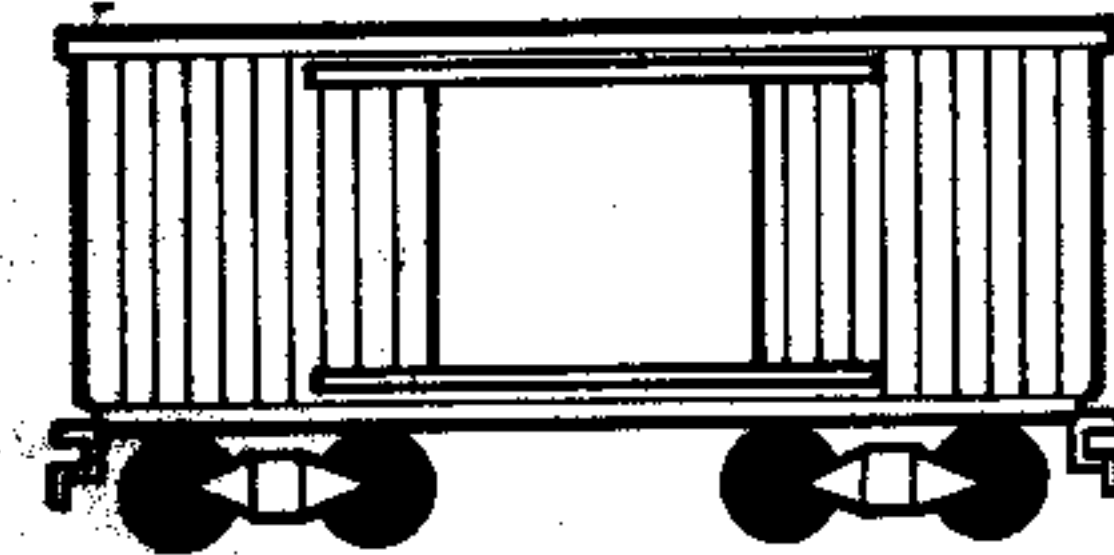


BOXCAR



PERIPHERALS

RS232

**A Stand-Alone Peripheral
for the Texas Instruments 99/4A**

Adding this space-saving, dual port module to your TI99/4A gives you more system capability without costly expansion extras. The daisy chain type connector achieves a simple direct plug-in installation/expansion for a compact and more portable system.

**Manual for the BOXCAR
Communications Interface Module**

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INTRODUCTION

The BOXCAR Communications Interface Module allows the TI 99/4A Home Computer User to operate the computer with a modem *and/or printer. Software packages such as TI's Terminal Emulator II*, TI Writer*, and numerous third party programs can be used to further enhance the usefulness of your computer. The module also enables the user to print with TI Logo*, TI Basic*, TI Extended Basic*, and many other program cartridges. The Communication Interface Unit contains one serial (RS232C) and one eight bit parallel input/output port, with the connectors easily accessible from the back of the unit. A small calculator-type transformer is included to power the unit. The module assures full system expansion capability by allowing connection of the Speech Synthesizer Module*, stand-alone memory expansion, disk systems, and other peripherals via the Daisy-Chain Expansion Connector.

Flexibility is also maintained by the module's internal software which supports the OPEN, CLOSE, INPUT, LIST, PRINT, OLD, AND SAVE BASIC statements. These statements allow the user to input or output data on both ports, as well as program listing to a printer.

NOTE: The BASIC language which is built into the computer can use the communications interface unit by itself without the need for a special software cartridge.

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*Appropriate software for proper operation, such as the Terminal Emulator II package, is required.

INSTALLATION

To install your Communication Interface Module please CAREFULLY READ and FOLLOW these next steps.

CAUTION: The electronic components in the module can be damaged by STATIC ELECTRICITY. To avoid the possibility of such damage AVOID TOUCHING the connector contacts on either side of the unit.

