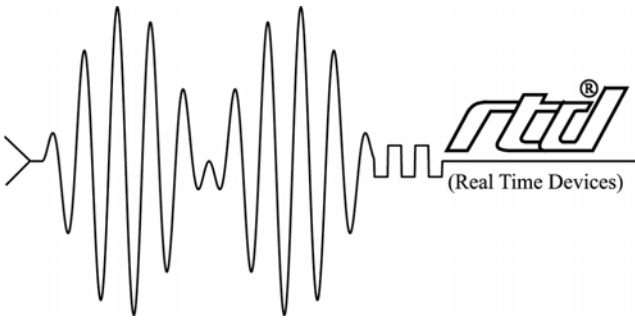
CM202
NE2000 Ethernet utilityModule

User's Manual



RTD Embedded Technologies, Inc.
"Accessing the Analog World"®

BDM-610020015
Rev. B

CM202
NE2000 Ethernet utilityModule
User's Manual

RTD Embedded Technologies, Inc.
103 Innovation Blvd.
State College, PA 16803-0906

Phone: +1-814-234-8087
FAX: +1-814-234-5218

E-mail
sales@rtd.com
techsupport@rtd.com

web site
http://www.rtd.com

Revision History

97.11.17	Initial release.
99.12.07	Revised with RTDUSA PCB layout
2000.03.08	Added CN4 pinout
Rev. A	New Manual Naming Method
Rev. B	Changed to National Semi. AT/LANTIC chip

Published by:

RTD Embedded Technologies, Inc.
103 Innovation Blvd.
State College, PA 16803-0906

Copyright 2005 by RTD Embedded Technologies, Inc.
All rights reserved
Printed in U.S.A.

The RTD Logo is a registered trademark of RTD Embedded Technologies. cpuModule and utilityModule are trademarks of RTD Embedded Technologies. PhoenixPICO and PheonixPICO BIOS are trademarks of Phoenix Technologies Ltd. PS/2, PC/XT, PC/AT and IBM are trademarks of International Business Machines Inc. MS-DOS, Windows, Windows 95, Windows 98 and Windows NT are trademarks of Microsoft Corp. PC/104 is a registered trademark of PC/104 Consortium. All other trademarks appearing in this document are the property of their respective owners.

Table of Contents

CHAPTER 1 INTRODUCTION 1

CM202 ETHERNET UTILITYMODULE 1

CHAPTER 2 INSTALLING THE UTILITYMODULE 3

RECOMMENDED PROCEDURE 3

CHAPTER 3 CONNECTING THE UTILITYMODULE 4

FINDING PIN 1 OF CONNECTORS 4
COMPONENT LOCATIONS 4
PC/104 BUS CONNECTORS, CN1 AND CN2 6
10BASE-T CONNECTOR, CN3 8
10BASE-T CONNECTOR, CN4 8
AUI CONNECTORS, CN5 AND CN6 9
10BASE2 CONNECTOR, CN7 10

CHAPTER 4 CONFIGURING THE UTILITYMODULE 11

JUMPER SETTINGS 11
SETUP PROGRAM 11

CHAPTER 5 USING THE UTILITYMODULE 13

DIAGNOSTIC LEDS 13
LED CONNECTOR 14
BOOT ROM SOCKET 14
POWER CONSUMPTION 14

CHAPTER 6 REFERENCE INFORMATION 15

ETHERNET REFERENCES 15
TYPES OF ETHERNET 15
TYPES OF ETHERNET CABLE 15
ETHERNET FRAMES 16
IEEE 802 MAC NUMBER 16

CHAPTER 7 RETURN POLICY AND WARRANTY 17

RETURN POLICY 17
LIMITED WARRANTY 18

Chapter 1 INTRODUCTION

This manual gives information about the CM202 NE2000-compatible Ethernet utilityModule. This module supports Ethernet communications using 10BASE-T or 10BASE2 media, or an external interface to 10BASE5 or optical fiber using an AUI interface.

CM202 Ethernet utilityModule

The CM202 Ethernet utilityModule was designed to provide Ethernet communications support for the RTD Embedded Technologies cpuModules and other standard PC/104 processor modules.

Features

The following are major features of the CM202 utilityModule.

