

Productivity®Open Overview

ProductivityOpen leverages the modern processing power of Arduino and the proven industrial value of the Productivity1000 input and output modules while making use of the wide variety of Arduino MKR form factor shields.

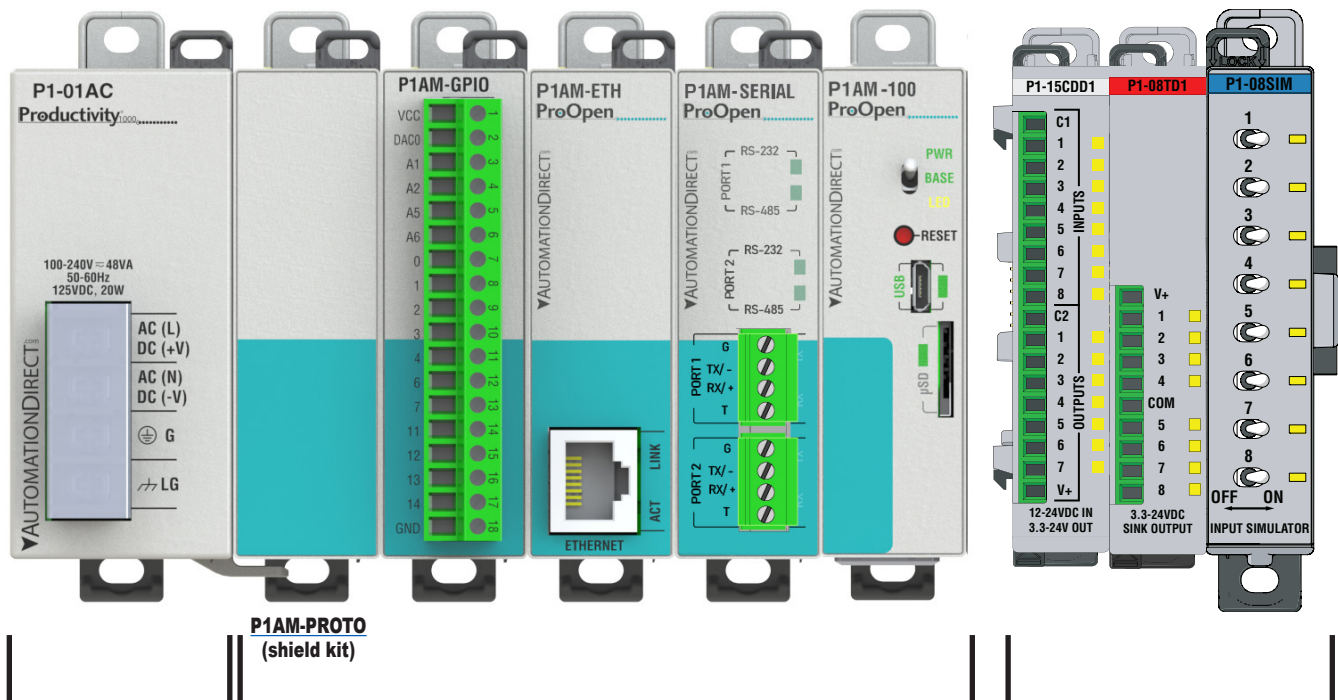
The P1AM-100 module is programmed with the Arduino IDE or ProductivityBlocks, an optional proprietary block programming environment.

Features

- Supports Productivity1000 input and output modules
- Supports Arduino MKR form factor shields
- UL-listed CPU
- UL-listed ProductivityOpen branded shields



Productivity®Open Modules		
Part Number	Price	Description
P1AM-100	\$69.00	Arduino compatible CPU
P1AM-ETH	\$55.00	Ethernet shield
P1AM-SERIAL	\$55.00	Serial shield, RS-232 & RS-485
P1AM-GPIO	\$61.00	Extended I/O shield
P1AM-PROTO	\$44.50	Custom housing kit
P1AM-START1	\$288.00	Maker community start kit
P1AM-START2	\$223.00	Industrial community start kit



**Productivity1000
Power Supply**

**The power of Arduino in
ProductivityOpen.**

**Productivity1000
Industrial grade,
I/O Modules**

Productivity®Open Overview

Productivity1000 I/O Modules

A variety of discrete and analog I/O modules from our Productivity1000 line is available for use with the [P1AM-100](#).

