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Cloud-9

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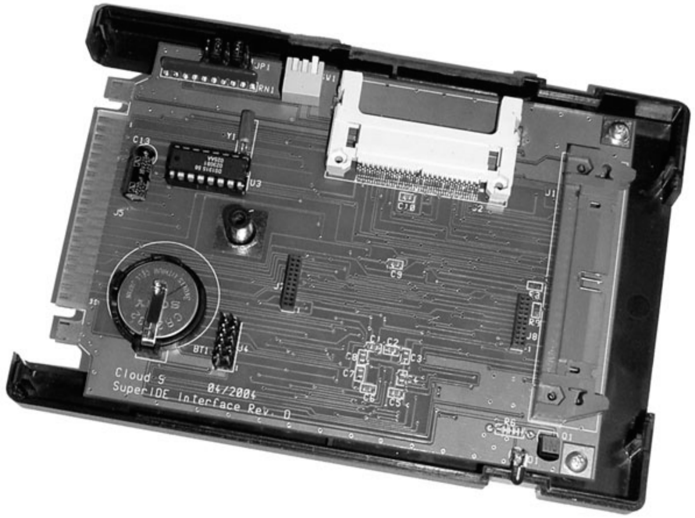
SuperIDE Interface

User Manual



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While reasonable efforts have been made in the preparation of this manual to assure its accuracy, Cloud-9 does not assume liability resulting from any errors in or omissions from this manual, or from the use of the information contained herein.

7. Additional Information

Disk BASIC Support

Version 1.1 and later of Cloud-9's HDB-DOS product supports the SuperIDE interface. If you have HDB-DOS 1.0 and would like to obtain the newer version, please contact Cloud-9 via email: support@cloud9tech.com.

NitrOS-9 Support

The SuperIDE Interface has NitrOS-9 support through the Super Driver Pack, a Cloud-9 product.

If Problems Arise

Although our products are engineered with quality and care, Cloud-9 can not guarantee that you won't run into problems.

If you have a problem or question, please contact us via the Internet at support@cloud9tech.com. You can also visit our website at http://www.cloud9tech.com for up-to-date information on your product.

The included BASIC software automatically detects the type of Color Computer being used, and makes the proper adjustments when reading/writing FLASH. Refer to the source code for consideration when writing your own FLASH programming software.

Table Of Contents

Offset	Value
$7100	Read/Write Mode ($00 = Read ROM, $01 = Read FLASH, $FF = Write FLASH)
$7101	Multi-Pak Slot where FLASH or ROM is located (0-3, or $FF if no Multi-Pak is present)
$7102	FLASH bank to read/write (0-3)
$7103	Page to read/write (0-125 on a CoCo 1/2, 0-123 on a CoCo 3)
$7104	Page size (should be 128)
$7105-06	ROM base address (usually $C000)
$7107-08	Address of FLASH Bank Selection Register ($FF49, $FF59, $FF69 or $FF79)
$7109-0A	Address of a 128 byte buffer. This buffer either contains data to write to the FLASH (in write mode) or will hold the contents of a FLASH or ROM page (read mode).
$710B-0C	Two byte checksum of the contents of the FLASH/ROM page (in Read Mode).

Once the parameters from $7100 to $710A have been set, the caller may JSR into the subroutine at $7000 and the selected operation will be performed.

After reading a page of FLASH or ROM, a two byte checksum of that page is automatically computed and stored at $710B-0C. This value is the sum of all bytes in the page, and can be used as a verification mechanism.

Special Considerations

It is important to note that not all of the ROM can be read, nor all of the FLASH programmed. On a CoCo 2, all but the last 256 bytes ($FF00-$FFFF) of FLASH can be read/written. On a CoCo 3, all but the last 512 bytes ($FE00-$FFFF) of FLASH can be read/written.

FLASH. Unless you fully understand what you are doing, you should never set this bit.

Bits 6-2 are undefined. Reads of these bits will always return zero. Writes to these bits are ignored.

Bits 1-0 are used to software select the FLASH banks 0 - 3.

