GETTING STARTED

CHAPTER

1

In This Chapter...

Introduction

Intended Use of This Product

The PIAM-100 is a small computer with on-board I/O based on the "Open-Source Arduino platform". This product can be used to solve various control and automation tasks using customized programs.

The user community website of PIAM-100 (http://go2adc.com/p1am) is where you will find various demo programs and libraries that will allow you to jump right into programming and design.

Follow all applicable safety parameters when connecting to external I/O sensors and devices.

Any use other: than described in this manual is not permitted, as this may expose the user to possible harm and/or damage to the device or connected equipment.

The P1AM-100 must not be altered or modified. The safety instructions as well as the maximum permissible ambient conditions and operating parameters are given in Chapter 2 "Technical Specifications".

The instruction manual is meant to be read thoroughly while being mindful of safe and proper operation. It contains important information on mounting, operating and handling the P1AM-100.

⚠️ **CAUTION:** *The P1AM CPU Base Controller uses pins A3 and A4 so any shield that uses these same pins will have a conflict. The MKR RGB shield is one that has this conflict.*

Purpose of this Manual

Thank you for purchasing the AutomationDirect ProductivityOpen Arduino compatible Controller. This user manual provides information that will help you install, set up, program, troubleshoot, and maintain your ProductivityOpen project.

The manual includes information that is critical to the safety of the personnel who will install and use the controller and to the machinery, processes, and equipment controlled by the P1AM-100.

The manual also includes important information about power and signal wiring, mounting the CPU and modules, and configuring the system.

Important Online Resources

Access to ADC Community based help for your ProductivityOpen projects is available from our website: http://go2adc.com/p1am.

You will need libraries and other files available from our GitHub page at https://github.com/facts-engineering/P1AM

The P1AM libraries and Board Support Package and other support files are located on Github.

A variety of other useful information about the Productivity1000 I/O modules, as well as code for example tasks and more is available at https://facts-engineering.github.io.

The P1AM-100 may be programmed by Arduino IDE which may be downloaded from https://www.arduino.cc/en/Main/Software. A graphical programming tool customized for P1AM-100 based on ArduBlock (ProductivityBlocks®)is accessible from the Tools menu in the Arduino IDE.

In addition, the Productivity1000 series power supplies and I/O modules, which work with the P1AM-100, include an installation insert.

Use a QR symbol reader or click on graphic icon to see an overview video.

Conventions Used

NOTE: *When you see the "note pad" icon in the left-hand margin, the paragraph to its immediate right will be a special note. Notes represent information that may make your work quicker or more efficient. The word NOTE in boldface will mark the beginning of the text.*

WARNING: *When you see the "exclamation point" icon in the left-hand margin, the paragraph to its immediate right will be a warning. This information could prevent injury, loss of property, or even death in extreme cases. Any warning in this manual should be regarded as critical information that should be read in its entirety. The word WARNING in boldface will mark the beginning of the text.*

Key Topics for Each Chapter

The beginning of each chapter will list the key topics that can be found in that chapter.

Install Programming Software

NOTE: *An active Internet connection is required to download the Arduino IDE and access the libraries and board driver.*

The P1AM-100 CPU may be programmed with the Arduino IDE. ProductivityBlocks® is an optional graphical environment used with the IDE that AutomationDirect has adapted to make Productivity1000 I/O modules conveniently accessible as blocks.

1. Download the latest version of the Arduino IDE software from https://www.arduino.cc/en/Main/Software.

2. Library Install:

    a. In the Arduino IDE go to "Sketch -> Include Library -> Manage Libraries…"

    b. Leave the Type and Topic filters as "All" and type "P1AM" in the "Filter your search…" box

    c. Click on the P1AM by FACTS Engineering that appears

    d. Click the Install button

    e. Close the Library Manager window

    f. Confirm the installation by checking for "File -> Examples -> P1AM-100". Several categories of examples should be present.

3. Arduino Board Support Package Install:

    a. Go to "File->Preferences" and paste the following link into the "Additional Boards Manager URLs" field.