Productivity1000 Discrete Modules

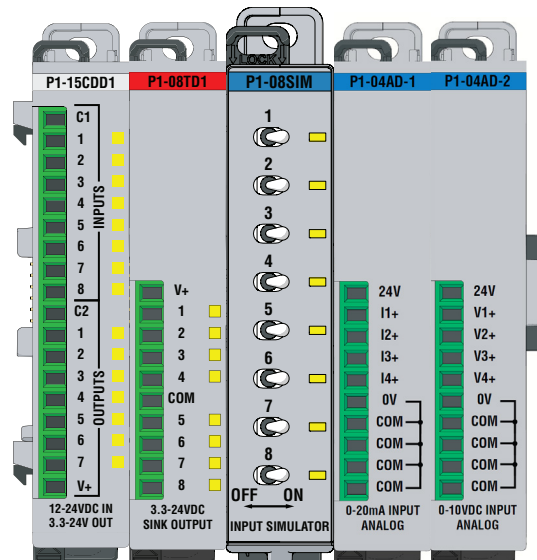
Part Number	Number of Inputs	Description	
Input Modules			
<u>P1-08SIM</u>	8	Input Simulator Module	
<u>P1-08ND3</u>	8	Sinking/Sourcing 12–24 VDC Input	
<u>P1-16ND3</u>	16	Sinking/Sourcing 12–24 VDC Input	
<u>P1-08NE3</u>	8	Sinking/Sourcing 24V AC/DC	
<u>P1-16NE3</u>	16	Sinking/Sourcing 24V AC/DC	
<u>P1-08NA</u>	8	AC Isolated 100–240 VAC	
Output Modules			
	Number of Outputs		
<u>P1-08TD1</u>	8	Sinking DC Output	
<u>P1-08TD2</u>	8	Sourcing DC Output	
<u>P1-15TD1</u>	15	Sinking DC Output	
<u>P1-15TD2</u>	15	Sourcing DC Output	
<u>P1-08TA</u>	8	AC Output	
<u>P1-08TRS</u>	8	Isolated Relay Output	
<u>P1-16TR</u>	16	Relay Output	
Input/Output Modules			
	Inputs	Outputs	
<u>P1-15CDD1</u>	8	7	Input: Sinking/Sourcing; Output: Sinking
<u>P1-15CDD2</u>	8	7	Input: Sinking/Sourcing; Output: Sourcing
<u>P1-16CDR</u>	8	8	Input: Sinking/Sourcing; Output: Relay

Productivity1000 Specialty Modules

Part Number	Description
Input Modules	
P1-04PWM	4 channels of sinking/sourcing 0–20 kHz, 0–100% duty cycle outputs
P1-02HSC	2 independent single-ended 5–24 VDC inputs that accept up to 100kHz of pulse/direction and quadrature signals and 2 5–24 VDC general-purpose high-speed inputs.

Productivity1000 Analog Modules

Part Number	Number of Inputs	Description	
Input Modules			
P1-04AD	4	Analog Input (Current/Voltage)	
P1-04AD-1	4	Analog Input (Current)	
P1-04AD-2	4	Analog Input (Voltage)	
P1-04ADL-1	4	Analog Input (Current)	
P1-04ADL-2	4	Analog Input (Voltage)	
P1-08ADL-1	8	Analog Input (Current)	
P1-08ADL-2	8	Analog Input (Voltage)	
P1-04RTD	4	RTD Input	
P1-04THM	4	Thermocouple Input	
P1-04NTC	4	Thermistor Input	
Output Modules			
	Number of Outputs		
P1-04DAL-1	4	Analog Output (Current)	
P1-04DAL-2	4	Analog Output (Voltage)	
P1-08DAL-1	8	Analog Output (Current)	
P1-08DAL-2	8	Analog Output (Voltage)	
Input/Output Modules			
	Inputs	Outputs	
P1-4ADL2DAL-1	4	2	Analog Input/Analog Output (Current)
P1-4ADL2DAL-2	4	2	Analog Input/Analog Output (Voltage)



