

1: Introduction

The SNAP PAC System

The SNAP PAC System™ is an integrated system of hardware and software from Opto 22 for industrial control, remote monitoring, and data acquisition applications. Designed to simplify the typically complex process of understanding, selecting, buying, and applying an automation system, the SNAP PAC System consists of four integrated components:

PAC Project™ Software Suite—easy-to-use flowchart-based control programming, HMI (human-machine interface) development and runtime, and optional OPC server and database connectivity software

SNAP PAC controllers—standalone or rack-mounted industrial controllers with networking options

SNAP PAC brains—intelligent I/O processors for distributed control on Ethernet (wired and wireless) and serial networks

SNAP I/O™—analog, digital, and serial I/O modules for connecting to field devices, machines, and sensors

These four simple but flexible components form a system capable of handling any application from basic equipment monitoring to complete factory automation.

SNAP PAC System Architecture

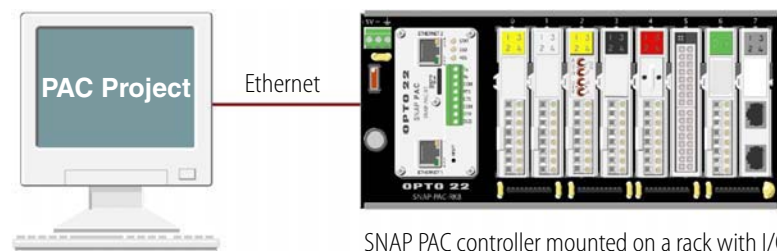
All components work together, no matter what the system's size. When your system needs to expand, investments in development time and field wiring remain largely intact; you simply add more brains and I/O. If new capabilities are required, additional software and controllers can also be added with minimal time and expense.

The next few pages show examples of initial systems and several ways in which they might be expanded.

Example #1: Minimal Initial System

The simplest system consists of just one rack-mounted controller with I/O plus PAC Project Basic software. PAC Project Basic includes both control programming (PAC Control) and HMI development (PAC Display). The software is free, and the system includes free product support and free training.

Example #1: Minimal Initial System



PC for developing
PAC Control strategy and
running PAC Display HMI

SNAP PAC controller mounted on a rack with I/O. The controller runs the control program independently and provides I/O processing and communication.

Control Programming. You use both flowcharting and scripting (optional) to develop the PAC Control program, or *strategy*, on your PC. You name each I/O point, variable, or other element in the strategy with names that are significant to your application, and the commands you use in the strategy logic are in plain English. With this simplicity, however, you also have advanced functions like subroutines, pointers, and string handling.

After you develop the strategy, you download it to the controller, where it runs independently from the PC to monitor and control the local I/O.

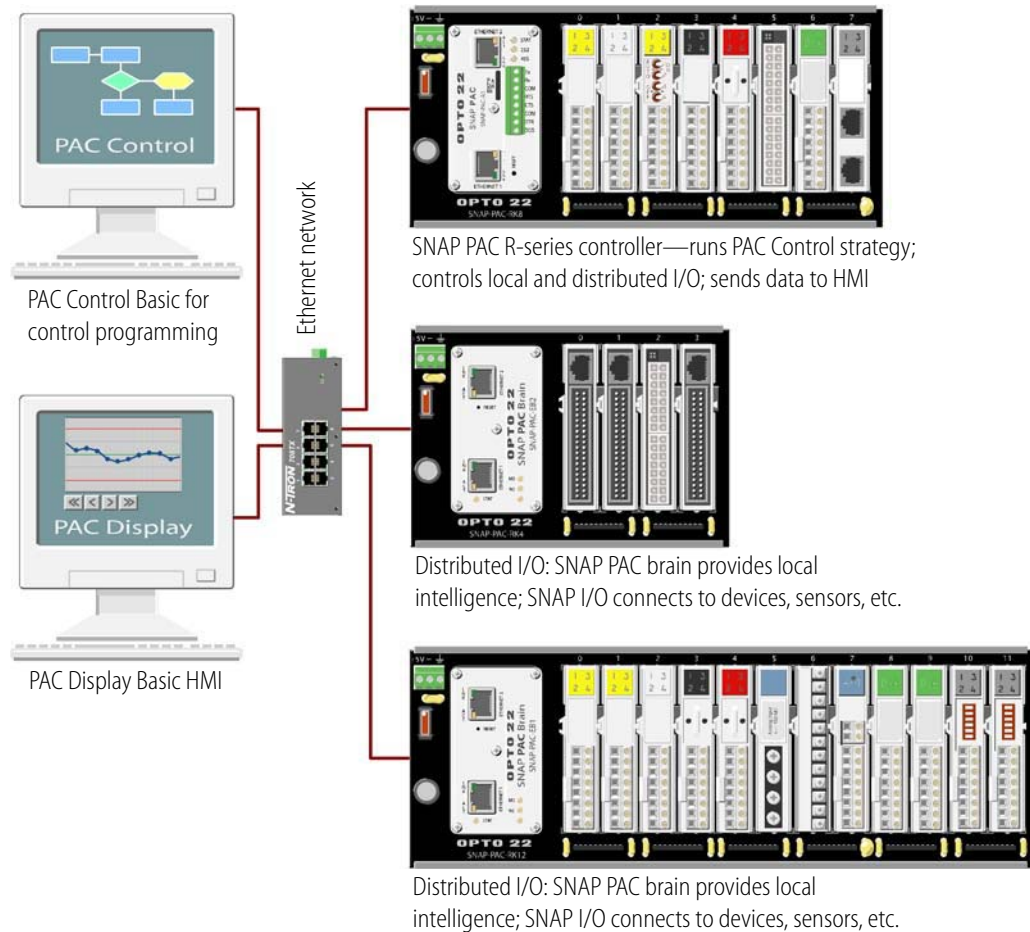
Building the HMI. The database of tags—I/O points, variables, etc.—that you named and described when developing the control strategy in PAC Control is automatically available when you start creating the HMI. You build the HMI using our built-in PAC Display graphics library or imported graphics, and you animate the graphics by simply linking them to tags in the database.

