



USER MANUAL

10/100 ETHERNET SWITCHING HUB



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10/100 ETHERNET SWITCHING HUB

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INTRODUCTION

10/100 Ethernet Switching Hub



The *10/100 Ethernet Switching Hub* from Parvus Corp. is a 5-port network switch that enables up to five embedded computing devices to be networked together using 10BaseT or 100BaseTX Ethernet connections. Measuring only 3.550" x 3.775" in size, this product is available in four different configurations to accommodate a broad range of both PC/104 and other embedded systems environments (i.e. Compact PCI, VME, PMC, ETX, DIMM-PC, ISA, etc.).



Each version of this embedded Ethernet switch offers IEEE 802.3 and IEEE 802.3u compliance with five auto-configurable 10/100 transceiver ports and independent Fast Ethernet media access controllers, a high-speed address look-up engine, 1 Mbit embedded frame buffer memory and auto-MDI-MDIX network installation. The board also provides non-blocking switching performance for all data traffic environments, including backpressure and pause frame flow control schemes.



Ethernet connections are made through either onboard RJ-45 jacks or right-angle Molex connectors. The 4-pin Molex headers enable embedded systems to optionally mount RJ-45 jacks in a faceplate, endcap or enclosure using a Parvus cable set (sold separately), which includes five female Molex to RJ-45 cables.



Enabling full-bandwidth 10/100 Mbps switched access to the Internet or networked devices, this embedded Ethernet/Fast Ethernet switch has been environmentally tested by parvus for operating temperatures below -70°C and above +100°C for approximately two hours with circulated air. Potential applications for the switching hub include machine monitoring, process control, test and measurement, environmental control, remote data acquisition, and communications gateways in avionics/aerospace, defense, factory automation, medical, telecom and transportation fields.

Part numbers PRV-1059X-01 (RJ-45) and PRV-1059X-02 (Molex) include the 104-pin PC/104 header and are designed to be powered through the PC/104 bus. PRV-1059X-03 (RJ-45) and PRV-1059X-04 (Molex), however, do not have the PC/104 bus, but instead have a 2-pin Molex connector for external power connections. All versions include mounting holes to facilitate simple installation.

Features

- 5 Auto-configured ports (straight/twist)
- Auto-negotiation and speed auto-sensing support
- Back pressure-based flow control of half duplex ports
- Baseline wander correction circuitry
- RJ-45 jack or Molex panel mount connectors

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- Highly integrated DSP-based 10/100 switch
 - 3-pin header for optional security mode
 - LED activities indicators
 - Look-up engine supports as many as 4,096 MAC address entries
 - Low power dissipation
 - Pause frame-based switch fabric delivers true non-blocking switching
 - Ports can work at 10Mbps or 100 Mbps, full duplex or half duplex mode
 - Simple networking installation through auto-MDI/MDIX (All ports can act as uplink)
 - Store-and-forward switching mode
 - 2-Pin Power Header for External Power Connections (PRV-1059X-03, -04 Only)
 - 16-bit PC/104 Bus (PRV-1059X-01, -02 Only)

About PC/104

The PC/104 specification is characterized by its small form-factor (3.550" x 3.775"), stackable 104-pin/socket ISA bus connector, and reduced bus signal drive, making PC/104's size, durability, expandability, reliability, quality, and power consumption ideal for embedded computing. PC/104 technology leverages the same readily available development tools used with personal desktop computers to dramatically improve time-to-market for embedded systems development. The full PC/104 specification can be found at the PC/104 Consortium Web site: http://www.pc104.org/technology/pc104_tech.html

INSTALLATION

Board Installation:

The hub does not require drivers or software configuration. Carefully remove the board from its anti-static bag. Users can immediately use any of the features of the product simply by attaching the cables and supplying power to the unit through either the PC/104 bus or 2-pin power header, depending on the version purchased. For PC/104 applications, make sure all pins are lined up before insertion. Attach the 10/100 Ethernet Switching Hub into a PC/104 card stack by mating PC/104 bus connector to PC/104 bus connector.