P1AM-100 Arduino Compatible CPU

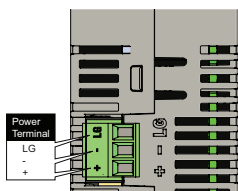
P1AM-100 \$69.00

The P1AM-100 is an Arduino-compatible CPU. It uses the Atmel SAMD21G18 microcontroller and can be programmed using Arduino IDE or ProductivityBlocks. It interfaces with all Productivity1000 Series I/O modules connected to the right side

of the P1AM-100 and most Arduino MKR form factor shields connected to the left side. The specifications are listed in the tables below.



P1AM-100



WARNING: Use only a P1000 power supply **OR** an external 24V power supply, not both simultaneously.



User Specifications

User Memory	256kB Flash with 10kB used for bootloader
Memory Type	Flash: 256kB, SRAM: 32kB
Base Controller and I/O Power Requirement 1	24VDC $\pm 2\%$ Plan 0.5 W for the SAMD chip and base controller Plan 1.25 W per P1000 I/O module Plan 9W for max. header power draw (which provides max. 4.25 W power to left side connected shields)
Recommended Fuse (External)	Edison S5061-R, Time Delay, 1A Fuse For 9–15 modules: Edison S5062-R, Time Delay, 2A Fuse
Peripherals	MicroB USB, Arduino MKR-compatible, microSD card slot for data logging (32GB max), User controlled LED
Hardware Limits of System 2	15 Productivity1000 I/O Modules; Arduino MKR shields
Programming	Programmed in C/C++ with the Arduino IDE or ProductivityBlocks

¹ If you do not use a Productivity1000 power supply, like the P1-01AC, P1-02A, or P1-01DC, then use a power supply that has transformer isolation. Use different 24VDC supplies for the CPU and inductive loads to keep the CPU power clean and free of voltage spikes caused by switching solenoids, motors and relay coils.

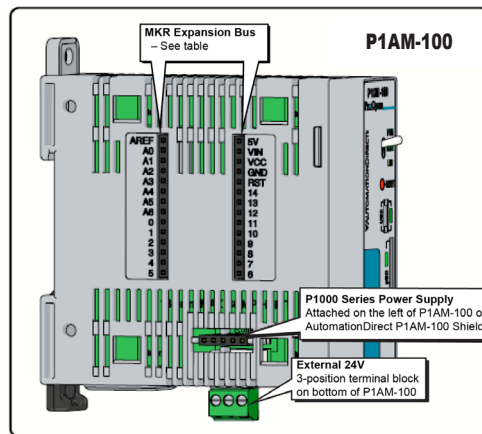
² See "MKR Expansion Bus Pins" table and notes for shield power budget restrictions.

General Specifications

Operating Temperature	0° to 60°C (32° to 140°F)
Storage Temperature	-20° to 70°C (-4° to 158°F)
Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	IEC60068-2-6 (Test Fc)
Shock	IEC60068-2-27 (Test Ea)
Heat Dissipation	4000mW
Enclosure Type	Open Equipment
Module Location	Productivity1000 I/O modules connect on the right side of module. Productivity1000 power supply, P1AM Shields and MKR Shields connect on the left side on the module.
Weight	76g (2.8 oz)
Agency Approvals	UL 61010-1 and UL 61010-2-201 File E139594, Canada & USA; CE

CPU Status Indicators

PWR	Green LED is illuminated when power is ON
BASE	Green LED is illuminated when BASE controller is powered and has been initialized
LED	Yellow LED is illuminated when commanded by user program. LED can be referred to as LED_BUILTIN or Pin 32.



