2040
SERIES

SERVICE MANUAL

The 2040 Dual Disk System Service Kit will provide the Service Center means to isolate defective components or subassemblies by way of utilizing the internal diagnostics of the 2040, program diagnostics and trouble-shooting guides included on diskette and cassette.

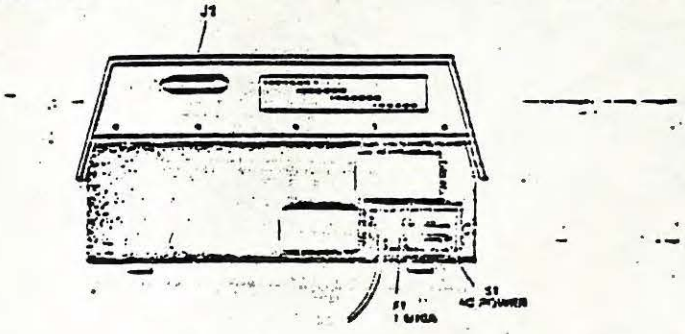
Some of the procedures are redundant but each procedure performs different operations even though it seems to be the same procedure;

The service procedures have been broken into categories to enable you to do an overall check or test a particular area of the 2040 system. The procedure relating to the SA 390 drive exercises all areas including alignment capability. Alignment procedures have been deleted due to necessary special tools and training. Commodore will provide this training in designated locations and times. You will be notified of schedule.

We have also included in the 2040 Service Kit, a price list for SA 400.

1. Position the computer and 2040 near one another in an open work area.

2. Locate the power switch on each machine and place the rocker switch in the OFF position (the white dot on the switch not visable).



3.0 Plug the power cord into an AC outlet. Power on the 2040 System without connecting to the 2001. Check the three (3) LEDs located on the front panel. (fig. 1) They should turn on momentarily. If all the LEDs do not extinguish then a problem has developed in the system. The diagram below indicates possible location of the defective component.

LEDs	Possible Defective Component
● ● ●	6532's, 6530, 6504
○ ● ●	6332 at L1
● ● ○	6332 at H1

fig. 1

4.0 Power 2040 System OFF before replacing any components. After changing components and problems still exist, replace Digital Logic assembly.

5.0 Connect a PET to IEEE cable between the systems.

6.0 Apply power to the 2001 and note the power on message. Power on the 2040, the LEDs on the front panel should light momentarily.

7.0 Before you start testing the 2040 system, it's a good idea to load the PET DOS SUPPORT program into the 2001. The program is designed for easier accessability to the commands of the 2040 system. See Appendix B for detail description of the use of PET DOS SUPPORT.

7.1 To load a program from mini-diskette:

7.1.1 Place the "2040 System Test" diskette in drive 0 of the 2040 system and close the door.

TYPE

LOAD"*",8 [RETURN]

Drive 0 on the 2040 system will initialize the diskette and load the first program on the diskette. Note the error LED on the front panel of the 2040. If an error occures then some problem occured. Power OFF the 2001 system then back on. Repeat this step. Be sure to remove diskette before turning power OFF.

7.1.2 If you are unsuccessful the second time to load the program from drive 0, try to load the program from drive 1. The procedure is as follows:

1. Insert 2040 Test mini-diskette into drive 1.

2. TYPE

OPEN 1,8,15,"I1" [RETURN]

This will initilize the mini-diskette on drive 1.

3. When the cursor returns to the screen

TYPE

LOAD"1: PET*,8 [RETURN]

The program should now load in the 2001. If the error light turns on, you have isolated the defect to the Digital Logic or analog assembly. By trying to load the program from both drives eliminated drive failure. Proceed to step 7.2 for loading procedures from cassette tape.

4. TYPE

RUN [RETURN]

The screen will now display PET DOS SUPPORT. See Appendix B for detail description of the use of PET DOS SUPPORT.

5. To load the first test program use the following procedure:

TYPE

↑LOG* [RETURN]

The Logic Diagnostic program will be called from storage on the mini-diskette and be loaded into the 2001.

6. Proceed to 8.0 for operating instructions of the Logic Diagnostic test.

7.2 To load a program from cassette tape.

7.2.1 Connect the C2N unit to the tape interface connector on the 2001 or use the internal cassette unit.

7.2.2 Place the 2040 SYSTEM TEST/C tape in the cassette and rewind the tape.

7.2.3 Load the first program on the tape by depressing the "SHIFT" key and "RUN/STOP" key simultaneously. When the program finishes loading, the 2001 will display PET DOS SUPPORT program. See appendix B for detail description of the use of PET DOS SUPPORT.

7.2.4 Load the Logic Diagnostic program from cassette tape by depressing the "SHIFT" key and "RUN/STOP" key simmultaneously.

The 2001 will display:

SEARCHING
FOUND LOGIC DIAGNOSTIC
LOADING

7.2.5 The Logic Diagnostic program will load from cassette tape and execute. The entire loading process should take approximately one minute.

8.0 LOGIC DIAGNOSTIC TEST

8.1 Follow the instructions that appear on the display of the 2001. If the logic components on the Digital board are in working order, the front panel LEDs will randomly blink. If a problem has been detected a slow distinct pattern will be present. Reference the chart on the screen of the 2001 to isolate defective component.

FAIL STATES OF DIAGNOSTICS

STATE	COMPONENTS-POSITION
● ● ●	6532— E1, C1
● ● o	6332— K1
● o ●	6332 - H1
● o o	2114 - C4 to F4 C5 to F5
o ● ●	6532 - E1, C1, Connector P1
o ● o	6530 - K3 6504 - H3
o o ●	6530 - K3

When the program detects an error condition, it will loop on the address where the error has occured. The select line on the chip will toggle at a steady rate. In the case of a RAM failure, the select line will toggle the 1K blocks. Note, the block with the error condition and replace one of the two RAMs in the block.

8.2 If you are unable to isolate the failure replace the digital logic board.

8.3 Turn power off before replacing any components on the 2040 system.

8.4 Power the 2040 system back on.
LOADING

8.5 Depress "RUN/STOP" key on the 2001, then depress the "SHIFT" key and "CLEAR HOME" key simultaneously. The 2001 display will now be blank.

8.6 To restart the "LOGIC DIAGNOSTIC" program:

TYPE

RUN [RETURN]

8.7 When the program has been run for 15 minutes and no failures have occured you can assume the Digital Logic board is O.K.

9.0 "READ/WRITE" TEST:

The Read/Write test allows you to verify the Read/Write heads of the drive. Gross alignment errors and the analog booard are also checked.

9.1 Load the READ/WRITE test program from:

a) mini-diskette

or

b) cassette

9.1.1 FROM MINI-DISKETTE

TYPE

↑READ* [RETURN]

NOTE: Be sure to initilize drive before trying to load a program.

9.2 FROM CASSETTE TAPE

TYPE

LOAD "READ/WRITE" [RETURN]

When the cursor returns to the screen:

TYPE

RUN [RETURN]

The 2001 screen will instruct you to:

9.3 Insert formatted mini-diskettes labeled "A" in both drives and close the drive doors.

NOTE:You may create an "A" mini-diskette by formatting a blank mini-diskette on a known good 2040 system.

9.4 The first part of this program initializes both drives and checks the stepper motors. Answer thee question yes or no. If the answer is yes the program will continue to the next check. If the answer is no a malfunction has been detected. Possible failures are Drive Unit, Analog Assembly, Bad Media, or 6522.

To verify a drive failure, connect a good drive unit in place of the suspected drive. You do not have to remove the drive in question. Set the good drive on top of the suspected drive and connect it to the appropriate connectors. This procedure allows you to verify the drive without disassembly of the 2040.

9.5 The second part of the program actually reads a sector on each track. The left side of the display shows two numbers, 0 and 1. These are the drive numbers. The graph displays tracks that have been tested. A black square or squares indicates one of the following devices is bad. Replace in order.

1. Bad Media
2. Bad Analog
3. Bad Drive

NOTE: Remember to turn power off and remove diskettes before changing assemblies.

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2. Bad Analog
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TYPE

RUN [RETURN]

NOTE: Special tools and training are necessary for Head Alignment and Carriage Limiter Adjustment. DO NOT proceed with these two dajustments unless you have been factory trained.

the screen of the 2001 to isolate defective component.

val and ex-change.

9.6 To complete the "Read/Write" program, the screen will ask you to repeat the test or to format the mini-diskette. The formatting of the mini-diskette is the last procedure of the test.

Upon completion of this test you will have checked the validity of the Digital Logic assembly, Analog assembly and parts of the drives. You should be able to load programs from mini-diskettes at this time. If not, repeat previous tests or consult Commodore Customer Service.

10.0 2040 TEST/ADJUST

The "Test/Adjust" program was designed to allow the user to test the function of the 390 Drives for correct operation. The program also contains the software to allow a trained user to align the SA 390 drives in the 2040 system. The program is menu oriented which allows the user to test specific functions of the Drive or to run the chain of tests to insure proper operation. Reference Appendix A for detailed explaination of each section.

10.1 Load the "Test/Adjust" program from mini-diskette by inserting the 2040 Test Diskette into Drive 0.

TYPE

↑2040 TEST* [RETURN]

NOTE: Be sure to initilize the drive before attempting to load the program.

10.2 The "Test/Adjust" program is now displaying the first menu. For simplicity the program has been broken down into catagories.

Procedure 1

SA 390 Test and Checkout is a step by step procedure through all the different tests performed on the disks;

Procedure 2

SA 390 Adjustment and Alignment. This procedure will allow you to do all mechanical adjustments pertaining to the drive.

NOTE: Special tools and training are necessary for Head Alignment and Carriage Limiter Adjustment. DO NOT proceed with these two adjustments unless you have been factory trained.

