

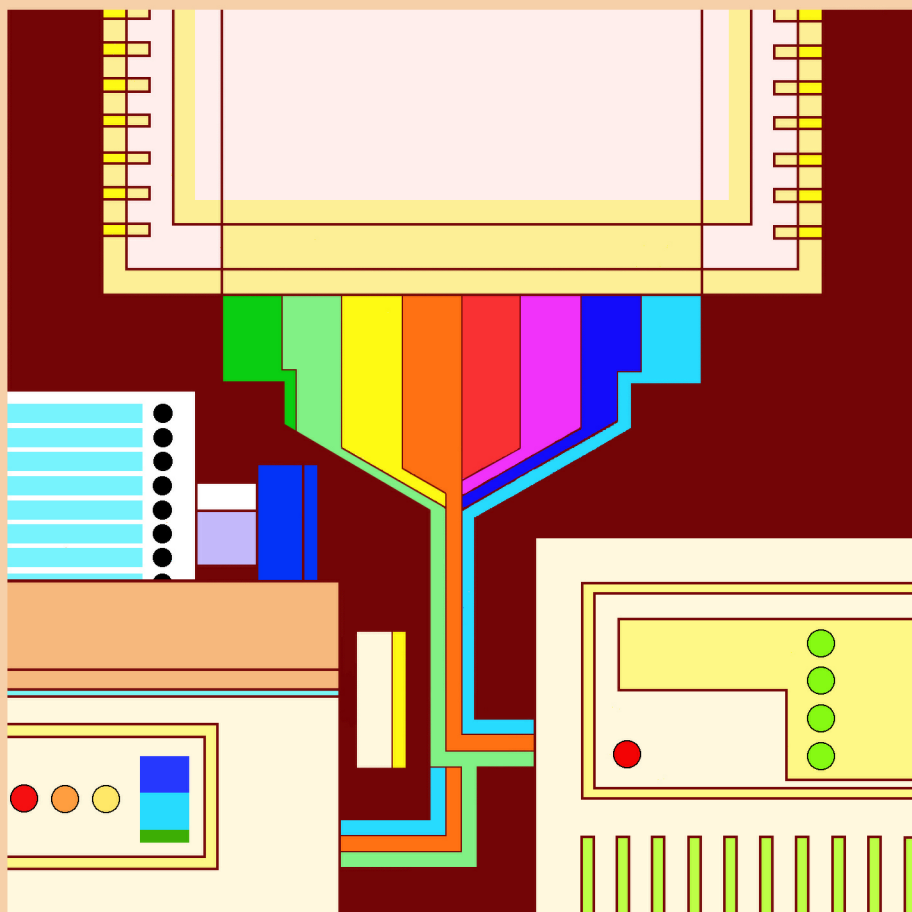
Apple II



Super Serial Card

Installation and Operating Manual

PART 1



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Apple II

Super Serial Card

Installation and Operating Manual

Please read this manual before attempting to install the Super Serial Card in the Apple Computer. Incorrect installation could cause permanent damage to both the Super Serial Card and the Apple.

RADIO AND TELEVISION INTERFERENCE

The equipment described in this manual generates and uses radio frequency energy. If it is not installed and used properly, that is in strict accordance with our instructions, it may cause interference to radio and television reception.

This equipment has been tested and complies with the limits for a Class B computing device in accordance with the specifications in Subpart J of Part 15 of FCC rules. These rules are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that the interference will not occur in a particular installation.

You can determine whether your computer is causing interference by turning it off. If the interference stops, it was probably caused by the computer. If your computer does cause interference to radio or television reception, you can try to correct the interference by using one or more of the following measures:

- Turn the TV or radio antenna until the interference stops.
- Move the computer to one side or the other of the TV or radio.
- Move the computer farther away from the TV or radio.
- Plug the computer into an outlet that is on a different circuit from the TV or radio. (That is, make certain the computer and the TV or radio are on circuits controlled by different circuit breakers or fuses.)

If necessary, you should consult your dealer or an experienced radio/television technician for additional suggestions. You may find the following booklet prepared by the Federal Communications Commission helpful:

"How to Identify and Resolve Radio-TV Interference Problems"

This booklet is available from the U.S. Government Printing Office, Washington, DC 20402, Stock number 004-000-00345-4.

Downloaded from www.Apple2Online.com

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PREFACE

The Super Serial Card (SSC) provides a two-way serial interface to a wide variety of devices, including printers, terminals, plotters, and other computers. All these devices can be connected to the SSC either directly or via modem.

The SSC replaces both the P8 and P8A variety of Apple II Serial Interface Card, although it does not manipulate all specific Apple II memory locations in the same way. The SSC also replaces the Apple II Communications Card, and supports Terminal Mode. Finally, the SSC supports Apple II parallel interface card software commands.

The Super Serial Card conforms to the Electronic Industries Association (EIA) interface definitions A through E. (To obtain a copy of the EIA RS-232-C Standard, write to the EIA Engineering Department, Electronics Industries Association, 2001 Eye Street, N.W., Washington, D.C. 20006.)

The SSC can be configured to the attached external device in three ways: (1) by setting switches on the card itself, (2) by typing in commands at the keyboard under the Monitor, Integer BASIC, Applesoft or DOS, or (3) by issuing commands from assembly language, BASIC or Pascal programs. The SSC can be configured and operated by programs in Integer BASIC, APPLESOFT, Pascal, and assembly language.

How you prepare, install and use the Super Serial Card depends on what you connect to it:

- Read Chapter 1 for unpacking and cable clamp preparation instructions.
- If you are going to connect a printer, terminal or some other device directly to the SSC, then read the first four sections of Chapter 2. (Many commonly used switch settings are listed in Table 2-1 for your convenience.) You only need to read the section Printer Mode Commands of Chapter 2 if you need special commands to change the SSC's characteristics.
- If you are going to connect a device to the SSC via a modem or similar communications equipment, then read the first four sections of Chapter 3. (Switch settings for many Communications Mode applications are listed in Table 3-1.) You only need to read the section Communications Mode Commands of Chapter 3 if you need special commands to change the SSC's characteristics.
- If you want to use the Apple II as an unintelligent terminal connected via a modem, read the section Terminal Mode of Chapter 3.
- Troubleshooting Hints are discussed in Appendix E.

The SSC also emulates ("imitates") the Apple II Serial Interface Card (both the P8 and P8A varieties), and supports many of the software commands used by the Apple II parallel printer interface card and the Apple II Communications Card. These are all discussed in Appendix B.

Chapter 4 explains how the SSC works, both in everyday terms (Serial Data Communication Simply Explained) and from an engineering viewpoint (Theory of Operation). The Theory of Operation section is keyed to the schematic diagram in Appendix C. Chapter 4 also contains a section on SSC modes and configurations.

Appendix A discusses SSC firmware and its entry points in the SSC ROM, as well as the Apple II memory locations the firmware uses.

Appendix C contains SSC specifications and connector pin assignments, and its schematic diagram.

Appendix D lists the ASCII codes and their equivalents. Appendix E has troubleshooting hints. Appendix F explains the SSC error codes.

A glossary explains the meaning of most important terms as they apply to the SSC.

The Reference Card summarizes the switch settings and commands for the SSC Printer Mode and Communications Mode.

There are three symbols that set off information of special importance:



This symbol points to a paragraph that contains especially useful information.



Watch out! This symbol precedes a paragraph that warns you to be careful.



This symbol precedes a warning that you are about to harm hardware or destroy data.

CHAPTER 1

GETTING STARTED

This chapter takes you through the first steps of getting acquainted with your Super Serial Card (SSC). After unpacking the SSC and examining it, you will assemble the short internal cable (if it is not already assembled) that connects the 10-pin cable socket on the SSC to the 25-pin socket at the back of the Apple II case.

UNPACKING

As you unpack your Super Serial Card (Figure 1-1), check the contents against the items described on the packing list.

Fill out the pre-addressed warranty card and mail it in. If any items are missing, contact the dealer you purchased the SSC from.

You will need a shielded external cable (not provided as part of the SSC package) to connect the external device--the printer, modem, terminal, or other computer--to your Apple II. Suitable cables are available through your Apple dealer.

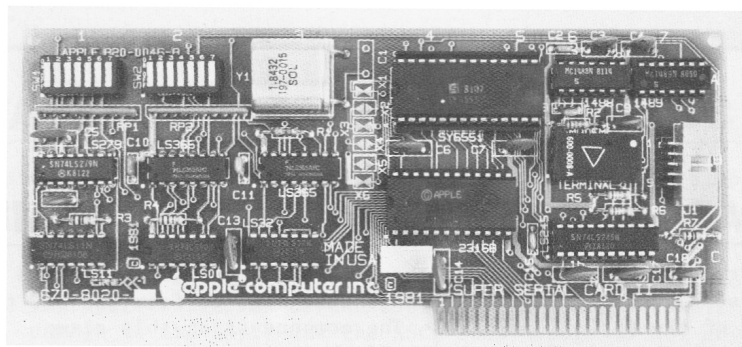


Figure 1-1. Photo of the Super Serial Card

A CLOSE LOOK

Let's examine the Super Serial Card for a moment. Pick up the SSC carefully and put it on a flat surface oriented as shown in Figure 1-1. Now use Figure 1-2 to help identify the chief parts of the SSC. Those that you will have to deal with as you prepare it for installation are:

- The jumper block. This ordinarily points toward the word **TERMINAL**; if you attach a modem to the SSC, you will turn this around so the arrow points toward the word **MODEM** (Chapter 3).
- The switches. The left group is numbered from SW1-1 through SW1-7; the right group is numbered from SW2-1 through SW2-7. You can see the characters "SW1" and "SW2" printed on the SSC.
- The edge connector. It is important not to touch the gold fingers on this connector: they must make a clean electrical contact in the Apple II connector slot when you install the SSC (Chapter 2 or Chapter 3).
- The cable socket. The next section of this chapter explains how to install the short internal cable between the SSC and the Apple II case.

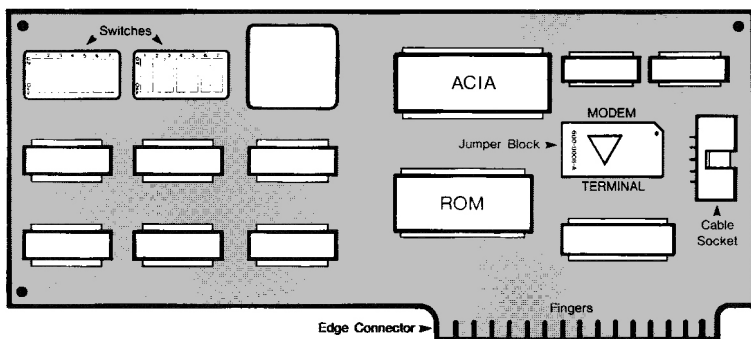


Figure 1-2. Line Drawing of the SSC

PREPARING CABLE AND CLAMP ASSEMBLY

Before preparing and installing the SSC, you may need to prepare the clamp assembly for the internal cable that will go from the SSC to the back of the Apple II's case. The components of this clamp assembly are shown in Figure 1-3. If these components are already assembled, skip to the next section, Attaching the Internal Cable to the SSC.

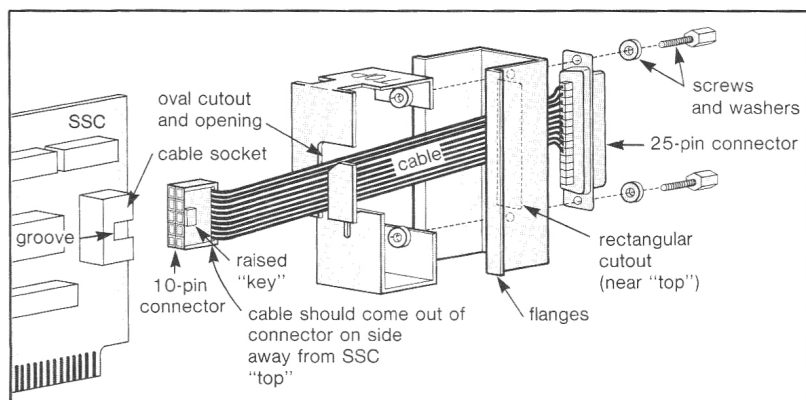


Figure 1-3. Components of Internal Cable and Clamp Assembly

Lay the short cable down as shown in Figure 1-3. Pick up the clamp piece that has the word TOP stamped on one end. Hold this clamp piece with the word TOP facing away from you, and the oval cutout toward the smaller connector on the cable. Bend the cable slightly, and insert it into the oval cutout through the opening; then straighten the cable in the cutout so that it moves easily.