MKR Expansion Bus Pins

GPIO	A0–A6, 0–14
Analog Input Pins	A0–A6
Analog Output Pins	A0
PWM Pins	0–8, 10, A3, A4
Interrupt Pins	0, 1, 4–8, A1, A2
5V	5V supply output
Vin	5V regulated supply
VCC	3.3 V supply output
GND	Ground
RST	Reset
AREF	Analog Input Reference

Critical Notes:

Pins A3, A4, and 8–10 are used for the base controller. Do not exceed 46mA combined from pins 0, 1, and 4–10. Do not exceed 3.3 V on any I/O pin. Do not exceed 7mA on any I/O pin. Do not apply power to 5V or VCC

Reset Switch Specifications

- Press once to manually reset code execution, the Base Controller, and all P1000 Series modules.
- Press twice quickly to put the P1AM CPU into bootloader mode.

Toggle Switch Specifications

- Switch can be read using the "digitalRead" function.
- Switch can be referred to as "SWITCH_BUILTIN" or Pin 31.

Shields

P1AM-ETH

\$55.00

Ethernet Communications Shield

The P1AM-ETH is a housed Arduino Compatible Ethernet Shield based on the Wiznet W5500 Ethernet Controller. It interfaces to the left side

of the [P1AM-100](#) CPU and most Arduino MKR form factor shields.



General Specifications

Operating Temperature	0° to 60°C (32° to 140°F)
Storage Temperature	-20° to 70°C (-4° to 158°F)
Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	IEC60068-2-6 (Test Fc)
Shock	IEC60068-2-27 (Test Ea)
Heat Dissipation	750mW
Enclosure Type	Open Equipment
Power Budget	150mA/5V
Recommended Library	Arduino Ethernet
Module Location	Connects to the left side of the P1AM-100 CPU.
Weight	20g (0.8 oz.)
Agency Approvals	UL 61010-1 and UL 61010-2-201 File E139594, Canada & USA CE

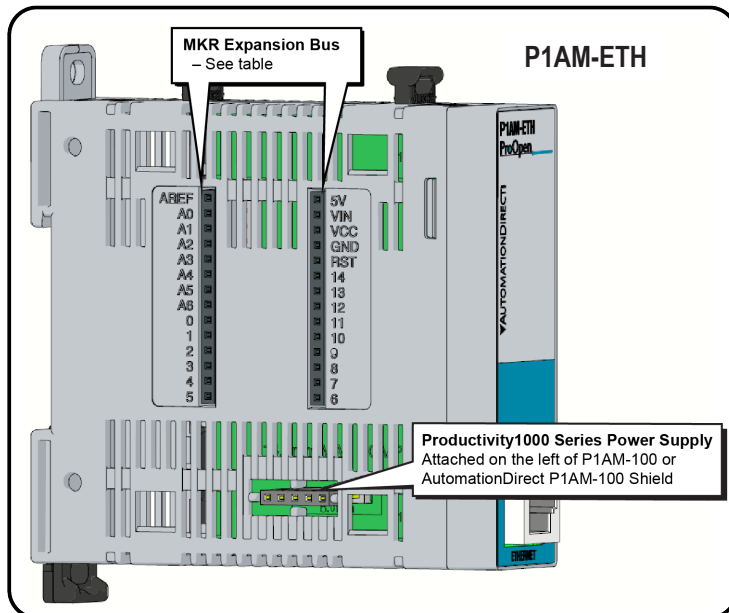
Ethernet Features

Supports Hardwired TCP Protocols:

- TCP, UDP, ICMP, IPV4, ARP, IGMP, PPPOE
- Supports 8 independent sockets simultaneously
- Supports Power Down Mode
- Supports Wake on LAN over UDP
- Supports High Speed Serial Peripheral Interface (SPI MODE 0, 3)
- Internal 32K bytes of Memory for TX/RX Buffers
- 10BaseT / 100BaseTX Ethernet PHY embedded
- Supports Auto Negotiation (Full and Half Duplex, 10 and 100-based)
- Does Not Support IP Fragmentation
- 3.3 V operation with 5V I/O signal tolerance
- LED outputs (Full / Half duplex, Link, Speed, Active)

!WARNING!

