Serial/Communications

USBS 2401-I

One-Port Isolated USB-Bus Serial Communication Converter with 921.6 kbps Data Rate, ASIC Chip and 6-ft USB Cable

USER'S MANUAL

VER. C • 2002

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Introduction

Overview

The CyberResearch **USBS 2401-I** equips the PC with 1 isolated USB to RS-422/485 Asynchronous serial port providing a versatile interface for common RS-422/485 needs. The **USBS 2401-I** connects through the PC's external USB port, so it does not require opening the computer case. Resources such as IRQ's and I/O addresses are also not utilized. It does require a system that supports USB in hardware and operating system.

What's Included

The **USBS 2401-I** is shipped with the following items. If any of these items is missing or damaged, contact the supplier.

- **USBS 2401-I** Isolated USB to RS-422/485 Serial I/O Adapter
- USB Cable Part Number CA179 for Connecting to Upstream Host/Hub
- Sealevel Software

Installation

Operating System Installation

Please note that you should install the software before the hardware.

Choose **Install Software** at the beginning of the CD and select the **Serial I/O** software drivers and install **SeaCOM**.

System Installation

The screen captures below are taken from a Windows 98 installation. Your particular operating system may differ slightly from what is shown based on your version of windows.

The **USBS 2401-I** can be connected to any Upstream Type "A" port either at the PC host or an Upstream Hub. The **USBS 2401-I** is hot-pluggable, meaning there is no need to power down your computer prior to installation. The **USBS 2401-I** has an onboard 8 position dip switch that is used to configure the interface. Prior to connecting the **USBS 2401-I** be sure to configure this dip switch for your specific application. Please see the Configuration section for more information. The **USBS 2401-I** is defaulted to RS-422 mode so changes are only required if you will be using the product in an RS-485 application.

1. After installing the software connect **USBS 2401-I** to an Upstream Host or Hub.

   A "New Hardware Found," dialog box will appear. This indicates that the system has recognized the new device and will now proceed to locate a driver.

Since you have already installed the software by running "Setup", simply click "Next" to proceed. The drivers that were installed during setup will automatically be used to configure the adapter for use.

Windows has now located a driver and installed the software. After the driver has been located click "Finish. You should see one more "New Hardware Found", indicating the actual port being created. If you view your systems Device Manager at this point, you should have a new "COM" port in the Port(COM & LPT) Device Class. It should look similar to the screen shot on the following page.
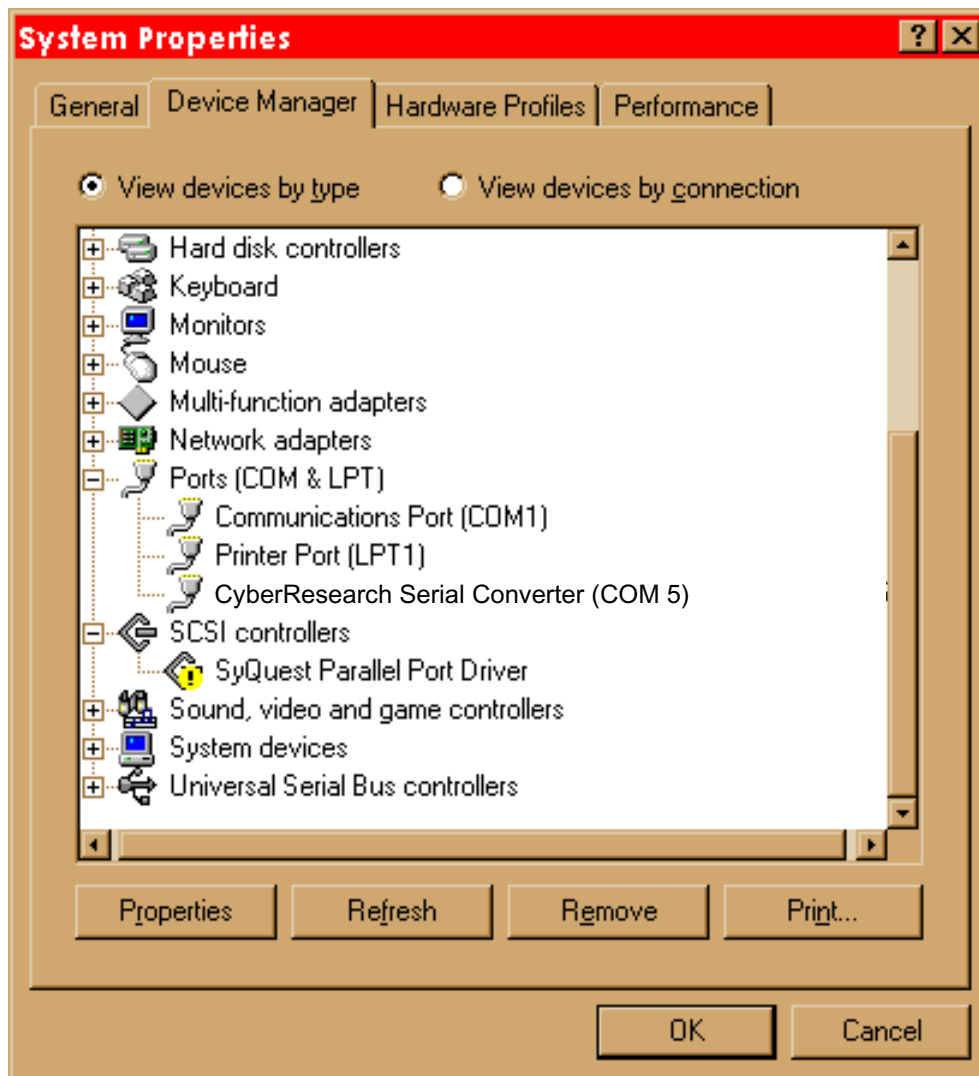
You can access your new COM: port by using the assigned COM: identifier shown above. In this case, it is COM5: but this assignment will vary from system to system. At this point, the hardware is recognized. To verify operation use CyberResearch supplied WinSSD diagnostic utility. WinSSD can be found in the Start menu under Programs, SeaCOM group.

