CyberResearch®

Serial Communications

COMHP 7804

Universal PCI 8-Port RS-232/422/485 Serial Interface Card, 921.6 kbps Data Rate, 128-Byte FIFO Buffer, with 8 DB-9M Connectors on Included Cable (for 3.3 or 5V slots)

USER'S MANUAL

VER. F • 2003

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Contents

Introduction

Overview

The CyberResearch **COMHP 7804** is an eight channel RS-232/485/422 PCI Bus serial I/O adapter supporting data rates up to 921.6Kbps.

The RS-232 compatibility allows for connection to devices utilizing the RS-232 electrical interface, such as modems, data-entry terminals, and plotters.

RS-422 provides excellent communications for long distance device connections up to 4000ft., where noise immunity and high data integrity are essential.

RS-485 is optimized for 'Multi-Drop' or 'Party-line' operations selecting data from multiple peripherals (as many as 31 devices can be connected on an RS-485 bus).

In both RS-485 and RS-422 modes, the card works seamlessly with the standard operating system serial driver. In RS-485 mode, our special auto-enable feature allows the RS-485 ports to be viewed by the operating system as a COM: port. This allows the standard COM: driver to be utilized for RS-485 communications. Our on-board hardware automatically handles the RS-485 driver enable.

The **COMHP 7804** also features Universal Bus (3.3 and 5.0V) operation.

What is Included

The **COMHP 7804** is shipped with the following items. If any of these items is missing or damaged, contact CyberResearch.

- **COMHP 7804** Serial I/O Adapter
- Software CD

Card Setup

Address and IRQ selection

The **COMHP 7804** is automatically assigned I/O addresses and IRQs by your motherboard BIOS or by a 'Plug-n-Play' Operating System. Adding or removing other hardware or moving the adapter to another slot may change the assignment of I/O addresses and IRQs.

Clock Modes

The **COMHP 7804** employs a unique clocking option that allows the end user to select from divide by 8 and divide by 1 clocking modes. This mode is selected at S9.

To select the Baud rates commonly associated with COM: ports (i.e. 2400, 4800, 9600, 19.2,…115.2K Bps) place the switch to the divide by 8 (Silkscreen - D8). In this mode the standard 14.7456 MHz oscillator is divided by 8 resulting in 1.8432Mhz, which provides standard COM: port frequencies.

To select the higher data rates place the switch to the divide by 1 (Silkscreen – D1). In this position all data rates are 8 times the configured rate.

Baud Rates and Oscillator value

The following table shows some common data rates and the rates you should choose to achieve them when using the **COMHP 7804** in the D1 mode. If the O/S of choice is Windows 95/98/ME/2000/NT/XP, the oscillator value (14.7456 MHz) should entered into the 'Advanced Tab' on 95/98/Me/2000/XP Device Manager applet. When using Windows NT, the 'Advanced Ports' applet in the Control Panel should be launched and the oscillator value may be entered in the 'Advanced' tab. When using any other OS (i.e. Linux, or QNX) the following tables should be used.

For this Data Rate	Choose this Data Rate
1200 bps	150 bps
2400 bps	300 bps
4800 bps	600 bps
9600 bps	1200 bps
19.2K bps	2400 bps
57.6 K bps	4800 bps
115.2 K bps	14.4K bps
230.4K bps	28.8K bps
460.8K bps	57.6 K bps
921.6K bps	115.2 K bps

If your communications package allows the use of Baud rate divisors, choose the appropriate divisor from the following table:

For this Data Rate	Choose this Divisor
1200 bps	768
2400 bps	384
4800 bps	192
9600 bps	96
19.2K bps	48
38.4K bps	24
57.6K bps	12
115.2K bps	8
230.4K bps	4
460.8K bps	2
921.6K bps	1

Electrical Interface Selection

Each of the eight ports on the **COMHP 7804** can be individually configured as an RS-232, RS-422, or RS-485 interface. This is selectable via the port DIP-switch, each is labeled with its port number (i.e. S1 = Port1, S2 = Port2 etc.)

