CM102
IDE and Floppy Controller utilityModule

User's Manual

BDM-610020012
Rev. A

ISO9001 and AS9100 Certified

CM102
IDE and Floppy utilityModule
User's Manual

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Revision History

1.0 New
1.1. Upgraded to allow stand-alone capability
1.2. Upgraded according to new LAS0 mapping - Firmware ver4.
1.3. Extended with Appendix. C.
1.4. Modified LAS1+8 register – Firmware ver.5.
1.5. Power connector description
1.6. Watchdog timer description extension
1.7. New chapter: 5.4. Reset signals
1.8. Minor Corrections
1.9. Power connector, JP4 jumper extensions
Rev. A New manual naming method

Published by:

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

Table of Contents

Chapter 1 Introduction

This manual gives information on the CM102 IDE Hard Drive and Floppy Controller utilityModule. This module allows you to connect standard IDE hard drives, CD-ROM's and floppy drives to your PC/104 system and provides connectors for Keyboard and reset lines from your cpuModule for system configuration. This manual was written primarily for use of the CM102 with the RTD family of IDAN systems. A power connector is available to connect to the hard drive and floppy drive along with a power I/O terminal block for powering your external system devices. A battery is included for the cpuModule backup of the Real Time Clock. There is a speaker installed for use with the cpuModule.

CM102 IDE and Floppy Controller utilityModule

The CM102 utilityModule was designed to provide an IDE hard drive and floppy controller in the PC/104 stack to support the Real Time Devices family of cpuModules and IDAN systems.

Features

The following are major features of the CM102 utilityModule.

IDE Controller and Drive

- Enable/Disable mode -- Allows disabling the controller when not connected to IDE drives.
- Jumper selection of primary or secondary IDE interface in bus mode
  - Primary -- IDE Interface at 1F0-1F7h, 3F6-3F7h, Interrupt 14
  - Secondary -- IDE Interface at 170-177h, 376-377h, Interrupt 15

Floppy Controller

- Supports two 360 KB, 1.2MB, 720KB or 1.44MB drives
- Enable/Disable mode -- Allows disabling the controller when not connected to floppy drives.
- Solder Blob "B1" to configure the Floppy interface as primary or secondary mode.

Real Time Clock Battery

- The battery, BAT1, is a solder-in long life backup that is typically 3.0 to 3.6 V. Real Time Clocks on cpuModules take an input voltage of 2.40 to 4.15 V.
- This battery is used by the cpuModule when the system power is removed, to preserve the date and time of the Real Time Clock.
- There is a protection circuit to prevent applying a charge to the battery and limit the output current.

Speaker

- A speaker is soldered on the utilityModule and connected to pins 1 and 2 of Multifunction connector CN8.

Connectors

Connectors provided are:

- CN1: PC/104 Bus (XT)
- CN2: PC/104 Bus (AT)
- CN3: Reserved
- CN4: IDE cable connector
- CN5: Floppy cable connector
- CN6: Drive power interface connector
- CN7: Auxiliary Power connector
- CN8: cpuModule utility connector
- CN9: Keyboard / Reset connector
- CN10: IDE drive activity external LED connector
- TB1: +5, +12 Vdc, and ground I/O terminal block
- TB2: -12 Vdc and two grounds I/O terminal block

General Specifications

- Dimensions: 3.575 x 3.775 x 0.6" (90.2 x 95.9 x 15 mm)
- Weight (mass): 3.0 ounces (85 grams)
- 6-layer PCB
- Operating conditions: (not including drive)
- temperature: -40 - +85 degrees C
- relative humidity: 0 - 95%, non-condensing
- Storage temperature: -55 to +85 degrees C
- Power Requirements: 125 mA @ 5 Vdc (typical)

Chapter 2 Configuring the utilityModule

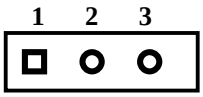
The following sections contain information on configuring the utilityModule.

Jumpers JP1 JP2 JP3

The utilityModule is configured by positioning jumpers. Jumpers are labeled on the board as **"JP"** followed by a number.