The other clamp piece has flanges (Figure 1-3) and a rectangular opening that is closer to one end (its top end) than to the other. Hold this clamp piece with its top end away from you and its flanges facing the 25-pin connector end of the cable. Then tilt the connector and feed it completely through the rectangular cutout.

Now slide the two clamp pieces all the way down the cable until they are right up against the 25-pin connector, and their screw holes line up with the connector's screw holes. Slide the washers onto the screws and then thread the screws a couple of turns into the lined-up holes. Don't screw them in very far.

ATTACHING INTERNAL CABLE TO SSC

This step in the preparation of your Super Serial Card is simple to do, but you must do it carefully.



It is very important to connect the cable to the SSC correctly. Improper connection of the cable to the SSC may result in damage to the Apple and the SSC; such damage is NOT covered by your warranty.

Lay the SSC down on a flat surface, component-side up and gold fingers at the lower right. Examine the 10-pin end of the cable: the wires come out of the SIDE of the connector--the same side as the raised "key" in the plastic (Figure 1-3). Hold the connector so

the wires are on the side away from the SSC, and insert the connector firmly into the cable socket along the right edge of the SSC. The raised "key" should slide into the groove in the cable socket (Figure 1-4).



If the cable is now jammed between the 10-pin cable socket and the SSC board, the connector is plugged in backwards. Unplug the connector and reconnect it so that the cable is on the side AWAY from the SSC (Figure 1-5).

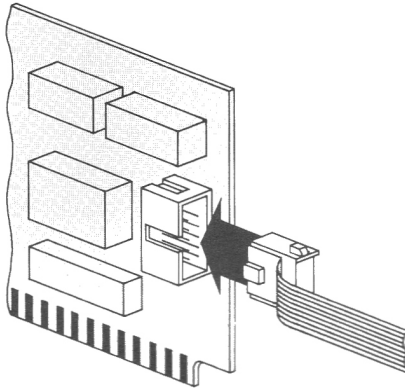


Figure 1-4. Sliding the "Key" into the Groove

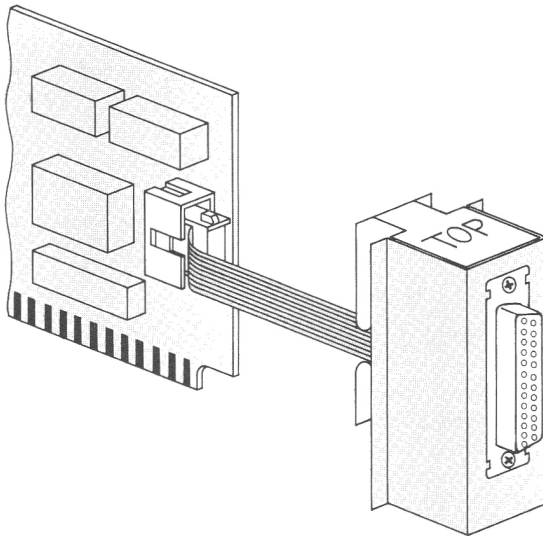


Figure 1-5. Internal Cable Attached Correctly to SSC

CHAPTER 2

PRINTER MODE

This chapter explains how to prepare, install and use the SSC in Printer Mode, and change the SSC's activities via commands.

PREPARING THE SSC FOR PRINTER MODE

The SSC is ready to operate in Printer Mode when the jumper block and switches SW1-5 and SW1-6 are correctly positioned (Figure 2-1).

If the triangle on the jumper block is pointing down toward the word **MODEM**, remove the block (using an IC Extractor, if necessary) and carefully reinsert it so the triangle is pointing toward **TERMINAL**.

Using a pointed object, set switch SW1-5 **OFF** and switch SW1-6 **ON** as shown in Figure 2-1.

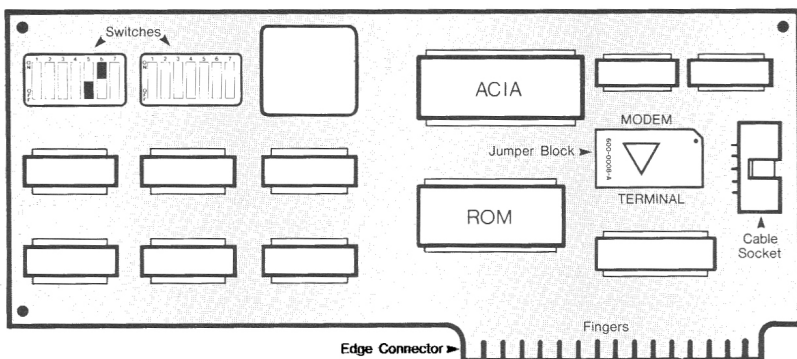


Figure 2-1. SSC Set for Printer Mode



When the jumper block is pointing toward **TERMINAL**, it is acting as a Modem Eliminator. Therefore, **DO NOT** connect a separate Modem Eliminator, or it will cancel the effect of the jumper block, and the attached device will not work.

SETTING THE SWITCHES

Use a pointed object, such as the tip of a ballpoint pen, to flip the appropriate tiny switches on the SSC. A switch is ON when the top of the switch rocker is pushed in, and OFF when the bottom is in. The following subsections explain what settings to use.

COMMONLY USED SETTINGS

Table 2-1 lists the switch settings you can use for direct connection, via the SSC, of some commonly used printers. Most printers can use any one of several setups.

Printer	Switch Settings. Cable Connections. Other Information
IDS 560 Paper Tiger	SW1: OFF OFF OFF ON OFF ON ON SW2: ON ON * * OFF OFF OFF Printer Mode, HW Hndshk, 9600 baud, 1 stop bit, ** width IDS SW1: - - - ON ON OFF OFF SW2: - - - - OFF - - SSC/IDS pins: 3/3, 7/7, 20/20; all IDS jumpers removed
NEC 5510 Spinwriter	SW1: OFF ON ON ON OFF OFF OFF SW2: ON ON * * OFF OFF ON P8A Mode, ETX/ACK, 1200 baud, 1 stop bit, ** line width NEC switches: OFF ON OFF OFF OFF OFF ON ON SSC/NEC pins: 2/2, 3/3, 7/7, 20/6&8; 4&5 tied on NEC end May need keystroke to force first ETX after power-up.
NEC 5510 Spinwriter	SW1: OFF ON ON ON OFF ON OFF SW2: ON ON * * OFF OFF ON Printer Mode, hardware handshake, rest same as above NEC switches: OFF ON OFF OFF OFF OFF ON ON SSC/NEC pins: 3/3, 6/6&8, 7/7, 20/20; 4&5 NOT tied
Qume Sprint 5	SW1: OFF ON ON ON OFF ON ON SW2: ON OFF * * OFF OFF OFF Printer Mode, HW Hndshk, 1200 baud, 1 stop bit, ** width Qume switches: 1200 baud, no modem; pins: 3, 4, 7, 20 Qume asserts RTS and DTR only when ready to receive data
Qume Sprint 9/35	SW1: OFF OFF OFF ON OFF ON ON SW2: ON OFF * * OFF OFF OFF Printer Mode, HW Hndshk, 9600 baud, 1 stop bit, ** width Qume ETX-ACK/XON-XOFF switch set to ETX-ACK for HW Hndshk

Table 2-1. Commonly Used Switch Settings for Printer Mode

BAUD RATE

No matter what type of printer or terminal you connect to the SSC, the SSC is going to pass information between the Apple II and the device at a certain prearranged speed, called the baud rate. Since the Apple II can usually send and receive information faster than what is connected to it, the simplest way to determine the baud rate is to consult the user manual for the device you will connect. Find out what rate is the fastest the device can handle (up to 19,200 baud). Once you know this, you are ready to set the baud rate switches on the SSC.

Baud	SW1-1	SW1-2	SW1-3	SW1-4	Baud	SW1-1	SW1-2	SW1-3	SW1-4
50	ON	ON	ON	OFF	1200	OFF	ON	ON	ON
75	ON	ON	OFF	ON	1800	OFF	ON	ON	OFF
110*	ON	ON	OFF	OFF	2400	OFF	ON	OFF	ON
135**	ON	OFF	ON	ON	3600	OFF	ON	OFF	OFF
150	ON	OFF	ON	OFF	4800	OFF	OFF	ON	ON
300	ON	OFF	OFF	ON	7200	OFF	OFF	ON	OFF
600	ON	OFF	OFF	OFF	9600	OFF	OFF	OFF	ON
(* 109.92)		(** 134.58)			19200	OFF	OFF	OFF	OFF

Table 2-2. Baud Rate Switch Settings



Make sure the printer or terminal you connect is set (with its own switches, dials or thumb wheels) to the SAME baud rate! If you don't, the SSC will send and receive unrecognizable garbage.

DATA FORMAT AND PARITY

The SSC sends each character (such as a "3" or an "F" or a Carriage Return) as a string of zeroes and ones (bits). The way it can send a character in Printer Mode, using switch settings, is this:

- first a single start bit to signal to the printer or terminal that a character is coming;
- then a string of 8 data bits representing the character;
- no error-checking parity bit;
- one or two stop bits to signal the end of a character.

For Printer Mode, the only aspect of the data format you can change with switch settings is whether to send one stop bit or two. If you set the baud rate switches to 50, 75 or 110 baud, set switch SW2-1 OFF (two stop bits). For all other baud rates, set switch SW2-1 ON (one stop bit) unless the documentation for the device you are connecting specifies otherwise.

The SSC does not send or check parity bits in Printer Mode unless you select some parity using the <n>P command, explained later in this chapter.

CARRIAGE RETURN DELAY

If you connect a slow printer to the SSC, and it has no handshaking capability, you may need to set switch SW2-2 ON to cause the Apple II to wait 1/4 second after a Carriage Return (<CR>). This gives

the print head assembly time to reposition to the beginning of the next line. Otherwise, set switch SW2-2 OFF (no delay).

Additional delay values (32 ms and 2 s) are available via the <n>C command described later in this chapter.

LINE WIDTH AND VIDEO ON/OFF

Switches SW2-3 and SW2-4 determine the printer or terminal line width and also turn the Apple II video screen on or off.

If you are connecting a printer to the SSC, select the appropriate switch settings for the number of characters the printer can fit on a line. If you set the line width to 40, the Apple II video screen is turned on, since it too can display 40 characters per line, and so can display an exact replica of what is being printed.

If you plan to connect a terminal to the SSC, set the switches for the number of characters the terminal screen can display on a line—usually 72 or 80. For these line widths, the Apple II video screen is off.

Line Width	Video Screen	SW2-3	SW2-4
40 char/line	on	ON	ON
72 char/line	off	ON	OFF
80 char/line	off	OFF	ON
132 char/line	off	OFF	OFF

Table 2-3. Line Width and Video Switch Settings

The switch settings that turn off the Apple II video screen take effect only after PR# under BASIC or DOS. <CTRL-I> commands are still recognized, and cause the message APPLE SSC: to appear on the Apple II video screen.

GENERATE <LF> OUT

If you are connecting a printer to the SSC, check the printer's user manual to see if it automatically generates a linefeed (<LF>) after a carriage return (<CR>). If it does not, set switch SW2-5 ON.

If your printer does automatically generate a linefeed after a carriage return, or if you are connecting some other device that does not need automatic linefeed generation, set switch SW2-5 OFF.

SPECIAL SWITCHES

Switch SW2-6 controls forwarding of interrupts to the Apple II. Since the Apple II and II+ do not handle interrupts, set SW2-6 OFF.

Normally, switch SW1-7 is ON and switch SW2-7 is OFF. In the rare cases where the device uses pin 19, Secondary Clear To Send, in place of pin 4 or 20, Clear To Send, set SW1-7 OFF and SW2-7 ON.

Your Super Serial Card is now ready to install and use in Printer Mode.

INSTALLATION PROCEDURE

This section explains how to install the SSC and its internal cable in the Apple II. If the cable clamp is not already assembled, do so now, following the instructions given in Chapter 1.