Procedure 3

2040 Drive Compatibility. This procedure will allow you to check the alignment compatibility between the drives. It will format a mini-diskette on one drive and attempt to read it on the other.

Procedure 4

SA 390 Test Menu. Allows the user to individually select a test for all known problems without running through all the tests. After the selected test is completed it is a good idea to do a complete test.

Procedure 5

SA 390 Adjustment Menu. Allows the user to do the individual adjustments without going through all the adjustment procedures.

NOTE: Special tools and training are needed for Head Alignment and Carriage Limiter adjustment. DO NOT proceed with these two adjustments unless you have been authorized by the factory.

11.0 FINAL SYSTEM TEST

The Final System Test performs an overall test of the system. This test is divided into two parts, First part being file handeling, read and write to and from different tracks, and exercises the 390 drives. Second part checks for soft errors,(soft errors are errors that are corrected by firmware). This proceedure will detect all soft errors and will print out on the screen how many soft errors have accured for each track of the diskette

11.1 Insert the 2040 SYSTEM TEST Diskette into Drive 0 and initilize the diskette.

11.2 TYPE

↑FI* [RETURN]

11.3 You will be instructed to insert the two formated "A" diskettes and press RETURN

11.4 The program will first execute a new command on Drive 0 then on Drive 1 to check the mechanial movement of the drives. After the mechanical test the program will go thru a sequense of reads and writes.

11.5 If the test fails, note the failure and return to the appropriate test proceedure for finding the defective component. Continue to the next part of the test by pressing the "C" key

11.6 The screen will inform you to insert the 2040 SYSTEM TEST diskette into drive 0 and press RETURN

11.7 The program will now load the diagnostic code to check for soft errors. Asterisks will be written across the screen during the loading of the machine code.

11.8 Remove the 2040 SYSTEM TEST diskette and insert the "S" diskettes in both drives. Press RETURN when ready.

11.9 The "S" diskettes contain a worst case pattern that covers the entire diskette. This part of the program attempts to read the entire diskette without obtaining a soft error. If a soft error occurs, the quanty of the soft errors and the track number on which they occure will be printed on the screen. Two complete passes of each drive is nessary to complete the test.

11.10 If an error has occured restart the test by pressing the "R" key and noting the error on the second pass. If the error still occures verify that all modifications have been done on the 2040 SYSTEM and the head alignment is correct.

11.11 After the completion of all the tests the 2040 SYSTEM has been exercized to the known limits of the software.

APPENDIX

A ADJUSTMENT PROCEDURE

B PET DOS SUPPORT

C COMPONENT CROSS REFERENCE

D SA 390 PARTS REFERENCE

APPENDIX

A

ADJUSTMENT

PROCEEDURES

A.0 HEAD STEPPER TEST

This test insures free operation and correct motion of the head carriage and stepper motor. The test first moves the head out to track 0 and then it moves the head in to track 34. The final portion of the test moves the head in and out between track 34 and track 0. If the drive does not respond as outlined above, there are two probable causes.

1. Bad stepper motor (replace the drive).

2. Improper stepper control (check stepper control circuits. Possible bad 6522).

A.1 LED TEST

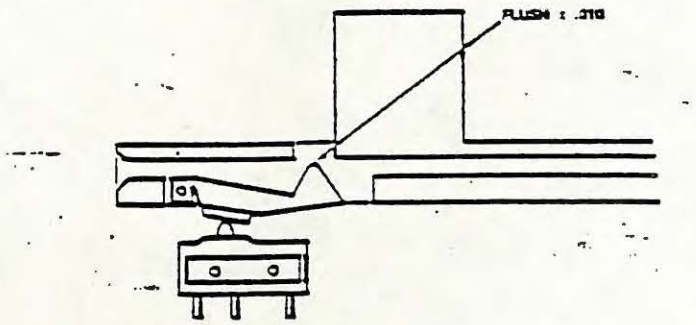
This test checks the LED on the drive specified. The tests are on, off, and blinking. If the LED does not respond properly then skip (use yes responses) to the blink portion and check the signals to the LED. Possible failures are:

1. Signal to LED (replace the drive).

2. No signal to LED (could be the analog board, cables or the 6532 (E1) replace the faulty part).

A.2 WRITE PROTECT SWITCH TEST

This test allows the user to check the function of the write protect switch on the disk drive. The drive's LED will be on for protected and off for not protected.



Failure of this test can be caused by the following:

1. Bad switch (replace drive).

2. Improperly adjusted switch.

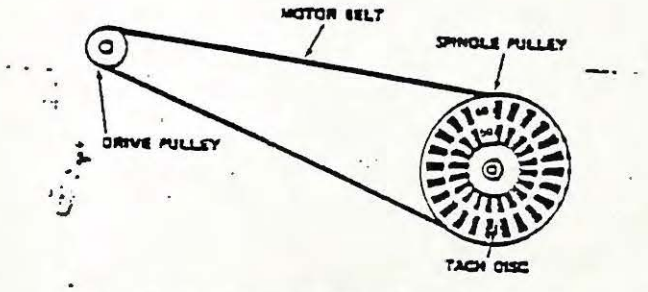
3. Bad electronics (check 6530 UK3).

A.3 MOTOR SPEED ADJUSTMENT

Motor Test - will check motor operation and speed calibration. Adjust the motor speed pot with small flat blade screw driver until proper strobe pattern is stationary. Adjusting pot clockwise will move strobe counter-clockwise.

Turn the pot R-12 located on the motor control PCB until the dark lines on the spindle pulley appear motionless. For 60 HZ use the outside ring of lines. For the 50 HZ observe the inside ring. Reference Figure 4.

NOTE: This adjustment can be made only in an area where there is flourescent lighting.



A.4 MOTER SPEED TEST

This test checks the speed of the spindle motor to insure it is within tolerence. If the drive fails this test it should be replaced or if possible, realigned.

A.5 HEAD ALIGNMENT

NOTE: This adjustment is not normally required even on head replacement due to the pre-aligned head and carriage assembly, but if the stepper motor mounting screws are accidently loosened, if parts damage has occured or you are experiencing interchange problems use the following procedure to check and adjust the head alignment.

Remove and adjust drive 0 first. The drive may be removed by extracting the four (4) phillips screws from the bottom of the 2040 system and by removing the head and edge connectors from the analog board.

Once drive 0 is adjusted, replace drive 1 with it. The analog board can be removed from drive 1 by removing the connectors and extracting the two (2) phillips screws securing it in place. The analog board will slide off its mounts. Remove drive 1 by extracting the four (4) phillips screws holding the drive in place and sliding the drive out through the front panel.

Take a piece of cardboard (approximately 5" x 15" size) and lay it across the analog board extending to the right edge of the 2040 system. Locate the drive under test on the cardboard and connect the head and edge connectors to the analog. Place the drive in a horizontal position (on its left side). Now you are ready to adjust the drive.

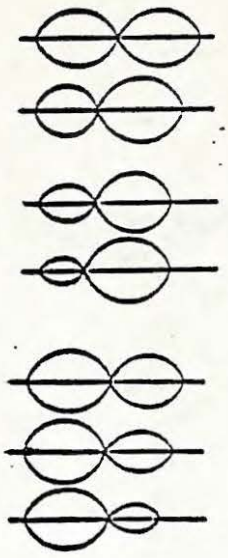
Use a dual trace scope and adjust the scope as follows:

Mode:	Add
Sweep:	20 MS
Volts/Div.:	50 MV
Probes:	3-X1
Trigger:	External

Connect channel 1 probe to TP4, channel 2 probe to TP3, on the analog. NOTE ANALOG PARTS LOCATION FOR LOCATION. Connect trigger probe to pin 9 on position UM5 of the digital board. Adjust the trigger level during the head alignment for a lobe pattern on the display.

Head alignment check with the scope should be performed in a horizontal position. Adjustments may be made from underneath or the drive may be put in a vertical position, then returned to a horizontal position for the check. Adjust stepper motor by loosening two clamp screws and slightly twisting the motor in the desired direction. Tighten with torque driver (#10). The initial head alignment should be made for maximum output and equal lobe sizes on scope display.

If either "hysteresis checks" result in unequal lobe sizes, then adjust to split the difference between the two lobes. If this occures, repeat the alignment check to assure that all positions result in appropriate lobe patterns. Appropriate patterns are lobes which are within 80% in size of each other. Note diagrams.



Even amplitude (100%) on track

Left 80% of right + 1 mil off track toward TK0

Left 60% of right + 2 mil off track toward TK0

Left 40% of right + 3 mil off track toward TK0

Right 80% of left - 1 mil off track toward 34

Right 60% of left - 2 mil off track toward 34

Right 40% of left - 3 mil off track toward 34

A.6 HEAD ALIGNMENT CHECK

This test is simply a validate of the system test diskette.

This diskette has a file that encompasses the entire disk. If any errors occur then there may be an alignment problem. Either replace the drive or align it.

NOTE: Insure your diskette is in good condition before using this test.

A.7 WRITE PROTECT SWITCH ADJUST

Use write protect adjustment tool or diskette to adjust write-protect switch. Drive LED will detect protected--LED on and unprotected--LED off.

1. Loosen write protect switch screws and slightly tighten pivot screw (closest to spindle).

2. Insert tool until "shim stock" notch is even with opening in top of disk guide.

3. Raise switch with hex driver until switch closes (watch drive LED).

4. Tighten screws with torque driver (#11).

5. Push tool in all the way until it bottoms against the Platen stop (this will now line up the unprotect slot).

6. Remove write protect tool.

7. Close door.

APPENDIX

B

PET DOS

SUPPORT PROGRAM

DOS SUPPORT PROGRAM WEDGE by Robert J. Fairbairn

The purpose of this program is to aid the PET 2001 User in operating the 2040 Dual Floppy Disk System. This instruction sheet has been written with the assumption that the reader has a working knowledge of the PET 2001 and the 2040.

