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Productivity3000®

Hardware User Manual

P3-USER-M



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Issue	**Date**	**Description of Changes**
1st Edition	9/09	Original
2nd Edition	10/10	Updated Communications and Getting Started chapters. Relocated Analog I/O Specifications after Discrete I/O Specifications. Updated error codes found in Appendix B. Made minor corrections throughout manual.
3rd Edition	03/12	Changed GS-EDRV product information to the GS-EDRV100. Added new P3-HSO, P3-HSI and P3-16TD3P module information. Made minor corrections throughout manual.
4th Edition	11/12	Added P3-530 and P3-RX configuration information. Made minor corrections throughout manual.
4th Edition Rev. A	12/13	P3000 expansion limitations updated. Made minor corrections throughout manual.
4th Edition Rev. B	07/14	Added P3-SCM Communications Module Information Added EtherNet/IP information to Chapter 6. Made minor corrections throughout manual.
4th Edition Rev. C	04/18	Added P3-550E CPU Module Information. Made general updates and corrections throughout manual.
4th Edition Rev. D	08/18	Removed all references to DA-EU-M manual. Removed OS and Hardware requirements section from Appendix A.
4th Edition Rev. E	10/18	Added ProNet and CPoE to Chapter 6
4th Edition Rev. F	2/19	Revised link: www.productivitypac.com to www.automationdirect.com/productivity/p3000 in all instances.
4th Edition Rev. G	5/19	Added note to P3-550 and P3-550E CPUs for available LCD replacement part – P/N P3-LCD. Replaced ZIPLink modules ZL-LTB16-24 and ZL-LTB32-24 with ZL-LTB16-24-1 and ZL-LTB32-24-1 respectively.
4th Edition Rev. H	8/19	Updated trademark logo throughout manual. Corrected graphics, page 6-37.
4th Edition Rev. I	02/20	Added Appendix C for network security.
4th Edition Rev. J	04/20	Updated formatting.
4th Edition Rev. K	06/20	Updated P3-HSI description. Obsoleted P3-RS.

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4th Edition Rev. P	11/22	P3-16TDS obsoleted. Updated manual formating.
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4th Edition Rev. R	06/23	Obsoleted P3-550 CPU.
4th Edition Rev. S	09/23	Obsoleted P3-06DAS-1 module, updated P3-16AD-1 specs (A/ct).
4th Edition Rev. T	03/24	Obsoleted P3-06DAS-2 module
4th Edition Rev. U	10/24	Updated P3-HSO SureServo2 connection diagram
4th Edition Rev. V	10/30/24	Updated P3-16NA module display, added hyperlinks to footers.
4th Edition Rev. W	06/25	Added P3-622 CPU module data.
4th Edition Rev. X	11/25	Updated UL cert for P3-HSO, P3-HSI, and P3-PCM modules.

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GETTING STARTED!



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Introduction

Purpose of this Manual

Thank you for purchasing the AutomationDirect Productivity3000® family of system control products. This hardware user manual provides information that will help you install, set up, program, troubleshoot, and maintain your Productivity3000 system. The manual includes information that is critical to the safety of the personnel who will install and use the controller and for safe operation of the machinery, processes, and equipment controlled by the Productivity3000 system.

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

About Getting Started

If you are familiar with Programmable Controllers in general, then following the simple steps in this first chapter may be all you require to start being productive using a Productivity3000 CPU system. After you have completed the steps, your Productivity3000 controller will be running the ladder logic project that you programmed.

Online Help Files and Other Documentation

The Productivity3000 programming software, Productivity Suite, is available as a download from our website.

See http://www.aboutplcs.com/

The Productivity Suite software includes searchable online help topics covering all aspects of the software, instruction set, module setup, and communications.

In addition an informative installation insert is included with each base, power supply, CPU, and I/O module packaging.

Technical Support

We strive to make our manuals the best in the industry. We rely on your feedback to let us know if we are reaching our goal. If you cannot find the solution to your particular application, or, if for any reason you need technical assistance, please call us at:

770–844–4200

Our technical support group will work with you to answer your questions. They are available Monday through Friday from 9:00 A.M. to 6:00 P.M. Eastern Time. We also encourage you to visit our web site where you can find technical and non-technical information about our products and our company.

http://www.automationdirect.com

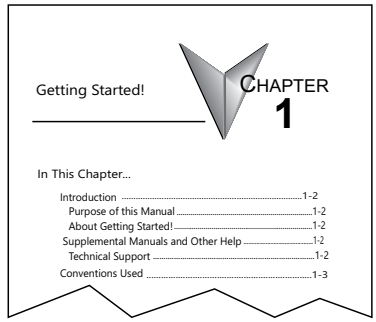
Conventions Used

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.


Getting Started!

CHAPTER 1

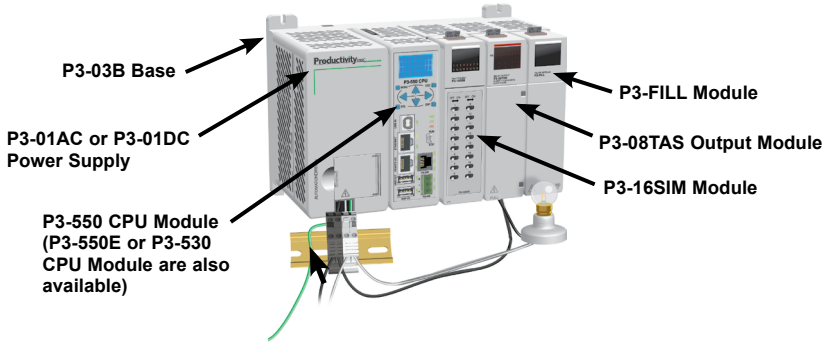
In This Chapter...

Introduction 1-2
Purpose of this Manual 1-2
About Getting Started! 1-2
Supplemental Manuals and Other Help 1-2
Technical Support 1-2
Conventions Used 1-3

Before you begin...

It is recommended that the following items be available to make this short step-by-step introduction to the Productivity3000® CPU go smoothly.

Example Productivity3000 System



PC Running Windows OS



Not available from Automationdirect.com.

Productivity Suite Programming Software PS-PGMSW



Download software from our webste at: www.productivityCPU.com

USB-A to USB-B Programming Cable (P3-550 only)



If using the P3-530(E) CPU, then use an Ethernet cable for programming. Refer to the help file for information on Ethernet communication set up procedures

Screwdriver TW-SD-VSL-1



Wire Strippers DN-WS



Hookup Wire



AC Power Cord



Not available from Automationdirect.com.

Productivity Suite System Requirements



Productivity Suite, a Windows-based programming software, is available as a FREE download at http://www.automationdirect.com/support/software-downloads?itemcode=Productivity%20Suite > Please check our website for current operating systems requirements.

NOTE: *USB or Ethernet cable is also required for communications between PC and CPU.*

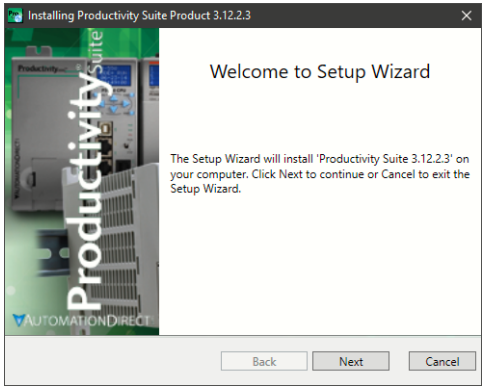
Step 1: Install Programming Software



1. Download the latest version of the Productivity Suite Programming Software from the Automationdirect website, or insert the Productivity Suite Programming Software USB thumb drive into your PC USB port.
2. By default Productivity Suite will be saved in the "Download" folder as a ".zip" file.
   - Right Click on the ProSuite_xxx.zip file in the Download folder.
   - Choose "Extract All" from the drop-down menu. A popup box will open.
   - Select the "Browse" button and navigate to the folder where you prefer to store the program, or accept the default location.
   - Click on "Select Folder" button and in the next box choose "Extract".

NOTE: *See the Productivity Suite Installation and Productivity Suite Startup topics for additional details if needed.*

3. Navigate to the choosen folder and double click on the ProSuite ".exe" file.
4. The "Setup Wizard" window (shown below) will appear. Select Next.



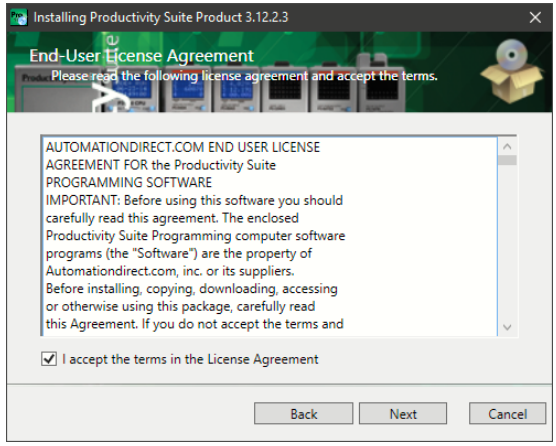
5. Carefully read the software license agreement. If you agree to the terms and conditions of this agreement, select the "I accept the terms of the License Agreement" and then the "Next" button.

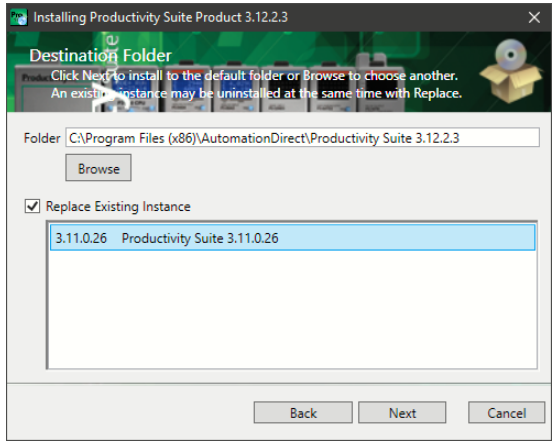
6. The "Destination Folder" window will open next. The default loaction will appear in the text box: C:\Program Files\AutomationDirect\Productivity Suite <Software Version>. Should you desire a different folder choose:

   a. Browse: This option allows you to select another folder for installation.

If the installer detects a previous version of Productivity Suite on your PC, there is another option available with this window:

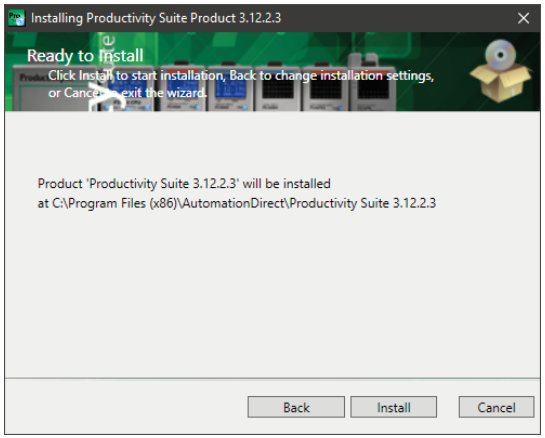
   b. Replace Existing Instance: This option allows you to uninstall the previous version of the software and install the new version in its place. If you check this option, select the version in the window that you want to delete. Click "Next" to continue.

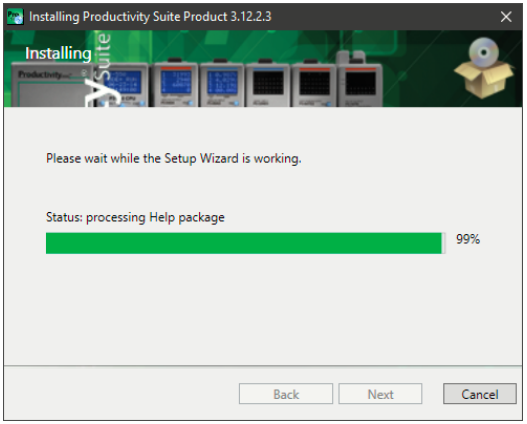




7. Once you have selected the install folder or after deleting any previous instances, click "Install" to begin the installation.

A status window will appear displaying the status of the installation.



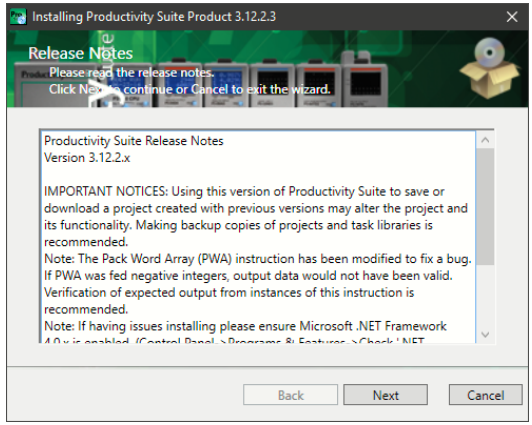


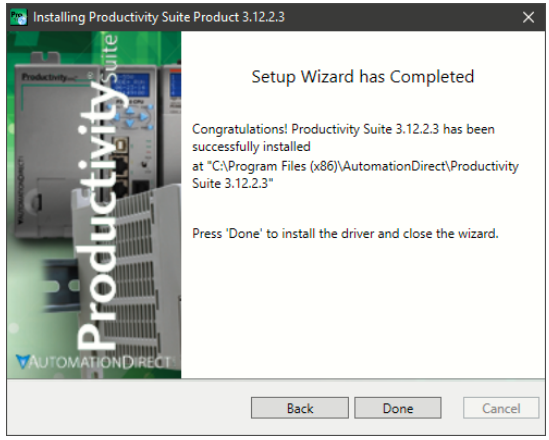
A shortcut icon will automatically be placed on the Desktop during installation.



8. The next screen to appear contains the Release Notes for this version of the Productivity Suite software. This is an opportunity to review the software version release notes. You may read these before selecting the "Next" button.

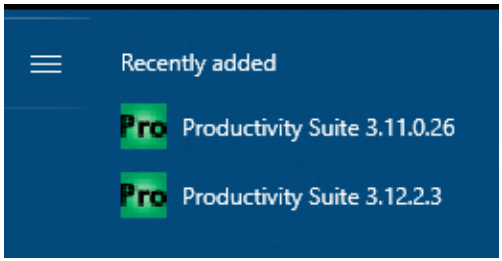
9. The Installation is now complete. Select "Done".





Step 2: Launch Programming Software

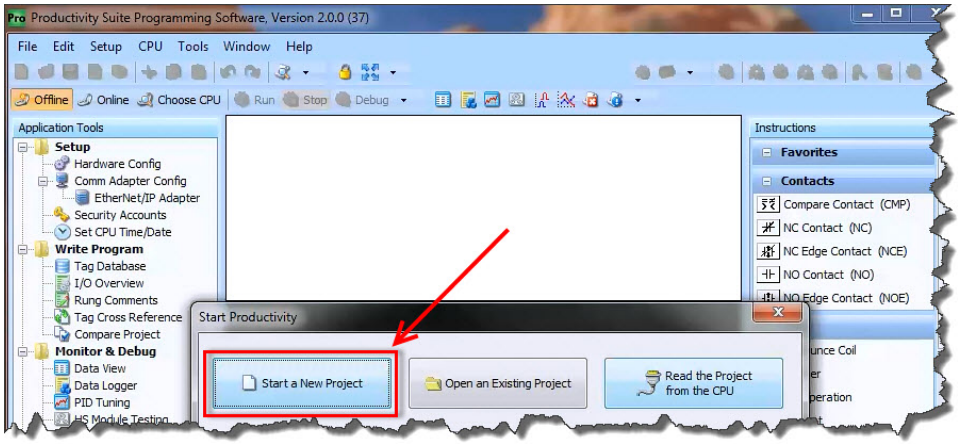
After installing the Productivity Suite Programming Software, PS-PGMSW, launch the software by double clicking the desktop Productivity Suite Icon. Or from the PC's 'Start' menu, select Productivity Suite x.x.x.x.



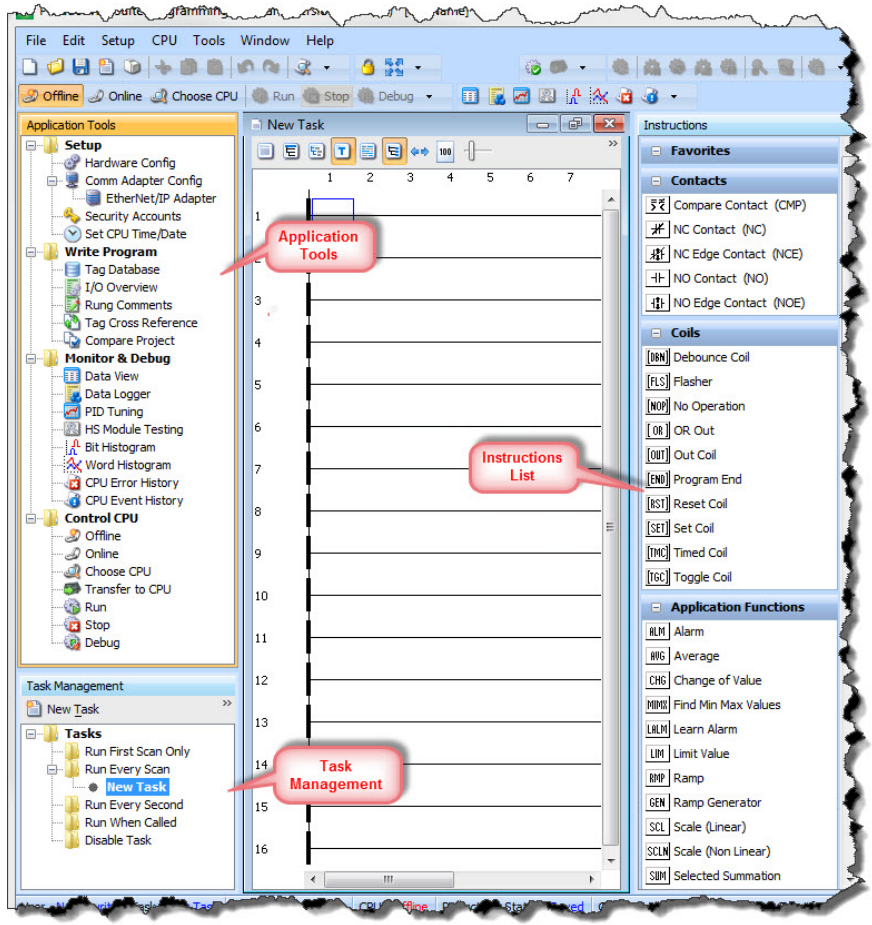
The Productivity Suite Programming Software will start up and display the Main Window as shown below.

NOTE: *The recommended minimum screen size for the Productivity Suite Software is 1920 X 1080 pixels.*

Click on the 'Start a New Project' in the Start Productivity dialog box to open a programming window.



The Programming Window is divided into menus and toolbars that work together to make project development as simple as possible.



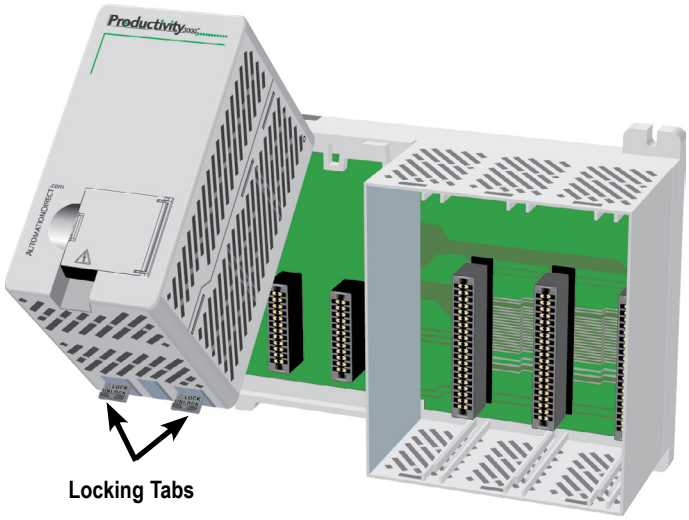
Online Help

It is essential that you use the Productivity Suite online Help to familiarize yourself with the software. Keep it open on your desktop and refer to it frequently as you build your system. Click on the toolbar Help button to open the Help file.

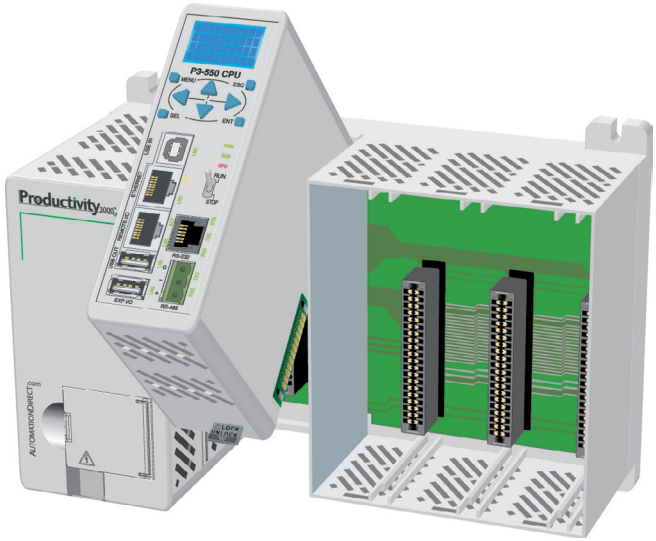
Step 3: Install Hardware

The Productivity3000® CPU system components snap together to form a configured CPU in minutes. See Chapter 5, Installation and Wiring, for more detailed hardware installation information, but these are the basic steps:

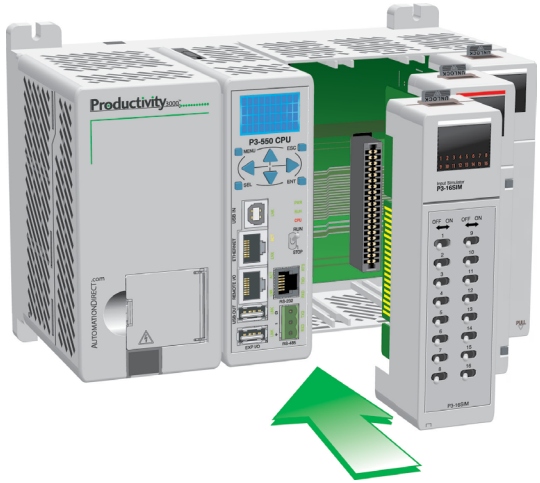
1. Install power supply in the base and engage locking tabs.



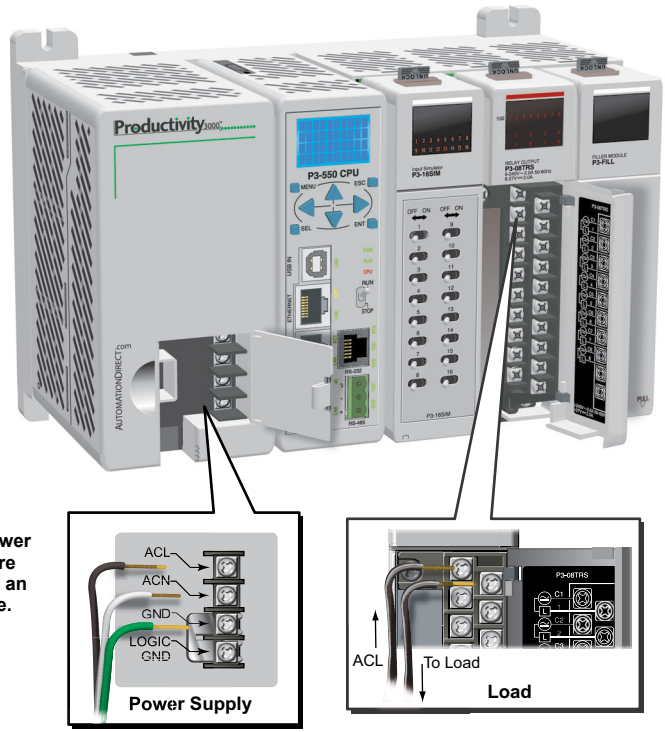
2. Install CPU in the base and engage locking tab.



3. Install I/O Modules and engage locking tabs.



4. Connect appropriate wiring to power supply and I/O, a P3-01AC and P3-08TAS in this example.



In this case, The power supply and load are being connected to an AC current source.

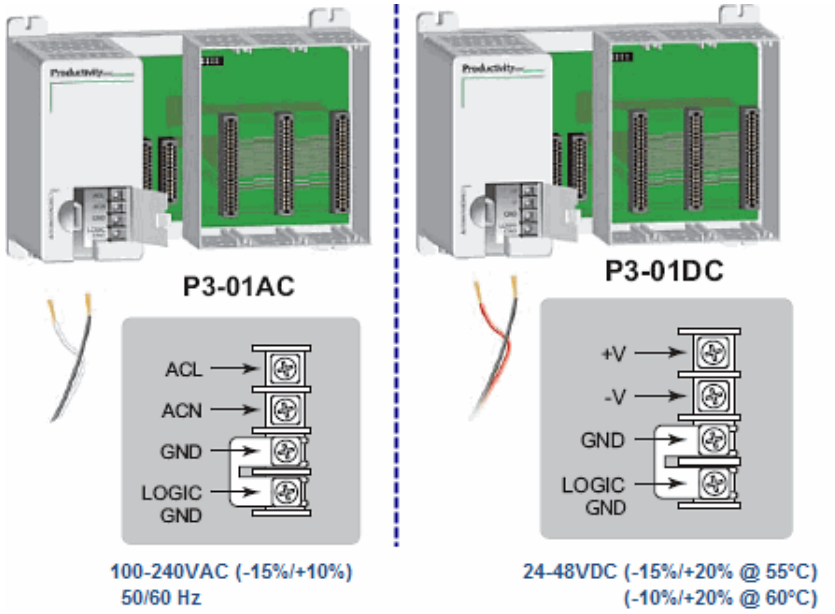
5. Connect USB cable (P3-550 only). Use a standard USB cable with Type A and Type B connectors as shown below.

   If using the P3-622, P3-550E, or P3-530, connect a standard Ethernet cable from the PC to the CPU.



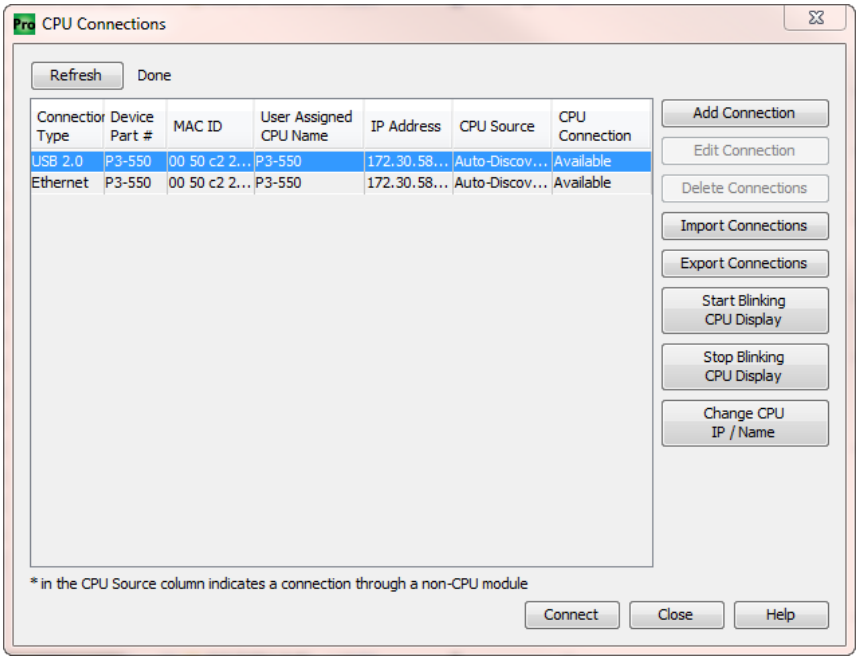
Step 4: Apply Power to CPU.

Ensure proper wiring has been made to the CPU and the correct voltage is available before applying power to the CPU. Once this is verified, apply power to the CPU. The CPU will perform a self evaluation and verification when power is applied. See Chapters 2 and 5 of this manual for more power supply and input wiring information.



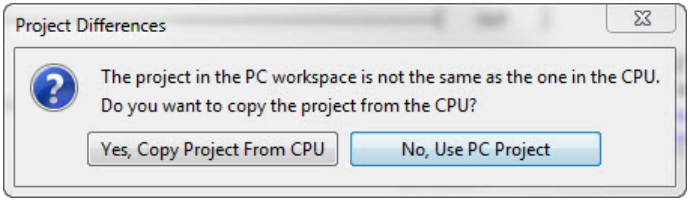
Step 5: Establish PC to CPU Communications

Select the Choose CPU Icon on the Control CPU Toolbar and the dialog shown below will appear.



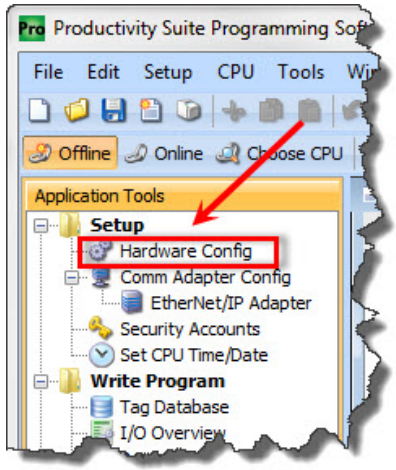
Highlight the CPU listed in the dialog box and select “Connect”.

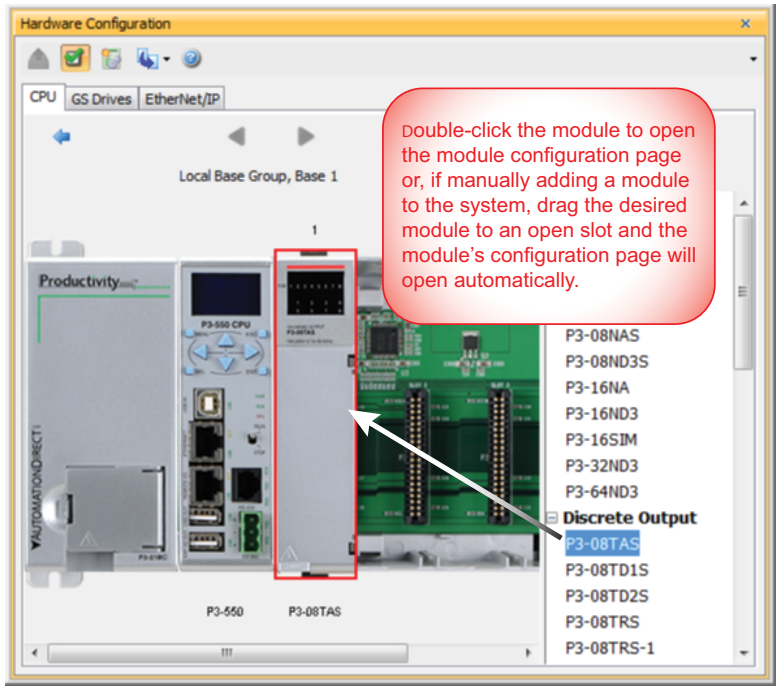
When initially going Online with the CPU, a popup window will notify you of a project difference between the CPU and the PC. Select “No, Use PC Project”.



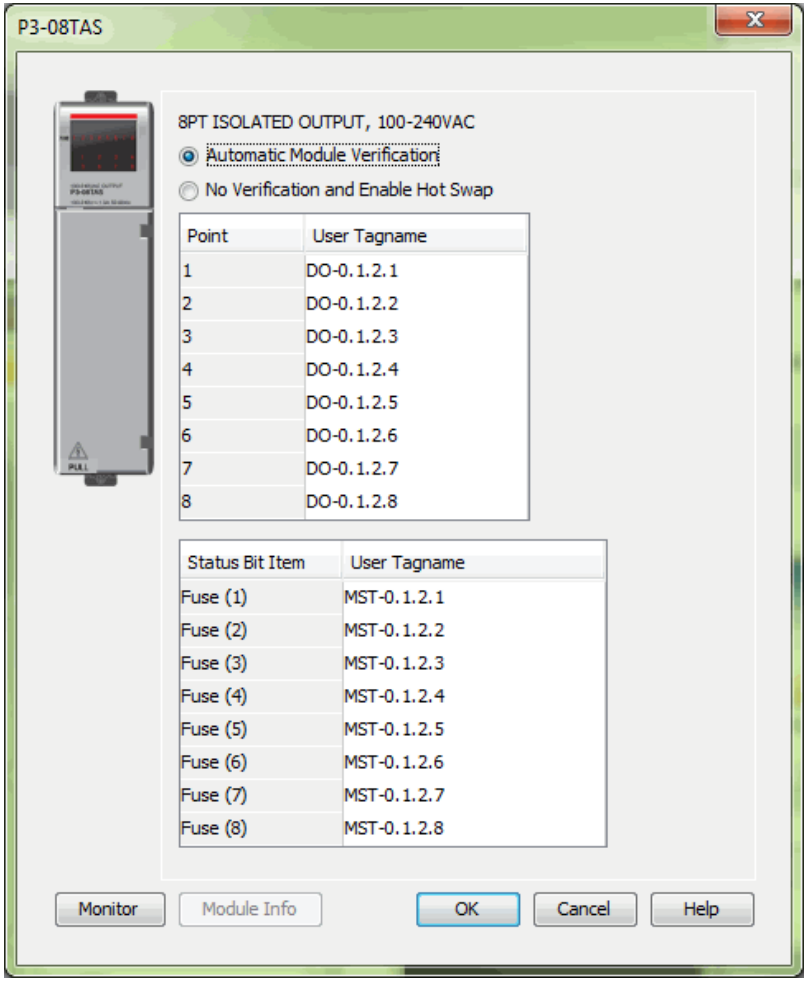
Step 6: Open/Read Hardware Configuration

Before we create a project we must configure the hardware so we'll have the input and output tags. With the CPU in STOP Mode, select Hardware Configuration under Application Tools and the following screen opens.





This screen shows the user tag names for all eight I/O points. Select OK.



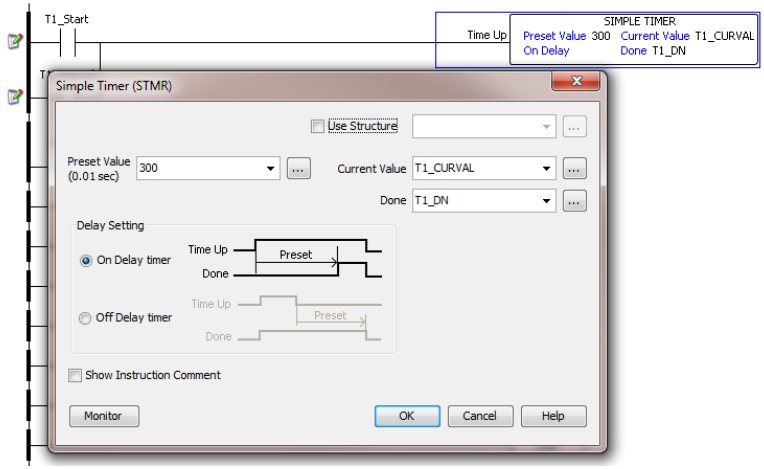
Step 7: Create a Project

We're going to start entering a simple example ladder logic program in the order that follows.

Rung #1

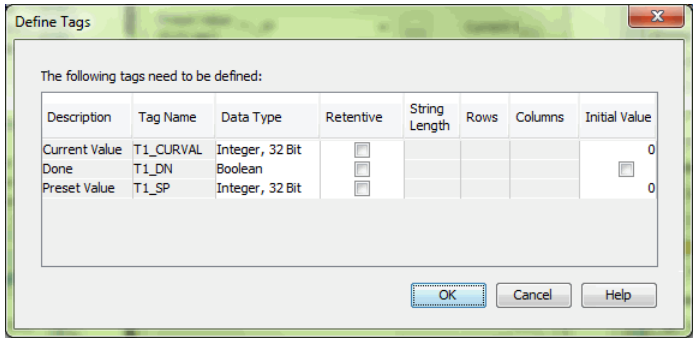
Place the box cursor on the END position on Rung #1 as shown below. From the Instructions List, scroll down to Counters/Timers and click & drag a Simple Timer (STMR) into the box. A Simple Timer (STMR) dialog box pops up.

1. Click on text box at Preset Value. Enter '300' (0.01 sec timebase) for a 3 second preset (T1_SP).
2. Enter 'T1_CURVAL' into the Current Value test box.



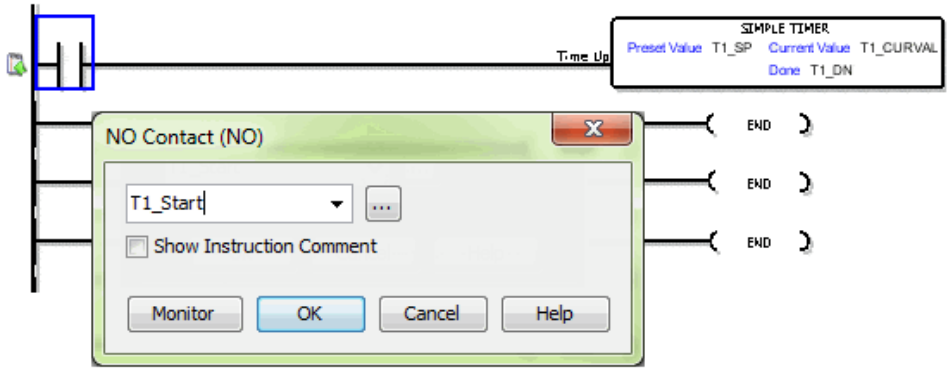
3. Enter 'T1_DN' into the Done text box.
4. Select OK.

   The Define Tags dialog box opens. Select OK.

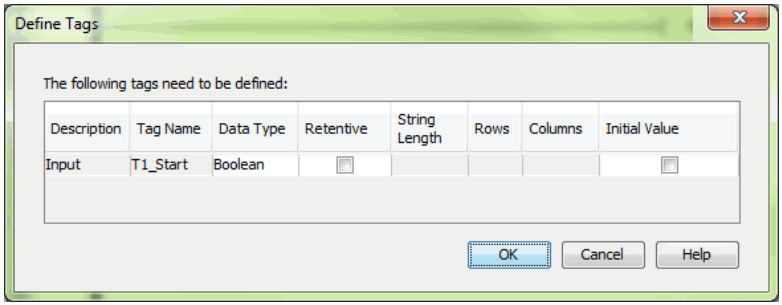


Place the Box Cursor on the first position on Rung #1 as shown below. From the Instruction List, scroll to Contact and click & drag a Contact (NO) into the box. A NO Contact (NO) dialog box pops up.

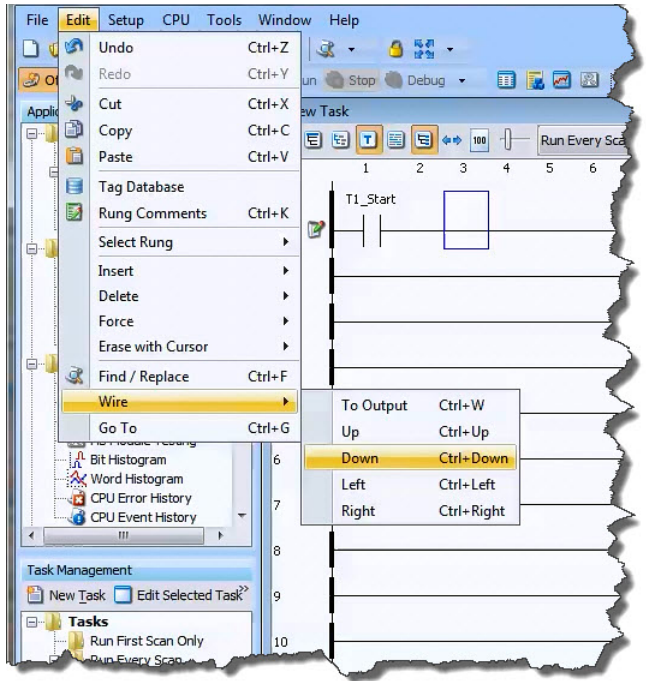
1. Enter 'T1_Start' into the text box.
2. Select OK.

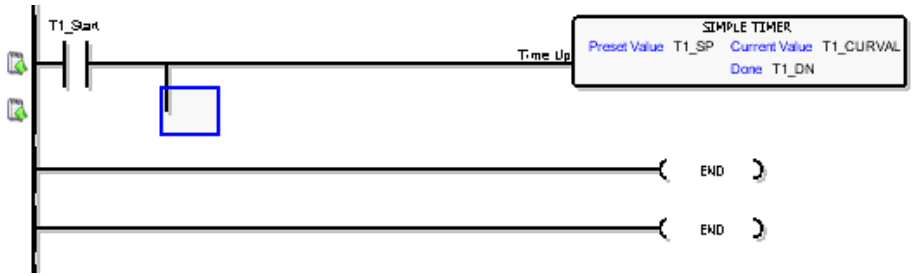


The Define Tags dialog box opens. Select OK.



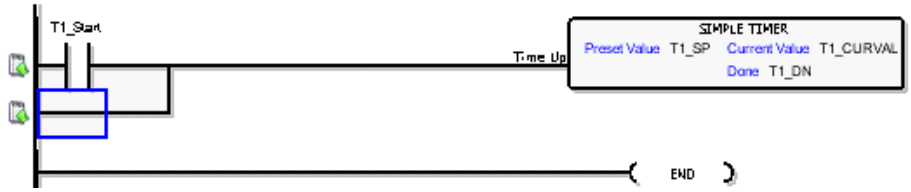
With the cursor in the position to the right of contact 'T1_Start', we are going to begin drawing a branch circuit. Under the Edit drop down menu, select Wire, then select Down. Notice that a wire has been added.





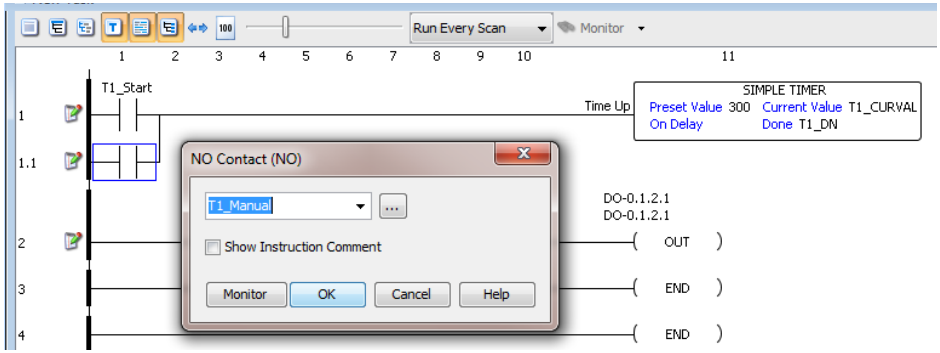
NOTE: *There is a wire Erase With Cursor tool in the Edit drop down menu that is used to erase any lines that were created using the Wire tools.*

Next we'll draw a wire to the left. Under the Edit drop down menu, select Wire, then select Left.

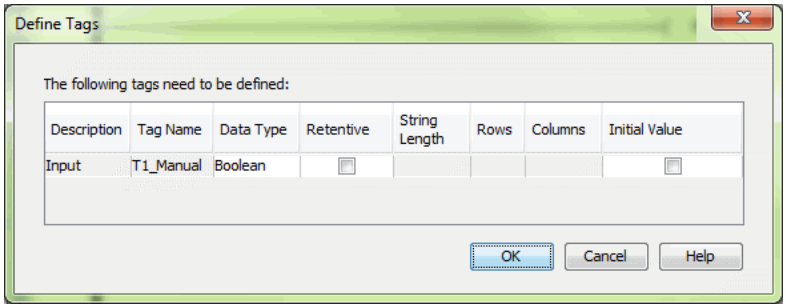


Next we'll add another normally-open contact. Place the box cursor on the first position on Rung #1.1. From the Instruction List click & drag a Contact (NO) into this box. A NO Contact (NO) dialog box pops up.

1. Enter 'T1_Manual' into the text box.
2. Select OK.



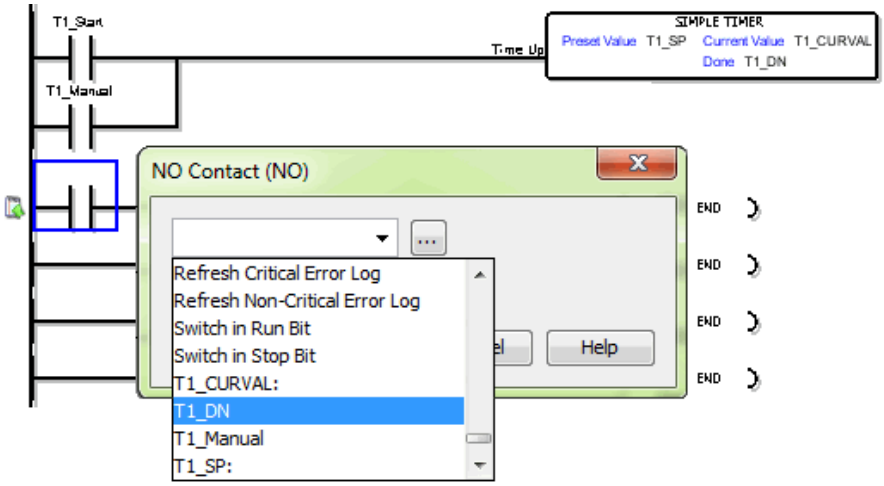
The Define Tags dialog box opens. Select OK.



Rung #2

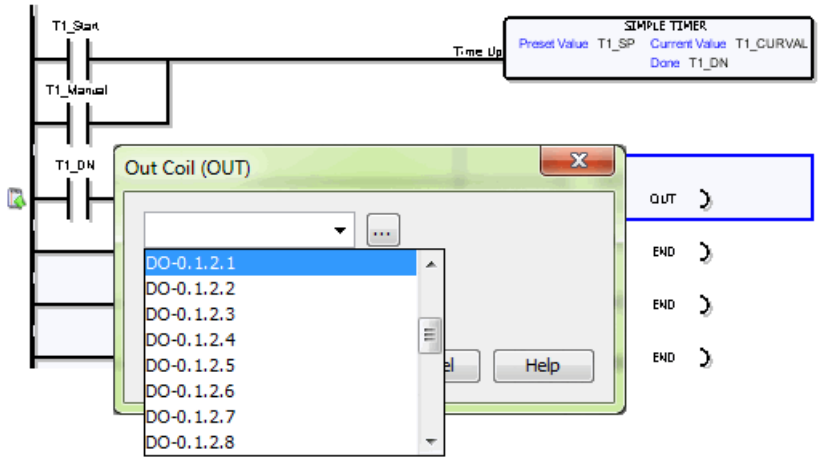
Next we'll add another normally-open contact at the start of rung 2. Click & drag a Contact (NO) into this box. A NO Contact (NO) dialog box pops up.

1. In the text box scroll down and select 'T1_DN'.
2. Select OK.

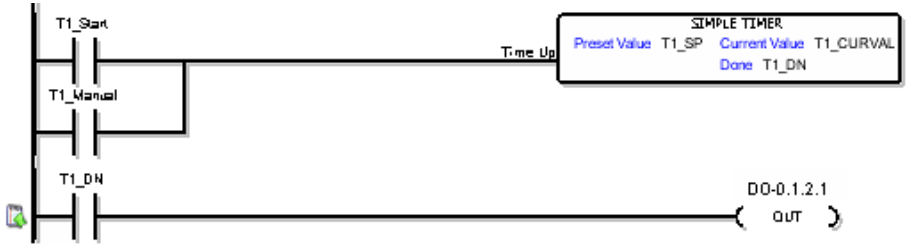


Next we'll add an Out coil at the end of the rung. Place the cursor at the end of the rung and from the Instructions list drag & drop an Out Coil (OUT). An Out Coil (OUT) dialog box pops up.

1. In the text box scroll down and select 'DO-0.1.2.1'.
2. Select OK.

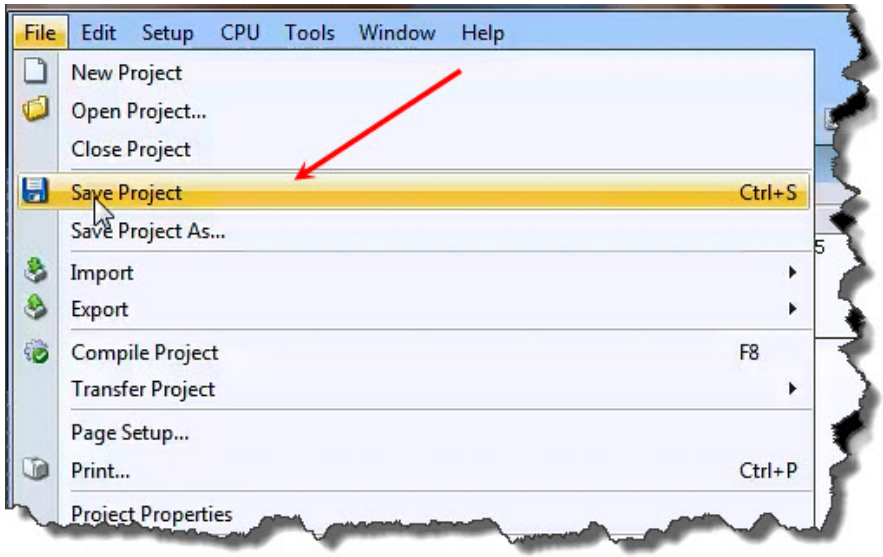


The ladder program now looks like this. When either of the T1 contacts are energized, the timer starts. When it times out, contact T1_DN energizes and turns on the rung 2 output.



Step 8: Save Project

Save the project by opening the File drop down menu and selecting Save Project.

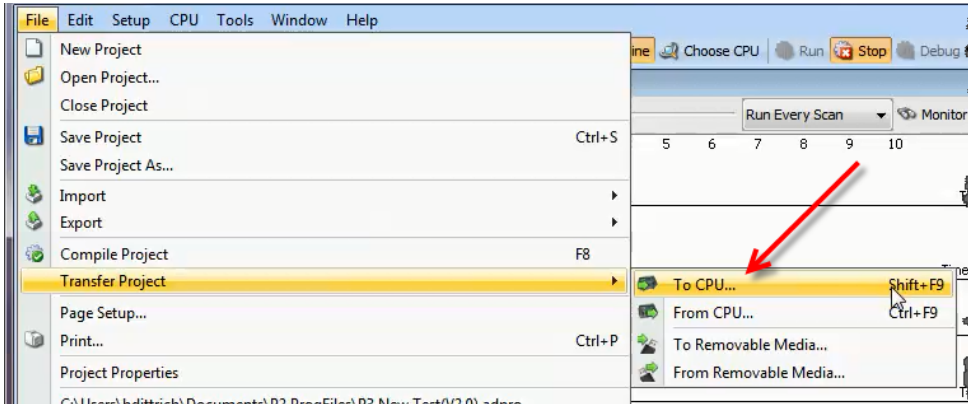


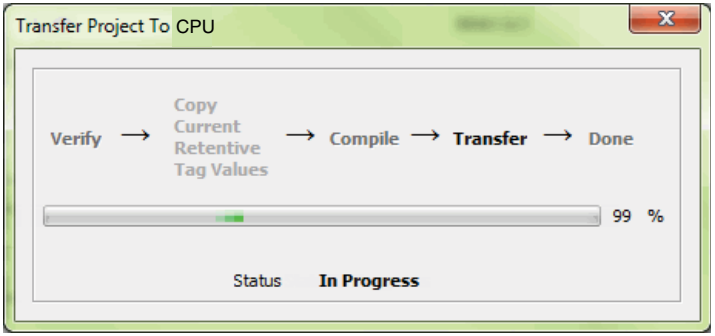
Step 9: Write Project to CPU

Next we will transfer the project to the CPU. Transfer Project is accessed by selecting Transfer Project from the File Menu of the Main Menu.

Select "To CPU" from the Transfer Project menu.

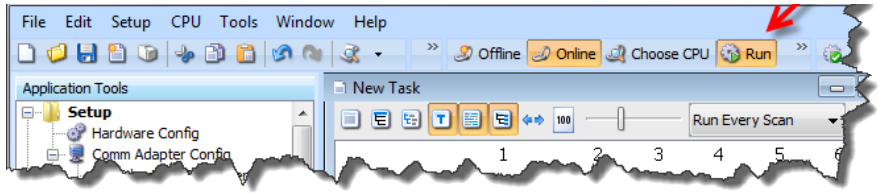
The project will then be Transferred to the CPU from the PC. During the transfer a status window will open displaying the process.



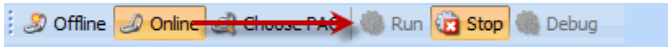


Step 10: Place CPU in RUN Mode

Next, verify the Run/Stop switch on the CPU is placed to the Run position and then place the CPU in RUN mode on the Control CPU Toolbar so the ladder logic program executes.

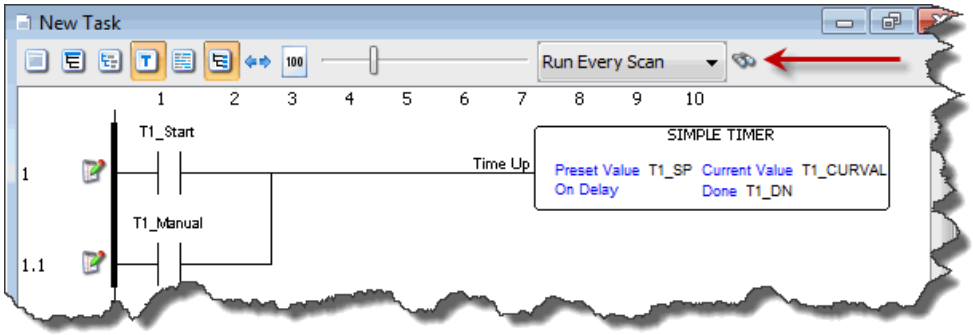


NOTE: *If the Run/Stop switch on the CPU is in the Stop position, the Run button on the Control CPU Toolbar will be disabled. j*



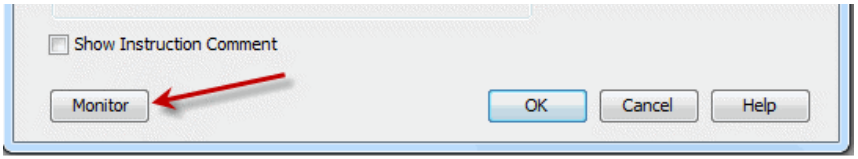
Step 11: Test the Project Using Monitor Mode

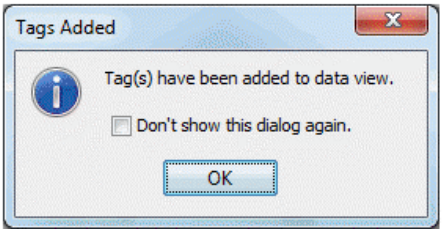
In this next step, use the Monitor Mode and Data View to test the ladder logic program. Select Monitor Mode from the top of the Ladder Logic screen to display the status of Boolean and Integer Tags.



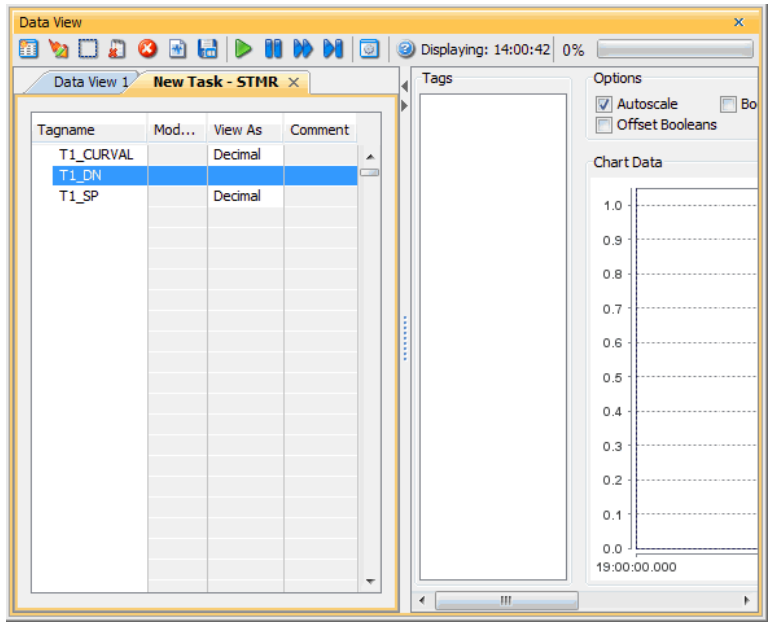
Using Data View, the Tag values can be viewed or manipulated for testing the project. The Data View window can be accessed by selecting Data View from the Tools Menu of the Main Menu.

For the Simple Timer Instruction, a Monitor button is provided that, when selected, will load the tags associated with the instruction into Data View.

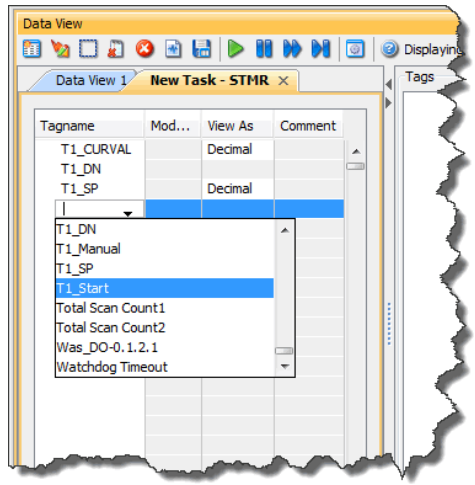




The tags will be placed in a separate Tab titled New Task - STMR as seen below.

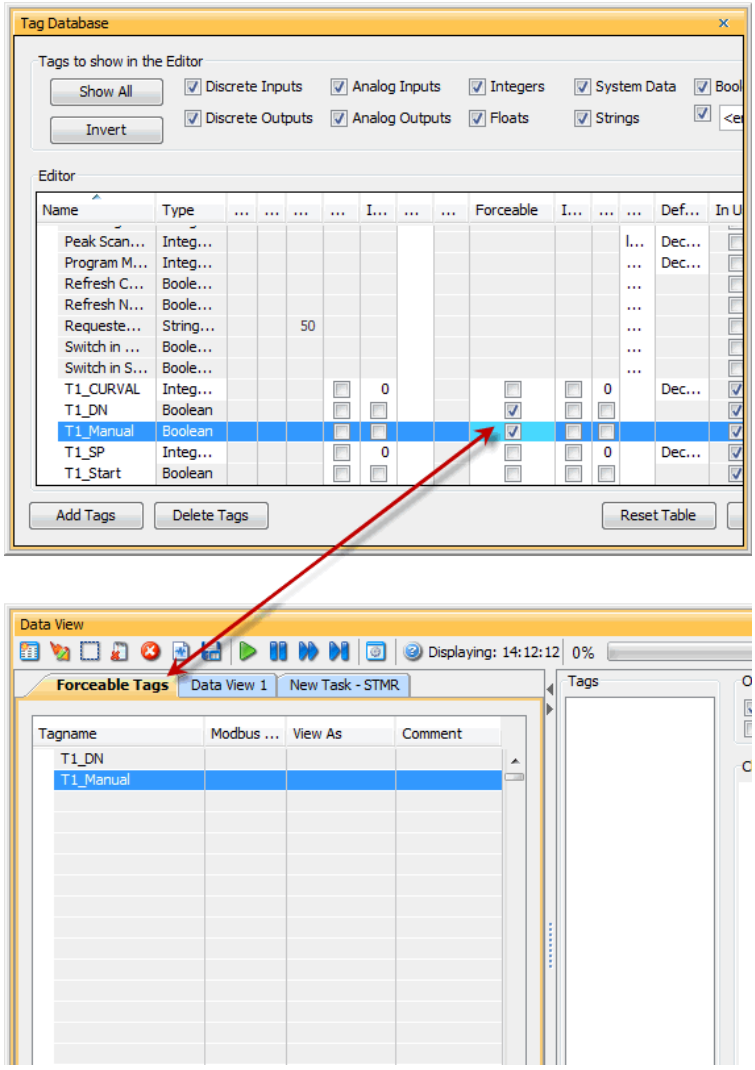


The remaining tagnames in the Ladder Logic can be added to the Data View window by clicking on a blank area in the Tagname column. This will display a drop down menu where the tags can be selected. Scroll down the list and select the tags to be added.



Once all of the tagnames have been added, they may now be monitored and manipulated. See the Data View help file topic for additional details if needed.

NOTE: *Force must be enabled for a Tag in the Tag Database, before Force can be used in Data View.*



SPECIFICATIONS



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NOTE: P3-550 discontinued as of 06/2023. Please consider P3-550E as a replacement.

NOTE: P3-16TD3P discontinued as of 10/2022. Please consider P3-16TD1 or P3-16TD2 as a replacement.

NOTE: The P3-RS module has been discontinued as of 6/20. Use P3-RX or a P1-RX system as a replacement.

Overview

CPU System

The Productivity3000® system. is a modular system that requires a base to accommodate the various modules. Bases are available in sizes of 3, 5, 8 and 11 I/O module slots. It contains additional dedicated slots for the power supply and the CPU unit. You can place any I/O module into any slot without power budget or module type restrictions.

The backplane incorporates a discrete and analog I/O processor which unloads the I/O module communication task from the CPU. This distributed processing architecture results in outstanding performance at a very low cost. The backplane includes a USB 2.0 high-speed (480 Mbps) communication path directly from the CPU to specialty modules and to the discrete and analog module backplane processor.

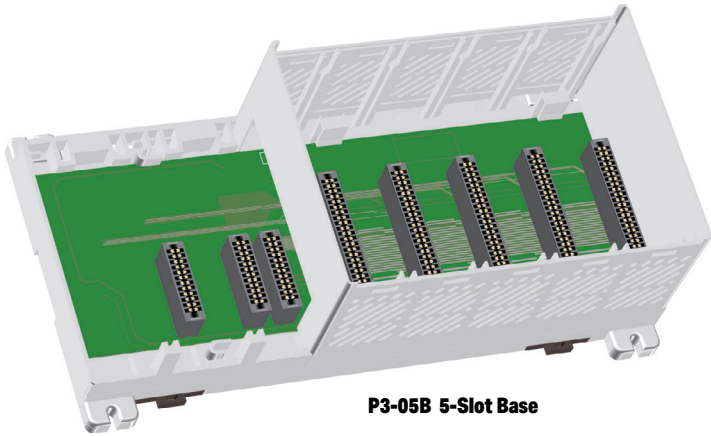
Up to 4 local expansion bases can be "daisy chained" from the CPU base using a P3-EX expansion module and the (included) expansion cable. Expansion bases can be any size, and in any order, for a maximum number of 55 slots of local I/O when using 11 slot bases.

The base supports hot swapping and has electronic module keying for each slot.



P3-03B, P3-05B, P3-08B, P3-11B Bases

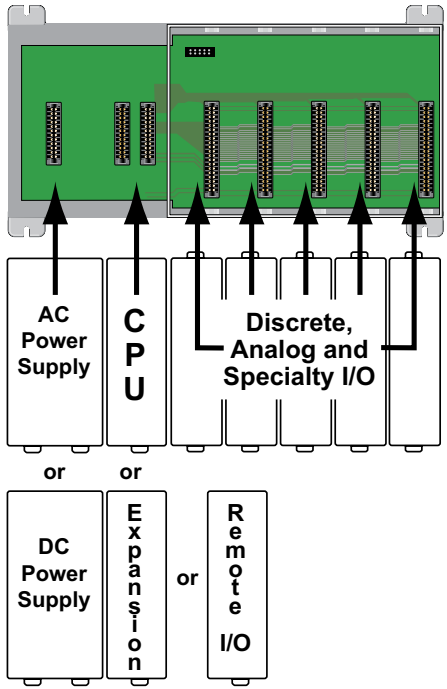
The P3-03B, P3-05B, P3-08B, and P3-11B are 3, 5, 8, and 11-slot, local, expansion, and remote I/O bases.

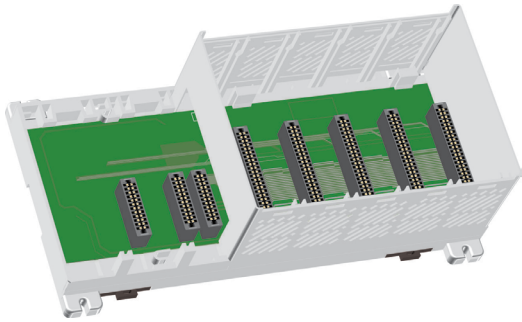


P3-05B 5-Slot Base

NOTE: *See Chapter 5 for base dimensions.*

Base Configuration





Base Specifications	
Input or Output Modules per Base	3, 5, 8, or 11
Power Supply Slots	1 (P3-01AC or P3-01DC)
CPU Slots	1 (P3-622, P3-550(E)/530, P3-RS/RX and P3-EX compatible)
Module Types Supported	Discrete, analog and specialty
Module Placement Restrictions	None. Any I/O module may be installed in any I/O slot without power supply budget or module type restrictions.
I/O Module Hot Swap Support	Yes. (All discrete and analog modules can be software enabled for Hot Swap operation)
Module Keying	Electronic to slot
Maximum Number of Local Bases	5

General Specifications	
Operating Temperature	0°C– 60°C (32°F–140°F)
Storage Temperature	-20ºC–70ºC (-4ºF–158ºF)
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	2.5 W
Weight	P3-03B: 1.365 lbs (21.8 oz.), 619g P3-05B: 1.658 lbs (26.5 oz.), 752g P3-08B: 2.158 lbs (34.5 oz.), 978g P3-011B: 2.682 lbs (42.9 oz.), 1216g
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.

**Meets EMC and Safety requirements. See the Declaration of Conformity for details.*

P3-01AC and P3-01DC Power Supplies

There are two power supplies available; both provide isolated 24VDC, 5VDC, and 3.3 VDC to the Productivity®3000 bases.

The P3-01AC input power supply requires power from an external 100-240 VAC source.

The P3-01DC input power supply requires power from an external 24-48 VDC source.

No Power Budgeting

No power budgeting is required with either power supply. Any combination of I/O modules may be installed in any slots without power budget considerations.



P3-01AC



P3-01DC

Terminal Block Specifications (both models)	
Number of Positions	4 screw terminals
Pitch	0.3 inch (7.62 mm)
Wire Range	22–14 AWG (0.324 to 2.08 sq. mm) solid conductor 22–14 AWG (0.324 to 2.08 sq. mm) stranded conductor 3/64 inch (1.2 mm) insulation maximum
Screw Driver Width	1/4 inch (6.5 mm) maximum
Screw Size	M3 size
Screw Torque	7–9 inch-pounds (0.882–1.02 N·m)

P3-01AC Specifications



P3-01AC

IMPORTANT!

Hot-Swapping Information

Note: This device cannot be Hot Swapped.

WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

P3-01AC User Specifications	
Input Voltage Range (Tolerance)	100 to 240 VAC (-15% / +10%)
Rated Operating Frequency	50 to 60 Hz with ± 5% tolerance
Maximum Input Power	72W
Cold Start Inrush Current	12A 3ms
Maximum Inrush Current (Hot Start)	12A 3ms
Input Fuse Protection (Internal)	Micro fuse 250V, 2A, slow blow Non-replaceable
Efficiency	83%
Output	24VDC @ 1.4 A (± 10%) 5VDC @ 2.1 A (± 5%) 3.3 VDC @ 6.1 A (± 5%)
Maximum Output Power	57W combined
Heat Dissipation	17W
Isolated User 24VDC Output	None
Output Protection for Over Current, Over Voltage, and Over Temperature	Self resetting for all three voltage outputs to base
Under Input Voltage Lock-out	55–65 VAC
Over Input Voltage Lock-out	265–280 VAC
Input Transient Protection	Varistor, plus input choke and filter
Operating Design Life	10 years at full load at 40°C ambient and 5 years at 60°C (140°F) ambient

P3-01AC General Specifications	
Operating Temperature	0°C– 60°C (32°F–140°F)
Storage Temperature	-20ºC–70ºC (-4ºF–158ºF)
Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	IEC60068-2-6 (Test Fc)
Shock	IEC60068-2-27 (Test Ea)
Enclosure Type	Open equipment
Voltage Withstand (dielectric)	1900VDC applied for 2s
Insulation Resistance	>10MΩ @ 500VDC
Module Location	Power supply slot in any local, expansion, or remote base in a Productivity3000® system..
Weight	345g (12.1 oz)
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.

*Meets EMC and Safety requirements. See the Declaration of Conformity for details.

P3-01DC Specifications



P3-01DC

IMPORTANT!

Hot-Swapping Information

Note: This device cannot be Hot Swapped.

WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

P3-01DC User Specifications

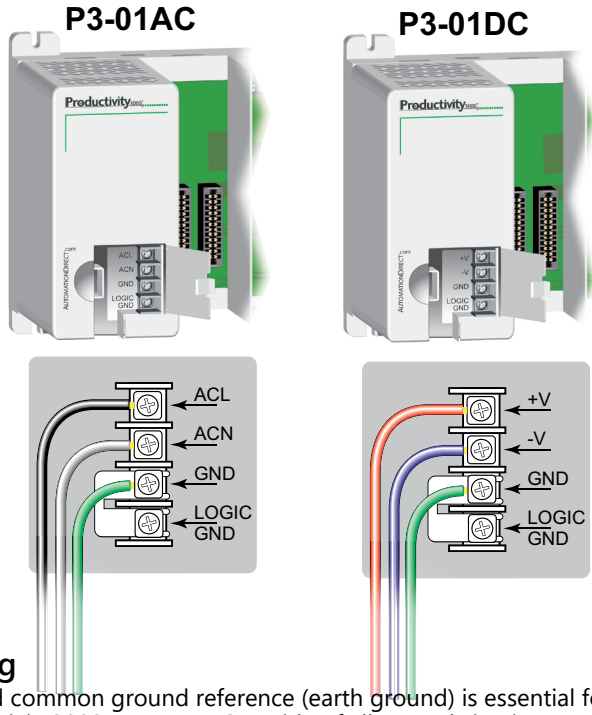
Input Voltage Range (Tolerance)	24 to 48 VDC (-15% / +20% at 55°C) 24 to 48 VDC (-10% / +20% at 60°C)	
Maximum Input Ripple	< ± 5%	
Maximum Input Power	67W	
Cold Start Inrush Current	10.5 A, 210µS @ 24VDC	
Maximum Inrush Current (Hot Start)	10.5 A, 210µS @ 24VDC	
Input Fuse Protection (Internal)	Micro fuse 250V, 4A, slow blow non-replaceable	
Input Reverse Polarity Protection	Yes	
Output	F1 Rev. or lower: 24VDC @ 1.4 A (±10%) 5VDC @ 2.1 A (±5%) 3.3 VDC @ 6.1 A (±5%)	F2 Rev. or higher: 24VDC @ 1A (±10%) 5VDC @ 2.0 A (±5%) 3.3 VDC @ 6.09 A (±5%)
Maximum Output Power	57W Combined	
Heat Dissipation	14W	
Isolated User 24VDC Output	None	
Output Protection for Over Current, Over Voltage and Over Temperature	Self resetting for all three voltage outputs to base	
Under Input Voltage Lock-out	< 19.8 VDC	
Over Input Voltage Lock-out	None	
Input Transient Protection	Varistor, plus input choke and filter	
Operating Design Life	10 years at full load at 40°C ambient and 5 years at 60°C (140°F) ambient	

P3-01DC General Specifications

Operating Temperature	0°C– 60°C (32°F–140°F)
Storage Temperature	-20ºC–70ºC (-4ºF–158ºF)
Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	IEC60068-2-6 (Test Fc)
Shock	IEC60068-2-27 (Test Ea)
Enclosure Type	Open equipment
Voltage Withstand (dielectric)	750VDC applied for 2s
Insulation Resistance	>10MΩ @ 500VDC
Module Location	Power supply slot in any local, expansion, or remote base in a Productivity3000® system..
Weight	558g (19.7 oz)
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.

**Meets EMC and Safety requirements. See the Declaration of Conformity for details.*

Power Connections



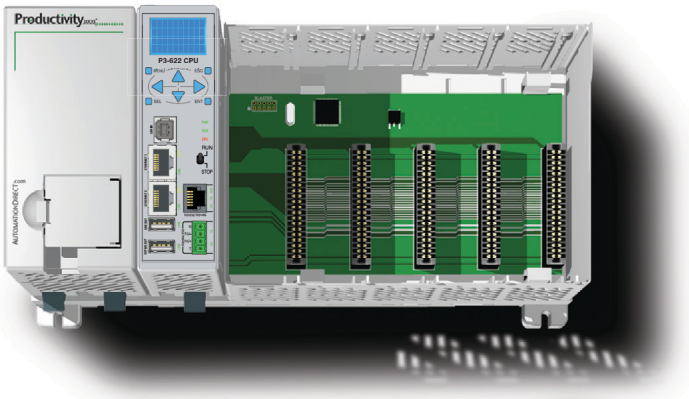
Grounding

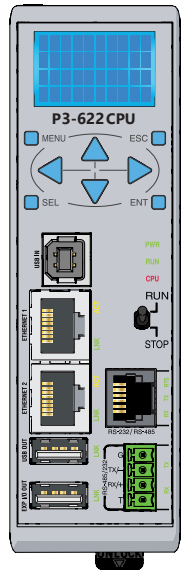
A good common ground reference (earth ground) is essential for proper operation of the Productivity3000® system.. One side of all control circuits, power circuits and the ground lead must be properly connected to earth ground by either installing a ground rod in close proximity to the enclosure or by connecting to the incoming power system ground. There must be a single-point ground (i.e. copper bus bar) for all devices in the enclosure that require an earth ground.

Productivity3000® CPU Modules

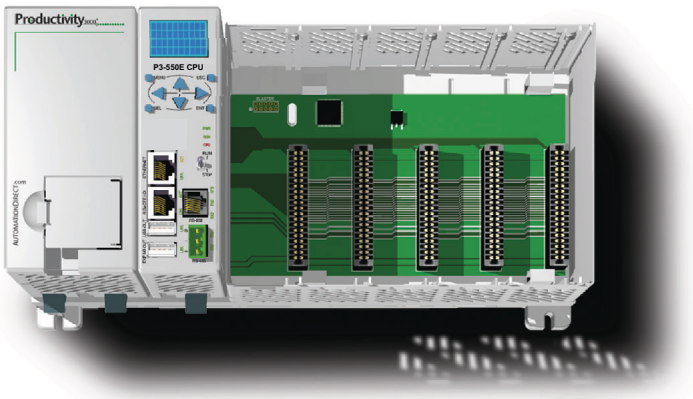
Each Productivity3000 System requires one CPU module mounted in the controller slot in the first base of the local base group. The CPU stores and executes the user's program. There are three CPU modules available:

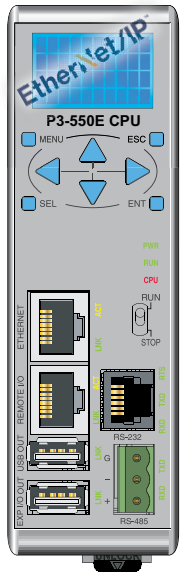
P3-622





P3-550E

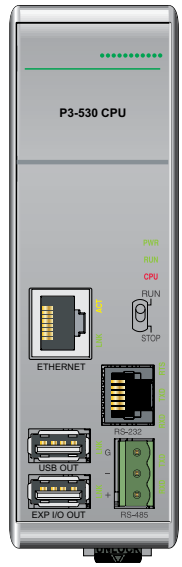




Productivity®3000 CPU Modules

P3-530





P3-622 Specifications

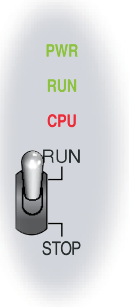
SPECIALTY MODULES SPECIFICATIONS

CHAPTER 4

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HSI LED Indicators 4–5
HSI Wiring Examples 4–6
High-Speed Output (HSO) Module Overview 4–9
HSO LED Indicators 4–12
HSO Wiring Examples 4–12
High-Speed Module Tester Utility 4–16
P3-SCM Serial Communications Module 4–17
P3-SCM Specifications 4–17
P3-SCM LED Indicators 4–21

CPU Status Indicators	
PWR	Green LED is illuminated when power is on
RUN	Green LED is illuminated when CPU is in RUN mode
CPU	Red LED is illuminated during power on reset, or power down

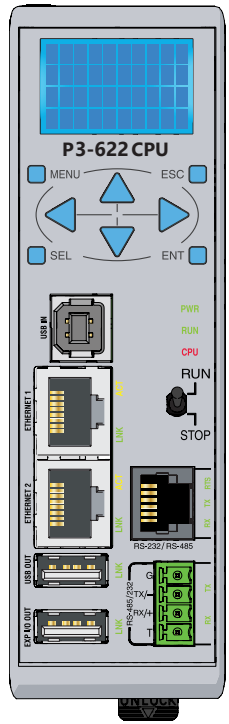


CPU Run/Stop Switch	
RUN position	Executes user program, run-time edits possible
STOP position	Does not execute user program, normal program load position

P3-622 Specifications

CPU Specifications			
User Memory	50MB (Includes program, data and documentation)		
Memory Type	Flash and battery-backed RAM		
Retentive Memory**	492K		
Scan Time	2.4 ms (3K Boolean, 1K I/O)		
Display	LCD, 4x10 characters, back-lit, 8 control buttons		
Communications; 6 Integrated Ports	**USB IN:** Programming, monitoring, debug, firmware **ETHERNET1:** (10/100 Mbps Ethernet) programming, monitoring, debug, firmware, Email SMTP Client, MQTT/MQTTS, Modbus TCP Client (32 slaves) and server (32 masters), EtherNet/IP scanner (128 scanner connections) and adapter (16 connections) **ETHERNET2*:** (10/100 Mbps Ethernet) 32 GS Drives, 16 remote base groups, 4 ProtosX TCP couplers, 4 PS-AMC modules **USB OUT:** (2.0) Data logging or project transfer **EXP I/O OUT:** (2.0 Proprietary) 4 P3-EX local expansion bases **RJ12:** RS-232/485 Programmable **TB (4-Pin):** RS-485/232 programmable, removable terminal included.		
Hardware Limits of System	**17 Base Groups** 1 local (P3-622) + 16 remote (P3-RS / P3-RX) **5 Bases per Base Group** 1 P3-622 or P3-RS or P3-RX + 4 Expansion (P3-EX) **85 Bases Total** 1 (CPU) + 16 (remote) + 68 (expansion) **59,840 Hardware I/O Points** (All 64-point I/O modules) **32 GS Series Drives** as Remote I/O		
Instruction Types	Application functions Array functions Counters/timers Communications Data handling	Drum sequencers Math functions PID Program control String functions	System functions Contacts Coils HSI/HSO Motion control
Real Time Clock Accuracy	±1s typical at 25°C (77°F) ambient ±2s per day maximum at 60°C (140°F) ambient		

**The 'ETHERNET 2' port can be configured as 'Default (Remote I/O)' or 'User Defined'. If 'User Defined' is selected this port will have the same specification as the 'ETHERNET 1' port with the exception that this port does not have Default Gateway or DNS capability.*



IMPORTANT!

Hot-Swapping Information

Note: This device cannot be Hot Swapped.

P3-622 Specifications

General Specifications	
Operating Temperature	0°C– 60°C (32°F–140°F)
Storage Temperature	-20ºC–70ºC (-4ºF–158ºF)
Humidity	5 to 95% (non-condensing)
Altitude	2,000 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	2297mW
Overvoltage Category	II
Enclosure Type	Open equipment
Module Location	Controller slot in the local base in a Productivity3000® system.
Weight	235g (8.28 oz)
Agency Approvals	UL 61010-1 and UL 61010-2-201 File E139594, Canada and USA CE (EN 61131-2 EMC, EN 61010-1 and EN 61010-2-201 Safety)*

**Meets EMC and Safety requirements. See the Declaration of Conformity for details.*



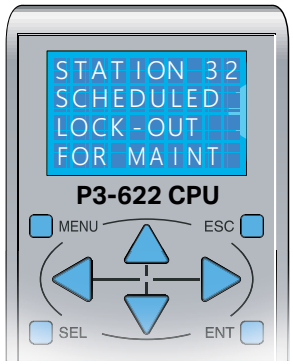
NOTE: *The most recent Productivity Suite software and firmware versions may be required to support new modules and new features.v*

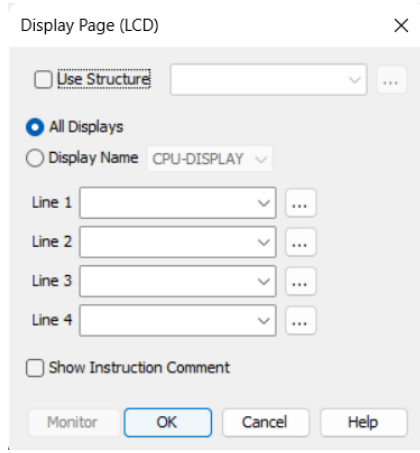
P3-622 LCD Message Display

The P3-622 CPU incorporates a 4 line x 10 character LCD for CPU system alarms and information or for displaying user-defined messages.

LCD control buttons located beneath the display allow the user to navigate through a menu and arrow buttons allow for configuration of time and date settings.

For user defined messages, the display is configured using the ProductivitySuite Programming Software. An LCD Page instruction allows the user to program text into user-defined tags and display the messages based on the ladder execution.

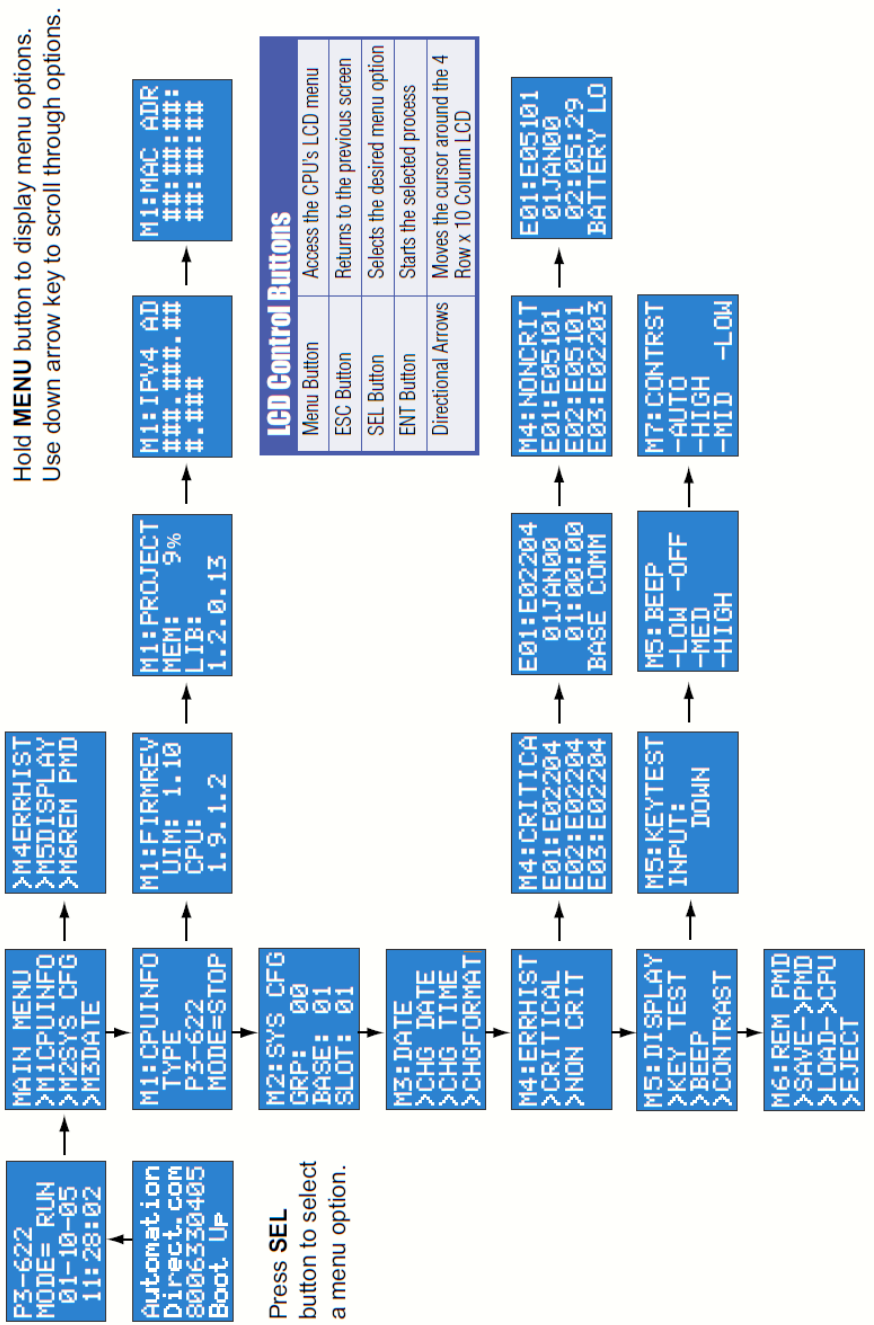




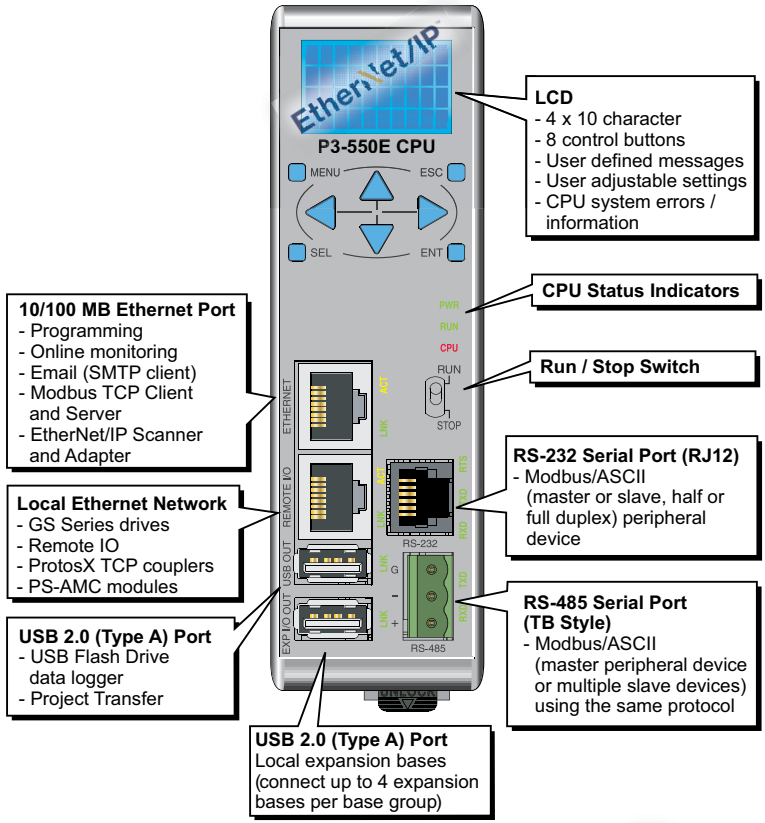
LCD Control Buttons	
Menu Button	Access the CPU's LCD menu
ESC Button	Returns to the previous screen
SEL Button	Selects the desired menu option
ENT Button	Starts the selected process
Directional Arrows	Moves the cursor around the 4 Row x 10 Column LCD

NOTE: *A replacement LCD display is available at automationdirect.com. Order Part number P3-LCD.*

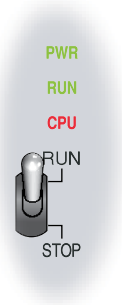
P3-622 Front Panel LCD Monitoring and Configuration



P3-550E Specifications



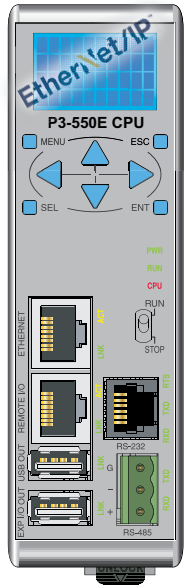
CPU Status Indicators	
PWR	Green LED is illuminated when power is on
RUN	Green LED is illuminated when CPU is in RUN mode
CPU	Red LED is illuminated during power on reset, power down, or watch-dog time-out.



CPU Run/Stop Switch	
RUN position	Executes user program, run-time edits possible
STOP position	Does not execute user program, normal program load position

P3-550E Specifications

CPU Specifications			
User Memory	50MB (Includes program, data and documentation)		
Memory Type	Flash and battery-backed RAM		
Retentive Memory**	492K		
Scan Time	600µs (3K Boolean, 1K I/O)		
Display	LCD, 4x10 characters, back-lit, 8 control buttons; LCD characters are 5x7 with a dot pitch of 0.45 mm; 2.25 mm x 3.15 mm		
Communications; 6 Integrated Ports	**ETHERNET:** (10/100 Mbps Ethernet) programming, monitoring, debug, firmware, Email SMTP Client, Modbus TCP Client (32 slaves) and server (32 masters), EtherNet/IP scanner (128 scanner connections) and adapter (16 connections) REMOTE I/O: (10/100 Mbps Ethernet) 16 P3-RS or RX remote base groups, 4 ProtosX TCP couplers, 4 PS-AMC modules, and 32 GS Drives **USB OUT:** (2.0) Data logging or project transfer using USB-FLASH Pen Drive **EXP I/O OUT:** (2.0 Proprietary) 4 P3-EX local expansion bases **RS-232:** Modbus RTU, ASCII full or half duplex **RS-485:** Removable terminal Included, (1200-115.2k Baud) ASCII, Modbus		
Hardware Limits of System	**17 Base Groups** 1 local (P3-550E) + 16 remote (P3-RS / P3-RX) **5 Bases per Base Group** 1 P3-550E or P3-RS or P3-RX + 4 Expansion (P3-EX) **85 Bases Total** 1 (CPU) + 16 (remote) + 68 (expansion) **59,840 Hardware I/O Points** (All 64-point I/O modules)		
Instruction Types	Application functions Array functions Counters/timers Communications Data handling	Drum sequencers Math functions PID Program control String functions	System functions Contacts Coils HSI/HSO Motion control
Real Time Clock Accuracy	±5s typical at 25°C (77°F) ambient: 1sec/day** ±15s per day maximum at 60°C (140°F) ambient: 2 sec/day**		



General Specifications	
Operating Temperature	0°C– 60°C (32°F–140°F)
Storage Temperature	-20ºC–70ºC (-4ºF–158ºF)
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	7W
Enclosure Type	Open equipment
Module Location	Controller slot in the local base in a Productivity3000® system.
Weight	260g (9oz)
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.

**Meets EMC and Safety requirements. See the Declaration of Conformity for details.*
*** Revision B and higher.*

IMPORTANT!

Hot-Swapping Information
Note: This device cannot be Hot Swapped.

WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

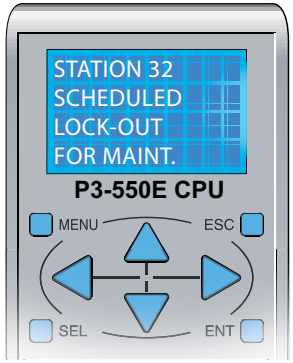
***NOTE:** The most recent Productivity Suite software and firmware versions may be required to support new modules and new features.*

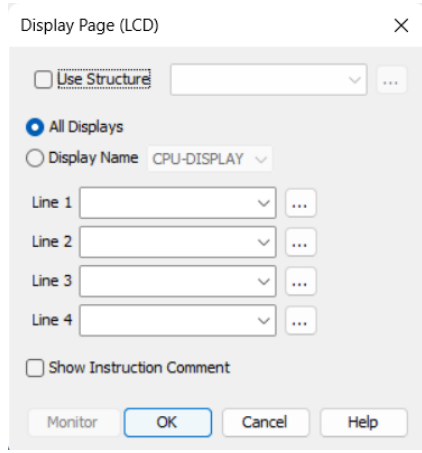
P3-550E LCD Message Display

The P3-550E CPU incorporates a 4 line x 10 character LCD for CPU system alarms and information or for displaying user-defined messages.

LCD control buttons located beneath the display allow the user to navigate through a menu and arrow buttons allow for configuration of time and date settings.

For user defined messages, the display is configured using the ProductivitySuite Programming Software. An LCD Page instruction allows the user to program text into user-defined tags and display the messages based on the ladder execution.

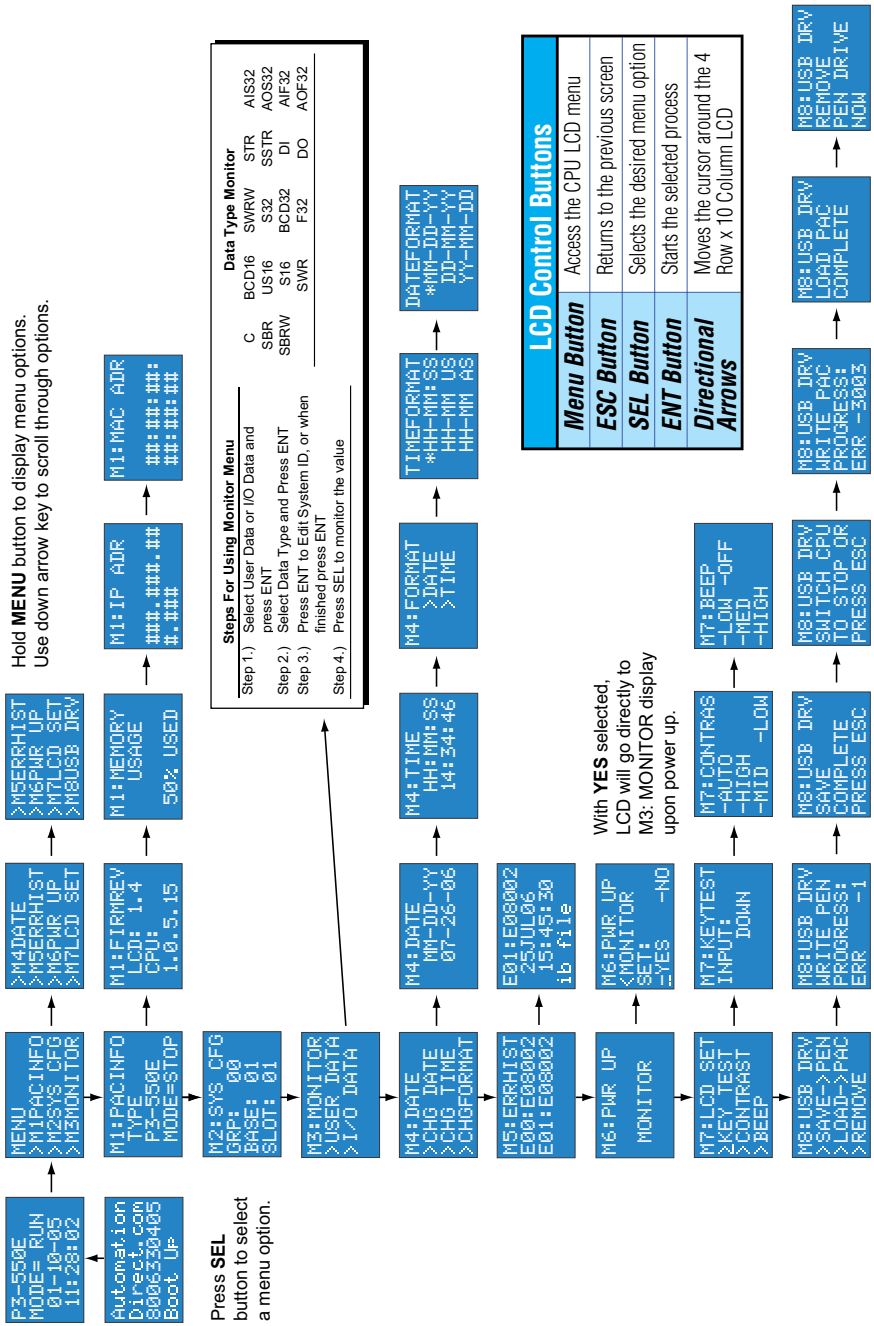




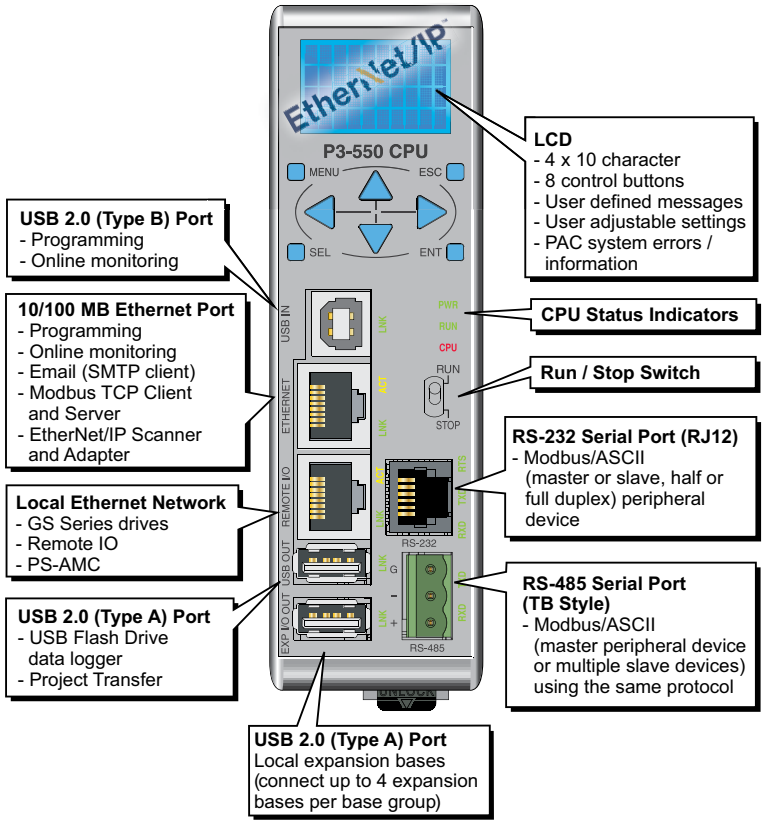
LCD Control Buttons	
Menu Button	Access the CPU's LCD menu
ESC Button	Returns to the previous screen
SEL Button	Selects the desired menu option
ENT Button	Starts the selected process
Directional Arrows	Moves the cursor around the 4 Row x 10 Column LCD

NOTE: *A replacement LCD display is available at automationdirect.com. Order Part number P3-LCD.*

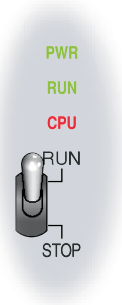
P3-550E Front Panel LCD Monitoring and Configuration



P3-550 Specifications (Retired 06/2023)



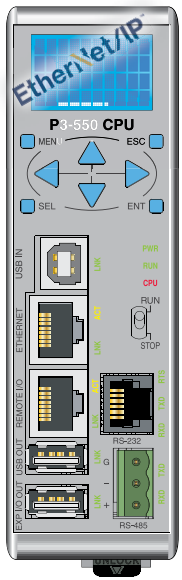
CPU Status Indicators	
PWR	Green LED is illuminated when power is on
RUN	Green LED is illuminated when CPU is in RUN mode
CPU	Red LED is illuminated during power on reset, power down, or watch-dog time-out.



CPU Run/Stop Switch	
RUN position	Executes user program, run-time edits possible
STOP position	Does not execute user program, normal program load position

P3-550 Specifications (Retired 06/2023)

CPU Specifications			
User Memory	50MB (Includes program, data and documentation)		
Memory Type	Flash and battery backed RAM		
Retentive Memory	Models C3 and earlier: 100K Models D and later: 492K		
Scan Time	600µs (3K Boolean, 1K I/O)		
Display	LCD, 4x10 characters, backlit, 8 control buttons; LCD characters are 5x7 with a dot pitch of 0.45 mm; 2.25 mm x 3.15 mm		
Communications; 7 Integrated Ports	**USB IN:** Programming, monitoring, debug, firmware **ETHERNET:** (10/100 Mbps Ethernet) programming, monitoring, debug, firmware, Email SMTP client, EtherNet/IP scanner/adapter (128 Scanner connections) and Modbus TCP client (32 slaves) and server (32 masters) REMOTE I/O: (10/100 Mbps Ethernet) 16 P3-RS/RX remote base groups, 4 ProtosX TCP couplers, 4 PS-AMC modules, and 32 GS Drives **USB OUT:** (2.0) Data logging or project transfer using SDCZ4-2048-A10 Pen Drive **EXP I/O OUT:** (2.0 Proprietary) 4 P3-EX local expansion bases **RS-232:** (RJ12, 1200-115.2k Baud) Modbus RTU, ASCII full or half duplex **RS-485:** Removable terminal included, (1200-115.2k Baud) ASCII, Modbus		
Hardware Limits of System	**17 Base Groups** 1 Local (P3-550(E)) + 16 remote (P3-RS/RX) **5 Bases per Base Group** 1 P3-550(E) or P3-RS/RX + 4 expansion (P3-EX) **85 Bases Total** 1 P3-550(E), 16 P3-RS/RX, & 68 P3-EX **59,840 Hardware I/O Points** (All 64-point I/O modules)		
Instruction Types	Application functions Array functions Counters/timers Communications	Data handling Drum sequencers Math functions PID	Program control String functions System functions High-speed I/O Motion control
Real Time Clock Accuracy	±5s typical at 25°C (77°F) ambient ±15s per day maximum at 60°C (140°F) ambient		



NOTE: *To utilize the 492K of retentive memory in the P3-550(E) rev. D or later CPU, you must use Productivity® 3000 software version 1.0.7.XX and firmware version 1.1.13.XX or later.*

General Specifications	
Operating Temperature	0°C– 60°C (32°F–140°F)
Storage Temperature	-20ºC–70ºC (-4ºF–158ºF)
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	7W
Enclosure Type	Open equipment
Module Location	Controller slot in the local base in a Productivity3000® system.
Weight	260g (9oz)
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.

**Meets EMC and Safety requirements. See the Declaration of Conformity for details.*

IMPORTANT!

Hot-Swapping Information
Note: This device cannot be Hot Swapped.

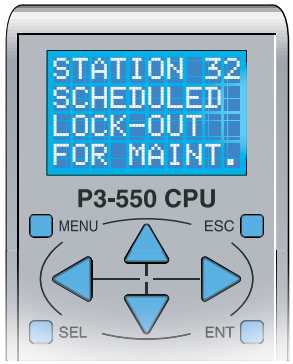
WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

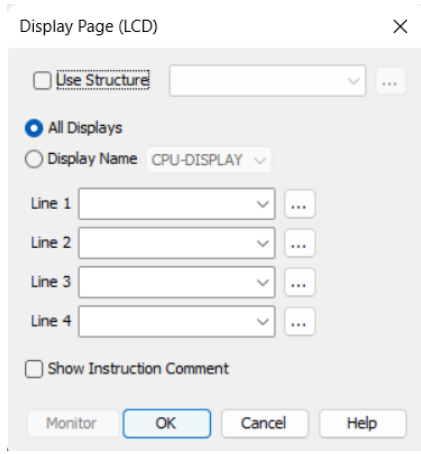
P3-550 LCD Message Display

The P3-550 CPU incorporates a 4 line x 10 character LCD for CPU system alarms and information or for displaying user-defined messages.

LCD control buttons located beneath the display allow the user to navigate through a menu and arrow buttons allow for configuration of time and date settings.

For user defined messages, the display is configured using the ProductivitySuite Programming Software. An LCD Page instruction allows the user to program text into user-defined tags and display the messages based on the ladder execution.

