PRINTER PERIPHERALS™

ParallAx TI

PRINTER INTERFACE FOR TI-99/4A COMPUTERS

*Connects any standard parallel-input printer to the TI-99/4A computer.

*Self-powered: works with or without Peripheral Expansion System.

*Compact, easy to install and use. Runs all standard software.

*Added features:
- Set left margin
- Set line length
- Set line to line spacing

*Built-in Self-Test of interface and printer.

AXIOM®

AXIOM®
AXIOM CORPORATION

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Telephone: (818) 365-9521 • TWX: 910-496-1746

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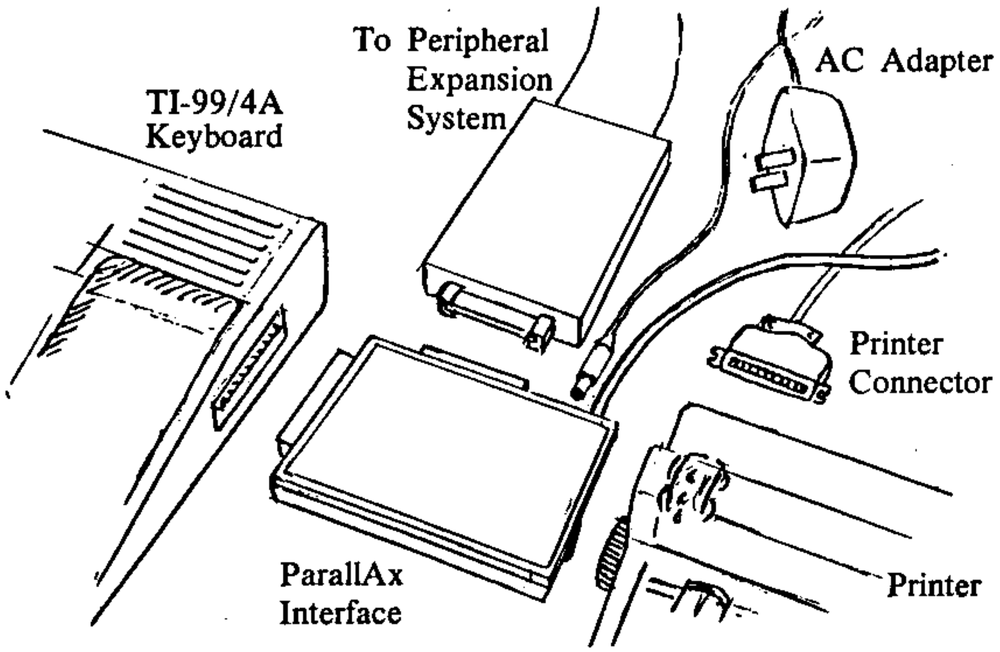
INTRODUCTION

The Axiom ParallAx is a general purpose printer interface for connecting your TI-99/4A computer to any parallel-input printer. The ParallAx is a self-powered, and so can be used whether or not you have the 99/4A's Peripheral Expansion System. You can have your ParallAx installed and running in minutes, and in only a little longer you can be ready to take full advantage of the interface's special features.

INSTALLATION

If you purchased both the ParallAx and a printer at the same time, you should follow the instructions provided by the printer manufacturer in unpacking and setting up your printer before unpacking the ParallAx interface. By setting up, we mean removing any shipping restraints, setting any switches, and installing the ribbon and paper.

Once you are familiar with your printer, you should unpack your ParallAx and its AC adapter. You will find that the interface box has a rectangular connector protruding from one end (this connects to your computer) and a cable with the printer connector on its end. Near to the cable's exit from the interface box is a socket for applying power from the AC adapter. You should use the following sequence for hooking them up.



(a) Turn OFF power to printer, interface, and computer.

(b) Open the access door on the right side of your TI-99/4A keyboard unit. This exposes the edge of a circuit card which brings signals in and out of the computer.

If you are using the Solid State Speech Synthesizer, or have other "sidecar" modules already plugged into this side of your keyboard unit, then open the access door on the right side of the last one of them.

