A.2-PiC900 CPU - Central Processing Unit Module

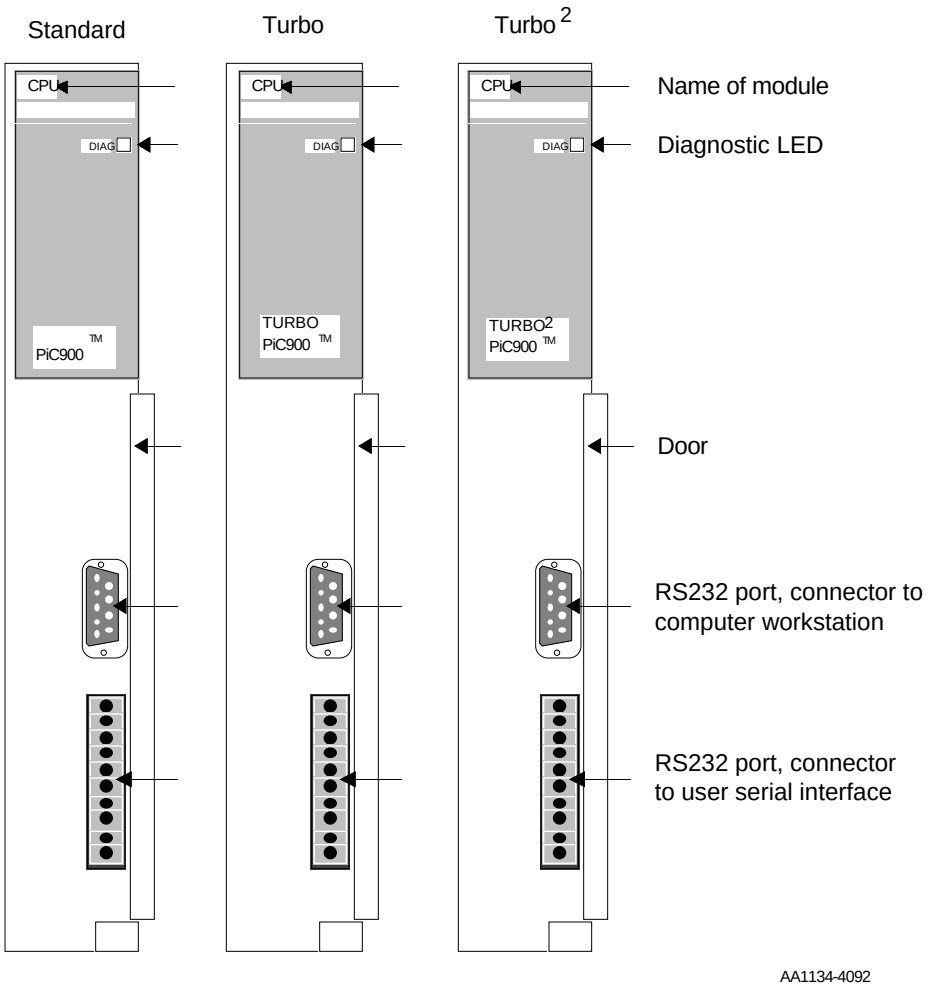
Introduction

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

- A processor IC which provides overall control.
- RAM or EPROM memory which contains the application program and RAM memory which contains data accumulated as the system runs.
- ROM memory which contains the Giddings & Lewis Operating System (GLOS).
- RS232 ports to communicate with the computer workstation and a user serial interface device.

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

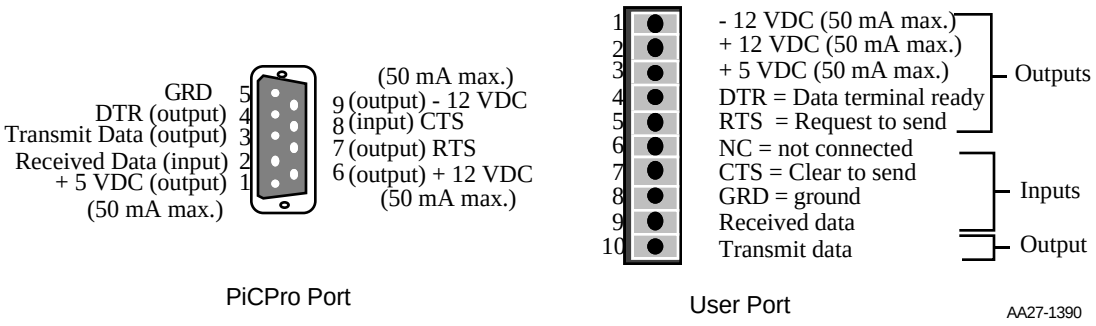
Figure A2-1. Types of CPU Modules



Connections

This module has two RS232 ports. The PiCPro port (9-pin D connector) communicates with the workstation serial port and the User Port 2 (10-pin screw terminal connector) communicates with an (optional) serial interface device.

