LAN17222HR/18222HR

PCI/104-Plus Dual Gigabit Ethernet Controller

User's Manual

BDM-610020087 Rev. E

RTD Embedded Technologies, Inc.
AS9100 and ISO 9001 Certified

RTD Embedded Technologies, Inc.
103 Innovation Boulevard
State College, PA 16803 USA
Telephone: 814-234-8087
Fax: 814-234-5218

www.rtd.com

sales@rtd.com
techsupport@rtd.com

Revision History

Rev A	Initial Release
Rev B	Added IDAN connector Pinout
Rev C	Added PCI Slot Selector Switch table
Rev D	Updated Figure 2
Rev E	Updated LED connector descriptions.

Advanced Analog I/O, Advanced Digital I/O, aAIO, aDIO, a2DIO, Autonomous SmartCal, "Catch the Express", cpuModule, dspFramework, dspModule, expressMate, ExpressPlatform, HiDANplus, "MIL Value for COTS prices", multiPort, PlatformBus, and PC/104EZ are trademarks, and "Accessing the Analog World", dataModule, IDAN, HiDAN, RTD, and the RTD logo are registered trademarks of RTD Embedded Technologies, Inc (formerly Real Time Devices, Inc.). PS/2 is a trademark of International Business Machines Inc. PCI, PCI Express, and PCIe are trademarks of PCI-SIG. PC/104, PC/104-Plus, PCI-104, PCIe/104, PCI/104-Express and 104 are trademarks of the PC/104 Embedded Consortium. All other trademarks appearing in this document are the property of their respective owners.

Failure to follow the instructions found in this manual may result in damage to the product described in this manual, or other components of the system. The procedure set forth in this manual shall only be performed by persons qualified to service electronic equipment. Contents and specifications within this manual are given without warranty, and are subject to change without notice. RTD Embedded Technologies, Inc. shall not be liable for errors or omissions in this manual, or for any loss, damage, or injury in connection with the use of this manual.

Copyright © 2015 by RTD Embedded Technologies, Inc. All rights reserved.

Table of Contents

1 Introduction **6**

1.1 Product Overview ... 6

1.2 Board Features ... 6

1.3 Ordering Information ... 6

1.4 Contact Information ... 7
- 1.4.1 Sales Support 7
- 1.4.2 Technical Support 7

2 Specifications **8**

2.1 Operating Conditions ... 8

2.2 Electrical Characteristics ... 8

3 Board Connection **9**

3.1 Board Handling Precautions ... 9

3.2 Physical Characteristics ... 9

3.3 Connectors and Jumpers ... 10
- 3.3.1 External I/O Connectors 10
- 3.3.2 Bus Connectors 10
  - CN1: PCI Connector 10
  - CN2/3: ISA AT/XT Connectors 10
- 3.3.3 External LED Connectors: 11
- 3.3.4 RJ45 Twisted Pair Ethernet, CN4, CN6 11
- 3.3.5 Twisted Pair Ethernet CN5 and CN7 11

3.4 Steps for Installing ... 12
- 3.4.1 Switch SW1 – PCI Slot Selector 13

4 IDAN Connections **14**

4.1 Module Handling Precautions ... 14

4.2 Physical Characteristics ... 14

4.3 Connectors ... 15
- 4.3.1 External I/O Connectors 15
- 4.3.2 Bus Connectors 15
  - CN1: PCI Connector 15
  - CN2/3: ISA AT/XT Connectors 15

4.4 IDAN Twisted Pair Ethernet PORT1, PORT2 ... 15

4.5 Steps for Installing ... 16

5 Functional Description **17**

5.1 Block Diagram ... 17

5.2 PCI to PCIe Bridge ... 17
- 5.2.1 PCI Express Hub 17

5.3 Intel WG82574IT Gigabit Ethernet Controller ... 17

6 Troubleshooting **18**

7 Additional Information **19**

7.1 PC/104 Specifications ... 19

7.2 PCI and PCI Express Specification ... 19

8 Limited Warranty **20**

Table of Figures

Figure 1: LAN17222 6
Figure 2: Board Dimensions 9
Figure 3: Board Connections 10
Figure 4: RJ-45 Jack Connector 11
Figure 5: Example 104™Stack 12
Figure 6: IDAN Dimensions 14
Figure 7: Example IDAN System 16
Figure 8: LAN17222 Block Diagram 17

Table of Tables

Table 1: Ordering Options 6
Table 2: Operating Conditions 8
Table 3: Electrical Characteristics 8
Table 4: External LED Connector Pinout 11
Table 5: RJ45 Signal Assignments 11
Table 6: DIL Signal Assignments 11
Table 7: PCI Slot Selector Switch 13
Table 8: LAN17222HR IDAN Pin Out 15

1 Introduction

1.1 Product Overview

The LAN17222 is design to provide two Gigabit Ethernet connections to PCI/104-Plus stacking systems. The board contains two Gigabit Ethernet controllers each with its own RJ-45 or 0.1" connector for access. This board runs completely off of the PCI bus, using a PCI to PCIe Bridge to utilize Intel's WG82574IT Gigabit Ethernet controller.

