SYM-1 DISK OPERATING SYSTEM FOR THE COMMODORE

1541 DISK DRIVE

MONITOR LINKS

RAE LINKS

BAS LINKS

Distributed by

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INTRODUCTION

The SYM-1 DOS for the Commodore 1541 disk drive greatly expands the capability and compatibility of the SYM-1. Although several disk systems are available for the SYM-1, all are relatively expensive. In addition, each offers its own unique disk formating, which prevents disk interchangeability and greatly limits access to commercial and public software. The SYM-1 1541 DOS helps to fill this gap by using the Commodore 1541 disk drive to create Commodore compatible disks. Since the Commodore 1541 has the DOS built into it, the SYM-1 DOS can take advantage of the Commodore DOS features and reside in RAM or EPROM very compactly (approx. 3K). It can function equally well in an unexpanded SYM-1, a development system, or even a fully expanded system. With the installation of SYM-1 1541 DOS the SYM-1 can become a much more powerful little computer that is easier and more enjoyable to use.

Functionally, the SYM-1 1541 DOS consists of four modules: the Primitive routines, the Monitor link, the RAE link, and the BAS link. The primitives include all of the low level routines needed to communicate with the Commodore 1541 disk drive over the serial bus. The SYM-1 has several different VIA ports that could be connected to the serial bus. However, the primitive interface routines are dependent on the selected bus configuration on the VIA. The standard VIA port configuration uses VIA #1 (Port A) on the A-connector. Other configurations are available upon request at a nominal fee. The Monitor link interfaces with SUPERMON. All commands are vectored through the unrecognized syntax vector (URSVEC) and may be easily enhanced or altered as desired. When system vectors are used, a return vector is placed in system RAM for additional patches. The commands include load and save memory to disk with the option for a relocated load. Other commands allow easy display of the disk directory, reading the error channel, changing the device number to another drive, and sending Commodore 1541 DOS commands. The assembler editor (RAE) link includes the monitor disk commands which are implemented through the DC command. The load and save commands use special forms of the PUT and GET commands. The load command will load RAE source files with the option for an append and the save will save the source

files.   Files may also be assembled from disk.   To enter
RAE, a simple monitor jump command is used which then
completely configures the file parameters for a 28K (or
whatever size desired) system.   The monitor may be
reentered with a control C and all of the monitor commands
are still available.   To start BASIC a simple monitor jump
command is also used, which configures BASIC for a 28K
system with 80 columns and then patches in the new command
processor using INVEC and OUTVEC.   The disk commands are
implemented through OUTVEC so that future commands maybe
added easily and used under program control. Currently,
commands to load and save program files to disk are
supported.   The other disk commands are also available.   It
is possible to exit BASIC with a control C and then warm
start it again with a .G command without the loss of the
BASIC text.   Normal cassette I/O is functional in BASIC,
RAE, and SUPERMON.   \

The SYM-1 1541 DOS system includes the following:

1.   Hardware interface module for the serial
     bus connection to the SYM-1.   VIA #1,
     Port A.   (optional configurations available)

2.   Complete source listing for the primitives,
     monitor, RAE, and BAS links with Cross
     Referenced Label Listing

3.   Cassette tape with object code.
     (normal start address $7000, but others
     available at no charge)

4.   SYM-1 1541 DOS manual.

5.   EPROM with object code for primitives and
     monitor links.   (optional)

6.   Source files on disk or cassette.
     (optional)

INSTALLATION AND SET UP

The SYM-1 1541 Disk Operating System is easy to set up and run. The interface module supplied connects onto the A-connector of the SYM-1 board so that the side of the 22/44 connector with the most wires is on the top side of the SYM-1 board. Please make sure that all power is off to the SYM-1 and the disk drive before making any connections. If a special I/O configuration was ordered, please see the special instructions for the installation. The microclip must be connected to the reset signal of the SYM-1 board located at connector pins AA-13 or E-7 (res). This allows the disk drive to be reset when the SYM-1 is reset. The disk drive din plug is connected into the interface module jack. If additional 1541 drives are used, they should be chained using the extra connector on the back of each drive according to the instructions in the drive manual. The DOS system software assumes the main drive to be device #8. A second drive can be used as device #9. It is possible to connect and address more than two 1541 disk drives, but the device number must be set up through the Monitor Link command (SC #x) using ØA hex (#1Ø) or ØB hex (#11). Device numbers less than 8 are not supported except in the RAE Link where device #Ø is the cassette tape. To install the EPROM, if ordered, please see the special instructions.