Configuration

Electrical Interface Selection

The port on the **USBS 2401-I** has the ability to be used in both half and full duplex RS-422/485 applications. This is selectable through DIP-switch SW1. The chart below describes each of the switch position's function. Please refer to the following page for switch setting examples. Switch SW1, in the "ON" position, either enables, adds or connects, based on the function of the switch position listed below. Switch SW1, position OFF, disables, removes or disconnects .

SW1	Function
1	**RS-485 Two Wire Auto Enable/Disable**
2	**Echo Enable/Disable**
3	**Adds or removes the 120 ohm termination**
4	**Adds or removes the 1K ohm pull-up resistor in the RS-422/RS-485 receiver circuit (Receive data only)**
5	**Adds or removes the 1K ohm pull-down resistor in the RS-422/RS-485 receiver circuit (Receive data only)**
6	**Connects the TX+ to RX+ for RS-485 two wire operation**
7	**Connects the TX- to RX- for RS-485 two wire operation**
8	**Not Used**

Switch Examples

Please use the following examples to configure your adapter.
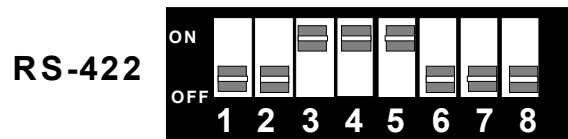
RS-422

Figure 1- RS-422, 4 Wire RS-485 (Default)
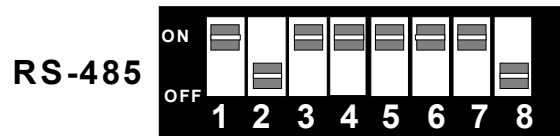
RS-485

Figure 2 - RS-485, 2 Wire with Echo
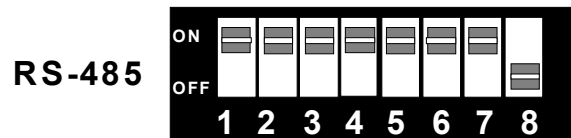
RS-485

Figure 3 - RS-485, 2 Wire No Echo

Technical Description

The **USBS 2401-I:** utilizes a USB UART. This chip features programmable baud rate, data format, 128 byte Dual Port TX Buffer, and 384 byte Dual Port RX Buffer. The RS-422/485 transceiver supports data rates up to 921.6K baud.

