PCX

ARCNET® Network Interface Modules for PC/XT/AT (ISA) Bus Computers

INSTALLATION GUIDE

INTRODUCTION

The PCX series of ARCNET network interface modules (NIMs) links PC/XT/AT (ISA) compatible computers with the ARCNET local area network (LAN).

ARCNET is classified as a token-bus LAN operating at 2.5 Mbps while supporting 255 nodes. Interfacing ARCNET to a host computer usually requires a NIM which plugs into the host computer's bus.

The PCX incorporates the COM90C65 ARCNET controller chip and the module is compatible with all of the popular network operating systems such as Novell's NetWare, Microsoft's Windows for Workgroups and QNX Software Systems' QNX version 4.2 or greater. Jumpers are used to set the memory and I/O base addresses and the interrupt source.

Each PCX module has two LEDs on the board for monitoring network operation and bus access to the module. The PCX also has an external DIP switch so that node addresses can be easily reassigned without removing the module. Interrupt lines are jumper selectable.

Several cabling types are supported by the PCX—the PCX-CXS supports coaxial cable in a star configuration; the PCX-CXB supports coaxial cable in a bus configuration; the PCX-TPB supports twisted-pair in a bus configuration; the PCX-TPS supports twisted-pair in a star configuration; and the PCX-FOG supports duplex glass fiber optic cable with either ST or SMA connectors.

CONTEMPORARY CONTROLS®

SPECIFICATIONS

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

Data Rate
2.5 Mbps

Dimensions
3.9" x 4.3"
(99mm x 109mm)

Shipping Weight
1 lb. (.45kg)

Memory Mapping
Supports memory mapping of RAM buffer and boot PROM on selected 16K segments within the lower 1 MB address space. Module decodes 24 bits of memory addressing.

I/O Mapping
Supports I/O mapping on selected 16-byte boundaries

Interrupt Lines
Supports strapping of IRQ2/9, 3, 4, 5 or 7

Compatibility
PCX series NIMs are fully compatible with all of Contemporary Controls' (CCs') ARCNET products and PC/XT/AT computers.

POWER REQUIREMENTS

Model	+5V	-5V
PCX-CXS	150mA	15mA
PCX-CXB	150mA	50mA
PCX-FOG-SMA	220mA	N/A
PCX-FOG-ST	220mA	N/A
PCX-TPB	150mA	50mA
PCX-TPS	150mA	15mA

INSTALLATION

The PCX can be installed in any XT/AT compatible, 8-bit, ISA computer bus. To install the PCX, remove the cover of the computer exposing the motherboard and expansion slots (connectors). Care should be taken when installing the PCX 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 PCX from its protective ESD package. Remove the backplate of the computer adjacent to the desired slot (connector). The PCX can then be inserted into this slot by applying a downward even pressure until it stops and is firmly seated into the connector. The PCX backplate can be secured to the computer by installing the small screw used to attach the original backplate. Installation is completed by replacing the computer's cover.

CONFIGURING JUMPER SETTINGS

I/O Address Map

I/O address space is selected in blocks of 16 contiguous bytes. A total of eight blocks can be selected using select pins IOS2-IOS0. These select lines are decoded and used to select a 12 bit register which is compared to address lines A15-A4. The user has a choice of eight I/O address blocks to choose from. Refer to Table 1 for I/O map selection and Figure 1 for the E3 jumper locations. To program the I/O address block, select the desired I/O address range from Table 1 and install jumpers at the corresponding I/O select lines at block location E3. The default setting is 0300. If a jumper is not to be used, simply move the jumper to one side of the jumper block so that only one pin is covered.