Do not add or remove modules with field power applied!



MKR Expansion Bus Pins

GPIO	A0-A6, 0-14
Analog Input Pins	A0-A6
Analog Output Pins	A0
PWM Pins	0-8, 10, A3, A4
Interrupt Pins	0, 1, 4-8, A1, A2
5V	5V supply output
Vin	5V regulated supply
VCC	3.3 V supply output
GND	Ground
RST	Reset
AREF	Analog Input Reference

Critical Notes:

Pins A3, A4, and 8-10 are used for the base controller.
Do not exceed 46mA combined from pins 0, 1, and 4-10.
Do not exceed 3.3 V on any I/O pin.
Do not exceed 7mA on any I/O pin.
Do not apply power to 5V or VCC

Header Pins Used for Ethernet Shield

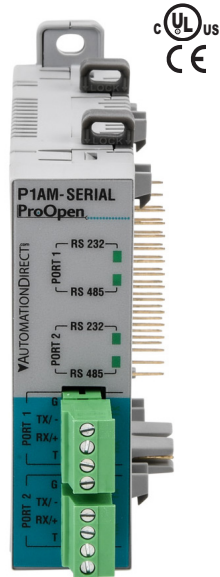
Pins Used	Function	Description
5	ETH SS	
8	MOSI	
9	SCK	SPI pins are shared with other devices on SPI bus
10	MISO	

Shields

P1AM-SERIAL \$55.00

Serial Communications Shield

The P1AM-SERIAL is a housed Arduino MKR form factor shield. It connects to the left side of the [P1AM-100](#) CPU and most Arduino MKR form factor boards.



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

Serial Features

- Supports RS-232 and RS-485
- RS232/RS485 selectable in program
- Status LEDs (RS-232/RS485 mode selection, TX and RX activity)

General Specifications

Operating Temperature	0° to 60°C (32° to 140°F)
Storage Temperature	-20° to 70°C (-4° to 158°F)
Humidity	5 to 95% (non-condensing)
Altitude	2000 meters max.
Pollution Degree	2
Environmental Air	No corrosive gases permitted
Vibration	IEC60068-2-6 (Test Fc)
Shock	IEC60068-2-27 (Test Ea)
Heat Dissipation	380mW
Overvoltage Category	II
Voltage Withstand (dielectric)	Non-isolated
Insulation Resistance	Non-isolated
Enclosure Type	Open equipment
Power Budget	115mA/3.3 V
Recommended Library	P1AM_Serial
Module Location	Connects to the left side of the P1AM-100 CPU. P1-01AC, P1-02AC, and P1-01DC can connect to the left side of the Shield.
Weight	77g (2.7 oz.)
Agency Approvals	UL 61010-1 and UL 61010-2-201 File E139594, Canada & USA CE

Header Pins Used for Serial Shield

Pins Used	Function	Description
3	P1 Mode	Port 1 Mode (Low=RS485 High=RS232)
14	P1 TX-	Port 1 Data -
13	P1 RX+	Port 1 Data +
A6	P1 DE/RE	Port 1 Driver Enable / Receiver Enable
2	P2 Mode	Port 2 Mode (Low=RS485, High=RS232)
0	P2 TX-	Port 2 Data -
1	P2 RX+	Port 2 Data +
6	P2 DE/RE	Port 2 Driver Enable / Receiver Enable

Note: If a P1AM-GPIO module is installed alongside a P1AM-SERIAL module, the above pins will be unavailable to the P1AM-GPIO.