1.2 Board Features

- 2 Independent Gigabit Ethernet Connections
  - Intel 82574IT Gigabit Ethernet Controllers
    - One controller per channel
    - Auto-Crossover for MDI/MDI-X at all speeds
    - MSI and MSI-X support
    - Supports up to 256K TCP
    - 9KB Jumbo Frame Support, 40KB packet buffer size
    - IPv4 and IPv6 support
    - Industrial Temperature rated, requiring no heat sinking
- Onboard Multi colored LED to monitor Link Status, Speed, and Activity for each port
- External connectors for LEDs for bringing out the LED signals to the user or the frame of an IDAN.
- ISA Bus used as a signal pass through connector
- PCI Bus:
  - 32-bit, 33 MHz PCI Bus
  - PCI Master Controller allows PCI Express access to PCI Target Devices
  - PCI Target Controller allows full transparent access to PCI Express resources
  - Message Signaled Interrupt (MSI) support
  - Legacy Interrupt support
  - Four Bus Masters

1.3 Ordering Information

The LAN17222 is available with the following options:

Table 1: Ordering Options

Part Number	Description
LAN17222HR	PC/104-*Plus* Dual Gigabit Ethernet Controller
IDAN-LAN17222HR	PC/104-*Plus* Dual Gigabit Ethernet Controller in IDAN enclosure
LAN18222HR	PCI-104 Dual Gigabit Ethernet Controller
IDAN-LAN18222HR	PCI-104 Dual Gigabit Ethernet Controller in IDAN enclosure

Figure 1: LAN17222

The Intelligent Data Acquisition Node (IDAN™) building block can be used in just about any combination with other IDAN building blocks to create a simple but rugged 104™ stack. This module can also be incorporated in a custom-built RTD HiDAN™ or HiDANplus High Reliability Intelligent Data Acquisition Node. Contact RTD sales for more information on our high reliability systems.

1.4 Contact Information

1.4.1 Sales Support

For sales inquiries, you can contact RTD Embedded Technologies sales via the following methods:

Phone: 1-814-234-8087 Monday through Friday, 8:00am to 5:00pm (EST).
E-Mail: sales@rtd.com

1.4.2 Technical Support

If you are having problems with you system, please try the steps in the Troubleshooting section of this manual.

For help with this product, or any other product made by RTD, you can contact RTD Embedded Technologies technical support via the following methods:

Phone: 1-814-234-8087 Monday through Friday, 8:00am to 5:00pm (EST).
E-Mail: techsupport@rtd.com

2 Specifications

2.1 Operating Conditions

Table 2: Operating Conditions

Symbol	Parameter	Test Condition	Min	Max	Unit
V_{cc5}	5V Supply Voltage		4.75	5.25	V
V_{cc3}	3.3V Supply Voltage		n/a	n/a	V
T_a	Operating Temperature		-40	+85	C
T_s	Storage Temperature		-55	+125	C
RH	Relative Humidity	Non-Condensing	0	90%	%
MTBF	Mean Time Before Failure	23C	TBD		Hours

2.2 Electrical Characteristics

Table 3: Electrical Characteristics

Symbol	Parameter	Test Condition	Min	Max	Unit
P	Power Consumption	V_{cc5} = 5.0V		0.5	W
I_{cc5}	5V Input Supply Current	Active		100	mA
I_{BUS5}	5V Current between buses			8.0	A
$I_{BUS3.3}$	3.3V Current between buses			3.0	A
I_{BUS12}	12V Current between buses			1.0	A
PCI Bus					
$V_{IH3.3}$	PCI 3.3V Input High Voltage	JP300 = 1-2 (3.3V)	1.65	3.3	V
$V_{IL3.3}$	PCI 3.3V Input Low Voltage	JP300 = 1-2 (3.3V)	0	0.7	V
V_{IH5}	PCI 5V Input High Voltage	JP300 = 2-3 (5V)	2.0	5.5	V
V_{IL5}	PCI 5V Input Low Voltage	JP300 = 2-3 (5V)	0	0.8	V
I_{IL}	PCI Input Leakage	0<V_I<VIO	-10	10	uA
I_{OZ}	PCI Hi-Z Leakage	0<V_I<VIO		10	uA
$V_{OH3.3}$	PCI 3.3V Output High Voltage	JP300 = 1-2 (3.3V), I_{OUT} = -0.5mA	2.97		V
$V_{OL3.3}$	PCI 3.3V Output Low Voltage	JP300 = 1-2 (3.3V) , I_{OUT} = 1.5mA		0.33	V
V_{OH5}	PCI 5V Output High Voltage	JP300 = 2-3 (5V) , I_{OUT} = -12mA	2.4		V
V_{OL5}	PCI 5V Output Low Voltage	JP300 = 2-3 (5V) , I_{OUT} = 12mA		0.4	V

3 Board Connection

3.1 Board Handling Precautions

To prevent damage due to Electrostatic Discharge (ESD), keep your board in its antistatic bag until you are ready to install it into your system. When removing it from the bag, hold the board at the edges, and do not touch the components or connectors. Handle the board in an antistatic environment, and use a grounded workbench for testing and handling of your hardware.