The finished HMI runs on the PC and is used by technicians and operators to monitor the control system, respond to alarms, and so on.

Example #2: Small Initial System

A small SNAP PAC System might begin with a SNAP PAC rack-mounted controller, a few distributed I/O units with SNAP PAC brains, and the free PAC Project Basic software. Free product support and free training are also included.

Example #2: Small Initial System



Distributed I/O. The PAC Control strategy runs independently on the controller to monitor and control both the I/O on the controller’s rack and the distributed I/O.

Many functions are distributed to the brains and handled locally, including latching, high-speed counting (up to 20 KHz, depending on the brain and I/O module), watchdog timers, thermocouple linearization, offset and gain, ramping, proportional-integral derivative (PID) loop control, and more. This distributed intelligence leaves the controller free for supervisory tasks, and if communication with the controller is ever lost, these locally handled functions continue without interruption.

Networking. As for networking options, the rack-mounted SNAP PAC R-series controller used for this initial system offers two *independent* Ethernet network interfaces, which can be used to segment the control network from the company network, if desired. The SNAP PAC brains include two *switched* Ethernet network interfaces, which means you can choose to daisy-chain the brains together if you want to eliminate or reduce the need for Ethernet routers and switches.

If you need wireless capability, choose Wired+Wireless™ models of the controller and brains. You can use an 802.11a,b,g wireless LAN, a wired Ethernet network, or both, and you can switch between them without changing PAC Control logic. (For more, see [“Using Wireless Networking” on page 57.](#))

Expanding Your System

When it comes time to scale up, the SNAP PAC System is simple to expand. If you started with the small system discussed above, here are several ways in which you might want to expand. Free product support and free training are still included, no matter what the size of your system.

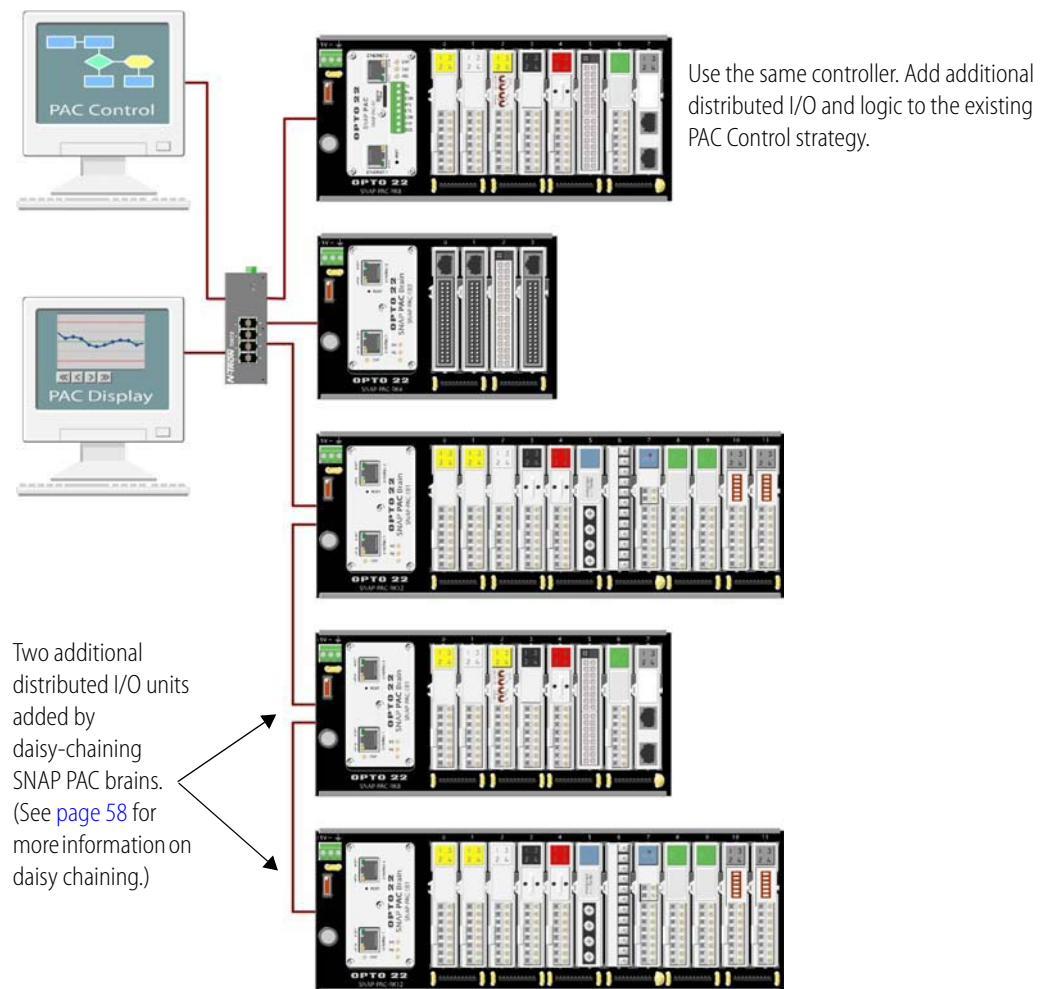
Adding More Distributed I/O

Suppose a new process is added to your manufacturing line, or additional equipment needs monitoring. Simply add the necessary brains and I/O, choosing whatever combination of analog, digital, and serial modules you need at any location. All types of modules can be mixed on the same rack and handled by the same brain.

You may not even need to purchase additional Ethernet network hardware, except for cables, since you can use the SNAP PAC brain's two switched Ethernet network interfaces to daisy-chain the added I/O units. (See [page 58](#).)

In your PAC Control strategy, just add the logic necessary to control and monitor the new distributed I/O units, and then download the revised strategy to the controller.