Switch 1 (Silk M0)	Switch 2 (Silk M1)	Mode Select
OFF	OFF	232
OFF	ON	422
ON	OFF	485 With Echo
ON	ON	458 No Echo

Line Termination

Typically, each end of the RS-485 bus must have line-terminating resistors (RS-422 terminates at the receive end only). A 120-ohm resistor is across each RS-422/485 input in addition to a 1K-ohm pull-up/pull-down combination that biases the receiver inputs. Switch SW1 allows customization of this interface to specific requirements. Each switch position corresponds to a specific portion of the interface. If multiple **COMHP 7804** adapters are configured in an RS-485 network, only the boards on each end should have switches T, P & P **ON.** Refer to the following table for each position's operation:

Switch	Name	Function
3	T	Adds or removes the 120 ohm termination.
4	PU	Adds or removes the 1K ohm pull-up resistor in the RS-422/RS-485 receiver circuit
5	PD	Adds or removes the 1K ohm pull-down resistor in the RS-422/RS-485 receiver circuit
6	L	Connects the TX- to RX- for RS-485 two-wire operation.
7	L	Connects the TX+ to RX+ for RS-485 two-wire operation.

RS-485 'Echo'

The RS-485 'Echo' is the result of connecting the receiver inputs to the transmitter outputs. Every time a character is transmitted; it is also received. This can be beneficial if the software can handle echoing (i.e. using received characters to throttle the transmitter) or it can confuse the system if the software does not. An RS-485 'No Echo' option is selected by placing both Mode switches (M0, M1) in the 'On' position.
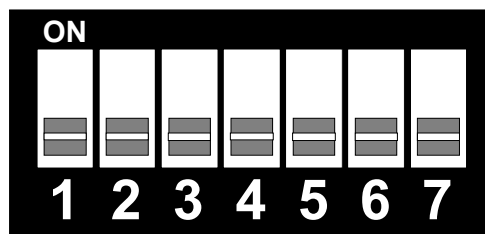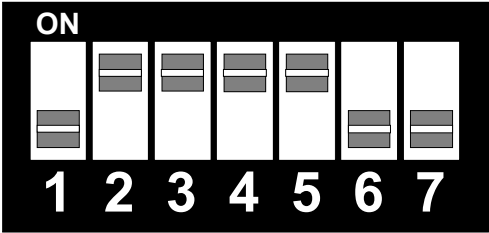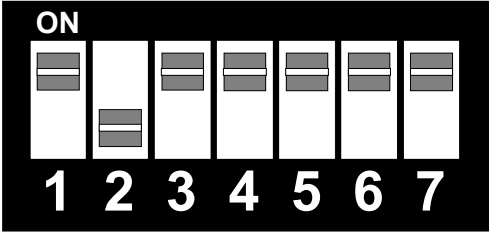

Figure 1 - RS-232 Mode
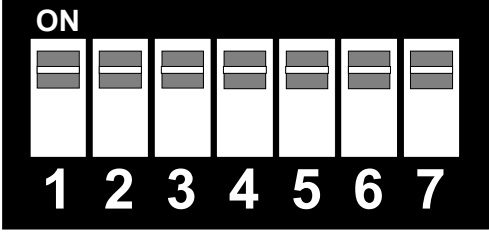
Figure 2 - RS-422 Mode

Figure 3 - RS-485 with 'Echo'

Figure 4 - RS-485 No 'Echo'

Installation

Operating System Installation

Windows 95/98/ME/NT/2000/XP

Do not install the Adapter in the machine until the software has been fully installed.