- Turn OFF the main computer console and any devices that may be attached.
- The Communications module should be placed next to the main console. NOTE: The unit MUST be to the LEFT of the Speech Module for proper operation.
- An optional strip of Velcro is included if you feel that the normal force of the connector contact will not hold the unit in more rugged environments. To attach the Velcro simply pull the two strips apart and peel the backing off of the "loop" side. This strip should go on the main console just above the door. The other strip, the "hook" side, should be attached in the same manner to the communication unit above the extending connector.
- Align the module's connector with the console's expansion connector (make sure the console's door is up, exposing the expansion connector inside).
- Firmly but carefully push the module toward the console until the connectors are firmly joined. Initially it may help to angle the module slightly. The module should be flush with the computer console. If any obstruction is encountered before the module is fully inserted, pull the two units apart and visually inspect both the console and module connectors to ensure there are no mechanical obstructions in the connector's path.
- After the module is in place, any additional peripherals may be connected in a similar manner or per their appropriate instructions.
- Plug the small jack of the transformer into the receptacle at the back of the module. Make sure the jack is firmly seated in the receptacle.

INSTALLATION CON'T.

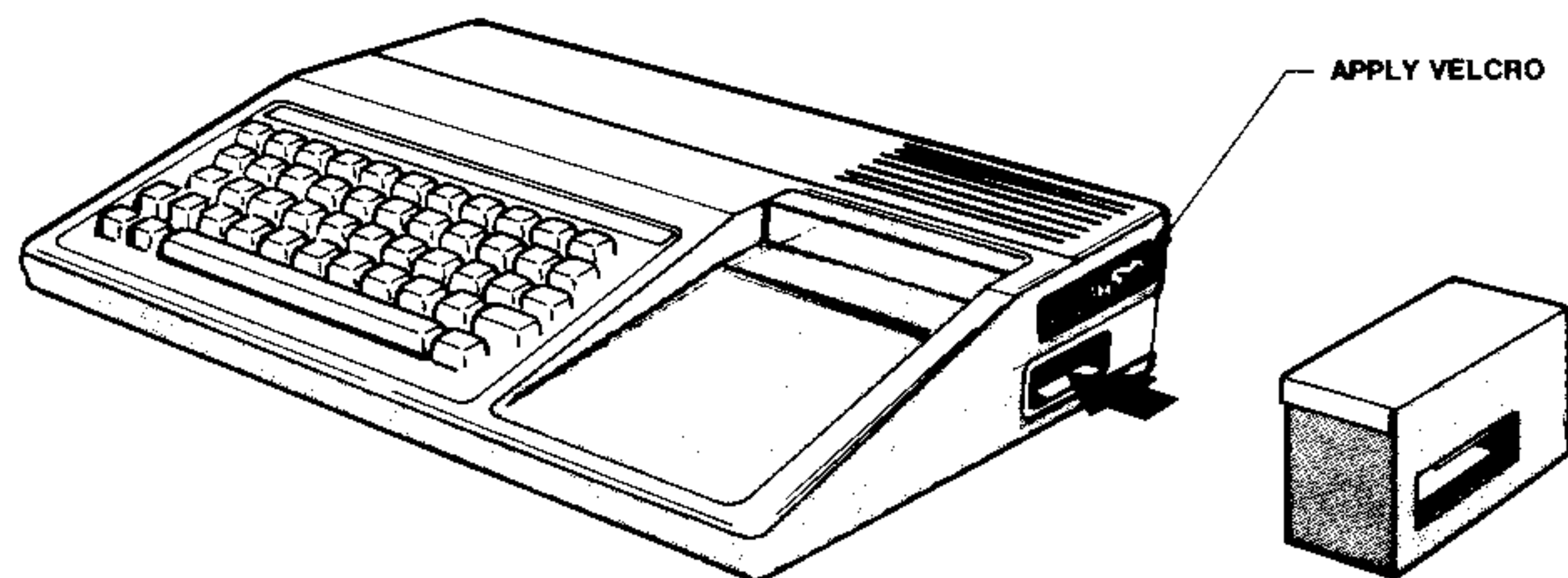
- To connect a standard 25 pin RS-232 cable to the unit simply align the side of the connector cable to match the angled sides of the unit's connector on the edge of the board and push together. See the printer or modem manual for the connection of the other end.
- To connect a parallel I/O cable first locate either the polarizing key or small raised triangle on the side of the cable's 16 pin "box" connector. This key or triangle should face the back of the module when inserted.