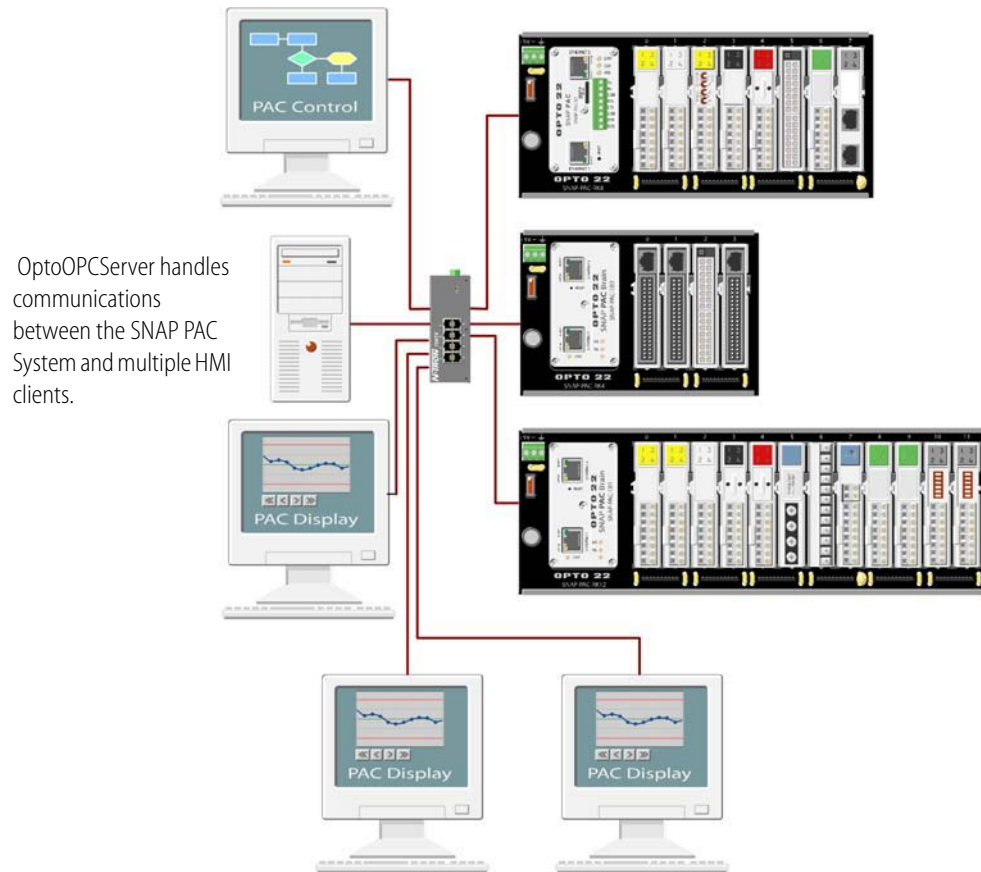
Adding More Distributed I/O



Adding More HMI Seats

Suppose the new process requires additional seats for the HMI, or a second HMI. For multiple PCs running a PAC Display HMI, we strongly recommend purchasing OptoOPCServer. OptoOPCServer is designed for fast, efficient handling of communications between multiple clients and Opto 22 hardware.

Adding More HMI Seats



Adding Large Numbers of Additional I/O

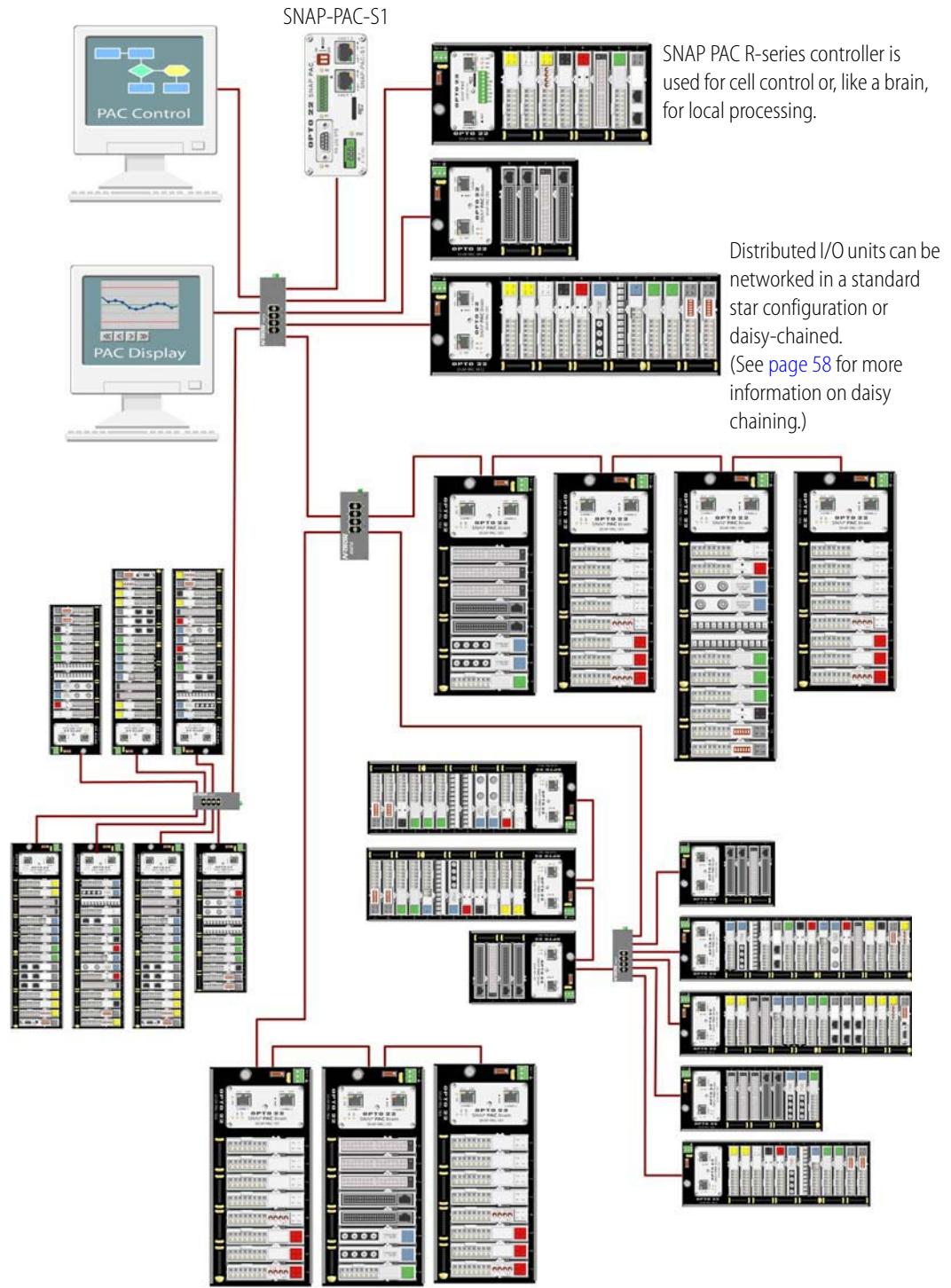
For very extensive distributed control systems, such as a traditional DCS, you'll want to move up from the rack-mounted R-series controller to a SNAP PAC standalone (S-series) controller. The S-series controller is more powerful and can run twice as many PAC Control flowcharts simultaneously.

