COCO SDOS®

Supplement
Software Dynamics Operating System
for
Radio Shack 64K Color Computer

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CoCo SDOS(R)

Supplement for
The Software Dynamics Operating System
for the Radio Shack 64k Color Computer

CoCo SDOS

Color Computer SDOS

INTRODUCTION

This document gives information about how to use the SDOS disk operating system on the Radio Shack TRS-80 Color Computer. Only information which is Color-Computer specific is provided here. General details about the operation of SDOS are provided in the SDOS User's Guide and the SDOS Application Programmer's Guide. This document is only intended to act as a supplement to the Guides, and should be read with them.

Must I really read all these documents?

Well, no. But the more you know about your SDOS, the less confused you will be when something unusual happens. You don't need to memorize all this information, but it is extremely helpful to know where to look. We have found that the best way to learn about SDOS is to read the manuals very quickly once (so you've seen everything and know roughly where you saw it), slowly once (to gain understanding), and then again once every 6 months. Customers that do this tell us that it just amazing what they discover in the manuals after each re-reading; we think that their growing sophistication really allows them understand parts of the manual that they didn't notice or couldn't figure out on the first few passes.

RELATION OF SDOS TO THE REST OF THE WORLD

SDOS is a "Disk Operating System" designed to operate on a wide variety of microcomputer systems based on either the Motorola 6800 or 6809 microprocessor (SDOS is a registered trademark of Software Dynamics, the company that developed it). SDOS "manages" the operation of the computer in order to make it easy to use compared to the bare hardware. It stores user data on disks and keeps track of what is stored, runs programs when requested, and does screen/keyboard and printer input/output as necessary to talk to the computer user.

SDOS has been under continuous development since 1978, and now has single-user, timesharing, and network (multiple-computer) versions. It is used in variety of applications, from business to process control to software development. One of the particular attractions is the ability of the various SDOS systems to run each other's software, in spite of large changes to the environment.

This document is about the version of SDOS available on the Radio Shack Color Computer. This version of SDOS is highly compatible with the other existing versions. This means that software tools that are available on larger micros using SDOS can be used on the Color Computer, for program development, running of applications, word processing, etc. It also means that applications you write for the CoCo can operate, virtually unchanged, on other kinds of computers running SDOS.

WARNING: Before using SDOS, we seriously suggest you spend an hour looking at the SDOS manual, especially the section on "Concepts" and "Using the Keyboard". This will help answer a lot of questions.

HARDWARE REQUIREMENTS

CoCo SDOS requires a 64k byte Radio Shack Color Computer, a television set, a Radio Shack Color Computer floppy disk controller and at least one Radio Shack Color Computer disk drive, all connected in the manner prescribed by Radio Shack. One of the drives must be drive number Ø. We suggest two disk drives for ease of use. SDOS has the capability of handling larger capacity floppy disks and/or Winchester disk drives, but this version of the CoCo SDOS does not implement this ability (future revisions will probably relax this constraint). No special configuration of the disk drives is required; if they work with Radio Shack Disk Extended Color BASIC, they should work fine with SDOS.

CoCo SDOS has been tested with some floppy disk controllers and disk drives not manufactured by Radio Shack. Certain incompatibilities of such controllers/drives with Radio Shack's may prevent access to the second side of a double-sided diskette, or limit the number of drives accessible.

HARDWARE OPTIONS SUPPORTED

The CoCo SDOS system additionally supports the following hardware:

1) Up to 4 disk drives
2) An RS232 compatible line printer via the CoCo serial input/output port. The data in line is used by the software as a "printer busy, please wait" feedback line, so it cannot be used as an input device. The baud rate is defaulted to 6ØØ baud (identical to RS BASIC), but may be changed via the SDOSSET command. The printer driver software in CoCo SDOS assumes that the printer is configured for AutoLineFeed, but this can also be changed by the SDOSSET command. Basically, if the printer works with RS Basic, it should work with SDOS.
3) Modem cartridge (Radio Shack catalog number 26-2226), to provide an additional serial port for both input and output. The modem card, if used, must be plugged into the Multi-Pack expansion chassis in slot number 3, and the disk controller plugged into slot number 4. The Selector switch on the front of the expansion chassis must be set to "4". The modem card can be used to perform serial I/O at any baud rate from 5Ø baud to 19.2K baud (refer to the SDOSSET command); the default baud rate is 3ØØ baud (standard for modems). The modem card can also be used to allow SDOS to be controlled from a true 24 by 8Ø CRT, if the optional SEDIT/TYPE diskette is purchased.