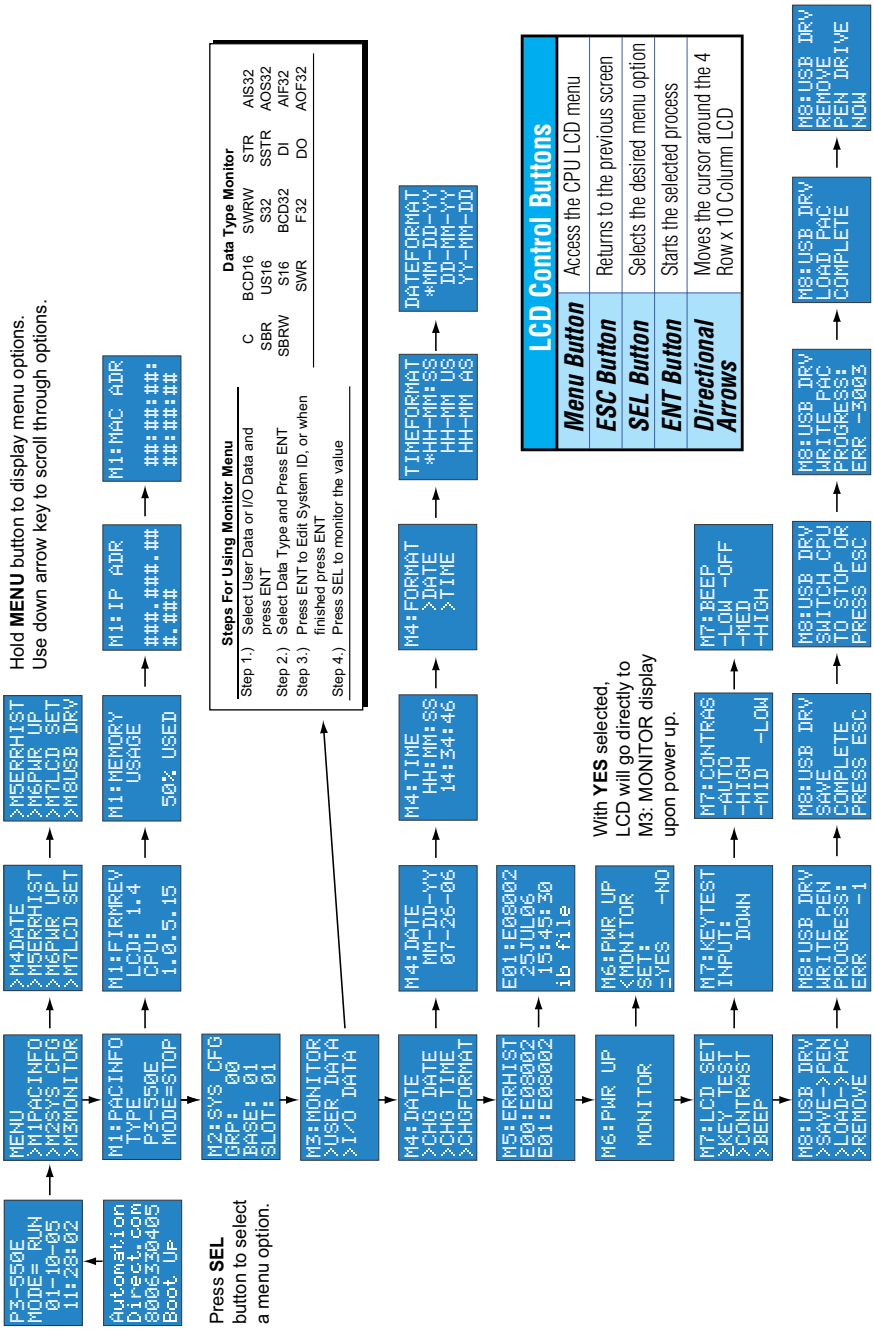




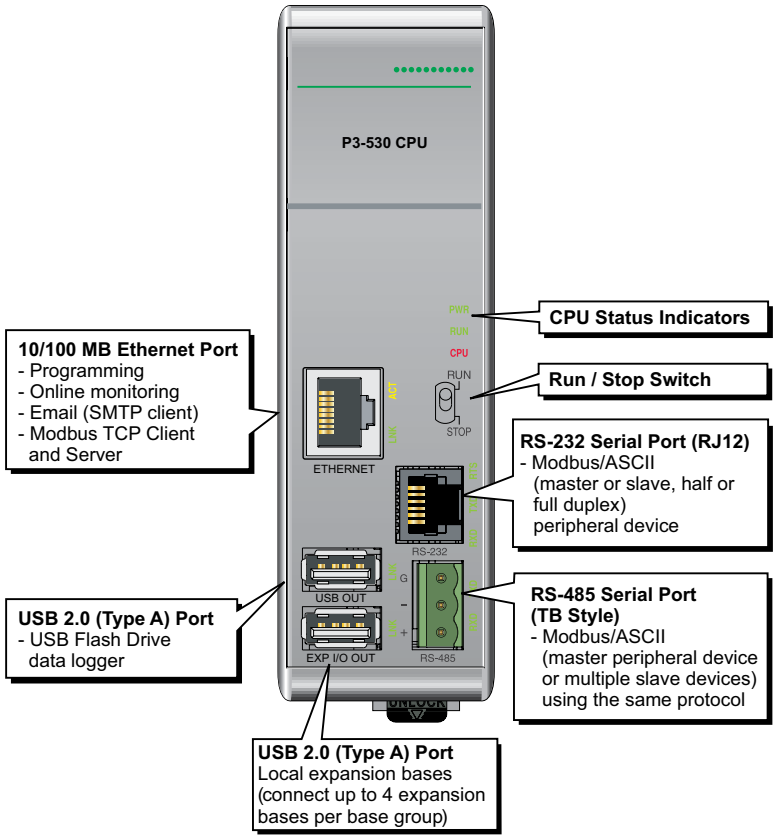
LCD Control Buttons	
Menu Button	Access the CPU's LCD menu
ESC Button	Returns to the previous screen
SEL Button	Selects the desired menu option
ENT Button	Starts the selected process
Directional Arrows	Moves the cursor around the 4 Row x 10 Column LCD

NOTE: *A replacement LCD display is available at automationdirect.com. Order Part number P3-LCD.*

P3-550 Front Panel LCD Monitoring and Configuration

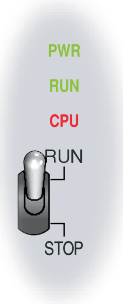


P3-530 Specifications



NOTE: *P3-530 CPU has no LCD display.*

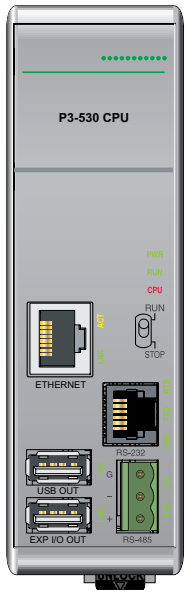
CPU Status Indicators	
PWR	Green LED is illuminated when power is on
RUN	Green LED is illuminated when CPU is in RUN mode
CPU	Red LED is illuminated during power on reset, power down, or watch-dog time-out.



CPU Run/Stop Switch	
RUN position	Executes user program, run-time edits possible
STOP position	Does not execute user program, normal program load position

CPU Specifications

User Memory	25MB (Includes program, data and documentation)	
Memory Type	Flash and Battery Backed RAM	
Retentive Memory	492K	
Scan Time	600µs (3K Boolean, 1K I/O)	
Communications; 5 Integrated Ports	**ETHERNET:** (10/100 Mbps Ethernet)programming, monitoring, debug, firmware, Email SMTP Client, Modbus TCP Master (64 Slaves) and Slave (8 Masters) **USB OUT:** (2.0) Data Logging using SDCZ4-2048-A10 Pen Drive **EXP I/O OUT:** (2.0 Proprietary) 4 P3-EX Local Expansion Bases **RS-232:** (RJ12, 1200-115.2k Baud) Modbus RTU, ASCII full or half duplex **RS-485:** Removable Terminal Included, (1200-115.2k Baud) ASCII, Modbus	
Hardware Limits of System	**5 Bases Total** 1 P3-530 + 4 Expansion (P3-EX) **3520 Hardware I/O Points** (All 64-point I/O Modules)	
Instruction Types	Application Functions Array Functions Counters/Timers Communications Data Handling Drum Sequencers	Math Functions PID Program Control String Functions System Functions High Speed I/O
Real Time Clock Accuracy	±5s typical at 25°C ±15s per day maximum at 60°C	



General Specifications

Operating Temperature	0°C– 60°C (32°F–140°F)
Storage Temperature	-20ºC–70ºC (-4ºF–158ºF)
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	7W
Enclosure Type	Open equipment
Module Location	Controller slot in the local base in a Productivity3000® system.
Weight	260g (9oz)
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.

**Meets EMC and Safety requirements. See the Declaration of Conformity for details.*

IMPORTANT!

Hot-Swapping Information

Note: This device cannot be Hot Swapped.

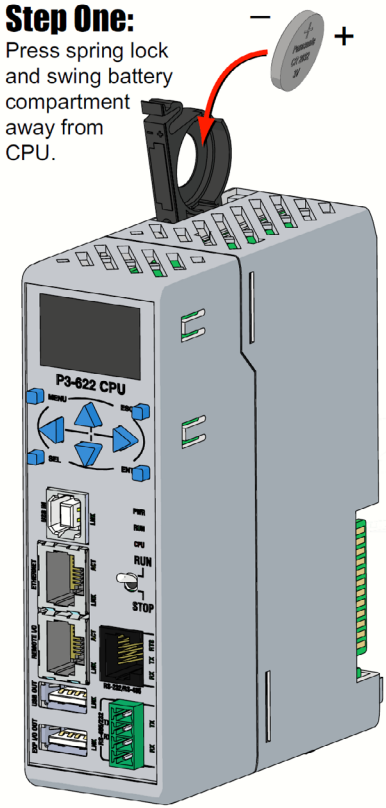
WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

NOTE: *The most recent Productivity Suite software and firmware versions may be required to support new modules and new features.*

Battery (Optional)

A battery is included with some CPU modules, but is not installed. The battery can be installed to retain the Time and Date along with any Tagname values that are set up as retentive.

The battery is not needed for program backup.



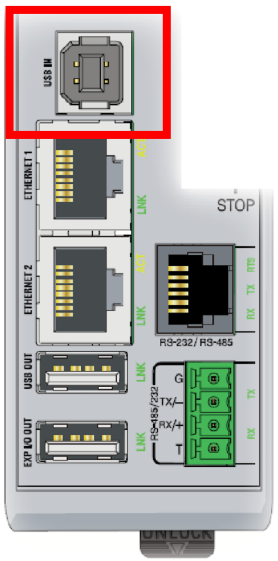


Battery (Optional)	
D2-BAT-1	Coin type, 3.0 V Lithium battery, 560mA, battery number CR2354

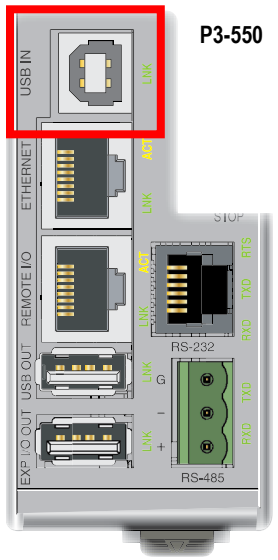
CPU Port Specifications

The P3 CPUs (P3-622, P3-550(E), & P3-530) have multiple communications ports. The following pages contain the individual port specifications and pin-out diagrams.

P3-622



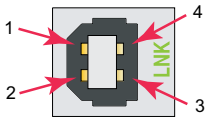
P3-550



USB IN Port P3-622 & P3-550

Used exclusively for connecting to a PC running the ProductivitySuite programming software.

USB Type B Slave Input Specifications	
Port Name	USB IN
Description	Standard USB 2.0 Slave input for programming and online monitoring, with built-in surge protection. Not compatible with older 1.0/1.1 full speed USB devices.
Transfer Rate	480 Mbps
Port Status LED	Green LED is illuminated when LINK is established to programming software.
Cables	USB Type A to USB Type B: 3ft cable part # USB-CBL-AB3 6ft cable part # USB-CBL-AB6 10ft cable part # USB-CBL-AB10 15ft cable part # USB-CBL-AB15

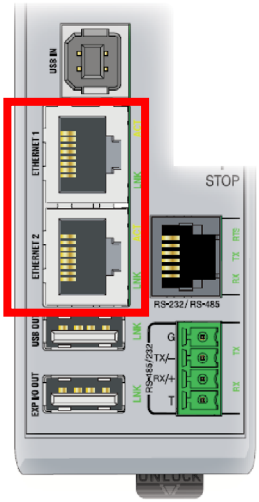


Mating face of USB type B female

Pin #	Signal
1	+5
2	–Data
3	+Data
4	GND

P3-622 Ethernet Ports

P3-622



Ethernet 1 Port

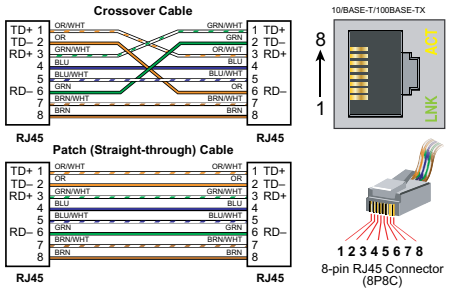
RJ-45 style connector used for:

- Connection to a PC running the ProductivitySuite programming software
- EtherNet/IP Scanner (CPU is the originator, up to 128 connections, max 32 devices)
- EtherNet/IP Adapter (CPU is the target, up to 16 connections, max 4 devices) Modbus TCP Client connections (Modbus requests sent from the CPU)
- Modbus TCP Server connections (Modbus requests received by the CPU)
- MQTT/MQTTs (4 brokers)
- Outgoing E-mail

Ethernet 2 Port

RJ-45 style connector used for:

- Connection to a Remote I/O network of devices using the Productivity Remote Protocol, e.g. P3-RX remotes slaves, ProtosX couplers, PS-AMC modules, and GS drives.
- Can be user defined and used as a secondary multipurpose ethernet port with the exception that this port shares Default Gateway and DNS capability with the Ethernet 1 Port.



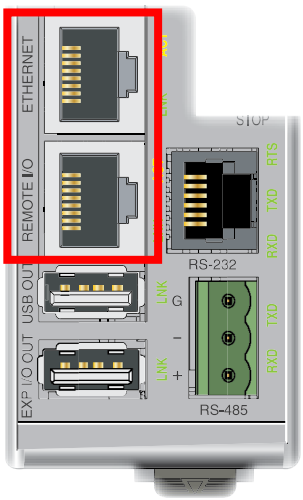
Ethernet Specifications

Port Name	ETHERNET1	ETHERNET2*
Description	Standard transformer isolated Ethernet port with built-in surge protection for programming, online monitoring, MQTT/MQTTS, Email (SMTP client), Modbus/TCP client/server connections (fixed IP or DHCP) and Ether-Net/IP Scanner/ Adapter.	Standard transformer isolated Ethernet port with built-in surge protection for connection to the P3-RS/RX, ProtosX remote I/O, GS Drives with optional communication mudules, and PS-AMC modules.
Transfer Rate	10/100 Mbps	
Port Status LED	Green LED illuminated when network LINK is established. Yellow LED is illuminated when port is active (ACT).	
Cables	Use a Patch (straight through) cable when a switch or hub is used. Both ports support Auto MDI/MDI-X. (Cables are available at automationdirect.com; e.g., C5E-STPBL-S10)	

**The 'ETHERNET 2' port can be configured as 'Default (Remote I/O)' or 'User Defined'. If 'User Defined' is selected this port will have the same specification as the 'ETHERNET 1' port and shares Default Gateway and DNS capability with the Ethernet 1 Port.*

P3-550(E) & P3-530 Ethernet Ports

P3-550(E)



Ethernet Port

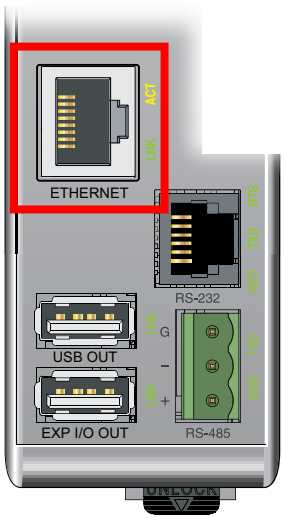
RJ-45 style connector used for:

- Connection to a PC running the ProductivitySuite programming software
- Modbus TCP Client connections (Modbus requests sent from the CPU)
- Modbus TCP Server connections (Modbus requests received by the CPU)
- Outgoing E-mail

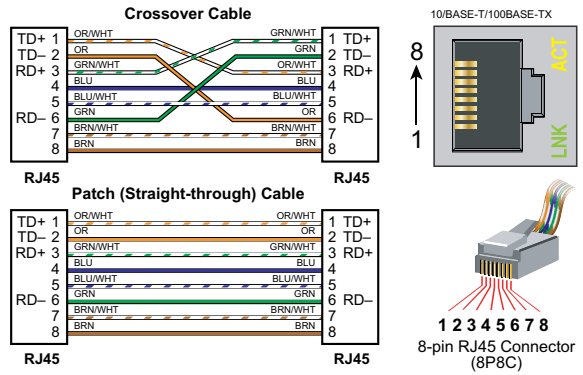
Remote I/O Port P3-550(E)

RJ-45 style connector used for connecting to a Remote I/O network consisting of P3-RS/RX Remote Slaves, ProtosX TCP couplers, PS-AMC modules, and GS drives.

P3-530

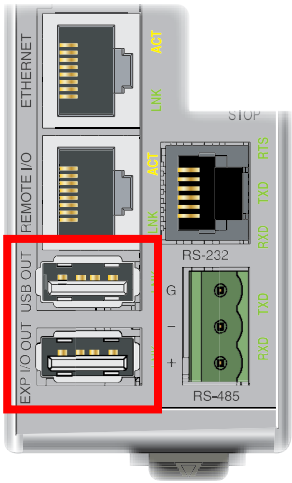


Ethernet Specifications		
Port Name	ETHERNET	REMOTE I/O P3-550(E)
Description	Standard transformer isolated Ethernet port with built-in surge protection for programming, online monitoring, Email (SMTP client), Modbus/TCP client/server connections (fixed IP or DHCP) and EtherNet/IP Scanner/ Adapter [P3-550(E)].	Standard transformer isolated Ethernet port with built-in surge protection for connection to the P3-RS/RX Remote I/O system. Supports 16 Remote I/O slaves, 4 ProtosX TCP couplers, 4 PS-AMC modules, and 32 GS Series drives.
Transfer Rate	10/100 Mbps	
Port Status LED	Green LED illuminated when network LINK is established. Yellow LED is illuminated when port is active (ACT).	
Cables	Use a Patch (straight through) cable when a switch or hub is used. Use a Crossover cable when a switch or hub is not used. (Cables are available at automationdirect.com)	



USB Ports

P3-622
P3-550(E)



USB OUT Port

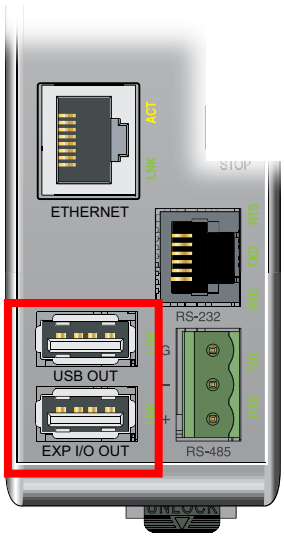
Used for data logging (P3-622/P3-550(E)/P3-530) or project transfers (P3-622/P3-550(E) only) to and from a USB-FLASH Pen Drive (may work with other pen drives).

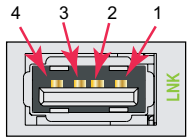
EXP I/O OUT Port

USB port used only for Expansion I/O connections to local P3-EX modules in a Productivity®3000 base with I/O.

USB Type A Master Output Specifications		
Port Name	USB OUT	EXP I/O OUT
Description	Standard USB 2.0 Master output for connection to high-speed Flash drive (Recommended pen drive: Sandisk SDCZ4-2048-A10) for data logging (P3-622, P3-550(E)/P3-530) or program transfer (P3-622/P3-550(E) only) with built-in surge protection. Not compatible with older full speed USB devices. A 0.5m male-to-female "port extender" cable is included to assist with Flash drive connection.	Proprietary USB 2.0 Master output for connection with up to four P3-EX local expansion bases, with built-in surge protection.
Transfer Rate	480 Mbps	
Port Status LED	Green LED is illuminated when LINK is established to connected device	
Cables	None required	USB Type A to USB Type B: 6ft cable part # P3-EX-CBL6 (included with P3-EX module)

P3-530





Mating face of USB type A female

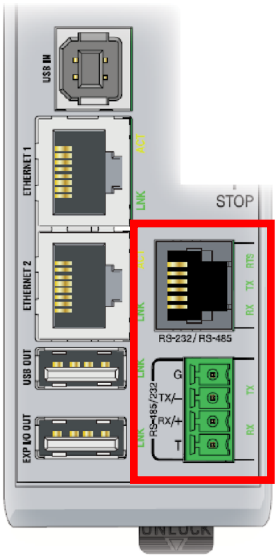
USB OUT

Pin #	Signal
1	+5
2	– Data
3	+ Data
4	GND

EXP I/O OUT

Pin #	Signal
1	Reset
2	– Data
3	+ Data
4	GND

P3-622 CPU Programmable RS-232/RS-485 Ports

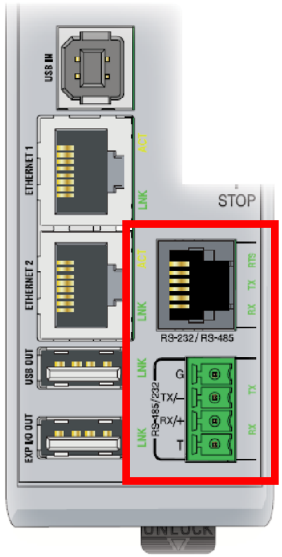


P3-622

RS-232 Specifications	
Port Name	**RS-485**
TXD	RS-232 Transmit output
RXD	RS-232 Receive input
RTS	Handshaking output for modem control (RJ12 only)
GND	Logic ground
Maximum Output Load (TXD/RTS)	3kΩ, 1000pf
Minimum Output Voltage Swing	±5V
Output Short Circuit Protection	±15mA

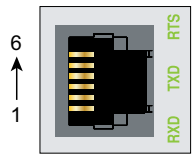
RS-485 Specifications	
TXD+/RXD+	RS-485 transceiver high
TXD-/RXD-	RS-485 transceiver low
GND	Logic ground
Input Impedance	19kΩ
Termination Resistance (TB jumper wire “T” to “+”)	120Ω. To use, add jumper between pin 1 and pin 2. Resistor is internally connected between pins 1 and 3.
Maximum Load	50 transceivers, 19kΩ each, 60Ω termination
Output Short Circuit Protection	±250mA, thermal shut-down protection
Electrostatic Discharge Protection	Contact ±4KV, Air ±8KV per IEC61000-4-2 Cable is installed for testing
Electrical Fast Transient Protection	±1kV per IEC61000-4-4
Mimimum Differential Output Voltage	1.5 V with 60Ω load
Fail Safe Inputs	Logic high input state if inputs are connected
Maximum Common Mode Voltage	-7.5 V to 12.5 V

P3-622 CPU Programmable RS-232/RS-485 Ports



P3-622

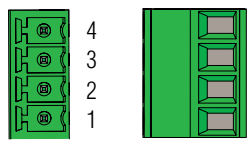
RJ12 Connector	
Description	Programmable RS232/485 Port - Non-isolated RS-232 DTE port connects the CPU as a Modbus RTU Master /Slave or ASCII peripheral device. Includes selectable internal termination for RS485 mode. - Non-isolated RS-485 port connects the CPU as a Modbus/ASCII master or slave to a peripheral device. Includes support to enable internal termination. Includes ESD/EFT protection and automatic echo cancellation when transmitter is active
Data Rates	Selectable, 1200, 2400, 4800, 9600, 19200, 33600, 38400, 57600, and 115200
+5V Cable Power	210mA maximum at 5V when in RS-232 mode, ±5%. Reverse polarity and overload protected.
Port Status LED	Green LED illuminated when active for TXD, RXD and RTS
Cable Options	EA-MG-PGM-CBL D2-DSCBL USB-RS232-1 with D2-DSCBL FA-CABKIT



6-pin RJ12 Female Modular Connector

Pin#	RS232	RS485
6	GND	GND
5	RTS	
4	TXD	TXRX-
3	RXD	TXRX+
2	+5V, 210mA	Do not connect
1	GND	GND

4 Position Terminal Block	
Description	Programmable RS485/232 Port - Non-isolated RS-232 DTE port connects the CPU as a Modbus/ASCII master or slave to a peripheral device. Includes ESD and built in surge protection - Non-isolated RS-485 port connects the CPU as a Modbus/ASCII master or slave to a peripheral device. Includes ESD/EFT protection and automatic echo cancellation when transmitter is active
Data Rates	Selectable, 1200, 2400, 4800, 9600, 19200, 33600, 38400, 57600, and 115200
Port Status LED	Green LED illuminated when active for TXD and RXD
Cable Options	Go to AutomationDirect.com for RS232 and RS-485 cable selection.

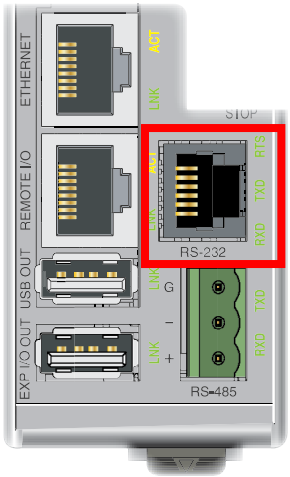


PCON-KIT

Pin #	RS232	RS485
4	GND	GND
3	TXD	TXRX-
2	RXD	TXRX+
1	Do not connect	TERMINATE

P3-550(E) and P3-530 RS-232/RS-485 Ports

P3-550(E)



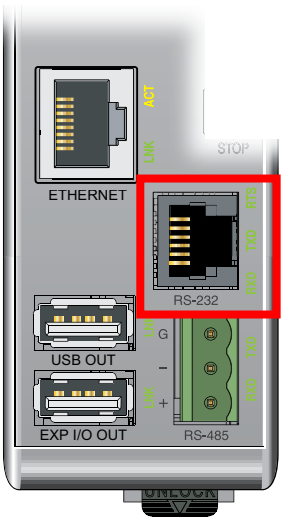
RS-232 Port

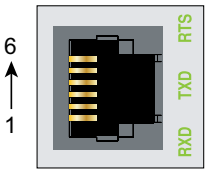
RJ-12 style connector used for:

- Modbus RTU Master connections
- Modbus RTU Slave connections
- ASCII full or half duplex communications
- Custom Protocol Incoming and Outgoing communications

RS-232 Specifications	
Port Name	RS-232
Description	Non-isolated RS-232 DTE port connects the CPU as a Modbus/ASCII master or slave to a peripheral device. Includes ESD and built-in surge protection.
Data Rates	Selectable, 1200, 2400, 9600, 19200, 33600, 38400, 57600, and 115200 Baud.
+5V Cable Power Source	210mA maximum at 5V, ±5%. Reverse polarity and overload protected.
TXD	RS-232 Transmit output
RXD	RS-232 Receive input
RTS	Handshaking output for modem control.
GND	Logic ground
Maximum Output Load (TXD/RTS)	3kΩ, 1,000pf
Minimum Output Voltage Swing	±5V
Output Short Circuit Protection	±15mA
Port Status LED	Green LED is illuminated when active for TXD, RXD and RTS
Cable Options	FA-ISOCON for converting RS-232 to isolated RS-485

P3-530

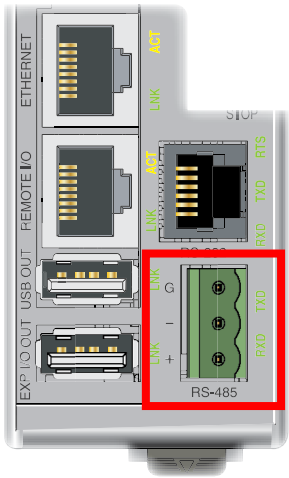




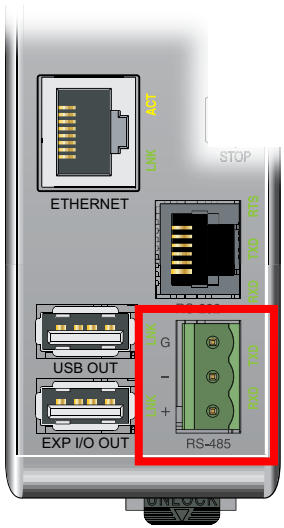
6-pin RJ12 Female Modular Connector

Pin #	Signal	
1	GND	Logic Ground
2	+5V	210 mA Maximum
3	RXD	RS-232 Input
4	TXD	RS-232 Output
5	RTS	RS-232 Output
6	GND	Logic Ground

P3-550(E)



P3-530



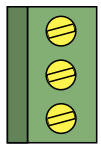
RS-485 Port

A 3-pin removable terminal block used for:

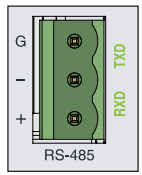
- Modbus RTU Master connections
- Modbus RTU Slave connections
- ASCII Incoming and Outgoing communications
- Custom Protocol Incoming and Outgoing communications

RS-485 Port Specifications

Port Name	RS-485
Description	Non-isolated RS-485 port connects the CPU as a Modbus/ASCII master or slave to a peripheral device. Includes ESD/EFT protection and automatic echo cancellation when transmitter is active.
Data Rates	Selectable, 1200, 2400, 9600, 19200, 33600, 38400, 57600, and 115200 bps
TXD+/RXD+	RS-485 transceiver high
TXD-/RXD-	RS-485 transceiver low
GND	Logic ground
Input Impedance	19kΩ
Maximum load	50 transceivers, 19kV each, 60V termination
Output Short Circuit Protection	±250mA, thermal shut-down protection
Electrostatic Discharge Protection	±8kV per IEC1000-4-2
Electrical Fast Transient Protection	±2kV per IEC1000-4-4.
Minimum Differential Output Voltage	1.5 V with 60V load
Fail safe inputs	Logic high input state if inputs are unconnected
Maximum Common Mode Voltage	-7.5 V to 12.5 V.
Port Status LED	Green LED illuminated when active for TXD and RXD
Cable Options *	L19827-100, L19827-500, L19827-1000 or Belden 9841 equivalent



Removable connector included.



Pin #	Signal
G	GND
–	TXD-/RXD-
+	TXD+/RXD+

Terminal Block Specifications

Number of Positions	3
Pitch	5mm
Wire Range	28-12 AWG solid conductor 30-12 AWG stranded conductor
Screw Driver Width	1/8 inch (3.175 mm) maximum
Screw Size	M2.5
Screw Torque	4.5 lb·in (0.51 N·m)

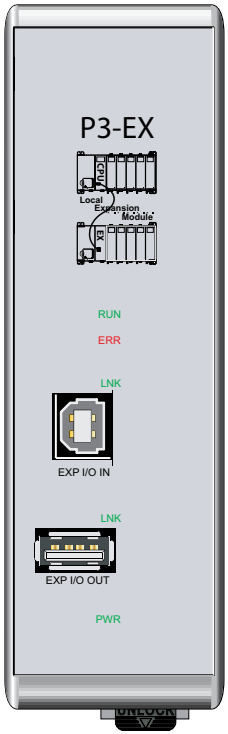
Productivity3000® System Expansion

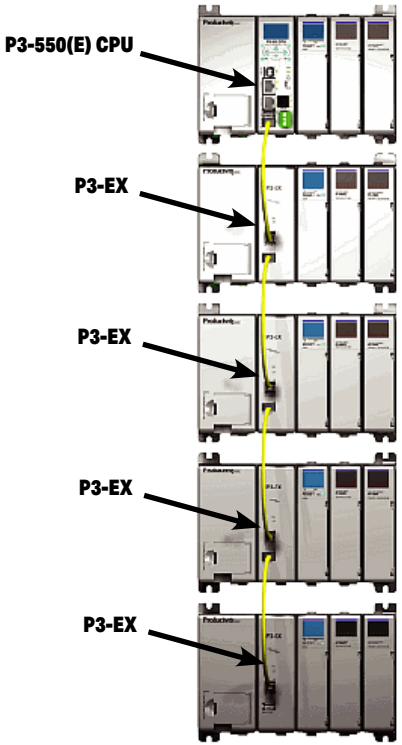
The Productivity3000® system. can be expanded by using the P3-EX, P3-RS, P3-RX, or PS-AMC modules when using the **P3-622** or **P3-550(E)** CPU or expanded with the P3-EX module when using the **P3-530** CPU. The local, expansion, and remote I/O (**P3-622 & P3-550(E)** only) are assigned preconfigured or user-defined tag names which can be easily referenced in the ladder logic program.

P3-EX Expansion Module

The P3-EX high-performance expansion module provides local I/O expansion to a CPU or Remote I/O. Includes 6-foot USB expansion cable.w

The system can have up to 68 expansion bases by adding four expansion bases at the CPU base and four expansion bases per Remote I/O Slave (up to 16 slaves). Each expansion base uses the P3-EX expansion module for USB-based I/O bus connectivity.

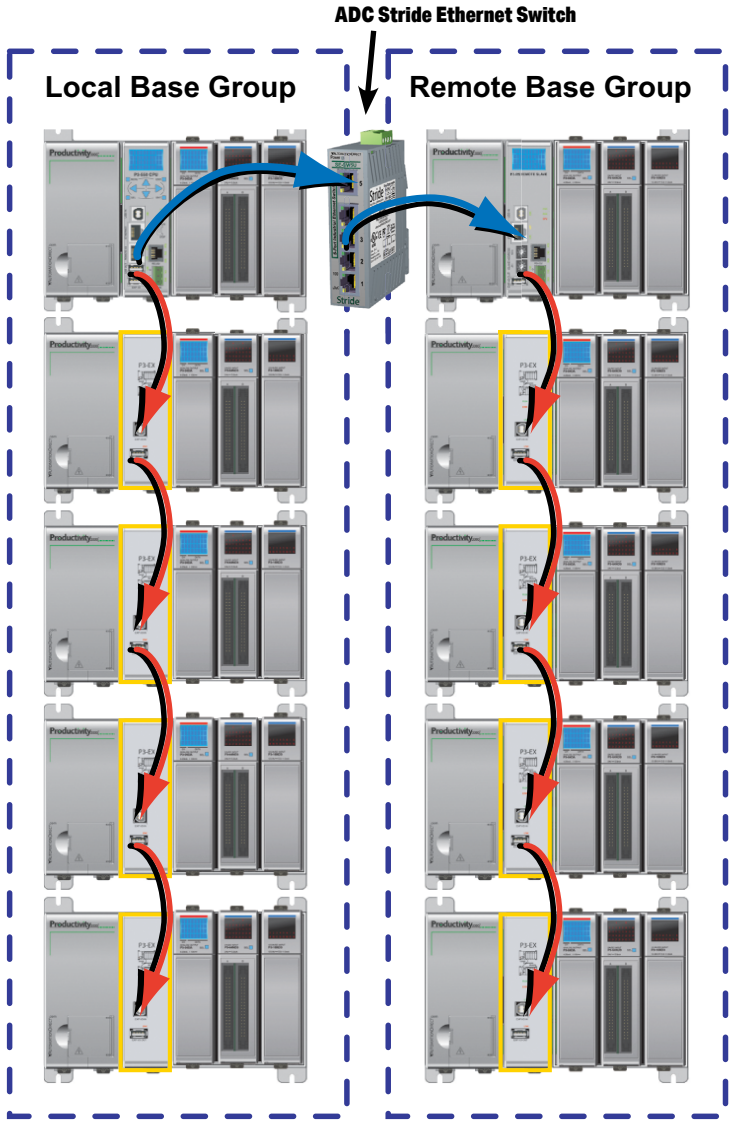




A 6-foot USB cable is included with the P3-EX module (Replacement cable: part number P3-EX-CBL6).

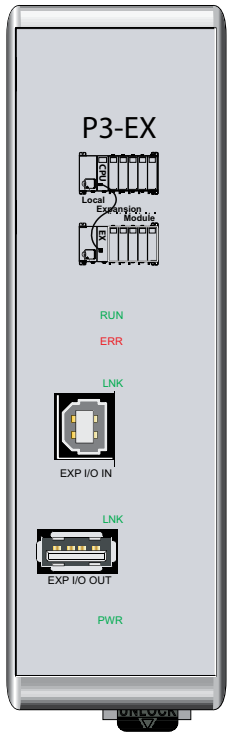


P3-EX Expansion Module Example



P3-EX Module Specifications

Mounting Location	Controller slot of expansion base
Expansion Connectors	1 USB 2.0 Type A, 1 USB 2.0 Type B
Maximum Number of Expansion Modules per CPU or Remote Slave	4
Maximum Distance Between Modules	15 feet
Status Indicators	PWR - Green LED is illuminated when power is on. RUN - Green LED is illuminated when not in reset. Reset occurs during power-up, a watchdog timeout, or if an expansion cable is disconnected. ERR - Red LED is illuminated when a USB fault is detected. LINK - Green LED is illuminated when a USB link is established.
I/O Capabilities Max. Number of I/O per CPU System Max. Number of Expansion I/O Bases	59,840 (CPU base with 4 expansion bases plus 16 remote bases with 4 expansion bases per remote, with 11 64-point I/O modules per base) 68 (4 per CPU, 4 per remote base)
Module Setup	Automatic hardware verification
Expansion I/O Addressing	Automatic via tag names
USB Cables	6 foot: P3-EX-CBL6 (USB Type A to USB Type B)



General Specifications

Operating Temperature	0°C– 60°C (32°F–140°F)
Storage Temperature	-20ºC–70ºC (-4ºF–158ºF)
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	1W
Enclosure Type	Open equipment
Module Location	Controller slot in a local expansion base in a Productivty3000® system.
Weight	194g (6.24 oz)
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.

**Meets EMC and Safety requirements. See the Declaration of Conformity for details.*

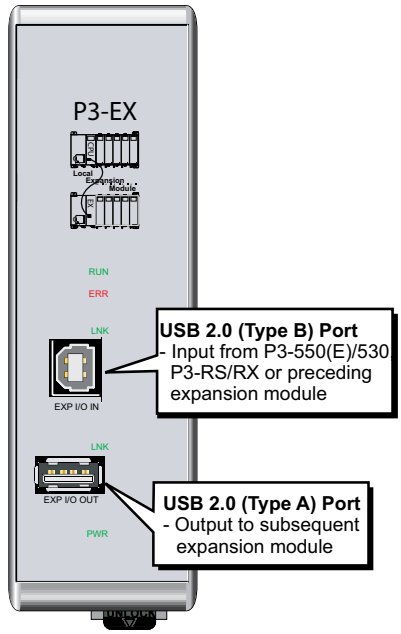
IMPORTANT!

Hot-Swapping Information

Note: This device cannot be Hot Swapped.

WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

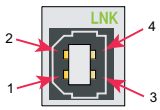
Expansion Module Status Indicators	
PWR	Green LED is illuminated when power is on.
RUN	Green LED is illuminated when not in reset. Reset occurs during power-up, a watchdog timeout, or an expansion cable is disconnected.
ERR	Red LED is illuminated when a USB fault is detected.
LNK	Green LED is illuminated when a USB link is established.



Port Specifications

Exp I/O Port Specifications		
Port Name	EXP I/O IN	EXP I/O OUT
Description	Proprietary USB 2.0 slave input for connection with a CPU, remote slave, or preceding P3-EX expansion base. The P3-EX Expansion Module includes the 6 foot USB cable P3-EX-CBL6.	Proprietary USB 2.0 master output for connection with the next P3-EX expansion base. Includes built-in surge protection.
Transfer Rate	480 Mbps	
Port Status LED	Green LED is illuminated when LINK is established to connected device	
Cables	USB Type A to USB Type B: 6ft cable part no. P3-EX-CBL6	

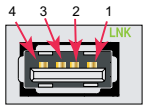
EXP I/O IN



Mating face of USB type B female

Pin #	Signal
1	Reset
2	– Data
3	+ Data
4	GND

EXP I/O OUT

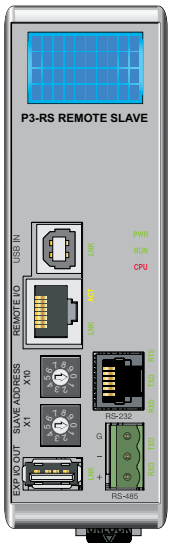


Mating face of USB type A female

Remote Slave Modules

The P3-RS and P3-RX are high-performance Remote Slave modules. Both modules feature several communications ports which support USB Expansion I/O, Ethernet Remote I/O, and serial devices. The P3-RS also includes a 4 line x 10 character LCD display and an additional USB IN (type B) port for remote CPU programming and monitoring.

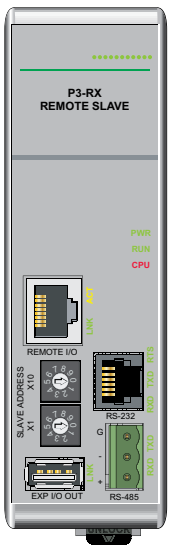
Up to 16 Remote Slaves can be connected to a single P3-550(E) for a remote I/O network.



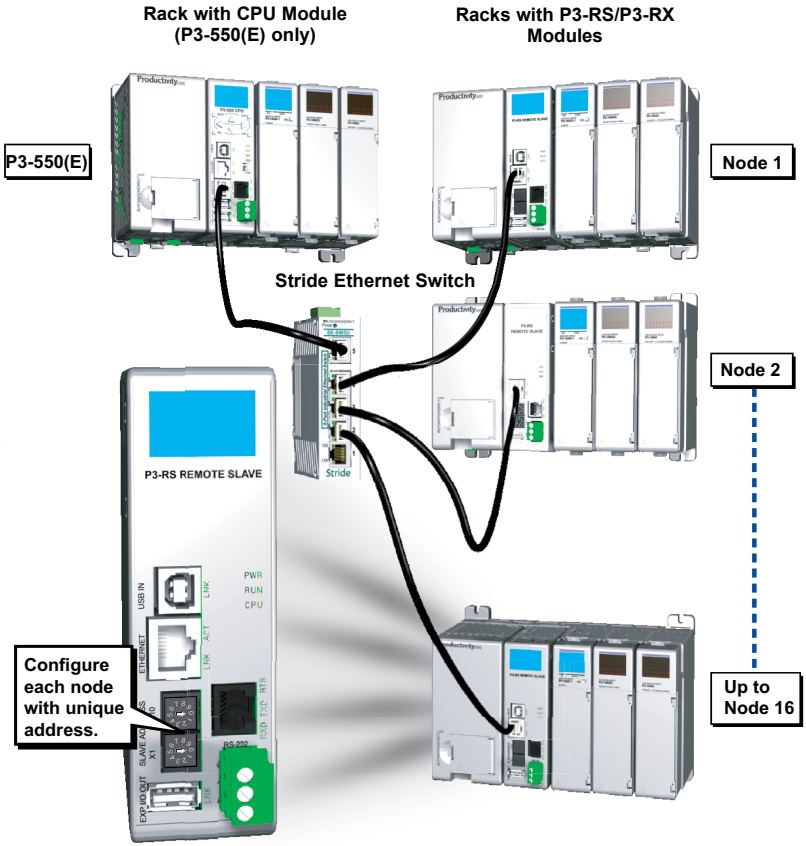
P3-RS



NOTE: *The P3-RS module is discontinued as of 06/20. Please use P3-RX as a replacement.*



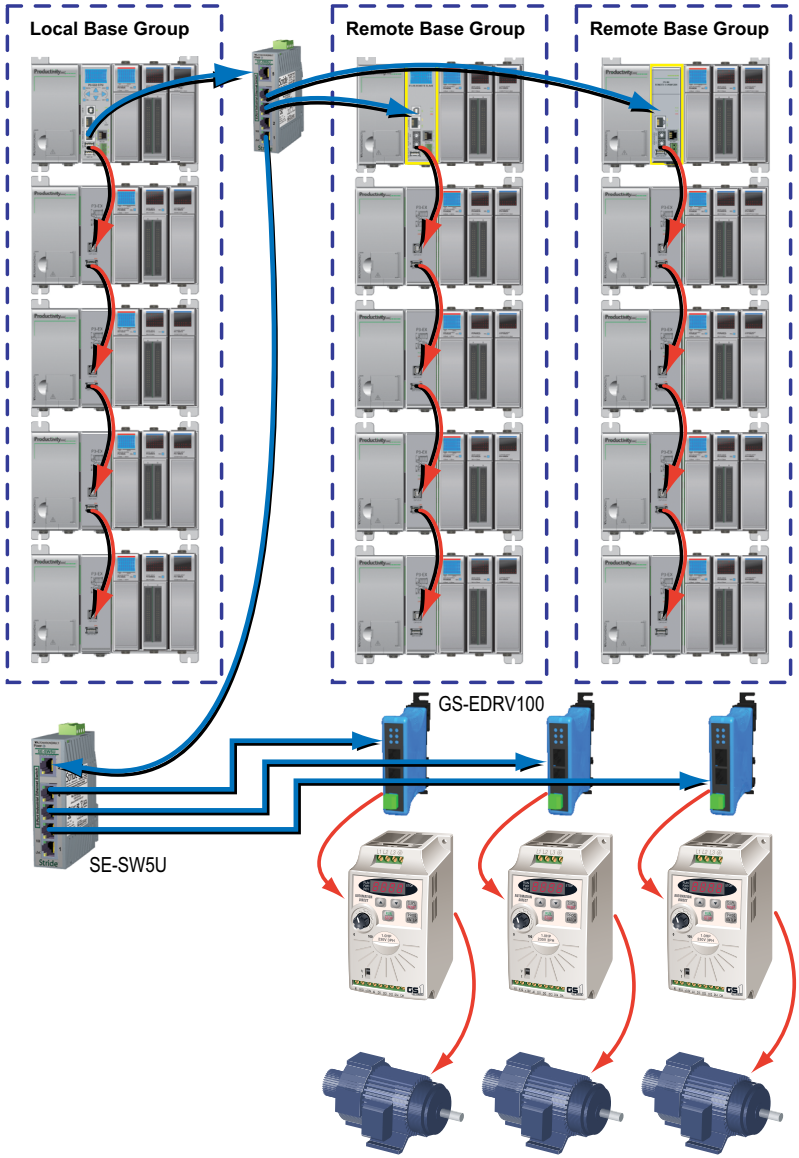
P3-RX



P3-RS/P3-RX Remote Slave Module Example (P3-622 Or P3-550(E) only)

Add up to 4 bases to each group using P3-EX expansion modules with USB connections.

Add up to 16 Remote Base Groups using P3-RS/RX Remote Slave modules and up to 32 GS Drives on the Remote I/O Ethernet Network.



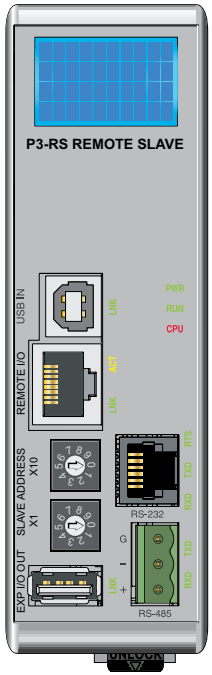
P3-RS Remote Slave Module Specifications

NOTE: *The P3-RS module is discontinued as of 06/20. Please use P3-RX as a replacement.*

Remote Slave Specifications P3-RS	
Mounting Location	Controller slot
Display	LCD, 4x10 characters, backlit, LCD characters are 5x7 with a dot pitch of 0.45 mm; 2.25 mm x 3.15 mm
Communications - 5 Integrated Ports	**USB IN:** (2.0, Type B) Programming, monitoring, debug **REMOTE I/O:** (10/100 Mbps Ethernet) 1 P3-550(E) **EXP I/O OUT:** (2.0, Type A, Proprietary) 4 P3-EX local expansion bases **RS-232:** (RJ12, 1200-115.2k Baud) ASCII, Modbus **RS-485:** (removable terminal included, 1200-115.2k Baud) ASCII, Modbus
Max. Number of Ethernet Remote I/O Bases	16
Max. Number of Expansion I/O Bases	68 (4 per CPU, 4 per remote base)
Max. Number of I/O per CPU System	59,840 (CPU Base with 4 expansion bases plus 16 remote bases with 4 expansion bases per remote, with 11 64-point I/O modules per base)

General Specifications	
Operating Temperature	0°C– 60°C (32°F–140°F)
Storage Temperature	-20ºC–70ºC (-4ºF–158ºF)
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	4W
Enclosure Type	Open equipment
Module Location	Controller slot in a remote base in a Productivity3000® system.
Weight	260g (9oz)
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.

**Meets EMC and Safety requirements. See the Declaration of Conformity for details.*



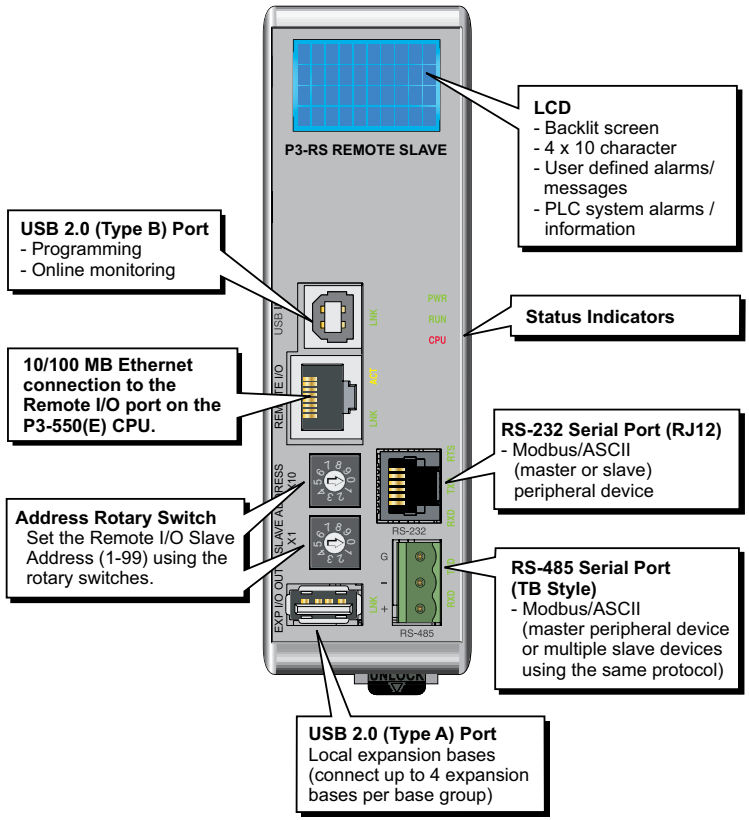
IMPORTANT!

Hot-Swapping Information

Note: This device cannot be Hot Swapped.

WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

P3-RS Remote Slave Module Front Panel



Status Indicators

RS Status Indicators	
PWR	Green LED is backlit when power is on
RUN	Green LED is backlit when CPU has valid project file with RS configured.
CPU	Red LED is backlit during power on reset, power down, or watch-dog time-out.

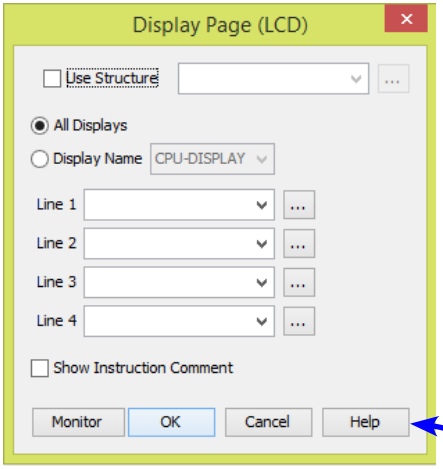


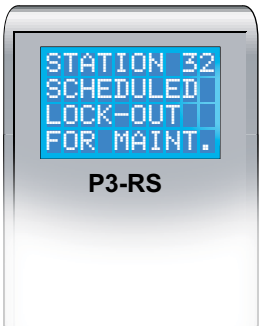
LCD Message Display (P3-RS only)

The P3-RS incorporates a 4 line x 10 character LCD for system errors and information or for displaying user-defined messages.

LCD characters are 5x7 with a dot pitch of 0.45 mm; 2.25 mm x 3.15 mm.





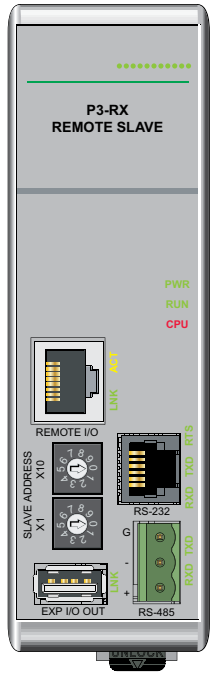


For user-defined messages, the display is configured using the ProductivitySuite Programming Software. An LCD Page instruction allows the user to program text into user-defined tags and display the messages based on the ladder execution.

See the ProductivitySuite Programming Software Help Files for complete details.

P3-RX Remote Slave Module Specifications

Remote Slave Specifications P3-RX	
Mounting Location	Controller slot
Communications - 4 Integrated Ports	**REMOTE I/O:** (10/100 Mbps Ethernet) 1 P3-550(E) **EXP I/O OUT:** (2.0, type A, proprietary) 4 P3-EX local expansion bases **RS-232:** (RJ12, 1200-115.2k Baud) ASCII, Modbus **RS-485:** (removable terminal included, 1200-115.2k Baud) ASCII, Modbus
Max. Number of Ethernet Remote I/O Bases	16
Max. Number of Expansion I/O Bases	68 (4 per CPU, 4 per remote base)
Max. Number of I/O per CPU System	59,840 (CPU Base with 4 expansion bases plus 16 remote bases with 4 expansion bases per remote, with 11 64-point I/O modules per base)



General Specifications	
Operating Temperature	0°C– 60°C (32°F–140°F)
Storage Temperature	-20ºC–70ºC (-4ºF–158ºF)
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	4W
Enclosure Type	Open equipment
Module Location	Controller slot in a remote base in a Productivity3000® system.
Weight	260g (9oz)
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.

**Meets EMC and Safety requirements. See the Declaration of Conformity for details.*

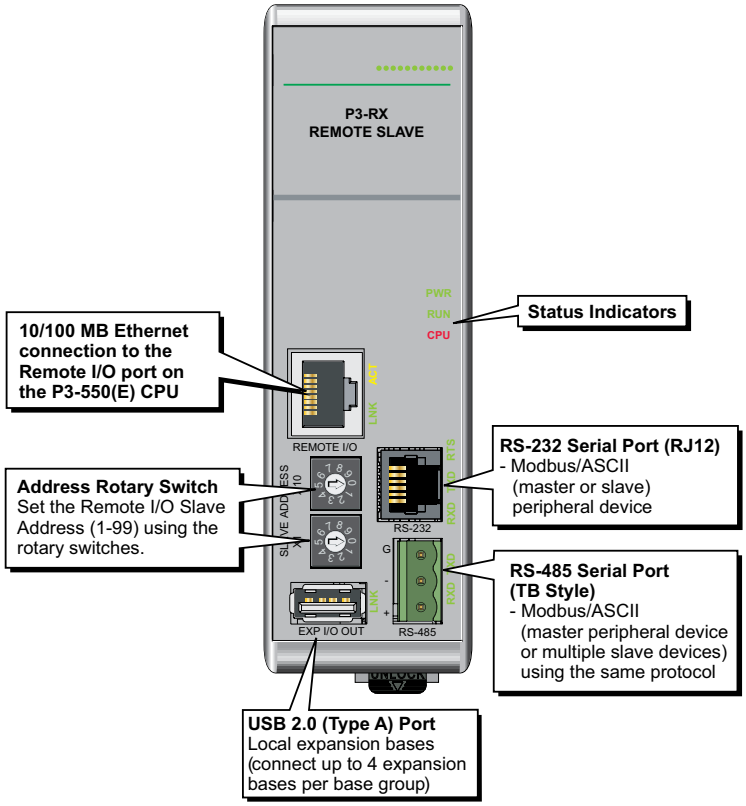
IMPORTANT!

Hot-Swapping Information
Note: This device cannot be Hot Swapped.

WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

NOTE: *When using the P3-RX, you must use Productivity3000® software version 1.0.7.XX and firmware version 1.1.13.XX or later.*

P3-RX Remote Slave Module Front Panel



Status Indicators

RS Status Indicators	
PWR	Green LED is backlit when power is on
RUN	Green LED is backlit when CPU has valid project file with RS configured.
CPU	Red LED is backlit during power on reset, power down, or watch-dog time-out.



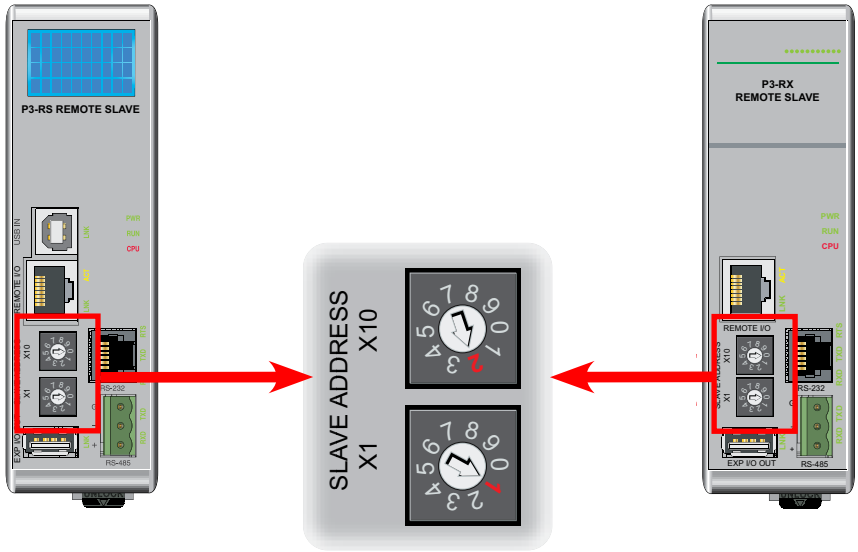
Setting the Remote Slave Address

Each Remote Slave must have a unique address between 1 and 99. The address is set using the two rotary switches located on the face of the module, X10 for setting the tens units and X1 for setting the ones unit.

For example, to set a remote slave address to 21, turn the X10 arrow until it points at number 2 and the X1 arrow until it points at number 1.

IMPORTANT NOTES:

- The factory setting of 00 is not a valid address.
- Address selection must be set prior to power-up.
- Slave addresses are only read on power-up.
- If there are duplicate slave addresses on the same network, a critical error (Error Code E2207) will occur.

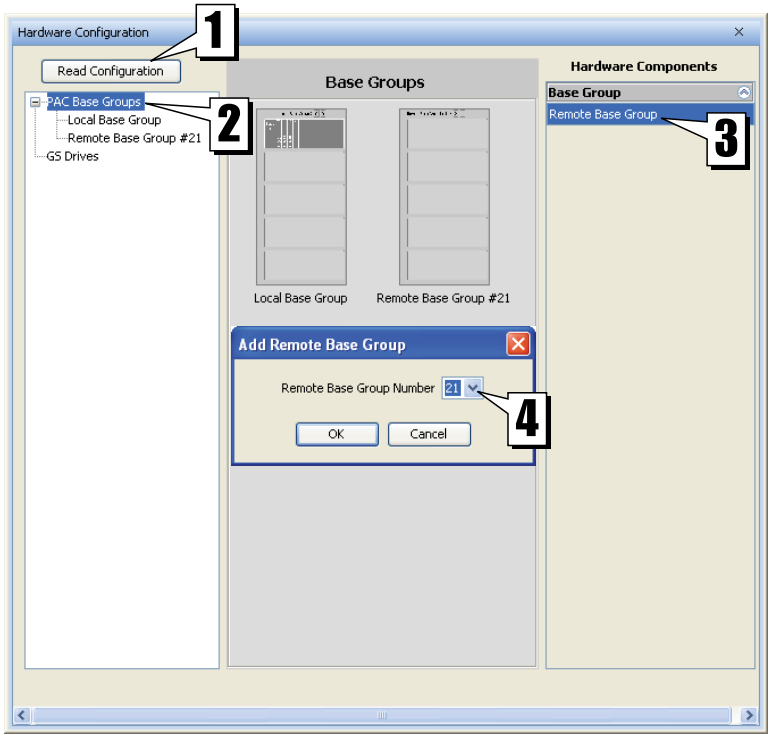


Setting the Remote Slave Address (continued)

It is also necessary to configure the remote addresses using the ProductivitySuite programming software.

For example, if connected online to a P3000 system with slaves installed, go to Hardware Configuration and select the Read Configuration (1) button. The CPU will automatically read the addresses of the remote slaves and add them to the configuration.

If setting up offline, go to Hardware Configuration, select CPU Base Groups (2), and then select Remote Base Group (3). In the Add Remote Base Group (4) window, select the same Remote Base Number as set on the rotary switches.



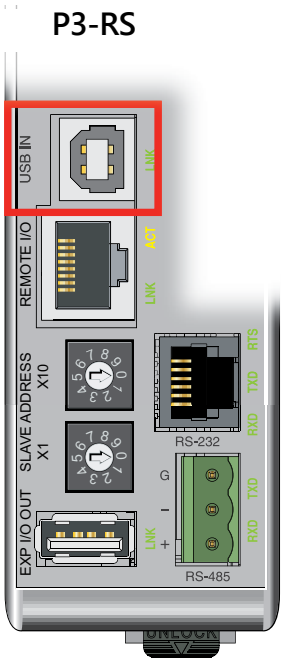
Port Specifications

The P3-RS and P3-RX Remote Slave modules have several communications ports and the following pages contain their specifications and pin-out diagrams.

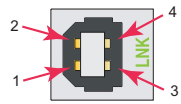
USB IN Port (P3-RS only)

Standard USB 2.0 (Type B) Slave input for remote CPU programming and online monitoring, with built-in surge protection.

P3-RS



USB IN Specifications	
Description	Standard USB 2.0 (Type B) Slave input for remote CPU programming and online monitoring, with built-in surge protection. Not compatible with older full speed USB devices.
Transfer Rate	480 Mbps
Port Status LED	Green LED is illuminated when LINK is established to programming software.
Cables	USB Type A to USB Type B: 3ft cable part # USB-CBL-AB3 6ft cable part # USB-CBL-AB6 10ft cable part # USB-CBL-AB10 15ft cable part # USB-CBL-AB15



Mating face of USB type B female

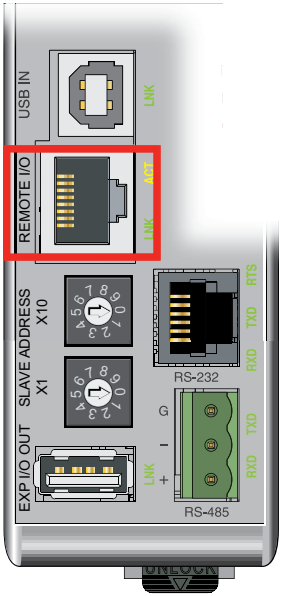
Pin #	Signal
1	+5
2	–Data
3	+Data
4	GND

NOTE: *The P3-RS module is discontinued as of 06/20. Please use P3-RX as a replacement.*

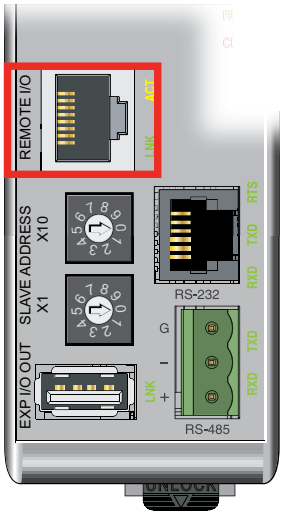
Remote I/O Port

Isolated Ethernet Port with built-in surge protection for connection to the CPU Remote I/O Master port.

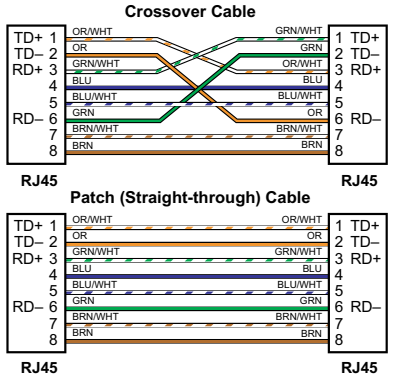
P3-RS

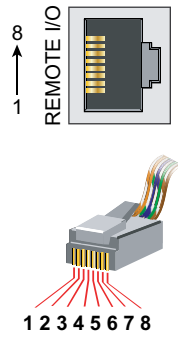


P3-RX



Remote I/O Port Specifications	
Description	Proprietary transformer isolated Ethernet Port with built-in surge protection for connection to CPU Remote I/O Master port.
Transfer Rate	10/100 Mbps
Port Status LEDs	Green LED is illuminated when network LINK is established. Yellow LED backlit when port is active (ACT).
Cables	Use a Patch (straight-through) cable when a switch or hub is used. Use a Crossover cable when a switch or hub is not used. (Cables are available at automationdirect.com)

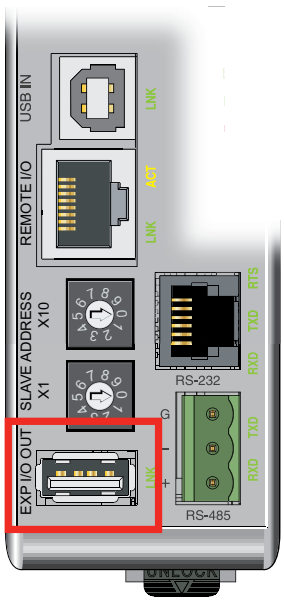




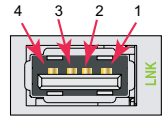
EXP I/O OUT Port

USB 2.0 (Type A) master output for connection for up to four P3-EX local expansion bases, with built-in surge protection.

P3-RS



EXP I/O OUT Specifications	
Description	Proprietary USB 2.0 (Type A) Master output for connection with up to four P3-EX local expansion bases, with built-in surge protection.
Transfer Rate	480 Mbps
Port Status LED	Green LED is illuminated when LINK is established to connected device
Cables	USB Type A to USB Type B. The P3-EX Expansion Module includes a 6 foot USB cable, part number P3-EX-CBL6.

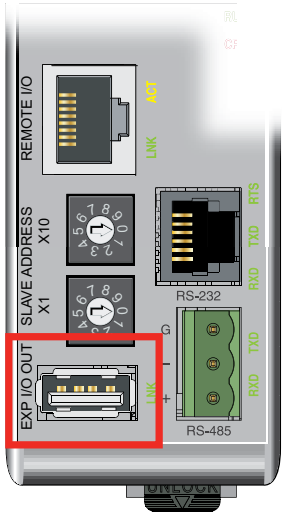


Mating face of USB type A female

Pin #	Signal
1	Reset
2	– Data
3	+ Data
4	GND

NOTE: *The P3-RS module is discontinued as of 06/20 Please use P3-RX as a replacement.*

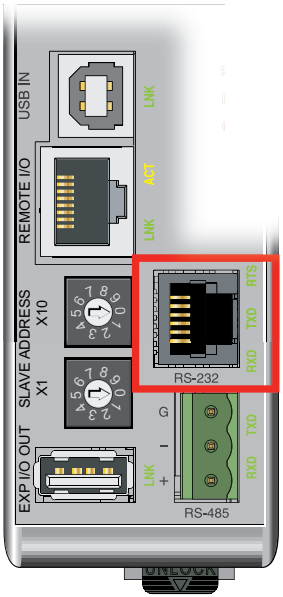
P3-RX



RS-232 Serial Port

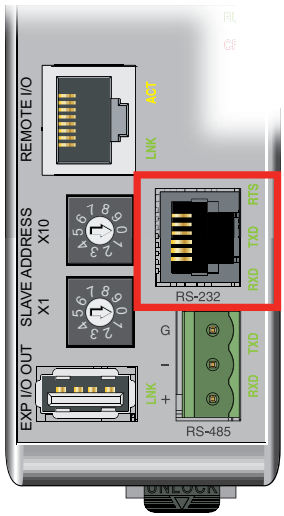
Non-isolated RS-232 DTE port connects the P3-RS/P3-RX as a Modbus or ASCII master or slave to a peripheral device.

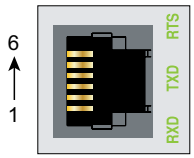
P3-RS



RS-232 Specifications	
Description	Non-isolated RS-232 DTE port connects the P3-RS/P3-RX as a Modbus or ASCII master or slave to a peripheral device. Includes ESD and built-in surge protection.
Data Rates	Selectable,1200, 2400, 9600, 19200, 33600, 38400, 57600, and 115200 bps.
+5V Cable Power Source	210mA maximum at 5V, ±5%. Limited by resettable fuse. Reverse polarity protected.
TXD	RS-232 Transmit output
RXD	RS-232 Receive input
RTS	Handshaking output for modem control.
GND	Logic ground
Maximum Output Load (TXD/RTS)	3kV, 1,000pf
Minimum Output Voltage Swing	±5V
Output Short Circuit Protection	±15mA
Port Status LED	Green LED is illuminated when active for TXD, RXD and RTS
Cable Options	FA-ISOCON for converting RS-232 to isolated RS-485

P3-RX





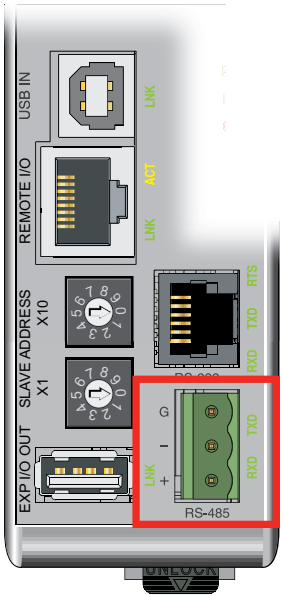
6-pin RJ12 Female Modular Connector

Pin #	Signal	
1	GND	Logic Ground
2	+5V	210 mA Maximum
3	RXD	RS-232 Input
4	TXD	RS-232 Output
5	RTS	RS-232 Output
6	GND	Logic Ground

RS-485 Serial Port

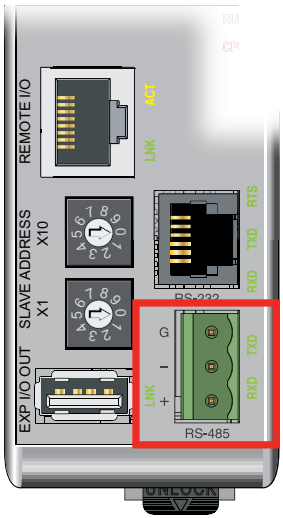
Non-isolated RS-485 port connects the P3-RS/P3-RX as a Modbus or ASCII master or slave to a peripheral device.

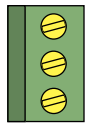
P3-RS



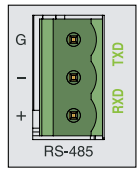
RS-485 Specifications	
Description	Non-isolated RS-485 port connects the P3-RS/P3-RX as a Modbus or ASCII master or slave to a peripheral device. Includes ESD/EFT protection and automatic echo cancellation when transmitter is active.
Data Rates	Selectable, 1200, 2400, 9600, 19200, 33600, 38400, 57600, and 115200.
TXD+/RXD+	RS-485 transceiver high
TXD-/RXD-	RS-485 transceiver low
GND	Logic ground
Input Impedance	19kΩ
Maximum load	50 transceivers, 19kV each, 60V termination
Output Short Circuit Protection	±250mA, thermal shut-down protection
Electrostatic Discharge Protection	±8KV per IEC1000-4-2
Electrical Fast Transient Protection	±2KV per IEC1000-4-4
Minimum Differential Output Voltage	1.5 V with 60V load
Fail safe inputs	Logic high input state if inputs are unconnected
Maximum Common Mode Voltage	-7.5 V to 12.5 V
Port Status LED	Green LED is illuminated when active for TXD and RXD
Cable Options	L19827-100, L19827-500, L19827-1000 or Belden 9841 equivalent

P3-RX





Removable connector included.



Pin #	Signal
G	GND
–	TXD-/RXD-
+	TXD+/RXD+

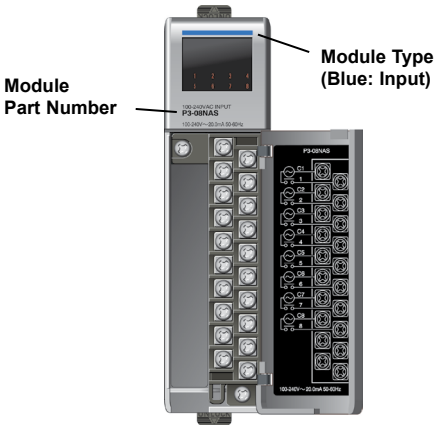
Terminal Block Specifications	
Number of Positions	3
Pitch	5 MM
Wire Range	28-12AWG Solid Conductor 30-12AWG Stranded Conductor
Screw Driver Width	1/8 inch (3.175mm) maximum
Screw Size	M2.5
Screw Torque	4.5 Lb-in

I/O Modules Overview

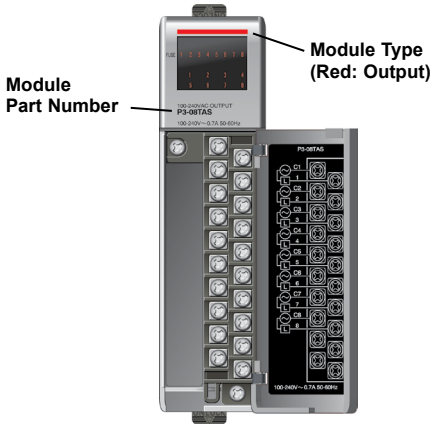
A variety of discrete and analog I/O modules are available for use in local, expansion, and remote I/O bases.

Each I/O module is identified as an "Input", "Output", or "Input/Output" module on its front panel using the color coding scheme listed below. See the following pages for discrete I/O module specifications, Chapter 3 for analog I/O module specifications and Chapter 4 for specialty module specifications.

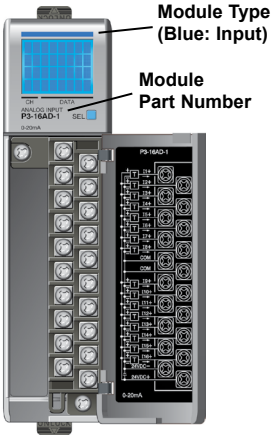
Discrete Input Modules



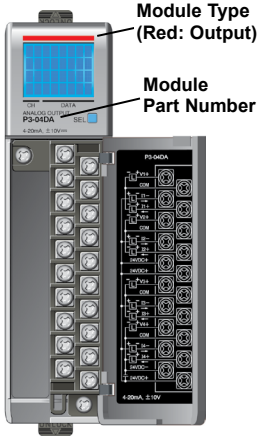
Discrete Output Modules



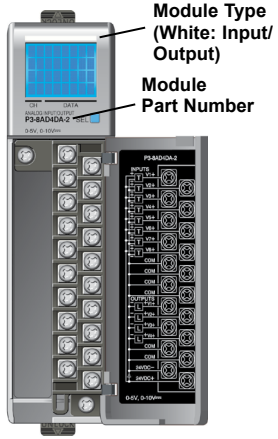
Analog Input Modules



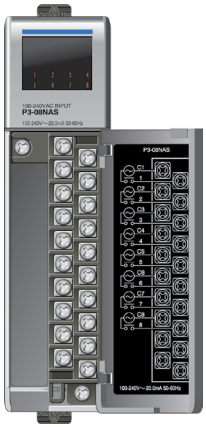
Analog Output Modules



Analog Input/Output Modules



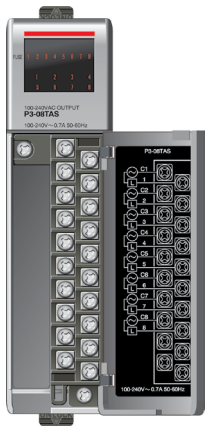
Discrete I/O Modules



Discrete Input Modules

Productivity3000 Discrete Input Modules			
Part Number	Number of Inputs	Description	See Page
P3-16SIM	16	Input Simulator Module	2-47
P3-08ND3S	8	Isolated Sinking/Sourcing DC Input	2-48
P3-16ND3	16	Sinking/Sourcing DC Input	2-51
P3-32ND3*	32	Sinking/Sourcing DC Input	2-54
P3-64ND3*	64	Sinking/Sourcing DC Input	2-56
P3-08NAS	8	Isolated AC Input	2-58
P3-16NA	16	Isolated AC Input	2-61

**ZIPLink required.*



Discrete Output Modules

Productivity3000 Discrete Output Modules			
Part Number	Number of Outputs	Description	See Page
P3-08TD1S	8	Isolated Sinking Output	2-64
P3-08TD2S	8	Isolated Sourcing Output	2-67
P3-16TD1	16	Sinking Output	2-70
P3-16TD2	16	Sourcing Output	2-73
P3-32TD1*	32	Sinking Output	2-76
P3-32TD2*	32	Sourcing Output	2-79
P3-64TD1*	64	Sinking Output	2-82
P3-64TD2*	64	Sourcing Output	2-85
P3-08TAS	8	Isolated AC Output	2-88
P3-16TA	16	AC Output	2-91
P3-08TRS	8	Isolated Relay Output	2-94
P3-16TR	16	Relay Output	2-97
P3-08TRS-1	8	Isolated Relay Output	2-100
P3-16TD3P*	16	Sinking/Sourcing Protected Output	2-103

**ZIPLink required.*

P3-16SIM Input Simulator

The P3-16SIM Input Simulator module provides 16 toggle switches to simulate input devices.



Input Specifications

Inputs per Module	16 Internal switches
OFF to ON Response	Max. 20ms
ON to OFF Response	Max. 20ms
Status Indicators	Logic Side (16 points)

General Specifications

Operating Temperature	0°C– 60°C (32°F–140°F),
Storage Temperature	-20ºC–70ºC (-4ºF–158ºF)
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	0.25 W
Enclosure Type	Open equipment
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000® system.
Weight	120g (4.23 oz)
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.

**Meets EMC and Safety requirements. See the Declaration of Conformity for details.*

WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

P3-08ND3S Isolated Sinking/Sourcing Input

The P3-08ND3S DC Input Module provides eight 12-24 VDC sinking or sourcing isolated inputs.



Terminal block sold separately; terminal block cover included with module.

Input Specifications

Inputs per Module		8 (sinking / sourcing)
Operating Voltage Range (Tolerance)	CE	12–24 VDC (±10%)
	UL	12–24 VDC (±10%)
Peak Voltage		26.4 VDC
Input Current (Typical)		5mA @ 12VDC 11mA @ 24VDC
Maximum Input Current @ Temp		12.5 mA @ 60° C (26.4 VDC)
Input Impedance		2.2 kΩ @ 12–24 VDC
ON Voltage Level		> 10VDC
OFF Voltage Level		< 3VDC
Minimum ON Current		4mA
Maximum OFF Current		2mA
OFF to ON Response		Max. 2ms typical 1ms
ON to OFF Response		Max. 2ms typical 1ms
Status Indicators		Logic Side (8 points)
Terminal Type (not included)		20-position removable terminal block
Commons		8 Isolated (1 point / common)

Removable Terminal Block Specifications

Number of Positions	20 screw terminals
Wire Range	22–14 AWG (0.324 to 2.08 sq. mm) Solid / stranded conductor 3/64 in. (1.2 mm) insulation maximum USE COPPER CONDUCTORS , 60°C or equivalent.
Screw Driver Width	1/4 inch (6.5 mm) maximum
Screw Size	M3 size
Screw Torque	Field terminals: 7–9 in./lb (0.882–1.02 N·m) Self-jacking screws: 2.7–3.6 in./lb (0.3–0.4 N·m). Do not over-tighten screws when installing terminal block.

We recommend using prewired ZIPLink cables and connection modules. See Chapter 5.
Terminal block cover included. If you wish to hand-wire your module, a removable terminal block is sold separately. Order part number P3-RTB.

P3-08ND3S Isolated Sinking/Sourcing Input (continued)

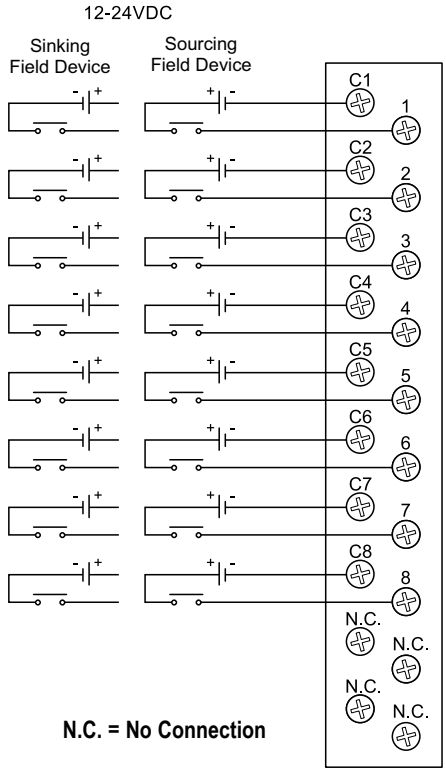
General Specifications	
Operating Temperature	0°C– 60°C (32°F–140°F),
Storage Temperature	-20ºC–70ºC (-4ºF–158ºF)
Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	IEC60068-2-6 (Test Fc)
Shock	IEC60068-2-27 (Test Ea)
Field to Logic Side Isolation	1500 VAC applied for 1 minute
Insulation Resistance	>10MΩ @ 500VDC
Heat Dissipation	2.81 W
Enclosure Type	Open equipment
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000® system..
Field Wiring	Removable terminal block (not included). Use ***ZIP***Link wiring system or optional terminal block. See Chapter 5.
Weight	80g (2.82 oz)
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.

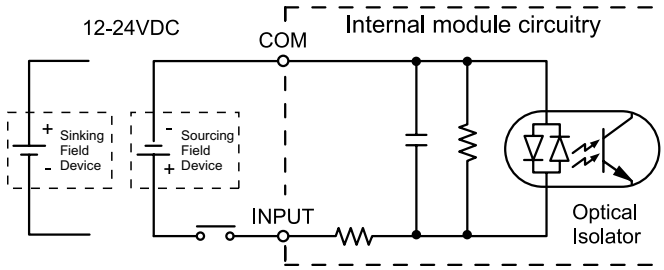
**Meets EMC and Safety requirements. See the Declaration of Conformity for details.*

WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

P3-08ND3S Isolated Sinking/Sourcing Input (continued)

Wiring Diagrams





P3-16ND3 Sinking/Sourcing Input

The P3-16ND3 DC Input Module provides sixteen 12-24 VDC sinking or sourcing inputs with four isolated commons.



Terminal block sold separately; terminal block cover included with module.

Input Specifications

Inputs per Module		16 (sinking / sourcing)
Operating Voltage Range (Tolerance)	CE	12–24 VDC (±10%)
	UL	12–24 VDC (±10%)
Peak Voltage		26.4 VDC
Input Current (Typical)		5mA @ 12VDC 11mA @ 24VDC
Maximum Input Current @ Temp		12.5 mA @ 60° C (26.4 VDC)
Input Impedance		2.2 kΩ @ 12–24 VDC
ON Voltage Level		> 10VDC
OFF Voltage Level		< 3VDC
Minimum ON Current		4mA
Maximum OFF Current		2mA
OFF to ON Response		Max. 2ms Typical 1ms
ON to OFF Response		Max. 2ms Typical 1ms
Status Indicators		Logic Side (16 points)
Terminal Type (not included)		20-position removable terminal block
Commons		4 Isolated (4 points / common)

Removable Terminal Block Specifications

Number of Positions	20 screw terminals
Wire Range	22–14 AWG (0.324 to 2.08 sq. mm) Solid / stranded conductor 3/64 in. (1.2 mm) insulation maximum USE COPPER CONDUCTORS , 60°C or equivalent.
Screw Driver Width	1/4 inch (6.5 mm) maximum
Screw Size	M3 size
Screw Torque	Field terminals: 7–9 in./lb (0.882–1.02 N·m) Self-jacking screws: 2.7–3.6 in./lb (0.3–0.4 N·m). Do not over-tighten screws when installing terminal block.

We recommend using prewired ZIPLink cables and connection modules. See Chapter 5.
Terminal block cover included. If you wish to hand-wire your module, a removable terminal block is sold separately. Order part number P3-RTB.

P3-16ND3 Sinking/Sourcing Input (continued)

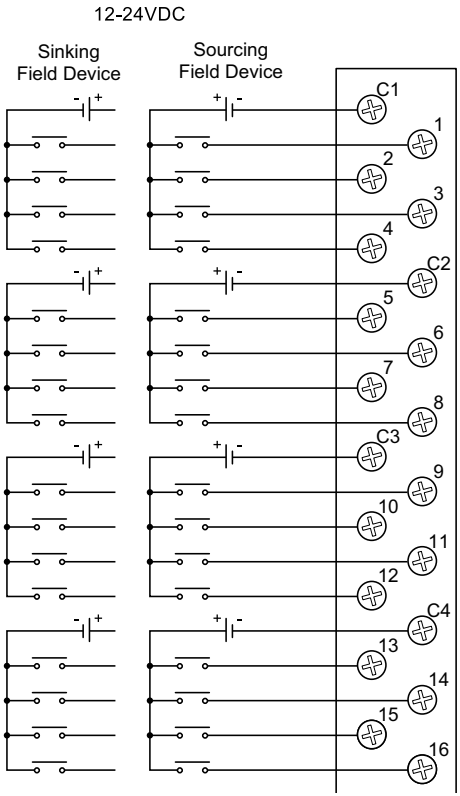
General Specifications	
Operating Temperature	0°C– 60°C (32°F–140°F),
Storage Temperature	-20ºC–70ºC (-4ºF–158ºF)
Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	IEC60068-2-6 (Test Fc)
Shock	IEC60068-2-27 (Test Ea)
Field to Logic Side Isolation	1500VAC applied for 1 minute
Insulation Resistance	>10MΩ @ 500VDC
Heat Dissipation	5.61 W
Enclosure Type	Open equipment
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000® system..
Field Wiring	Removable terminal block (not included). Use ***ZIP***Link wiring system or optional terminal block. See Chapter 5.
Weight	80g (2.82 oz)
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.

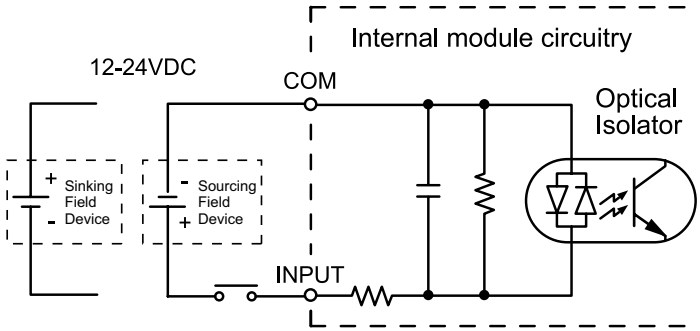
**Meets EMC and Safety requirements. See the Declaration of Conformity for details.*

WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

P3-16ND3 Sinking/Sourcing Input (continued)

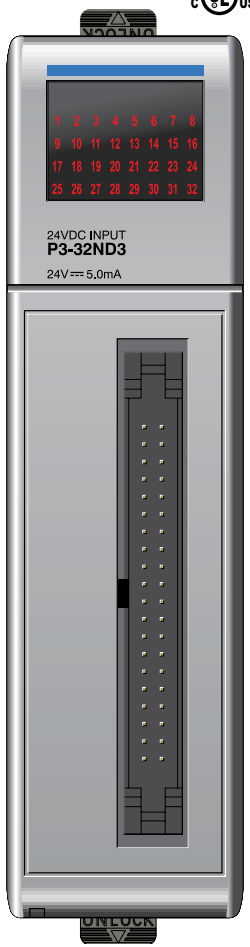
Wiring Diagrams





P3-32ND3 Sinking/Sourcing Input

The P3-32ND3 DC Input Module provides thirty-two 24VDC sinking or sourcing inputs with four isolated commons.



No terminal block sold for this module; ZIPLink required. See Chapter 5 for part numbers of ZIPLink cables and connection modules required with this module.

Input Specifications

Inputs per Module		32 (sinking / sourcing)
Operating Voltage Range (Tolerance)	CE	24VDC (±10%)
	UL	24VDC (±10%)
Peak Voltage		26.4 VDC
Input Current (Typical)		5mA @ 24VDC
Maximum Input Current @ Temp		6mA @ 60° C (26.4 VDC)
Input Impedance		4.7 kΩ @ 24VDC
ON Voltage Level		> 18VDC
OFF Voltage Level		< 8VDC
Minimum ON Current		3.5 mA
Maximum OFF Current		2mA
OFF to ON Response		Max. 2ms Typical 1ms
ON to OFF Response		Max. 2ms Typical 1ms
Status Indicators		Logic Side (32 points)
Connector Type		40-pin IDC
Commons		4 Isolated (8 points / common)

General Specifications

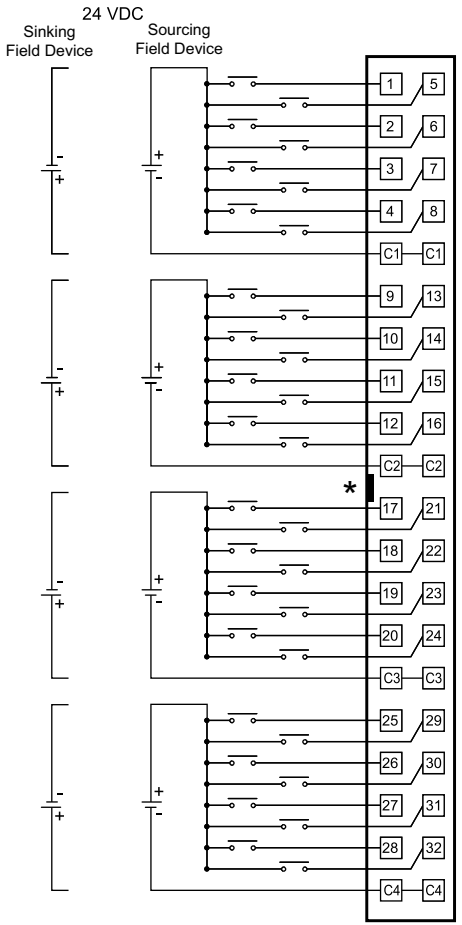
Operating Temperature	0°C– 60°C (32°F–140°F),
Storage Temperature	-20ºC–70ºC (-4ºF–158ºF)
Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	IEC60068-2-6 (Test Fc)
Shock	IEC60068-2-27 (Test Ea)
Field to Logic Side Isolation	1500VAC applied for 1 minute
Insulation Resistance	>10MΩ @ 500VDC
Heat Dissipation	5.96 W
Enclosure Type	Open equipment
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000® system..
Field Wiring	Use ***ZIP***Link wiring system. See Chapter 5.
Weight	120g (4.23 oz)
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.

**Meets EMC and Safety requirements. See the Declaration of Conformity for details.*

WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

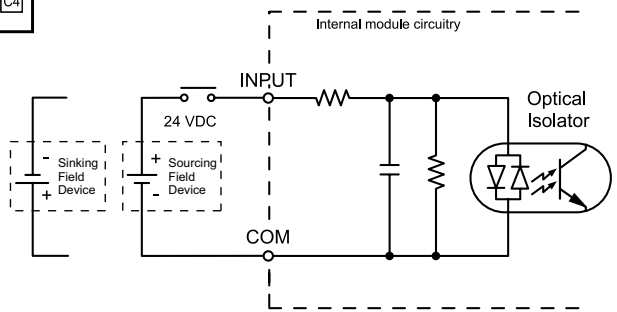
P3-32ND3 Sinking/Sourcing Input (continued)

Wiring Diagrams



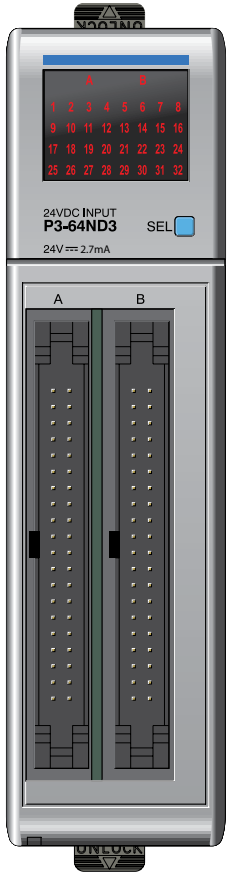
***Denotes key location of all associated ZIPLink cables.**

Connector Specifications	
Connector Type	IDC style header with latch, Omron XG4A-4034
Number of Pins	40 point
Pitch	0.1 in. (2.54 mm)



P3-64ND3 Sinking/Sourcing Input

The P3-64ND3 DC Input Module provides sixty-four 24VDC sinking or sourcing inputs with eight isolated commons.



No terminal block sold for this module; ZIPLink required. See Chapter 5 for part numbers of ZIPLink cables and connection modules required with this module.

Input Specifications

Inputs per Module		64 (sinking / sourcing)
Operating Voltage Range (Tolerance)	CE	24VDC (±10%)
	UL	24VDC (±10%)
Peak Voltage		26.4 VDC
Input Current (Typical)		2.7 mA @ 24VDC
Maximum Input Current @ Temp		3.5 mA @ 60° C (26.4 VDC)
Input Impedance		8.2 kΩ @ 24VDC
ON Voltage Level		> 18VDC
OFF Voltage Level		< 8VDC
Minimum ON Current		2mA
Maximum OFF Current		1.1 mA
OFF to ON Response		Max. 2ms Typical 1ms
ON to OFF Response		Max. 2ms Typical 1ms
Status Indicators		Logic Side (32 points x 2)
Connector Type		Two 40-pin IDC
Commons		8 Isolated (8 points / common)

General Specifications

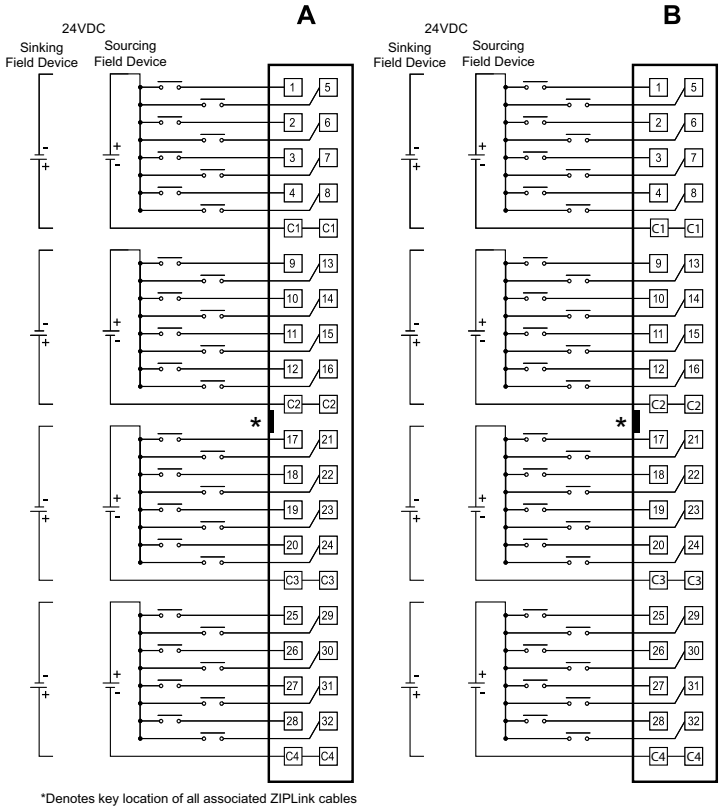
Operating Temperature	0°C– 60°C (32°F–140°F),
Storage Temperature	-20ºC–70ºC (-4ºF–158ºF)
Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	IEC60068-2-6 (Test Fc)
Shock	IEC60068-2-27 (Test Ea)
Field to Logic Side Isolation	1500VAC applied for 1 minute
Insulation Resistance	>10MΩ @ 500VDC
Heat Dissipation	6.91 W
Enclosure Type	Open equipment
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000® system..
Field Wiring	Use ***ZIP***Link wiring system. See Chapter 5.
Weight	170g (6.00 oz)
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.

**Meets EMC and Safety requirements. See the Declaration of Conformity for details.*

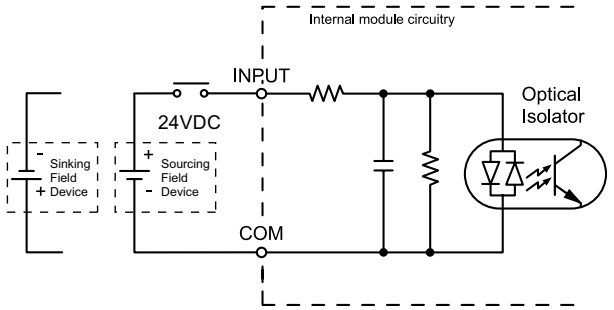
P3-64ND3 Sinking/Sourcing Input (continued)

Connector Specifications	
Connector Type	IDC style header with latch, Omron XG4A-4034
Number of Pins	40 point x 2
Pitch	0.1 in. (2.54 mm)

Wiring Diagrams

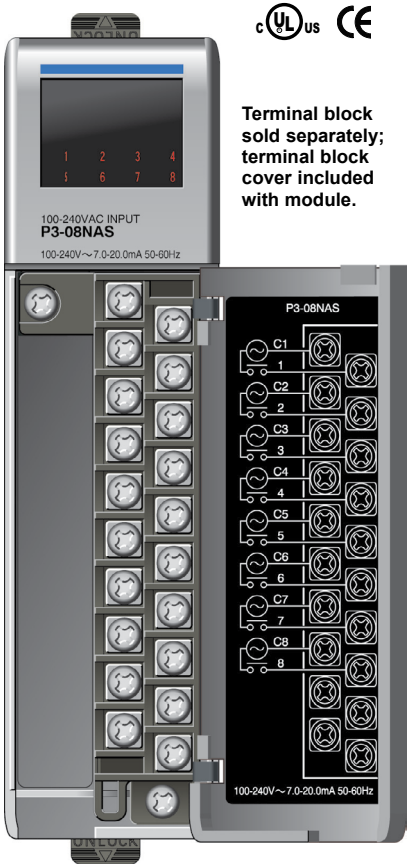


*Denotes key location of all associated ZIPLink cables



P3-08NAS AC Isolated Input

The P3-08NAS AC Isolated Input Module provides eight 100-240 VAC isolated inputs.



Terminal block sold separately; terminal block cover included with module.

Input Specifications

Inputs per Module		8
Operating Voltage Range (Tolerance)	CE	100–240 VAC (±20%)
	UL	100–240 VAC (±20%)
AC Frequency		47 - 63 Hz
Input Current (Typical)		8.5 mA @ 100VAC (50Hz) 10mA @ 100VAC (60Hz) 17mA @ 240VAC (50Hz) 20mA @ 240VAC (60Hz)
Maximum Input Current @ Temp		26mA @ 60° C (288VAC)
Input Impedance		15kΩ (50Hz), 12kΩ (60Hz)
ON Voltage Level		> 70VAC
OFF Voltage Level		< 20VAC
Minimum ON Current		5mA
Maximum OFF Current		2mA
OFF to ON Response		< 10ms
ON to OFF Response		< 25ms
Status Indicators		Logic side (8 points)
Terminal Type (not included)		20-position removable terminal block
Commons		8 Isolated (1 point / common)

Removable Terminal Block Specifications

Number of Positions	20 screw terminals
Wire Range	22–14 AWG (0.324 to 2.08 sq. mm) Solid / stranded conductor 3/64 in. (1.2 mm) insulation maximum USE COPPER CONDUCTORS , 60°C or equivalent.
Screw Driver Width	1/4 inch (6.5 mm) maximum
Screw Size	M3 size
Screw Torque	Field terminals: 7–9 in./lb (0.882–1.02 N·m) Self-jacking screws: 2.7–3.6 in./lb (0.3–0.4 N·m). Do not over-tighten screws when installing terminal block.

We recommend using prewired ZIPLink cables and connection modules. See Chapter 5.
Terminal block cover included. If you wish to hand-wire your module, a removable terminal block is sold separately. Order part number P3-RTB.

P3-08NAS AC Isolated Input (continued)

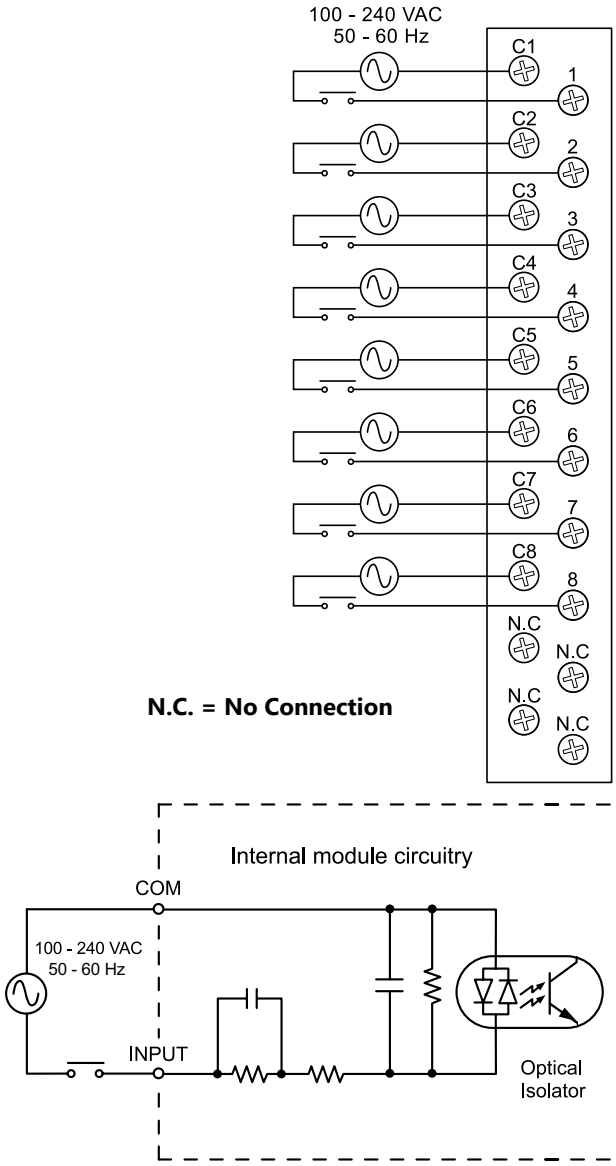
General Specifications	
Operating Temperature	0°C– 60°C (32°F–140°F),
Storage Temperature	-20ºC–70ºC (-4ºF–158ºF)
Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	IEC60068-2-6 (Test Fc)
Shock	IEC60068-2-27 (Test Ea)
Field to Logic Side Isolation	1500VAC applied for 1 minute
Insulation Resistance	>10MΩ @ 500VDC
Heat Dissipation	4.38 W
Enclosure Type	Open equipment
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000® system..
Field Wiring	Removable terminal block (not included). Use ***ZIP***Link wiring system or optional terminal block. See Chapter 5.
Weight	95g (3.35 oz)
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.

**Meets EMC and Safety requirements. See the Declaration of Conformity for details.*

WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

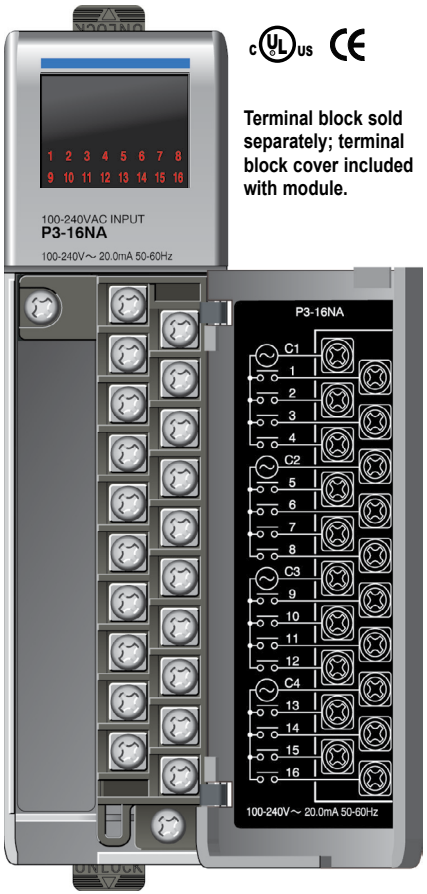
P3-08NAS AC Isolated Input (continued)

Wiring Diagrams



P3-16NA AC Input

The P3-16NA AC Input Module provides sixteen 100–240 VAC inputs with four isolated commons.



Terminal block sold separately; terminal block cover included with module.

Input Specifications

Inputs per Module		16
Operating Voltage Range (Tolerance)	CE	100–240 VAC (±20%)
	UL	100–240 VAC (±20%)
AC Frequency		47–63 Hz
Input Current (Typical)		8.5 mA @ 100VAC (50Hz) 10mA @ 100VAC (60Hz) 17mA @ 240VAC (50Hz) 20mA @ 240VAC (60Hz)
Maximum Input Current @ Temp		26mA @ 60° C (288VAC)
Input Impedance		15kΩ (50Hz), 12kΩ (60Hz)
ON Voltage Level		> 70VAC
OFF Voltage Level		< 20VAC
Minimum ON Current		5mA
Maximum OFF Current		2mA
OFF to ON Response		< 10ms
ON to OFF Response		< 25ms
Status Indicators		Logic side (16 points)
Terminal Type (not included)		20-position removable terminal block
Commons		4 Isolated (4 points / common)

Removable Terminal Block Specifications

Number of Positions	20 screw terminals
Wire Range	22–14 AWG (0.324 to 2.08 sq. mm) Solid / stranded conductor 3/64 in. (1.2 mm) insulation maximum USE COPPER CONDUCTORS , 60°C or equivalent.
Screw Driver Width	1/4 inch (6.5 mm) maximum
Screw Size	M3 size
Screw Torque	Field terminals: 7–9 in./lb (0.882–1.02 N·m) Self-jacking screws: 2.7–3.6 in./lb (0.3–0.4 N·m). Do not over-tighten screws when installing terminal block.

We recommend using prewired ZIPLink cables and connection modules. See Chapter 5.
Terminal block cover included. If you wish to hand-wire your module, a removable terminal block is sold separately. Order part number P3-RTB.