3.2 Physical Characteristics

- Weight: Approximately 55 g (0.12 lbs.)
- Dimensions: 90.17 mm L x 95.89 mm W (3.550 in L x 3.775 in W)

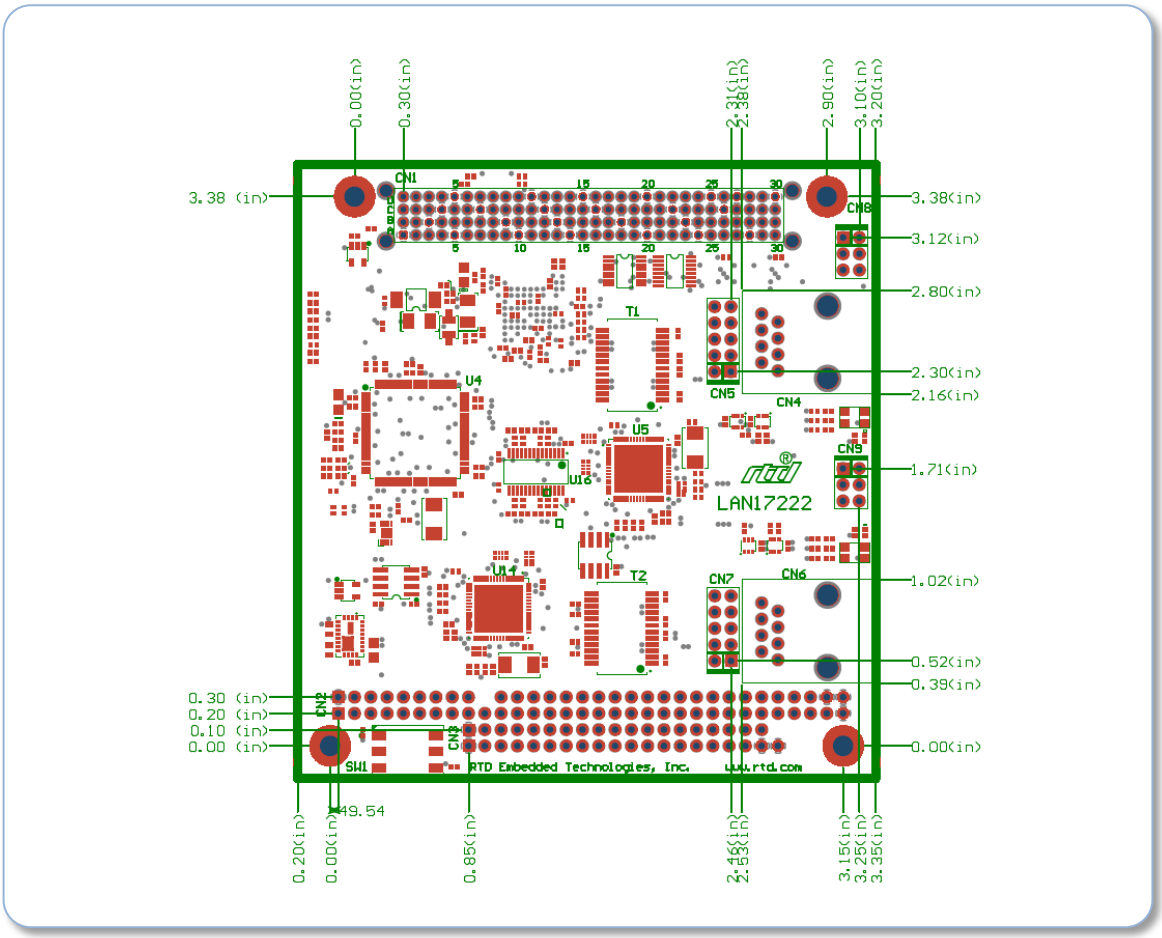


Figure 2: Board Dimensions

3.3 Connectors and Jumpers

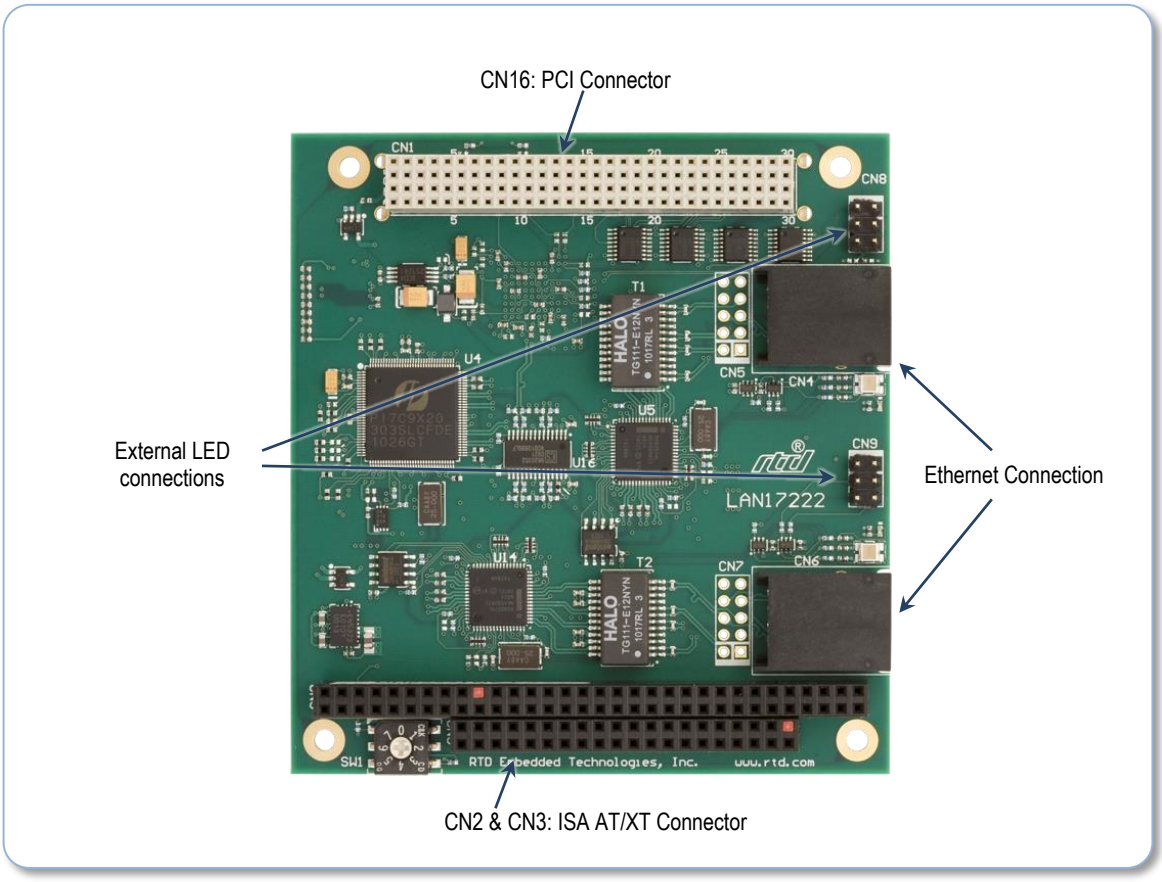


Figure 3: Board Connections

3.3.1 External I/O Connectors

- CN4/6: RJ-45 connector; used to interfacing with the two onboard Gigabit Ethernet ports.
- CN5/7: 2x5 0.1" DIL connector; used as a connection to the Gigabit Ethernet port for enclosed systems or ones in harsh conditions.
- CN8/CN9: 2x3 0.1" DIL connector; used to bring out the LED signals for user end-points or in an enclosed system.

3.3.2 Bus Connectors

CN1: PCI Connector

The PCI connector is the connection to the system CPU. The position and pin assignments are compliant with the *PCI/104 Specification*. (See PC/104 Specifications on page 19)

CN2/3: ISA AT/XT Connectors

The ISA AT/XT connector is the connection to ISA peripheral modules. The position and pin assignments are compliant with the *PC/104 Specification*. (See PC/104 Specifications on page 19)

3.3.3 External LED Connectors:

Connectors CN8 and CN9 are used as a user end point to bring out the LED signals. The LED signals that are brought out to the connectors are shown below. Pin 2, 4, 6 provide power to the external connectors. They are defaulted to +5V but can be changed to GND via a resistor option. Onboard LED drivers supply 24 mA of current to the LED signal pins.