1. Start Windows.

2. Insert the CD in to your CD drive.

3. If 'Auto-Start' is enabled for this drive the software will automatically launch. Otherwise, point your browser to the 'Index.htm' on the root of the CD

4. Select 'Install Software'.

5. Select the part number for your adapter from the listing.

6. Select 'Windows 95/98/ME/NT/2000/XP' then (depending on the OS version) select the 'Run from the current location' or 'Open' option. Follow the information presented on the screens that follow.

Physical Installation

The adapter can be installed in any PCI (5V or 3.3 V) expansion slot.

Do not install the Adapter in the machine until the software has been fully installed.

1. **Turn off PC power. Disconnect the power cord.**

2. Remove the PC case cover.

3. Locate an available PCI slot and remove the blank metal slot cover.

4. Gently insert the PCI adapter into the slot. Make sure that the adapter is seated properly.

5. Replace the screw. (This is required to ensure FCC Part 15 compliance.)

6. Replace the cover.

7. Install the cable (if applicable)

8. Connect the power cord

Installation is finished.

Technical Description

The **COMHP 7804** provides eight RS-232/422/485 ports from a single PCI slot. The **COMHP 7804** also features Universal Bus (3.3 and 5.0V) operation.

The **COMHP 7804** utilizes the 16C864 UART. This chip features programmable baud rates, data format, interrupt control and industry leading 128-byte transmit and receive FIFOs.

RS-422/485 (DB-9) Connector Pin Assignments

Signal	Name	Pin #	Mode
GND	Ground	5	
TX +	Transmit Data Positive	4	Output
TX-	Transmit Data Negative	3	Output
RTS+	Request To Send Positive	6	Output
RTS-	Request To Send Negative	7	Output
RX+	Receive Data Positive	1	Input
RX-	Receive Data Negative	2	Input
CTS+	Clear To Send Positive	9	Input
CTS-	Clear To Send Negative	8	Input

RS-232 (DB-9) Connector Pin Assignments

Signal	Name	Pin #	Mode
GND	Ground	5	
TD	Transmit Data	3	Output
RTS	Request To Send	7	Output
DTR	Data Terminal Ready	4	Output
RD	Receive Data	2	Input
CTS	Clear To Send	8	Input
DSR	Data Set Ready	6	Input
DCD	Data Carrier Detect	1	Input
RI	Ring Indicator	9	Input

Technical Note: Please terminate any control signals that are not going to be used. The most common way to do this is connect RTS to CTS and RI. Also, connect DCD to DTR and DSR. Terminating these pins, if not used, will help ensure you get the best performance from your adapter.

RS-232/422/485 (DB-78)

	Port #	1	2	3	4	5	6	7	8
RS-422/485	**RS-232**								
TX-	TD	36	12	27	3	75	51	66	42
RX-	RD	37	11	28	2	76	50	67	41
RTS-	RTS	17	31	8	22	56	70	47	61
CTS-	CTS	16	32	7	23	55	71	46	62
TX+	DTR	35	13	26	4	74	52	65	43
RTS+	DSR	18	30	9	21	57	69	48	60
RX+	DCD	38	10	29	1	77	49	68	40
CTS+	RI	15	33	6	24	54	72	45	63
GND	GND	34	14	25	5	73	53	64	44

Specifications

Environmental Specifications

Specification	Operating	Storage
Temperature Range	0º to 70º C (32º to 158º F)	-50º to 105º C (-58º to 221º F)
Humidity Range	10 to 90% R.H. Non-Condensing	10 to 90% R.H. Non-Condensing

Manufacturing

All Printed Circuit boards are built to UL 94V0 rating and are 100% electrically tested. These printed circuit boards are solder mask over bare copper or solder mask over tin nickel.

Power Consumption

Supply line	+3.3VDC	+5VDC	+12VDC	-12VDC
Rating	200 mA	400 mA	32 mA	30 mA

Physical Dimensions

Board length	6.5 inches	(16.51 cm.)
Board Height including Goldfingers	4.2 inches	(10.67 cm.)
Board Height excluding Goldfingers	3.875 inches	(9.84 cm.)