P3-16NA AC Input (continued)

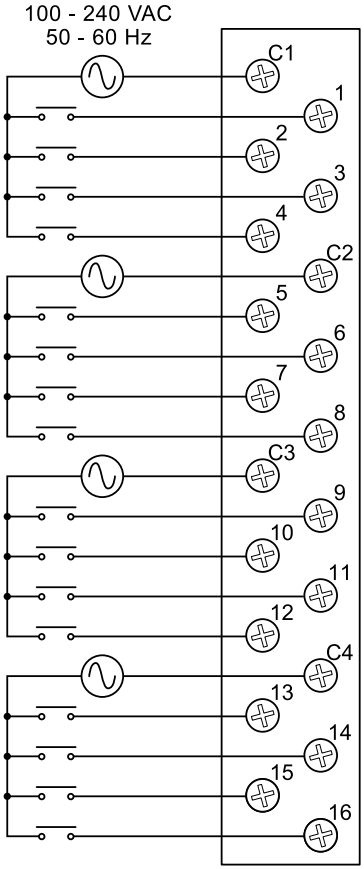
General Specifications	
Operating Temperature	0°C– 60°C (32°F–140°F),
Storage Temperature	-20ºC–70ºC (-4ºF–158ºF)
Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	IEC60068-2-6 (Test Fc)
Shock	IEC60068-2-27 (Test Ea)
Field to Logic Side Isolation	1500VAC applied for 1 minute
Insulation Resistance	>10MΩ @ 500VDC
Heat Dissipation	8.76 W
Enclosure Type	Open equipment
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000® system..
Field Wiring	Removable terminal block (not included). Use ***ZIP***Link wiring system or optional terminal block. See Chapter 5.
Weight	95g (3.35 oz)
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.

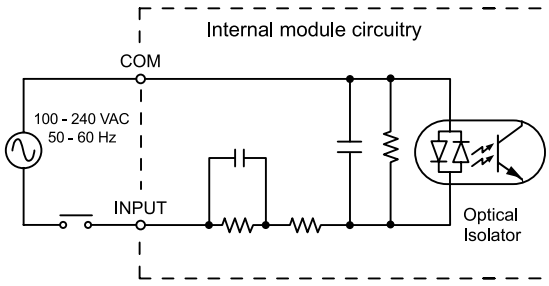
**Meets EMC and Safety requirements. See the Declaration of Conformity for details.*

WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

P3-16NA AC Input (continued)

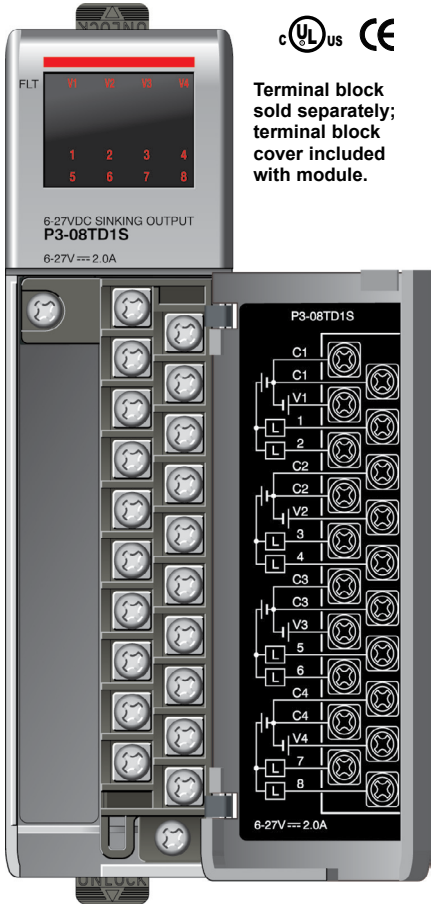
Wiring Diagrams





P3-08TD1S Sinking Output

The P3-08TD1S DC Output Module provides eight 6–27 VDC sinking outputs with four isolated commons.



Terminal block sold separately; terminal block cover included with module.

Output Specifications

Outputs per Module		8 (sinking)
Operating Voltage Range (Tolerance)	CE	6.25–24 VDC (-15% / + 20%)
	UL	6–27 VDC (-15% / + 10%)
Maximum Output Current @ Temp		2A / point, 4A / common @ 60°C
Minimum Output Current		0.4 mA
Maximum Leakage Current		0.3 mA @ 30VDC
On Voltage Drop		0.4 VDC @ 2A
Maximum Inrush Current		4A for 10ms, per point
OFF to ON Response		≤ 1ms
ON to OFF Response		≤ 1ms
Terminal Type (not included)		20-position removable terminal block
Status Indicators		Logic Side (8 points)
External 24 V Error Indicator*		Logic Side (4 points)
Commons		4 Isolated (2 points / common)
External DC Power required		24VDC ±10%, 30mA

***Note:** FLT (fault) indicates the absence of 24VDC at a V1, V2, V3, or V4 terminal.

Removable Terminal Block Specifications

Number of Positions	20 screw terminals
Wire Range	22–14 AWG (0.324 to 2.08 sq. mm) Solid / stranded conductor 3/64 in. (1.2 mm) insulation maximum USE COPPER CONDUCTORS , 60°C or equivalent.
Screw Driver Width	1/4 inch (6.5 mm) maximum
Screw Size	M3 size
Screw Torque	Field terminals: 7–9 in./lb (0.882–1.02 N·m) Self-jacking screws: 2.7–3.6 in./lb (0.3–0.4 N·m). Do not over-tighten screws when installing terminal block.

We recommend using prewired ZIPLink cables and connection modules. See Chapter 5.
Terminal block cover included. If you wish to hand-wire your module, a removable terminal block is sold separately. Order part number P3-RTB.

P3-08TD1S Sinking Output (continued)

General Specifications	
Operating Temperature	0°C– 60°C (32°F–140°F),
Storage Temperature	-20ºC–70ºC (-4ºF–158ºF)
Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	IEC60068-2-6 (Test Fc)
Shock	IEC60068-2-27 (Test Ea)
Field to Logic Side Isolation	1500VAC applied for 1 minute
Insulation Resistance	>10MΩ @ 500 VDC
Heat Dissipation	7.69 W
Enclosure Type	Open equipment
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000® system..
Field Wiring	Removable terminal block (not included). Use ***ZIP***Link wiring system or optional terminal block. See Chapter 5.
Weight	110g (3.88 oz)
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.

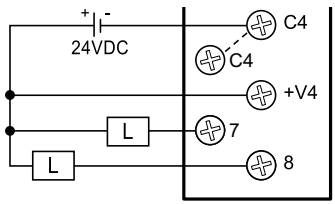
**Meets EMC and Safety requirements. See the Declaration of Conformity for details.*

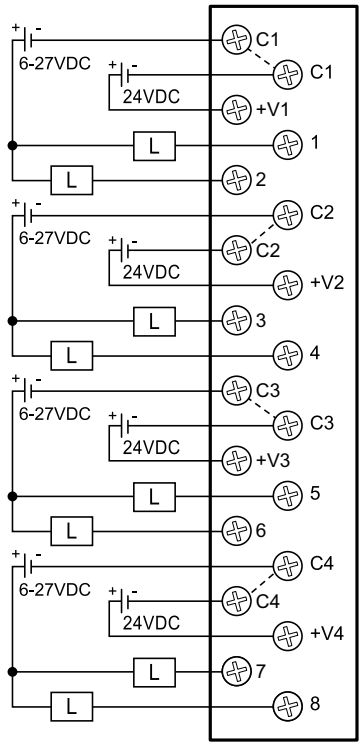
WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

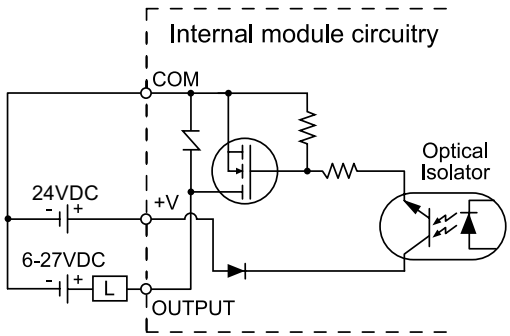
P3-08TD1S Sinking Output (continued)

Wiring Diagrams

- Shown rating in figure is an operating voltage
- Each C1 terminal is connected inside the module.
- Each C2 terminal is connected inside the module.
- Each C3 terminal is connected inside the module.
- Each C4 terminal is connected inside the module.

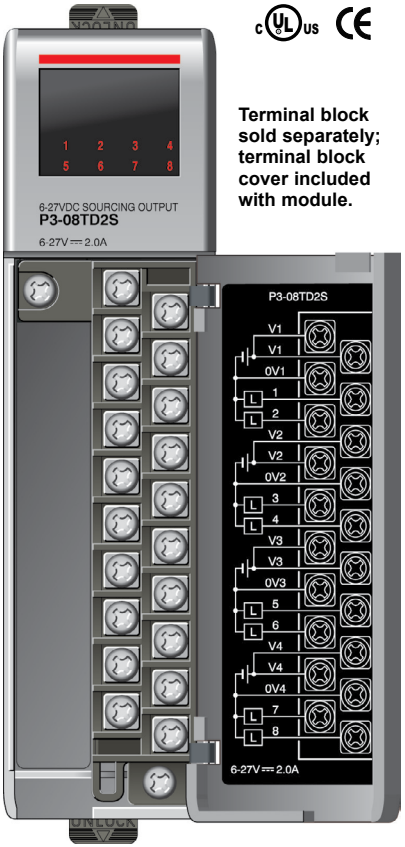






P3-08TD2S Sourcing Output

The P3-08TD2S DC Output Module provides eight 6–27 VDC sourcing outputs with four isolated commons.



Terminal block sold separately; terminal block cover included with module.

Output Specifications

Outputs per Module		8 (sourcing)
Operating Voltage Range (Tolerance)	CE	6.25–24 VDC (-15% / + 20%)
	UL	6–27 VDC (-15% / + 10%)
Maximum Output Current @ Temp		2A / point, 4A / common @ 60°C
Minimum Output Current		0.4 mA
Maximum Leakage Current		0.3 mA @ 30VDC
On Voltage Drop		0.4 VDC @ 2A
Maximum Inrush Current		4A for 10ms
OFF to ON Response		≤ 1ms
ON to OFF Response		≤ 1.5 ms
Terminal Type (not included)		20-position removable terminal block
Status Indicators		Logic Side (8 points)
Commons		4 Isolated (2 points / common)

Removable Terminal Block Specifications

Number of Positions	20 screw terminals
Wire Range	22–14 AWG (0.324 to 2.08 sq. mm) Solid / stranded conductor 3/64 in. (1.2 mm) insulation maximum USE COPPER CONDUCTORS , 60°C or equivalent.
Screw Driver Width	1/4 inch (6.5 mm) maximum
Screw Size	M3 size
Screw Torque	Field terminals: 7–9 in./lb (0.882–1.02 N·m) Self-jacking screws: 2.7–3.6 in./lb (0.3–0.4 N·m). Do not over-tighten screws when installing terminal block.

We recommend using prewired ZIPLink cables and connection modules. See Chapter 5.
Terminal block cover included. If you wish to hand-wire your module, a removable terminal block is sold separately. Order part number P3-RTB.

P3-08TD2S Sourcing Output (continued)

General Specifications	
Operating Temperature	0°C– 60°C (32°F–140°F),
Storage Temperature	-20ºC–70ºC (-4ºF–158ºF)
Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	IEC60068-2-6 (Test Fc)
Shock	IEC60068-2-27 (Test Ea)
Field to Logic Side Isolation	1500VAC applied for 1 minute
Insulation Resistance	>10MΩ @ 500VDC
Heat Dissipation	8.46 W
Enclosure Type	Open equipment
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000® system..
Field Wiring	Removable terminal block (not included). Use ***ZIP***Link wiring system or optional terminal block. See Chapter 5.
Weight	110g (3.88 oz)
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.

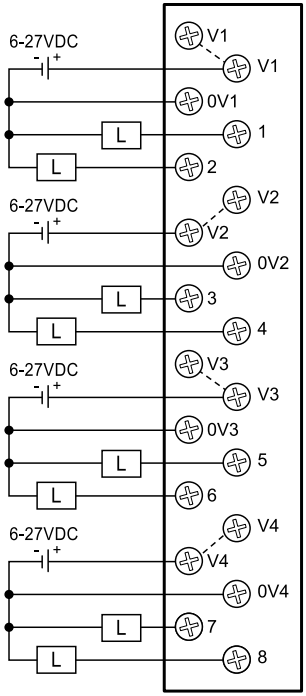
**Meets EMC and Safety requirements. See the Declaration of Conformity for details.*

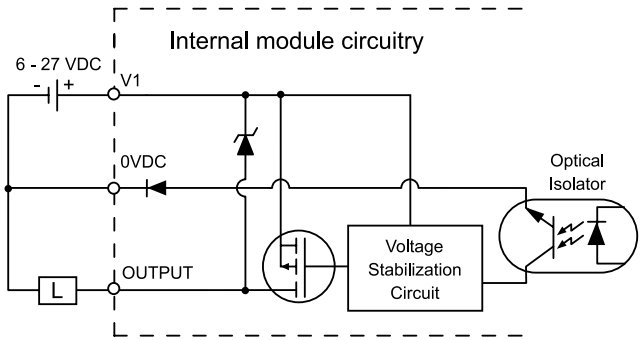
WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

P3-08TD2S Sourcing Output (continued)

Wiring Diagrams

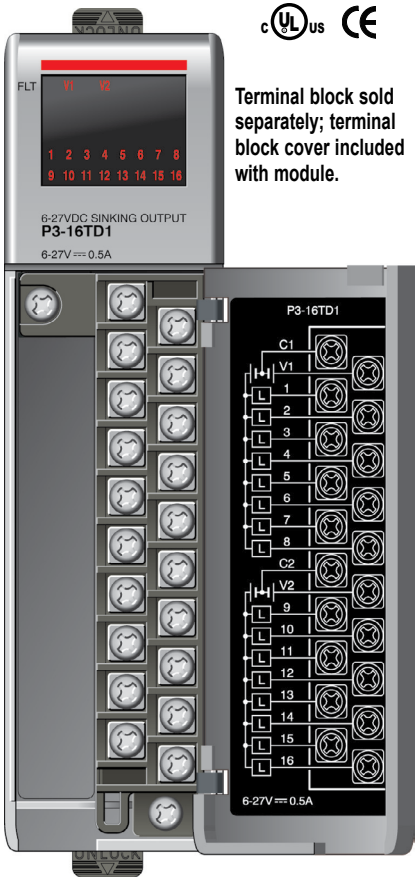
- Shown rating in figure is an operating voltage
- Each V1 terminal is connected inside the module.
- Each V2 terminal is connected inside the module.
- Each V3 terminal is connected inside the module.
- Each V4 terminal is connected inside the module.





P3-16TD1 Sinking Output

The P3-16TD1 DC Output Module provides sixteen 6-27 VDC sinking outputs with two isolated commons.



Terminal block sold separately; terminal block cover included with module.

Output Specifications

Outputs per Module		16 (sinking)
Operating Voltage Range (Tolerance)	CE	6.25–24 VDC (-15% / + 20%)
	UL	6–27 VDC (-15% / + 10%)
Maximum Output Current @ Temp		0.5 A / point, 4A / common @ 60°C
Minimum Output Current		0.4 mA
Maximum Leakage Current		0.3 mA @ 30VDC
On Voltage Drop		0.12 VDC @ 0.5 A
Maximum Inrush Current		2A for 10ms
OFF to ON Response		≤ 1ms
ON to OFF Response		≤ 1ms
Terminal Type (not included)		20-position removable terminal block
Status Indicators		Logic Side (16 points)
External 24 V Error Indicator		Logic Side (2 points)
Commons		2 Isolated (8 points / common)
External DC Power required		24VDC ± 10%, 30mA

Note: FLT (fault) indicates the absence of 24VDC at V1 or V2 terminal.

Removable Terminal Block Specifications

Number of Positions	20 screw terminals
Wire Range	22–14 AWG (0.324 to 2.08 sq. mm) Solid / stranded conductor 3/64 in. (1.2 mm) insulation maximum USE COPPER CONDUCTORS , 60°C or equivalent.
Screw Driver Width	1/4 inch (6.5 mm) maximum
Screw Size	M3 size
Screw Torque	Field terminals: 7–9 in./lb (0.882–1.02 N·m) Self-jacking screws: 2.7–3.6 in./lb (0.3–0.4 N·m). Do not over-tighten screws when installing terminal block.

We recommend using prewired ZIPLink cables and connection modules. See Chapter 5.
Terminal block cover included. If you wish to hand-wire your module, a removable terminal block is sold separately. Order part number P3-RTB.

P3-16TD1 Sinking Output (continued)

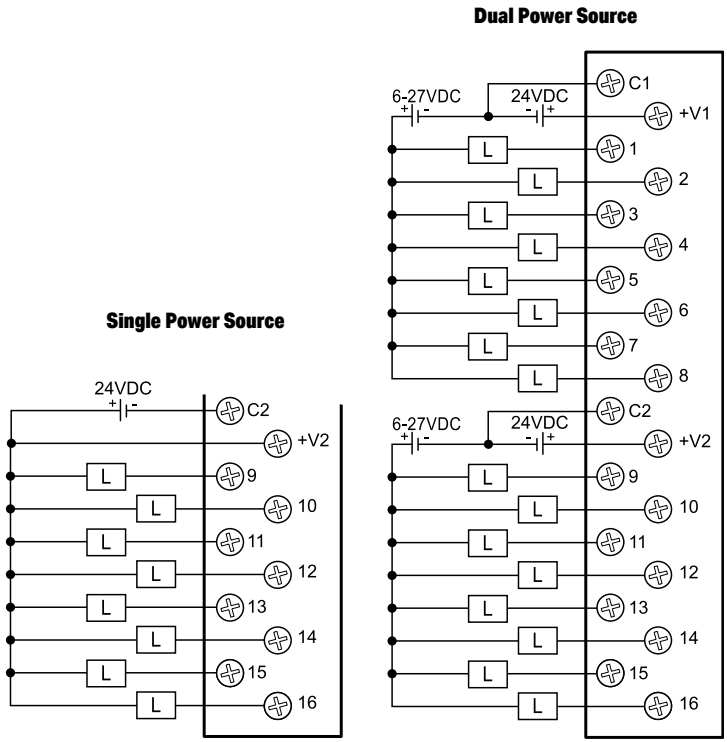
General Specifications	
Operating Temperature	0°C– 60°C (32°F–140°F),
Storage Temperature	-20ºC–70ºC (-4ºF–158ºF)
Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	IEC60068-2-6 (Test Fc)
Shock	IEC60068-2-27 (Test Ea)
Field to Logic Side Isolation	1500VAC applied for 1 minute
Insulation Resistance	>10MΩ @ 500VDC
Heat Dissipation	2.41 W
Enclosure Type	Open equipment
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000® system..
Field Wiring	Removable terminal block (not included). Use ***ZIP***Link wiring system or optional terminal block. See Chapter 5.
Weight	125g (4.41 oz)
Agency Approvals	UL508 and UL 1604 (Certified for Canada and USA) CE (EN61131-2*) This equipment is suitable for use in Class I, Division 2/Zone 2, Groups A, B, C, and D or non-hazardous locations only.

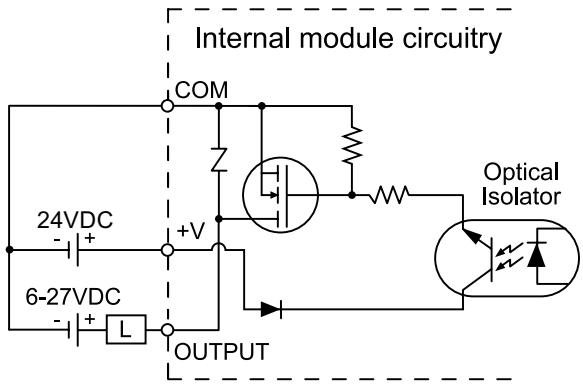
*Meets EMC and Safety requirements. See the Declaration of Conformity for details.

WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

P3-16TD1 Sinking Output (continued)

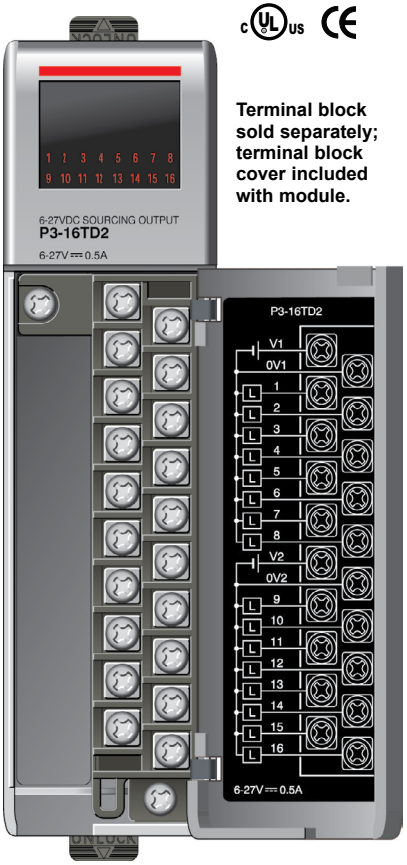
Wiring Diagrams





P3-16TD2 Sourcing Output

The P3-16TD2 DC Output Module provides sixteen 6-27 VDC sourcing outputs with two isolated commons.



Terminal block sold separately; terminal block cover included with module.

Output Specifications

Outputs per Module		16 (sourcing)
Operating Voltage Range (Tolerance)	CE	6.25–24 VDC (-15% / + 20%)
	UL	6–27 VDC (-15% / + 10%)
Maximum Output Current @ Temp		0.5 A / point, 4A / common @ 60°C
Minimum Output Current		0.4 mA
Maximum Leakage Current		0.3 mA @ 30VDC
On Voltage Drop		0.2 VDC @ 0.5A
Maximum Inrush Current		2A for 10ms
OFF to ON Response		≤ 1ms
ON to OFF Response		≤ 2ms
Terminal Type (not included)		20-position removable terminal block
Status Indicators		Logic Side (16 points)
Commons		2 Isolated (8 points / common)

Removable Terminal Block Specifications

Number of Positions	20 screw terminals
Wire Range	22–14 AWG (0.324 to 2.08 sq. mm) Solid / stranded conductor 3/64 in. (1.2 mm) insulation maximum USE COPPER CONDUCTORS , 60°C or equivalent.
Screw Driver Width	1/4 inch (6.5 mm) maximum
Screw Size	M3 size
Screw Torque	Field terminals: 7–9 in./lb (0.882–1.02 N·m) Self-jacking screws: 2.7–3.6 in./lb (0.3–0.4 N·m). Do not over-tighten screws when installing terminal block.

We recommend using prewired ZIPLink cables and connection modules. See Chapter 5.
Terminal block cover included. If you wish to hand-wire your module, a removable terminal block is sold separately. Order part number P3-RTB.

P3-16TD2 Sourcing Output (continued)

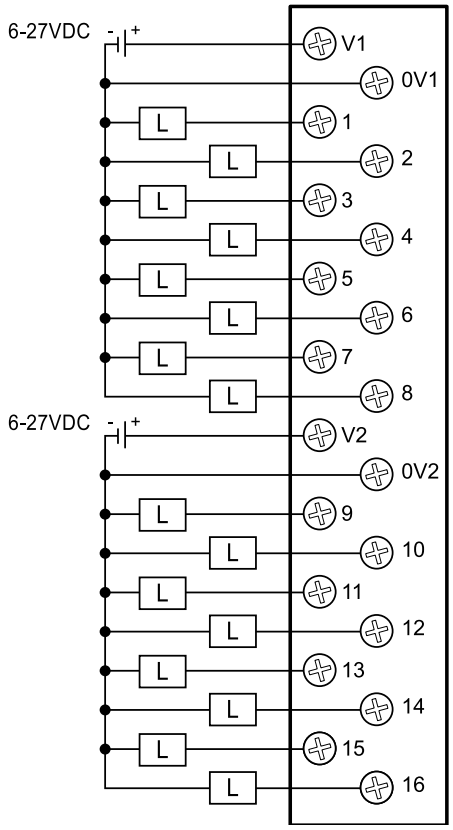
General Specifications	
Operating Temperature	0°C– 60°C (32°F–140°F),
Storage Temperature	-20ºC–70ºC (-4ºF–158ºF)
Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	IEC60068-2-6 (Test Fc)
Shock	IEC60068-2-27 (Test Ea)
Field to Logic Side Isolation	1500VAC applied for 1 minute
Insulation Resistance	>10MΩ @ 500VDC
Heat Dissipation	5.38 W
Enclosure Type	Open equipment
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000® system..
Field Wiring	Removable terminal block (not included). Use ***ZIP***Link wiring system or optional terminal block. See Chapter 5.
Weight	120g (4.23 oz)
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.

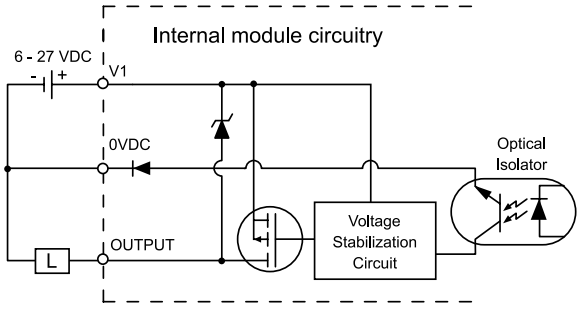
**Meets EMC and Safety requirements. See the Declaration of Conformity for details.*

WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

P3-16TD2 Sourcing Output (continued)

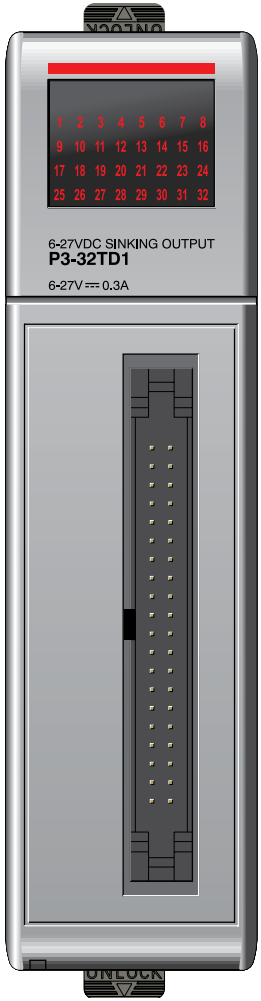
Wiring Diagrams





P3-32TD1 Sinking Output

The P3-32TD1 DC Output Module provides thirty-two 6–27 VDC sinking outputs with four isolated commons.



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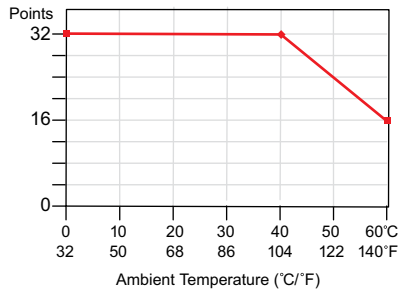
Output Specifications

Outputs per Module		32 (sinking)
Operating Voltage Range (Tolerance)	CE	6.25–24 VDC (-15% / + 20%)
	UL	6–27 VDC (-15% / +10%)
Maximum Output Current @ Temp		0.3 A / point, 2.4 A / common @ 60°C
Minimum Output Current		0.4 mA
Maximum Leakage Current		0.3 mA @ 30VDC
On Voltage Drop		0.3 VDC @ 0.3 A
Maximum Inrush Current		0.5 A for 10ms
OFF to ON Response		≤ 0.2 ms
ON to OFF Response		≤ 0.3 ms
Connector Type		40-pin IDC
Status Indicators		Logic Side (32 points)
Commons		4 Isolated (8 points / common)
External DC Power Required		24VDC ±10% @ 250mA

Connector Specifications

Connector Type	IDC style header with latch, Omron XG4A-4034
Number of Pins	40 point
Pitch	0.1 in. (2.54 mm)

Derating Chart



No terminal block sold for this module; ZIPLink required. See Chapter 5 for part numbers of ZIPLink cables and connection modules required with this module.

P3-32TD1 Sinking Output (continued)

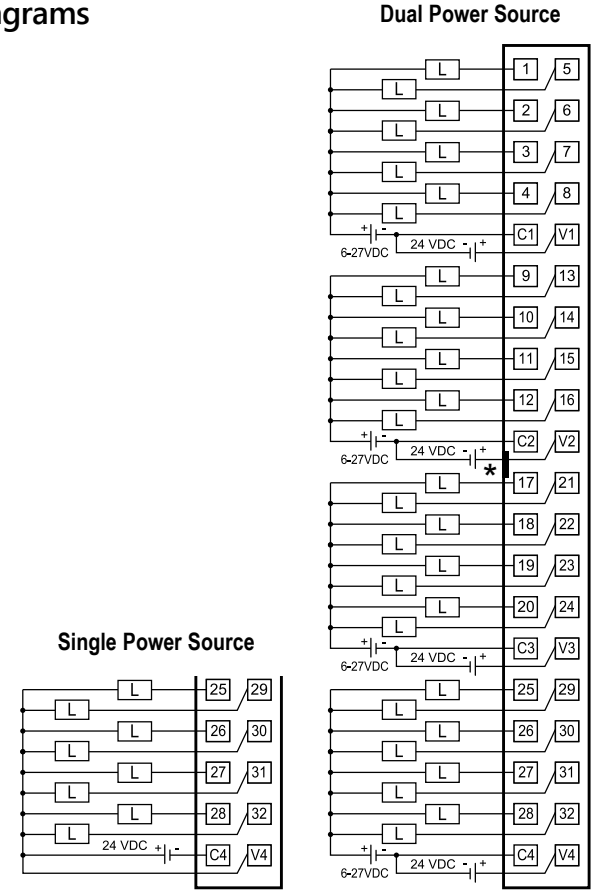
General Specifications	
Operating Temperature	0°C– 60°C (32°F–140°F),
Storage Temperature	-20ºC–70ºC (-4ºF–158ºF)
Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	IEC60068-2-6 (Test Fc)
Shock	IEC60068-2-27 (Test Ea)
Field to Logic Side Isolation	1500VAC applied for 1 minute
Insulation Resistance	>10MΩ @ 500VDC
Heat Dissipation	10.74 W
Enclosure Type	Open equipment
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000® system..
Field Wiring	Use ***ZIP***Link wiring system. See Chapter 5.
Weight	110g (3.88 oz)
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.

**Meets EMC and Safety requirements. See the Declaration of Conformity for details.*

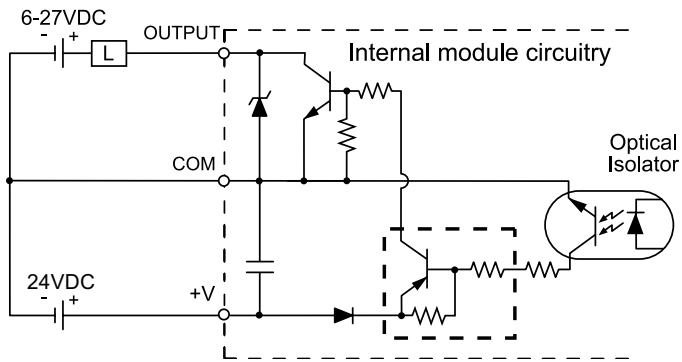
WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

P3-32TD1 Sinking Output (continued)

Wiring Diagrams

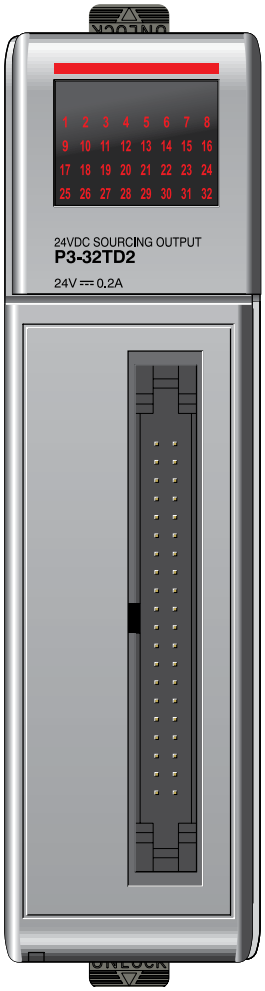


*Denotes key location of all associated ZIPLink cables.



P3-32TD2 Sourcing Output

The P3-32TD2 DC Output Module provides thirty-two 24 VDC sourcing outputs with four isolated commons.



c UL us CE

Output Specifications

Outputs per Module		32 (sourcing)
Operating Voltage Range (Tolerance)	CE	24VDC (-15% / + 20%)
	UL	24VDC (-20% / + 25%)
Maximum Output Current @ Temp		0.2 A / point, 1.6 A / common @ 60°C
Minimum Output Current		0.4 mA
Maximum Leakage Current		0.3 mA @ 30VDC
On Voltage Drop		0.3 VDC @ 0.2 A
Maximum Inrush Current		0.5 A for 10ms
OFF to ON Response		≤ 0.5 ms
ON to OFF Response		≤ 0.5 ms
Connector Type		40-pin IDC
Status Indicators		Logic Side (32 points)
Commons		4 Isolated (8 points / common)

Connector Specifications

Connector Type	IDC style header with latch, Omron XG4A-4034
Number of Pins	40 point
Pitch	0.1 in. (2.54 mm)

No terminal block sold for this module; ZIPLink required. See Chapter 5 for part numbers of ZIPLink cables and connection modules required with this module.



P3-32TD2 Sourcing Output (continued)

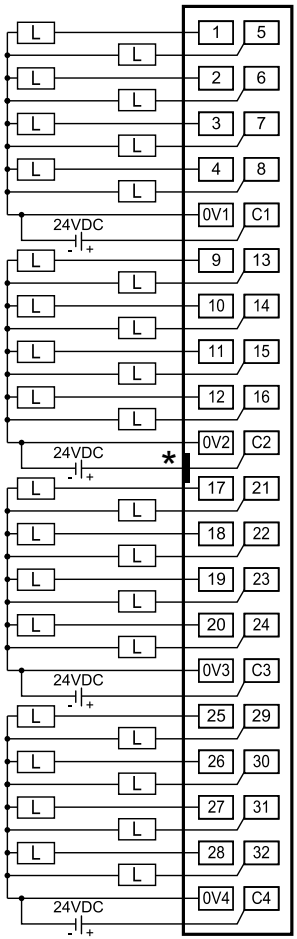
General Specifications	
Operating Temperature	0°C– 60°C (32°F–140°F),
Storage Temperature	-20ºC–70ºC (-4ºF–158ºF)
Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	IEC60068-2-6 (Test Fc)
Shock	IEC60068-2-27 (Test Ea)
Field to Logic Side Isolation	1500VAC applied for 1 minute
Insulation Resistance	>10MΩ @ 500VDC
Heat Dissipation	6.69 W
Enclosure Type	Open equipment
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000® system..
Field Wiring	Use ***ZIP***Link wiring system. See Chapter 5.
Weight	110g (3.88 oz)
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.

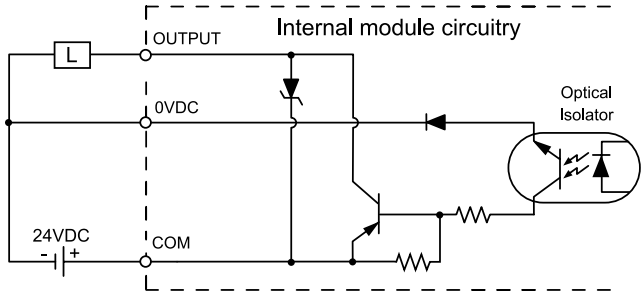
**Meets EMC and Safety requirements. See the Declaration of Conformity for details.*

WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

P3-32TD2 Sourcing Output (continued)

Wiring Diagrams

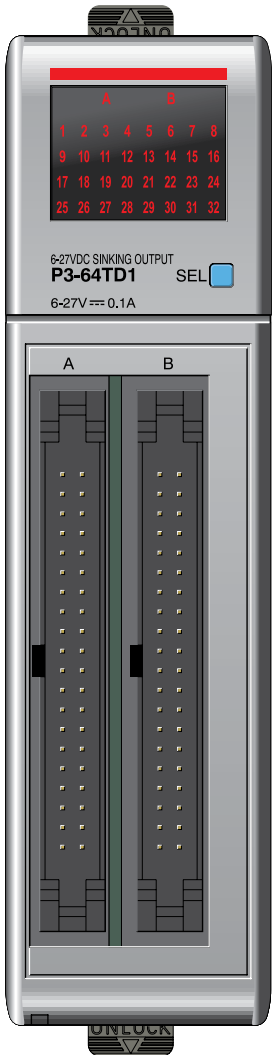




*Denotes key location of all associated ZIPLink cables.

P3-64TD1 Sinking Output

The P3-64TD1 DC Output Module provides sixty-four 6–27 VDC sinking outputs with eight isolated commons.



No terminal block sold for this module; ZIPLink required. See Chapter 5 for part numbers of ZIPLink cables and connection modules required with this module.

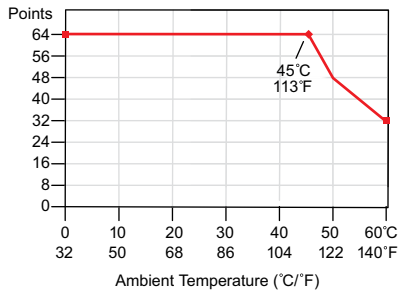
Output Specifications

Outputs per Module		64 (sinking)
Operating Voltage Range (Tolerance)	CE	6.25–24 VDC (-15% / + 20%)
	UL	6–27 VDC (-15% / +10%)
Maximum Output Current @ Temp		0.1A / point, 0.8A / common @ 60°C
Minimum Output Current		0.4 mA
Maximum Leakage Current		0.3 mA @ 30VDC
On Voltage Drop		0.3 VDC @ 0.1 A
Maximum Inrush Current		0.5 A for 10ms
OFF to ON Response		≤ 0.2 ms
ON to OFF Response		≤ 0.3 ms
Connector Type		Two 40-pin IDC
Status Indicators		Logic Side (32 points x 2)
Commons		8 Isolated (8 points / common)
External DC Power Required		24VDC ± 10% @ 210mA

Connector Specifications

Connector Type	IDC style header with latch, Omron XG4A-4034
Number of Pins	40 point
Pitch	0.1 in. (2.54 mm)

Derating Chart



P3-64TD1 Sinking Output (continued)

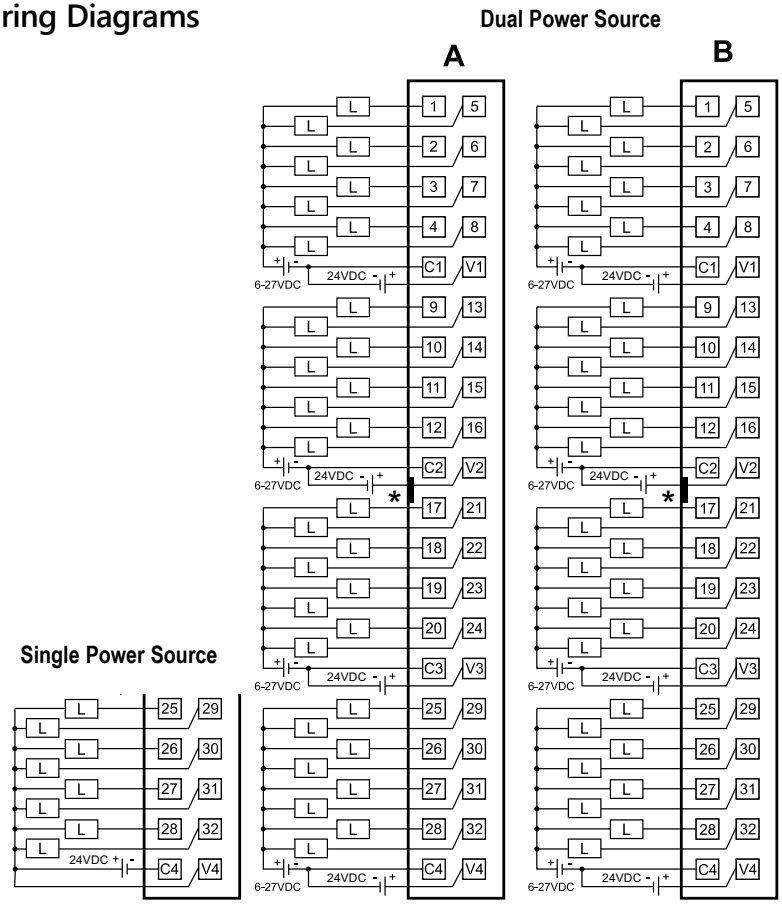
General Specifications	
Operating Temperature	0°C– 60°C (32°F–140°F),
Storage Temperature	-20ºC–70ºC (-4ºF–158ºF)
Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	IEC60068-2-6 (Test Fc)
Shock	IEC60068-2-27 (Test Ea)
Field to Logic Side Isolation	1500VAC applied for 1 minute
Insulation Resistance	>10MΩ @ 500VDC
Heat Dissipation	11.35 W
Enclosure Type	Open equipment
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000® system..
Field Wiring	Use ***ZIP***Link wiring system. See Chapter 5.
Weight	160g (5.64 oz)
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.

**Meets EMC and Safety requirements. See the Declaration of Conformity for details.*

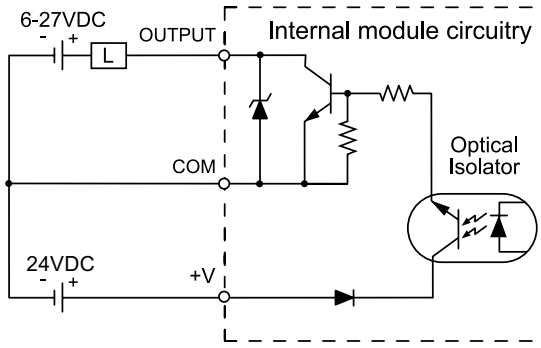
WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

P3-64TD1 Sinking Output (continued)

Wiring Diagrams

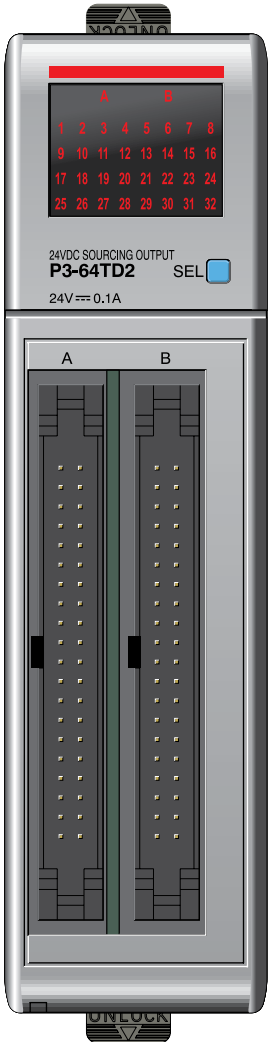


*Denotes key location of all associated ZIPLink cables



P3-64TD2 Sourcing Output

The P3-64TD2 DC Output Module provides sixty-four 24VDC sourcing outputs with eight isolated commons.



Output Specifications

Outputs per Module		64 (sourcing)
Operating Voltage Range (Tolerance)	CE	24VDC (-15% / + 20%)
	UL	24VDC (-20% / + 25%)
Maximum Output Current @ Temp		0.1 A / point, 0.8A / common @ 60° C
Minimum Output Current		0.4 mA
Maximum Leakage Current		0.3 mA @ 30VDC
On Voltage Drop		0.6 VDC @ 0.1 A
Maximum Inrush Current		0.5 A for 10ms
OFF to ON Response		≤ 0.5 ms
ON to OFF Response		≤ 0.5 ms
Connector Type		Two 40-pin IDC
Status Indicators		Logic Side (32 points x 2)
Commons		8 Isolated (8 points / common)

Connector Specifications

Connector Type	IDC style header with latch, Omron XG4A-4034
Number of Pins	40 point
Pitch	0.1 in. (2.54 mm)

No terminal block sold for this module; ZIPLink required. See Chapter 5 for part numbers of ZIPLink cables and connection modules required with this module.

P3-64TD2 Sourcing Output (continued)

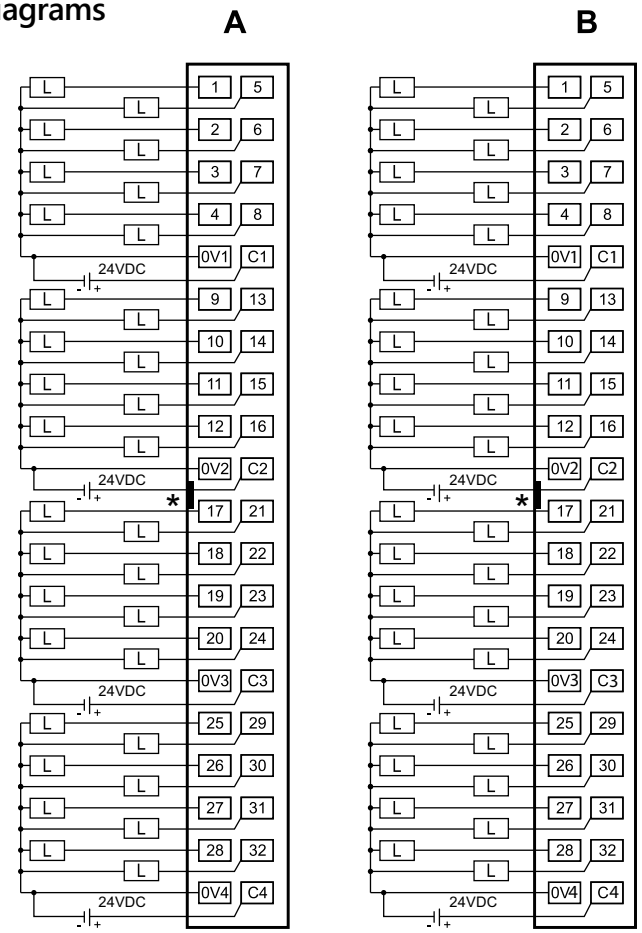
General Specifications	
Operating Temperature	0°C– 60°C (32°F–140°F),
Storage Temperature	-20ºC–70ºC (-4ºF–158ºF)
Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	IEC60068-2-6 (Test Fc)
Shock	IEC60068-2-27 (Test Ea)
Field to Logic Side Isolation	1500VAC applied for 1 minute
Insulation Resistance	>10MΩ @ 500VDC
Heat Dissipation	11.57 W
Enclosure Type	Open equipment
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000® system..
Field Wiring	Use ***ZIP***Link wiring system. See Chapter 5.
Weight	160g (5.64 oz)
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.

**Meets EMC and Safety requirements. See the Declaration of Conformity for details.*

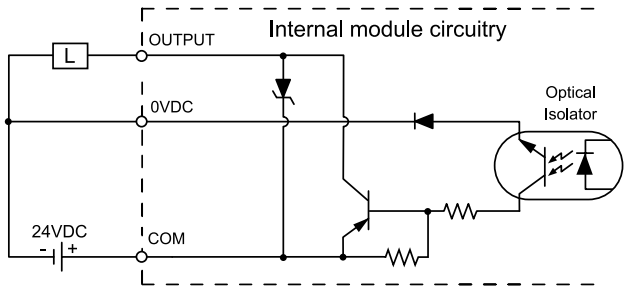
WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

P3-64TD2 Sourcing Output (continued)

Wiring Diagrams

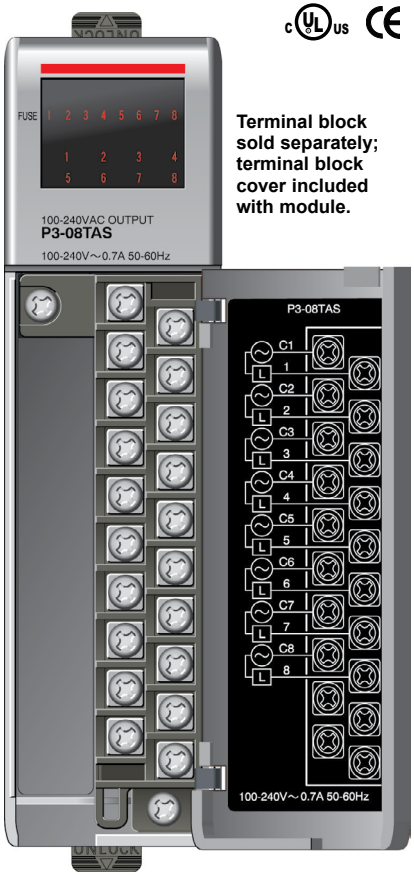


*Denotes key location of all associated ZIPLink cables



P3-08TAS Isolated AC Output

The P3-08TAS AC Output Module provides eight 100-240 VAC isolated outputs with eight fused commons.

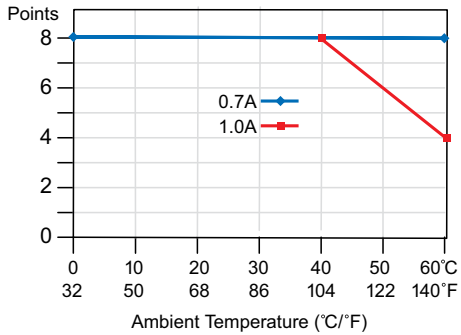


Terminal block sold separately; terminal block cover included with module.

Output Specifications		
Outputs per Module		8
Operating Voltage Range (Tolerance)	(CE)	100–240 VAC (-15% / +10%)
	(UL)	100–240 VAC (-20% / +20%)
Maximum Output Current @ Temp		1A / point @ 40°C 0.7 A / point @ 60°C
AC Frequency		47–63 Hz
Minimum Load (TYPE 2)		10mA
Maximum Leakage Current (TYPE 2)		4mA @ 264VDC
On Voltage Drop		1.5 VAC @ > 50mA 4.0 VAC @ < 50mA
Maximum Inrush Current		10A for 10ms
OFF to ON Response		1ms + 1/2 cycle
ON to OFF Response		1ms + 1/2 cycle
Status Indicators		Logic Side (8 points)
Error Status Indicator		Blown Fuse (one for each point)
Terminal Type (not included)		20-position removable terminal block
Commons		8 Isolated (1 point / common)
Fuses		3.15 A user replaceable fuse per common For replacement, order P3-FUSE-1. (Qty. 5/pkg.)

We recommend using prewired ZIPLink cables and connection modules. See Chapter 5.
Terminal block cover included. If you wish to hand-wire your module, a removable terminal block is sold separately. Order part number P3-RTB.

Derating Chart



		Current	
		1.0A	0.7A
Temp	0	8	8
	40	8	8
	60	4	8

P3-08TAS Isolated AC Output (continued)

General Specifications	
Operating Temperature	0°C– 60°C (32°F–140°F),
Storage Temperature	-20ºC–70ºC (-4ºF–158ºF)
Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	IEC60068-2-6 (Test Fc)
Shock	IEC60068-2-27 (Test Ea)
Field to Logic Side Isolation	1500VAC applied for 1 minute
Insulation Resistance	>10MΩ @ 500VDC
Heat Dissipation	12.46 W
Enclosure Type	Open equipment
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000® system..
Field Wiring	Removable terminal block (not included). Use ***ZIP***Link wiring system or optional terminal block. See Chapter 5.
Weight	125g (4.41 oz)
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.

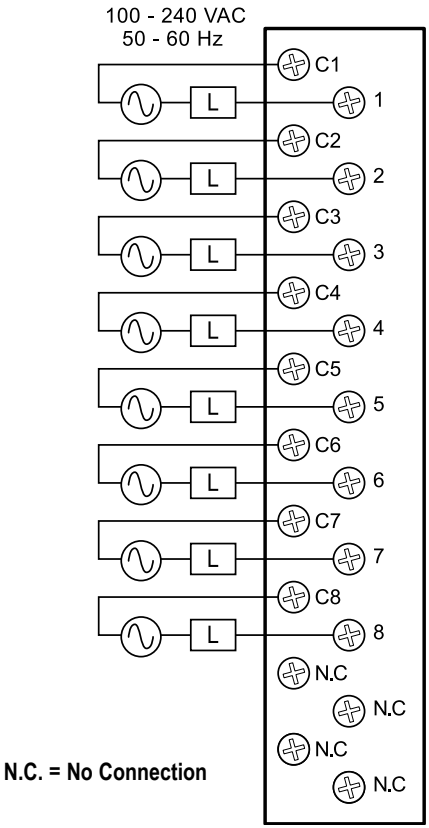
**Meets EMC and Safety requirements. See the Declaration of Conformity for details.*

WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

Removable Terminal Block Specifications	
Number of Positions	20 screw terminals
Wire Range	22–14 AWG (0.324 to 2.08 sq. mm) Solid / stranded conductor 3/64 in. (1.2 mm) insulation maximum USE COPPER CONDUCTORS , 60°C or equivalent.
Screw Driver Width	1/4 inch (6.5 mm) maximum
Screw Size	M3 size
Screw Torque	Field terminals: 7–9 in./lb (0.882–1.02 N·m) Self-jacking screws: 2.7–3.6 in./lb (0.3–0.4 N·m). Do not over-tighten screws when installing terminal block.

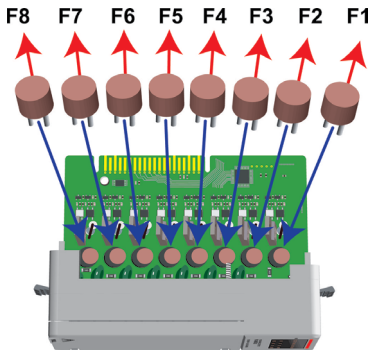
P3-08TAS Isolated AC Output (continued)

Wiring Diagrams

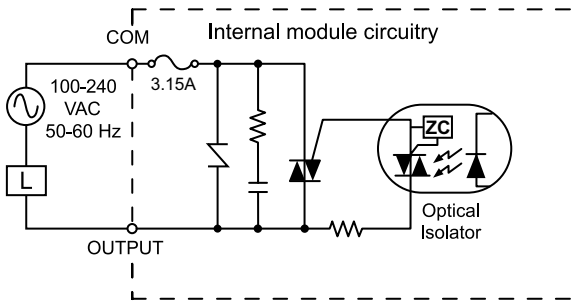


N.C. = No Connection

Replaceable Fuses

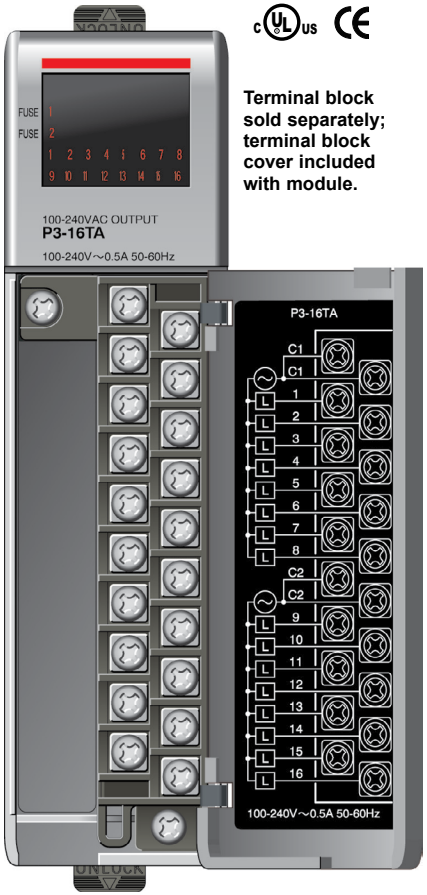


Order Part Number P3-FUSE-1 (Qty. 5 per pkg.). One spare included with module.



P3-16TA AC Output

The P3-16TA AC Output Module provides sixteen 100–240 VAC outputs with two isolated fused commons.



Terminal block sold separately; terminal block cover included with module.

Output Specifications

Outputs per Module		16
Operating Voltage Range (Tolerance)	(CE)	100–240 VAC (-15% / +10%)
	(UL)	100–240 VAC (-20% / +20%)
AC Frequency		47–63 Hz
Maximum Output Current @ Temp (Type 2)		0.5 A / point , 4A / common @ 60° C
Minimum Load (TYPE 2)		10mA
Maximum Leakage Current (TYPE 2)		4mA @ 264VDC
On Voltage Drop		1.5 VAC @ > 50mA 4.0 VAC @ < 50mA
Maximum Inrush Current		10A for 10ms
OFF to ON Response		1ms + 1/2 cycle
ON to OFF Response		1ms + 1/2 cycle
Status Indicators		Logic Side (16 points)
Error Status Indicator		Blown Fuse (one for each common)
Terminal Type (not included)		20-position removable terminal block
Commons		2 Isolated (8 points / common)
Fuses		6.3 A user replaceable fuse per common For replacement, order P3-FUSE-2. (Qty. 5/pkg.)

Removable Terminal Block Specifications

Number of Positions	20 screw terminals
Wire Range	22–14 AWG (0.324 to 2.08 sq. mm) Solid / stranded conductor 3/64 in. (1.2 mm) insulation maximum USE COPPER CONDUCTORS , 60°C or equivalent.
Screw Driver Width	1/4 inch (6.5 mm) maximum
Screw Size	M3 size
Screw Torque	Field terminals: 7–9 in./lb (0.882–1.02 N·m) Self-jacking screws: 2.7–3.6 in./lb (0.3–0.4 N·m). Do not over-tighten screws when installing terminal block.

We recommend using prewired ZIPLink cables and connection modules. See Chapter 5.
Terminal block cover included. If you wish to hand-wire your module, a removable terminal block is sold separately. Order part number P3-RTB.

P3-16TA AC Output (continued)

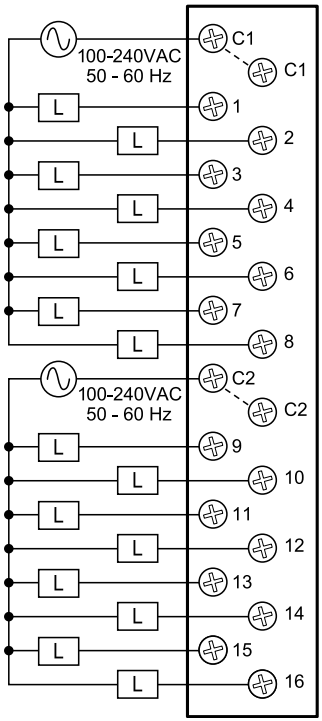
General Specifications	
Operating Temperature	0°C– 60°C (32°F–140°F),
Storage Temperature	-20ºC–70ºC (-4ºF–158ºF)
Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	IEC60068-2-6 (Test Fc)
Shock	IEC60068-2-27 (Test Ea)
Field to Logic Side Isolation	1500VAC applied for 1 minute
Insulation Resistance	>10MΩ @ 500VDC
Heat Dissipation	12.69 W
Enclosure Type	Open equipment
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000® system..
Field Wiring	Removable terminal block (not included). Use ***ZIP***Link wiring system or optional terminal block. See Chapter 5.
Weight	125g (4.41 oz)
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.

*Meets EMC and Safety requirements. See the Declaration of Conformity for details.

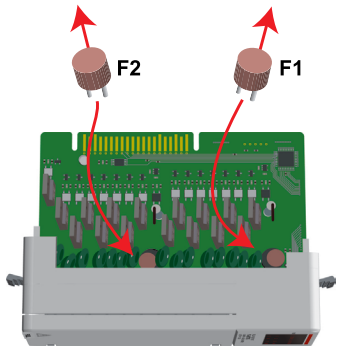
WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

P3-16TA AC Output (continued)

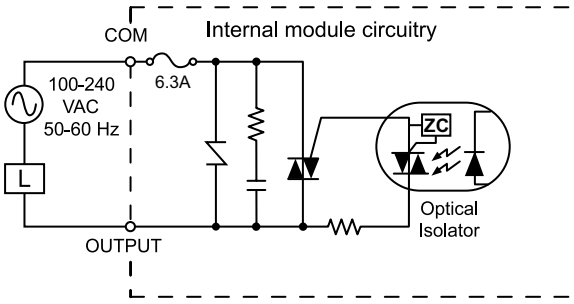
Wiring Diagrams



Replaceable Fuses

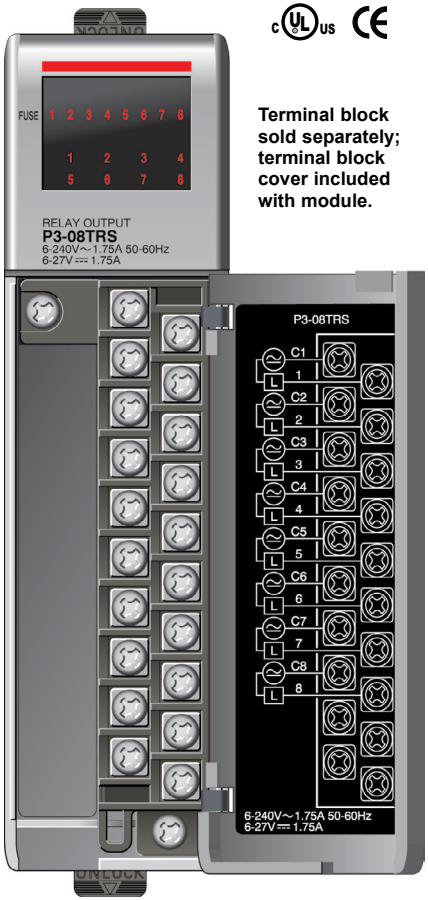


Order Part Number P3-FUSE-2 (Qty. 5 per pkg.). One spare included with module.



P3-08TRS Isolated Relay Output

The P3-08TRS Isolated Relay Output Module provides eight 1.75 amp relay outputs with eight fused commons.



Terminal block sold separately; terminal block cover included with module.

Output Specifications

Outputs per Module		8
Operating Voltage Range (Tolerance)	(CE)	6.25–24 VDC (-15% / + 20%) 6–240 VAC (-15% / + 10%)
	(UL)	6–27 VDC (-15% / + 10%) 6–240 VAC (-10% / + 10%)
Output type		Relay, form A (SPST)
AC Frequency		47–63 Hz
Maximum Output Current @ Temp		1.75 A per point @ 60°C for both AC and DC
Minimum Load Current		5mA @ 5VDC
Maximum Inrush Current		4A for 10ms
OFF to ON Response		≤ 10ms
ON to OFF Response		≤ 10ms
Status Indicators		Logic Side (8 points)
Error Status Indicator		Blown Fuse (one for each point)
Terminal Type (not included)		20-position removable terminal block
Commons		8 Isolated (1 point / common)
Fuses		3.15 A user replaceable fuse per common For replacement, order P3-FUSE-1. (Qty. 5/pkg.)

Removable Terminal Block Specifications

Number of Positions	20 screw terminals
Wire Range	22–14 AWG (0.324 to 2.08 sq. mm) Solid / stranded conductor 3/64 in. (1.2 mm) insulation maximum USE COPPER CONDUCTORS , 60°C or equivalent.
Screw Driver Width	1/4 inch (6.5 mm) maximum
Screw Size	M3 size
Screw Torque	Field terminals: 7–9 in./lb (0.882–1.02 N·m) Self-jacking screws: 2.7–3.6 in./lb (0.3–0.4 N·m). Do not over-tighten screws when installing terminal block.

We recommend using prewired ZIPLink cables and connection modules. See Chapter 5.
Terminal block cover included. If you wish to hand-wire your module, a removable terminal block is sold separately. Order part number P3-RTB.

Typical Relay Life

Voltage & Type of Load	Operations at 2A Load Current
30VDC Resistive	150K
30VDC Solenoid	75K
120VAC Resistive	210K
120VAC Solenoid	140K
240VAC Resistive	150K
240VAC Solenoid	100K

P3-08TRS Isolated Relay Output (continued)

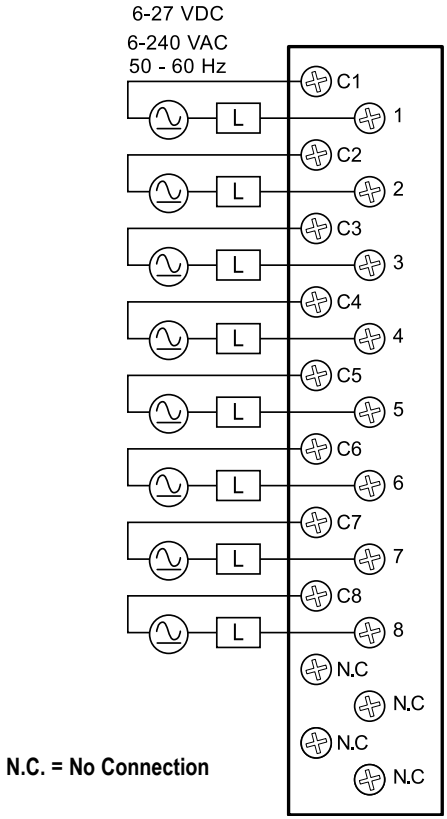
General Specifications	
Operating Temperature	0°C– 60°C (32°F–140°F),
Storage Temperature	-20ºC–70ºC (-4ºF–158ºF)
Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	IEC60068-2-6 (Test Fc)
Shock	IEC60068-2-27 (Test Ea)
Field to Logic Side Isolation	1500VAC applied for 1 minute
Insulation Resistance	>10MΩ @ 500VDC
Heat Dissipation	3.04 W
Enclosure Type	Open equipment
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000® system..
Field Wiring	Removable terminal block (not included). Use ***ZIP***Link wiring system or optional terminal block. See Chapter 5.
Weight	135g (4.76 oz)
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.

**Meets EMC and Safety requirements. See the Declaration of Conformity for details.*

WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

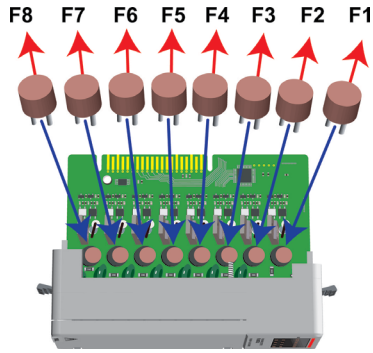
P3-08TRS Isolated Relay Output (continued)

Wiring Diagrams

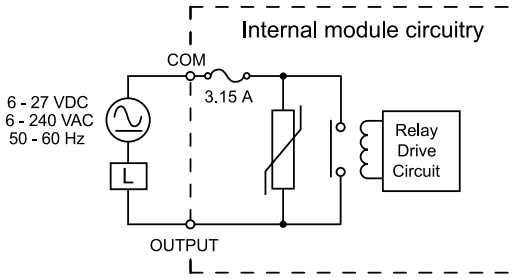


N.C. = No Connection

Replaceable Fuses

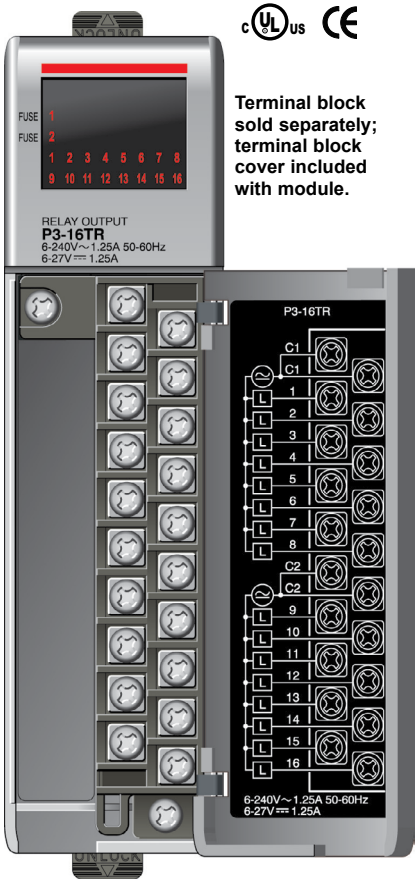


Order Part Number P3-FUSE-1 (Qty. 5 per pkg.). One spare included with module.



P3-16TR Relay Output

The P3-16TR Relay Output Module provides sixteen 1.25 amp relay outputs with two isolated fused commons.



Terminal block sold separately; terminal block cover included with module.

Output Specifications

Outputs per Module		16
Operating Voltage Range (Tolerance)	(CE)	6.25–24 VDC (-15% / + 20%) 6–240 VAC (-15% / + 10%)
	(UL)	6–27 VDC (-15% / + 10%) 6–240 VAC (-10% / + 10%)
Output type		Relay, form A (SPST)
AC Frequency		47–63 Hz
Maximum Output Current @ Temp		1.25 A / point, 6.3 A / common @ 60°C for both AC and DC
Minimum Load Current		5mA @ 5VDC
Maximum Inrush Current		4A for 10ms
OFF to ON Response		≤ 10ms
ON to OFF Response		≤ 10ms
Status Indicators		Logic Side (16 points)
Error Status Indicator		Blown Fuse (one for each common)
Terminal Type (not included)		20-position removable terminal block
Commons per module		2 Isolated (8 point / common)
Fuses		6.3 A user replaceable fuse per common For replacement, order P3-FUSE-2. (Qty. 5/pkg.)

Removable Terminal Block Specifications

Number of Positions	20 screw terminals
Wire Range	22–14 AWG (0.324 to 2.08 sq. mm) Solid / stranded conductor 3/64 in. (1.2 mm) insulation maximum USE COPPER CONDUCTORS , 60°C or equivalent.
Screw Driver Width	1/4 inch (6.5 mm) maximum
Screw Size	M3 size
Screw Torque	Field terminals: 7–9 in./lb (0.882–1.02 N·m) Self-jacking screws: 2.7–3.6 in./lb (0.3–0.4 N·m). Do not over-tighten screws when installing terminal block.

We recommend using prewired ZIPLink cables and connection modules. See Chapter 5.
Terminal block cover included. If you wish to hand-wire your module, a removable terminal block is sold separately. Order part number P3-RTB.

Typical Relay Life

Voltage & Type of Load	Operations at 1.25 A Load Current
30VDC Resistive	240K
30VDC Solenoid	110K
120VAC Resistive	320K
120VAC Solenoid	210K
240VAC Resistive	240K
240VAC Solenoid	140K

P3-16TR Relay Output (continued)

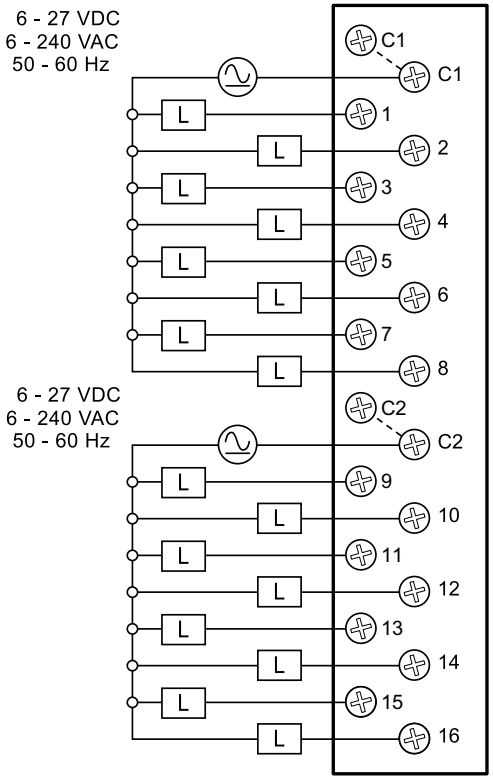
General Specifications	
Operating Temperature	0°C– 60°C (32°F–140°F),
Storage Temperature	-20ºC–70ºC (-4ºF–158ºF)
Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	IEC60068-2-6 (Test Fc)
Shock	IEC60068-2-27 (Test Ea)
Field to Logic Side Isolation	1500VAC applied for 1 minute
Insulation Resistance	>10MΩ @ 500VDC
Heat Dissipation	3.93 W
Enclosure Type	Open equipment
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000® system..
Field Wiring	Removable terminal block (not included). Use ***ZIP***Link wiring system or optional terminal block. See Chapter 5.
Weight	160g (5.64 oz)
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.

**Meets EMC and Safety requirements. See the Declaration of Conformity for details.*

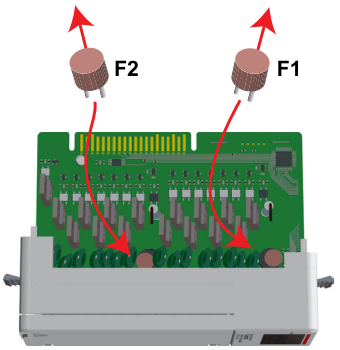
WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

P3-16TR Relay Output (continued)

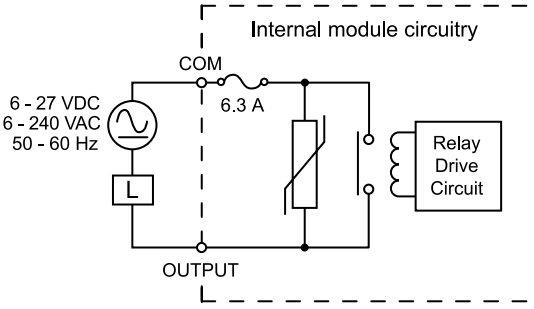
Wiring Diagrams



Replaceable Fuses

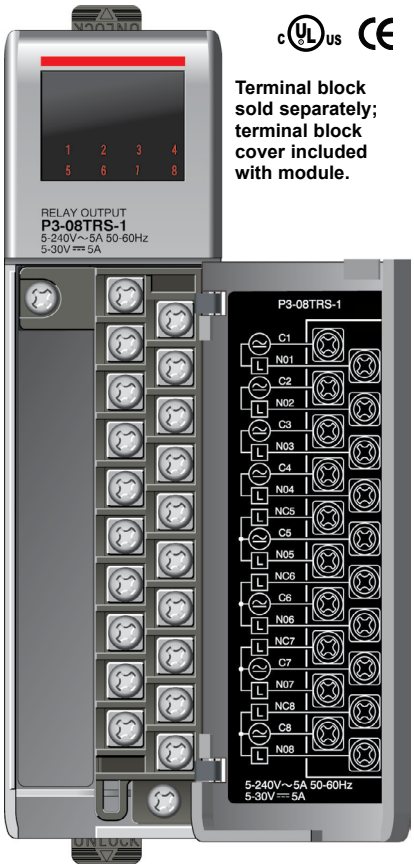


Order Part Number P3-FUSE-2 (Qty. 5 per pkg.). One spare included with module.



P3-08TRS-1 Isolated Relay Output

The P3-08TRS-1 High-Current Isolated Relay Output Module provides eight 5 amp relay outputs with eight fused commons.



Terminal block sold separately; terminal block cover included with module.

Output Specifications

Outputs per Module		8 relays (non-latching)
Commons per Module		8 (isolated)
Operating Voltage Range (Tolerance)	(CE)	6.25–24 VDC (-15% / +20%) 6–240 VAC (-15% / +10%)
	(UL)	5–30 VDC (-0% / +10%) 5–240 VAC (-0% / +10%)
Output Type		4 Form C (SPDT-NO/NC), 4 Form A (SPST-NO)
AC Frequency		47–63 Hz
On Voltage Drop		Minimal (90mV max for fuse at 10A)
Max Output Current @ Temperature (Resistive)*		6.3 A at 23°C (73.4°F), 5.0 A at 60°C (140°F) For both AC and DC
Maximum Leakage Current		Minimal (5µA for TVS diode)
Minimum Load		10mA @ 5VDC
Maximum Inrush Current		12A
External DC Required		None
OFF to ON Response		10ms
ON to OFF Response		5ms (Excluding NO bounce)
Terminal Type (not included)		20-position removable terminal block
Status Indicators		Logic side
Fuses		6.3 A user replaceable fuse per common For replacement, order P3-FUSE-2 (5/Pkg.)
Dielectric Strength (Between normally open and normally closed contacts on the same relay)		1500VAC @ 1 min logic to output and isolated output to output, 750VAC @ 1 min between contacts on same relay (Same as 1800VAC @ 1 sec and 900VAC @ 1 sec)
Transient Voltage Suppression (Bi-directional TVS diode)		482V clamp at 1.25 A peak pulse current
Mechanical Life Expectancy		>100,000 at 30 operations per minute

**Rating is for a normally-open contact. Normally-closed contacts have 1/2 the current handling capability.*

We recommend using prewired ZIPLink cables and connection modules. See Chapter 5.
Terminal block cover included. If you wish to hand-wire your module, a removable terminal block is sold separately. Order part number P3-RTB.

Removable Terminal Block Specifications

Number of Positions	20 screw terminals
Wire Range	22–14 AWG (0.324 to 2.08 sq. mm) Solid / stranded conductor 3/64 in. (1.2 mm) insulation maximum USE COPPER CONDUCTORS , 60°C or equivalent.
Screw Driver Width	1/4 inch (6.5 mm) maximum
Screw Size	M3 size
Screw Torque	Field terminals: 7–9 in./lb (0.882–1.02 N·m) Self-jacking screws: 2.7–3.6 in./lb (0.3–0.4 N·m). Do not over-tighten screws when installing terminal block.

P3-08TRS-1 Isolated Relay Output (continued)

General Specifications	
Operating Temperature	0°C– 60°C (32°F–140°F),
Storage Temperature	-20ºC–70ºC (-4ºF–158ºF)
Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	IEC60068-2-6 (Test Fc)
Shock	IEC60068-2-27 (Test Ea)
Field to Logic Side Isolation	1800VAC applied for 1s
Insulation Resistance	>10MΩ @ 500VDC
Heat Dissipation	3W
Enclosure Type	Open equipment
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000® system..
Field Wiring	Removable terminal block (not included). Use ***ZIP***Link wiring system or optional terminal block. See Chapter 5.
Terminal Type (not included)	20-position removable terminal block
Weight	286g (10.08 oz)
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.

**Meets EMC and Safety requirements. See the Declaration of Conformity for details.*

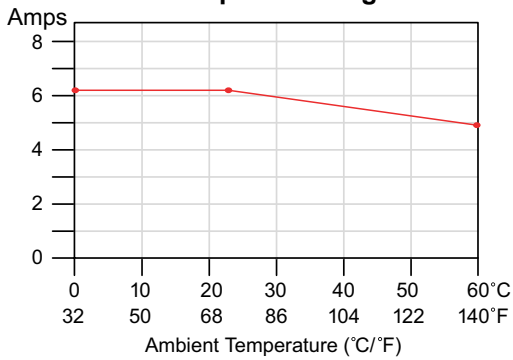
WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

Typical Relay Life*		
Voltage & Type of Load	Operating Current	Operations
24VDC Resistive	6.3 A	600,000
24VDC Solenoid	0.2 A	1,000,000
120VAC Resistive	6.3 A	600,000
120VAC Resistive	3A	1,000,000
120VAC Solenoid	0.5 A	500,000
240VAC Resistive	6.3 A	450,000
240VAC Resistive	3A	600,000
1/4 HP Motor	1.5 x FLA (motor)	30,000

**Ratings are for normally-open contacts. Normally-closed contacts have 1/2 the current handling capability.*

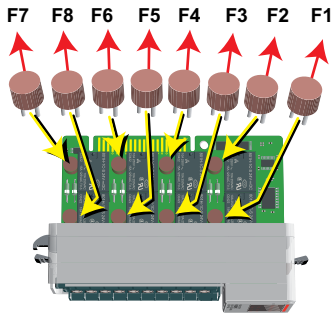
P3-08TRS-1 Isolated Relay Output (continued)

Output Derating



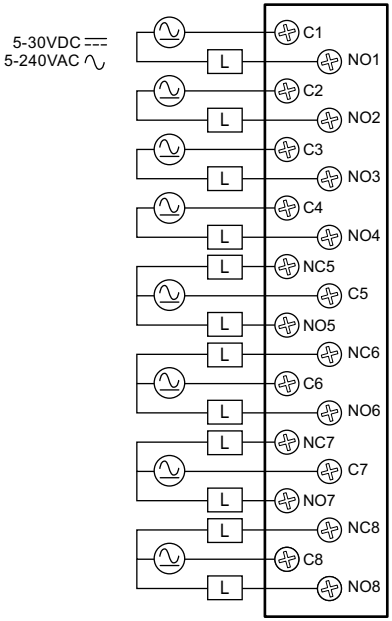
All 8 outputs on, 100% duty cycle allowed.

Replaceable Fuses

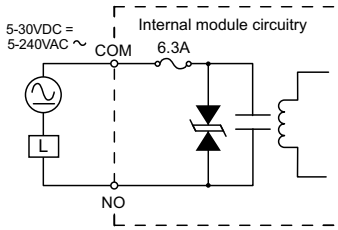


Order Part Number P3-FUSE-2 (Qty. 5 per pkg.). One spare included with module.

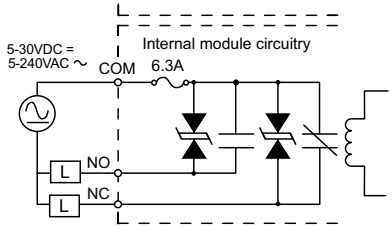
Wiring Diagrams



Outputs NO1 – NO4

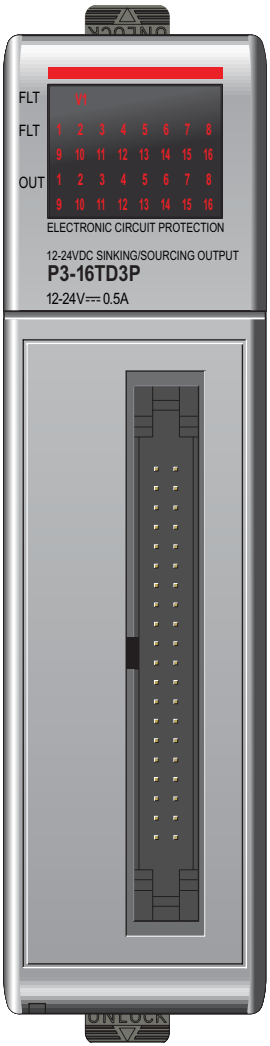


Outputs NO5 / NC5 – NO8 / NC8



P3-16TD3P Sinking/Sourcing Protected Output

The P3-16TD3P DC Output Module provides sixteen 12-24 VDC sinking or sourcing outputs with four internally connected commons.



Module also detects the following faults:

- Missing External 24 VDC
- Open Load
- Over Temperature
- Over Load Current

Connector Specifications	
Connector Type	IDC style header with latch, Omron XG4A-4034
Number of Pins	40 point
Pitch	0.1 in. (2.54 mm)

No terminal block sold for this module; ZIPLink required. See Chapter 5 for part numbers of ZIPLink cables and connection modules required with this module.

NOTE: P3-16TD3P discontinued as of 10/2022. Please consider P3-16TD1 or P3-16TD2 as a replacement.

NOTE: *The most recent Productivity Suite software and firmware versions may be required to support new modules and new features.*

P3-16TD3P Sinking/Sourcing Protected Output (continued)

Output Specifications	
Outputs per Module	16 (sinking / sourcing)
Operating Voltage Range (Tolerance)	10.2–26.4 VDC
Maximum Output Current	0.5 A continuous
On Voltage Drop	0.5 VDC
Maximum Inrush Current	Self-limited
OFF to ON Response	0.5 ms
ON to OFF Response	0.5 ms
Overcurrent Trip	1.2 A min., 2.4 A max.
Minimum Load Current to Avoid Open Load Fault Detection	113mA
Overtemperature Shutdown	Independent to each output
Minimum Load Resistance (for open load detection)	58kΩ
Status Indicators	Logic Side (16 points)
External 24V Error Indicator	Logic Side (1 points)
Fault Condition Indicator	Logic Side (16 points)
Connector Type	40-pin IDC
Commons per Module	4 (non-isolated)
Fuses	None
External DC Power Required	24VDC ±10% @ 85mA, Class 2 (must be ≥ Operating voltage)*

** Load voltage for source configuration must be less or equal to the external power voltage wired to the module. This requirement can be met by using a single power supply to provide both module's power (24V external power) and sourcing power for loads.*

General Specifications	
Surrounding Air Temperature	0°C– 60°C (32°F–140°F),
Storage Temperature	-20ºC–70ºC (-4ºF–158ºF)
Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	IEC60068-2-6 (Test Fc)
Shock	IEC60068-2-27 (Test Ea)
Field to Logic Side Isolation	1800 VAC applied for 1s
Insulation Resistance	>10MΩ @ 500VDC
Heat Dissipation	5.96 W
Enclosure Type	Open equipment
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000® system..
Field Wiring	Use *ZIP*Link wiring system, see Chapter 5. Must use copper conductors rated 75 degrees C or equivalent.
Weight	112.83 g (3.98 oz)
Agency Approvals	UL508 file E157382, Canada & USA CE (EN61131-2*)

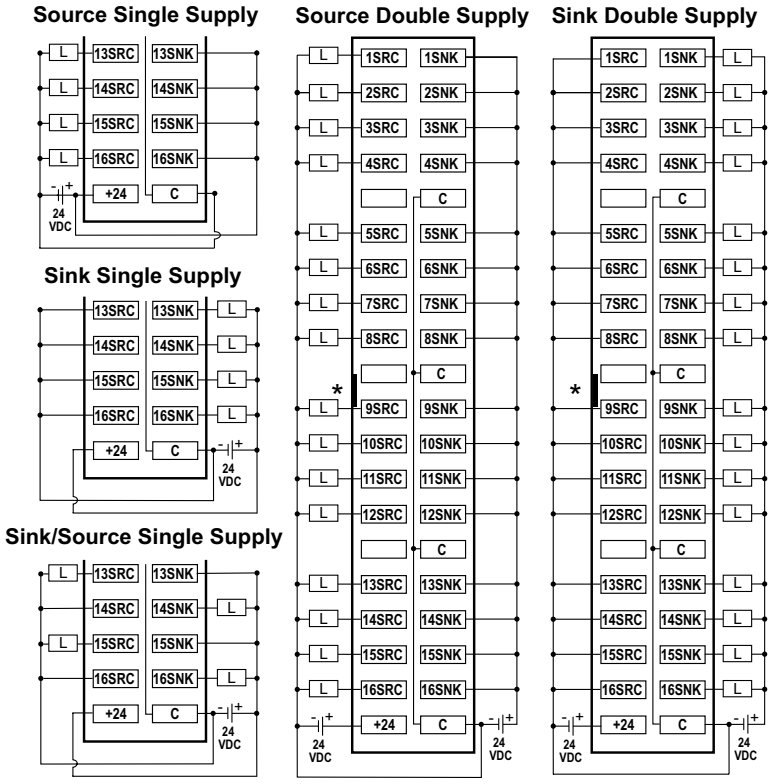
**Meets EMC and Safety requirements. See the Declaration of Conformity for details.*

P3-16TD3P Sinking/Sourcing Protected Output (continued)

LED Status		
Fault Condition	**Fault Status Indication**	Operation to Reset Fault
Missing External 24VDC	Second LED in row 1 is ON	Apply external 24VDC
Open Load (Note 1)	Corresponding LEDs (row 2 and 3) are ON	Connect the load
Over Temperature or Over Load Current		Turn the output OFF or power cycle

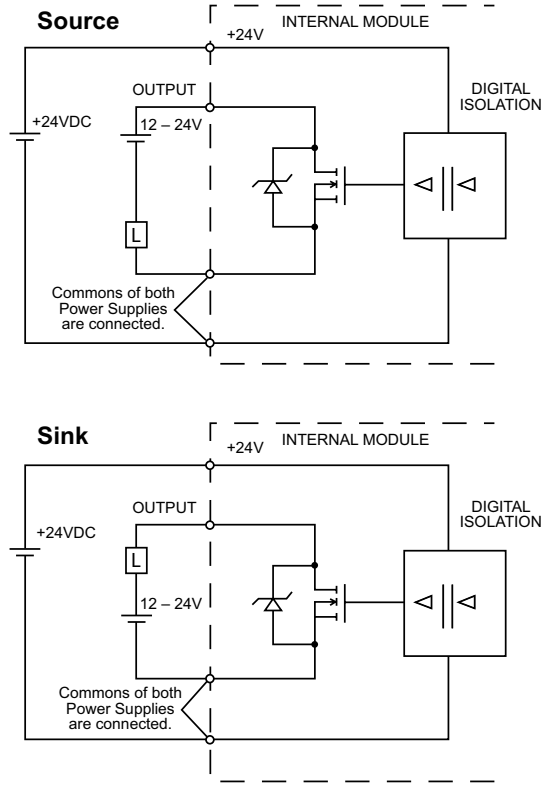
Note 1: Open Load Fault is always enabled, but is only valid when output is OFF. If Open Load Fault happens while output is ON, fault will not appear until you turn OFF output.

Wiring Diagrams



*Denotes key location of all associated ZIPLink cables.

P3-16TD3P Sinking/Sourcing Protected Output (continued)



NOTE: If two separate power supplies are used to supply module control logic and output, commons from both power supplies must be connected.

SPECIALTY MODULES SPECIFICATIONS



In This Chapter...

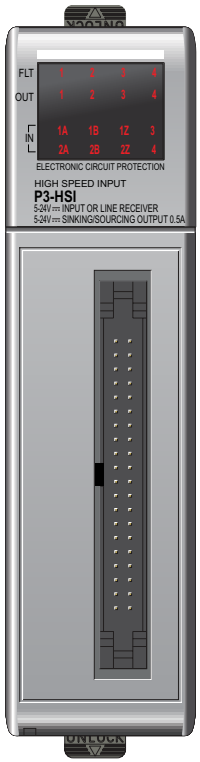
High-Speed Pulse Input (HSI) Module Overview 4–2
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High-Speed Pulse Input (HSI) Module Overview

The P3-HSI is a high-speed pulse (1MHz) input module. It has both differential (line receiver, 5V max) and single ended (5-24V) inputs that accept Pulse/Direction and Quadrature signals on each of the two independent input channels. Additionally, it has four general purpose high-speed pulse inputs and four general purpose 5–24 VDC, 0.5 amp outputs. All inputs are isolated.

Use the hardware configuration tool in the Productivity Suite programming software to setup the HSI module. See the Productivity Suite help file.

HSI Specifications



General Specifications	
Module Type	Intelligent
Modules per Base	No limit
I/O Points Used	None, mapped directly to tags in CPU
Surrounding Air 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)
Field to Logic Side Isolation	1800VAC applied for 1 second
Insulation Resistance	>10MΩ @ 500VDC
Heat Dissipation	5.76W
Enclosure Type	Open equipment
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000® System.
Field Wiring	Use *ZIP*Link Wiring System, see Chapter 5. Must use copper conductors rated 75 degrees C or equivalent.
Weight	113.4 g (4oz)
Agency Approvals	UL508 file E157382, Canada & USA CE (EN61131-2*) UL 61010-1 and UL 61010-2-201 File E139594, Canada & USA

**Meets EMC and Safety requirements. See the Declaration of Conformity for details.*

Connector Specifications	
Connector Type	IDC style header with latch, Omron XG4A-4034
Number of Pins	40 point
Pitch	0.1in. (2.54mm)

No terminal block sold for this module; ZIPLink required. See Chapter 5 for part numbers of ZIPLink cables and connection modules required with this module.





NOTE: *The most recent Productivity Suite software and firmware versions may be required to support new modules and new features.*

Power Specifications

External Power	24VDC +10% / -15%, Class 2
Maximum Voltage	26.4 VDC
Minimum Voltage	20.4 VDC
Current Consumption Excluding Outputs	47mA
Maximum Current Consumption Total of the 4 Status Outputs	2A

Differential (5V) Input Specifications

Pulse Inputs	Differential inputs (6 pts: 1A, 1B, 1Z, 2A, 2B, 2Z)
Isolation	Each input is isolated from other circuits
Input Signal Type, per Channel Select	Differential
Input Volts	5VDC
Input Volts Maximum	±5.6 VDC, limited by protection
Input Impedance	200Ω min., 500Ω max.
Inputs Rated Current	5VDC, 15mA 8mA typ., 15mA max.
Input Minimum ON Voltage	3.0 VDC
Input Maximum OFF Voltage	1.0 VDC
Input Minimum ON Current	5.0 mA
Input Maximum OFF Current	2.0 mA
OFF to ON Response Time	1A, 1B, 2A, 2B: 0.48 ms 1Z, 2Z, 3IN, 4IN: 6ms
ON to OFF Response Time	1A, 1B, 2A, 2B: 0.48 ms 1Z, 2Z, 3IN, 4IN: 6ms
Max. Input Frequency	1A, 1B, 2A, 2B: 1MHz 1Z, 2Z, 3IN, 4IN: 300kHz*

Note: The voltage difference between the input pairs must be between 3-5.6 volts.
** The Z pulse input (1Z & 2Z) is capable of capturing a 1 MHz wide pulse for the purpose of resetting an encoder count but a 3 microsecond pause (300 kHz) is required between pulses.*

Single Ended (5-24V) Input Specifications

Status Input	Single ended inputs (8 pts: 1A, 1B, 1Z, 2A, 2B, 2Z, 3IN, 4IN)
Isolation	Each input is isolated from other circuits
Input Volts Range	5–24 VDC
Input Volts Maximum	±34VDC, limited by protection
Input Impedance	1kΩ min., 5kΩ max.
Inputs Rated Current	5–24 VDC, 16mA 5.2 mA typ. @ 5VDC 22mA max. @ 34VDC
Input Minimum ON Voltage	4.5 VDC
Input Maximum OFF Voltage	2.0 VDC
Input Minimum ON Current	5.0 mA
Input Maximum OFF Current	1.4 mA
OFF to ON Response Time	1A, 1B, 2A, 2B: 0.48 ms 1Z, 2Z, 3IN, 4IN: 6ms
ON to OFF Response Time	1A, 1B, 2A, 2B: 0.48 ms 1Z, 2Z, 3IN, 4IN: 6ms
Max. Input Frequency	1A, 1B, 2A, 2B: 200kHz* 1Z, 2Z, 3IN, 4IN: 200kHz*

** Inputs are not limited to this speed but single ended signals are not usually reliable above 200kHz due to cabling capacitance.*

Status Output Specifications

Status Outputs	4 Outputs	
Output Signal Type, per Output	Current Sinking	Current Sourcing
Operating Voltage[1]	5–24 VDC	5–24 VDC[1]
Output Volts Maximum	36VDC	26.4 VDC[1]
Output Current Maximum	500mA	500mA
Overcurrent Protection	Short circuit detect and current limit with automatic retry for each output	
Output Self Limiting Current	1.2 to 2.4 amps	
Max Inrush Current	Self limited	
Output Voltage Drop	0.7 VDC @ 0.5 A	0.7 VDC @ 0.5 A
Thermal Protection	Independent overtemperature protection each output	
Output Voltage Clamp During Inductive Switching	+45VDC	-20VDC
Maximum OFF to ON Response	25ms[2]	
Maximum ON to OFF Response	25ms[2]	

Notes:
1. *Operating voltage of current sourcing outputs must be no greater than external power.*
2. *Measured at 5VDC operating voltage, 0.5 A load current.*

Resolution of Frequency Measurements for "Fast Mode"

Input Frequency	Sampling Period	Resolution
1Hz to 1MHz	1000ms	±1Hz
10Hz to 1MHz	100ms	±10Hz
100Hz to 1MHz	10ms	±100Hz
1MHz	1ms	±1000Hz

Inaccuracy of Frequency Measurements Due to Time Base Errors

25MHz Crystal for Time Base	
Inaccuracy at 25°C, Maximum	±30 PPM
Inaccuracy 0-60°C, Referenced to 25°C	±30 PPM
Inaccuracy Due to Aging, Maximum	±5 PPM/Year
Max Time Base Inaccuracy 0-60°C and 10 Years Operation	0.01%

Inaccuracy of Frequency Measurements[1,2] for "Slow Mode"

Input Frequency	Step/Dir	Quadrature 1X	Quadrature 4X
1Hz	±0.002 Hz	±0.002 Hz	±0.002 Hz
10Hz	±0.009 Hz	±0.009 Hz	±0.009 Hz
100Hz	±0.015 Hz	±0.015 Hz	±0.015 Hz
1kHz	±1Hz	±1Hz	±1Hz
10kHz	±100Hz	±100Hz	±100Hz
100kHz	±1000Hz	±1000Hz	±1000Hz
1MHz	±40000Hz	±40000Hz	±40000Hz

Inaccuracy of Frequency Measurements[1,2] for "Fast Mode"				
Input Frequency	Sampling Period	Step/Dir	Quadrature 1X	Quadrature 4X
1Hz	±1 Second	±1Hz	±1Hz	±1Hz
10Hz				
100Hz				
1kHz				
10kHz				
100kHz				
1MHz				

Inaccuracy of Frequency Measurements[1,2,3,4] for "Auto Mode"			
Input Frequency	**Step/Dir**	**Quadrature 1X**	**Quadrature 4X**
1Hz	±1Hz	±1Hz	±1Hz
10Hz			
100Hz			
1kHz			
10kHz	±100Hz	±100Hz	±100Hz
100kHz	±1000Hz	±1000Hz	±1000Hz
1MHz	±10000Hz	±10000Hz	±10000Hz

1. *For stable input signal at given input frequency.*
2. *For total measurement error add the time base error to the tabulated error.*
3. *Maximum sample period: 1 second.*
4. *Minimum sample period: 0.001.*

Module Range:	Target position range ±2.147 billion (32-bit signed integer)

NOTE: *Refer to the I/O Module Configuration Help File Topic (P212) in the Productivity Suite Software for more information on Mode selections.*

HSI LED Indicators

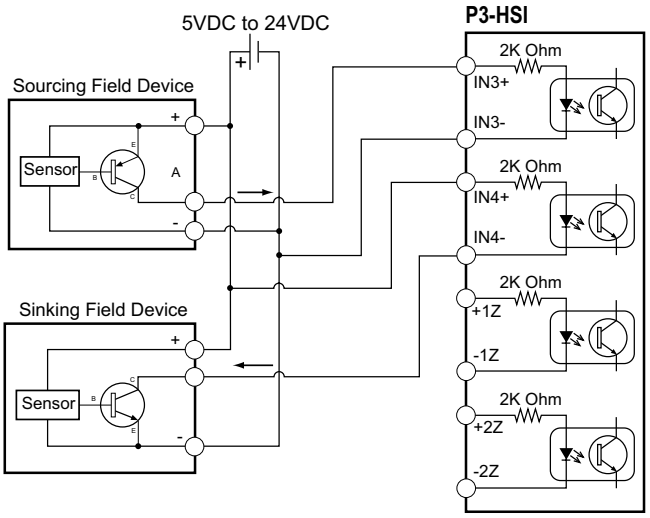


Status LEDs	
4 Fault Status LEDs	One per status output(FLT1, 2, 3,& 4)
8 Input LEDs	One per status input (1A, 1B, 1Z, 2A, 2B, 2Z, IN3 & IN4)
4 Output Status LEDs	(OUT1, OUT 2, OUT3, & OUT4)

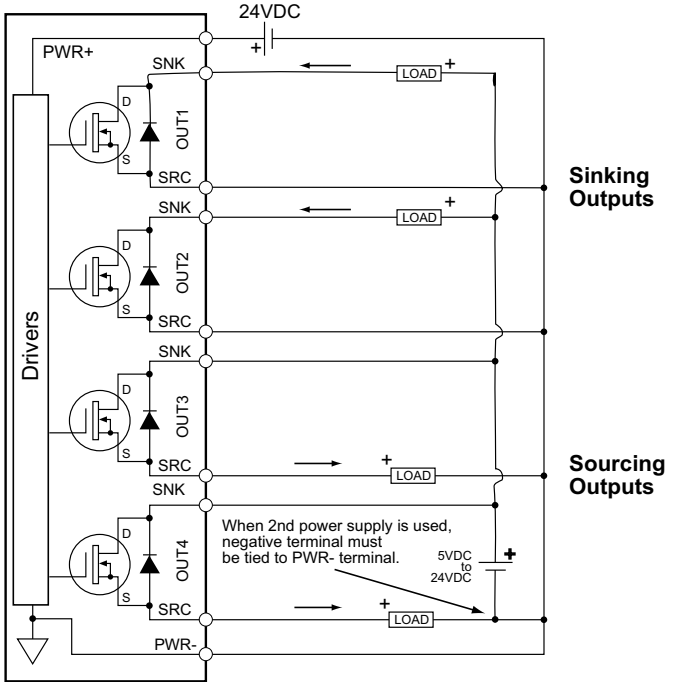
Note: All front panel fault LED's blinking indicates loss of external power.

HSI Wiring Examples

Status Inputs Wiring Diagram

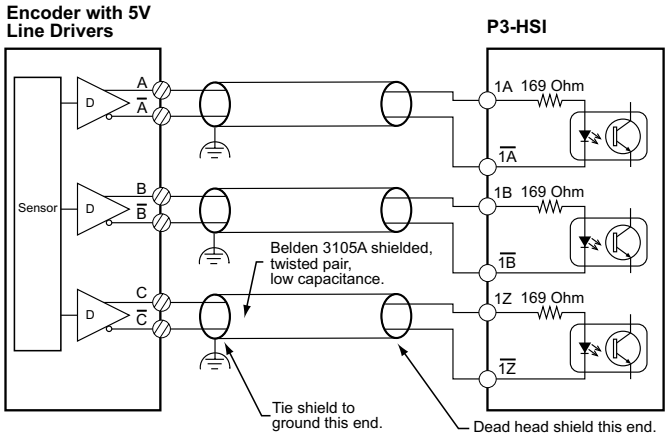


Status Outputs Wiring Diagram

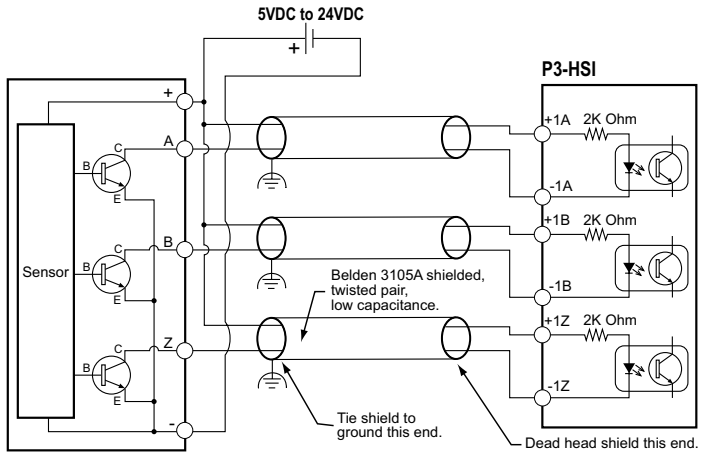


5V Encoder Inputs Wiring Diagram

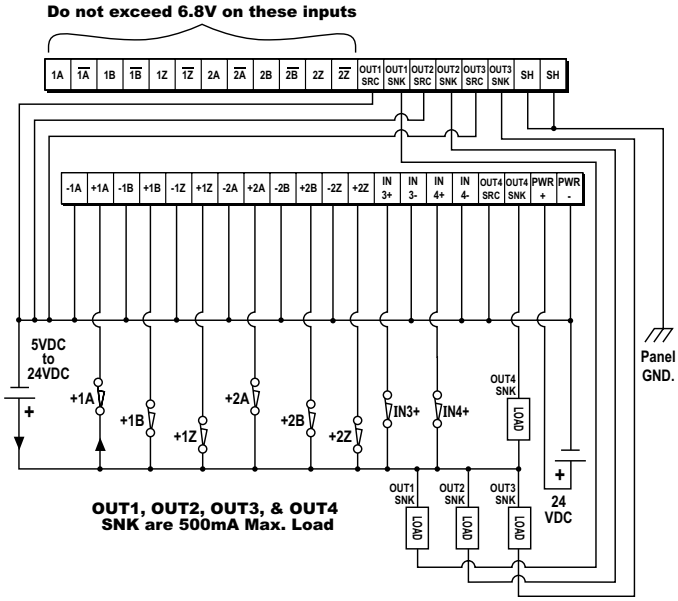
To prevent damage to P3-HSI 5V inputs, do not exceed 6.8 V or 30mA on inputs 1A, $\overline{1A}$, 1B, $\overline{1B}$, 1Z, $\overline{1Z}$, 2A, $\overline{2A}$, 2B, $\overline{2B}$, 2Z, & $\overline{2Z}$.



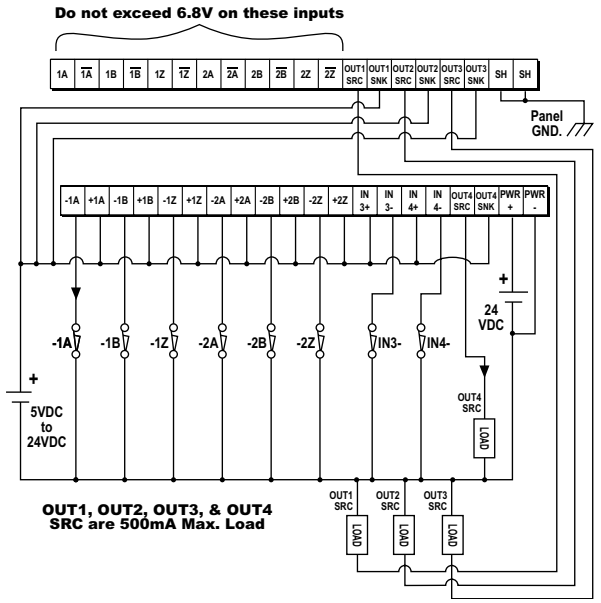
24V Encoder Inputs Wiring Diagram



Sinking I/O Wiring Diagram



Sourcing I/O Wiring Diagram

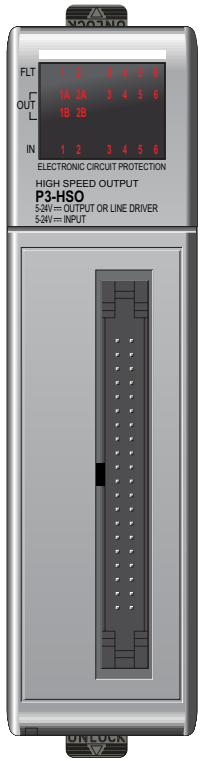


High-Speed Output (HSO) Module Overview

The P3-HSO is a high-speed (1MHz) output module that supports Pulse/Direction, Up/Down and Quadrature pulse output on each of the two independent output channels. It has both line driver and open drain outputs. Additionally, it has six general purpose high-speed inputs and four general purpose outputs. Simple move, velocity move, and additional high level instructions make it easy to implement the application's motion profile.

