

SERIAL BOXTM

**64K SERIAL PORT BUFFER
FOR COMMODORE COMPUTERS**

— USER MANUAL —

R. J. BRACHMAN ASSOCIATES, INC.
P.O. BOX 1077
HAVERTOWN, PENNSYLVANIA 19083

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(215) 622-5495

SERIAL BOX

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for Commodore Computers**

User Manual

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The serial port buffer, its concept and implementation, is patent pending. It may not be duplicated in whole, or in part, without license from R. J. Brachman Associates, Inc.

1. INSTALLATION

With the power off, remove your printer's (or serial interface card's) 6-pin DIN plug from your disk drive or computer. Carefully insert the SERIAL BOX's 6-pin DIN plug in the now-vacant receptacle. Now plug your printer's (or serial interface card's) 6-pin DIN plug into the 6-pin DIN socket on the SERIAL BOX.

If you are using a datasette, remove it from the cassette port. If you are using a serial interface card which utilizes the cassette port, leave it connected. Plug the SERIAL BOX's power connector (on the end of the single thin wire) onto the cassette port (or piggy-backed onto the serial interface card's connector) making sure that the connector faces down and the small circuit board is above the connector. If you are using a datasette, plug it back in onto the small circuit board.

Apply power to the system and confirm that the computer powers up normally. If not, please check your connections. Assuming all is well at this point, you are now ready to print.

SX-64 users: your computer does not have a cassette port. You will need to find power from another source. To use the USER port, you will have to remove the small power connector from the end of the long thin wire from the SERIAL BOX and then solder the end to pin 2 of a 12/24 pin (.156" center) connector.

2. NORMAL OPERATION

The SERIAL BOX powers up as a buffer for device #4 and responds as device #6. If you are using a printer or printer/plotter which is configured as device 5, 6 or 7, see section 3. on how to alter the SERIAL BOX channel and device number.

The SERIAL BOX is completely transparent to your system. Confirm this by printing some lines. The only difference will be a tremendous increase in the speed with which the computer appears to print. The delay from when the print command is issued to when the computer reports READY for the next command will be significantly reduced.

The three LEDs on the SERIAL BOX give status information. The green LED tells that everything is normal and the printer is active. The yellow LED tells that the SERIAL BOX is in PAUSE mode. It will continue to accept data from the computer but printing is suspended. The red LED tells that the buffer is full and cannot accept any more characters until some are printed out. If there is a device fault, e.g. the printer is off, both the green and the yellow LEDs will come on. If the buffer fills during this condition, all three LEDs will light. There are two push-buttons on the SERIAL BOX. One push-button controls the PAUSE feature. Push it one time and the SERIAL BOX will suspend printing and light the yellow LED. Push it again and the green LED will come on and printing will resume. The

other push-button resets the line counter when the skip-over-perforation feature (see section 4) is activated.

Pressing both push-buttons simultaneously causes the buffer to clear. CAUTION: clearing the buffer wipes out whatever codes have yet to be printed. They are lost forever! Be careful when using this feature. Your best bet is to halt the computer, e.g. using RUN/STOP or RUN/STOP and RESTORE and then clear the buffer. Clearing the buffer on the fly while the computer is still trying to print may hang the computer. Note: if the SERIAL BOX is in PAUSE mode when the buffer is cleared, it will revert to RUN mode after clearing.

3. THE SHADOW DEVICE

The SERIAL BOX also responds to commands on the serial bus directed to device #6. (This is the default on power up, however, the SERIAL BOX's device number can be changed under software control if it presents a conflict with another device.) Typically, commands would be directed to the SERIAL BOX as follows:

```
OPEN 6,6:PRINT#6,"command"
```

As long as the channel remains open, subsequent commands require only:

```
PRINT#6,"command"
```

The following table summarizes the commands available. Most commands require only a single character and commands can be concatenated. However, some commands do require a second byte as indicated with an asterisk:

- B* Alter the SERIAL BOX's device number
- C Clear the buffer (see CAUTIONS)
- D* Alter the SERIAL BOX channel
- L Activate line counter in LF-only mode
- M* Alter number of lines prior to extra LFs
- O Activate line counter in CR-also mode
- P Pause
- R Reset the line counter
- S Disable the line counter
- U Unpause (resume printing)
- X* Alter number of LFs for line counter

Command "B" — Alter the SERIAL BOX's device number

The SERIAL BOX powers up as device #6. To change it to another device, e.g. device #7, type the following:

```
OPEN 6,6:PRINT#6,"B7"
```

Note: only the numbers 4, 5, 6 and 7 are allowed. It is legal to alter the SERIAL BOX's device number to be the same as the channel to

be buffered, however, no codes will get through as they will all be intercepted by the SERIAL BOX with unknown results.

