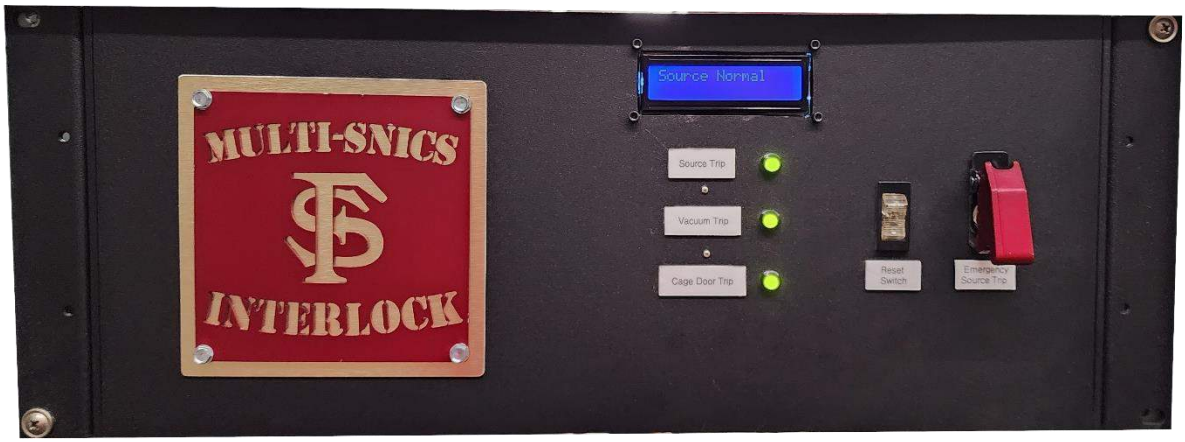
REVISION 1



MULTI-SNICS INTERLOCK

USER MANUAL

WRITTEN BY: JONAH GIBBONS
JOHN D. FOX LABORATORY

SAFETY NOTICE

Please take a moment to read and understand the following user manual before using or reconfiguring this Interlock System.
The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or each subsystem manufacture's intended use can result in damage, personnel injury or even death.
The protective features of this product may be impaired if it is used in a manner not specified in the operation instructions.

1. Operation by Trained Personnel:
   The Interlock System must be operated and configured by qualified and trained personnel who are familiar with the electrical and ion accelerator systems.

2. Lockout/Tagout Procedures:
   Before servicing the Interlock System, follow all applicable lockout/tagout procedures to ensure that controlled equipment is safely de-energized and secured to prevent inadvertent state changes that could cause damage, injury, or death.

3. Proper Cable Routing:
   High voltage differences between the ground, mid-, and high potential areas can cause arcing electrical sparks. Ensure proper isolation and insulation provides adequate separation of conducting materials.

4. Regular Maintenance:
   Regularly inspect the Interlock System for malfunctions. A basic set of test procedures is provided in this manual, but it is recommended to establish a general procedure for testing the Interlock System prior to, during, and after operating the ion accelerator.

5. Emergency Procedures:
   Establish and communicate emergency shutdown procedures in case of any system failure or malfunction. Ensure that all personnel are aware of these procedures.

6. Restricted Access:
   Restrict access and authority of the Interlock System's controls and components to authorized personnel only.

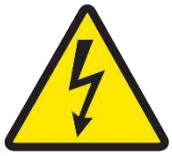
7. Environmental Considerations:
   Do not expose the system to extreme temperatures, moisture, or corrosive environments. Adverse conditions can affect the system's performance.

8. Hazard Identification:
   Clearly label all Interlock System control points and components to help users easily identify and understand their function.

9. Training:
   Ensure that all personnel responsible for operating the ion accelerator or the Interlock System receive proper training on its operation and safety procedures.

10. Emergency Shutdown:
    In case of an emergency, the Interlock System may be overridden or bypassed if required for safety reasons. Ensure that this process is well-documented and supervised. Operating the system in a bypassed state for periods extending beyond emergency conditions defeats the integrity and purpose of using an Interlock System and abiding by its established procedures. Bypassed conditions should be announced at every proceeding staff briefing to be sure the situation is not overlooked or forgotten until it is permanently resolved, and the bypass condition no longer exists.

11. High-power Danger:
    The Interlock System controls several high-power supplies that operate the ion source. These power supplies can cause extreme injury or death. Beware of the risk involved and consult with laboratory staff to ensure the risks are always mitigated.



12. Radioactive Hazard:
    The multi-SNICS is configured to use tritium cathodes. Tritium is radioactive and presents a health risk if you are exposed. Be sure you are briefed on the status of tritium inside the ion source and aware of the proper handling procedures to avoid a leak or release of tritium. If it is suspected that tritium has escaped containment. Immediately evacuate the room and report your concern to lab personnel.

Table of Contents

Overview

The Multi-SNICS has several very high voltage power supplies, a high vacuum chamber, several types of pumps, and is designed to work with tritium embedded cathodes. Tritium is a radioactive isotope of hydrogen that poses a significant health risk if ingested, inhaled, or absorbed into the body. To operate the Multi-SNICS safely, a comprehensive safety plan is required. Part of the plan is an Interlock System that acts as a fail-safe mechanism, actively monitoring key parameters such as closure of the cage doors surrounding the source, leaking tritium detection, vacuum pressure, building power, coolant flow, and smoke detection. In the event of deviations from safe operating conditions, the Interlock System initiates automatic shutdown procedures, preventing potential harm to personnel, the environment, and the equipment itself.

