A.3 - CPU - Central Processing Unit Module 91X

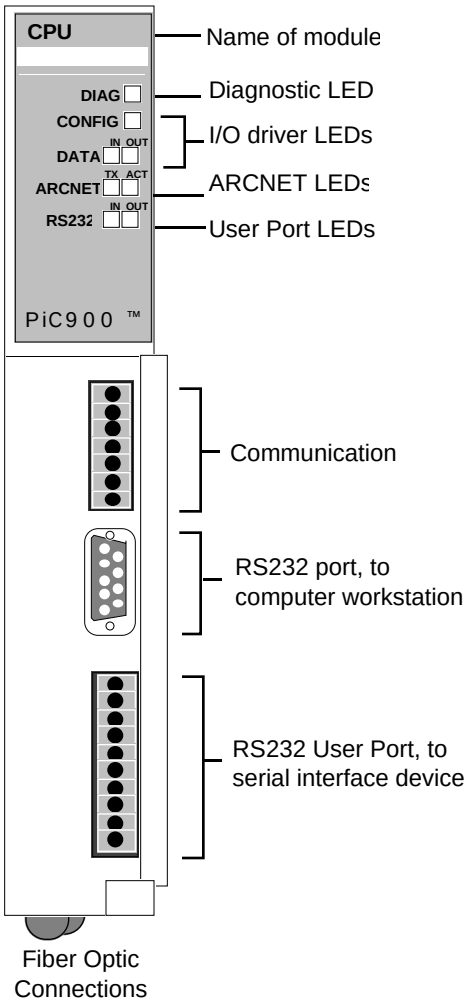
Introduction

The PiC91X CPU module controls the PiC900 system and executes the application program. It contains:

- A processor IC providing overall control
- Eight LEDs as shown in Figure A3-1
- RAM (EPROM optional) memory for the application program and for RAMDISK
- RAM memory for data storage as the system runs
- ROM memory for the system software
- RS232 ports to communicate with the computer workstation and with a serial interface device
- Optional communication (ARCNET and I/O expansion) capability
- Optional math coprocessor
- Optional flash memory for storing things like application source modules

The CPU module must always be in the second slot from the left in the system rack.

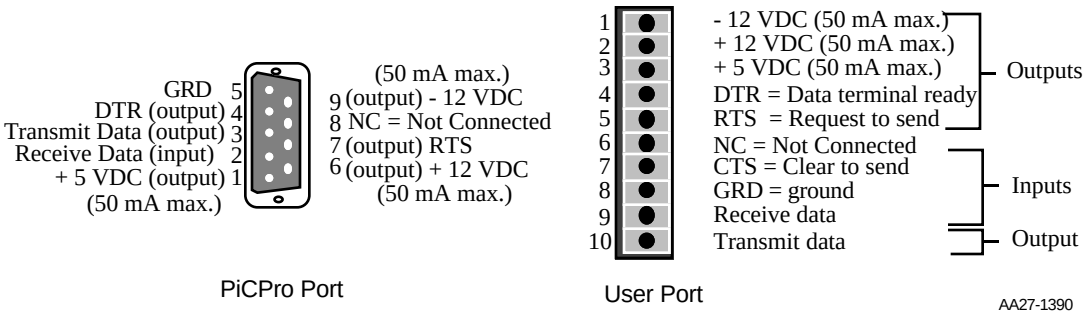
Figure A3-1. PiC91X CPU Module



Connections

The PiCPro Port (9-pin D connector) communicates with the workstation serial port and the User Port (10-pin screw terminal connector) communicates with an optional serial interface device.

Figure A3-2. Pinouts for the Two RS232 Communications Ports



The PiCPro Port allows the PiC900 to communicate with the workstation. This port is used when downloading an application program from the workstation into RAM memory. It may also be used to exchange data between the workstation and the PiC900 system while the PiC900 system is running.

The pinout for the PiCPro Port cable is shown below.

PiCPro Cable Pinout

9-pin female (to PC)		9-pin female (to PiCPro Port)
3	to RD	2
2	to TD	3
5	to GND	5

The User Port is used to communicate with a touch-screen, a hand-held controller, or other serial interface device.