The investments you've already made are not lost, however. The PAC Control strategy runs exactly the same on both controllers; just add the new I/O points and logic needed for the larger system and download it to the S-series.

The R-series rack-mounted controller you replaced is still a vital part of the system; it can run a separate strategy under the standalone controller's supervision or be used as a brain, since it has the same I/O processing and communication capabilities as a SNAP PAC brain.

Adding Large Numbers of Additional I/O

Add the new I/O points, logic, and variables to the PAC Control strategy. The SNAP-PAC-S1 controller runs the strategy and controls the entire system.



Adding Wireless Distributed I/O

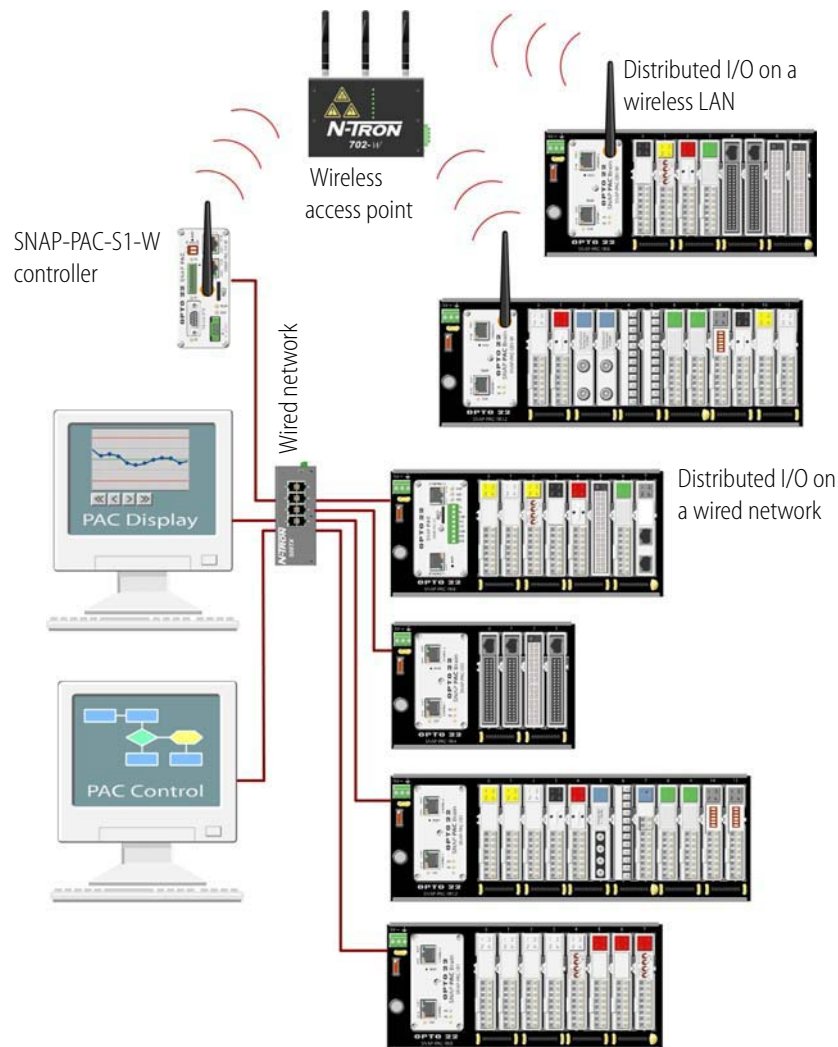
Suppose you need to control mobile machinery or monitor devices in an area where running Ethernet cable would be difficult. With Wired+Wireless controllers and brains, you can use a wireless local area network (LAN) to solve the problem.

Moving to wireless communication is simple: just replace the controller with a Wired+Wireless model and add the I/O you need. Mounting racks and I/O modules are exactly the same for either wired or wireless use, so you can convert existing I/O just by adding a Wired+Wireless brain.

In the PAC Control strategy, no special programming is necessary. Just configure the new I/O and add the logic to control it. For more information on using a wireless network, see [page 57](#).

Adding Wireless Distributed I/O

The SNAP-PAC-S1-W controller runs one PAC Control strategy that manages both wired and wireless distributed I/O. Use the same mounting racks and I/O for wired or wireless communication.