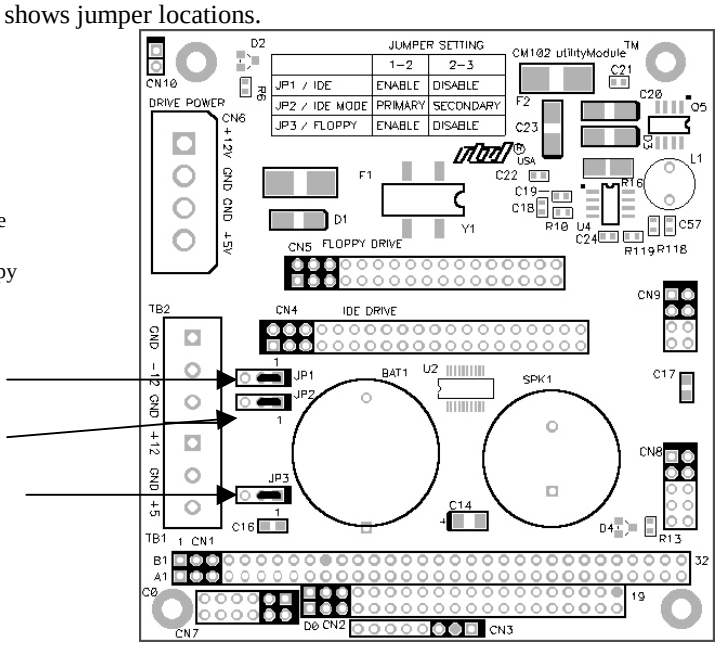
The Jumpers on the CM102 are three-pin jumpers allowing two settings:

- Pins 1 and 2 connected
- Pins 2 and 3 connected



The figure below shows jumper locations.

JP1 - IDE Enable
JP2 - IDE Mode
JP3 - Floppy Drive Enable



Jumper	Position 1-2	Position 2-3	Use
JP1	IDE ENABLE	IDE DISABLE	3 - pin jumper Use to Enable and Disable the IDE controller Factory Default: pins 1 - 2 (closed) IDE Enabled
JP2	IDE MODE PRIMARY	IDE MODE SECONDARY	3 - pin jumper Used to set the IDE controller to Primary or Secondary Factory Default: pins 1 - 2 (closed) IDE Primary
JP3	FLOPPY ENABLE	FLOPPY DISABLE	3 - pin jumper Use to Enable and Disable the Floppy controller Factory Default: pins 1 - 2 (closed) Floppy Enabled

Installing the utilityModule

Since the utilityModule uses a PC/104 stackthrough 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 a RTD cpuModule.

Recommended Procedure

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

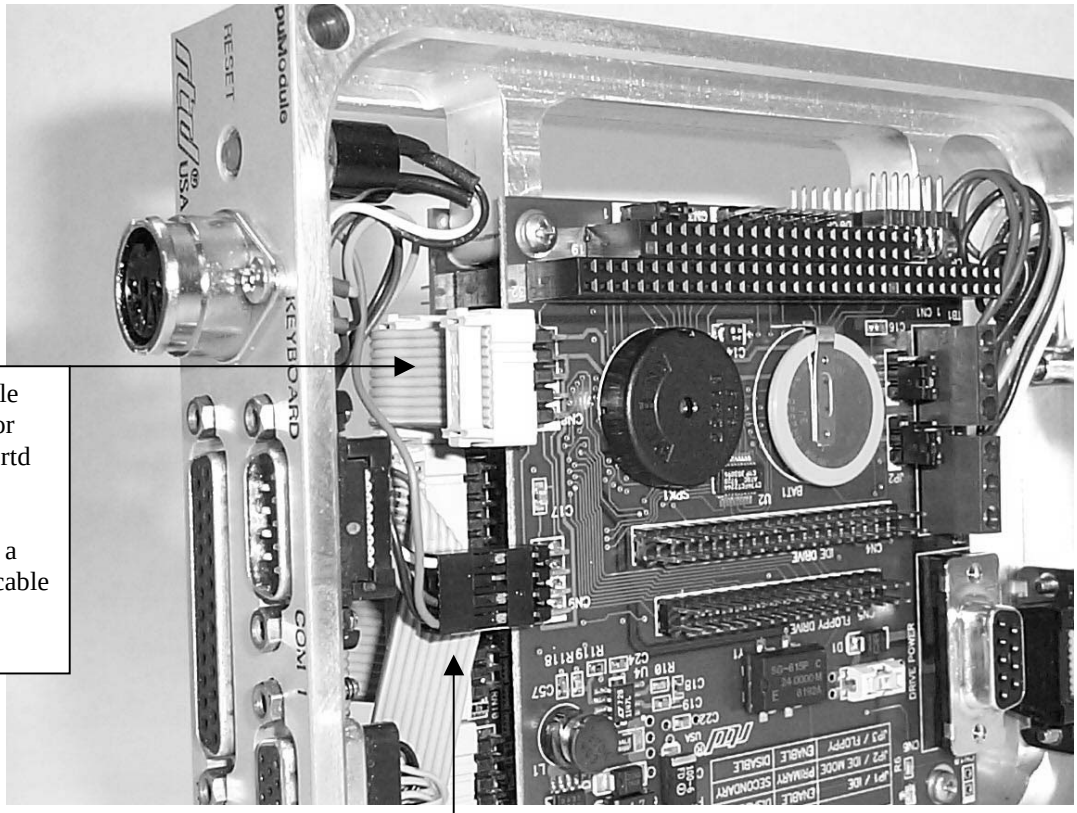
- Turn off power to the PC/104 system or stack.
- Select and install standoffs to properly position the utilityModule on the PC/104 stack.
- Touch a grounded metal part of the stack to discharge any buildup of static electricity.
- Remove the utilityModule from its anti-static bag.
- Check that keying 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 chapter is written based on the premise that you are using the cm102 utilityModule in conjunction with a RTD cpuModule and all pin descriptions are based upon RTD's standard for cpuModule pinouts.