NE2000 compatible Ethernet controller

- National AT/LANTIC DP83905 chipset
- 64KB SRAM Buffer
- Operates in 8-bit (XT) or 16-bit(AT) systems

Multiple Ethernet interfaces

- 10BASE-T UTP (unshielded twisted pair)
- 10BASE2 BNC
- 10BASE5 AUI (DIL16 or DSUB15 connectors)

Software Configurable

- Jumperless configuration for I/O address, interrupt, mode
- Configuration stored in EEPROM

Boot ROM socket

- Allows remote booting of cpuModule from a network server

Connectors

Connectors provided are:

- CN1 and CN2, PC/104 bus
- CN3, 10BASE-T port (RJ45)
- CN4, 10BASE-T port (DIL)
- CN5, AUI port (DSUB)
- CN6, AUI port (DIL)
- CN7, 10BASE2 port (BNC)

General Specifications

- Dimensions: 3.8 x 4.75 x 0.6" (97 x 120 x 16 mm) including connectors
- Weight: 0.24 lbs (0.11 Kg)
- 6-layer PCB, combined through-hole and surface-mount
- Operating Temperature:
  - 0 - 70 degrees C standard
  - -40 - +85 degrees C optional
  - Relative humidity: 0 - 95%, non-condensing
- Storage temperature: -55 to +85 degrees C

Chapter 2 INSTALLING THE UTILITYMODULE

Since the utilityModule uses a PC/104 stack through bus, the only hardware installation you will do is placing the module to the PC/104 stack. To do this, you will connect the PC/104 bus connector with the matching connector of another module.

Recommended Procedure

We recommend you follow the procedure below to ensure that stacking of the modules does not damage connectors or electronics.

- Turn off power to the PC/104 system or stack.
- Select and install standoffs to properly position the utilityModule on the PC/104 stack.
- Touch a grounded metal part of the stack to discharge any buildup of static electricity.
- Remove the utilityModule from its anti-static bag.
- Check that keying pins in the PC/104 bus connector are properly positioned.
- Check the stacking order: make sure an XT bus card will not be placed between two AT bus cards, or it will interrupt the AT bus signals.
- Hold the utilityModule by its edges and orient it so the bus connector pins line up with the matching connector on the stack.
- Gently and evenly press the utilityModule onto the PC/104 stack.

CAUTION: Do not force the module onto the stack! Wiggling the module or applying too much force may damage it. If the module does not readily press into place, remove it, check for bent pins or out-of-place keying pins, and try again.

Chapter 3 CONNECTING THE UTILITYMODULE

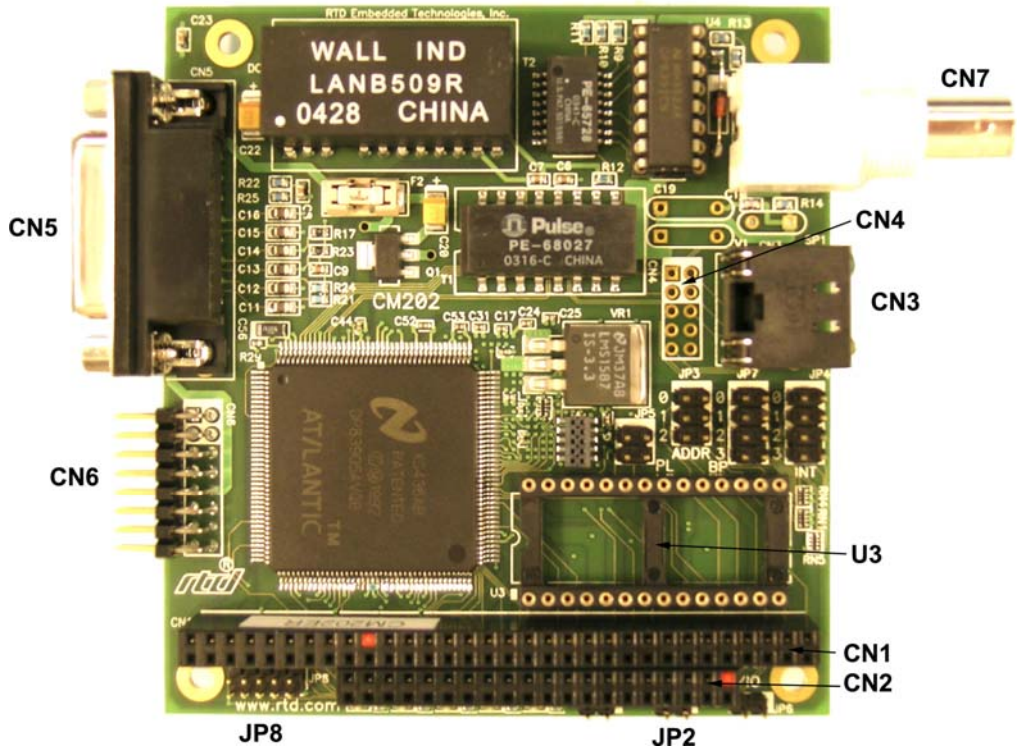
The following sections describe connectors of the utilityModule.