UNSUPPORTED DEVICES

There are a variety of special devices available for the CoCo. CoCo SDOS does not handle them directly, but they may be used by installing them in the Multi-Pack expansion chassis in slots 1 or 2. Application programs using such devices will require either assembly language interface routines, or properly sequenced PEEK/POKE statements (if you are using the BASIC compiler). Use of either of these, of course, makes the application program non-portable to other SDOS systems. It is unlikely that these devices can cause interrupts, but if they do, SDOS will get confused and will not operate properly because it has no software to handle interrupts from unknown devices.

COCO SDOS SOFTWARE DESCRIPTION

The CoCo SDOS package consists of 2 diskettes, manuals, and this document. It is needed in order to operate the other software packages requiring SDOS. The first disk is the SDOS Boot Disk, and the other disk contains EDIT/ASM.

The pieces are:

1) SDOS disk operating system Boot disk, plus SDOS User Guide and SDOS Application Programmer Guide manuals.
2) SDOS system utilities (also on Boot disk, described in SDOS User Guide)
3) Diskette formatter (also on Boot disk, described in this document)
4) EDIT (a line-oriented text editor), plus manual
5) 6809 Assembler (converts assembly source programs to computer object code) plus manual
6) 6809 Debugger (allows one to "debug" 6809 object code programs) plus manual
7) COCOUTILITY (copies files/to from RSDOS diskettes, described in this document)
8) PHONEBOOK (a demonstration program, described in this document).

SDOS SOFTWARE AVAILABLE

As of December, 1984, the following software packages are available for CoCo SDOS:

- Basic Compiler: BASIC for the most discriminating programmer, including long variable names, IF-THEN-ELSE, true subroutine with multiple parameters, and a host of other features.

- Keyed File Package: set of routines for BASIC compiler to allow ISAM like associative record retrieval from data files. This package would be used in any serious data management problem.

- SEDIT/TYPE: provides Full-Screen text editor that operates on disk files, and complete word/document processing facilities. Also allows operation of CoCo SDOS with 24 by 80 external CRT.

Modules planned for the near future:

- High-resolution graphics support from compiled BASIC.

STARTING SDOS ON THE COCO

To start your SDOS system, you need to push the CoCo RESET button and obtain the "Disk Extended Color BASIC" display. Simply insert a working copy of the SDOS Boot diskette into drive Ø (the very first first time you boot, you MUST insert the diskette labelled "MASTER SDOS Boot") and type:

```
RUN "SDOS
```

This results in the screen displaying a "Loading..." message. The disk heads will step quickly (make a "tick tick tick" noise), and after about 1Ø seconds the screen will clear again, and the SDOS banner will be displayed at the top of screen, as described in the SDOS User's guide. If you get unusual characters in the upper left-hand corner of your "Loading..." screen then your system is having difficulty reading the diskette. This is a rare event which indicates a worn-out boot diskette (cure: make a new copy of the Master Boot disk), or maybe a drive alignment or other electronic problem.

Once SDOS prints

```
.TIME
```

and you have entered the time (see SDOS User's Manual), it is ready to use (note: you MUST enter the time if you plan to do any file manipulation with SDOS). Read on if it does not ask for TIME.

REGISTERING YOUR SDOS

If your copy of SDOS is not yet registered (like most new purchases) SDOS will give you an explanatory message about registration codes. You should read this paragraph and the "READ ME FIRST" section of the SDOS User's Guide BEFORE you do ANYTHING from here. You can call Computer Systems Distributors to obtain the registration code (no charge), or you can mail in the included registration card and CSD will mail a registration code back. Be sure to COMPLETELY fill in the card, and PRINT LEGIBLY (or the returned registration code may be incorrect!). You should go read the "READ ME FIRST" section of the SDOS User's Guide right now.