Installing Network Cables:

The following types of cabling can be used with the 10/100 Ethernet Switching Hub:

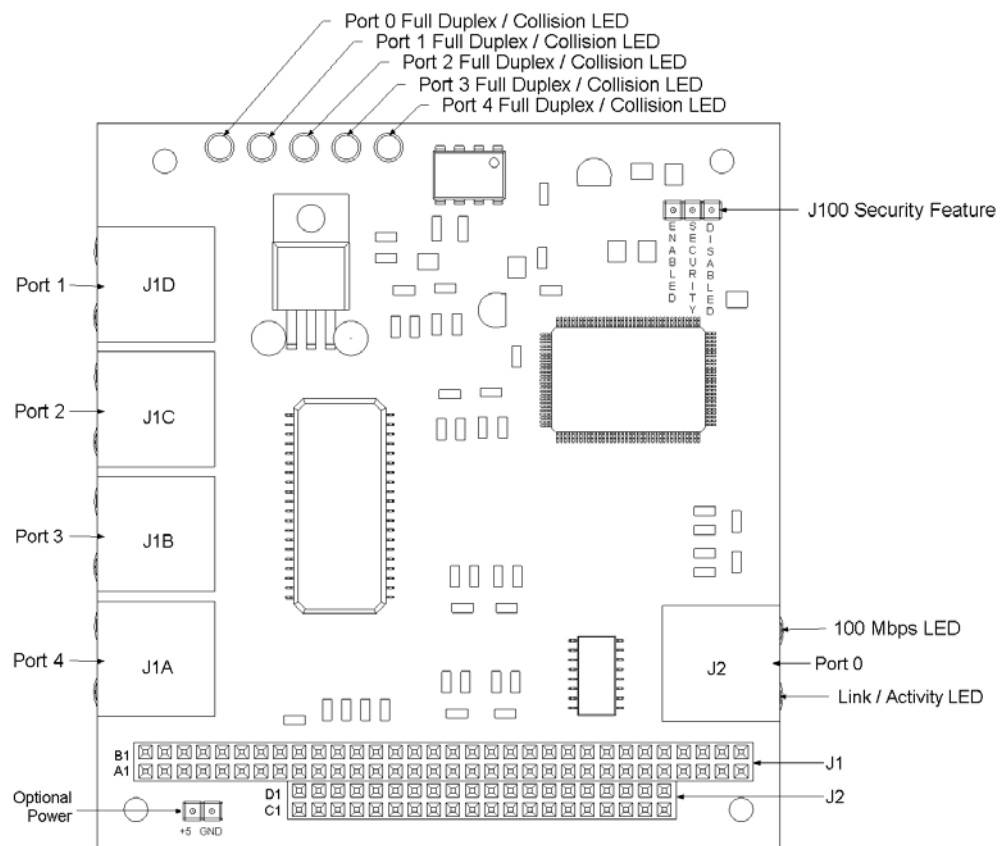
- 10BaseT Category 3,4 or 5 UTP/STP
- 100BaseTX Category 5 UTP/STP

Although Port 0 is defined as the uplink port, all five ports have been implemented and can serve as an uplink port. Twisted-pair crossed cabling (10BaseT or 100BaseT) is recommended yet not required for the uplink connection (hub-to-hub). Straight cabling for the remaining port connections (Hub-to-PC) is similarly recommended, but not required. It is also recommended to power down the unit when changing an uplink connection.