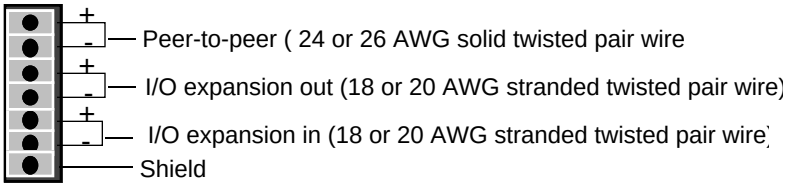
ARCNET and I/O Expansion are available on some PiC91X CPUs. The specification table at the end of this appendix lists the CPU modules that have this communication capability on board.

ARCNET and Local I/O Expansion

The ARCNET and I/O Expansion Port is used for ARCNET communications and local I/O expansion. The top two pins are used for peer-to-peer (ARCNET) communication connections using twisted pair wire. The next four pins are used for local [up to 40 feet (12 m) segment] I/O expansion (up to seven expansion racks) using twisted pair wire*. The bottom pin is a shield connection. When using shielded wire, connect the shields to it.

*Use shielded cables when it is necessary to meet EMC standards. The recommended wire has 100 Ω characteristic impedance.

Figure A3-3. Pinout for ARCNET and I/O Local Expansion Port



CAUTION

The network is polarity dependent.

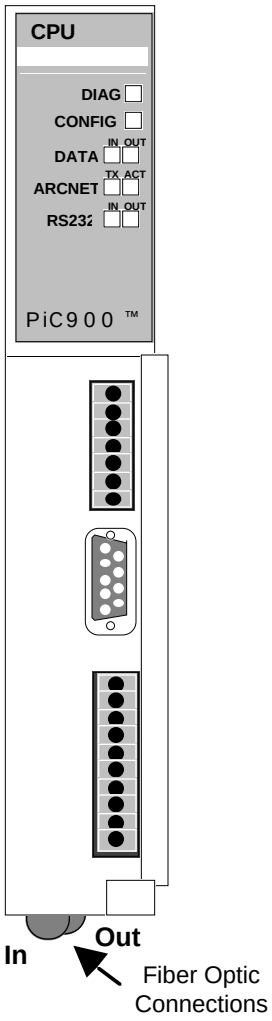
In peer-to-peer communications, always connect the positive (+) of the twisted pair interface of the first PiC to the positive (+) of the twisted pair interface of the second PiC and the negative (-) to the negative (-), etc.

In I/O expansion systems, connect the positive (+) of the twisted pair out of the CPU module to the positive (+) of the twisted pair in on the next module and the negative (-) to the negative (-), etc. Connect the positive (+) of the twisted pair in of the CPU module to the positive (+) of the twisted pair out on the next module and the negative (-) to the negative (-), etc.

Remote I/O Expansion

For remote I/O expansion [from 4 feet (1.2 m) to 2,000 feet (610 m)/segment], fiber optic cable is connected to the two bottom connectors on the CPU module as shown in Figure A3-4.

Figure A3-4. Location of Fiber Optic Connections for I/O Remote Expansion



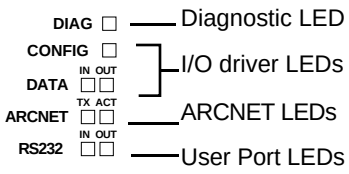
See Appendix N1 Peer-to-Peer Communication Connections for information on connecting PiCs on a network.

See Appendix N2 I/O Expansion Connections for more information on local and remote I/O expansion.

LEDs

There are seven communication LEDs on this CPU module in addition to the DIAG LED. They are located directly under the DIAG LED as shown in Figure A3-5.

Figure A3-5. Communication LEDs



The diagnostic LED on the CPU module flashes error codes under certain conditions. These codes are listed in Appendix M.

Below is a list of the remaining LEDs and what they mean.