Equipment

The Interlock System is based on a P1AM ProductivityOpen PLC controller. It has industrial grade ratings to endure harsh environments. There are a lot of options for modules that snap together and communicate on a Modbus. The expandability of this platform makes it a good choice for this application because it can evolve to meet new needs in the future. [Appendix E]

ProductivityOpen Controller

The Interlock System uses the following P1AM series modules:

- P1AM-100 – Main CPU [Appendix F]
- P1-01DC – Modbus Power Supply [Appendix G]
- P1AM-ETH – Ethernet Shield [Appendix H]
- P1AM-GPIO – General Purpose Input/Output Shield [Appendix I]
- P1-16ND3 – 16 Discrete Inputs [Appendix J]
- P1-08TRS (2x) – 8 Relay Outputs [Appendix K]
- P1-04ADL-2 – 4 Analog Inputs [Appendix L]

Main Power Supply

There is a Mean Well USA Inc AC/DC converter that converts 120 VAC to 24 VDC and is used to power everything in the rack-mounted enclosure.

Fiber Optic Isolation

The ion source has two high-voltage regions that must be electrically isolated to prevent a short circuit. The regions are each referred to as the high and mid-potential regions respective of their relative voltage potential. Each region has a fiber optic link to relay contact closures or analog signals between the Interlock System and the sensors and control devices. [Appendix M,N]

-Interlock System Enclosure (Ground Potential):

- 2x Bidirectional contact closure fiber transceivers
- Analog voltage signal fiber receiver

-Mid-potential Area:

- Bidirectional contact closure fiber transceiver
- Analog voltage signal fiber transmitter

-High-potential Area:

- Bidirectional contact closure fiber transceiver

LCD Screen

The screen is a commonly used 1602 LCD module with a built in HD44780 controller. It can display 2 lines of up to 16 characters. It receives display commands from the P1AM-GPIO shield.

*** It requires 5 VDC power but must have a common ground with the P1AM Modbus. Accessing the Modbus common was difficult and required modifying the GPIO shield by opening the case and soldering a wire to a through-via that connected to the Modbus common.***

Sensors

- Cage door contacts
- Fume hood flow switch
- Vacuum gauge threshold relays
- Vacuum gauge analog output [Appendix O]
- Tritium detector threshold relay
- Tritium detector analog output
- Building power monitor relay
- Coolant flow switches
- Smoke detector [Appendix Q]
- Titanium sublimation pump analog output [Appendix P]

Specifications

Interlock System Enclosure	120 VAC
Enclosure DC Power Supply	24 VDC
Bidirectional Fiber Transceivers	120 VAC
Fiber Mode	Single mode
Analog Signal Fiber Transmitter/Receiver	24 VDC
Analog Signal Voltage Range	0-10 VDC
Fiber Mode	Multi mode
P1-16ND3 Module Input Rating	12-24 VDC sink/source
P1-04ADL-2 Analog Module	0-10 VDC signals
Resolution	13-bit
Cage Door Contacts	Normally Closed
Fume Hood Flow Switch	Normally Closed
Vacuum Condition Relays	Normally Open
Analog Signal	0-10 VDC
Tritium Monitor Relay	Normally Closed
Analog Signal	0-10 VDC
Building Power Monitor Relay	Normally Closed
Coolant Flow Switches	Normally Closed
Smoke Detector	Normally Open
Sublimation Pump Analog Signal	0-10 VDC

Firmware

There is drag-and-drop, ladder logic, style programming software called Productivity Blocks, but it is also compatible with the Arduino development environment and can be programmed using C++. There is a micro-USB port on the P1AM-100 controller that is used to upload firmware and read serial output.

File Structure

interlock.ino

This is the main file for the software. It contains boot up procedures, main routines and any diagnostic functions for development and testing.

states.ino

This file contains the settings for the output conditions for different states.

tasks.ino

This file contains the main functions for checking the inputs, changing states, and updating interfaces.

web.ino

This file contains the html code for the webpage served by the ethernet module. The webpage shows the state and conditions of the inputs as well as the analog values.

diagnostics.ino

This file contains diagnostic functions and statements that can be copied into the main file or called from here if you un-comment them.

map.h

This file contains the names for the signals and maps the ports and pins to convenient variable names (in# or out#). Only change the comments for the signals to match what's connected to the interlock for reference.

config.h

This file contains the settings for the ethernet module, GPIO pins for the LCD screen, the states, the data structure, the normal conditions for the inputs, the alarm priority they are associated with, the Modbus modules, and the text strings used for the LCD display.

Diagnostics

The primary diagnostic tool for the Interlock System is the serial output which can be read by connecting a laptop to the micro-USB port on the P1AM-100. There is also a switch next to the port which enables a periodic report of the interlock state and any of the inputs that are tripped. When the controller first boots up, the heartbeat LED flashes while it waits for initialization to finish. Then it checks the Modbus to verify all the modules are reporting. Every full cycle of the controller loop has a heartbeat of three flashes of the LED on the P1AM-100. There is also a watchdog timer which will automatically reset the controller if it takes longer than 5 seconds to complete a loop.