Real-time Clock Registers

If your SuperIDE Interface has the real-time clock option, those registers will always be located at addresses $FF78-$FF79 and $FF7C. Please note that this is the same area as the real-time clock option for the TC^3 SCSI Controller, another Cloud-9 product. If you wish to use both a SuperIDE Interface and a TC^3 SCSI Controller in your system, then you must insure that only one of these devices has a real-time clock.

NOTE: If a real-time clock is present at this address, then $FF70 must NOT be used as the base address of the SuperIDE Interface.

FLASH Software Interface

Assembly language programmers who wish to access the FLASH read/write routines in FLASH.BIN may do so using the following information.

The FLASH.BIN routine loads at $7000 and can be called by JSRing to that location. The routine either reads or writes one page (128 bytes) of the FLASH. Subsequent calls are required to program an entire bank. In ROM Read mode, the contents of ROM Paks can also be read if the value at $7100 is $00.

There is a parameter block at $7100 that is referenced by the FLASH.BIN routine. That parameter block contains the following offsets:

1. Congratulations!

Thank you for purchasing the SuperIDE Interface, another one of the fine products offered by Cloud-9. This product was designed to be used with the Radio Shack/TRS-80 Color Computers 1, 2, and the Tandy Color Computer 3.

The SuperIDE Interface brings a wealth of storage options to your Color Computer, including readily available and inexpensive CompactFlash and IDE drives.

Features

- Full support of ATA-2/ATAPI IDE devices.
- CompactFlash socket for solid state storage.
- Uses state-of-the-art components for low power draw and decreased part count.
- 64K of internal FLASH holds four distinct 16K ROM images.
- Super Expansion Bus for future peripherals.
- Easy to use FLASH programming and IDE test software.
- Optional real-time clock for timekeeping.

System Requirements

In order to use the SuperIDE Interface, you need the following components:

- Radio Shack/TRS-80 Color Computer 1 or 2 with 64K RAM or a 128K Tandy Color Computer 3.
- Multi-Pak required for certain FLASH programming tasks.

2. Getting Started

We know you're excited about using your new SuperIDE Interface! However, before you plug it into your CoCo, please read the following pages carefully for important configuration information.

Examining the Interface

There are a number of jumpers and DIP switches on the SuperIDE Interface that must be set properly to reflect your particular system. In order to configure the interface completely, we will take it apart and familiarize ourselves with the layout of the board. Follow these steps to properly disassemble your interface:

1. Using a Phillips screwdriver, unscrew the screw on the top of the controller case.

2. Once the screw is out, CAREFULLY open the case by removing the top part of the case from the bottom. Put the top of the case and the screw aside and turn your attention to the bottom case and circuit board.

3. Orient the circuit board in the same manner as shown in the following picture.

6. Technical Information

This chapter provides detailed technical information on the SuperIDE Interface, including register layout and the software interface for programming the FLASH.

Hardware Register Layout

The hardware registers are documented below.

IDE Registers

The IDE registers of the SuperIDE Interface are arranged in the same order as the Glenside IDE Interface, making it 100% compatible with that product.

Register Offset	Function
0	Data
1	Error (read)/Features (write)
2	Sector count
3	Sector number
4	Cylinder low byte
5	Cylinder high byte
6	Device/head
7	Command
8	Latch

FLASH Bank Selection Register

This register is located just beyond the IDE registers, at offset $09 from the base address setting of the interface.

Bit 7 of this register is the FLASH Enable bit. This bit is set by the FLASH programming routine when writing to the

If this program is run on a CoCo 3, then additional options are available to save a 32K ROM Cartridge, or even the internal 32K ROM.

REMEMBER: For auto-start cartridges such as ROM Paks, be sure to place a piece of tape over pin 8 so that the cartridge does not auto-start. Also insure that DIP Switch 1 of the SuperIDE Interface is in the OFF (Up) position. Failure to do so will result in a crash when the program starts the transfer!

ROMXFER.BAS

Like GETROM.BAS, this program also uses FLASH.BIN. The convenience of ROMXFER is that it will transfer the contents of a ROM Pak or disk controller's EPROM in one Multi-Pak slot to the desired FLASH bank in another Multi-Pak slot.