Before connecting or disconnecting anything on the Apple, turn off the power with the switch at the back left corner of the Apple case. **THIS IS ABSOLUTELY NECESSARY.** If you try to connect or disconnect anything from the inside of your Apple when the power is on, you are likely to damage the circuits.

Do not unplug the Apple, just turn it off. If you unplug the Apple, you will isolate it from earth ground and leave it vulnerable to static discharges.

Remove the Apple cover by pulling up on the two back corners of the cover until the two corner fasteners pop apart. Slide the cover back until it is free of the case and then lift the cover off.

Look inside the Apple and locate the power supply case--the rectangular metal box along the left inside the Apple II. To avoid damaging the SSC, touch the power supply case with one hand; this discharges any static charge that may be on your clothes or body.

Along the back inside edge of the Apple you will see eight long narrow slots called connector slots. The connector slots are numbered from 0 at the left to 7 at the right. The numbers are printed along the back edge behind the connector slots. For use with Pascal, install the SSC in slot #1 for a printer, or slot #3 for a terminal. For use with BASIC, install the SSC in any slot from #1 through #7.



Handle the Super Serial Card as you would handle an expensive phonograph record. Grasp it only by the corners or edges, and do not touch the components or pins, especially the gold fingers on the edge connector.

There are three deep notches along the back of the Apple II case. Temporarily set the SSC down near the desired slot. Then take the clamp assembly and slide it down into the notch closest to the slot that the SSC will be in. Tighten the screws until the connector assembly can no longer be moved in the opening.

Grasp the upper corners of the SSC and insert the gold fingers of the edge connector into the slot in the back of the Apple, rear edge first. Gently push the front edge of the card down until it is level and firmly seated.

Note that the outer ends of the screws in the clamp assembly can act as nuts. They are threaded and can receive screws from the printer or terminal connector, to ensure a good connection with the Apple.

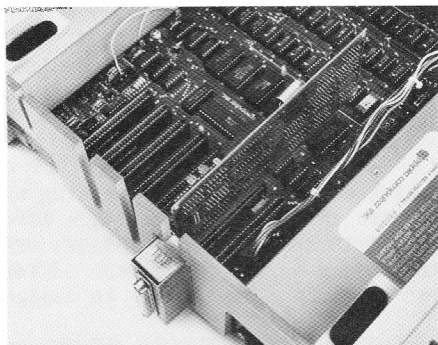


Figure 2-2. SSC in Slot #1 and Clamp Assembly in Notch

Slide the Apple case top plate in place and press down on the rear corners until the corner fasteners pop into place. The Super Serial Card is now installed.

EXTERNAL CABLE AND CONNECTOR

The SSC cable connector you installed in the notch is a standard DB-25 connector with 25 pins. Ten pins of the connector are connected internally to the SSC. Connector pin assignments are listed in Appendix C.

You will need a cable to connect your external device to the SSC connector on the Apple II. Shielded cables with 25-pin connectors on one end are available from your Apple dealer.

The cable must have internal shielding, with the shielding properly terminated at both ends, to prevent electromagnetic interference to nearby radios, television sets, and communication equipment. This shielding is necessary for the system to comply with Class B Federal Communications Commission limits as defined by Subpart J of Part 15 of the FCC rules. Unshielded cables are not recommended.



Make sure that all devices are connected to the same grounded AC power circuit (three-wire wall outlet) as the Apple II. Connecting ungrounded equipment to your Apple II can cause severe electrical damage.

USING THE SSC IN PRINTER MODE

Printer Mode allows you to use the SSC with a local (that is, directly connected) printer or terminal, as well as other local serial devices. After installing the SSC, you can control its operation from a BASIC, Pascal or assembly-language program, or even directly from the keyboard. The two parts of this section explain the easiest way to get the SSC up and running from the keyboard with a printer or terminal.

WITH A PRINTER

To use the SSC with a printer, do the following:

- Make sure the jumper block points toward **TERMINAL**.
- Under BASIC or DOS, boot the Apple II and then type in **PR#s** to send output to the printer (with the SSC in slot **s**).
- Under Pascal, boot the Apple II and then use the **F(iler T(ransfer** command to send output data to **#6:** or **PRINTER:** (with the SSC in slot **#1**).
- If the printer doesn't work, refer to Appendix E for troubleshooting hints, or consult your Apple dealer.

WITH A TERMINAL

To use the SSC with a terminal, do the following:

- Make sure the jumper block points toward **TERMINAL**.
- Under BASIC or DOS, boot the Apple II and then type in **PR#s** and **IN#s** to route both input and output through the terminal (with the SSC in slot **#s**).
- Under Pascal, boot the Apple II and then use the terminal as the input/output console (with the SSC in slot **#3**).
- If the terminal doesn't work, refer to Appendix E for troubleshooting hints, or consult your Apple dealer.

PRINTER MODE COMMANDS

You can issue any of the commands described in this section by embedding them in a computer program. Under BASIC, DOS or the Apple Monitor, you can also enter them directly at the Apple (or terminal) keyboard.

In a BASIC program, put the control character and command in a PRINT statement. In a Pascal program, issue the command in a WRITE or WRITELN statement.

When you enter the command character (usually <CTRL-I>; see below), the prompting message APPLE SSC: appears on the display screen. Subsequent characters, up to <RETURN>, will be interpreted as an SSC command. Pressing the left arrow key before pressing <RETURN> cancels the command and causes the APPLE SSC: prompt to reappear.

Many of these commands override the physical switch settings on the SSC. This makes it unnecessary to open the Apple II case and manually flip the SSC switches. To change the values back to the physical switch settings, reboot or reset the Apple II, or type in the Reset command described below.

COMMAND FORMATS

All commands are preceded by the Printer Mode command character (usually <CTRL-I>, see below) and followed by <RETURN>. The notation <CTRL-I> means "hold down the CTRL key while pressing I." There are three types of command formats:

- a number <n> followed by an uppercase letter (for example, 4D to set Data Format 4)
- simply an uppercase letter (for example, R to Reset the SSC)
- an uppercase letter followed by a space and then either E to Enable or D to Disable a feature (for example, L D to Disable automatic generation of linefeed characters)

The allowable range of <n> is given in each command description (next section). The choice of Enable or Disable is indicated as <E/D>.



The underscore character () before the <E/D> in Enable/Disable commands is merely a reminder that a space is required there.

The SSC checks only numbers and the first letters of commands and options. All such letters must be uppercase. Further letters, which you can add to assist your memory, have no effect on the SSC. For example, X(OFF E(nable is the same as X E. The SSC ignores invalid commands.

THE COMMAND CHARACTER

The normal command character in Printer Mode is <CTRL-I> (decimal 9; Appendix D). You can send the command character itself through the SSC by typing it twice in a row: <CTRL-I><CTRL-I>; no <RETURN> is required after this command. This special command allows you to transmit the command character without affecting the operation of the SSC, and without having to change to another command character and then back again later.

If you want to change the command character from <CTRL-I> to <CTRL-something else>, type <CTRL-I><CTRL-something else>. For example, to change the command character to <CTRL-W>, type <CTRL-I><CTRL-W>. To change back, type <CTRL-W><CTRL-I>. No <RETURN> is required after either of these commands.

The command character <CTRL-I> is ASCII code 9. Here is how to generate this character in BASIC and Pascal:

Integer BASIC:	PRINT "*command" *embedded <CTRL-I>
Applesoft BASIC:	PRINT CHR\$(9): "command"
Pascal:	WRITELN (CHR(9), 'command');

PRINTER MODE COMMAND SUMMARY

Table 2-4 is a summary of the commands available in Printer Mode. Some details, explained fully in the remainder of this chapter, have been omitted from the table for the sake of brevity. Commands marked with an asterisk are not supported by Pascal.

Format	Command Name	Values	Interpretation
<n>B	Baud Rate	0 - 15	see Table 2-5
<n>C	<CR> Delay	0 1 2 3	no delay 32 milliseconds 250 milliseconds (1/4 s) 2 seconds
<n>D	Data Format	0 1 2 3 4 5 6 7	8 data bits, 1 stop bit 7 data bits, 1 stop bit 6 data bits, 1 stop bit 5 data bits, 1 stop bit 8 data bits, 2 stop bits 7 data bits, 2 stop bits 6 data bits, 2 stop bits 5 data bits, 2 stop bits
<n>F	<FF> Delay	0 1 2 3	no delay (default) 32 milliseconds 250 milliseconds (1/4 s) 2 seconds
<n>L	<LF> Delay	0 1 2 3	no delay (default) 32 milliseconds 250 milliseconds (1/4 s) 2 seconds
<n>P	Parity	0,2,4,6 1 3 5 7	no parity (default = 0P) odd parity even parity MARK (parity bit always 1) SPACE (parity bit always 0)
* <n>T	Translate Lowercase (LC)	0 1 2 3	change LC to UC (default) leave LC (possible garbage) LC to UC inverse; leave UC LC to UC; UC to inverse
* C * R * Z	Column Overflow Reset the SSC Zap <CTRL>		auto-<CR> at column's end reset SSC + PR#0 and IN#0 ignore all <CTRL> commands
F <E/D> L <E/D> M <E/D> * T <E/D> X <E/D> * Not supported by Pascal.	Find Keyboard Generate <LF> Out Mask <LF> In Tab in BASIC XOFF Recognition	E or D E or D E or D E or D E or D	accept keyboard entries send <LF> out after <CR> drop <LF> in after <CR> recognize BASIC tabs detect XOFF; await XON

Table 2-4. Printer Mode Commands

COMMANDS THAT CHANGE SWITCH SETTINGS

The group of commands discussed in this section either directly override the SSC switch settings, or affect related behavior of the SSC. The Reset command restores the switch selections.

Baud Rate-<n>B

This command overrides the physical settings of switches SW1-1 through SW1-4 on the SSC. For example, to change the baud rate to 135 baud, type in <CTRL-I>4B<RETURN>.

<n>=	SSC Baud Rate	<n>=	SSC Baud Rate
0	use SW1-1 to SW1-4	8	1200
1	50	9	1800
2	75	10	2400
3	109.92 (110)	11	3600
4	134.58 (135)	12	4800
5	150	13	7200
6	300	14	9600
7	600	15	19200

Table 2-5. Baud Rate Selections

Data Format-<n>D

With this command you can override the settings of switch SW2-1. The table below shows how many data and stop bits correspond to each value of <n>. For example, <CTRL-I>2D<RETURN> causes the SSC to transmit each character in the form: one start bit (always transmitted), six data bits, and one stop bit.

<n>=	Data Bits	Stop Bits
0	8	1
1	7	1
2	6	1
3	5	1
4	8	2 (1 with Parity options 4 through 7)
5	7	2
6	6	2
7	5	2 (1-1/2 with Parity options 0 through 3)

Table 2-6. Data Format Selections

Parity-<n>P

You can use this command to determine the kind of parity the SSC is to generate when sending data and check for when receiving data. In general, parity checking is not needed in Printer Mode. However, there are five parity options available (Table 2-4).

<n>=	Parity to Use
0, 2, 4 or 6	none (default value)
1	odd parity (odd total number of ones)
3	even parity (even total number of ones)
5	MARK parity (parity bit always 1)
7	SPACE parity (parity bit always 0)

Table 2-7. Parity Selections

For example, type <CTRL-I>1P<RETURN> to cause the SSC to transmit and check for odd parity. Odd parity means that the high bit of every character is 0 if there is already an odd number of 1 bits in that character, or 1 if there is otherwise an even number of 1 bits in the character, making the total always odd. This is an easy (but not foolproof) way to check data for transmission errors. Parity errors are recorded in a status byte (Appendix F).

Set Time Delay-<n>C, <n>L, <n>F

Some printers are slow and do not provide a "printer busy" or handshake signal to the Apple II. The <n>C command causes the Apple II to delay a specified amount of time, after sending a carriage return character, before sending another group (usually another line) to it. This gives the print head enough time to return to the left side of the page so it is ready to continue printing.

The <n>C command overrides the setting of switch SW2-2 on the SSC. That switch provides only two choices: no delay or a 250 millisecond delay.

The <n>L command allows time after a linefeed character for a printer platen to turn so the paper is vertically positioned to receive the next line.

The <n>F command allows time after a form feed character for the printer platen to move the paper form to the top of the next page (typically a longer time than a linefeed).