Figure A2-2. Pinouts for the Two 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 while the PiC900 system is running the program in order to exchange data with the workstation.

The pinout for the PiCPro Port cable is shown below.

PiCPro Cable Pinout

9-pin female (to PC)		**9-pin female** (to Port 1)
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.

Theory of Operation

The CPU module performs the following tasks:

1. It runs diagnostic tests, checks the battery in the CSM, and performs many 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 / PiCServo-Pro.

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.

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 PiC900

You may need additional ICs to run your application program.

EPROMs. An application may be programmed into a pair of EPROMs, and then the EPROMs may be inserted in the CPU module. Recommended EPROMs include:

For the standard CPU:

Advanced Micro Devices® (AMD)	AM27C256-200DC (32K x 8)
Advanced Micro Devices (AMD)	AM27C010-200DC (128K x 8)

For the PiC900 Turbo CPU:

Advanced Micro Devices® (AMD)	AM27C256-100DC (32K x 8)
Advanced Micro Devices (AMD)	AM27C010-100DC (128K x 8)

For the PiC900 Turbo^2 CPU:

Advanced Micro Devices (AMD)	AM27C010-70DC (128K x 8)
Advanced Micro Devices (AMD)	AM27C010-55DC (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.

CMOS RAM. Some application programs need to store large amounts of data. A pair of RAM ICs may be factory installed in the CPU module to make extra memory available for such programs. To access this data, the program needs special I/O commands which are dealt with in the software manual.

Math coprocessor. It is optional on the 80C186 CPUs. 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. (A math coprocessor is standard on the 80486DX CPUs.)

PiC900 memory organization

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

1. DATA, used for executive data, bit memory, and user variables. Specific areas of memory are reserved for each of these functions.
2. EXPanded DATA; this pair of ICs is optional. These are the only memory sockets that may be left empty when an application is running.
3. LADder MEMory, where the application program is stored. May be replaced by EPROMs in which an application is programmed.
4. EXECutive MEMory, which contains executive code for the system, diagnostics, etc.

Figures A2-3 and A2-4 show the locations of the ICs for the 80C186 and the 80486 CPUs respectively.