CHECKSUM.BAS

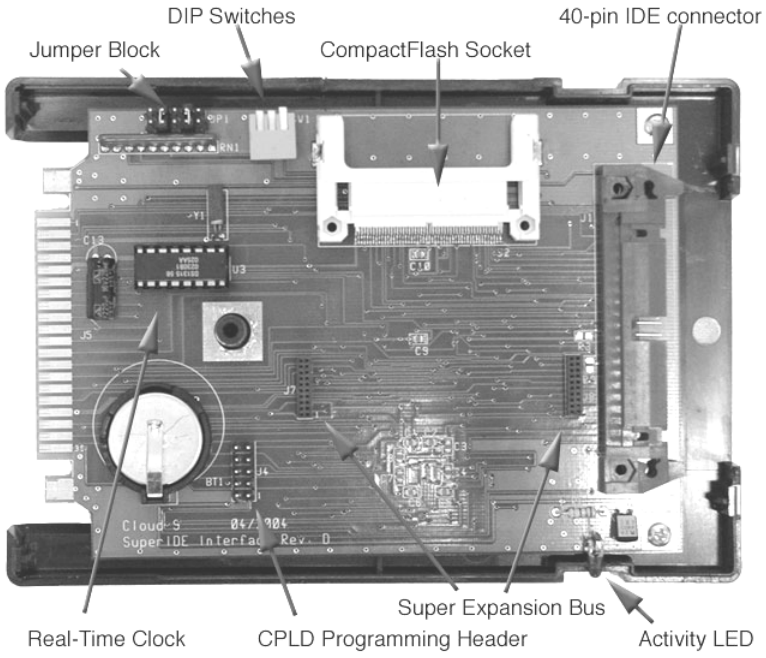
This program will provide a checksum on a ROM or bank of FLASH, returning the sum of all bytes. A blank FLASH bank should return the checksum value of 0, indicating that the FLASH contains all zeros.

ERASE.BAS

This program will erase a bank of FLASH by writing all $00s to the specified bank.

IDEPROBE.BAS

This program will detect the drive or drives attached to your interface and reports detailed information about each drive.



Now that the cover is off of your interface, let's go over the major parts of the circuit board.

40-pin IDE Interface

The 40-pin IDE connector allows you to connect one or two external IDE hard drives via a 40-pin IDE ribbon cable.

CPLD Programming Header

This 10 pin header is used to update the logic in the Altera CPLD.

Activity LED

This LED is activated when reading or writing to the IDE bus. Accesses to both the CompactFlash Socket as well as drives on the 40-pin connector will cause the LED to activate. Its location makes it easily visible on the left side of the interface when plugged into a Multi-Pak, or in the front of the CoCo when plugged directly into the CoCo's cartridge port.

CompactFlash Socket

The CompactFlash Socket allows you to connect widely available CompactFlash devices to the SuperIDE Interface. The CompactFlash device in this socket can be configured as either a master or slave. Please note that if the CompactFlash socket is in use, you can only attach one external hard drive to the 40-pin IDE connector.

⚠ **IMPORTANT !!! NEVER, NEVER Insert or remove A COMPACTFLASH in the socket while the POWER IS ON! To do so may damage the SuperIDE Interface and/or the CompactFlash!**

DIP Switches

The DIP switch block has three switches, and can be accessed even with the cover in place. The switches are labeled from right to left as 1, 2 and 3 and perform the following functions:

Switch 1: This is the auto-start switch. If this switch is ON (in the Down position), then the CART interrupt is triggered upon power up. If this switch is OFF (in the Up position) then the CART interrupt is not triggered on power up.

This switch is useful if you have an auto-start ROM, such as a game, in the selected FLASH bank. You should NOT turn the auto-switch on if your FLASH bank contains a DOS, such as HDB-DOS.

Switch 2 and 3: Both of these switches are used to select one of four 16K banks of the internal 64K of FLASH. The following table show the settings:

Switch 2 Position	Switch 3 Position	FLASH Bank

5. Supplied Software

The supplied SuperIDE Utilities disk provides additional software which can assist you in setting up your interface and drives properly. We highly recommend that you work from a backup of your original disk.

All BASIC programs are saved in ASCII format, and therefore will load somewhat slower from the disk. To speed up subsequent loads, LOAD, then SAVE the program back to disk.