Command "C" — Clear the buffer

Executing this command is identical to pressing both push-buttons simultaneously. CAUTION: clearing the buffer wipes out whatever codes have yet to be printed. They are lost forever! Be careful when using this feature. It is activated with the following:

```
OPEN 6,6:PRINT#6,"C"
```

Command "D" — Alter the SERIAL BOX channel

Most printers on the Commodore serial bus respond as device number 4. However, situations arise where a printer may respond as device 5, 6 or 7. In these instances, the "D" command will allow the SERIAL BOX to accept codes for a different device. E.g. to have the SERIAL BOX accept codes for a printer which responds as device number 5, type the following:

```
OPEN 6,6:PRINT#6,"D5"
```

Note: only the numbers 4, 5, 6 and 7 are allowed. Also, the SERIAL BOX will ignore attempts to alter the channel to the current shadow device number, normally device #6. If you are using a printer/plotter which responds as device #6, you must first alter the SERIAL BOX's device number (command "B"). The power-on defaults can be recovered (assuming that the SERIAL BOX has been altered to be device #7) as follows:

```
OPEN 7,7:PRINT#7,"B6D4"
```

Command "L" — Activate line counter in LF-only mode

Executing this command causes the SERIAL BOX to count line feeds and when a predetermined number has been counted, a preset number of extra line feeds are sent out. The line counter is reset and begins counting over. Use this mode when the program you are working with actually utilizes line feeds to advance the carriage. This command would be used for such things as skipping over perforations or double-spacing. The SERIAL BOX powers up counting 60 lines and sending 6 extra line feeds. However, the number of lines counted as well as the extra line feeds are changeable using the commands described below. The line counter is activated by typing the following:

```
OPEN 6,6:PRINT#6,"L"
```

Note: if a form feed is encountered, the SERIAL BOX resets the line counter in this mode automatically, without sending any extra line feeds.

Command "M" — Alter number of lines prior to extra LFs

The SERIAL BOX normally powers up counting 60 lines when the line counter is activated. This command lets you alter that number to permit things like double-spacing. The character following the "M" is the new number. Use the CHR\$() function to specify the new number of lines. E.g. to count only 30 lines prior to sending the extra line feeds, you would type the following:

```
OPEN 6,6:PRINT#6,"M";CHR$(30)
```

Note: be certain to include the second byte, otherwise the SERIAL BOX will interpret the carriage return following the "M" (equivalent to a CHR\$(13)) as the desired number of lines. Also note: the semicolon preceding the CHR*() is optional.

Command "O" — Activate line counter in CR-also mode

Executing this command causes the SERIAL BOX to count carriage returns as well as line feeds and when a predetermined number has been counted, a preset number of extra line feeds are sent out. The line counter is reset and begins counting over. Use this mode when working with BASIC which normally does not supply a line feed following a carriage return. This command can be used for such things as skipping over perforations for BASIC listings or double-spacing. The SERIAL BOX powers up counting 60 lines and sending 6 extra line feeds. However, the number of lines counted as well as the extra line feeds are changeable using the commands described elsewhere. The line counter in CR-also mode is activated by typing the following:

```
OPEN 6,6:PRINT#6,"O"
```

Command "P" — Pause

Issuing this command puts the SERIAL BOX in PAUSE mode. The yellow LED comes on and printing is suspended. This command is identical to pressing the PAUSE push-button. To execute this command, type:

```
OPEN 6,6:PRINT#6,"P"
```

Command "R" — Reset the line counter

This command resets the number of lines counted back to 0 and would be used to align paper along the perforations. Typically, you would PAUSE the SERIAL BOX, take the printer off-line, advance the carriage to the perforation, then type:

```
OPEN 6,6:PRINT#6,"R"
```

Note: this command behaves identically to pressing the RESET push-button. It operates the same whether in the LF-only or CR-also mode.