Now, having read the "READ ME FIRST" section, if you have your registration code, give it to SDOS. It is probably useful to save the registration code with your Master Boot diskette. If you can't get to us for your registation number then you may still use SDOS but will need to wait 3Ø minutes for it to be ready for use.

THE SYSTEM SERIAL NUMBER AND APPLICATION ENCRYPTION PROTECTION

SDOS and key proprietary modules are encrypted to match the Serial Number assigned to your SDOS system. Each system requires a unique owner's name be assigned to it. This is explained by several screens of text the first time you boot the system.

Because each system has a unique serial number, applications sold to SDOS users can be encrypted so that they only run on the intended machine, so a software producer can be assured of reasonable protection when developing software for the SDOS systems.

DEVICE NAMES AND TYPES

SDOS has device names which always end in ":". With CoCo SDOS, D0:, D1:, D2:, and D3: are the names of the disk drive units (corresponding to drive 0, 1, 2, and 3 respectively). CONSOLE: is the name of the CoCo screen for output, and also the keyboard for input (but you will hardly ever need to use this name). LPT: is the CoCo's Serial output port, and is used for the lineprinter or other serial devices that require output only. MODEM: is a true bi-directional serial I/O device which supports the Radio Shack RS-232 cartridge via the Multi-Pack Interface.

SDOSSET FOR SERIAL DEVICES AND VARIABLE BAUD RATES

SDOS allows the user to change serial device characteristics via a program called "SDOSSET". Under CoCo SDOS, SDOSSET can be used to change the baud rate on LPT: or MODEM: to any standard baud rate from 50 to 19200. SDOSSET can also be used to change screen "Wrap" mode (allows long lines to "wrap" past the right hand edge of the screen onto the left side of next line down) to "Chop" mode (lines wider than the screen are simply chopped off at the right margin) or back.

SDOSSET can also be used to change the printer from an AutoLineFeed to software-supplied linefeed by changing the device profile from MALAutoLFLPT to MALLPT.

EXTENDED KEYBOARD FEATURES

The CoCo Keyboard is provided with various extended features, including:

A full ASCII keyboard (all 96 ASCII codes can be generated)

Inline text editing using arrow keys

Auto-Repeat

Type-Ahead at ALL times, including when disks are busy

FULL ASCII CHARACTER KEYBOARD INPUT

CoCo.SDOS redefines the CoCo keyboard to allow the entry of all 128 ASCII codes. Users already used to the keyboard as defined by RS BASIC will find only two changes of consequence: unshifted @ is the "erase previous character key" instead of the left arrow (shift @ produces @ character), and the arrow keys are interpreted differently. The rest of the labelled keys produce exactly the expected result when used in conjuntion with the Shift key.

The unshifted arrow keys produce cursor movement characters, and allow intra-line editing as specified in the SDOS User's Guide in the section on "Using the Keyboard" (Up and Down arrow keys are reserved for use with the optional Screen Editor).

The "ENTER" key is the RETURN or <CR> key mentioned in the SDOS documentation. The "CLEAR" acts as a Control key does on conventional terminals, and is called the Control key in the SDOS documentation and in this document. "BREAK" on the keyboard means "ESCAPE" to SDOS. Shift "@" just gives the @ symbol.

"SHIFT" and "CLEAR" pushed together toggles the TV screen display case from "display everything in upper case" to "display in upper/lower case". Only newly displayed text will be affected. The system defaults to "display everything in upper case" when booted.

The following table gives a complete summary of the ASCII codes produced by various combinations of keys. The Key column gives the label on the lower part of the key. The columns under Unshifted, Shifted and Control show the corresponding character or hexadecimal code when the labelled key is depressed by itself, depressed simultaneously with either Shift key, or depressed simultaneously with the "Clear" key, respectively. "??" means illegal key combination; this will generally produce some character but it may change if CoCo SDOS changes.

Because the CoCo hardware uses reverse video for the lower case character set, characters such as { } (braces), (tilde), etc., even though entered correctly, will display as reverse video upper case equivalents ({ } print as reverse video [ ] (i.e., square brackets). They will be printed correctly on printers that support the full ASCII character set.