To use these interfaces, you must connect to the 10 pin Multifunction connector of the cpuModule to the 10 pin cpuModule utility connector of the CM102 making sure the orientation of pin 1 is correct**.** A 10-pin ribbon cable will correctly align all of the signals to the same pins on the corresponding board.



CN8 cpuModule utility connector connected to a rtd cpuModule Multifunction connector with a 10-pin ribbon cable in an IDAN configuration

CN9 Keyboard connector with wiring harness connected to reset switch and keyboard connector.

Connecting the utility cables

The following sections describe connectors of the utilityModule.

The figure below shows connector locations.

CN10 - IDE Drive Activity LED Connector

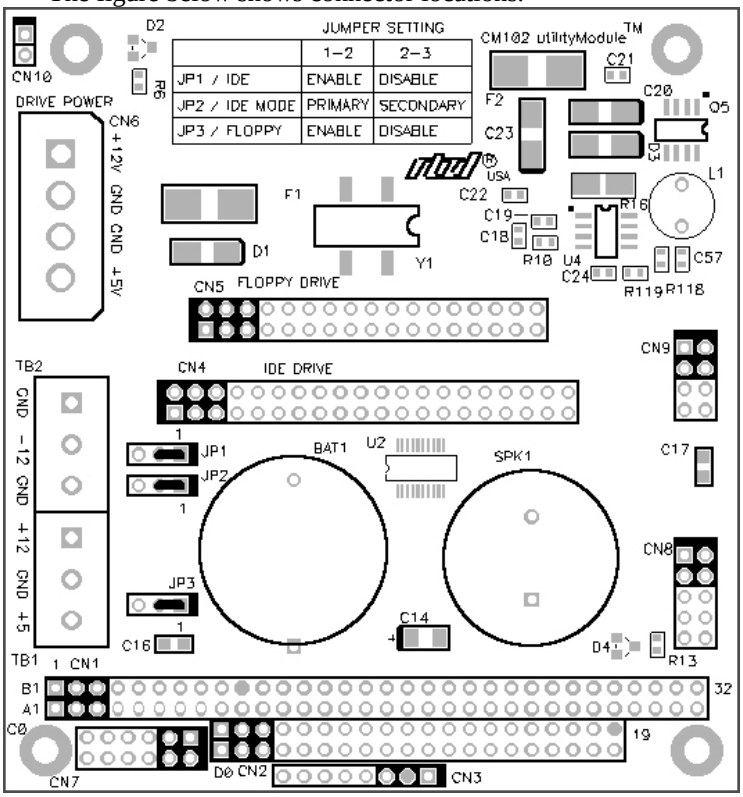
CN6 - Drive Power Connector

CN4 - IDE Drive Connector

TB2 - Power I/O Terminal Block

TB1 - Power I/O Terminal Block

CN1 - XT Bus
CN2 - AT Bus
CN7 - Power



CN5 - Floppy Drive Connector

CN9 - Keyboard and Reset Connector

CN8 - cpuModule Utility Connector

CN3 - Reserved

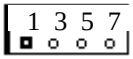
Connector Descriptions

Connectors		
Connector	**Function**	**Size**
CN1	PC/104 XT Bus	64 pin
CN2	PC/104 AT Bus	40 pin
CN3	**Factory use only**	-
CN4	IDE	40 pins
CN5	Floppy	34 pins
CN6	IDE / Floppy Power Out	4 pins
CN7	utilityModule Power	16 pins
CN8	cpuModule Utility	10 pins
CN9	Keyboard / Reset	8 pins
CN10	IDE Drive Activity LED	2 solder holes
TB1 & TB2	+5, +12, -12 Vdc Power I/O	6 terminals

Finding Pin 1 of Connectors

The pin 1 end of connectors is indicated by a white area silk-screened on the PC board. It is also indicated by a square solder pad visible on the bottom of the PC board.
Please make certain you have correctly identified pin 1 of a connector before you connect to it and attempt to use the utilityModule.

PIN ASSIGNMENT



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

Note: Signals marked with (*) are active low

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.

Signals marked with (*) are active low.

IDE Drive, CN4

CN4 is a 40-pin DIL connector used for connecting the IDE drive. The pinout of this connector is shown below.

