PCI20U

Universal Voltage PCI Bus ARCNET® Network Interface Modules

INSTALLATION GUIDE

INTRODUCTION

The PCI20U series of ARCNET network interface modules (NIMs) links PCI and PCI-X bus compatible computers with the ARCNET local area network (LAN). Since most PC motherboards have migrated from the +5 V PCI Bus to the +3.3V PCI Bus, a universal voltage PCI NIM is required. In addition, the PCI20U series supports the PCI Add-in card specification. Both standard height and low-profile brackets are provided. The PCI Bus allows for jumperless configuration and Plug and Play operation. The module operates with either an NDIS driver or a null stack driver in a Windows® environment. DOS drivers will operate when used with our enabler software.

Since the PCI20U is a universal voltage PCI card it can be used in either a PCI-X slot or a conventional PCI slot. PCI-X is an enhancement to the original PCI Local Bus Specification enabling devices to operate at speeds up to 133 MHz. If a PCI20U is installed into a bus capable of PCI-X operation, the clock remains at the 33 MHz frequency and other devices on that bus are restricted to using conventional PCI protocol.

The PCI20U incorporates the COM20022 ARCNET controller chip with enhanced features over the earlier generation ARCNET chips. New features include command chaining, sequential access to internal RAM, duplicate node ID detection and variable data rates up to 10 Mbps. Bus contention problems are minimized since the module's interrupt level and I/O base address are assigned through Plug and Play. There is no requirement for wait-state arbitration.

The PCI20U exploits the new features of the COM20022. This includes 10 Mbps communications utilizing the various EIA-485 transceiver options.

Each PCI20U module has two LEDs on the board for monitoring network operation and bus access to the module. It is equipped with an 8 position, general purpose DIP switch typically used to assign the ARCNET node address. Ultimately, the node address is configured via software so the DIP switch can also indicate user-defined functions such as data rate, cable interface, or master/slave status of the system.

CONTEMPORARY C**ONTROLS**®

There are several versions of the PCI20U ARCNET NIM. Three models support traditional ARCNET 2.5 Mbps di-pulse transceivers. The PCI20U-CXS supports coaxial star or point-to-point configurations facilitated by the use of active hubs. The PCI20U-CXB supports coaxial bus configurations while the PCI20U-TB5 supports twisted pair bus configurations using RJ-45 connectors. Both bus topology products usually do not require active hubs. Four models also support EIA-485 networks and both standard mode and backplane mode are supported. The PCI20U-485 (backplane mode) and PCI20U-485D (non-backplane mode) support DC-coupled operation. The PCI20U-4000 (backplane) and PCI20U-485X (non-backplane) support AC-coupled operation.

SPECIFICATIONS

Environmental
Operating temperature: 0°C to +60°C
Storage temperature: –40°C to +85°C

Data Rates
PCI20U-CXB, -CXS, -TB5   2.5 Mbps
PCI20U-485, -485D   10 Mbps, 5 Mbps, 2.5 Mbps, 1.25 Mbps, 625 kbps, 312.5 kbps, 156.25 kbps
PCI20U-4000, -485X   10 Mbps, 5 Mbps, 2.5 Mbps, 1.25 Mbps

Dimensions	*Shipping Weight*
2.50" x 4.72"	1 lb. (.45 kg)
(64 mm x 120 mm)	

I/O Mapping
Requires 16 bytes of I/O space for COM20022 controller

Interrupt Lines
Supports PCI INTA

Compatibility
PCI20U series NIMs are fully compatible with all of Contemporary Controls (CC) ARCNET products and PCI Bus computers.

Regulatory Compliance
CE Mark; CFR 47 Part 15 Class A

Power Requirements

Model	+5 V	+3.3 V	V I/O
PCI20U-4000	400 mA	30 mA	20 mA
PCI20U-485	400 mA	30 mA	20 mA
PCI20U-485D	400 mA	30 mA	20 mA
PCI20U-485X	400 mA	30 mA	20 mA
PCI20U-CXB	400 mA	30 mA	20 mA
PCI20U-CXS	400 mA	30 mA	20 mA
PCI20U-TB5	400 mA	30 mA	20 mA