<n>=	Time Delay
0	none
1	32 milliseconds
2	250 milliseconds (1/4 second)
3	2 seconds

Table 2-8. Time Delay Selections

Consult the user manual for the printer to find out how much time it takes to move its print head and platen, and so to determine an appropriate set of values for these three delays. The idea is to have at least enough time for the printer parts to move the required distance, but not so much time that overall printing speed is slowed down drastically. A typical set for a VERY slow printer would be <CTRL-I>2C<RETURN>, <CTRL-I>2L<RETURN>, <CTRL-I>3F<RETURN>; that is, the SSC waits 250 milliseconds after transmitting carriage returns, 250 milliseconds after transmitting linefeeds, and 2 seconds after transmitting form feed characters.

Generate <CR> On Column Overflow-C

Typing <CTRL-I>C<RETURN> causes the SSC to generate a carriage return character automatically any time the column count exceeds the printer line width.



Once this is on, only clearing the high-order bit at location \$578+s (where s is the slot the SSC is in) can turn this option back off. This option is normally off.

Generate <LF> Out-L_<E/D>

You can use this command to have the SSC automatically generate and transmit a linefeed character after each carriage return character. This overrides the setting of switch SW2-5. For example, you can type <CTRL-I>L E<RETURN> to cause your printer to print listings or double-spaced manuscripts for editing.

Mask (Suppress) <LF> In-M_<E/D>

If you type <CTRL-I>M E<RETURN>, the SSC will suppress any incoming linefeed character that immediately follows a carriage return character.

Reset the SSC-R

Typing <CTRL-I>R<RETURN> has the same effect as sending a PR#0 and an IN#0 to a BASIC program and then resetting the SSC. This keyboard command cancels all previous commands to the SSC and puts the physical switch settings back into force.

OTHER COMMANDS

The commands described here affect the handling of characters and tabs. The Translate command determines how characters will appear on the video screen. The Z and F commands prevent the SSC from responding to control characters or ALL characters coming from the keyboard, respectively. The X command causes the SSC to respond to the XON/XOFF software protocol. Finally, the T command implements the tabbing feature of BASIC.

Translate Lowercase Characters—<n>T

The Apple II Monitor "translates" all incoming lowercase characters into uppercase ones before sending them to the video screen or to a BASIC program. The SSC offers four translation options:

<n>= What to Do with Lowercase Characters

- | | |
|---|---|
| 0 | Change all lowercase characters to uppercase ones before passing them to a BASIC program or to the video screen. This is the way the Apple II monitor handles lowercase. |
| 1 | Pass along all lowercase characters unchanged. The appearance of the lowercase characters on the Apple II screen is undefined (garbage). |
| 2 | Display lowercase characters as uppercase inverse characters (that is, as black characters on a white background). |
| 3 | Pass lowercase characters to programs unchanged, but display lowercase as uppercase, and uppercase as inverse uppercase (that is, as black characters on a white background). |

Table 2-9. Lowercase Character Displays

Zap (Suppress) Control Characters—Z

Typing <CTRL-I>Z<RETURN> prevents the SSC from recognizing any further control characters (and hence commands) whether coming from the keyboard or contained in a stream of characters moving through the SSC.

If you issue the Z command described here, all further commands are ignored; this is useful if the data you are transmitting contains bit patterns that the SSC can mistake for control characters.



The only way to reinstate command recognition after the Z command is to reinitialize the SSC, or clear the high-order bit at location \$5F8+s (where s is the slot in which the SSC is installed).

Find Keyboard—F_<E/D>

You can protect incoming data from disruption by keystrokes with this command. For example, you can include an F D command in a program, followed by a routine that retrieves data coming in through the SSC, followed by F E later in the program. Default is F E.

XOFF Recognition—X_<E/D>

Typing <CTRL-I>X E<RETURN> causes the SSC to look for any XOFF (decimal 19; Appendix D) character coming from a device attached to the SSC, and to respond to it by halting transmission of characters

until the SSC receives an XON (decimal 17; Appendix D) from the device, signalling the SSC to continue transmission. In Printer Mode, the default value of this command is X D.



In Printer Mode, full duplex communication may not work with XOFF recognition turned on, so be careful.

Tab in BASIC-I_<E/D>

If you type in <CTRL-I>T E<RETURN>, the BASIC horizontal position counter is left equal to the column count. All TABs work, including back-tabs. TABs beyond column 40 require a POKE to location 36, as usual. Commas only work as far as column 40, and BASIC programs will be listed in 40-column format.

CHAPTER 3

COMMUNICATIONS MODE

This chapter explains how to prepare, install and use the SSC in Communications Mode, and change the SSC's activities via commands.

PREPARING THE SSC FOR COMMUNICATIONS MODE

The SSC is ready to operate in Communications Mode when the jumper block and switches SW1-5 and SW1-6 are correctly positioned.

If the triangle on the jumper block is pointing up toward the word MODEM, remove the block (using an IC Extractor, if necessary) and reinsert it with the triangle pointing toward MODEM (Figure 3-1).

Using a pointed object, set switches SW1-5 and SW1-6 both ON as shown in Figure 3-1. This puts the SSC in Communications Mode.

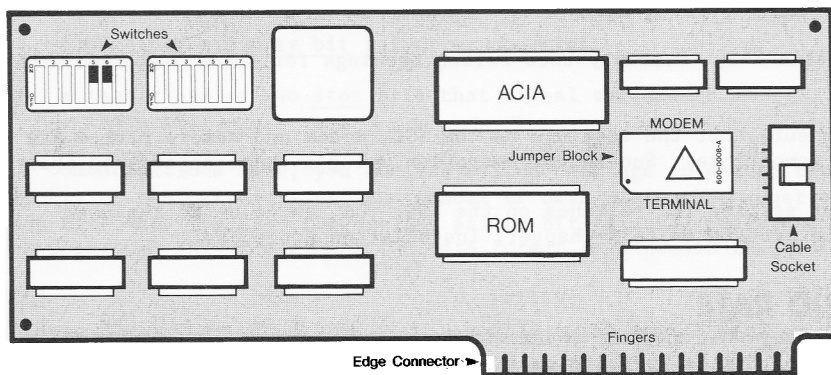


Figure 3-1. SSC Set for Communications Mode

SETTING THE SWITCHES

Use the tip of a ballpoint pen or some other sharp object to flip the appropriate tiny switches on the SSC. A switch is ON when the top of the switch rocker is pushed in. The following subsections explain what settings to use.

COMMONLY USED SETTINGS

Table 3-1 lists the switch settings you can use for connection to various devices and services via the SSC and a modem.

Application	Switch Settings, Cable Connections, Other Information
-------------	---

Apple II via modem	<u>SW1</u> : ON OFF OFF ON ON ON ON <u>SW2</u> : ON ON * * OFF OFF OFF Comm Mode, 300 baud, 8 data, 1 stop, * * parity If using SSC in each Apple, set both the same; for local connection, second jumper block points toward TERMINAL.
Apple III via modem	<u>SW1</u> : ON OFF OFF ON ON ON ON <u>SW2</u> : ON ON * * OFF OFF OFF Comm Mode, 300 baud, 8 data, 1 stop, * * parity Set Apple III RS-232-C Device Control Block to same values (See Apple III <u>Standard Device Drivers</u> manual).
Printer via modem	<u>SW1</u> : ON OFF OFF ON ON ON ON <u>SW2</u> : ON OFF * * OFF OFF OFF Comm Mode, 300 baud, 7 data, 1 stop, * * parity Baud rate is limited by modem and transmission lines; some modems can also use 1200 baud; SW1-7 is always ON, and SW2-7 is always OFF; SCTS hookup is at remote modem.
Dow Jones News and Quotes Reporter	<u>SW1</u> : ON OFF OFF ON ON ON ON <u>SW2</u> : ON OFF - ON OFF OFF OFF Comm Mode, 300 baud, 7 data, 1 stop, no parity Sample program at end of this chapter sets same traits. Use T command for Terminal Mode operation.

Table 3-1. Commonly Used Switch Settings for Communications Mode

Make sure that the settings on the SSC, modem and remote device are all compatible. Successful operation using a modem depends on this.

After setting the switches on the SSC, you can go on to the next major section of this chapter, Installation Procedure.

BAUD RATE

No matter what kind of modem and remote device you connect to the SSC, the SSC is going to pass information between the Apple II and the device at a certain prearranged speed, called the baud rate. Since the Apple II can usually send and receive information faster than what is connected to it, the simplest way to determine the maximum baud rate you can use is to consult the user manual for the modem and remote device you will connect. Find out what rate is the fastest they both can handle. Once you know this, you are ready to

set the baud rate switches on the SSC. The following table shows the correct switch positions.

Baud	SW1-1	SW1-2	SW1-3	SW1-4	Baud	SW1-1	SW1-2	SW1-3	SW1-4
50	ON	ON	ON	OFF	1200	OFF	ON	ON	ON
75	ON	ON	OFF	ON	1800	OFF	ON	ON	OFF
110*	ON	ON	OFF	OFF	2400	OFF	ON	OFF	ON
135**	ON	OFF	ON	ON	3600	OFF	ON	OFF	OFF
150	ON	OFF	ON	OFF	4800	OFF	OFF	ON	ON
300	ON	OFF	OFF	ON	7200	OFF	OFF	ON	OFF
600	ON	OFF	OFF	OFF	9600	OFF	OFF	OFF	ON
(* 109.92)		(** 134.58)			19200	OFF	OFF	OFF	OFF

Table 3-2. Baud Rate Switch Settings



If you are connecting a printer or terminal at the other end of the modem, make sure that it is set (with its own switches, dials or thumb wheels) to the SAME baud rate! If you don't, the SSC will send and receive unrecognizable garbage.

DATA FORMAT AND PARITY

The SSC sends each character (such as a "7" or an "H" or a "?") as a string of zeroes and ones (bits). The way it can send a character in Communications Mode, using switch settings, is this:

- first a single start bit to signal to the printer or terminal that a character is coming;
- then a string of 7 or 8 data bits representing the character;
- possibly a parity bit for error checking;
- lastly one or two stop bits that signal the end of a character.

For Communications Mode, you can use switch settings to change three aspects of the data format: the number of data bits, the number of stop bits, and the kind (if any) of parity bit to send. Switches SW2-1 through SW2-4 determine the data format as shown in this table.

Stop Bits	SW2-1	Data Bits	SW2-2	Parity Bits	SW2-3	SW2-4
1	ON	8	ON	none	--	ON
2	OFF	7	OFF	odd	ON	OFF
				even	OFF	OFF

Table 3-3. Data Format Selections

If SW2-1 is OFF, the number of stop bits will be 1 instead of 2 if both 8 data bits (SW2-2 ON) and a parity bit (SW2-4 OFF) have been selected.

To determine the correct combination of switch settings, consult the literature describing the device or timesharing service you plan to connect to the SSC in this mode.

The most commonly used format for ASCII data is: 7 data bits, 1 stop bit, and no parity bit (SW2-1 and SW2-4 ON; SW2-2 OFF).

If you set the data rate switches to 50, 75 or 110 baud, choose a switch combination that specifies 2 stop bits; for all data rates 135 baud or higher, use 1 stop bit (switch SW2-1 ON), unless device or timesharing service literature specifies otherwise.



To set the SSC for a data format different from those shown in this table, or to change the data format temporarily, use the SSC commands described later in this chapter.

GENERATE <LF> OUT

If the remote device (for example, a faraway printer) does not automatically generate linefeeds after carriage returns, and it desperately needs them, then set switch SW2-5 ON. Otherwise set SW2-5 OFF.

In Communications Mode, the SSC automatically discards incoming linefeeds that immediately follow carriage returns, unless you use the M D command as described later in this chapter.

SPECIAL SWITCHES

Switch SW2-6 controls forwarding of interrupts to the Apple II. Since the Apple II and II+ do not handle interrupts, set SW2-6 OFF.

For Communications Mode, set SW1-7 ON and SW2-7 OFF.

Your Super Serial Card is now ready to install and use in Communications Mode.

INSTALLATION PROCEDURE

This section explains how to install the SSC and its internal cable in the Apple II. If the cable clamp is not already assembled, do so now, following the instructions given in Chapter 1.



Before connecting or disconnecting anything on the Apple, turn off the power with the switch at the back left corner of the Apple case. **THIS IS ABSOLUTELY NECESSARY.** If you try to connect or disconnect anything from the inside of your Apple when the power is on, you are likely to damage the circuits.