If you are using the **TI-99/4A Peripheral Expansion System**, then you should disconnect its heavy cable connector from the right side of the keyboard unit, to expose the circuit card edge. You will then reconnect the Peripheral Expansion Cable to the card edge at the back of the Printer Interface (after removing the layer of plastic which protects the protruding card edge).

(c) Push the card-edge connector of your Printer Interface box firmly onto the exposed circuit card edge. Be sure the interface box is the right way up, with its rubber foot facing down to support it.

(d) Connect the plug at the end of the cable from your interface box to the parallel input of your printer. If your printer has them, you should also snap in the wire "bail locks" to hold the plug securely in place.

(e) Turn ON power to the ParallAx by plugging the AC adapter into a wall outlet (117 volts AC), and inserting the adapter's output connector in the socket next to the printer cable at the back of the interface.

(f) Turn ON power to printer next; and finally turn ON power to computer. If you hold down the keyboard's space-bar while switching on its power, it will start the self-test routine described in the next section.

CAUTION: Never connect or disconnect the interface while power is applied to it or to the computer or printer.

The sequence of turning on and off power to the keyboard, ParallAx, and printer is not important, but if the interface power is turned off while you are printing, you will probably "hang up" the computer and have to turn it off to restart properly. Turning off the printer while it is printing may hold up the program until power is restored, but it should then continue without

losing your program or data. Of course, most printers should not be turned off while operating — see your operators manual. The preferred way to stop the printer is to press CLEAR (FCTN 4) on the keyboard console, or possibly hit the OFFLINE button on the printer.

SELF TEST

When you have loaded the ribbon and paper, and have made the proper connections to the computer and printer, then you can check out the printer by activating "Self Test".

Hold down the SPACE BAR on the computer keyboard when you turn on its power. After a few moments of initialization, your printer will begin printing out all its standard characters in sequence, and will continue until the space bar is released. At the end of the test, the printer will perform a linefeed (to clear its buffer) and then start normal operation as if there had been no test routine.

If you do not get the printout expected, then you should recheck all the connections and try again before going to the troubleshooting hints in a later section. You can also help to identify whether the problem is in the printer or interface or computer, by performing any built-in self test the printer may have: the troubleshooting section steps you through this.

PRINTING WITH PACKAGED SOFTWARE

There are many programs commercially available for Word Processing or Business Calculations which are designed to be used with a printer. They should all run at once with your ParallAx and printer, because these use standard file structure and commands.

DEVICE NAME

The DEVICE NAME is **AXIOM** or **PIO** for opening files to send out to the printer. You will normally be asked questions by the program, such as . . .


```
WHERE DO YOU WANT LISTING?
1  SCREEN
2  SOLID STATE PRINTER
3  RS232 INTERFACE
4  OTHER
YOUR CHOICE?
```

You will select OTHER by typing

4 ENTER

and the program will prompt . . .

DEVICE NAME?

to which you reply by typing:

AXIOM ENTER

and this should be all that you need for directing printout through your ParallAx to your parallel printer.

Once properly addressed, the interface will transfer ALL bytes through to the printer unchanged; and so use of control codes for the printer depends only on the flexibility of the software.

If the program does not allow you to enter the interface device name in this way, there is still a good chance that it will generate the name **PIO** by itself, and give you the proper printout. If you come across a program which does not do this, *but* was expecting to send printout through an RS232 interface to a serial printer, then you can make a jumper modification so that the ParallAx responds to **RS232**. See Section on BASIC for a full description of this change and the limitations it imposes. See Page 14 for a list of known problem programs.

Disconnect any other interface cards you may have in your system, because they may also respond to **PIO** or **RS232.**

USING INTERFACE FEATURES

When you are entering the DEVICE NAME, you can also select formatting options for line length, margin and linefeed spacing, and the number of bits (7 or 8) in each character sent to the printer.