IDE Drive Connector, CN4

Pin	Signal	Function	in/out
1	RESET*	Reset HD	out
2	GND	Ground signal	--
3	HD7	HD data 7	in/out
4	HD8	HD data 8	in/out
5	HD6	HD data 6	in/out
6	HD9	HD data 9	in/out
7	HD5	HD data 5	in/out
8	HD10	HD data 10	in/out
9	HD4	HD data 4	in/out
10	HD11	HD data 11	in/out
11	HD3	HD data 3	in/out
12	HD12	HD data 12	in/out
13	HD2	HD data 2	in/out
14	HD13	HD data 13	in/out
15	HD1	HD data 1	in/out
16	HD14	HD data 14	in/out
17	HD0	HD data 0	in/out
18	HD15	HD data 15	in/out
19	GND	Ground signal	--
20	N/C	Not Connected	--
21	AEN	Address Enable	out
22	GND	Ground signal	--
23	IOW*	I/O Write	out
24	GND	Ground signal	--
25	IOR*	I/O Read	out
26	GND	Ground signal	--
27	IOCHRDY	I/O Channel Ready	in
28	BALE	Bus Address Latch Enable	out
29	N/C	Not Connected	
30	GND	Ground signal	--
31	IRQ	Interrupt Request	in
32	IOCS16*	16 bit transfer	in
33	A1	Address 1	out
34	GND	Ground signal	--
35	A0	Address 0	out
36	A2	Address 2	out
37	HCS0*	HD Select 0	out
38	HCS1*	HD Select 1	out
39	LED	HDD activity LED (-)	in
40	GND	Ground signal	--

Note: Signals marked with (*) are active low

Floppy Drive, CN5

CN5 is a 34-pin DIL connector that provides the standard signals to connect one or two floppy disk drives. The pinout of this connector is shown below.

Floppy Drive Connector, CN5			
Pin	**Signal**	**Function**	**In/out**
2	RWC*	write precompensation	out
4	N/C	Not Connected	--
6	N/C	Not Connected	--
8	INDEX*	index pulse	in
10	MOTEN1*	motor 1 enable	out
12	DRVSEL1*	drive select 1	out
14	DRVSEL2*	drive select 1	out
16	MOTEN2*	motor 2 enable	out
18	DIRECTION*	step direction	out
20	STEP*	step pulse	out
22	WRDATA*	write data	out
24	WREN*	write enable	out
26	TRACK0*	track 0 signal	in
28	WRPROT*	write protect	in
30	RDDATA*	read data	in
32	HEADSEL*	head select	out
34	DSKCHG*	disk change	in
ODD PINS	GND	Ground signal	--

Note: Signals marked with (*) are active low

Auxiliary Power, CN6, CN7, TB1, and TB2

WARNING! If you improperly connect power, the module will almost certainly be *destroye*d. Please verify power connections to the module *before* applying power.