FLASH.ASM/FLASH.BIN

These two files make up the FLASH programming routine used by the included BASIC programs. The interface to the routine is documented later.

FLASH.BAS

This program uses FLASH.BIN and allows you to program the contents of a disk file into a FLASH bank of your choosing.

GETROM.BAS

This program uses the assembly routines in FLASH.BIN and allows you to save a ROM image from a controller or ROM Pak to disk. When run, GETROM.BAS will prompt you for the Multi-Pak slot where the ROM resides and the size of the ROM. It will then obtain the ROM's contents and save it to the disk file specified.

The program will prompt you for the following information:

1. The base address of the SuperIDE Interface
2. The MPI slot of the SuperIDE interface
3. The FLASH bank where the DOS will be programmed
4. The name of the file to program

Once the information is provided, the file will be opened and its contents transferred to the appropriate bank of FLASH.

That's all there is to programming the FLASH!

ON (Down)	ON (Down)	0
ON (Down)	OFF (Up)	1
OFF (Up)	ON (Down)	2
OFF (Up)	OFF (Up)	3

Each of the four 16K banks can contain either a DOS (such as Disk BASIC, HDB-DOS or A-DOS), or the contents of a ROM Pak. We will learn later how to burn a ROM image into the FLASH.

Jumper Block

The jumper block allows the setting of the interface's base address, as well the Flash Bank Selection Register (FBSR) behavior on RESET/Power-Up.

There are 5 jumper pairs, for a total of 10 pins. Looking at the pins from right to left, the bottom row of pins is odd numbered (1, 3, 5, 7 and 9) and the top row of pins is even numbered (2, 4, 6, 8 and 10). Each top and bottom pin forms a pair that may or may not be covered with a shunt.

The following table shows the function of each of the five pairs of jumpers:

Jumper Pair	**Function if ON**	**Function if OFF**
1-2	FBSR resets on power cycle	FBSR resets on RESET
3-4	CompactFlash Socket is MASTER	CompactFlash Socket is SLAVE
5-6	Bit 4 of base address is SET	Bit 4 of base address is CLEAR
7-8	Bit 5 of base address is SET	Bit 5 of base address is CLEAR
9-10	Bit 6 of base address is SET	Bit 6 of base address is CLEAR

You will learn shortly how to set these jumpers for your specific system setup.

Super Expansion Bus

The Super Expansion Bus is a Cloud-9 expansion technology that allows addition of future peripherals to the CoCo's 40-pin bus, through two high-density 20-pin connectors.

Real-Time Clock

If your SuperIDE Interface has a real-time clock, you will see a 16 pin chip at this location. The real-time clock is always addressed at $FF78-$FF79 and $FF7C, irrespective of the base address of the IDE interface.

Configuring the Interface

In order to insure that your SuperIDE Interface matches your Color Computer system, it is important to set the state of the jumpers to reflect the proper base address as well as FBSR reset behavior.

Setting the Base Address

As shipped, the interface's base address is set up at a default of $FF50 to $FF59. We recommend keeping this setting if possible. In order to this, you must verify that no other devices in your system conflict with this address allocation.

If you do have a conflict then a base address must be selected where there are no conflicts. The interface allows a base address selection of $FF4X, $FF5X, $FF6X and $FF7X. Jumper pairs 5-6, 7-8 and 9-10 allow you to select one of these four base addresses.

One important note regarding base addresses: If your SuperIDE Interface has a real-time clock, then $FF70 must

Option 2: Use ROMXFER.BAS to directly transfer the contents of a ROM Pak or disk controller's EPROM to a FLASH bank (this requires a Multi-Pak).

For illustration, we will perform option #1.

Your first step is to choose the disk controller or ROM Pak that contains the ROM you want to transfer to FLASH. If it is a ROM Pak, **you will need to place tape over pin 8 to prevent the cartridge from auto-starting during the transfer process**. If it is a disk controller, then it isn't necessary to cover pin 8.

In either case, once the cartridge is properly prepped, insert it into a free slot of the Multi-Pak. Slot 1 is usually a good slot for this.

Put your SuperIDE Interface in slot 3 of the Multi-Pak, and your floppy disk controller in slot 4. Be sure the slot selection switch is set to 4.