NOTE: *Make sure you right click on the link and choose "Copy Link".*

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        i. https://raw.githubusercontent.com/facts-engineering/facts-engineering.github.io/master/package_productivity-P1AM-boardmanagermodule_index.json

    b. Go to "Tools -> Boards -> Board Manager". Type P1AM into the search box at the top. Mouse over the result and click install. The install may take several minutes to complete.

      c. If you are on a version of Windows before Windows 10 this is mandatory. For Windows 10 users, this may be run if you want the board to appear as P1AM-100 (or P1AM-200) in device manager.

        i. Download the "driver install" file from this link:
https://github.com/facts-engineering/P1AMCore/raw/master/drivers.zip.

        ii. Extract the file

        iii.Run the "P1AM-100_install.bat" file to complete the driver installation.

    d. If you are having trouble installing the BSP due to network issues such as firewall restrictions, you can use the "Arduino SAMD Boards" (specifically the MKRZERO) as an alternative. These are present in the board manager automatically.

4. Testing installation

    a. Attach the modules and/or shields you wish to use. REMEMBER modules/shields must not be connected or disconnected while power is applied - either 24V or USB.

    b. Plug the micro USB cable into the P1AM CPU and computer

        i. If using P1000 I/O modules power the system with 24V

    c. Go to "Tools -> Board:" and select the "P1AM-100 or P1AM-200" from the dropdown that appears.

    d. Go to "Tools -> Port" and select the "P1AM CPU" device that you have plugged in.

    e. Go to File -> Examples -> P1AM-100 (or P1AM-200) ->Basic->PrintModules to open the Print Modules example. Note that the PrintModules example is intended for a system with Productivity1000 modules connected and powered.

    f. Click the right facing arrow button under "Edit" to upload the code to the board.

    g. Go to "Tools -> Serial Monitor" and check to see that the name of module(s) you have in the base is printing to the terminal.

5. Next Steps

    a. Start with the "Basic" category of the P1AM CPU Library examples to become familiar with the API.

    b. Once you are comfortable with the basic examples you can move on to more complex routines included in the P1AM CPU examples.

6. Install ProductivityBlocks®

    a. Run the ProductivityBlocks Installer.

    b. ProductivityBlocks will be installed in the Documents -> ProductivityBlocks folder. The ProductivityBlocks programming environment is accessible from the Tools menu in the Arduino IDE.

   c. Example ProductivityBlocks programs are also included in this folder.

Mounting Hardware

Install Shields on the left side of the P1AM CPU and P1 I/O Modules on the right side of the P1AM CPU.

The ProductivityOpen Shields and Productivity1000 Input/Output modules are DIN rail mountable and designed to snap together to simplify connection. A system may include communications, inputs and outputs. See Chapter 3 of this manual and Chapters 4 and 5 of the Productivity1000 manual for more detailed hardware installation information.

WARNING! **Do not add or remove modules with field power applied!**

Step One: With latch in "locked" position, align connectors on the side of each module and stack by pressing together. An audible click indicates lock is engaged.
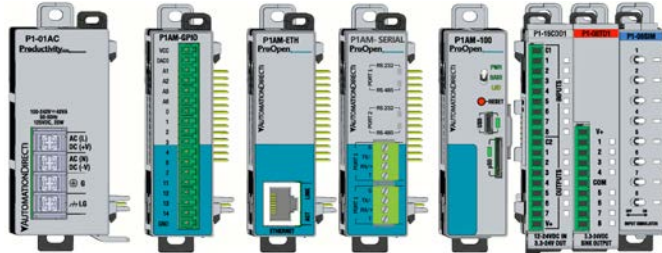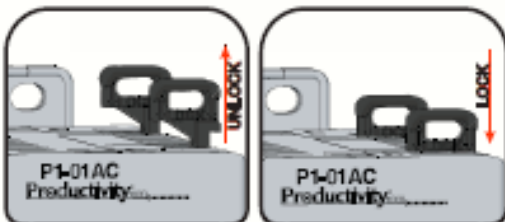

Step Two: Attach field wiring using the removable terminal block or ZIPLink wiring system.