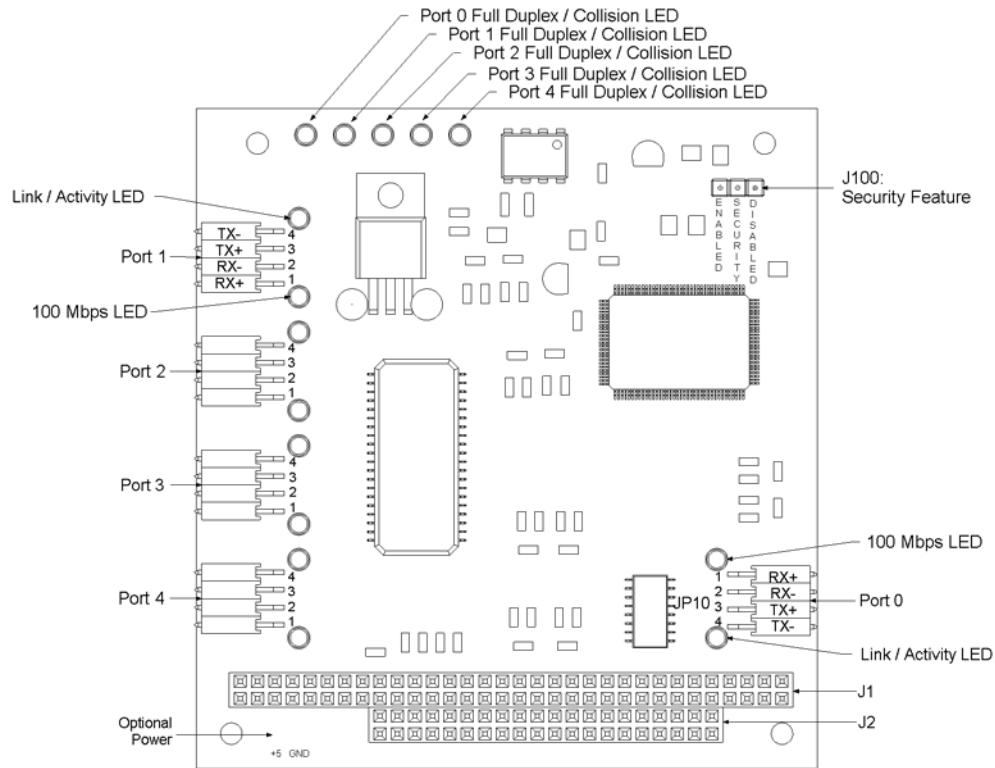
CONNECTION

Connector Placement

10/100 Ethernet Switching Hub (w/ local RJ-45 Jacks)



10/100 Ethernet Switching Hub (w/ 4-pin Molex Connectors)



Connector Pinouts

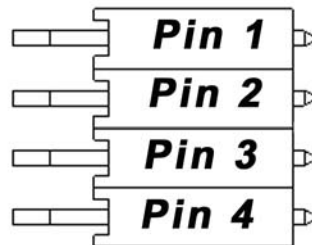
J1/J2: PC/104 Bus				
Pin	Row A	Row B	Row C	Row D
0	--	--	GND	GND
1	/IOck	GND	/SBHE	/MCS16
2	SD7	Rstdrv	LA23	/IOCS16
3	SD6	+5v	LA22	IRQ10
4	SD5	IRQ9	LA21	IRQ11
5	SD4	-5v	LA20	IRQ12
6	SD3	DRQ2	LA19	IRQ15
7	SD2	-12v	LA18	IRQ14
8	SD1	/Exfer	LA17	/DA0
9	SD0	+12v	/MR	DRQ0
10	IOrdy	(key)	/MW	/DA5
11	AEN	/SMW	SD8	DRQ5

12	SA19	/SMR	SD9	/DA6
13	SA18	/IOW	SD10	DRQ6
14	SA17	/IOR	SD11	/DA7
15	SA16	/DA3	SD12	DRQ7
16	SA15	DRQ3	SD13	+5v
17	SA14	/DA1	SD14	/MSTR
18	SA13	DRQ1	SD15	GND
19	SA12	/Rfrsh	(key)	GND
20	SA11	SCLK	--	--
21	SA10	IRQ7	--	--
22	SA9	IRQ6	--	--
23	SA8	IRQ5	--	--
24	SA7	IRQ4	--	--
25	SA6	IRQ3	--	--
26	SA5	/DA2	--	--
27	SA4	TC	--	--
28	SA3	BALE	--	--
29	SA2	+5v	--	--
30	SA1	OSC	--	--
31	SA0	GND	--	--
32	GND	GND	--	--