NOTE: This program has been placed in the public domain. Please refer all comments and suggestions to the Editor.

The normal method with which the PET communicates with an IEEE Buss device is by the BASIC commands OPEN, PRINT, GET, INPUT and CLOSE. These statements are somewhat verbose in nature and therefore more prone to operator error. There is also the limitation that INPUT and GET cannot be used in direct mode due to shared buffer areas. These isiosyncrasies create a strained 2001/USER/2040 interface which has been greatly improved with the WEDGE 3.1 program.

WEDGE 3.1 may be loaded (saved) as if it were a normal BASIC program. Note should be made of the fact that the 2040 has a special load file name '*' which if used immediatly after power up (reset) executes the following:

1. Initalizes Drive 0
2. Loads the first file on that drive

Thus if the command LOAD"*",8 is executed and the WEDGE program is the first directory entry it will be loaded. When the WEDGE rogram is executed it relocates itself up into the highest available RAM memory locations, links into the CHRGET routine and adjusts BASIC's top of memory pointer down. This technique uses about 350 bytes of the Users memory but normal machine operations may proceed without having to reload the WEDGE program until such time that a system reset is performed.

The WEDGE program functions by capturing the data that the PET operating system passes to BASIC, before the interpreter has a chance to parse it. Thus we can look for the escape characters and process the command without the use or knowledge of the BASIC interpreter.

There are four escape characters that are recognized by the WEDGE program. They will be processed only when they are found in column one of an input line, otherwise a SYNTAX ERROR will occur.

ESCAPE CHARACTERS

> - Passes commands to the Disk.
/ - LOAD's a program.
↑ - LOAD's and RUN's a program.

The greater than symbol when used preceeding a 2040 Disk command, passes that command directly to the floppy disk system. See the following examples.

Thus:
>10
is the same as:
PRINT#15,"10"
and:
>SØ:FILE1
is equal to:
PRINT#15,"SØ:FILE1"

As you can see the > symbol is a substitute for the PRINT#15 statement. Remember that an OPEN statement is required before a PRINT may be executed but no OPEN is required for the WEDGE.

The second function of the > escape character is the directory list command. As you know the directory of a minidisk can be loaded with a LOAD"$Ø",8. This LOAD will destroy any program you might have in memory. To avoid the destruction of the current program the WEDGE prints the directory on the screen.

>$Ø

Means - Display the entire directory of Drive Ø

>$1:Q*

Means - Display the directory entries of all files on Drive 1 that have names starting with the letter Q.

The third function of the > escape character is the error channel interrogation feature. The error channel is read by typing a > followed immediately by a RETURN. This is equivilent to the following program segment.

```
10 OPEN 15,8,15
20 INPUT#15,ER,MSG$,DRV,SEC
30 ?ER","MSG$","DRV","SEC
```

The LOAD / and LOAD-RUN ↑ escape characters operate the same as their BASIC counterparts only with a simpilified syntax as follows,

/WUMPUS

- The above command will load the program file WUMPUS. Both drives will be searched if required.

↑1:COPY DISK FILES

- This command will load the program COPY DISK FILES from Drive 1 (if it is there) and execute it.

The following requirements and limitations are placed on the WEDGE program user.

1. The WEDGE commands may only be used in direct mode.
2. Programs using GET or INPUT should disable the WEDGE by a POKE 1022,128 statement. This may also be done by typing the > followed by a K and a RETURN.
3. The WEDGE is restored by a POKE1022,08.
4. You may also disable the WEDGE by typing >K.