Do not unplug the Apple, just turn it off. If you unplug the Apple, you will isolate it from earth ground and leave it vulnerable to static discharges.

Remove the Apple cover by pulling up on the two back corners of the cover until the two corner fasteners pop apart. Slide the cover back until it is free of the case and then lift the cover off.

Look inside the Apple and locate the power supply case--the rectangular metal box along the left inside the Apple II. To avoid damaging the SSC, touch the power supply case with one hand; this discharges any static charge that may be on your clothes or body.

Along the back inside edge of the Apple you will see eight long narrow slots called connector slots. The connector slots are numbered from 0 at the left to 7 at the right. The numbers are printed along the back edge behind the connector slots. For use with Pascal and a modem, install the SSC in slot #2. For use with BASIC, install the SSC in any slot from #1 through #7.



Handle the Super Serial Card as you would handle an expensive phonograph record. Grasp it only by the corners or edges, and do not touch the components or pins, especially the gold fingers on the edge connector.

There are three deep notches along the back of the Apple II case. Temporarily set the SSC down near the desired slot. Then take the clamp assembly and slide it down into the notch closest to the slot that the SSC will be in. Tighten the screws until the connector assembly can no longer be moved in the opening.

Grasp the upper corners of the SSC and insert the gold fingers of the edge connector into the slot in the back of the Apple, rear edge first. Gently push the front edge of the card down until it is level and firmly seated. Figure 3-2 shows how the SSC looks when installed in slot #2.

Note that the outer ends of the screws in the clamp assembly can act as nuts. They are threaded and can receive screws from the printer or terminal connector, to ensure a good connection with the Apple.

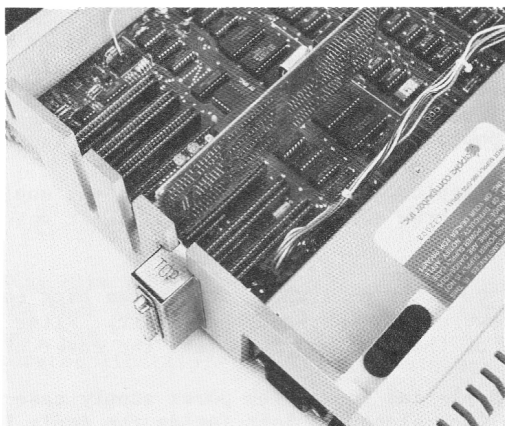


Figure 3-2. SSC in Slot #2 and Clamp Assembly in Notch

Slide the Apple case top plate in place and press down on the rear corners until the corner fasteners pop into place. The Super Serial Card is now installed.

EXTERNAL CABLE AND CONNECTOR

The SSC cable connector you installed in the notch is a standard DB-25 connector with 25 pins. Ten pins of the connector are connected internally to the SSC.

You will need a cable to connect the modem or other device to the SSC connector on the Apple II. Cables with 25-pin connectors on one end are available from your Apple dealer.

The cable must have internal shielding, with the shielding properly terminated at both ends, to prevent electromagnetic interference to nearby radios, television sets, and communication equipment. This shielding is necessary for the system to comply with Class B Federal Communications Commission limits as defined by Subpart J of Part 15 of the FCC rules. Unshielded cables are not recommended.



Make sure that all devices are connected to the same grounded AC power circuit (three-wire wall outlet) as the Apple II. Connecting ungrounded equipment to your Apple II can cause severe electrical damage.

USING SSC IN COMMUNICATIONS MODE

Communications Mode allows you to use the SSC with a modem, connected to a remote device (such as a remote printer, terminal, or other computer). After installing the SSC, you can control its operation

from a BASIC, Pascal or assembly-language program, or even directly from the keyboard. To use the SSC in Communications Mode, do the following:

- Make sure the jumper block points toward MODEM.
- Under BASIC or DOS, boot the Apple II, and then type in PR#s and IN#s to route input and output, respectively, to and from the remote device. (The SSC is in slot s.)
- Under Pascal, boot the Apple II and then use #7: or REMIN: for input, and #8: or REMOUT: for output. (The SSC is in slot #2.)
- If the modem and remote device don't work, refer to Appendix E for troubleshooting hints, or consult your Apple dealer.

COMMUNICATIONS MODE COMMANDS

You can issue any of the commands described in this section by embedding them in a computer program. Under BASIC or DOS, you can also enter them directly at the Apple (or remote terminal) keyboard.

In a BASIC program, put the control character and command in a PRINT statement. In a Pascal program, embed the command in a WRITE or WRITELN statement.

Before keyboard entry of these commands has any effect on the SSC, you must first issue an IN#s command (with the SSC in slot s). When you then enter the command character (usually <CTRL-A>, see below), the prompt APPLE SSC: appears on the display screen. Subsequent characters up to <RETURN> will be interpreted as an SSC command. Pressing the left arrow key before pressing <RETURN> cancels the command and causes the APPLE SSC: prompt to reappear.

Many of these commands override the physical switch settings on the SSC. This makes it unnecessary to open the Apple II case and manually change the SSC switch settings. To change the values back to the physical switch settings, reboot or reset the Apple II, or type in the Reset command described below.

COMMAND FORMATS

All commands are preceded by the Communications Mode command character (usually <CTRL-A>, see below) and followed by <RETURN>. The notation <CTRL-A> means "hold down the CTRL key while pressing A." There are three types of command formats:

- a number <n> followed by an uppercase letter (for example, 4D to set Data Format 4)
- simply an uppercase letter (for example, R to Reset the SSC)
- an uppercase letter followed by a space and then either E to Enable or D to Disable a feature (for example, L D to Disable automatic generation of linefeed characters)

The allowable range of <n> is given in each command description below. The choice of Enable or Disable is written as <E/D>.



The underscore character () before the <E/D> in Enable/Disable commands is merely a reminder that a space is required there.

The SSC checks only numbers and the first letters of commands and options. All such letters must be uppercase. Further letters, which you can add to assist your memory, have no effect on the SSC. For example, E(cho E(nable is the same as E E. The SSC ignores invalid commands.

THE COMMAND CHARACTER

The normal command character in Communications Mode is <CTRL-A>. You can send the command character itself through the SSC by typing it twice in a row: <CTRL-A><CTRL-A> (no <RETURN> necessary). This special command allows you to transmit the command character without affecting the operation of the SSC, and without having to change to another command character and then back again later.

If you want to change the command character from <CTRL-A> to <CTRL-something else>--for example, <CTRL-W>--type <CTRL-A><CTRL-W>. To change back, type <CTRL-W><CTRL-A>. No <RETURN> is required after either of these commands.



Do not change the control character to <CTRL-S>, <CTRL-T> or <CTRL-R>, since in Communications Mode the SSC interprets these as special control commands from a remote device.

The command character <CTRL-A> is ASCII code 1. Here is how to generate this character in BASIC and Pascal:

Integer BASIC:	PRINT "*"command" *embedded <CTRL-A>
Applesoft BASIC:	PRINT CHR\$(2): "command"
Pascal:	Writeln (Chr(2), 'command');

COMMUNICATIONS MODE COMMAND SUMMARY

Table 3-4 is a summary of the commands available in Communications Mode. Some details, explained fully in the remainder of this chapter, have been omitted from the table for the sake of brevity. Commands marked with an asterisk are not supported by Pascal.

Format	Command Name	Values	Interpretation
<n>B	Baud Rate	0 - 15	see Table 3-5
<n>C	<CR> Delay	0 1 2 3	no delay 32 milliseconds 250 milliseconds (1/4 s) 2 seconds
<n>D	Data Format	0 1 2 3 4 5 6 7	8 data bits, 1 stop bit 7 data bits, 1 stop bit 6 data bits, 1 stop bit 5 data bits, 1 stop bit 8 data bits, 2 stop bits 7 data bits, 2 stop bits 6 data bits, 2 stop bits 5 data bits, 2 stop bits
<n>F	<FF> Delay	0 1 2 3	no delay (default) 32 milliseconds 250 milliseconds (1/4 s) 2 seconds
<n>L	<LF> Delay	0 1 2 3	no delay (default) 32 milliseconds 250 milliseconds (1/4 s) 2 seconds
<n>P	Parity	0,2,4,6 1 3 5 7	no parity (default = 0P) odd parity even parity MARK (parity bit always 1) SPACE (parity bit always 0)
* <n>S	Screen Slot	0-7	chain SSC output to slot n
* <n>T	Translate Lowercase (LC)	0 1 2 3	change all LC to UC leave LC (possible garbage) LC to UC inverse; leave UC LC to UC; UC to inverse
* B * R * T Z	Break Reset the SSC Terminal Mode Zap <CTRL>		transmit 233 ms BREAK SW reset + PR#0 and IN#0 (see Terminal Mode section) ignore all <CTRL> commands
* E <E/D> F <E/D> L <E/D> M <E/D> X <E/D> * Not supported by Pascal.	Echo Find Keyboard Generate <LF> Out Mask <LF> In XOFF Recognition	E or D E or D E or D E or D E or D	echo input on the screen accept keyboard entries send <LF> out after <CR> drop <LF> in after <CR> detect XOFF; await XON

Table 3-4. Summary of Communications Mode Commands

COMMANDS THAT CHANGE SWITCH SETTINGS

The commands discussed in this section either override the SSC switch settings, or affect related behavior of the SSC. The Reset command restores the switch selections.

Baud Rate- $\langle n \rangle$ B

This command overrides the physical settings of switches SW1-1 to SW1-4 on the SSC. For example, to change the rate to 9600 baud, type $\langle \text{CTRL-A} \rangle 14 \text{B} \langle \text{RETURN} \rangle$.

$\langle n \rangle =$	SSC Baud Rate	$\langle n \rangle =$	SSC Baud Rate
0	use SW1-1 to SW1-4	8	1200
1	50	9	1800
2	75	10	2400
3	109.92 (110)	11	3600
4	134.58 (135)	12	4800
5	150	13	7200
6	300	14	9600
7	600	15	19200

Table 3-5. Baud Rate Selections

Data Format- $\langle n \rangle$ D

With this command you can override the settings of switches SW2-1 and SW2-2. The table below shows how many data and stop bits correspond to each value of $\langle n \rangle$. For example, typing $\langle \text{CTRL-A} \rangle 3 \text{D} \langle \text{RETURN} \rangle$ causes the SSC to transmit each character in the form: one start bit (always transmitted), five data bits, and one stop bit.

$\langle n \rangle =$	Data Bits	Stop Bits
0	8	1
1	7	1
2	6	1
3	5	1
4	8	2 (1 with $\langle n \rangle$ P options 4 through 7)
5	7	2
6	6	2
7	5	2 (1-1/2 with $\langle n \rangle$ P options 0 through 3)

Table 3-6. Data Format Selections

Parity- $\langle n \rangle$ P

You can use this command to determine the kind of parity the SSC is to generate when sending data and check for when receiving data. There are five parity options available:

<n>=	Parity to Use
Ø, 2, 4 or 6	none
1	odd parity (odd number of 1's)
3	even parity (even number of 1's)
5	MARK parity (parity bit always 1)
7	SPACE parity (parity bit always Ø)

Table 3-7. Parity Selections

For example, type <CTRL-A>1P<RETURN> to cause the SSC to transmit and check for odd parity. Odd parity means that the high bit of every character is Ø if there is already an odd number of 1 bits in that character, or 1 if there is otherwise an even number of 1 bits, making the total always odd. This is an easy (but not foolproof) way to check data for transmission errors. (See Appendix F.)

Generate <LF> Out-L_<E/D>

You can use this command to have the SSC automatically generate and transmit a linefeed (<LF>) character after each carriage return (<CR>) character. This overrides the setting of switch SW2-5. For example, you can type <CTRL-A>L E<RETURN> to cause your printer to produce double-spaced listings or manuscripts for editing.

Mask (Suppress) <LF> In-M_<E/D>

If you type <CTRL-A>M D<RETURN>, the SSC will not remove incoming linefeed (<LF>) characters that immediately follow carriage return (<CR>) characters.

Reset the SSC-R

Typing <CTRL-A>R<RETURN> has the same effect as sending a PRØ and an INØ to a BASIC program and then resetting the SSC. This keyboard command cancels all previous commands to the SSC and puts the physical switch settings back into force.