CAUTION! **Ensure all latches are secured after modules are connected.**
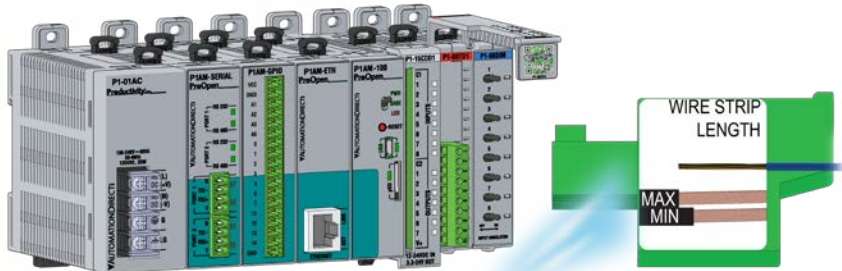
Step Three: To unstack modules, pull locking latch up into the unlocked position and then pull modules apart.

Power the System

NOTE: Ensure all modules are connected to the system before power is applied. Do not assemble or disassemble the system while power is applied.
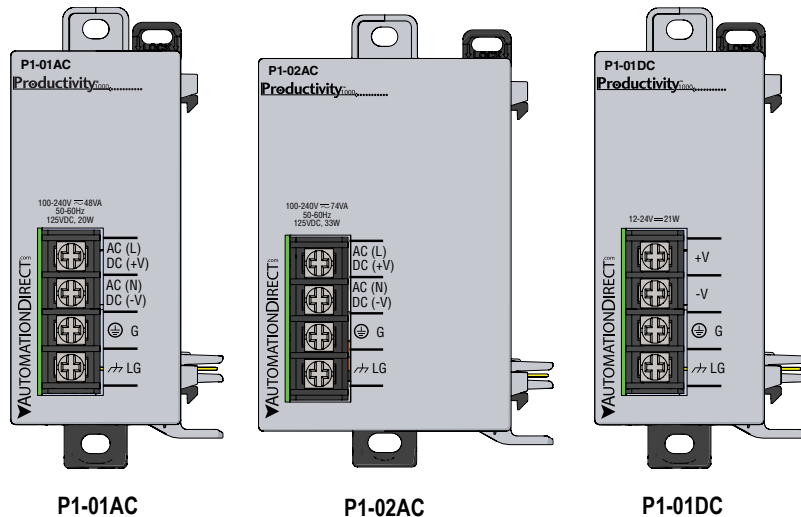
Productivity1000 Power Supplies:

1. Connect one of the Productivity1000 power supplies to P1AM CPU. Should you choose Arduino MKR compatible shields instead of or in addition to the ProductivityOpen shields, the Productivity1000 power supplies cannot be used. In this case an alternative power supply is required (See below for information on connecting an external power supply).

P1000 AC input power supplies:

- P1-01AC: AC Input 85–132 / 170–264 VAC, 16W
  (power for P1AM-100 and up to 8 modules)
- P1-02AC: AC Input 85–132 / 170–264 VAC, 26W
 (power for P1AM-100 and up to 15 modules)

P1000 DC input power supplies:

- P1-01DC: DC Input 12–24 VDC, 16W
  (power for P1AM-100 and up to 8 modules)

| P1-01AC | P1-02AC | P1-01DC |

CAUTION: *Ensure that only one power supply source is connected to the Arduino system. When a Productivity1000 power supply is connected immediately to the left of the CPU module, the bottom Power Connector must be removed before connecting P1-01AC Power Supply. This precludes connection of two separate power supplies. If an AutomationDirect shield is connected between a Productivity1000 power supply and the CPU module care must be taken to ensure an external power supply is not connected to the bottom terminals.*

2. OR using an alternative 24VDC external power source connect directly to P1AM CPU Optional Power Connector terminals. This option allows for the use of Input/Output modules from the Productivity1000 family as well as all Arduino MKR compatible shields.