For an example, typing the DEVICE NAME

AXIOM . LF=2 . MA=10 ENTER

will give double spaced (2 linefeeds) printout with a ten character margin. Codes for each option start with a period, and they can be combined in any order.

. CR	no automatic Carriage Return/Linefeed. Overrides . LF = settings
. LF	no automatic paper advance — for over-printing
. LF = 2	(or 3 etc.) for double spaced (triple, etc.)
. LL = 40	gives 40 character line length; see notes in BASIC section
. MA = 5	gives 5 space margin, MA value must be less than LL value.
. DA	passes only 7 bits of character to printer

These formatting features will not be necessary when your programs provide the same features; they may even conflict with them.

Line lengths of .LL=81 to .LL=132 will only work if your program also asks you for number of columns and accepts your number (81 through 132). LL numbers less than 80 can be entered at any time. (See notes on VARIABLE, Page 10.)

The TI-99/4A generates both CR and LF (carriage return and linefeed) at the end of each line. The .LF interface feature is useful if you find your text is double spaced when you didn't want it to be. This is usually caused by the printer treating the two different control codes (CR and LF) as both requesting a paper advance. Many printers have a switch to change how they treat these two codes: check through the printer's manual, because it gives you more flexibility for underlining etc. if the printer is set to advance paper only on a linefeed.

USING PRINTER FEATURES

Your printer manual will probably list a number of special features which can be called on by sending control code sequences to the printer. Most of these sequences begin with ESC (which is short for escape, and means 'don't treat the following characters as text'), and then have one or more characters to define the function.

These control codes are quite easy to generate from BASIC (see next section) where you can create the codes

you need as part of your program: but they can be difficult when you are using a packaged program. The biggest problem is where to look for explanations — to the manuals for the computer, the printer, this interface, or the software you are running? If you are really lucky, you will find that the software manual will have a section on using printer features, and you won't have to read further in this section. If it doesn't, then we hope these notes will help you to find the right sources.

What Control Codes to use?

Look to your printer manual which will have lists and detailed descriptions of the code sequences and their use. It is a good idea to practice using control code sequences by running TI BASIC and trying out the examples listed, before you try to insert these codes into a packaged program.

What are Control Codes, anyway?

There is a standard code for sending text to micro-computers, called ASCII (American Standard Code for Information Interchange). The codes are not really very different from the old Morse Code, except that each character is represented by a group of seven 1's or 0's (bits) instead of patterns of long or short. You can make 128 different patterns out of 7 bits, which computer people number from 0 to 127. Of these, 32 to 126 are for alphabets, numbers, punctuation; and 0 to 31 are reserved for control functions. Finally, 127 is called DELETE and is usually ignored — but certain printers have used it to clear a line from their memory. You have already heard about Linefeed and Carriage Return which have codes 10 and 13; the most important for special features is ESCAPE code number 27.

What happens to the 8th bit when ASCII only uses 7?

Even 16-bit computers like your TI-99/4A manipulate text in 8-bit bytes: so there is indeed an extra bit for each character. To print ASCII most printers require this bit to be zero; and if high, some will print special symbols and foreign characters. Most packaged programs will take care

of this extra bit for you; but if you find printout with unexpected strange characters, you should try entering DEVICE NAME? as AXIOM.DA so that the extra bit is forced to zero.

Can you enter Control Codes from the keyboard?

Probably — it depends on the software. The FCTN and CTRL keys can be combined with other keys to generate control codes, and your ParallAx interface is guaranteed to pass them through unchanged to the printer. But some programs are designed to check your typing and throw away control codes — you will just have to experiment, and as a last resort contact the software designers if you cannot make it work. Try it on a 'dummy' run of the program.

A table of Function and Control Key Codes is shown in the TI-99/4A User's Reference Guide, Appendix III-2. You will see that the computer can interpret each keystroke in more than one way (BASIC mode and PASCAL mode). An example, ESC is typed CONTROL.(hold down CTRL key and type a period before releasing CTRL) but can have two numeric values, 155 or 27. These are different because of that 'extra bit' we discussed, and the value will depend on details of how the program was written: you may be able to force the 27 by using Device Name AXIOM.DA which strips the extra bit. While experimenting, you should use a simple control code before going to the complex sequences. We suggest BELL (CTRL-G) or LINEFEED (CTRL-J) which are both easy to recognize on a printer.