The PC/104 bus always uses Row A and B, while Row C and D are for 16 bit systems. B10 and C19 are keyed locations. For more information about the PC/104 specification, please visit the PC/104 Consortium Web site: http://www.pc104.org/technology/pc104_tech.html

Ports 1,2,3,4,0: JP2, JP4, JP6, JP8, JP10 (for Molex Connector Version) or J1D, J1C, J1B, J1A, J2 (for RJ-45 Connector Version)

Port Pin Assignments (for Molex):



Pin	Function (Port 0-4)
4	Tx -
3	Tx+
2	Rx -
1	Rx+

CON2/J101: 2-Pin Power Connector (Not Loaded on PC/104 versions)

Pin 1	+5VDC
Pin 2	GND

J100: Security (Used to Limit Flow of Packets)

By default, pins 2 and 3 are jumpered, while pin 1 is open to allow full functionality and disabling of the security feature, if desired. To enable security feature, jumper pins 1 and 2. See SWITCH OPERATIONS section to learn more about the security feature. Default setting shown:



SWITCH OPERATIONS

Auto-Negotiation

The Switching Hub has been implemented with auto-negotiation features that communicate with a link partner to determine the speed and duplex with which to operate. Auto-negotiation automatically configures each port for 100BaseT/10BaseT full and half-duplex operation and tells a link partner that it supports Pause frames (full-duplex flow control).

Auto MDI-/MDIX Crossover

The board also determines whether or not it needs to cross over between pairs, virtually eliminating the need for an external crossover cable. If it interoperates with a device that cannot automatically correct for crossover, the switching hub makes the necessary adjustment prior to commencing auto-negotiation. Similarly, if the hub interoperates with a device that implements MDI-MDIX crossover, a random algorithm determines which device performs the crossover.

Media Access Controllers (MAC)

Five independent MACs perform the 802.3 protocol functions, including frame formatting, frame stripping, CRC checking, CSMA/CD enforcement, collision handling, etc. Before a packet can be sent out, the transmit block must check if the line is available for transmission. The transmit line is available all the time when the port is in full-duplex mode, but the line could be busy receiving a packet if the port is in half-duplex mode. If the line is busy, the transmitter waits by deferring its transmission. When the line is available, the transmission insures a minimum interpacket gap of at least 96 bits has occurred and then transmits a 56-bit preamble and an 8-bit Start of Frame Delimiter (SFD) ahead the basic frame.

For half-duplex mode, the hub also monitors the collision signals while it is transmitting. If a collision is detected (i.e. both transmitter and receiver of a half-duplex MAC are active at the same time), the MAC transmits a JAM pattern and then delays the retransmission for a random time period determined by the IEEE 802.3 backoff algorithm. In full-duplex mode, the collision signal and backoff algorithm is ignored.

Backoff

In half-duplex mode, the Ethernet Hub's MACs implement a truncated binary exponential backoff algorithm, starting with a randomly small backoff time followed by progressively longer and longer random backoff times. The random times prevent two or more MACs from always attempting re-transmission at exactly the same time. The progressively longer backoff times give a wider random range giving congested links a better chance of finding a winning transmitter. The MACs will rest the progressively longer backoff time circuit after 16 consecutive re-transmit trials.

Half- and Full-Duplex Flow Control

Half- and Full-duplex flow control is used to throttle the end station to avoid dropping packets during network congestion. When the free buffer space is almost empty or the output queue is almost full, the MACs force a collision in the input port when sensing an incoming packet.

10/100 Switch

The switch receives good packets from the MACs, processes them, and forwards them to the appropriate MACs for transmission. The switch learns what port an end station is connected to by remembering each packet's Source Address along with the port number the packet came in on.

Lookup Engine

The Address Lookup Engine (ALE) gets the addresses from each packet received from each port, performing all address searching, learning and aging functions for all five ports at "wire speed" rates. The address table has storage for up to 4096 entries in the embedded SRAM. The aging time is from 300 to 600 seconds or 5 to 10 minutes.