Use the hardware configuration tool in the Productivity Suite programming software to setup the HSO module. See the Productivity Suite help file.

For applications requiring specialized motion control, consider the PS-AMC module.



General Specifications

Module Type	Intelligent
Modules per Base	No limit
I/O Points Used	None, mapped directly to tags in CPU
Surrounding Air 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)
Field to Logic Side Isolation	1800VAC applied for 1s
Insulation Resistance	>10MΩ @ 500VDC
Heat Dissipation	6.26 W
Enclosure Type	Open equipment
Agency Approvals	UL508 file E157382, Canada & USA CE (EN61131-2*) UL 61010-1 and UL 61010-2-201 File E139594, Canada & USA
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000® System.
Field Wiring	Use ZIPLink Wiring System, see Chapter 5. Must use copper conductors rated 75°C or equivalent.
Weight	114g (4oz)

**Meets EMC and Safety requirements. See the Declaration of Conformity for details.*

Connector Specifications

Connector Type	IDC style header with latch, Omron XG4A-4034
Number of Pins	40 point
Pitch	0.1 in. (2.54 mm)

No terminal block sold for this module; ZIPLink required. See Chapter 5 for part numbers of ZIPLink cables and connection modules required with this module.





***NOTE:** The most recent Productivity Suite software and firmware versions may be required to support new modules and new features.*

Power Specifications

External Power	24VDC +10%/-15%, Class 2
Maximum Voltage	26.4 VDC
Minimum Voltage	20.4 VDC
Current Consumption Excluding Outputs	130mA
Maximum Current Consumption Total of the 4 Status Outputs	2A

Pulse Outputs Specifications

Pulse Outputs	2 Channels	
Output Pulse Type, per Channel Select	Selectable for pulse & direction, up/down or quadrature	
Output Signal Type, per Channel Select	RS-422 Line Driver Current Sinking and Sourcing	Open Drain FET Outputs Current Sinking
Output Volts	RS-422 levels	24VDC
Output Volts Maximum	5VDC	36VDC
Protection for Overcurrent and Short Circuit to Power	Current limit and Thermal shutdown2	Current limit and Thermal shutdown1
Protection Short to Ground	Yes	Yes
Overcurrent Trip Level	Output current limit ±200mA max.2	100mA minimum
Maximum Continuous Output Current	±60mA	40mA
Max Switching Frequency, 1m Cable	1MHz	500kHz*
Max Switching Frequency, 10m Cable	1MHz	200kHz*

Notes:
1. *Any fault shuts off the output. Fault is indicated and output is kept off until a new move start is received.*
2. *RS-422 thermal faults auto reset after device cool down.*

** Outputs are not limited to these speeds but single ended signals produced by the FETs are not usually reliable above these speeds due to cabling capacitance.*

Status Input Specifications

Status Input	6 inputs
Isolation	Each status input is individually isolated from all other circuits
Input Volts Range	5–24 VDC
Input Volts Maximum	±34VDC, limited by protection
Input Impedance	1kΩ min., 5kΩ max.
Inputs Rated Current	5–24 VDC, 16mA 5.2 mA typ. @ 5VDC 22mA max. @ 34VDC
Input Minimum ON Voltage	4.5 VDC
Input Maximum OFF Voltage	2.0 VDC
Input Minimum ON Current	5.0 mA
Input Maximum OFF Current	1.4 mA
OFF to ON Response Time	4ms
ON to OFF Response Time	4ms

Status Output Specifications

Status Outputs	4 Outputs	
Output Signal Type, per Output	Current Sinking	Current Sourcing
Operating Voltage[1]	5–24VDC	5–24VDC[1]
Output Volts Maximum	36VDC	26.4 VDC[1]
Output Current Maximum	500mA	500mA
Overcurrent Protection	Short circuit detect, overcurrent shutdown[1]	
Output Self Limiting Current	1.2 to 2.4 amps	
Max. Inrush Current	Self limited	
Output Voltage Drop	0.7 VDC @ 0.5 A	0.7 VDC @ 0.5 A
Thermal Protection	Independent overtemperature protection each output	
Output Voltage Clamp During Inductive Switching	+45VDC	-20VDC
Maximum OFF to ON Response	25ms[2]	
Maximum ON to OFF Response	25ms[2]	

Notes:
1. *Any fault shuts off the output. Fault is indicated and output is kept off until a new move start is received.*
2. *Operating voltage for current sourcing outputs must be less or equal to the External power.*
3. *Measured at 5V operating voltage, 0.5 A load.*

Resolution of Frequency Output Measurements

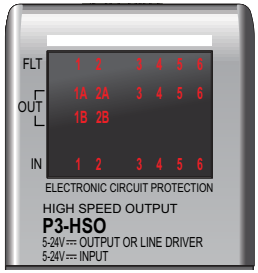
Output Frequency	Resolution
1kHz	0.01 Hz
10kHz	0.67 Hz
100kHz	67Hz
1MHz	6622Hz

Inaccuracy of Output Frequency Due to Time Base Errors

25 MHz Crystal for Time Base	
Inaccuracy at 25°C, Maximum	±30 PPM
Inaccuracy 0-60°C, Referenced to 25°C	±30 PPM
Inaccuracy Due to Aging, Maximum	±5 PPM/Year
Max Time Base Inaccuracy 0-60°C and 10 Years Operation	0.01%

Module Range:	Target position range ±2.147 billion (32-bit signed integer)

HSO LED Indicators

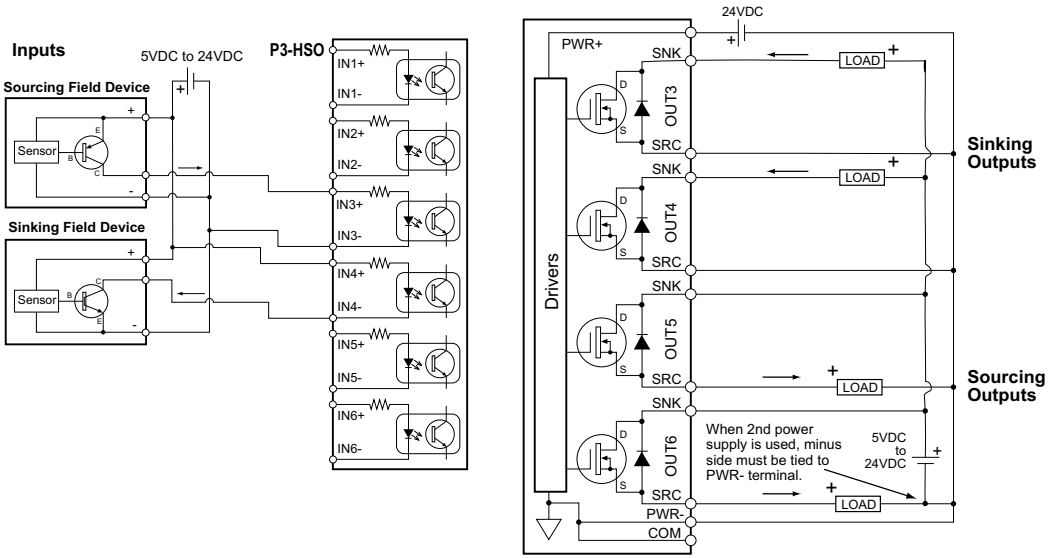


Status LEDs	
6 Fault Status LEDs	One per pulse output and one per status output (FLT1, 2, 3, 4, 5 & 6)
6 Input LEDs	One per status input (IN1, 2, 3, 4, 5 & 6)
8 Output Status LEDs	(OUT1A &1B, OUT 2A & 2B, OUT3, 4, 5 & 6)

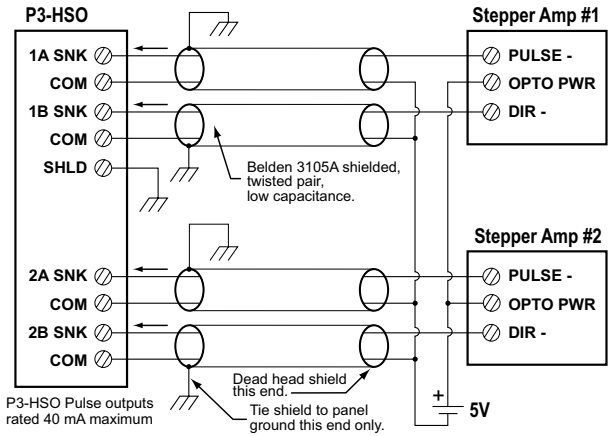
Note: All front panel fault LED's blinking indicates loss of external power.

HSO Wiring Examples

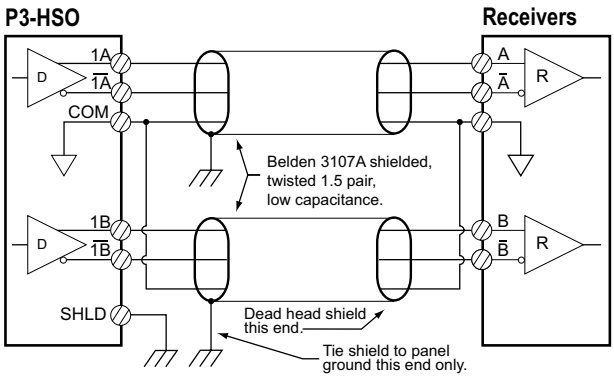
Status Inputs and Outputs



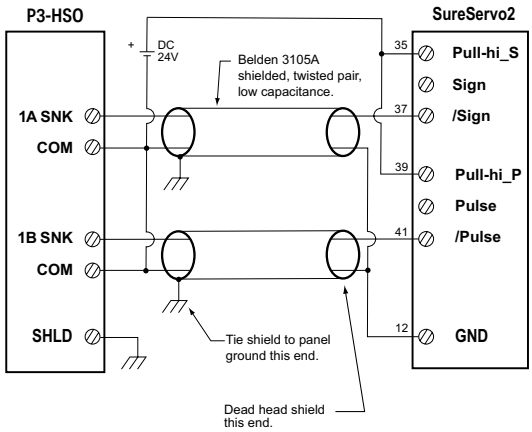
Sinking Pulse Output Wiring Diagram



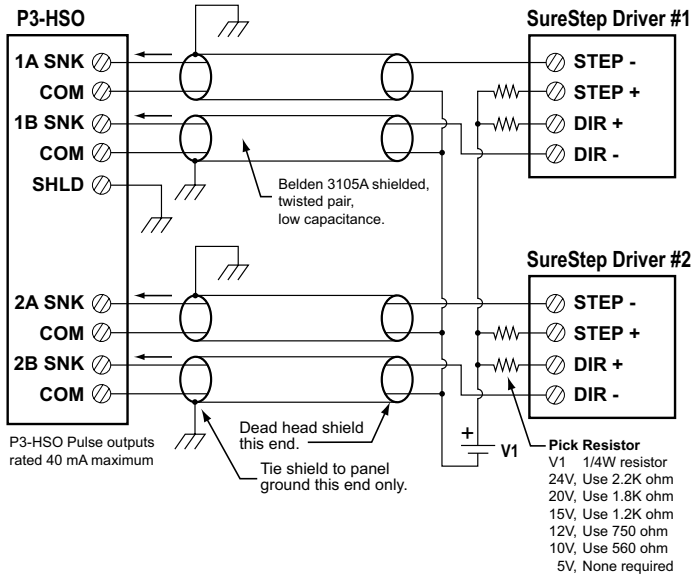
Line Driver Pulse Output Wiring Diagram



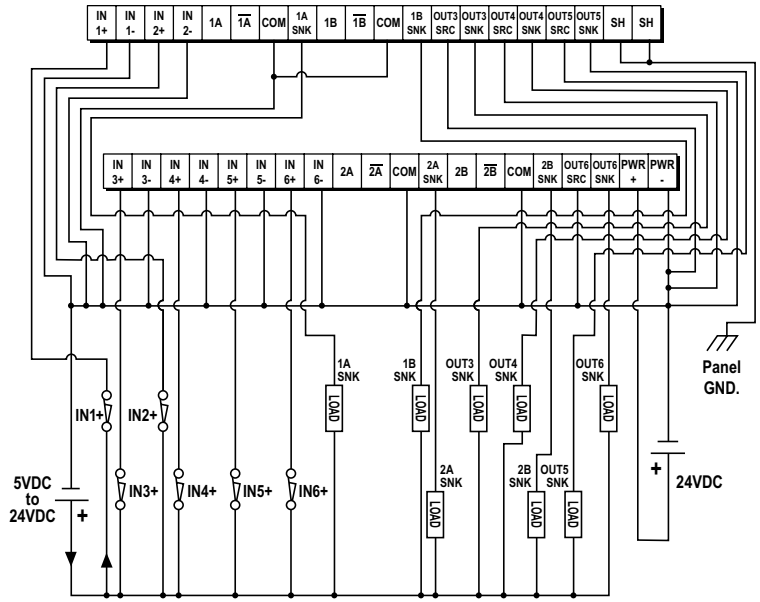
SureServo Wiring Diagram



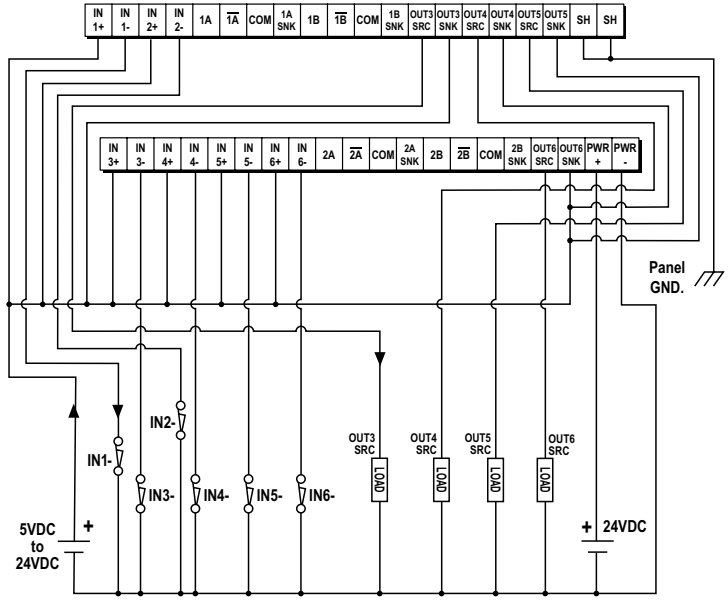
SureStep Wiring Diagram



Sinking I/O Wiring Diagram

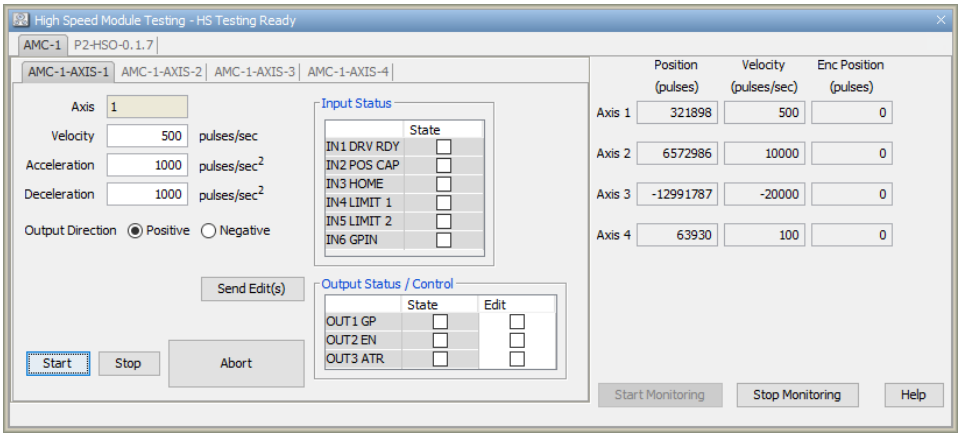


Sourcing I/O Wiring Diagram



High-Speed Module Tester Utility

The High-Speed Module Tester is a software utility that allows a user to test P3-HSO and PS-AMC module's inputs and outputs. It is highly recommended that you simulate your P3-HSO and PS-AMC functions before attempting to control the module from your CPU program. This software utility, seen below, can be useful with debugging, confirming field wiring and verifying external device operation.



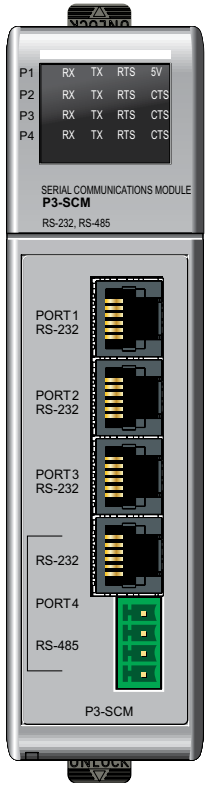
Refer to the Productivity Suite help file for more information on the High-Speed Module Tester Utility.

P3-SCM Serial Communications Module

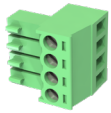
The P3-SCM is a 4-port serial communications module capable of Modbus, ASCII and Custom Communications Protocols. The P3-SCM is also able to power the C-more Micro through RS-232 (Port 1 only) for use with the Productivity3000®.

This module contains (4) RS-232 (RJ12) ports half or full duplex, (1) RS-485 port (4-wire terminal block) half duplex, all supporting Modbus RTU Master/Slave, ASCII In/Out and Custom Protocol up to 38.4K baud rate.

P3-SCM Specifications



Removable RS-485 Terminal Connector included.



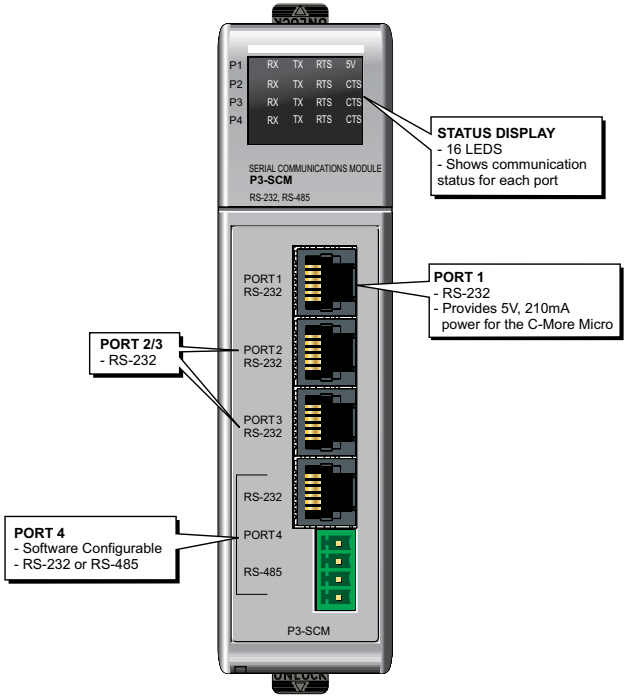
General Specifications	
Module Type	Intelligent
Modules per Base	Base size limited, 11 Max
Modules per Group	11 Max
I/O Points Used	None, mapped directly to tags in CPU
Field Wiring Connector	4 - RJ12, 1 - 4 Position Terminal Block
Operating Temperature	0° to 60°C (32° to 140°F) IEC 60068-2-14 (Test Nb, Thermal Shock)
Storage Temperature	-20° to 70°C (-4° to 158°F) IEC 60068-2-1 (Test Ab, Cold) IEC 60068-2-2 (Test Bb, Dry Heat) IEC 60068-2-14 (Test Na, Thermal Shock)
Humidity	5 to 95% (non-condensing) IEC 60068-2-30 (Test Db, Damp Heat)
Environmental Air	No corrosive gases permitted (EN61131-2 pollution degree 1)
Vibration	IEC60068-2-6 (Test Fc)
Shock	IEC60068-2-27 (Test Ea)
Field to Logic Side Isolation	None
Insulation Resistance	No Isolation
Noise Immunity	NEMA ICS3-304 IEC 61000-4-2 (ESD) Impulse 1000V @ 1µS pulse IEC 61000-4-4 (FTB) RFI, (145MHz, 440MHz 5W @ 15cm) IEC 61000-4-3 (RFI)
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000 System.
Weight	260g (9oz)
Agency Approvals[1]	UL508 file E157382, Canada & USA CE (EN61131-2007) UL 61010-1 and UL 61010-2-201 File E139594, Canada & USA

1. *To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page*

Removable Terminal Block Specifications	
Number of Positions	4 Screw Terminals, 3.5MM Pitch
Wire Range	16–28 AWG, Solid/Stranded Conductor "Use Copper Conductors, 75°C or Equivalent".
Screwdriver Size	TW-SD-VSL-1 (recommended)
Screw Torque	0.4 N·m

RS-485 Cable Options	
Recommended	Recommend L19827-100, L19827-500, L19827-1000 or Belden #9841

NOTE: *The most recent Productivity Suite software and firmware versions may be required to support new modules and new features.*



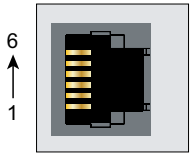
P3-SCM Configuration Options

Configuration Item	Port 1 (RS-232)	Ports 2, 3 & 4 (RS-232)	Port 4 (when RS-485)
Protocol Selections	Disabled, Modbus RTU, ASCII/Custom		
Data Rate	1200,2400,4800,9600,19200, 33600, & 38400		
Parity	None, Odd or Even		
Data Bits[4]	7 or 8 Bit		
RTS Off Delay Time[1]	None, or 0–5,000 ms		N/A
RTS On Delay Time[1]	None, or 0–5,000 ms		N/A
Modbus Character Timeout[2]	None, or 0–10,000 ms		
Communication Timeout (Timeout between query and response)	100–30,000 ms		
Response/Request Delay Time	N/A		None, or 1–5,000 ms
Comm Heartbeat Value[2]	2–1,000 s		
Node Address (Station)	1 to 247		
CTS	N/A	Ignore, Wait, System Input[3]	N/A
Enable/Disable CTS Wait Timeout	N/A	Enable Timeout, Disable Timeout (Never Timeout)	N/A
CTS Wait Timeout	N/A	100–999,900 ms	N/A
RTS	On, Off, Assert During Transmit, System Output		N/A
Port 4 RS-485 2-Wire Mode	N/A		Disable, Enable
MODBUS Port Security	Read/Write, Read Only		

1. *For "None" selection with Modbus RTU protocol, Modbus.org minimums are used. This minimum is 3.5 character times up to 19, 200 baud rate and 1.75 ms over 19,200 baud rate.*
2. *Only applies to MODBUS messages*
3. *CTS signal is only provided on Ports 2, 3 & 4*
4. *7-bit data is only supported with Odd or Even parity*

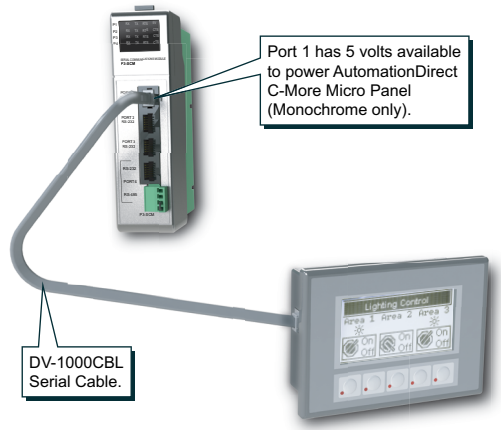
Port 1 RS-232 Specifications

Port Name	RS-232
Description	Non-isolated RS-232 DTE port connects the CPU as a Modbus/ASCII master or slave to a peripheral device. Includes ESD and built-in surge protection.
Data Rates	Selectable, 1200, 2400, 4800, 9600, 19200, 33600 and 38400.
+5V Cable Power Source	210mA maximum at 5V, ± 5%. Reverse polarity and overload protected.
TXD	RS-232 Transmit output
RXD	RS-232 Receive input
RTS	Handshaking output for modem control.
GND	Logic ground
Maximum Output Load (TXD/RTS)	3kΩ, 1,000pf
Minimum Output Voltage Swing	±5V
Output Short Circuit Protection	±15mA
Port Status LED	Red LED is illuminated when active for TXD, RXD, RTS



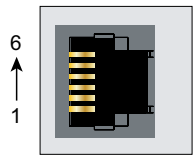
6-pin RJ12 Female Modular Connector

Pin #	Signal	
1	GND	Logic Ground
2	+5V	210mA Maximum
3	RXD	RS-232 Input
4	TXD	RS-232 Output
5	RTS	RS-232 Output
6	GND	Logic Ground



Ports 2, 3 and 4 RS-232 Specifications

Port Name	RS-232
Description	Non-isolated RS-232 DTE port connects the CPU as a Modbus/ASCII master or slave to a peripheral device. Includes ESD and built-in surge protection.
Data Rates	Selectable, 1200, 2400, 4800, 9600, 19200, 33600 and 38400.
TXD	RS-232 Transmit output
RXD	RS-232 Receive input
RTS	Handshaking output for flow control.
CTS	Handshaking input for flow control.
GND	Logic ground
Maximum Output Load (TXD/RTS)	3kΩ, 1,000pf
Minimum Output Voltage Swing	±5V
Output Short Circuit Protection	±15mA
Port Status LED	Red LED is illuminated when active for TXD, RXD, RTS



6-pin RJ12 Female Modular Connector

Pin #	Signal	
1	GND	Logic Ground
2	CTS	RS-232 Input
3	RXD	RS-232 Input
4	TXD	RS-232 Output
5	RTS	RS-232 Output
6	GND	Logic Ground

RS-232 Ports 1, 2, 3 and 4

Electrical Specifications	Min	Typ	Max	Units
Output ON (3kΩ, 1000pF Load)	5.0	5.2		Volts
Output OFF (3kΩ, 1000pF Load)		-5.2	-5.0	Volts
Output Short-Circuit Current		15		mA
Short-Circuit Duration			No Limit	Seconds
Output Resistance	300			Ohm
Input ON Threshold		1.6	2.4	Volts
Input OFF Threshold	0.6	1.2		Volts
Input Resistance	3k	5k	7k	Ohm

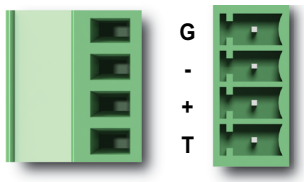
Line Specifications for RS-232 Ports

RS-232 Line Specifications	Options	Units
Data Rate Setting	1200,2400,4800,9600,19200, 33600, & 38400	Baud
Data Rate Error	±2	%
Data Bits Setting[1]	7 or 8	Bits
Stop Bits Setting	1	Bits
Parity Setting	None[1], Odd or Even	Parity
Data Transmission	Half duplex or Full duplex[2]	N/A
Network	Point-to-Point	N/A

1. 7-bit data are only supported with odd or even parity
2. Full duplex is only supported for ASCII/Custom Protocol

Port 4 (RS-485 Configuration)

Port Name	RS-485
Description	Non-isolated RS-485 port connects the CPU as a Modbus/ASCII master or slave to a peripheral device. Includes ESD/EFT protection and automatic echo cancellation when transmitter is active.
Data Rates	Selectable, 1200, 2400, 4800, 9600, 19200, 33600 and 38400.
TXD+/RXD+	RS-485 transceiver high
TXD-/RXD-	RS-485 transceiver low
GND	Logic ground
Input Impedance	19kΩ
Maximum load	50 transceivers, 19kΩ each, 60Ω termination (two 120Ω resistors at each end)
Output Short-Circuit Protection	±250mA, thermal shut-down protection
Electrostatic Discharge Protection	±8KV per IEC1000-4-2
Electrical Fast Transient Protection	±2KV per IEC1000-4-4.
Minimum Differential Output Voltage	1.5V with 60Ω load
Fail safe inputs	Logic high input state if inputs are unconnected
Maximum Common Mode Voltage	-7.5V to 12.5V.
Port Status LED	Red LED illuminated when active for TXD and RXD
Cable Options	Recommend L19827-100, L19827-500, L19827-1000 or Belden #984



Pin #	Signal
G	GND
–	TXD-/RXD-
+	TXD+/RXD+
T	TERMINATION

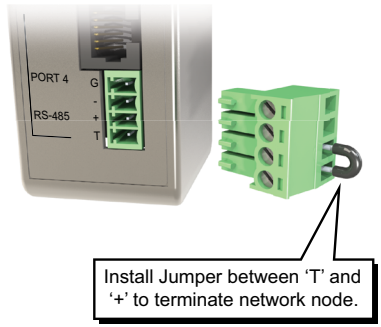
RS-485 Port 4

Electrical Specifications	Min	Type	Max	Units
Driver Differential Output (60Ω load)	1.5			Volts
Driver Common-Mode Output			3	Volts
Driver Short-Circuit Output Current			250	mA
Short-Circuit Duration (Thermal Shutdown)			No Limit	Sec-onds
Receiver Differential Input Threshold	200			mV
Receiver Common-Mode Input	-7		12	Volts
Input Resistance	12k			Ohm
Termination Resistance (TB jumper wire 'T' to '+')		120		Ohm
Cable Length (38400 BAUD max.)			1200	Meters

Line Specifications for RS-485 Port

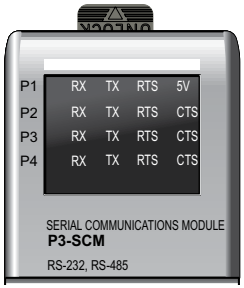
RS-485 Line Specifications	Options	Units
Data Rate Setting	1200,2400,4800,9600,19200, 33600, & 38400	Baud
Data Rate Error	±2	%
Data Bits Setting[1]	7 or 8	Bits
Stop Bits Setting	1	Bits
Parity Setting	None[1], Odd or Even	Parity
Data Transmission	Half duplex	N/A

1. 7-bit data are only supported with odd or even parity



** Jumper not included*

P3-SCM LED Indicators



Diagnostic LEDs

LED	Port 1	Port 2	Port 3	Port 4
RXD	X	X	X	X
TXD	X	X	X	X
RTS	X	X	X	X
CTS		X	X	X
5V	X			

1. All RS232 & RS485 LED's reflect the actual electrical level of the signal, there is no direct firmware control of LED's
2. RS232 LED's RXD, TXD, RTS & CTS are turned ON when their voltage on the RS232 wire is postive
a - This occurs when the UART I/O signal is low (GND)
b - They are turned OFF when the voltage on the RS232 wire is negative
3. RS485 LED's RXD, TXD, RTS & CTS are turned ON when the UART I/O signal is low (GND)
4. 5V LED is ON when 5V power is good, 5V LED is OFF when 5V is shorted to ground

Port 4 LED Behavior

Port 4	RX	TX	RTS	CTS
RS232	Flickers on RXD activity, OFF when idle	Flickers on TXD activity, OFF when idle	ON when asserted, OFF otherwise	ON when asserted, OFF otherwise
RS485				Always OFF

Analog I/O Specifications



In This Chapter...

Analog I/O Modules Overview 3–2
Analog I/O Modules 3–3
P3-04ADS Isolated Analog Input 3–4
P3-08AD Analog Input 3–10
P3-16AD-1 Analog Input 3–15
P3-16AD-2 Analog Input 3–20
P3-08RTD Analog Input 3–25
P3-08THM Analog Input 3–30
P3-04DA Analog Output 3–35
P3-08DA-1 Analog Output 3–41
P3-08DA-2 Analog Output 3–46
P3-06DAS-1 Isolated Analog Output (Retired) 3–51
P3-06DAS-2 Isolated Analog Output (Retired) 3–56
P3-16DA-1 Analog Output 3–61
P3-16DA-2 Analog Output 3–66
P3-8AD4DA-1 Analog Input/Output 3–71
P3-8AD4DA-2 Analog Input/Output 3–77

Analog I/O Modules Overview

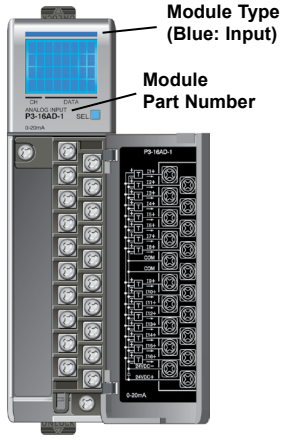
A variety of analog I/O modules are available for use in local, expansion, and remote I/O bases.

Each I/O module is identified as an "Input", "Output", or "Input/Output" module on its front panel using the color coding scheme listed below. See Chapter 2 for discrete I/O module specifications, Chapter 4 for specialty module specifications and Chapter 5 for valuable system installation and wiring information. The following pages contain the analog I/O module specifications.

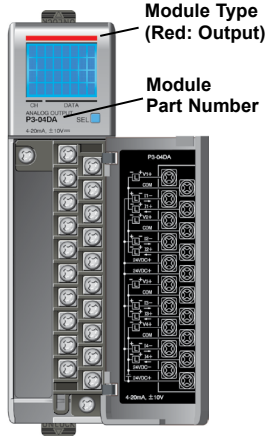
There are fifteen analog I/O modules available. The specifications and wiring diagrams, along with configuration and scaling information are in this chapter.

Use the hardware configuration tool in the Productivity Suite programming software to setup the I/O modules. See the Productivity Suite help file.

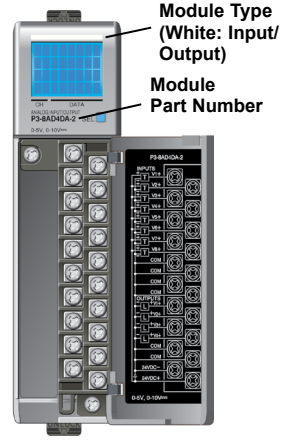
Analog Input Modules



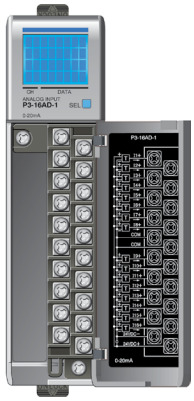
Analog Output Modules



Analog Input/Output Modules

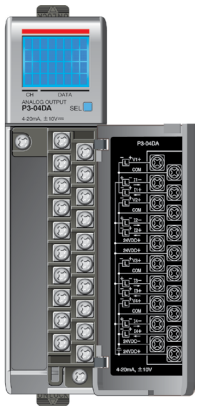


Analog I/O Modules



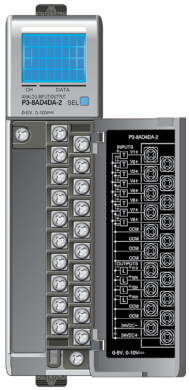
Analog Input Modules

Productivity3000 Analog Input Modules			
Part Number	Number of Channels	Description	See Page
P3-04ADS	4	Isolated Analog Input	3-4
P3-08AD	8	Analog Input	3-10
P3-16AD-1	16	Analog Input (Current)	3-15
P3-16AD-2	16	Analog Input (Voltage)	3-20
P3-08RTD	8	Analog RTD Input	3-25
P3-08THM	8	Analog Thermocouple Input	3-30



Analog Output Modules

Productivity3000 Analog Output Modules			
Part Number	Number of Channels	Description	See Page
P3-04DA	4	Analog Output	3-35
P3-08DA-1	8	Analog Output (Current)	3-41
P3-08DA-2	8	Analog Output (Voltage)	3-46
P3-06DAS-1	6	Isolated Analog Output (Current)	3-51
P3-06DAS-2	6	Isolated Analog Output (Voltage)	3-56
P3-16DA-1	16	Analog Output (Current)	3-61
P3-16DA-2	16	Analog Output (Voltage)	3-66

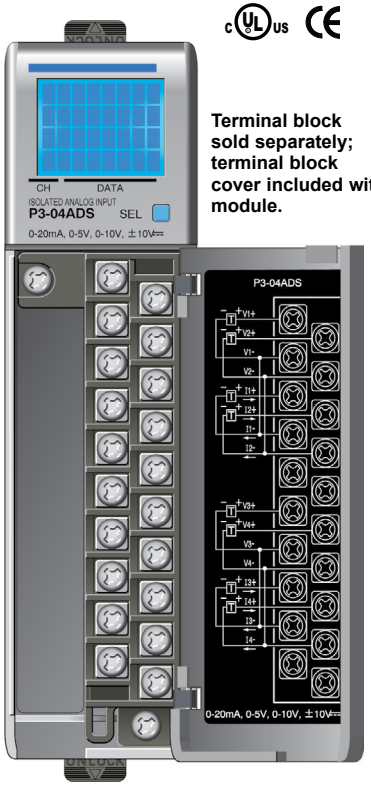


Analog Input/Output Modules

Productivity3000 Analog Input/Output Modules			
Part Number	Number of Channels	Description	See Page
P3-8AD4DA-1	8/4	Analog Input/Output (Current)	3-71
P3-8AD4DA-2	8/4	Analog Input/Output (Voltage)	3-77

P3-04ADS Isolated Analog Input

The P3-04ADS Isolated Voltage/Current Analog Input Module provides four isolated channels for receiving ± 10VDC, 0 to 5VDC, 0 to 10VDC and 0 to 20mA signals.



Terminal block sold separately; terminal block cover included with module.

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)
Field to Logic Side Isolation	1800VAC applied for 1s
Insulation Resistance	>10MΩ @ 500VDC
Heat Dissipation	2.6 W
Enclosure Type	Open equipment
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000® system.
Field Wiring	Removable terminal block (not included). Use ***ZIP***Link wiring system or optional terminal block. See Chapter 5.
Terminal Type (not included)	20-position removable terminal block
Weight	61g (2.14 oz)
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.

**Meets EMC and Safety requirements. See the Declaration of Conformity for details.*

WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

We recommend using prewired ZIPLink cables and connection modules. See Chapter 5.
Terminal block cover included. If you wish to hand-wire your module, a removable terminal block is sold separately. Order part number P3-RTB.

P3-04ADS Isolated Analog Input (continued)

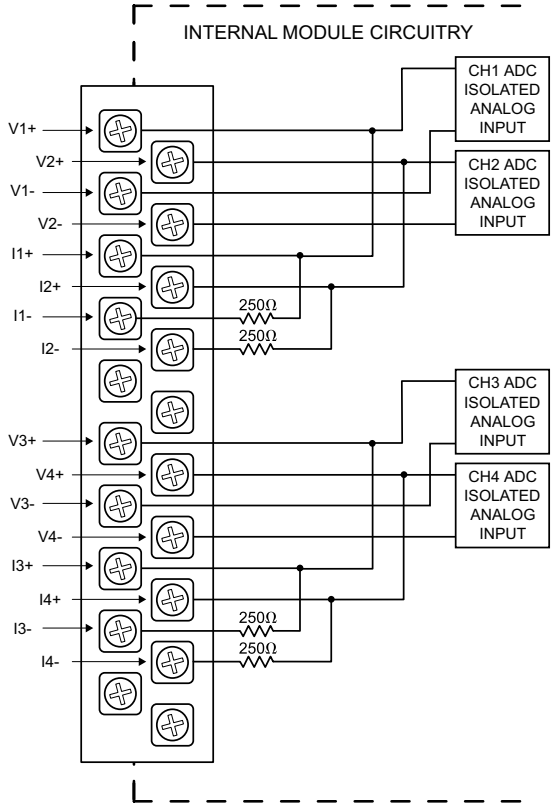
Input Specifications	
Input Channels	4 Channel-to-Channel Isolated
Module Signal Input Ranges*	±10VDC, 0–5 VDC, 0–10 VDC, 0–20 mA
Resolution	15 bit + sign (0-10 V), 16-bit (all others)
Value of LSB (least significant bit)	±10V = 305µV 0–5 V = 152µV 0–10 V = 305µV 0–20mA = 0.610µA
Data Range	0 to 65535 counts unipolar -32768 to +32767 counts bipolar
Isolated Loop Pwr for Ext. Xmitters	20–30 VDC, current limited to < 30mA
Input Type	Differential
Common Mode Rejection Ratio	-75dB min. @ DC, -500kHz
Maximum Continuous Overload	±31mA, current input ±100V, voltage input
Input Impedance	250kΩ ±5% voltage input 250Ω ±0.1% ¼ W. current input
Filter Characteristics	Active low pass, -3dB @ 30Hz, -10dB @ 55Hz
Sample Duration Time	1.28 ms per channel (does not include ladder scan time)
All Channel Update Rate	5.2 ms
Open Circuit Detection Time	Zero reading within 1s
Conversion Method	Successive Approximation
Accuracy vs. Temperature	±25 PPM / °C max
Maximum Inaccuracy	0.1% of range voltage, 0.2% of range current (including temperature drift)
Linearity Error (End to End)	±0.025% of range maximum, Monotonic with no missing codes
Input Stability and Repeatability	±0.02% of range maximum after 10 min.
Full Scale Calibration Error (not including Offset)	±0.05% of range maximum
Offset Calibration Error	±0.05% of range maximum
Max Crosstalk	-96dB 1 LSB
Channel to Channel Isolation	900VDC applied for 1s
Recommended Fuse (external)	Edison S500-32-R, 0.032A fuse on current inputs only
External DC Power Required	NONE for the module

** Select any two ranges via hardware jumpers. Range setting is for channels 1 and 3; and channels 2 and 4.*

Removable Terminal Block Specifications	
Number of Positions	20 screw terminals
Wire Range	22–14 AWG (0.324 to 2.08 sq. mm) Solid / stranded conductor 3/64 in. (1.2 mm) insulation maximum USE COPPER CONDUCTORS , 60°C or equivalent.
Screw Driver Width	1/4 inch (6.5 mm) maximum
Screw Size	M3 size
Screw Torque	Field terminals: 7–9 in./lb (0.882–1.02 N·m) Self-jacking screws: 2.7–3.6 in./lb (0.3–0.4 N·m). Do not over-tighten screws when installing terminal block.

P3-04ADS Isolated Analog Input (continued)

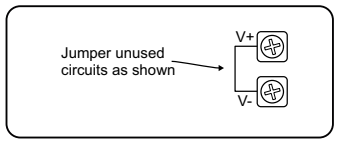
Wiring Diagrams

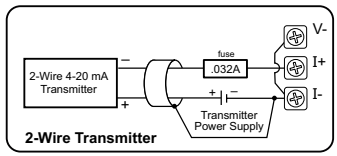


Current Input Circuits

An Edison S500-32-R 0.032A fast-acting fuse is recommended for all 4-20mA current loops.

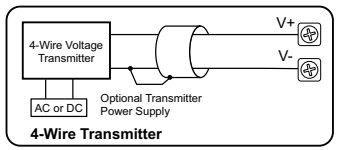
Unused Circuits



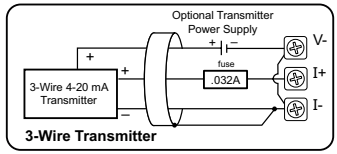


2-Wire Transmitter

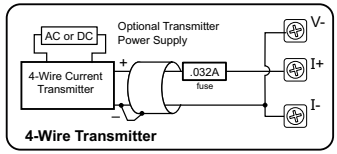
Voltage Input Circuits



4-Wire Transmitter



3-Wire Transmitter

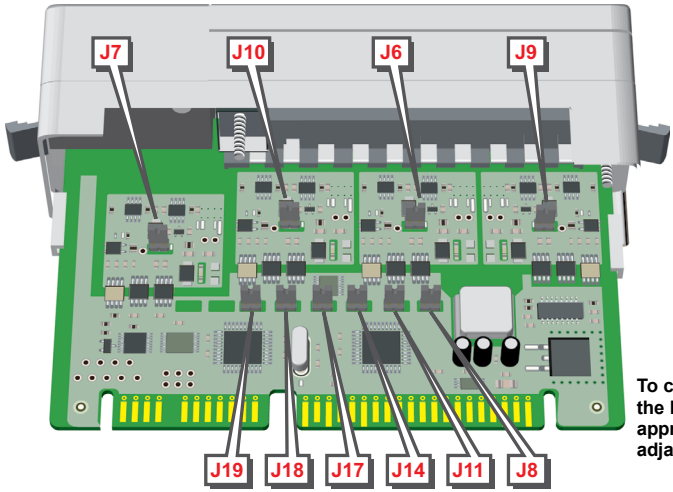


4-Wire Transmitter

NOTES:

1. Shield connected to signal source common.
2. If current is chosen, I- **MUST** be jumpered to V-. For example, when using 4-20 mA source for Input 3, I3- must be connected to V3-.

P3-04ADS Isolated Analog Input (continued)



To change the configuration of the P3-04ADS module, select the appropriate jumper position from the adjacent Jumper Orientation Table.

P3-04ADS Jumper Orientation

J19	J18	J17	J14	J11	J8	J7	J10	J6	J9	Function
N	N	-	-	-	-	-	-	-	-	Enable channel 1
Y	N	-	-	-	-	-	-	-	-	Enable channel 1 & 2
N	Y	-	-	-	-	-	-	-	-	Enable channel 1, 2 & 3
Y	Y	-	-	-	-	-	-	-	-	Enable all channels
-	-	N	N	-	-	Y	-	Y	-	Range 0-5V for channels 1 & 3
-	-	Y	N	-	-	N	-	N	-	Range 0-10V for channels 1 & 3
-	-	N	Y	-	-	N	-	N	-	Range +/-10V for channels 1 & 3
-	-	Y	Y	-	-	Y	-	Y	-	Range 0-20mA for channels 1 & 3
-	-	-	-	N	N	-	Y	-	Y	Range 0-5V for channels 2 & 4
-	-	-	-	Y	N	-	N	-	N	Range 0-10V for channels 2 & 4
-	-	-	-	N	Y	-	N	-	N	Range +/-10V for channels 2 & 4
-	-	-	-	Y	Y	-	Y	-	Y	Range 0-20mA for channels 2 & 4

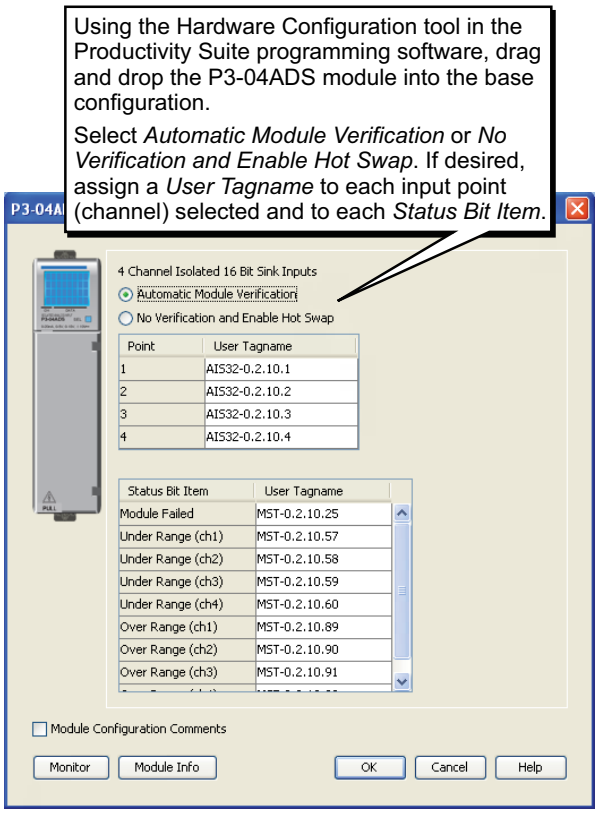
Legend: N = No jumper installed (open)
Y = Jumper installed

Configuration/Diagnostic Settings

Number of Channels to Scan	Hardware jumpers per module
Range Selection	Hardware jumpers
Input Under Range Status Bits	1 bit per channel
Output Over Range Status Bits	1 bit per channel
Module Diagnostics Failure	1 bit per module

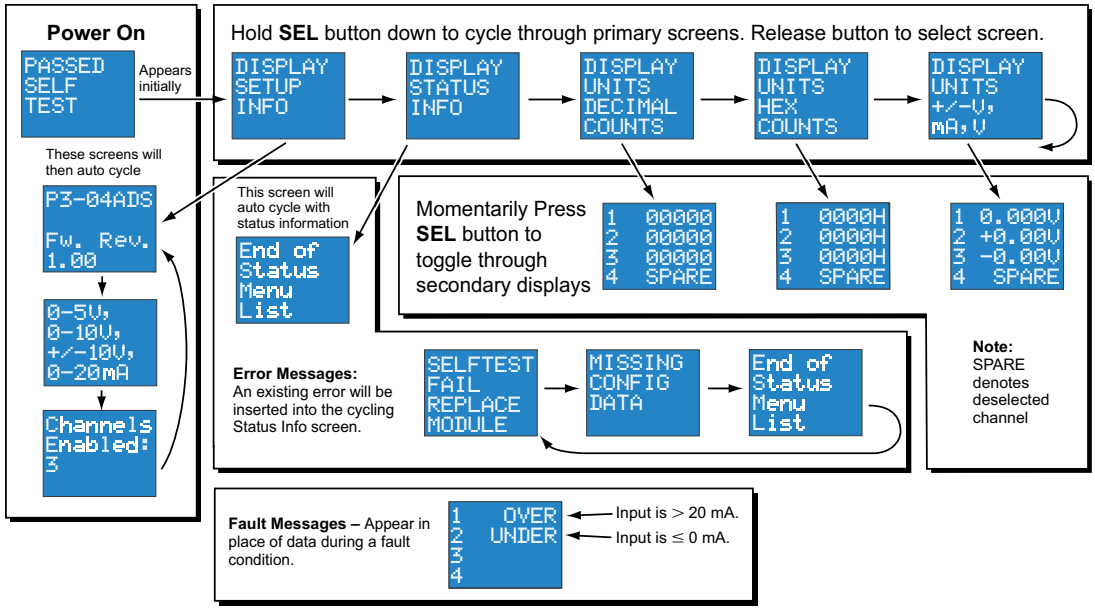
P3-04ADS Isolated Analog Input (continued)

Module Configuration



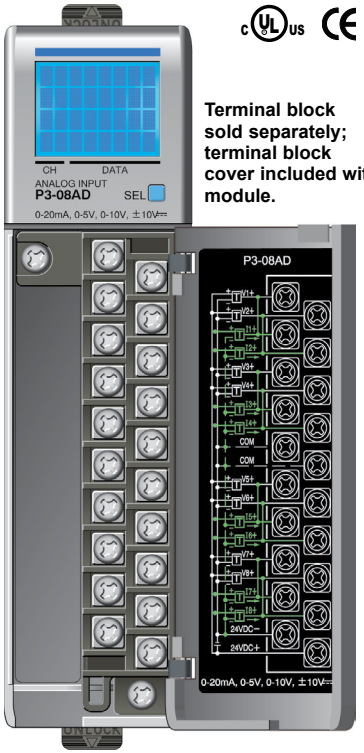
P3-04ADS Isolated Analog Input (continued)

LCD Panel Display



P3-08AD Analog Input

The P3-08AD Voltage/Current Analog Input Module provides 8 channels for receiving ±10VDC, ±5VDC, 0 to 5VDC, 0 to 10VDC, and 0 to 20mA signals.



Terminal block sold separately; terminal block cover included with module.

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)
Field to Logic Side Isolation	1800VAC applied for 1s
Insulation Resistance	>10MΩ @ 500VDC
Heat Dissipation	1.1 W
Enclosure Type	Open equipment
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000® system.
Field Wiring	Removable terminal block (not included). Use ***ZIP***Link wiring system or optional terminal block. See Chapter 5.
Terminal Type (not included)	20-position removable terminal block
Weight	105g (3.73 oz)
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.

**Meets EMC and Safety requirements. See the Declaration of Conformity for details.*

WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

We recommend using prewired ZIPLink cables and connection modules. See Chapter 5.
Terminal block cover included. If you wish to hand-wire your module, a removable terminal block is sold separately. Order part number P3-RTB.

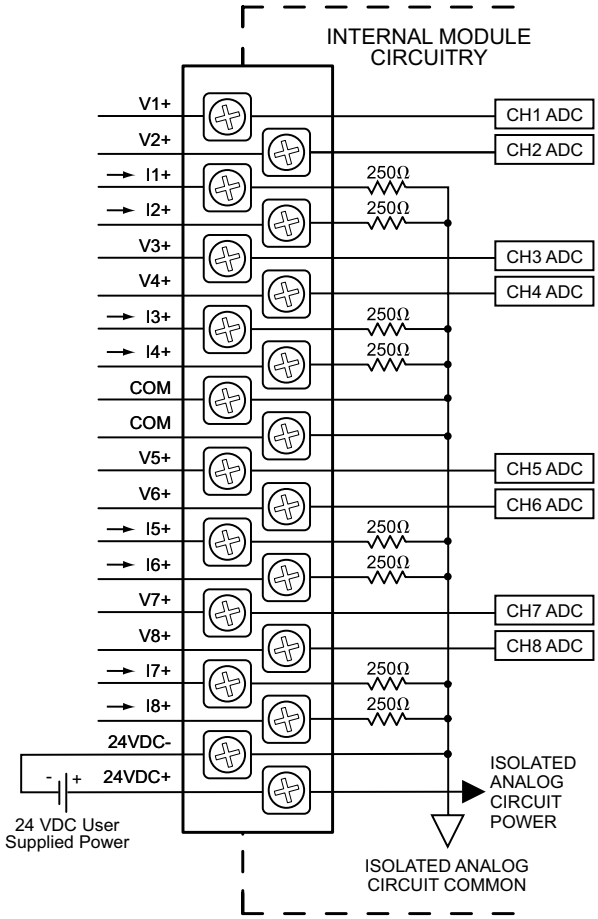
P3-08AD Analog Input (continued)

Input Specifications	
Input Channels	8
Module Signal Input Ranges	±10VDC, ±5VDC, 0 - 5VDC, 0 - 10VDC, 0 - 20mA
Signal Resolution	16 bit
Resolution Value of LSB (least significant bit)	1 LSB = 1 count ±10V = 305µV ±5V = 152µV 0 - 5V = 76µV 0 - 10V = 152µV 0 - 20mA = 0.305µA
Data Range	0 to 65535 counts unipolar -32768 to +32767 counts bipolar
Maximum Continuous Overload	±31mA, current input ±100V, voltage input
Input Impedance	1MΩ ±10% voltage input 250Ω ±0.1%, 1/4 W current input
Hardware Filter Characteristics	Low pass 1st order, -3dB@48Hz
Sample Duration Time	455µs per channel (does not include ladder scan time)
All Channel Update Rate	4ms
Open Circuit Detection Time	Zero reading within 1s (current input only)
Conversion Method	Successive Approximation
Accuracy vs. Temperature	±10PPM / °C Maximum
Maximum Inaccuracy	0.1% of range voltage, 0.2% of range current (including temperature drift)
Linearity Error (end to end)	±0.01% of range max., ±10V & ±5V ±0.015% of range max.,0-10 V, 0-5 V & 0-20 mA Monotonic with no missing codes
Input Stability and Repeatability	±0.035% of range (after 10 min. warmup)
Full Scale Calibration Error (not including offset)	±0.1% of range maximum
Offset Calibration Error	± .065% of range maximum
Max Crosstalk	-96dB
Recommended Fuse (external)	Edison S500-32-R, .032A fuse on current inputs only
External DC Power Required	24VDC (-20% / + 25%) 33mA

Removable Terminal Block Specifications	
Number of Positions	20 screw terminals
Wire Range	22–14 AWG (0.324 to 2.08 sq. mm) Solid / stranded conductor 3/64 in. (1.2 mm) insulation maximum USE COPPER CONDUCTORS , 60°C or equivalent.
Screw Driver Width	1/4 inch (6.5 mm) maximum
Screw Size	M3 size
Screw Torque	Field terminals: 7–9 in./lb (0.882–1.02 N·m) Self-jacking screws: 2.7–3.6 in./lb (0.3–0.4 N·m). Do not over-tighten screws when installing terminal block.

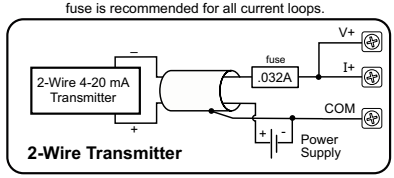
P3-08AD Analog Input (continued)

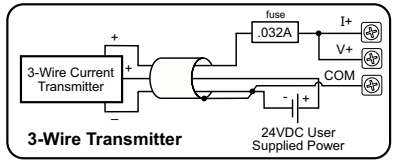
Wiring Diagrams

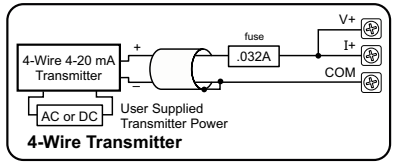


Current Sinking Input Circuits

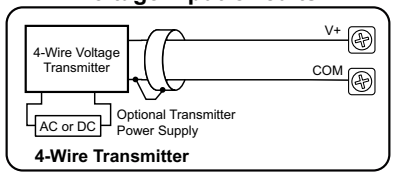
An Edison S500-32-R 0.032A fast-acting fuse is recommended for all current loops.

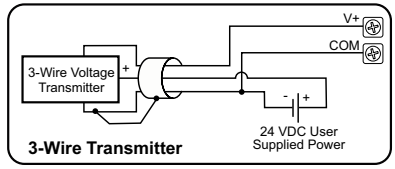






Voltage Input Circuits



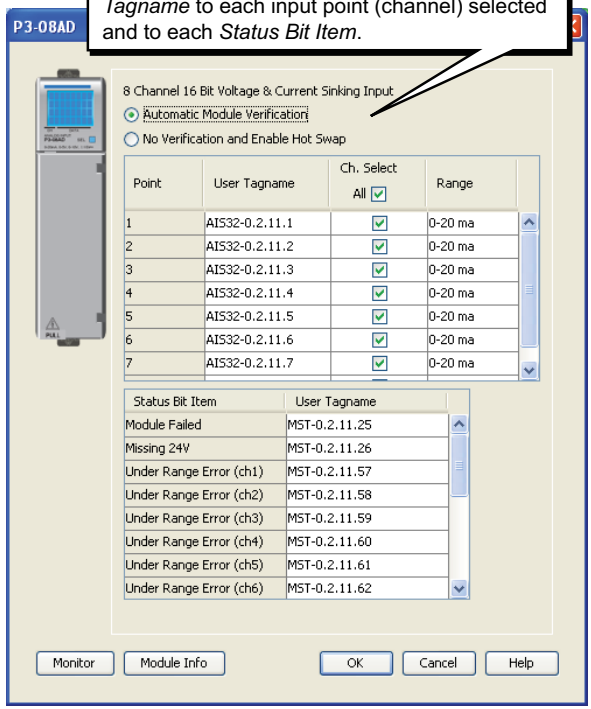


P3-08AD Analog Input (continued)

Module Configuration

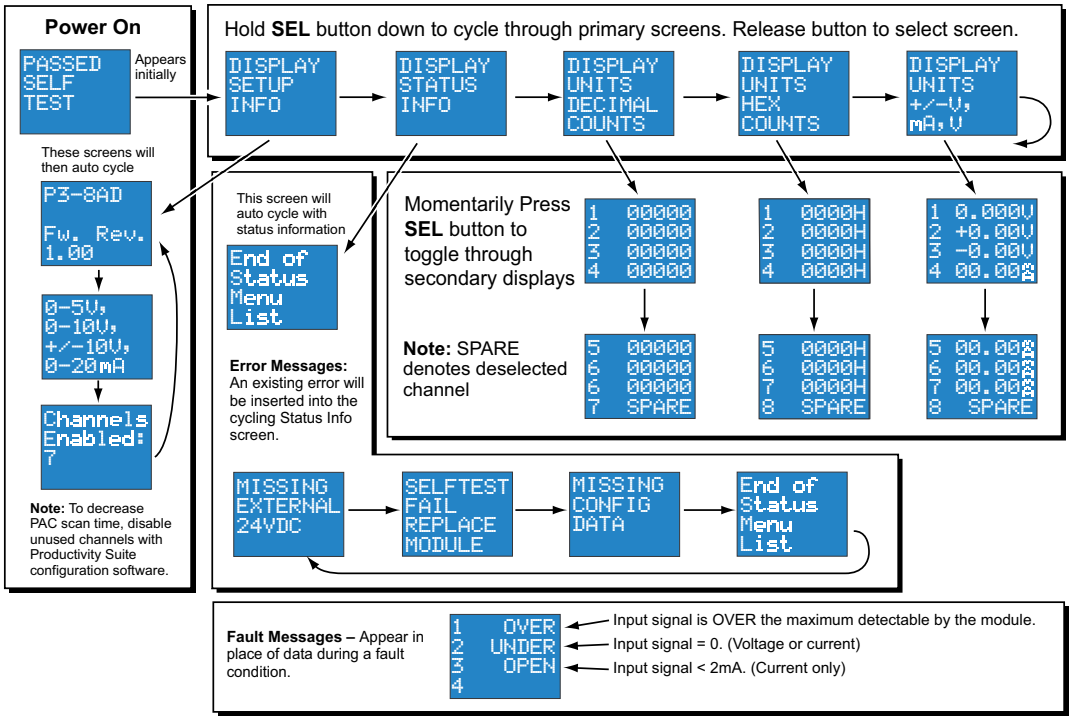
Using the Hardware Configuration tool in the Productivity Suite programming software, drag and drop the P3-08AD module into the base configuration.

Select *Automatic Module Verification* or *No Verification and Enable Hot Swap*. Select *Range* type for each input. If desired, assign a *User Tagname* to each input point (channel) selected and to each *Status Bit Item*.



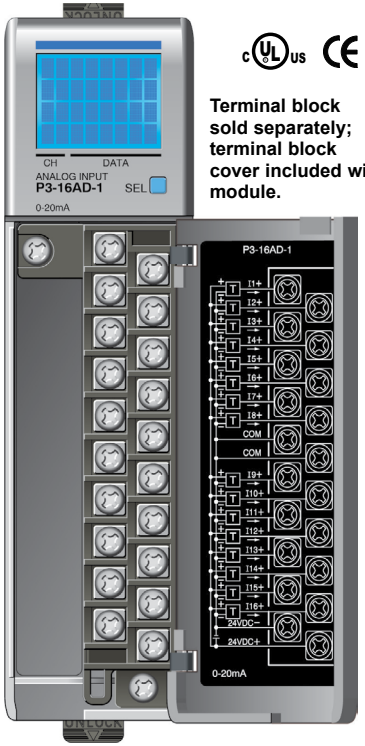
P3-08AD Analog Input (continued)

LCD Panel Display



P3-16AD-1 Analog Input

The P3-16AD-1 Current Analog Input Module provides sixteen channels for receiving 0 to 20mA input signals.



Terminal block sold separately; terminal block cover included with module.

Input Specifications

Input Channels	16 sinking
Module Signal Input Range	0–20 mA
Signal Resolution	16 bit
Resolution Value of LSB (least significant bit)	0–20 mA = 0.305e-9 A per count; nA/ct (1 LSB = 1 count)
Data Range	0-65535 counts
Input Type	Single-ended (1 common)
Maximum Continuous Overload	±31mA
Input Impedance	250Ω ±0.1% ¼W
Filter Characteristics	Low Pass, -3dB @ 100Hz
Sample Duration Time	7ms per channel (ladder scan time not included)
All Channel Update Rate	112ms
Open Circuit Detection Time	Zero reading within 1s
Conversion Method	Successive approximation
Accuracy vs. Temperature	±25PPM / °C maximum
Maximum Inaccuracy	0.1% of range (including temperature drift)
Linearity Error (end to end)	±10 LSB maximum (±0.015% of range) Monotonic with no missing codes
Input Stability and Repeatability	±10 LSB
Full Scale Calibration Error (not including offset)	±10 LSB maximum (±0.015% of range)
Offset Calibration Error	±10 LSB maximum
Max Crosstalk	-76dB, ±10 LSB
Recommended Fuse (external)	Edison S500-32-R, 0.032A fuse
External DC Power Required	24VDC (-20% / +25%), 20mA

Removable Terminal Block Specifications

Number of Positions	20 screw terminals
Wire Range	22–14 AWG (0.324 to 2.08 sq. mm) Solid / stranded conductor 3/64 in. (1.2 mm) insulation maximum USE COPPER CONDUCTORS , 60°C or equivalent.
Screw Driver Width	1/4 inch (6.5 mm) maximum
Screw Size	M3 size
Screw Torque	Field terminals: 7–9 in./lb (0.882–1.02 N·m) Self-jacking screws: 2.7–3.6 in./lb (0.3–0.4 N·m). Do not over-tighten screws when installing terminal block.

We recommend using prewired ZIPLink cables and connection modules. See Chapter 5.
Terminal block cover included. If you wish to hand-wire your module, a removable terminal block is sold separately. Order part number P3-RTB.

P3-16AD-1 Analog Input (continued)

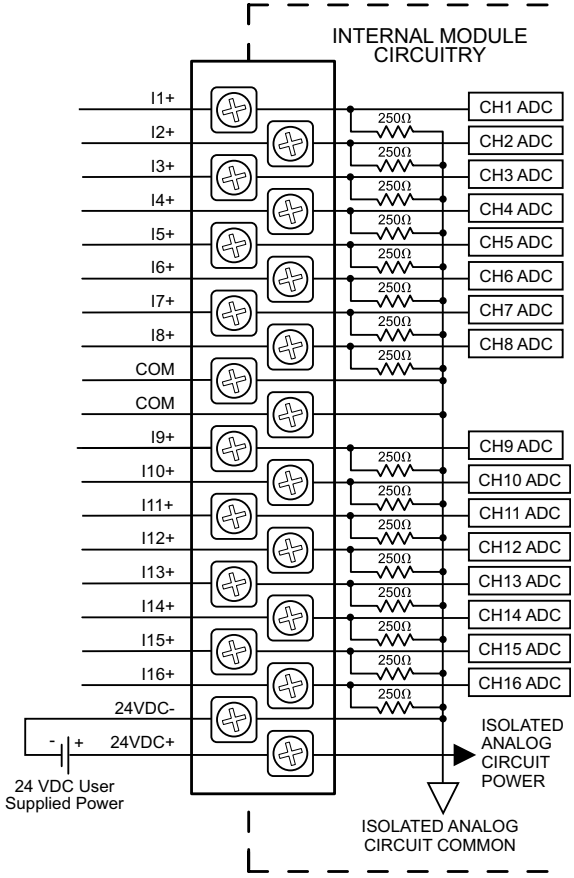
General Specifications	
Operating Temperature	0° to 60°C (32° to 140°F),
Storage Temperature	-20° to 70°C (-4° to 158°F)
Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	IEC60068-2-6 (Test Fc)
Shock	IEC60068-2-27 (Test Ea)
Field to Logic Side Isolation	1800VAC applied for 1s
Insulation Resistance	>10MΩ @ 500VDC
Heat Dissipation	2.1 W
Enclosure Type	Open equipment
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000® system.
Field Wiring	Removable terminal block (not included). Use ***ZIP***Link wiring system or optional terminal block. See Chapter 5.
Terminal Type (not included)	20-position removable terminal block
Weight	105g (3.73 oz)
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.

**Meets EMC and Safety requirements. See the Declaration of Conformity for details.*

WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

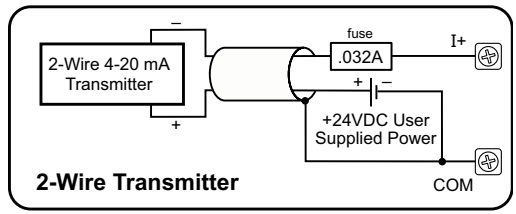
P3-16AD-1 Analog Input (continued)

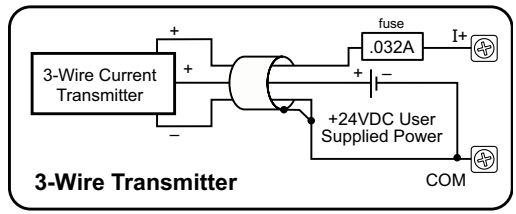
Wiring Diagrams

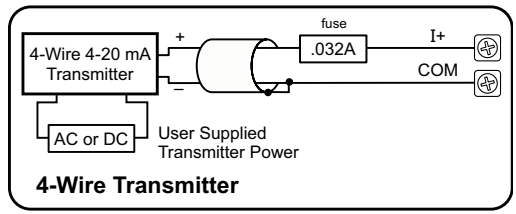


Current Input Circuits

An Edison S500-32-R 0.032A fast-acting fuse is recommended for current loops.



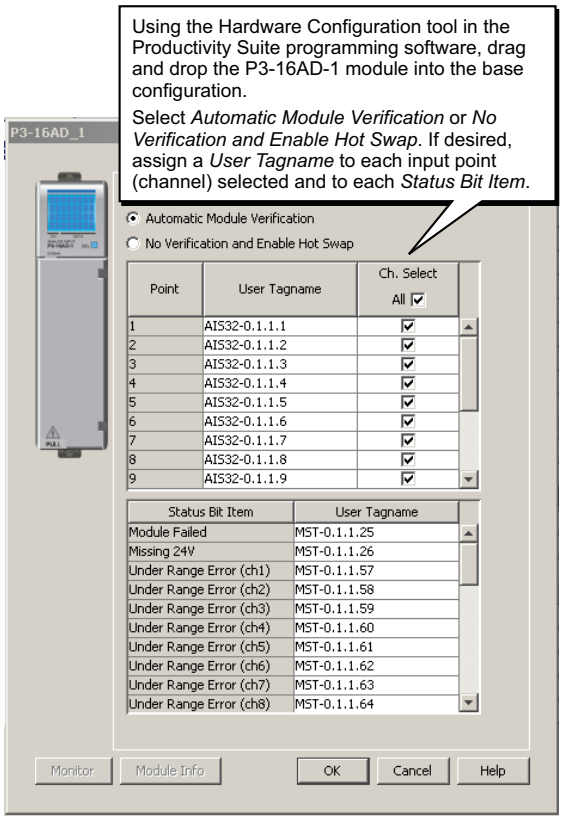




Note: Do not connect both ends of shield.

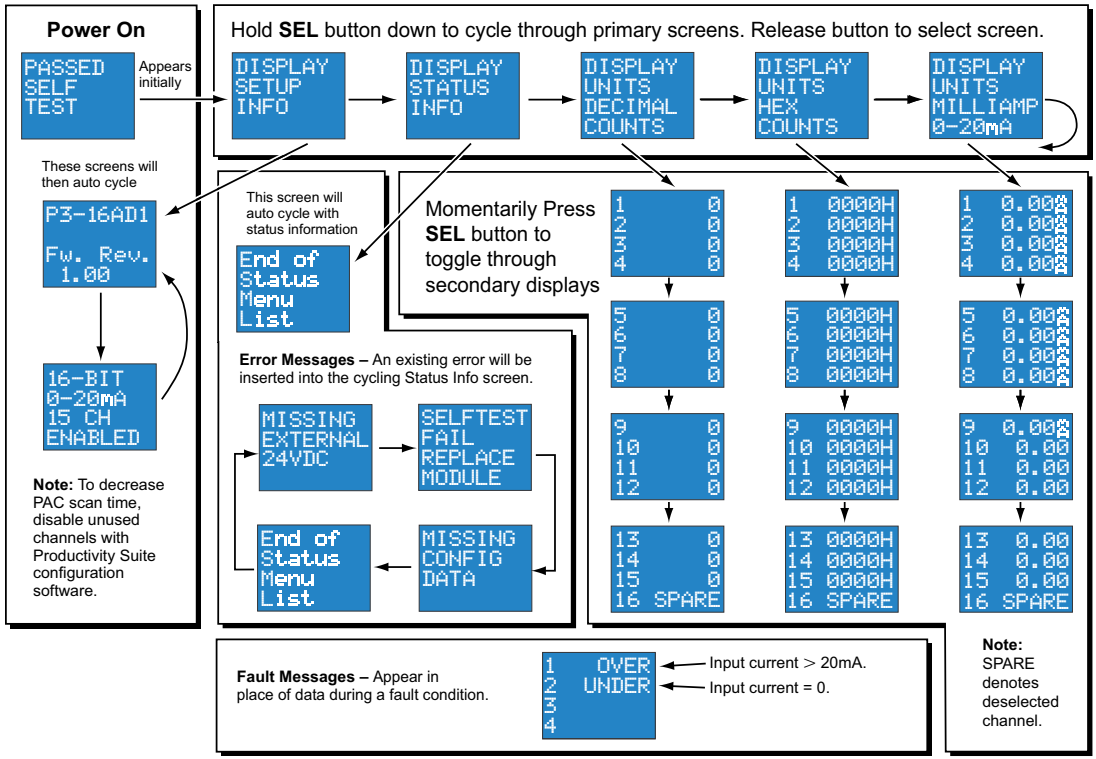
P3-16AD-1 Analog Input (continued)

Module Configuration



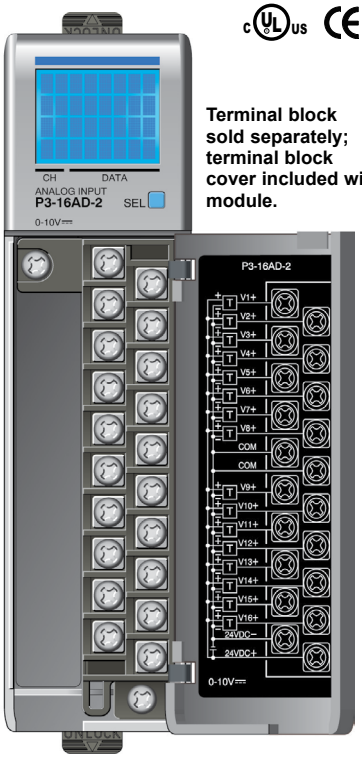
P3-16AD-1 Analog Input (continued)

LCD Panel Display



P3-16AD-2 Analog Input

The P3-16AD-2 Voltage Analog Input Module provides sixteen channels for receiving 0 to 10 VDC signals.



Terminal block sold separately; terminal block cover included with module.

Input Specifications	
Input Channels	16
Module Signal Input Range	0–10 VDC
Signal Resolution	16 bit
Resolution Value of LSB (least significant bit)	0–10 VDC = 152µV per count (1 LSB = 1 count)
Data Range	0 to 65535 counts
Input Type	Single-ended (one common)
Maximum Continuous Overload	±100V
Input Impedance	250kΩ (typical)
Filter Characteristics	Low Pass, -3dB @ 100Hz
Sample Duration Time	7ms per channel (ladder scan time not included)
All Channel Update Rate	112ms
Open Circuit Detection Time	Zero reading within 1s
Conversion Method	Successive approximation
Accuracy vs. Temperature	±25PPM / °C maximum
Maximum Inaccuracy	0.1% of range (including temperature drift)
Linearity Error (end to end)	±10 LSB maximum (±0.015% of range) Monotonic with no missing codes
Input Stability and Repeatability	±10 LSB
Full Scale Calibration Error (not including offset)	±10 LSB maximum (±0.015% of range)
Offset Calibration Error	±10 LSB maximum
Max Crosstalk	-76dB, 10 LSB
External DC Power Required	24VDC (-20% / +25%), 41mA maximum

Removable Terminal Block Specifications	
Number of Positions	20 screw terminals
Wire Range	22–14 AWG (0.324 to 2.08 sq. mm) Solid / stranded conductor 3/64 in. (1.2 mm) insulation maximum USE COPPER CONDUCTORS , 60°C or equivalent.
Screw Driver Width	1/4 inch (6.5 mm) maximum
Screw Size	M3 size
Screw Torque	Field terminals: 7–9 in./lb (0.882–1.02 N·m) Self-jacking screws: 2.7–3.6 in./lb (0.3–0.4 N·m). Do not over-tighten screws when installing terminal block.

We recommend using prewired ZIPLink cables and connection modules. See Chapter 5.
Terminal block cover included. If you wish to hand-wire your module, a removable terminal block is sold separately. Order part number P3-RTB.

P3-16AD-2 Analog Input (continued)

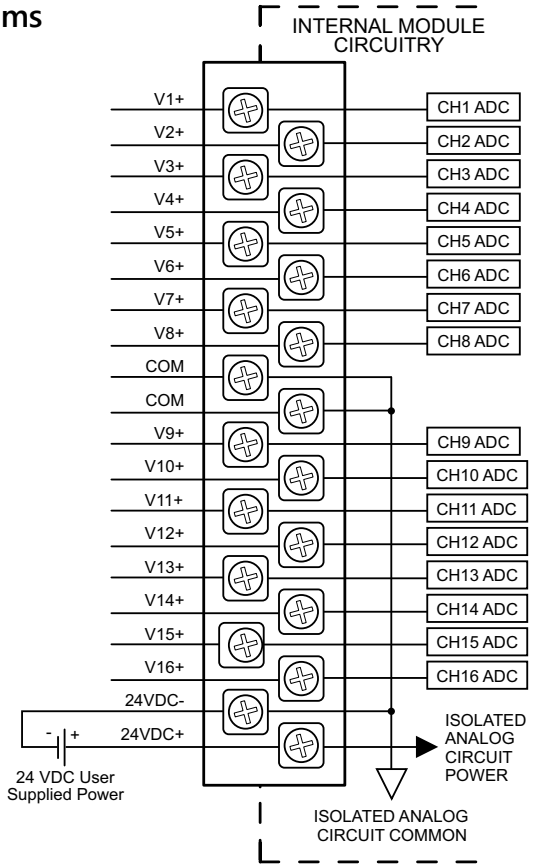
General Specifications	
Operating Temperature	0° to 60°C (32° to 140°F),
Storage Temperature	-20° to 70°C (-4° to 158°F)
Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	IEC60068-2-6 (Test Fc)
Shock	IEC60068-2-27 (Test Ea)
Field to Logic Side Isolation	1800 VAC applied for 1s
Insulation Resistance	>10MΩ @ 500 VDC
Heat Dissipation	1.4 W
Enclosure Type	Open equipment
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000® system.
Field Wiring	Removable terminal block (not included). Use ***ZIP***Link wiring system or optional terminal block. See Chapter 5.
Terminal Type (not included)	20-position removable terminal block
Weight	105g (3.73 oz)
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.

**Meets EMC and Safety requirements. See the Declaration of Conformity for details.*

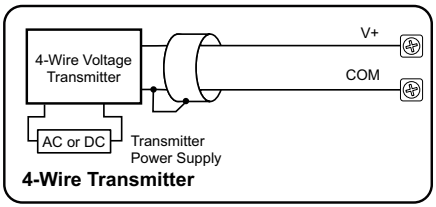
WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

P3-16AD-2 Analog Input (continued)

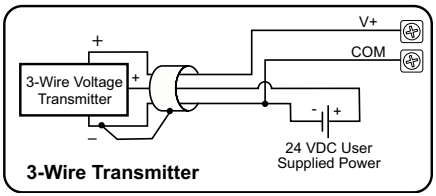
Wiring Diagrams



Voltage Input Circuits

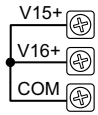


4-Wire Transmitter



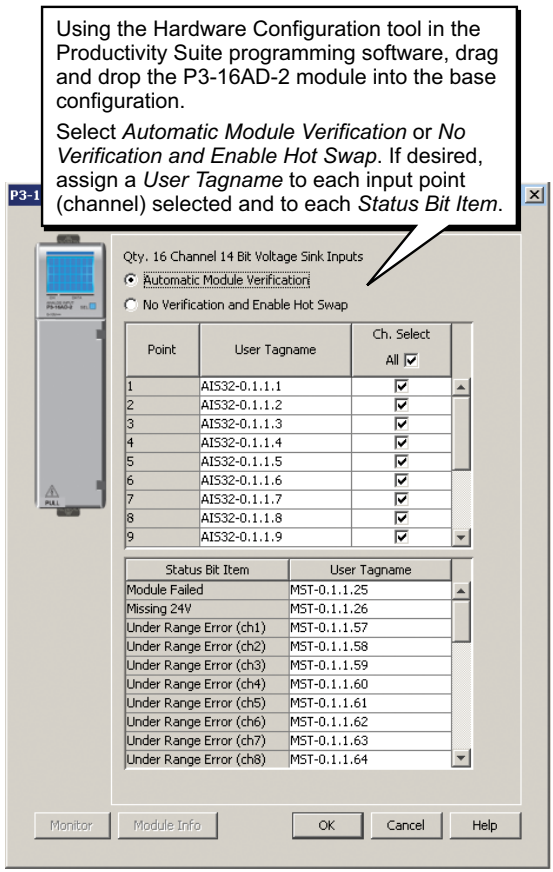
3-Wire Transmitter

Notes for maximum accuracy:
1. Jumper unused inputs to common.



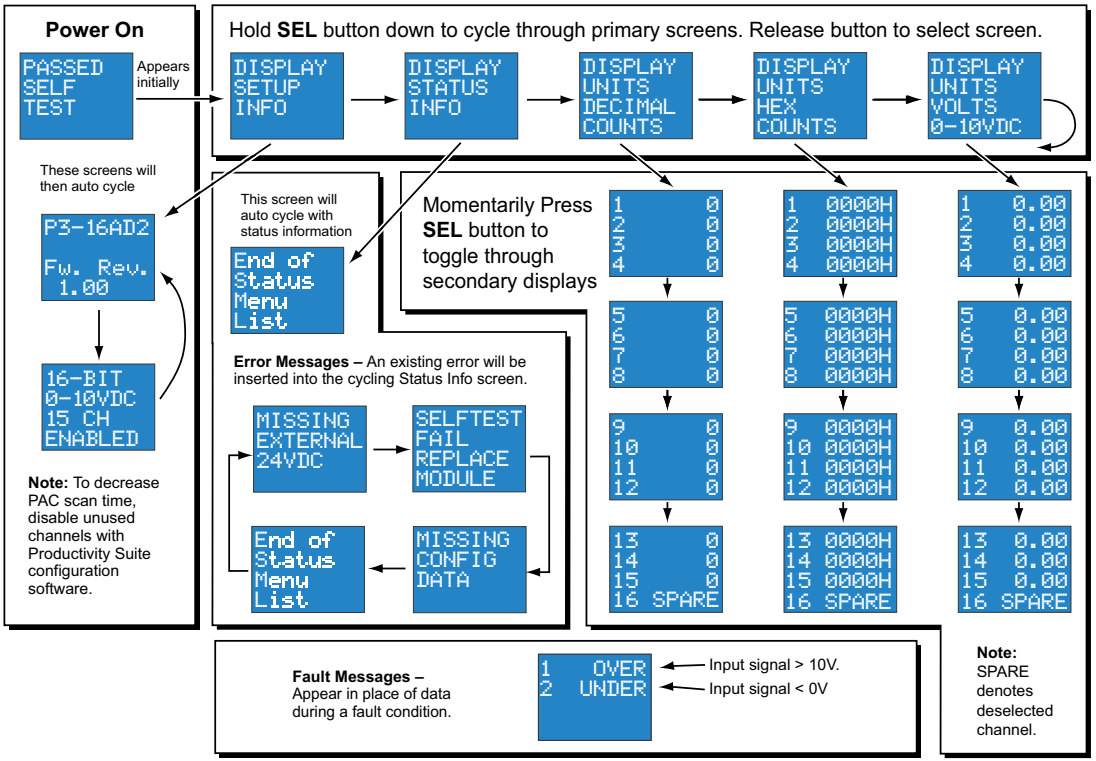
P3-16AD-2 Analog Input (continued)

Module Configuration



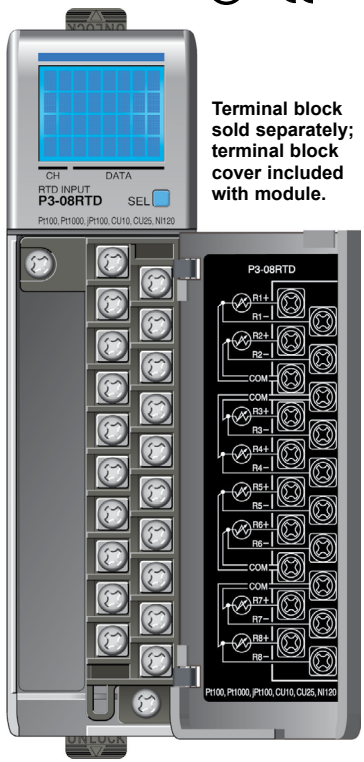
P3-16AD-2 Analog Input (continued)

LCD Panel Display



P3-08RTD Analog Input

The P3-08RTD input module provides eight differential channels for receiving RTD and resistance input signals.



Terminal block sold separately; terminal block cover included with module.

RTD Input Specifications

Input Channels	8 Differential
Max. Common Mode Voltage	5VDC
Data Format	Floating Point
Common Mode Rejection	-90dB min. @ DC, -150dB min. @ 50/60Hz
Absolute Maximum Ratings	Fault protected input, ±50V
Internal Resolution	16 bit, ± 0.1°C or °F (up to 100 Hz filter)
Input Ranges (RTD Types)	Pt100 -200°C/850°C (-328°F/1562°F) Pt1000 -200°C/595°C (-328°F/1103°F) JPt100 -100°C/450°C (-148°F/ 842°F) 10Ω Cu. -200°C/260°C (-328°F/ 500°F) 25Ω Cu. -200°C/260°C (-328°F/ 500°F) 120Ω Ni. -80°C/260°C (-112°F/ 500°F)
RTD Linearization	Automatic
Excitation Current (all ranges)	200µA
Accuracy vs. Temperature	±5ppm per °C (maximum)
Full Scale Calibration	±1°C
Offset Calibration Error	±1 count (negligible)
Linearity Error (end to end)	±0.5°C maximum, ±0.01°C typical, Monotonic with no missing codes
Maximum Inaccuracy	±1°C maximum (excluding RTD error) (including temperature drift)
Warm-up Time	2 minutes for ±0.2% repeatability
Sample Duration (Single channel update rate)	Dependent on Digital Filter Settings -- 488ms @ 10Hz, 88ms @ 50 Hz, 75ms @ 60Hz, 56ms @ 100Hz, 48ms @ 250Hz
Filter Characteristics	Digital filter cutoff frequencies: 10Hz, 50Hz, 60Hz, 100Hz, or 250Hz
All Channel Update Rate	Single channel update rate times the number of enabled channels
Open Circuit Detection Time	Positive full scale reading within 2s
Conversion Method	Sigma-Delta
External DC Power Required	None

Resistance Input Specifications

Internal Resolution	16 bit, .0015% of full scale range in ohms (up to 100Hz filter)
Resistance Input Ranges and CPU Resolution	0–10,000Ω, Resolution 1Ω 0–6,250Ω, Resolution 0.1 Ω 0–3,125Ω, Resolution 0.1 Ω 0–1,562.5 Ω, Resolution 0.1 Ω 0–781.25 Ω, Resolution 0.1 Ω 0–390.625 Ω, Resolution 0.01 Ω 0–195.3125 Ω, Resolution 0.01 Ω
Accuracy vs. Temperature	±25ppm per °C (maximum)
Full Scale Calibration	±0.02% of full scale range
Offset Calibration Error	±0.0015% of full scale range in ohms
Linearity Error (end to end)	±0.0015% of full scale range maximum at 25°C, Monotonic with no missing codes
Maximum Inaccuracy	±0.10% of full scale range

P3-08RTD Analog Input (continued)

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	0.33 W
Enclosure Type	Open equipment
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000® system.
Field Wiring	Removable terminal block (included). The P3-08RTD module is not compatible with the ***ZIP***Link wiring system.
Terminal Type	20-position removable terminal block (included)
Weight	107.8g (3.79 oz)
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.

**Meets EMC and Safety requirements. See the Declaration of Conformity for details.*

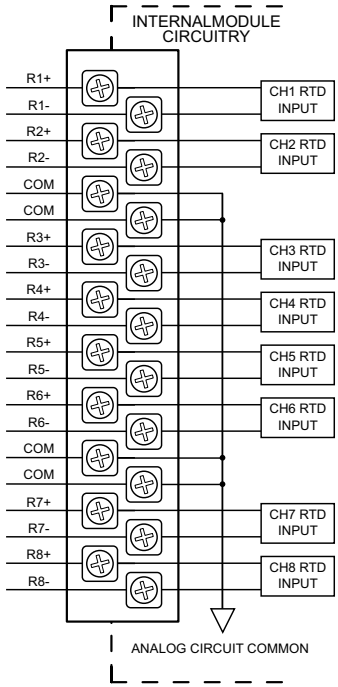
WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

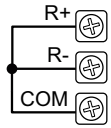
Removable Terminal Block Specifications	
Number of Positions	20 screw terminals
Wire Range	22–14 AWG (0.324 to 2.08 sq. mm) Solid / stranded conductor 3/64 in. (1.2 mm) insulation maximum USE COPPER CONDUCTORS , 60°C or equivalent.
Screw Driver Width	1/4 inch (6.5 mm) maximum
Screw Size	M3 size
Screw Torque	Field terminals: 7–9 in./lb (0.882–1.02 N·m) Self-jacking screws: 2.7–3.6 in./lb (0.3–0.4 N·m). Do not over-tighten screws when installing terminal block.

Diagnostics	
Module Diagnostics Failure	1 bit per module
Module Not Ready	1 bit per module
Channel Burn-out (RTD only)	1 bit per channel
Under-range (RTD only)	1 bit per channel
Over-range	1 bit per channel

P3-08RTD Analog Input (continued)

Wiring Diagrams

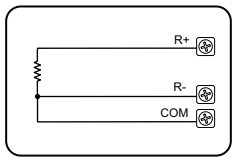




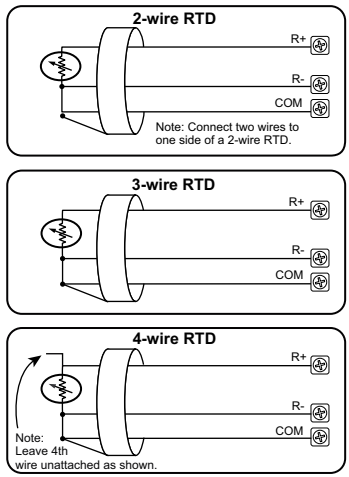
Notes for maximum accuracy:

1. For 2-wire RTD, attach third wire to module common.
2. R+, R-, and COM wires to an RTD must be equal length and type. Refer to RTD manufacturer's recommendations.
3. Do not use cable shield as sensing wire.
4. When applicable, connect shield to RTD common only, otherwise connect to module common only. Do not connect shield at both ends.
5. Jumper unused inputs to common.

Resistance Input

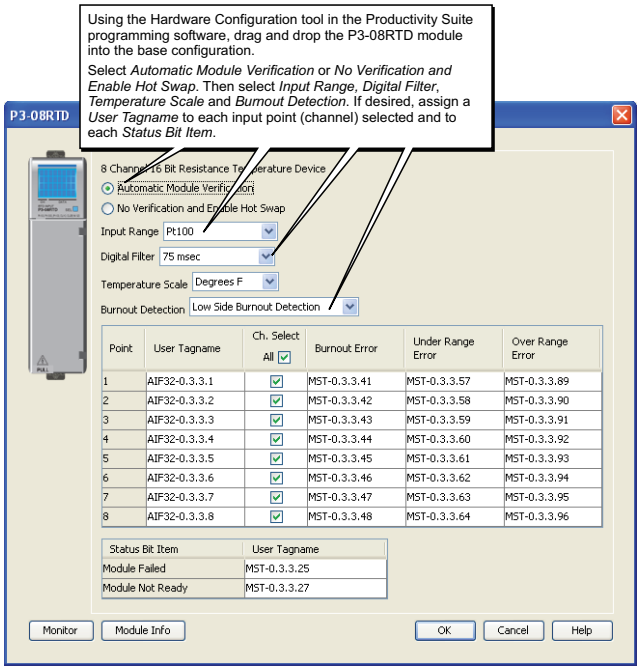


RTD Input Circuits



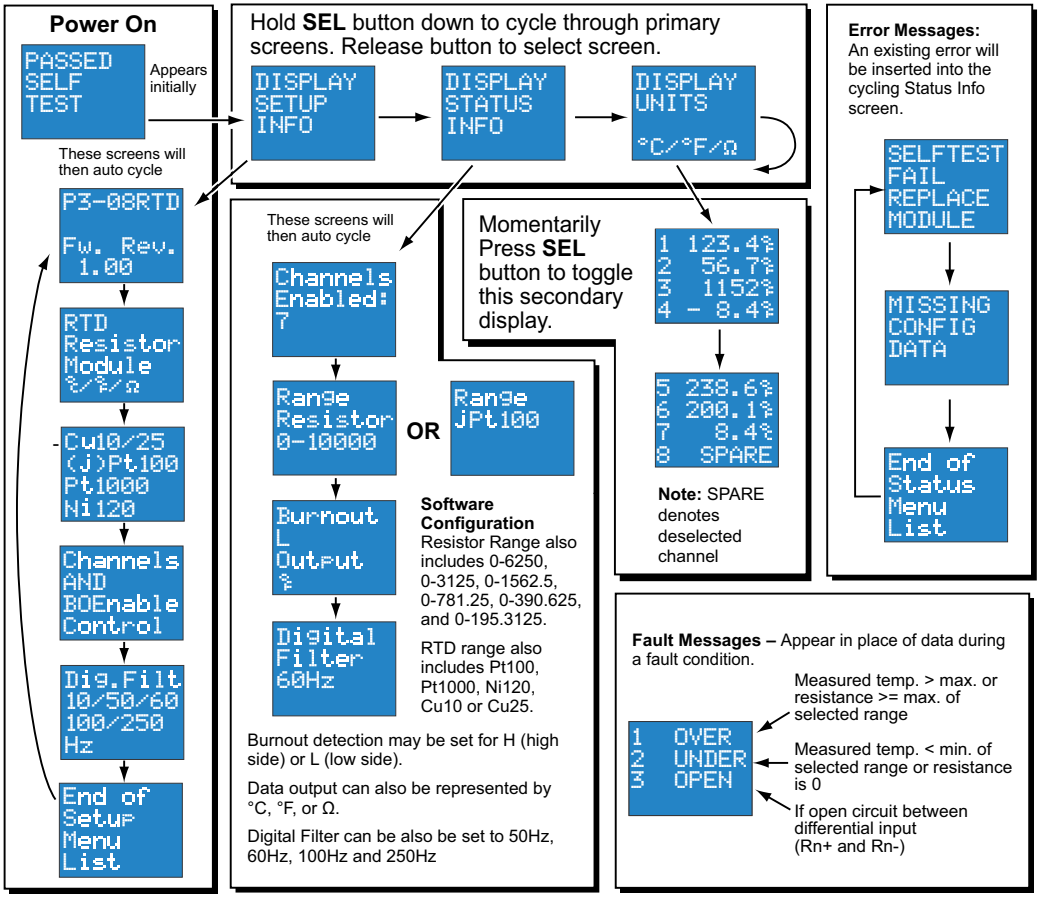
P3-08RTD Analog Input (continued)

Module Configuration



P3-08RTD Analog Input (continued)

LCD Panel Display



P3-08THM Analog Input

The P3-08THM Thermocouple Input Module provides eight differential channels for receiving thermocouple and voltage input signals.



Terminal block sold separately; terminal block cover included with module.

T/C Input Specifications

Input channels	8 differential
CPU Data Format	Floating point
Common Mode Range	±1.25 V
Common Mode Rejection	100dB @ DC and 130dB @ 60Hz
Input Impedance	>5M ohms
Maximum Ratings	Fault-protected inputs to ±50VDC
Resolution	16-bit, ±0.1°C or °F
Thermocouple Input Ranges	Type J -190° to 760°C (-310° to 1400°F); Type E -210° to 1000°C (-346° to 1832°F); Type K -150° to 1372°C (-238° to 2502°F); Type R 65° to 1768°C (149° to 3214°F); Type S 65° to 1768°C (149° to 3214°F); Type T -230° to 400°C (-382° to 752°F); Type B 529° to 1820°C (984° to 3308°F); Type N -70° to 1300°C (-94° to 2372°F); Type C 65° to 2320°C (149° to 4208°F);
Cold Junction Compensation	Automatic
Thermocouple Linearization	Automatic
Accuracy vs. Temperature	±50PPM / °C maximum
Linearity Error	±1°C Maximum (±0.5°C typical), Monotonic with no missing codes
Maximum Inaccuracy	±3°C Max (excluding thermocouple error) (including temperature drift)
Warm-up Time	30 Minutes for ±1°C Repeatability 2 minutes to reach voltage specifications
Sample Duration Time	270ms
All Channel Update Rate	2.16 s
Open Circuit Detection Time	10-15 secs typical, 20 secs max.
Conversion Method	Sigma-Delta
External DC Power	None

Voltage Input Specifications

Linear mV Device Input Ranges	0–39.0625 mVDC, ±39.0625 mVDC, ±78.125 mVDC, 0–156.25 mVDC, ±156.25 mVDC, 0–1250 mVDC
Max Voltage Input Offset Error	0.05% @ 0° -60°C, typical 0.04% @ 25°C
Max Voltage Input Gain Error	0.06% @ 25°C
Max Voltage Input Linearity Error	0.05% @ 0° -60°C, typical 0.03% @ 25°C
Max Voltage Input Inaccuracy	0.2% @ 0° -60°C, typical 0.06% @ 25°C

P3-08THM Analog Input (continued)

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)
Field to Logic Side Isolation	1800VAC applied for 1s
Insulation Resistance	>10MΩ @ 500VDC
Heat Dissipation	0.36 W
Enclosure Type	Open equipment
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000® system.
Field Wiring	Removable terminal block (included). The P3-08THM module is not compatible with the ***ZIP***Link wiring system.
Terminal Type	20-position removable terminal block (included)
Weight	150g (5.3 oz)
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.

** Meets EMC and Safety requirements. See the Declaration of Conformity for details.*

WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

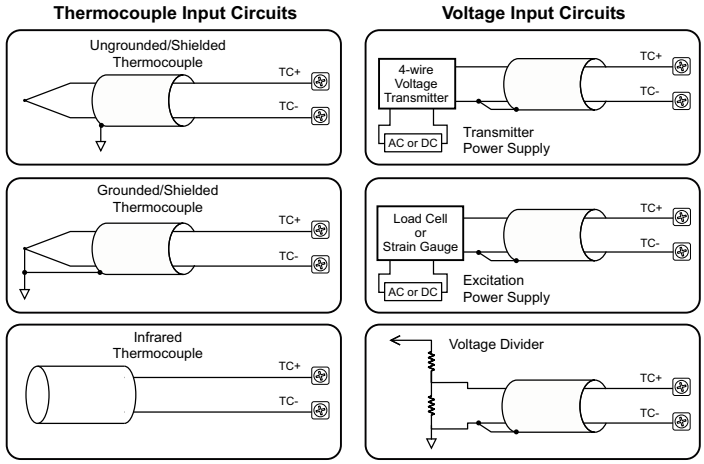
Removable Terminal Block Specifications	
Number of Positions	20 screw terminals
Wire Range	22–14 AWG (0.324 to 2.08 sq. mm) Solid / stranded conductor 3/64 in. (1.2 mm) insulation maximum USE COPPER CONDUCTORS , 60°C or equivalent.
Screw Driver Width	1/4 inch (6.5 mm) maximum
Screw Size	M3 size
Screw Torque	Field terminals: 7–9 in./lb (0.882–1.02 N·m) Self-jacking screws: 2.7–3.6 in./lb (0.3–0.4 N·m). Do not over-tighten screws when installing terminal block.

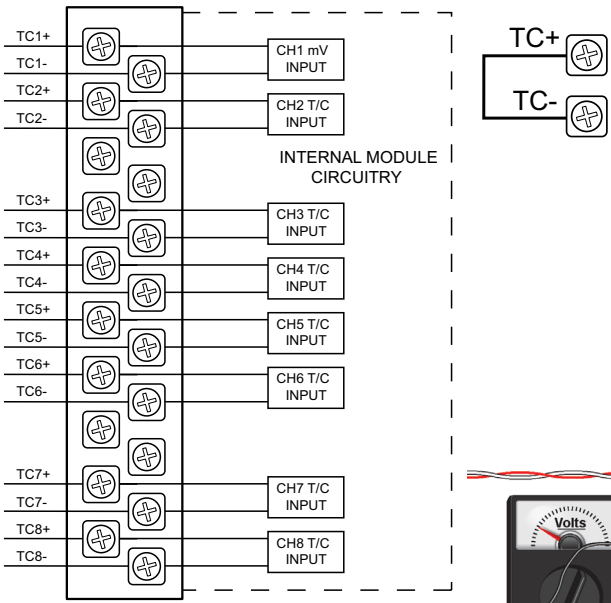
** Use shielded, twisted thermocouple wire that matches the thermocouple type.*

Configuration/Diagnostics	
Burn-out Detection: High Side/Disable	1-bit per module
°C/°F (T/C only)	1 bit per module
Module Diagnostics Failure	1 bit per module
Burn-out (on if T/C input is open – no connection between TCn+ and TCn-)	1 bit per channel
Channel Under-range (T/C only)	1 bit per channel
Channel Over-range (T/C only)	1 bit per channel

P3-08THM Analog Input (continued)

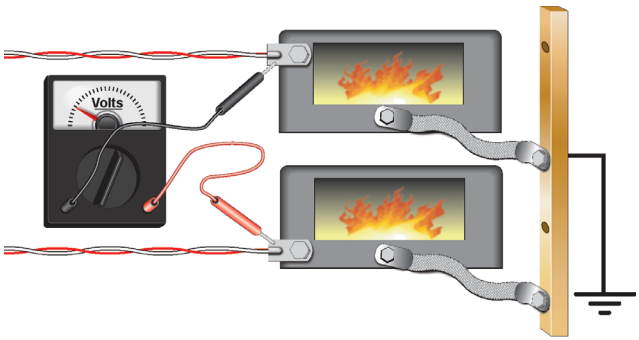
Wiring Diagrams





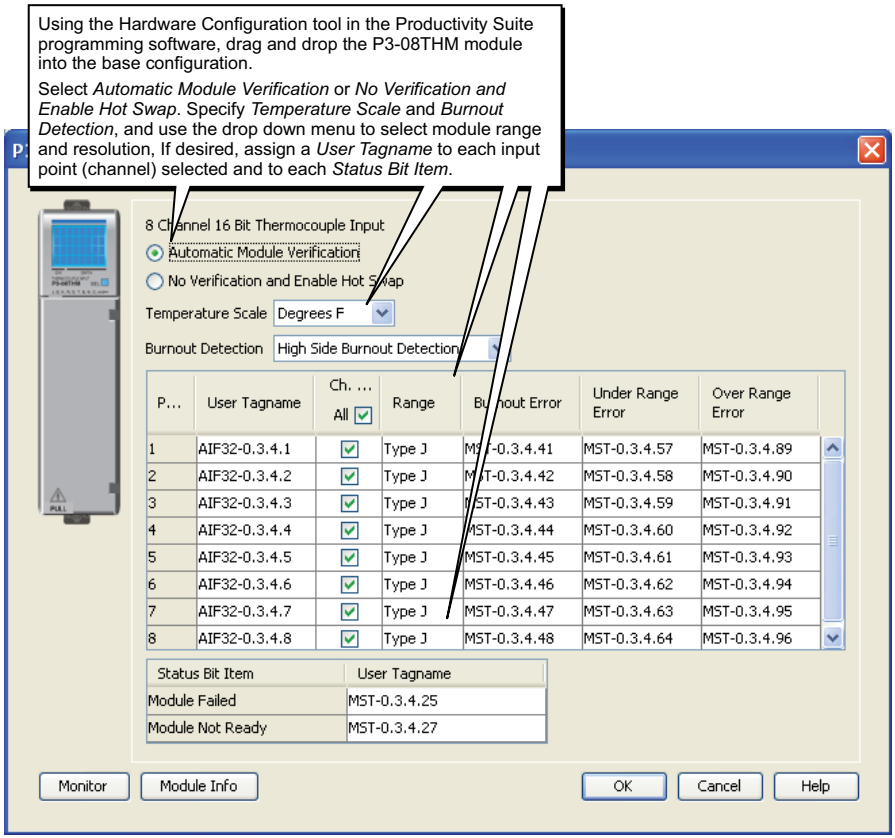
NOTES:

1. Connect shield to thermocouple signal/ground only. Do not connect to both ends.
2. Install jumper wire on each unused input, TC+ to TC-.
3. With grounded thermocouples, take precautions to prevent having a voltage potential between thermocouple tips. A voltage of 1.25V or greater between tips will skew measurements.
4. Use shielded, twisted thermocouple extension wire that matches the thermocouple type. Use thermocouple-compatible junction blocks.