Insert the SuperIDE Distribution Diskette into the floppy drive and type:

```
RUN”GETROM”
```

Follow the prompts and supply a filename. The contents of that disk controller or ROM Pak will be saved to the filename.

When the program is complete, you will be returned to Disk BASIC. Now, it is time to run the program to transfer the ROM on disk into the FLASH on the interface.

To start, type:

```
RUN”FLASH”
```

4. Programming the FLASH

The SuperIDE Utilities disk that comes with your SuperIDE Interface contains software to extract a ROM from a ROM Pak or disk controller. It also contains software to program a ROM image into any of the four FLASH banks on the interface.

Typically you will want to program the FLASH on the SuperIDE Interface if you intend to use it in a specific application. In such a scenario, the interface would be plugged directly into the side of the cartridge port, with an IDE-compatible DOS such as HDB-DOS in one of the FLASH banks.

You may also want to just keep the SuperIDE Interface in a slot in the Multi-Pak and have one or more ROM Paks programmed into the FLASH, allowing them to be selected on the fly.

Let's take a look at different scenarios for programming the FLASH using the supplied utilities.

Programming an Existing ROM into FLASH

To program a ROM Pak or disk controller ROM into the FLASH, you have several options:

Option 1: Save a ROM Pak or disk controller EPROM's contents to disk using GETROM.BAS, then program the desired FLASH bank in the SuperIDE Interface using FLASH.BAS.

NOT be used as a base address, as it will cause an addressing conflict to occur.

The following table shows how to set the jumper shunts based on the desired base address. Please note that when a jumper shunt is OFF, the corresponding bit is SET:

Address	J5-J6 (Bit 4)	J7-J8 (Bit 5)	J9-J10 (Bit 6)
$FF4X	Shunt OFF	Shunt ON	Shunt ON
$FF5X	Shunt OFF	Shunt ON	Shunt OFF
$FF6X	Shunt OFF	Shunt OFF	Shunt ON
$FF7X	Shunt OFF	Shunt OFF	Shunt OFF

Setting the FLASH Reset Behavior

The Flash Bank Selection Register (FBSR) is located at offset $09 from the base address of the interface. At power-up, this register holds the value of DIP Switches 2-3, which determine which of the four banks of 16K appear in the CoCo's ROM space at $C000. Software can modify the value in this register to automatically select a different bank of FLASH.

If jumper pair 1-2 contains a shunt, then the contents of the FBSR will remain the same even through hardware reset, and only a power cycle will cause the FBSR value to change back to the DIP switch settings.

If jumper pair 1-2 does NOT contain a shunt, then contents of the FBSR are reset to the state of the DIP switches upon pressing the RESET button.

For a CoCo 1 or CoCo 2, we recommend that you keep the shunt ON, since these Color Computers run from ROM. Hence, pressing the RESET button insures that the last value written to the FBSR remains, and that the corresponding FLASH bank stays mapped into memory space.

Reassembling the SuperIDE Interface

Now that you have configured your interface, you should replace the top cover and secure it with the screw that you removed earlier. Note that both the CompactFlash Socket and the DIP Switches are still accessible even with the cover in place. This allows you to easily switch FLASH banks or the auto-start switch without having to remove the cover.

Adding Drives

Once you have configured the SuperIDE Interface, it is time to hook one or more IDE drives. You can add up to two drives to the system: a master drive and a slave drive. Each of these drives must be set as master and slave in order to be identified properly. Refer to your drive's documentation to determine how to set your drive as a master or slave.

If you want to use a CompactFlash card in the built-in CF socket, then you can only add one hard drive to the bus via ribbon cable. In this case, you can also set the CompactFlash to be a master or slave by shunting jumpers 3 and 4 on the on-board jumper block. Remember, if the shunt is ON, the CompactFlash is a master, and the external drive must be set as a slave. If the shunt is OFF, the CompactFlash is a slave, and the external drive must be set as a master.

Connecting to the CoCo

Now, it's time to connect the SuperIDE Interface to your Color Computer. Be sure that power is OFF on your Color Computer and your Multi-Pak, then insert the SuperIDE Interface is in slot 3. Your floppy disk controller should reside in slot 4.