There is a diagnostics file in the firmware package which has some tools for diagnosing problems. In the file is a library called ArduinoTrace which has two useful functions for diagnosing firmware problems line by line. Reading the code and the comment lines can give a better clue as to the expected behavior of the Interlock System. Using the TRACE() and DUMP() functions provided by the ArduinoTrace library allow you to put markers in the code and dump variable data to the serial output so it is more easy to follow the program's behavior.

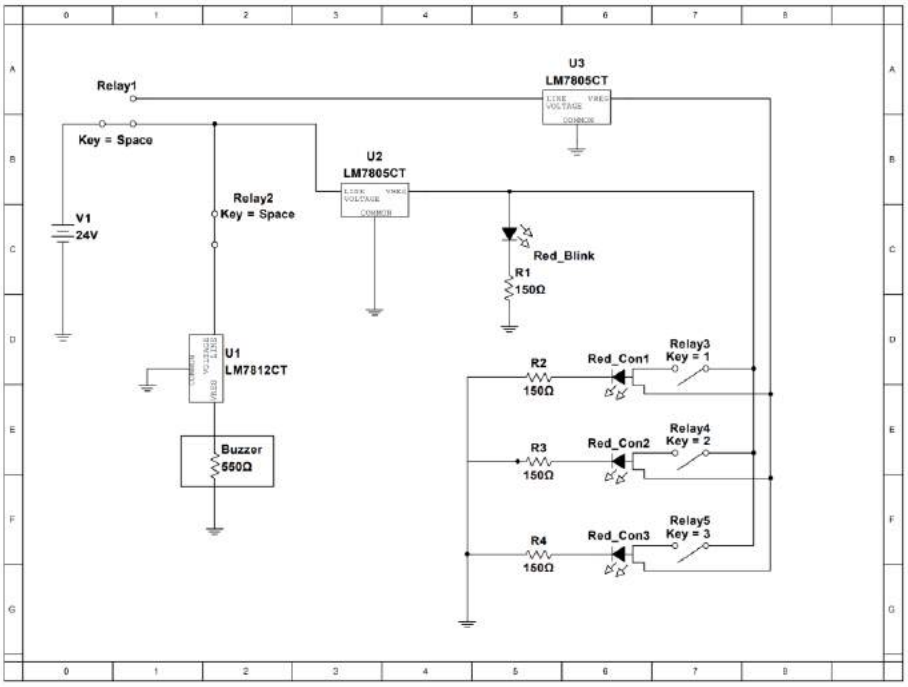
The ethernet shield has a webpage server that provides a graphical display of the system state. It is set to automatically refresh every few seconds. This was designed to be a secondary display to provide information remotely to any computer which is connected to the lab's local area network.

Sample Test Procedure

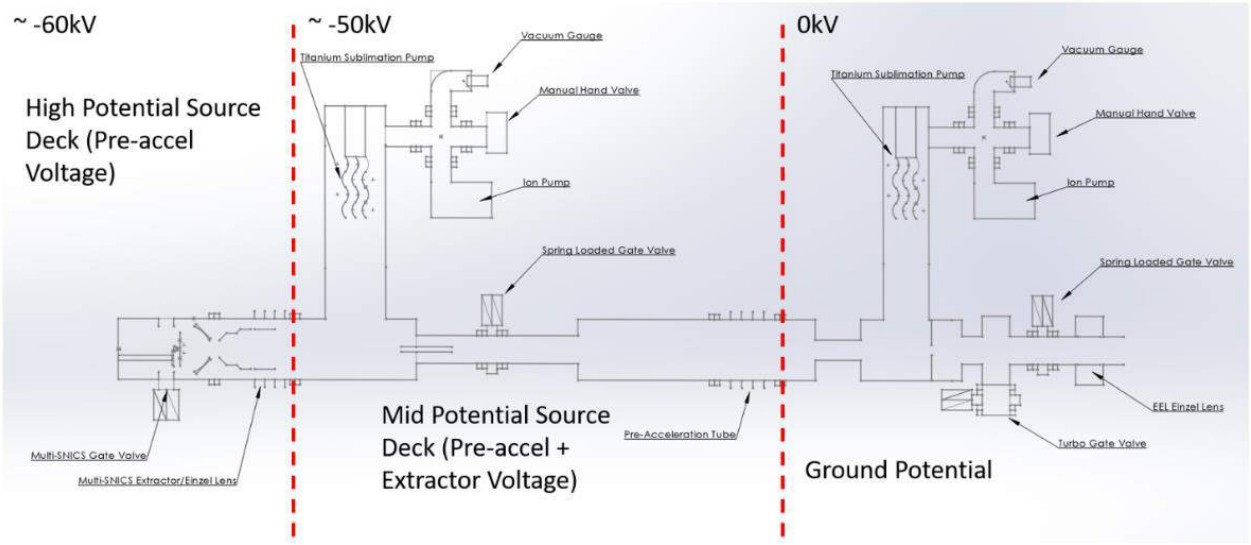
A test procedure should be thorough and standardized. Starting with a list of the sensors, one method would be to test each of the sensors in order to verify that they are reporting the appropriate alarm. Verify that when they are tripped, the Interlock System responds with a buzzer alarm, an LED showing the trouble state, and the LCD showing the proper message. Then inducing a lower-level cage door trouble condition followed by a vacuum system trouble condition and a source trouble condition to demonstrate that the Interlock System escalates to higher trouble conditions when additional sensors are tripped. After each alarm, verify that the appropriate systems have been disabled and locked out in response to the trouble condition.