Table 4: External LED Connector Pinout

Pin Function	Connector		Pin Function
Link/Activity LED	1	2	+5V or GND (+5V Default)
Link at 1Gbps	3	4	+5V or GND (+5V Default)
Link at 100Mbps	5	6	+5V or GND (+5V Default)

3.3.4 RJ45 Twisted Pair Ethernet, CN4, CN6

Connectors CN4 and CN6 are for UTP (Unshielded Twisted Pair) wiring normally used for 10/100/1000 Base-T Ethernet. It is the default factory installed twisted pair connector on the board. The following table gives the pin out of CN4 and CN6.

Pin	1000 Function	10/100 Function
1	MDI_A+	Transmit +
2	MDI_A-	Transmit -
3	MDI_B+	Receive +
4	MDI_C+	Not Used
5	MDI_C-	Not Used
6	MDI_B-	Receive -
7	MDI_D+	Not Used
8	MDI_D-	Not Used

Table 5: RJ45 Signal Assignments

CN4 and CN6 are standard female RJ-45 connectors. The figure below shows the pin numbering when **looking into the connector**:

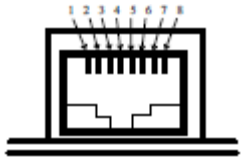


Figure 4: RJ-45 Jack Connector

3.3.5 Twisted Pair Ethernet CN5 and CN7

CN5 and CN7 are optional connectors which can be factory installed in place of the RJ45 connector. This connector is not installed when the RJ45 connector is installed. The pin out of CN5 and CN7 is in the table below.