Features

- Hot-Pluggable device

- Does not require opening the case

- No system resources are required (i.e. I/O ports or IRQ's)

- LED status indicators for "USB Enabled", "TD", and "RD"

Connector Pin Assignments (DB25 Male)

The **USBS 2401-I** complies with the **EIA-530** pin out with the following signals supported

Signal		Name	Pin #	Mode
GND		Ground	7	
RDB	RX+	Receive Positive	16	Input
RDA	RX-	Receive Negative	3	Input
TDB	TX+	Transmit Positive	14	Output
TDA	TX-	Transmit Negative	2	Output

*Technical Note: **The modem control signals are biased as follows : RTS is connected to CTS, DTR is connected to DCD and DSR, and RI is tied inactive**.*

Specifications

Environmental Specifications

Specification	Operating	Storage
Temperature Range	0º to 50º C (32º to 122º F)	-20º to 70º C (-4º to 158º F)
Humidity Range	10 to 90% R.H. Non-Condensing	10 to 90% R.H. Non-Condensing

Manufacturing

- All CyberResearch 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	+5 VDC		
Rating	100 mA		

Mean Time Between Failures (MTBF)

Greater than 150,000 hours. (Calculated)

Physical Dimensions

Package Length	3.8 inches	(9.66 cm)
Package Width	2.3 inches	(5.84 cm)
Package Height	1.0 inches	(2.54 cm)

Appendix A - Troubleshooting

Serial Utility test software is supplied with the CyberResearch adapter and should be used in the troubleshooting procedures. Using this software and following these steps, most common problems can be eliminated.

1. If your adapter isn't working, first check to make sure that USB support is enabled in the System BIOS and it is functioning properly in the operating system. This can be done by using either the Windows 98/ME or Windows 2000 Device Manager.

2. Ensure that the CyberResearch software has been installed on the machine so that the necessary files are in place to complete the installation.

3. When the **USBS 2401-I** is configured properly, the USB Enabled LED (EN) will be lit. This should allow you to use Sealevel's WinSSD utility and the supplied loopback plug to check communications. The supplied loopback plug connects TD to RD. If you decide to test the Modem Control Signals, a full pin loopback plug will be required. Details on loopback plugs are included on WinSSD. Contact CyberResearch if you need further assistance

4. When testing the **USBS 2401-I** in loopback mode, you should see both the TD and RD LED"s flashing as well as seeing echoed data on the screen. The loopback test first transmits a HEX pattern, 55AA, and then an ASCII string of data. If this test passes, then the **USBS 2401-I** is ready for use in your application.

5. Please note that if the card is configured for 2 wire RS-485 with no echo a loopback test is not possible. The receiver in this case will be turned off and the test will fail. If you plan on using this device in two wire mode test the adapter in RS-422 mode first. Then configure the adapter for your application.

Appendix B - Electrical 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 partyline 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 - Ground Loop Phenomenon

What is Ground Loop?

Ground loop Phenomenon occurs when two (or more) pieces of equipment are connected together with a common ground and a different ground potential exists at each location. This current can cause the connected equipment to experience noise that in turn causes data transmission errors. In extreme cases ground current can cause equipment malfunction or even destruction.

Cabling Recommendations

When connecting the **USBS 2401-I** in an RS-485 network, care should be taken that both ends of the network are not isolated from ground (see Figure 4). This "floating" ground condition could cause capacitive or inductive coupling of voltages that will cause a break down in the DC to DC converter circuit or in the opto-isolator circuit. This condition will cause data errors and possibly destruction of the receiver circuit.
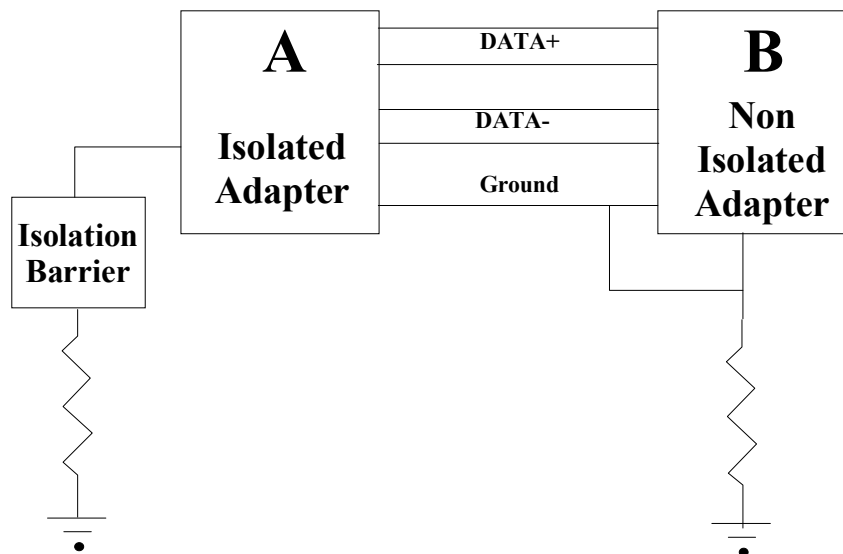