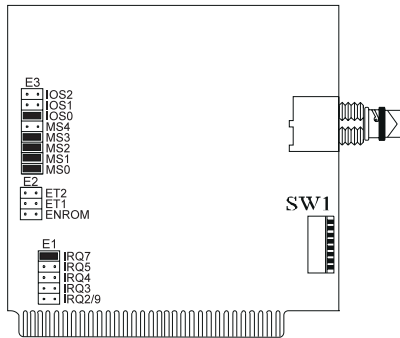| IOS2	IOS1	IOS0	I/O ADDRESS RANGE
■	■	■	0260-026F
■	■		0290-029F
■		■	02E0-02EF
■			02F0-02FF
	■	■	0300-030F
	■		0350-035F
		■	0380-038F
			03E0-03EF

■ = Install Jumper

Table 1- I/O Map Selection

Figure 1-Address, Interrupt and Node ID Switch Locations

Internal Reset Logic

Generated from either a hardware or software reset is an internal reset
signal of pulse width equal to 102.4μs. A hardware reset occurs when a
logic high signal is asserted on the RESET IN input of the COM90C65. A
software reset occurs when I/O locations base + 8, 9, A, or B are accessed.
During the entire reset process the transmitter of the COM90C65 is
disabled and the Status Register assumes the following state:

BIT 7	(RI)	=	1
BIT 6	(ETS2)	Not Affected	
BIT 5	(ETS1)	Not Affected	
BIT 4	(POR)	=	1
BIT 3	(TEST)	=	0
BIT 2	(RECON)	=	0
BIT 1	(TMA)	=	0
BIT 0	(TA)	=	1

Next, the maskable interrupts will be disabled and Page 00 will be selected
for both the receive and transmit RAM buffers. When the RESET IN signal
occurs, the COM90C65 will generate an interrupt from the nonmaskable
Power On Reset interrupt. After the 102.4μs internal reset signal time, the
COM90C65 will start by reading its own NODE ID and executing two write
cycles to the RAM buffer. Address 00 HEX is written with D1 HEX and
address 01 HEX is written with the NODE ID. The host system software
can then read RAM buffer address 01 to determine the PCX's NODE ID
setting. **Note:** Only if the D1 pattern appears in the RAM buffer can proper
operation be assured.

External RAM

The COM90C65 provides all of the signals necessary to allow smooth arbitration of all RAM buffer operations. The external 2K x 8 RAM buffer is used to hold up to four data packets with a maximum length of 508 bytes per message. The RAM buffer is accessed by both the host CPU system and the COM90C65. The host system can write commands to and read the status of the COM90C65.

Memory Address Decoding

The memory mapped mode implements the traditional mapping to an ARCNET PROM and RAM buffer into a single 16K memory segment. Memory space is required for the 2K RAM buffer and the 8K PROM. To accommodate these two requirements, a 16K segment must be selected from the PC host address space. Pins MS4-MS0 are decoded in order to generate a 9-bit register value that is compared to address bus lines A19-A11 in order to select a 16K segment. Within the selected 16K segment, the PROM occupies the upper 8K of the selected segment and is accessed when A13 equals a logic 1. The 2K RAM is enabled when A13 equals a logic 0. The actual location of the 2K RAM within the 8K portion depends upon the decoding of address lines A11 and A12 and the programming of MS0 and MS1. Refer to Table 2 for the RAM and PROM address values. To program the memory address block, select the desired memory address range from Table 2 and install jumpers at the corresponding memory select lines at block location E3. Refer to Figure 1 for the E3 jumper block location. The default setting is D:4000. If a jumper is not to be used, simply move the jumper to one side of the jumper block so that only one pin is covered.