Cage door contacts	Test by opening the cage doors
Fume hood flow switch	Test by turning off the breaker in the electrical closet two stories above the lab
Vacuum gauge threshold relays	Test by changing the vacuum threshold level or by running the sublimation pump
Vacuum gauge analog output	Run the sublimation pump or cross check with other gauges nearby in the line
Tritium detector threshold relay	Change the calibration zero or use a test method prescribed in the manual
Tritium detector analog output	Change the calibration zero or use a test method prescribed in the manual
Building power monitor relay	Open the breaker located in the rack cabinet under the Interlock System enclosure
Coolant flow switches	Turn off the coolant pump
Smoke detector	Press the test button located on the smoke detector
Titanium sublimation pump analog output	Turn on the pump and cross check the current shown on the controller with the current measured by the analog output

Appendix A: LED and Buzzer Wiring Diagram



Appendix B: Multi-SNICS Diagram



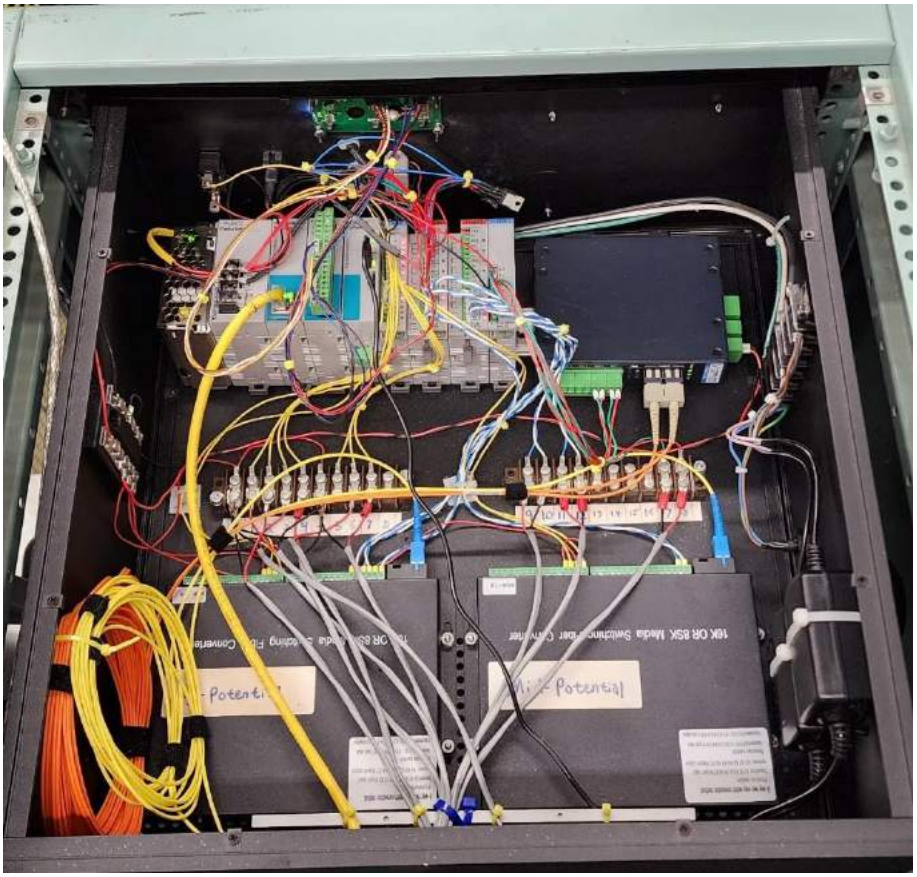
Appendix C: Port Map

	Logic Port	Name	Wire Terminal	Normal State	
Input:	1.1	Reset Button	-	NO	
	1.2	Emergency Interlock Switch	-	NC	
	1.3	Cage Door Sensor	Main 1	NC	
	1.4	Fume Hood Flow Switch	Main 2	NC	
	1.5	Vacuum Condition 2 - Ground	Main 3	NO	
	1.6	Tritium Monitor Relay	Main 4	NC	
	1.7	(UNUSED)	-	-	
	1.8	Building Power Failure Relay	Main 6	NC	
	1.9	Coolant Flow Switch 2 - Ground	Main 7	NC	
	1.10	Vacuum Condition 1 - Mid Potential	Fiber K9 - Mid	NO	
	1.11	(UNUSED)	-	-	
	1.12	Coolant Flow Switch 1 - Mid Potential	Fiber K9 - High	NC	
	1.13	Smoke Detector - High Potential	Fiber K10 - High	NO	
	1.14	(UNUSED)	-	-	
	1.15	(UNUSED)	-	-	
	1.16	(UNUSED)	-	-	
	(analog)	Tritium Sniffer - Ground	Main 17 & 18		
	(analog)	Vacuum Gauge - Mid Potential	Fiber - Mid		
	(analog)	Sublimation Pump - Mid Potential	Fiber - Mid		
Output:	2.1	Green and Flashing Red LEDs	-		
	2.2	Buzzer	-		
	2.3	Red LED Trouble 1	-		
	2.4	Red LED Trouble 2	-		
	2.5	Red LED Trouble 3	-		
	2.6	Pre-accelerator Power Supply	Main 9 & 10		
	2.7	Gate Valve - Ground	Main 11 & 12		
	2.8	Gate Valve - Mid Potential	Fiber K1 - Mid		
	3.1		-		
	3.2		-		
	3.3		-		
	3.4		-		
	3.5		-		
	3.6	High-volt Power Supplies	Fiber K1 - High		
	3.7	Boiler	Fiber K2 - High		
	3.8	Ionizer	Fiber K3 - High		