The power supply can be conveyed to the utilityModule either through the PC/104 bus (CN1 and CN2) or through the Auxiliary Power connectors, CN7, TB1, AND TB2. The utilityModule only uses +5 VDC and ground. +12 VDC, -12 VDC and -5 VDC may be required on other PC/104 boards in the system.

Drive Power, CN6

CN6 is used to power an external Hard drive, CD-ROM, and Floppy drive. The pinout is the same as a standard power connector used on PC-Computer Power Supplies for ease of use with a standard power cable.

Drive Power Connector CN6

Pin	Signal	Function
1	+12 V	+12 Volts DC
2	GND	Ground
3	GND	Ground
4	+5 V	+5 Volts DC

Looking down at the connector, the pinout of the Drive Power connector CN6 is:

1	2	3	4
+ 12 V	GND	GND	+ 5 V

Auxiliary Power Connector CN7

The auxiliary power connector is used to supply 3.3 volts for the PCI bus of the cpuModule if a stackthrough connector is installed

Pin	Signal	Function
1	GND	Ground
2	+5 V	+5 Volts DC
3	N/C	RESERVED
4	+12 V	+12 Volts DC
5	-5 V	-5 Volts DC
6	-12 V	-12 Volts DC
7	GND	Ground
8	+5 V	+5 Volts DC
9	GND	Ground
10	+3.3 V	See Note
11	CPU V+	See Note
12	+3.3 V	See Note

Facing the connector pins, the pinout of the Auxiliary Power connector is:

11	9	7	5	3	1
CPU V+	GND	GND	-5 V	N/C	GND
3.3 V	3.3 V	+5 V	-12 V	+12 V	+5 V
12	10	8	6	4	2

NOTES!

-5 VDC, +12 VDC and -12 VDC voltages are not used by the module, but are connected to the PC/104 bus connectors, CN1 and CN2.

The 3.3 V pins are used to supply the PCI bus if the stackthrough connector to the cpuModule is installed.

The CPU V+ is based upon the voltage the cpu uses which can vary between cpuModules.

Don’t use this as a source of 3.3 volts and don’t connect this pin to a 3.3 volt power supply.

Power I/O, TB1 and TB2

TB1 and TB2 are power I/O connectors and are primarily for use in IDAN systems. The terminals are marked clearly with the appropriate signal for ease of external power I/O connections. -12 Vdc and +12 Vdc are not used on the utilityModule but connect directly to the bus to supply other modules in the stack. Use a flat blade screwdriver to tighten the screw against the inserted wire.

Terminal block Connector TB1

Pin	Signal	Function
TB1-1	+12 V	+12 Volts DC
TB1-2	GND	Ground
TB1-3	+5 V	+5 Volts DC
TB2-1	GND	Ground
TB2-2	-12 V	-12 Volts DC
TB2-3	GND	Ground

cpuModule Utility Connector, CN8

The cpuModule Utility Connector CN8 is a feed-through connector to the following interfaces of a RTD cpuModule:

- AT keyboard
- Speaker input
- System reset output
- Battery output

The following table gives the pinout of the CN8 and its connections to CN9.

CN8 Pin	Signal	Function	CN9 Pin
1	SPKR+	Speaker input	N/C
2	SPKR-	Speaker input (+5 volts)	N/C
3	RESET	Manual push button reset	7
4	N/C	RESERVED	N/C
5	KBD	Keyboard Data	3
6	KBC	Keyboard Clock	4
7	CPU GND	Battery Neg (cpu Gnd)	2 & 8
8	KBP	Keyboard Power (+5 volts)	1
9	BAT	Battery Pos	N/A
10	N/C	RESERVED	N/A

Facing the connector pins, the pinout is:

9	7	5	3	1
BAT	CPU GND	KBD	RESET	SPKR+
N/C	KBP	KBC	N/C	SPKR-
10	8	6	4	2

Keyboard connector, CN9

The keyboard connector CN9 is a feed through-connector to the following interfaces of a cpuModule:

- AT keyboard
- System reset input

The following table gives the pinout of the keyboard connector.