INSTALLATION

The PCI20U can be installed in any PCI Bus compatible computer. With the power detached from the computer, remove the cover of the computer—exposing the motherboard and expansion slots (connectors). Care should be taken when installing the PCI20U because both it and the exposed computer motherboard are sensitive to electrostatic discharge. To prevent inadvertent damage, touch the metal case of the internal power supply to discharge yourself then proceed to remove the PCI20U from its protective ESD package. Remove the backplate of the computer adjacent to the desired slot (connector). The PCI20U can then be inserted into this slot by applying a downward even pressure until it stops and is firmly seated into the connector. The PCI20U backplate can be secured to the computer by installing the small screw used to attach the original backplate. Hardware installation is completed by replacing the computer cover.

Software Drivers

Unlike ISA Bus computers, PCI Bus computers frequently have their resources assigned by the operating system. The PCI20U requires a 16-byte I/O range for the COM20022 ARCNET controller and one interrupt line. Depending upon the sophistication of the software driver, the PCI20U assignment may be done automatically by the driver with little concern on the part of the user. This is called Plug and Play operation. Some software drivers, especially those originally written for ISA bus computers, may not verify resource allocation automatically— requiring the user to accomplish this task. This is called jumperless operation. It is important that the user appreciate the type of software driver being used since it is sometimes difficult to remove software drivers once they are installed.

OEM Software Driver

If the PCI20U has been specified by an Original Equipment Manufacturer (OEM) for use with their equipment, follow the instructions of the OEM and utilize their driver disk.

Microsoft® Networking

If your intention is to use Microsoft Networking with Windows 95, 98, NT or 2000, you will require an NDIS 4.0 driver. Obtain this driver from our web site and follow the instructions on its use. This is a Plug and Play driver so it is unnecessary to use our enabler software or verify resources. With this driver you can operate with the various transport layers supported by Microsoft including TCP/IP.

Legacy ISA Software Driver

The PCI20U is register compatible with our PCX20 ISA adapter, PC10420 PC/104 adapter, PCM20 PC card adapter, as well as SMSC's COM20020 Evaluation Board. If the software driver was originally written for the ISA or PC104 versions of these adapters and the intent is to operate this same driver using the PCI20U under Windows 95, 98 or ME, then enabler software is required to map the system resources to the I/O and interrupt requirements of the legacy driver. The required enabler software is available on our web site. Only use this software when a Plug and Play driver does not exist. Follow the instructions in the README.TXT file (which can be found in the enabler file set) before attempting an installation of this software.
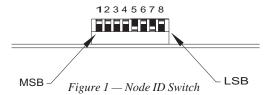
Other Operating Systems

With Windows NT/2K/XP, you must have a Plug and Play driver. The enabler software cannot be used. For other operating systems such as Linux or QNX, view our web site for the latest support on these operating systems.

Node ID Switch

Although not always necessary with the COM20022, the PCI20U provides a separate input port that reads an 8-bit DIP switch (SW1) located at the top edge of the module. This switch is intended to serve as a node ID switch, although it can serve as a general purpose switch if desired. The node ID switch has no connection to the COM20022 ARCNET controller chip.

The most significant bit (MSB) is switch position 1, and the least significant bit (LSB) is switch position 8. A switch in the open position (off position or away from the printed circuit board) introduces a logic "1". Figure 1 shows the node ID switch. In this example the switch is set to hexadecimal address F5.

Figure 1 — Node ID Switch

Indicator Lights

There are two LEDs located at the PCI20U backplate. The yellow LED indicates that the PCI20U is being accessed via its I/O address. The green LED indicates that the PCI20U is transmitting ARCNET traffic to the network.

FIELD CONNECTIONS

The PCI20U is available in several transceiver options. Each transceiver, which is matched to a particular cable type, is identified by a suffix appended to the model numbers. The capabilities of each transceiver differs.
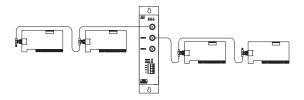

Figure 2 — A hub is required to extend bus segments.

-CXB Coaxial Bus

For hubless systems, the -CXB transceiver can be used. NIMs are interconnected with RG-62/u cables and BNC Tee connectors. Each -CXB NIM represents a high-impedance connection in both the powered and unpowered states. Therefore, passive termination must be applied to both ends of a bus segment. Use BNC-style 93 (nominal) ohm resistors at each end. The maximum segment length is 1000 feet and the maximum number of NIMs that can be connected to a segment is eight.