SPECIAL INSTRUCTIONS FOR THE EPROM OPTION

If you ordered the EPROM option you received a 2716 (2K) EPROM containing the Monitor Link and the Primitive Routines. The cassette tape supplied contains the object code for the RAE and BAS Links plus several other relocated versions of the entire system object code, which should be helpful in customizing your system. To install the EPROM, select the appropriate ROM socket on the SYM-1 board and set the jumpers for the desired socket, for the correct start address shown on the EPROM label, and for the 2716 type EPROM. Please be sure that all power is off when making these changes. Insert the EPROM into the socket carefully, remembering that it is static sensitive. After connecting the interface module as described in the section on Installation and Set Up, the System is ready to use.

The standard version of the SYM-1 1541 DOS is located at $7000-$7C75, which corresponds with the source code listing in the manual. The EPROM version assumes that the RAE and BAS Links are located at $7800-$7C75. If you find it necessary to use the RAE and BAS Link portions of another relocated version of the object code, the high addresses of the J 0 (BASIC cold start vector) and J 4, J 5 (RAE warm and cold start vectors) must be changed, in addition to several jumps to system routines. To consolidate the DOS routines, you might consider installing a 2K static RAM chip, such as a 6116 in the 2K memory space above your EPROM for the RAE and BAS Links. The RAE and BAS Links were not put into EPROM so that both may be expanded and enhanced. As each portion increases in size, they probably will no longer reside concurrently in the limited 2K memory space. However, it will be possible to overlay the Links in memory as necessary when running RAE or BASIC.

COMMAND SUMMARY

MONITOR LINK:

1. S2 xxxx,yyyy/FILENAME
    save memory to disk with the name
2. L2 /FILENAME load memory
    L2 xxxx/FILENAME relocated memory load
3. CONTROL D reenter file name
4. SC #x change device number
    SC ! read error channel
    SC ? list directory
        BREAK Key, pause listing
        SPACE BAR, continue listing
    SC /DISKCOMMAND send disk command
5. J0 cold start BASIC
    J5 cold start RAE

RAE LINK:

1. PUT/FILENAME save source file
2. GET/FILENAME load source file
    GET/FILENAME A append to source file
3. DC #x change device number
    DC ! read error channel
    DC ? list directory
    DC /DISKCOMMAND send disk command
4. .CT FILENAME continue on disk

BASIC LINK:

1. CONTROL C exit to monitor
2. #SP "FILENAME" save program to disk
3. #LP "FILENAME" load program from disk
4. #DC "#x" (same as RAE LINK)
    #DC "!"
    #DC "?"
    #DC "/DISKCOMMAND"

USING THE SYSTEM

After completing the necessary installation steps you
are now ready to proceed with testing your System. The
normal power up sequence should involve turning on the
peripherals and disk drive first and then the SYM-1.
Occasionally the error light on the drive will flash, which
is not a problem. Your might want to reset the SYM-1 which
should reset the disk drive, causing it to start
momentarily and stop if all is set up properly. The next
step is to load the desired object code from tape. For
your convenience the object code is supplied on cassette at
two or more different start addresses ($7000 and $9000).
This is not necessary if you have installed the EPROM
option. Following a successful tape load please verify the
object code and make sure the check sum agrees with the
value on your tape directory. If all is OK, use the
SUPERMON command G xxxx to cold start the DOS where xxxx is
the start address of the object code. The drive will
become active, briefly, and the error light may flash, but
not always. To clear the error channel use the command: SC
!.

The command format is designed to be simple and
similar for each of the software links. In reading this
section please refer to the Command Summary section for the
correct command format. One of the first steps required to
use the System is to "NEW" (format) a blank disk. This is
accomplished by sending the 1541 disk NEW command as
described in the 1541 manual. The advantage of using the
SYM-1 1541 DOS commands is that the procedure is greatly
simplified, since the CBM BASIC commands, OPEN, PRINT, and
CLOSE are not required. They are an integral part of the
single command: SC /N0:Disk Name,ID#. Other disk commands
may be sent in a similar manor, such as: initialize (SC
/I), validate (SC /V), or rename a file (SC
/R0:Newname=Oldname) etc. This format is also used by the
RAE and BAS Links with the appropriate command (ie DC /...
or #DC "/...", respectively).