Finding Pin 1 of Connectors

Pin 1 of connectors is indicated by a square solder pad visible on the bottom of the PC board.

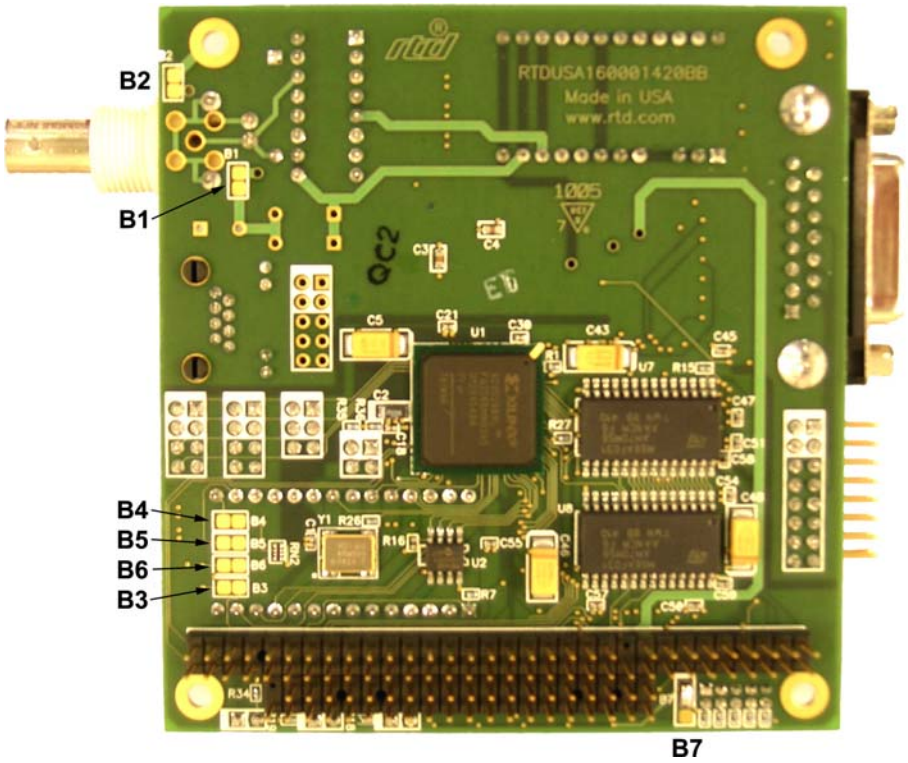
Component Locations

The figure below shows locations of major components, including connectors.



Connector	Function	Dimension
CN1	XT PC/104 bus	64 pin
CN2	AT PC/104 bus	32 pin
CN3	UTP Port (RJ45)	8 pin
CN4	UTP Port (DIL)	10 pin
CN5	AUI Port (DB15)	15 pin
CN6	AUI Port (DIL)	16 pin
CN7	BNC Port	2 pin
JP2	Data Width Jumper	2 pin
JP8	LED Connector	10 pin

The figure below shows the solder jumpers on the bottom side of the board.



Jumper	Function	Dimension
B1	10BASE2 Digital Ground	2 pin
B2	10BASE2 Frame Ground	2 pin
B3	Factory Use	2 pin
B4	Factory Use	2 pin
B5	Factory Use	2 pin
B6	Factory Use	2 pin
B7	LED Selection 1-2 On Board 2-3 External (JP8)	3 pin

PC/104 Bus Connectors, CN1 and CN2

Connectors CN1 and CN2 provide PC/104 bus connections. CN1 carries XT bus signals, and CN2 carries additional signals for the AT bus. The signals on CN1 and CN2 conform to the IEEE P966 standard for the PC/104 bus.