Keyboard translation table

Key	Unshifted	Shifted	Control
@	:7F (delete)	@	??
LeftArrow	$Ø8 (backspace)	_ (underscore)	??
RightArrow	$ØC (formfeed)	~ (tilde)	??
UpArrow	$ØB (vert tab)	^ (caret)	??
DownArrow	$ØA (linefeed)	| (vert bar)	??
ENTER	:ØD (return)	:ØD (return)	??
SPACE	SPACE	SPACE	??
BREAK	$1B (escape)	:Ø3 (^C)	??
;	;	+	??
,	,	<	{
.	.	>	}
/	/	?	\ (backslash)
:	:	*	??
-	-	=	??
Ø	Ø	:Ø9 (tab)	:ØØ (null)
A	a	A	$Ø1
B	b	B	$Ø2
C	c	C	$Ø3
D	d	D	$Ø4
E	e	E	$Ø5
F	f	F	$Ø6
G	g	G	$Ø7
H	h	H	$Ø8
I	i	I	$Ø9
J	j	J	$ØA
K	k	K	$ØB
L	l	L	$ØC
M	m	M	$ØD
N	n	N	$ØE
O	o	O	$ØF
P	p	P	$1Ø
Q	q	Q	$11
R	r	R	$12
S	s	S	$13
T	t	T	$14
U	u	U	$15
V	v	V	$16
W	w	W	$17
X	x	X	$18
Y	y	Y	$19
Z	z	Z	$1A
1	1	!	$1C
2	2	"	$1D
3	3	#	$1E
4	4	$	$1F
5	5	%	??
6	6	&	??
7	7	'	` (accent grave)
9	8	(	[
9	9	)	]

THE BUILT-IN DEBUGGER

Control-D entered from the keyboard at any time freezes the system and transfers control to IDB, the resident 68Ø9 machine language debugger program. The screen will flash, and a register dump will appear. The debugger uses its own screen memory area so it will not interfere with the user's screen display. When switching screen displays between the debugger and SDOS, a 1/2 second pause allows keyboard bounce to settle out, so SDOS does not see the last keystroke given to the debugger and vice versa.

If you enter the debugger accidentally, simply typing G without typing anything else will return control back to SDOS without any ill effects.

For details on how to use the debugger, refer to the IDBØ9 Debugger User's Manual. Also see the DEBUG command discussed in the SDOS Users manual.

SDOS PERFORMANCE FEATURES

SDOS keeps in memory the most recently used disk sectors allowing faster disk data access. SDOS also pre-reads the possible disk data needed. After each disk write, SDOS does a verify operation that assures your data is recorded correctly.

Devices operated under SDOS use interrupts, which means a program can be running simultaneously while SDOS is performing disk, printer, or serial Input/Output. The result is faster program execution, keyboard type-ahead, and a time-of-day clock.

With typical computer applications like accounting or data-base queries, these fast I/O features of SDOS show significant improvement over other systems. Sometimes SDOS data buffering slows things, the most notable case is in diskette copying.

DISK ERROR STATUS

SDOS keeps track of disk errors by type of operation and severity. Such disk errors are displayed when the DISMOUNT command is used to remove a diskette from a drive. Errors are divided into two types: "soft" and "hard". Soft errors are those from which the software can recover automatically; hard errors cause loss of data. The purpose for recording the errors is to help the operator decide when a diskette, disk drive, or disk controller is beginning to fail; when the failures start, soft disk errors begin to accumulate quickly. If ignored too long, the soft disk errors become hard, and the system becomes unreliable. Soft errors will occasionally occur even in "perfect" systems, but if always present they suggest marginal disk problems. Hard errors result in error messages being printed. "Disk write protected" or "Disk not ready" cause hard errors, but they are not indicative of imminent hardware failure.

DISMOUNT AND THE DATA BUFFERING IT ALLOWS

SDOS holds the most recently used disk data in memory because this statistically speeds up programs. Because of this buffering you can't just remove diskettes once they have been placed in a drive. To remove a diskette from a drive,

You MUST use the "DISMOUNT Dn:" command

If you fail to do this, you may damage the removed diskette and the diskette replacing it, because data intended for one may end up on the other. When the DISMOUNT command is used, SDOS will show you a count of the total disk controller operations and also the number of any hard or soft disk errors plus disk controller status at the time of error.