Pin	1000 Function	10/100 Function	RJ-45 Pin
1	MDI_B+	Receive +	3
2	MDI_B-	Receive -	6
3	MDI_C+	Not Used	4
4	MDI_C-	Not Used	5
5	MDI_A+	Transmit +	1
6	MDI_A-	Transmit -	2
7	MDI_D+	Not Used	7
8	MDI_D-	Not Used	8
9	Shield Ground		
10	Shield Ground		

Table 6: DIL Signal Assignments

3.4 Steps for Installing

1. Always work at an ESD protected workstation, and wear a grounded wrist-strap.
2. Turn off power to the PC/104 system or stack.
3. Select and install stand-offs to properly position the module on the stack.
4. Remove the module from its anti-static bag.
5. Check that pins of the bus connector are properly positioned.
6. Check the stacking order; make sure all of the busses used by the peripheral cards are connected to the cpuModule.
7. Hold the module by its edges and orient it so the bus connector pins line up with the matching connector on the stack.
8. Gently and evenly press the module onto the PC/104 stack.
9. If any boards are to be stacked above this module, install them.
10. Attach any necessary cables to the PC/104 stack.
11. Re-connect the power cord and apply power to the stack.
12. Boot the system and verify that all of the hardware is working properly.

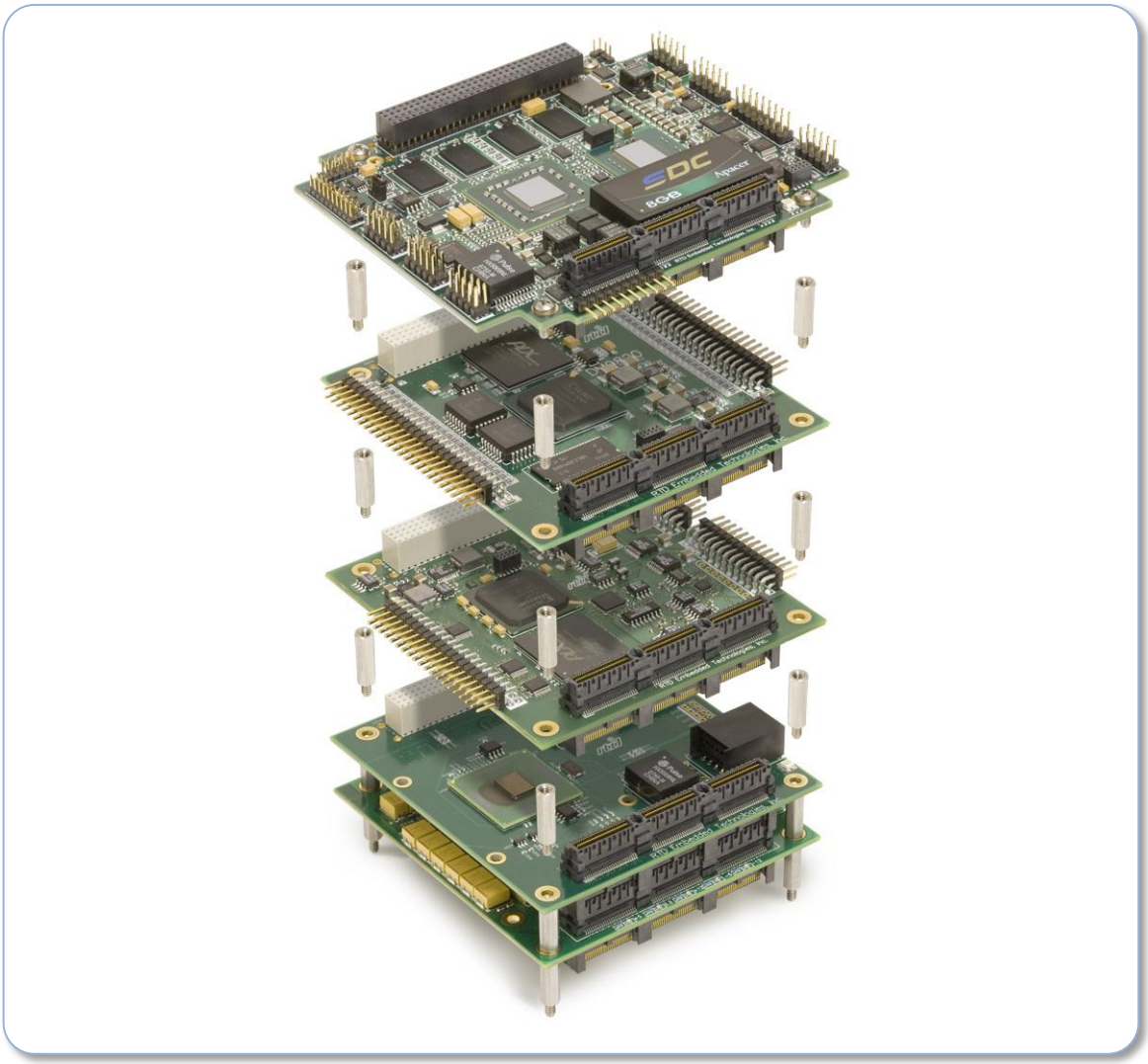


Figure 5: Example 104™ Stack

3.4.1 SWITCH SW1 – PCI SLOT SELECTOR

This rotary switch is used to set the positioning of the LAN17222 with respect to the CPU module and other PC/104-*Plus* or PCI/104 cards in the stack.