CONFIG I/O expansion rack configured	On	Communication established with this expansion rack connected in an I/O expansion loop.
	Off	Communication not established
DATA IN I/O expansion line activity in	Dull glow Off	Indicates the line receiving in is active. No activity in
DATA OUT I/O expansion line activity out	Dull glow Off	Indicates the line transmitting out is active. No activity out
ARCNET TX ARCNET transmit status	On Blinking Off	Normal network activity Network reconfiguration Not active part of network
ARCNET ACT ARCNET active status	Flash/On Off	Data being transferred to/from ARCNET interface No data transfer
RS232 IN User Port data IN	On Off	Data being received at user port No data being received at user port
RS232 OUT User Port data OUT	On Off	Data being transmitted from user port No data being transmitted at user port

Theory of Operation

The CPU module performs the following tasks:

1. It runs diagnostic tests, checks the battery in the CSM, and performs other routine maintenance tasks.
2. It executes the application program, communicating with the I/O modules.
3. It maintains communication with the workstation through the PiCPro port. This port is dedicated to the communication functions of PiCPro / PiCServoPro.

4. It maintains communication with the user interface device through the User port. Details of this communication depend partly on the type of interface device. Refer to the manual that comes with the device.
5. If ARCNET and I/O communications are on board, it supports peer-to-peer, ARCNET and I/O communication capability.

Diagnostics

The CPU runs diagnostic tests on each module in the system rack whenever power is turned on to the PiC900. The CSM is tested first, then the CPU module, then all the I/O modules in turn.

A module's DIAG LED is on while it is being tested, and goes off when its internal circuitry checks out. If a DIAG LED does not go out after the diagnostic tests, a fault has been detected. See the Troubleshooting section of the Hardware chapter.

Additional Integrated Circuits (ICs) for the PiC91X

You may need additional ICs to run your application program.

EPROMs. Your application and/or RAMDISK data may be programmed into a pair of EPROMs, and then the EPROMs may be inserted in the CPU module. Recommended EPROMs are:

Advanced Micro Devices (AMD) AM27H010-70DC (128K x 8)

The Software manual gives directions for creating a file in a format suitable for an EPROM. This file may be loaded from a workstation into the EPROMs using any of a number of commercially available EPROM Programmers. The file originates at address zero and, therefore, requires no offset. The file uses the 16-bit word format. Your programmer must have the capability of programming even addressed information into one 8-bit device and odd addressed information into another 8-bit device.

Math coprocessor. This is optional. It may be required for some applications. The socket for this IC is next to the memory ICs. See Appendix K for the installation procedure.