CAUTION: Reversal of this connector may cause damage to either the unit or the printer on the other side of the cable. Carefully check for proper alignment of this connector. Also **VERIFY** that the cable you use has the proper connections for the printer being connected.

- For connection of the other end of the cable refer to the manual for the printer.
- When the system is configured, power-up should be performed in the following sequence.
 1. Turn printer on in deselected mode
 2. Turn on any other peripheral equipment
 3. Plug in the module's transformer

NOTE: When not in use the transformer should be removed from the outlet.

 4. Turn on monitor or TV
 5. Turn on console



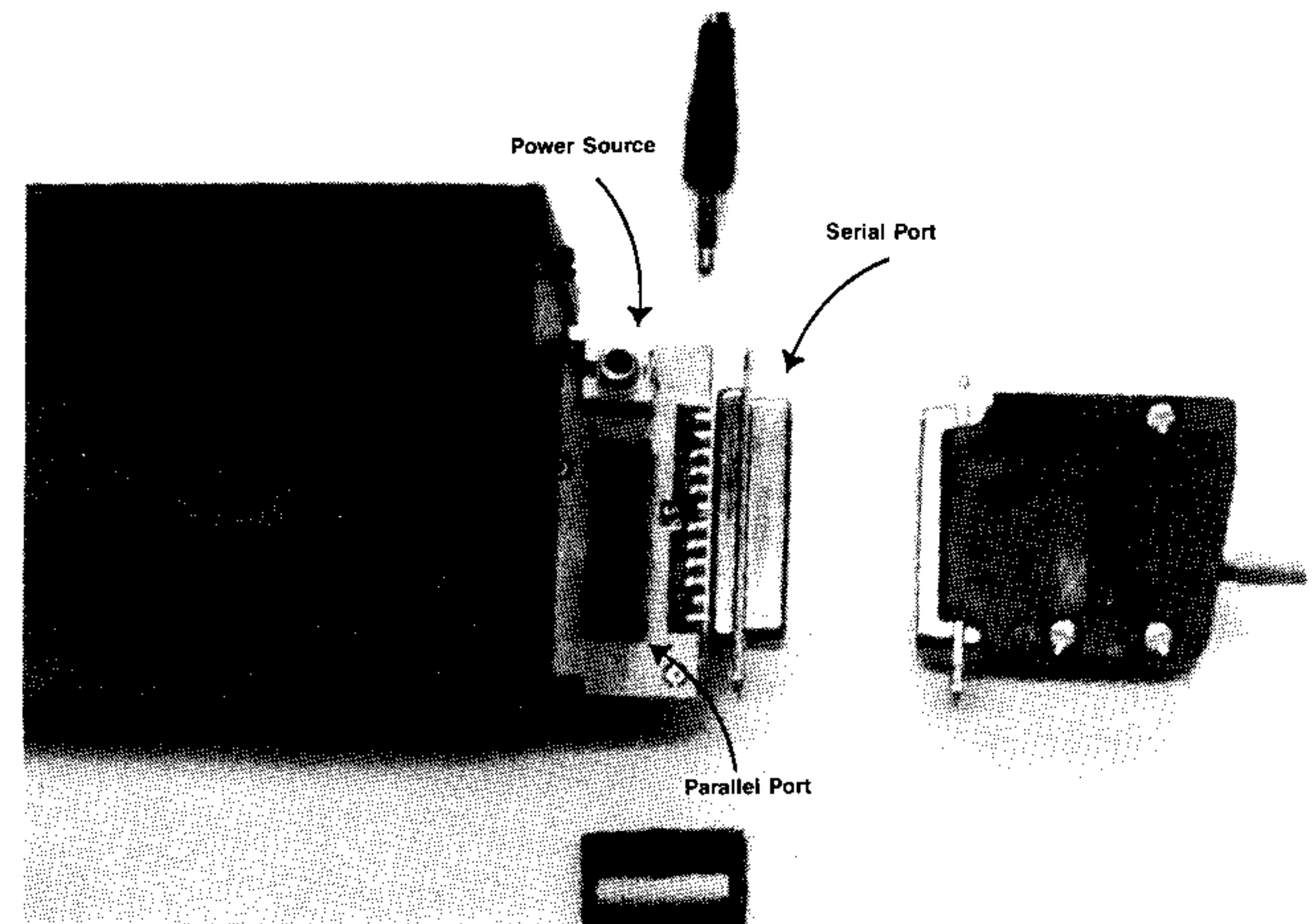
4.