The following tables list the connector pinouts:

PC/104 XT Bus Connector, CN1		
Pin	**Row A**	**Row B**
1	IOCHCHK*	0V
2	SD7	RESETDRV
3	SD6	+5V
4	SD5	IRQ9
5	SD4	-5V
6	SD3	DRQ2
7	SD2	-12V
8	SD1	ENDXFR*
9	SD0	+12V
10	IOCHRDY	(KEYING PIN)
11	AEN	SMEMW*
12	SA19	SMEMR*
13	SA18	IOW*
14	SA17	IOR*
15	SA16	DACK3
16	SA15	DRQ3
17	SA14	DACK1*
18	SA13	DRQ1
19	SA12	REFRESH
20	SA11	SYSCLK
21	SA10	IRQ7
22	SA9	IRQ6
23	SA8	IRQ5
24	SA7	IRQ4
25	SA6	IRQ3
26	SA5	DACK2*
27	SA4	TC
28	SA3	BALE
29	SA2	+5V
30	SA1	OSC
31	SA0	0V
32	0V	0V

PC/104 AT Bus Connector, CN2		
Pin	**Row C**	**Row D**
0	0V	0V
1	SBHE*	MEMCS16*
2	LA23	IOCS16*
3	LA22	IRQ10
4	LA21	IRQ11
5	LA20	IRQ12
6	LA19	IRQ15
7	LA18	IRQ14
8	LA17	DACK0*
9	MEMR*	DRQ0
10	MEMW*	DACK5*
11	SD8	DRQ5
12	SD9	DACK6*
13	SD10	DRQ6
14	SD11	DACK7*
15	SD12	DRQ7
16	SD13	+5V
17	SD14	MASTER*
18	SD15	0V
19	(KEYING PIN)	0V

Note: Two locations on the bus have mechanical keying pins to help prevent misconnection of the PC/104 bus. These keying pins are a part of the PC/104 standard, and we strongly recommend you leave them in place.

If you have other modules without keying pins, we suggest you modify them to include keying.

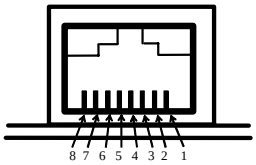
10BASE-T connector, CN3

Connector CN3 is for UTP (Unshielded Twisted Pair) wiring normally used for 10BASE-T Ethernet. It is wired in parallel with CN4. Do not use both CN3 and CN4 at the same time.

The following table gives the pinout of CN3.

Pin	Signal	Function	in/out
1	TX+	Transmit +	out
2	TX-	Transmit -	out
3	RX+	Receive +	in
4	N.C.	not connected	
5	N.C.	not connected	
6	RX-	Receive -	in
7	N.C.	not connected	
8	N.C.	not connected	

The figure below shows the pin numbering of CN3 when **looking into the connector**:



RJ-45 Jack Connector

CN3 is a standard female RJ-45 connector. One example of a mating plug is:

- AMP 5-554739-3 (unshielded)

10BASE-T connector, CN4

Connector CN4 is for UTP (Unshielded Twisted Pair) wiring normally used for 10BASE-T Ethernet. It is a 0.1 inch spacing, dual-in-line header connector. It is wired in parallel with CN3. Do not use both CN3 and CN4 at the same time.

The following table gives the pinout of CN4.

Pin	Signal	Function	in/out
1	TX+	Transmit +	out
2	RX-	Receive -	in
3	TX-	Transmit -	out
5	RX+	Receive +	in
4, 6 - 10	N.C.	not connected	

AUI connectors, CN5 and CN6

Connectors CN6 and CN5 implement the AUI (Attachment Unit Interface). This interface can be used to connect an external MAU (Media Attachment Unit) to convert to 10BASE5, Optical Fiber, or another communication media.

These connectors carry the following signals:

- Balanced Pair Transmit signal
- Balanced Pair Receive signal
- Balanced Pair Collision Detect signal
- Power supply (+12Vdc from PC/104 bus) for an external transceiver

V+ Protection

The +12V output of the AUI connectors CN6 and CN5 are protected by F2, a 500mA fast-acting picofuse mounted near CN6 and CN5.