Figure A2-3. Positions of the ICs on 80C186 CPU

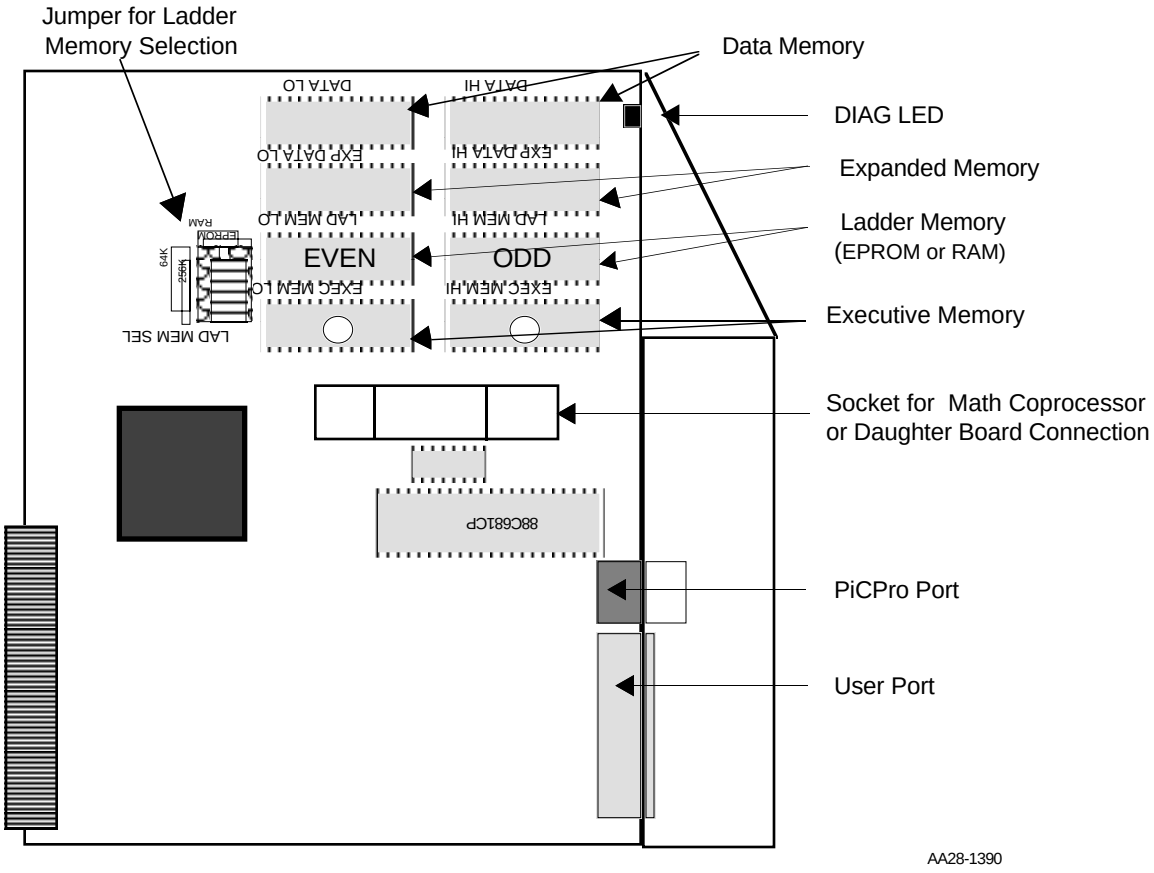
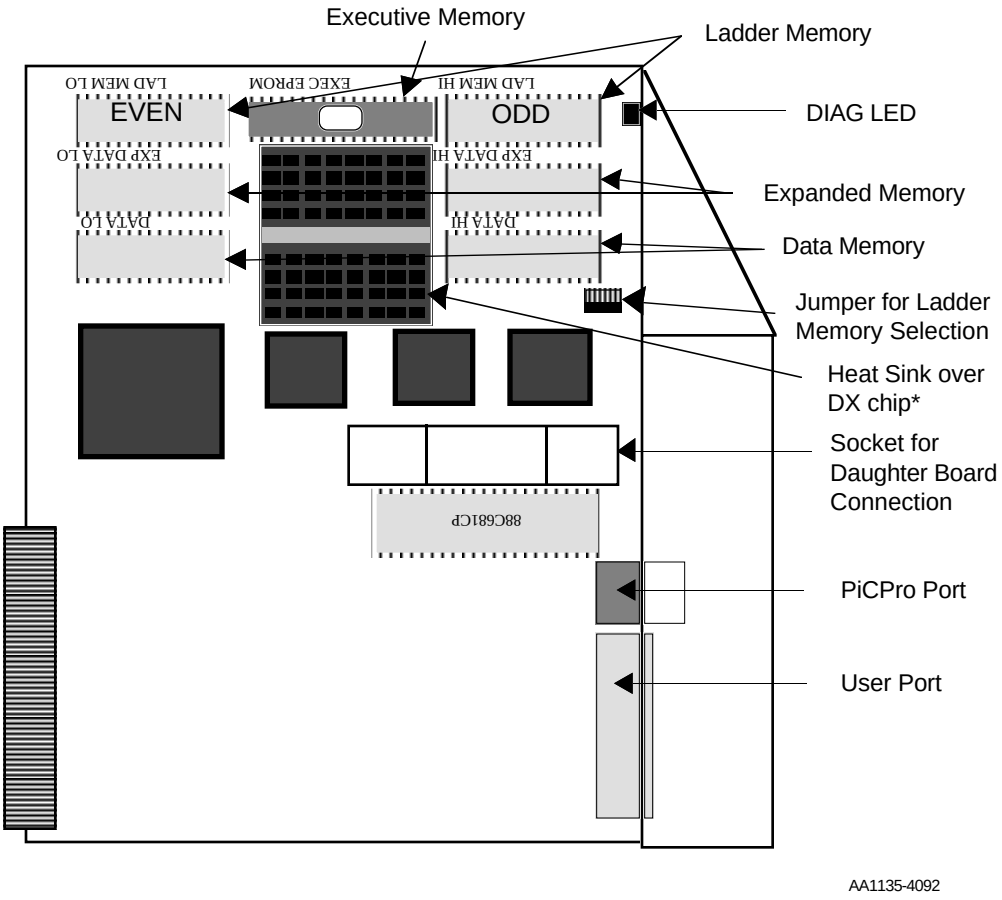


Figure A2-4. Positions of the ICs on 80486 CPU



*NOTE: The 80486SX CPU does not have a heat sink over the chip.