REMOVING THE COMMUNICATIONS INTERFACE MODULE

To remove your Communication Interface Module **CAREFULLY READ** and **FOLLOW** these next steps.

CAUTION: The electronic components in the module can be damaged by **STATIC ELECTRICITY**. To avoid the possibility of such damage **AVOID TOUCHING** the connector contacts on either side of the unit.

- Turn the power **OFF** to the appropriate devices in the reverse sequence than in the installation section, after the printer has been deselected.
- Disconnect the Communications unit's transformer from the wall outlet.
- Remove any cabling that is not required.
- Disconnect any expansion units or peripherals to the right of the module.
- Carefully remove the Communication unit by using a slight rocking motion as you pull the module away from the console.
- If desired the other peripherals may be re-added to re-configure the system.



5.

PROGRAMMING AND SET UP

In order to compensate for the various manufacturers' specifications for printers, modems, and terminal interfaces, user software programmable "switches" have been provided to insure the proper operation of either port with your printer or other equipment. The User should first review the manual for the device to be used and derive the parameters required for its proper operation. The software switch options are detailed on the next page. Also in Appendix C is a handy reference card. The Software Switch options are described as follows:

BAUD RATE: (Bits Per Second) The rate at which serial data is transmitted and received. Parallel data transfer is measured by characters per second (CPS) and is limited by the "handshaking" speed of the printer or terminal.

DATA BITS: (7 or 8) Number of bits per character that are transmitted or received.

PARITY: (Odd, Even, None) Addition of a check bit to do a first level check on single bit transmission or reception errors. If enabled will generate an error code (if errors are detected).

STOP BITS: (one bit is the default value, .TW is for two bits) Additional bits are added at the end of a character transmission to tell the receiver that this is the end of this transmission.

CHECK PARITY: Checks the bit transmission for possible errors and allows these to be flagged to the operator.

NULLS: Use of the .NU parameter causes six (6) null characters to be transmitted after each carriage return. This allows time for the printer's mechanism to fully return before starting to print the next line.

ECHO OFF: Use of the .EC parameter inhibits retransmission of each character received at the sending device. This can also be used to allow a remote terminal to edit the data before the computer receives it.

CARRIAGE RETURN and LINEFEED OFF: Use of .CR will inhibit the automatic transmission of a carriage return and linefeed code at the end of each variable length display type record. If disabled, also forces Nulls and Linefeed to be disabled.

COMMUNICATIONS INTERFACE PROGRAMMING GUIDE SOFTWARE SWITCH OPTIONS

OPTION	PARAMETERS	ENTER	DEFAULT*
BAUD RATE	110,300,600,1200, 2400,4800 9600	.BA = PARAMETER	.BA = 300
DATA BITS	7 or 8	.DA = PARAMETER	.DA = 7
PARITY	ODD, EVEN, NONE	.PA = 0 (or E or N)	.PA = 0
CHECK PARITY	-	.CH	No parity checked
NULLS	-	.NU	No nulls
TWO STOP BITS	-	.TW	One stop bit
CRLF OFF	-	.CR	Carriage return supplied
LF OFF	-	.LF	Line Feed Supplied
ECHO OFF	-	.EC	Echo on

*Default value is selected if not specified in OPEN or LIST statement.