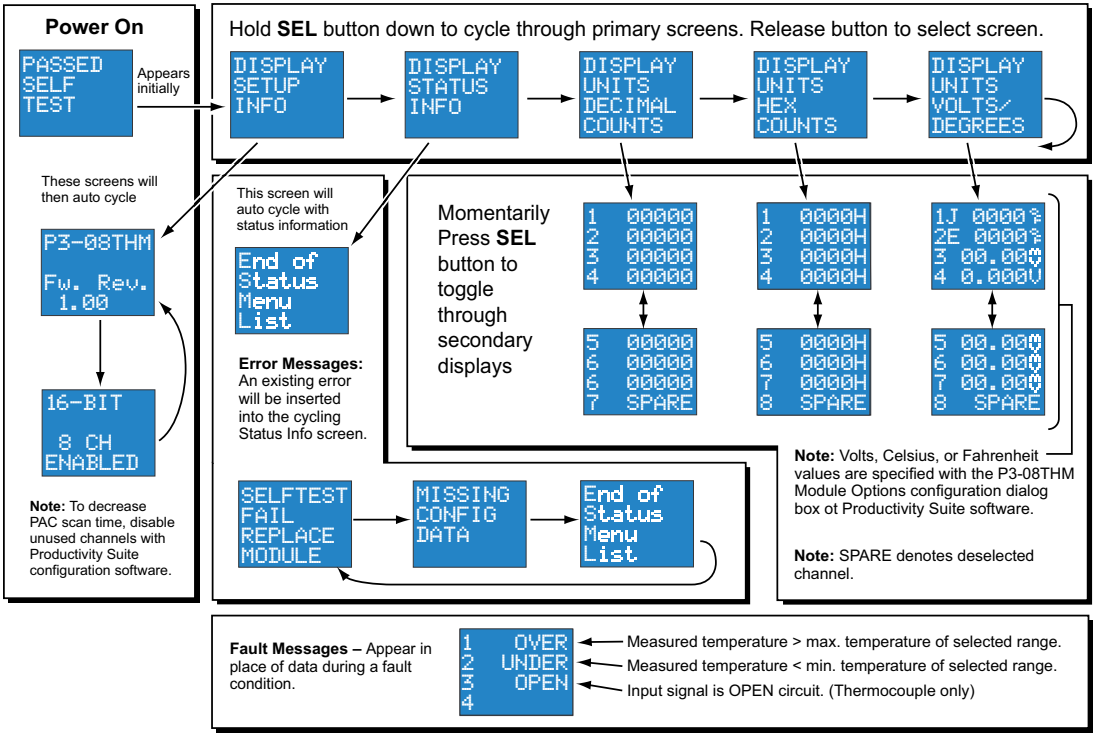
P3-08THM Analog Input (continued)

Module Configuration



P3-08THM Analog Input (continued)

LCD Panel Display



P3-04DA Analog Output

The P3-04DA Voltage/Current Analog Output Module provides four channels of ±10VDC or 4–20 mA sink/source selectable outputs.



Terminal block sold separately; terminal block cover included with module.

We recommend using prewired ZIPLink cables and connection modules. See Chapter 5.
Terminal block cover included. If you wish to hand-wire your module, a removable terminal block is sold separately. Order part number P3-RTB.

Output Specifications	
Output Channels	4
Module signal output range	±10V or 4–20 mA sink or source selectable each channel
Signal Resolution	16-bit
Resolution Value of LSB (least significant bit)	±10V = 305µV/ count 4–20 mA = 0.244 µA/ count 1 LSB = 1 count
Data Range	0–65535 counts unipolar and -32768 to +32767 counts bi-polar
Output Type	Voltage outputs sourcing/sinking at 10mA max, or Current outputs sink or source at 20mA max.
Output Value in Fault Mode	Voltage outputs 0V or 0mA current outputs
Load Impedance (Minimum External Power Supply)	>1000Ω voltage outputs)(19.2–30 VDC) 0–755 Ω Sinking, 0–600 Ω Sourcing (19.2 VDC) 0–875Ω Sinking, 0–700 ΩSourcing (21.6 VDC) 0–1000 Ω Sinking, 0–855 Ω Sourcing (24.0 VDC) 0–1110 Ω Sinking, 0–970 ΩSourcing (26.4 VDC) 0–1350 Ω Sinking, 0–1150 Ω Sourcing (30VDC)
Maximum Capacitive Load	.01µF maximum voltage outputs
Maximum Inductive Load	1 mH maximum current outputs
Allowed Load Type	Grounded
Maximum Inaccuracy (% of range)	0.1% voltage, 0.1% current (including temperature drift)
Maximum Full Scale Calibration Error (not including offset error)	±0.025% of range maximum voltage outputs ±0.025% of range maximum current outputs
Accuracy vs. Temperature	±25 ppm/ °C max f.s. calibration change (±0.0025% of range / °C)
Max Crosstalk	-80dB, 6 LSB
Linearity Error (End to End)	±16 LSB maximum (±0.025% of full scale) Monotonic with no missing codes
Output Stability and Repeatability	±10 LSB after 10 minute warm-up (typical)
Output Ripple	0.05% of Full Scale
Output Settling Time	0.3 ms max, 5µs min (full scale change)
All Channel Update Rate	0.6ms
Maximum Continuous Overload	Voltage Outputs current limited to 35mA typical. Current Outputs open circuit protected
Type of Output Protection	15VDC Peak Output Voltage Current outputs current limited to <=20mA
Output Signal (power-up, -down)	0V voltage outputs, 0mA current outputs
External DC Power Required	94mA voltage operation 4 channels 126mA current operation 4 channels 24VDC -20% / +25%

P3-04DA Analog Output (continued)

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)
Field to Logic Side Isolation	1800VAC applied for 1s
Insulation Resistance	>10MΩ @ 500 VDC
Heat Dissipation	2.6 W voltage outputs 3.4 W current outputs
Enclosure Type	Open equipment
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000® system.
Field Wiring	Removable terminal block (not included). Use ***ZIP***Link wiring system or optional terminal block. See Chapter 5.
Terminal Type (not included)	20-position removable terminal block
Weight	105g (3.73 oz)
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.

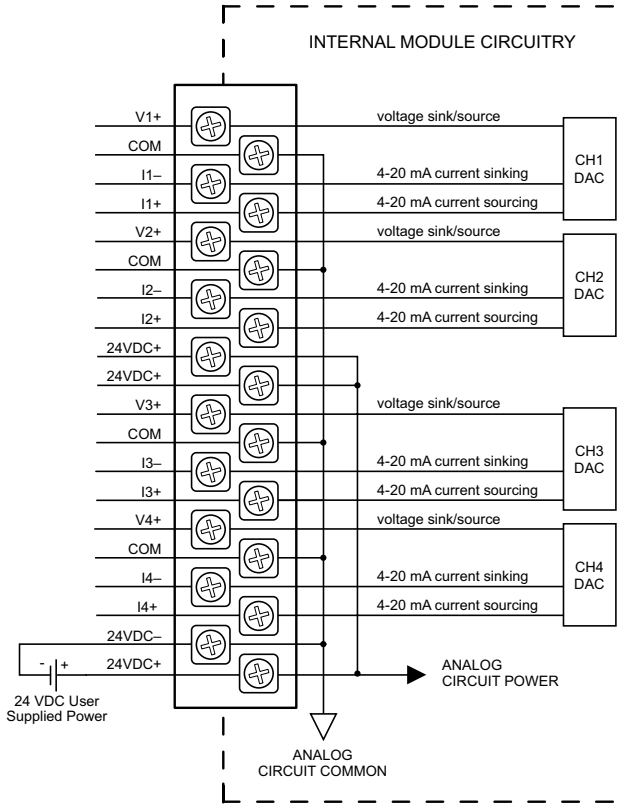
**Meets EMC and Safety requirements. See the Declaration of Conformity for details.*

WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

Removable Terminal Block Specifications	
Number of Positions	20 screw terminals
Wire Range	22–14 AWG (0.324 to 2.08 sq. mm) Solid / stranded conductor 3/64 in. (1.2 mm) insulation maximum USE COPPER CONDUCTORS , 60°C or equivalent.
Screw Driver Width	1/4 inch (6.5 mm) maximum
Screw Size	M3 size
Screw Torque	Field terminals: 7–9 in./lb (0.882–1.02 N·m) Self-jacking screws: 2.7–3.6 in./lb (0.3–0.4 N·m). Do not over-tighten screws when installing terminal block.

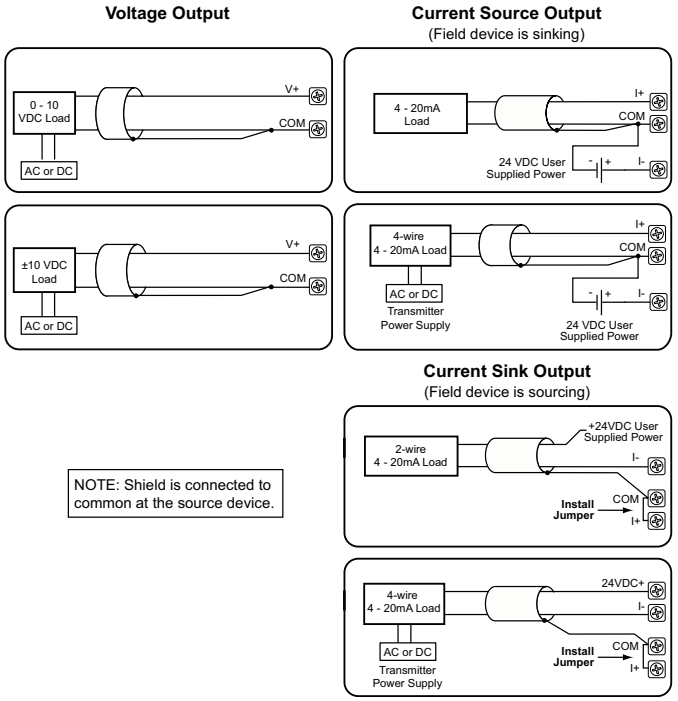
P3-04DA Analog Output (continued)

Wiring Diagrams



P3-04DA Analog Output (continued)

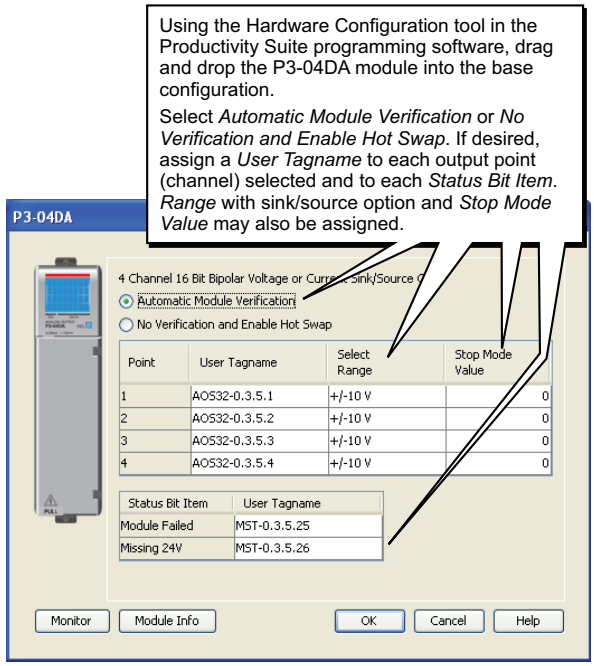
Wiring Diagrams (continued)



NOTE: Shield is connected to common at the source device.

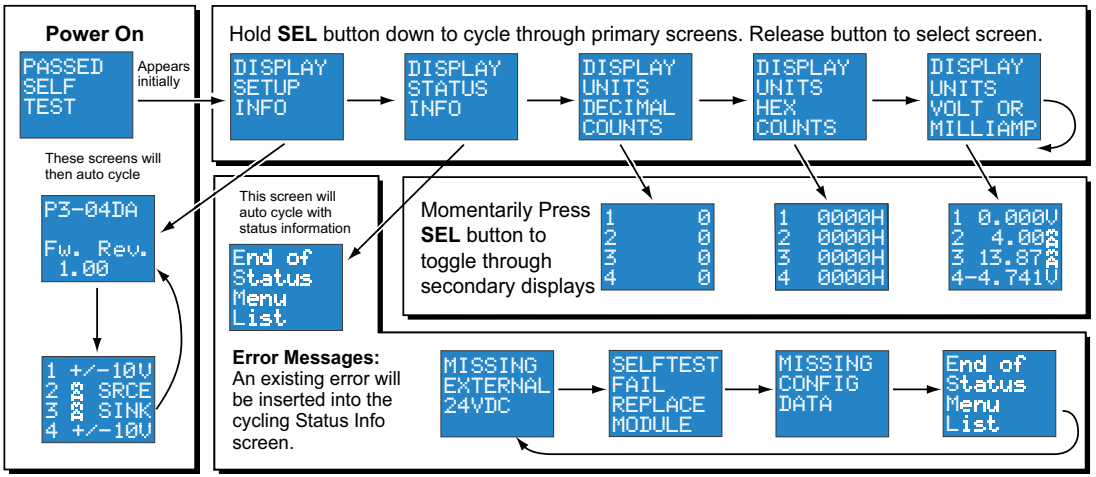
P3-04DA Analog Output (continued)

Configuration Settings



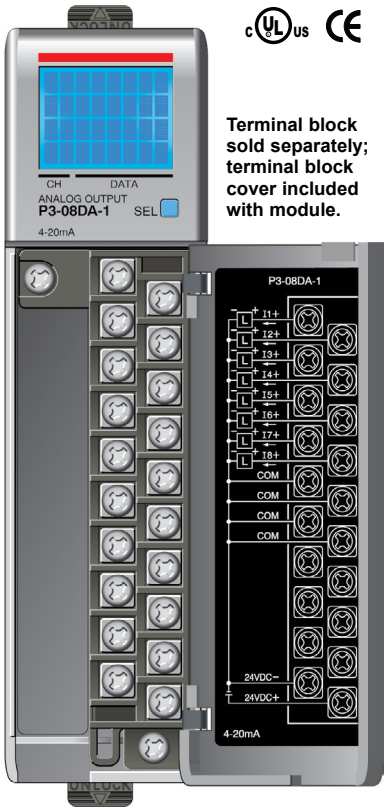
P3-04DA Analog Output (continued)

LCD Panel Display



P3-08DA-1 Analog Output

The P3-08DA-1 Current Analog Output Module provides eight channels of 4 to 20mA sourcing outputs.



Terminal block sold separately; terminal block cover included with module.

Output Specifications	
Output Channels (commons)	8
Module Signal Output Range	4–20 mA
Output Signal Resolution	16-bit
Resolution Value of LSB (least significant bit)	4–20 mA = 0.244 µA / count 1 LSB = 1 count
Data Range	0 to 65535 counts
Output Type (sourcing)	Current: 20mA max
Output Value in Fault Mode	Near 0mA
Load Impedance	0–570 Ω (19.2 VDC) 0–690 Ω (21.6 VDC) 0–810 Ω (24.0 VDC) 0–930 Ω (26.4 VDC) 0–1100 Ω (30.0 VDC) Minimum Load 0Ω @ 0-45°C 125Ω @ 45-60°C
Maximum Inductive Load	1mH
Allowed Load Type	Grounded
Maximum Inaccuracy	0.1% of range (including temperature drift)
Maximum Full Scale Calibration Error (not including offset error)	±0.025% of range maximum
Maximum Offset Calibration Error	±0.025% of range maximum
Accuracy vs. Temperature	±25ppm/ °C maximum full-scale calibration change (±0.0025% of range / °C)
Max Crosstalk	-96dB, 1 LSB
Linearity Error (end to end)	±16 LSB maximum (±0.025% of full scale) monotonic with no missing codes
Output Stability and Repeatability	±10 count after 10 min. warm-up (typical)
Output Ripple	0.05% of full scale
Output Settling Time	0.3 ms max, 5µs min (full scale change)
All channel Update Rate	0.6 ms
Maximum Continuous Overload	Outputs open circuit protected
Type of Output Protection	Electronically current limited to 20mA or less
Output Signal at Power-up and Power-down	4mA
External DC Power Required	24VDC (-20% / + 25%), 180mA

We recommend using prewired ZIPLink cables and connection modules. See Chapter 5.
Terminal block cover included. If you wish to hand-wire your module, a removable terminal block is sold separately. Order part number P3-RTB.

P3-08DA-1 Analog Output (continued)

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)
Field to Logic Side Isolation	1800VAC applied for 1s
Insulation Resistance	>10MΩ @ 500VDC
Heat Dissipation	4.7 W
Enclosure Type	Open equipment
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000® system.
Field Wiring	Removable terminal block (not included). Use ***ZIP***Link wiring system or optional terminal block. See Chapter 5.
Terminal Type (not included)	20-position removable terminal block
Weight	105g (3.73 oz)
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.

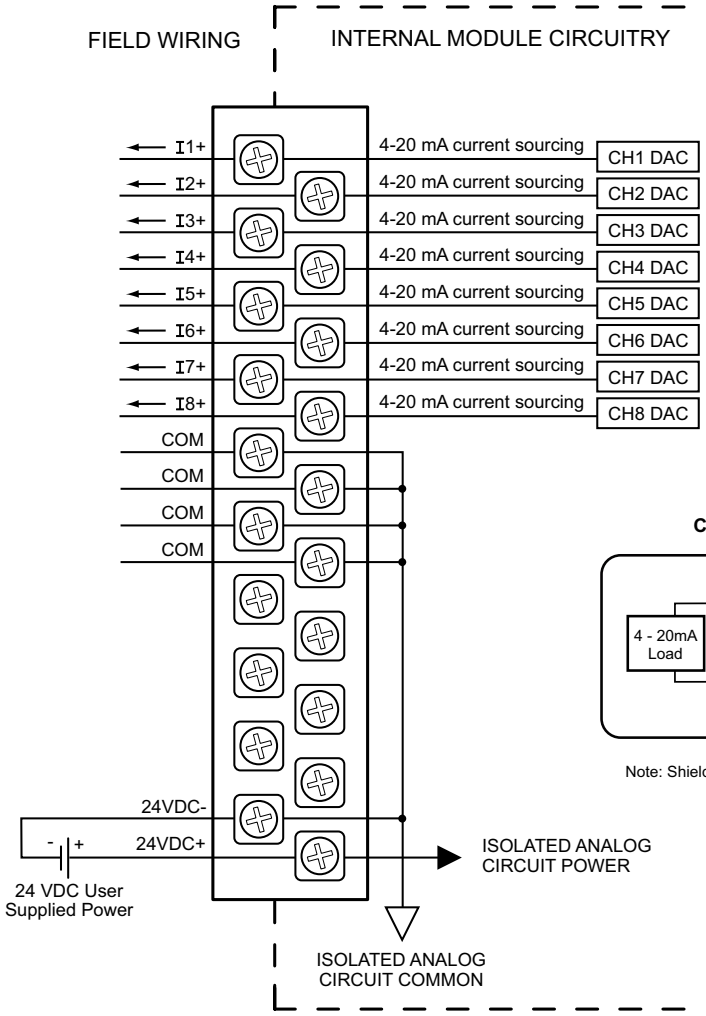
**Meets EMC and Safety requirements. See the Declaration of Conformity for details.*

WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

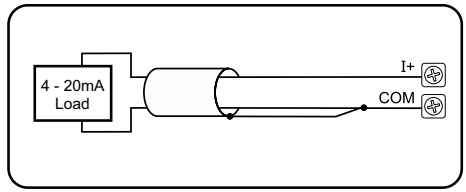
Removable Terminal Block Specifications	
Number of Positions	20 screw terminals
Wire Range	22–14 AWG (0.324 to 2.08 sq. mm) Solid / stranded conductor 3/64 in. (1.2 mm) insulation maximum USE COPPER CONDUCTORS , 60°C or equivalent.
Screw Driver Width	1/4 inch (6.5 mm) maximum
Screw Size	M3 size
Screw Torque	Field terminals: 7–9 in./lb (0.882–1.02 N·m) Self-jacking screws: 2.7–3.6 in./lb (0.3–0.4 N·m). Do not over-tighten screws when installing terminal block.

P3-08DA-1 Analog Output (continued)

Wiring Diagrams



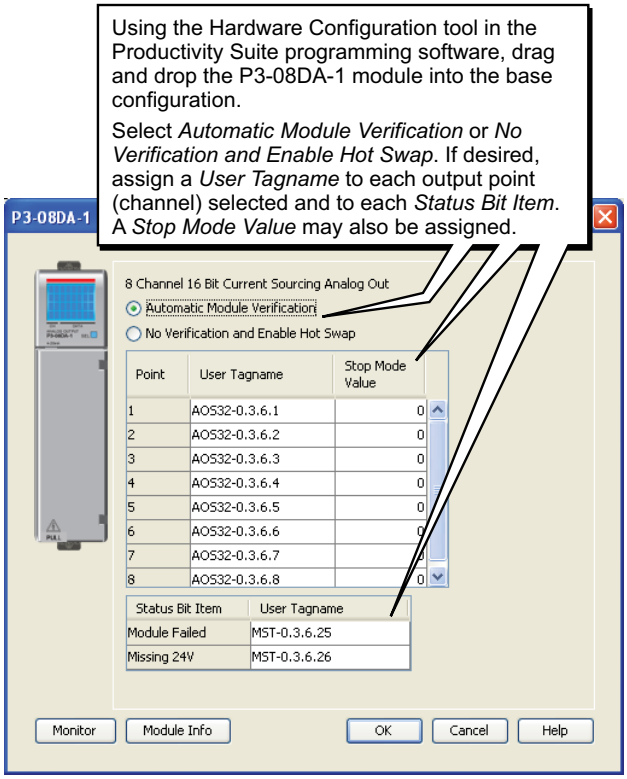
Current Source Output Circuit



Note: Shield is connected to common at the source device.

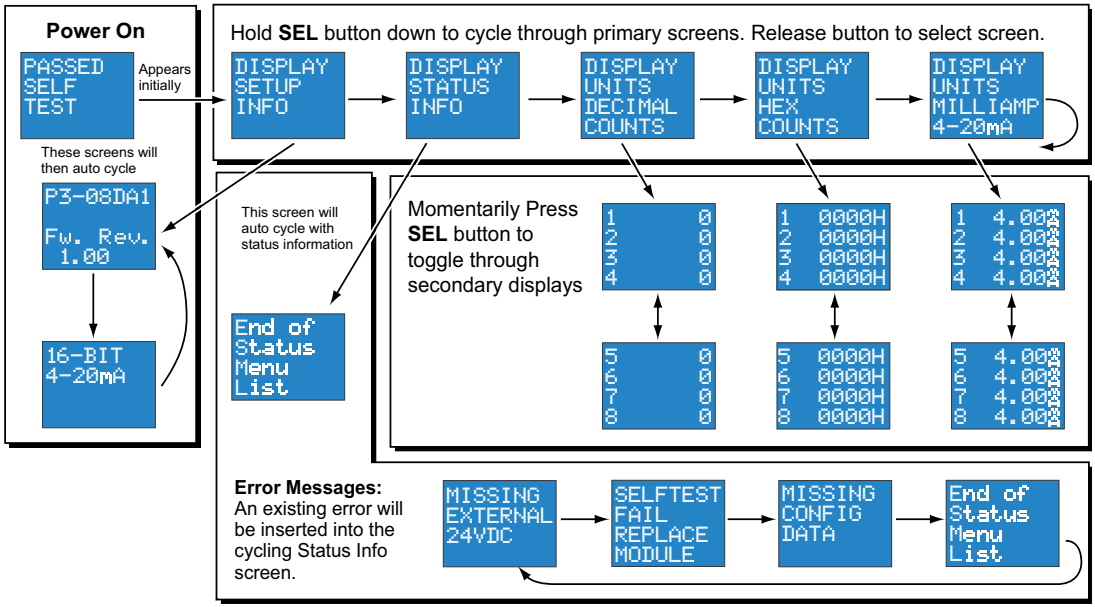
P3-08DA-1 Analog Output (continued)

Module Configuration



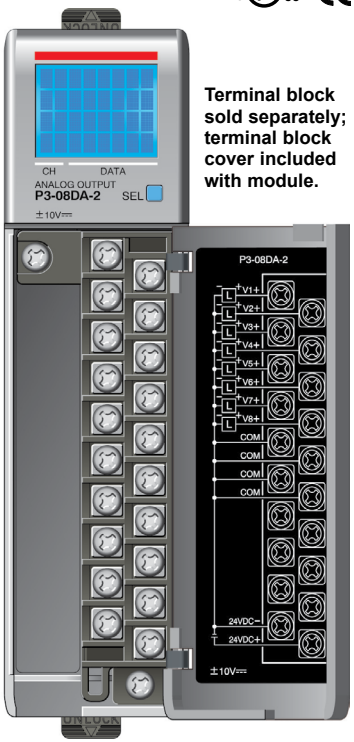
P3-08DA-1 Analog Output (continued)

LCD Panel Display



P3-08DA-2 Analog Output

The P3-08DA-2 Voltage Analog Output Module provides eight channels of ±10 VDC outputs.



Terminal block sold separately; terminal block cover included with module.

Output Specifications	
Output Channels	8
Module Signal Output Range	±10VDC
Output Signal Resolution	16-bit
Resolution Value of LSB (least significant bit)	±10V = 305µv/count 1 LSB = 1 count
Data range	-32768 to +32767
Output Type (sourcing/sinking)	Voltage (10mA max current)
Output Value in Fault Mode	0V
Load Impedance	≤1000Ω
Maximum Capacitive Load	0.01 µF maximum
Allowed Load Type	Grounded
Maximum Inaccuracy	0.1% of range (including temperature drift)
Maximum Full Scale Calibration Error (not including offset error)	±0.025% of range maximum
Maximum Offset Calibration Error	±0.025% of range maximum
Accuracy vs. Temperature	±25ppm/ °C maximum full scale calibration change (± .0025% of range / °C)
Max Crosstalk	-96 dB, 1 LSB
Linearity Error (End to End)	±16 LSB maximum (±0.025% of full scale) Monotonic with no missing codes
Output Stability and Repeatability	±10 LSB after 10 min. warm-up (typical)
Output Ripple	0.05% of full-scale
Output Settling Time	0.3 ms max, 5µs min (full scale change)
All Channel Update Rate (typical)	0.6ms
Maximum Continuous Overload	Outputs current limited to 40mA typical Continuous overloads on multiple outputs can damage the module.
Type of Output Protection	0.1µf Transient Suppressor
Output Signal (power-up, -down)	0V
External DC Power Required	24VDC (-20% / + 25%), 120mA

We recommend using prewired ZIPLink cables and connection modules. See Chapter 5.
Terminal block cover included. If you wish to hand-wire your module, a removable terminal block is sold separately. Order part number P3-RTB.

P3-08DA-2 Analog Output (continued)

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)
Field to Logic Side Isolation	1800 VAC applied for 1s
Insulation Resistance	>10MΩ @ 500VDC
Heat Dissipation	3.3 W
Enclosure Type	Open equipment
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000® system.
Field Wiring	Removable terminal block (not included). Use ***ZIP***Link wiring system or optional terminal block. See Chapter 5.
Terminal Type (not included)	20-position removable terminal block
Weight	105g (3.73 oz)
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.

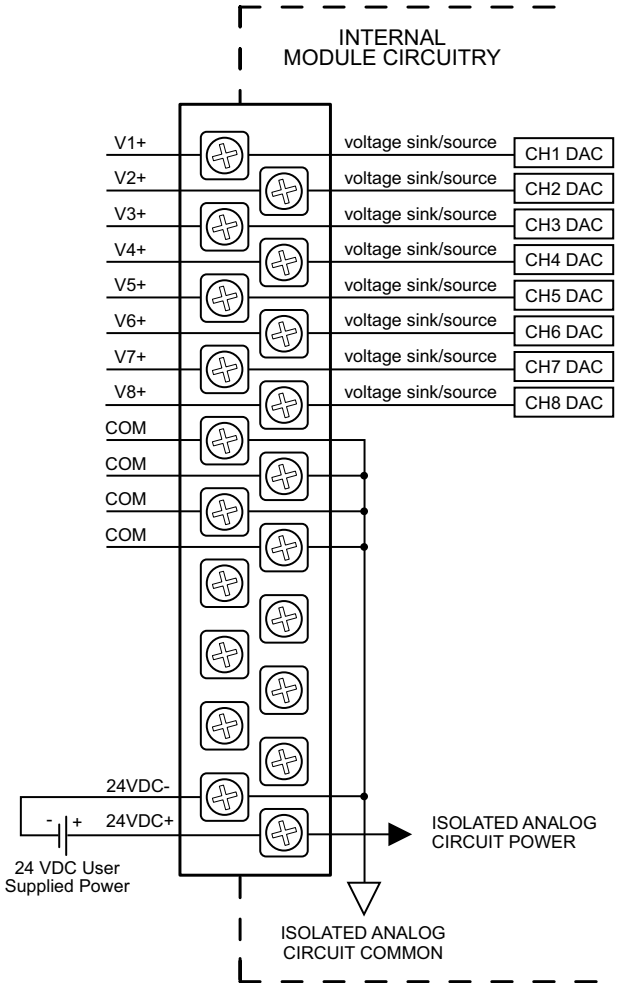
**Meets EMC and Safety requirements. See the Declaration of Conformity for details.*

WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

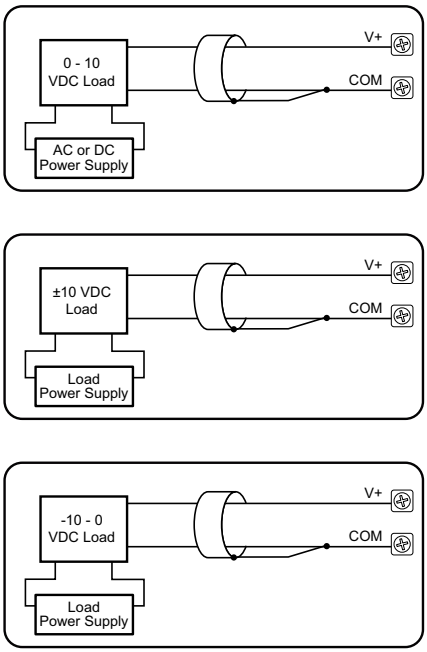
Removable Terminal Block Specifications	
Number of Positions	20 screw terminals
Wire Range	22–14 AWG (0.324 to 2.08 sq. mm) Solid / stranded conductor 3/64 in. (1.2 mm) insulation maximum USE COPPER CONDUCTORS , 60°C or equivalent.
Screw Driver Width	1/4 inch (6.5 mm) maximum
Screw Size	M3 size
Screw Torque	Field terminals: 7–9 in./lb (0.882–1.02 N·m) Self-jacking screws: 2.7–3.6 in./lb (0.3–0.4 N·m). Do not over-tighten screws when installing terminal block.

P3-08DA-2 Analog Output (continued)

Wiring Diagrams

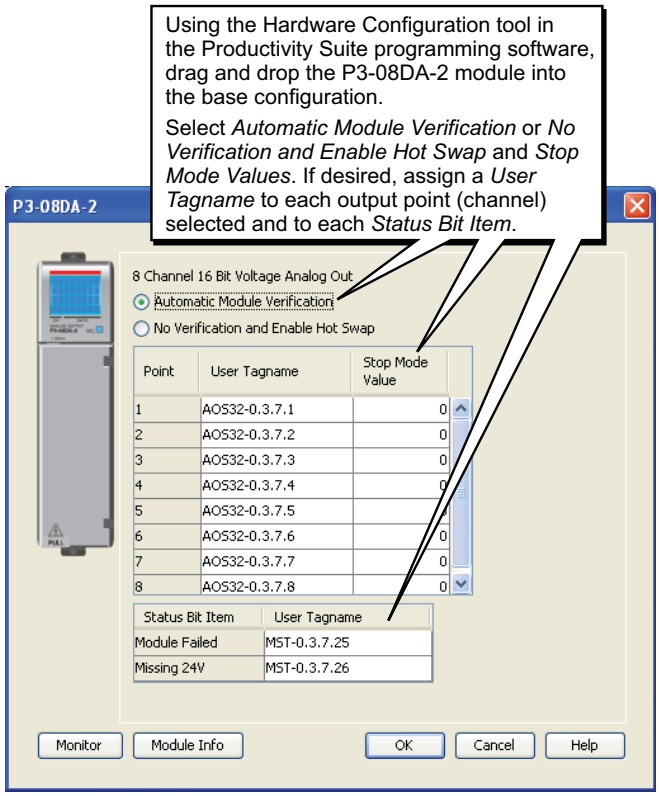


Voltage Output Circuits



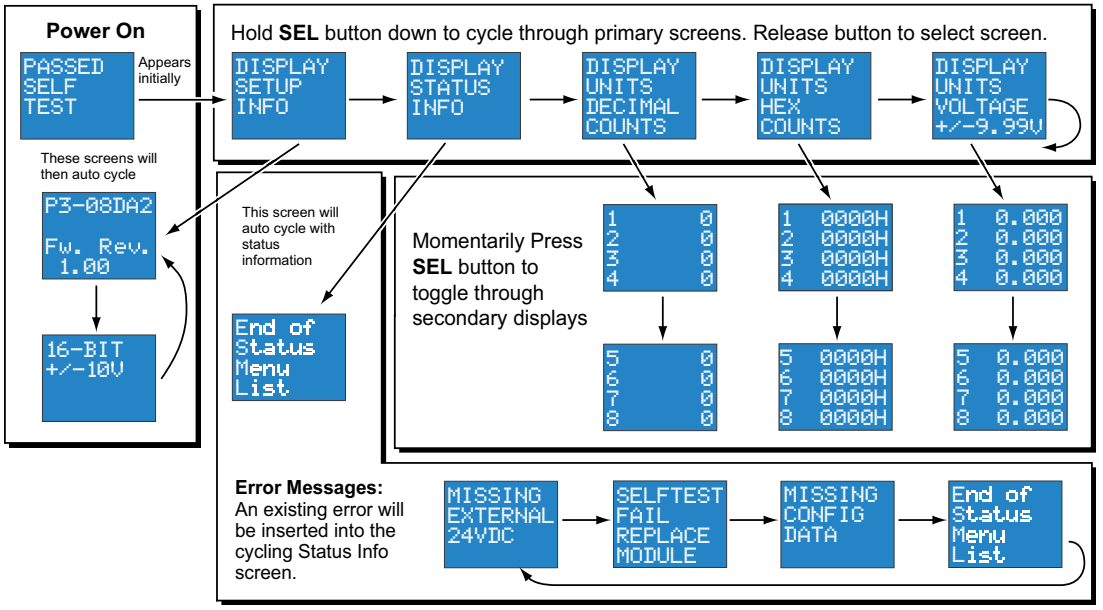
P3-08DA-2 Analog Output (continued)

Module Configuration



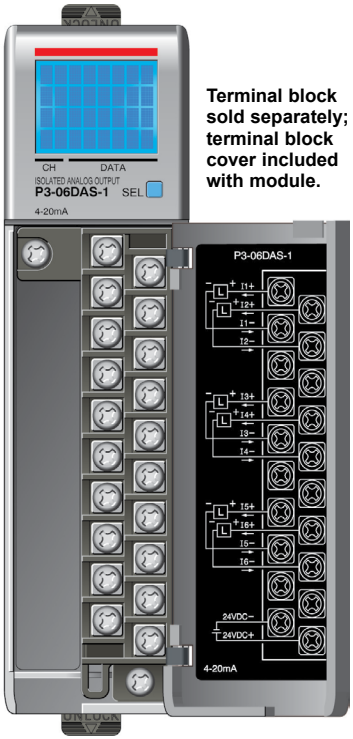
P3-08DA-2 Analog Output (continued)

LCD Panel Display



P3-06DAS-1 Isolated Analog Output (Retired)

The P3-06DAS-1 Current Analog Output Module provides six channel-to-channel isolated 4–20 mA outputs.



Terminal block sold separately; terminal block cover included with module.

Output Specifications	
Output channels (commons)	6 (6 isolated)
Module Signal Output Range	4–20 mA
Signal Resolution	16-bit
Resolution Value of LSB (least significant bit)	4–20mA = 0.244 µA/count 1 LSB = 1 count
Data Range	0 to 65535 counts
Output Type (sourcing)	Current: 20mA max (isolated)*
Channel to AUX Power Isolation	1800VDC applied for 1.8 second (100% tested)
Channel to Channel Isolation	900VDC applied for 1.8 second (100% tested)
Output Value in Fault Mode	Less than 4mA
Load Impedance	0–750 Ω
Maximum Inductive Load	1mH
Allowed Load Type	Floating or Grounded
Maximum Inaccuracy	0.1% of range
Maximum Full Scale Calibration Error (not including offset error)	±0.065% of range maximum
Maximum Offset Calibration Error	±.065% of range maximum
Accuracy vs. Temperature	±25 ppm/ °C maximum full scale calibration change (± 0.0025% of range / °C)
Max Crosstalk (DC, 50 Hz, 60 Hz)	-96dB, 1 LSB**
Linearity Error (end to end)	±16 LSB maximum (±0.025% of full scale) monotonic with no missing codes
Output Stability and Repeatability	±16 LSB after 10 min. warm-up (typical)
Output Settling Time	0.3 ms maximum, 5µs minimum (full scale change)
All Channel Update Rate	0.6 ms
Type of Output Protection	Electronically current limited to 20mA or less
Output Signal (power-up, -down)	Less than or equal to 4mA***
External DC Power Required	24VDC (-20% / + 25%), 250mA

**Module generates isolated loop power for each channel*
***To achieve maximum crosstalk per spec, isolation must be maintained, all commons have to be separated*
****Less than 4mA, if the module is not configured or in the RESET stage*

We recommend using prewired ZIPLink cables and connection modules. See Chapter 5.
Terminal block cover included. If you wish to hand-wire your module, a removable terminal block is sold separately. Order part number P3-RTB.

P3-06DAS-1 was retired 09/2023

P3-06DAS-1 Isolated Analog Output (continued)

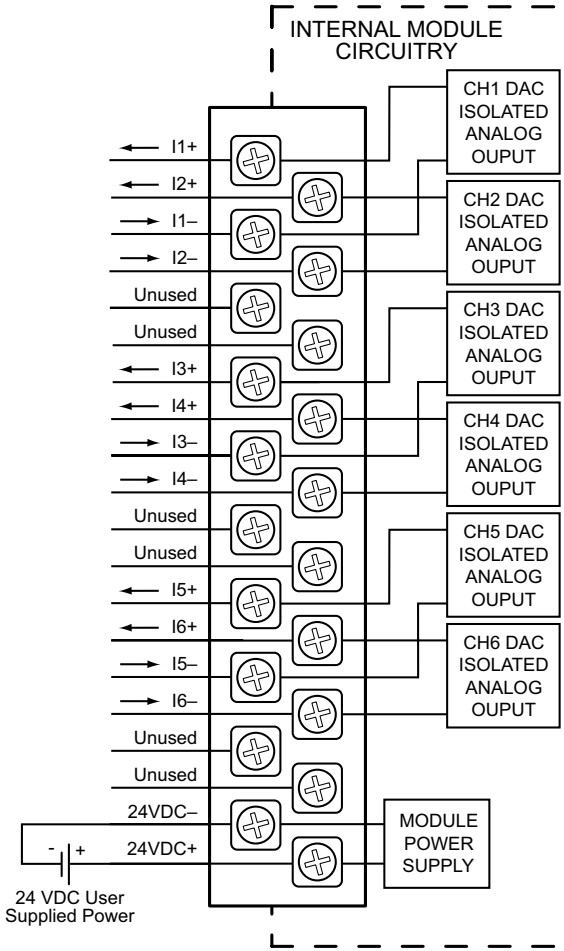
General Specifications	
Operating Temperature	0° to 60°C (32° to 140°F),
Storage Temperature	-20° to 70°C (-4° to 158°F)
Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	IEC60068-2-6 (Test Fc)
Shock	IEC60068-2-27 (Test Ea)
Field to Logic Side Isolation	1800 VDC applied for 1.8 seconds (100% tested)
Insulation Resistance	>10MΩ @ 500VDC
Heat Dissipation	3.38 W
Enclosure Type	Open equipment
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000® system.
Field Wiring	Removable terminal block (not included). Use ***ZIP***Link wiring system or optional terminal block. See Chapter 5.
Terminal Type (not included)	20-position removable terminal block
Weight	108.8 g (3.82 oz)
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.

**Meets EMC and Safety requirements. See the Declaration of Conformity for details.*

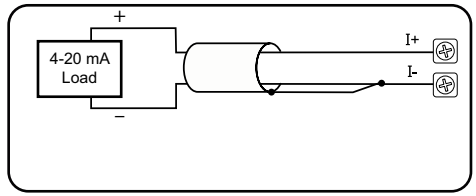
Removable Terminal Block Specifications	
Number of Positions	20 screw terminals
Wire Range	22–14 AWG (0.324 to 2.08 sq. mm) Solid / stranded conductor 3/64 in. (1.2 mm) insulation maximum USE COPPER CONDUCTORS , 60°C or equivalent.
Screw Driver Width	1/4 inch (6.5 mm) maximum
Screw Size	M3 size
Screw Torque	Field terminals: 7–9 in./lb (0.882–1.02 N·m) Self-jacking screws: 2.7–3.6 in./lb (0.3–0.4 N·m). Do not over-tighten screws when installing terminal block.

P3-06DAS-1 Isolated Analog Output (continued)

Wiring Diagrams



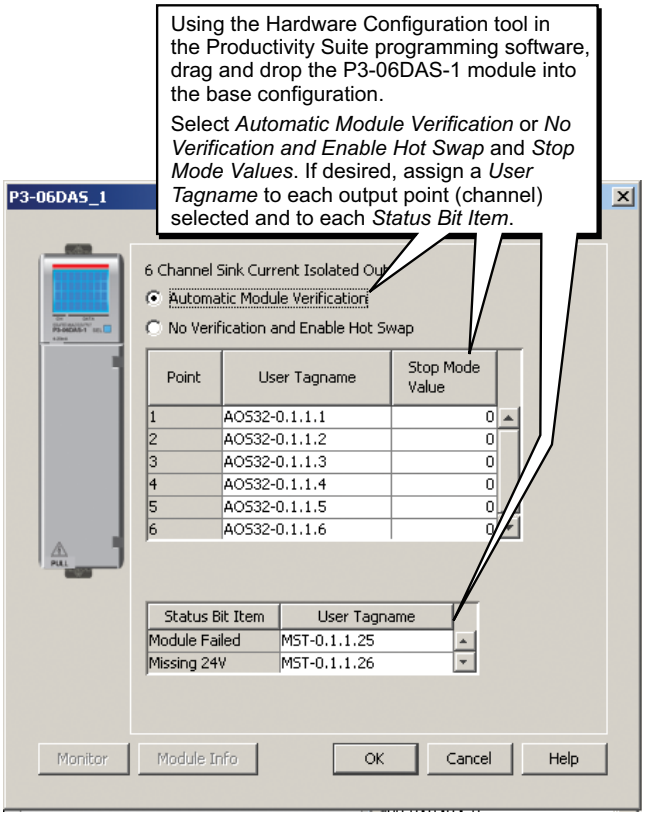
Current Output Circuits



NOTES:
1. Shield connected to signal source common.
2. Isolated analog outputs can work with sinking and sourcing field devices.

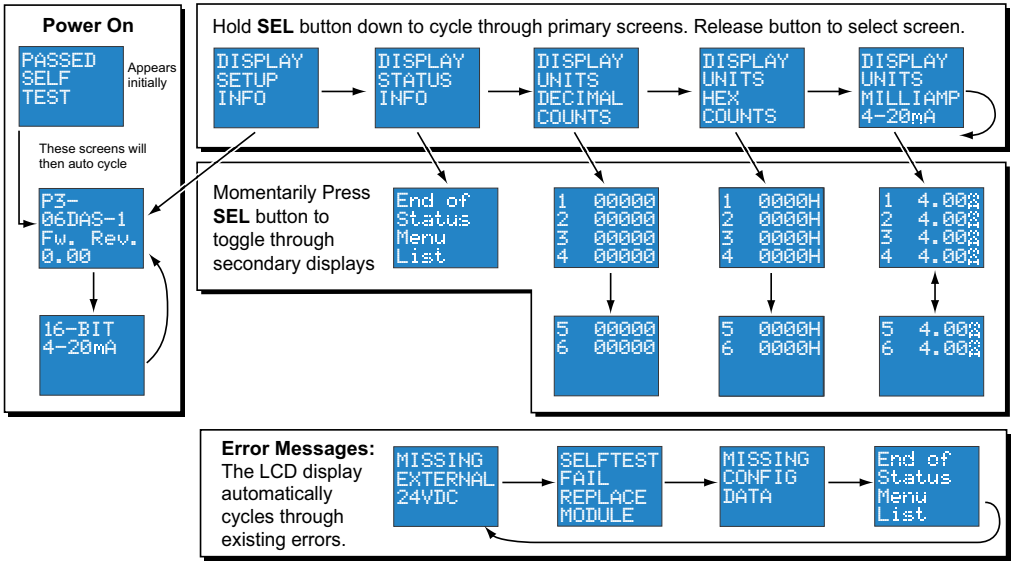
P3-06DAS-1 Isolated Analog Output (continued)

Module Configuration



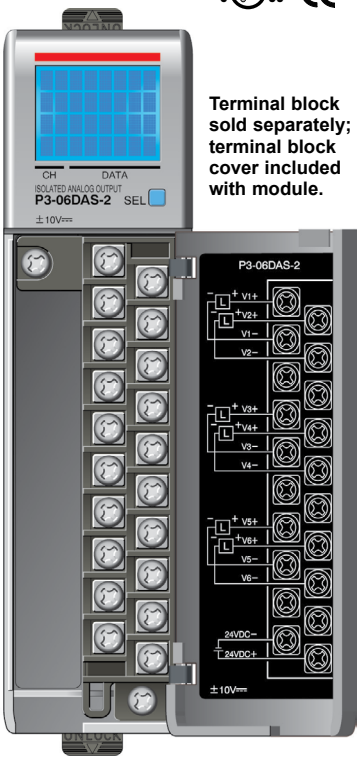
P3-06DAS-1 Isolated Analog Output (continued)

LCD Panel Display



P3-06DAS-2 Isolated Analog Output (Retired)

The P3-06DAS-2 Voltage Analog Output Module provides six channel-to-channel isolated ±10VDC outputs.



Terminal block sold separately; terminal block cover included with module.

Output Specifications	
Output channels	6 (6 isolated)
Module Signal Output Range	±10V
Signal Resolution	16 bit
Resolution Value of LSB (least significant bit)	16 Bit Resolution ±10V = 305µV
Data Range	-32768 to +32767 counts
Output Type (sourcing/sinking)	Voltage (10mA max current)
Channel to AUX Power Isolation	1800VDC applied for 1.8 second (100% tested)
Channel to Channel Isolation	900VDC applied for 1.8 second (100% tested)
Output Value in Fault Mode	0V
Load Impedance	≤1000Ω
Maximum Capacitive Load	0.01µF maximum
Allowed Load Type	Floating or grounded
Maximum Inaccuracy	±0.1% of range
Maximum Full Scale Calibration Error (not including offset error)	±.065% of range maximum voltage
Maximum Offset Calibration Error	±0.065% of range maximum
Accuracy vs. Temperature	±25 ppm/ °C maximum f.s. calibration change (±0.0025% of range / °C)
Maximum Crosstalk	-96dB, 1 LSB
Linearity Error (End to End)	±16 LSB maximum (±0.025% of full scale) Monotonic with no missing codes
Output Stability and Repeatability	±10 LSB after 10 min. warm-up (typical)
Output Ripple	0.01% of full scale
Output Settling Time	0.100 µs max, 40µs min (full scale change)
All Channel Update Rate	1.05 ms
Maximum Continuous Overload	Outputs current limited to 15mA typical
Type of Output Protection	15VDC Peak Output Voltage
Output Signal (power-up, -down)	0V
External DC Power Required	24VDC (-20% / + 25%), 287mA

P3-06DAS-2 was retired 03/2024

We recommend using prewired ZIPLink cables and connection modules. See Chapter 5.
Terminal block cover included. If you wish to hand-wire your module, a removable terminal block is sold separately. Order part number P3-RTB.

P3-06DAS-2 Isolated Analog Output (continued)

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)
Field to Logic Side Isolation	1800 VDC applied for 1.8 seconds (100% tested)
Insulation Resistance	>10MΩ @ 500VDC
Heat Dissipation	5.8 W
Enclosure Type	Open equipment
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000® system.
Field Wiring	Removable terminal block (not included). Use ***ZIP***Link wiring system or optional terminal block. See Chapter 5.
Terminal Type (not included)	20-position removable terminal block
Weight	108.8g (3.82 oz)
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.

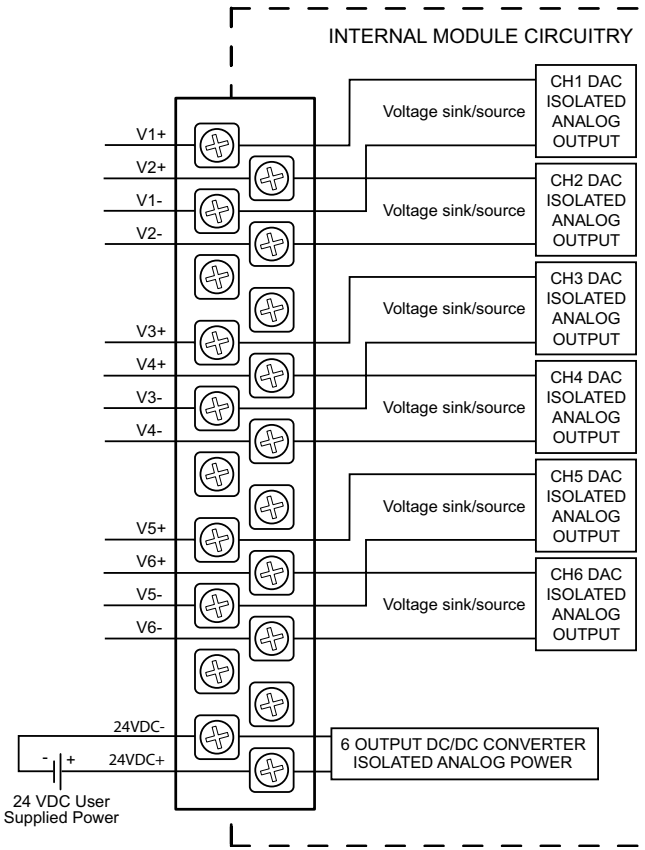
**Meets EMC and Safety requirements. See the Declaration of Conformity for details.*

WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

Removable Terminal Block Specifications	
Number of Positions	20 screw terminals
Wire Range	22–14 AWG (0.324 to 2.08 sq. mm) Solid / stranded conductor 3/64 in. (1.2 mm) insulation maximum USE COPPER CONDUCTORS , 60°C or equivalent.
Screw Driver Width	1/4 inch (6.5 mm) maximum
Screw Size	M3 size
Screw Torque	Field terminals: 7–9 in./lb (0.882–1.02 N·m) Self-jacking screws: 2.7–3.6 in./lb (0.3–0.4 N·m). Do not over-tighten screws when installing terminal block.

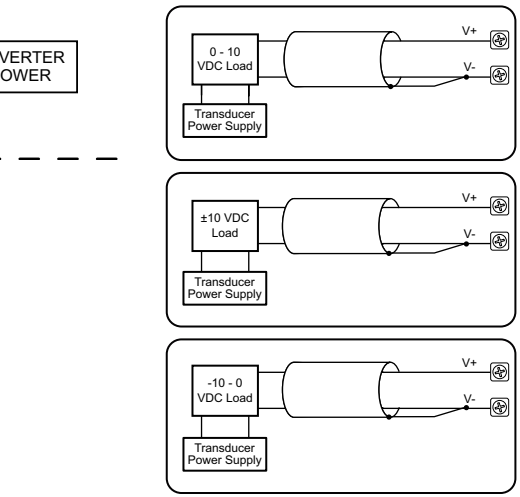
P3-06DAS-2 Isolated Analog Output (continued)

Wiring Diagrams



Voltage Output Circuits

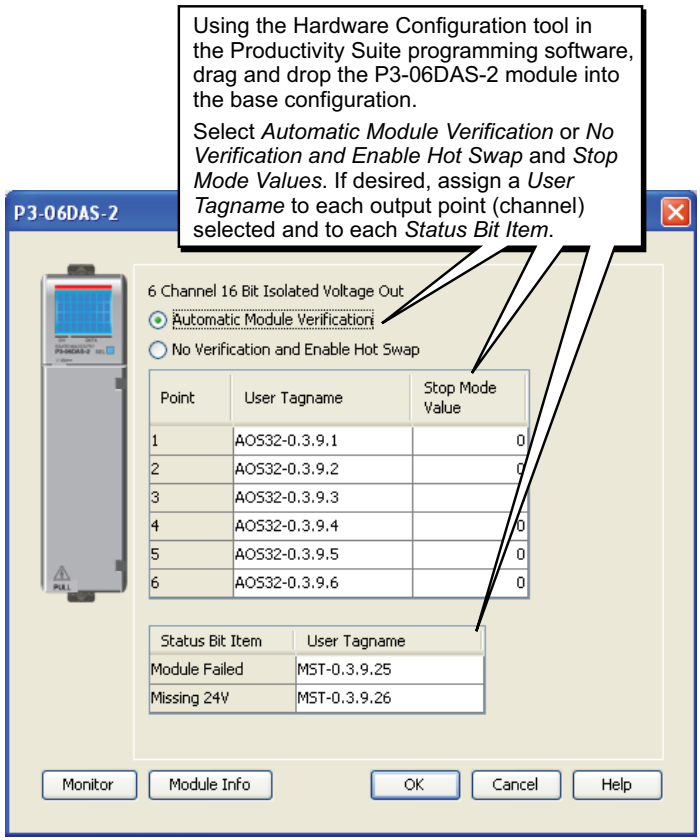
V- can be either isolated or grounded.



NOTES: Shield connected to signal source common.

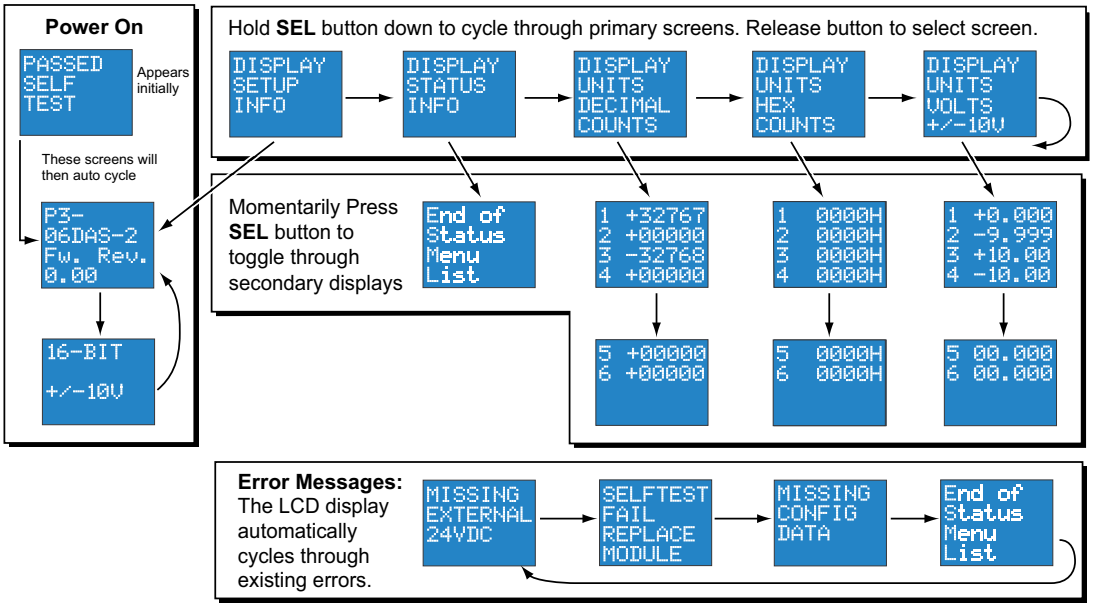
P3-06DAS-2 Isolated Analog Output (continued)

Module Configuration



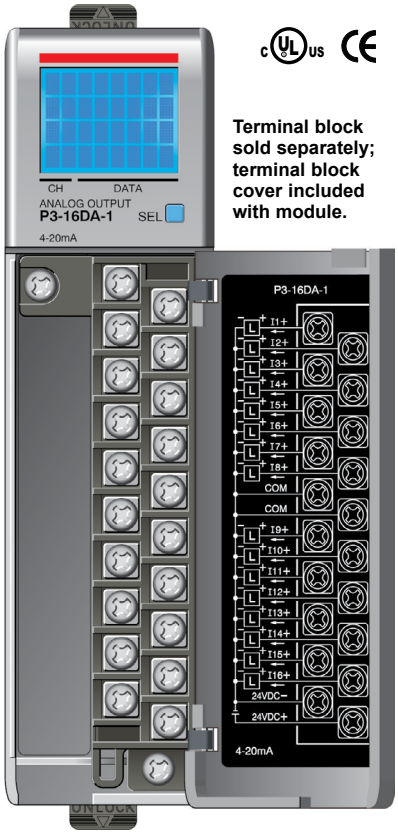
P3-06DAS-2 Isolated Analog Output (continued)

LCD Panel Display



P3-16DA-1 Analog Output

The P3-16DA-1 Current Analog Output Module provides sixteen channels of 4–20 mA sourcing outputs.



Terminal block sold separately; terminal block cover included with module.

Output Specifications	
Output Channels	16 (non-isolated)
Module Signal Output Range	4–20 mA
Output Signal Resolution	16-bit
Resolution Value of LSB (least significant bit)	4–20 mA = 0.244 µA/count 1 LSB = 1 count
Data Range	0 to 65535 counts
Output Value in Fault Mode	Less than 4mA
Load Impedance (Minimum External Power Supply)	0–570 Ω (19.2 VDC) 0–690 Ω (21.6 VDC) 0–810 Ω (24.0 VDC) 0–930 Ω (26.4 VDC) 0–1100 Ω (30.0 VDC) Minimum Load 0Ω @ 0–45°C, 125Ω@45-60°C,ambient
Maximum Inductive Load	1mH
Allowed Load Type	Grounded
Maximum Inaccuracy	0.1% of range (including temperature drift)
Maximum Full Scale Calibration Error (not including offset error)	±0.025% of range maximum
Maximum Offset Calibration Error	±0.025% of range maximum
Accuracy vs. Temperature	±25ppm/ °C maximum full scale calibration change (± .0025% of range / °C)
Max Crosstalk	-96dB, 1 LSB
Linearity Error (end to end)	±16 LSB maximum (±0.025% of full scale) monotonic with no missing codes
Output Stability and Repeatability	±10 LSB after 10 min. warm-up (typical)
Output Ripple	0.05% of full scale
Output Settling Time	0.3 ms max, 5µs min (full scale change)
All Channel Update Rate	0.6 ms
Maximum Continuous Overload	Outputs open circuit protected
Type of Output Protection	Electronically current limited to 20mA or less
Output Signal at Power-up and Power-down	4mA
External DC Power Required	24VDC (-20% / + 25%), 356mA

We recommend using prewired ZIPLink cables and connection modules. See Chapter 5.
Terminal block cover included. If you wish to hand-wire your module, a removable terminal block is sold separately. Order part number P3-RTB.

P3-16DA-1 Analog Output (continued)

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)
Field to Logic Side Isolation	1800VAC applied for 1s
Insulation Resistance	>10MΩ @ 500VDC
Heat Dissipation	9.0 W
Enclosure Type	Open equipment
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000® system.
Field Wiring	Removable terminal block (not included). Use ***ZIP***Link wiring system or optional terminal block. See Chapter 5.
Terminal Type (not included)	20-position removable terminal block
Weight	105g (3.73 oz)
Agency Approvals	UL508 and UL1604 (Certified for Canada and USA) CE (EN61131-2:2003) This equipment is suitable for use in Class I, Division 2/Zone 2, Groups A, B, C, and D or non-hazardous locations only.

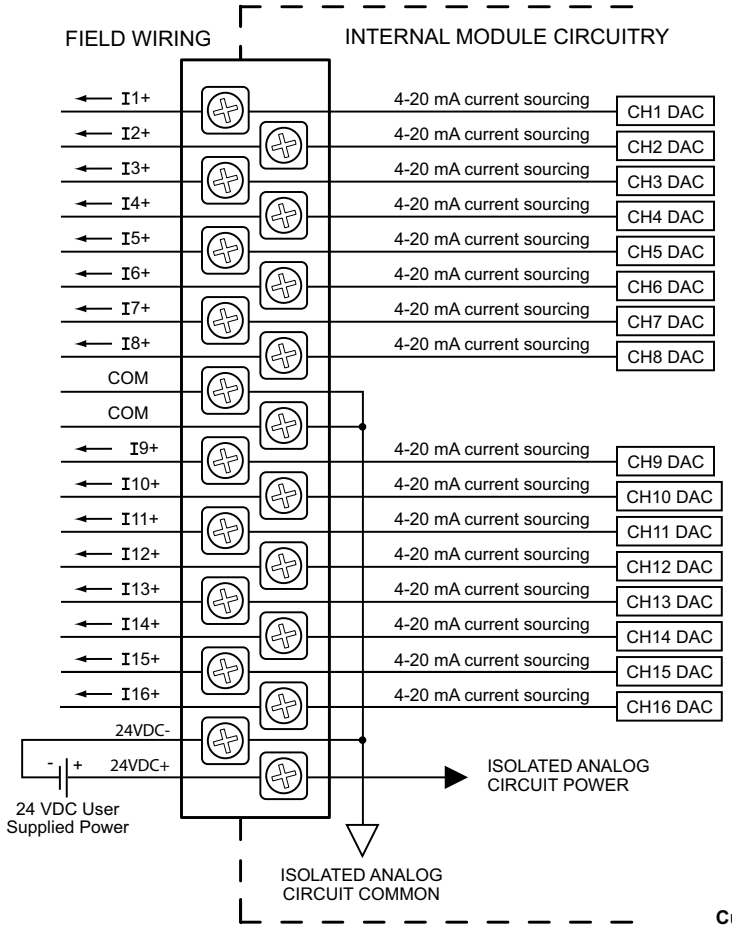
**Meets EMC and Safety requirements. See the Declaration of Conformity for details.*

WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

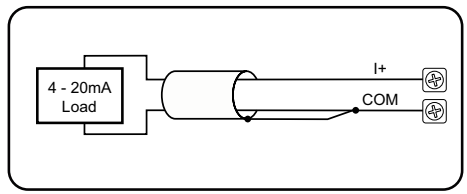
Removable Terminal Block Specifications	
Number of Positions	20 screw terminals
Wire Range	22–14 AWG (0.324 to 2.08 sq. mm) Solid / stranded conductor 3/64 in. (1.2 mm) insulation maximum USE COPPER CONDUCTORS , 60°C or equivalent.
Screw Driver Width	1/4 inch (6.5 mm) maximum
Screw Size	M3 size
Screw Torque	Field terminals: 7–9 in./lb (0.882–1.02 N·m) Self-jacking screws: 2.7–3.6 in./lb (0.3–0.4 N·m). Do not over-tighten screws when installing terminal block.

P3-16DA-1 Analog Output (continued)

Wiring Diagrams



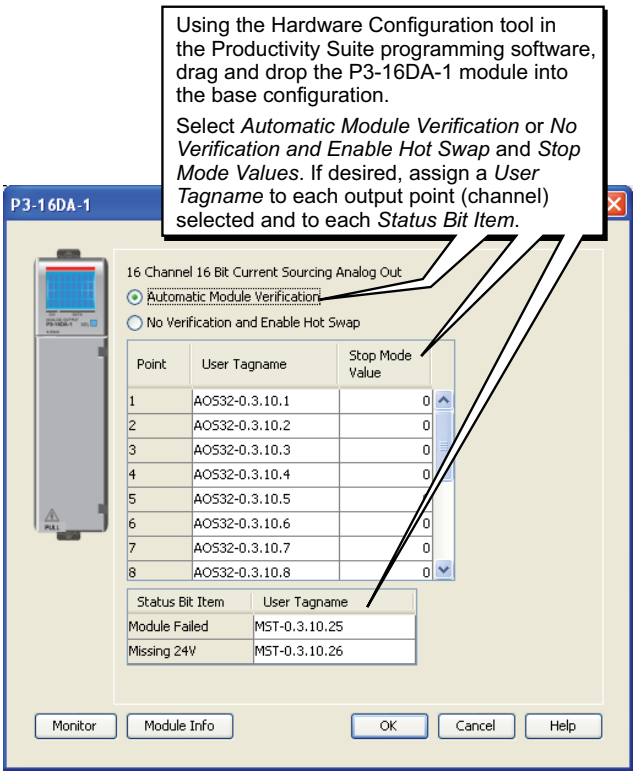
Current Source Output Circuit



NOTE: Shield is connected to common at the source device.

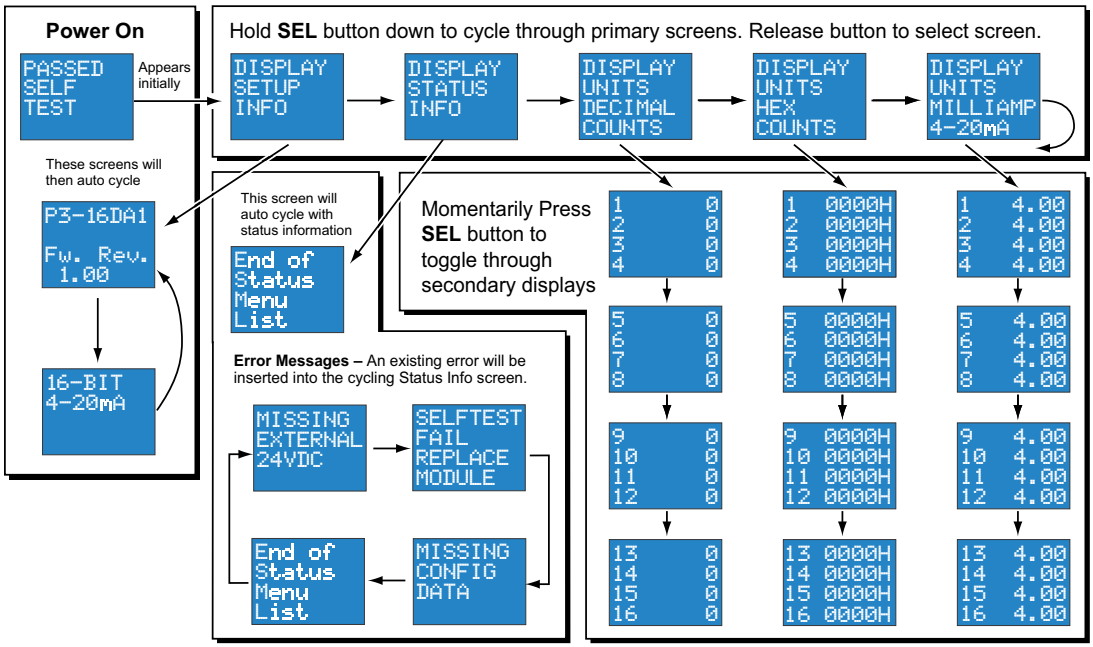
P3-16DA-1 Analog Output (continued)

Module Configuration



P3-16DA-1 Analog Output (continued)

LCD Panel Display



P3-16DA-2 Analog Output

The P3-16DA-2 Voltage Analog Output Module provides sixteen channels of ±10VDC outputs.



Terminal block sold separately; terminal block cover included with module.

Output Specifications	
Output Channels	16
Module Signal Output Range	±10VDC
Output Signal Resolution	16-bit
Resolution Value of LSB (least significant bit)	±10V = 305µV/count 1 LSB = 1 count
Data Range	-32768 to +32767
Output type (sourcing/sinking)	Voltage (10mA max current)
Output Value in Fault Mode	0V
Output Impedance	0.2 Ω typical
Load Impedance	≤1000Ω
Maximum Capacitive Load	0.01 µF maximum
Allowed Load Type	Grounded
Maximum Inaccuracy	0.1% of range (including temperature drift)
Maximum Full Scale Calibration Error (not including offset error)	±0.025% of range maximum
Maximum Offset Calibration Error	±0.025% of range maximum
Accuracy vs. Temperature	±25 ppm/ °C maximum f.s. calibration change (±0.0025% of range / °C)
Max Crosstalk	-96dB, 1 LSB
Linearity Error (end to end)	±16 LSB maximum (±0.025% of full scale) Monotonic with no missing codes
Output Stability and Repeatability	±10 LSB after 10 min. warm-up (typical)
Output Ripple	0.05% of full scale
Output Settling Time	0.3 ms max, 5µs min (full scale change)
All Channel Update Rate	0.6 ms
Maximum Continuous Overload	Outputs current limited to 40mA typical Continuous overloads on multiple outputs can damage the module.
Type of Output Protection	0.1µF Transient Suppressor
External DC Power Required	24VDC (-20% / + 25%), 252mA

We recommend using prewired ZIPLink cables and connection modules. See Chapter 5.
Terminal block cover included. If you wish to hand-wire your module, a removable terminal block is sold separately. Order part number P3-RTB.

P3-16DA-2 Analog Output (continued)

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)
Field to Logic Side Isolation	1800VAC applied for 1s
Insulation Resistance	>10MΩ @ 500VDC
Heat Dissipation	6.4 W
Enclosure Type	Open equipment
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000® system.
Field Wiring	Removable terminal block (not included). Use ***ZIP***Link wiring system or optional terminal block. See Chapter 5.
Terminal Type (not included)	20-position removable terminal block
Weight	105g (3.73 oz)
Agency Approvals	UL508 and UL1604 (Certified for Canada and USA) CE (EN61131-2*) This equipment is suitable for use in Class I, Division 2/Zone 2, Groups A, B, C, and D or non-hazardous locations only.

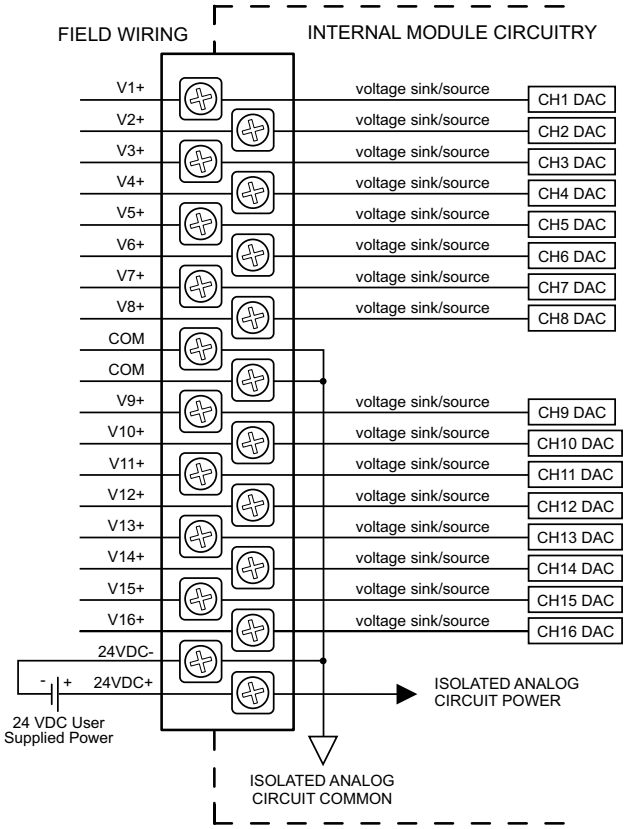
**Meets EMC and Safety requirements. See the Declaration of Conformity for details.*

WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

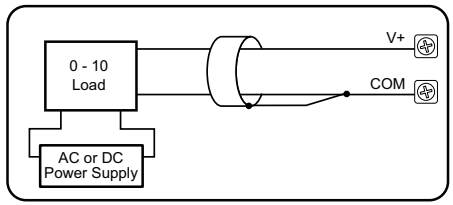
Removable Terminal Block Specifications	
Number of Positions	20 screw terminals
Wire Range	22–14 AWG (0.324 to 2.08 sq. mm) Solid / stranded conductor 3/64 in. (1.2 mm) insulation maximum USE COPPER CONDUCTORS , 60°C or equivalent.
Screw Driver Width	1/4 inch (6.5 mm) maximum
Screw Size	M3 size
Screw Torque	Field terminals: 7–9 in./lb (0.882–1.02 N·m) Self-jacking screws: 2.7–3.6 in./lb (0.3–0.4 N·m). Do not over-tighten screws when installing terminal block.

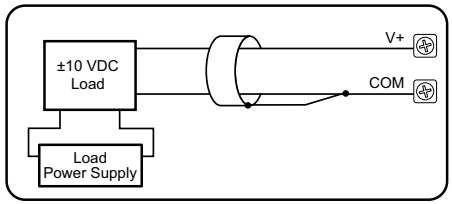
P3-16DA-2 Analog Output (continued)

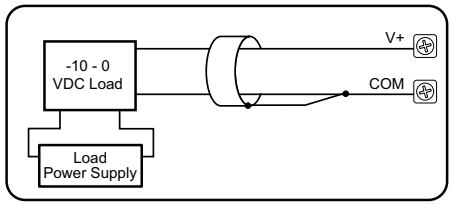
Wiring Diagrams



Voltage Output Circuits

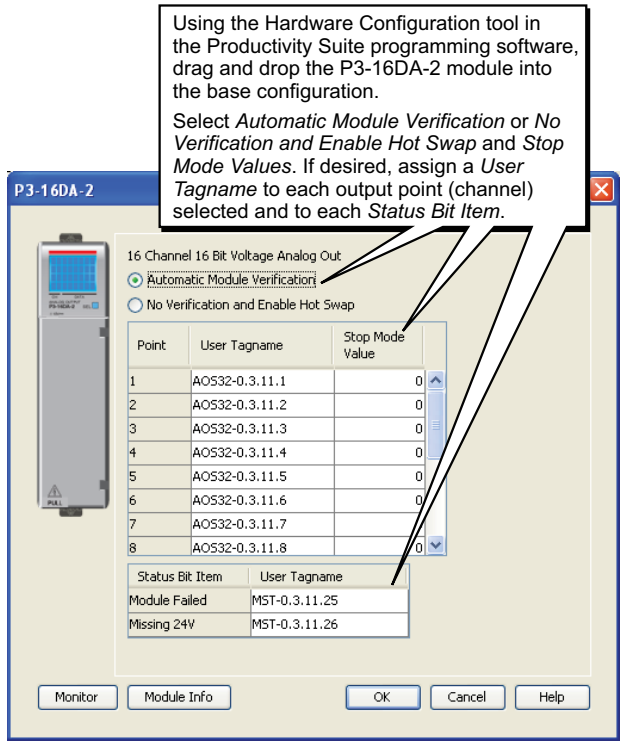






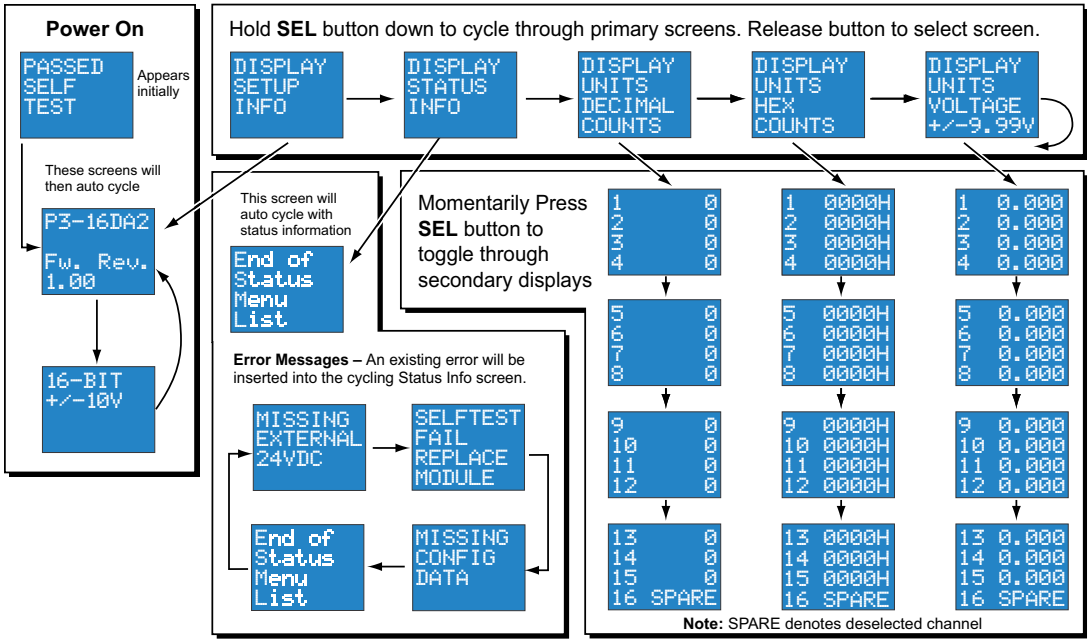
P3-16DA-2 Analog Output (continued)

Module Configuration



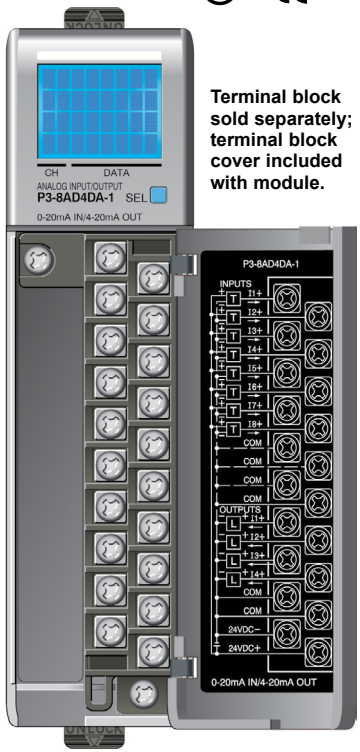
P3-16DA-2 Analog Output (continued)

LCD Panel Display



P3-8AD4DA-1 Analog Input/Output

The P3-8AD4DA-1 Current Analog Input/Output Module provides eight channels of current sinking 0–20 mA inputs and four channels of current sourcing 4–20 mA outputs.



Terminal block sold separately; terminal block cover included with module.

Input Specifications	
Input channels	8 (1 common)
Module Signal Input Range	0–20 mA
Signal Resolution	12–16 bit, depending on Input Resolution
Input Resolution & Update Rate *See Note 1*	Fine: 7.1 ms, 0.305 µA, 16 bit Medium: 1.78 ms, 1.22 µA, 14 bit Coarse: 444µs, 4.88 µA, 12 bit
Data Range	0-65535 counts
Input Type	Single Ended (one common)
Maximum Continuous Overload	±31mA
Input Impedance	250Ω ±0.1% ¼W
Hardware Filter Characteristics	Low pass 1st order, -3dB @ 48Hz
All Channel Update Rate *See Note 2*	Fine: 56.8 ms Medium: 14.24 ms Coarse: 3.55 ms
All Channel Update Rate	56.8 ms
Open Circuit Detection Time	Zero reading within 1s
Conversion Method	Successive approximation
Accuracy vs. Temperature	±15PPM / °C maximum
Maximum Inaccuracy	0.1% of range
Linearity Error (end to end)	0.015% of range maximum Monotonic with no missing codes
Input Stability and Repeatability	±0.015% of range (after 10 min. warm up)
Full Scale Calibration Error (not including offset)	±0.05% of range maximum
Offset Calibration Error	±.0.05% of range maximum
Maximum Crosstalk	-96dB ±1–0.015% of full scale maximum
Recommended Fuse (external)	Edison S500-32-R, 0.032A fuse
External DC Power Required	24VDC (-20% / + 25%), 183mA maximum

Note 1: The Input Resolution of Fine returns 16 bit resolution. Medium and Coarse are 14 and 12 bit respectively. The 12 and 14 bit input values are scaled to 0-65535.

Note 2: Valid when all channels are set for the same Input Resolution.

We recommend using prewired ZIPLink cables and connection modules. See Chapter 5.
Terminal block cover included. If you wish to hand-wire your module, a removable terminal block is sold separately. Order part number P3-RTB.

P3-8AD4DA-1 Analog Input/Output (continued)

Output Specifications	
Outputs per module	4 (1 common)
Module signal output range	4–20 mA
Output Signal resolution	16-bit
Resolution Value of LSB (least significant bit)	0.244 µA/count 1 LSB = 1 count
Data Range	0–65535 counts
Output Type	Current sourcing, 20mA max
Output Value in Fault Mode	≤4mA
Load Impedance (Minimum Ext. Power Supply)	0–480 Ω (19.2 VDC) 0–600 Ω (21.6 VDC) 0–715 Ω (24.0 VDC) 0–840 Ω (26.4 VDC) 0–1010 Ω(30.0 VDC)
Maximum Inductive Load	1mH
Allowed Load Type	Grounded
Maximum Inaccuracy	±0.1% of range
Maximum Full Scale Calibration Error (not including offset error)	±0.065% of full scale
Maximum Offset Calibration Error	±0.065% of full scale
Accuracy vs. Temperature	±15ppm/ °C maximum full scale calibration change (±0.025% of range / °C)
Maximum Crosstalk	-96dB
Linearity Error (end to end)	±0.015% of range maximum Monotonic with no missing codes
Output Stability and Repeatability	±.015% after 10 min. warm-up typical
Output Ripple	0.01% of Full Scale at 50/60 Hz
Output Settling Time	Rising Time 200µs Falling Time 135µs (full scale change)
All Channel Update Rate	3.55 ms
Maximum Continuous Overload	Outputs open circuit protected
Type of Output Protection	Electronically current limited to 20mA or less
Output Signal (power-up, -down)	≤4mA

Removable Terminal Block Specifications	
Number of Positions	20 screw terminals
Wire Range	22–14 AWG (0.324 to 2.08 sq. mm) Solid / stranded conductor 3/64 in. (1.2 mm) insulation maximum USE COPPER CONDUCTORS , 60°C or equivalent.
Screw Driver Width	1/4 inch (6.5 mm) maximum
Screw Size	M3 size
Screw Torque	Field terminals: 7–9 in./lb (0.882–1.02 N·m) Self-jacking screws: 2.7–3.6 in./lb (0.3–0.4 N·m). Do not over-tighten screws when installing terminal block.

P3-8AD4DA-1 Analog Input/Output (continued)

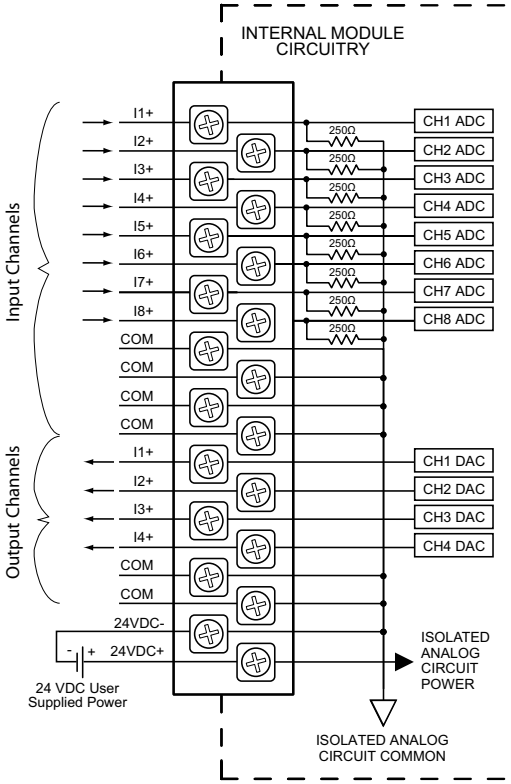
General Specifications	
Operating Temperature	0° to 60°C (32° to 140°F),
Storage Temperature	-20° to 70°C (-4° to 158°F)
Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	IEC60068-2-6 (Test Fc)
Shock	IEC60068-2-27 (Test Ea)
Field to Logic Side Isolation	1800VAC applied for 1s
Insulation Resistance	>10MV @ 500VDC
Heat Dissipation	3.8 W
Enclosure Type	Open equipment
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000® system.
Field Wiring	Removable terminal block (not included). Use ***ZIP***Link wiring system or optional terminal block. See Chapter 5.
Terminal Type (not included)	20-position removable terminal block
Weight	106.9g (3.76 oz)
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.

*Meets EMC and Safety requirements. See the Declaration of Conformity for details.

WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

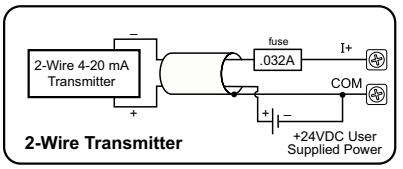
P3-8AD4DA-1 Analog Input/Output (continued)

Wiring Diagrams

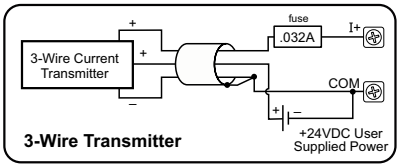


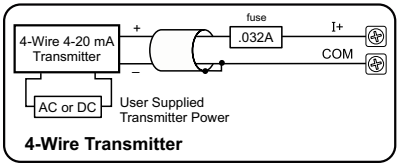
Note: This module includes input and output channels. Before connecting field wiring, verify that you are connecting to the appropriate terminals.

Current Input Circuits



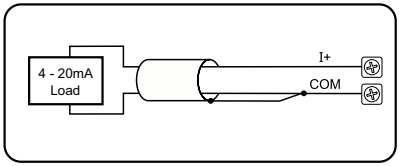
An Edison S500-32-R 0.032A fast-acting fuse is recommended for all 4-20 mA current loops.





Note: Do not connect both ends of shield.

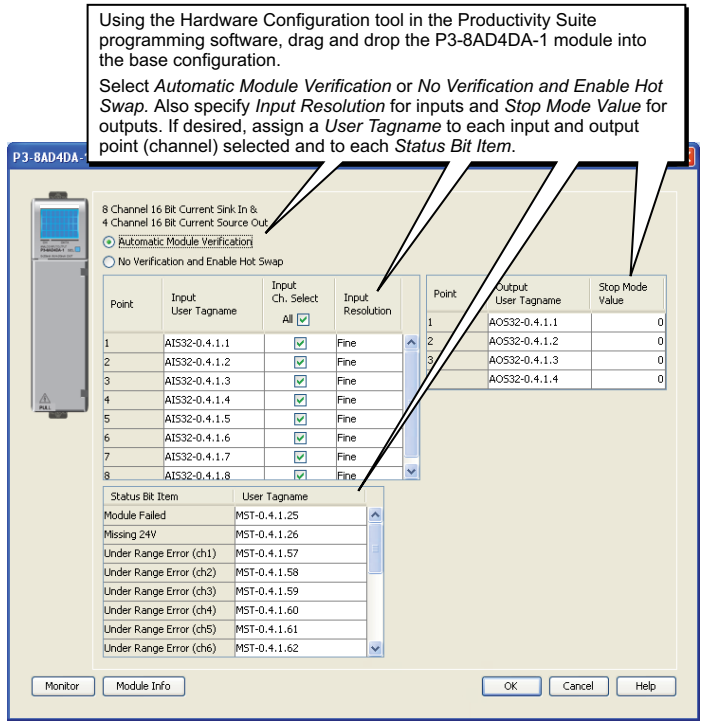
Current Output Circuits



Note: Shield is connected to common at the source device.

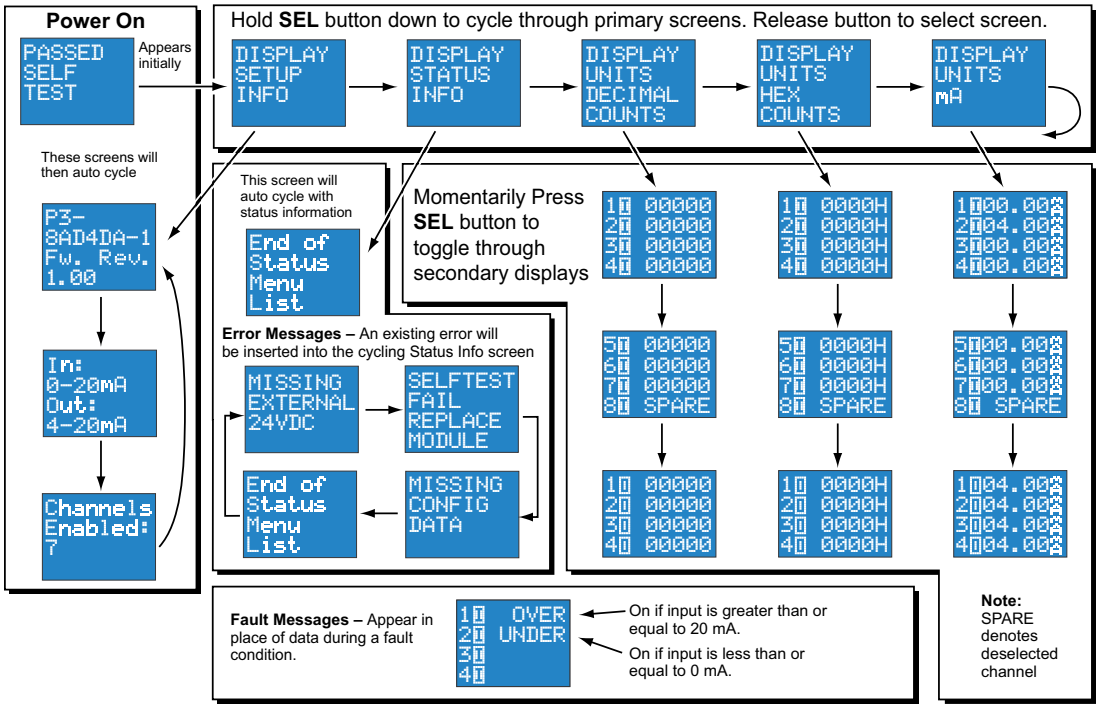
P3-8AD4DA-1 Analog Input/Output (continued)

Module Configuration



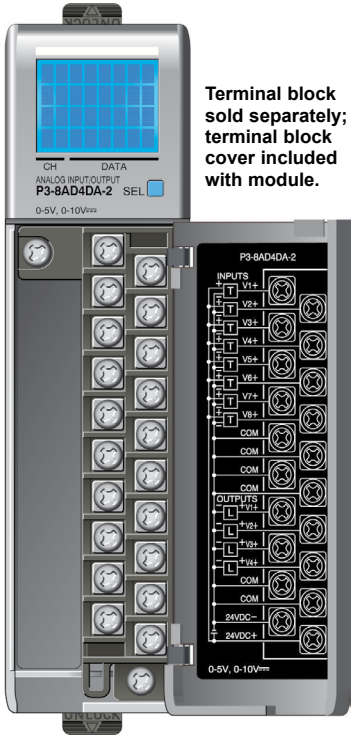
P3-8AD4DA-1 Analog Input/Output (continued)

LCD Panel Display



P3-8AD4DA-2 Analog Input/Output

The P3-8AD4DA-2 Voltage Analog Input/Output Module provides eight channels of 0–5 VDC and 0–10 VDC inputs and four channels of 0–5 VDC and 0–10 VDC outputs.



Terminal block sold separately; terminal block cover included with module.

Input Specifications	
Input channels	8 inputs (1 common)
Input ranges	0–5V, 0–10V
Signal resolution	12–16 bit, depending on Input Resolution
0-5V Input Resolution & Update Rate *See Note 1*	Fine: 7.1ms, 76µV, 16 bit Medium: 1.78 ms, 305µV, 14 bit Coarse: 444µs, 1.22 mV, 12 bit
0-10V Input Resolution & Update Rate *See Note 1*	Fine: 7.1 ms, 152µV, 16 bit Medium: 1.78 ms, 610µV, 14 bit Coarse: 444µs, 2.44 mV, 12 bit
Data Range	0–65535 counts
Maximum continuous overload	±100V, voltage input
Input impedance	1MV (± 10%) voltage input
Hardware Filter Characteristics	Low pass 1st order, -3dB @ 80Hz
All Channel Update Rate *See Note 2*	Fine: 56.8 ms Medium: 14.24 ms Coarse: 3.55 ms
Conversion Method	Successive approximation
Accuracy vs. Temperature	±15PPM / °C Maximum
Maximum Inaccuracy	0.1% of range
Linearity Error (end to end)	±0.015% of range maximum Monotonic with no missing codes
Input Stability and Repeatability	±0.025% of range (after 10 min. warm up)
Full Scale Calibration Error (minus offset)	±0.05% of range maximum
Offset Calibration Error	±0.05% of range maximum
Max Crosstalk	-96dB
External DC Power Required	24VDC (-20% / +25%), 90mA maximum

Note 1: The Input Resolution of Fine returns 16 bit resolution. Medium and Coarse are 14 and 12 bit respectively. The 12 and 14 bit input values are scaled to 0-65535.

Note 2: Valid when all channels are set for the same Input Resolution.

We recommend using prewired ZIPLink cables and connection modules. See Chapter 5.
Terminal block cover included. If you wish to hand-wire your module, a removable terminal block is sold separately. Order part number P3-RTB.

P3-8AD4DA-2 Analog Input/Output (continued)

Output Specifications	
Output channels	4 (1 common)
Output ranges	0–10V, 0–5V
Output Signal resolution	16-bit
Resolution Value of LSB (least significant bit)	0–5V = 76µV/count 0–10V = 152µV/count 1 LSB = 1 count
Data Range	0–65535 counts
Output Type	Voltage sourcing/sinking at 10mA max.
Output Value in Fault Mode	0V
Load Impedance	≤1125Ω
Maximum capacitive load	0.01 µF maximum
Allowed Load Type	Grounded
Maximum Inaccuracy	0.1% of range
Maximum Full Scale Calibration Error (not including offset error)	±0.065% of range maximum
Maximum Offset Calibration Error	±0.065% of range maximum
Accuracy vs. Temperature	±25ppm/ °C maximum full scale calibration change (± 0.0025% of range / °C)
Max Crosstalk	-96dB
Linearity Error (end to end)	0.015% of full scale Monotonic with no missing codes
Output Stability and Repeatability	±0.015% after 10 min. warm-up typical
Output Ripple	0.01% of Full Scale at 50/60 Hz
Output Settling Time	0.5 ms max, 5µs min (full scale change)
All Channel Update Rate	5ms
Maximum Continuous Overload	Outputs current limited to 15mA typical
Type of Output Protection	15VDC peak output voltage
Output Signal (power-up, -down)	0V

Removable Terminal Block Specifications	
Number of Positions	20 screw terminals
Wire Range	22–14 AWG (0.324 to 2.08 sq. mm) Solid / stranded conductor 3/64 in. (1.2 mm) insulation maximum USE COPPER CONDUCTORS , 60°C or equivalent.
Screw Driver Width	1/4 inch (6.5 mm) maximum
Screw Size	M3 size
Screw Torque	Field terminals: 7–9 in./lb (0.882–1.02 N·m) Self-jacking screws: 2.7–3.6 in./lb (0.3–0.4 N·m). Do not over-tighten screws when installing terminal block.

P3-8AD4DA-2 Analog Input/Output (continued)

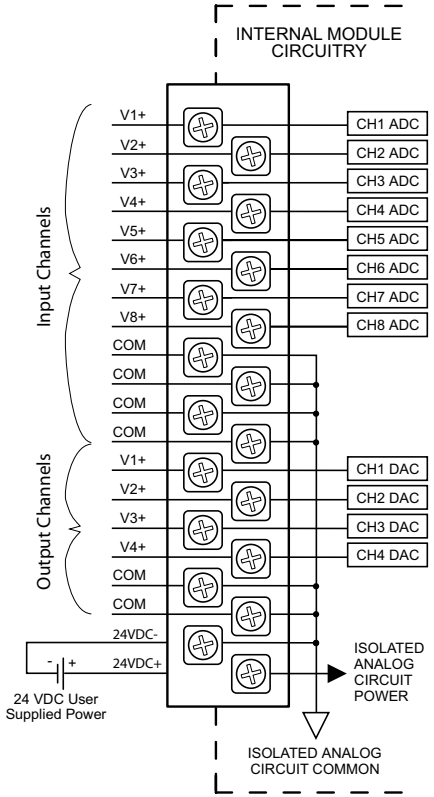
General Specifications	
Operating Temperature	0° to 60°C (32° to 140°F),
Storage Temperature	-20° to 70°C (-4° to 158°F)
Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	IEC60068-2-6 (Test Fc)
Shock	IEC60068-2-27 (Test Ea)
Field to Logic Side Isolation	1800VAC applied for 1s
Insulation Resistance	>10MΩ @ 500VDC
Heat Dissipation	2.5 W
Enclosure Type	Open equipment
Module Keying to Backplane	Electronic
Module Location	Any I/O slot in any local, expansion, or remote base in a Productivity3000® system.
Field Wiring	Removable terminal block (not included). Use ***ZIP***Link wiring system or optional terminal block. See Chapter 5.
Terminal Type (not included)	20-position removable terminal block
Weight	105g (3.73 oz)
Agency Approvals	UL508 file E157382, Canada & USA UL1604 file E200031, Canada & USA CE (EN61131-2*) This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.

**Meets EMC and Safety requirements. See the Declaration of Conformity for details.*

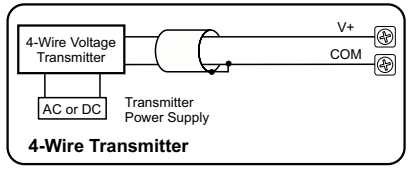
WARNING: Explosion hazard – Substitution of components may impair suitability for Class I, Division 2.

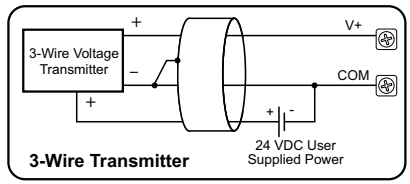
P3-8AD4DA-2 Analog Input/Output (continued)

Wiring Diagrams

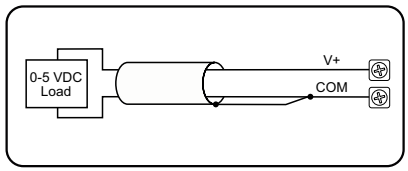


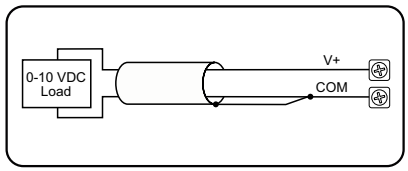
Voltage Input Circuits





Voltage Output Circuits

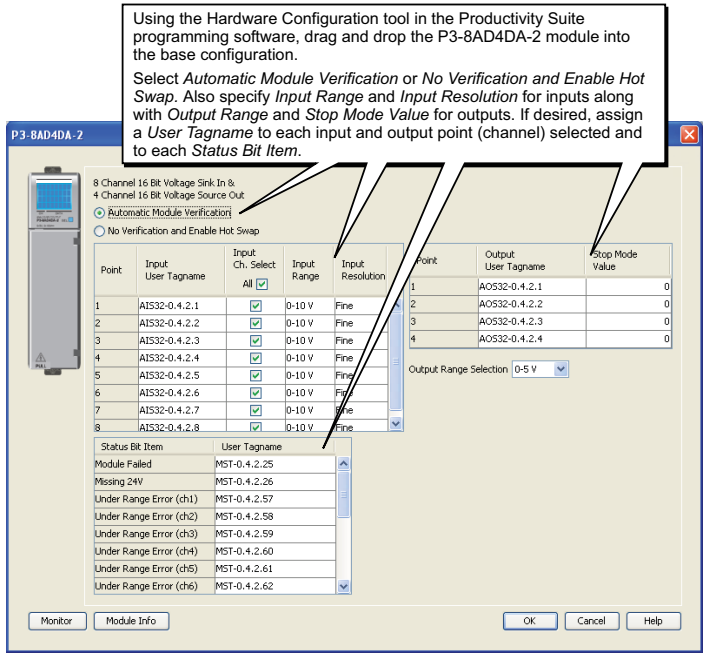




Note: This module includes input and output channels. Before connecting field wiring, verify that you are connecting to the appropriate terminals.

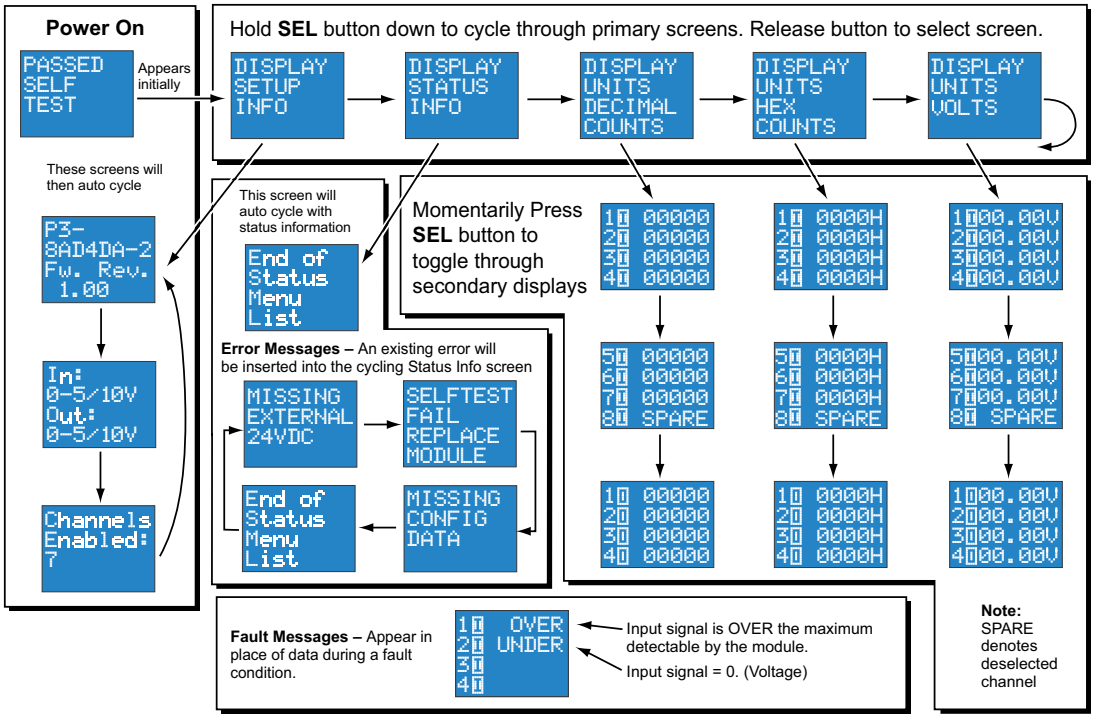
P3-8AD4DA-2 Analog Input/Output (continued)

Module Configuration



P3-8AD4DA-2 Analog Input/Output (continued)

LCD Panel Display



INSTALLATION AND WIRING



In This Chapter...

Safety Guidelines 5–2
Productivity3000® Mechanical Design Introduction 5–5
Dimensions and Installation 5–6
Mounting Guidelines 5–7
Wiring Guidelines 5–14
I/O Module Wiring Options 5–16
System Wiring Strategies 5–22

Safety Guidelines



NOTE: *Products with CE marks perform their required functions safely and adhere to relevant standards as specified by CE directives provided they are used according to their intended purpose and that the instructions in this manual are adhered to. The protection provided by the equipment may be impaired if this equipment is used in a manner not specified in this manual. A listing of international affiliates is available on our Web site at http://www.automationdirect.com.*



WARNING: Providing a safe operating environment for personnel and equipment is your responsibility and should be your primary goal during system planning and installation. Automation systems can fail and may result in situations that can cause serious injury to personnel or damage to equipment. Do not rely on the automation system alone to provide a safe operating environment. You should use external electromechanical devices, such as relays or limit switches, that are independent of the CPU application to provide protection for any part of the system that may cause personal injury or damage. Every automation application is different, so there may be special requirements for your particular application. Make sure you follow all national, state, and local government requirements for the proper installation and use of your equipment.

Plan for Safety

The best way to provide a safe operating environment is to make personnel and equipment safety part of the planning process. You should examine every aspect of the system to determine which areas are critical to operator or machine safety. If you are not familiar with CPU system installation practices, or your company does not have established installation guidelines, you should obtain additional information from the following sources.

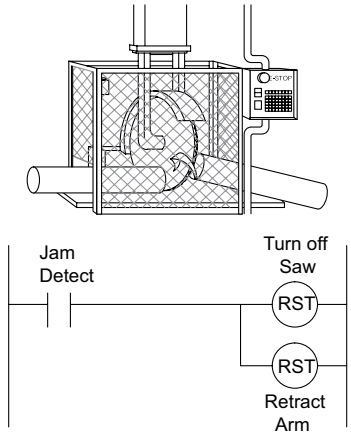
- NEMA — The National Electrical Manufacturers Association, located in Washington, D.C., publishes many different documents that discuss standards for industrial control systems. You can order these publications directly from NEMA. Some of these include:
  - ICS 1, General Standards for Industrial Control and Systems
  - ICS 3, Industrial Systems
  - ICS 6, Enclosures for Industrial Control Systems
- NEC — The National Electrical Code provides regulations concerning the installation and use of various types of electrical equipment. Copies of the NEC Handbook can often be obtained from your local electrical equipment distributor or your local library.
- Local and State Agencies — many local governments and state governments have additional requirements above and beyond those described in the NEC Handbook. Check with your local Electrical Inspector or Fire Marshall office for information.