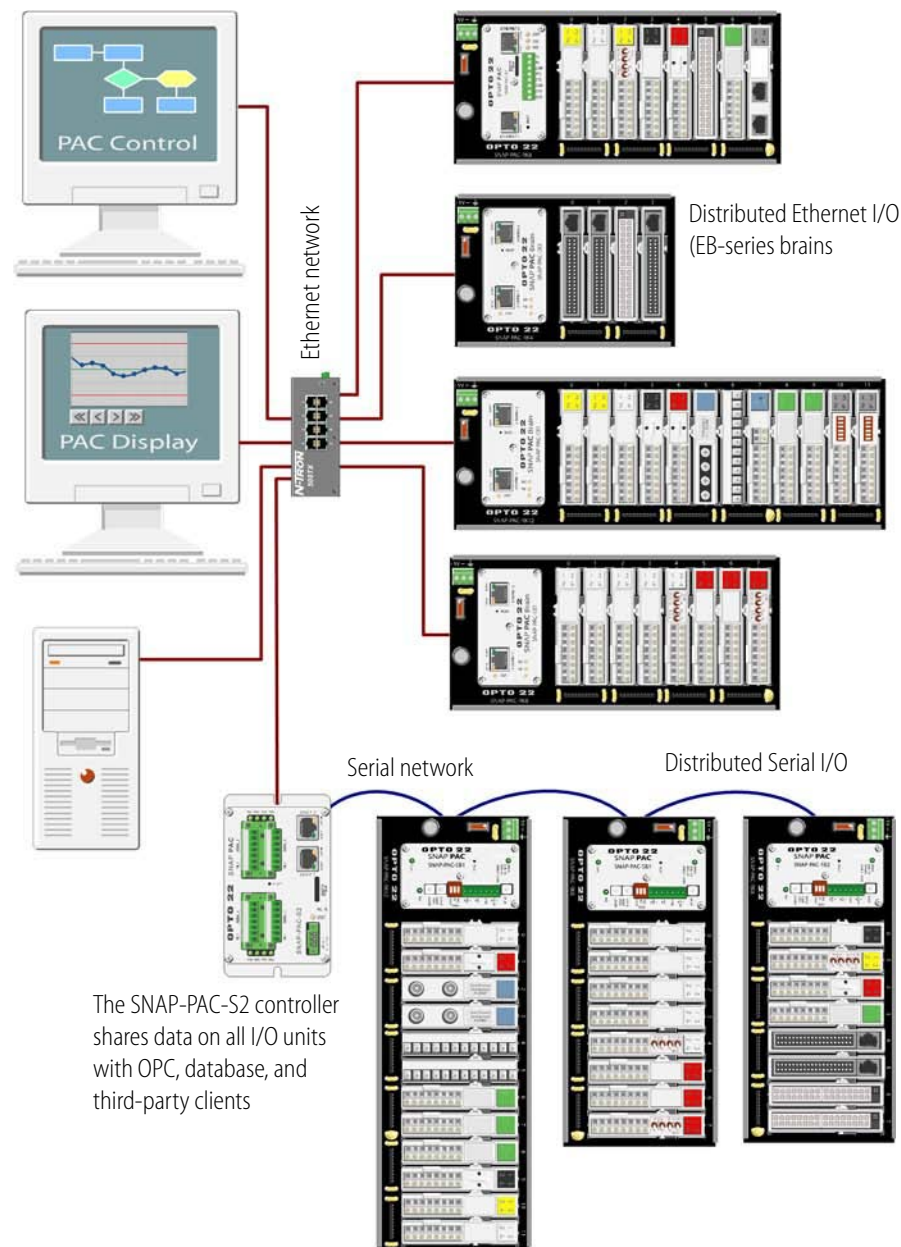
Combining Serial and Ethernet Distributed I/O

If you need to combine both serial and Ethernet distributed I/O in the same system, you can do so easily. A SNAP PAC S-series controller has two independent Ethernet interfaces plus one or more RS-485 serial ports for connections to serial I/O. The SNAP-PAC-S2 controller includes four serial ports, all of which can be software configured for RS-232 or RS-485, as needed.

The PAC Control strategy handles both Ethernet and serial I/O at the same time. Because the same commands and variables apply to I/O on both networks, and the same I/O modules are used on both, no special programming is needed. The same programmed process can control both.

Combining Serial and Ethernet Distributed I/O

The SNAP-PAC-S2 controller runs one PAC Control strategy that manages all distributed I/O—Ethernet and Serial.

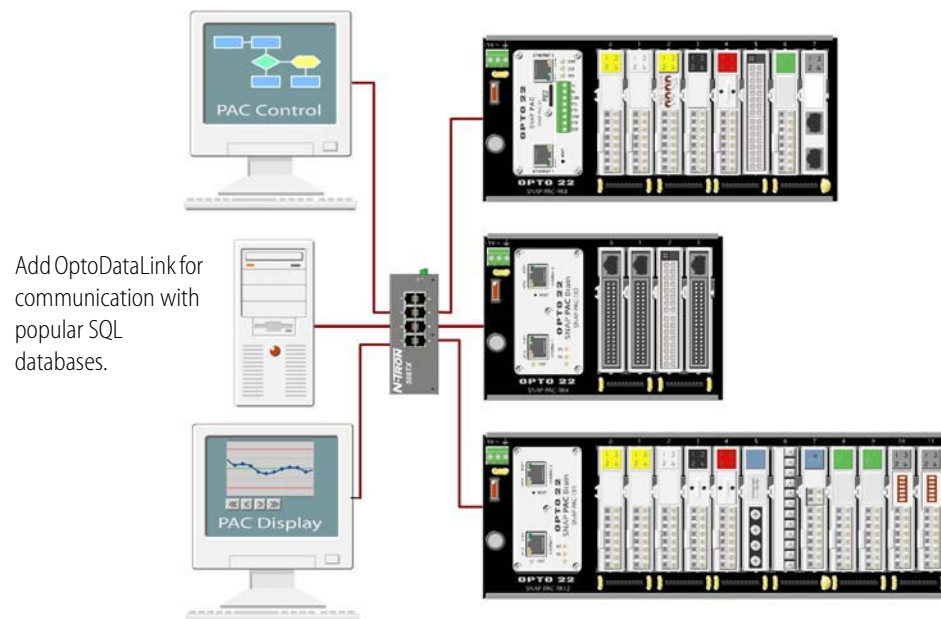


Delivering SNAP PAC System Data to Company Databases

To connect to company databases, purchase OptoDataLink. This software provides data exchange between the SNAP PAC System and popular databases such as Microsoft® SQL Server, Microsoft Access, and MySQL.