For those of you that love bits, the leftmost 8 bits of any displayed status is that of a Western Digital 1791 floppy controller's status with one exception: the status value :FFØØ. For those of you that don't love bits, the only important thing is the error count: if it is small, don't worry about it. If it is large, there is something funny happening with the controller/drive/diskette. Talk to your favorite hardware hacker.

If the status value is :FFØØ, and there is a large number of errors (more than 1 in 3ØØ operations), probably the diskette was formatted for RSDOS and not SDOS. Although it is possible to use such a disk with SDOS, it will generally make your SDOS system terribly slow. Please format using "DSKINI Ø,Ø" via RSDOS or "DSKINI" via SDOS.

FORMATTING, INITIALIZING AND BACKING UP

All diskettes used by SDOS must first be formatted using "DSKINI Ø,Ø" (before booting SDOS), or the DSKINI.DO file provided on the SDOS EDIT/ASM disk. We recommend you format a whole box of diskettes at once, as formatting is dangerous to the health of disks containing good data (because of the possibility of operator error), so the less often you do it, the safer you are.

Diskettes which cause large DISMOUNT error counts may be "tired"; sometimes re-formatting them can make them usable again (be sure you take all the data you want off a disk before you format it, as formatting destroys every useful bit of information on disk, leaving it entirely "blank"). If formatting a diskette is not successful, the diskette is probably permanently damaged, and should be discarded.

To format a disk under SDOS, place the diskette containing DSKINI.DO and FORMAT into drive Ø (after doing the appropriate DISMOUNT commnds), and simply type

```
DSKINI
```

DSKINI.DO invokes the FORMATFLOPPY program and feeds it a set of canned answers to make it do the dirty work. Formatting can only occur in drive Ø, so BE SURE to remove your system disk before answering "YES" to the final question. In spite of all the questions it asks, the FORMAT program provided with SDOS is not intended to format disks of any other type than those needed by CoCo SDOS.

Once having formatted a disk, it can be made useable to SDOS by one of two steps: copying a diskette already useable by SDOS onto the new disk (see SDCOPY, COPY or SDOSDISKBACKUP commands), or running the SDOSDISKINIT program (see the SDOS manual). This step is called "initializing the file system".

SDOS provides software "sector interleaving", called MAPALGORITHMS. To get a good Mapalgorithm it is probably easiest to just copy a disk that already has been initialized. If necessary you can use SDOSDISKINIT, with a Mapalgorithm of :704 to produce a new data disk; we have determined that this value works well on the CoCo (for you hackers, this map value means spiralled by 7 sectors per track and sectors spaced with 3 intervening sectors). Choice of the wrong Mapalgorithm will make SDOS disks run very slowly.

The SDOS boot disk has a special organization. Another boot disk can ONLY be made by copying the original boot disk via SDOSDISKBACKUP or RSDOS BACKUP.

A standard data/program disk can be made by copying the EDIT/ASM disk and deleting those files you don't want.

PRACTICAL USE OF SDOS

First, one boots SDOS system up, tells it what time it is, and then dismounts the boot diskette. A "working disk" containing DEFAULTPROGRAM and the programming tools/utilities needed should then be placed in DØ:; it is nice to have some empty space on the working disk for miscellaneous shuffling exercises. With a single drive system, you will need to minimize the tools you place on the working disk so as to maximize the available disk space. On a two or more drive system, we suggest that D1: should generally be reserved to hold the files related to the project you are currently working on.

DO SOMETHING FUN WITH SDOS RIGHT AWAY!