Address Searching

The address-searching engine is used to search the output of each MAC destination address. It arbitrates the 5 input destination addresses and grants one lookup at a time. Data is read from the SRAM table, and status is compared with the entry's contents. If the compare matches, it returns the output port number to the output port queue manager. If the compare does not match, the packet is treated as a broadcast packet and is sent to all output ports except the source port.

Address Learning

An address-learning engine is used to learn the source address. Up to 4096 MAC address/port number mappings can be stored in the address table.

Address Aging

Continuous address aging ensures that a node is disconnected from the network segment, or if it becomes inactive, its entry is removed from the address table. On each aging sweep of the table (average sweep time is 5 minutes), the hub reads each entry of the memory block and updates the aging status bit.

Security

The 10/100 Ethernet Switching Hub has an optional security mode to restrict the flow of packets through the switch. When security is enabled, packets received from Ports 1 to 4 can only go out to Port 0. The mode treats Port 0 as an Uplink or Router port, preventing Ports 1 to 4 from talking directly to each other. When security is disabled, packets traverse normally through the switch. See CONNECTION section for more information.

SPECIFICATIONS

Environmental

Operating Temperature 0°C to +70°C (but can be certified to extended temperatures)

Electrical

Requirements +5VDC (< 50mV Noise/Ripple)
Power Consumption Up to 4.0 Watts (typical)

Mechanical

Dimensions 3.550" x 3.775"

At Parvus® we design and manufacture our products to ISO-9001 standards to meet the demanding requirements of embedded applications like yours. We not only strive to offer high-caliber products and performance, but our technical support Web site (<http://tech.parvus.com>) and phone-in support line (801-483-1533) are ready to serve you. Following is a sampling of our PC/104-related products available for purchase:

High Functionality CPU

SpacePC® 4500 Chipset CPU-4500X-00	PC/104-Plus, Intel Celeron 400MHz, 128MB SDRAM, Intel 10/100 Ethernet, VGA, IDE, Audio, 2 Serial, 4 USB, Parallel, IDE
SpacePC® 4320 CPU-4320X-04	PC/104-Plus, AMD Geode GX1 266/300MHz, 128MB SDRAM, 10/100 Ethernet, LCD-TFT/CRT, IDE, Audio, 2 Serial, 1 USB
SpacePC® 2320 CPU-2320X-04	PC/104, AMD Geode GX1 266/300MHz, 128MB SDRAM, 2 USB 10/100 Ethernet, DiskonChip, LCD/CRT, IDE, AC97, 2 Serial
SpacePC® 4200 CPU-4200-00	PC/104-Plus, 5x86, AMD Elan SC520 133MHz, 64MB SDRAM, 2x 10/100 Ethernet, 4 serial, IDE, Parallel, Low Power, etc.
SpacePC® 2200 CPU-2200X-01	PC/104, 486DX4, STPC 75MHz, 32MB EDO DRAM, 10/100 Ethernet, 4 Serial, DiskonChip, CRT, IDE, Lower Power, etc.
SpacePC® 2110 CPU-2110X-00	PC/104, 386SX, ALI M6117C 40MHz, 4MB DRAM, Ethernet, 4 Serial, 2 CAN, 16 DIO, DiskonChip, IDE, Parallel, etc.
SpacePC® 2100 CPU-2100X-01	PC/104, 386SX, ALI M6117C 40MHz, 8MB DRAM, 2 Serial, DiskonChip, IDE, Parallel, Lower Power Consumption, etc.
PPC/104-555 PRV-1169X-01	Motorola MPC555 PowerPC, 32 digital I/O, two RS-232, two CAN 2.0B, LCD/CRT, IDE and FDD controllers, etc.
ipLINK™ PRV-1001X-01	8-bit 30MHz Rabbit 2000, 128K SRAM, Ethernet, 4 Serial, 21 DIO, onboard power supply, and TCP/IP capabilities.