Three Levels of Protection

WARNING: The control program must not be the only form of protection for any problems that may result in a risk of personal injury or equipment damage.

The publications mentioned provide many ideas and requirements for system safety. At a minimum, you should follow these regulations. Also, you should use the following techniques, which provide three levels of system control.

1. Orderly system shutdown sequence in the CPU control program.
2. Mechanical disconnect for output module power.
3. Emergency stop switch for disconnecting system power.



Orderly System Shutdown

The first level of fault detection is ideally the CPU control program, which can identify machine problems. Certain shutdown sequences should be performed. These types of problems are usually things such as jammed parts, etc. that do not pose a risk of personal injury or equipment damage.

System Power Disconnect

You should also use electromechanical devices, such as master control relays and/or limit switches, to prevent accidental equipment startup at an unexpected time. These devices should be installed in a manner that will prevent any machine operations from occurring.

For example, if the machine in the illustration has a jammed part, the CPU control program can turn off the saw blade and retract the arbor. If the operator must open the guard to remove the part, you should also include a bypass switch that disconnects all system power any time the guard is opened.

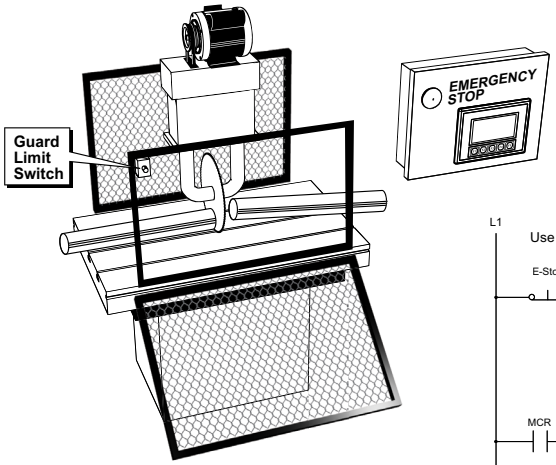
Emergency Stop Circuits

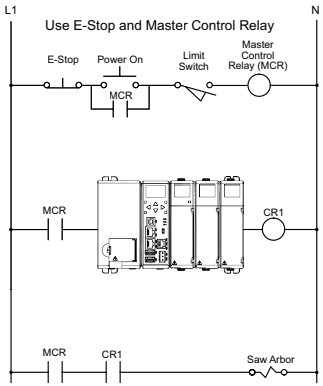
Emergency stop (E-Stop) circuits are a critical part of automation safety. For each machine controlled by a CPU, provide an emergency stop device that is wired outside the CPU and easily accessed by the machine operator.

E-stop devices are commonly wired through a master control relay (MCR) or a safety control relay (SCR) that will remove power from the CPU I/O system in an emergency.

MCRs and SCRs provide a convenient means for removing power from the I/O system during an emergency situation. By de-energizing an MCR (or SCR) coil, power to the input (optional) and output devices is removed. This event occurs when any emergency stop switch opens. However, the CPU continues to receive power and operate even though all its inputs and outputs are disabled.

The MCR circuit could be extended by placing a CPU fault relay (closed during normal CPU operation) in series with any other emergency stop conditions. This would cause the MCR circuit to drop the CPU I/O power in case of a CPU failure (memory error, I/O communications error, etc.).





WARNING: For some applications, field device power may still be present on the terminal block even though the CPU is turned off. To minimize the risk of electrical shock, remove all field device power before you expose or remove CPU wiring.

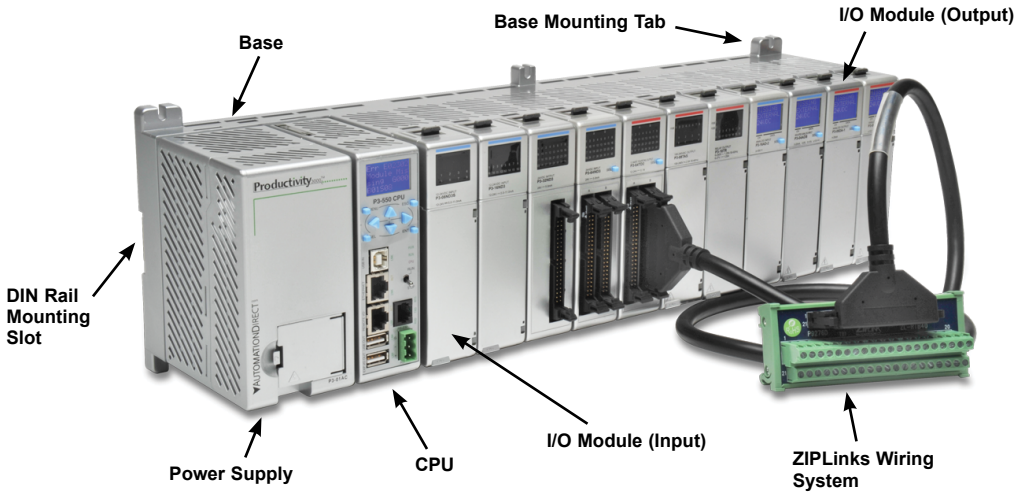
Productivity3000® Mechanical Design Introduction

The Productivity3000 is a modular system that requires a base to accommodate the various modules. Bases are available with 3, 5, 8 and 11 I/O module slots. The bases contain additional dedicated slots for the power supply and the CPU. You can place any I/O module in any I/O slot without power budget or module type restrictions.

Each Productivity3000 system requires one CPU module mounted in the controller slot in the first base of the local base group. The system can be expanded with the P3-RS, P3-RX, P3-EX, or PS-AMC modules.

NOTE: *The P3-RS module is discontinued as of 6/20. Please use P3-RX as a replacement.*

Typical Productivity3000 System

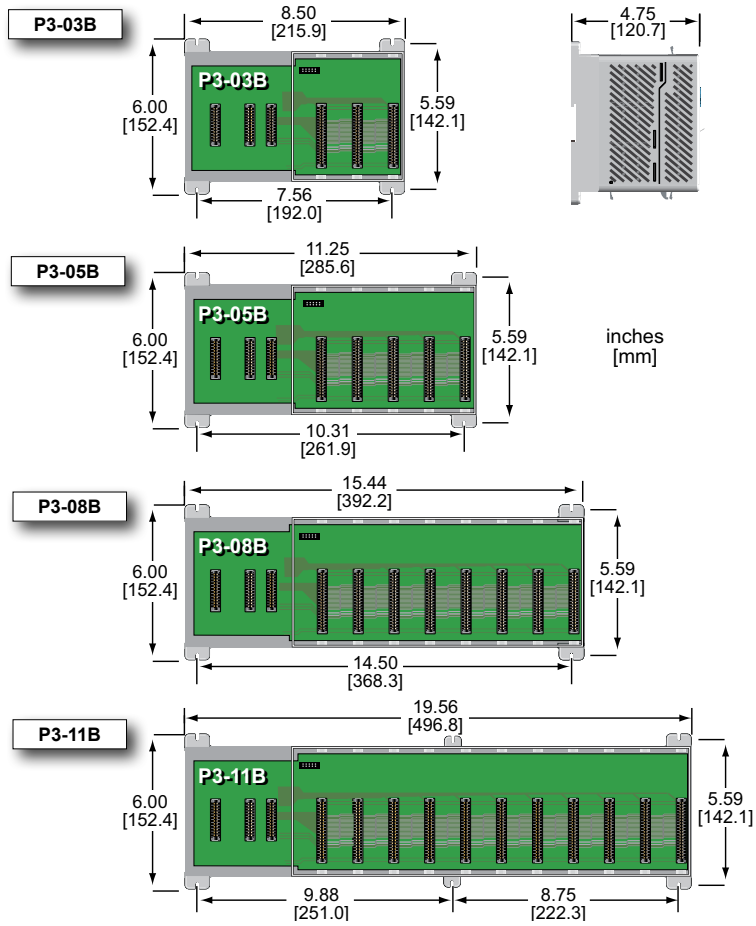


Dimensions and Installation

Before installing the CPU system you will need to know the dimensions of the components considered. These diagrams provide the base dimensions to use in defining your enclosure specifications. Remember to leave room for potential expansion. If you are using other components in your system, refer to the appropriate manual to determine how those units can affect mounting dimensions.

The height dimension is the same for all bases. The depth varies depending on your choice of I/O module. The Productivity3000® is designed to be mounted on standard 35mm DIN rail, or it can be surface mounted. Make sure you have followed the installation guidelines for proper spacing of bases.

Base Dimensions



Mounting Guidelines

Enclosures

Your selection of a proper enclosure is important to ensure safe and proper operation of your Productivity3000® system. Applications for the Productivity3000 system vary and may require additional hardware considerations. The minimum considerations for enclosures include:

- Conformance to electrical standards
- Protection from the elements in an industrial environment
- Common ground reference
- Maintenance of specified ambient temperature
- Access to the equipment
- Security or restricted access
- Sufficient base spacing for proper installation and maintenance of the equipment

Mounting Position

Mount the bases horizontally, as shown in the illustration on the following page, to provide proper ventilation. Do not mount the bases vertically, upside down, or on a flat horizontal surface.

Mounting Clearances

Provide a minimum clearance of 2 inches (50mm) between the bases and all sides of the enclosure. Allow extra door clearance for operator panels and other door mounted items. There should be a minimum of 3 inches (76mm) clearance between the base and any wire duct, and a minimum of 7.2 inches (183mm) from base to base in a multiple base installation.

Grounding

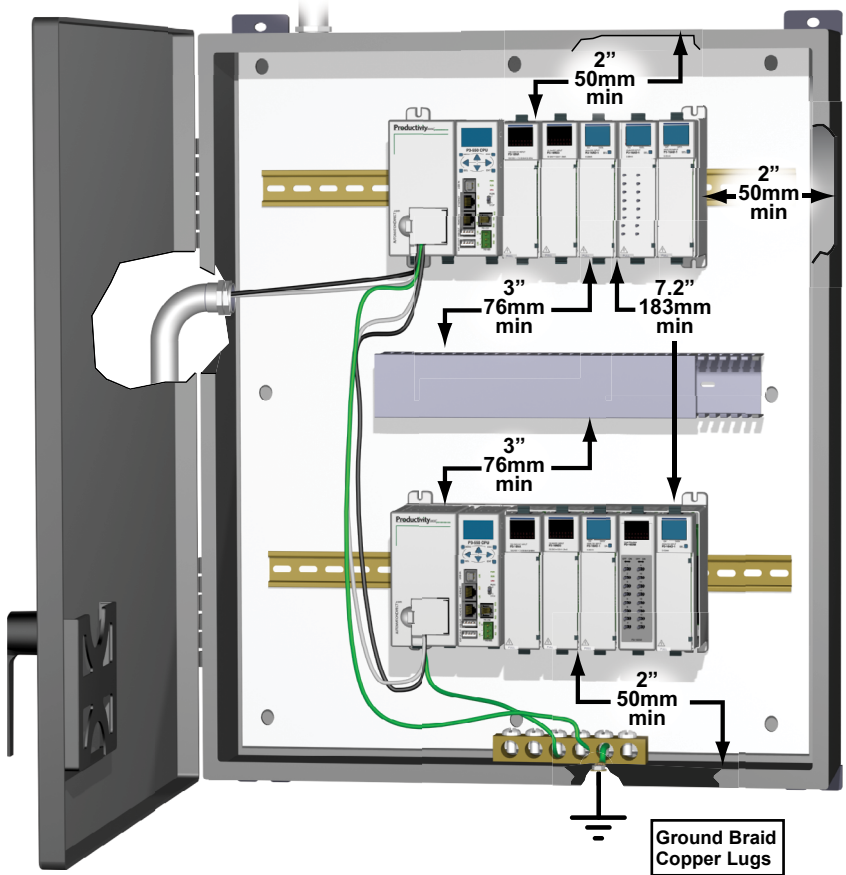
A good common ground reference (earth ground) is essential for proper operation of the Productivity3000 system. One side of all control circuits, power circuits and the ground lead must be properly connected to earth ground by either installing a ground rod in close proximity to the enclosure or by connecting to the incoming power system ground. There must be a single-point ground (i.e. copper bus bar) for all devices in the enclosure that require an earth ground.

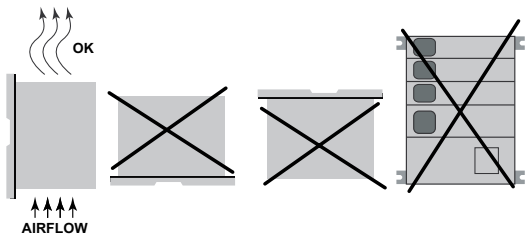
Temperature Considerations

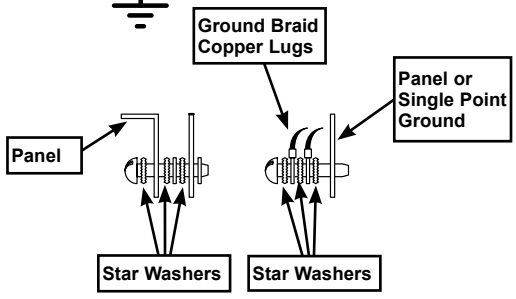
The Productivity3000 system should be installed within the operating temperature specifications. If the temperature deviates above or below the specification, measures such as cooling or heating the enclosure should be taken to maintain the specification.

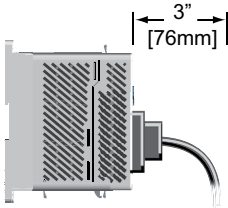
Power Considerations

The Productivity3000 system is designed to be powered by 110/240 VAC or 24/48 VDC via one of the Productivity3000 power supplies. The Productivity3000 has achieved CE certification without requiring EMF/RFI line noise filters on the AC power supply. Please review the European Union (CE) appendix for more information.









NOTE: Add 3 inches (76 mm) to mounting depth when using *ZIP*Link cable ZL-CBL40.

In addition to the panel layout guidelines, other specifications can affect the installation of a CPU system. Always consider the following:

- Environmental Specifications
- Power Requirements
- Agency Approvals
- Enclosure Selection and Component Dimensions

Class 1, Division 2 Approval

This equipment is suitable for use in Class 1, Division 2, Zone 2, groups A, B, C and D or non–hazardous locations only.



WARNING: Explosion Hazard: Substitution of components may impair suitability for Class 1, Division 2, Zone 2. Do not disconnect equipment unless power has been switched off or the area is known to be non–hazardous.

Agency Approvals

Some applications require agency approvals for particular components. The Productivity3000® system agency approvals are listed below:

- UL (Underwriters' Laboratories, Inc.)
- CUL (Canadian Underwriters' Laboratories, Inc.)
- CE (European Economic Union)

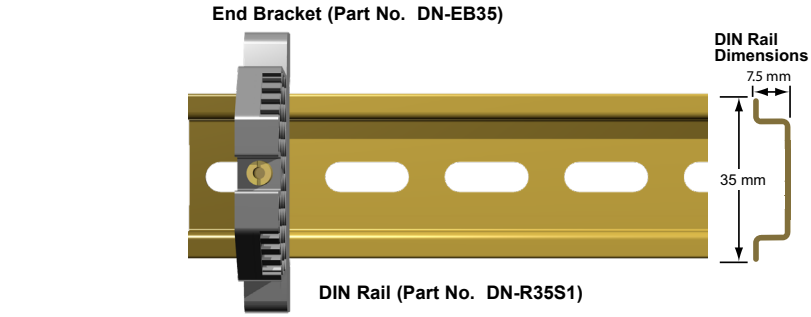


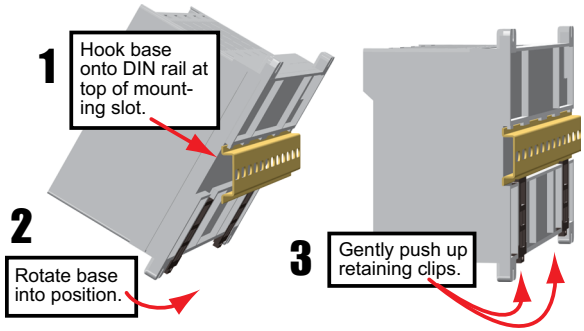
NOTE: *See the "EU Directive" appendix in this manual for more information.*

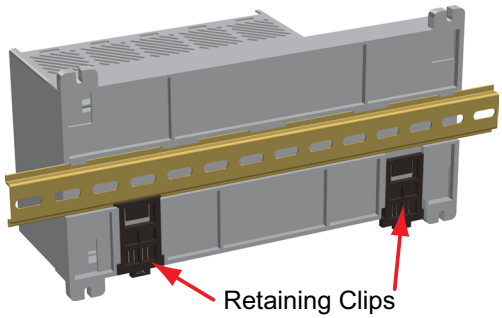
Using Mounting Rails

The Productivity3000® bases can be secured to the cabinet using mounting rails. You should use rails that conform to DIN EN standard 50 022. We offer a complete line of DIN rail, DINnectors and DIN rail mounted apparatus. These rails are approximately 35mm high, with a depth of 7.5 mm. If you mount the base on a rail, you should also consider using end brackets on each side of the base. The end brackets help keep the base from sliding horizontally along the rail. This helps minimize the possibility of accidentally pulling the wiring loose.

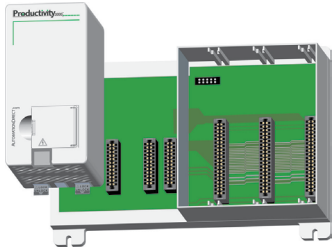
If you examine the bottom of the base, you'll notice retaining clips. To secure the base to a DIN rail, place the base onto the rail and gently push up on the retaining clips. The clips lock the base onto the rail. To remove the base, pull down on the retaining clips, slightly lift up the base, and pull it away from the rail.



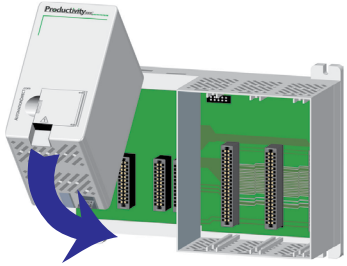




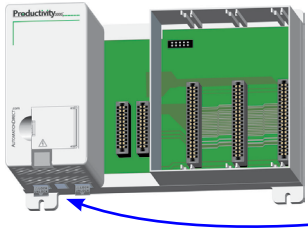
Installing the Power Supply



Step One: Locate the left most socket in the base.



Step Two: Insert the Power Supply at a 45° angle into the notch located at the top of the base and rotate down until seated in socket.

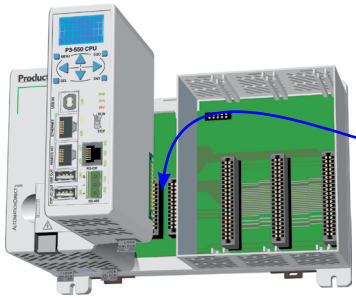


Step Three: Snap the two retaining tabs into the locked position.

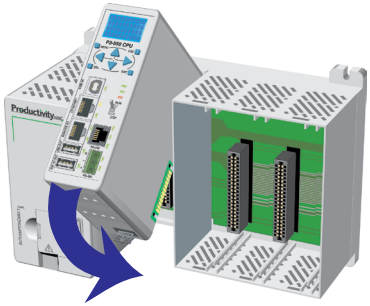
WARNING: **Explosion hazard – Do not connect or disconnect connectors or operate switches while circuit is live unless the area is known to be non-hazardous. Do not hot swap.**

Installing the CPU

This installation procedure also applies to the P3-EX expansion module and the P3-RS/ P3-RX remote slave modules.



Step One: Locate the two sockets next to the power supply; the CPU will be inserted into this location.



Step Two: Insert the CPU at a 45° angle into the notch located at the top of the base and rotate downward until seated.

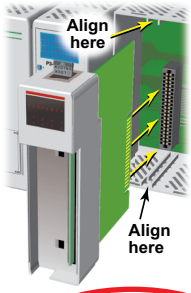


Step Three: Snap retaining tab into the locked position.

WARNING: **Explosion hazard – Do not connect or disconnect connectors or operate switches while circuit is live unless the area is known to be non-hazardous. Do not hot swap.**

NOTE: *The P3-RS module is discontinued as of 6/20. Please use P3-RX as a replacement.*

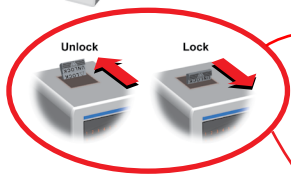
Installing the I/O Modules

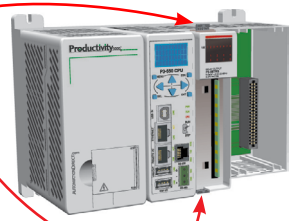


WARNING: Do not apply field power until the following steps are completed. See hot-swapping procedure for exceptions.

Step One: Align circuit card with slot, slide in and press firmly to seat module into connector.

Step Two: Pull top and bottom locking tabs toward module face. Click indicates lock is engaged.

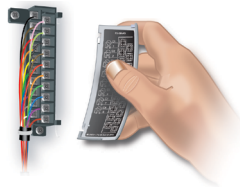




Step Three: Attach field wiring using optional terminal block or ZIPLink wiring system and install cover.



To install or remove terminal block cover, press middle to flex cover.



WARNING: Explosion hazard – Do not connect or disconnect connectors or operate switches while circuit is live unless the area is known to be non-hazardous. Do not hot-swap modules unless the area is known to be non-hazardous.

WARNING: The Productivity3000® CPU supports Hot Swap. Individual modules, expansion bases, and entire remote base groups can be taken offline, removed, and replaced while the rest of the CPU system continues controlling your process. Hot Swapping is performed with a HOT (powered) system. EXTREME care must be taken to prevent damage to components, terminal blocks, or even personal injury due to a short circuit from the live terminal block. Before attempting to use the hot swap feature, be sure to read the hot swap topic in the ProductivitySuite Help file for details on how to plan your installation for use of this powerful feature.

Wiring Guidelines

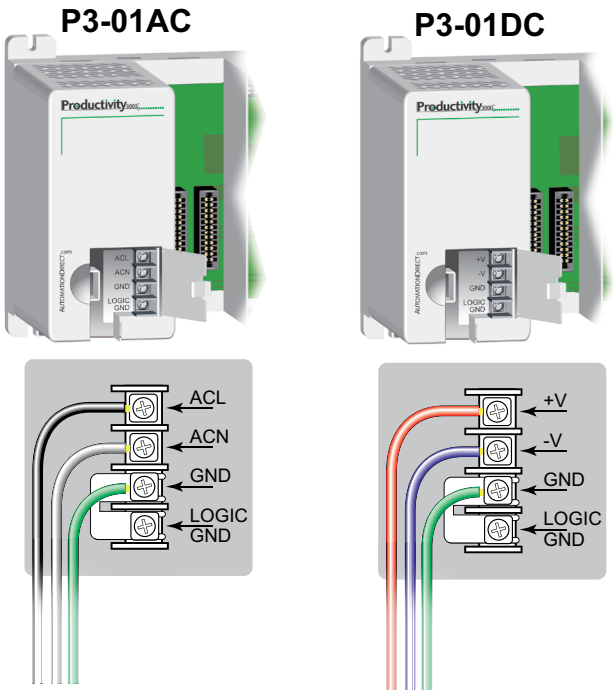
Wiring to the Power Supply

Connect the AC or DC power source input wiring to the power supply as shown. The power supply terminals can accept up to 14AWG solid or stranded wire. Do not over-tighten the terminal screws; the recommended torque is 7 to 9 inch-pounds (0.882 to 1.02 N·m).

WARNING: Once the power wiring is connected, secure the terminal block cover in the closed position. When the cover is open there is a risk of electrical shock if you accidentally touch the connection terminals or power wiring.

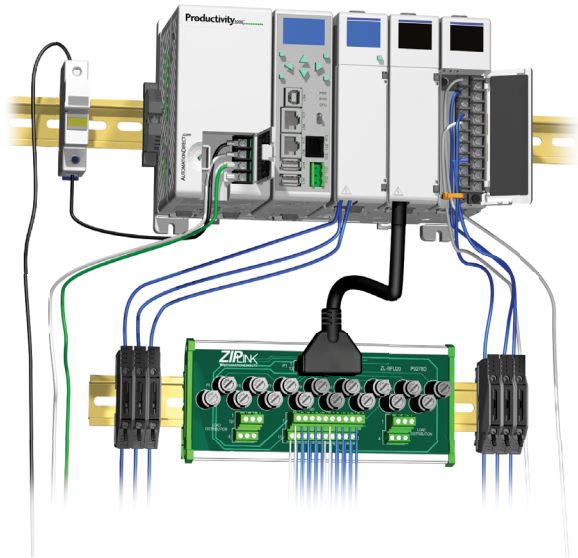
Grounding

A good common ground reference (earth ground) is essential for proper operation of the Productivity3000® system. One side of all control circuits, power circuits and the ground lead must be properly connected to earth ground by either installing a ground rod in close proximity to the enclosure or by connecting to the incoming power system ground. There must be a single-point ground (i.e. copper bus bar) for all devices in the enclosure that require an earth ground.



Fuse Protection

Some of the Input and Output I/O module circuits do not have internal fuses. In order to protect your modules, we suggest you add external fuses to your I/O wiring. A fast-blow fuse with a lower current rating than the I/O bank's common current rating can be wired to each common. Or, a fuse with a rating of slightly less than the maximum current per output point can be added to each output. Refer to the I/O module specifications in Chapter 2 to find the maximum current per output point or per output common. Adding the external fuse does not guarantee the prevention of CPU damage, but it will provide added protection.



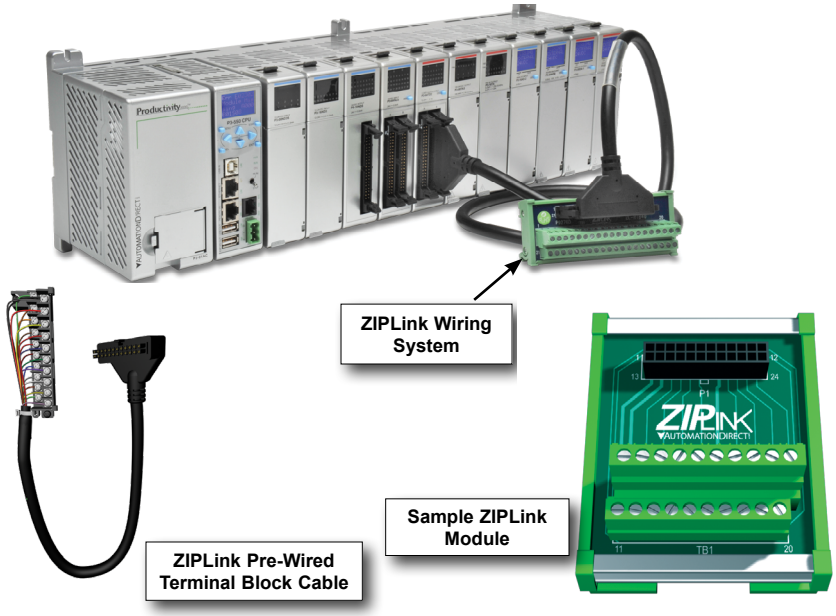
I/O Module Wiring Options

There are two available methods for wiring most I/O modules: The ZIPLink wiring system or hand wiring to the optional removable I/O module terminal blocks.

NOTE: *The high-density 32-point and 64-point I/O module design requires the use of the ZIPLink wiring system. Thermocouple and RTD modules are not compatible with the ZIPLink system and are shipped with the terminal blocks included.*

ZIPLink Wiring System

The ZIPLink wiring system is the recommended method, which allows quick and easy connection using cables that are prewired to the I/O module terminal blocks at one end and plug into a ZIPLink connector module terminal block at the other end. Use the tables on the following page to specify your ZIPLink wiring system.



Terminal Block With Pigtail Cable

For most I/O modules you can also purchase ZIPLink pigtail cables.



ZIPLink Wiring System Selection Tables

ZIPLink Selector Productivity3000 Analog-In Module				
PLC		ZIPLink		
Analog Module	# of Terms	Component	Module	Cable
P3-04ADS	20	Feedthrough	ZL-RTB20	ZL-P3-CBL20-*L
P3-08AD	20	Feedthrough	ZL-RTB20	ZL-P3-CBL20-*L
P3-16AD-1	20	Feedthrough	ZL-RTB20	ZL-P3-CBL20-*L
P3-16AD-2	20	Feedthrough	ZL-RTB20	ZL-P3-CBL20-*L
P3-08RTD2	Matched Only	See Note 1		
P3-08THM2	T/C Wire Only	See Note 1		
P3-04DA	20	Feedthrough	ZL-RTB20	ZL-P3-CBL20-*L
P3-08DA-1	20	Feedthrough	ZL-RTB20	ZL-P3-CBL20-*L
P3-08DA-2	20	Feedthrough	ZL-RTB20	ZL-P3-CBL20-*L
P3-06DAS-1	20	Feedthrough	ZL-RTB20	ZL-P3-CBL20-*L
P3-06DAS-2	20	Feedthrough	ZL-RTB20	ZL-P3-CBL20-*L
P3-16DA-1	20	Feedthrough	ZL-RTB20	ZL-P3-CBL20-*L
P3-16DA-2	20	Feedthrough	ZL-RTB20	ZL-P3-CBL20-*L
P3-8AD4DA-1	20	Feedthrough	ZL-RTB20	ZL-P3-CBL20-*L
P3-8AD4DA-2	20	Feedthrough	ZL-RTB20	ZL-P3-CBL20-*L

Productivity3000 Input Module ZIPLink Selector				
PLC		ZIPLink		
Input Module	# of Terms	Component	Module Part No.	Cable Part No.
P3-08NAS	20	Feedthrough	ZL-RTB20	ZL-P3-CBL20*
P3-08ND3S	20	Feedthrough	ZL-RTB20	ZL-P3-CBL20*
P3-16NA	20	Feedthrough	ZL-RTB20	ZL-P3-CBL20-*L
P3-16ND3	20	Feedthrough	ZL-RTB20	ZL-P3-CBL20-*L
		Sensor	ZL-LTB16-24-1	ZL-P3-CBL20-*L
P3-32ND3	40	Feedthrough	ZL-RTB40	ZL-CBL40*
		Sensor	ZL-LTB32-24-1	ZL-CBL40*
P3-64ND31	40	Feedthrough	ZL-RTB40	ZL-CBL40*
		Sensor	ZL-LTB32-24-1	ZL-CBL40*

** Select the cable length by replacing the * with: Blank = 0.5m, -1 = 1.0m, or -2 = 2.0m.*
1. These modules are not supported by the ZIPLink wiring system.
2. The P3-64ND3, P3-64TD1 and P3-64TD2 modules have two 32-point connectors and require two ZIPLink cables and two ZIPLink connector modules

ZIPLink Wiring System Selection Tables, continued

Productivity3000 Output Module ZIPLink Selector				
PLC		ZIPLink		
Output Module	# of Terms	Component	Module Part No.	Cable Part No.
P3-08TAS	20	Feedthrough	ZL-RTB20	ZL-P3-CBL20*
P3-08TD1S	20	Feedthrough	ZL-RTB20	ZL-P3-CBL20-*L
P3-08TD2S	20	Feedthrough	ZL-RTB20	ZL-P3-CBL20-*L
P3-08TRS	20	Feedthrough	ZL-RTB20	ZL-P3-CBL20*
P3-16TA	20	Feedthrough	ZL-RTB20	ZL-P3-CBL20*
		Fuse	ZL-RFU20	ZL-P3-CBL20*
P3-16TD1	20	Feedthrough	ZL-RTB20	ZL-P3-CBL20*
		Fuse	ZL-RFU204	ZL-P3-CBL20*
		Relay (sinking)	ZL-RRL16-24-1	ZL-P3-CBL20*
P3-16TD2	20	Feedthrough	ZL-RTB20	ZL-P3-CBL20*
		Fuse	ZL-RFU204	ZL-P3-CBL20*
		Relay (sourcing)	ZL-RRL16-24-2	ZL-P3-CBL20
P3-16TR	20	Feedthrough	ZL-RTB20	ZL-P3-CBL20*
		Fuse	ZL-RFU204	ZL-P3-CBL20*
P3-08TRS-13	20	Feedthrough	ZL-RTB20	ZL-P3-CBL20*
		Fuse	ZL-RFU204	ZL-P3-CBL20*
P3-32TD1	40	Feedthrough	ZL-RTB40	ZL-CBL40*
		Fuse	ZL-RFU404	ZL-CBL40*
P3-32TD2	40	Feedthrough	ZL-RTB40	ZL-CBL40*
		Fuse	ZL-RFU404	ZL-CBL40*
P3-64TD11	40	Feedthrough	ZL-RTB40	ZL-CBL40*
		Fuse	ZL-RFU404	ZL-CBL40*
P3-64TD21	40	Feedthrough	ZL-RTB40	ZL-CBL40*
		Fuse	ZL-RFU404	ZL-CBL40*
P3-16TD3P	40	Feedthrough	ZL-RTB40	ZL-CBL40*

** Select the cable length by replacing the * with: Blank = 0.5m, -1 = 1.0m, or -2 = 2.0m.*
1. The P3-64ND3, P3-64TD1 and P3-64TD2 modules have two 32-point connectors and require two ZIPLink cables and two ZIPLink connector modules.
2. The P3-08TRS-1 output module is derated not to exceed 2A per point maximum when used with the ZIPLink wiring system.
3. Note: Fuses (5 x 20 mm) are not included. See Edison Electronic Fuse section for (5 x 20 mm) fuse. S500 and GMA electronic circuit protection for fast-acting maximum protection. S506 and GMC electronic circuit protection for time-delay performance. Ideal for inductive circuits.
To ensure proper operation, do not exceed the voltage and current rating of ZIPLink module.
ZL-RFU20 = 2A per circuit; ZL-RFU40 = 400mA per circuit.

ZIPLink Wiring System Selection Tables, continued

Productivity3000 Specialty Module ZIPLink Selector				
PLC		ZIPLink		
Input Module	# of Terms	Component	Module Part No.	Cable Part No.
P3-HSI	40	Feedthrough	ZL-RTB40	ZL-CBL40*S
P3-HSO	40	Feedthrough	ZL-RTB40	ZL-CBL40*S

** Select the cable length by replacing the * with: Blank = 0.5m, -1 = 1.0m, or -2 = 2.0m.*

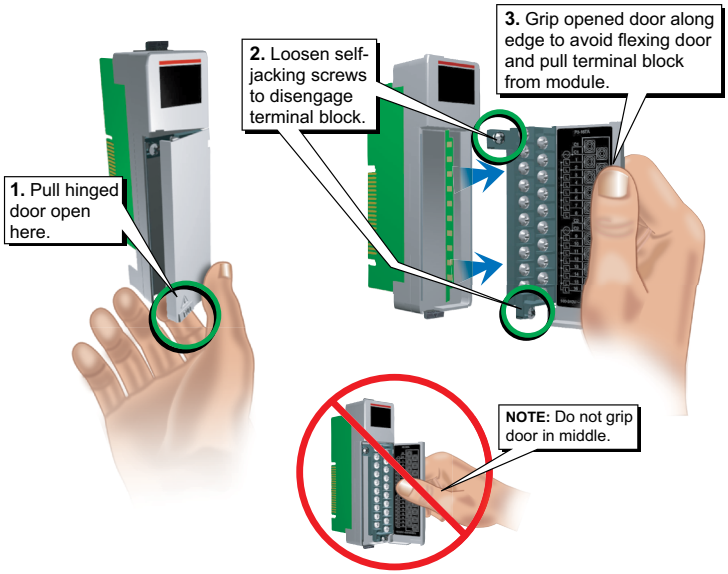
Removable Terminal Blocks (Optional)

The hand wiring method consists of purchasing the optional removable I/O module terminal block (part no. P3-RTB) and hand wiring from the I/O terminal block to a DIN rail mounted terminal block.



Removable Terminal Block P3-RTB

Terminal Block Removal



Removable Terminal Block Specifications	
Number of Positions	20 screw terminals
Wire Range	22–14 AWG (0.324 to 2.08 sq. mm) Solid / stranded conductor 3/64 in. (1.2 mm) insulation maximum “USE COPPER CONDUCTORS , 60°C” or equivalent.
Screw Driver Width	1/4 inch (6.5 mm) maximum
Screw Size	M3 size
Screw Torque	Field terminals - 7–9 in·lb (0.882 - 1.02 N·m) Self-jacking screws - 2.7–3.6 in·lb (0.3 - 0.4 N·m) Do not overtighten screws when installing terminal block.

Planning the I/O Wiring Routes

The following guidelines provide general information on how to wire the I/O connections to Productivity3000® CPU's. For specific information on wiring a particular I/O module refer to the module specifications in Chapter 2.

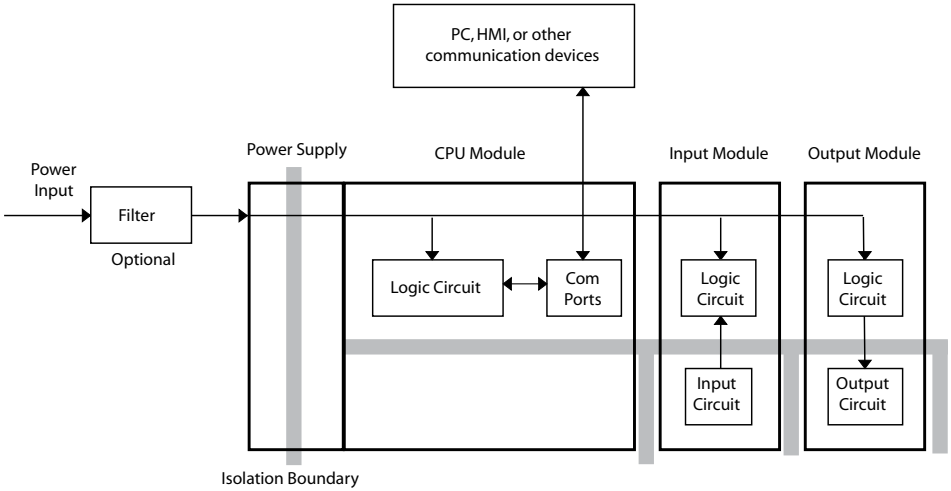
1. If using removable terminal blocks, follow the wire size guidelines in the I/O modules specifications in Chapter 2.
2. Always use a continuous length of wire. Do not splice wires to attain a needed length.
3. Use the shortest possible wire length.
4. Use wire trays for routing where possible.
5. Avoid running wires near high energy wiring.
6. Avoid running input wiring close to output wiring where possible.
7. Minimize voltage drops where wires must run a long distance, by considering multiple wires for the return line.
8. Avoid running DC wiring in close proximity to AC wiring where possible.
9. Avoid creating sharp bends in the wires.
10. When using P3-01DC power supplies, install the recommended powerline filter to reduce power surges and EMI/RFI noise.

System Wiring Strategies

The Productivity3000® system is very flexible and will work in many different wiring configurations. By studying this section before actual installation, you can find the best wiring strategy for your application. This will help to lower system cost and avoid wiring errors and safety problems.

CPU Isolation Boundaries

CPU circuitry is divided into three main regions separated by isolation boundaries, shown in the drawing below. Electrical isolation provides safety, so that a fault in one area does not damage another. The transformer in the power supply provides magnetic isolation between the primary and secondary sides. Optical isolators provide isolation in Input and Output circuits. This isolates logic circuitry from the field side, where factory machinery connects. The discrete inputs are isolated from the discrete outputs because each is isolated from the logic side. Isolation boundaries protect the devices which are connected to the communication ports, such as PCs and HMIs, from power input faults or field wiring faults. When wiring a CPU, it is extremely important to avoid making external connections that connect logic side circuits to any other.

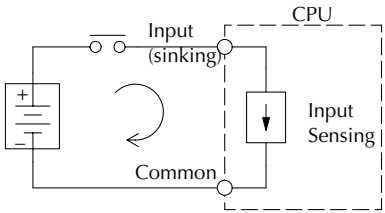


Sinking/Sourcing Concepts

Before wiring field devices to the CPU I/O, it's necessary to have a basic understanding of "sinking" and "sourcing" concepts. Use of these terms occurs frequently in input or output circuit discussions. The purpose of this section is to explain the terms. The short definitions are as follows:

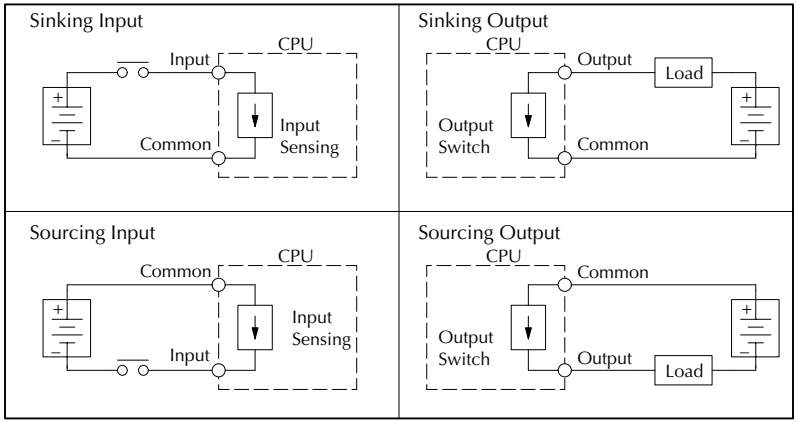
- Sinking = Path to supply ground (–) or switching ground
- Sourcing = Path to supply source (+) or switching +V

These terms only apply to DC circuits, not AC circuits. Input and output points that are either sinking or sourcing can conduct current in only one direction. This means it is possible to wire the external supply and field device to the I/O point with current trying to flow in the wrong direction, in which case the circuit will not operate.



The diagram on the left shows a "sinking" CPU input. To properly connect the external supply, connect it so that the input provides a path to ground (–). Start at the CPU input terminal, follow through the input sensing circuit, exit at the common terminal, and connect the supply (–) to the common terminal.

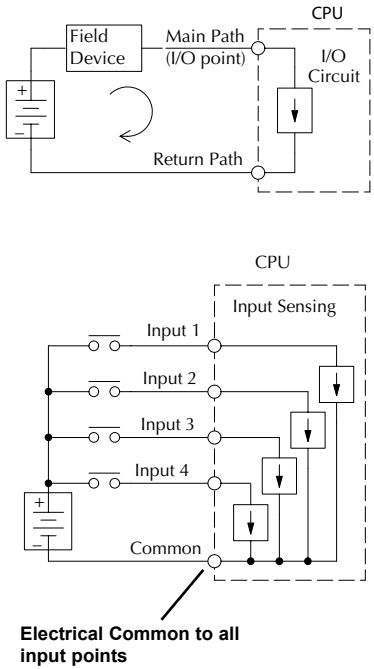
The switch between the supply (+) and the input completes the circuit. Current flows in the direction of the arrow when the switch is closed. By applying the circuit principle above to the four possible combinations of input/output sinking/sourcing types, we have the four circuits as shown below.



I/O "Common Terminal" Concepts

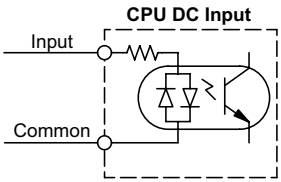
In order for a CPU I/O circuit to operate, current must enter at one terminal and exit at another. This means at least two terminals are associated with every I/O point. In the figure below, the input or output terminal is the main path for the current. One additional terminal must provide the return path to the power supply.

If there was unlimited module CPU space then every I/O point could have two dedicated terminals as the figure above shows. Providing this level of flexibility is not practical or necessary for most applications. So, most I/O point groups share the return path (common) among two or more I/O points. The figure below shows a group (or bank) of four input points which share a common return path. In this way, the four inputs require only five terminals instead of eight.



NOTE: *In the circuit above, the current in the common path is equal to the sum of the energized channels. This is especially important in output circuits, where larger gauge wire is sometimes needed for the commons.*

DC Input Wiring Methods

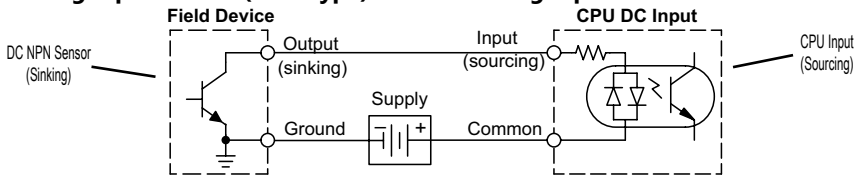


I/O modules with DC inputs can be wired as either sinking or sourcing inputs. The dual diodes (shown in this diagram) allow current to flow in either direction. Inputs grouped by a common point must be either all sinking or all sourcing. DC inputs typically operate in the range of +12-24 VDC.

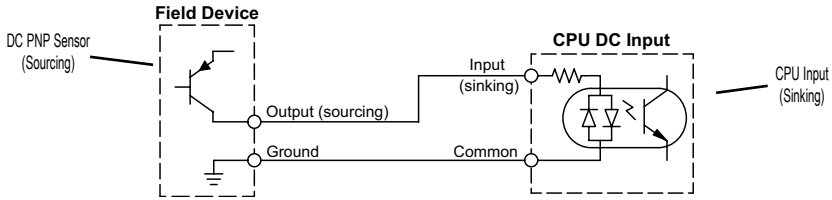
Sinking Input Sensor (NPN Type) to CPU Sourcing Input

In the following example, a field device has an open-collector NPN transistor output. When energized, it sinks current to ground from the DC input point. The CPU input current is sourced from the common terminal connected to power supply (+).

Sourcing Input Sensor (PNP Type) to CPU Sinking Input



In the following example, a field device has an open-emitter PNP transistor output. When energized, it sources current to the CPU input point, which sinks the current to ground. Since the field device loop is sourcing current, no additional power supply is required for the module.



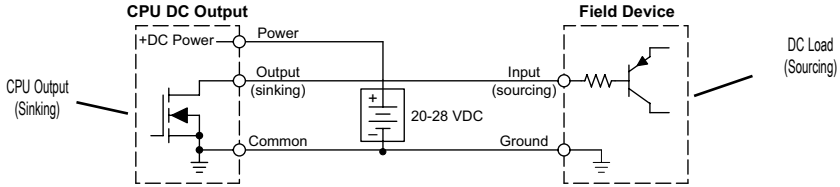
DC Output Wiring Methods

I/O modules with DC output circuits are wired as all current sinking only or current sourcing only depending on which output module part number is used. DC outputs typically operate in the range of +5 – 24 VDC.

CPU Sinking Output to Sourcing Load Device

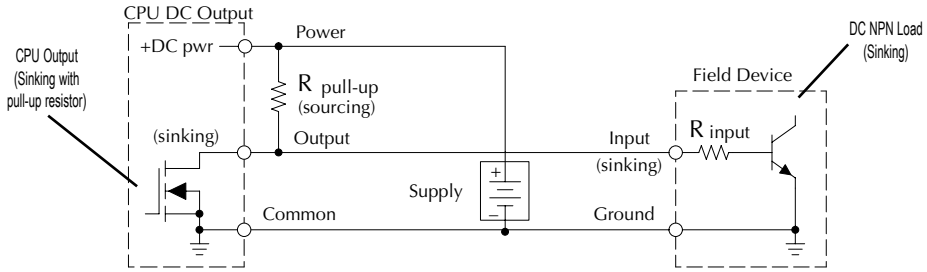
Many applications require connecting a CPU output point to a DC input on a field device load. This type of connection is made to carry a low-level DC signals.

In the following example, the CPU output point sinks current to ground (common) when energized. The output is connected to a field device load with a sourcing input.



CPU DC Sinking Output to Sinking Load Device

In the example below, a sinking output point is connected to the sinking input of a field device load. In this case, both the CPU output and field device input are sinking type. Since the circuit must have one sourcing and one sinking device, we add sourcing capability to the CPU output by using a pull-up resistor. In the circuit below, we connect Rpull-up from the output to the DC output circuit power input.



NOTE: *DO NOT attempt to drive a heavy load (>25mA) with this pull-up method.*

NOTE: *Using the pull-up resistor to implement a sourcing output has the effect of inverting the output point logic. In other words, the field device input is energized when the CPU output is OFF, from a ladder logic point-of-view. Your ladder program must comprehend this and generate an inverted output. Or, you may choose to cancel the effect of the inversion elsewhere, such as in the field device.*

It is important to choose the correct value of Rpull-up. In order to do so, we need to know the nominal input current to the field device (Iinput) when the input is energized. If this value is not known, it can be calculated as shown (a typical value is 15mA). Then use Iinput and the voltage of the external supply to compute Rpull-up. Then calculate the power

$$I_{input} = \frac{V_{input\ (turn-on)}}{R_{input}}$$

$$R_{pull\text{-}up} = \frac{V_{supply} - 0.7}{I_{input}} - R_{input}$$

$$P_{pull\text{-}up} = \frac{V_{supply}^2}{R_{pull\text{-}up}}$$

Ppull-up (in watts), in order to size Rpull-up properly.

Relay Outputs - Wiring Methods

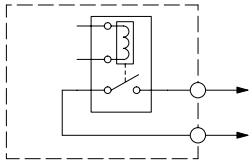
Relay outputs are available for the Productivity3000®. Relays are best for the following applications:

- Loads that require higher currents than the solid-state outputs can deliver
- Cost-sensitive applications
- Some output channels need isolation from other outputs (such as when some loads require different voltages than other loads)

Some applications in which NOT to use relays:

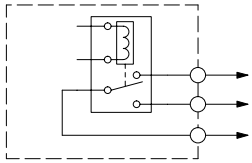
- Loads that require currents under 10mA
- Loads which must be switched at high speed or heavy duty cycle

Relay with Form A contacts



Relay outputs are available in two contact arrangements. Form A type, or SPST (single pole, single throw) type. They are normally open and are the simplest to use. The Form C, or SPDT (single pole, double throw) type has a center contact which moves and a stationary contact on either side. This provides a normally closed contact and a normally open contact.

Relay with Form C contacts



The relays in some relay output modules share common terminals, which connect to the wiper contact in each relay of the bank. Other relay modules have relays which are completely isolated from each other. In all cases, the module drives the relay coil when the corresponding output point is on.

Relay Outputs – Transient Suppression for Inductive Loads in a Control System

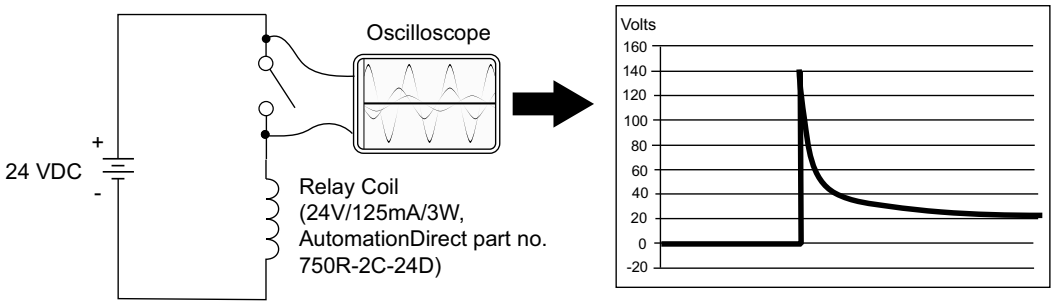
The following pages are intended to give a quick overview of the negative effects of transient voltages on a control system and provide some simple advice on how to effectively minimize them. The need for transient suppression is often not apparent to the newcomers in the automation world. Many mysterious errors that can afflict an installation can be traced back to a lack of transient suppression.

What is a Transient Voltage and Why is it Bad?

Inductive loads (devices with a coil) generate transient voltages as they transition from being energized to being de-energized. If not suppressed, the transient can be many times greater than the voltage applied to the coil. These transient voltages can damage PLC outputs or other electronic devices connected to the circuit, and cause unreliable operation of other electronics in the general area. Transients must be managed with suppressors for long component life and reliable operation of the control system.

This example shows a simple circuit with a small 24V/125mA/3W relay. As you can see, when the switch is opened, thereby de-energizing the coil, the transient voltage generated across the switch contacts peaks at 140V.

Example: Circuit with no Suppression



In the same circuit, replacing the relay with a larger 24V/290mA/7W relay will generate a transient voltage exceeding 800V (not shown). Transient voltages like this can cause many problems, including:

- Relay contacts driving the coil may experience arcing, which can pit the contacts and reduce the relay's lifespan.
- Solid state (transistor) outputs driving the coil can be damaged if the transient voltage exceeds the transistor's ratings. In extreme cases, complete failure of the output can occur the very first time a coil is de-energized.
- Input circuits, which might be connected to monitor the coil or the output driver, can also be damaged by the transient voltage.

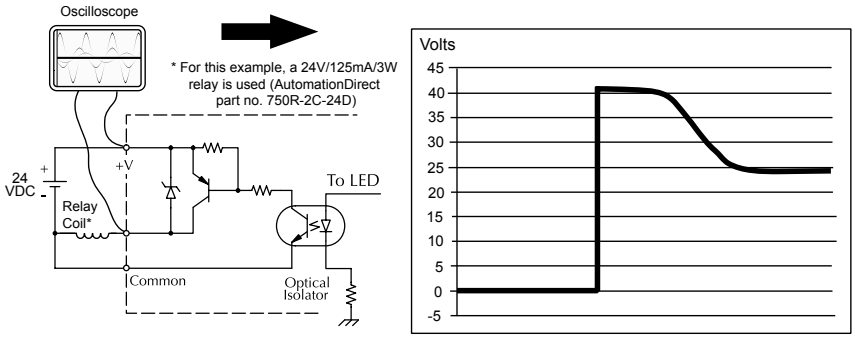
A very destructive side-effect of the arcing across relay contacts is the electromagnetic interference (EMI) it can cause. This occurs because the arcing causes a current surge, which releases RF energy. The entire length of wire between the relay contacts, the coil, and the power source carries the current surge and becomes an antenna that radiates the RF energy. It will readily couple into parallel wiring and may disrupt the PLC and other electronics in the area. This EMI can make an otherwise stable control system behave unpredictably at times.

CPU's Integrated Transient Suppressors

Although the CPU's outputs typically have integrated suppressors to protect against transients, they are not capable of handling them all. It is usually necessary to have some additional transient suppression for an inductive load.

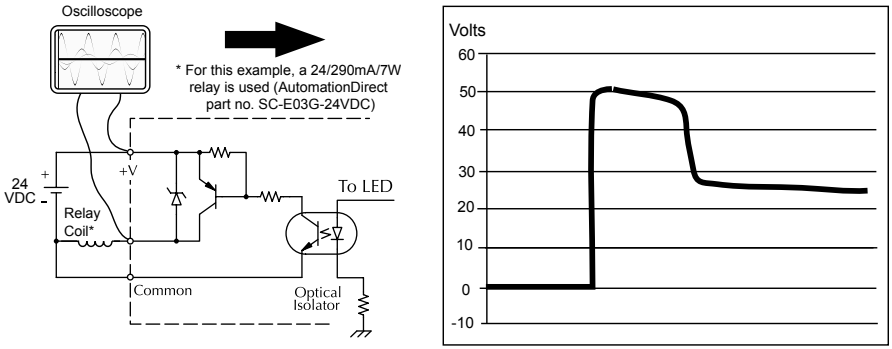
Here is another example using the same 24V/125mA/3W relay used earlier. This example measures the PNP transistor output of a D0-06DD2 PLC, which incorporates an integrated Zener diode for transient suppression. Instead of the 140V peak in the first example, the transient voltage here is limited to about 40V by the Zener diode. While the PLC will probably tolerate repeated transients in this range for some time, the 40V is still beyond the module's peak output voltage rating of 30V.

Example: Small Inductive Load with Only Integrated Suppression



The next example uses the same circuit as above, but with a larger 24V/290mA/7W relay, thereby creating a larger inductive load. As you can see, the transient voltage generated is much worse, peaking at over 50V. Driving an inductive load of this size without additional transient suppression is very likely to permanently damage the PLC output.

Example: Larger Inductive Load with Only Integrated Suppression

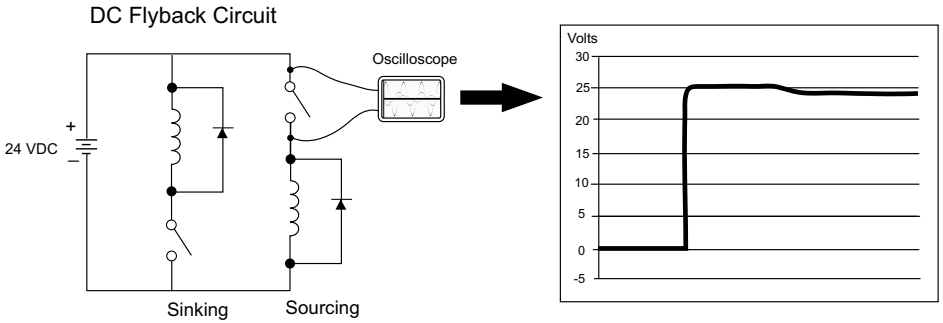


Additional transient suppression should be used in both these examples. If you are unable to measure the transients generated by the connected loads of your control system, using additional transient suppression on all inductive loads would be the safest practice.

Types of Additional Transient Protection

DC Coils:

The most effective protection against transients from a DC coil is a flyback diode. A flyback diode can reduce the transient to roughly 1V over the supply voltage, as shown in this example.



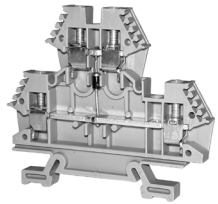
Many AutomationDirect socketed relays and motor starters have add-on flyback diodes that plug or screw into the base, such as the AD-ASMD-250 protection diode module and 784-4C-SKT-1 socket module shown below. If an add-on flyback diode is not available for your inductive load, an easy way to add one is to use AutomationDirect's DN-D10DR-A diode terminal block, a 600VDC power diode mounted in a slim DIN rail housing.



AD-ASMD-250
Protection Diode Module



784-4C-SKT-1
Relay Socket



DN-D10DR-A
Diode Terminal Block

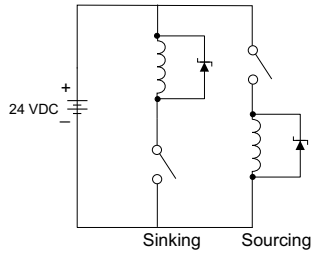
Two more common options for DC coils are Metal Oxide Varistors (MOV) or TVS diodes. These devices should be connected across the driver (CPU output) for best protection as shown below. The optimum voltage rating for the suppressor is the lowest rated voltage available that will NOT conduct at the supply voltage, while allowing a safe margin.

AutomationDirect's ZL-TSD8-24 transorb module is a good choice for 24VDC circuits. It is a bank of 8 uni-directional 30V TVS diodes. Since they are uni-directional, be sure to observe the polarity during installation. MOVs or bi-directional TVS diodes would install at the same location, but have no polarity concerns.



ZL-TSD8-24
Transorb Module

DC MOV or TVS Diode Circuit



AC Coils:

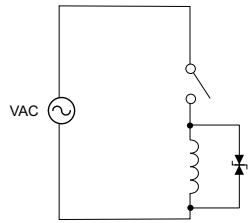
Two options for AC coils are MOVs or bi-directional TVS diodes. These devices are most effective at protecting the driver from a transient voltage when connected across the driver (PLC output) but are also commonly connected across the coil. The optimum voltage rating for the suppressor is the lowest rated voltage available that will NOT conduct at the supply voltage, while allowing a safe margin.

AutomationDirect's ZL-TSD8-120 transorb module is a good choice for 120VAC circuits. It is a bank of eight bi-directional 180V TVS diodes.



ZL-TSD8-120
Transorb Module

AC MOV or Bi-Directional Diode Circuit





NOTE: *Manufacturers of devices with coils frequently offer MOV or TVS diode suppressors as an add-on option which mount conveniently across the coil. Before using them, carefully check the suppressor ratings. Just because the suppressor is made specifically for that part does not mean it will reduce the transient voltages to an acceptable level.*

For example, a MOV or TVS diode rated for use on 24–48 VDC coils would need to have a high enough voltage rating to NOT conduct at 48V. That suppressor might typically start conducting at roughly 60VDC. If it were mounted across a 24V coil, transients of roughly 84V (if sinking output) or -60V (if sourcing output) could reach the PLC output. Many semiconductor PLC outputs cannot tolerate such levels.

COMMUNICATIONS



P3-550 Retired 06/2023

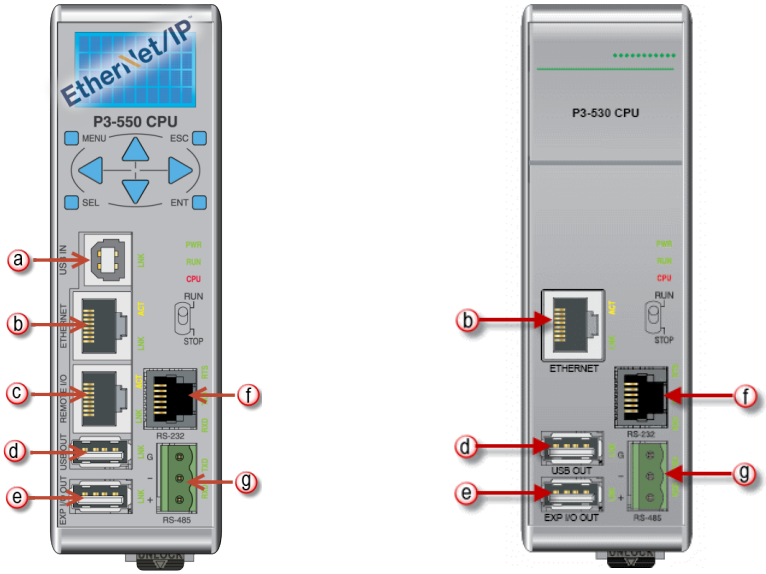
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Communications: Capabilities

Communication Ports

The AutomationDirect P3000 CPUs are provided with several Communications Ports. Each of these ports are described in the sections below.



ⓐ USB IN: The USB IN programming port is a USB Type B style connector located on the upper left side of the CPU. It is used exclusively for connecting to a PC running the Productivity Suite Programming Software. Installing the programming software will install the USB driver as well. See Communications: Connectivity section for connection information.

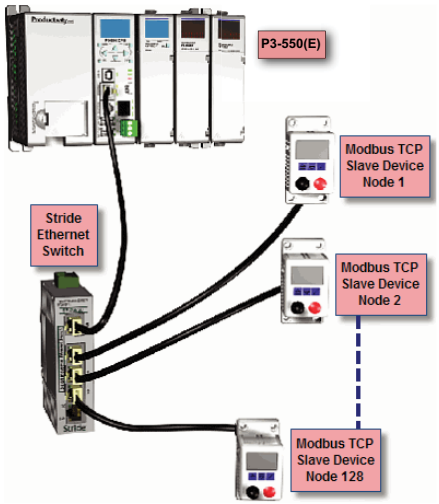
NOTE: *The USB IN port is NOT compatible with 1.0/1.1 full speed USB devices.*

Communications: Ethernet

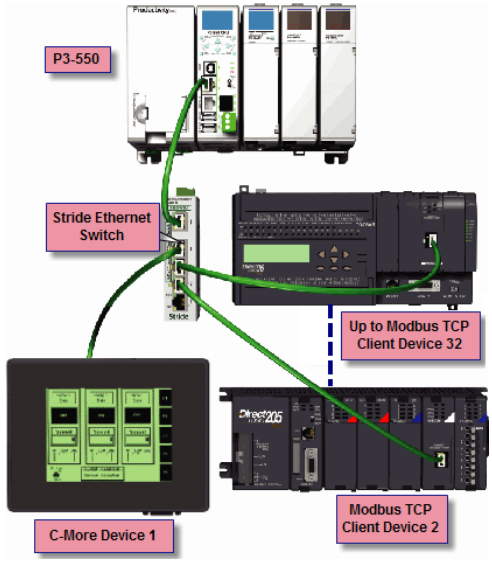
ⓑ Ethernet: The Ethernet port is 10/100 Base-T Ethernet with an RJ-45 style connector. It is used for:

- Connection to a PC running the Productivity Suite programming software.
- Modbus TCP Client connections (Modbus requests sent from the CPU).
- Modbus TCP Server connections (Modbus requests received by the CPU).
- Outgoing Email.
- Modbus TCP Client connections: The CPU can connect to 32 Modbus TCP server devices concurrently by means of communications instructions in the ladder program (MRX, MWX, RX, WX). It is possible to connect to more than 32 Modbus TCP server devices, but not concurrently.
- This is accomplished by having communications instructions for more than 32 devices in the ladder program and controlling the enabling and disabling of the instructions so that only 32 devices are enabled at a given time. To connect to non Productivity3000® devices, use the MRX (Modbus Read) and MWX (Modbus Write) instructions. To connect to other P3000 CPU's, use the RX (Network Read) and WX (Network Write) instructions.

Modbus TCP Client (MRX-MWX)



Modbus TCP Client (RX-WX)

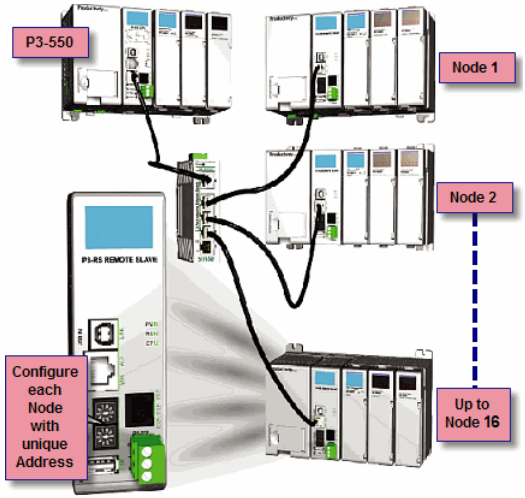


- The greatest difference between the RX and the MRX is the RX Tag Name in the target CPU can be referenced directly and does not need a corresponding Modbus address. The way this is accomplished is by mapping local and remote tagnames together within the local CPU's RX instruction. Once the instruction is set up to read a remote project, the "Tags of Remote Project" or "Array Tags of Remote Project" drop down lists will be accessible. Map the Tag of the Remote project to a Tag in the Local project to read this data.

Communications: Remote I/O

- Modbus TCP Server connections: The CPU can serve data back to 32 Modbus TCP Client devices concurrently. If 32 Modbus TCP Client devices are connected to the CPU, then any new TCP connection requests will be denied until one of the existing 32 devices drops its connection. If the Client device connecting to the CPU is not a Productivity3000® device, then a Modbus address must be assigned to the tag that is being requested. This is done in the Tag Database window. If the device connecting to the CPU is another P3000 CPU or C-more panel, no Modbus address is required. See Communications Port Configuration for port configuration, Communications: Connectivity section for connection information and Communications: Ethernet section for Ethernet set up.

Remote I/O Slaves



Ⓒ Remote I/O: The Remote I/O port is 10/100Base-T Ethernet with an RJ-45 style connector. It is used for connecting to a Remote I/O network consisting of P3-RS or P3-RX Remote Slaves and/or PS-AMC modules and/or GS Drives.

NOTE: *GS Drives require an additional communication module (GS-EDRV100 for GS 1, 2 and 3 series) or Modbus TCP communications card (for GS4 and GS20 series) to communicate on the Productivity remote network.*

- Remote Slaves: The P3-622, P3-550E, and P3-550 CPUs can connect with up to 16 P3-RS/RX Remote Slaves and 4 PS-AMC modules. The P3-622 and P3-550E will auto detect all remote units that are configured with unique station addresses (by means of two rotary switches on the front of the P3-RS module). The configuration can be managed in the Hardware Configuration in the Productivity Suite Programming Software. See ***Communications Remote I/O and GS Drives*** for configuration information and ***Communications: Connectivity*** section for connection information.

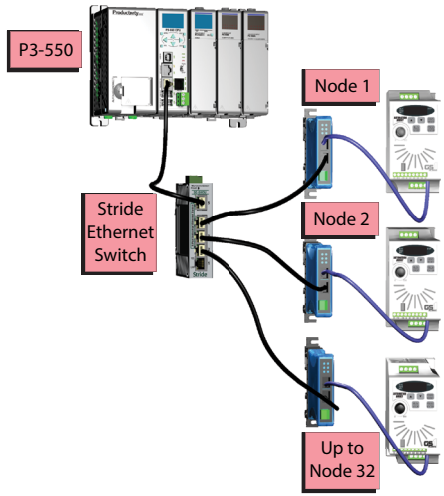
Communications: GS Drive Devices

GS Drive Devices: The P3-550(E) CPU can connect to up to 32 GS Drive communication modules/cards. The P3-550(E) will auto detect all GS Drive communication modules/cards that have a unique address (configured by the bank of dipswitches on the module). The configuration can be managed in the Hardware Configuration in the Productivity Suite programming software. See Communications: Remote I/O and GS Drives section for configuration information and Communications: Connectivity section for connection information.

USB OUT: The USB OUT data port is the upper port of two USB 2.0 Type A connectors on the CPU. The USB OUT port uses a SDCZ4-2048-A10 Pen Drive (may work with other pen drives) for data logging only in the P3-530 or for data logging and project transfers in the P3-550(E).

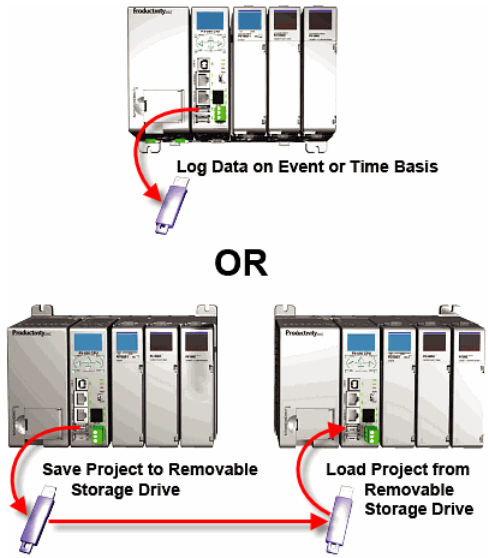
NOTE: *The USB OUT port is NOT compatible with 1.0/1.1 full speed USB devices.*

Remote GS1 (GS-EDRV100)



- Project Transfer (P3-550(E) only): For security, this feature is disabled by default when creating a new project. It can be enabled in the Hardware Configuration panel for the P3-550(E). Once enabled, projects may be transferred between a CPU and Removable Storage Device, or between a Removable Storage Device and PC. Files stored on the Removable Storage Device by a P3-550(E) or the Productivity Suite programming software are stored under a default name, so only one project may be handled at a time on a Removable Storage Device. Existing projects on the Removable Storage Device will be overwritten without a prompt.
- Data Logging: The Data Logger tool allows setup of periodic or event-based data logging of tag and System Errors to the Removable Storage Drive. Data Logger setup is accessed under the Monitor & Debug Menu. See Communications: Connectivity section for more information.

USB Removable Storage Drive



Communications (cont'd)

P3-EX Expansion Network



ⓔ EXP I/O OUT: The Expansion I/O port is the lower port of two USB 2.0 Type A connectors on the CPU. The EXP I/O Out port is only used for connections to local P3-EX modules in a Productivity3000® base with I/O. Expansion I/O is treated as local I/O by the CPU and is completely scan synchronous.

Except that PS-AMC modules run asynchronously with respect to the ladder scan, so AMC status bits should be used for interlocking logic if necessary.

The I/O is automatically detected on power up.

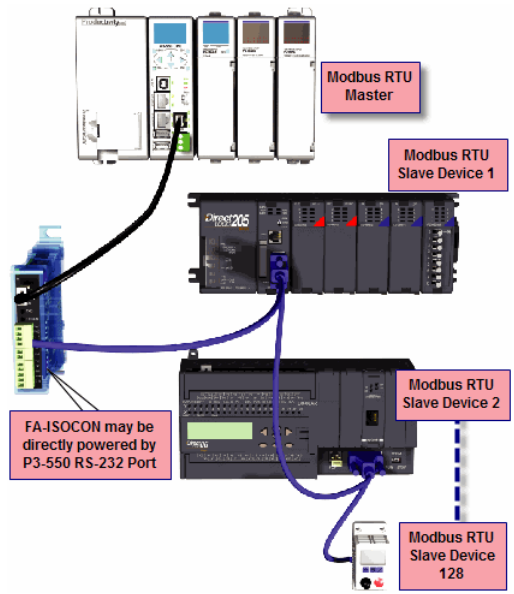
CAUTION: This port is ONLY for Expansion I/O. The signal pins on this port are NOT standard USB. DO NOT USE A USB REPEATER TO EXTEND THE RANGE OF THIS PORT. See Communications Connectivity for more information.

ⓕ RS-232: The RS-232 port is an RJ-12 connector located on the right side of the CPU. This port can be used for:

- Modbus RTU Master connections.
- Modbus RTU Slave connections.
- ASCII Incoming and Outgoing communications.
- Custom Protocol Incoming and Outgoing communications.

Modbus RTU Master connections: The RS-232 port is intended to be used for point-to-point connections but it is possible to connect up to 128 devices on a network if a RS-232 to RS-485/422 converter is connected to the port (such as a FA-ISOCON). This is accomplished by using the communications instructions in the ladder project (MRX, MWX, RX, WX). If 4-wire RS-485 or RS-422 communications is needed, using this port with an FA-ISOCON is the best method. See Communications: Connectivity section for more information.

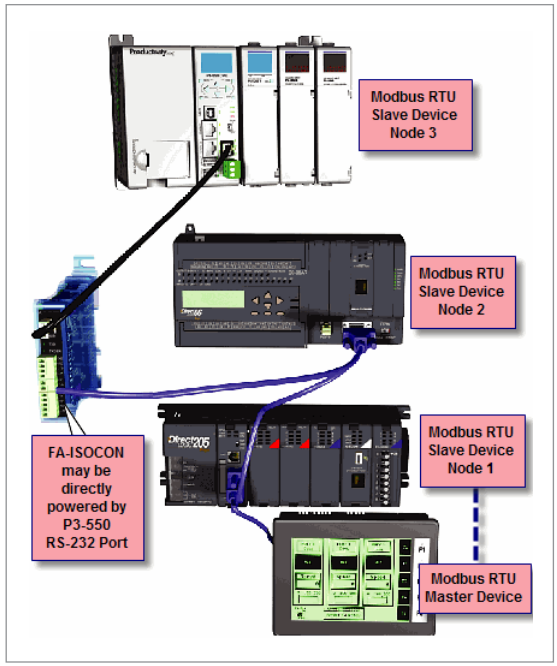
RS-232 Modbus RTU Master Network Topology



Communications: Modbus RTU

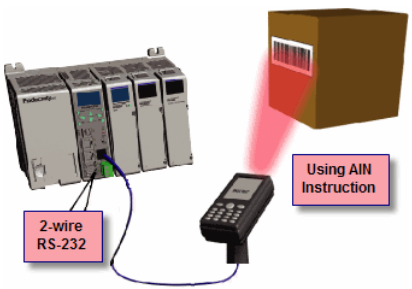
- Modbus RTU Slave connections: The RS-232 port is intended to be used for point-to-point connections but it is possible for the RS-232 port to be used on a Modbus RTU network by using a RS-232 to RS-485/422 converter. The port is addressable in the Hardware Configuration in the Productivity Suite programming software. It is important to note that the RS-232 port cannot be a Modbus RTU master and slave concurrently. If the port is set to Modbus RTU and there are no communications instructions (MRX, MWX, RX, WX) in the project, the CPU will automatically respond to Modbus requests from a Modbus master. See Communications: Connectivity section for more information.

RS-232 Modbus RTU Slave Network Topology

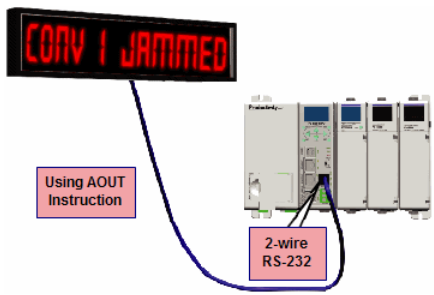


ASCII Incoming and Outgoing communications: The RS-232 port can be used for sending and receiving non-sequenced String data. This feature is typically used for receiving bar code strings from a scanner or sending statistical data to a terminal or serial printer using the ASCII IN and ASCII OUT instructions. See Communications: Connectivity section for more information.

RS-232 ASCII In Communication



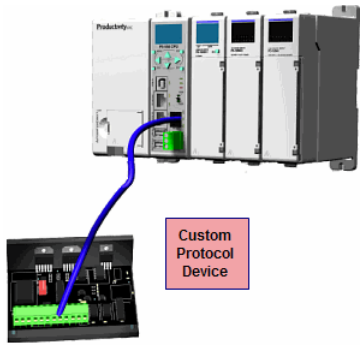
RS-232 ASCII In Communication



Communications: Modbus RTU

- Custom Protocol Incoming and Outgoing communications: The RS-232 port can be used for sending and receiving non-sequenced byte arrays to various devices. This function is typically used for communicating with devices that don't support the Modbus protocol but have another serial communications protocol. This is accomplished by using the Custom Protocol In and Custom Protocol Out instructions. The RS-232 port is intended to be used for point-to-point connections but it is possible for the RS-232 port to be used on a multi-node network by using a RS-232 to RS-485/422 converter. See Communications: Connectivity for more information.

RS-232 Custom Protocol In and Out

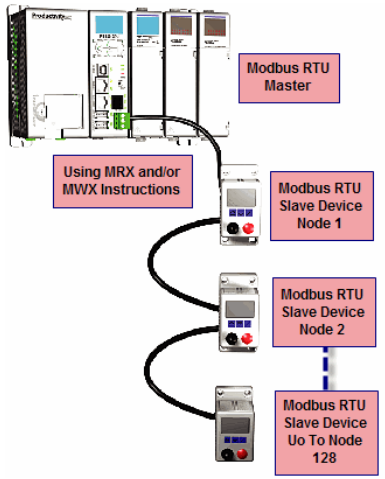


⑨ RS-485: The RS-485 port is a 3-pin removable terminal block. The RS-485 port can be used for:

- Modbus RTU Master connections.
- Modbus RTU Slave connections.
- ASCII Incoming and Outgoing communications.
- Custom Protocol Incoming and Outgoing communications.

Modbus RTU Master connections: The RS-485 network port is used for multi-node networks. The CPU can connect to 128 Modbus RTU slave devices on a network. This is accomplished by using the communications instructions in the ladder project (MRX, MWX, RX, WX). See Communications: Connectivity section or more information.

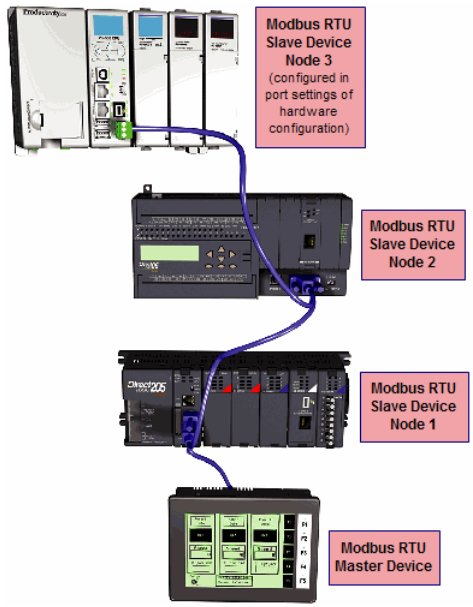
RS-485 Modbus RTU Master Network Topology



Communications: Modbus RTU

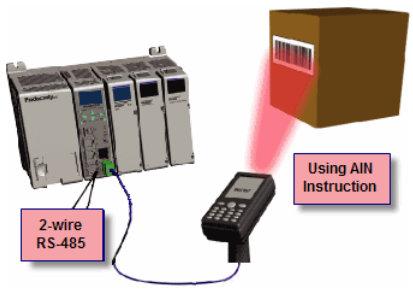
- Modbus RTU Slave connections: The RS-485 network port is used for multi-node networks. The port is addressable in the Hardware Configuration in the Productivity Suite programming software. If the port is set to Modbus RTU and there are no communications instructions (MRX, MWX, RX, WX) in the project, the CPU will automatically respond to Modbus requests from a Modbus master. See Communications Connectivity for more information.

RS-485 Modbus RTU Slave Network Topology

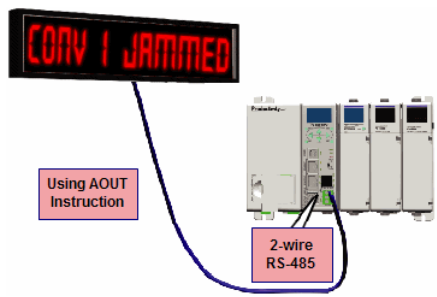


- ASCII Incoming and Outgoing communications: The RS-485 port can be used for sending and receiving non-sequenced String data. If long distances are required between the ASCII device and the CPU, the RS-485 port is the better selection because of its increased distance support (1,000 meters). ASCII communications are typically used for receiving bar code strings from a scanner or sending statistical data to a terminal or serial printer using the ASCII IN and ASCII OUT instructions. See Communications: Connectivity section for more information.

RS-485 ASCII In Communication



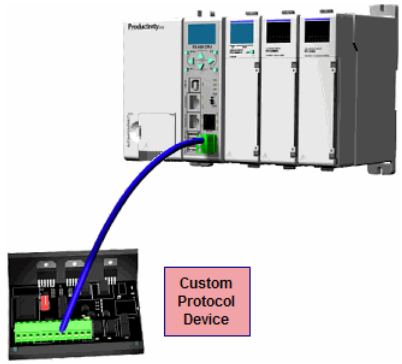
RS-485 ASCII Out Communication



Communications: Custom Protocol In and Out

Custom Protocol Incoming and Outgoing communications: The RS-485 port can be used for sending and receiving non-sequenced byte arrays to various devices. This function is typically used for communicating with devices that don't support the Modbus protocol but have another serial communications protocol. If long distances are required between the device and the CPU, the RS-485 port is the better selection because of its increased distance support (1,000 meters). This feature is accomplished by using the Custom Protocol In and Custom Protocol Out instructions. See Communications: Connectivity section for more information.

RS-485 Custom Protocol In and Out

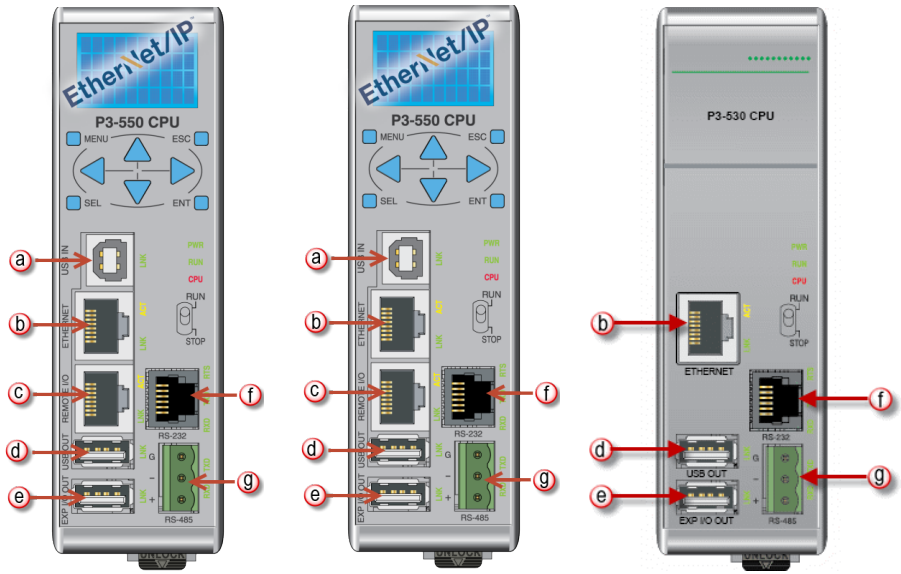


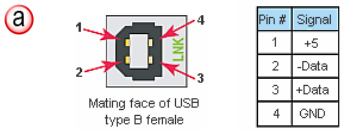
Communications: Connectivity

Communication Ports

The AutomationDirect P3000 CPUs are designed with several Communications Ports, seven communications ports on the P3-622 and P3-550, six on P3-550E, and five communications ports on the P3-530. The connectivity for each of these ports is described in the sections below. The Communication Ports available are:

- USB IN Port (P3-622/P3-550 only): Programming port with a USB Type B female connector.
- Requires a USB Type A-B cable (such as the P3-EX-CBL6 cable).





Pin #	Signal
1	+5
2	-Data
3	+Data
4	GND

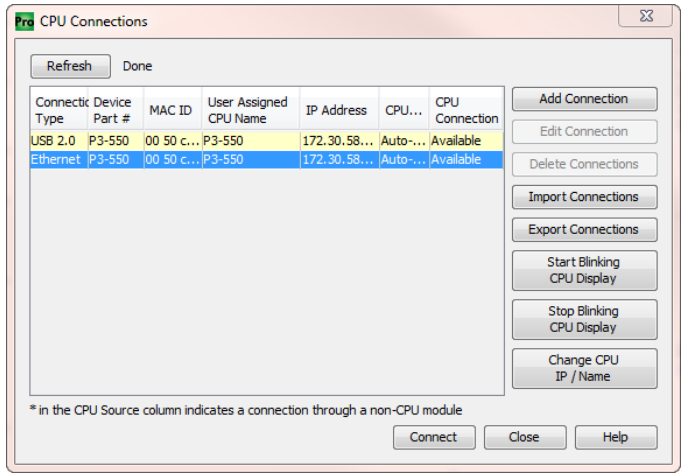


Communications: USB Port

The USB Port is the simplest method of connecting the Productivity Suite programming software to the P3-622 or P3-550 CPU. After the programming software has been installed, connect a USB A to B cable from the PC to the CPU. Once the software has been opened, click on CPU and select the "Choose CPU" option. The dialog shown below will appear.

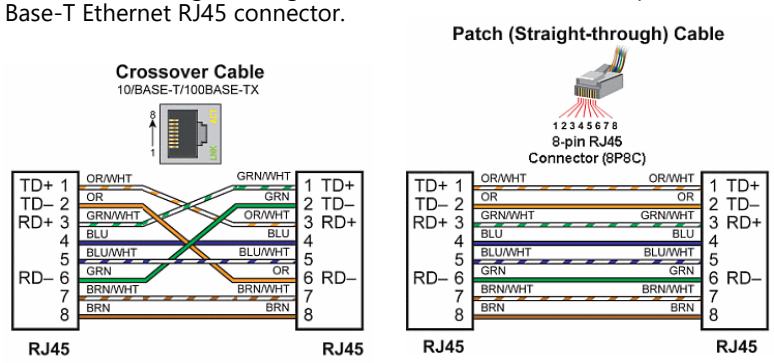
Highlight the CPU listed in the dialog box and click on "Connect". No configuration is required.

NOTE: *The USB IN port is NOT compatible with older 1.0/1.1 full speed USB devices.*



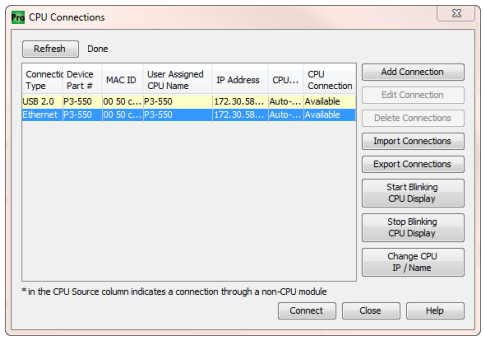
Communications: Ethernet Port

ⓑ Ethernet Port: Programming and Modbus TCP Client/Server port with 10/100 Base-T Ethernet RJ45 connector.



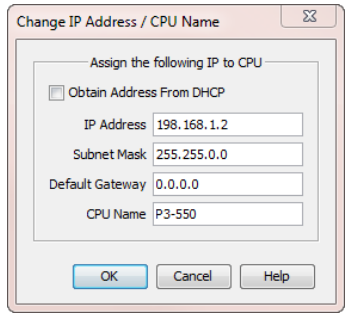
General Information:

- Crossover cables can be used to directly connect two endpoint Ethernet devices such as a PC network interface card and the CPU. Patch (or Straight-through) cables are used to connect an endpoint Ethernet device to an Ethernet switch.
- The maximum distance for one cable or segment is 100 meters (328 feet). If the distance required between 2 devices is greater than 100 meters, add an Ethernet switch to extend the distance. An Ethernet switch can be added every 100 meters (or less) almost indefinitely. Each Ethernet switch added will incur some latency (actual amount differs between switches and manufacturers). So if a very long distance is needed between 2 Ethernet devices, it may be better to convert to fiber optics.
- The External Ethernet Port can be used as a programming port, a Modbus TCP Client port, a Modbus TCP Server port, or to communicate to other P3000 CPUs. The External Ethernet Port can also be used to send emails using the EMAIL instruction.
- Create a Connection: To communicate with the Productivity Suite programming software, connect a crossover Ethernet cable from the PC to the CPU External Ethernet Port or connect a patch (straight-through) Ethernet cable from the PC to an Ethernet switch and another patch cable from the Ethernet switch to the External Ethernet Port. Once the software has been opened, click on CPU and select the "Choose CPU" option. The dialog shown below will appear.

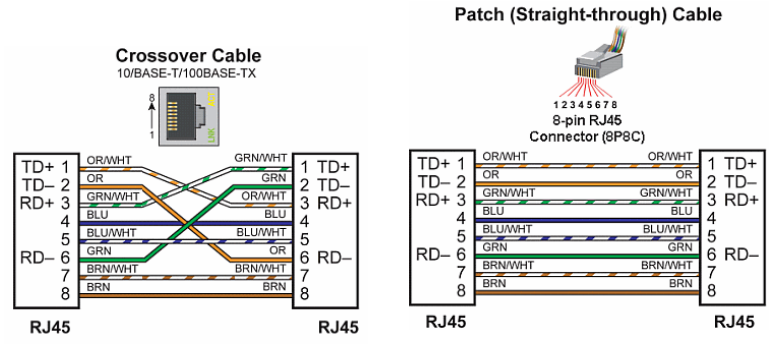


Communications: Remote I/O Ethernet Port

- Highlight the CPU that you wish to connect to and press the "Connect" button. You may see CPUs that are not on the same subnet as your PC within the CPU Connections dialog box, but this does not mean you can connect to them. To connect to the CPU, you must configure either your PC or your CPU to be in the same subnet. You can easily change the Ethernet settings of the CPU by highlighting it and selecting the "Change CPU IP/Name" button (shown below). Or if you prefer, the PC Setup section of this chapter contains information on configuring the Ethernet settings of your PC.



Ⓒ Remote I/O Ethernet Port (P3-550(E) only): Ethernet RJ45 connector for P3-RS/RX Remote Slave, and/or PS-AMC modules and/or GS Drive with communications modules.



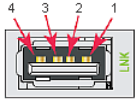
- Crossover cables can be used to directly connect endpoint Ethernet devices and the CPU. For example, connecting a P3-RS or P3-RX Remote Slave Module to the P3-550(E) CPU. Patch (or Straight-through) cables are used to connect an endpoint Ethernet device to an Ethernet switch.
- The maximum distance for one cable or segment is 100 meters (328 feet). If the distance required between 2 devices is greater than 100 meters, add an Ethernet switch to extend the distance. An Ethernet switch can be added every 100 meters (or less) almost indefinitely. Each Ethernet switch added will incur some latency (actual amount differs between switches and manufacturers). So if a very long distance is needed between 2 Ethernet devices, it may be better to convert to fiber optics.
- The Remote I/O Ethernet Port is used to communicate to the Remote I/O Network, consisting of Remote Slave bases (P3-RS/RX modules), PS-AMC modules, and GS Drives (with an additional Modbus TCP communications module/card). It is highly recommended that the network attached to this port be isolated from other networks and it is absolutely necessary that it be isolated from other Remote I/O networks. See Remote I/O and GS Drives topic for details.

Communications: USB OUT Port

NOTE: *USB Project Transfers are NOT supported by the P3-530 CPU.*

d USB OUT Port: USB Port for Data logging or project transfer with USB 2.0 Type A connector.

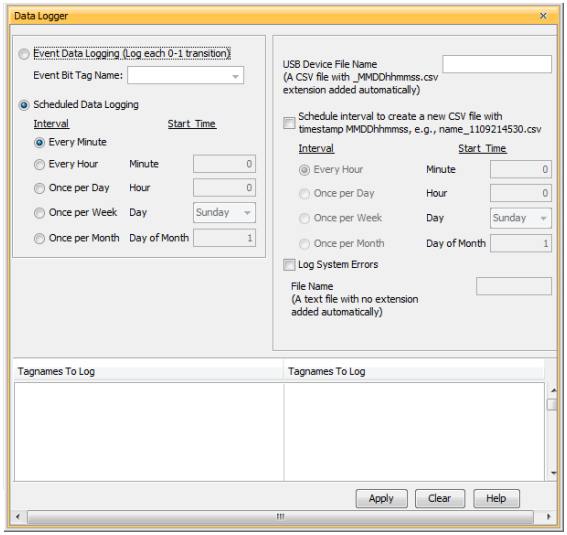
- This Port serves two purposes: Data logging with the P3-530 or data logging and project transfers with the P3-550(E), require a SDCZ4-2048-A10 Removable Storage Device (may work with other pen drives).



Mating face of USB type A female

Pin#	Signal
1	+5
2	-Data
3	+Data
4	GND

NOTE: *The USB OUT port is NOT compatible with older 1.0/1.1 full speed USB devices.*



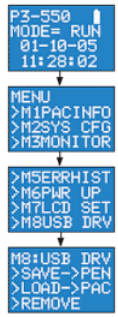
- Data logging is set up in the Productivity Suite Programming Software Data Logger configuration window. See Data Logger Memory section of the previous chapter for setup instructions.
- Project Transfer to and from a USB drive can be accomplished several different ways:
- Transfer project to USB Drive from PC programming software.
- Transfer project from USB Drive to PC programming software.
- Transfer project from USB Drive to P3-550(E) CPU.
- Transfer project from P3-550(E) CPU to USB Drive.

NOTE: *You must first select the "Enable project transfer to/from USB drive" checkbox in the P3-550(E) CPU Module Configuration.*

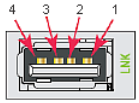
NOTE: *Before transferring a project to the CPU via USB pen drive, ensure that you are NOT connected with the programming software either by USB or Ethernet. If you attempt the transfer with the software connected via USB or Ethernet, a PACCON Error will appear on the LCD of the P3-550(E).*

Communications: USB OUT Port

- To transfer a project to or from a USB Drive from the PC programming software, insert the USB Drive into a USB Port on the PC. Go to File and Transfer Project and select *To USB Drive* or **From USB Drive**.
- To transfer a project to or from a USB Drive on the P3-550(E) CPU, press Menu on the CPU display LCD and scroll down to the M8USB DRV option as seen on right.
- Select ">SAVE->PEN" to load the project that is currently on the CPU down to the connected USB Drive.
- Select ">LOAD->CPU" to load the project that is currently on the USB Drive to the CPU.



ⓔ Expansion I/O OUT Port: Expansion I/O Port with USB 2.0 Type A connector.



Mating face of USB type A female

Pin#	Signal
1	+5
2	-Data
3	+Data
4	GND

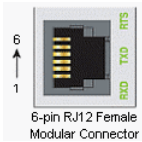


CAUTION: THE EXPANSION I/O PORT IS ONLY FOR CONNECTING TO OTHER PRODUCTIVITY3000® I/O BASES WITH A P3-EX MODULE IN THE CPU SLOT. THIS PORT IS NOT A STANDARD USB A PORT. NOTE THAT IN THE DIAGRAM ABOVE, PIN 1 IS USED FOR THE SYSTEM RESET SIGNAL AND IS NOT THE TYPICAL +5VDC VBUS SIGNAL ON MOST USB A PORTS. DO NOT USE EXTENDERS, CONVERTERS OR HUBS OF ANY SORT ON THIS PORT. A P3-EX-CBL6 CABLE SHIPS WITH EACH P3-EX MODULE. IT IS NOT RECOMMENDED TO USE ANY CABLE OTHER THAN THE ONE SUPPLIED.

- After this connection is made, power cycle the system and the CPU will automatically detect the expansion I/O units. They can be used once the Hardware Configuration has been read into the programming software. Up to 4 expansion I/O bases may be added to a CPU.

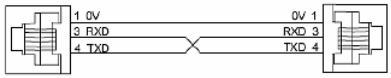
Communications: RS-232 Port

ⓕ RS-232 Port: Serial RS-232 multipurpose communications port with RJ12 connector.



Pin#	Signal	
1	GND	Logic Ground
2	+5V	210mA Maximum
3	RXD	RS-232 Input
4	TXD	RS-232 Output
5	RTS	RS-232 Output
6	GND	Logic Ground

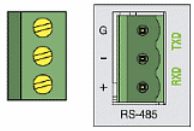
- The RS-232 Port can be connected to Modbus RTU master or slave devices, as well as devices that output non-sequenced ASCII strings or characters. The manner in which these devices are wired to the CPU depends whether the device is considered to be DTE (Data Terminal Equipment) or DCE (Data Communications Equipment).
- If two DTE devices are connected together, the RX and TX signals should cross or the RX of one device should go to the TX of the other device and the TX of one device should go to the RX of the other device (as shown below).



- The CPU is considered a DTE device. Most Modbus or ASCII devices being connected to the CPU will also be considered a DTE device and will need to swap TX and RX, but you should always consult the documentation of that device to verify. If a communication device, such as a Modem, is placed between the CPU and another Modbus or ASCII device it will most likely require connecting the signals straight across (TX to TX and RX to RX). Again, this can differ from manufacturer to manufacturer so always consult the documentation before wiring the devices together.
- The RTS signal on pin 5 of the RS-232 Port will turn on when the TX signal is turned on and the RTS signal will turn off when the TX signal turns off. The amount of time that the RTS signal turns on before the TX signal turns on and the amount of time that the RTS signal waits before turning off after the TX signal turns off is adjustable in the P3-550(E) or P3-530 CPU Module Configuration for the RS-232 Port. The RTS signal is very often required for media converters, such as a RS-232 to RS-422/485 converter (much like the FA-ISOCON).
- The RTS signal is sometimes required for use with Radio modems as well (Key on and off control).
- There is also +5VDC @ 210mA on pin 2 available for powering an external device such as the C-more Micro panel.

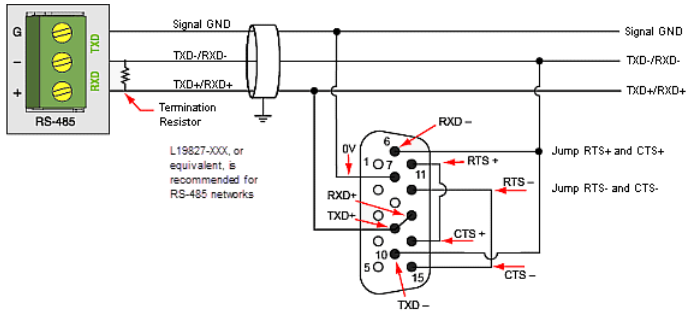
Communications: RS-485 Port

g RS-485 Port: Serial RS-485 multipurpose communications port with removable 3-pin connector.



Pin #	Signal
G	GND
–	TXD-/RXD-
+	TXD+/RXD+

- The RS-485 Port is useful for connecting multiple Modbus and ASCII devices on one network and/or connecting devices to the CPU at distances greater than 50 feet (RS-232 limit). The RS-485 standard supports distances of up to 1000 meters without requiring a repeater. The RS-485 Port on the CPU can support up to 50 devices, depending on each device's load (this assumes a 19K Ohm load for each device). This number can be increased by placing an RS-485 repeater on the network, if necessary.
- This port only supports RS-485 2-wire connections. For 4-wire RS-485 or RS-422, a converter, such as an FA-ISOCON, should be used with the RS-232 Port.



DL06 CPU Port 2

- A 120 Ohm resistor is required at each end of the network for termination.

Communications ASCII and Custom Protocol Functionality

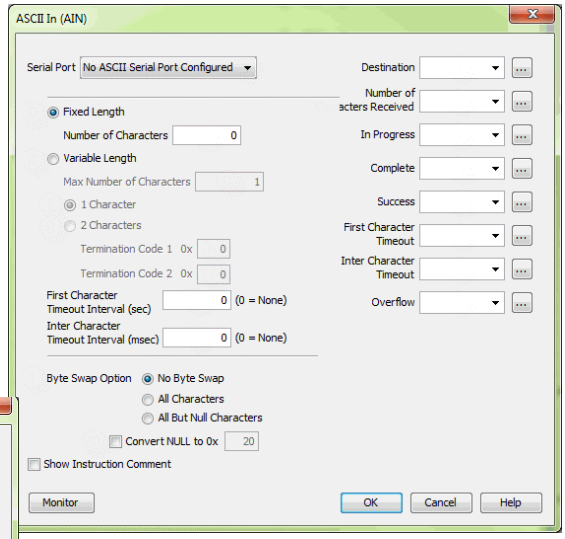
Besides Modbus RTU, there are two additional functions supported on the serial ports in the Productivity3000® system.

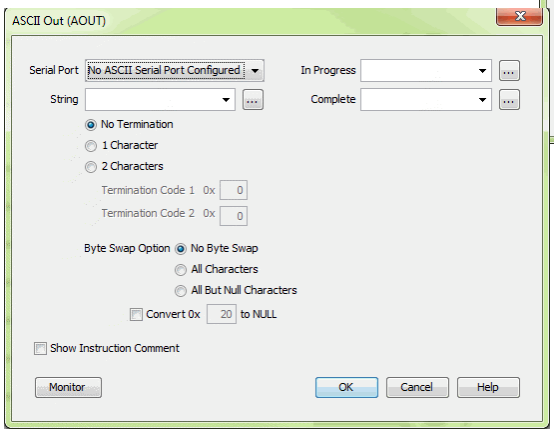
- The first function is the ability to send and receive text-based data with devices such as bar code readers and serial printers.
- The second function is the ability to communicate serially with other devices that do not support the Modbus protocol and lack a Productivity3000 driver.

ASCII Instructions

The ASCII In/Out instructions use the String data type to send or receive text-based data through the serial port. The String data type is only intended for use with the "printable character set". This can include numbers, letters or special characters.

- With the ASCII In instruction, the CPU can receive a fixed length of characters or a variable length of characters with a termination code (an 'end of message' character).





- The ASCII Out instruction sends text-based data out of the serial port to various devices for control, printing or display.

Full duplex Mode (P3-550(E)/530)

1. RS232 can be set to FulDuplex node. Half Duplex is selected by default. This cna be changed in the Hardware Configuration window for the CPU serial port.
2. AIN and AOUT instructions may be enabled at the same time.
3. AOUT may be enabled while AIN is already active, and vice versa.
4. The user may control treatment of buffered data before AIN is enabled using the checkbox mentioned above.
5. RTS mode must be either always on or always off. Assert during transmit is not available.

Half duplex Mode [default] (P3-550(E)/530)

The ASCII instruction limitations are that it is not advisable to use the ASCII Out instruction to send a String to a device that will respond (if the response is needed) and to use the ASCII IN (AIN) instruction to try to receive this data.

1. AIN and AOUT cannot be enabled at the same time on the same serial port.
2. When the AOUT completes, the AIN cannot be enabled until the next logic scan.
3. The user may control treatment of buffered data before AIN is enabled using the checkbox mentioned above.

Custom Protocol Instructions

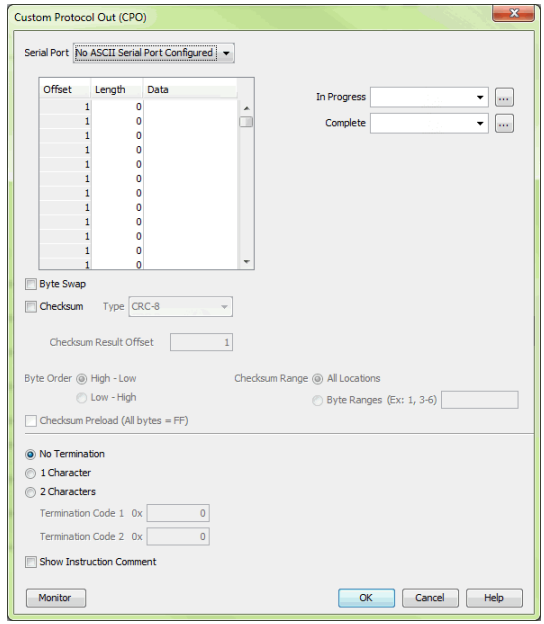
The Custom Protocol is a HEX based protocol used to communicate with devices that do not have the standard Modbus RTU Protocol. There are two instructions used with Custom Protocol communication:

- Custom Protocol Out (CPO)
- Custom Protocol In (CPI)

Custom Protocol Out

The Custom Protocol Out instruction allows the user to send a 'byte formatted' packet of data out of the CPU serial port.

Constant values and/or Tag values can be used as the source for data transmitted. There are several formatting options including Byte Swap and Checksum.



The Checksum option allows the user to select where in the packet the checksum should be inserted, what type of Checksum (CRC-8 bit, CRC-16 bit, CRC-32 bit, XOR-8 bit, XOR-16 bit and XOR 32 bit), which bytes of the data source should be used in the calculation of the checksum, what the byte order should be of the checksum (if greater than 8 bit) and how to preload the checksum calculation.