With the SDOS package we provide a free PHONEBOOK program. This program demonstrates the kinds of things one can do with SDOS, and shows the power of the BASIC compiler option using the Keyed File Package. The Phonebook program keeps a data base of persons, addresses and phone numbers, which you can access by Person Name or Company Name. To run the program, set up an SDOS data disk, and place DEFAULTPROGRAM and PHONEBOOK on it (you can also do this by copying the diskette containing PHONEBOOK and deleting everything but DEFAULTPROGRAM and PHONEBOOK). The reason for making an "empty" disk is to have lots of room for the Phonebook data base. Place this diskette in DØ: (remembering to perform all the required DISMOUNT commands), and type PHONEBOOK to start it up. Commands are given to the program by typing a keyword (like FIND) followed by the name of the desired person/company (type HELP to find out what command are available). The type of name needed is specified inside < > characters. We suggest that you use

LASTNAME, FIRSTNAME

for the name of people. Partial names can be used; this helps when you don't know the entire name of a person or company, but do know the first few letters.

The file PHONEBOOK.BAS contains the source of the BASIC program so you may see how it was done; use the LIST command to see the file content.

HOW TO STOP RUNNING SDOS AT THE END OF A SESSION

When you are through using SDOS for awhile, and wish to run RSBASIC or (heaven forbid), some program not needing SDOS, you need merely DISMOUNT all of the diskettes, remove the diskettes from their drives, and press the RESET button on the Color Computer. Control will return to RSBASIC.

The COCOUTILITY program reads and writes Radio Shack files and transfers them to SDOS and vice-versa. This utility is intended to transfer text files and doesn't imply a transfered program will run. To use the program, type its name, and then type HELP to see what commands it has available. When entering an RSDOS file name, be sure to use "/" as the delimiter character, as this program is a bit more fussy than RSDOS on file name syntax.

CAN I RUN RSDOS BASIC UNDER SDOS ?

Unfortunately, RSDOS BASIC is designed in a way that makes it incompatible with SDOS, so one cannot run such programs under SDOS. You can always switch off SDOS to run RSBASIC normally. There IS a really nice compiler BASIC available under SDOS (mentioned above), and generally one can convert (although not always easily) an RSDOS BASIC program to a form compatible with the compiler.

COCO INTERRUPT VECTORS

Due to the design of the Radio Shack BASIC ROMs, the memory locations $10Ø-$111 inclusive are reserved to hold JMP-to-interrupt routine instructions. Although SDOS technically reserves $Ø-$7FFF exclusively for use by application programs, a special exception has been made to allow SDOS to operate in the Color Computer with these ROMs. Users writing assembly code MUST NOT damage these locations. Locations $1ØØ-$1Ø5 inclusive are intended by the BASIC ROMs for SWI2 and SWI3 machine instruction traps; they are actually used as entry points into application programs under SDOS, and so use of SWI2 and SWI3 instructions is outlawed under SDOS.

TECHNICAL SUPPORT POLICY

Questions about the use of SDOS and its tools should be written and mailed to CSD. CSD will respond as quickly as possible in writing with the necessary information, at NO CHARGE.

Be sure to include, if at all possible, hardcopy printout of an example of your problem (see the SDOS LOG command), a well-thought out description of what you intended to do, you think the difficulty is, what you think the solution might be (this helps us determine how your thinking might have gone astray), your address, phone number (in case we need to call you for more information), a description of your computer background (so we can answer the question at the appropriate level) and the date. Please use a copy of the enclosed SDOS PROBLEM REPORT form.

To keep the cost of the software low, we cannot provide free telephone support. However, telephone consultation is available at a fixed hourly rate (with 15 minute minimum charge), billable to Visa or MasterCharge. CSD will cancel the billing if, in our opinion, consultation points out a problem with the documentation or a bug in the software. Software Dynamics should not be called for support since they are a consulting firm and will not deal direct with the general public at the retail level.

Discounts on upgrades to newer versions of software are available if you return the original diskette(s) you bought when ordering the upgrade, so save those master disks.

Copy and use the form below for all problem correspondance with CSD.

********** COCO SDOS PROBLEM REPORT **********

PRODUCT (PROGRAM) AFFECTED _____ REVISION _____

REPORTED BY _____ REPORT DATE _____

ADDRESS _____ PHONE (___) _____
(give hours at above phone)

CITY,STATE,ZIP _____

REPRODUCIBLE BUG (Y or N) EXAMPLE ENCLOSED (Y or N)

USERS COMPUTER EXPERIENCE _____

_____

USERS NOTES ABOUT PROBLEM _____

_____

_____

_____

_____

_____