Pinouts

The following table gives the pinout of CN5.

Pin	Signal	Function	in/out
1	GND	Ground	--
2	COL+	Collision Detect +	in
3	TX+	Transmit +	out
4	GND	Ground	--
5	RX+	Receive +	in
6	GND	Ground	--
7	N.C.	not connected	
8	GND	Ground	--
9	COL-	Collision Detect -	in
10	TX-	Transmit -	out
11	GND	Ground	--
12	RX-	Receive -	in
13	+12V	+12 volts DC	out
14	GND	Ground	--
15	N.C.	not connected	

The following table gives the pinout of connector CN6.

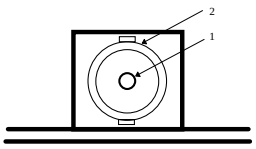
Pin	Signal	Function	in/out
1	GND	Ground	--
2	COL-	Collision Detect -	in
3	COL+	Collision Detect +	in
4	TX-	Transmit -	out
5	TX+	Transmit +	out
6	GND	Ground	--
7	GND	Ground	--
8	RX-	Receive -	in
9	RX+	Receive +	in
10	+12V	+12 volts DC	out
11	GND	Ground	--
12	GND	Ground	--
13	N.C.	not connected	
14	N.C.	not connected	
15	GND	Ground	--
16	N.C.	not connected	

10BASE2 connector, CN7

Connector CN7 is a BNC bayonet connector for coaxial cable normally used with 10BASE2 Ethernet.

The pinout of CN7 is:

Pin	Signal	Function	in/out
1	SIGNAL	Signal to 50 ohm cable	in/out
2	GND	Signal Ground	--



BNC Connector CN7

Chapter 4 CONFIGURING THE UTILITYMODULE

The following sections contain information about configuring the utilityModule.

Please read this entire section before attempting to use the utilityModule!

Jumper Settings

Data Width Jumper, JP2

Jumper JP2 selects between 8-bit and 16-bit mode. When in 8-bit mode, the CM202 can be used in an XT bus system. This also reduces the on-board buffer to half of its normal size. When in 16-bit mode, an AT bus is required. The normal mode of operation is 16-bit mode.

JP2	Description
Empty	16-bit (AT) Mode
Installed	8-bit (XT) Mode

Note: Eight bit mode must be used when using a boot ROM.

10BASE2 Ground, B1 and B2

Solder jumpers B1 and B2 are used to attach the ground of the coax connector to either digital ground, or to frame ground. By default, neither jumper is closed, so the coax connector ground is isolated.

Solder Jumper	Description
B1	Close to connect coax ground to digital ground
B2	Close to connect coax ground to frame ground

Other Jumpers

All other jumpers on the CM202 are for factory use only, and should not be jumpered.

Setup Program

The CM202 does not require jumpers to configure it. The configuration is stored in an EEPROM, which is loaded at powerup. A setup utility is provided that lets you view or change the existing setting of the board. This program can be used to view the active I/O address, the interrupt, the Media Type in use, and the MAC address of the board. You can use the program to change settings for I/O address, Interrupt, Media Type, and Remote Boot ROM, and save your selection to the EEPROM. These settings then are recalled from EEPROM whenever the module is reinitialized.

Note: Earlier versions of the CM202 used a different Ethernet chip, and therefore use a different setup utility. Be sure that the Setup Utility that you are using is for an AT/LANTIC based board.

Default Settings

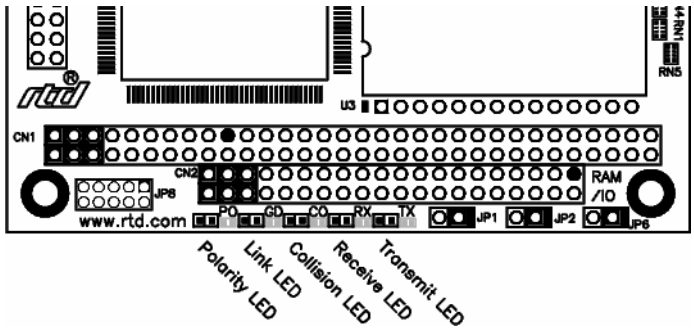
The factory default settings for CM202SET options are:

Option	Factory Default
I/O address	340h
Interrupt	IRQ5
Media type	10BASE-T
Boot ROM	Disabled

Chapter 5 USING THE UTILITYMODULE

Diagnostic LEDs

During operation, six LEDs are used to indicate status and provide some diagnostic information in case of malfunctions. The locations of these LEDs are shown in the figure below. In order for these LEDs to work, solder jumper B7 must be across pins 1 & 2 (default setting).