Command "S" — Disable the line counter

Issuing this command turns the line counter off. To reactivate, you must send the "L" or "O" command. Disable the line counter by typing:

```
OPEN 6,6:PRINT#6,"S"
```

Note: once the line counter is disabled, it will no longer retain its position and if reactivated, the number of lines counted resets back to 0.

Command "U" — Unpause (resume printing)

Executing this command turns the green LED on and resumes printing if any data remains in the buffer. Issuing this command is identical to hitting the PAUSE button a second time. It is sent by typing:

```
OPEN 6,6:PRINT#6,"U"
```

Command "X" — Alter number of LFs for line counter

The SERIAL BOX normally powers up adding 6 extra line feeds each time the desired number of lines are counted when the line counter is activated. This command lets you alter that number to permit things like double-spacing, or using preprinted forms. The character following the "X" is the new number. Use the CHR\$() function to specify the new number of line feeds. E.g. to add just 1 extra line feed after counting the desired number of lines, you would type the following:

```
OPEN 6,6:PRINT#6,"X";CHR$(1)
```

Note: be certain to include the second byte, otherwise the SERIAL BOX will interpret the carriage return following the "X" (equivalent to a CHR\$(13)) as the desired number of extra line feeds. Also note: the semi-colon preceding the CHR\$() is optional.

4. SPECIAL FUNCTIONS

Turbobuffering

When the SERIAL BOX is in PAUSE mode, it accepts codes from your computer faster than when in RUN mode. In fact, it accepts codes as fast as your computer can possibly send them (nearly 680 characters per second). Therefore, to speed up a long printout, pause the SERIAL BOX first, send the print codes, then start up your printing. Note: this does not speed up your printer or decrease printing time. It does, however, return control of your computer much more quickly. The increase in speed depends on the printer or interface card, however, you can expect an increase of anywhere from 10 to 35%.

Some word processors provide a prompt after each page to permit page alignment. You can still take advantage of the turbobuffer feature when using this type of word processor by simply timing how long it takes the SERIAL BOX to accept one page while in the PAUSE mode. For example, say it takes 7 seconds to download one page to the SERIAL BOX. You would start the printing, wait 7 seconds, then respond to the prompt for the next page, wait 7 seconds, respond again, etc.

Skip-over-perforations

For normal BASIC listings, all that needs to be done is to issue the "O" command to produce 60 lines per page and 6 extra lines between pages. However, if paper other than 8.5" by 11.5" is used, then the number of lines to be counted and the number of extra line feeds should be adjusted. E.g. say the form used is 8.5" by 5.5" and only 1 extra space at the top and bottom is desired. You would align the carriage along the perforation then type:

```
OPEN 6,6:PRINT#6,"M";CHR$(34);"X";CHR$(2); "L" or  
OPEN 6,6:PRINT#6,"M";CHR$(34);"X";CHR$(2); "O"
```

This will print 34 lines then send 2 extra line feeds.

Double spacing

Double spacing is performed by typing:

```
OPEN 6,6:PRINT#6,"M";CHR$(1);"X";CHR$(1);"L" or  
OPEN 6,6:PRINT#6,"M";CHR$(1);"X";CHR$(1);"O"
```

This sends one extra line feed for each line printed. Triple spacing can be accomplished by sending a CHR\$(2) after the "X".

Multiple printers

If you are using two different printers (with two different device numbers) and a "Y" connector, just put the SERIAL BOX before the "Y" connector and uses the "D" command to select which printer is to be buffered. The other printer will remain inactive.

5. NOTES AND CAUTIONS

You can download an 8K bit-mapped screen to the SERIAL BOX in 21 seconds. However, not all graphics programs will be as fast. Some programs interleave periods of "thinking" with periods for printing. The SERIAL BOX cannot speed up the "thinking" process. Therefore, you will get your computer back faster, but only after the last "thinking" interval. Other graphics programs send out their print codes so slowly (one was clocked at 80 characters per second) that no speed-up will occur at all!

The proper method for clearing the buffer is to pause the SERIAL BOX, stop the computer from sending print codes, and then clear the buffer. If using the push-buttons, hold the RESET push-button and then press the PAUSE push-button. This will prevent accidental printing.

If you are using a serial interface card which is not powered from the computer, power up the SERIAL BOX first to prevent the serial interface card from getting "confused."

If the SERIAL BOX lights both the green and yellow LEDs, then it has detected a "device not present" error. Correct the problem and then clear the buffer.