I/O & Datacom

PCMCIA Dual Interface PRV-01016X-01,-02,-03	Two-slot PCMCIA controller board supporting Type I, II, III PCMCIA memory, I/O and ATA cards. Top, left or front-loading.
OrbiTrak™ 8R PRV-5023X-01	Integrated PC/104 navigation module with 8-channel Trimble Lassen LP GPS receiver, 2 serial, 16DIO, odometer Input
MPEG104™ Encoder PRV-5020X-01	RealTime MPEG-1 Encoder, PC/104-Plus, Four (4) Composite Video Input (CVBS), One Stereo Audio input, 4 GPDIO
FG104™ Frame Grabber PRV-5017X-01	PC/104-Plus Frame Grabber, NTSC / PAL / SECAM, Four (4) Composite, Up to 768 x 576 Pixel Resolution, 24 GPDIO
Sonic Audio™ SP	Sound Blaster Pro Compatible, ESS1869 Audio Chip, 2 Serial

PRV-5019X-01	Ports, 1 Parallel Port, Four Audio Inputs, Two Outputs
24 Point Form C Relay PRV-0728X-01	Dual-purpose output capability with 16 digital I/O ports, 24 relays, Form C outputs rated for 1 amp switching current.
104FX™ Video Card PRV-5018X-01	LCD/CRT SVGA Video Controller. Supports TFT, STN, DSTN, EL, Plasma. LCD Resol: 1280 x 1024. CRT Resol: 1024x768.
62 Point Isolated Digital I/O PRV-0648X-01	42 field-configurable points for input or output. Up to 36 Volts AC or DC. Optically isolated.
High Density Digital I/O PRV-0696X-01	70 point logic level board has 48 points @ 300mA, active low, surge protected outputs.
Compact Flash & IDE Adapter PRV-1028X-01	Carrier for Compact Flash disk and/or 2.5" laptop hard drive or up to two other IDE devices in master/slave configuration.
Biohenticator™ Fingerprint Sensor board PRV-1168X-01	PC/104 fingerprint identification device. 300 x 300 dpi pixel sensor array. Parallel port and ISA interface. Form-C relays. Configuration jumpers. 1.5cm X 1.5cm sensor area.
10/100 Ethernet Switch PRV-1059X-01, -02	Fast Ethernet Switch. IEEE802.3, IEEE802.3u compliant. 5 auto-configurable ports. Local RJ-45 or 4-pin Molex connectors.
VersiNet 10Mbit Ethernet PRV-0713X-02	NE2000 and NE2000 Plus supports 10BaseT or AUI connections and 2 serial ports.
Fast1394 3-Port FireWire PRV-5026X-01	3-Port PC/104-Plus FireWire (IEEE-1394b) card. Supports S100, S200, S400 and S800 transfer rates at speeds up to 800 Mbps.
1553 Dual Interface PRV-0949X-01	Two UTMC SuMMIT chips provide two dual-redundant MIL-STD-1553 busses for any PC/104 system.
1553/Ethernet PRV-0950X-01	Provides both a MIL-STD-1553 bus and NE2000 Plus Ethernet.
MultiComm™ PRV-5021X-01 /5022X-01	Support 8 independent serial ports as either eight (8) RS-232, or four (4) RS-232 and four (4) RS-422/485 ports; Ethernet; CAN

DC/DC Power and Thermal Management Products

OnPower™ 20 PRV-0411X-01	20W, +5VDC @ 4A, -5 VDC @ 200mA, -12 VDC @ 400mA <i>Input Range: 7-19 VDC</i>
OnPower™ 30 PRV-0510X-01	30W, 15-60 VDC, 5 VDC @ 6A (10A Surge)
OnPower™ 50 PRV-0634X-01, -02	50W, 15-60 VDC, +5Vdc @ 5A, +12/+15 VDC@2A, -12/-15 VDC @400mA
OnPower™ 75 PRV-0617X-01	75W, 9-60 VDC, +5Vdc @ 15A, +12 VDC @ 2.5A, -12 VDC @ 500mA
OnPower™ 90	90W, 9-60 VDC, +5Vdc @ 18A, +12 VDC @ 2.5A,