Appendix A - Troubleshooting

1. Identify all I/O adapters currently installed in your system. This includes your on-board serial ports, controller cards, sound cards etc. The I/O addresses used by these adapters, as well as the IRQ (if any) should be identified.

2. Configure your CyberResearch adapter so that there is no conflict with currently installed adapters. No two adapters can occupy the same I/O address.

3. Make sure the CyberResearch adapter is using a unique IRQ. While the CyberResearch adapter does allow the sharing of IRQs, many other adapters (i.e. SCSI adapters & on-board serial ports) <u>do not</u>. The IRQ is typically selected by the BIOS or operating system. Some BIOS setup software will allow changing the IRQ, but others do not. Another method of changing assigned resources is to try changing PCI slots. This will typically cause the BIOS or OS to reassign the resources.

4. Make sure the CyberResearch adapter is securely installed in a motherboard slot.

5. When running DOS or Windows 3.x refer to the supplied CyberResearch and this User Manual to verify that the CyberResearch adapter is configured correctly. This software contains a diagnostic program 'SSD' (D:\software\seacom\Other\DOS\DIAG, where D: = the driver letter of your CDROM drive) will verify if an adapter is configured properly. This diagnostic program is written with the user in mind and is easy to use. You can use D:\software\seacom\Other\DOS\PCI\FindPCI.exe to determine resources that have been assigned to your adapter. Make sure that if available, the 'Use Plug-n-Play" option is turned **'OFF'** in your BIOS. Having this option set to **'ON**' in DOS or Windows 3.x will cause erratic operations.

6. For Windows95/98/ME/NT/2000, the diagnostic tool 'WinSSD' is installed in the SeaCOM folder on the Start Menu during the setup process. First find the ports using the Device Manager, then use 'WinSSD' to verify that the ports are functional.

7. Always use the CyberResearch diagnostic software when troubleshooting a problem. This will eliminate any software issues from the equation.

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Appendix B - Electrical Interface

RS-232

Quite possibly the most widely used communication standard is RS-232. This implementation has been defined and revised several times and is often referred to as RS-232-C/D/E or EIA/TIA-232-C/D/E. It is defined as "*Interface between Data Terminal Equipment and Data Circuit- Terminating Equipment Employing Serial Binary Data Interchange*". The mechanical implementation of RS-232 is on a 25-pin D sub connector. The IBM PC computer defined the RS-232 port on a 9 pin D sub connector and subsequently the EIA/TIA approved this implementation as the EIA/TIA-574 standard. This standard has defined as the "*9-Position Non-Synchronous Interface between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange*". Both implementations are in wide spread use and will be referred to as RS-232 in this document. RS-232 is capable of operating at data rates up to 20K bps / 50 ft. The absolute maximum data rate may vary due to line conditions and cable lengths. RS-232 often operates at 38.4K bps over very short distances. The voltage levels defined by RS-232 range from -12 to +12 volts. RS-232 is a single ended or unbalanced interface, meaning that a single electrical signal is compared to a common signal (ground) to determine binary logic states. A voltage of +12 volts (usually +3 to +10 volts) represents a binary 0 (space) and -12 volts (-3 to -10 volts) denote a binary 1 (mark). The RS-232 and the EIA/TIA-574 specification define two types of interface circuits **D**ata **T**erminal **E**quipment (**DTE**) and **D**ata **C**ircuit-Terminating **E**quipment (**DCE***).* The CyberResearch adapter is a DTE interface.