A. USING THE MONITOR LINK.

When using the Monitor Link, the Load and Save
commands require the memory addresses to be entered in
hexadecimal numbers similar to other SUPERMON commands.
The Save command requires that 2 address parameters be

entered, while the Load command may have either zero or one parameters depending on whether a relocated Load is desired. The "/" is used to delineate the start of the file name or disk command. In general, file names may contain any ASCII character including spaces. However, spaces are not allowed in file names for the RAE and BAS Links. The reason for permitting spaces in the Monitor Link is to read and/or rename a 1541 compatible disk file, which quite often contain spaces. If a typing error occurs while inputting the file name, it may be reentered in the Monitor Link by typing a control D. A new prompt "/" is provided, permitting entry of the new file name. When using the SC #x, SC !, and SC ? commands no <Return> is required to execute the command. When listing the disk directory, it is possible to interrupt it by typing the Break key. The listing may be continued by hitting the space bar. This can be very useful for viewing long directory listings. However, when you interrupt the listing, the drive will continue to turn, so it is best not to pause for long periods of time. All of the Monitor disk commands are patched through the URSVEC in system RAM. To use software which also requires the URSVEC, a new URSVEC has been provided (NEW.URSV) located at $A606 in system RAM. It functions the same as the original URSVEC, returning to the Monitor ERMSG routine.

B. USING THE RAE LINK.

To enter RAE and initialize the RAE Link the Monitor J 5 command is used. Following initialization, the following file parameters are set: Source files $200-$5FFC, Label files $6000-$6EFC, and Relocation Buffer $6F00. The command format for the RAE Link is similar to the Monitor Link with some important differences. The GET and PUT commands are used to load and save RAE source files to disk. These commands utilize the RAE GET and PUT vectors normally used for cassette tape input and output. When the RAE Link is initialized, these vectors are set to the disk routines, with the default device number set to 8. To use the normal cassette GET and PUT commands the device number must be set to zero (DC #0). The form for these commands are: GE/Filename and PU/Filename. There is no need to enter a space after the GE or PU, since the "/" delineates the start of the file name. No spaces are permitted in file names. It is also possible to append a source file from disk to one in memory, the format is: GE/Filename A. When saving a very large source file to disk there may be a slight delay before the drive starts to save the data as certain parameters are set up. The other disk commands are implemented through the RAE DC command, using the DC

vector. To aid in future enhancements, a new DC vector (NEW.DCV) has been provided in system RAM at $A610. All returns to RAE after a DC command are vectored through the new DC vector, which provides a return. To assemble source files from disk the command .CT Filename is used as the pseudo op directive.

It is possible to alter the RAE Link initialization sequence by altering the RAE.SETUPV located at $A600 in system RAM. Normally when RAE is entered via a Monitor J 5 command, a Monitor Execute command occurs which vectors the program flow through the RAE.SETUPV and then to RAE.SETUP. By changing the RAE.SETUPV to a user supplied routine, RAE may be configured differently. It is important to note that the GET, PUT, and DC vectors set up procedure should not be altered.

C. USING THE BASIC LINK.

To enter BASIC and initialize the BAS Link, the Monitor J 0 command is used. Following initialization the BASIC HIMEM is set to 28672 ($7000), the column limit to 80, and the device number is set to 8. The BASIC software link provides the same features as the Monitor and RAE software links. All commands are patched through OUTVEC except the exit to Monitor command (control C) which is linked via INVEC. Similar to the other links, a new INVEC (NEW.INV, $A60C) and a new OUTVEC (NEW.OUTV, $A609) are provided in system RAM.

As with the RAE Link, it is possible to alter the BAS Link initialization sequence. Normally when BASIC is entered via a Monitor J 0 command, program flow goes to BAS.INIT which performs a Monitor Execute commmand. Program flow is then directed through the BAS.COLDV and subsequently to the BAS.COLD routine. By changing the BAS.COLDV loacated at $A603 in system RAM to a user supplied routine, the BASIC initialization parameters may be changed.