Appendix D: Trouble Modes

	Low		Medium		High
	Cage Door Trip		**Vacuum Trip**		**Source Trip**
	(Trouble 1)		(Trouble 2)		(Trouble 3)
Outputs	Pre-accelerator Supply Off		Pre-Accelerator Supply Off		Pre-Accelerator Supply Off
	Other High-Power Supplies Off		Other High-Power Supplies Off		Other High-Power Supplies Off
			Both Gate Valves Closed		Close Both Gate Valves
			Ionizer		Boiler
					Ionizer
Inputs	Cage Door Contact		Vacuum Condition (Gnd)		Emergency Source Trip Switch
			Vacuum Condition (Mid)		Fume Hood Flow Switch
					Tritium Monitor Relay
					Building Power Failure Relay
					Smoke Detector

Appendix E: Interlock System Enclosure

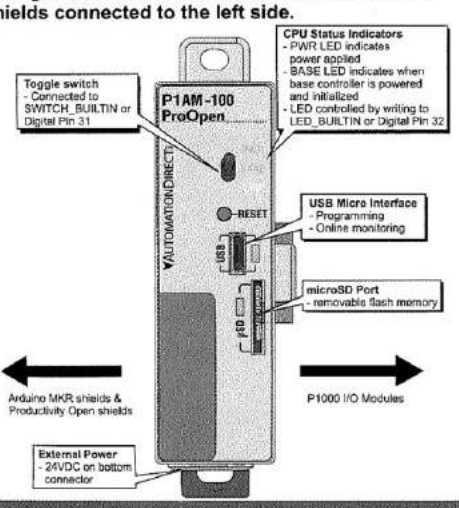


Appendix F: P1AM-100 Product Description

AUTOMATIONDIRECT
Productivity Open

P1AM-100 Arduino® MKR Compatible CPU

The P1AM-100 is an Arduino-compatible CPU. It uses the Atmel SAMD21G18 and can be programmed in C++ using Arduino IDE. It interfaces with all P1000 Series I/O modules connected to the right side and most Arduino MKR form factor shields connected to the left side.



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. 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*

*See CE Declaration of Conformance for details.

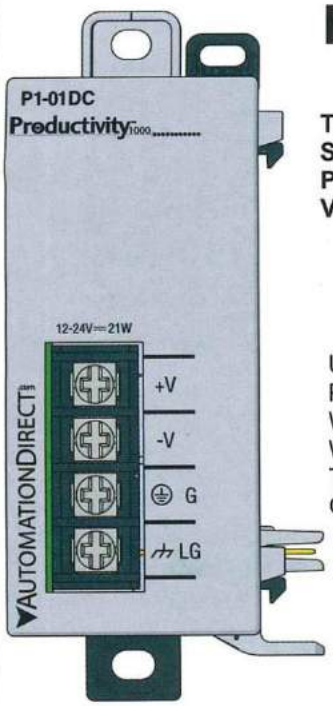
Link to GitHub

Link to full additional resources

Appendix G: P1-01DC Product Description

AUTOMATIONDIRECT.com

Productivity1000



P1-01DC Power Supply

The P1-01DC Universal Input Power Supply provides isolated power to the Productivity1000 base from an external 12–24 VDC source.

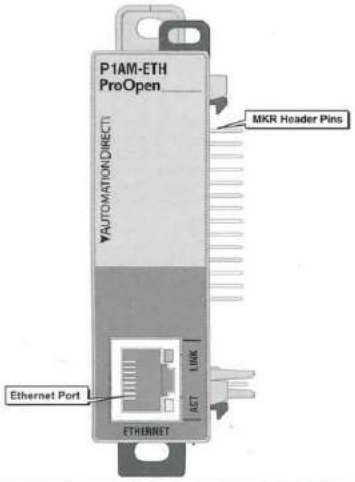
Warranty: Thirty-day money-back guarantee. Two-year limited replacement (See www.productivity1000.com for details).

Appendix H: P1AM-ETH Product Description

AUTOMATIONDIRECT
Productivity Open

P1AM-ETH Arduino® MKR Compatible Shield

The P1AM-ETH is a housed Arduino MKR form factor Ethernet Shield based on the Wiznet W5500 Ethernet Controller. It connects to the left side of the P1AM-100 CPU and most Arduino MKR form factor boards.



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 (See back for details)
Module Location	Connects to the left side of the P1AM-100 CPU. P1-01AC/02AC can connect to the left side of the CPU.
Weight	20g (0.8 oz)
Agency Approvals	UL 61010-1 and UL 61010-2-201 File E139594, Canada & USA CE*

*See CE Declaration of Conformance for details.