If the red LED lights, then the buffer is full and the SERIAL BOX cannot accept any more print codes until some are printed. When this occurs, the SERIAL BOX can only accept one print code when one is sent to the printer. Therefore, the computer will hang up if the SERIAL BOX is in PAUSE mode.

6. LIMITED WARRANTY

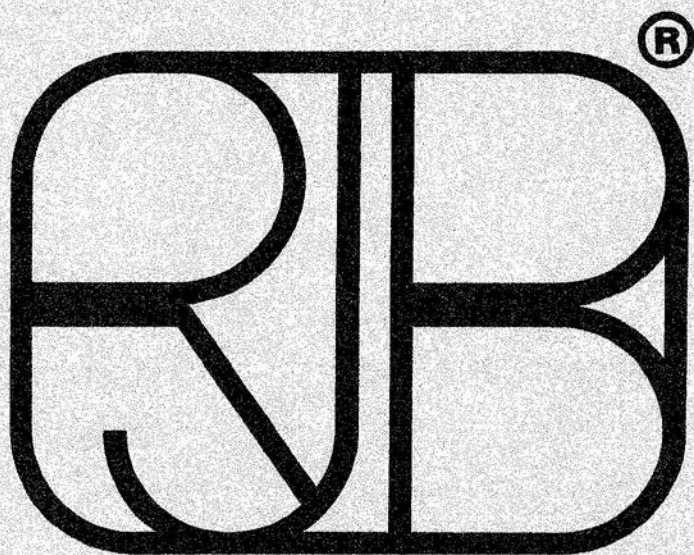
R. J. Brachman Associates, Inc. (hereafter referred to as BAI) warrants the SERIAL BOX manufactured by it to be free of defects in material and workmanship for a period of one year from date of shipment. The liability of BAI under this warranty is limited solely to repairing, replacing, or issuing credit (at BAI's discretion) for any SERIAL BOX manufactured by it and returned by the CUSTOMER during the warranty period provided that:

- A. BAI is promptly notified in writing upon discovery of such defects by the CUSTOMER.
- B. The defective unit is returned to BAI, all shipping charges are prepaid by the CUSTOMER.
- C. BAI's examination of the unit shall disclose to BAI's satisfaction, that such defects have not been caused by CUSTOMER abuse, misuse, neglect, improper installation, repair, alteration or accident.

BAI shall not, under any circumstances be liable to the CUSTOMER for any loss of profits, loss of use, damages or consequential damages of any kind based upon a breach of warranty.

BAI reserves the right to discontinue particular models without notice, and to make modifications in design without incurring any obligation to make such modifications to units previously delivered.

BAI shall not be liable for any delays in operation or consequential damages under this warranty. There is no other obligation expressed or implied.