ERROR CODES

Many of the more common errors which occur are handled by the 1541 disk drive DOS. An error condition is noted by the flashing red light on the drive. To find which error actually occurred, the error channel may be read. Some errors are handled by the SYM-1 1541 DOS routines. The Primitive routines set a bit in the status register depending on the type of error. When the error occurs, the status register is displayed. The significance of the bits are as follows:

Status Bit	Hex Value	Description
1000 0000	80	device not present
0100 0000	40	EOI
0010 0000	20	ATN error
0001 0000	10	not used
0000 1000	8	not used
0000 0100	4	not used
0000 0010	2	Read time out
0000 0001	1	Send time out

The Monitor Link handles all of its errors using the typical Monitor method of displaying the accumulator. Within the RAE Link the following additional error codes may be encountered:

        31 - Text file overflow
        32 - Device number error
        33 - Disk I/O error
             with status register displayed
        34 - File name error

Similar to the RAE Link, the BAS Link handles a few errors internally. The error codes are:

        31 - Device number error
        32 - File name error
        33 - Load error
        34 - Save error
        35 - Text overflow error
        36 - Disk command error

TABLE OF SYSTEM RAM VECTORS

1. RAE.SETUPV $A600   Used to set up and start RAE following a monitor J 5 command.

2. BAS.COLDV $A603   Used to set up and cold start BASIC following a monitor J O command.

3. NEW.URSV $A606   The new monitor URS vector which maybe user patched for more monitor commands.

4. NEW.OUTV $A609   The BASIC Link patches in via OUTVEC and moves the routine address (TOUT) to NEW.OUTV.

5. NEW.INV $A60C   The BASIC Link patches in via INVEC and moves the routine address to NEW.INV

6. NEW.DCV $A610   The RAE DC vector is used to patch all disk utility commands. The NEW.DCV allows the addition of even more commands.

7. ACC.VEC $A613   A vector for future use. The high address of the running version of DOS is saved so that utilities may vector to the system routines via the jump table.

TABLE OF SYSTEM AND PRIMITIVE VECTORS

SYSTEM VECTORS

1. LOADV	$xx03	Load program to RAM. P1= device #, P2=reloc. addr. P3=reloc. flag.
2. SAVEV	$xx06	Save RAM to disk. P1=device #, P2=start addr., P3=end addr.
3. DISKCMDV	$xx09	Send 1541 disk command. Command sequence in FNAME, file name length in FN.LEN, and device # in C.DEV.
4. DISK.STV	$xx0C	Read disk error/status channel.
5. DIR.ENTV	$xx0F	Display directory. Device # in Accum. when called.
6. GETNAMEV	$xx12	Monitor Link get file name and length routine.
7. DISKCLOSEV	$xx15	Open channel for I/O, SET. LISTN, and UNLISTN.
8. DISKOPENV	$xx18	Open channel for I/O, SET. LISTN, send file name, and UNLISTN.
9. SETUPVIAV	$xx1B	Initialize and set up VIA #1.

PRIMITIVE VECTORS

10. TALKV	$xx1E	Command serial device to TALK.
11. LISTENV	$xx21	Command serial device to LISTEN.
12. SECONDV	$xx24	Send LISTEN/secondary addr.
13. TALKSAV	$xx27	Send TALK/secondary addr.
14. CIOUTV	$xx2A	Out byte to serial port.
15. UNTALKV	$xx2D	Tell serial bus to UNTALK.
16. UNLISTENV	$xx30	Tell serial bus to UNLISTEN.
17. ACPTRV	$xx33	Input byte from serial bus.

UTILITIES AND ENHANCEMENTS

The basic SYM-1 1541 DOS provides a flexible foundation for the addition of future commands and utilities. Many commands are possible such as Append to BASIC programs, a RUN command to load and run a program, and OPEN and CLOSE commands to write data to disk. Utilities could be used to copy diskettes and to read/write a disk sector. Many new enhancements and utilities will become available in the near future at a very reasonable cost.

DISCLAIMER

The SYM-1 1541 DOS System has been extensively tested and is guaranteed to function as described. It was designed to be as flexible as possible and to accommodate system differences and individual software enhancements. However, it is possible that some software may require changes to fully utilize the DOS System. If and when problems are encountered, please contact me and I will attempt to find a solution.

I personally guarantee that each purchaser will receive a functioning hardware interface module and a readable copy of the DOS object code on cassette. If either part is found to be defective, please return that part within 90 days from the date of purchase and it will be replaced free of charge. No other guarantees are either expressed or implied and the user assumes all responsibility for the use and suitability of this System for his or her applications.

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SYM-1 1541 DOS SYSTEM

All prices include shipping and handling unless otherwise stated. Please allow 4-6 weeks for delivery. Overseas orders add $10.00.

    (1) SYM-1541 DOS $95.00
    (2) DOS - Special I/O config. (add $25.00)
    (3) EPROM option (add $15.00)
    (4) Source files on disk or cassette $25.00

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