Once the controllers are firmly in place, turn on your Multi-Pak and then your Color Computer.

```
EXEC &HE010
```

Determining the Active FLASH Bank

You can determine which of the four banks of FLASH memory is active by reading the FBSR. Type the following (assuming the SuperIDE Interface's base address is $FF50):

```
PRINT PEEK(&HFF59)
```

as Disk BASIC, HDB-DOS, A-DOS, etc. the following commands will work on a CoCo 1/2:

```
POKE 113,0:POKE &HFF59,X (where X is the bank
0-3)
EXEC 40999
```

If the FLASH bank you are switching to contains a ROM Pak image such as a game, be sure the auto-switch (DIP Switch 1) is in the OFF (Up) position, and type the following on a CoCo 1/2:

```
POKE &HFF59,X (where X is the bank 0-3)
EXEC &HC000
```

Depending upon the contents of the target FLASH bank, your CoCo may go into a crash mode. This is normal, due to the fact that the ROM that BASIC is fetching instructions from is actually being totally replaced at the point of the POKE command. If this happens, press the RESET button and the code should execute properly.

CoCo 3 FLASH Bank Software Switching

Depending on the type of ROM image, there are two different methods for software selection of a FLASH bank. If you are switching to a FLASH bank containing a DOS such as Disk BASIC, HDB-DOS, A-DOS, etc. the following commands will work on a CoCo 3:

```
POKE &HFF59,X (where X is the bank 0-3)
POKE 113,0:DLOAD
```

If the FLASH bank you are switching to contains a ROM Pak image such as a game, be sure the auto-switch (DIP Switch 1) is in the OFF (Up) position, and type the following on a CoCo 3:

```
POKE &HFF59,X (where X is the bank 0-3)
```

3. Using the FLASH

One of the innovations of the SuperIDE Interface is its utilization of FLASH memory technology to store ROM code. This technology totally replaces the antiquated EPROM that is found on older floppy and hard drive controllers.

Unlike EPROMs, FLASH memory brings several benefits to Color Computer users. First, FLASH can be programmed in-circuit, without any additional hardware. Second, FLASH technology delivers a large amount of storage in an extremely small footprint. This allows multiple ROMs to be stored in the same chip and selected via hardware or software by the user.

How the FLASH is Partitioned

The SuperIDE Interface contains 64K of internal FLASH, which is partitioned into four banks: bank 0, bank 1, bank 2 and bank 3. Each bank can hold 16K of code.

Typically, a ROM image will reside in each bank. These ROM images can be DOS's such as Disk BASIC, HDB-DOS or A-DOS, etc, or they can be ROM Paks, such as games and applications.

While all banks can hold code, only one bank is active at any given time. It is up to the user to determine which bank will hold code, and to which bank the interface will start from at power-on.

There are two methods of FLASH bank selection: the hardware switching method and the software switching method.

Hardware Switching

DIP Switches 2 and 3, located on the side of the SuperIDE Interface, can select bank 0, 1, 2 or 3 as the desired bank to reference on power-up. Simply set up the switches for the desired bank to be active. Due to the location of the DIP Switch on the interface, we recommend that you turn OFF your system and remove the SuperIDE Interface to properly set the switch.

If the desired FLASH bank contains a DOS such as Disk BASIC, HDB-DOS, A-DOS, etc., then the auto-start switch (DIP Switch 1) should be in the OFF (Up) position.

Conversely, if the desired FLASH bank contains a ROM Pak game image, you can elect to turn on the auto-start switch. This will cause the game to auto-start when your CoCo is powered up.

Software Switching

Use of the FLASH Bank Selection Register (FBSR) allows you to switch to a ROM in a specific FLASH bank without necessarily having to power down your CoCo. The procedure for software switching between a CoCo 1/2 and a CoCo 3 are slightly different, due to the fact that the CoCo 1/2 runs BASIC from ROM, whereas the CoCo 3 runs BASIC from RAM.

The FBSR is located at offset $09 from the base address of the SuperIDE Interface. So for example, if the interface base address is $FF50, then the FBSR is at $FF59.

CoCo 1/2 FLASH Bank Software Switching

Depending on the type of ROM image, there are two different methods for software selection of a FLASH bank. If you are switching to a FLASH bank containing a DOS such