PRINTING FROM BASIC:

OPEN, PRINT #, CLOSE

Try typing in the following simple program, and running it:

```
10 OPEN #1:"AXIOM"
20 PRINT #1:"Now I have a Printer!"
30 CLOSE #1
40 END
```

```
Now I have a Printer!
```


Let us give brief comments on each line of the program:

`10 OPEN #1:"AXIOM"`	Opens File #1, and tells the computer that File #1 talks to the device named 'AXIOM".
`20 PRINT #1:"Now...`	Sends "Now I have a Printer!" and a carriage return/linefeed to the printer.
`30 CLOSE #1`	Closes the file you defined in line 10. You cannot use the **Print #1:** command again until a new File #1 is opened.
`40 END`	Tells the computer the program is finished.

(NOTE) The commands and the DEVICE NAME **AXIOM** are all in Upper Case (capitals), and you would get a message "I/O ERROR0 00" if you enter lower case by mistake. Other Device Names and options are listed below.

LIST

To list a BASIC program in memory to the printer, the command is as follows:

`LIST"AXIOM"` ENTER

The listing of the program in memory will be output to the printer.

`LIST"AXIOM":20-30` ENTER

will list out the specified section of your program.

The Interface will support OPEN, PRINT #, CLOSE, and LIST. Other operations such as SAVE, OLD, INPUT will cause an error message to be generated.

Depressing "CLEAR" (holding down 'FCTN' and typing '4') will terminate the output to the printer. A message will be printed on the screen " * I/O ERROR 36 IN..." when the program breaks.

DEVICE NAMES AND OPTIONS

AXIOM and **PIO** are both valid device names for accessing your printer, and either may be used according to your preference. The optional 'software-switch-settings' listed below can also be added to either name.

You may come across a program written specifically for a serial printer attached to one of the older serial I/O modules. This would have a device name such as **RS232** or **RS232/1** or **RS232/2**. If you cannot change the name, then you can modify the Axiom interface to respond to the **RS232** names as well as **AXIOM** and **PIO**. This modification is described in the last section, Troubleshooting and Jumper Options.

SOFTWARE SWITCH SETTINGS

There are a number of features which you can select by adding special symbols to the DEVICE NAME.

. DA	8th bit of input character is ignored
. CR	No automatic CR or LF at end of line. Overrides .LF settings
. LF	No automatic LF at end of line (just CR)
. LF = 1 - 9	Multiple spaced lines with 1 - 9 linefeeds
. LL = 1 - 132	Line length 1 to 132 — See note on 'variable' if LL > 80
. MA = 0 - 131	Left margin setting; less than .LL value

These settings may be added in any order to the device name. For example

```
10 OPEN #1:"AXIOM.MA=20.LL=48.LF=2"
```

will produce printout with a 20 column left margin, and then 28 columns of print, all double spaced.

VARIABLE:
This is an optional part of the OPEN statement, which defines the block length for data transfer to your printer. The printer routine assumes a block length of 80 characters, so if you want to use 96 or 132 columns, you must reset the variable format.

```
10 OPEN #1:"AXIOM.LL=132",VARIABLE 132
```

There should be a single space between VARIABLE and the number. Whenever you find an unexpected linefeed in your printout, you should suspect the data block being overfilled.

CODE CONVERSION

Apart from the 7/8 bit selection (.DA), ALL codes are

transmitted to the printer unmodified by the ParallAx. This means that you can work directly from your printer manual for the control codes to set up the printer. The BASIC function CHR$ ( ) will create any code needed.

ERROR CODES

Listed below are the error codes related to the operation of TI BASIC programs that use the AXIOM Interface Card.