LED	Name	Meaning	Normal State
D1	TX	Transmitting to network	Flashing
D2	RX	Receiving from network	Flashing
D3	CO	Collision Detected	Off
D4	PO	Polarity of signal incorrect	Off
D5	GD	Link established (UTP)	On (10BASE-T only)

Collision LED

The Collision LED is normally off, and flashes when the module detects a collision on the network. Collisions may be due to low-quality cable which allows crosstalk between the transmit and receive pairs, miswiring, or a malfunctioning device on the network. A few collisions may also occur during normal operation of a busy network.

Transmit LED

The Transmit LED flashes when the module tries to transmit on the network. It is active when using 10BASE-T (UTP), 10BASE2 (BNC), or an external AUI transceiver.

Receive LED

The Receive LED flashes when the module detects a receive signal or senses a collision on the network cable. It is active when using 10BASE-T (UTP), 10BASE2 (BNC), or an external AUI transceiver.

Polarity LED

The Polarity LED is normally off. It is turned on to indicate incorrect polarity of a received signal, which would normally be caused by incorrect wiring.

Link LED

The Link LED is turned on when a valid 10BASE-T link is detected by the chipset. It is only active when using the 10BASE-T UTP connection with link integrity checking enabled. If it is off, the UTP wiring may be broken or incorrect, link integrity checking may be disabled, or you may be using the 10BASE2 or AUI interface.

LED Connector

The signals for the LEDs are also available on connector JP8. This allows LEDs to be placed on the outside of an enclosure, or another more convenient location. In order to use JP8, solder jumper B7 must be across pins 2 & 3. The LEDs are driven to 5V through a 332 Ohm resistor, resulting in a drive current of about 12 mA with an LED forward voltage of 1.0V.

The location of JP8 is shown on page 4. The pin assignments are shown in the following table.

Pin	Polarity	Signal	Description
1	Cathode	TX	Transmitting to network
2	Anode		
3	Cathode	RX	Receiving from network
4	Anode		
5	Cathode	CO	Collision Detected
6	Anode		
7	Cathode	GN	Link established (UTP)
8	Anode		
9	Cathode	PO	Polarity of signal incorrect
10	Anode		

Boot ROM Socket

In some applications, you may wish to use the boot ROM socket of the utilityModule to boot a connected cpuModule from a remote server.

The socket will accommodate a 28 pin EPROM or Flash memory devices of size 8k, 16k, or 32k. The device must be a 5V device with a byte-wide architecture.

Power Consumption

Power consumption of the utilityModule depends on which Ethernet interface is used and the degree of activity on the network.

The following table gives typical power consumption:

Configuration	AUI	TP	BNC
Consumption	250 mA	250 mA	600 mA

Chapter 6 REFERENCE INFORMATION

Ethernet References

For a complete description of the Ethernet interface, consult IEEE Standard 802.3, available from www.ieee.org.

Types of Ethernet

There are three standard types of 10 Megabit Ethernet, of which 10BASE-T is by far the most common, and 10BASE5 is by far the least common.

Ethernet Type	Nickname	Data transfer rate	Topology	Cable type	Maximum Segment length
10BASE-T	"Cheapernet"	10 Mbps	Star	100 ohm UTP (unshielded twisted pair)	100 m 328 ft
10BASE2	"Thin" Ethernet	10 Mbps	Bus	RG-58 coaxial	185 m 607 ft
10BASE5	"Thick" Ethernet	10 Mbps	Bus	RG-11 coaxial	500 m 1640 ft

Types of Ethernet cable

Ethernet uses one of three standard cable types:

Ethernet Type	Cable type	Impedance	Denomination
10BASE-T	UTP	100 Ohm	unshielded twisted pair
10BASE2	RG-58	50 Ohm	Ethernet thin
10BASE5	RG-11	50 Ohm	Ethernet thick

Note: Although 8-conductor telephone wire is commonly used for 10BASE-T connections, this type wire is not the correct 100 ohm UTP, as it does not use twisted-pairs. Using such wire may cause excessive crosstalk, resulting in a large number of collisions and poor network performance.