Procedure for Installing ICs into LAD MEM

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 A2-3 and A2-4 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 LO. Use an insertion tool to position it over the left LAD MEM 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. On 80C186 CPUs, the jumper labeled LAD MEM SEL controls the sockets labeled LAD MEM HI/LO. (See Figure 2-3 for jumper location.) You must select the correct jumper position for the amount of memory (64K or 256K) and for the type of IC (EPROM or RAM) you are inserting.

   On 80486 CPUs, the jumper selection is only for the type of IC (EPROM or RAM) you are inserting. (See Figure 2-4 for jumper location.)

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 module specifications								
Function			Executes the application program. Executes Diagnostics on the system and its modules. Communicates through the RS232 ports to external devices.								
CPUs							Number of servo axes available at five update rates*				
Model	**CPU**	**Part Number**	**Speed**	**App Mem**	**RAM Mem**	**User Mem**	**8 ms**	**4 ms**	**2 ms**	**1 ms**	**.5 ms**
SAVE	80C186	502-03680-11	6 MHz	64K	0	32K	4	2	1	0	0
STANDARD	80C186	502-03510-11	8 MHz	64K	0	32K	6	4	2	1	0
	80C186	502-03510-21	8 MHz	64K	64K	32K	6	4	2	1	0
	80C186	502-03510-31	8 MHz	64K	256K	32K	6	4	2	1	0
	80C186	502-03510-41	8 MHz	256K	0	32K	6	4	2	1	0
	80C186	502-03510-51	8 MHz	256K	64K	32K	6	4	2	1	0
	80C186	502-03510-61	8 MHz	256K	256K	32K	6	4	2	1	0
TURBO	80C186	502-03638-11	16 MHz	64K	0	32K	16	8	4	2	1
	80C186	502-03638-21	16 MHz	64K	64K	32K	16	8	4	2	1
	80C186	502-03638-31	16 MHz	64K	256K	32K	16	8	4	2	1
	80C186	502-03638-41	16 MHz	256K	0	32K	16	8	4	2	1
	80C186	502-03638-51	16 MHz	256K	64K	32K	16	8	4	2	1
	80C186	502-03638-61	16 MHz	256K	256K	32K	16	8	4	2	1
TURBO^2	80486SX	502-03794-40	16 MHz	256K	0	32K	16	12	6	3	1
	80486SX	502-03794-60	16 MHz	256K	256K	32K	16	12	6	3	1
	80486DX	502-03814-40	25 MHz	256K	0	32K	32	16	8	4	2
	80486DX	502-03814-60	25 MHz	256K	256K	32K	32	16	8	4	2

*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.

With the TURBO and TURBO^2 models, your system can have up to 16 servo axes and 16 digitizing axes. With the SAVE and STANDARD models, the following combinations are possible:

Servo Axes	Digitizing Axes
6	0
5	1 to 4
4	1 to 8
3	1 to 12
2 or less	1 to 16

Math coprocessor (optional with 80C186 CPU models.)	Numeric coprocessor Part Number 401-54187-10
NOTE: A math coprocessor is standard on the 80486DX models. No math coprocessor is available with the 80486SX models.	
Memory	1 Megabyte max.
PiCPro port (to workstation) User port (to serial interface device)	RS232 serial port, secured protocol Software selectable baud rate (300 to 115200 baud) RS232 serial port Supports RTS/CTS hardware handshaking Baud rates to 19.2 K
Logic side power requirements (typical)	295 mA @ +5V (502-03680-XX)* 310 mA @ +5V (502-03510-XX)* 369 mA @ +5V (502-03638-XX)* 500 mA @ +5V (502-03794-XX) 750 mA @ +5V (502-03814-XX) 10 mA @ +15V (all) 10 mA @ -15V (all) 5 µA @ +3V (all)** *Add 110 mA at +5V when math coprocessor is installed. **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
Noise immunity	Conforms to ICS 3-304 for noise immunity (NEMA showering arc) Conforms to IEC publication 801 part 2 level 1, 2, 3, and 4 for electrostatic discharge immunity

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