To extend a bus segment beyond 1000 feet, an active hub is required. If the hub port is of the -CXS type, connection can be made if a few simple rules are followed. Only connect this type of hub at the end of a segment. Do not connect the hub to the middle of a segment since the hub port is not of the high impedance type. Do not terminate the end which attaches to the hub port since a -CXS port effectively terminates the end of a bus segment. Simply remove the BNC Tee connector and terminator from the segment end and attach the cable directly to the hub port. The opposite segment end still requires termination if no hub connection is being made.

-CXS Coaxial Star

In a coaxial star system, NIMs and hubs are interconnected in a point-to-point fashion using coaxial cable. A NIM can connect to one other NIM or can connect to an unused port on a hub. Hub-to-hub connections are allowed.

In a two-node system, simply connect the two -CXS NIMs together using RG-62/u coaxial cable. The length of cable cannot exceed 2000 feet.

If more than two NIMs are used on a network, either an active or passive hub is required. With passive hubs, a maximum of four NIMs can be interconnected. Unused ports on the passive hub must be terminated with a 93 ohm (nominal) resistor. The maximum length allowed between a passive hub port and a NIM is 100 feet.

Active hubs provide overall better performance than passive hubs since greater distances can be achieved along with a degree of isolation. Connect each NIM to a port on the hub using RG-62/u coaxial cable. This length of cable cannot exceed 2000 feet nor can the length of cable between two cascaded hubs exceed 2000 feet. However, up to ten hubs can be cascaded thereby providing an overall cable length of 22,000 feet. Unused ports on active hubs need not be terminated.
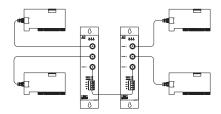

Figure 3 — Point-to-point connections are required between -CXS NIMs and hubs

-TB5 Twisted-Pair Bus

The -CXB transceiver can be modified to drive a balanced cable system with the addition of some parts. This configuration is called -TB5 and it supports shielded or unshielded twisted-pair cable such as Category 5. Dual RJ-45 connectors replace the single BNC connector in order to support the popular modular plug connectors. Follow the connector pin assignments in Table 2 when using this connector or when mixing cable types. Wiring between NIMs is accomplished in a daisy-chain fashion with point-to-point cables connecting the various NIMs to create a bus segment. The end NIMs will have one vacant RJ-45 socket which is to hold the RJ-45 style 100-ohm terminator required to terminate the end points of the bus segment. Use twisted-pair cable and observe polarity. Modular plugs must be installed on this cable such that they do not invert the signals. Most satin cable does not twist the pairs nor maintain signal polarity. Do not use this cable. To test the proper cable connections, hold both ends of the cable side by side with the retaining clips facing the same direction. The color of the wire in the right-most position of each plug must be the same if there is no inversion of the cable. If this is not the case, the cable is inverted. Up to eight -TB5 NIMs can be connected to one segment which cannot exceed 400 feet in length.

The overall distance of a twisted-pair network can be expanded beyond 400 feet if hubs are used. Use a hub port that supports the same -TB5 interface.
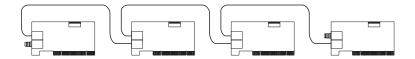
Figure 4 — TB5 NIMs are connected in a daisy-chain fashion.

-485D DC-Coupled EIA-485 (Non-Backplane Mode)

The PCI20U-485D supports DC-coupled EIA-485 communication via a daughter board which replaces the coaxial hybrid transceiver. This daughter board receives the conventional P1 and P2 pulses intended for the coaxial hybrid transceiver and converts them to an elongated P1 pulse (the width is equal to P1 and P2) suitable for the EIA-485 differential driver. Therefore, do not set the COM20022 to backplane mode for EIA-485 communication as recommended in Standard Microsystems Corporation's (SMSC) application note and data sheet since CC implements the same signaling on this daughter board. With our approach, the same software driver used for coaxial networks will function with the EIA-485 version of the PCI20U without modification.
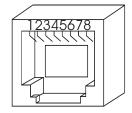

Figure 5 — Modular Jack Numbering Orientation

On each NIM, one three-position screw terminal (see Figure 6) connector provides a convenient daisy-chain connection for attaching multiple nodes onto one segment. Make sure that the phase integrity of the wiring remains intact. Be sure to use the proper cable. Refer to Table 3 for connector pin assignments.