OTHER COMMANDS

The commands described in this subsection control the handling of characters and of the video screen. Three commands control timed delays following transmission of <CR>, <LF> and <FF> characters. The Translate command controls the display of lowercase and uppercase characters. The Z and F commands suppress control characters and characters entered at the keyboard, respectively. The X command causes the SSC to check the character stream for XOFF, as part of the XON/XOFF protocol. Finally, the <n>S command routes video output to a selected slot, and the E command suppresses display (echo) of characters on the screen.

Set Time Delays-<n>C, <n>L, <n>F

Some printers are slow and do not provide a "printer busy" or handshake signal to the Apple II. If such a printer is connected to the SSC via a modem, you may want to use these three delay commands.

The <n>C command causes the Apple II to delay a specified amount of time, after sending a carriage return character, before sending another group (usually another line) to it. This gives the print head enough time to return to the left side of the page so it is ready to continue printing.

The <n>L command allows time after a linefeed character for a printer platen to turn so the paper is vertically positioned to receive the next line.

The <n>F command allows time after a form feed character for the printer platen to move the paper form to the top of the next page (typically a longer time than a Linefeed).

<n>=	Time Delay
Ø	none
1	32 milliseconds
2	25Ø milliseconds (1/4 second)
3	2 seconds

Table 3-8. Time Delay Selections

Consult the user manual for the printer to find out how much time it takes to move its print head and platen, and so to determine an appropriate set of values for these three delays if a printer is used as the remote device. The idea is to have at least enough time for the printer parts to move the required distance, but not so much time that overall printing speed is slowed down drastically.

Translate Lowercase Characters-<n>T

The Apple II monitor "translates" all incoming lowercase characters into uppercase ones before sending them to the video screen or to a BASIC program. With the <n>T command, four options are available:

<n>= What to Do with Lowercase Characters

- Ø Change all lowercase characters to uppercase before passing them to a BASIC program or to the video screen. This is what the Apple II monitor does to lowercase.
- 1 Pass along all lowercase characters unchanged. The appearance of the lowercase characters on the Apple II screen is undefined (garbage).
- 2 Display lowercase characters as uppercase inverse characters (that is, as black characters on a white background).
- 3 Pass lowercase characters to programs unchanged, but display lowercase as uppercase, and uppercase as inverse uppercase (that is, as black characters on a white background).

Table 3-9. Lowercase Character Displays

Zap (Suppress) Control Characters-Z

Typing <CTRL-A>Z<RETURN> prevents the SSC from recognizing any further control characters (and hence commands) in the stream of characters moving through the SSC.

If you issue the Z command, all further commands are ignored; this is useful if the data you are transmitting contains bit patterns that the SSC can mistake for control characters.



The only way to reinstate command recognition after invoking the Z command is to reset the SSC, or clear the high-order bit at location \$5F8+s (with the SSC in slot s).

Find Keyboard-F_<E/D>

You can protect incoming data from disruption by keystrokes with this command. For example, you can include <CTRL-A>F D in a program, followed by a routine that retrieves data coming in through the SSC, followed by <CTRL-A>F E later in the program.

XOFF Recognition-X_<E/D>

In Communications Mode, the SSC automatically recognizes any XOFF (decimal 19; Appendix D) character coming from a device attached to it, and responds to it by halting transmission of characters. The SSC resumes transmission as soon as it receives an XON character (decimal 17; Appendix D) from the device. To disable XOFF recognition, use <CTRL-A>X D<RETURN>.

Specify Screen Slot-⟨n⟩S

With this command you can specify the slot number of the device where you want text or listings displayed. (Normally this is slot #0, the Apple II video screen.) This allows "chaining" of the SSC to another card slot, such as an 80-column-display peripheral card. For the firmware in the SSC to pass on information to the firmware in the other card, the other card must have an output entry point within its C\$00 space; this is the case for all currently available 80-column-display cards for the Apple II.

For example, let's say you have the SSC in slot #2 with a remote terminal connected to it, and an 80-column-display card in slot #3. Type <CTRL-A>3S<RETURN> to cause the data from the remote terminal to be chained through the card in slot #3, so that it is displayed on the Apple II in 80-column format. (Not available in Pascal.)

Echo Characters on the Screen-E_⟨E/D⟩

For the Apple II, as for most computers, displaying (echoing) a character on the video screen is a separate step from receiving it from the keyboard, though we tend to think if these as one step, as on a typewriter. For example, if you type in <CTRL-A>E D<RETURN>, the SSC does not forward incoming characters to the Apple II screen. This can be used to hide someone's password entered at a terminal, or to avoid double-display of characters.

TERMINAL MODE

Under Communication Mode, the SSC can enter Terminal Mode and make the Apple II act like an unintelligent terminal. This is useful for connecting the Apple II to a computer timesharing service, or for conversing with another Apple II.

Terminal Mode makes it possible to generate lowercase characters, plus the ten ASCII characters not provided on the Apple II keyboard (plus ESC, since <ESC> is used for this feature).

To generate lowercase characters, press <ESC> (the "ESCAPE" key near the upper left corner of the Apple II keyboard) once, and then type alphabetic characters as you would normally do. After that, to capitalize a single letter, press <ESC> again before typing the letter. To lock the keyboard in uppercase, press <ESC> twice in succession. To get back to lowercase, press <ESC> once, as before.

To generate one of the special ASCII characters listed in Table 3-10, first press <ESC> once (if necessary) to place the keyboard in lowercase mode. Then press <ESC> a second time, followed by one of the top-row keys as shown in Table 3-10. For example, to send a tilde, make sure the keyboard is in lowercase mode, then type <ESC> followed by 9.

<ESC> followed by:	1	2	3	4	5	6	7	8	9	0	:
generates:	FS	US	[\	_	{		}	~	ESC	RUB
or in hexadecimal:	9C	9F	DB	DC	DF	FB	FC	FD	FE	9B	FF

Table 3-10. Special ASCII Character Generation

TERMINAL MODE COMMANDS

The commands that specifically affect Terminal Mode are listed in Table 3-11. The Translate, Echo and XOFF commands are described earlier in this chapter.

Format	Command Name	Interpretation
T	Enter Terminal Mode	Go into Terminal Mode.
B	Transmit a Break Signal	Send a 233-millisecond BREAK (signoff) signal.
* E <E/D>	Echo Enable/Disable	Default E D (full-duplex); use E E for half-duplex.
S <E/D>	Special Characters Enable/Disable	Default S E; allows/defeats generation of lowercase and special characters (Table 3-10).
* <n>T	Translate Lowercase Characters	Determine treatment of incoming lowercase characters.
* X <E/D>	XOFF Recognition Enable/Disable	Default X E; in Terminal Mode, X E makes SSC detect <CTRL-R> and <CTRL-T> (remote-control OFF & ON, respectively), but not <CTRL-S>.
Q	Quit (Exit from) Terminal Mode	Return to normal Communications Mode operation.
* Fully described earlier in this chapter.		

Table 3-11. Terminal Mode Commands

Enter Terminal Mode-T

This causes the Apple II to function as a full-duplex unintelligent terminal. You can use this command in conjunction with the ECHO command to simulate the half-duplex terminal mode of the old Apple II Communications Card. Type <CTRL-A>T<RETURN> to enter this mode.



If you enter Terminal Mode and don't see what you type echoed on the Apple video screen, probably the modem link has not yet been established, or you need to use the E(cho E(nable command.

Transmit a Break Signal-B

Typing <CTRL-A>B<RETURN> causes the SSC to transmit a 233-millisecond break signal, recognized by most time-sharing systems as a signoff.

Special Characters-S_(E/D)

Typing <CTRL-A>S E<RETURN> causes the SSC to interpret <ESC><n> pairs as special characters, allowing a keyboard in this way to generate all possible ASCII characters. If you type <CTRL-A>S D<RETURN>, the SSC will treat the <ESC> key like any other key.

Quit (Exit from) Terminal Mode-Q

Type <CTRL-A>Q<RETURN> to exit from terminal mode.

A TERMINAL MODE EXAMPLE

You can use the sample program below to change the SSC temporarily from the characteristics you ordinarily use, to the characteristics needed to make the Apple II into a dumb terminal connected to the Dow Jones News & Quotes Reporter. This program assumes that the SSC is set for Communications Mode and that the jumper block is pointing toward MODEM. Neither of these conditions can be changed by software. This program also assumes that the SSC is in slot #1 and that you want to chain I/O to an 80-column card in slot #3; these conditions you can change via software. To change this Integer BASIC program to an Applesoft program, substitute CHR\$(5) for D\$ and CHR\$(2) for A\$, and leave out program lines 40 and 42.

```
10 REM *****
20 REM *   THIS PROGRAM SETS UP THE SSC FOR DOW JONES   *
30 REM *****
40 D$="": REM TYPE <CTRL-D> ESCAPE CHARACTER BETWEEN QUOTES
42 A$="": REM TYPE <CTRL-A> COMMAND CHARACTER BETWEEN QUOTES
50 PRINT D$;"PR#1": REM SSC IS IN SLOT #1;
52 PRINT A$;"6 BAUD": REM SET BAUD RATE TO 300;
54 PRINT A$;"1 DATA": REM DATA FORMAT OF 7 DATA, 1 STOP
56 PRINT A$;"0 PARITY": REM AND NO PARITY;
58 PRINT A$;"LF DISABLE": REM NO <LF> GENERATION AFTER <CR>.
60 PRINT A$;"3 SLOTCN": REM CHAIN TO CARD IN SLOT #3
62 PRINT A$;"TERM MODE": REM AND ENTER TERMINAL MODE.
70 REM *****
72 REM * NOW YOU SHOULD BE IN TERMINAL MODE, GETTING THE *
74 REM * INFO YOU NEED FROM THE DOW JONES SERVICE. WHEN *
76 REM * FINISHED, EXIT WITH THE <CTRL-A>Q(UIT COMMAND. *
78 REM *****
100 REM Q(UIT COMMAND SENDS CONTROL BACK TO THIS PROGRAM:
110 PRINT A$;"RESET": REM RESET SWITCH-SELECTED OPTIONS
120 END
```

CHAPTER 4

HOW THE SCC WORKS

This chapter is divided into three major sections. The first explains what the SCC does, using everyday terms wherever possible. Those of you already familiar with serial data communication can skip this section.

The second section is for anyone who wants an overview of the SCC's operating modes and configuration possibilities.

The third section is a dyed-in-the-wool hardware theory of operation for both the expert and the adventuresome layperson.

SERIAL DATA COMMUNICATION

The SCC is a device that performs serial data communication. Let's consider communication first, then data, and then serial data and data transfer.

Communication is easy enough: getting information from here to there or from there to here. In this discussion, the Apple II is "here." "There" can be nearby (local) or far enough away (remote) that some intermediate device, like a telephone, is needed. Information moving from here to there (out of the Apple) is called output; information moving from there to here (into the Apple) is called input.

Data denotes information in its many forms. For successful data communication, it is essential that both the sender and receiver agree on their interpretation of the data transferred.

Inside the Apple II, data can be numbers and letters and symbols, or program instructions for the computer to carry out, or pointers to storage locations, or error message numbers, or codes for generating pictures or sounds (or lots of other things).

In the Apple II, as in all other computers, data is represented in codes made up of ones and zeros, the only two digits allowed in the binary (two-element) system. Each one or zero is called a Binary digit or bit. In the binary system, as in our ordinary decimal

system, you can count to as high a number as you want--it just takes more digits to get there than in the decimal system--and use each number as a code to represent that number of different items. Table 4-1 gives some examples of how many items you can represent with various quantities of digits.

System	Digits	Using	You can represent
decimal	0 - 9	1	ten items (0 through 9)
		2	one hundred (0 through 99)
		3	one thousand (0 through 999)
binary	0 and 1	1	two items (0 or 1)
		2	four (0, 1, 10 or 11)
		3	eight (0 through 111)
		4	sixteen (0 through 1111)
		5	thirty-two (0 through 11111)
		6	sixty-four (0 through 111111)
		7	one hundred twenty-eight
		8	two hundred fifty-six, etc.

Table 4-1. Binary and Decimal Digits and Quantities

For printers, plotters, terminals, and many other devices, 128 codes are enough to distinguish all the necessary characters: 52 for the upper and lowercase alphabet, 10 for the decimal digits, and dozens of others for punctuation marks and special symbols. As a result, the 128-character American Standard Code for Information Interchange (ASCII) is widely used. (This 7-bit code is listed in Appendix D.)