Note: *All PC/104-Plus and PCI/104 modules (including the LAN17222) must be on the same side of the CPU module.*

If the LAN17222 is the first module from the CPU module, set the switch to position "0". If it is the second module from the CPU, set the switch to position "1". Similarly, position "2" refers to the third module and position "3" refers to the fourth module away from the CPU module.

The PCI slot number can be configured as follows:

Table 7: PCI Slot Selector Switch

Switch Position	*PCI Slot Number*
0	*Slot 0 (Closest to CPU)*
1	*Slot 1*
2	*Slot 2*
3	*Slot 3*
4	*Undefined*
5	*Undefined*
6	*Undefined*
7	*Undefined*

4 IDAN Connections

4.1 Module Handling Precautions

To prevent damage due to Electrostatic Discharge (ESD), keep your module in its antistatic bag until you are ready to install it into your system. When removing it from the bag, hold the module by the aluminum enclosure, and do not touch the components or connectors. Handle the module in an antistatic environment, and use a grounded workbench for testing and handling of your hardware.

4.2 Physical Characteristics

- Weight: Approximately 0.21 Kg (0.46 lbs.)
- Dimensions: 151.972 mm L x 129.978 mm W x 16.993 mm H (5.983 in L x 5.117 in W x 0.669 in H)

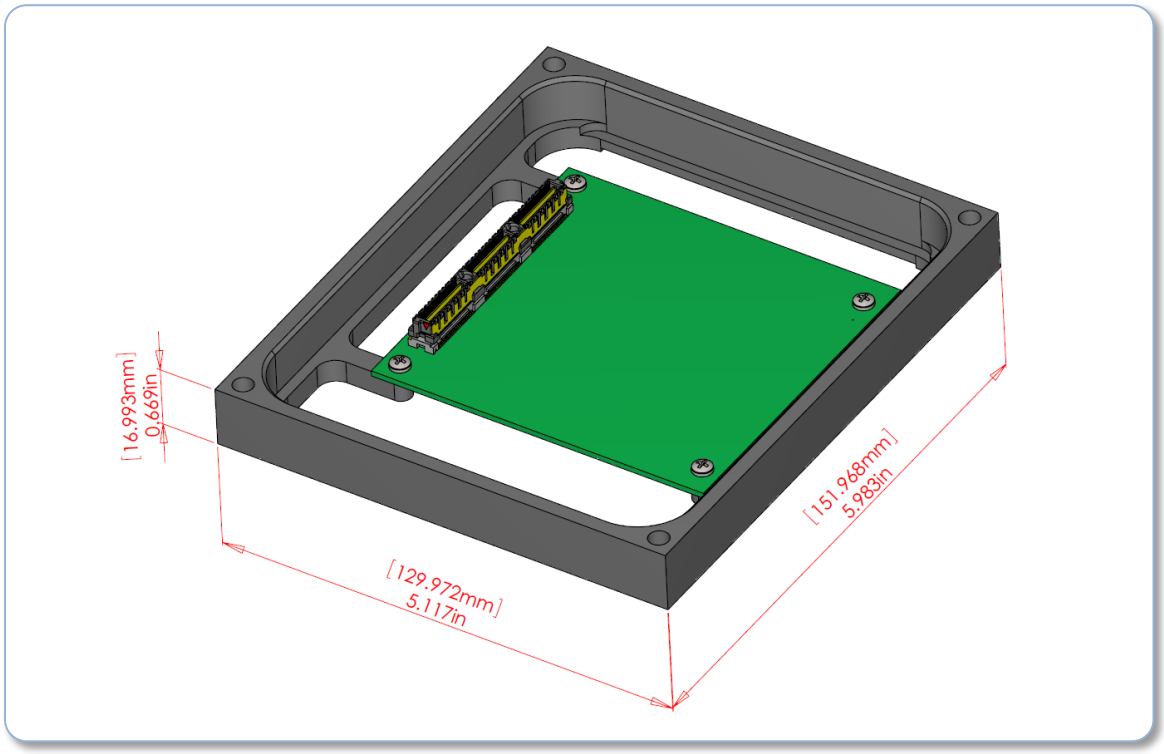


Figure 6: IDAN Dimensions

4.3 Connectors

4.3.1 External I/O Connectors

Two Gigabit Ethernet connectors bring out the two ports to the IDAN frame via a D-Sub connector

4.3.2 Bus Connectors

CN1: PCI Connector

The PCI connector is the connection to the system CPU. The position and pin assignments are compliant with the *PCI/104 Specification*. (See PC/104 Specifications on page 19)

CN2/3: ISA AT/XT Connectors

The ISA AT/XT connector is the connection to ISA peripheral modules. The position and pin assignments are compliant with the *PC/104 Specification*. (See PC/104 Specifications on page 19)

4.4 IDAN Twisted Pair Ethernet PORT1, PORT2

As an IDAN, the Ethernet signals are available on a male, DB-9 connector. A DB-9 to RJ-45 adapter is also included for each port.