MS4	MS3	MS2	MS1	MS0	RAM ADDRESS RANGE	PROM ADDRESS RANGE
■	■	■	■	■	C:0000-C:07FF	C:2000-C:3FFF
■	■	■	■		C.0800-C:0FFF	C:2000-C:3FFF
■	■	■		■	C:1000-C:17FF	C:2000-C:3FFF
■	■	■			C:1800-C:1FFF	C:2000-C:3FFF
■	■		■	■	C:4000-C:47FF	C:6000-C:7FFF
■	■		■		C:4800-C:4FFF	C:6000-C:7FFF
■	■			■	C:5000-C:57FF	C:6000-C:7FFF
■	■				C:5800-C:5FFF	C:6000-C:7FFF
■		■	■	■	C:C000-C:C7FF	C:E000-C:FFFF
■		■	■		C:C800-C:CFFF	C:E000-C:FFFF
■		■		■	C:D000-C:D7FF	C:E000-C:FFFF
■		■			C:D800-C:DFFF	C:E000-C:FFFF
■			■	■	D:0000-D:07FF	D:2000-D:3FFF
■			■		D:0800-D:0FFF	D:2000-D:3FFF
■				■	D:1000-D:17FF	D:2000-D:3FFF
■					D:1800-D:1FFF	D:2000-D:3FFF
	■	■	■	■	D:4000-D:47FF	D:6000-D:7FFF
	■	■	■		D:4800-D:4FFF	D:6000-D:7FFF
	■	■		■	D:5000-D:57FF	D:6000-D:7FFF
	■	■			D:5800-D:5FFF	D:6000-D:7FFF
	■		■	■	D:8000-D:87FF	D:A000-D:BFFF
	■		■		D:8800-D:8FFF	D:A000-D:BFFF
	■			■	D:9000-D:97FF	D:A000-D:BFFF
	■				D:9800-D:9FFF	D:A000-D:BFFF
		■	■	■	D:C000-D:C7FF	D:E000-D:FFFF
		■	■		D:C800-D:CFFF	D:E000-D:FFFF
		■		■	D:D000-D:D7FF	D:E000-D:FFFF
		■			D:D800-D:DFFF	D:E000-D:FFFF
			■	■	E:0000-E:07FF	E:2000-E:3FFF
			■		E:0800-E:0FFF	E:2000-E:3FFF
				■	E:1000-E:17FF	E:2000-E:3FFF
					E:1800-E:1FFF	E:2000-E:3FFF

■ = Install Jumper

Table 2-User Configuration of Memory Map

Extended Timeout Function

There are four possible timeouts which can be selected on the PCX NIM. The timeouts are selected using the E2 jumper block on the pins labeled ET1 and ET2. The logic states of these pins are reflected in bits 6 (ET2) and 5 (ET1) of the status register. It must be remembered that all ARCNET nodes in the network must be set for the same timout settings. Refer to Table 3 to select the proper timeout settings for the network. Besides the response time, extended timeouts affect the idle time and the reconfiguration time.

ET2	ET1	Response Time (µs)	Idle Time (µs)	Reconfig Time (ms)
■	■	1209.6	1318.4	1680
■		604.8	659.2	1680
	■	302.4	329.6	1680
		75.6	82.4	840

■ = Jumper Installed

Table 3-Timeout Settings

PROM Enable

The PROM can be enabled by inserting a jumper at location E2 entitled ENROM. If the PROM is disabled (jumper not installed), the PCX occupies a 2K segment of memory only.

Interrupts

A total of five interrupts are available for selection. Invoke the desired interrupt by installing a jumper corresponding to the selected interrupt at jumper block location E1. Only one interrupt can be selected at any one time. The default interrupt setting is IRQ7. Refer to Figure 1 for the E1 jumper block location.

Indicator Lights

There is a dual LED located at the PCX backplate. The yellow LED indicates that the PCX is being accessed via its I/O address. The green LED indicates that the PCX is receiving ARCNET traffic on the network.

Node ID Switch

An 8-bit DIP switch is used to set the ARCNET node address. Any value except zero is a valid ARCNET node address. If zero is set in the switches, the ARCNET LAN adapter will disable its transmitter and not join the network until a non-zero node ID is set via software. The RAM buffer cannot be accessed when the node ID is zero.

The node ID switch SW1 is read left to right (when viewing the printed circuit board in a horizontal plane with components on top) with the MSB to the far left (position 1) and the LSB to the far right (position 8). A logic "1" occurs when the switch is moved away from the board (switch is opened). Figure 2 shows the node ID switch. In this example, the switch is set to hexadecimal address F5.

MSB *Figure 2-Node ID Switch* **LSB**
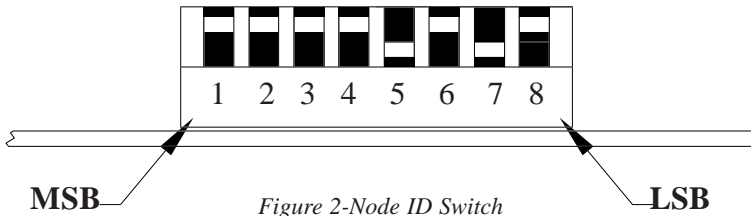
FIELD CONNECTIONS

The type and style of field connectors depends upon the cabling option selected. Cabling options are identified by a suffix designation applied to the family model number.