Throughout the world, post, telegraph, telex and wire services use 5-bit and 6-bit code sets, even though so few bits cannot represent a very large selection of items. Meanwhile, computers have a penchant for sending each other streams of 8-bit codes with obscure meanings. As long as sender and receiver agree on interpretation, any set of codes will do. The SSC can send all of them.

PARALLEL DATA IN THE APPLE II

The Apple II is called an eight-bit processor because the basic unit of data it uses and moves around internally is an eight-bit byte. The Apple II has sets of eight lines interconnecting its various internal parts, so it can move around all eight bits at the same time. Since the bits travel together like eight cars side by side on an eight-lane highway, data in the Apple II is called parallel data, and data movements within the Apple II are called parallel data transfers (Figure 4-1).

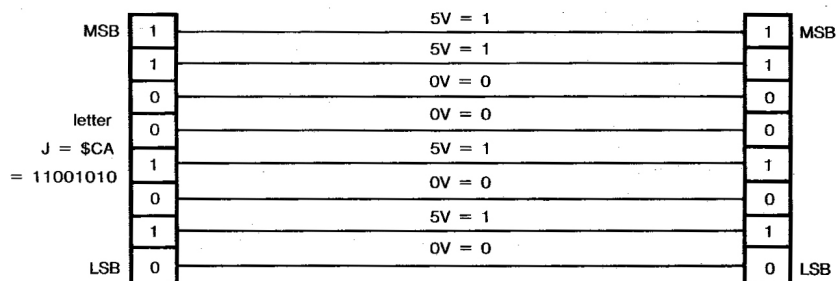


Figure 4-1. Parallel Data Transfer

SERIAL DATA FOR LONG DISTANCES

Just as it would be extremely costly to build highways with eight lanes in each direction over great distances, so it is costly to connect two widely separated pieces of equipment using eight lines in each direction. So, many manufacturers produce computers, printers, plotters, terminals and so forth that send and receive information along one line in each direction, one bit after another. Such a setup, with bits moving from one place to another like a string of cars in a single lane, is called a serial data transfer (Figure 4-2).

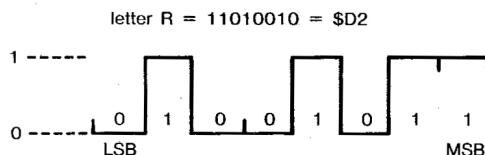


Figure 4-2. Serial Data Transfer

DATA CONVERSION

Changing parallel data to serial data or vice versa is called data conversion (Figure 4-3). By convention (see the later subsection describing RS-232-C), whenever parallel data is converted to serial data, the right-hand bit is sent first. It is as though there were a traffic law that when a multi-lane highway narrows to a single lane, the car in the right lane goes first, then the car from the next lane to the left, etc.

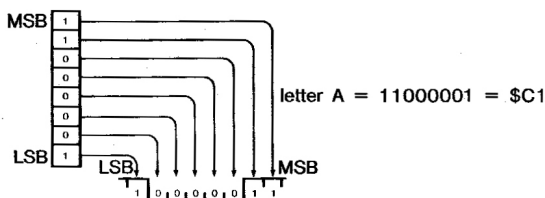


Figure 4-3. Parallel-to-Serial Data Conversion

RS-232-C DATA FORMATS

Serial data communication became popular so quickly that a group of manufacturers and the telephone company formed the Electronic Industries Association (EIA) to agree upon standard ways of sending and receiving data. What has become the most widely used standard in the world is called Revision C of standard RS-232, or RS-232-C. The SSC sends and receives data in accordance with this standard. The serial data has the form shown in Figure 4-3, plus a start bit at the beginning, an optional parity bit after the five to eight data bits, and finally one or two stop bits at the end (Figure 4-4). This is the data format that most RS-232-C devices use.

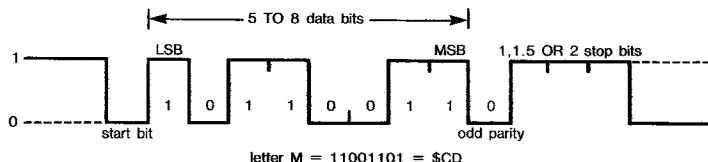


Figure 4-4. RS-232-C Serial Data Format

What is this mysterious parity bit all about? It is an optional extra bit set to 0 or 1 to make the total number of data and stop bits set to 1 an odd number (odd parity) or an even number (even parity); or this extra bit can always be set to 0 (called SPACE parity) or to 1 (MARK parity).

The combined total of data and parity bits set to 1 in Figure 4-4 is 5, an odd number (and the parity bit is 1), so it qualifies as a correct character if odd parity (or MARK parity) has been agreed upon by sender and receiver. However, if that same character were received under even parity (or SPACE parity), the receiving device would signal that a transmission error had occurred. If one bit in a character changes during transmission, parity checking will detect the error. If two bits change, the error will go undetected.

RS-232-C SIGNALS

Since the RS-232-C standard stems from the early days of telephone and telegraph, the names given to its signals may sound quaint to our "modern" ears. However, the signals correspond to familiar conditions that we take for granted when using a telephone. Table 4-2 lists the basic signals required by the RS-232-C standard, and what conditions they correspond to in a telephone call that you originate. Think of yourself as the Data Terminal (a terminus or end point of the conversation), and the phone as the Data Set (the communication device). Note: not is indicated by a bar above a signal name.

RS-232-C Signal	Abbrev.	Similar to
Data Terminal Ready	DTR	you pick up the phone
Data Set Ready	DSR	the phone is working
Request To Send	RTS	you want to talk
Clear To Send	CTS	the phone has established a connection and the person at the other end is ready to listen
Transmit Data	TxD	you speak into the phone
not Request To Send	RTS	you've finished talking and are ready to listen or to hang up
not Clear To Send	CTS	the phone has sent your words and is ready for your next request to send a message
not Data Terminal Rdy	DTR	you hang up

Table 4-2. RS-232-C Signals As Interpreted by the Sender

Here are the RS-232-C signals and how you would interpret them if you were to answer a telephone call (Table 4-3).

RS-232-C Signal	Abbrev.	Similar to
Ring Indicator	RI	the phone rings (optional)
Data Set Ready	DSR	you pick up the phone; it works
Data Carrier Detect	DCD	you hear background noise
Receive Data	RxD	you hear what is said
not Data Set Ready	DSR	the other party has hung up

Table 4-3. RS-232-C Signals As Interpreted by the Receiver

Modems

All of the above signals refer to the interaction between what RS-232-C calls Data Terminal Equipment (DTE--end points of data transfers, such as the Apple II or a printer) and what it calls Data Communication Equipment (DCE--transmitting or receiving devices, such as modems).

What is a modem? The name is short for Modulator/DeModulator. As a modulator it takes electrical signals from a computer or printer (or other device) that it is connected to, and turns them into musical tones over a telephone line. As a demodulator it takes the musical tones it detects on a telephone line and turns them back into electrical signals for use by the printer or computer (or other device) that it is connected to. It also handles the RS-232-C control signals to and from that device (Figure 4-5).

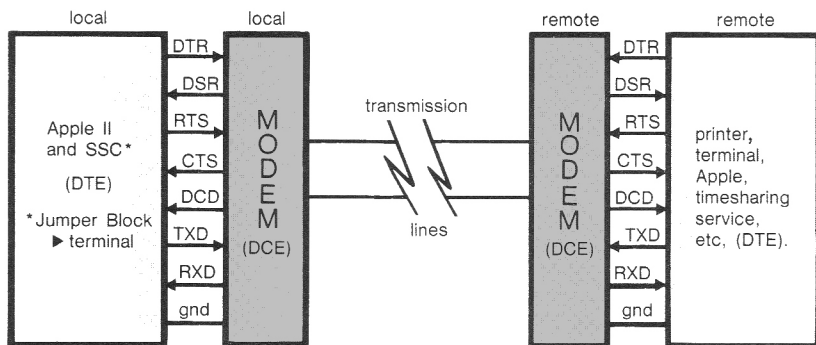


Figure 4-5. An RS-232-C Setup with Modems

By convention, the calling (originate) modem produces a fairly high tone (let's say LA) as the background or carrier signal that it sends; it then modulates (changes) that tone to S0 to mean 0 and T1 to mean 1. Meanwhile, the called (answer) modem plays a lower tone, M1, as a carrier signal, and modulates that tone to RE to indicate 0 or FA to indicate 1. In this way, both modems can send and receive information along the same wires without interpreting what they send as received messages and vice versa. (All their voices sound alike.)

Modem Eliminators

RS-232 signals are designed for the interactions of two DTE's, two DCE's, and telephone lines, as shown in Figure 4-5. What if you just want to connect two DTE's together in the same room, directly (for example, an Apple II and a printer)? You can use what is called a null modem or modem eliminator. The jumper block on the SSC does just that when it is connected with its triangle pointing toward the word TERMINAL.

By using different tones to send and receive information, modems can make sure that what comes from the "mouthpiece" (transmit register) of one DTE gets routed to the "earpiece" (receive register) of the other. A null modem simply crosses those two wires (Figure 4-6).

To simulate the other signal exchanges that modems would perform, the null modem interconnects the signal wires as shown in Figure 4-6. Thus RTS gets turned back to the sender as CTS as though the phone had instantly established a connection; RTS is also connected to DCD on the other side to pretend that a carrier signal has been detected. Finally, connecting DTR (willing to transfer data) from one side to both RI and DSR (a call arriving) on the other side completes the simulated telephone connection. (RI is optional.) The jumper block does it all!

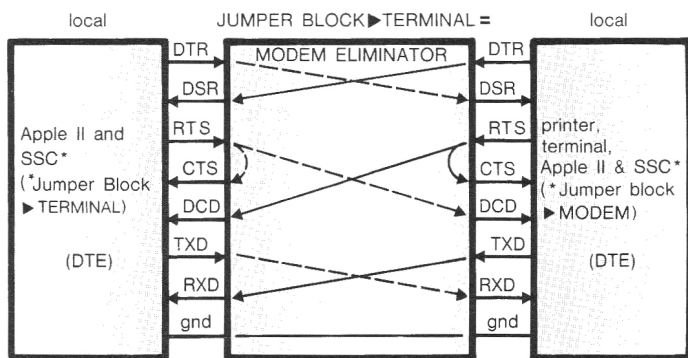


Figure 4-6. An RS-232-C Setup with a Modem Eliminator

SSC MODES AND CONFIGURATIONS

Figure 4-7 outlines the possible operating modes of the Super Serial Card and their relationships to each other.

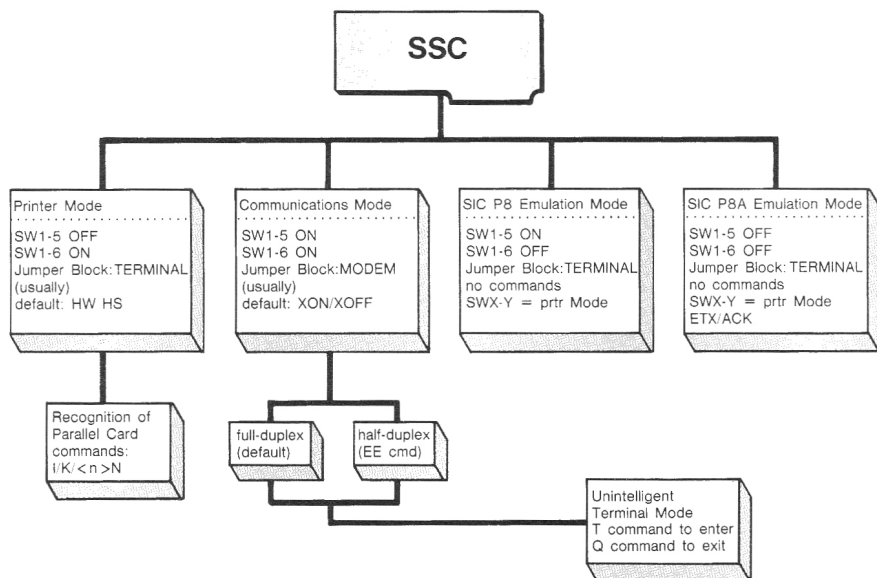


Figure 4-7. SSC Operating Modes

Figure 4-8 illustrates the chief configurations possible with the Super Serial Card and how to set them up.