OptoDataLink uses the same tagname database you already developed in PAC Control. Simply choose data elements from the list and use OptoDataLink's configuration tool to link the data source and the data destination.

Delivering SNAP PAC System Data to Company Databases



Communicating with Third-Party Systems

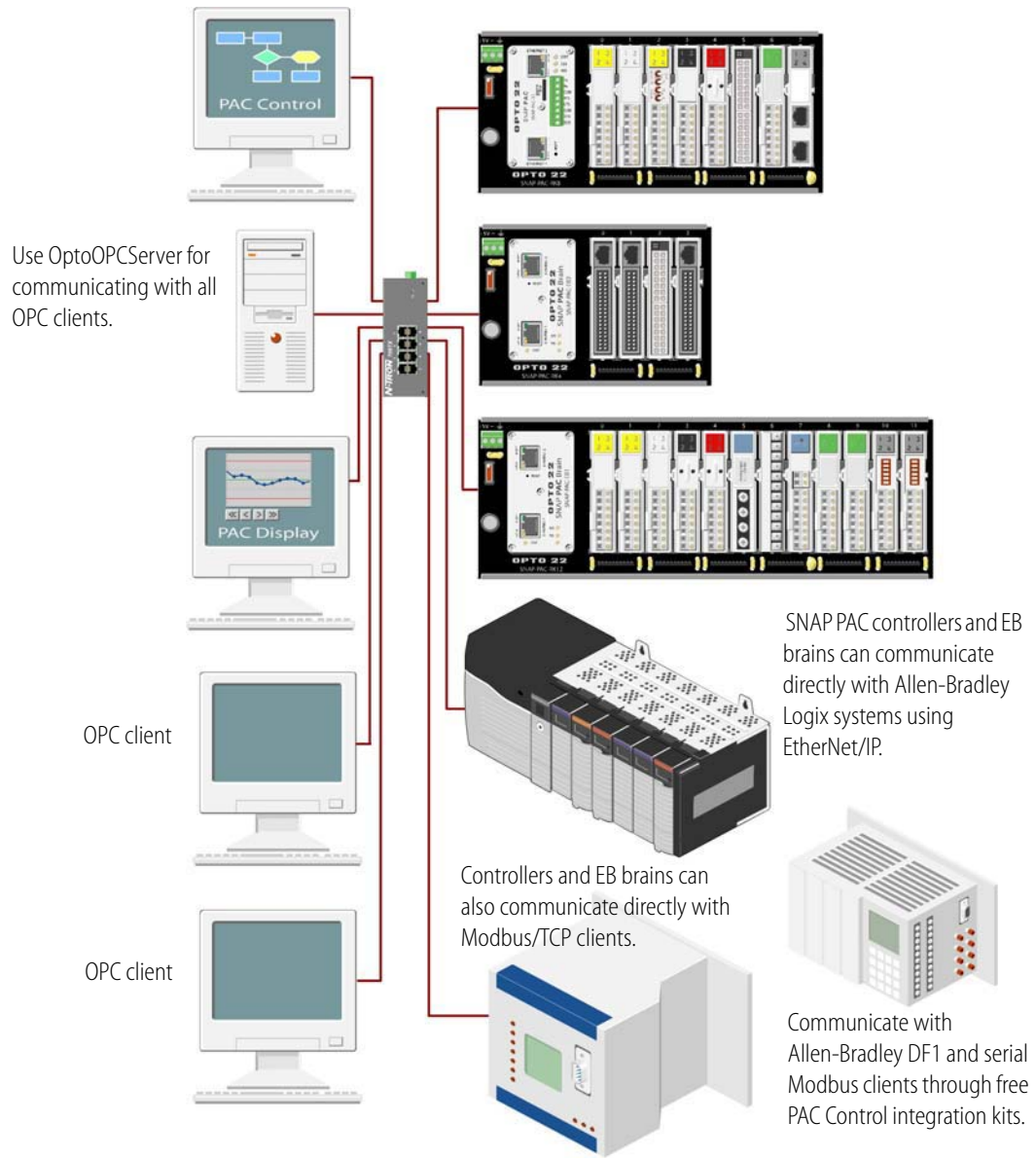
To communicate with **OPC 2.0**-compliant clients, purchase OptoOPCServer. With its efficient multi-threaded engine and report-by-exception method of communicating with clients, OptoOPCServer keeps network traffic on industrial automation and manufacturing networks to a minimum while exchanging data with OPC clients such as Microsoft products, third-party packages, and custom applications you create with tools such as Visual C++.

For **Modbus** systems, SNAP PAC controllers and brains can communicate directly with systems using Modbus/TCP; see the *Modbus/TCP Protocol Guide* (Opto 22 form #1678) for instructions. Or you can download our free integration kits to use Modbus/TCP or serial Modbus with PAC Control.

For **Allen-Bradley CompactLogix** and **ControlLogix** PLCs and RSLogix software, SNAP PAC controllers and brains can communicate directly using the built-in EtherNet/IP protocol. Details are in form #1770, the *EtherNet/IP for SNAP PAC Protocol Guide*. Step-by-step videos are on our website.

For **Allen-Bradley Data Highway** systems, our free integration kit for PAC Control provides an easy method of communicating with A-B drivers or PLCs that use the DF1 protocol.

Communicating with Third-Party Systems



Using Redundant Networking

If you are concerned about the stability of your network links, you'll want to look at redundant networking. Purchase PAC Project Professional and use an S-series controller as your main controller, plus R-series controllers for distributed I/O. Because each S-series and R-series controller has two independent Ethernet network interfaces (two separate IP addresses for each controller), they can be used to create redundant network links. PAC Project Pro adds the software support. For more information, see ["Ethernet Networking Options" on page 54](#).