DB-9 Pin	1000 Function	10/100 Function	RJ-45 Pin
1	MDI_B+	Receive +	3
2	MDI_C+	Not Used	4
3	MDI_A+	Transmit +	1
4	MDI_D+	Not Used	7
5	Shield Ground		N/C
6	MDI_B-	Receive -	6
7	MDI_C-	Not Used	5
8	MDI_A-	Transmit -	2
9	MDI_D-	Not Used	8

Table 8: LAN17222HR IDAN Pin Out

4.5 Steps for Installing

1. Always work at an ESD protected workstation, and wear a grounded wrist-strap.
2. Turn off power to the IDAN system.
3. Remove the module from its anti-static bag.
4. Check that pins of the bus connector are properly positioned.
5. Check the stacking order; make sure all of the busses used by the peripheral cards are connected to the cpuModule.
6. Hold the module by its edges and orient it so the bus connector pins line up with the matching connector on the stack.
7. Gently and evenly press the module onto the IDAN system.
8. If any boards are to be stacked above this module, install them.
9. Finish assembling the IDAN stack by installing screws of an appropriate length.
10. Attach any necessary cables to the IDAN system.
11. Re-connect the power cord and apply power to the stack.
12. Boot the system and verify that all of the hardware is working properly.

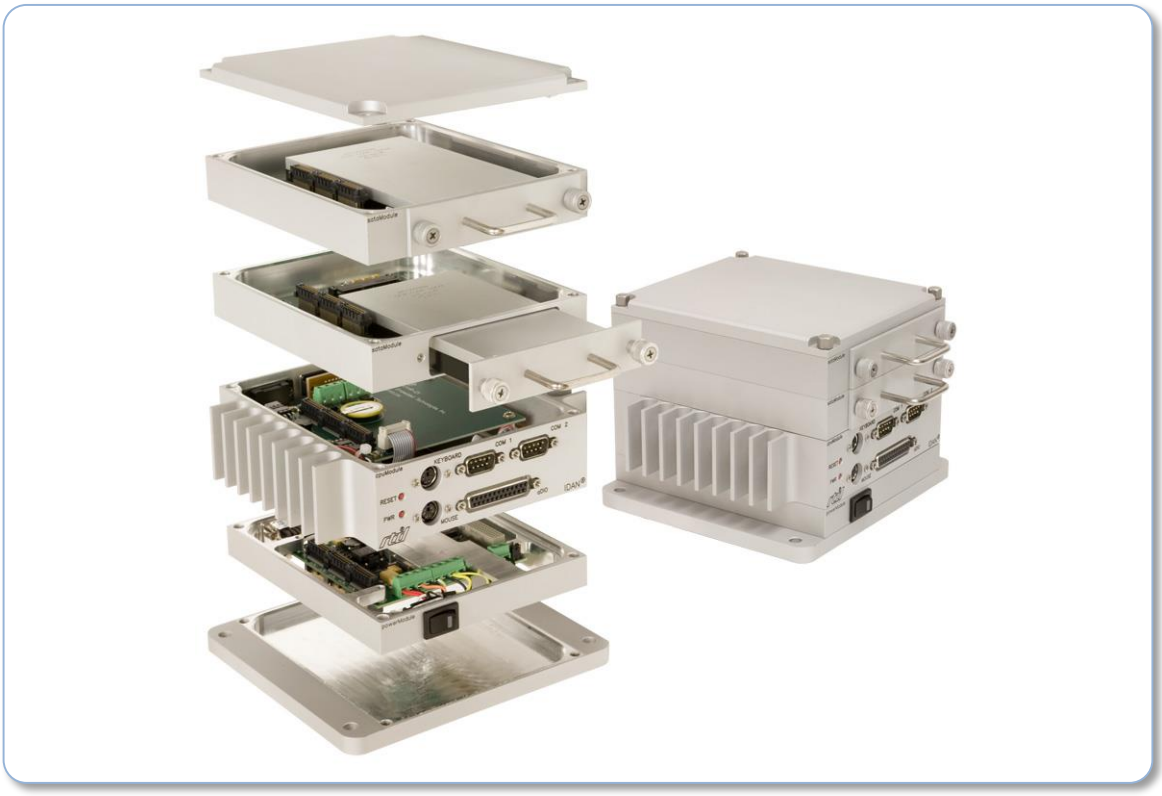


Figure 7: Example IDAN System

5 Functional Description

5.1 Block Diagram

The Figure below shows the functional block diagram of the LAN17222. The various parts of the block diagram are discussed in the following sections.