*Figure 4 – **USBS 2401-I** cabling example*

Appendix D - 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. Character boundaries for asynchronous communications are defined by a starting bit followed by a pre-defined number of data bits (5, 6, 7, or 8). 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.
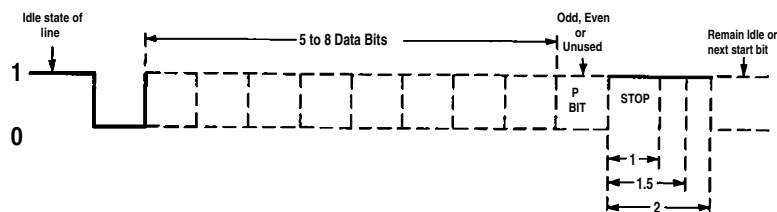

Figure 5 - Asynchronous Communications Bit Diagram

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).

Appendix E - Silk-Screen
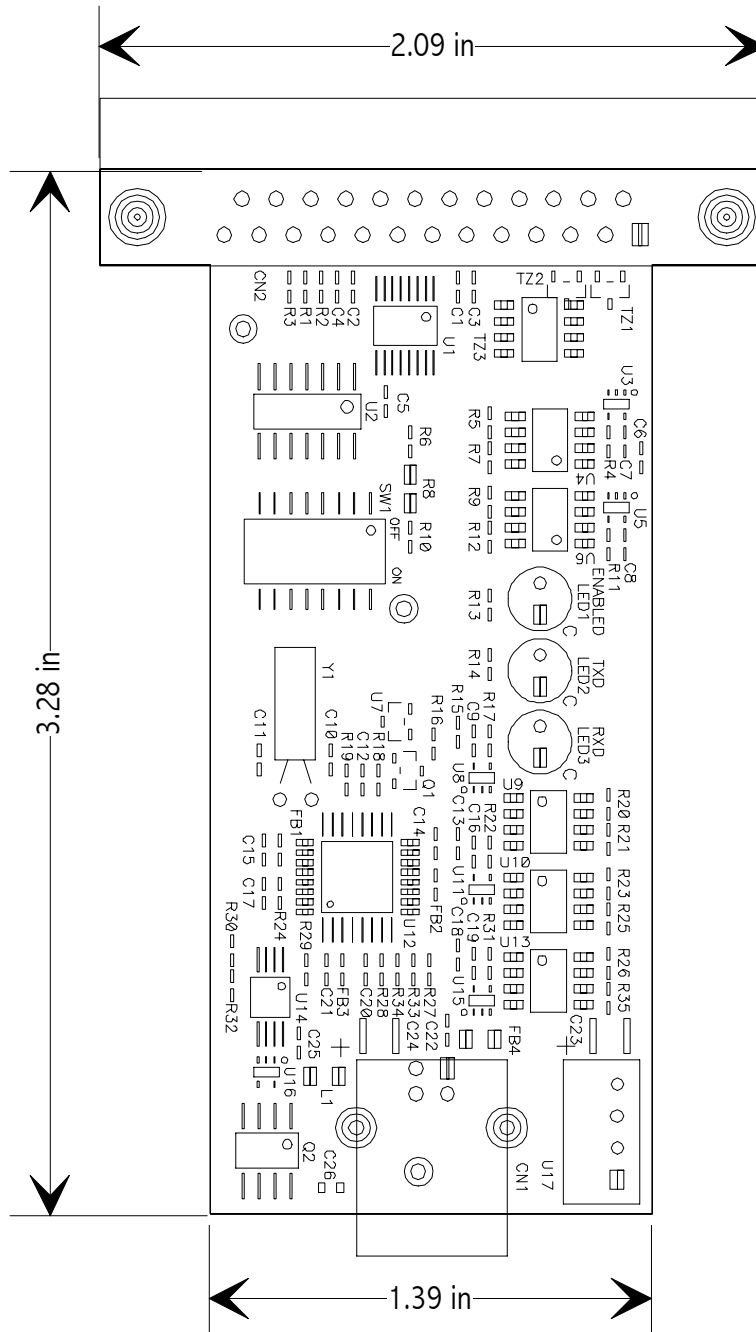
Appendix F - Compliance Notices

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 his own 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 B - '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'

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 EMC directives.

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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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