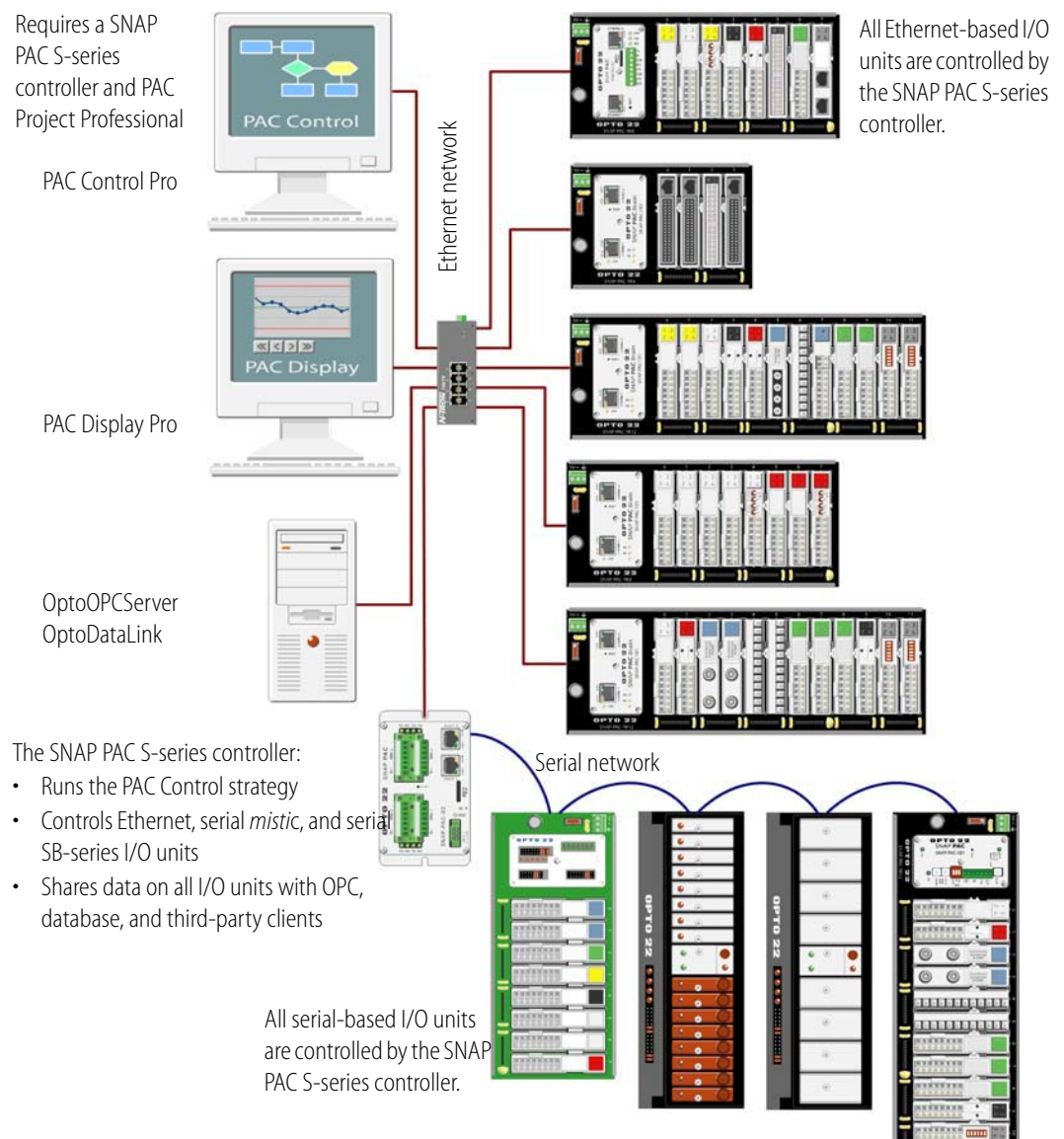
Incorporating Legacy Opto 22 Systems

If you've been an Opto 22 customer for several years and need to update older systems or integrate them with newer Ethernet-based systems, the SNAP PAC System provides a good migration path. You'll need PAC Project Professional and a SNAP PAC S-series controller.

PAC Control Professional includes the ability to import legacy OptoControl strategies, and PAC Display Professional can import OptoDisplay projects. PAC Display Pro can also communicate directly with FactoryFloor controllers on the Ethernet network.

SNAP PAC S-series controllers include one or more RS-485 serial ports that support not only serial SNAP PAC SB-series brains but also legacy Opto 22 *mistic* hardware, such as the serial B3000, B3000-BRS, and *mistic* bricks.

Incorporating Legacy Opto 22 Systems



What's In this Guide

This guide describes the SNAP PAC System and its uses and includes specifications and wiring diagrams for the system's four components. This guide assumes that you have some familiarity with TCP/IP and Ethernet networking, serial networking if you are using serial I/O, and wireless LAN communications if you are using Wired+Wireless. If you are not familiar with these subjects, we strongly suggest you consult commercially available resources to learn about them before attempting to install or use the SNAP PAC System.

The following sections are included in this user's guide:

Chapter 1: Introduction—description of the SNAP PAC System architecture, information about related documents, and how to reach Opto 22 Product Support.

Chapter 2: Choosing System Components—descriptions and comparison charts for system components, to help you choose which components you need for your system. Additional information can be found in the components' data sheets (see "[SNAP PAC System Data Sheets](#)," below).

Chapter 3: Networking Options—explanation and diagrams showing the networking options provided by SNAP PAC controllers and brains, including Ethernet network link redundancy, segmented networking, daisy-chaining, and communicating with serial devices and I/O.

Chapter 4: Installing and Wiring System Components—brief instructions for installing SNAP PAC System components and wiring the system to field devices. Additional information may be available in a user's guide for the component (see "[SNAP PAC System User's Guides](#)" on page 13).

Appendix A: I/O Specifications—specifications for all SNAP I/O modules: digital, analog, and serial.

Appendix B: Dimensional Diagrams—dimensional diagrams for all SNAP PAC System hardware.

Related Documents

See the following SNAP PAC System documents for the information shown. Most documents are available for free download on our website, www.opto22.com. The easiest way to find a document is to search on its form number.