RS-422

The RS-422 specification defines the electrical characteristics of balanced voltage digital interface circuits. RS-422 is a differential interface that defines voltage levels and driver/receiver electrical specifications. On a differential interface, logic levels are defined by the difference in voltage between a pair of outputs or inputs. In contrast, a single ended interface, for example RS-232, defines the logic levels as the difference in voltage between a single signal and a common ground connection. Differential interfaces are typically more immune to noise or voltage spikes that may occur on the communication lines. Differential interfaces also have greater drive capabilities that allow for longer cable lengths. RS-422 is rated up to 10 Megabits per second and can have cabling 4000 feet long. RS-422 also defines driver and receiver electrical characteristics that will allow 1 driver and up to 32 receivers on the line at once. RS-422 signal levels range from 0 to +5 volts. RS-422 does not define a physical connector.

RS-485

RS-485 is backwardly compatible with RS-422; however, it is optimized for party line or multi-drop applications. The output of the RS-422/485 driver is capable of being **Active** (enabled) or **Tri-State** (disabled). This capability allows multiple ports to be connected in a multi-drop bus and selectively polled. RS-485 allows cable lengths up to 4000 feet and data rates up to 10 Megabits per second. The signal levels for RS-485 are the same as those defined by RS-422. RS-485 has electrical characteristics that allow for 32 drivers and 32 receivers to be connected to one line. This interface is ideal for multi-drop or network environments. RS-485 tri-state driver (not dual-state) will allow the electrical presence of the driver to be removed from the line. Only one driver may be active at a time and the other driver(s) must be tri-stated. RS-485 can be cabled in two ways, two wire and four wire mode. Two-wire mode does not allow for full duplex communication, and requires that data be transferred in only one direction at a time. For half-duplex operation, the two transmit pins should be connected to the two receive pins (Tx+ to Rx+ and Tx- to Rx-). Four wire mode allows full duplex data transfers. RS-485 does not define a connector pin-out or a set of modem control signals. RS-485 does not define a physical connector.

Appendix C - Asynchronous Communications

Serial data communications implies that individual bits of a character are transmitted consecutively to a receiver that assembles the bits back into a character. Data rate, error checking, handshaking, and character framing (start/stop bits) are pre-defined and must correspond at both the transmitting and receiving ends.