Link to GitHub

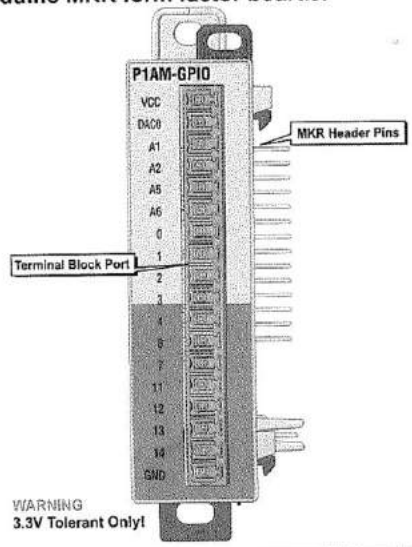
Link to additional resources

Appendix I: P1AM-GPIO Product Description

AUTOMATIONDIRECT
Productivity Open

P1AM-GPIO Arduino® MKR Compatible Shield

The P1AM-GPIO is a housed Arduino MKR form factor shield that brings a subset of the MKR header pins out to the front 18 position terminal block. Most pins include basic electrical protection. It connects to the left side of the P1AM-100 CPU and most Arduino MKR form factor boards.



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 P1AM-100 CPU. P1-01AC/02AC can connect to the left side of shield or CPU.
Connector Type	Sold Separately
Weight	56g (2.0 oz)
Agency Approvals	UL 61010-1 and UL 61010-2-201 File E139594, Canada & USA CE*

*See CE Declaration of Conformance for details.

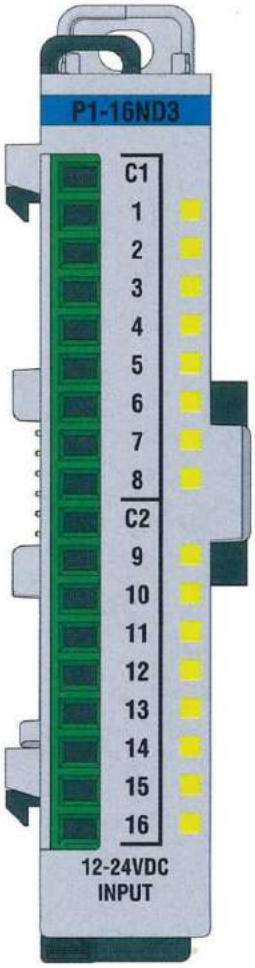
Link to GitHub

Link to full additional resources

Appendix J: P1-16ND3 Product Description

AUTOMATIONDIRECT.com

Productivity1000



P1-16ND3 Fast Response DC Input

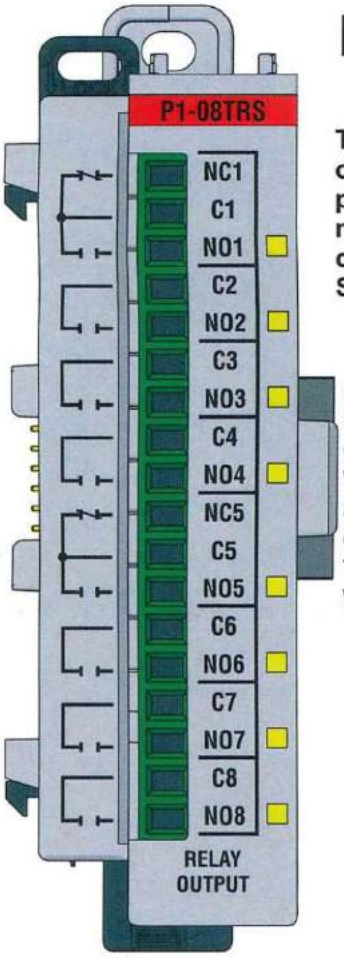
The P1-16ND3 Fast Response Input Module provides sixteen 12–24 VDC sink/source inputs with two isolated commons for use with the Productivity1000 System.

Terminal Block sold separately, (see wiring options on page 3).
Warranty: Thirty-day money-back guarantee. Two-year limited replacement (See www.productivity1000.com for details).

Appendix K: P1-08TRS Product Description

AUTOMATIONDIRECT.com

Productivity1000



P1-08TRS Isolated Relay

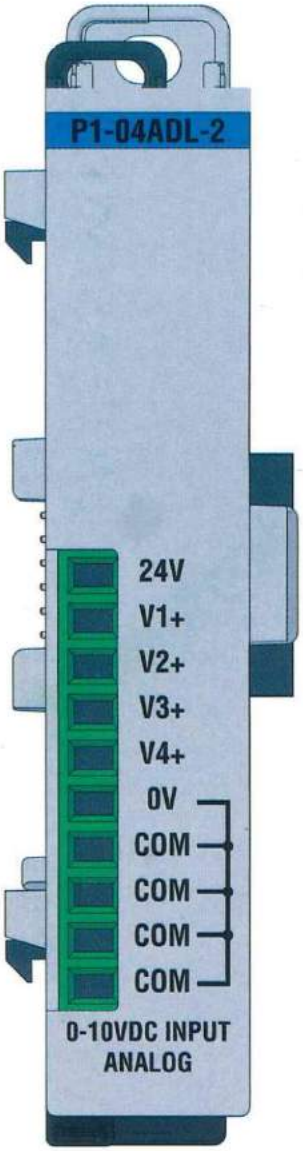
The P1-08TRS high-current isolated relay output module provides eight 3A surge-protected outputs. The P1-08TRS offers both normally open and normally closed relay contacts for use with the Productivity1000 System.