PRV-0975X-01	-5 VDC @ 500mA, -12 VDC @500mA
PC/104+ Power Interface PRV-0974X-01	PC/104-plus to PC/104 conversion; +5 and ± 12 VDC to ISA, +3.3 Vdc @ 6A to PCI, (2) Fans
PC/104 Fan Card I PRV-0509X-01	5 VDC, (2) Bi-directional fans.
Environmental Fan II PRV-0509X-07, -06	5 VDC, (2) Bi-directional fans, intelligent temperature sensor, Optional humidity and pressure sensors

Interconnection & Development

Double Height Adapter PRV-0414X-04	Designed for PC/104 modules with tall components (i.e. CPU, fans, heatsinks) that exceed PC/104 specification height (0.60").
ISA/104 Bus Adapter PRV-0415X-03	16-bit ISA card with PC/104 header for development and testing in an ISA environment. Speeds development and reduces costs.
Diagnostic Board PRV-0876X-01	Monitors entire 16-bit PC/104 bus activity while the card stack is running.
PC/104 POST Code Board PRV-0867X-01	BIOS Power-On-Self-Test (POST) codes are read at I/O port 80h during troubleshooting to establish system failure point.
Quad KVM Switch PRV-0886X-01	Up to 4 separate PC/104 CPUs can share one set of I/O devices. Routes signals from VGA, COM port, and utility connector.
PC/104 Quad Motherboard I PRV-0662X-01	Mounts up to 4 PC/104 boards in 2" high profile. Power indication LEDs; on-board power filtering.
PC/104 Quad Motherboard II PRV-0889X-01	Provides a platform for mounting up to four PC/104 cards in a space less than 1.30" high.

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For more information about this or other products in the parvus line of development tools or control systems call (801) 483-1533 from 8:00AM to 5:00PM Mountain Time, E-mail us at parvus@parvus.com or visit our web-site at: <http://www.parvus.com>

LIMITED WARRANTY

The parvus Corporation warrants this product to be free of defects in materials and workmanship, and that the product meets or exceeds the current specifications published by parvus. This Warranty is valid for a period of one (1) year from the date of purchase. parvus reserves the right to repair or replace any Warranted products at its sole discretion. Any product returned to parvus for repair or replacement under the provisions of this warranty must be accompanied by a valid Return Material Authorization (RMA) number issued by the parvus Customer Service Department.

The parvus Corporation makes no warranty not expressly set forth in this document. parvus disclaims and excludes all implied warranties of merchantability and fitness for a particular purpose. The aggregate liability of parvus arising from or relating to (regardless of the form of action or claim) is limited to the total of all payments made to purchase the product. parvus shall not in any case be liable for any special, incidental, consequential, indirect or punitive damages, even if parvus has been advised of the possibility of such damages. parvus is not responsible for lost profits or revenue, loss of the use of software, loss of data, costs of recreating lost data, or the cost of any substitute equipment or program.

This Warranty shall be governed by the laws of the United States of America and the State of Utah, and any claim brought under this Warranty may only be brought in state or federal court located in Salt Lake County, State of Utah, and purchaser hereby consents to personal jurisdiction in such courts.

FEDERAL COMMUNICATIONS COMMISSION RADIO FREQUENCY INTERFERENCE STATEMENT

Warning: The equipment described herein has been designed to comply with the limits for a Class B computing device, pursuant to Subpart J of Part 15 of FCC rules. Only peripherals (computer input/output devices, terminals, printers, etc.) designed to comply with the Class B limits may be attached to this computer.

INSTRUCTIONS TO USER: This equipment generates and uses radio frequency energy and if not installed and used properly, i.e., in strict accordance with the operating instructions, reference manuals, and the service manual, may cause interference to radio or TV reception. It has been designed to comply with the limits for a Class B computing device pursuant to Subpart J of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when operated in a residential installation.

For further information contact:

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