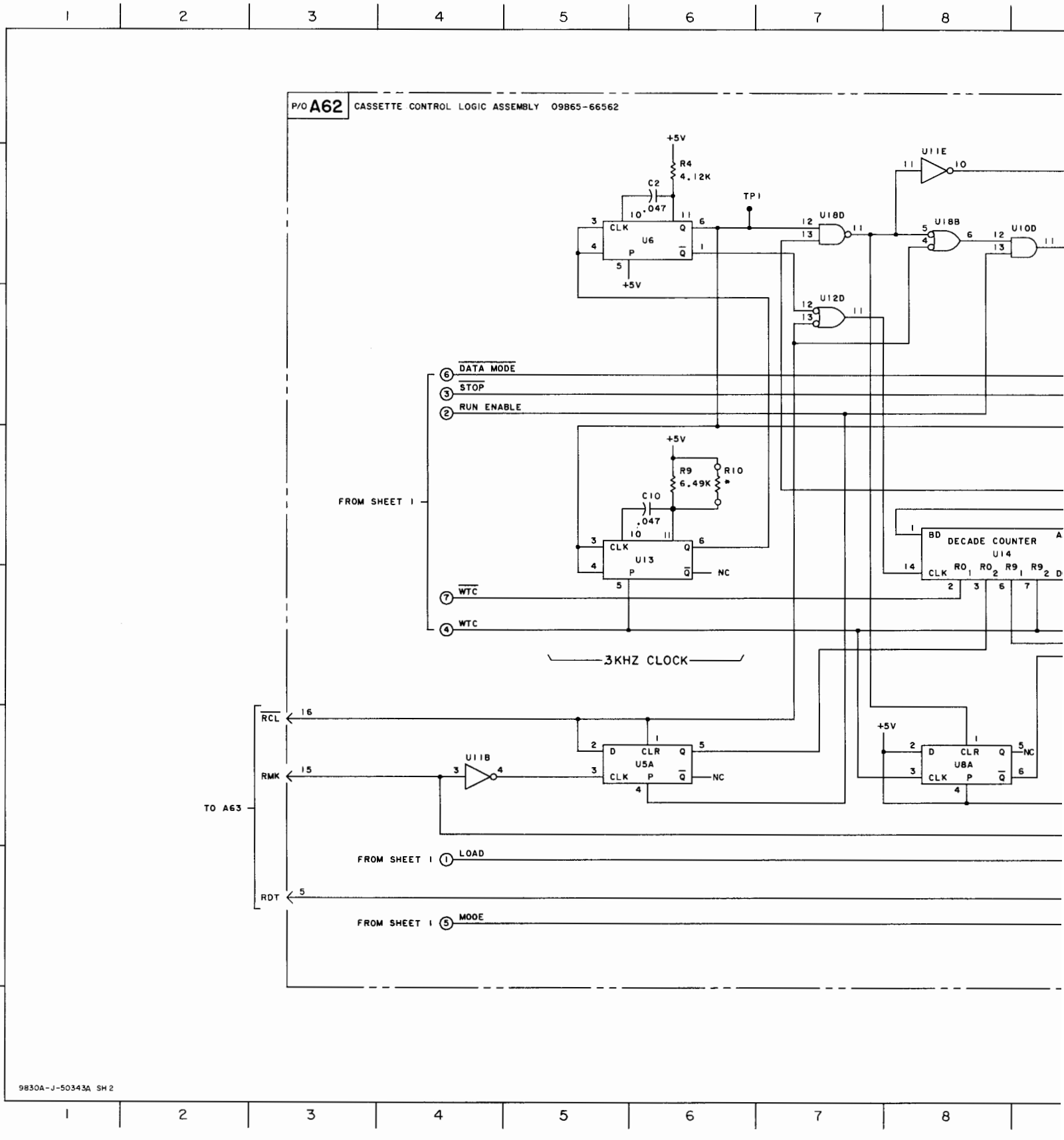


Figure 7-6. Cassette Control Logic A62 (Sheet 2 of 2)


7
8
9
10
11
12
13
14
15
U11E
U18D
U18B
U10D
U12D
U18A
9-BIT
SHIFT
REGISTEI
BD
DECADE COUNTER
U14
CLK
R0 1
R0 2
R9 1
R9 2
D
A
U18C
U11F
TP6
U10B
U11D
U17D
U12C
U9A
U9B
U11A
U12A
U12B
+5V
U8A
U8B
CLR
Q
NC
P