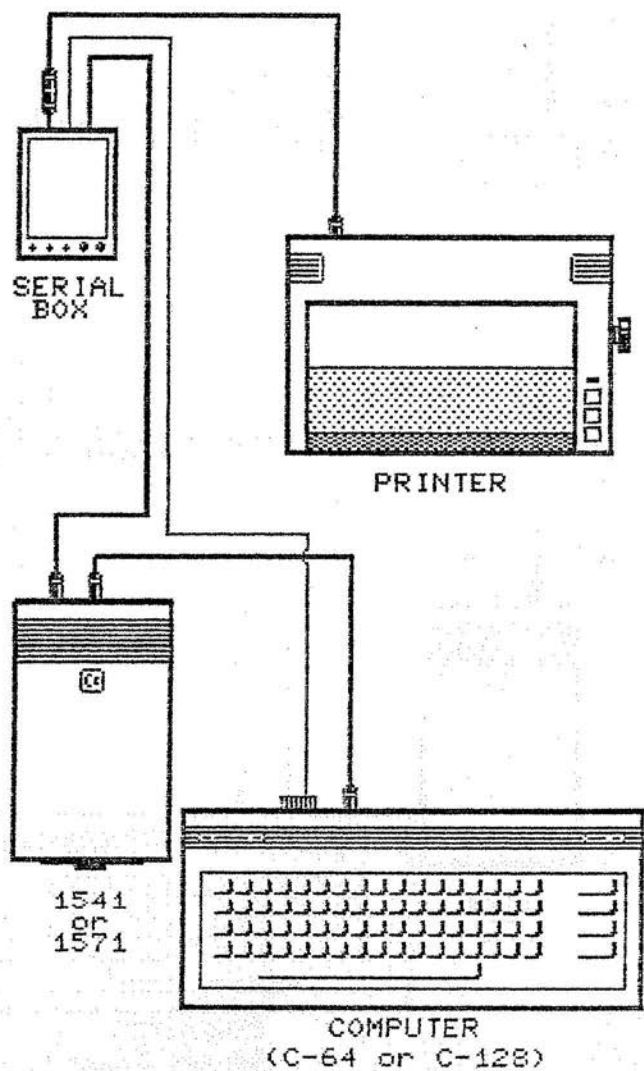


ASSOCIATES, INC.

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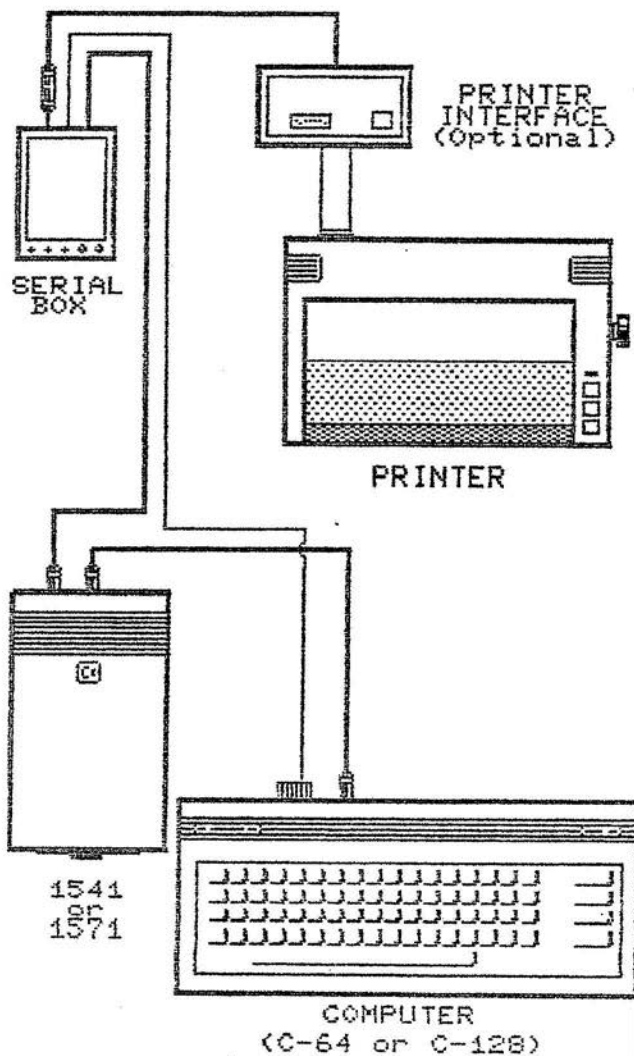
Typical Hookup: Serial Box to Commodore-compatible Printer



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Typical Hookup: Serial Box to Centronics-type Printer



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SERIAL BUS EFFICIENCY

The Commodore Serial Bus is a bit-serial implementation of the IEEE-488 communications interface. The IEEE-488 interface contains 8 data bits plus control lines. The Commodore Serial Bus has 1 data bit plus control lines. On the Commodore Serial Bus, commands are intermixed with data depending on the state of the ATN control line.

When the C64 or C128 sends out a string to a Serial Bus device, it first sends ATN low to indicate a command byte. It then sends out a Listen Address (LA) indicating which device (e.g. 8 for the disk drive, 4 for the printer) and then a secondary address (SA). The computer then lets ATN go high and sends out the string. When finished, the last byte is sent under EOI and then the command sequence is repeated with an Unlisten (UNL) instead of an LA.

Since the SERIAL BOX must faithfully send out all bytes received, it must buffer command bytes (LA, SA, UNL) as well as data bytes. In addition, SERIAL BOX must store a two byte forward pointer to the next command byte so that the command sequence is properly replicated to the printer. SERIAL BOX always stores a secondary address, even if it is a dummy. Therefore, each Serial Bus transaction has an 8-byte overhead associated with the first character.