Ethernet frames

The following are standard Ethernet frames.

- ETHERNET_II Primarily used by TPC/IP
- ETHERNET_802.3 Default frame for Netware 3.11
- ETHERNET_802.2 Default frame for Netware 3.12 and 4.x
- ETHERNET_SNAP Primarily used by Appletalk

IEEE 802 MAC number

The CM202 utilityModule is identified with an Organizationally Unique Identifier (OUI) and company ID number:

00-D0-81

The MAC (Media Access Control) number of the utilityModule is thus:

00-D0-81-xx-xx-xx

...where the last three bytes are the serial number of the board, unique for each adapter.

Chapter 7 RETURN POLICY AND WARRANTY

Return Policy

If you wish to return a product to the factory for service, please follow this procedure:

Read the Limited Warranty to familiarize yourself with our warranty policy.

Contact the factory for a Return Merchandise Authorization (RMA) number.

Please have the following available:

- Complete board name
- Board serial number
- A detailed description of the board's behavior

List the name of a contact person, familiar with technical details of the problem or situation, **along with their phone and fax numbers, address, and e-mail address** (if available).

List your shipping address!!

Indicate the shipping method you would like used to return the product to you.
We will not ship by next-day service without your pre-approval.

Carefully package the product, using proper anti-static packaging.

Write the RMA number in large (1") letters on the outside of the package.

Return the package to:

RTD Embedded Technologies, Inc.
103 Innovation Blvd.
State College PA 16803-0906
USA

Limited Warranty

RTD Embedded Technologies, Inc. warrants the hardware and software products it manufactures and produces to be free from defects in materials and workmanship for one year following the date of shipment from RTD Embedded Technologies, INC. This warranty is limited to the original purchaser of product and is not transferable.

During the one year warranty period, RTD Embedded Technologies will repair or replace, at its option, any defective products or parts at no additional charge, provided that the product is returned, shipping prepaid, to RTD Embedded Technologies. All replaced parts and products become the property of RTD Embedded Technologies. Before returning any product for repair, customers are required to contact the factory for an RMA number.

THIS LIMITED WARRANTY DOES NOT EXTEND TO ANY PRODUCTS WHICH HAVE BEEN DAMAGED AS A RESULT OF ACCIDENT, MISUSE, ABUSE (such as: use of incorrect input voltages, improper or insufficient ventilation, failure to follow the operating instructions that are provided by RTD Embedded Technologies, "acts of God" or other contingencies beyond the control of RTD Embedded Technologies), OR AS A RESULT OF SERVICE OR MODIFICATION BY ANYONE OTHER THAN RTD Embedded Technologies. EXCEPT AS EXPRESSLY SET FORTH ABOVE, NO OTHER WARRANTIES ARE EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, AND RTD Embedded Technologies EXPRESSLY DISCLAIMS ALL WARRANTIES NOT STATED HEREIN. ALL IMPLIED WARRANTIES, INCLUDING IMPLIED WARRANTIES FOR MECHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED TO THE DURATION OF THIS WARRANTY. IN THE EVENT THE PRODUCT IS NOT FREE FROM DEFECTS AS WARRANTED ABOVE, THE PURCHASER'S SOLE REMEDY SHALL BE REPAIR OR REPLACEMENT AS PROVIDED ABOVE. UNDER NO CIRCUMSTANCES WILL RTD Embedded Technologies BE LIABLE TO THE PURCHASER OR ANY USER FOR ANY DAMAGES, INCLUDING ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES, EXPENSES, LOST PROFITS, LOST SAVINGS, OR OTHER DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THE PRODUCT.

SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES FOR CONSUMER PRODUCTS, AND SOME STATES DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATIONS OR EXCLUSIONS MAY NOT APPLY TO YOU.

THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM STATE TO STATE.

RTD Embedded Technologies, Inc.
103 Innovation Blvd.
State College PA 16803-0906
USA
Our website: www.rtd.com