PiC900 memory organization

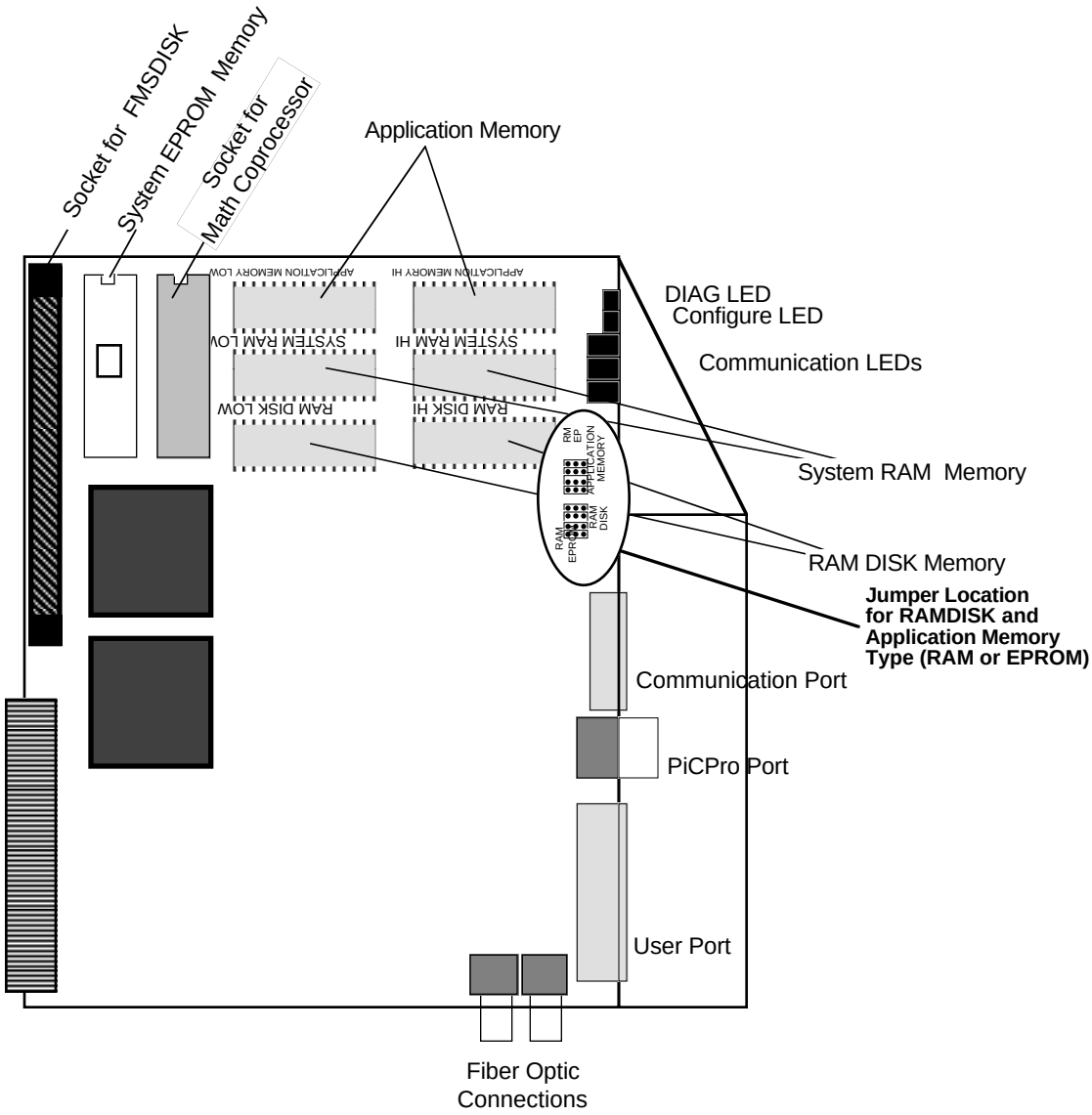
The CPU module supports up to 1 Megabyte of memory. This memory is divided into four groups. The groups are:

1. System Memory is used for executive data, bit memory, and user variables. Specific areas of memory are reserved for each of these functions.

2. RAM Disk is used to provide extra memory for program data storage. It is a factory-installed option. To access the data on the RAMDISK, you use special I/O commands covered in the software manual. These are the only memory sockets that may be left empty when an application is running. May be replaced by EPROMs in which the data is programmed.
3. Application Memory is where the application program is stored. May be replaced by EPROMs in which an application is programmed.
4. System EPROM contains executive code for the system, diagnostics, etc.

Figure A3-6 shows the locations of the ICs for the PiC91X.

Figure A3-6. Positions of the ICs on PiC91X



Procedure for Installing ICs into Application Memory/RAMDISK Sockets

1. Lay the CPU module on a static-free surface, label side up. Ground yourself using a properly grounded wrist strap before you open the module. These are standard precautions before handling any electronic components.
2. Press the plastic tabs at the top and bottom of the module toward each other and lift off the module cover.

CAUTION

Do not touch the pins on any of the ICs. IC circuitry can be easily damaged. Broken or bent pins prevent the IC from functioning properly.

3. Use Figure A3-6 to see where the ICs should be placed. If a pair of ICs occupies the sockets already, use an IC-removal tool to remove them.
4. To insert a new pair of ICs, start with the one labeled LOW. Use an insertion tool to position it over the left socket with the indented end facing right. Check the writing on the circuit board and the orientation of the other ICs.

CAUTION

Check that the IC is going in the correct socket. The processor cannot access an IC in the wrong place.

Make sure the IC is oriented correctly. If it is installed backwards, it may be destroyed when power is turned on to the system.

Line up the pins and push it in place. Repeat with the HI IC in the right socket of the pair.