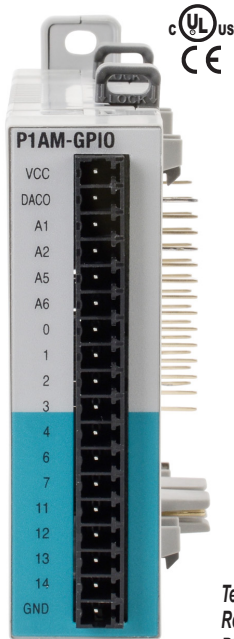
Shields

P1AM-GPIO \$61.00

Header Pin Breakout Module

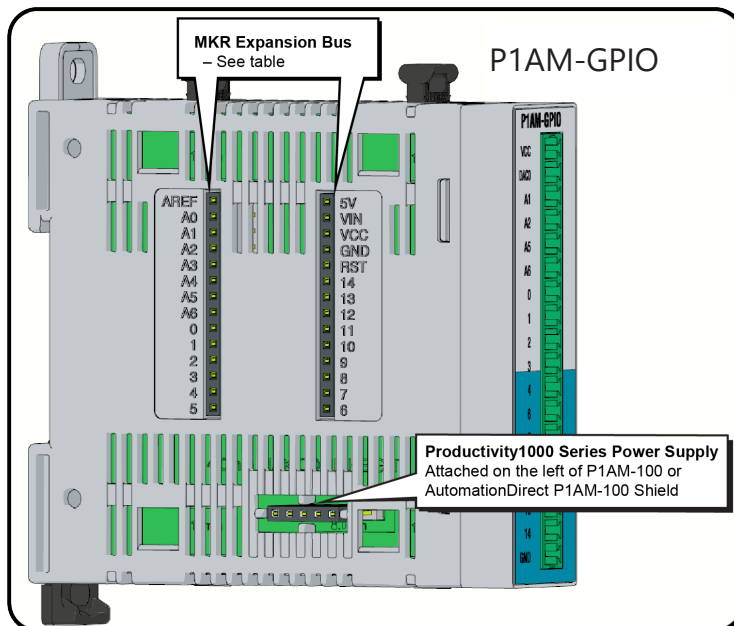
The P1AM-GPIO is a housed Arduino MKR form factor shield that brings a subset of the MKR header pins to the front faceplate with an 18-position terminal block. These pins include

basic overvoltage, undervoltage, and overcurrent protection. It connects to the left side of the P1AM-100 CPU and most Arduino MKR form factor shields.



General Specifications	
Operating Temperature	0° to 60°C (32° to 140°F)
Storage Temperature	-20° to 70°C (-4° to 158°F)
Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	IEC60068-2-6 (Test Fc)
Shock	IEC60068-2-27 (Test Ea)
Heat Dissipation	475mW
Enclosure Type	Open Equipment
Module Location	Connects to the left side of the <u>P1AM-100</u> CPU.
Weight	56g (2.0 oz.)
Agency Approvals	UL 61010-1 and UL 61010-2-201 File E139594, Canada & USA CE

Terminal block connector sold separately.
Recommended connector options
P2-RTB or P2-RTB-1.



MKR Expansion Bus Pins	
GPIO	A0-A6, 0-14
Analog Input Pins	A0-A6
Analog Output Pins	A0
PWM Pins	0-8, 10, A3, A4
Interrupt Pins	0, 1, 4-8, A1, A2
5V	5V supply output
Vin	5V regulated supply
VCC	3.3 V supply output
GND	Ground
RST	Reset
AREF	Analog Input Reference

Critical Notes:

Pins A3, A4, and 8-10 are used for the base controller.
Do not exceed 46mA combined from pins 0, 1, and 4-10.
Do not exceed 3.3 V on any I/O pin.
Do not exceed 7mA on any I/O pin.
Do not apply power to 5V or VCC

!WARNING!

Do not add or remove modules
with field power applied!

P1AM Kit

P1AM-PROTO \$44.50

The P1AM-PROTO is an Arduino-compatible kit of parts that includes everything you need to make your own customized shield in the MKR form factor.

Arduino Housing Kit

This kit includes:

- Custom MKR stacking-headers
- PC Board with 100mm (0.1 in.) grid of through-holes
- Plastic Productivity housing
- Footprint for 18-pin terminal block receptacle (Right Angle, Through Hole, 3.81 mm pitch) and plug for user I/O connections
- ProductivityOpen Overlay which can be easily cut to expose parts (LEDs, connectors, etc.) custom to the user.