*Default for OLD/SAVE commands is .BA = 300, one stop bit; rest are not allowed.

NOTE: For parallel I/O, only nulls, echo off, CRLF, and LF off are applicable.

TYPICAL EXAMPLES:

RS232 Serial Interface
 OPEN #1: "RS232 .BA = 1200 TW.PA = E"
 SAVE "RS232/1.DA = 8.CH.PA = E"
 LIST "RS232"

PARALLEL I/O INTERFACE
 OPEN #2 "PIO/1.NU"
 LIST "PIO"
 OLD "PIO/1"

PROGRAMMING AND SET UP Con't.

LINEFEED OFF: Use of .LF will act like the .CR except that the carriage return will still be transmitted.

All of the above switch options are usable on the serial RS232 interface. Only NULLS, ECHO OFF, CARRIAGE RETURN/LINEFEED OFF and LINEFEED OFF are applicable for the parallel input/output port.

All switch options must be specified via the OPEN, LIST, OLD and SAVE statements. Statements such as CLOSE, INPUT, and PRINT operate on files or devices which have been previously specified and opened.

For simplicity, a commonly used set of default values have been assumed so that it is only necessary to specify the switches that are to be changed from the default values.

PROGRAM STATEMENTS:

The principle statements which are used with the Communications Interface Module are the following:

OPEN	PRINT	SAVE	LIST
CLOSE	INPUT	OLD	

The user is referred to the "TI 99/4A User's Reference Manual" for a thorough discussion of each of these statements, as well as examples of their use.

Device Names

The two ports on the Communications Interface Module can be called various names to differentiate their function as well as position in the system. The Serial Port can be either RS232 or RS232/1, and the parallel port likewise PIO or PIO/1. By special order, a unit can be addressed as RS232/2 and PIO/2 such that adding this unit to your system with a standard module will give you two serial ports and two parallel ports. Each having a separate device name.

GENERAL OPERATING CONSIDERATIONS:

- Do not connect or disconnect the communications interface module while power is applied to the console, printer or the module itself. This action may cause the printer or console to "Lock Up", requiring restart of the appropriate device.
- To stop printer activity, port communications or any similar task in process, hold down the FCTN key and press the #4 key to generate a clear/halt action via an induced Input/Output error.
- The TI99/4A generates both a CR (carriage return) and LF (linefeed) at the end of each line. This action may cause double spacing of printed material. Use of the .LF option will eliminate the double spacing.
- To send control codes to the printer or terminal the BASIC function CHR\$(xx), where xx = hexadecimal value, can be used to create the control codes. This statement allows codes to be generated and sent within a program.

TESTING AND VERIFICATION OF PROPER OPERATION

Your communication Interface Module has been pre-tested for proper operation before shipment. Operation can be verified to certain limits by executing the following examples:

Example #1: Open and close the RS-232 port

```
> OPEN #1: "RS-232.BA=1200.NU.TW"  
(return)  
> (Done) Valid response. If error code or  
other message comes up refer to  
appropriate section on error codes  
or in case of difficulty:  
> CLOSE #1 (enter)  
> (Done)
```

Example #2: Open and close the parallel input/output port

```
> OPEN #3: "PIO" (enter)  
> (Done)  
> CLOSE #3 (enter)  
> (Done)
```

Printing Example:

```
10 OPEN #1: "RS232" (add software switches  
where required)  
20 PRINT #1: "THIS IS A TEST!"  
30 CLOSE #1  
40 END  
> RUN (enter)
```

THIS IS A TEST!

IN CASE OF DIFFICULTY:

If the Communications Interface Module does not appear to be operating properly, please check the following items:

- Verify Home Computer operation without unit connected.
- Insure that the module is to the left of the speech synthesizer.
- Check both the connections and cabling for the proper cable and a good secure connection.
- Verify printer switch settings are what you want; and that they match the software switch options settings.
- Insure that the wall transformer is plugged into a "live" wall outlet.
- Check to see if system is "locked up" by restarting over.
- If a test mode is available on the printer, terminal or modem, try to verify that it performs properly.
- Insure that the proper printer or modem cable is used as some devices may require a special cable.
- Perform the test indicated in the Testing and Verification section.
- Be sure if a special cartridge is required for your application, that it is properly seated in the slot.