NOTE: For Users that have a business keyboard PET (CBM) the at key " " may be used in place of the > . This eliminates shifting for the escape character.

```
   'S2153
.  'RINT"□"TAB(11)"____________________"
20  'RINTTAB(11)"■ PET DOS SUPPORT "
30 PRINTTAB(14)"NOW  LOADED
40 PRINTTAB(9)"  COMMANDS FOLLOWING"
50 PRINTTAB(7)"A > OR @  IN COLUMN 1 WILL"
60 PRINTTAB(9)"BE PASSED TO THE DISK.■"
90 PRINTTAB(7)"CMD        DESCRIPTION"
140 PRINTTAB(7)"$      DIRECTORY BOTH DRIVES
150 PRINTTAB(7)"$0     DIRECTORY DRIVE 0
160 PRINTTAB(7)"$1     DIRECTORY DRIVE 1■"
180 PRINTTAB(7)"  ALL 2040 COMMANDS MAY BE
190 PRINTTAB(7)"ENTERED AS IF THEY WERE IN
200 PRINTTAB(7)"A PRINT# STATEMENT.
220 PRINTTAB(11)"■■SPECIAL COMMANDS
230 PRINTTAB(7)"■/      LOAD A PROGRAM
240 PRINTTAB(7)"↑      RUN  A PROGRAM
250 PRINT"  SPECIAL COMMANDS START IN COL 1 AND
260 PRINT"ARE FOLLOWED BY A 2040 FILENAME.
270 NEW
EADY.
```

```
 INE # LOC      CODE        LINE

  )2  0000                ;*********************************
  )3  0000                ;*
0004  0000                ;*  PET DOS SUPPORT
0005  0000                ;*
0006  0000                ;*    04-27-79
0007  0000                ;*
0008  0000                ;*  BOB FAIRBAIRN
0009  0000                ;*
0010  0000                ;*********************************
0011  0000                ;*
0012  0000                ;* VERSION 3.1 6/14/79
0013  0000                ;*    ADD @ PROMPT FOR BUSINESS
0014  0000                ;*    KEYBOARD. ADD STOP KEY CHECK
0015  0000                ;*    IN DIRECTORY PRINT. ADD
0016  0000                ;*    HALT IN DIRECTORY PRINT
0017  0000                ;*
0018  0000                ;BASIC VARIABLES USED
0019  0000                VERCK  =$009D          ;VERIFY FLAG
0020  0000                SAL    =$00C7          ;INDIRECT POINTER LO
0021  0000                SAH    =$00C8          ;HI
0022  0000                MS1    =$F000          ;MESSAGE 1
0023  0000                MS19   =$F0AE          ;READY MESSAGE
0024  0000                GRBTOP =$005C          ;INDIRECT POINTER
0025  0000                MEMSIZ =$0034          ;POINTER TO TOP MEM
0026  0000                TXTPTR =$0077          ;POINTER TO BUF
  27  0000                SPERR  =$0010          ;EOI ERROR BIT
  28  0000                BUF    =$0200          ;BASIC INPUT BUFFER
0029  0000                SATUS  =$0096          ;STATUS BYTE
0030  0000                SA     =$00D3          ;SECONDARY ADDRESS
0031  0000                FA     =$00D4          ;PRIMARY ADDRESS
0032  0000                FNLEN  =$00D1          ;FILE NAME LENGTH
0033  0000                FNADR  =$00DA          ;FILE NAME ADDRESS
0034  0000                EAL    =$00C9          ;END ADDR LO
0035  0000                EAH    =$00CA          ;HI
0036  0000                VARTAB =$002A          ;END OF BASIC PGM.
0037  0000                ;PROGRAM VARIABLES
0038  0000                CR     =$0D            ;SYMBOLIC CARRIAGE RETURN
0039  0000                DEVADR =$03FE          ;DEVICE ADDRESS
0040  0000                FLAG   =$03FF          ;BYTE USED AS A FLAG
0041  0000                PIAK   =$E812          ;KEYBOARD I/O PORT
0042  0000                CMDLN  =CMDEND-CMD     ;LENGTH OF RELCOATE
```

```
INE #  LOC.    CODE      LINE

   44  0000              ;PET ROUTINES USED
   45  0000              LINPRT  =$DCD9          ;PRINT LINE #
0046   0000              SPMSG   =$F315          ;SEND A MESSAGE
0047   0000              LD15    =$F322          ;LOAD ROUTINE
0048   0000              TWAIT   =$F8E6          ;WAIT FOR STOP KEY
0049   0000              CHRGET  =$0070          ;INPUTS CHARACTERS
0050   0000              CHRGOT  =$0076          ;GET LAST CHAR
0051   0000              NEWSTT  =$C6C4          ;NEW STATEMENT EXEC
0052   0000              PRT     =$E3D8          ;PRINT A CHARACTER
0053   0000              LISTN   =$F0BA          ;SEND LISTEN
0054   0000              SECND   =$F123          ;SEND SA
0055   0000              CIOUT   =$F16F          ;SEND CHARACTER
0056   0000              UNLSN   =$F183          ;UN LISTEN
0057   0000              ACPTR   =$F18C          ;GET A CHARCATER
0058   0000              TALK    =$F0B6          ;SEND TALK
0059   0000              OPENI   =$F466          ;OPEN FILE
0060   0000              CLSEI   =$F6F0          ;CLOSE FILE
0061   0000              MAIN    =$C392          ;REENTER BASIC
0062   0000              RUNC    =$C572          ;CLEAR VARIABLES
0063   0000              LNKPRG  =$C442          ;LINK BASIC LINES
0064   0000              UNTLK   =$F17F          ;UN TALK
```

```
LINE # LOC      CODE        LINE

0066  0000                ;WEDGE IN ROUTINE WITH THE
0067  0000                ;COMMAND PARSER AND EXECUTITION
0068  0000                      *=$0700
0069  0700                ;
0070  0700  EA             CMD    NOP                ;THROWN AWAY
0071  0701  E6 77                  INC TXTPTR         ;BUMP POINTER
0072  0703  D0 02                  BNE WG100
0073  0705  E6 78                  INC TXTPTR+1
0074  0707  AD FE 03       WG100  LDA DEVADR         ;WEDGE IN ?
0075  070A  30 3F                  BMI WG997          ;NO ....
0076  070C  A5 77                  LDA TXTPTR         ;FIRST COLUMN
0077  070E  D0 3B                  BNE WG997          ;GET OUT NOT FIRST CHR
0078  0710  A5 78                  LDA TXTPTR+1
0079  0712  C9 02                  CMP #>BUF          ;IN BUFFER?
0080  0714  D0 35                  BNE WG997
0081  0716                ;
0082  0716  A0 00          WG110  LDY #$00           ;.Y IS BUF INDEX
0083  0718  8C FF 03              STY FLAG           ;FLAG SET FOR DIR
0084  071B  B1 77                  LDA (TXTPTR),Y
0085  071D  C9 3E                  CMP #'>            ;COMMAND PROMPT?
0086  071F  F0 12                  BEQ WG115          ;YES...
0087  0721  C9 40                  CMP #'@            ;BUSINESS KEYBOARD PROMPT
0088  0723  F0 0E                  BEQ WG115          ;YES...
0089  0725  C8                    INY
0090  0726  8D FF 03              STA FLAG           ;SET FLAG FOR LOAD
0091  0729  C9 2F                  CMP #'/            ;LOAD PROMPT
0092  072B  F0 6D                  BEQ DODIR
0093  072D  C9 5E                  CMP #94            ;CHECK FOR ARROW
0094  072F  F0 69                  BEQ DODIR
0095  0731  D0 18                  BNE WG997
0096  0733  C8             WG115  INY
0097  0734  B1 77                  LDA (TXTPTR),Y
0098  0736  F0 3B                  BEQ RDERR          ;READ ERROR CHANNEL
0099  0738  C9 24                  CMP #'$            ;DIRECTORY?
0100  073A  F0 5E                  BEQ DODIR          ;YES
0101  073C  C9 4B                  CMP #'K            ;KILL THE WEDGE
0102  073E  D0 0E                  BNE NOTDIR
0103  0740  A9 80                  LDA #$80           ;KILL THE WEDGE
0104  0742  4D FE 03              EOR DEVADR
0105  0745  8D FE 03              STA DEVADR
0106  0748  C8                    INY
0107  0749  84 77                  STY TXTPTR
0108  074B  4C 76 00       WG997  JMP CHRGOT
```

```
LINE # LOC      CODE        LINE

   0  074E                 ;
   1  074E                 ; SEND COMMAND TO DISK
0112  074E                 ;
0113  074E  AD FE 03    NOTDIR LDA DEVADR       ;GET DEVICE ADDRESS
0114  0751  85 D4             STA FA
0115  0753  A9 6F             LDA #$6F          ;SECONDARY ADDRESS 15
0116  0755  85 D3             STA SA
0117  0757  20 BA F0          JSR LISTN
0118  075A  A5 D3             LDA SA
0119  075C  20 28 F1          JSR SECND         ;SEND SECONDARY ADDR
0120  075F  E6 77        BUMP   INC TXTPTR
0121  0761  A0 00             LDY #$00          ;INDEX=0
0122  0763  B1 77             LDA (TXTPTR),Y    ;GET THE FIRST CHARACTER
0123  0765  F0 06             BEQ WG120         ;ZERO IS LAST CHAR
0124  0767  20 6F F1          JSR CIOUT         ;SEND THE CHAR
0125  076A  B8                CLV
0126  076B  50 F2             BVC BUMP          ;MORE
0127  076D                 ;
0128  076D  20 83 F1    WG120  JSR UNLSN        ;UN LISTEN
0129  0770  B8                CLV
0130  0771  50 24             BVC WG998
0131  0773                 ;
0132  0773                 ; READ THE ERROR CHANNEL
0133  0773                 ;
  34  0773  84 77        RDERR  STY TXTPTR       ;FIX POINTER
  35  0775  AD FE 03           LDA DEVADR        ;SET FA
  36  0778  85 D4              STA FA
0137  077A  20 B6 F0          JSR TALK
0138  077D  A9 6F             LDA #$6F          ;COMMAND CHANNEL SA
0139  077F  85 D3             STA SA
0140  0781  20 28 F1          JSR SECND         ;SEND SA
0141  0784  20 8C F1    WG140  JSR ACPTR        ;GET BYTE FROM DISK
0142  0787  C9 0D             CMP #CR
0143  0789  F0 06             BEQ WG130
0144  078B  20 D8 E3          JSR PRT           ;PRINT BYTE TO SCREEN
0145  078E  B8                CLV
0146  078F  50 F3             BVC WG140         ;LOOP FOR MORE
0147  0791  20 D8 E3    WG130  JSR PRT           ;PRINT CR
0148  0794  20 7F F1          JSR UNTLK         ;UN TALK
0149  0797  4C 76 00    WG998  JMP CHRGOT        ;DONE WITH CMD
```

```
NE # LOC     CODE        LINE

  1  079A                ;
0. 2  079A                ;PRINT THE DIRECTORY
0153  079A                ;
0154  079A  C8            DODIR  INY                ;GET LENGTH OF CMD
0155  079B  B1 77                LDA (TXTPTR),Y
0156  079D  D0 FB                BNE DODIR
0157  079F  84 77                STY TXTPTR.       ;SET POINTER
0158  07A1  88                   DEY
0159  07A2  84 D1                STY FNLEN         ;SET LENGTH (-1)
0160  07A4  A9 01                LDA #<BUF+1       ;FILE NAME ADDRESS
0161  07A6  85 DA                STA FNADR
0162  07A8  A9 02                LDA #>BUF
0163  07AA  85 DB                STA FNADR+1
0164  07AC  AD FE 03             LDA DEVADR        ;DEVICE ADDRESS
0165  07AF  85 D4                STA FA
0166  07B1  AD FF 03             LDA FLAG          ; 0 MEANS DIR
0167  07B4  D0 79                BNE LOAD          ;DO A LOAD
0168  07B6  A9 60                LDA #$60          ;SECONDARY ADDR
0169  07B8  85 D3                STA SA
0170  07BA  20 66 F4             JSR OPENI         ;OPEN THE FILE
0171  07BD  20 B6 F0             JSR TALK          ;TELL DISK TO TALK
0172  07C0  A5 D3                LDA SA            ;SECONDARY ADDRESS
0173  07C2  20 28 F1             JSR SECND
0174  07C5  A9 00                LDA #$00
 75   07C7  85 96                STA SATUS         ;SET STATUS TO 0
 6    07C9  A0 03                LDY #$03          ;LOOP THREE TIMES
0177  07CB                ;
0178  07CB  8C FF 03      WG220  STY FLAG          ;SAVE NEW COUNT
0179  07CE  20 8C F1             JSR ACPTR         ;GET A CHAR
0180  07D1  48                   PHA
0181  07D2  A4 96                LDY SATUS         ;CHECK STATUS
0182  07D4  D0 4D                BNE WG235         ;BAD STATUS
0183  07D6  20 8C F1             JSR ACPTR
0184  07D9  A4 96                LDY SATUS         ;CHECK STATUS
0185  07DB  D0 46                BNE WG235
0186  07DD  AA                   TAX               ; INTO X REG
0187  07DE  68                   PLA               ;RESTORE FIRST CHAR
0188  07DF  AC FF 03             LDY FLAG          ;MORE TO DO?
0189  07E2  88                   DEY
0190  07E3  D0 E6                BNE WG220         ;NOT DONE YET
0191  07E5  8D FF 03             STA FLAG          ;SWAP X AND A
0192  07E8  8A                   TXA
0193  07E9  AE FF 03             LDX FLAG
0194  07EC  20 D9 DC             JSR LINPRT        ;PRINT LINE NUMBER
0195  07EF  A9 20                LDA #'            ;PRINT A SPACE
0196  07F1  20 D8 E3             JSR PRT
0197  07F4  20 8C F1      WG250  JSR ACPTR
0198  07F7  A6 96                LDX SATUS
0199  07F9  D0 29                BNE WG230         ;BAD
0200  07FB  C9 00                CMP #$00          ;EOL
 01   07FD  F0 1A                BEQ WG240
 202  07FF  20 D8 E3             JSR PRT
0203  0802  AD 12 E8             LDA PIAK          ;CHECK FOR STOP KEY
0204  0805  C9 EF                CMP #$EF          ;IS IT THERE ?
0205  0807  F0 1B                BEQ WG230         ;YES...
```

```
 NE # LOC     CODE        LINE

 06  0809  20 E4 FF            JSR $FFE4       ;GET A CHAR FROM KEYBOARD
0207 080C  F0 E6              BEQ WG250       ;NOTHING...
0208 080E  C9 20              CMP #$20        ;SPACE BAR?
0209 0810  D0 E2              BNE WG250       ;NO...
0210 0812  20 E4 FF    WG255  JSR $FFE4       ;ANY KEY STARTS
0211 0815  F0 FB              BEQ WG255
0212 0817  D0 DB              BNE WG250       ;(JMP)
0213 0819  A9 0D       WG240  LDA #CR
0214 081B  20 D8 E3           JSR PRT
0215 081E  A0 02              LDY #$02        ; DO TWICE
0216 0820  B8                 CLV
0217 0821  50 A8              BVC WG220
0218 0823  68          WG235  PLA             ;CLEAN UP
0219 0824  20 F0 F6    WG230  JSR CLSEI       ;CLOSE FILE
0220 0827  A9 0D              LDA #CR         ;PRINT A RETURN
0221 0829  20 D8 E3           JSR PRT
0222 082C  4C 76 00    WG999  JMP CHRGOT      ;RETURN TO BASIC
```

```
 INE # LOC      CODE        LINE

  24  082F                 ;
  25  082F                 ; LOAD A FILE
0226  082F  A9 00          LOAD   LDA #$00
0227  0831  85 96                 STA SATUS        ;CLEAR STATUS.
0228  0833  85 9D                 STA VERCK        ;LOAD NOT VERIFY
0229  0835  20 22 F3              JSR LD15         ;LOAD A PROGRAM
0230  0838  20 E6 F8              JSR TWAIT        ;STOP KEY
0231  083B  A5 96                 LDA SATUS
0232  083D  29 10                 AND #SPERR       ;CHECK STATUS (EOI OK)
0233  083F  D0 EE                 BNE LOAD
0234  0841  A0 AE                 LDY #MS19-MS1    ;SAY READY
0235  0843  20 15 F3              JSR SPMSG        ;PRINT A MESSAGE
0236  0846  A5 CA                 LDA EAH          ;SET BASIC'S POINTERS
0237  0848  85 2B                 STA VARTAB+1
0238  084A  A5 C9                 LDA EAL
0239  084C  85 2A                 STA VARTAB
0240  084E  20 72 C5              JSR RUNC         ;FIX POINTERS
0241  0851  20 42 C4              JSR LNKPRG       ;FIX LINKS
0242  0854  AD FF 03              LDA FLAG         ;CHECK FOR LOAD OR RUN
0243  0857  C9 2F                 CMP #'/          ;LOAD ?
0244  0859  D0 03                 BNE WG300        ;NO...
0245  085B  4C 92 C3              JMP MAIN         ;LOAD RETURN TO BASIC
0246  085E  A9 00          WG300  LDA #$00         ;SET TXTPTR FOR RUN
0247  0860  A0 04                 LDY #$04
0248  0862  85 77                 STA TXTPTR
0249  0864  84 78                 STY TXTPTR+1
0250  0866  4C C4 C6              JMP NEWSTT       ;RUN PROGRAM
0251  0869                 CMDEND
```

```
 INE # LOC     CODE        LINE

  53  0869                ;
  54  0869                ;THIS ROUTINE POKES TOP OF MEMORY
0255  0869                ;DOWN RELOCATES THE PARSER AND
0256  0869                ;SETS THE WEDGE
0257  0869                ;
0258  0869  A5 34         POKE    LDA MEMSIZ        ;POKE TOP DOWN
0259  086B  18                    CLC               ;MINUS ONE
0260  086C  E9 69                 SBC #<CMDLN
0261  086E  85 34                 STA MEMSIZ
0262  0870  A5 35                 LDA MEMSIZ+1
0263  0872  E9 01                 SBC #>CMDLN
0264  0874  85 35                 STA MEMSIZ+1
0265  0876                ;
0266  0876                ;MOVE THE CODE
0267  0876                ;
0268  0876  A0 01         MOVE    LDY #$01          ;SET UP FROM ADDR
0269  0878  A9 00                 LDA #<CMD
0270  087A  85 C7                 STA SAL
0271  087C  A9 07                 LDA #>CMD
0272  087E  85 C8                 STA SAH
0273  0880  A5 34                 LDA MEMSIZ        ;SET UP TO ADDR
0274  0882  85 5C                 STA GRBTOP
0275  0884  A5 35                 LDA MEMSIZ+1
0276  0886  85 5D                 STA GRBTOP+1
 277  0888  B1 C7         MOV1    LDA (SAL),Y       ;RELOCATE
 278  088A  91 5C                 STA (GRBTOP),Y
0279  088C  C8                    INY
0280  088D  D0 F9                 BNE MOV1
0281  088F  E6 5D                 INC GRBTOP+1
0282  0891  E6 C8                 INC SAH
0283  0893  A5 C8                 LDA SAH
0284  0895  C9 08                 CMP #>CMDEND
0285  0897  F0 02                 BEQ MOV2
0286  0899  B0 04                 BCS WEDGE
0287  089B  A0 00         MOV2    LDY #$00
0288  089D  F0 E9                 BEQ MOV1
0289  089F                ;
0290  089F                ;WEDGE INTO BASIC
0291  089F                ;
0292  089F  A9 4C         WEDGE   LDA #$4C          ;JUMP INSTRUCTION
0293  08A1  85 70                 STA CHRGET
0294  08A3  A4 34                 LDY MEMSIZ
0295  08A5  A6 35                 LDX MEMSIZ+1
0296  08A7  C8                    INY
0297  08A8  D0 01                 BNE WEDGE1
0298  08AA  E8                    INX
0299  08AB  84 71         WEDGE1  STY CHRGET+1
0300  08AD  86 72                 STX CHRGET+2
0301  08AF  A9 08                 LDA #$08          ;DEFAULT ADDR
0302  08B1  8D FE 03              STA DEVADR
  03  08B4  60                    RTS
 ,04  08B5                       .END


ERRORS = 0000
```