P/O A62
CASSETTE CONTROL LOGIC ASSEMBLY 09865-66562
+5V
R4
4.12K
C2
.047
TP1
U6
CLK
P
Q
U11E
U18D
U18B
U10D
U12D
DATA MODE
STOP
RUN ENABLE
FROM SHEET 1
R9
6.49K
R10
C10
.047
U13
NC
WTC
3KHZ CLOCK
DECADE COUNTER
U14
CLR
RCL
RMK
TO A63
U11B
U5A
U8A
LOAD
RDT
MODE

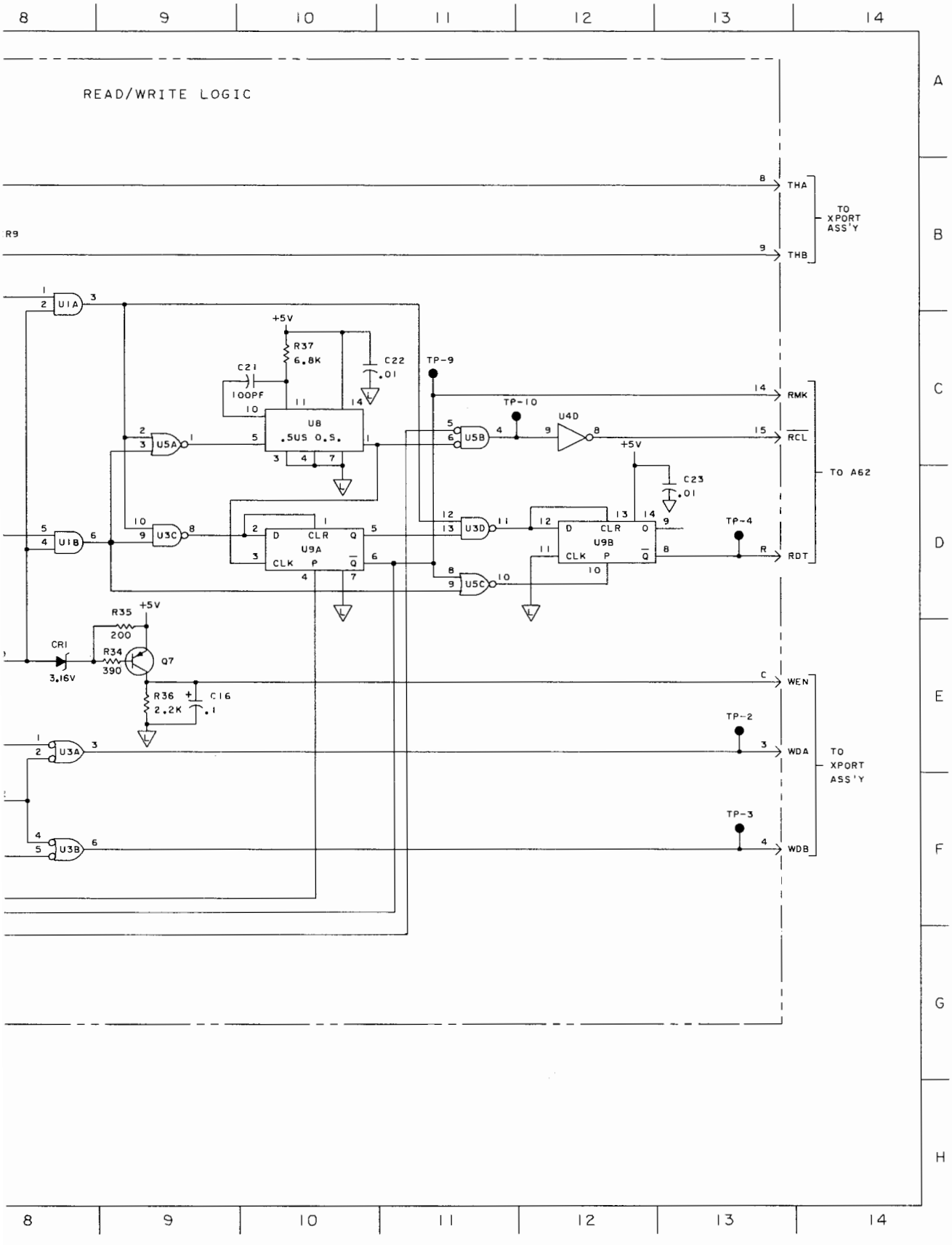
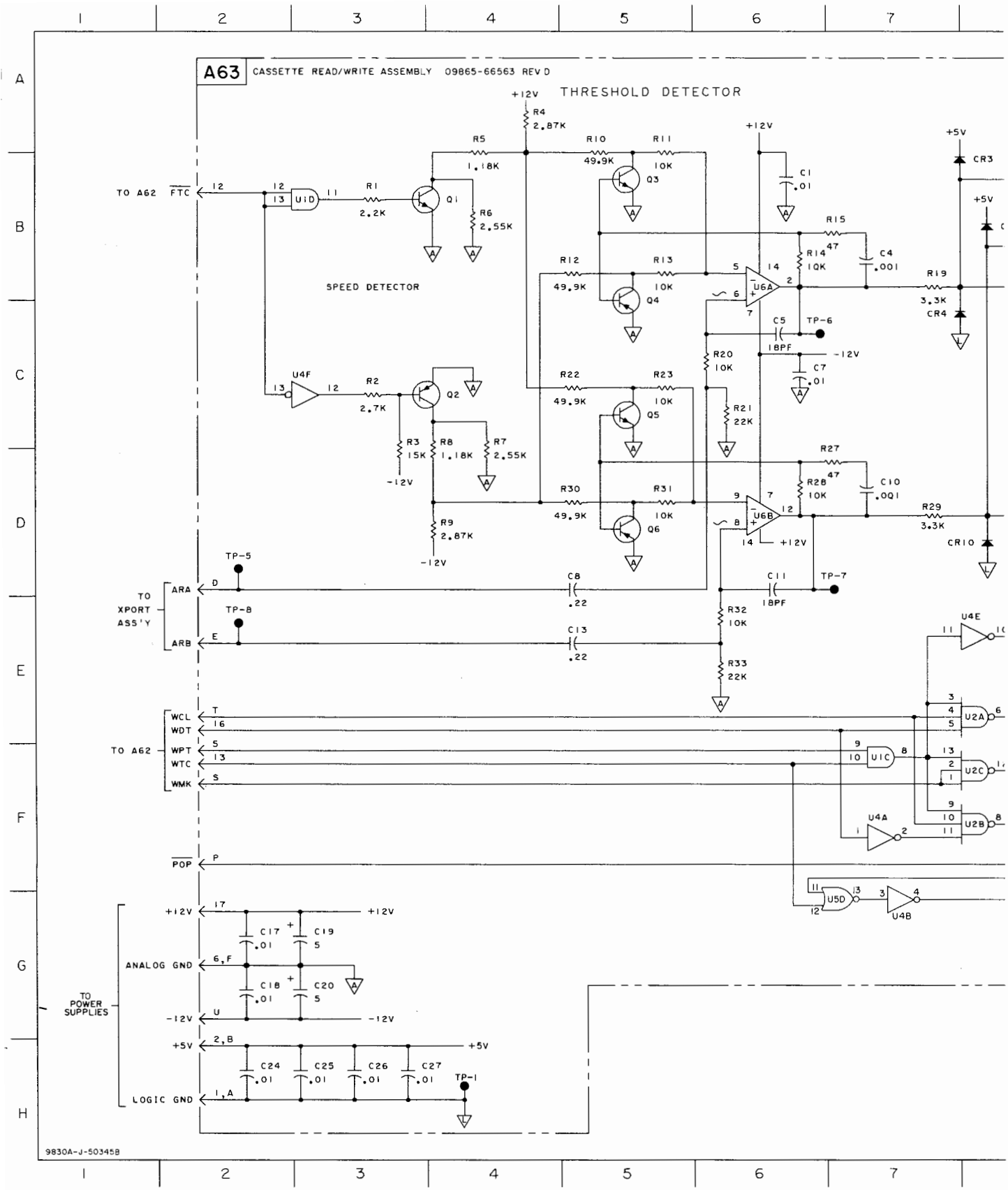