General Specifications

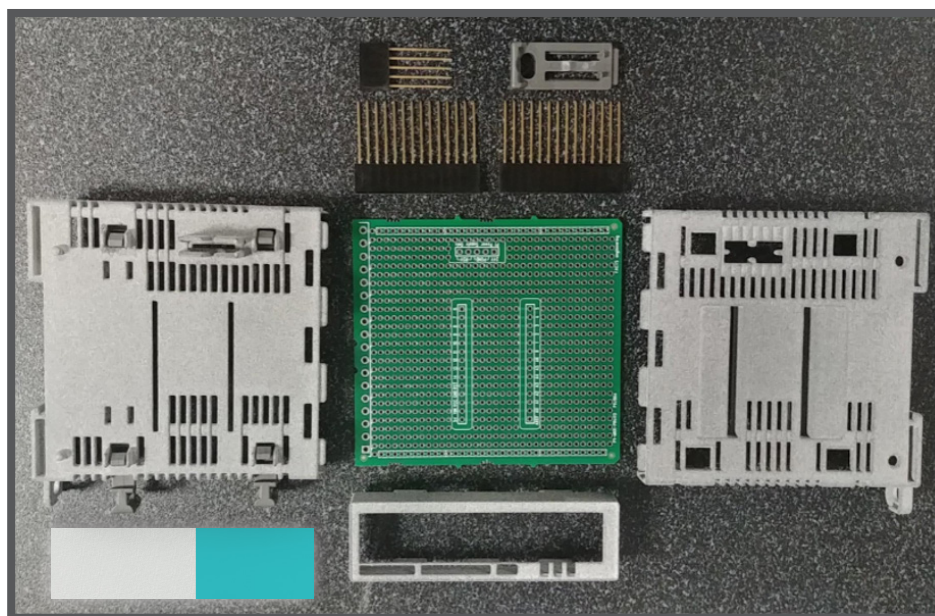
Operating Temperature	0° to 60°C (32° to 140°F)
Storage Temperature	-20° to 70°C (-4° to 158°F)
Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Enclosure Type	Open Equipment
Module Location	Connects to the left side of the P1AM-100 CPU .



P1AM-PROTO



P1AM-PROTO
(with overlay applied)



VIEW OF DISASSEMBLED P1AM-PROTO

Starter Kit Boxes

P1AM-100 Starter Kit Components

ProductivityOpen has two starter kits available - P1AM-START1 and P1AM-START2. Each kit allows you to get up and running in short order. Kit components are listed in the tables below.

P1AM-START1 \$288.00



A convenient start to a project which will use primarily Arduino MKR Zero shields:

- [P1AM-100](#) module - Arduino compatible CPU module
- [P1AM-ETH](#) shield - Ethernet communication module
- [P1AM-GPIO](#) shield - Header Pin Breakout module
- [P1-4ADL2DAL-1](#) Productivity1000 analog expansion I/O module
- [PSL-24-030](#) power supply – 24VDC (adjustable) output, 1.25 A, 30W, 120/240 VAC or 125–375 VDC nominal input, 1-phase
- [P1-10RTB](#) 10-pin terminal block
- [P2-RTB](#) 18-pin terminal block
- 3-pin terminal block
- AC power cord
- [USB-CBL-AMICB6](#) USB programming cable

P1AM-START2 \$223.00



A convenient start to a project which will use primarily Productivity1000 input and output modules:

- [P1AM-100](#) module - Arduino compatible CPU module
- [P1-01AC](#) power supply
- [P1-08TRS](#) Productivity1000 relay output module
- [P1-08SIM](#) Productivity1000 simulator input module
- [P2-RTB](#) 18-pin terminal block
- 3-pin removable terminal block
- AC power cord
- [USB-CBL-AMICB6](#) USB programming cable