SYMBOL TABLE

SYMBOL	VALUE						
CPTR	F18C	BUF	0200	BUMP	075F	CHRGET	0070
CHRGOT	0076	CIOUT	F16F	CLSEI	F6F0	CMD	0700
CMDEND	0869	CMDLN	0169	CR	000D	DEVADR	03FE
DODIR	079A	EAH	00CA	EAL	00C9	FA	00D4
FLAG	03FF	FNADR	00DA	FNLEN	00D1	GRBTOP	005C
LD15	F322	LINPRT	DCD9	LISTN	F0BA	LNKPRG	C442
LOAD	082F	MAIN	C392	MEMSIZ	0034	MOV1	0888
MOV2	089B	MOVE	0876	MS1	F000	MS19	F0AE
NEWSTT	C6C4	NOTDIR	074E	OPENI	F466	PIAK	E812
POKE	0869	PRT	E3D8	RDERR	0773	RUNC	C572
SA	00D3	SAH	00C8	SAL	00C7	SATUS	0096
SECND	F128	SPERR	0010	SPMSG	F315	TALK	F0B6
TWAIT	F8E6	TXTPTR	0077	UNLSN	F183	UNTLK	F17F
VARTAB	002A	VERCK	009D	WEDGE	089F	WEDGE1	08AB
WG100	0707	WG110	0716	WG115	0733	WG120	076D
WG130	0791	WG140	0784	WG220	07CB	WG230	0824
WG235	0823	WG240	0819	WG250	07F4	WG255	0812
WG300	085E	WG997	074B	WG998	0797	WG999	082C

END OF ASSEMBLY

```
*
   PC  IRQ  SR AC XR YR SP
.;0401 E62E 32 04 5E 00 F8

.;0700 EA E5 77 D0 02 E5 78 AD
.;0708 FE 03 30 3F A5 77 D0 3B
.;0710 A5 78 C9 02 D0 35 A0 00
.;0718 8C FF 03 B1 77 C9 3E F0
.;0720 12 C9 40 F0 0E C8 8D FF
.;0728 03 C9 2F F0 6D C9 5E F0
.;0730 69 D0 18 C8 B1 77 F0 3B
.;0738 C9 24 F0 5E C9 4B D0 0E
.;0740 A9 80 4D FE 03 8D FE 03
.;0748 C8 84 77 4C 76 00 AD FE
.;0750 03 85 D4 A9 6F 85 D3 20
.;0758 BA F0 A5 D3 20 28 F1 E6
.;0760 77 A0 00 B1 77 F0 06 20
.;0768 6F F1 B8 50 F2 20 83 F1
.;0770 B8 50 24 84 77 AD FE 03
.;0778 85 D4 20 B6 F0 A9 6F 85
.;0780 D3 20 28 F1 20 8C F1 C9
.;0788 0D F0 06 20 D8 E3 B8 50
.;0790 F3 20 D8 E3 20 7F F1 4C
.;0798 76 00 C8 B1 77 D0 FB 84
.;07A0 77 88 84 D1 A9 01 85 DA
.;07A8 A9 02 85 DB AD FE 03 85
.;07B0 D4 AD FF 03 D0 79 A9 60
.;07B8 85 D3 20 66 F4 20 B6 F0
.;07C0 A5 D3 20 28 F1 A9 00 85
.;07C8 96 A0 03 8C FF 03 20 8C
.;07D0 F1 48 A4 96 D0 4D 20 8C
.;07D8 F1 A4 96 D0 46 AA 68 AC
.;07E0 FF 03 88 D0 E6 8D FF 03
.;07E8 8A AE FF 03 20 D9 DC A9
.;07F0 20 20 D8 E3 20 8C F1 A6
.;07F8 96 D0 29 C9 00 F0 1A 20
.;0800 D8 E3 AD 12 E8 C9 EF F0
.;0808 1B 20 E4 FF F0 E6 C9 20
.;0810 D0 E2 20 E4 FF F0 FB D0
.;0818 DB A9 0D 20 D8 E3 A0 02
.;0820 B8 50 A8 68 20 F0 F6 A9
.;0828 0D 20 D8 E3 4C 76 00 A9
.;0830 00 85 96 85 9D 20 22 F3
.;0838 20 E6 F8 A5 96 29 10 D0
.;0840 EE A0 AE 20 15 F3 A5 CA
.;0848 85 2B A5 C9 85 2A 20 72
.;0850 C5 20 42 C4 AD FF 03 C9
.;0858 2F D0 03 4C 92 C3 A9 00
.;0860 A0 04 85 77 84 78 4C C4
.;0868 C6 A5 34 18 E9 69 85 34
.;0870 A5 35 E9 01 85 35 A0 01
.;0878 A9 00 85 C7 A9 07 85 C8
.;0880 A5 34 85 5C A5 35 85 5D
.;0888 B1 C7 91 5C C8 D0 F9 E6
.;0890 5D E6 C8 A5 C8 C9 08 F0
.;0898 02 B0 04 A0 00 F0 E9 A9
.;08A0 4C 85 70 A4 34 A6 35 C8
.;08A8 D0 01 E8 84 71 86 72 A9
.;08B0 03 8D FE 03 60 AA AA AA
.;08B8 AA AA AA AA AA AA AA AA
.?
```