-CXS Coaxial Star

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 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.

-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 bus segment 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.

Fiber Optic (-FOG, -ST, -SMA)

The fiber optic option is designated -FOG; however, a further designation is required in order to specify the type of connector. The -FOG-ST uses the ST style connector while the -FOG-SMA uses the SMA style connector. Cable sizes of 50, 62.5 or 100 micron duplex cable can be used with either connector.

Fiber optic connections require a duplex cable arrangement. Only star and distributed star topologies are supported. Two unidirectional cable paths provide the duplex link. There are two devices on each NIM. One device, colored light gray, is the transmitter and the other, dark gray, is the receiver. Remember that "light goes out of the light (gray)." To establish a working link between a NIM and another NIM or a hub to a NIM, the transmitter of point A must be connected to a receiver at point B. Correspondingly, the receiver at point A must be connected to a transmitter at point B. This establishes the duplex link. Up to 2km of 62.5μm fiber optic cable can be used per segment.

Twisted-Pair Bus (-TPB)

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-11 socket which is to hold the RJ-11 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. Up to eight -TPB 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 a balanced twisted-pair signal (-TPS) or use a BALUN. Contemporary Controls (CC) recommends a Mux Labs BALUN (available from CC under the part number BALUN)

connected to a -CXS port on a MOD HUB expansion module. The BALUN converts the balanced twisted-pair signals to single-ended signals suitable to the -CXS port. A more direct approach is to use a MOD HUB expansion module with a -TPS port. The -TPS port has an internal BALUN and provides an identical RJ-11 connection as the BALUN. Unfortunately, the signal sense is inverted from the -TPB module so that an inverted cable connection is required to either the BALUN or -TPB port. Connect either of these devices to one of the end NIMs on the segment. This requires the removal of the terminator at that end. The BALUN or -TPS port provides the termination.

-TPS Twisted-Pair Star

The -TPS option is available and incorporates the same BALUN circuitry used on the MOD HUB (-TPS) expansion modules. When wiring a (-TPS) NIM to a (-TPS) hub port, the cable connection is non-inverted.
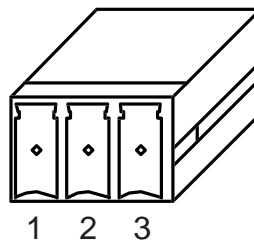
Modular Connector Pin Assignments

6-Contacts	Usage	
Pin	-TPB	-TPS
1	Not Available	Not Available
2	Not Used	Not Used
3	Line- (Phase B)	Line+ (Phase A)
4	Line+ (Phase A)	Line- (Phase B)
5	Not Used	Not Used
6	Not Available	Not Available
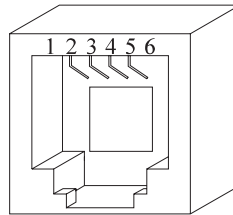
Table 4-Modular Connector Pin Assignments for -TPB, -TPS

Figure 3-Modular Jack Numbering Orientation

Pin	-TPB
1	LINE+
2	LINE-
3	SHIELD

Table 5-Screw Terminal Connector Pin Assignments for -TPB

Figure 4-Screw Terminal Connector Numbering Orientation

Electromagnetic Compatibility

The PCX 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 comprehensive 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 interactive on-line technical manuals, downloadable software
drivers and utility programs that can test the product. When contacting one
of our offices, just ask for Technical Support.

Warranty

Contemporary Controls (CC) warrants its product to the original purchaser
for one year from the product's shipping date. If a CC product fails to
operate in compliance with its specification during this 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. This warranty does not cover repair of
products that have been damaged by abuse, accident, disaster, misuse, or
incorrect installation.

CC's limited warranty covers products only as delivered. User modification
may void the warranty if the product is damaged during installation of the
modifications, 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.

More warranty information can be found on our web site www.ccontrols.com.

Returning Products for Repair

Before returning a product for repair, contact Customer Service. A
representative will instruct you on our return procedure.

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