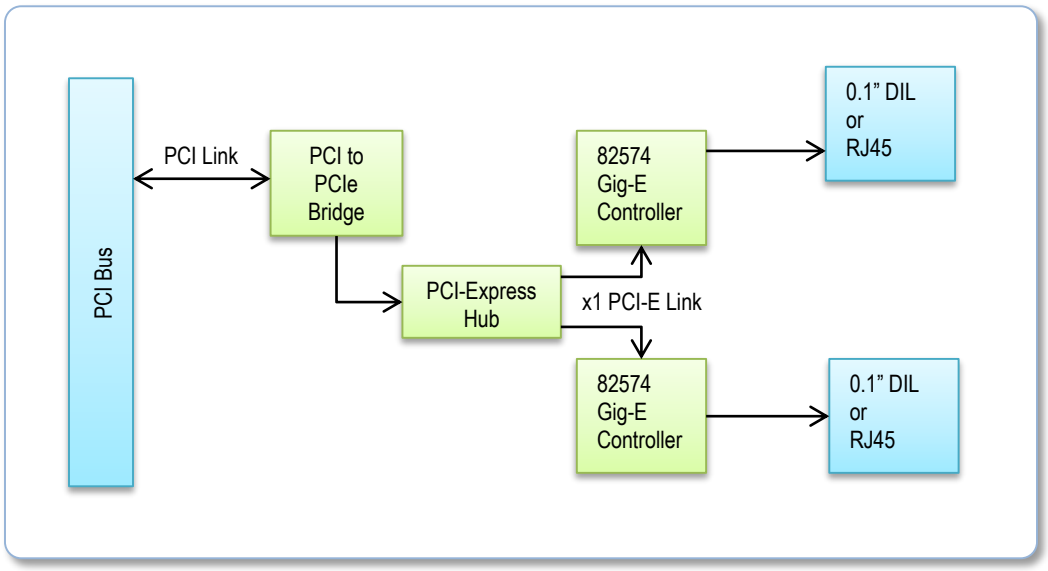


Figure 8: LAN17222 Block Diagram

5.2 PCI to PCIe Bridge

The PCI to PCI-Express Bridge allows this Legacy PCI device to take advantage of PCI Express interfacing chips. It utilizes a single 33 MHz, 32-Bit PCI lane to create an x1 PCI Express link. This link is replicated and sent to the two Gigabit Ethernet controllers on the board.to PCI Bridge allows legacy PCI devices to be used with newer PCI Express chipsets.

5.2.1 PCI Express Hub

The LAN17222 has an onboard PCI Express Signal Hub which allows it to provide a PCI Express link to each of the Ethernet controllers.

5.3 Intel WG82574IT Gigabit Ethernet Controller

The LAN17222 features two Gigabit Ethernet ports controlled by Intel's WG82574IT Gigabit Ethernet controller. The WG82574IT is an industrial temperature rated Gigabit Ethernet controller which features Auto-Crossover for MDI/MDI-X, 9KB Jumbo Frame Support, 40KB packet buffer size and IPv4/6 support.

5.4 Link/Activity/Speed LEDs

Each Ethernet port has LED indicators which show link, activity and the speed of the connection.

- Yellow LED: On indicates the link has been established. Blinks with activity
- Blue LED: On indicates connection at 100 Mbps speed.
- Green LED: On indicates connection at 1 Gbps speed.

6 Troubleshooting

If you are having problems with your system, please try the following initial steps:

- **Simplify the System** – Remove modules one at a time from your system to see if there is a specific module that is causing a problem. Perform you troubleshooting with the least number of modules in the system possible.

- **Swap Components** – Try replacing parts in the system one at a time with similar parts to determine if a part is faulty or if a type of part is configured incorrectly.

If problems persist, or you have questions about configuring this product, contact RTD Embedded Technologies via the following methods:

Phone: +1-814-234-8087
E-Mail: techsupport@rtd.com

Be sure to check the RTD web site (http://www.rtd.com) frequently for product updates, including newer versions of the board manual and application software.

7 Additional Information

7.1 PC/104 Specifications

A copy of the latest PC/104 specifications can be found on the webpage for the PC/104 Embedded Consortium:

www.pc104.org

7.2 PCI and PCI Express Specification

A copy of the latest PCI and PCI Express specifications can be found on the webpage for the PCI Special Interest Group:

www.pcisig.com

8 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 a Return Material Authorization (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 merchantability 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.

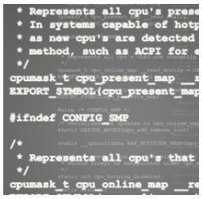
Some states do not allow the exclusion or limitation of incidental or consequential damages for consumer products, and some states do not allow limitations on how long an implied warranty lasts, so the above limitations or exclusions may not apply to you.

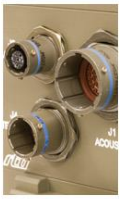
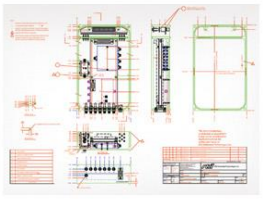
This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

RTD Embedded Technologies, Inc.
103 Innovation Boulevard
State College, PA 16803 USA
Telephone: 814-234-8087
Fax: 814-234-5218

www.rtd.com

sales@rtd.com
techsupport@rtd.com



Copyright 2015 by RTD Embedded Technologies, Inc. All rights reserved.