- The LG and minus terminals on the external power supply connection are internally shorted.
- Use separate 24VDC supplies, one for the P1AM CPU and another for inductive loads to keep the P1AM CPU supply power clean and free of voltage spikes caused by switching inductive loads.
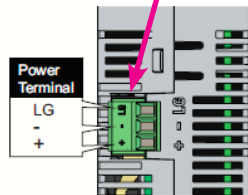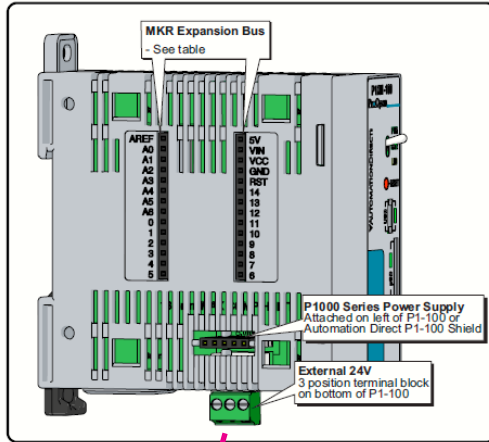

RHINO Power Supply P/N PSV24-50s

Example of Alternative 24VDC Power Supply

Terminal Block Specifications

Part Number	PCON-KIT
Number of positions	3 screw terminals
Pitch	3.5 mm
Wire Range	28–16 AWG (0.324 to 3.31 mm²) Solid / Stranded conductor 1/4 in (6–7 mm) Strip Length
Conductors	Use copper conductors, 75°C or equivalent
Screw Driver Width	1/8 in (3.175 mm) Maximum
Screw Size	M2
Screw Torque	1.7 lb·in (0.4 N·m)

Recommended screw driver P/N: TW-SD-MSL-2

3. OR using USB input power, connect to the microB USB port on the face of the P1AM CPU. USB power is intended for programming and will not power Productivity1000 Input /output modules.
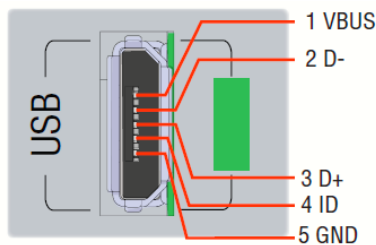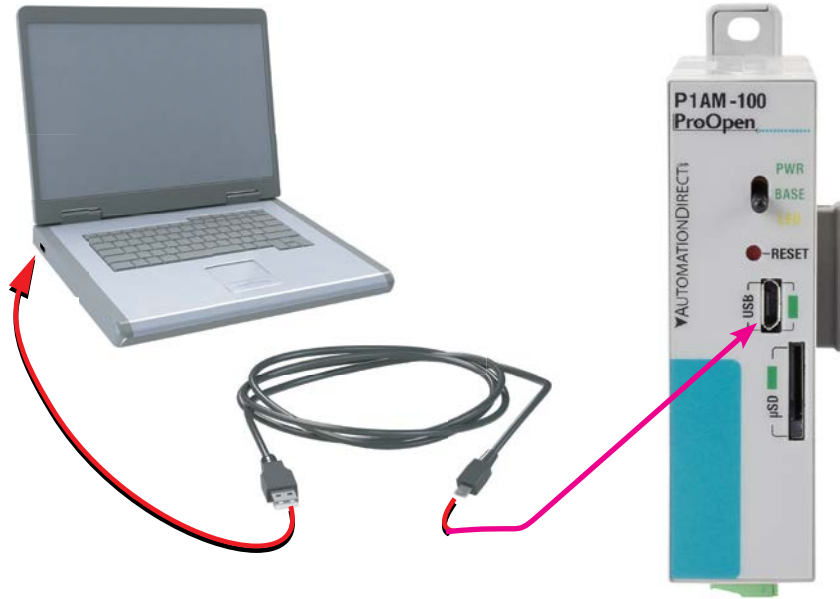
Micro USB Type B Input Specifications	
Port Name	Micro USB
Description	Standard Micro USB input for programming and monitoring
Port Status LED	Green LED is illuminated when a power cable is plugged in.

Cables	USB Type A to Micro USB Type B:
	    6ft cable part # USB-CBL-AMICB6
	    15ft cable part # USB-CBL-AMICB15