APPENDIX

C

COMPONENT
CROSS REFERENCE

2040 Digital Logic Assembly Parts Cross Reference

REF. DES.	DESCRIPTION	PART#	DEALER PRICE
C-1-C6, C8-C18, C21 C23-C29	.1 MF 50V	900020-01	.23
C31, C33, C35-C46	.1 MF 50V	900020-01	.23
C7	100 PF 50V	900010-17	.05
C19, C22	10 MF 20V	900402-09	.48
C20	.01MF 50V	900010-38	.05
C30, C32	10 MF 25V	900100-01	.10
C34	47 MF 16V5	900100-33	.33
CR1-CR6	1N5402	900753-01	.28
CR7-CR9	1N4001	900750-01	.11
P1	IEEE Conn. Right Angle	903206-01	5.85
P2	Header, .1 Spacing, 20 Pin	9033H-01	1.60
P3	Header, .156 Spacing,5 Pin	903302-02	.13
P4	Header, .156 Spacing,3 Pin	903302-13	.09
P4	Header, .156 Spacing,6 Pin	903302-06	.14
P5	Header, .1 Spacing, 2 Pin	903307-12	.08
R1, R2, R12-R14	470 ohm, 1/4 W 5%	901550-58	.05
R3, R4	5.1 K ohms 1/4 W, 5%	901550-03	.05
R5, R6	2.4 K ohms 1/4 W, 5%	901550-85	.05
R7, R15, R16	2 K ohms, 1/4 W, 5%	901550-53	.05
R8	10 K ohms, 1/4 W, 5%	901550-20	.05
R9	100 K ohms, 1/4 W, 5%	901550-07	.05
UA1, UE6, UL2	74 LS 04	901521-02	.34
UA3, UB3	74 LS 42	901521-17	.85
UA4	7414	901522-19	.95
UA6	74 04	901525-01	.45
UB1, UB2, UD2	MC 3446	901524-01	2.47
UB4, UH6, UJ2	74 LS 00	901521-01	.32
UB6, UC6, UD6	74 LS 193	901521-26	1.15
UC1, UE1	6532 PIA	901458-01	10.50
UC3, UD3, UE3, UF3	74 LS 157	901521-11	.75
UJ5, UK5, UL5	74 LS 157	901521-11	.75
UC4, UD4, UE4, UF4	6114 RAM	901453-02	12.00
UC5, UD5, UE5, UF5	6114 RAM	901453-02	12.00
UF6, UH2	74 LS 02	901521-21	.48
UH1	6332-21, ROM	901468-07	20.00
UH3	6504 MPU	901455-01	10.00
UH5	74190	901522-16	1.18
UJ6, UN2	7406	901522-06	.36
UK3	6530 PIA	901466-02	14.00
UK6	6316 ROM	901467-01	20.00
UL1	6332-20 ROM	901468-06	20.00
UM2	LM555	901523-01	.45
UM3	6522 VIA	901437-01	12.00
UM5	74 LS 133	901521-15	.85
UM6, UN6	74 LS 165	901521-12	1.55
UN1	6502 MPU	901435-01	11.25

REF. DES.	DESCRIPTION	PART #	PRICE
UN5, UP5	74 LS 164	901521-28	1.23
VR1, VR2	7812 +12V 1.5A REG	901528-04	2.25
VR3	LM 323 +5 3A REG	901528-01	7.00
Y1	16 MHZ Crystal	900557-01	1.40
	28 PIN I.C. Socket	904150-05	.50
	24 PIN I.C. Socket	904150-04	.35
	40 PIN I.C. Socket	904150-06	.60

2040 Analog Assembly Parts Reference

REF. NUMBER	DESCRIPTION	PART NUMBERS	DEALER PRICE
C1,C2	4.7NF 25V Elect.	900101-07	$ .16
C3,C4,C10,C11,C14	.1MF 50V Cerm	900020-01	23
C5,C15	300PF 500V Mica	900050-16	.45
C6,C7	750PF 300V Mica	900050-15	.83
C8	.033MF 50V Cerm	900020-03	.54
C9	10MF 20V Tant	900402-09	.48
C12	4700PF 200V Mica	900050-17	.53
C13	1.6MF 15V Tant	900105-01	1.20
C16	680PF 300V Mica	900050-01	.79
C17,C18	.01MF 50V Cerm	900010-38	.06
CR1-CR16	IN4003 Diode	900750-03	.11
CR17-CR26	IN4148 Diode	900850-01	.05
L1	100MH RF Choke	901301-01	2.30
L2,L5	150MH RF Choke	901301-02	1.30
L3,L4	680MH RF Choke	901301-03	1.18
P6	5 Pin Header (Power)	903302-02	.40
P7	20 Pin Header	903311-01	1.60
P9,P10	4 Pin Header (Read/Write Head)	903315-01	.98
Q1,Q2,Q5,Q6	2N4403	902704-010	.18
Q3,Q4,Q7-Q10	2N4401	902652-01	.15
R1-R4,R27	1K ohm ¼W	901550-01	.05
R5-R12	680 ohm ¼W	901550-31	.05
R13,R19,R20,R28, R31,R38	20K ohm ¼W	901550-92	.05
R14,R23,R47	2K ohm ¼W	901550-53	.05
R15	272 ohm ¼W 1%	901751-10	.17
R16	909 ohm ¼W 1%	901751-13	.17
R17	750 ohm ¼W 1%	901751-09	.17
R18,R25	2.26K ohm ¼W 1%	901751-14	.17
R21	300 ohm ¼W	901550-70	.05
R22	100 ohm ¼W	901550-49	.05
R24	604 ohm ¼W 1%	901751-11	.17
R26	510 ohm ¼W	901550-38	.05
R30,R37	845 ohm ¼W 1%	901751-12	.17
R32,R40	3K ohm ¼W	901550-33	.05
R33,R41-R45	9.09K ohm ¼W 1%	901751-15	.17
R36	75^ohm ¼W	901550-45	.05
R39	68^ohm ¼W	901550-94	.05
R46	75K ohm ¼W	901550-86	.05
RP1,RP2	330 ohm Resistor Pack	902422-01	.75
RP3	680 ohm Resistor Pack	902422-02	.75
UA2	9602 One Shot	901510-01	.80
UA3	7486 Exclusiv or Gate	901522-18	.50
UA4	LM 311 Voltage Comparator	901523-04	.90
UA5	LM 592 OP-AMP	901523-08	2.35
UB1,UD1	7406 Hex Inv. Buffer	901522-06	.40
UB2,UC1	74LS04 Hex Inv.	901521-02	.35
UB3	74LS74 Flip-Flop	901521-06	.50
UC3	Q2T2905 Transistor Pack	902551-01	1.96
UC5	Q2T2222 Transistor Pack	902550-01	1.96