OPEN:

CODE 00 — Device named in the statement or command cannot be opened: verify that you have typed name in upper case.

CODE 02 — The software switch option entry is in error, such as incorrect first two characters of an option, or illegal values.

CODE 06 — A hardware error occured and the device cannot be opened.

PRINT:

CODE 32 — Similar to 02.

CODE 36 — Some type of hardware error occured. Also caused by pressing CLEAR to stop a pending or in-progress operation. (FCTN-4)

MISC ERROR CODES:

CODE 43, 73, 83, 93 — Executing an illegal command.

TROUBLESHOOTING

If you have any troubles with printing, we suggest that you save the program you have been working on, and then try the ParallAx Self-Test. [Keyboard power OFF; wait a few seconds; power ON while pressing space bar.]

- Self Test is OK

  Problems are most likely to be in the software.
  Did you use capital letters for the Device Name? Or extra spaces? Re-read Pages 4-5.
  Does the printer need initialization? (Was it left in Graphics Mode?)
  If printout has extra linefeeds and spaces, check the data block setting — VARIABLE.

- Self Test prints, but wrong characters

  'Stuck' data bits give repeated patterns ...0123012389... instead of ...0123456789...
  Are all connectors pushed in firmly?
  Check cable from interface to printer for loose wires or damage.

- No Self-Test: Screen shows TI logo, then menu

  Computer does not 'see' ParallAx interface.
  Probably not getting power to interface: check if AC adapter plugged in correctly.
  Possible hardware fault on ParallAx.

- No Self-Test: Screen goes light blue

  Generally a problem between ParallAx interface and printer.
  Release space bar (end the Self-Test), and: — Screen stays blank:

  Probably printer was 'BUSY' or 'OFFLINE' (or faulty).
  Check the printer signal cable.
  Possible hardware error or intermittent power.

  Screen shows TI logo:

  Printer not responding to ParallAx signals.
  Check the printer signal cable (STR not seen?)
  Try to check printer with different data source.

  Try the printer's built-in Self-Test: but remember that this only tests the mechanism and not the data input and 'handshaking' with the interface.

- No Self-Test: Screen dark. Hardware problem in some part of system

  1. Check if keyboard unit is "hung up" in Reset. Keyboard power OFF; wait 5 seconds; Power ON again. Cured?

  2. Try hooking up only some parts of your system at a time. Start with keyboard console only, build up until fault appears.
  3. If problem appears only with interface, then try disconnecting printer, and powering ON again. If you now get a light blue screen, then printer (or cable) was causing failure. Otherwise, the interface is at fault; follow return policy on warranty card.

JUMPER OPTIONS (only for special applications)

The ParallAx has a number of options which can be selected by changing jumper-wires on the interface card. The plastic box may be opened after the printer and computer are turned OFF and disconnected. A small Phillips-head screwdriver is needed to open the interface box; and soldering equipment for changing the jumpers. The location of these jumpers is shown in the Appendix.

The modifications should only be attempted by someone experienced at electronics assembly and soldering: don't try if you have any doubts!

J1:	OPEN (no jumper)	DEVICE NAME is **PIO** or **AXIOM**
J1:	Jumper installed	DEVICE NAME as above or **RS232**, **RS232/1**, **RS232/2**. Options .DA, .LL, .MA, .LF= are lost, replaced by .DA=7 or = 8.
J2,3:	As shipped	CRU Address $1B00
J2,3:	Cut traces and jumper other 2 sides of square	CRU Address $1E00
J4:	As shipped	Power from AC adapter
J4:	Cut at (X) and jumper J4	Power from printer (250 mA from pin 18 of connector)

MISC ERROR CODE.

APPENDIX 1:
PROBLEM PROGRAMS

In this appendix we are providing notes on programs which require special attention. If you discover other problems, or find better solutions to those listed, then please mail them to us at Axiom. We will be updating these notes with each printing of the manual, and all your comments and suggestions will be appreciated.

NO PROBLEMS

These can use AXIOM or PIO with any of their dot options. They can use RS232 (and /1 and /2) if the ParallAx is jumpered for it.