Asynchronous communications is the standard means of serial data communication for PC compatibles and PS/2 computers. The original PC was equipped with a communication or COM: port that was designed around an 8250 Universal Asynchronous Receiver Transmitter (UART). This device allows asynchronous serial data to be transferred through a simple and straightforward programming interface. A starting bit followed by a pre-defined number of data bits (5, 6, 7, or 8) defines character boundaries for asynchronous communications. The end of the character is defined by the transmission of a pre-defined number of stop bits (usually 1, 1.5 or 2). An extra bit used for error detection is often appended before the stop bits.
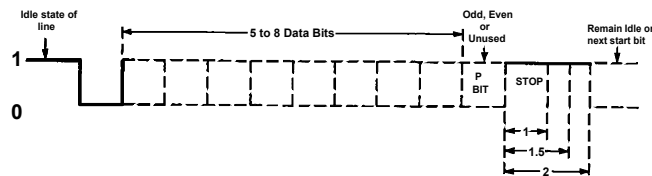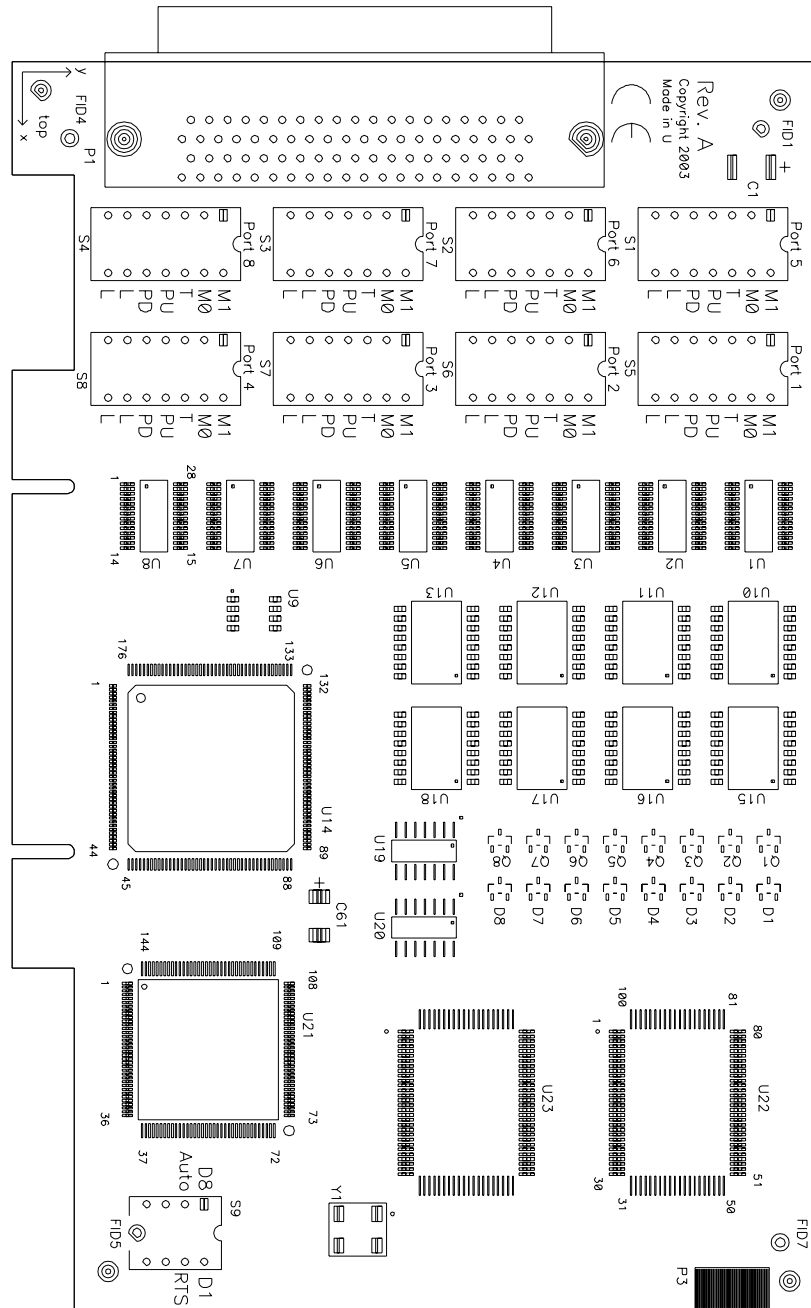

Figure 5 - Asynchronous Communications Bit Diagram

This special bit is called the parity bit. Parity is a simple method of determining if a data bit has been lost or corrupted during transmission. There are several methods for implementing a parity check to guard against data corruption. Common methods are called (E)ven Parity or (O)dd Parity. Sometimes parity is not used to detect errors on the data stream. This is refereed to as (N)o parity. Because each bit in asynchronous communications is sent consecutively, it is easy to generalize asynchronous communications by stating that each character is wrapped (framed) by pre-defined bits to mark the beginning and end of the serial transmission of the character. The data rate and communication parameters for asynchronous communications have to be the same at both the transmitting and receiving ends. The communication parameters are baud rate, parity, number of data bits per character, and stop bits (i.e. 9600,N,8,1).

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Appendix D - Silk-Screen

Appendix E - Compliance Notices

Federal Communications Commission Statement

FCC - This equipment has been tested and found to comply with the limits for Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in such case the user will be required to correct the interference at the users expense.

EMC Directive Statement

Products bearing the CE Label fulfill the requirements of the EMC directive (89/336/EEC) and of the low-voltage directive (73/23/EEC) issued by the European Commission.

To obey these directives, the following European standards must be met:

EN55022 Class A - "Limits and methods of measurement of radio interference characteristics of information technology equipment"

EN55024 – "Information technology equipment Immunity characteristics Limits and methods of measurement".