If the device requires a different Checksum calculation, this can be done outside of the instruction in other ladder code and the resulting Tag values can be inserted where appropriate in the packet.

Termination characters can also be specified when needed.

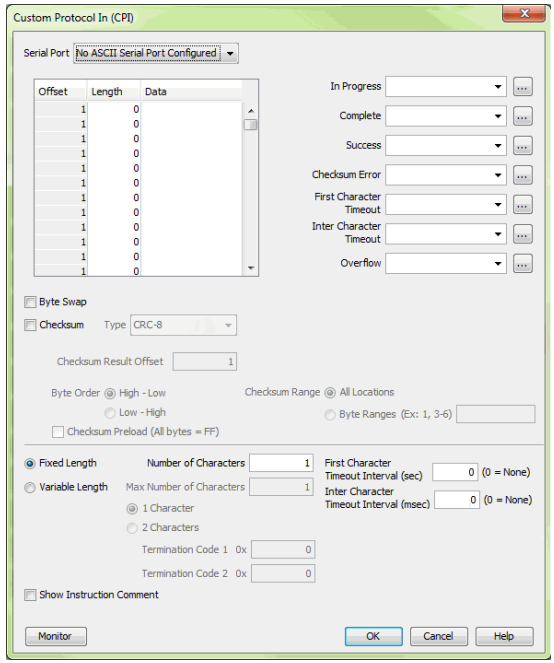
The Custom Protocol Out instruction is for transmission only. If information needs to be received from field devices, the Custom Protocol In instruction will have to be used. Unlike ASCII, the Custom Protocol will buffer the received data. When the Custom Protocol In instruction is executed, it will retrieve any data held in this buffer. Therefore, the lost responses found with ASCII communication do not occur with Custom Protocol communication.

Custom Protocol In

The Custom Protocol In instruction has similar formatting options to the Custom Protocol Out instruction.

The Custom Protocol In instruction will calculate the Checksum of the data packet received based on the criteria specified in the instruction and this will determine the state of the status bits assigned to the instruction. If the Checksum calculation passes based on the criteria specified in the instruction, the "Success" status bit will become true. If the Checksum calculation fails, the "Checksum Error" status bit will become true.

With the CPI instruction, the packet termination must be specified, either in terms of a termination character(s) or a packet length. If a Checksum is expected in the reply, be sure to include this in the Fixed Length value specified.



Communications: Ethernet

TCP and UDP Port Numbers

When doing TCP/IP and UDP/IP communications, there is a Source Port number and Destination Port number for every message. The Client device must be aware of the Destination Port Number(s) that the Server device is expecting to see and the Server device must listen for this Destination Port number. After the Server device has received the message with the Destination Port Number that it is listening on, it will formulate the return message (if the applications require this) with the Source Port Number from the message sent as its Destination Port Number.

It is important to understand a little about the Port numbering concept because many Ethernet devices, such as routers with firewalls, will block messages with Destination Port numbers that are not configured for that device. Listed below are the default Port Numbers used in the Productivity3000® system. Some of these are configurable, allowing more flexibility when going through routers in many applications.

Port	Port Number (Decimal Format)	TCP or UDP	Configurable
Programming Software CPU Discovery	8888	UDP	No
Programming Software Connection and Project Transfer	9999	UDP	No
Modbus Client Connections (MRX, MWX, RX and WX instructions)	502	TCP	Yes
Modbus Server Connections	502	TCP	Yes
GS-Drive Discovery	28784	UDP	No
GS-Drive Connection	502	TCP	No
Remote I/O Discovery	8887	UDP	No
Remote I/O Connection	8877	UDP	No
Email Instruction	25	TCP	No
Ethernet IP	44818	TCP	Yes
Ethernet IP	2222	UDP	No*
* Adapters may choose to respond using another port number.			

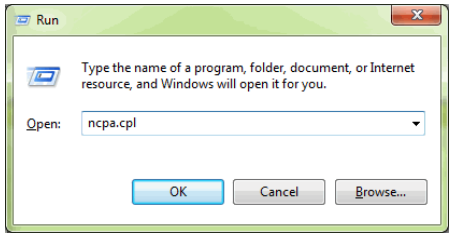
IP Addressing and Subnetting

IP Addresses (used in conjunction with the Subnet Mask and Default Gateway address) are used for network routing. This allows for easy and logical separation of networks.

It is outside of the scope of this help file to explain how IP Addresses and Subnet masks are configured for actual usage. There are many books, documents and tools (Subnet calculators) on the internet that provide this information. Each facility and network will incorporate their own rules and guidelines for how their networks are to be configured.

PC Setup

For testing and verification purpose, it is recommended that the PC and the CPU be on an isolated Ethernet switch. Configure the PC's network interface card setting as described below.

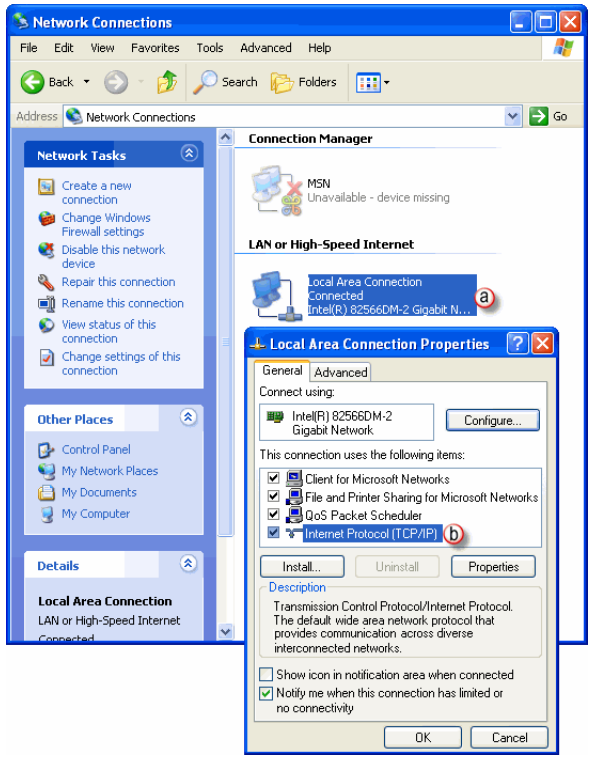


1. Go to Start, then Run, type ncpa.cpl in the Open field and click on OK to bring up the Network Connections dialog.

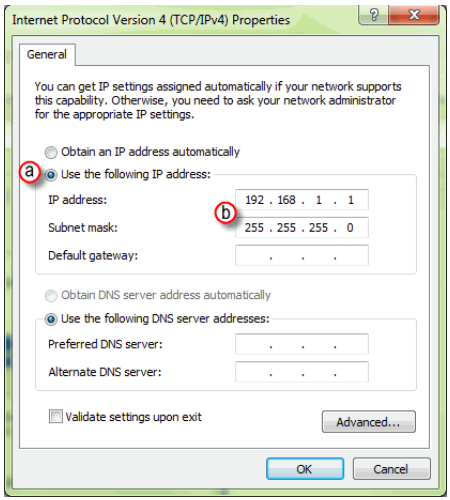
NOTE: *Many system settings on your computer require Administrative privileges. Consult with your IT department for necessary privileges and approvals.*

NOTE: *You should record initial settings prior to making any network configuration changes.*

2. Network Connections
   - (a) Right click on the Network interface shown in the Network Connections dialog and select Properties. If there is more than one Network Interface on the PC, be sure to choose the one connected to the Ethernet Switch with the CPU on it.
   - (b) From the Local Area Connection Properties window, highlight the Internet Protocol(TCP/IP) selection and click on Properties.



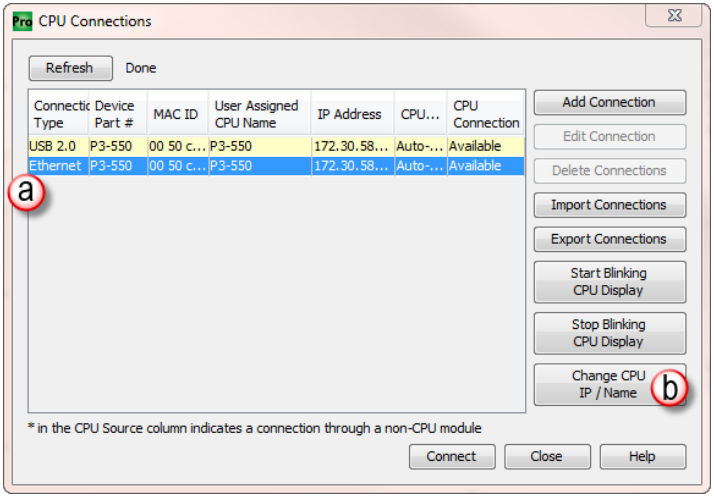
3. Internet Protocol (TCP/IP) Properties.
   - (a) In the Properties window, select Use the following IP address.
   - (b) Enter an IP Address of 192.168.1.1 and Subnet Mask 255.255.255.0 and select OK. Select OK again on the Local Area Connection Properties window.



CPU Setup

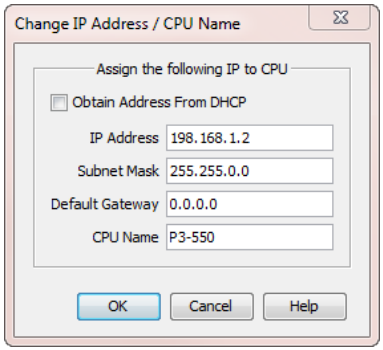
Now configure the CPU's network IP setting as shown below.

1. Select CPU from the Productivity3000® software Main Menu and then select Choose CPU from the drop down menu.
2. The CPU Connections window will open as shown below.



ⓐ Click to highlight the CPU connected to the Ethernet switch.
ⓑ Select the "Change CPU IP/Name" button.

3. The Change IP Address/CPU Name window will open as shown below.
   - Enter an IP Address of 192.168.1.2 and Subnet Mask 255.255.0.0 for the CPU's network IP setting and select OK.



The CPU is now configured with the correct IP Address for connectivity with the PC. The IP Address and Subnet Mask settings will very likely differ from what will be used in the actual application. Consult the Network Administrator of the facility where the CPU will be installed to get the appropriate settings for that network.

TCP Connection Behavior with Modbus TCP and Network Instructions

When performing communications over TCP, a Connection must be established before the applications can transfer data. The connection is typically maintained until the application decides that the connection is no longer needed and then the connection will be severed. Frequent connects and disconnects are not efficient for the Client or the Server and can add unnecessary network traffic. But maintaining connections needlessly is also costly to the Client and Server in terms of processing and memory so this should also be avoided.

The CPU allows user control of Client connections through enabling and disabling the rungs containing Modbus and Network instructions. The MRX, MWX, RX and WX instructions have two options for sending messages: Automatic Poll and Manual Poll.

Automatic Poll sends out messages at a specified rate. Enabling the instruction performs a TCP connect with the Server device. Once the connection is established, the instruction messages are sent at the rate entered in the poll rate field. This continues until the instruction is disabled. The TCP connection will automatically be severed five seconds after the instruction is disabled.

Manual Poll sends out a message each time the instruction is enabled. Enabling the instruction performs a TCP connect with the Server device and sends the message one time. The TCP connection will automatically be severed five seconds after receiving the reply from the Server device. If the instruction gets another positive edge enable within the five seconds, the message will be sent and the disconnect of the TCP connection will be delayed by an additional five seconds.

Communications Modbus Functionality

Master/Client Function Code and Data Type Support

The following table lists the Modbus data type, the function code and the CPU source data type that is supported when the CPU is the Client or Master on a Modbus TCP or serial connection.

Modbus Client/Master Support (Using MRX and MWX Instructions)				
Function Code	**Function Name**	**Modbus 984 Addressing (Zero Based)**	**Modbus 984 Addressing**	**Productivity3000® Tag Types (Data designation or source)**
01	Read Coil Status	000000 - 065535	000001 - 065536	Discrete Output (DO)
				Boolean (C)
				Boolean System (SBRW)
02	Read Coil Status	100000 - 165535	100001 - 165536	Discrete Input (DI)
				Boolean (C)
				Boolean System (SBRW)
03	Read Holding Registers	400000 - 465535	400001 - 465536	Integer 8 bit Unsigned (U8)
				Integer 16 bit (S16)
				Integer 16 bit Unsigned (U16)
				Integer 16 bit BCD (B16)
				Integer 32 bit (S32)
				Integer 32 bit BCD (B32)
				Integer 32 bit Float (F32)
				Integer 16 bit System (SWRW)
04	Read Input Registers	300000 - 365535	300001 -365536	Integer 8 bit Unsigned (U8)
				Integer 16 bit (S16)
				Integer 16 bit Unsigned (U16)
				Integer 16 bit BCD (B16)
				Integer 32 bit (S32)
				Integer 32 bit BCD (B32)
				Integer 32 bit Float (F32)
				Integer 16 bit System (SWRW)
05	Write Single Coil	000000 - 065535	000001 - 065536	Discrete Input (DI)
				Discrete Output (DO)
				Boolean (C)
				Boolean System (SBRW)
				Boolean System Read Only (SBR)

Modbus Client/Master Support (Using MRX and MWX Instructions) (continued)				
Function Code	**Function Name**	**Modbus 984 Addressing (Zero Based)**	**Modbus 984 Addressing**	**Productivity3000® Tag Types (Data designation or source)**
06	Write Single Register	400000 - 465535	400001 - 465536	Integer 8 bit Unsigned (U8)
				Integer 16 bit (S16)
				Integer 16 bit Unsigned (U16)
				Integer 16 bit BCD (B16)
				Integer 32 bit (S32)
				Integer 32 bit BCD (B32)
				Integer 32 bit Float (F32)
				Integer 16 bit System (SWRW)
				Integer 16 bit System Read Only (SWR)
15	Write Multiple Coils	000000 - 065535	000001 - 065536	Discrete Input (DI)
				Discrete Output (DO)
				Boolean (C)
				Boolean System (SBRW)
				Boolean System Read Only (SBR)
16	Write Multiple Registers	400000 - 465535	400001 - 465536	Integer 8 bit Unsigned (U8)
				Integer 16 bit (S16)
				Integer 16 bit Unsigned (U16)
				Integer 16 bit BCD (B16)
				Integer 32 bit (S32)
				Integer 32 bit BCD (B32)
				Integer 32 bit Float (F32)
				Integer 16 bit System (SWRW)
				Integer 16 bit System Read Only (SWR)

Slave/Server Function Code and Data Type Support

The following table lists the Modbus data type, the function code and the CPU source data type that is supported when the CPU is the Server or Slave on a Modbus TCP or serial connection.

Modbus Server/Slave Support			
Function Code	**Function Name**	**Modbus 984 Addressing**	**Productivity3000® Tag Types (Data designation or source)**
01	Read Coil Status	000001 - 065536	Discrete Output (DO)
			Boolean (C)
			Boolean System (SBRW)
02	Read Coil Status	100001 - 165536	Discrete Input (DI)
			Boolean System Read Only (SBR)
03	Read Holding Registers	400001 - 465536	Integer 8 bit Unsigned (U8)
			Integer 16 bit (S16)
			Integer 16 bit Unsigned (U16)
			Integer 16 bit BCD (B16)
			Integer 32 bit (S32)
			Integer 32 bit BCD (B32)
			Integer 32 bit Float (F32)
			Integer 16 bit System (SWRW)
			String
04	Read Input Registers	300001 -365536	Analog Input, Integer 32 bit (AIS32)
			Analog Input, Float 32 bit (AIF32)
			Integer 16 bit System Read Only (SWR)
05	Write Single Coil	000001 - 065536	Discrete Output (DO)
			Boolean (C)
			Boolean System (SBRW)
06	Write Single Register	400001 - 465536	Integer 8 bit Unsigned (U8)
			Integer 16 bit (S16)
			Integer 16 bit Unsigned (U16)
			Integer 16 bit BCD (B16)
			Integer 32 bit (S32)
			Integer 32 bit BCD (B32)
			Integer 32 bit Float (F32)
			Integer 16 bit System (SWRW)
			Integer 16 bit System Read Only (SBR)
			String
15	Write Multiple Coils	000001 - 065536	Discrete Output (DO)
			Boolean (C)
			Boolean System (SBRW)

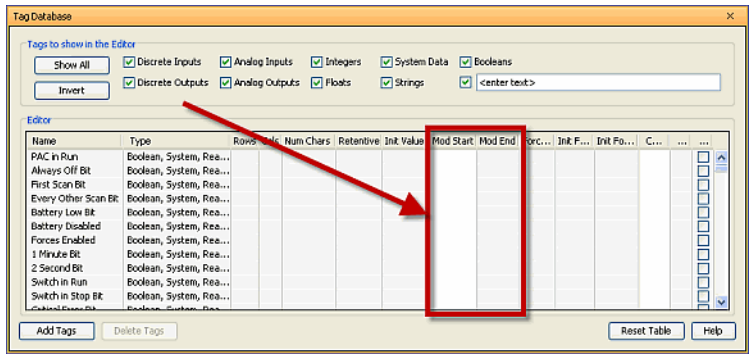
Modbus Server/Slave Support (continued)			
Function Code	**Function Name**	**Modbus 984 Addressing**	**Productivity3000® Tag Types (Data designation or source)**
16	Write Multiple Registers	400001 - 465536	Integer 8 bit Unsigned (U8)
			Integer 16 bit (S16)
			Integer 16 bit Unsigned (U16)
			Integer 16 bit BCD (B16)
			Integer 32 bit (S32)
			Integer 32 bit BCD (B32)
			Integer 32 bit Float (F32)
			Integer 16 bit System (SWRW)
			Integer 16 bit System Read Only (SBR)
			String

Assigning Modbus Addresses to Tags

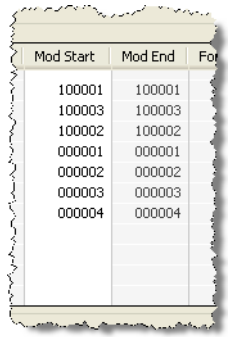
There are many different data types in the CPU. Because of this, the Modbus addresses need to be mapped to the various tag data types in the CPU.

There are two ways to map Modbus addresses to Tags in the Programming software: 1.) Modbus mapping in Tag Database window; 2.) Modbus mapping when creating Tags.

1. Modbus mapping in Tag Database window:
   - There are only two data sizes in the Modbus protocol: bits and words. In the CPU, there are multiple size types, so it is sometimes necessary to map multiple Modbus addresses to a single Tag entity. There are also array data structures in the CPU. When Modbus addresses are mapped to arrays, they will be mapped as a contiguous block of addresses. This is, in fact, the most efficient method to handle Modbus communications.
   - In the Tag Database window, there are two columns named “Mod Start” and “Mod End”. To map a Modbus address to a tag in the Tag Database window, simply double-click in the Mod Start field for the Tag.

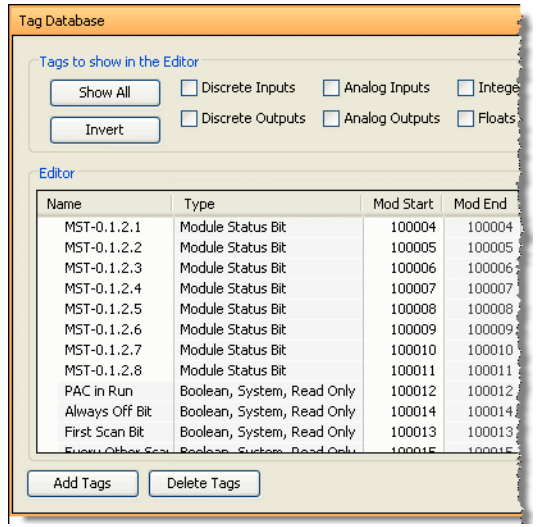


When you do this, you will see two values appear in the field. The left most value is the Modbus data type. This is fixed based upon the tag data type. The chart below indicates the four different Modbus data types in the 984 addressing scheme.



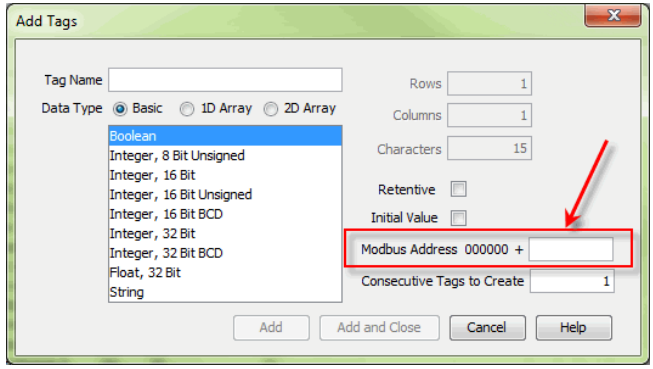
Address Identifier	Modbus 984 Address Type
0xxxxx	Coil (Read/Write bit)
1xxxxx	Input (Read Only bit)
3xxxxx	Input Register (Read Only 16 bit word)
4xxxxx	Holding Register (Read/Write 16 bit word)

The right most value that you see in the "Mod Start" field is the address offset (range is from 1 – 65535). You can accept the value that is pre-filled for you or the value can be changed. The software automatically pre-fills the address offset with the next available address.



2 Modbus mapping when creating Tags:

- Modbus addresses can be assigned to Tags as they are created in the Tag Database.



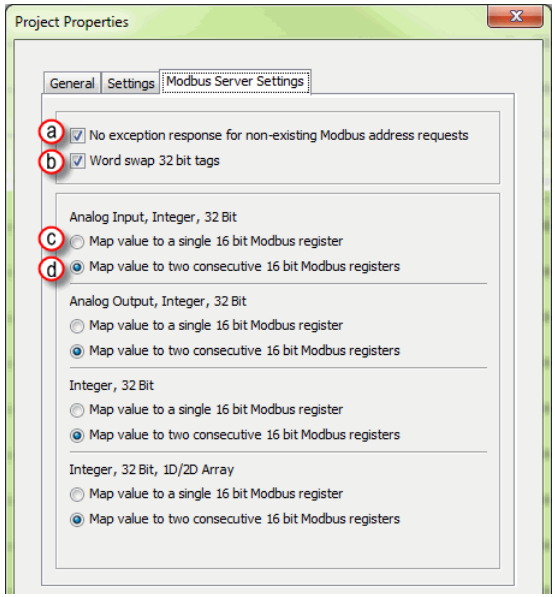
- Type in the Modbus offset value when entering the Tag Name and Data Type. If the address is already assigned, a warning message will appear.



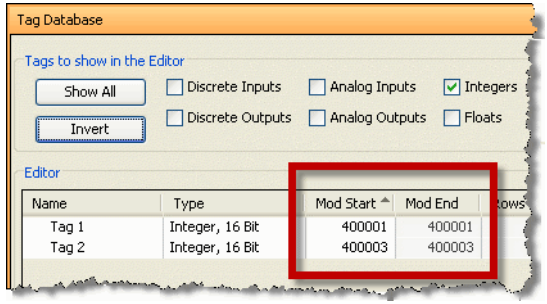
Modbus Options

The Modbus protocol does not have a specific method outlined for data types outside of bits and 16-bit words. Most systems now have 32-bit data types. In order to transport 32-bit data types across Modbus, they must be placed into two Modbus 16-bit registers. Unfortunately, some devices do not support this and there are sometimes incompatibilities in the order of the 16-bit high word and low word handling between the devices.

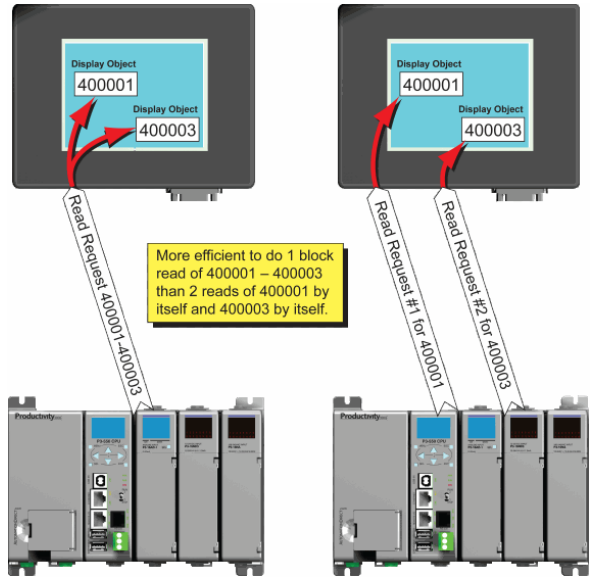
In order to help alleviate this situation, there are some options for handling this in the programming software. To find the Modbus Address options, go to File and click on Project Properties and then click on the "Modbus Server Settings" tab.



ⓐ No exception response for non-existing Modbus address requests: Because the Modbus addresses can be manually assigned to tags, it is possible that gaps can occur in the Modbus address mapping. For example: Tag1 has Modbus address 400001 assigned to it and Tag 2 has Modbus address 400003 assigned to it.



- Most Modbus Master/Client devices will attempt to optimize their data requests to a Modbus Slave/Server device by requesting blocks of data instead of individual registers. In the case mentioned previously, most Modbus masters would send one read request starting at 400001 and a size of three instead of sending two read requests starting at 400001 with size one and 400003 with size one as shown below.



- In the example shown above on left, a Modbus Slave/Server device should give an exception response since there is no Modbus Address of 400002 in the device. This method can cause a lot of inefficiencies. By selecting the "No exception response for non-existing Modbus address requests" option, the CPU will not give an exception response to the request. Note that if Modbus address 400002 by itself were requested it would give an exception response.

ⓑ Word swap option (S-32, AIS-32, AOS-32, F-32, FI-32, FO-32):

- Word swap allows the word order of 32-bit tags to be changed when sending the values across Modbus. The default selection is on, which returns the data low word first.
- Tag1 (Integer, 32-Bit) = 305,419,896 (hex = 0x12345678)

  Tag1 Modbus address = 400001, 400002

  Modbus reply for Tag1 (Word Swap ON) = 01 03 04 56 78 12 34
  (56 78: Low Word First; 12 34: High Word Last)

  Modbus reply for Tag1 (Word Swap OFF) = 01 03 04 12 34 56 78
  (12 34: High Word First; 56 78: Low Word Last)

ⓒ Map value to a single 16 bit Modbus register:

- This option allows for compatibility with devices that do not support 32-bit Modbus functionality. This option can be selected individually for the Analog Input and Output Signed 32 data types and the Internal Signed 32 data types, including the array form of these data types. This function is only useful when the value contained in a 32-bit tag does not exceed a signed 15-bit value (32,765).

  Tag1 (Integer, 32-Bit) = 22136 (hex = 0x00005678)

- With "Map value to a single 16 bit Modbus register" turned OFF =

  Tag1 Modbus address = 400001, 400002

- Modbus reply for Tag1 (Word Swap ON) = 01 03 04 56 78 00 00
- With "Map value to a single 16 bit Modbus register" turned ON =

  Tag 1 Modbus address = 400001

- Modbus reply for Tag1 = 01 03 02 56 78

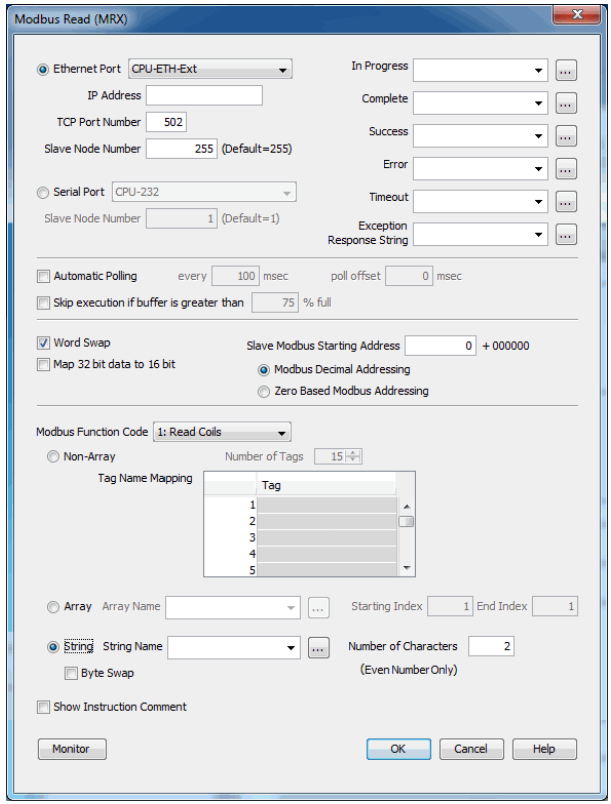
ⓓ Map value to two consecutive 16-bit Modbus registers: Allows for 32-bit data types to be mapped to two consecutive 16-bit registers. This option is selected as default.

- All of the options in the "Modbus Address" tab of the Project Properties only apply to the Modbus Slave/Server functionality. Similar options are available for the Modbus Master/Client functions as well and are available in the MRX and MWX Modbus instructions.

Modbus Instructions

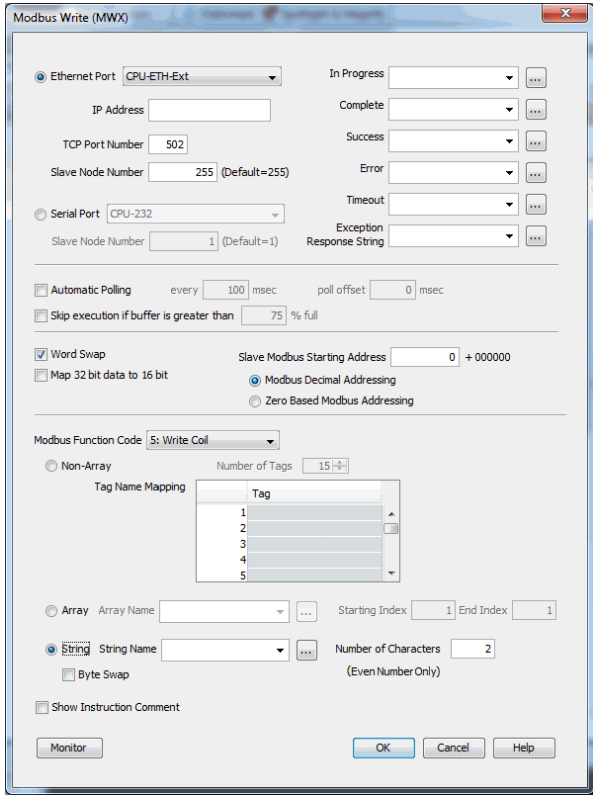
To read or set data in other Modbus Slave/Server devices, there are two instructions available in the programming software, Modbus Read and Modbus Write.

- The Modbus Read (MRX) instruction is used to read data from other Modbus devices into Tags of the CPU.
- The MRX instruction can be used for Modbus TCP or Modbus RTU. There are several status bits that can be used to determine whether the read message was successful and if it was not, the reason why.



There is an "Automatic Polling" feature in the instruction to make it easier to read a device on a pre-determined poll rate. There is also a "poll offset" field that can be used when simultaneous instructions are enabled with the Automatic Polling feature to help stagger the flow of messages being sent to the network.

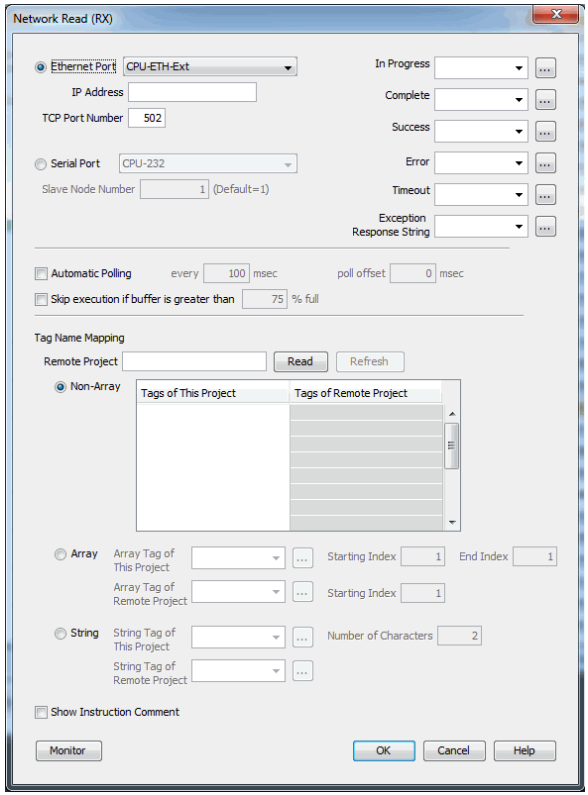
- The Modbus Write (MWX) instruction is very similar in layout and configuration to the MRX instruction. It is used to write values to a Modbus device from the tags in the CPU.



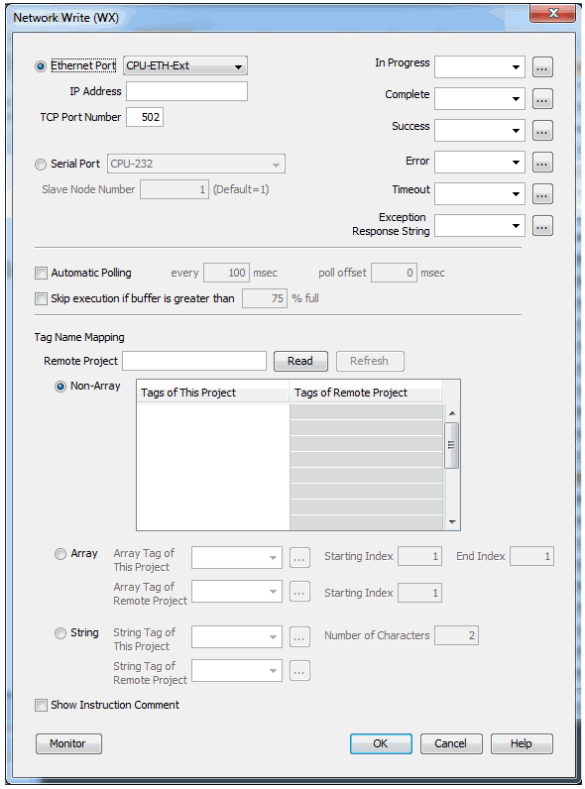
- The MWX operates very similarly to the MRX instruction. There are also many status bits to indicate the success or reason of failure when sending a message.
- The Automatic Polling option is also available to the MWX instruction, although greater care should be taken when using this feature in this instruction. This is explained in better detail in the "Message Queue" section.

Network Instructions

The Network Read (RX) and Network Write (WX) instructions are used to communicate to other CPUs. They are very similar in operation to the MRX and MWX instructions but they target Tag Names instead of Modbus addresses in the other CPU. There is also a significant performance gain in using the RX and WX instructions when communicating to other CPUs as opposed to using the MRX and MWX instructions.



The same status bits are available in the RX instruction as in the MRX instruction and operate in the same manner. The greatest difference in the RX versus the MRX is that with the RX, the Tag Name in the target CPU can be referenced directly and does not need a corresponding Modbus address. The way this is accomplished is by mapping local and remote tag names together within the local CPU's RX instruction. Once the instruction is set up to read a remote project, the "Tags of Remote Project" or "Array Tags of Remote Project" drop down lists will be accessible. Map the Tag of the Remote project to a Tag in the Local project to read this data.



The WX instruction operates in the same manner except that the data from the Local tags will be written into the Tags of the remote project. No Modbus mapping is required.

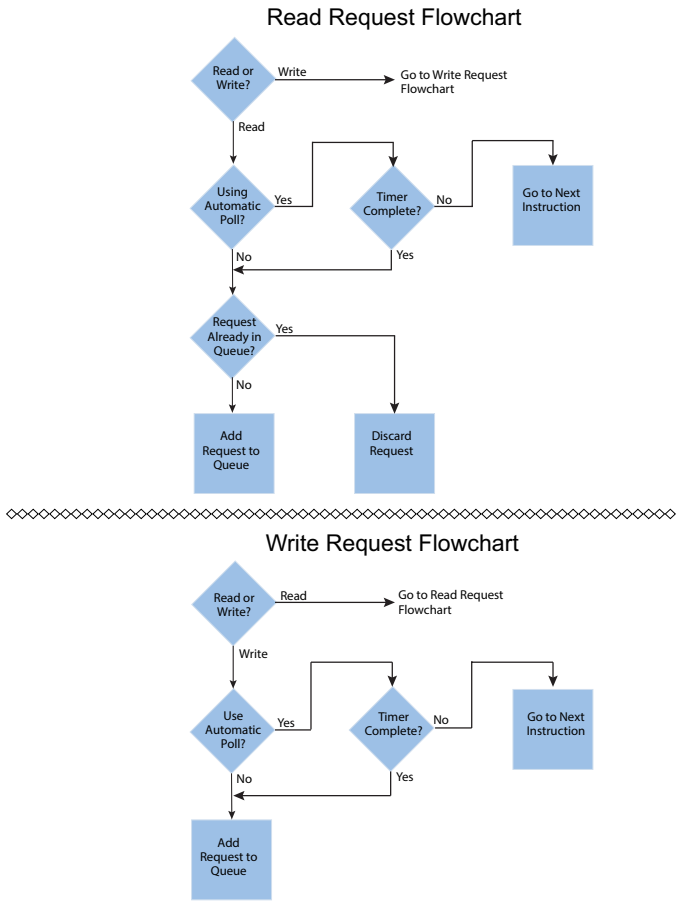
NOTE: *The PC programming software project for the Remote CPU must be accessible by the PC running the programming software for the Local project.*

Automatic Poll versus Manual Polling and Interlocking

In many cases when performing multiple communications requests to other devices, the message flow must be explicitly controlled in ladder code so that a message is not sent while another one is in operation. This usually requires writing 'interlocking' code between the instructions which typically involves the use of timers and shift registers, etc. Sometimes this is necessary because of the application but in other cases where the CPU just wants to read changing values from other devices and the frequency of that update is not critical it would be much more efficient to skip the unnecessary code complexity of interlocking.

The desire to make it easier to communicate to other devices brought about the "Automatic Polling" feature and the "Message Queue" in the CPU. The Automatic Polling feature allows the user to choose the rate at which they desire to send messages without having to use a separate timer and enable logic. The 'Message Queue' allows the user to stage the messages from the ladder code to go out to each physical communications port without requiring interlocking logic.

The implementation of how the message queue works is slightly different based on whether the request is a read request or a write request.



Write requests will fill the queue much faster than read requests. That's why it is advisable to carefully choose when doing write requests whether to use the "Automatic Poll" feature or to manually send write requests only when needed (data to write has changed). When designing a system, it is important to know the total time it takes to send a request and get a reply for each target device. The Poll time should be longer than this time. The longer the poll time can be, within tolerance of the application, the better the overall network performance. So for efficiency in programming and for the best possible performance for the system, conservative poll rates should be used when utilizing the "Automatic Poll" feature.

There is also a "Poll offset" field in the communications instructions. This helps prevent the instructions from being queued all at the same time. When the CPU project starts, there is a master timer that begins. The ladder scan will look to see if the instruction is enabled. If it is enabled, it will begin the Automatic Poll timer at the specified poll offset value from the master time clock.

Message Queue

If the application requires more explicit, orderly control of each message sent to the devices, turn off the "Automatic Poll" feature. Using the instruction's status bits, logically control each message as required.

All of the above explains how messages get into the "queue". There are several factors involved with how each queue (1 for each physical port) is emptied.

- Serial port queues: The serial port queues empty slower than the Ethernet port queues, not just because of the hardware speed itself but because of the nature of serial communications. Each request sent must wait for a response or a timeout (whichever comes first). Once the reply is received for a request or a timeout has occurred, the next item in the list can be sent. So the response time of the slave devices on the network will largely affect the speed at which the queue fills and empties.
- Ethernet port queues: The Ethernet port queue can empty faster because when sending requests to multiple devices, the CPU does not have to wait on a response from one device before sending a request to another device due to the inherent nature of the Ethernet hardware. However, sending multiple requests to the same Ethernet device does necessitate that the CPU waits for a response from the first request before sending another request to that same device.

Another difference in the Ethernet port queue versus the Serial port queue spawns from the TCP 'connection' based behavior of Modbus TCP. If a TCP connection is lost to a device and there are still requests in the queue for that device, those requests will be dropped from the queue. There are three ways this can happen:

1. If a TCP timeout occurs (server device fails to respond within specified timeout value), the TCP connection is lost.
2. If the server device closes the connection, then all of the requests will be dropped.
3. And, finally, if all rungs with communications instructions to a device are disabled for five seconds, the CPU will drop the TCP connection for that device in order to free up valuable resources that could be used elsewhere in the system.

This is another factor that should be considered when designing the system. If it is imperative that no message be lost when communicating to a device, each instruction should be explicitly handled one by one (interlocking logic).

EtherNet/IP for the Productivity Series

Terminology Definitions

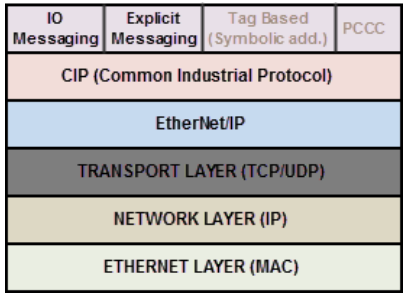
A lot of terminology associated with EtherNet/IP is not always clear. Some of these terms are listed below along with their respective definitions.

- Scanner: This is the term used to describe the device that initiates the EtherNet/IP sessions. The Scanner is sometimes referred to as the "Originator" as well. In more standard Ethernet terms, the Scanner would often be called the "Client".
- Adapter: This is the device that responds to the EtherNet/IP communications that are initiated by the Scanner. The Adapter is also known as the "Target" as well. Typically, the Adapter is an Ethernet "Server".
- Object: In EtherNet/IP, an Object is a representation of a defined set of Ethernet connections, behaviors, services and data attributes. There are standard objects and there are custom defined objects as well. See Object Modeling example below.
- Class: A Class is a set of Objects that are related in some fashion. See Object Modeling example below.
- Instance: An Instance is an actual, usable manifestation of an Object. See Object Modeling example below.
- Attributes: Attributes are the specific items within an Object Class. The category of Attributes should be the same for all Instances of an Object but the actual Attribute itself might vary. See Object Modeling example below.
- Connection Point: A Connection Point value is the "Class Code" reference for a data block. This value is required for access to input and output data in IO Messaging. It is typically defined for each input and output data block by the Adapter device manufacturer.
- IO Messaging: IO Messaging (also called "Implicit Messaging") is a method of reading and writing blocks of data without defining the Connection Point and size for each block transfer. The Connection Point, size and transfer rate (RPI) are defined at the beginning and then the data blocks are transferred at the specified intervals.
- Explicit Messaging: This method of reading or writing data requires that each message defines the type of data and size of data needed for each request.

Object Modeling Example:

- Class ------- Definition of Automobile
- Attributes -- Make, Model, etc...
- Object ------ A Ford Mustang
- Instance ----Sally's Ford Mustang

Network Layer Chart



The diagram above illustrates the OSI seven layer model and how EtherNet/IP fits into this model. In general, there are three basic layers for sending and receiving data in the EtherNet/IP protocol:

- EtherNet/IP layer (Register Session, etc...)
- CIP layer (CIP Forward Open, etc...)
- The uppermost layer,which contains several different types of messaging.

The ODVA specification defines many different types of messaging that reside on the CIP layer. Two types of messaging supported in the phase 1 release of the Productivity3000® EtherNet/IP protocol are IO Messaging and Explicit Messaging. IO Messaging is accomplished through a Class 1 Connection and Explicit Messaging can be accomplished through a Class 3 Connection or an Unconnected Message.

Tag Based Messaging (used for reading and writing values to Allen Bradley Control and ComCPUtLogix PLCs) and PCCC (used for reading and writing values to Allen Bradley MicroLogix and SLC PLCs) are planned for subsequent phases of this protocol.

EtherNet/IP Data

When doing IO Messaging, the data that is transported is defined as "Input" data and "Output" data. Don't confuse this type of data with what most PLCs define as Input data and Output data. In most PLCs, Inputs are typically associated with an Input module that reads point from real word devices. Outputs are typically associated with an Output module that turns off and on real word devices.

In IO Messaging, Input data is data that is sent from the target device back to the Originator or to multiple devices that are listening (multicast messages). Output data is data that is sent from the Target device. This data may or may not be connected to real word devices. That is completely dependent upon the Adapter device. For example: When the Productivity3000 is configured as an EtherNet/IP Adapter device, the Input data and Output data is defined in internal data arrays and does not directly tie to any Input and Output point to the real world. If it is desired to tie these array elements to real word devices, that must be accomplished in code by Copy commands (or other instructions).



NOTE: *The Scanner (originator) in the P3000 will only accept messages from an Adapter (target) device that the Scanner has established a connection to.*



NOTE: *The Adapter (target) in the P3000 will respond back to a Scanner (originator) in the method (Multicast or Unicast) that is sent in the forward open message from the Scanner (originator).*

Class 1 and Class 3 Connections

What are they and how are they best used?

- Class 1 Connection is the transport mechanism that IO Messaging uses to send data. The basic concept is that data is sent in one direction: the Originator sends Output data in a Unicast UDP message to the Target and the Target sends Input data in either a Unicast message back to the Originator or Multicast UDP messages to multiple devices. The Input data and Output data messages have no relationship to each other. This method works well for Remote I/O type data and is very efficient due to little overhead and reduced handshaking messages on the wire. Class 3 Connection is one of the mechanisms that Explicit messaging uses. Class 3messaging uses TCP messages unlike Class 1. Each Class 3 request has a header that defines the type of data requested as well as the size requested. It allows for more flexibility in messaging but does create additional overhead.



NOTE: *Explicit messaging can be accomplished with unconnected messages as well for more infrequent requests. Explicit messaging is a slower performing method of communications but it typically allows for more flexibility and control when the situation requires it.*

When can the P3000 CPU use Class 1 or Class 3 Connections?

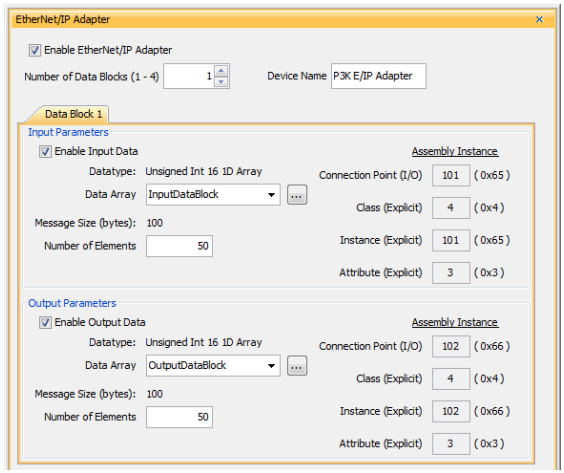
- Class 1 and Class 3 Connections can be accomplished with the Productivity3000® CPU as an Adapter or as a Scanner or both simultaneously.

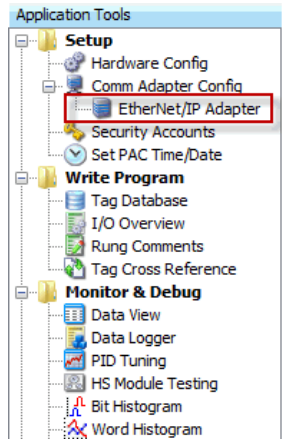
How many connections can the P3000 support for Ethernet IP?

- 4 - TCP
- 4 - Ethernet IP
- 4 - CIP (Up to 4 CIP connections are allowed per Ethernet IP connection. Therefore, if one device can support 4 CIP connections then you can have up to a total of 16 CIP connections using 4 devices)

Example Setup: Productivity3000 as EtherNet/IP Adapter

The Adapter setup is accomplished through the EtherNet/IP Adapter setup under the Comm Adapter Config section of the Setup menu as seen on right.

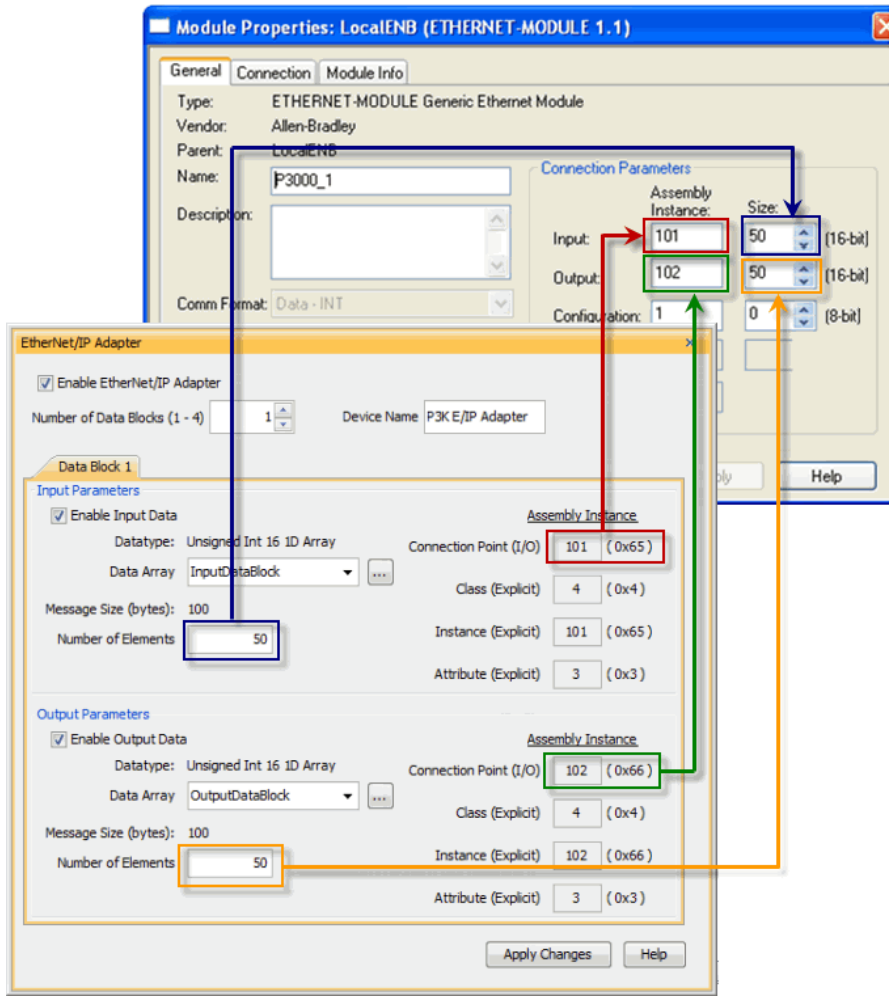




When the EtherNet/IP Adapter is selected from the menu the window shown here will open.

Fill in the required parameters and once configured these parameters will be used to configure the Scanner side as shown in the examples below. The first example shows how to setup a Class 1 IO Message connection from a 3rd party EtherNet/IP Scanner device (an Allen Bradley PLC).

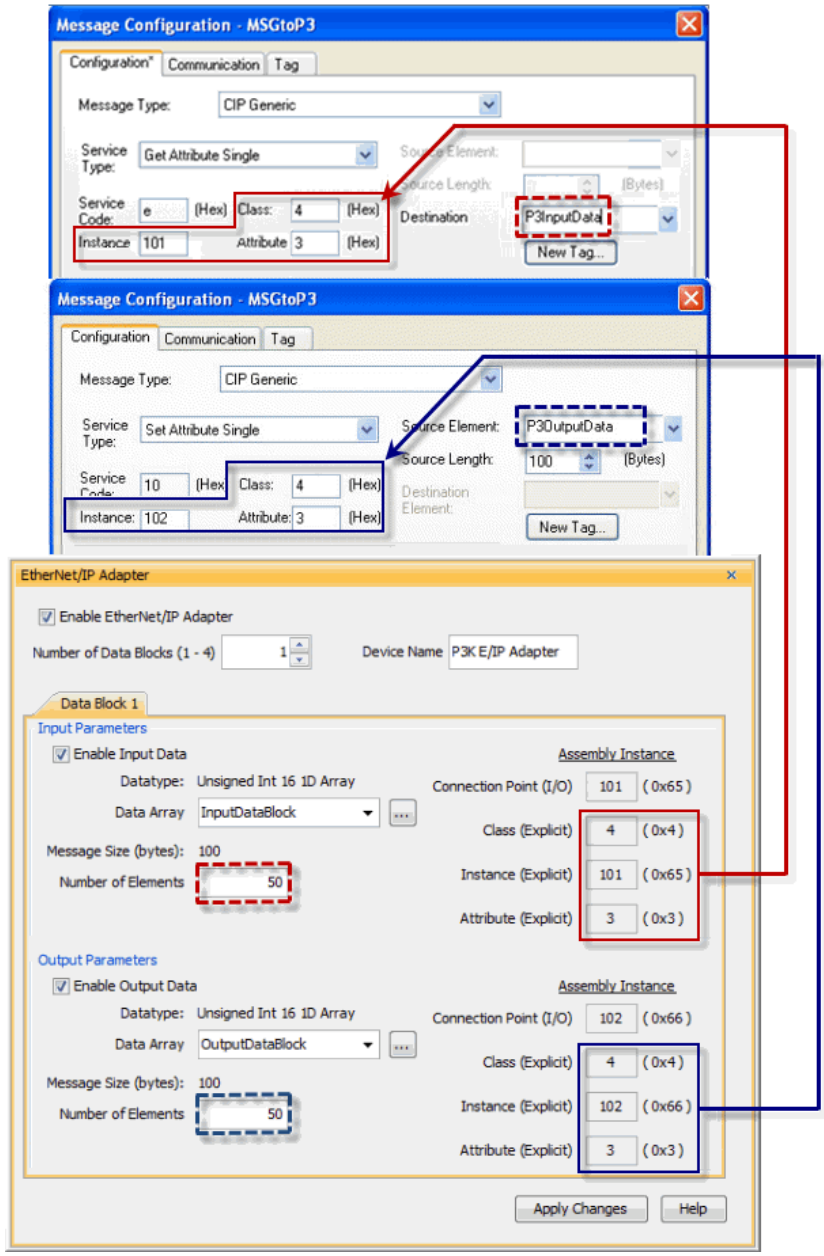
RS Logix5000 Control/CompactLogix Generic Ethernet Device Setup



The following example shows how a Class 3 Explicit Message might be accomplished from a 3rd party device (Allen Bradley PLC). As you can see the Input Data must be retrieved in one connection or message and the output data in another. Remember that Class 3 messaging is not as efficient in protocol messaging as Class 1 but it does allow for granular control.

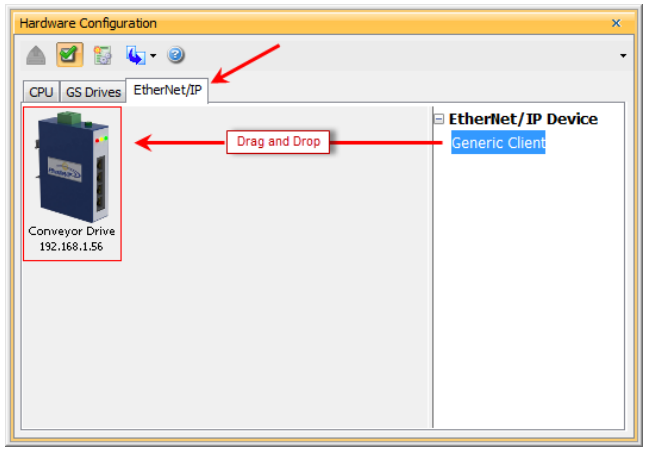
NOTE: *In this example, size configuration is not shown on the Scanner side. The tag created for the Destination must be large enough to contain the data requested (shown with dashed boxes).*

RS Logix5000 MSG instruction for Control/CompactLogix



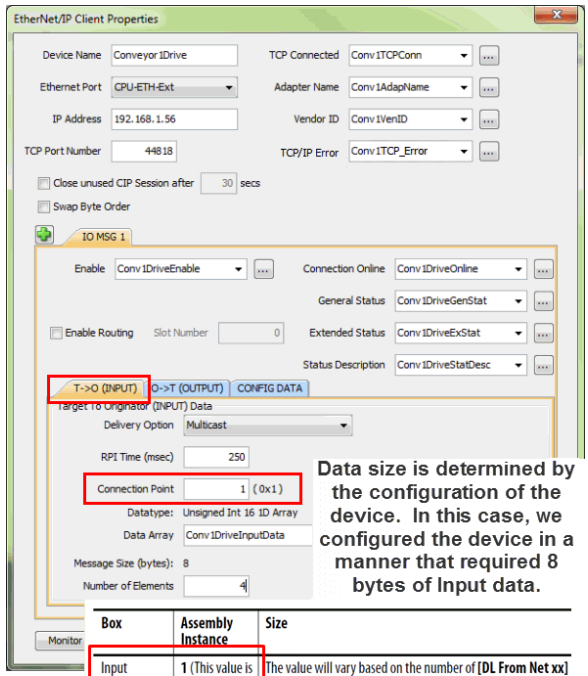
Example Setup: Productivity3000® as EtherNet/IP Scanner

This example shows how to connect the Productivity3000 Scanner function to an EtherNet/IP adapter device using Class1 IO Messaging. First, create an EtherNet/IP device in the Hardware Configuration as seen below:



Configure the parameters to match the settings of the Adapter device. The image on right shows the setup of the Input data.

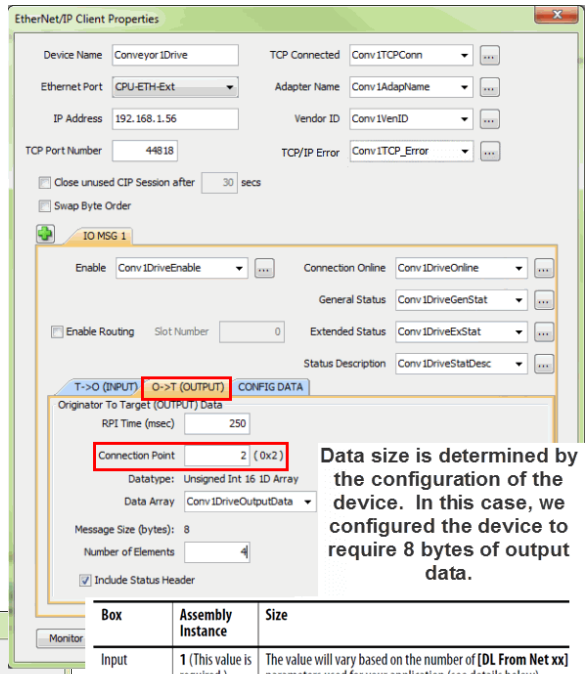
The size, in this case, is dynamic to the configuration of the device. For this particular example, we configured the device in a manner that allows it to publish 8 bytes of data for Input. Many devices will have a fixed configuration that should be published in the manufacturer's documentation.



Data size is determined by the configuration of the device. In this case, we configured the device in a manner that required 8 bytes of Input data.

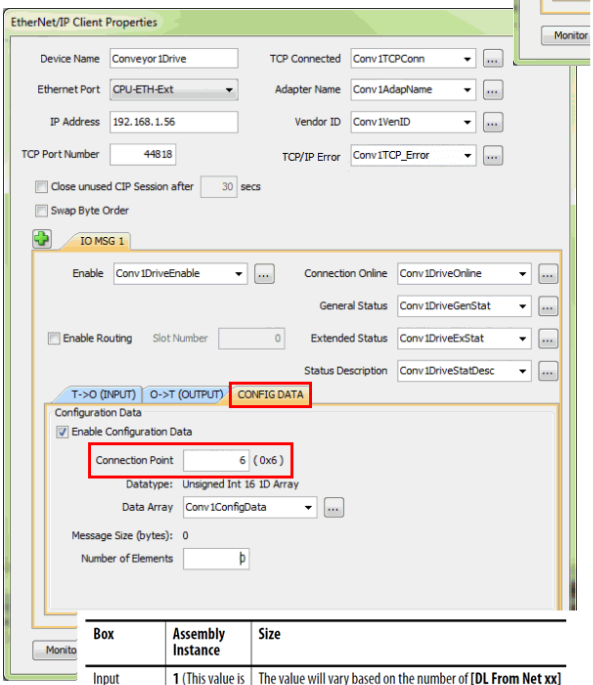
Box	Assembly Instance	Size
Input	**1** (This value is required.)	The value will vary based on the number of **[DL From Net xx]** parameters used for your application (see details below).
Output	**2** (This value is required.)	The value will vary based on the number of **[DL To Net xx]** parameters used for your application (see details below).
Configuration	**6** (This value is required.)	**0** (This value is required.)

The Output data must also be configured. Its data is also dynamic based upon the configuration. In our example, we configured the device in a manner that caused it to require 8 bytes of Output data.



Data size is determined by the configuration of the device. In this case, we configured the device to require 8 bytes of output data.

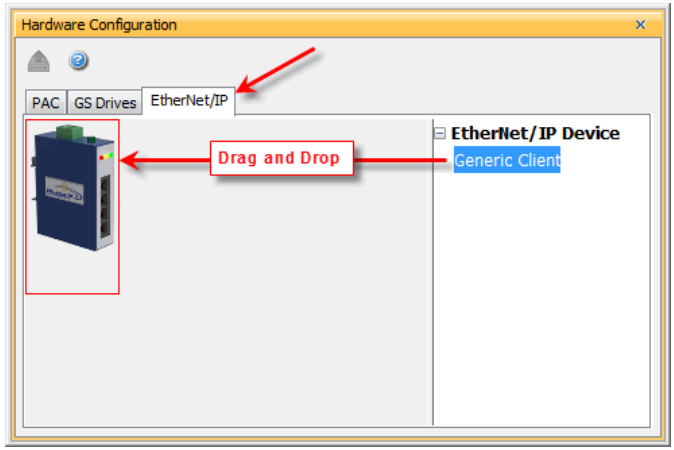
Box	Assembly Instance	Size
Input	**1** (This value is required.)	The value will vary based on the number of **[DL From Net xx]** parameters used for your application (see details below).
Output	**2** (This value is required.)	The value will vary based on the number of **[DL To Net xx]** parameters used for your application (see details below).
Configuration	**6** (This value is required.)	**0** (This value is required.)

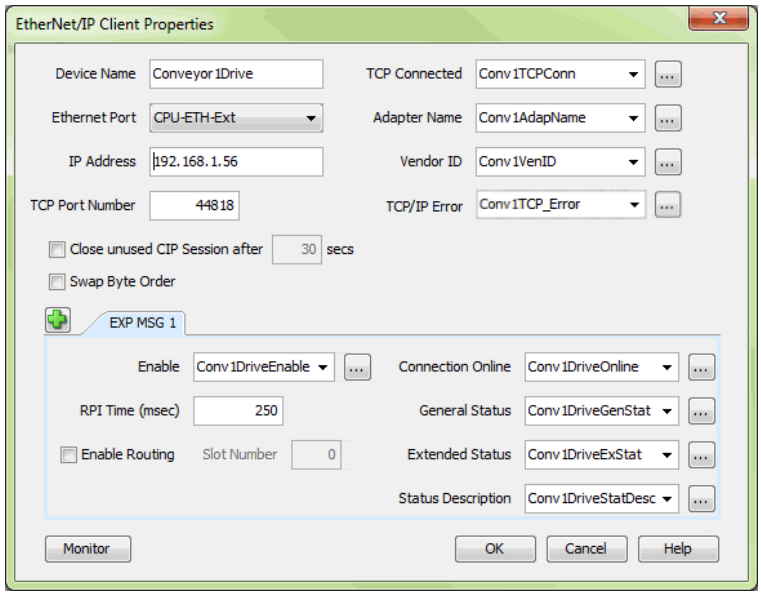


Box	Assembly Instance	Size
Input	**1** (This value is required.)	The value will vary based on the number of **[DL From Net xx]** parameters used for your application (see details below).
Output	**2** (This value is required.)	The value will vary based on the number of **[DL To Net xx]** parameters used for your application (see details below).
Configuration	**6** (This value is required.)	**0** (This value is required.)

The image on left shows the setup for the Configuration data. The Configuration data, for most devices, is a fixed size. Some devices will require that the Configuration data Connection Point be included in the Forward Open message (as shown on left) even if the size is 0. Some devices will require that the Configuration data Connection Point not be in the Forward Open and the checkbox option in the image below would need to be de-selected.

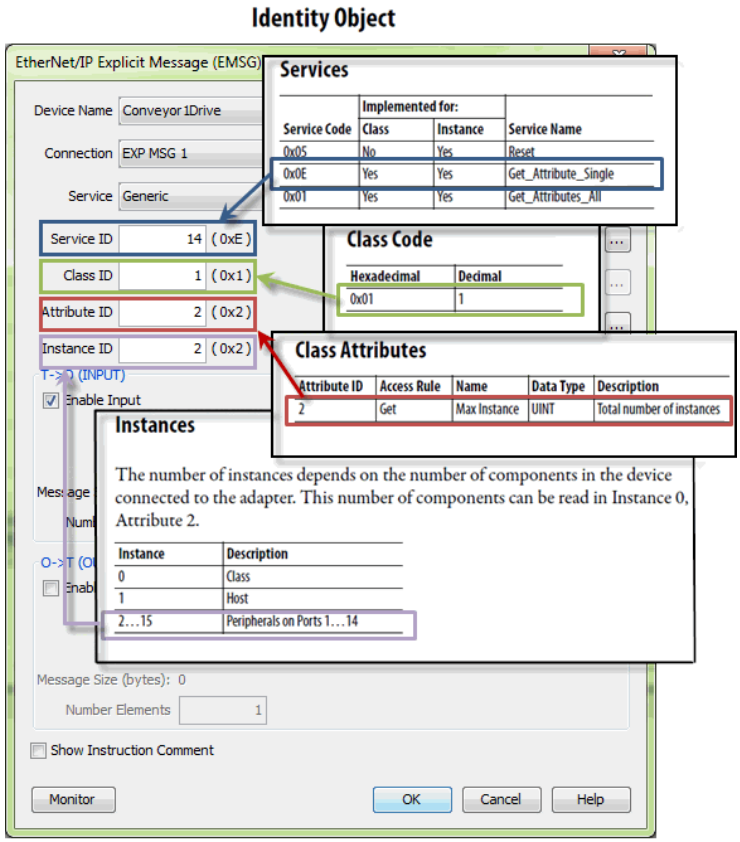
The following example shows how to connect the Productivity3000® Scanner function to an EtherNet/IP adapter device using Class 3 Explicit Messaging. As with IO Messaging, an EtherNet/IP device must be created in the Hardware Configuration as seen below:





Explicit Messages can be performed in 2 ways: Unconnected or Connected (Class 3). The advantage of using Unconnected messaging is it allows more discrete control of each request. The disadvantage of Unconnected messaging is that Unconnected messages have a lower priority and will take longer to get serviced on some devices. Connected messages get serviced faster since there is a connection established to the device. If Connected messaging is desired, create an Explicit Message tab as shown in the image above. If Unconnected messaging is desired, do not create an Explicit Message tab. Only fill out the information in the upper portion of the EtherNet/IP Client Properties window.

Once the desired parameters have been entered, the device may now be referenced in the Explicit Message Instruction. If Unconnected messaging has been selected, choose the Unconnected MSG option in the Connection drop down box. If Connected messaging has been selected, choose the Explicit Message that was configured in the EtherNet/IP Client Properties window in the Connection drop down box. The rest of the settings should be matched to the specifications documented by the manufacturer. An example for requesting the Identity of a device is shown below. The data array configured for this function must be sufficient in size to hold the returned data from the device for this object. Data can also be written to the device if it supports an object for this purpose. If data is being written, enable the Output selection and specify the data array and size required by that device's object.



Troubleshooting Tips:

1. Use the diagnostic tags in the Hardware Configuration and Explicit Message Instruction:
    - As explained previously in the Network Layer Chart section, there are multiple layers of messaging involved with EtherNet/IP. If it appears that the Productivity3000 is not communicating with another EtherNet/IP device, there are diagnostic tags available to narrow down which layer of the protocol is preventing successful communications.

a. At the TCP layer, there is a TCP Connected field that will expose the status of the TCP/IP connection when a tag is populated in this field.

b. There is an Adapter Name field for a String tag and a Vendor ID field for an Integer tag. Both of these fields can help to identify whether the Productivity3000 is connected to the correct device or not.

c. At the CIP layer, there is a Connection Online field for a Boolean tag.

d. There are three additional fields to help determine why the CIP session might not be successful: General Status for an Integer tag, Extended Status for an Integer Data Array and Status Description for a String tag.

2. Use the TCP connected tag:

- Step 1 is to check the TCP Connected tag. If the connection has been enabled (by turning on the tag configured in the Enable field or triggering an Explicit Message instruction with an Unconnected MSG specified) and the TCP Connected tag is not true, check the following items:

  a. Cabling. Ensure that all of the cables are connected and in good shape. In most cases, the Ethernet port that the cable is connected to should indicate a Link Good LED. Ensure that any interim Ethernet switches are powered up and functioning and that the end device is powered up and functional.

  b. IP address and correct subnet. Check that the IP address entered into the IP Address field is the correct address for the device that you are connecting to. Also check that the EtherNet/IP device's IP address and subnet mask is compatible with the IP address and subnet mask of the Productivity3000. If there are any routers in between the two, ensure that a proper default gateway that matches the router's IP address is configured. If you are unfamiliar with proper IP addressing and subnet configuration, consult with the network administrator for guidance.

  c. TCP Port number. The default listening TCP port number for EtherNet/IP is 44818. Check that the target device is listening on this specific port number. If it is not, change the value in TCP Port Number field to the appropriate value. If there are interim router devices that are using port forwarding, ensure that the router is properly configured for this setup.



NOTE: *Attempting to do IO Messaging across routers (different subnets) is unlikely to be successful. IO Messaging uses multicast messaging in many cases and the Port number is not necessarily fixed when the IO Messaging is established (the Forward Open message has the ability to 'negotiate' the port number used for the IO Messages).*

  d. Adapter Name and Vendor ID. If the network contains many EtherNet/IP devices and these devices may not necessarily be connected to the Productivity3000, it may be a good safeguard to check the Adapter Name and Vendor ID returned and verify that these devices are the correct devices to connect to.

3. Use the Connection Online and Error tags:

- If the TCP Connected tag is true and the Adapter Name and Vendor ID look correct, the next tags to look at are the Connection Online, the General Status, the Extended Status and the Status Description.
- If the Enable tag is true and the Connection Online tag is not true, check the General Status value along with the Extended Status value(s) and the Status Description. If the General Status value and the Extended Status value(s) are part of the defined errors from the ODVA specification,

the Status Description should also return a more descriptive String. Once these errors are known, it may possible to very simply make the adjustment in the settings to correct the issue. If it is not obvious from the description, first check the manufacturer's documentation for corrective action in this particular scenario.

- If the manufacturer's documentation doesn't give corrective action, check the EtherNet/IP Error Code List in this chapter for possible solutions.



NOTE: *This may not always solve the problem as each device manufacturer may publish the error for slightly different reasons.*

- If the Connection Online tag is true and the data being received is different than what is expected, verify that the correct Connection Point values and/or Class, Instance, Attribute values are configured. There may be multiple areas of available data in that device. Verify that the correct data types are being used for both sides. If the data types are mismatched, this may make the data 'appear' to be incorrect.
- Another great tool that can be used is Wireshark. Wireshark is a free network analyzer tool that can be downloaded from www.wireshark.net .



NOTE: *Using this tool implies some knowledge of how networking protocols function. Using Wireshark will also require that you have a true Ethernet hub (not an unmanaged switch) or a managed switch with Port mirroring capability.*

You may also use the following basic steps to check your Ethernet IP Setup.

Ethernet IP I/O Message Troubleshooting:

1. Does the IP Address set up in the Scanner match the Adapter IP Address?
2. Is the enable tag entered into the Scanner turned ON?
3. Does the connection point entered into the I/O Message Data Block match the connection point of the Adapter?
4. Does the number of elements match the Adapter?
5. Does the data type match the Adapter?
6. Steps 4 & 5 are important because the number of bytes being read from or written to the Adapter have to match the Adapter bytes allocated.

Ethernet IP Explicit Message Troubleshooting:

1. Does the IP Address set up in the Scanner match the Adapter IP Address?
2. Is the enable tag entered into the Scanner turned ON when not using the Unconnected MSG connection type?
3. Make sure the logic for the EtherNet/IP Explicit Message (EMSG) is TRUE so the instruction is enabled.
4. When using Get or Set single attributes in the Service field make sure the Instance ID matches the Instance ID of the Adapter.
5. When using Generic in the Service field make sure the Service ID, Class ID, Attribute ID and Instance ID match the Adapter settings.
6. Does the number of elements match the Adapter?
7. Does the data type match the Adapter?
    - Steps 6 & 7 are important because the number of bytes being read from or written to the Adapter have to match the Adapter bytes allocated.

ProNET

Productivity Network (ProNET) provides the ability to share data with other P-Series CPU's, This can easily be accomplished using the Productivity Network (PNET) setup in the Hardware Configuration window used to join a data sharing network consisting of other P-Series controllers.

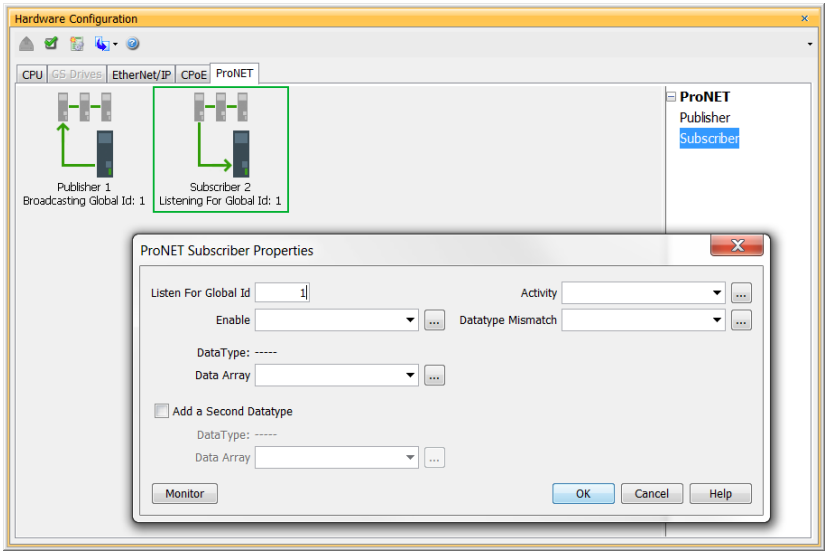
Each member of the data sharing network receives data from all of the other P-Series controllers on that data sharing network. Each node can optionally send data to the other nodes of the data sharing network by electing to "publish" data.

The ProNET configuration uses UDP broadcast packets to publish the blocks of data to the network. One caveat with the use of broadcast packets is that it limits the scope of the shared data network to the local broadcast domain.

ProNET uses the verbs 'publishing' and 'subscribing' to describe how the controller data is exchanged with other P-Series controllers on the data sharing network.

Publishing is analogous to sending data, and is done only if ProNET is configured to 'publish' one or more of its assigned tags. If so configured, the P-Series controller will broadcast a packet that contains the data from the selected tags.

Subscribing is analogous to receiving data, and is accomplished by 'subscribing to' a publisher's global ID of any P-Series CPU on the data sharing network set up to publish its data.



The ProNET configuration works with a 1D array tag(s) that can contain up to 65535 elements, however you are limited to 32 total 32-bit elements, 64 total 16-bit elements, or 128 total 8-bit or Boolean elements of data per publisher array data type. These tags provide the local storage for the data sent and received over the data-sharing network.



NOTE: *The message size for each data type is limited to 128 bytes regardless of the defined array size.*

Data Type	Number of Elements
Boolean	128
Integer 8-Bit	128
Integer 16-Bit	64
Integer 32-Bit	32
Integer 64-Bit	32

When the input logic to the ProNET configuration is Enabled, it operates at a fixed rate of 10 times per second (100ms). The instruction will publish all of the elements of the array that it is configured to publish, and will process any ProNET nodes that it receives. When the input logic is OFF, (the device is disabled), it DOES NOT publish any of its tags and DOES NOT process any ProNET nodes that it receives.

Custom Protocol over Ethernet Functionality

Besides Modbus RTU, EtherNet/IP, and ProNET the Productivity1000 system has the ability to communicate via Ethernet with other devices using the Custom Protocol over Ethernet (CPoE).

Custom Protocol over Ethernet

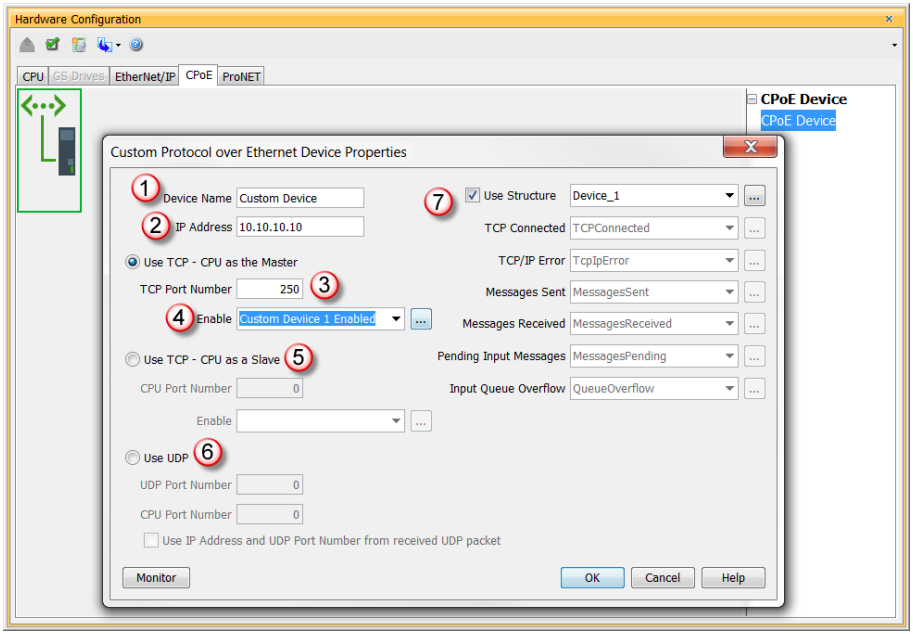
The Custom Protocol is a HEX based protocol used to communicate with devices that do not support one of the other protocols on Productivity1000. There are two steps to initiate communications via the Custom Protocol over Ethernet:

- First you must set up a device in the hardware configuration under the CPoE tab.
- Then you must use the Custom Protocol Ethernet (CPE) instruction to initiate messages.

Hardware Configuration

First you must set up a device to talk to in the CPoE tab of the hardware configuration. This will Require you to:

1. Enter a Device Name
2. Enter the IP Address of the device you wish to communicate with.
3. Enter the port number of the device.
4. Enter an Enable tag to enable the device if using TCP.



5. Choose whether you wish to Use the PLC as the master or the slave device via TCP connection
6. Choose whether you wish to use a UDP connection.
7. Enter tags for status of this device for troubleshooting (Example below shows the Structure method used).

Custom Protocol Ethernet Instruction

Next you must use the Custom Protocol Ethernet instruction in ladder.

1. The instruction can be chosen Receive or Send messages to the Custom Device.
2. The user can choose to use:
   - A table with tags that allow the user to send a specific data.
   - An array tag that is numerical can be used to Send/Receive from.
   - A string tag that contains an ASCII string to be sent or string location to receive characters to.

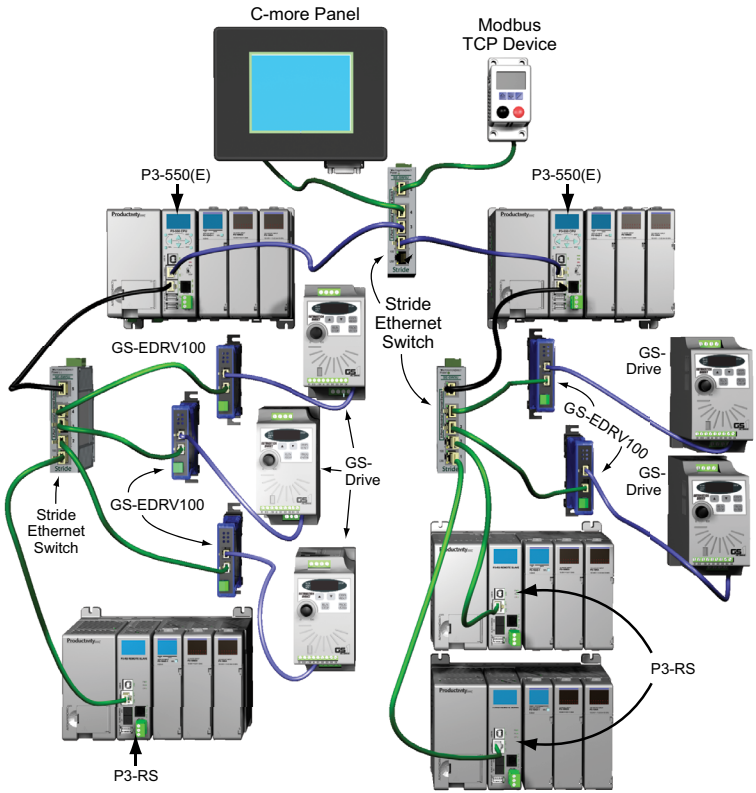
Communications: Remote I/O and GS-Drives

Things To Consider for the design of Remote I/O and GS-Drives

It is important to understand that only one Remote I/O network can be on an unmanaged switch. If two or more Remote I/O networks are mixed into the same physical LAN (local area network), duplicate IP addressing will occur and the system will not function properly. Multiple Remote I/O networks can be used on a managed switch using the VLAN feature to create a virtual separation of the different networks, but multicasting messages are necessary for the network to function properly. Care must be taken when designing a system this way (using a managed switch).

Even if only one Remote I/O network is being used in a facility, it is strongly recommended to keep it on a dedicated network, physically isolated from other networks. As mentioned above, the Productivity3000 Remote I/O network makes use of multi-casting messages and many devices will not function properly in this situation.

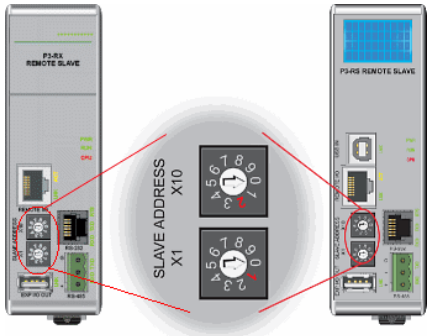
The GS Drive configuration does not use multicasting in its setup but there are some initial UDP broadcast messages that occur upon discovery when initiated from the software and at power up. This should be considered if installing the GS Drive network with other devices.



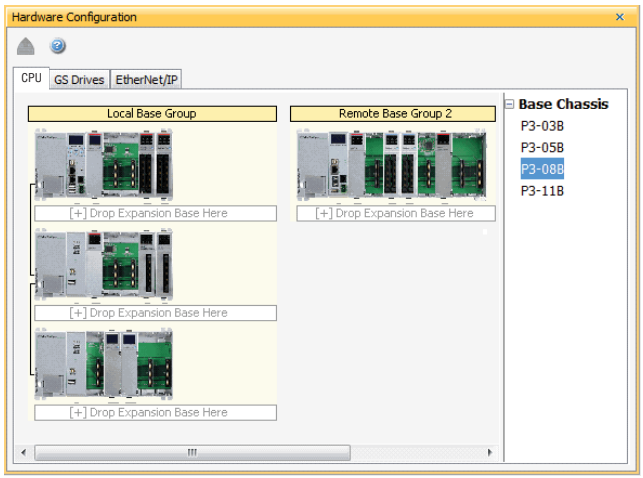
Configuration of Remote Slaves

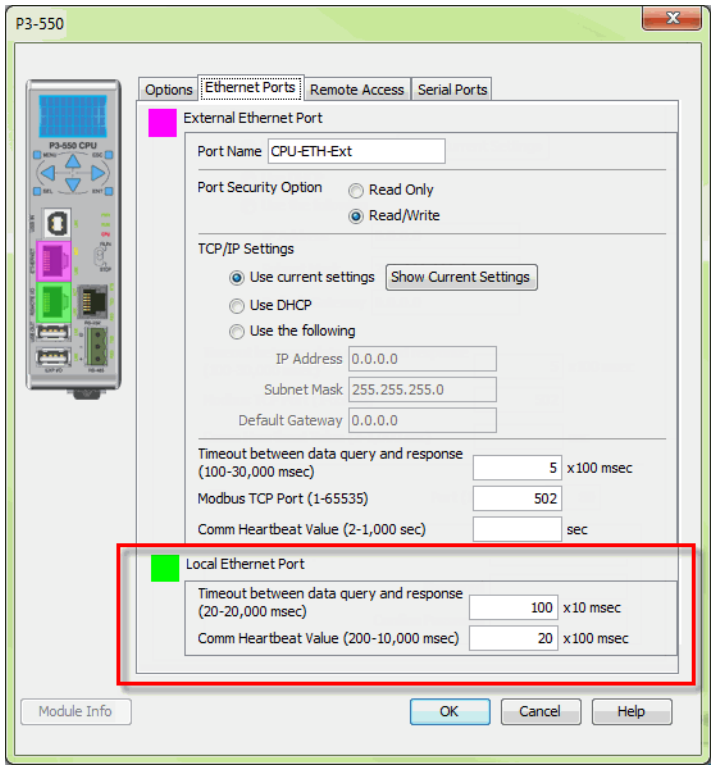
NOTE: *The P3-RS module is discontinued as of 6/20. Please use P3-RX as a replacement.*

The Productivity3000® Remote I/O is very easy to configure. Each P3-RS or P3-RX Remote Slave module's address is set by rotary switches on the front of the module. The X1 switch is used to set the least significant digit and the X10 switch is used to set the most significant digit. So if the X10 switch were set to 2 and the X1 switch were set to 4, the Slave Address of that module would be 24. Valid addresses are 01-99; 00 is not valid. Each slave module must have a unique address and up to 16 slave units are allowed on a single system.



The address rotary switches are only read by the P3-RS/RX at power up. Power must be cycled after an address change for it to take effect. Connect a straight through (patch) Ethernet cable from the front of the P3-RS/RX module to an Ethernet switch. Connect a straight through cable from the P3-550(E) Local Ethernet (Remote I/O) port (lower Ethernet port) to the same switch. Open up the Productivity Suite Programming software and connect to the P3-550(E). Once the software is connected, open Hardware Configuration. Select the "Read Configuration" button in the upper left hand corner of this dialog and the P3-550(E) will automatically discover the slave modules connected to the switch and return all found P3-RS/RX modules and their configurations (bases and I/O modules).

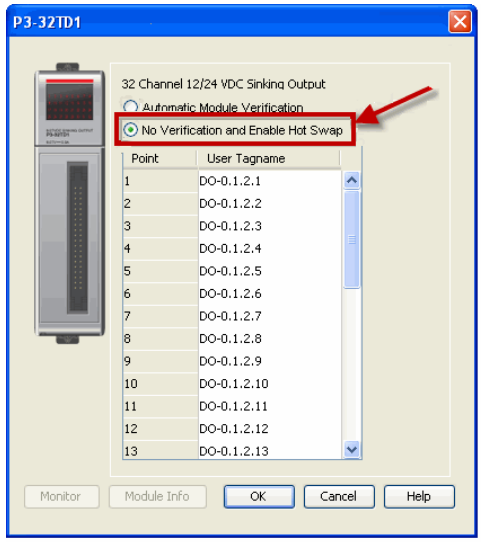


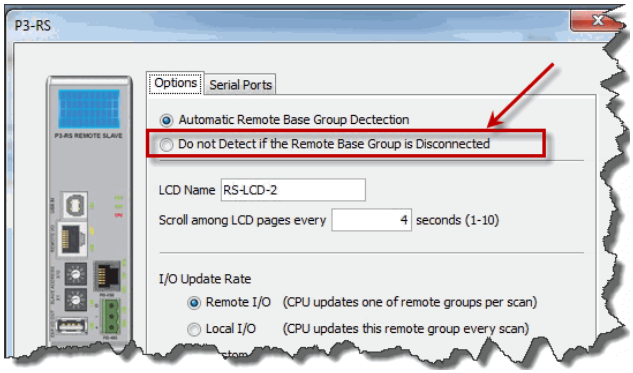


There are two fields that can be configured in regards to connectivity to the slave modules (see the Local Ethernet Port Settings section of this chapter for a more detailed explanation of these settings). The above diagram shows the CPU hardware configuration popup where these settings can be found.

1. Timeout between data query and response: This is the time allowed (in 10 millisecond units) between when the CPU sends a message to the P3-RS/RX and when a response is required. If the CPU does not receive the response within the time specified, the outcome will depend on how the P3-RS/RX and its I/O modules are configured:

CAUTION: IF A TIMEOUT OCCURS AND A MODULE WITHIN A P3-RS/RX BASE OR EXPANSION BASE CONNECTED TO THE P3-RS/RX HAS THE "AUTOMATIC MODULE VERIFICATION" SELECTION ENABLED, THE CPU WILL GO OUT OF RUN MODE AND A CRITICAL ERROR WILL BE GENERATED.





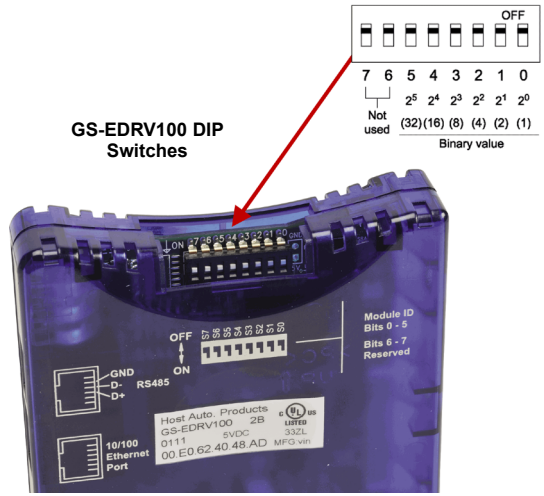
- If a timeout occurs but all of the modules within the P3-RS/RX base or expansion bases connected to the P3-RS/RX have the "No Verification and Enable Hot Swap" selection enabled and the P3-RS/RX module has the "Do not Detect if the Remote Base Group is Disconnected" selection enabled (see above), the CPU will remain in Run and a non-critical error will be generated.

CAUTION: If a timeout occurs and the P3-RS/RX module has the "Automatic Remote Base Group Detection" selection enabled, the CPU will go out of run mode and a critical error will be generated.

2. Comm Heartbeat Value: (previous page graphic) This value is used to help the P3-RS/RX determine that the P3-550(E) is no longer communicating to it. If the P3-RS/RX module does not receive a message from the P3-550(E) within the time frame specified in the "Comm Heartbeat Value" field in the P3-550(E) configuration window, the P3-RS/RX module will turn off all of its outputs.

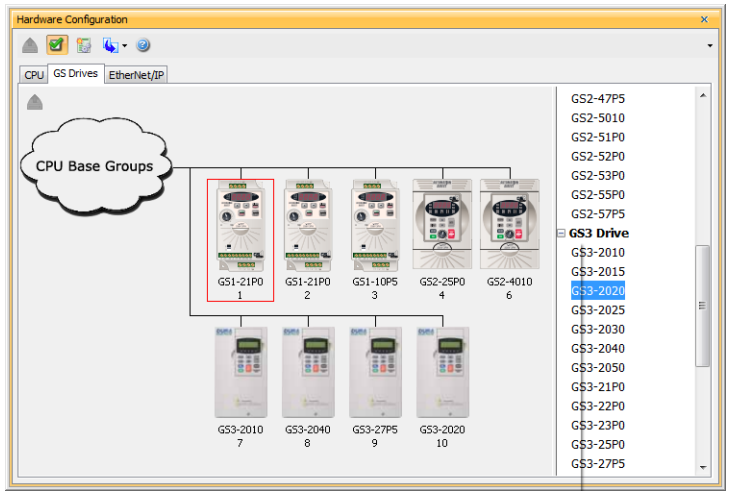
Configuration of GS-Drive Connections

GS Drive connections are set up in a similar manner as the Remote Slaves. Set a unique address for each GS-EDRV100 using its DIP switches. Or set the DIP switches to 0 and select the address using NetEdit (free download at AutomationDirect.com). 01–64 are valid addresses for a GS-EDRV100 in a Productivity3000® system. Since the DIP switch settings can only represent 00-63, setting a GS-EDRV100 to address 64 must be done using NetEdit.

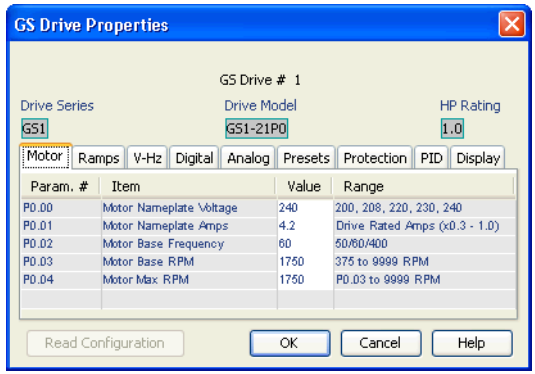


After the GS-EDRV100 modules' addresses have been set, be sure to connect the serial cable that comes with the GS-EDRV100 to the GS-Drive serial port. The GS-EDRV100 will automatically configure the GS-Drive serial port to the correct settings. Once the GS-EDRV100 is properly addressed and connected to the GS-Drive, connect a straight through (patch) Ethernet cable from the Ethernet port of the GS-EDRV100 to an Ethernet switch. Connect a straight through cable from the P3-550(E) Local Ethernet Port (Remote I/O) to the same switch.

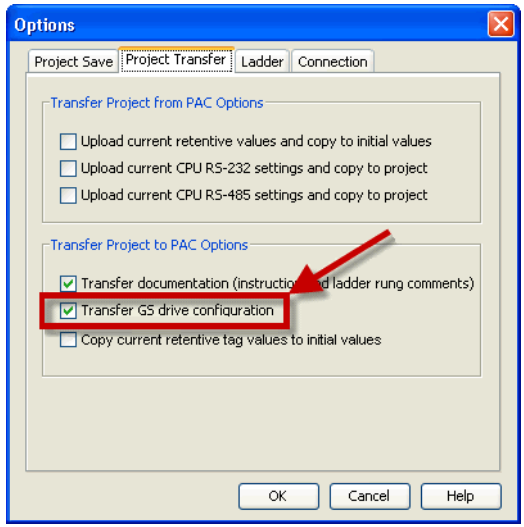
Open the Productivity Suite Programming software and go online with the P3-550(E). Select Setup and then Hardware Configuration. Select the "Read Configuration" button in the upper left hand corner of this dialog and the P3-550(E) will automatically discover all of the GS-EDRV100s connected to the switch and display all found GS-Drives.



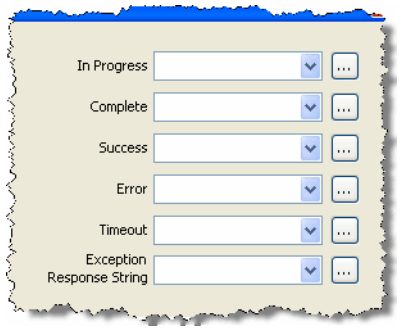
Once the drives have been discovered, the configuration of each drive can be read and written from the programming software.



To allow the P3-550(E) to automatically write the drive parameters on each CPU project transfer and when the CPU is powered up, a setting must be configured in the P3-550(E) project. Go to Tools and Options and select the "Project Transfer" tab. Select the "Transfer GS drive configuration" as shown below. Drive parameters are ONLY transferred to the GS Drive at project transfer or at boot up of the CPU.



To monitor the status of the connection between the P3-550(E) and the GS-EDRV100 modules, use the status bits of the GS Read and GS Write instructions as shown below. If a Timeout occurs or an error is received, this can be monitored in the ladder code and appropriate action can be taken.



The Communications Heartbeat function is configured differently for the GS Drives than the Remote Slaves. Primarily because, as mentioned previously, there are two possible communication paths that could be lost:

- P3-550(E) to GS-EDRV100.
- GS-EDRV100 to GS drive.

To configure the GS Drives to detect and react to loss of communications, there a set of parameters that should be configured in the drive. The example below shows the parameters for a GS1, 2, or 3 series drive.

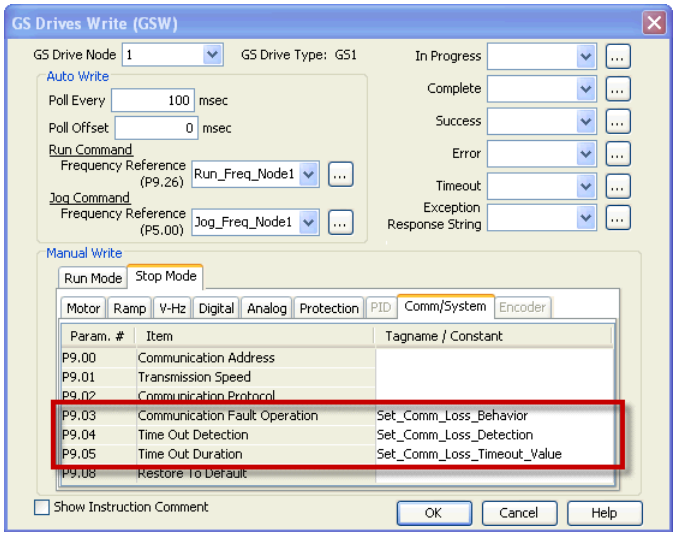
- Parameter P9.03 determines what the drive will do when it detects loss of communications.
- Parameter P9.04 enables the transmission loss detection feature.
- Parameter P9.05 determines the amount of time the drive will wait for a transmission before assuming that the link is lost and react according to how parameter P9.03 is configured.

Communications Parameters

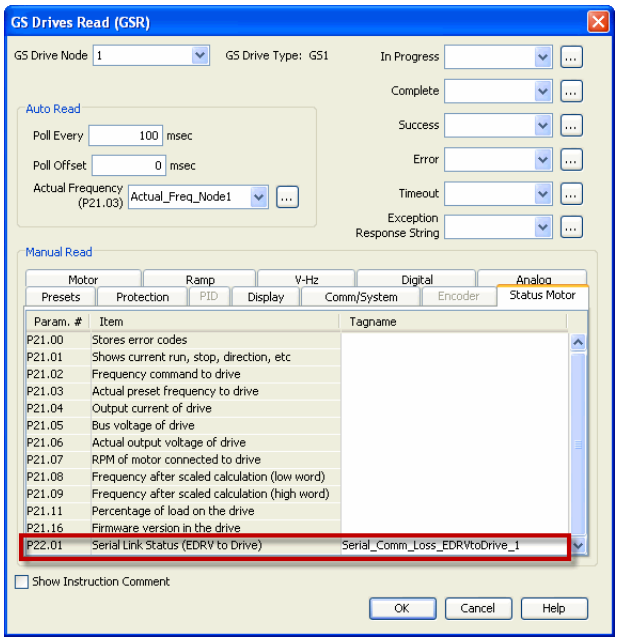
GS2 Parameter	Description	Range	Default
P9.00	Communication Address	01 to 254	01
P9.01	Transmission Speed	00: 4800 baud 01: 9600 baud 02: 19200 baud 03: 38400 baud	01
P9.02	Communication Protocol	00: Modbus ASCII mode 7 data bits,no parity,2 stop bits 01: Modbus ASCII mode 7 data bits,even parity,1 stop bit 02: Modbus ASCII mode 7 data bits,odd parity,1 stop bit 03: Modbus RTU mode 8 data bits,no parity,2 stop bits 04: Modbus RTU mode 8 data bits,even parity,1 stop bit 05: Modbus RTU mode 8 data bits,odd parity,1 stop bit	00
P9.03	Transmission Fault Treatment	00: Display fault and continue operating 01: Display fault and RAMP to stop 02: Display fault and COAST to stop 03: No fault displayed and continue operating	00
P9.04	Time Out Detection	00: Disable 01: Enable	00
P9.05	Time Out Duration	0.1 to 60.0 seconds	0.5
◆P9.07	Parameter Lock	00: All parameters can be set and read 01: All parameters are read-only	00

The GS-EDRV100 reads these configured parameters and if they are configured for detecting communications loss, it will also monitor for loss of communications on the Ethernet side. If communications are lost on the Ethernet side, the GS-EDRV100 will shut down the GS Drive.

It is very important to note that if the communications loss feature is enabled; either a GS Drive Read or GS Drive Write instruction needs to be configured to communicate to the GS-EDRV100 and GS Drive at a poll rate that will prevent the GS-EDRV100 and GS Drive from detecting a loss of communication.

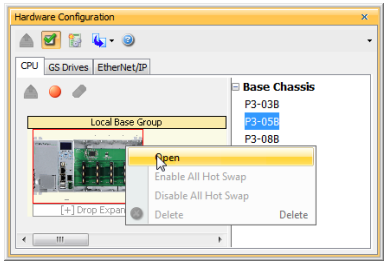


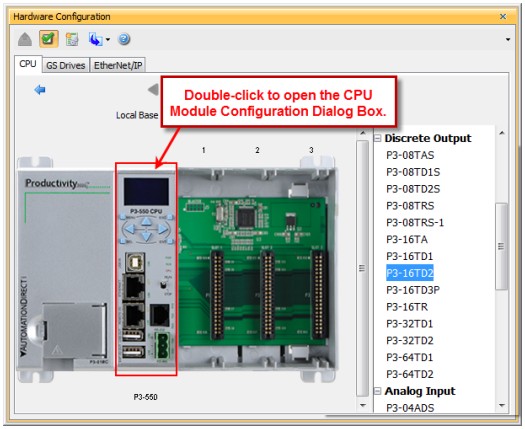
There is also a parameter (P22.01) that can be monitored to check the health of the serial connection between the GS-EDRV100 and the GS Drive. This parameter can be monitored in the ladder code and appropriate action taken if serial communications loss is detected.



Communications: Port Configuration

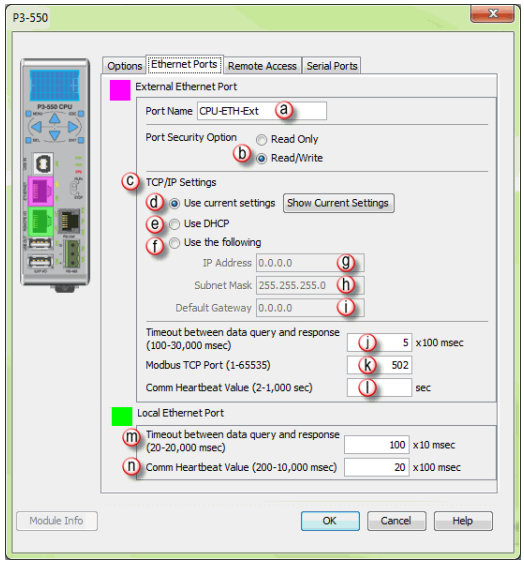
The Communications Port Configuration for any module containing comm ports is accessed from the Hardware Configuration window. For example, to access the P3-550(E) communications port configuration, first select the Local Base





Group from the Hardware Configuration window by double left-clicking the Local Base Group or by right-clicking the Local Base Group and selecting Open from the drop down menu as seen above.

Then select the P3-550(E) by double left-clicking the CPU or by right-clicking the CPU and selecting Open from the drop down list as seen above. This will display the P3-550(E) configuration window seen here.



Although the following descriptions will focus on the P3-550(E) communications ports, the settings also apply to any other module containing these ports (P3-530, P3-RS, P3-RX).

Communications: Port Configuration

Ethernet Configuration

Ethernet Ports: There are two 10/100Base-T Ethernet ports on the P3-550(E) CPU.

- External Ethernet: The upper Ethernet port is referred to as the "External Ethernet Port". This port can connect to Modbus TCP Client devices, Modbus TCP Server devices and PCs running the Productivity3000 programming software.
- The External Ethernet Port is configured with an IP Address, Subnet Mask and Default Gateway, allowing it to function seamlessly on a typical LAN network.
- Local Ethernet: The lower Ethernet (Remote I/O)port is referred to as the "Local Ethernet Port". This port functions as a Productivity3000 Remote I/O Client. The Local Ethernet Port is not configurable and each CPU Remote I/O network should be located on its own physical or logical network.



NOTE: *Two CPU Remote I/O networks cannot co-exist on the same LAN.*

External Ethernet Port Settings

ⓐ Port Name: Allows the entry of a unique Name for the External Ethernet Port. This Name is referenced in the Communications instructions (MRX, MWX, RX, WX) to select the Port to send the request from.

ⓑ Port Security Option: This Option can be used as a simple Security measure to prevent Modbus TCP write requests from being accepted by the CPU. To allow Reads and Writes, select Read/Write.

ⓒ TCP/IP Settings: The IP Setting of this Port may be changed in several ways:

- The Settings may be entered manually in the Choose CPU tool in the Productivity Suite programming software. This allows the user to make changes to the IP to allow connection by the computer running the Productivity Suite programming software. Changes are sent using Multicast Messages.
- The Settings can be saved as part of the project. This must be Enabled in the P3-550(E) Hardware Configuration Settings by selecting Use the Following (discussed on Item f below). If handled this way, the Settings stored in the project will take effect at Project Transfer and at boot up only. The Settings may be changed after boot up.

ⓓ Use Current Settings: When selected, Project Transfer or boot up will not make changes to the TCP/IP Settings of the CPU.