T.I.WRITER
T.I.LOGO II
T.I.BASIC & EXTENDED BASIC
DISK MANAGER II
TERMINAL EMULATOR II
PERSONAL RECORD KEEPING
and many others . . .

MUST USE RS232

These programs were written when there were only RS232 and TP (Thermal Printer) and did not obey the programmer's guidelines to allow any device to be serviced. If they are in cartridge (Command Module) form, then you must change your jumper setting to RS232 to use them. If they are on disk or cassette, then you may be able to change the program and re-save it. An example is given below for MAIL LIST, and similar fixes should work for most BASIC programs.

PERSONAL REPORT GENERATOR
TAX/INVENTORY RECORD KEEPING
NUTRITION AND WEIGHT CONTROL

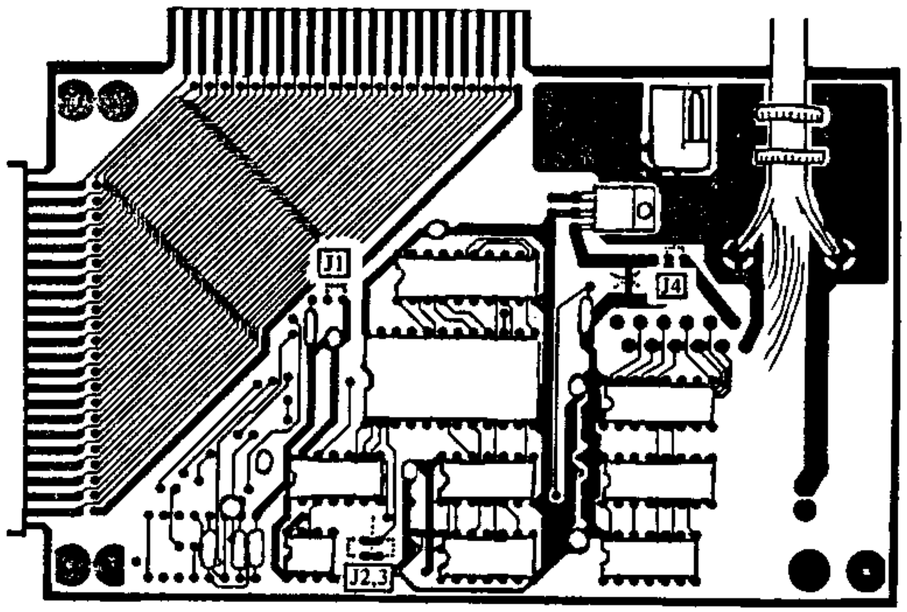
MAIL LIST .. can be corrected ..
-change lines 1140, 1150, 1160 from
```
      1140 IF SEG$(DEV$,1,5)="RS232" THEN 1170
      1150 OPEN #9:"TP",FIXED 32,OUTPUT
      1160 GOTO 1200
```
-to read
```
      1140 REM
      1150 REM
      1160 REM
```
-note that these line numbers must still exist.

OTHER PROBLEM PROGRAMS

EDITOR/ASSEMBLER
The device name used for this program must have an extra period (dot) after it, or after the last option called.

EXTENDED BASIC : PRINT USING EXAMPLE
```
10 PRINT #1,USING"##.##":3.14159
3.14
```


APPENDIX 2:
HARDWARE INFORMATION



J1 : DEVICE NAME (see page 10)
J2,3 : CRU BASE ADDRESS
J4 : POWER FROM AC ADAPTER/PRINTER
Cut at (X) and Jumper J4 if 5V DC @ 250 mA available on connector pin 18 of your printer.

PRINTER CONNECTOR

36 position AMPHENOL TYPE 57, MICRO RIBBON.

1	STR
2-9	DATA 1-8
10	NOT CONNECTED
11	BUSY
16	0 VOLTS
17	SHIELD GROUND
18	POWER (if 250 mA@5V; Jumper J4)
19	SIGNAL GROUND