If none of the above corrections work, refer to the Warranty and Service section below.

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I. CUSTOMER OBLIGATIONS

A. CUSTOMER assumes full responsibility that the Boxcar Peripherals 32K Ram Memory Unit meets the specifications, capacity, capabilities, versatility, and other requirements desired by CUSTOMER.

B. CUSTOMER assumes full responsibility for the overall effectiveness and efficiency of the operating environment in which the Equipment is to function and full responsibility for its installation.

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D. No action arising out of any claimed breach of this AGREEMENT or transaction under this AGREEMENT may be brought more than one (1) year after the cause of action has accrued or more than two (2) years after the date of delivery of the Equipment, whichever first occurs.

E. Notwithstanding the limitations and warranties provided in this agreement, Microdistributors International, Inc.'s liability hereunder for damages incurred by Customer or others shall not exceed the amount paid by Customer for the particular equipment involved.

APPENDIX A - Error Codes

Listed below are the error codes related to the operation of TI BASIC* statements that use the communications interface module.

STATEMENT	CODE	DESCRIPTION
OPEN	00	Device cannot be opened.
	02	The software switch option entry is in error; such as incorrect first two characters of an option, invalid BAUD rate, incorrect number of data bits, or well as RELATIVE record type specified in the OPEN statement.
	06	A hardware error occurred and the device cannot be opened.
INPUT	24	INTERNAL data type record is too large to be read into the buffer space allocated.
	26	A hardware error occurred. Also caused by pressing CLEAR to stop the reception of a pending or an in progress operation.
PRINT	36	Same as code 26
OLD	50	Program cannot be loaded.
	52	Illegal use of .EC, .CR, .LF, .NU, or .DA switch option with OLD statement. Also see code 02.
	54	Program is too large to load.
	56	Same as code 26
SAVE	60	Program cannot be saved.
	62	Use of .EC, .CR, .LF, .NU, or .DA switch option with SAVE statement. Also see code 02.
	66	Same as code 26
ADDITIONAL Error Codes	43, 73, 83, 93	Executing an illegal command

APPENDIX B - Cable Diagrams

Cables used to connect to other computers, modems, or terminals/printers to the RS232 port must use EIA RS232C 25-pin male connectors. The serial I/O port pins are defined as follows:

PIN #	MNEMONIC	OUTPUT/INPUT	FUNCTION
1	—	Ground	Protective ground
2	RD	Input	Serial data in
3	TX	Output	Serial data out
5	CTS	Output	Clear to send
6	DSR	Output	Data set ready (pull up resistor to +5v)
7	—	Ground	Logic or signal ground
8	DCD	Output	Data carrier detect
20	DTR	Input	Data terminal ready

Other pins are not connected.

Pins listed above are required in either one or both of the cables diagrammed below. All unlisted pins need not be wired. It does not matter which end of the cable you plug into the RS232 Communications Interface or the device. Be sure both ends are wired as follow:

WIRING for Connecting Two Home Computers by Direct Cables or Modems

RS232	Computer/Modem
1	1
2	3
3	2
6	20
7	7
20	6

APPENDIX B Cont.

WIRING for Terminals

RS232	Terminal
1	1
2	2
3	3
5*	5
6*	6
7	7
8*	8
20	20

*Not required for proper operation of the RS232 Communications Interface, but may be required for proper operation of accessory devices.

Wiring for printers should be derived from close examination of the requirements of the specific printer type used.

The pins for the parallel I/O port are defined as follows:

PIN#	FUNCTION
1	Handshake OUT
2	Data, LSB
3	Data
4	Data
5	Data
6	Data
7	Data
8	Data
9	Data, MSB
10	Handshake IN
11	Logic ground
12	Not connected
13	Not connected
14	Not connected
15	Not connected
16	Logic ground