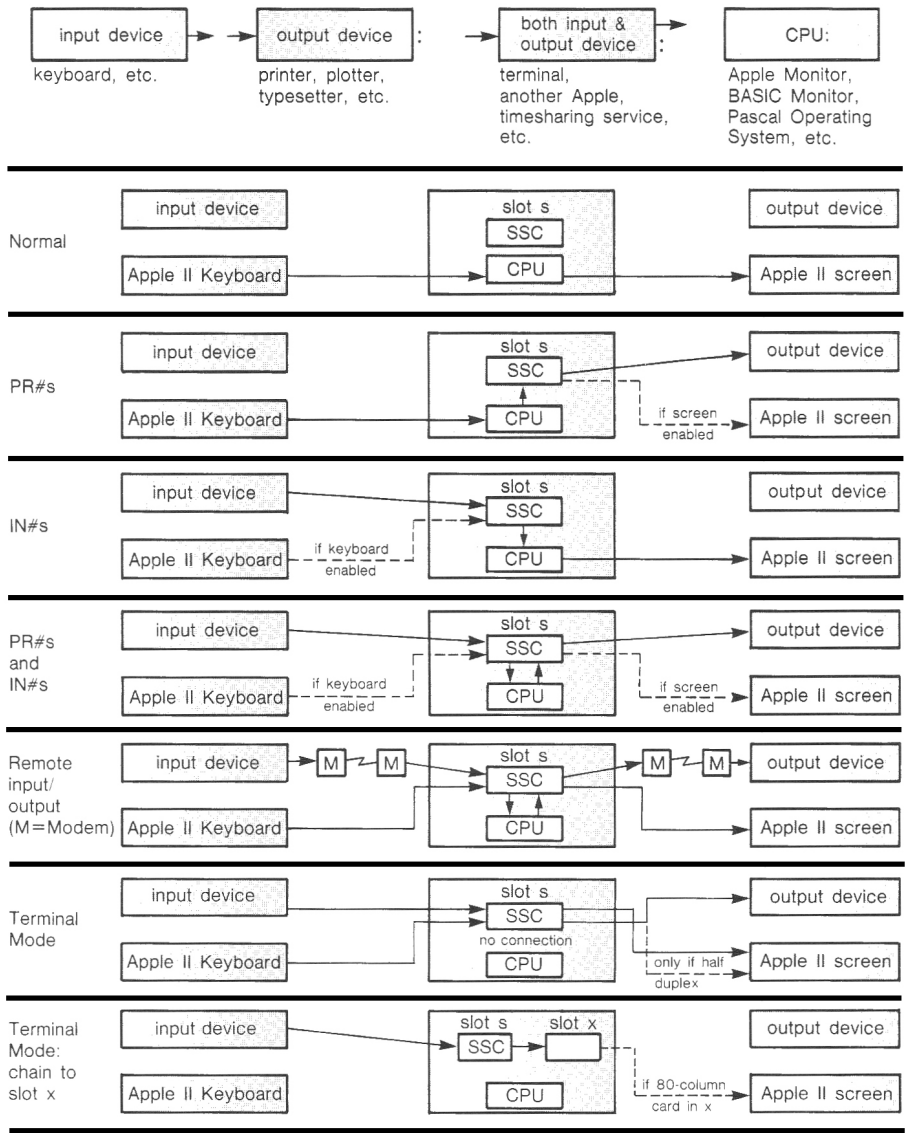


Figure 4-8. SSC Configurations

THEORY OF OPERATION

This section explains the SSC's overall theory of operation, but not the internal workings of each IC chip. If you would like such information, it is best to obtain specifications from the IC manufacturers. The most complex component is the ACIA, which is a Synertek 6551 or equivalent.

While reading through this section, you may find it useful to refer to Figure 4-9, a block diagram of the SSC, or to the schematic diagram in Appendix C. All references in the form 1A, 3C, etc., pertain to coordinates on the printed circuit board itself. Here is an inventory of the main components of the SSC:

- 50-pin connection to the Apple II peripheral connector slot
- a 12-line address bus
- addressing and control logic (1B, 1C, 2C, 3C)
- a 2K-by-8-bit ROM (4B-5C)
- jumpers and bow ties for optional substitution of RAM (3-4A)
- two blocks of 7 switches each (1A, 2A)
- two registers for reading the switch settings (2B, 3B)
- an Asynchronous Communications Interface Adapter (ACIA; 4-5A) with its internal registers:
 - status/reset register control register
 - transmit/receive data register command register
- a 1.8432 MHz oscillator (3A) for the ACIA
- a transmit interface (6A) and a receive interface (7A)
- an 8-line data bus
- a buffer for the data bus (6C)
- a jumper block (6B) that can function as a modem eliminator
- a 10-pin header (7B) to connect the SSC to a DB-25 jack via a short internal cable (discussed in Appendix C)

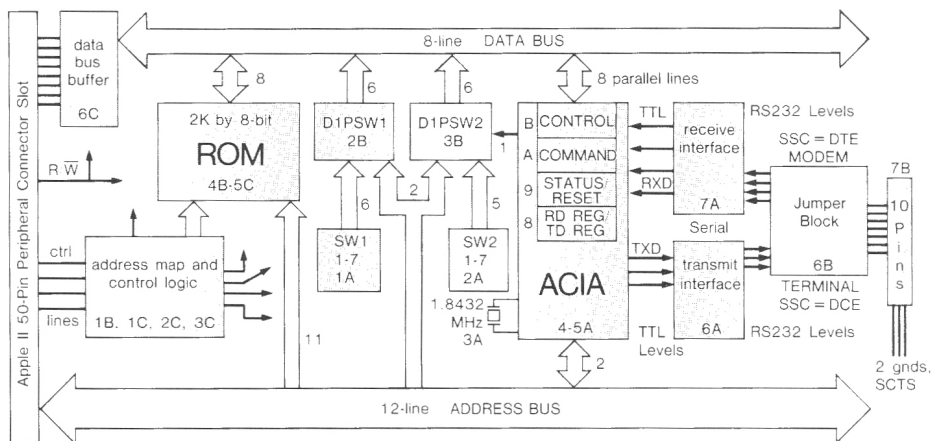


Figure 4-9. Overall Block Diagram of the SSC

ADDRESSING AND CONTROL LOGIC

The twelve address lines (A0 - A11) from the Apple II provide all the necessary \$C000 addressing on the SSC. Control logic at 1B, 1C, 2C and 3C, plus the signals RESET, DEVICE SELECT, I/O SELECT, and I/O STROBE, ensure the routing of signals to the appropriate addresses.

The SSC follows the Apple II protocol in its use of the \$C800 address space. An LS279 (1B) serves as a NAND gate, a pair of inverters, and a set-reset latch. The latch is set by an access to the \$Csxx space, and is reset by access to the \$CFxx space or by a reset. When this set-reset latch is set, the Apple II can access the \$C800 space on the SSC. A small RC filter prevents the latch from being reset by spurious noise.

ROM/RAM Space

The 2K ROM (4B-5C) containing the SSC driver firmware resides in the \$C800 - \$CFFF address space. However, an LS00 (2C) and an LS32 (3C) remap the addresses from the range \$Cs00 - \$CsFF to the range \$CF00 - \$CFFF, since the \$CFxx addresses are unusable. (Access to them disables use of the \$C800 address space.) As a result of this remapping, only one ROM is required, and none of the ROM space is wasted.

The SSC can use a 2K-by-8-bit RAM in place of the ROM. Between columns 3 and 4 and rows A and B on the SSC, there are three jumper pads and three bow ties. If you solder the jumper pads and cut the bow ties, pins 18, 20 and 21 will be, respectively, chip enable, output enable and read-write control (instead of ROM enables).

The ROM (or RAM) addresses are mapped as follows (Table 4-4). The first 256-byte block is the Peripheral Card ROM Space, selected when I/O SELECT from the Apple II drops to 0 volts. The remaining seven blocks are in the I/O Expansion ROM Space, selected when I/O STROBE from the Apple II drops to 0 volts.

<u>SSC ROM/RAM Addresses</u>	<u>Become Apple II Addresses</u>
\$0700 - \$07FF	\$Cs00 - \$CsFF
\$0000 - \$00FF	\$C800 - \$C8FF
\$0100 - \$01FF	\$C900 - \$C9FF
\$0200 - \$02FF	\$CA00 - \$CAFF
\$0300 - \$03FF	\$CB00 - \$CBFF
\$0400 - \$04FF	\$CC00 - \$CCFF
\$0500 - \$05FF	\$CD00 - \$CDFF
\$0600 - \$06FF	\$CE00 - \$CEFF

Table 4-4. SSC Address Remapping

Registers in Peripheral I/O Space

Whenever DEVICE SELECT drops to 0 volts, the Apple II is addressing the SSC's Peripheral I/O Space (the sixteen bytes starting at $\$C080 + s0$). This signal is combined logically with address lines A0 through A3 to select one of the six registers that reside in that space (Table 4-5).

Chip selected	Address(+s0)	Purpose of register
LS365 (2B)	$\$C081$	store state of SW1 (1A) (read)
LS365 (3B)	$\$C082$	store state of SW2 (2A) and state of CTS (read)
ACIA (4-5A)	$\$C088$	receive (read), transmit (write)
ACIA (4-5A)	$\$C089$	status (read), reset (write)
ACIA (4-5A)	$\$C08A$	command (read and write)
ACIA (4-5A)	$\$C08B$	control (read and write)

Table 4-5. Registers in SSC Peripheral I/O Space

The two LS365 chips act as buffers so that the state of eleven of the fourteen available switches, plus the state of RS-232-C signal Clear To Send (CTS), can be read. There are 3.3K ohm pullup resistors at the switch inputs of the LS365 chips. A closed switch pulls down an input, and it is read as zero.

Three switches are not connected to the LS365s. Switch SW2-6, when ON, passes interrupt requests from the ACIA to the Apple II. (The Apple II, however, currently does not support interrupts.) Setting switches SW1-7 ON and SW2-7 OFF connects DB-25 pin 8 (DCD) to the DCD input of the ACIA. Setting SW1-7 OFF and SW2-7 ON splices pin 19, Secondary Clear To Send (SCTS), onto the DCD input of the ACIA when the jumper block is in the TERMINAL position.

The ACIA has two pins used to select one of its four registers. While address lines A2 and A3 select the chip, A0 and A1 select the actual register. The SSC firmware reads and writes ACIA register contents; these registers are discussed in detail in Appendix A.

THE ACIA

The Asynchronous Communications Interface Adapter (ACIA) is the central and most complex element of the SSC. It and the crystal at 3A form a 1.8432 MHz oscillator. The ACIA divides this frequency down to one of the fifteen baud rates it supports. The ACIA also handles all incoming and outgoing primary RS-232-C signals. The ACIA registers (discussed fully in Appendix A) control hardware handshaking and select the baud rate, data format and parity. Finally, the ACIA performs parallel/serial and serial/parallel data conversion, and single-buffers data transfers.

DATA INPUT AND OUTPUT

The MCI489 at 7A converts the incoming serial data from RS-232-C to TTL voltage levels. The MCI488 at 6A converts the outgoing serial data from TTL to RS-232-C voltage levels, and in conjunction with three capacitors limits the output slew rate. Three of the received handshake lines (Clear To Send, Data Carrier Detect, and Data Set Ready) have 15K ohm pullup resistors so the SSC will work with devices that do not assert those signals.

DATA BUS

The 8-bit data bus on the SSC is, of course, a parallel bus. The ACIA takes output from it and gives input to it in parallel form. Also connected to the bus are the two switch detection registers (2B and 3B) and the ROM or RAM chip.

An LS245 (6C) buffers the output to the data bus, and minimizes input loading. The data bus has a 3.3K ohm pullup resistor on each line so the data inputs on the LS245 are not floating when it turns on in output mode.

JUMPER BLOCK

The jumper block has two positions: when its arrow points toward MODEM, the SSC looks like Data Terminal Equipment (DTE); that is, the SSC is prepared to talk to Data Communication Equipment (DCE), such as a modem. When installed with its arrow pointing toward TERMINAL, the jumper block acts as a modem eliminator (null modem); that is, the SSC looks like the DCE on the other device's side of a serial communication connection. In this position, the SSC can talk directly to a printer or any other DTE. Figure 4-6 shows the signal swapping that the jumper block in the TERMINAL position performs.



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