EN60950 (IEC950) - "Safety of information technology equipment, including electrical business equipment"

Warning
This is a Class A Product. In a domestic environment, this product may cause radio interference in which case the user may be required to take adequate measures to prevent or correct the interference.

Always use cabling provided with this product if possible. If no cable is provided or if an alternate cable is required, use high quality shielded cabling to maintain compliance with FCC/EMC directives.

Product Service

Diagnosis and Debug

CyberResearch, Inc. maintains technical support lines staffed by experienced Applications Engineers and Technicians. There is no charge to call and we will return your call promptly if it is received while our lines are busy. Most problems encountered with data acquisition products can be solved over the phone. Signal connections and programming are the two most common sources of difficulty. CyberResearch support personnel can help you solve these problems, especially if you are prepared for the call.

To ensure your call's overall success and expediency:

1)   Have the phone close to the PC so you can conveniently and quickly take action that the Applications Engineer might suggest.
2)   Be prepared to open your PC, remove boards, report back-switch or jumper settings, and possibly change settings before reinstalling the modules.
3)   Have a volt meter handy to take measurements of the signals you are trying to measure as well as the signals on the board, module, or power supply.
4)   Isolate problem areas that are not working as you expected.
5)   Have the source code to the program you are having trouble with available so that preceding and prerequisite modes can be referenced and discussed.
6)   Have the manual at hand. Also have the product's utility disks and any other relevant disks nearby so programs and version numbers can be checked.

Preparation will facilitate the diagnosis procedure, save you time, and avoid repeated calls. Here are a few preliminary actions you can take before you call which may solve some of the more common problems:

1)   Check the PC-bus power and any power supply signals.
2)   Check the voltage level of the signal between SIGNAL HIGH and SIGNAL LOW, or SIGNAL+ and SIGNAL– . It CANNOT exceed the full scale range of the board.
3)   Check the other boards in your PC or modules on the network for address and interrupt conflicts.
4)   Refer to the example programs as a baseline for comparing code.

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Warranty Notice

CyberResearch, Inc. warrants that this equipment as furnished will be free from defects in material and workmanship for a period of one year from the confirmed date of purchase by the original buyer and that upon written notice of any such defect, CyberResearch, Inc. will, at its option, repair or replace the defective item under the terms of this warranty, subject to the provisions and specific exclusions listed herein.

This warranty shall not apply to equipment that has been previously repaired or altered outside our plant in any way which may, in the judgment of the manufacturer, affect its reliability. Nor will it apply if the equipment has been used in a manner exceeding or inconsistent with its specifications or if the serial number has been removed.

CyberResearch, Inc. does not assume any liability for consequential damages as a result from our products uses, and in any event our liability shall not exceed the original selling price of the equipment.

The equipment warranty shall constitute the sole and exclusive remedy of any Buyer of Seller equipment and the sole and exclusive liability of the Seller, its successors or assigns, in connection with equipment purchased and in lieu of all other warranties expressed implied or statutory, including, but not limited to, any implied warranty of merchant ability or fitness and all other obligations or liabilities of seller, its successors or assigns.

The equipment must be returned postage prepaid. Package it securely and insure it. You will be charged for parts and labor if the warranty period has expired.

Returns and RMAs

If a CyberResearch product has been diagnosed as being non-functional, is visibly damaged, or must be returned for any other reason, please call for an assigned RMA number. The RMA number is a key piece of information that lets us track and process returned merchandise with the fastest possible turnaround time.

PLEASE CALL FOR AN RMA NUMBER!

Packages returned without an RMA number will be refused!

In most cases, a returned package will be refused at the receiving dock if its contents are not known. The RMA number allows us to reference the history of returned products and determine if they are meeting your application's requirements. When you call customer service for your RMA number, you will be asked to provide information about the product you are returning, your address, and a contact person at your organization.

Please make sure that the RMA number is prominently displayed on the outside of the box.

• Thank You •

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