5. The jumper labeled APPLICATION MEMORY controls the sockets labeled APPLICATION MEMORY HI/LOW. The jumper labeled RAM DISK controls the sockets labeled RAM DISK HI/LOW. (See Figure 3-6 for jumper location.) You must select the correct jumper position for the type of IC (EPROM or RAM) you are inserting.
6. Replace the module cover. Insert the CPU module in the rack next to the CSM. Turn on power at the main disconnect switch and check the LEDs.

Specification Table

Characteristics **CPU 91X module specifications**											
Function Executes the application program. Executes Diagnostics on the system and its modules. Communicates through the RS232 port to external devices. Can provide ARCNET and I/O expansion from module											
CPUs **Note on the 91X label** The first digit is for the PiC900 family. The second digit is for the processor (1 for the 80C186EC). The third digit is for the speed (1 for 10 MHz, 2 for 20 MHz).							Number of servo axes available at five update rates**				
Model	**CPU**	**Part Number**	**Speed**	**App Mem**	**RAM**	**User Mem**	**8 ms**	**4 ms**	**2 ms**	**1 ms**	**.5 ms**
911	80C186EC	502-03941-11	10 MHz	128K	0K	64K	6	4	2	1	0
Standard	80C186EC	502-03941-21	10 MHz	128K	128K	64K	6	4	2	1	0
	80C186EC	502-03941-51	10 MHz	384K	256K	64K	6	4	2	1	0
912	80C186EC	502-03963-11	20 MHz	128K	0K	64K	16	8	4	2	1
Turbo	80C186EC	502-03963-21	20 MHz	128K	128K	64K	16	8	4	2	1
	80C186EC	502-03963-31*	20 MHz	128K	128K	64K	16	8	4	2	1
	80C186EC	502-03963-41*	20 MHz	384K	128K	64K	16	8	4	2	1
	80C186EC	502-03963-51	20 MHz	384K	256K	64K	16	8	4	2	1
	80C186EC	502-03963-61*	20 MHz	384K	256K	64K	16	8	4	2	1

*ARCNET and I/O expansion communications are standard on these modules.

**The number of axes listed is typical for RATIO_GR, RATIOCAM, VEL_STRT, POSITION and DISTANCE move types. Applications which use time axes, servo tasks, RATIO_RL, M_LINCIR , or M_SCRVLC moves require more CPU time. Consult Giddings & Lewis for assistance if you want to exceed the number of axes in this chart.

Flash memory system board (optional)	4 Megabyte FMS Board 502-03882-00 8 Megabyte FMS Board 502-03882-20
Math coprocessor (optional)	Numeric coprocessor Part Number 401-54187-10
Memory	1 Megabyte max.
PiCPro Port (to workstation)	RS232 serial port, secured protocol Software selectable baud rate (300 to 57.6K baud)

User Port (to serial interface device)	RS232 serial port Supports RTS/CTS hardware handshaking Baud rates to 19.2 K
Logic side power requirements (typical)	430 mA @ +5V (502- 03941-11, -21, -51) 500 mA @ +5V (502- 03963-11, -21, -51) 870 mA @ +5V (502- 03963-31, -41, -61)* 4 mA @+15V (all) 10 mA @-15V (502- 03941-11, -21, -51 502- 03963-11, -21, -51) 39 mA @-15V (502- 03963-31, -41, -61) 2.5µA @ +3V (all)** NOTE: Add 110 mA at +5V when math coprocessor is installed. *CPUs with ARCNET and I/O capabilities on board. **From the battery during power down.
Operating temperature range	7° C to 55° C (45° F to 131° F)
Storage temperature range	-40° C to 85° C (-40° F to 185° F)
Humidity	0 to 95%, non-condensing
EMC Compliant Emissions Noise immunity	 Operates with emissions below EN55011/ CISPR 11 Class A limits Immune to: • Electrostatic discharge (4K V contact mode) per IEC1000-4-2 • RF electromagnetic fields per IEC 1000-4-3 • Electrical fast transients per IEC 1000-4-4 on incoming power lines Refer to the EMC Guidelines for more information.
UL and C/UL Listed	File No. E126417 NRAQ Programmable Controllers
Physical size	1.6" wide x 12" high x 8.4" deep (including latch) 41 mm x 305 mm x 213 mm