Pin	Signal	Function
1	KBP	Keyboard Power (+5 volts)
2	CPU GND	cpuModule Ground
3	KBD	Keyboard Data
4	KBC	Keyboard Clock
5	N/C	RESERVED
6	N/C	RESERVED
7	RESET	Manual push button reset
8	CPU GND	cpuModule Ground

Facing the connector pins, the pinout is:

7	5	3	1
RESET	N/C	KBD	KBP
CPU GND	N/C	KBC	CPU GND
8	6	4	2

Chapter 4 Using the utilitymodule

IDE Drive

The CM102 provides an IDE interface standard IDE Drive. This drive can be set up as the primary or the secondary drive (you must be sure that your CPU BIOS supports both primary and secondary drives).
Since the CM102 provides the IDE decoding on-board you must be sure to disable any other IDE controllers that might be present in your system or set one of the controllers to ***Secondary*** to prevent controller chip interface conflicts.
You may need to run the bios setup program for your cpuModule or computer to configure the correct hard drive type.

Floppy Drive

The CM102 provides a Floppy Drive interface. This drive can be set up as the primary or the secondary (you must be sure that your CPU BIOS supports both primary and secondary drives).
Since the CM102 provides the Floppy decoding on-board you must be sure to disable any other Floppy controllers that might be in your system or set one of the controllers to ***Secondary*** to prevent controller chip interface conflicts.
Solder blob "B1" is factory default set as primary and should only be changed if two floppy drive controllers are being used.
You may need to run the bios setup program for your cpuModule or computer to configure the correct Floppy drive type.

Power Protection Circuitry

To reduce the risk of damage due to power-supply problems, the utilityModule includes several protective components.

Module Power-Supply Protection

The utilityModule includes components to help prevent damage due to problems with the +5 VDC power supply from the PC/104 bus or power-supply connector. Protection is provided for:

- Over-current
- Reversed polarity
- Excessive voltage

This protection is only for the utilityModule, and will not protect other devices in a PC/104 stack .
The protective fuse is replaceable and is available from electronics suppliers. Its description and part number are:

Littelfuse Nano^2 SMF 1.0 amp, R451-001

Caution: Replace fuses only with parts of identical current and voltage rating.

Speaker and Battery

The utilityModule provides a small speaker for cpuModule sound output. The speaker has 8 ohms of impedance and can be driven from the standard 0.1 watts of power supplied by the cpuModule.
A lithium battery provides approximately 3 Vdc of backup power to the Real Time Clock on the cpuModule. It has a diode to prevent a charge from being applied to the battery and resistor to limit the output current. To disable the protection circuit, install a solder blob on "B2" on the bottom side of the board next to CN8.

Chapter 5 RETURN POLICY and WARRENTY

Return Policy

If the utilityModule requires repair, you may return it to us by following the procedure listed below:

Caution: Failure to follow this return procedure will *almost always* delay repair! Please help us expedite your repair by following this procedure.

1) Read the limited warranty which follows.
2) Contact the factory and request a Returned Merchandise Authorization (RMA) number.
3) On a sheet of paper, write the name, phone number, and fax number of a technically-competent person who can answer questions about the problem.
4) On the paper, write a detailed description of the problem with the product. Answer the following questions:

- Did the product ever work in your application?
- What other devices were connected to the product?
- How was power supplied to the product?
- What features did and did not work?
- What was being done when the product failed?
- What were environmental conditions when the product failed?

5) Indicate the method we should use to ship the product back to you.

- We will return warranty repairs by UPS Ground at our expense.
- Warranty repairs may be returned by a faster service at your expense.
- Non-warranty repairs will be returned by UPS Ground or the method you select, and will be billed to you.

6) Clearly specify the address to which we should return the product when repaired.
7) Enclose the paper with the product being returned.
8) Carefully package the product to be returned *using anti-static packaging!* We will not be responsible for products damaged in transit for repair.
7) Write the RMA number on the outside of the package.
8) Ship the package to:

RTD Embedded Technologies, Inc.
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State College, PA 16803
USA

Chapter 6 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.

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

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