APPENDIX

D

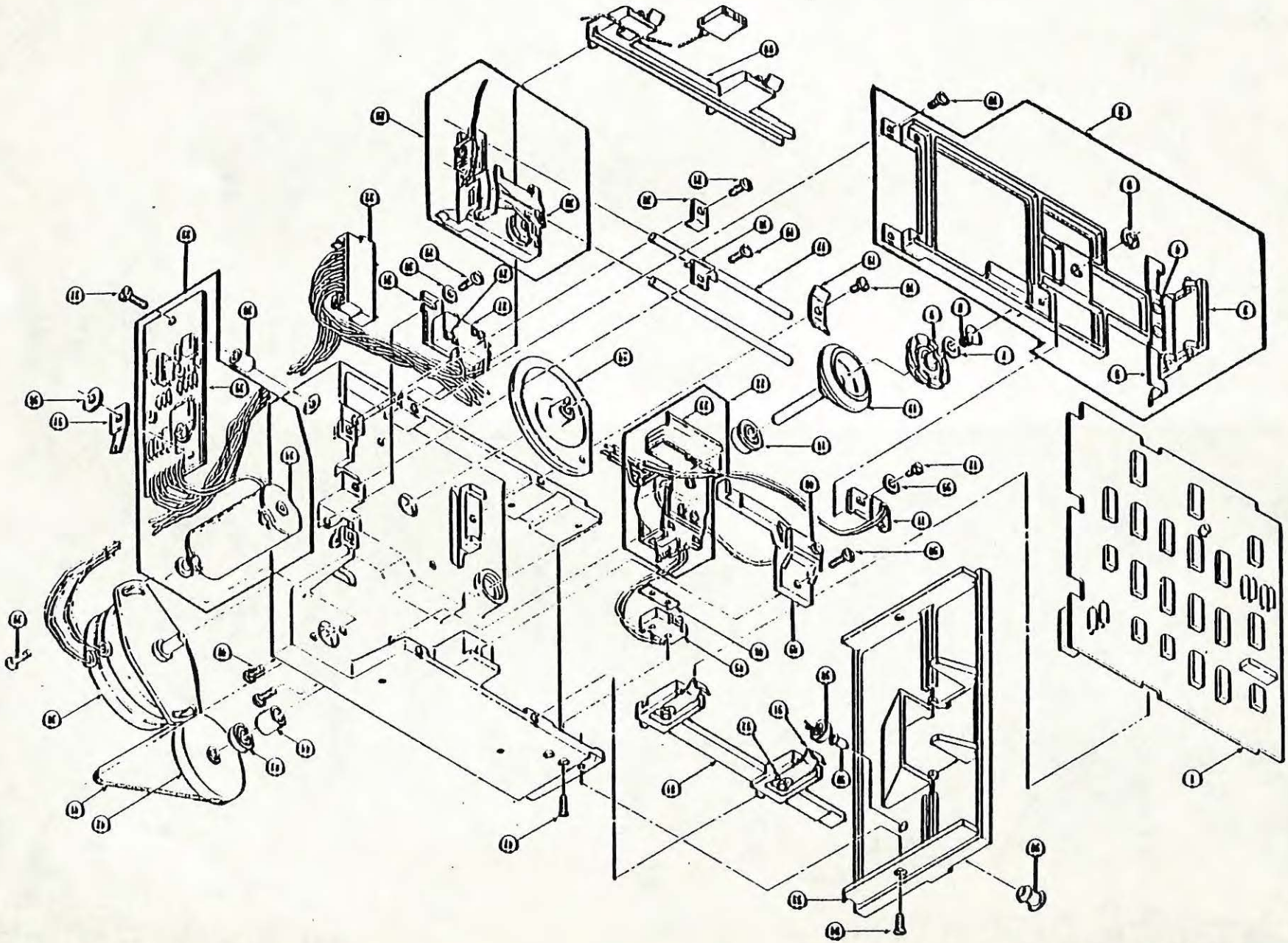
SA 390

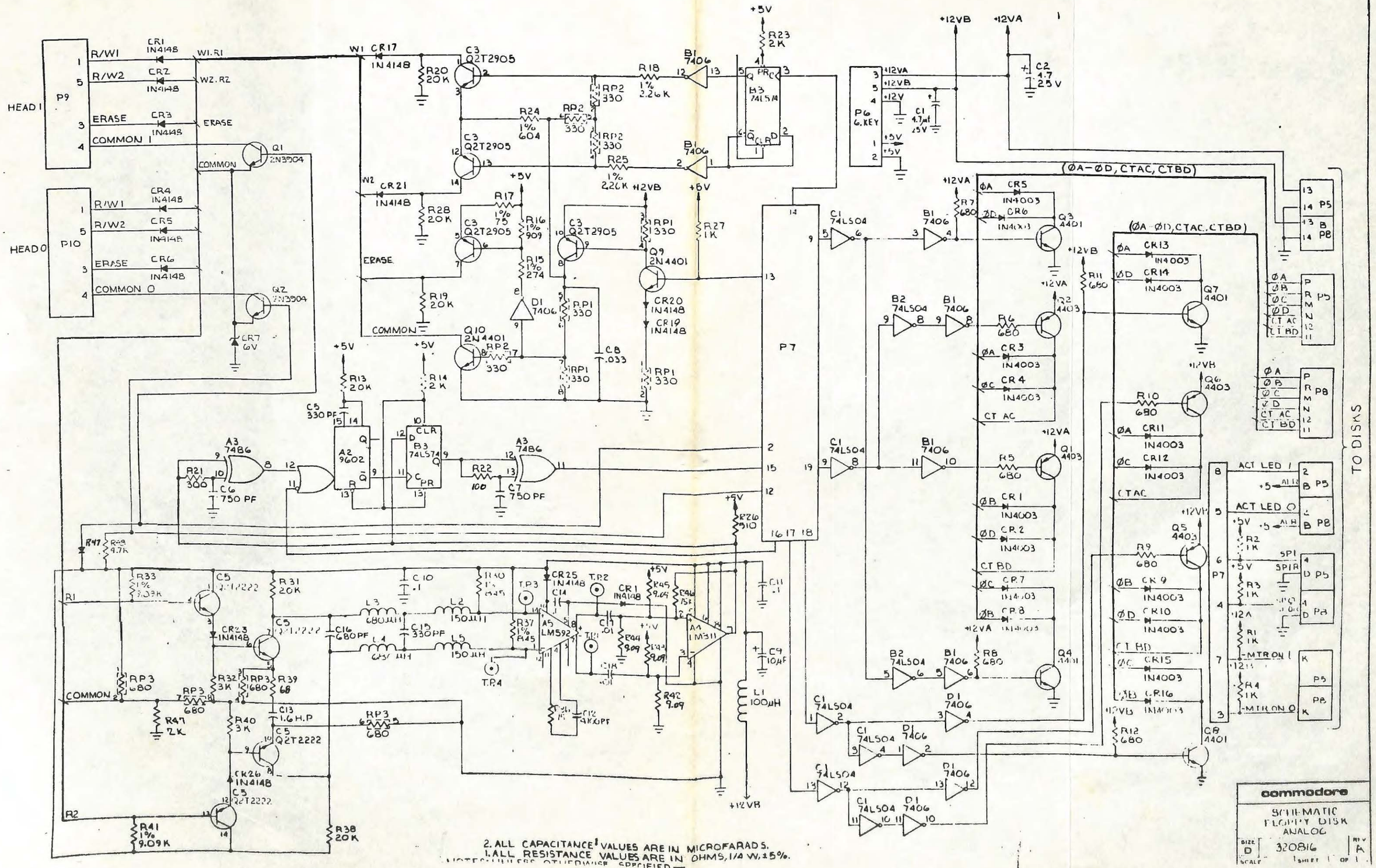
PARTS REFERENCE

SPARE PARTS PRICE LIST FOR SHUGART 390 DRIVE

REF. NUMBER	PART NUMBER	DESCRIPTION	PRICE
47	10166-0	Screw 2/56X.500	.50
19,16,10,4	10186-0	SCW#6-32X.19 T10159	.50
39,12,29	10187-0	SCW#6-32X.25 T10159	.50
50	10189-0	SCW BH 6-32X.375 T1	.50
37	10191-0	SCW#6-32X.50 T10159	.50
43	*10804-0	Bearing, Ball	4.50
14	*10805-0	Bearing, Ball	5.00
6	11305-0	Ring Retaining	.50
58	11312-0	Fastener, LED	1.00
54	11900-0	Screw 6/32X.250	.50
56	12501-0	Lock Wahser #6 T12502	.50
57	15663-0	Tab, Fasion	.50
59	15915-0	LED, Red	1.50
45	17212-0	Switch Write Protect	3.00
35	25063-0	Drive Mtr Speed Control AM	22.00
24	54003-1	Cam-Actuator	.50
17	54006-0	Rod, Guide	1.50
13	*54032-0	Spindle-Machined	27.00
31	54038-0	Plate Trk 0	1.00
34	54047-0	Drive Motor	28.50
41	54048-0	Belt, Drive	5.00
25	54055-0	Carriage Head ASM	91.50
5	54057-0	Stop, Diskette	.50
46	54062-0	Plate Nut	.50
9	54066-1	Hub Clamp ASM	6.50
33	54067-0	Drive Motor ASM	45.00
38	*54068-0	Step Motor ASM	27.00
2	54070-0	Hub Frame ASM	39.50
3	54073-0	Door Hinge ASM	2.00
53	54077-2	Cover, Front	2.50
1,520	54078-0	Keeper, Guide Rod	.50
60	*54089-0	Guide Disk ASM Right Side	1.50
61	*54090-0	Guide Disk ASM Left Side	1.50
44	*54097-0	Spacer, Long	1.00
18	54099-0	Clamp, Guide Rod	.50
49	54125-0	Platen, Machined Complete	1.50
7	54131-0	Collar Hub	.50
8	54132-1	Spring, Clamp	.50
42	*54138-0	Pulley ASM	22.00
26	54145-0	Load Button ASM	1.50
1	320817-01	Analog Board	45.00