Terminal Block sold separately, (see wiring options on page 3).
Warranty: Thirty-day money-back guarantee. Two-year limited replacement (See www.productivity1000.com for details).

Appendix L: P1-04ADL Product Description

AUTOMATIONDIRECT.com

Productivity1000



P1-04ADL-2 Analog Input

The P1-04ADL-2 Low Resolution Voltage Analog Input Module provides four channels for converting 0–10 VDC analog signals to digital values of 0–8191 (13-bit) for use with the Productivity1000 system.

Terminal Block sold separately, (see wiring options on page 5).

Warranty: Thirty-day money-back guarantee. Two-year limited replacement (See www.productivity1000.com for details).

Appendix M: ADH-010TX/RX-03-1 Analog Fiber Link Information

RLH Industries, Inc.
Fiber Optic Link

4 Channel 0~10VDC Fiber Converter

Home / Products / Fiber Optic Converters / 4 Channel 0~10VDC Fiber Converter

Transmit four 0~10VDC Analog Signals over Fiber with High Speed and Accuracy

Specs

Powering Voltage
Standard Model – 24VDC

Maximum Power Consumption
Transmitter – 8 Watts (Maximum)
Receiver – 10 Watts (Maximum)

Fiber Connectors
ST or SC

Fiber Type
Dual and Single Fiber available
Singlemode up to 120km
Multimode up to 2km, supports 62.5µm and 50µm

System Accuracy
Signal Accuracy: 99.9%
Ambient Temp Effect: Approximately 0.2% over range -40°F to +158°F
Update Rate: 12.8µs (78,000 updates per second)
Signal Resolution: 16 Bits
Sensitivity: 2^16 (65,536) Steps
Range: 0-10VDC
Maximum Signal Output: 10.6VDC

*Additional Input/Output specifications available in data sheet

LED
POWER – DC Power OK
FIBER – Fiber Receiving
Input – Analog Input Status
Output – Analog Output Status

Surge Protection
Varistors & Automatic resettable fuses
DC Input Isolation 1.5kV
Voltage Reversal Protection

Construction
Powder coated steel and aluminum alloy
Physical Dimensions H 4.93" x W 1.20" x D 3.93" (125mm x 31mm x 100mm)

Mounting Style
Standard DIN rail (T-35)
Wall mount (with included ears)

Operating
Temperature -40°F to +158°F (-40°C to +70°C)
Humidity 95%

Appendix N: Bidirectional Fiber Link Information

BIDI 8CH Dry Contact Closure to Fiber optic Extender

Feature

1. Support 8 channel of bidirectional dry contact closure over one singlemode Fiber optic or one multi-mode fiber. Long transmission distance: Singlemode Fiber up to 20km. Multimode Fiber up to 500m.

2. Full digital Uncompressed and Lossless transmission. Special ASIC design and high-speed DSP technology. Industrial grade design, high reliability. LEDs for power supply and optical fiber link, data status indication can monitor the operating status of the system.

3. Advanced adaptive technology, no need to adjust when using. Plug and Play design ensures adjustment-free installation and operation.

4. Typically used in applications with Access Control System, Alarm Event Triggering, Building Automation and Environmental Control Systems, Fire & Alarm Systems, PIR signal Transmission, Traffic Signal Control Equipment, etc

Specification:

Optical interface: SC (FC/ST optional)
Suitable fiber: universal singlemode 1310/1550μm (9/125μm) and mulimode 850μm (50/125μm), 1310μm (62.5/125μm).
Power supply: AC 100V~240V,DC5V2A.
Power adapter: US/EU/UK/AU is optional

Appendix O: AGC302 Vacuum Gauge Controller Connection

InstruTech®

Series 302 Active Vacuum Gauge Controller

- **Vacuum gauge readout and power supply for InstruTech active vacuum gauge modules**
- **Analog output, RS232, USB and RS485 serial communications**
- **Two setpoint relays**
- **Space-saving 1/8-DIN panel mount housing easily adapts to instrument or rack-mount panel installations**

Description

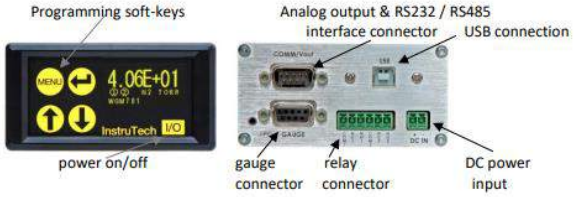
The AGC302 vacuum gauge controller is a power supply and readout instrument offered specifically for the InstruTech active vacuum gauge series WGM701 pirani-cold cathode combination gauge, CCM502 cold cathode gauge, PCM301 pirani-capacitance combination gauge, CDM900 capacitance diaphragm gauge (CDG) and other brands of CDGs. Note that the vacuum gauges listed above do not necessarily require the AGC302 to operate. These gauges provide analog output signals that can be directly interfaced with user's control system. As such, AGC302 is recommended only when a bench top, panel or rack mount display installation is required.

Furthermore, the AGC302 controller can be used to provide two setpoint relays as well as serial communications for these types of devices. If needed, AGC302 can also be used with other InstruTech active gauges such as the CVM201, CVM211 convection or CCM501, IGM401, IGM402 ionization gauges although these gauges are provided with their own integrated displays. The controller is powered by user supplied 20 to 28 Vdc, or by InstruTech PS301 optional power supply. The controller provides power to the InstruTech active gauges operating on 24 Vdc including the CDM900 CDG, however other brands of CDGs operating on ±15 Vdc power require an external power supply provided by the user.