8 BYTE OVERHEAD ASSOCIATED WITH EACH BUS TRANSACTION

LA, SA	2 Bytes
Pointer	2 Bytes
UNL, dummy	2 Bytes
Pointer	2 Bytes

SERIAL BOX has 64 Kbytes of RAM of which 59.5 Kbytes are available for the printer. This amounts to 60928 bytes of storage. If all transactions consisted of a single character, SERIAL BOX would only be able to store 6770 characters, i.e. $60928 / (8 \text{ bytes overhead} + 1 \text{ character})$, not very impressive!

Fortunately, normal programs send more than one character out per bus transaction. The overhead remains fixed at 8 characters. Thus the number of actual characters stored becomes a function of the ratio of command sequences to characters. If the channel is opened one time and all bytes were sent, the SERIAL BOX could store 60924 bytes before the BUFFER FULL light came on, assuming that the SERIAL BOX were in PAUSE mode. Thus if a program were written that consisted of a PRINT#4, followed by a single character, only 6770 characters would be stored (assuming PAUSE mode). This is because each PRINT#4 causes a complete bus transaction.

The following two programs (written for the C64) demonstrate the worst case and best case usage of the SERIAL BOX.

```

100 REM PROGRAM 1 - WORST CASE USAGE OF THE SERIAL BOX
110 REM STORES ONLY 6770 CHARACTERS BEFORE FULL LIGHT COMES ON
120 REM
130 OPEN6,6
140 PRINT#6,"C":PRINT#6,"P":REM CLEAR THE BUFFER AND PAUSE
150 OPEN4,4: REM SEND OUT BLOCKS OF 100 A'S
160 FOR I=0 TO 7000
170 FOR J=1 TO 100
180 PRINT#4,"A";
190 NEXT J
200 PRINT I;"[CRSLFT]00 CHAR":PRINT "[CRSUP]";
210 NEXT I
220 REM
230 REM PROGRAM FREEZES WHEN BUFFER FULL LIGHT COMES ON
240 REM
250 REM WHEN THE BUFFER FULL LIGHT COMES ON,
260 REM PRESS THE STOP KEY AND UNPAUSE OR CLEAR THE BUFFER
270 REM TYPE IN GOTO 300
280 REM
300 REM
310 PRINT:PRINT I=1000*J;" ACTUAL CHARACTERS STORED"
320 END

```

```

100 REM PROGRAM 2 - BEST CASE USAGE OF THE SERIAL BOX
110 REM STORES 60924 CHARACTERS BEFORE FULL LIGHT COMES ON
120 REM
130 OPEN6,6
140 PRINT#6,"C":PRINT#6,"P":REM CLEAR THE BUFFER AND PAUSE
145 PRINT "[CLR]":PRINT " OO CHAR"
146 OPEN4,4:CHD4
150 REM SEND OUT BLOCKS OF 100 A'S
160 FOR I=0 TO 7000
170 FOR J=1 TO 100
180 PRINT "A";
190 NEXT J
195 REM DIRECT SCREEN POKE OF THE COUNT
200 L#="" "+STR$(I):LE=LEN(L#)
204 L1=MID$(L#,LR,1):L2=MID$(L#,LR-1,1):L3=MID$(L#,LR-2,1)
208 POKE 1065,ASC(L3#):POKE 1066,ASC(L2#):POKE 1067,ASC(L1#)
210 NEXT I
220 REM
230 REM PROGRAM FREEZES WHEN BUFFER FULL LIGHT COMES ON
240 REM
250 REM WHEN THE BUFFER FULL LIGHT COMES ON,
260 REM PRESS THE STOP KEY AND UNPAUSE DR CLEAR THE BUFFER
270 REM TYPE IN GOTO 300
280 REM
300 PRINT#4:CLOSE4
310 PRINT:PRINT I=1000*J;" ACTUAL CHARACTERS STORED"
320 END

```

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SERIAL BOX USER MANUAL ADDENDUM FOR OWNERS OF:

Xetec Supergraphix Jr.
Xetec Graphics Printer Interface
Micro-world MW-302
Seikooha SP-1000VC
Ritecan C+
selected Axiom interfaces

Your printer or interface utilizes non-standard timing and requires a command to the SERIAL BOX to work correctly. This command can be sent to the SERIAL BOX by holding the RESET push-button down during power-up or by sending the "J" command after power-up and following each system reset. The syntax would be:

```
OPEN 6,6:PRINT#6,"J"
```

The SERIAL BOX will now operate correctly with the printers and interfaces listed above. If you use the RESET push-button to put the SERIAL BOX in "J" mode during power-up or reset, the SERIAL BOX will confirm that it is in "J" mode by coming up in PAUSE (yellow LED) mode instead of RUN (green LED) mode.