ⓔ Use DHCP: This specifies that the CPU should request its IP Settings from a DHCP Server on the network.



NOTE: *If the CPU is set to use DHCP for it's IP Settings it cannot, in all likelihood, be used as a Modbus TCP Server.*

Communications: Port Configuration

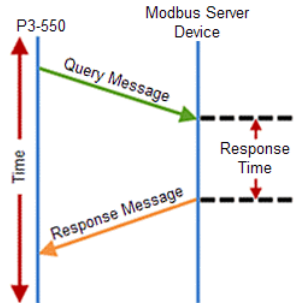
ⓕ Use The Following: If this Option is selected, the CPU will set itself to the specified project Settings upon Project Transfer or at boot up.

ⓖ IP Address: This field is where the IP Address is specified in Four Octets.

For Example: 192.168.1.5

ⓗ Subnet Mask: This field is where the Subnet Mask is specified in Four Octets (i.e., 255.255.255.0). The Subnet Mask is used in conjunction with the IP Address to configure a Logical Network.

ⓘ Default Gateway: This field is where the Default Gateway Address is specified in Four Octets (i.e., 192.168.1.1). This is typically the IP Address of the router on the network. If a target IP Address is specified in an outgoing message from the CPU that is not in the Local Subnet, the Default Gateway Address is where this message will be sent.



ⓙ Timeout Between Data Query and Response: The Time period specified in this field is the Time between the queries sent from the CPU (via a Communication instruction, such as a MRX, MWX, RX or WX) and the Time a response from that device is received. If the Response takes longer to receive (or is not received) than the specified Time period, a Timeout Error will occur for the given instruction. Each instruction has a Timeout Status bit that can be assigned to it. See the diagram shown here.

ⓚ Modbus TCP Port: This is the listening TCP Port Number for Modbus TCP connections. If necessary, this value can be adjusted for advanced router access. In most situations, this Number should be left at 502.

ⓛ Comm Heartbeat Value: This feature allows the ladder logic in the CPU to know if a device has stopped communicating to the CPU. If a value is placed in this field, the CPU will start a timer between each communication packet coming in to the CPU. If a communication packet fails to be received by the CPU within the specified time period, the System Bit Ethernet Heartbeat Timeout Bit will become true.

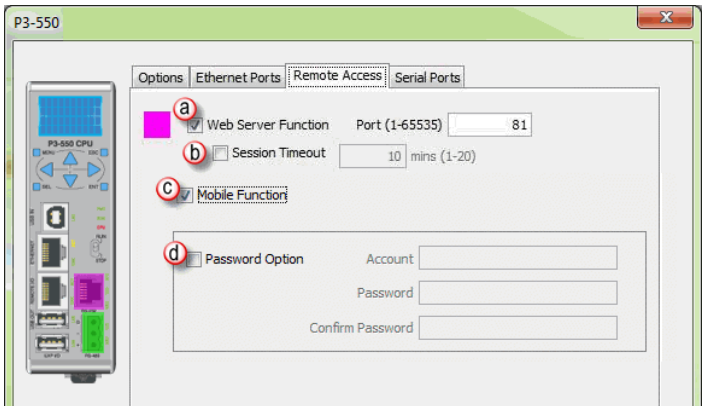
Remote Access Configuration

Local Ethernet Port Settings

ⓜ Timeout Between Data Query and Response: The Time period specified in this field is the Time between the queries sent from the CPU (for Remote I/O Nodes, PS-AMC modules and GS Drive Nodes) and the Time a Response from that device is Received. If the Response takes longer to receive (or is not received) than the specified Time period, a Timeout Error will occur for the given device and an Error will be generated in the Error Log. For P3-RS/RX Timeouts, the Error will be critical or non-critical, dependent on the Hot-Swap settings for that unit, its I/O Modules and P3-EX Bases. See Modbus Server diagram shown on previous page.

ⓝ Comm Heartbeat Value: This value specifies how long the Remote I/O Slaves and PS-AMC modules should wait for a communication packet from the CPU. If a communication packet is not received from the CPU within the specified time period, all outputs on the Remote Slave will be turned OFF.

Remote Access Configuration



ⓐ Web Server Function: Allows the ability to make a non secure web connection to the P3-550(E) in order to access the USB pen drive and view read-only system tags. When enabled, a port number selection is required.

- Port: (Default 80) Allows user to set a port number ranging from 1-65535.

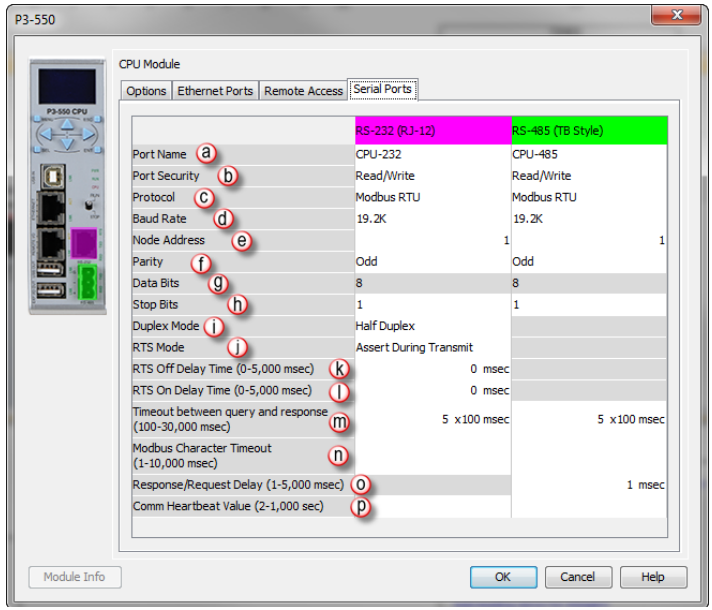
ⓑ Session Timeout: Allows the user to set a specific time limit (1-20 mins.) on inactivity that will close the Web Server connection. If there is no activity between the PC and the Web Server for the specified time limit, the connection will close.

ⓒ Mobile Function: Enables Remote Access which allows the CPU Data Remote Monitor App to monitor the selected tags.

ⓓ Password Option: Allows the user to set a password for access to the Web Server.

- Enter an account name and password of up to a combination of 16 numbers and characters (can include special characters).

Serial Configuration



When the Serial Ports Tab is selected, the Serial Ports settings are displayed as shown below.

There are two Serial Ports on the P3-550(E) CPU. There is an RS-232 Port with an RJ-12 connector and a 2-wire RS-485 Port with a removable three point terminal block. Both Ports are capable of Modbus RTU Client (device that initiates communications requests) and Server (device that responds to communications requests) communications. They are also capable of ASCII outgoing strings and incoming strings.

RS-232 and RS-485 Port Settings

ⓐ Port Name: Allows the entry of a unique Name for the RS-232 and RS-485 Ports. This name is referenced inside of the Communications instructions (MRX, MWX, RX, WX) and ASCII instructions (AIN, AOUT, CPO, CPI) to select the Port to send or receive the request.

ⓑ Port Security: This Option can be used as a simple Security measure to prevent Modbus TCP write requests from being accepted by the CPU. To allow Reads and Writes, select Read/Write.

ⓒ Protocol: This field determines whether the Port is used for Modbus RTU communications, sending or receiving ASCII Strings or performing the Custom Protocol function.

ⓓ Baud Rate: Choose the Baud Rate that your device and the CPU should communicate in this field. The appropriate choice will vary greatly with device, application and environment. The important point is that all devices communicating on the network need to be set to the same Baud Rate. The available Baud Rates are 1200, 2400, 9600, 19200, 33600, 38400, 57600 and 115200 bps.

RS-232 and RS-485 Port Settings

ⓔ Node Address: This field is used only when the CPU is a Modbus RTU Server device. This field is used to uniquely identify the CPU on the network. This setting is also sometimes referred to as a Station Address. This field can be set from 1 to 247.

ⓕ Parity: The Parity Bit is used as a simple, low-level form of Error Detection. All devices on the network need to be at the same Parity setting. The appropriate choice will vary with devices. Valid selections are None, Even and Odd.

ⓖ Data Bits: This field determines whether the communications packet uses Seven Data Bits or Eight Data Bits. Eight Data Bits is the only valid selection for Modbus RTU. Either Seven or Eight Data Bits can be selected when using ASCII communications. Set this field to match the device that is connected to the CPU.

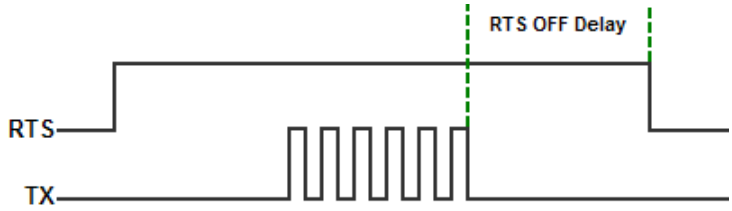
ⓗ Stop Bits: This field determines whether the communications packet uses One or Two Stop Bits. Set this field to match the device that is connected to the CPU.

ⓘ Duplex Mode: In ASCII/Custom Protocol mode Half Duplex of Full Duplex can be chosen.

- Half Duplex: When selected, the serial port can either transmit or receive, but not both at the same time.
- Full Duplex: When selected, allows the serial port to transmit and receive simultaneously. (Only available in ASCII/Custom Protocol).

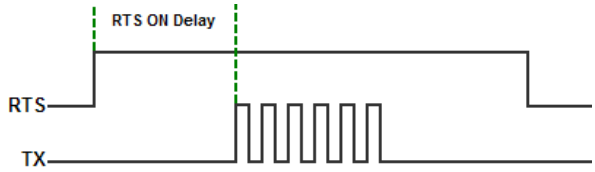
ⓙ RTS Mode: Set the RTS mode to control the Request to Send signal out of the Serial Port.

ⓚ RTS Off Delay Time (RS-232 Only): This Time period is the amount of Time between the end of the data transmission to when the RTS signal is turned off.

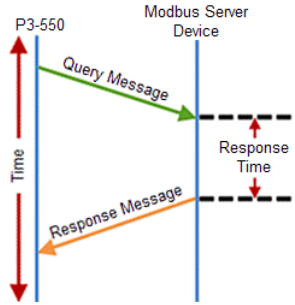


RS-232 and RS-485 Port Settings

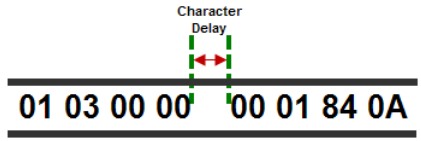
(l) RTS On Delay Time (RS-232 Only): This Time period is the amount of Time between when the RTS Signal is turned ON and the data transmission begins. The diagram illustrates this. This setting may be needed when using media converters (RS-232 to RS-485 converters) and/or radio modems. A delay may be needed after the assertion of the RTS Signal and when the data transmission begins for processing time in the device.



(m) Timeout Between Query and Response: The Time period specified in this field is the Time between the queries sent from the CPU (via a Communication instruction, such as an MRX, MWX, RX, or WX) and the Time a Response from that device is Received. If the Response takes longer to receive (or is not received) than the specified Time period, a Timeout Error will occur for the given instruction. Each instruction has a Timeout Status bit that can be assigned to it.



(n) Modbus Character Timeout: The Modbus Character Delay Time is specified as the Time between two bytes (or characters) within a given Modbus Message. The Modbus RTU specification states that this time must be no more than 1.5 Character Times (real time based on Baud Rate). Sometimes delays do occur between bytes when using radio modems, media converters, etc. This setting allows some tolerance in these situations for the incoming Modbus Messages in the CPU. The CPU will wait for the amount of time specified in this field before discarding the incomplete packet. If the CPU does not receive the remainder of the Message within the specified Time Frame, it will discard the first portion of the Message and wait for a new Message. The diagram illustrates this. This setting may be needed when using media converters (RS-232 to RS-422/485 converters) and/or radio modems. A delay may be needed at the end of the data transmission for processing time in the devices.

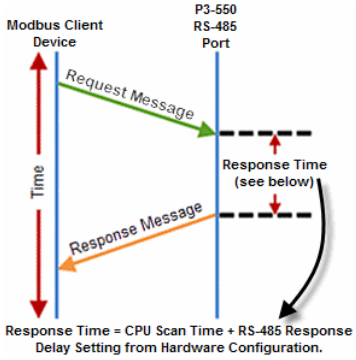


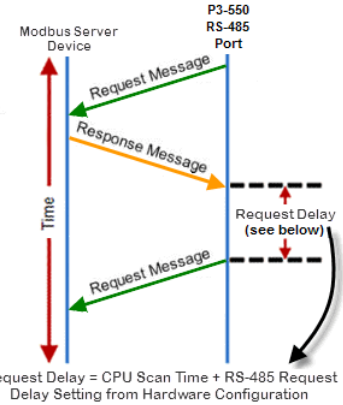
RS-232 and RS-485 Port Settings

(o) Response/Request Delay Response/Request Delay (RS-485 Only): This setting is used when the CPU is a Modbus RTU Server or Client on the RS-485 Port.

The total Response Time can be up to the Total CPU Scan Time + the Value specified in this field. When using 2-wire RS-485 communications, sometimes Echoes can occur since both devices use the same differential signal pair to send and receive.

- If acting as a Server (on left below), upon receiving a Modbus Request, the CPU will wait for the time period specified in this field before sending a Response. This can be used with slow clients that need extra time to change from sending to receiving.
- If acting as a Client (on right below), after receiving a Modbus Response, the CPU will wait for the time period specified in this field before sending another Request. This can be used to delay request messages in order to give extra time for slow server devices.



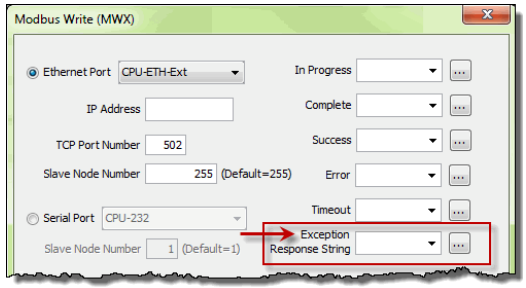


(p) Comm Heartbeat Value: This feature allows the ladder logic in the CPU to know if a device has stopped communicating to the CPU. If a value is placed in this field, the CPU will start a timer between each communication packet coming in to the CPU. If a communication packet fails to be received by the CPU within the specified Time period, the System Bit RS-232 Heartbeat Timeout Bit or RS-485 Heartbeat Timeout Bit will become true.

Communications: Error Codes

NOTE: *The only time you will see Communications Error Codes is when the CPU is the Master of a Communications Network.*

To simplify the process of identifying a possible Error, the Productivity3000® CPU will automatically report to a specific memory location an Error Code that helps identify the existing issue. The Error Codes are reported in the Exception Response String Tag specified in the instruction as shown below.



The Exception Response String field is available on the following instructions:

- GS Drives Read
- GS Drives Write
- Modbus Read
- Modbus Write
- Network Read
- Network Write
- Dataworx Request

The Table shown below provides a list of Productivity3000 Communication Error Codes that may be reported by the Productivity CPU.

Productivity3000 Communication Error Codes

Error Code	Description	Suggested Fix
01	Function Code not supported	Check instruction or connected device and correct Function code or address range selected.
02	Address out of range. This error is typically generated when a Modbus address has been requested that does not exist in the CPU.	Check instruction or connected device and correct Function code or address range selected.
03	Illegal Data Value. This error is typically generated when the Modbus request sent to the CPU is formed incorrectly.	Check the Modbus request against the Modbus protocol specification (www.modbus.org) to verify that it was formed correctly.
04	Device Failure	Check connected device
06	Slave Device is Busy. This error is typically due to excess communications to the EDRV.	Slow down the poll rate in the GS instruction.

P3000 EtherNet/IP Error Codes

 --- CPU server currently supported errors

 --- CPU server (will not generate error)
Note: Other adapters may generate this error

P3000 EtherNet/IP Error Codes				
General Status Error	**Extended Status Error**	**Name**	**Description**	**P3000 Supported**
0x01	0x0100	Connection In Use/ Duplicate Forward Open	A connection is already established from the target device sending a Forward Open request or the target device has sent multiple forward open request. This could be caused by poor network traffic. Check the cabling, switches and connections.	✓
0x01	0x0103	Transport Class/ Trigger Combination not supported	The Transport class and trigger combination is not supported. The Productivity3000 CPU only supports Class 1 and Class 3 transports and triggers: Change of State and Cyclic.	✓
0x01	0x0106	Owner Conflict	An existing exclusive owner has already configured a connection to this Connection Point. Check to see if other Scanner devices are connected to this adapter or verify that Multicast is supported by adapter device if Multicast is selected for Forward Open. This could be caused by poor network traffic. Check the cabling, switches and connections.	✓
0x01	0x0107	Target Connection Not Found	This occurs if a device sends a Forward Close on a connection and the device can't find this connection. This could occur if one of these devices has powered down or if the connection timed out on a bad connection. This could be caused by poor network traffic. Check the cabling, switches and connections.	✓
0x01	0x0108	Invalid Network Connection Parameter	This error occurs when one of the parameters specified in the Forward Open message is not supported such as Connection Point, Connection type, Connection priority, redundant owner or exclusive owner. The Productivity3000 CPU does not return this error and will instead use errors 0x0120, 0x0121, 0x0122, 0x0123, 0x0124, 0x0125 or 0x0132 instead.	✓
0x01	0x0109	Invalid Connection Size	This error occurs when the target device doesn't support the requested connection size. Check the documentation of the manufacturer's device to verify the correct Connection size required by the device. Note that most devices specify this value in terms of bytes. The Productivity3000 CPU does not return this error and will instead use errors 0x0126, 0x0127 and 0x0128.	✗
0x01	0x0110	Target for Connection Not Configured	This error occurs when a message is received with a connection number that does not exist in the target device. This could occur if the target device has powered down or if the connection timed out. This could be caused by poor network traffic. Check the cabling, switches and connections.	✗
0x01	0x0111	RPI Not Supported	This error occurs if the Originator is specifying an RPI that is not supported. The Productivity3000 CPU will accept a minimum value of 10ms on a CIP Forward Open request. However, the CPU will produce at the specified rate up to the scan time of the installed project. The CPU cannot product any faster than the scan time of the running project.	✓

P3000 EtherNet/IP Error Codes

General Status Error	Extended Status Error	Name	Description	P3000 Supported
0x01	0x0112	RPI Value not acceptable	This error can be returned if the Originator is specifying an RPI value that is not acceptable. There may be six additional values following the extended error code with the acceptable values. An array can be defined for this field in order to view the extended error code attributes. If the Target device supports extended status, the format of the values will be as shown below: • Unsigned Integer 16, Value = 0x0112, Explanation: Extended Status code • |Unsigned Integer 8, Value = variable, Explanation: Acceptable Originator to Target RPI type, values: 0 = The RPI specified in the forward open was acceptable (O -> T value is ignored), 1 = unspecified (use a different RPI), 2 = minimum acceptable RPI (too fast), 3 = maximum acceptable RPI (too slow), 4 = required RPI to corrected mismatch (data is already being consumed at a different RPI), 5 to 255 = reserved. • Unsigned Integer 32, Value = variable, Explanation: Value of O -> T RPI that is within the acceptable range for the application. • Unsigned Integer 32, Value = variable, Explanation: Value of T -> O RPI that is within the acceptable range for the application.	✗
0x01	0x0113	Out of Connections	The Productivity3000 EtherNet/IP Adapter connection limit of 4 when doing Class 3 connections has been reached. An existing connection must be dropped in order for a new one to be generated.	✓
0x01	0x0114	Vendor ID or Product Code Mismatch	The compatibility bit was set in the Forward Open message but the Vendor ID or Product Code did not match.	✓
0x01	0x0115	Device Type Mismatch	The compatibility bit was set in the Forward Open message but the Device Type did not match.	✓
0x01	0x0116	Revision Mismatch	The compatibility bit was set in the Forward Open message but the major and minor revision numbers were not a valid revision.	✓
0x01	0x0117	Invalid Produced or Consumed Application Path	This error is returned from the Target device when the Connection Point parameters specified for the O -> T (Output) or T -> O (Input) connection is incorrect or not supported. The Productivity3000 CPU does not return this error and uses the following error codes instead: 0x012A, 0x012B or 0x012F.	✗
0x01	0x0118	Invalid or Inconsistent Configuration Application Path	This error is returned from the Target device when the Connection Point parameter specified for the Configuration data is incorrect or not supported. The Productivity3000 CPU does not return this error and uses the following error codes instead: 0x0129 or 0x012F.	✗
0x01	0x0119	Non-listen Only Connection Not Opened	This error code is returned when an Originator device attempts to establish a listen only connection and there is no non-listen only connection established. The Productivity3000 CPU does not support listen only connections as Scanner or Adapter.	✓

P3000 EtherNet/IP Error Codes

General Status Error	Extended Status Error	Name	Description	P3000 Supported
0x01	0x011A	Target Object Out of Connections	The maximum number of connections supported by this instance of the object has been exceeded.	✗
0x01	0x011B	RPI is smaller than the Production Inhibit Time	The Target to Originator RPI is smaller than the Target to Originator Production Inhibit Time. Consult the manufacturer's documentation as to the minimum rate that data can be produced and adjust the RPI to greater than this value.	✗
0x01	0x011C	Transport Class Not Supported	The Transport Class requested in the Forward Open is not supported. Only Class 1 and Class 3 classes are supported in the Productivity3000 CPU.	✗
0x01	0x011D	Production Trigger Not Supported	The Production Trigger requested in the Forward Open is not supported. In Class 1, only Cyclic and Change of state are supported in the Productivity3000 CPU. In Class 3, Application object is supported.	✗
0x01	0x011E	Direction Not Supported	The Direction requested in the Forward Open is not supported.	✗
0x01	0x011F	Invalid Originator to Target Network Connection Fixed/ Variable Flag	The Originator to Target fixed/variable flag specified in the Forward Open is not supported . Only Fixed is supported in the Productivity3000 CPU.	✗
0x01	0x0120	Invalid Target to Originator Network Connection Fixed/ Variable Flag	The Target to Originator fixed/variable flag specified in the Forward Open is not supported. Only Fixed is supported in the Productivity3000 CPU.	✗
0x01	0x0121	Invalid Originator to Target Network Connection Priority	The Originator to Target Network Connection Priority specified in the Forward Open is not supported. Low, High, Scheduled and Urgent are supported in the Productivity3000 CPU.	✗
0x01	0x0122	Invalid Target to Originator Network Connection Priority	The Target to Originator Network Connection Priority specified in the Forward Open is not supported. Low, High, Scheduled and Urgent are supported in the Productivity3000 CPU.	✗
0x01	0x0123	Invalid Originator to Target Network Connection Type	The Originator to Target Network Connection Type specified in the Forward Open is not supported. Only Unicast is supported for O -> T (Output) data in the Productivity3000 CPU.	✓
0x01	0x0124	Invalid Target to Originator Network Connection Type	The Target to Originator Network Connection Type specified in the Forward Open is not supported. Multicast and Unicast is supported in the Productivity3000 CPU. Some devices may not support one or the other so if this error is encountered try the other method.	✓
0x01	0x0125	Invalid Originator to Target Network Connection Redundant_Owner	The Originator to Target Network Connection Redundant_ Owner flag specified in the Forward Open is not supported. Only Exclusive owner connections are supported in the Productivity3000 CPU.	✓
0x01	0x0126	Invalid Configuration Size	This error is returned when the Configuration data sent in the Forward Open does not match the size specified or is not supported by the Adapter. The Target device may return an additional Unsigned Integer 16 value that specifies the maximum size allowed for this data. An array can be defined for this field in order to view the extended error code attributes.	✗

P3000 EtherNet/IP Error Codes

General Status Error	Extended Status Error	Name	Description	P3000 Supported
0x01	0x0127	Invalid Originator to Target Size	This error is returned when the Originator to Target (Output data) size specified in the Forward Open does not match what is in the Target. Consult the documentation of the Adapter device to verify the required size. Note that if the Run/Idle header is requested, it will add 4 additional bytes and must be accounted for in the Forward Open calculation. The Productivity3000 CPU always requires the Run/Idle header so if the option doesn't exist in the Scanner device, you must add an additional 4 bytes to the O -> T (Output) setup. Some devices may publish the size that they are looking for as an additional attribute (Unsigned Integer 16 value) of the Extended Error Code. An array can be defined for this field in order to view the extended error code attributes. NOTE: This error may also be generated when a Connection Point value that is invalid for IO Messaging (but valid for other cases such as Explicit Messaging) is specified, such as 0. Please verify if the Connection Point value is valid for IO Messaging in the target device.	✓
0x01	0x0128	Invalid Target to Originator Size	This error is returned when the Target to Originator (Input data) size specified in the Forward Open does not match what is in Target. Consult the documentation of the Adapter device to verify the required size. Note that if the Run/Idle header is requested, it will add 4 additional bytes and must be accounted for in the Forward Open calculation. The Productivity3000 CPU does not support a Run/Idle header for the T -> O (Input) data. Some devices may publish the size that they are looking for as an additional attribute (Unsigned Integer 16 value) of the Extended Error Code. An array can be defined for this field in order to view the extended error code attributes. NOTE: This error may also be generated when a Connection Point value that is invalid for IO Messaging (but valid for other cases such as Explicit Messaging) is specified, such as 0. Please verify if the Connection Point value is valid for IO Messaging in the target device.	✓
0x01	0x0129	Invalid Configuration Application Path	This error will be returned by the Productivity3000 CPU if a Configuration Connection with a size other than 0 is sent to the CPU. The Configuration Connection size must always be zero if it this path is present in the Forward Open message coming from the Scanner device.	✓
0x01	0x012A	Invalid Consuming Application Path	This error will be returned by the Productivity3000 CPU if the Consuming (O -> T) Application Path is not present in the Forward Open message coming from the Scanner device or if the specified Connection Point is incorrect.	✓
0x01	0x012B	Invalid Producing Application Path	This error will be returned by the Productivity3000 CPU if the Producing (T -> O) Application Path is not present in the Forward Open message coming from the Scanner device or if the specified Connection Point is incorrect.	✓
0x01	0x012C	Config. Symbol Does not Exist	The Originator attempted to connect to a configuration tag name that is not supported in the Target.	✗
0x01	0x012D	Consuming Symbol Does not Exist	The Originator attempted to connect to a consuming tag name that is not supported in the Target.	✗
0x01	0x012E	Producing Symbol Does not Exist	The Originator attempted to connect to a producing tag name that is not supported in the Target.	✗
0x01	0x012F	Inconsistent Application Path Combination	The combination of Configuration, Consuming and Producing application paths specified are inconsistent.	✗

P3000 EtherNet/IP Error Codes

General Status Error	Extended Status Error	Name	Description	P3000 Supported
0x01	0x0130	Inconsistent Consume data format	Information in the data segment not consistent with the format of the data in the consumed data.	✗
0x01	0x0131	Inconsistent Product data format	Information in the data segment not consistent with the format of the data in the produced data.	✗
0x01	0x0132	Null Forward Open function not supported	The target device does not support the function requested in the NULL Forward Open request. The request could be such items as “Ping device”, “Configure device application”, etc.	✗
0x01	0x0133	Connection Timeout Multiplier not acceptable	The Connection Multiplier specified in the Forward Open request not acceptable by the Target device (once multiplied in conjunction with the specified timeout value). Consult the manufacturer device’s documentation on what the acceptable timeout and multiplier are for this device.	✗
0x01	0x0203	Connection Timed Out	This error will be returned by the Productivity3000 CPU if a message is sent to the CPU on a connection that has already timed out. Connections time out if no message is sent to the CPU in the time period specified by the RPI rate X Connection multiplier specified in the Forward Open message.	✗
0x01	0x0204	Unconnected Request Timed Out	This time out occurs when the device sends an Unconnected Request and no response is received within the specified time out period. In the Productivity3000 CPU, this value may be found in the hardware configuration under the Ethernet port settings for the P3-550(E) or P3-530.	✓
0x01	0x0205	Parameter Error in Unconnected Request Service	This error occurs when Connection Tick Time/Connection time-out combination is specified in the Forward Open or Forward Close message this is not supported by the device.	✗
0x01	0x0206	Message Too Large for Unconnected_Send Service	Occurs when Unconnected_Send message is too large to be sent to the network.	✗
0x01	0x0207	Unconnected Acknowledge without Reply	This error occurs if an Acknowledge was received but no data response occurred. Verify that the message that was sent is supported by the Target device using the device manufacturer’s documentation.	✗
0x01	0x0301	No Buffer Memory Available	This error occurs if the Connection memory buffer in the target device is full. Correct this by reducing the frequency of the messages being sent to the device and/or reducing the number of connections to the device. Consult the manufacturer’s documentation for other means of correcting this.	✗
0x01	0x0302	Network Bandwidth not Available for Data	This error occurs if the Producer device cannot support the specified RPI rate when the connection has been configured with schedule priority. Reduce the RPI rate or consult the manufacturer’s documentation for other means to correct this.	✗
0x01	0x0303	No Consumed Connection ID Filter Available	This error occurs if a Consumer device doesn’t have an available consumed_connection_id filter.	✗
0x01	0x0304	Not Configured to Send Scheduled Priority Data	This error occurs if a device has been configured for a scheduled priority message and it cannot send the data at the scheduled time slot.	✗

P3000 EtherNet/IP Error Codes

General Status Error	Extended Status Error	Name	Description	P3000 Supported
0x01	0x0305	Schedule Signature Mismatch	This error occurs if the schedule priority information does not match between the Target and the Originator.	✗
0x01	0x0306	Schedule Signature Validation not Possible	This error occurs when the schedule priority information sent to the device is not validated.	✗
0x01	0x0311	Port Not Available	This error occurs when a port number specified in a port segment is not available. Consult the documentation of the device to verify the correct port number.	✗
0x01	0x0312	Link Address Not Valid	The Link address specified in the port segment is not correct. Consult the documentation of the device to verify the correct port number.	✗
0x01	0x0315	Invalid Segment in Connection Path	This error occurs when the target device cannot understand the segment type or segment value in the Connection Path. Consult the documentation of the device to verify the correct segment type and value. If a Connection Point greater than 255 is specified this error could occur.	✓
0x01	0x0316	Forward Close Service Connection Path Mismatch	This error occurs when the Connection path in the Forward Close message does not match the Connection Path configured in the connection. Contact Tech Support if this error persists.	✗
0x01	0x0317	Scheduling Not Specified	This error can occur if the Schedule network segment or value is invalid.	✗
0x01	0x0318	Link Address to Self Invalid	If the Link address points back to the originator device, this error will occur.	✗
0x01	0x0319	Secondary Resource Unavailable	This occurs in a redundant system when the secondary connection request is unable to duplicate the primary connection request.	✗
0x01	0x031A	Rack Connection Already established	The connection to a module is refused because part or all of the data requested is already part of an existing rack connection.	✗
0x01	0x031B	Module Connection Already established	The connection to a rack is refused because part or all of the data requested is already part of an existing module connection.	✗
0x01	0x031C	Miscellaneous	This error is returned when there is no other applicable code for the error condition. Consult the manufacturer's documentation or contact Tech support if this error persist.	✗
0x01	0x031D	Redundant Connection Mismatch	This error occurs when these parameters don't match when establishing a redundant owner connection: O -> T RPI, O -> T Connection Parameters, T -> O RPI, T -> O Connection Parameters and Transport Type and Trigger.	✗
0x01	0x031E	No more User Configurable Link Resources Available in the Producing Module	This error is returned from the Target device when no more available Consumer connections available for a Producer.	✗

P3000 EtherNet/IP Error Codes

General Status Error	Extended Status Error	Name	Description	P3000 Supported
0x01	0x031F	No User Configurable Link Consumer Resources Configured in the Producing Module	This error is returned from the Target device when no Consumer connections have been configured for a Producer connection.	✗
0x01	0x0800	Network Link Offline	The Link path is invalid or not available.	✗
0x01	0x0810	No Target Application Data Available	This error is returned from the Target device when the application has no valid data to produce.	✗
0x01	0x0811	No Originator Application Data Available	This error is returned from the Originator device when the application has no valid data to produce.	✗
0x01	0x0812	Node Address has changed since the Network was scheduled	This specifies that the router has changed node addresses since the value configured in the original connection.	✗
0x01	0x0813	Not Configured for Off-subnet Multicast	The producer has been requested to support a Multicast connection for a consumer on a different subnet and does not support this functionality.	✗
0x01	0x0814	Invalid Produce/Consume Data format	Information in the data segment not consistent with the format of the data in the consumed or produced data. Errors 0x0130 and 0x0131 are typically used for this situation in most devices now.	✗
0x02	N/A	Resource Unavailable for Unconnected Send	The Target device does not have the resources to process the Unconnected Send request.	✗
0x04	N/A	Path Segment Error in Unconnected Send	The Class, Instance or Attribute value specified in the Unconnected Explicit Message request is incorrect or not supported in the Target device. Check the manufacturer's documentation for the correct codes to use.	✗
0x09	Index to error	Error in Data Segment	This error code is returned when an error is encountered in the Data segment portion of a Forward Open message. The Extended Status value is the offset in the Data segment where the error was encountered.	✗
0x0C	Optional	Object State Error	This error is returned from the Target device when the current state of the Object requested does not allow it to be returned. The current state can be specified in the Optional Extended Error status field.	✗
0x10	Optional	Device State Error	This error is returned from the Target device when the current state of the Device requested does not allow it to be returned. The current state can be specified in the Optional Extended Error status field.	✗
0x13	N/A	Not Enough Data	Not enough data was supplied in the service request specified.	✗
0x15	N/A	Too Much Data	Too much data was supplied in the service request specified.	✗

MAINTENANCE AND TROUBLESHOOTING



In This Chapter...

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Hardware Maintenance

Standard Maintenance

The Productivity3000® is a low maintenance system requiring only a few periodic checks to help reduce the risks of problems. Routine maintenance checks should be made regarding two key items.

- Air quality (cabinet temperature, airflow, etc.)
- CPU battery

Air Quality Maintenance

The quality of the air your system is exposed to can affect system performance. If you have placed your system in an enclosure, check to see that the ambient temperature is not exceeding the operating specifications. If there are filters in the enclosure, clean or replace them as necessary to ensure adequate airflow. A good rule of thumb is to check your system environment every one to two months. Make sure the Productivity3000 is operating within the system operating specifications.

CPU Battery Replacement

A battery is included with the CPU, but is not installed. The battery can be installed to retain the Time and Date along with any Tagname values that are set up as retentive.

The battery is not needed for program backup.



LCD Display Replacement

Battery (Optional)	
D2-BAT-1	Coin type, 3.0V Lithium battery, 560mA, battery number CR2354

Should the LCD display fade out and become unreadable, a replacement LCD is available at automationdirect.com. Order part number P3-LCD.

Diagnostics

Diagnostics

Your Productivity3000® system performs many pre-defined diagnostic routines with every CPU scan. The diagnostics have been designed to detect various types of failures for the CPU and I/O modules. There are two primary error classes, critical and non-critical.

Critical Errors

Critical errors are errors the CPU has detected that offer a risk of the system not functioning safely or properly. If the CPU is in Run Mode when the critical error occurs, the CPU will switch to Stop Mode (Remember, in Stop Mode all outputs are turned off). If the critical error is detected while the CPU is in Stop Mode, the CPU will not enter Run Mode until the error has been corrected. Here are some examples of critical errors:

- Base power supply failure
- Parity error or CPU malfunction
- I/O configuration errors
- Certain programming errors

Non-Critical Errors

- Non-critical errors are errors that are flagged by the CPU as requiring attention. They can neither cause the CPU to change from Run Mode to Stop Mode, nor do they prevent the CPU from entering Run Mode. There are system tags the application program can use to detect if a non-critical error has occurred. The application program can be used to take the system to an orderly shutdown or to switch the CPU to Stop Mode if necessary.
- Some examples of non-fatal errors are:
- Backup battery voltage low
- All I/O module errors
- Certain programming errors

Finding Diagnostic Information

The CPU automatically logs critical and non-critical error codes. This information can be found in the following places marked with a time and date stamp.

- The LCD on the CPU module by scrolling through the menu.
- The CPU Error History window under the Monitor Debug tool of ProductivitySuite lists the 20 most recent critical and non-critical errors.

Appendix B in this manual has a complete list of error messages sorted by error types.

Error Codes

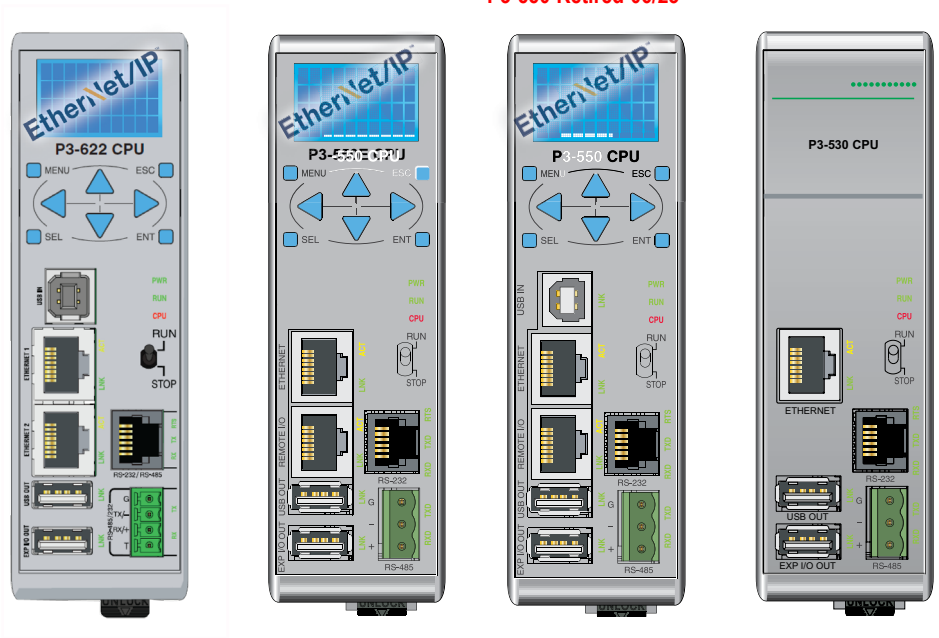
See Appendix B for Productivity3000 Error Codes.

CPU Indicators

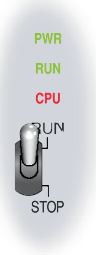
The Productivity3000® CPU has indicators on the front to help you diagnose problems with the system. The table below gives a quick reference of potential problems associated with each status indicator. Following the table will be a detailed analysis of each of these indicator problems.

Indicator Status	Potential Problems
PWR (off)	1. System voltage incorrect
	2. Power supply/CPU is faulty
	3. Other component such an I/O module has power supply shorted
RUN (will not come on)	1. CPU programming error
	2. Switch in STOP position
CPU (blink)	CPU internal error

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CPU Status Indicators	
PWR	Green LED is illuminated when power is on
RUN	Green LED is illuminated when CPU is in RUN mode
CPU	Red LED is illuminated during power on reset, power down, or watch-dog time-out.



PWR Indicator

There are three general reasons for the CPU power status LED (PWR) to be OFF:

1. Power to the base is incorrect or is not applied.
2. Base power supply is faulty.
3. Other component(s) have the power supply shut down.

Incorrect Base Power

If the voltage to the power supply is not correct, the CPU and/or base may not operate properly or may not operate at all. Use the following guidelines to correct the problem.



WARNING: To minimize the risk of electrical shock, always disconnect the system power before inspecting the physical wiring.

1. First, disconnect the system power and check all incoming wiring for loose connections.
2. If you are using a separate termination panel, check those connections to make sure the wiring is connected to the proper location.
3. If the connections are acceptable, reconnect the system power and measure the voltage at the base terminal strip to insure it is within specification. If the voltage is not correct shut down the system and correct the problem.
4. If all wiring is connected correctly and the incoming power is within the specifications required, the base power supply should be returned for repair.

Faulty CPU

There is not a good check to test for a faulty CPU other than substituting a known good one to see if this corrects the problem. If you have experienced major power surges, it is possible the CPU and power supply have been damaged. If you suspect this is the cause of the power supply damage, a line conditioner which removes damaging voltage spikes should be used in the future.

Device or Module Causing the Power Supply to Shutdown

It is possible a faulty module can shut down the power supply. This 5V can be coming from the base or from the CPU communication ports.

To test for a device causing this problem:

1. Turn off power to the CPU.
2. Disconnect all external devices (i.e., communication cables) from the CPU.
3. Reapply power to the system.

If the power supply operates normally you may have either a shorted device or a shorted cable. If the power supply does not operate normally then test for a module causing the problem by following the steps below:

If the PWR LED operates normally the problem could be in one of the modules. To isolate which module is causing the problem, disconnect the system power and remove one module at a time until the PWR LED operates normally. Follow the procedure below:

- Turn off power to the base.
- Remove a module from the base.
- Reapply power to the base.

Bent base connector pins on the module can cause this problem. Check to see the connector is not the problem.

Run Indicator

If the CPU will not enter the Run mode (the RUN indicator is off), the problem is usually in the application program, unless the CPU has a critical error. If a critical error has occurred, the CPU LED should be on. (You can use a programming device to determine the cause of the error.)

A complete list of error codes can be found in Appendix B.

CPU Indicator

If the CPU indicator is on, a critical error has occurred in the CPU. Generally, this is not a programming problem but an actual hardware error. The CPU indicator should blink briefly and then do an automatic reboot.

If the error clears, you should monitor the system and determine what caused the problem. You will find this problem is sometimes caused by high frequency electrical noise introduced into the CPU from an outside source. Check your system grounding and install electrical noise filters if the grounding is suspected. If power cycling the system does not reset the error, or if the problem returns, you should replace the CPU.

Communications Problems

If you cannot establish communications with the CPU, check these items.

- The cable is disconnected.
- The cable has a broken wire or has been wired incorrectly.
- The cable is improperly terminated or grounded.
- The device connected is not operating at the correct baud rate.
- The device connected to the port is sending data incorrectly.
- A grounding difference exists between the two devices.
- Electrical noise is causing intermittent errors.
- The CPU has a bad communication port and the CPU should be replaced.

If an error occurs, the indicator will come on and stay on until a successful communication has been completed.

I/O Module Troubleshooting

Things to Check

If you suspect an I/O error, there are several things that could be causing the problem.

- A blown fuse
- A loose terminal block
- The 24 VDC supply has failed
- The module has failed
- The I/O configuration check detects a change in the I/O configuration

Error Codes

See Appendix B for Productivity3000® error code information.

Also, in the Productivity Suite programming software, you can go to:

Tools > CPU Error History, and

Tools > CPU Event History

Next, "Read CPU Error/Event History to get an updated list of critical errors, non-critical errors and events that should indicate problems or changes to the I/O. This list will give the "GBS" (group, base, slot numbers).

Some Quick Steps

When troubleshooting the Productity3000 I/O modules there are a few facts you should be aware of which may assist you in quickly correcting an I/O problem:

- The output modules cannot detect shorted or open output points. If you suspect one or more points on a output module to be faulty, you should measure the voltage drop from the common to the suspect point. Remember, when using a Digital Volt Meter, leakage current from an output device, such as a triac or a transistor, must be considered. A point which is off may appear to be on if no load is connected to the point.
- The I/O point status indicators on the modules are logic side indicators. This means the LED which indicates the on or off status reflects the status of the point in respect to the CPU. On an output module, the status indicators could be operating normally, while the actual output device (transistor, triac etc.) could be damaged. With an input module, if the indicator LED is on, the input circuitry should be operating properly. To verify proper functionality, check to see that the LED goes off when the input signal is removed.
- Leakage current can be a problem when connecting field devices to I/O modules. False input signals can be generated when the leakage current of an output device is great enough to turn on the connected input device. To correct this, install a resistor in parallel with the input or output of the circuit. The value of this resistor will depend on the amount of leakage current and the voltage applied but usually a 10K to 20K resistor will work. Ensure the wattage rating of the resistor is correct for your application.
- The easiest method to determine if a module has failed is to replace it if you have a spare. However, if you suspect another device to have caused the failure in the module, that device may cause the same failure in the replacement module as well. As a point of caution, you may want to check devices or power supplies connected to the failed module before replacing it with a spare module.

Testing Output Points

Output points can be set on or off using the force function to override a point even while the program is running. However, this is not a recommended method to test the output points. If you want to do an I/O check independent of the application program, follow this procedure:

Step	Action
1	Use ProductivitySuite programming software to communicate online to the CPU.
2	Change to Program Mode.
3	Go to the first rung of the ladder.
4	Insert a rung with an "END" statement. (This will cause program execution to occur only at address 0 and prevent the application program from turning the I/O points on or off).
5	Change to Run Mode.
6	Use the programming device to set (turn) on or off the points you wish to test.
7	When you finish testing I/O points delete the "END" statement at the first rung.



WARNING: Depending on your application, forcing I/O points may cause unpredictable machine Operation that can result in a risk of personal injury or equipment damage. Make sure you have taken all appropriate safety precautions prior to testing any I/O points.

The LCD on Analog I/O modules displays actual voltage, current, and digital values without connecting a meter.

Noise Troubleshooting

Electrical Noise Problems

Noise is one of the most difficult problems to diagnose. Electrical noise can enter a system in many different ways and falls into one of two categories, conducted or radiated. It may be difficult to determine how the noise is entering the system but the corrective actions for either of the types of noise problems are similar.

- Conducted noise is when the electrical interference is introduced into the system by way of an attached wire, panel connection, etc. It may enter through an I/O module, a power supply connection, the communication ground connection, or the chassis ground connection.
- Radiated noise is when the electrical interference is introduced into the system without a direct electrical connection, much in the same manner as radio waves.

Reducing Electrical Noise

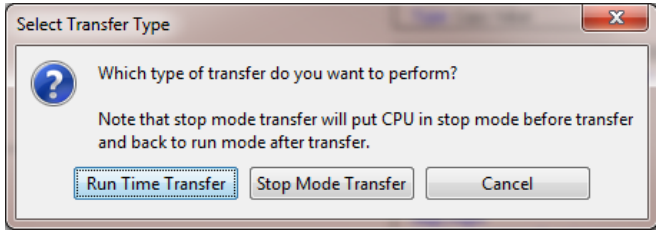
While electrical noise cannot be eliminated it can be reduced to a level that will not affect the system.

- Most noise problems result from improper grounding of the system. A good earth ground can be the single most effective way to correct noise problems. If a ground is not available, install a ground rod as close to the system as possible. Ensure all ground wires are single point grounds and are not daisy chained from one device to another. Ground metal enclosures around the system. A loose wire is no more than a large antenna waiting to introduce noise into the system; therefore, you should tighten all connections in your system. Loose ground wires are more susceptible to noise than the other wires in your system. Review Chapter 5, Installation and Wiring, if you have questions regarding how to ground your system.
- Electrical noise can enter the system through the power source for the CPU and I/O. Installing an isolation transformer for all AC sources can correct this problem. DC power sources should be well grounded, good quality power supplies. Switching DC power supplies commonly generate more noise than linear supplies.
- Separate input wiring from output wiring. Never run I/O wiring close to high voltage wiring.

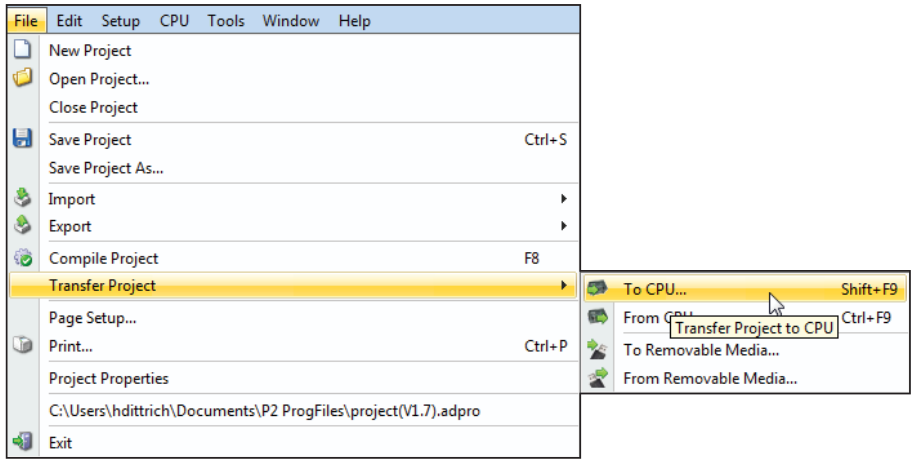
Run Time vs. Stop Mode Transfer Instruction

Here we describe the actions and differences between Run Time & Stop Mode transfers.

The above dialog is accessed two ways:



1. From the Transfer to CPU icon on the tool bar, or
2. From the File menu > Transfer Project > To CPU



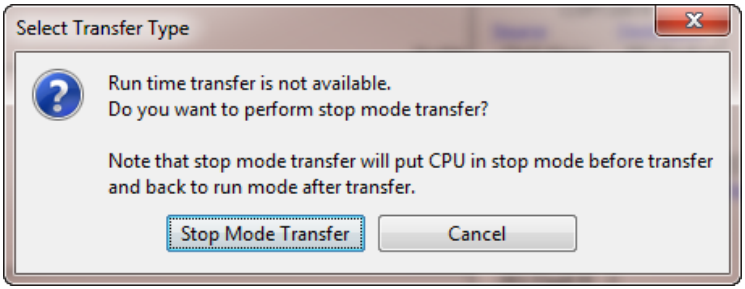
Run Time Transfers

Run Time transfers allow the user to transfer edits to a project back into the CPU without stopping the CPU scan, therefore not stopping the process. Be aware that a Run Time transfer will affect the length of your scan time, which should be considered if your process is susceptible to varying or lengthy scan times. The download time is longer compared to a Stop Mode transfer.

During a Run Time transfer, the current project file continues running until the entire project file is transferred to the CPU. Once downloaded, the ladder logic files swap and begin executing the new file. The Tag Database is shared between the two project files during a Run Time transfer, therefore current operating values will not be effected.

Because the Tag database is shared, any edits to the Tag database will force a Stop Mode transfer.

Stop Mode Transfers



Stop Mode transfers allows the user to transfer any and all ladder, Tag database and configuration changes to the CPU.

Because the CPU is in stop mode, the project transfer is much faster than a Run Time transfer and also loads all initial values to the tags once the project is switched from Stop to Run.

There are also conditions that will force the user to perform a Stop Mode transfer.

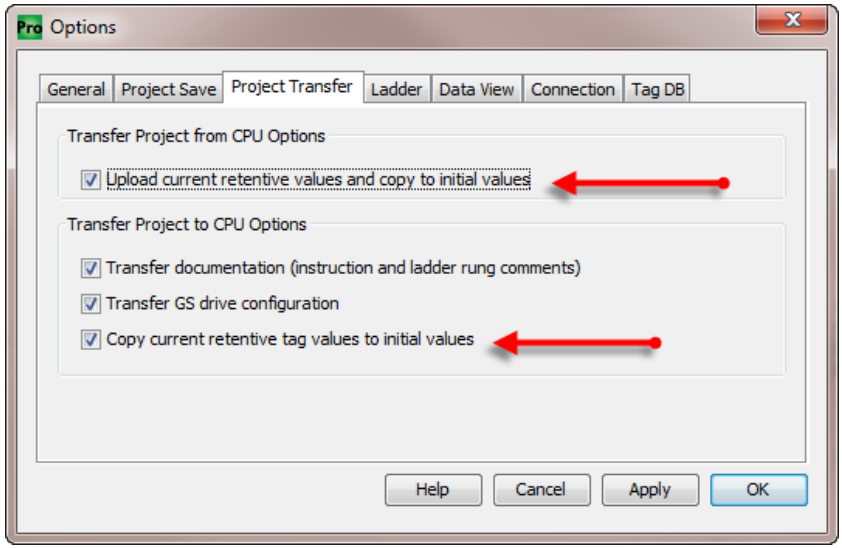
1. Any changes to the hardware configuration, such as:
    a. Adding or removing hardware.
    b. Changing the configuration of a piece of hardware.
        - Ethernet or serial port configuration.
        - Hot swap enable or disable on any module or base.
2. Adding or changing any Array data type Tags.
3. Adding or changing any String data type Tags.



NOTE: *Be careful when performing a Stop Mode transfer. The retentive values in your PC project may not be current and non-retentive data will be cleared (reset to 0) when you switch your CPU from Stop to Run.*

As the CPU goes from stop to run after a Stop Mode Transfer, tags are initialized as if the project is being executed for the first time. This includes Retentive Tags. If it's desirable that the values of Retentive Tags be retained through a Stop Mode Transfer, there are two methods available. Both options may be enabled and they can be found under Tools > Options > Project Transfer

1. Upload current retentive values and copy to initial values. This option works during program upload. When selected, place the CPU in Stop Mode so Retentive Tag values are stable, then upload the project. Productivity Suite will copy the current value of all Retentive Tags to their Initial Values in the Tag Database of the project. Perform your edits and transfer the project back to the CPU. When the CPU goes back to run, your Retentive Tags will be initialized with their old values. This is a simple process and is convenient for quick edits to the program, but the CPU must sit in Stop Mode while the project is edited to ensure that no retentive values have changed during editing.
2. Copy current retentive tag values to initial values. This option works during program download. This process is more involved, but the CPU will use the values from the project currently running as the initial values of the project being transferred. For more information refer to the Options topic in the help file.



Forcing I/O Points

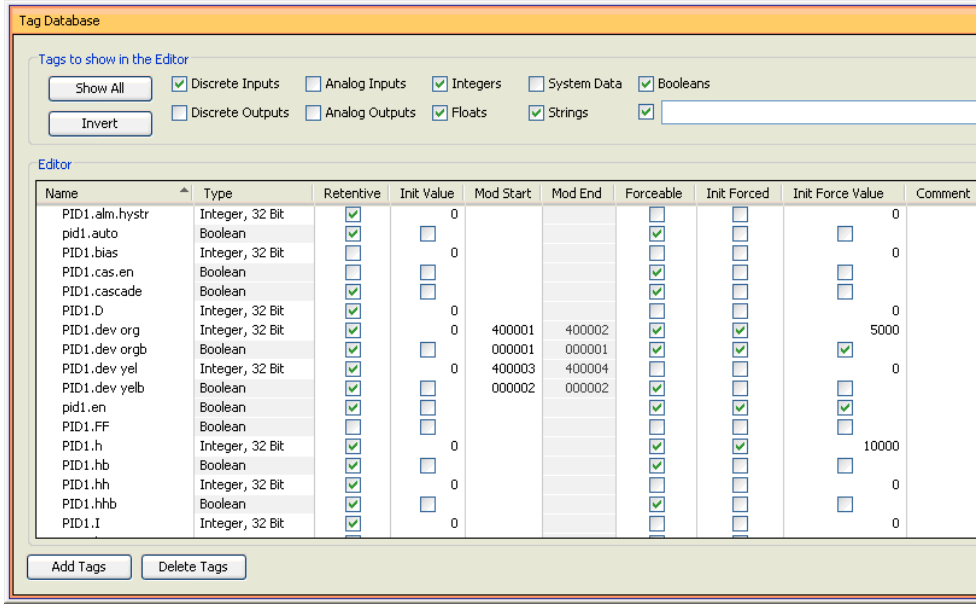
Here we are going to describe the actions, expectations and indications when forcing a value within the Productivity3000® controller.

Advantages of Forces

Almost all tags can be written to within your software without the use of Forces. However, if the ladder logic or an external device (Operator interface panel, Modbus device, etc.) is connected to your controller and writing to those tags, the values you write from a Data View will be over-written. Conversely, if you write a Force value, this will not be overwritten or reset until you manually remove the force or reset by means of a Stop to Run mode transition, Stop mode project transfer, or a controller power cycle.

Enabling Forces

The Productivity3000 is a Tag based controller and forcing a tag begins by identifying any tag you wish to be "Forceable" within the Tag database.

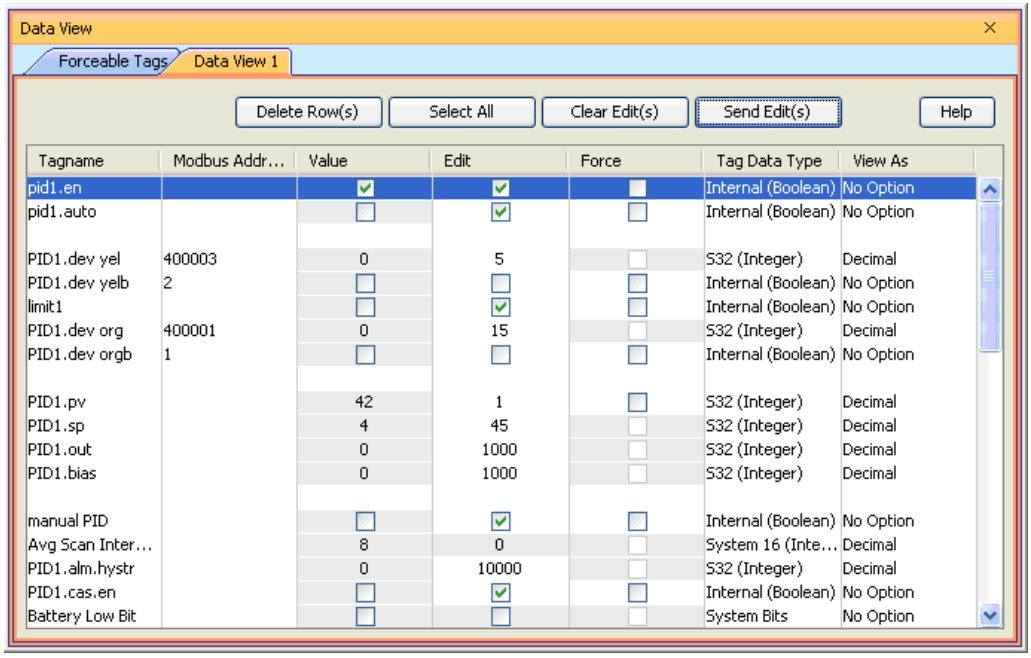


There are three columns within the Tag database that affect the forcing of all tags.

1. "Forceable" - Checking the box in this column identifies the corresponding tag as being able to be forced within the system.
2. "Init Forced" - Checking the box in this column identifies that corresponding tag as being forced as soon as the project is loaded and the processor is switched to Run mode.
3. "Init Force Value" - The state of the box in this column identifies the initial forced state of the Boolean tag:
   - A check mark in a box equals a logical "1" or "ON", and
   - An unchecked box equals a logical "0" or "OFF". The value placed in this field for Integer or Floating point tags will be written into the tag.

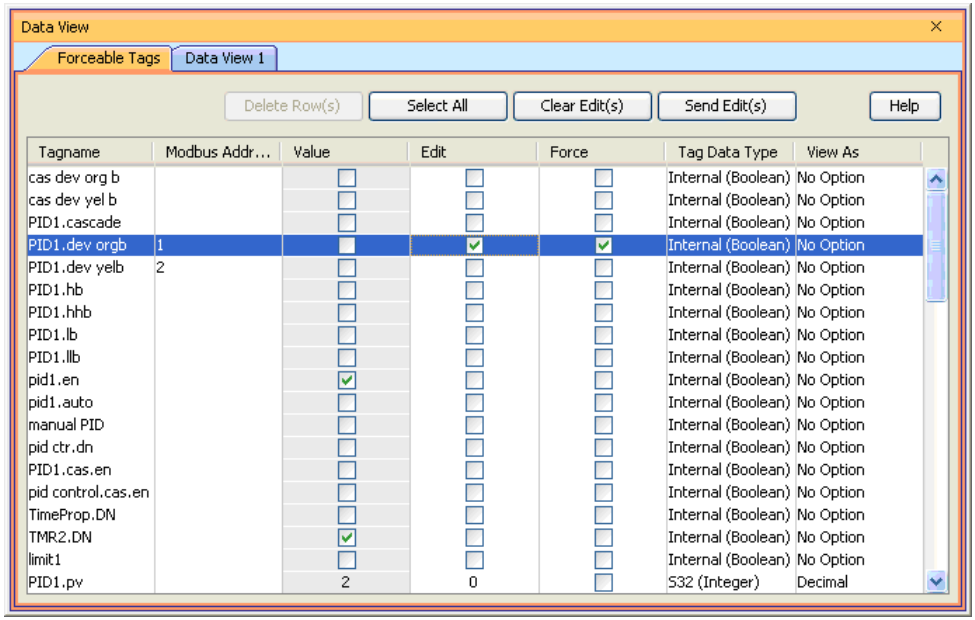
Forcing Tags in Your System

All forcing of tags is accomplished through the Data View window.



Tagname	Modbus Addr...	Value	Edit	Force	Tag Data Type	View As
pid1.en		☑	☑	☐	Internal (Boolean)	No Option
pid1.auto		☐	☑	☐	Internal (Boolean)	No Option
PID1.dev yel	400003	0	5	☐	S32 (Integer)	Decimal
PID1.dev yelb	2	☐	☐	☐	Internal (Boolean)	No Option
limit1		☐	☑	☐	Internal (Boolean)	No Option
PID1.dev org	400001	0	15	☐	S32 (Integer)	Decimal
PID1.dev orgb	1	☐	☐	☐	Internal (Boolean)	No Option
PID1.pv		42	1	☐	S32 (Integer)	Decimal
PID1.sp		4	45	☐	S32 (Integer)	Decimal
PID1.out		0	1000	☐	S32 (Integer)	Decimal
PID1.bias		0	1000	☐	S32 (Integer)	Decimal
manual PID		☐	☑	☐	Internal (Boolean)	No Option
Avg Scan Inter...		8	0	☐	System 16 (Inte...	Decimal
PID1.alm.hystr		0	10000	☐	S32 (Integer)	Decimal
PID1.cas.en		☐	☑	☐	Internal (Boolean)	No Option
Battery Low Bit		☐	☐	☐	System Bits	No Option

From the DataView Window, enter the tags you wish to force, or you can view all forceable tags from the "Forceable Tags" tab automatically created for you when you enable tags as forceable in the tag database.



Tagname	Modbus Addr...	Value	Edit	Force	Tag Data Type	View As
cas dev org b		☐	☐	☐	Internal (Boolean)	No Option
cas dev yel b		☐	☐	☐	Internal (Boolean)	No Option
PID1.cascade		☐	☐	☐	Internal (Boolean)	No Option
PID1.dev orgb	1	☐	☑	☑	Internal (Boolean)	No Option
PID1.dev yelb	2	☐	☐	☐	Internal (Boolean)	No Option
PID1.hb		☐	☐	☐	Internal (Boolean)	No Option
PID1.hhb		☐	☐	☐	Internal (Boolean)	No Option
PID1.lb		☐	☐	☐	Internal (Boolean)	No Option
PID1.llb		☐	☐	☐	Internal (Boolean)	No Option
pid1.en		☑	☐	☐	Internal (Boolean)	No Option
pid1.auto		☐	☐	☐	Internal (Boolean)	No Option
manual PID		☐	☐	☐	Internal (Boolean)	No Option
pid ctr.dn		☐	☐	☐	Internal (Boolean)	No Option
PID1.cas.en		☐	☐	☐	Internal (Boolean)	No Option
pid control.cas.en		☐	☐	☐	Internal (Boolean)	No Option
TimeProp.DN		☐	☐	☐	Internal (Boolean)	No Option
TMR2.DN		☑	☐	☐	Internal (Boolean)	No Option
limit1		☐	☐	☐	Internal (Boolean)	No Option
PID1.pv		2	0	☐	S32 (Integer)	Decimal

From either of these windows you have the option to select the check box in the Force column. When this box is checked and the row is selected (selected rows show high-lighted blue) and you select the Send Edit(s) button, the current row(s) will be forced.

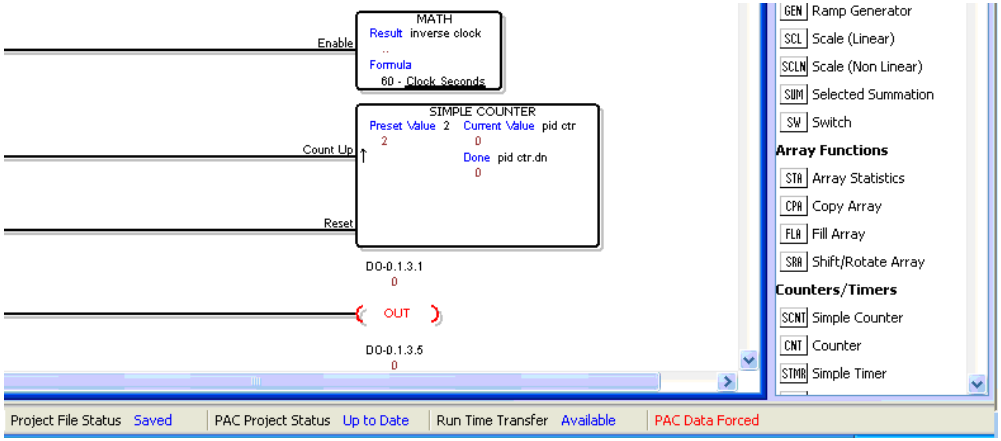


NOTE: *You can select multiple rows by clicking and holding down the left mouse button and dragging up or down. This selects consecutive rows. If you wish to select various rows, simple hold the "Ctrl" control key on your keyboard while left mouse clicking the rows.*

Identifying Forced Values

There are two indications that forces are active on your controller.

1. All active forces will be shown in the Forceable tab of the Data View window as shown in the previous view.
2. You will also see "CPU Data Forced" in Red in the lower right of the Status bar of your software.



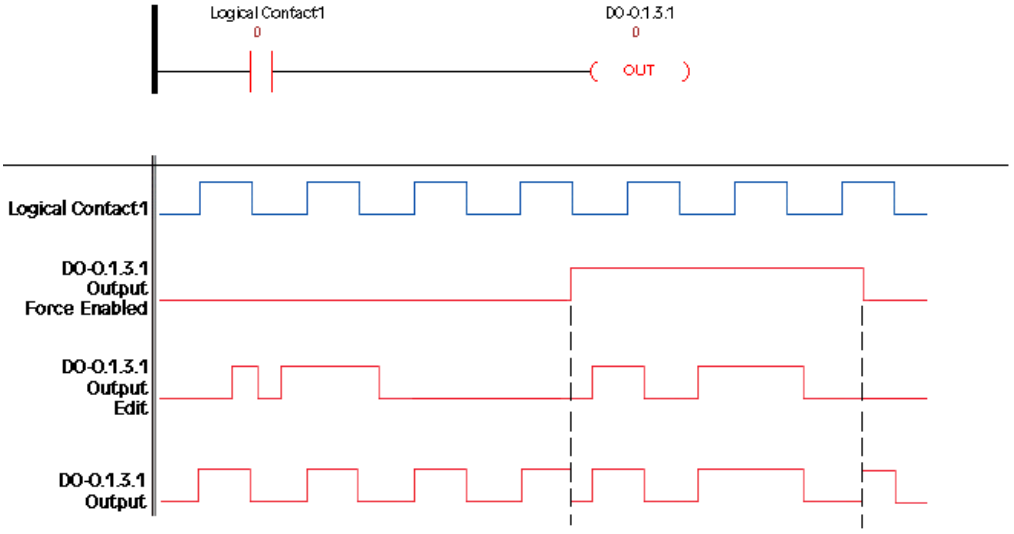
NOTE: *Only Forced tags with an initial force value specified in the Tag database will be retained after a Stop to Run transition, Stop Mode transfer, or a power cycle. All forced values are retained during a Run Time transfer.*

Force Value Timing Chart

The chart below shows how the states of a Digital Output are varied when forces and edits are applied. The ladder rung at the top of the chart shows the logical arrangement of Logical Contact1 and Digital Output DO-0.1.3.1.

Under normal operation, Logical Contact1 is driven by a clock pulse. This clock pulse is then fed to the Digital Output DO-0.1.3.1. Edits written to the contact or the coil from the Data View window within the software will be written one time and will not be forced. With the clock pulse driving the contact, any software edits made to this contact will be allowed but will be overwritten by the logic on the very next scan. Any software edits made to the output will not be allowed and will not register. Edits can only change the state of the output if there are no other logistic or outside factors influencing the output.

In order to change the state of Logical Contact1 or Digital Output DO-0.1.3.1 while the clock pulse is driving it, a force must be introduced. The DO-0.1.3.1 Output Edit line represents edits sent to the digital output from the Data View window. The DO-0.1.3.1 Output Force Enabled line shows the point at which the software forces the output edit to take effect. The dotted lines represent the force being enabled and then disabled by the user. When the force is enabled, any edits made will register at the output regardless of Logical Contact1's state. When the force is disabled, all output edits will be ignored.



EUROPEAN UNION DIRECTIVES (CE)



In This Chapter...

European Union (EU) Directives A–2
Basic EMC Installation Guidelines A–4

European Union (EU) Directives



NOTE: *The information contained in this section is intended as a guideline and is based on our interpretation of the various standards and requirements. Since the actual standards are issued by other parties, and in some cases governmental agencies, the requirements can change over time without advance warning or notice. Changes or additions to the standards can possibly invalidate any part of the information provided in this section.*

This area of certification and approval is absolutely vital to anyone who wants to do business in Europe. One of the key tasks that faced the EU member countries and the European Economic Area (EEA) was the requirement to bring several similar yet distinct standards together into one common standard for all members. The primary purpose of a single standard was to make it easier to sell and transport goods between the various countries and to maintain a safe working and living environment. The Directives that resulted from this merging of standards are now legal requirements for doing business in Europe. Products that meet these Directives are required to have a CE mark to signify compliance.

Member Countries

As of January 1, 2007, the members of the EU are Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithonia, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, and United Kingdom. Iceland, Liechtenstein, and Norway together with the EU members make up the European Economic Area (EEA) and all are covered by the Directives.

Applicable Directives

There are several Directives that apply to our products. Directives may be amended, or added, as required.

- Electromagnetic Compatibility Directive (EMC) — this Directive attempts to ensure that devices, equipment, and systems have the ability to function satisfactorily in an electromagnetic environment without introducing intolerable electromagnetic disturbance to anything in that environment.
- Machinery Safety Directive — this Directive covers the safety aspects of the equipment, installation, etc. There are several areas involved, including testing standards covering both electrical noise immunity and noise generation.
- Low Voltage Directive — this Directive is also safety related and covers electrical equipment that has voltage ranges of 50–1000VAC and/or 75–1500VDC.
- Battery Directive — this Directive covers the production, recycling, and disposal of batteries.

Compliance

Certain standards within each Directive already require mandatory compliance. The EMC Directive, which has gained the most attention, became mandatory as of January 1, 1996. The Low Voltage Directive became mandatory as of January 1, 1997.

Ultimately, we are all responsible for our various pieces of the puzzle. As manufacturers, we must test our products and document any test results and/or installation procedures that are necessary to comply with the Directives.

As a machine builder, you are responsible for installing the products in a manner which will ensure compliance is maintained. You are also responsible for testing any combinations of products that may (or may not) comply with the Directives when used together. The end user of the products must comply with any Directives that may cover maintenance, disposal, etc. of equipment or various components. Although we strive to provide the best assistance available, it is impossible for us to test all possible configurations of our products with respect to any specific Directive. Because of this, it is ultimately your responsibility to ensure that your machinery (as a whole) complies with these Directives and to keep up with applicable Directives and/or practices that are required for compliance.

Productivity3000® systems manufactured by Koyo Electronics Industries or FACTS Engineering, when properly installed and used, conform to the Electromagnetic Compatibility (EMC), Low Voltage Directive, and Machinery Directive requirements of the following standards.

- Product Specific Standard for Programmable Controllers
  EN61131–2:2003 Programmable controllers, equipment requirements and tests.
- This is the product specific standard for PACs and covers the low voltage and EMC Directives as required for European CE certification. This standard has many tests together with test procedures and limits, but also references the below standards for some tests:
- IEC 60068-2-1:1990 part 2 tests A, 60068-2-2:1974 part 2 test B, IEC 60068-2-6:1995, Part 2: Test Fc, IEC 60068-2-14:1984 Part 2 Test N, IEC 60068-2-27:1987 Part 2 Test Ea, IEC 60068-2-30:1980, Part 2 Test Db, IEC 60068-2-31:1969 Part Test Ec, IEC 60068-2-32:1975 Part 2 Test Ed, IEC 60417 (all parts), IEC 60664-1:1992 Part 1, IEC 60664-3:1992, IEC 60695-2-1 (all sheets), Part 2: IEC 60707:1999 IEC 60947-5-1:1997 Part 5-1 IEC 60947-7-1:2002 Part 7-1, I EC 60950-1:2001 Part 1, IEC 61000-4-2:1995, Part 4-2, IEC 61000-4-3:2002 Part 4-3, IEC 61000-4-4:1995, IEC 61000-4-5:1995 Part 4-5, IEC 61000-4-6:1996, Part 4-6, IEC 61000-4-8:1993 Part 4-8, IEC 61000-4-12:1995 Part 4-12, IEC 61010-1:2001 Part 1, CISPR 11:1999, CISPR 16-1:1999 Part 1, CISPR 16-2:1999 Part 2
- For undated references, the latest edition of the referenced document (including any amendments) applies.
- Warning on Electrostatic Discharge (ESD)
  We recommend that all personnel take necessay precautions to avoid the risk of transferring static charges inside the control cabinet, while clear warnings and instructions should be provided on the cabinet exterior. Such precautions may include the use of earth straps, grounding mats and similar static-control devices, or the powering off of the equipment inside the enclosure before opening the cabinet door.
- Warning on Radio Interference (RFI)
  This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

General Safety

- External switches, circuit breaker or external fusing, are required for these devices.
- The switch or circuit breaker should be mounted near the programmable controller equipment.

Special Installation Manual

The installation requirements to comply with the requirements of the Machinery Directive, EMC Directive and Low Voltage Directive are slightly more complex than the normal installation requirements found in the United States.

Other Sources of Information

Although the EMC Directive gets the most attention, other basic Directives, such as the Machinery Directive and the Low Voltage Directive, also place restrictions on the control panel builder. Because of these additional requirements it is recommended that the following publications be purchased and used as guidelines:

- BSI publication TH 42073: February 1996 – covers the safety and electrical aspects of the Machinery Directive
- EN 60204–1:1992 – General electrical requirements for machinery, including Low Voltage and EMC considerations
- IEC 1000–5–2: EMC earthing and cabling requirements
- IEC 1000–5–1: EMC general considerations

It may be possible for you to obtain this information locally; however, the official source of applicable Directives and related standards is:

The Office for Official Publications of the European Communities L–2985 Luxembourg; quickest contact is via the web at http://publications.europa.eu

Another source is:

British Standards Institution – Sales Department

Linford Wood

Milton Keynes

MK14 6LE

United Kingdom; the quickest contact is via the web at www.bsigroup.com

Basic EMC Installation Guidelines

Enclosures

The simplest way to meet the safety requirements of the Machinery and Low Voltage Directives is to house all control equipment in an industry standard lockable steel enclosure. This normally has an added benefit because it will also help to reduce EMI emissions. Per IEC/EN 61131-2, the PLC is tested in a metal enclosure. The level of RF emissions is actually higher outside of cabinet and may be well above limits. Holes in the enclosure, for the passage of cables or to mount operator interfaces, can increase internal levels of emissions.

Mains Filters

Productivity3000® AC powered base power supplies do not require extra mains filtering to comply with the EMC Directive on conducted RF emissions.

DC powered base power supplies require a mains filter. A CORCOM 6MV1 filter was tested and reduced emissions to an acceptable level.

Suppression and Fusing

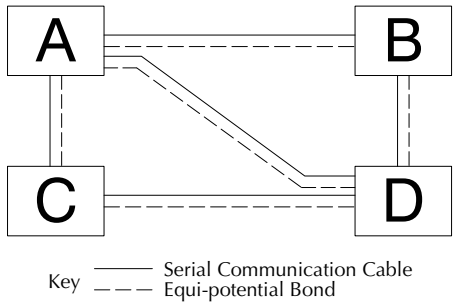
In order to comply with the fire risk requirements of the Low Voltage and Machinery Directive standards EN 61010–1 and EN 60204–1, it is necessary to fuse both sides of the power inputs (on both AC and DC units).

Transient suppressors must be protected by fuses and the capacity of the transient suppressor must be greater than the blow characteristics of the fuses or circuit breakers to avoid a fire risk. A recommended AC supply input arrangement for the Productivity 3000 is to use twin 3 amp TT fused terminals with fuse blown indication, such as DINnectors DN–F10L terminals, or twin circuit breakers.

Internal Enclosure Grounding

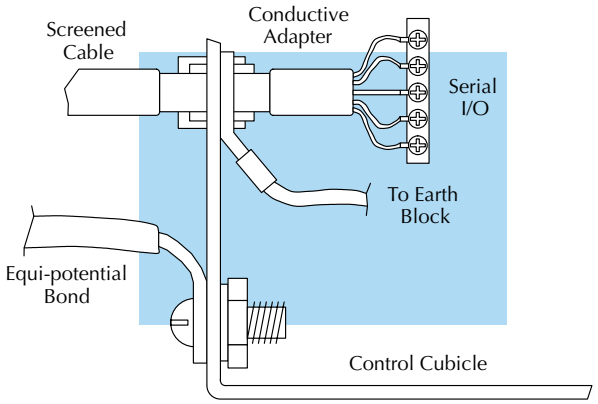
A heavy-duty star earth terminal block should be provided in every cubicle for the connection of all earth ground straps, protective earth ground connections, mains filter earth ground wires, and mechanical assembly earth ground connections. This should be installed to comply with safety and EMC requirements, local standards, and the requirements found in IEC 1000–5–2. The Machinery Directive also requires that the common terminals of the programmable controller input modules, and common supply side of loads driven from programmable controller output modules should be connected to the protective earth ground terminal.

Equipotential Grounding



Adequate site earth grounding must be provided for equipment containing modern electronic circuitry. The use of isolated earth electrodes for electronic systems is forbidden in some countries. Make sure you check any requirements for your particular destination. IEC 1000–5–2 covers equipotential bonding of earth grids adequately, but special attention should be given to apparatus and control cubicles that contain I/O devices, remote I/O racks, or have inter-system communications with the primary PAC system enclosure. An equipotential bond wire must be provided alongside all serial communications cables, and to any separate items of the plant which contain I/O devices connected to the programmable controller. The diagram shows an example of four physical locations connected by a communications cable.

Communications and Shielded Cables

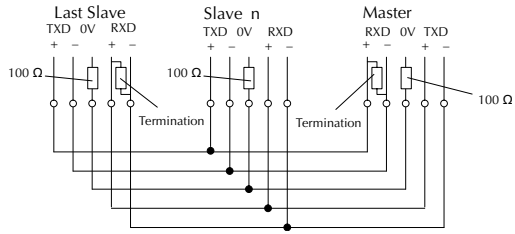


Good quality 24 AWG minimum twisted-pair shielded cables, with overall foil and braid shields are recommended for analog cabling and communications cabling outside of the programmable controller enclosure. To date it has been a common practice to only provide an earth ground for one end of the cable shield in order to minimize the risk of noise caused by earth ground loop currents between apparatus. The procedure of only grounding one end, which primarily originated as a result of trying to reduce hum in audio systems, is no longer applicable to the complex industrial environment. Shielded cables are also efficient emitters of RF noise from the PAC system, and can interact in a parasitic manner in networks and between multiple sources of interference.

The recommendation is to use shielded cables as electrostatic “pipes” between apparatus and systems, and to run heavy gauge equipotential bond wires alongside all shielded cables. When a shielded cable runs through the metallic wall of an enclosure or machine, it is recommended in IEC 1000–5–2 that the shield should be connected over its full perimeter to the wall, preferably using a conducting adapter, and not via a pigtail wire connection to an earth ground bolt. Shields must be connected to every enclosure wall or machine cover that they pass through.

Analog and RS232 Cables

Providing an earth ground for both ends of the shield for analog circuits provides the perfect electrical environment for the twisted pair cable as the loop consists of signal and return, in a perfectly balanced circuit arrangement, with connection to the common of the input circuitry made at the module terminals. RS232 cables are handled in the same way.



Multidrop Cables

RS422 twin twisted pair, and RS485 single twisted pair cables also require a 0V link, which has often been provided in the past by the cable shield. It is now recommended that you use triple twisted pair cabling for RS422 links, and twin twisted pair cable for RS485 links. This is because the extra pair can be used as the 0V inter-system link. With loop DC power supplies earth grounded in both systems, earth loops are created in this manner via the inter-system 0v link. The installation guides encourage earth loops, which are maintained at a low impedance by using heavy equipotential bond wires. To account for non–European installations using single-end earth grounds, and sites with far from ideal earth ground characteristics, we recommend the addition of 100 ohm resistors at each 0V link connection in network and communications cables.

Shielded Cables Within Enclosures

When you run cables between programmable controller items within an enclosure which also contains susceptible electronic equipment from other manufacturers, remember that these cables may be a source of RF emissions. There are ways to minimize this risk. Standard data cables connecting CPUs and/or operator interfaces should be routed well away from other equipment and their associated cabling. You can make special serial cables where the cable shield is connected to the enclosure's earth ground at both ends, the same way as external cables are connected.

Analog Modules and RF Interference

The readings from all analog modules will be affected by the use of devices that exhibit high field strengths, such as mobile phones and motor drives.

All AutomationDirect products are tested to withstand field strength levels up to 10V/m, which is the maximum required by the relevant EU standards. While all products pass this test, analog modules will typically exhibit deviations of their readings. This is quite normal, however, systems designers should be aware of this and plan accordingly.

When assembling a control system using analog modules, these issues must be adhered to and should be integrated into the system design. This is the responsibility of the system builder/commissioner.

Network Isolation

For safety reasons, it is a specific requirement of the Machinery Directive that a keyswitch must be provided that isolates any network input signal during maintenance, so that remote commands cannot be received that could result in the operation of the machinery. To avoid the introduction of noise into the system, any keyswitch assembly should be housed in its own earth grounded steel box and the integrity of the shielded cable must be maintained.

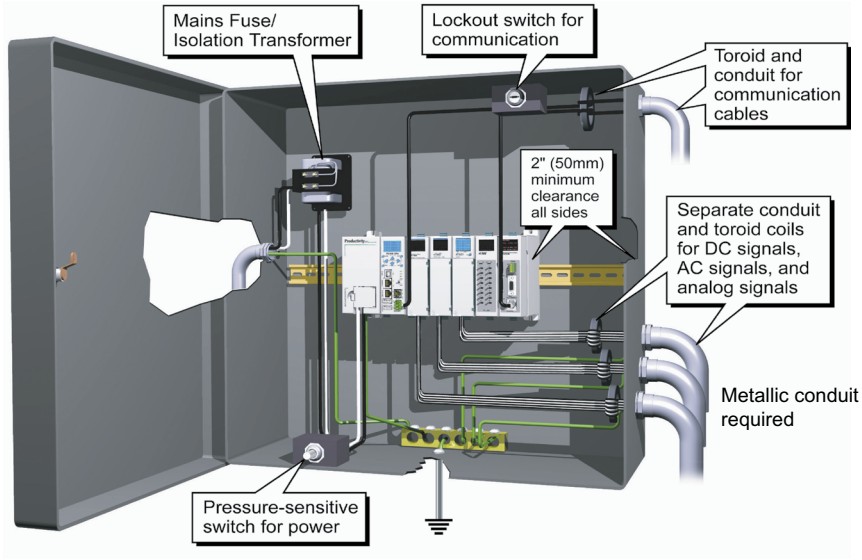
Again, for further information on EU directives we recommend that you check the EU Commission's official web site at:

http://ec.europa.eu/growth/single-market/european-standards/harmonised-standards.

It is good Engineering practice to install toroid inductors on the I/O wiring and the communications cables such as listed in the table below.

Toroid Inductors

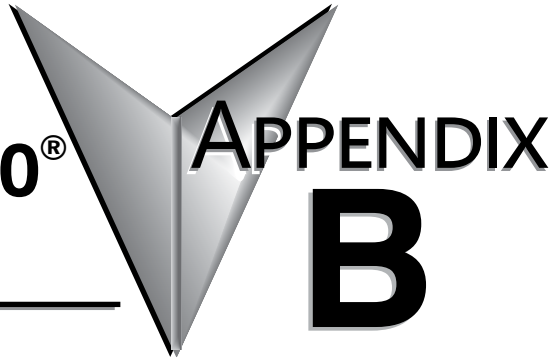
Manufacturer	Mfg. Part Number	Outside Diameter	Inside Diameter	Length
RS Online	260–6795	17.5 mm	9.5 mm	28.5 mm
Fair-Rite	2643665702	17.5 mm	9.5 mm	28.5 mm
Wurth Elektronick	742 700 9	17.5 mm	9.5 mm	28.5 mm



Items Specific to the Productivity3000®

- It is the responsibility of the system designer to earth one side of all control and power circuits, and to earth the braid of screened cables.
- This equipment must be properly installed while adhering to the installation standards IEC 1000–5–1, IEC 1000–5–2 and IEC 1131–4.
- It is a requirement that all PLC equipment must be housed in a protective steel enclosure, which limits access to operators by a lock and power breaker. If access is required by operators or untrained personnel, the equipment must be installed inside an internal cover or secondary enclosure.
- It should be noted that the safety requirements of the machinery directive standard EN60204–1 state that all equipment power circuits must be wired through isolation transformers or isolating power supplies, and that one side of all AC or DC control circuits must be earthed.
- Both power input connections to the programmable controller must be separately fused using 3 amp T type anti–surge fuses, and a transient suppressor fitted to limit supply overvoltages.
- If the equipment is used in a manner not specified by the manufacturer the protection provided by the equipment may be impaired.

PRODUCTIVITY3000® ERROR CODES



In This Appendix:

Productivity3000® Error Codes B–1
Communications Error Codes B–2
Module Error Codes B–3
CPU Error Codes B–5
Project Error Codes B–6
Project Error Messages B–8

Communications Error Codes

Error Code	Description	Suggested Fix
01	Function Code not supported	Check instruction or connected device and correct Function code or address range selected.
02	Address out of range. This error is typically generated when a Modbus address has been requested that does not exist in the CPU.	Check instruction or connected device and correct Function code or address range selected.
03	Illegal Data Value. This error is typically generated when the Modbus request sent to the CPU is formed incorrectly.	Check the Modbus request against the Modbus protocol specification (www.modbus.org) to verify that it was formed correctly.
04	Device Failure	Check connected device

Module Error Codes

Error Code	Cause	Solution
E02101	One or more module status bits are set.	Examine the individual module status bits for the module(s) in question to determine the cause of the error and appropriate action.
E02110	Module firmware is incompatible with project.	Recompile and transfer project to CPU. If problem persists, upgrade module firmware to latest version, then recompile and transfer project using latest Programming Software.
E02111	Module firmware is incompatible with project.	Recompile and transfer project to CPU. If problem persists, upgrade module firmware to latest version, then recompile and transfer project using latest Programming Software.
E02112	Module configuration data is invalid.	Recompile and transfer project to CPU. If problem persists, upgrade module firmware to latest version, then recompile and transfer project using latest Programming Software.
E02113	Module configuration data is invalid.	Recompile and transfer project to CPU. If problem persists, upgrade module firmware to latest version, then recompile and transfer project using latest Programming Software.
E02114	Unable to configure module.	Restart CPU. If problem persists, recompile and transfer project to CPU. If problem persists, upgrade module firmware to latest version, then recompile and transfer project using latest Programming Software.
E02115	Unable to configure module.	Restart CPU. If problem persists, recompile and transfer project to CPU. If problem persists, upgrade module firmware to latest version, then recompile and transfer project using latest Programming Software.
E02201/ E02202	Intelligent module is not communicating.	Remove and reinstall the module. If the problem persists, the module is defective and must be repaired or replaced.
E02203	P3-EX is not communicating with CPU or P3-RS/P3-RX. Or, local base is not communicating with its CPU or P3-RS/P3-RX. Hot swap is enabled for the base.	Verify base has power. Disconnect and reconnect base communication cable. If problem persists, replace base communication cable, or P3-EX. If problem persists, cycle power to base. If problem persists, restart system.
E02204	P3-EX is not communicating with CPU or P3-RS/P3-RX. Or, local base is not communicating with its CPU or P3-RS/P3-RX. Hot swap is enabled for the base.	Verify base has power. Disconnect and reconnect base communication cable. If problem persists, replace base communication cable, or P3-EX. If problem persists, cycle power to base. If problem persists, restart system.
E02205	P3-RS/P3-RX is not communicating with CPU. Hot swap is enabled for the entire remote base group.	Verify that the P3-RS/RX is properly connected via Ethernet to the CPU “Remote I/O” port and that the P3-RS/RX is powered on. If problem persists, verify that Ethernet equipment, such as switches and cables are functioning properly.
E02206	P3-RS/P3-RX is not communicating with CPU. Hot swap is enabled for the entire remote base group.	Verify that the P3-RS/RX is properly connected via Ethernet to the CPU “Remote I/O” port and that the P3-RS/RX is powered on. If problem persists, verify that Ethernet equipment, such as switches and cables are functioning properly.

Module Error Codes - Continued

Error Code	Cause	Solution
E02207	Multiple remote slaves are set to same group number.	Make sure that each slave module in the network is set to a unique group number.
E02208	An expansion base is connected to the USB OUT port on the CPU.	Move cable to EXP I/O OUT port.
E02209	More than four expansion bases have been connected to the CPU.	Disconnect additional expansion bases.
E02301	Expected module is not installed, or the installed module is defective. Hot swap is enabled for the slot.	Install the correct module.
E02302	Expected module is not installed, or the installed module is defective. Hot swap is not enabled for the slot.	Install the correct module.
E02401	GS-Drive configuration cannot be transferred to GS-Drive due to communications error.	Make sure GS-Drive is in STOP mode and motor is not in motion, then either power-cycle CPU or re-transfer project to CPU.
E02402	GS-Drive configuration cannot be transferred to GS-Drive due to GS-Drive error. Number in parentheses is MODBUS exception code.	Verify E-Drive and GS-Drive are properly installed and functioning, then either power-cycle CPU or re-transfer project to CPU.
E02403	GS-Drive configuration cannot be transferred to GS-Drive while motor is in motion.	Make sure GS-Drive is in STOP mode and motor is not in motion, verify all Ethernet equipment is properly installed and configured, then either power-cycle CPU or re-transfer project to CPU.
E02404	GS-Drive configuration cannot be transferred to GS-Drive because GS drive type and model do not match project.	Correct GS drive type and model in project.

CPU Error Codes

Error Code	Cause	Solution
E05101	The CPU battery is low.	Replace CPU Battery.
E05102	The Base identifier (EPROM) is invalid.	Replace the unit. If unit is in warranty, call AutomationDirect for an RA number.
E05103	The P3-550(E) or P3-RS cannot communicate with the User Interface Module (LCD).	Replace the unit. If unit is in warranty, call AutomationDirect for an RA number.
E05104	Too many display messages were sent to the User Interface Module (LCD) in a short period of time.	Reduce the rate at which messages to the LCD are triggered.
E05105	The User Interface Module (LCD) did not receive firmware from the P3-550(E) or P3-RS.	If error persists after power cycle, replace the unit. If unit is in warranty, call AutomationDirect for an RA number.
E05106	I2C bus has locked up.	Self-recoverable. If problem persists, restart system.
E05107	UIM Task Can not access File System.	Restart system, if reoccurs notify support.
E05108	Missing or improperly formatted Pen Drive.	Insert valid Pen Drive (FAT16 or FAT32).
E05109	Error Reading or Writing to the Pen Drive.	Replace Pen Drive.
E05110	CPU has an existing Connection to Productivity Suite, UIM Action can not be performed.	Wait until CPU Connection is closed or restart system.
E05111	One or more project files are missing from Pen Drive.	Transfer complete project to Pen Drive.
E05120	The module specified has a Firmware Error.	Replace the unit. If unit is in warranty, call AutomationDirect for an RA number.
E05121	The module specified has a Hardware Error.	Replace the unit. If unit is in warranty, call AutomationDirect for an RA number.
E05122	The module specified has an Internal Error.	Replace the unit. If unit is in warranty, call AutomationDirect for an RA number.

Project Error Codes

Error Code	Cause	Solution
E03000 - E03199	Internal firmware file system error.	Power cycle CPU. If problem persists, contact AutomationDirect for repair or replacement.
E03201 - E03299	Internal firmware operating system error.	Power cycle CPU. If problem persists, contact AutomationDirect for repair or replacement.
E03301	Unable to exit RUN mode.	Power cycle CPU. If problem persists, contact AutomationDirect for repair or replacement.
E03801 - E03899	Internal firmware USB error.	Problem should self recover. If problem persists, power cycle CPU.
E03901	A scan exceeded the timeout specified in CPU Hardware Configuration.	Verify that For/Next loops are handled properly. Adjust the timeout setting.
E04101	Scan attempted access beyond array limits. Txxxx is task ID. Rxxxx is rung number.	Correct problem in ladder logic or data that caused invalid access.
E04201	Internal firmware Data Logging error.	Problem should self recover. If problem persists, power cycle CPU.
E04202	Cannot create data logging folder.	Ensure a supported storage device is properly installed in USB OUT port on CPU. If problem persists, restart system.
E04203	Cannot write data to data logging storage device.	Ensure a supported storage device is properly installed in USB OUT port on CPU. If problem persists, restart system.
E04204	Internal firmware Data Logging buffer is greater than 50% full.	Problem should self recover. If problem persists, power cycle CPU.
E04205	Internal firmware Data Logging buffer overflow.	Problem should self recover. If problem persists, power cycle CPU.
E04210	Invalid system ID found while loading project.	Load new project.
E04220	Email instruction failed.	Problem should self recover. If problem persists, power cycle CPU.
E04230	Base firmware may be corrupt.	Power cycle base. If problem persists, power cycle CPU or P3-RS/RX. If problem persists, reload firmware for the CPU or the P3-RS/RX in control of the Base Group.
E04300 - E04302	A project file is missing.	Load new project.
E04303	Internal firmware project loader failure.	Problem should self recover. If problem persists, power cycle CPU.
E04304	Project load failure limit exceeded. Project has been removed.	Load new project.
E04305 - E04306	Internal firmware project loader failure.	Problem should self recover. If problem persists, power cycle CPU. If problem persists, load new project.
E04307	Project file corrupt.	Load new project.
E04308 - E04315	Internal firmware project loader failure.	Load new project.
E04316	Project upload failed.	Retry the process.
E04317	Internal firmware project loader failure.	Load new project.

Project Error Codes - Continued

Error Code	Cause	Solution
E04318	Modbus TCP connection limit exceeded.	Reduce the number of concurrently enabled MRX, MWX, RX and WX Instructions to no more than 64.
E04319	Internal error.	Self-recoverable, if problem persists restart CPU.
E04320	One or more RS232 parameters contain invalid values.	Verify that all RS232 parameters in project contain valid settings.
E04321	One or more RS485 parameters contain invalid values.	Verify that all RS485 parameters in project contain valid settings.

Project Error Messages

Error Message	Cause	Solution
Cannot create a task with the name '<taskname>' because a task with that name already exists.	The name of the new task already exists.	Create a unique task name.
The help file '<helpfilename>' cannot be found.	The help file cannot be found in the location that it was installed.	Re-install the software. The P3-HELP.chm file should be located in the following folder: C:\ProgramFiles\AutomationDirect\ ProductivitySuite\data\help
The topic '<topicname>' does not exist.	A referenced help topic has either been changed, moved, or deleted from the help file.	Re-install the software or download the Latest Help File version.
Task name cannot be empty.	An attempt was made to create a task without a task name.	Create a unique task name.
The task name has an invalid character '<taskname>'.	An attempt was made to create a task with an invalid character in the name.	Create a unique task name using valid characters only.
The task name '<taskname>' already exists.	The name of the new task already exists.	Create a unique task name.
Tagname cannot be all digits.	A tagname that consists of only digits was entered.	There must be at least one letter in a tagname.
Cannot complete the operation because the P3-550(E) folder already exists.	The P3-550(E) folder already exists on the target removable USB drive and the create folder option is checked.	Uncheck the create folder option in the dialog and try transfer again.
Cannot complete the operation because the P3-550(E) folder does not exist.	The P3-550(E) folder does not exist on the target removable USB drive and the create option is not checked.	Check the create folder option in the dialog and try transfer again.
Cannot complete the operation due to failure to create the P3-550(E) folder.	System could not create the P3-550(E) folder.	This might be due to a read only drive.
Failed to reboot CPU.	CPU failed to reboot.	Reboot CPU again or cycle power.
Failed to get CPU date & time.	CPU failed to return date & time data.	Check CPU to PC connection.
Failed to set CPU date & time.	CPU failed to set date & time.	Check CPU to PC connection.
CPU does not exist.	A CPU does not exist in the configuration.	Add a CPU to the hardware configuration or connect to the CPU and select "read configuration" in the Hardware Configuration dialog.
Rebooting the CPU failed.	CPU failed to reboot.	Reboot CPU again or Cycle power
The IP address '<IP Address>' is already on the network. Please use a different address.	The new CPU IP address is used by another entity on the network.	Select a unique IP address. You may need to contact your networks IT department to verify.
Cannot change CPU name.	Failed to change CPU name due to a CPU error or a network problem	Check CPU to PC connection.

Project Error Messages - Continued

Error Message	Cause	Solution
Cannot change IP configuration due to CPU error.	CPU failed to change IP configuration.	Check CPU to PC connection and network configuration. Connections through a router may also cause conflicts.
Cannot change IP configuration due to network problem.	CPU failed to respond to the IP configuration request.	Check CPU to PC connection and network configuration. Connections through a router may also case conflicts.
The project GS drive for address <GS Drive ID> has a type mismatch. The project configuration has a type of <GS Drive Model> while the physical configuration has a type of <GS Drive Model>. **Please correct the project configuration before continuing.**	The GS drive type in the software works CPUe is different from the physical configuration.	Check the Hardware Configuration or connect to the CPU and in the hardware configuration dialog select “Read Configuration”.
The base found on group <CPU GroupId> base <CPU BaseId> is invalid.	The base ID returned from CPU is invalid.	Check the hardware configuration or connect to the CPU and in the hardware configurations dialog select “Read Configuration”.
Could not connect to the CPU.	CPU is not able to be connected.	Check CPU to PC connection.
Could not disconnect the CPU.	CPU is not able to be disconnected.	Check CPU to PC connection.
Could not connect to the selected CPU.	Failed to validate security on connection.	Check CPU to PC connection and required security passwords.
Cannot blink CPU due to CPU error.	CPU failed to blink CPU run light.	Check CPU to PC connection and clear existing CPU errors.
Cannot blink CPU due to network problem.	CPU failed to respond to the blink request.	Check CPU to PC connection and network configuration. Connections through a router may also cause conflicts.
Failed to retrieve I/O inventory from CPU ‘<CPU Name>’.	CPU failed to respond to the inventory request.	Check CPU to PC connection and request again.
Failed to put the CPU to run mode.	CPU is not able to be put in run mode.	CPU mode switch must be in the Run position and errors cleared.
Failed to put the CPU to stop mode.	CPU is not able to be put in stop mode.	Check CPU to PC connection.
Failed to put the CPU to debug mode.	CPU is not able to be put in debug mode.	Check CPU to PC connection. CPU must be in STOP before entering debug mode.
CPU has existing connection.	CPU cannot be connected since it has already connected to another software.	Verify existing connections.
Failed to put the CPU into <CPU Mode> mode because CPU connection is lost.	CPU connection is lost while setting CPU mode.	Check CPU to PC connection.

Project Error Messages - Continued

Error Message	Cause	Solution
Failed to put the CPU into <CPU Mode> mode because CPU has existing critical error.	Cannot set CPU mode due to critical errors on the CPU.	Check CPU to PC connection and clear errors.
Failed to put the CPU into run mode because the CPU switch is set to the STOP position.	Cannot set CPU to run mode since the run/stop switch is in the stop position.	Place the CPU switch in Run.
Could not connect to the detected CPU.	An unknown failure occurred on connection.	Check CPU to PC connection.
You do not have permission to access this feature.	The security setup does not allow the current user to perform this operation.	Check CPU to PC connection and required security passwords.
You need to specify a user name.	The name on a user account was deleted while editing the profile.	Specify the user name.
You need to specify a password.	The password on a user account was deleted while editing the profile.	Specify the password.
The two passwords do not match.	The password on a user account was changed and the verification does not match the new value.	Re-enter the password and check to make sure both are the same.
At least one user needs to have "Project Transfer From CPU and Monitor Data" selected to enable the protection feature.	Project Transfer from CPU and Data Monitor security was enabled without a user with these rights currently defined.	Define at least one user with the appropriate project transfer rights.
At least one user needs to have "Project Transfer To CPU" selected to enable the protection feature.	Project Transfer to CPU security was enabled without a user with these rights currently defined.	Define at least one user with the appropriate project transfer rights.
You must connect to a CPU first.	User tried to Set Factory Defaults, Reboot the CPU, Read the SRAM, or Clear CPU Memory without first being connected to the CPU.	Check CPU to PC connection.
The current project does not contain a CPU in the configuration. Go to: Setup>Hardware Config to correct the problem.	The user tried to download a project that does not contain a CPU to the CPU or USB Pen Drive.	Add a CPU to the hardware configuration or connect to the CPU and in the hardware configurations dialog select "read configuration".
The CPU firmware is in service mode. The requested action is not available in this mode.	The user tried to transfer a project to a CPU that is in Service Mode.	Check CPU to PC connection and upgrade firmware.
Please select a search result first.	In the Find dialog, User pressed the GoTo button before selecting an entry in the Search Results list.	Define your search criteria and try again.
Incorrect Key Code.	User entered an invalid license keycode.	Verify correct key code was entered. Pay close attention to capitalization, and mixture of letters and numbers.

Project Error Messages - Continued

Error Message	Cause	Solution
Cannot create CPU P3-530 with existing remote base groups or GS drives.	Project has been created using a P3-550(E) and remote base groups or GS drives and programmer is trying to modify the hardware configuration to a P3-530.	P3-530 does not support remote I/O or GS drives. Remove the remote I/O or GS drives from configuration and add the P3-530 or continue to use the P3-550(E).
The project I/O configuration has a CPU mismatch. The project configuration has "P3-550(E)" while the physical I/O has "P3-530". Any remote base groups and GS drives that are not compatible with the physical CPU will be deleted if the CPU is used. Do you want to replace the project configuration?	CPU in base that the programming software is online with is different from the CPU in hardware configuration.	Either replace the CPU in the base with the CPU configured in the hardware configuration or change the hardware configuration in the project.
Cannot add a remote base group for the CPU P3-530	The P3-530 does not support remote I/O.	Remove any remote I/O from hardware configuration.
Cannot add a GS drive for CPU P3-530.	The P3-530 does not support remote GS Drives.	Remove any remote GS Drives from hardware configuration.

Security Considerations for Control Systems Networks



In This Appendix...

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Security Considerations for Control Systems Networks

Manufacturers are realizing that to stay competitive, their Automation and Control Systems need to be more integrated within their plant. The systems often need to be integrated with upstream Enterprise Data Systems, and even further integrated to allow information to be accessible across multiple plants, or even through the Internet. This convergence of the IT world with the Automation World creates challenges in maintaining secure systems and protecting your investments in processes, personnel, data and intellectual property.

While Automation Networks and Systems have built-in password protection schemes, this is only one very small step in securing your systems. Automation Control System Networks need to incorporate data protection and security measures that are at least as robust as a typical business computer system. We recommend that users of PLCs, HMI products and SCADA systems perform your own network security analysis to determine the proper level of security required for you application. However, the Department of Homeland Security's National Cybersecurity and Communications Integration Center (NCCIC) and Industrial Control Systems Cyber Emergency Response Team (ICS-CERT) has provided direction related to network security and safety under an approach described as "Defense in Depth", which is published at www.us-cert.gov/sites/default/files/recommended_practices/NCCIC_ICS-CERT_Defense_in_Depth_2016_S508C.pdf.

This comprehensive security strategy involves physical protection methods, as well as process and policy methods. This approach creates multiple layers and levels of security for industrial automation systems. Such safeguards include the location of control system networks behind firewalls, their isolation from business networks, the use of intrusion detection systems, and the use of secure methods for remote access such as Virtual Private Networks (VPNs). Further, users should minimize network exposure for all control system devices and such control systems and these systems should not directly face the internet. Following these procedures should significantly reduce your risks both from external sources as well as internal sources, and provide a more secure system.

It is the user's responsibility to protect such systems, just as you would protect your computer and business systems. AutomationDirect recommends using one or more of these resources in putting together a secure system:

- US-CERT's Control Systems Security Program at the following web address: www.us-cert.gov/control_systems/
- Special Publication 800-82 of the National Institute of Standards and Technology – Guide to Industrial Control Systems (ICS) Security https://csrc.nist.gov/publications/detail/sp/800-82/rev-2/final
- ISA99, Industrial Automation and Control Systems Security http://www.isa.org/MSTemplate.cfm?MicrositeID=988&CommitteeID=6821 (please note this is a summary and these standards have to be purchased from ISA)

The above set of resources provides a comprehensive approach to securing a control system network and reducing risk and exposure from security breaches. Given the nature of any system that accesses the internet, it is incumbent upon each user to assess the needs and requirements of their application, and take steps to mitigate the particular security risks inherent in their control system.