Termination

Each end of the segment must be terminated in the characteristic impedance of the cable. A 120-ohm resistor can be invoked with a jumper which resides on the EIA-485 daughter board. With the middle jumper inserted at location E1 on the daughter board, 120 ohms of resistance is applied across the twisted-pair (Figure 7). With the jumper removed, no termination is applied. If external termination is desired, remove this jumper and install a 120-ohm 1/4 watt resistor across pins 1 and 2 on the screw terminal connector. Incorporating a resistance value less than 120 ohms is not recommended since it may excessively load the EIA-485 transceivers.

Modular Connector Pin Assignments	
8-Contacts	
Pin	Usage
1	Not Used
2	Not Used
3	Not Used
4	Line– (Phase B)
5	Line+ (Phase A)
6	Not Used
7	Not Used
8	Not Used

Table 2 — Modular Connector Pin Assignments

Bias

In addition to the termination, it is also necessary to apply bias to the twisted-pair network so that when the line is floated, differential receivers will not assume an invalid logic state. There are two precision bias resistors (Rb) of equal value on each daughter board. One resistor is tied to the +5 V line and the other is tied to ground. Each resistor has a jumper associated with it. If the two jumpers are installed, the resistor tied to +5 V is connected to the (+) signal line while the grounded resistor is connected to the (–) line. This voltage drop will bias the differential receivers into the "1" state when no differential drivers are enabled. Differential receivers typically switch at or near zero volts differential and are guaranteed to switch at +/–200 mV. Through the transition point, 70 mV of hysteresis will be experienced. Therefore, a positive bias of 200 mV or greater will ensure a defined state. We recommend that bias be applied to both ends of the wiring segment by installing the two end jumpers located at position E1 on the daughter board. This is to be done for only the two NIMs located at the end of the segment. All other NIMs will have their jumpers removed.

The termination and bias rules are simple. If the NIM is located at the extreme ends of the segment, install all three jumpers at location E1 on the daughter board. If the NIM is located between the two end NIMs, remove all three jumpers. If external termination is desired, remove the middle jumper at E1.

TRANSCEIVER		
-485	-485D	-485X
PIN		
1 LINE+	LINE+	LINE
2 LINE–	LINE–	LINE
3 SHIELD	SHIELD	SHIELD

Table 3 — Screw Terminal Connector Pin Assignments for -485, -485D and -485X

For EIA-485 DC operation, it is very important that all devices on the wiring segment be referenced to the same ground potential in order that the common mode voltage requirement (+/–7 Vdc) of the EIA-485 specification is achieved. This can be accomplished by running a separate ground wire between all computers or by relying upon the third wire ground of the power connector assuming that the DC power return is connected to chassis ground on the computer. Another approach would be to connect the DC common of each computer to a cold water pipe. Connected systems, each with different elevated grounds, can cause unreliable communications or can damage the EIA-485 differential drivers. Therefore, it is important that an adequate grounding method be implemented. A ground connection can be found at pin 3 of the screw terminal connector.

Segments of -485D connected NIMs can be extended through the use of active hubs. Select an AI Series hub or repeater with a -485D compatible port. Connect one end of the segment to this port following the same termination rules as used for a NIM. This hub port counts as one NIM when cable loading is being calculated. The NIM electrically closest to the hub port should not have any termination or bias applied. Follow the same rules for other segments attached to different hub ports. Maintain the same cabling polarity
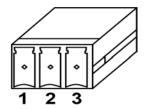

Figure 6 — Screw Terminal Connector Numbering Orientation

as the NIMs by using cable connections that do not invert the signals.

-485X AC-Coupled EIA-485

The AC-coupled EIA-485 transceiver offers advantages over DC-coupled EIA-485. No bias adjustments are needed since each transceiver has its own fixed bias network isolated by a pulse transformer. Unlike the DC-coupled EIA-485, wiring polarity is unimportant. Either inverted or straight-through cable can be used or even mixed within one AC-coupled network. Much higher common mode voltage levels can be achieved with AC coupling due to the transformer coupling which has a 1000 Vdc breakdown rating.