The SERIAL BOX will work correctly with ALL serial bus printers when in "J" mode. However, normal ("K" mode) operation is preferred for printers and interfaces not listed above. It is possible to turn off "J" mode by turning the computer off and on, or by resetting the computer or by executing the "K" command by using the following syntax:

```
OPEN 6,6:PRINT#6,"K"
```

NOTE: "J" mode on the SERIAL BOX differs from normal operation in several ways. In RUN mode, it will be slower, taking in data at a rate of 300 to 500 characters per second (CPS). In PAUSE mode, it will still be as fast as normal, i.e. it will take in data at up to 577 CPS.

In "J" mode, printer problems (e.g. off-line, out-of-paper) will hang up your computer if it is still trying to transmit data to the SERIAL BOX or another serial bus device. If you wish to take the printer off-line, or turn it off, PAUSE the SERIAL BOX first! Also, never clear the SERIAL BOX on the fly when in "J" mode. Stop the computer from sending print codes first. Next, PAUSE the SERIAL BOX by pressing the PAUSE push-button, then while still holding the PAUSE button, press RESET to clear out the buffer.

Just a reminder, if you are using two printers, of which only one requires "J" mode, you have two options. You can put the SERIAL BOX in "J" mode and leave it there and it will work correctly for both printers. Or you can concatenate the "J" and "K" commands along with the string to switch printers.

E.G. OPEN 6,6:PRINT#6,"DSJ" or OPEN 6,6:PRINT#6,"D4X"

V6.00 and up

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SERIAL BOX USER MANUAL ADDENDUM FOR OWNERS OF:

- Commodore DPS-1101
- Commodore 1520 printer/plotter
- selected Commodore 1526s
- Cardco ?/B
- Blue Chip and other delay wheels
- * ANY printer or interface which has trouble

Your printer or interface utilizes non-standard timing and requires a command to the SERIAL BOX to work correctly. This command can be sent to the SERIAL BOX by holding the PAUSE push-button down during power-up or by sending the "T" command after power-up and following each system reset. The syntax would be:

```
OPEN 6,6:PRINT#6,"T"
```

The SERIAL BOX will now operate correctly with the printers and interfaces listed above. If you use the PAUSE push-button to put the SERIAL BOX in "T" mode during power-up or reset, the SERIAL BOX will confirm that it is in "T" mode by coming up in PAUSE (yellow LED) mode instead of RUN (green LED) mode.

The SERIAL BOX will work correctly with ALL serial bus printers when in "T" mode. However, normal ("K" mode) operation is preferred for printers and interfaces not listed above. It is possible to turn off "T" mode by turning the computer off and on, or by resetting the computer or by executing the "K" command by using the following syntax:

```
OPEN 6,6:PRINT#6,"K"
```

NOTE: "T" mode on the SERIAL BOX differs from normal operation in several ways. In RUN mode, it will be slower, taking in data at a rate of 300 to 500 characters per second (CPS). In PAUSE mode, it will still be as fast as normal, i.e. it will take in data at up to 677 CPS.

In "T" mode, printer problems (e.g. off-line, out-of-paper) will hang up your computer if it is still trying to transmit data to the SERIAL BOX or another serial bus device. If you wish to take the printer off-line, or turn it off, PAUSE the SERIAL BOX first! Also, never clear the SERIAL BOX on the fly when in "T" mode. Stop the computer from sending print codes first. Next, PAUSE the SERIAL BOX by pressing the PAUSE push-button, then while still holding the PAUSE button, press RESET to clear out the buffer.

Just a reminder, if you are using two printers, of which only one requires "T" mode, you have two options. You can put the SERIAL BOX in "T" mode and leave it there and it will work correctly for both printers. Or you can concatenate the "T" and "K" commands along with the string to switch printers.

```
E.G. OPEN 6,6:PRINT#6,"D5T"   or   OPEN 6,6:PRINT#6,"D4K"  
E.G. OPEN 6,6:PRINT#6,"TBD6"   REM FOR THE 1520 ONLY
```

V6.06 and up