* Not Field Replaceable





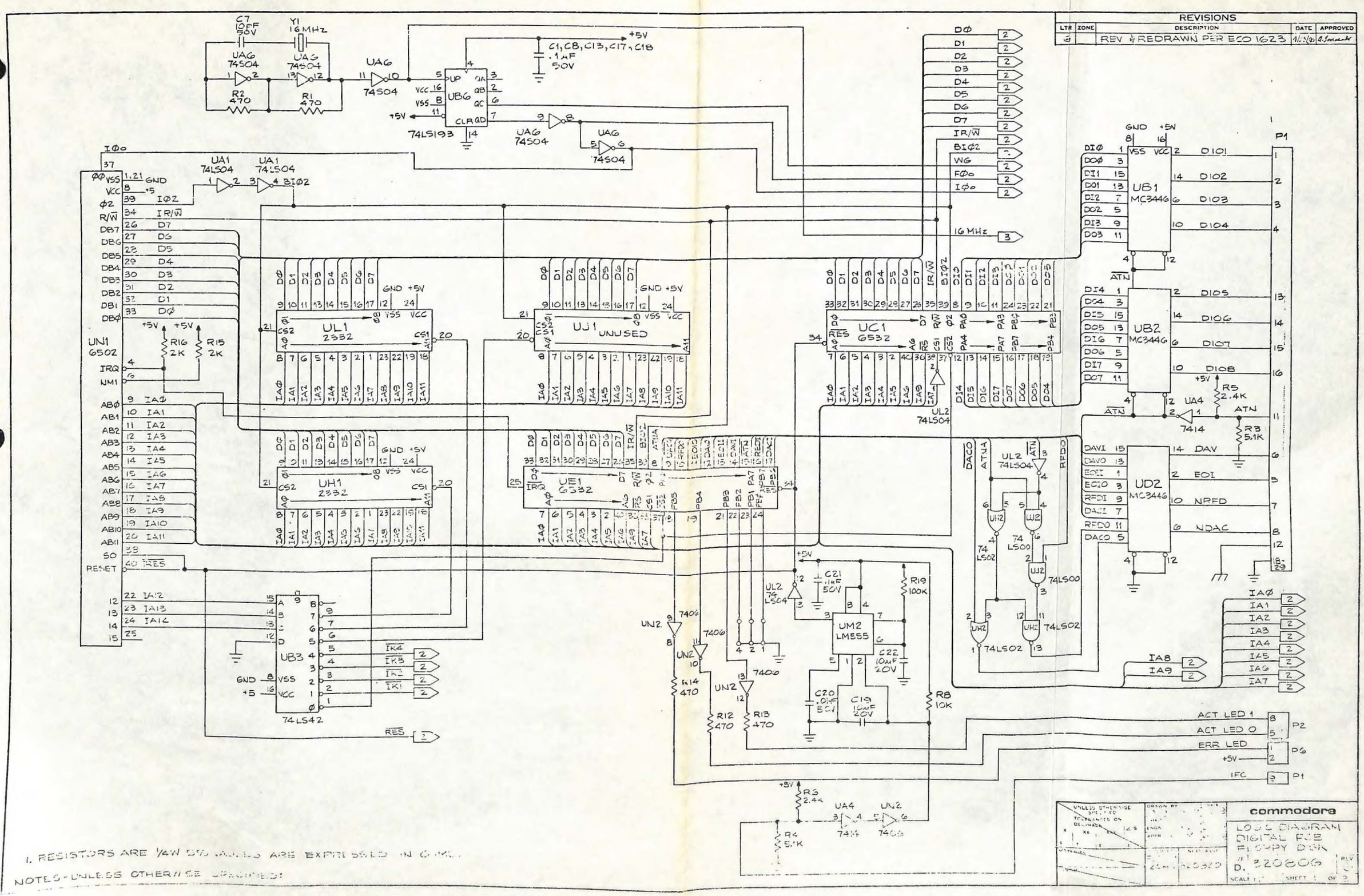
2. ALL CAPACITANCE VALUES ARE IN MICROFARADS.
1. ALL RESISTANCE VALUES ARE IN OHMS, 1/4 W, ±5%.
UNLESS OTHERWISE SPECIFIED

commodore

SCHEMATIC
FLOPPY DISK
ANALOG

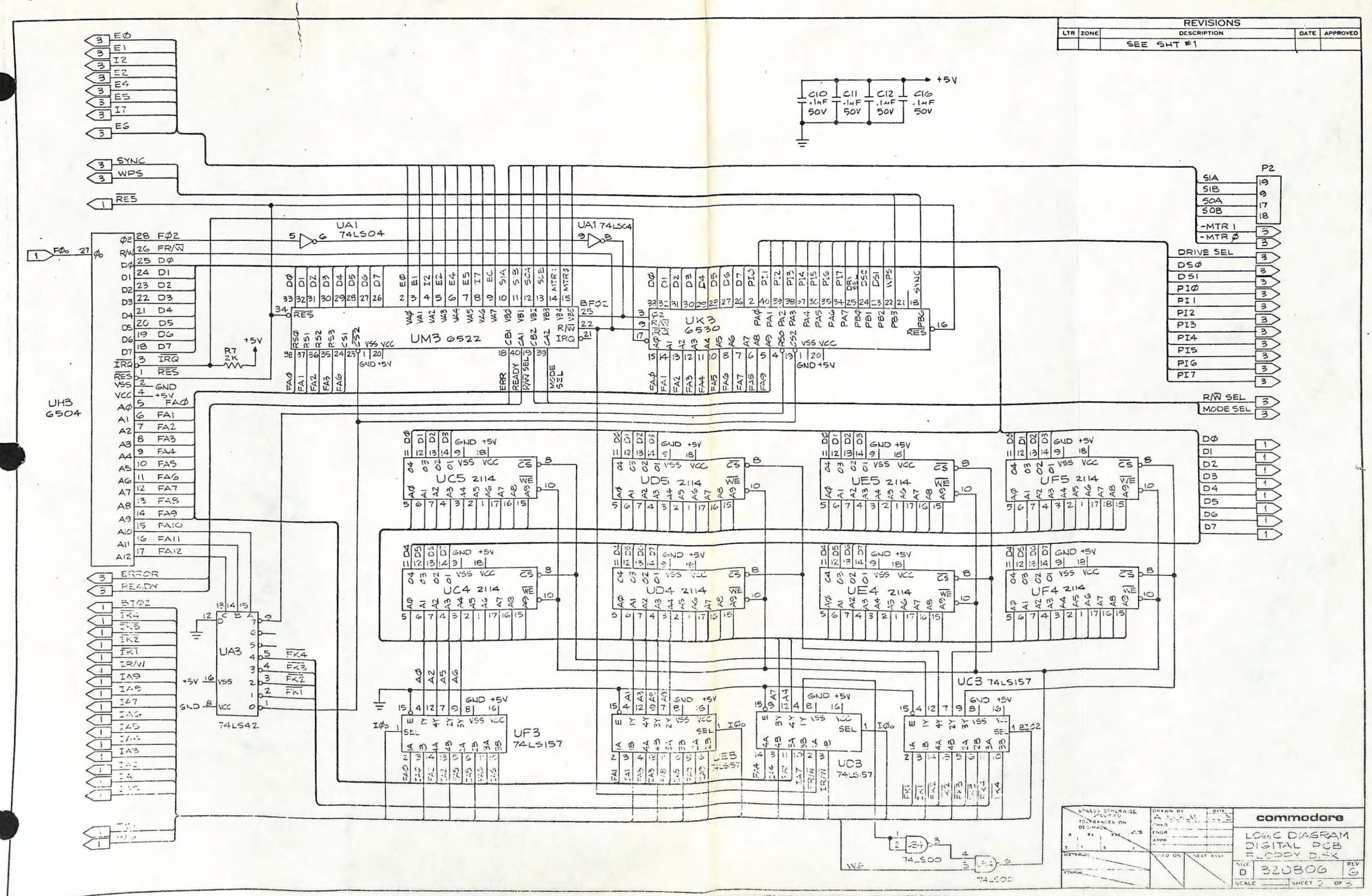
SIZE D | 320816 | REV A

SCALE | SHEET 1 OF 1



1. RESISTORS ARE 1/4W 5% VALUES ARE EXPRESSED IN OHMS.

NOTES - UNLESS OTHERWISE SPECIFIED:


REVISIONS
LTR ZONE DESCRIPTION DATE APPROVED
SEE SHT #1
UH3 6504
UA1 74LS04
UM3 6522
UK3 6530
UC5 2114
UD5 2114
UE5 2114
UF5 2114
UC4 2114
UD4 2114
UE4 2114
UF4 2114
UA3 74LS42
UF3 74LS157
UE3 74LS157
UD3 74LS157
UC3 74LS157
74LS00
P2
DRIVE SEL
R/W SEL
MODE SEL
ERROR
READY
+5V
commodore
LOGIC DIAGRAM
DIGITAL PCB
FLOPPY DISK
SIZE D
320806
REV G
SCALE
SHEET 2 OF 3

REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPROVED
		SEE SHEET #1		

P4 — KEY: 10, 5, 8, 6, 9, 7, 4, 3, 1, 2

CR8 IN4001 — CR4 IN5402 — CR3 IN5402 — CR2 IN5402 — CR1 IN5402

VR2 7812 — C31 1µF 35V — C32 10µF 25V

CR7 IN4001

VR1 7812 — C29 1µF 35V — C30 10µF 25V

CR9 IN4001 — CR6 IN5402 — CR5 IN5402

VR3 LM323 — C33 1µF 35V — C34 47µF 16V — C2-C6, C9, C14, C15, C23-C28 .1µF 50V

P3: +12VA, +12VB, +5V, +5V

P2: DATA OUT, WRITE ENABLE, DRV SEL, WPØ, HD SEL 1, HD SEL Ø, WP1, DATA IN, 16 MHz, DSØ, DS1, MODE SEL, PIØ, PI1, PI2, PI3, PI4, PI5, PI6, PI7, R/W SEL, -MTR 1, -MTR Ø, READ INHIBIT

UL2 74LS04 — UJ6 7406 — 74LS00 — UH6 74LS00 — UJ2 74LS00

UH5 74LS 190 (DN/UP, CLK, RC) — UE6 74LS04 — UF6 74LS02

UMG 74LS165 (QH, CLK, LOAD, CLK INH) — UN6 74LS165

UK6 2316 (D0-D7, VCC +5V, VSS, A0-A10, CS1, CS3, CS2)

WPS, ERROR, EØ, E1, I2, E2, E4, E5, I7, E6, READY

UCG 74LS193 (LD, DN, UP, CLR, QC, QD, CY) — UF6 74LS02 — UE6 74LS04

UD6 74LS193 — UF6 74LS06

UP5 74164 — UN5 74164 (CLR, A, B, CLK, QA-QH)

UM5 74LS133 (SRØ-SR9)

UJ5 74LS157 — UK5 74LS157 — UL5 74LS157 (1SEL, SEL, MODE SEL)

SYNC

UE6 74LS04 — UJ6 7406 — P2

UNLESS OTHERWISE SPECIFIED TOLERANCES IN DECIMALS .X ± .XX ± .XXX ±	DRAWN BY A.J.C.J.M.	DATE 7/7/83	commodore
MATERIAL	ENGR		LOGIC DIAGRAM DIGITAL PCB FLOPPY DISK
FINISH	APPR		SIZE D 320806 REV C
	USED ON	NEXT ASSY	SCALE — SHEET 3 OF 3