Figure 7-7. Cassette Read/Write Memory A63


A63 CASSETTE READ/WRITE ASSEMBLY 09865-66563 REV D
THRESHOLD DETECTOR
SPEED DETECTOR
TO A62 FTC
TO XPORT ASS'Y
ARA
ARB
TO A62
WCL
WDT
WPT
WTC
WMK
POP
TO POWER SUPPLIES
ANALOG GND
LOGIC GND
+12V
-12V
+5V
R1 2.2K
R2 2.7K
R3 15K
R4 2.87K
R5 1.18K
R6 2.55K
R7 2.55K
R8 1.18K
R9 2.87K
R10 49.9K
R11 10K
R12 49.9K
R13 10K
R14 10K
R15 47
R19 3.3K
R20 10K
R21 22K
R22 49.9K
R23 10K
R27 47
R28 10K
R29 3.3K
R30 49.9K
R31 10K
R32 10K
R33 22K
C1 .01
C4 .001
C5 18PF
C7 .01
C8 .22
C10 .001
C11 18PF
C13 .22
C17 .01
C18 .01
C19 5
C20 5
C24 .01
C25 .01
C26 .01
C27 .01
CR3
CR4
CR10
Q1
Q2
Q3
Q4
Q5
Q6
U1D
U1C
U2A
U2B
U2C
U4A
U4B
U4E
U4F
U5D
U6A
U6B
TP-1
TP-5
TP-6
TP-7
TP-8
9830A-J-50345B