Specifications

measurement range	dependent on active vacuum gauge device connected (see vacuum gauge data sheets)
display	bright OLED, 3 digit plus 2 digit exponent, user-selectable Torr, mbar or Pa
display update rate	0.5 sec
weight	9 oz. (250 g)
temperature	operating: 0 to +40 °C storage: -40 to +70 °C
humidity	0 to 95% relative humidity, non-condensing
input signal	analog input from one of the following active vacuum gauge devices: full range cold cathode-pirani combination gauge: WGM701 cold cathode gauge: CCM502 pirani-capacitance combination gauge: PCM301 capacitance diaphragm gauge: CDM900 or other brands of CDGs
analog output	retransmit analog input from the active vacuum gauge device connected
serial communications	RS232 and RS485 - ASCII protocol
housing	1/8-DIN panel-mount enclosure (aluminum extrusion)
input power	20-28 Vdc, 2 W plus the wattage required for the active vacuum gauge connected protected against power reversal and transient over-voltages
setpoint relays	two single-pole double-throw relays (SPDT) / 5 A at 30 Vdc, 5 A at 250 Vac, resistive load
connectors	gauge: 9-pin D-sub female (mating connector provided as part of the gauge cable) analog output: 9-pin D-sub male RS232 serial communications: 9-pin D-sub male or USB RS485 serial communications: 9-pin D-sub male relay outputs: 6-pin pluggable terminal block (mating connector included) power: 2-pin pluggable terminal block (mating connector included)

Controls & Connections



Appendix P: Titanium Sublimation Pump Connection

Remote I/O Connection (P5 connector)

An external analogue unit can be connected to the I/O connector to set some sublimation parameters and receive feedback from the field.

It is a 9-pins Male D type connector. The pin layout is shown in the following figure.

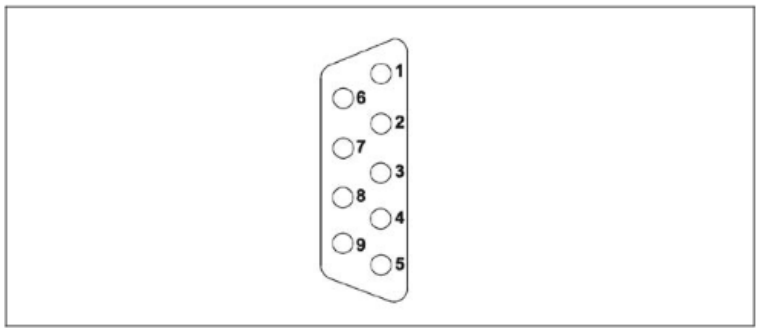


Figure 7 I/ O connector layout

The correspondence between pin and signal is:

Pin 1 Input signal. Voltage range 0 to 10 Vdc. Used for setting sublimation current value between 30 A (corresponding to 6 Vdc) and 50 A (corresponding to 10 Vdc).

Pin 2 Input signal. Voltage range 0 to 5 Vdc. Used for setting pressure threshold value: minimum value $1*10^{-10}$ mbar (corresponding to 0 Vdc), maximum value $1*10^{-4}$ mbar (corresponding to 5 Vdc).

Pin 3 Interlock. This pin must be shorted to one of the common pins (number 4 or 6 to 9) (the jumper is furnished with the controller).

Pin 4 Not Connected

Pin 5 Output signal. Voltage range 0 to 10 Vdc. Used to feedback the sublimation current value applied during sublimation (0 Vdc = 0 A, 10 Vdc = 50 A).

Pin 6 to 9. Common.

Appendix Q: Smoke Detector Information

INSTALLATION AND MAINTENANCE INSTRUCTIONS

i3 Series Photoelectric Smoke Detector

SYSTEM SENSOR
3825 Ohio Avenue, St. Charles, Illinois 60174
800/736-7672, FAX: 630/377-6495
www.systemsensor.com

Models: 2W-B, 2WT-B, 4W-B, 4WT-B

ELECTRICAL SPECIFICATIONS	2-WIRE	4-WIRE
System Voltage –Nominal:	12/24	12/24 VDC Non-polarized
Min.:	8.5	8.5 VDC
Max.:	35	35 VDC
Max. Supply Ripple Voltage:	30	30 % peak to peak of applied voltage
Avg. Standby Current:	50	50 µA average
Peak Standby Current:	100	— µA
Max. Alarm Current:	130	20 mA 12 Volt Systems
(For 2W-B and 2WT-B, panel must limit current)	130	23 mA 24 Volt Systems
Min. Alarm Current	10mA	—
Alarm Contact Ratings:	—	0.5 Amp @ 30 V AC/DC
Alarm Reset Time:	0.3	0.3 sec
Max. Start-up Capacitance:	0.1	— µF
Latching Alarm: Reset by momentary power interruption		
Maximum Initial Start-up Time:	45	15 sec
Alarm Verification Start-up Time*:	15	15 sec

*Assumes the panel's alarm verification reset time is 10 seconds or less. Should the alarm verification reset exceed 10 seconds, use the maximum initial start-up time.