There are disadvantages to the AC-coupled transceiver as compared to the DC-coupled technology. The DC-coupled distances are longer (900 feet) than the AC-coupled distance (700 feet)[1]. The AC-coupled transceiver will operate at 1.25, 2.5, 5.0 and 10 Mbps while the DC-coupled transceiver will operate over all seven data rates.

The cabling rules of the -485X are similar to the -485D. One three-position screw terminal connector is provided to attach network cabling. Wire a maximum of 13 NIMs in a daisy-chain fashion. On the end NIMs insert a jumper at E1 on both -485X daughter boards to invoke 120-ohm termination resistors (Figure 7). Termination can also be accomplished by installing a 120-ohm, ¼ watt resistor across pins 1 and 2 of the screw terminals at each end of the bus segment. Refer to Table 3 for connector pin assignments. Termination should not be applied to any of the NIMs located between the two end NIMs of the segment. Do not mix -485D and -485X NIMs together on one segment; however, bridging of the technologies is possible using active hubs with the appropriate transceivers. To extend -485X segments, use a hub as discussed under the -485D section. Make sure the active hub transceivers are of the -485X type. Cable inversion is not of any consequence.

[1] *Distance figures based on 2.5 Mbps operation.*

-4000 AC-Coupled EIA-485 (backplane mode)

The -4000 transceiver is used when backplane mode operation is desired. It is similar to the -485X transceiver in operation but has some subtle differences. A maximum of 8 NIMs may be connected on a single bus segment with up to 262 feet of twisted-pair cable.   Termination can be accomplished by installing a TB5-TER, RJ-45 terminator in the unused RJ-45 jack.
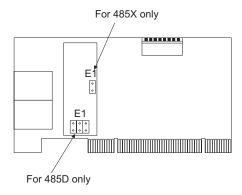
For 485X only

E1

E1

For 485D only

Figure 7 — Jumper settings for EIA-485 models.

-485 DC-Coupled EIA-485 (backplane mode)

The -485 transceiver is used when backplane mode operation is desired. All operating parameters are the same as the -485D transceiver except that the COM20022 is set for backplame mode operation. Refer to the -485D section for operating details.

Electromagnetic Compatibility

The PCI20U series complies with Class A radiated and conducted emissions as defined by CFR 47 Part 15 and EN55022. This equipment is intended for use in non-residential areas.

Warning

This is a Class A product as defined in EN55022. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

NEED MORE HELP INSTALLING THIS PRODUCT?

More information can be found on our web site at www.ccontrols.com. Browse the Technical Support section of our site for a look at our on-line technical manuals, downloadable software drivers and utility programs that can test the product. When contacting us, just ask for technical support.

Warranty

Contemporary Controls (CC) warrants its new product to the original purchaser for two years from the product shipping date. Product returned to CC for repair is warranted for one year from the date that the repaired product is shipped back to the purchaser or for the remainder of the original warranty period, whichever is longer.

If a CC product fails to operate in compliance with its specification during the warranty period, CC will, at its option, repair or replace the product at no charge. The customer is, however, responsible for shipping the product; CC assumes no responsibility for the product until it is received.

CC's limited warranty covers products only as delivered and does not cover repair of products that have been damaged by abuse, accident, disaster, misuse, or incorrect installation. User modification may void the warranty if the product is damaged by the modification, in which case this warranty does not cover repair or replacement.

This warranty in no way warrants suitability of the product for any specific application. IN NO EVENT WILL CC BE LIABLE FOR ANY DAMAGES INCLUDING LOST PROFITS, LOST SAVINGS, OR OTHER INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THE PRODUCT EVEN IF CC HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, OR FOR ANY CLAIM BY ANY PARTY OTHER THAN THE PURCHASER.

THE ABOVE WARRANTY IS IN LIEU OF ANY AND ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED OR STATUTORY, INCLUDING THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR PARTICULAR PURPOSE OR USE, TITLE AND NONINFRINGEMENT.

Returning Products for Repair

Return the product to the location from which it was purchased by following the instructions at the URL below:

www.ccontrols.com/rma.htm

DECLARATION OF CONFORMITY

Additional compliance documentation can be found on our website.

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