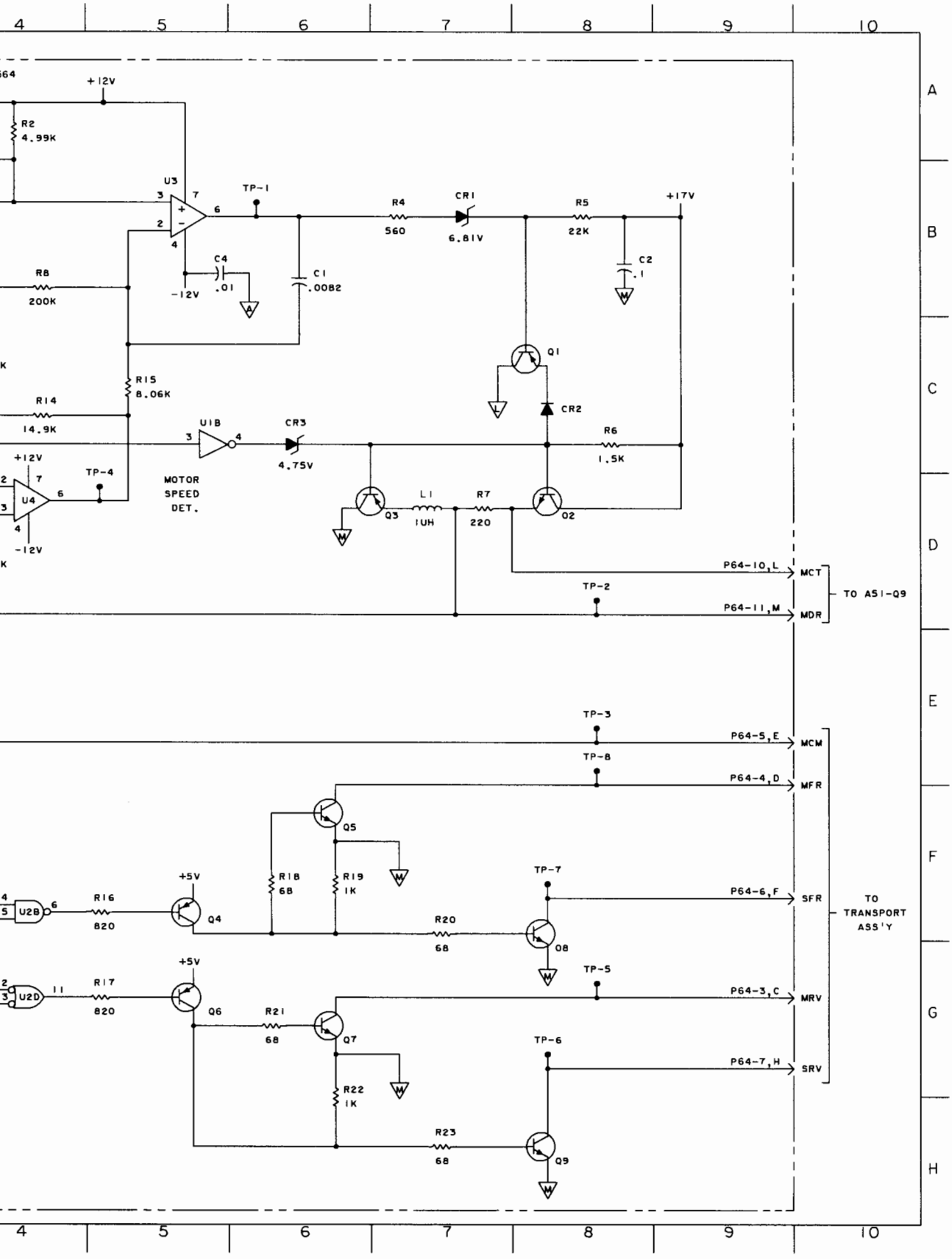
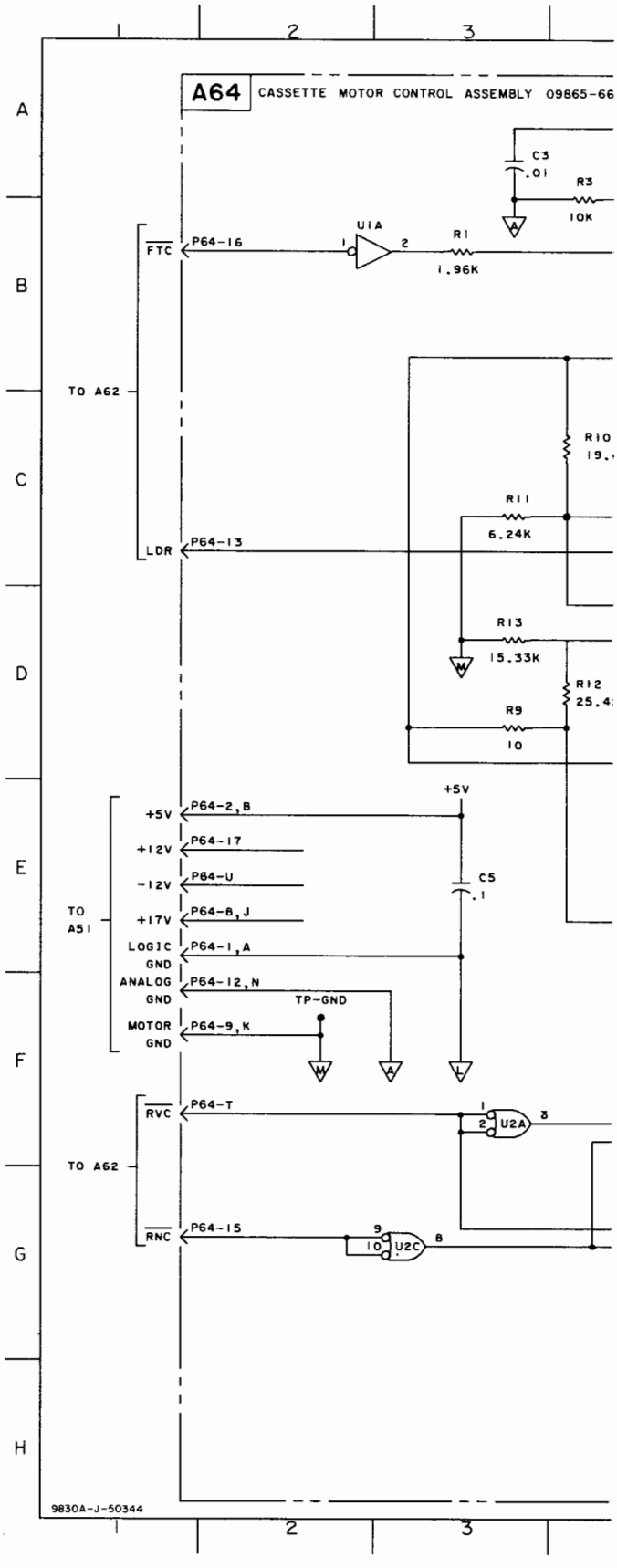


Figure 7-8. Cassette Motor Control A64


A64 CASSETTE MOTOR CONTROL ASSEMBLY 09865-66
C3
.01
R3
10K
U1A
R1
1.96K
FTC
P64-16
TO A62
LDR
P64-13
R10
R11
6.24K
R13
15.33K
R12
R9
10
+5V
P64-2,B
+12V
P64-17
-12V
P64-U
+17V
P64-B,J
LOGIC GND
P64-1,A
ANALOG GND
P64-12,N
MOTOR GND
P64-9,K
TO A51
TP-GND
C5
.1
RVC
P64-T
U2A
TO A62
RNC
P64-15
U2C
9830A-J-50344