SNAP PAC System Data Sheets

For these products	See this document	Form #
PAC Project Basic and Professional Software Suites	<i>PAC Project Software Suite Data Sheet</i>	1699
OptoOPCServer	<i>OptoOPCServer Data Sheet</i>	1487
OptoDataLink	<i>OptoDataLink Data Sheet</i>	1662
SNAP PAC S-series controllers	<i>SNAP PAC S-Series Controllers Data Sheet</i>	1584
SNAP PAC R-series controllers	<i>SNAP PAC R-Series Controllers Data Sheet</i>	1594
SNAP PAC brains	<i>SNAP PAC Brains Data Sheet</i>	1689

For these products	See this document	Form #
SNAP PAC racks	<i>SNAP PAC Racks Data Sheet</i>	1684
SNAP power supplies	<i>SNAP Power Supplies Data Sheet</i>	1120
SNAP PAC Motion Control Subsystem	<i>SNAP PAC Motion Control Subsystem Data Sheet</i>	1672
SNAP digital input modules (4-channel)	<i>SNAP Digital Input Modules Data Sheet</i>	0773
SNAP digital output modules (4-channel)	<i>SNAP Digital Output Modules Data Sheet</i>	1144
SNAP high-density digital modules (more than 4 channels)	<i>SNAP High-Density Digital I/O Modules Data Sheet</i>	1556
SNAP analog input modules	<i>SNAP Analog Input Modules Data Sheet</i>	1065
SNAP analog input modules with channel-to-channel isolation	<i>SNAP Isolated Analog Input Modules Data Sheet</i>	1182
SNAP analog output modules	<i>SNAP Analog Output Modules Data Sheet</i>	1066
SNAP quadrature module	<i>SNAP Quadrature Input Module Data Sheet</i>	1053
SNAP-pH/ORP module	<i>SNAP-pH/ORP Input Module Data Sheet</i>	1416
SNAP load cell modules	<i>SNAP Load Cell Modules Data Sheet</i>	1590
SNAP power monitoring module	<i>SNAP-AIPM Module Data Sheet</i>	1453
SNAP serial communication modules	<i>SNAP Serial Communication Modules Data Sheet</i>	1184
SNAP Profibus communication module	<i>SNAP Profibus Module Data Sheet</i>	1585
SNAP Wiegand protocol module	<i>SNAP Wiegand Module Data Sheet</i>	1365
SNAP TEX cables & breakout boards	<i>SNAP TEX Cables & Breakout Boards Data Sheet</i>	1756
SNAP TEX DIN-rail kits, spare parts, and tools for mounting and wiring	<i>SNAP TEX Mounting/Wiring Tools and Spare Parts Data Sheet</i>	1772
Recommended for use with the SNAP PAC System: N-TRON industrial Ethernet switches and wireless access points	<i>Network Infrastructure Data Sheet</i>	1825

SNAP PAC System User's Guides

For these products or uses	See this document	Form #
Develop PAC Control programs (strategies)	<i>PAC Control User's Guide</i>	1700
	<i>PAC Control Command Reference</i>	1701
	<i>PAC Control Commands Quick Reference</i>	1703
Build PAC Display HMIs	<i>PAC Display User's Guide</i>	1702
Assign IP addresses, configure hardware	<i>PAC Manager User's Guide</i>	1704
Communicate with OPC clients	<i>OptoOPCServer User's Guide*</i>	1439
Exchange data with company databases	<i>OptoDataLink User's Guide*</i>	1705
Install/use SNAP PAC S-series controllers	<i>SNAP PAC S-Series Controller User's Guide</i>	1592
Install/use SNAP PAC R-series controllers	<i>SNAP PAC R-Series Controller User's Guide</i>	1595
Install/use SNAP PAC brains	<i>SNAP PAC Brain User's Guide</i>	1690

For these products or uses	See this document	Form #
Install/use SNAP PAC Motion Control Sub-system	<i>SNAP PAC Motion Control Subsystem User's Guide</i>	1673
Write custom applications for SNAP PAC controllers and brains	<i>OptoMMP Protocol Guide</i>	1465
Communicate with Modbus systems	<i>Modbus/TCP Protocol Guide</i> <i>Modbus/Serial Integration Kit for PAC Project</i> <i>Modbus/TCP Integration Kit for PAC Project</i>	1678 1660 1644
Communicate with Allen-Bradley systems	<i>EtherNet/IP for SNAP PAC Protocol Guide</i> <i>Allen-Bradley DF1 Integration Kit For PAC Control</i>	1770 1706
Communicate with Profibus networks	<i>SNAP Profibus Module User's Guide</i>	1585
Install/use SNAP high-density digital modules (more than 4 channels)	<i>SNAP High-Density Digital I/O Modules User's Guide</i>	1547
Communicate with serial devices	<i>SNAP Serial Communication Module User's Guide</i>	1184

* Not available on our website; included in product purchase

Other Useful SNAP PAC System Documents

For this purpose	See this document	Form #
Comparing programmable automation controllers to PLCs	White Paper: Understanding Programmable Automation Controllers (PACs) in Industrial Automation	1634
Using wireless products in automation applications	<i>Overcoming Concerns about Wireless PACs and I/O in Industrial Automation</i>	1814
Integrating SNAP PAC System hardware and software with older Opto 22 systems	<i>SNAP PAC System Migration Technical Note</i>	1688
	<i>FactoryFloor to PAC PProject Migration Technical Note</i>	1692
	<i>Legacy and Current Product Comparison Charts</i>	1693
	<i>PAC Control User's Guide, Legacy Edition</i>	1710
	<i>PAC Control Command Reference, Legacy Edition</i>	1711
	<i>PAC Control Commands Quick Reference, Legacy Edition</i>	1713
	<i>PAC Display User's Guide, Legacy Edition</i>	1712
	<i>PAC Manager User's Guide, Legacy Edition</i>	1714

For Help

Sales

Here's how to purchase SNAP PAC System components:

- Contact one of our worldwide distributors (a list of distributors is on our website, www.opto22.com; click the How To Buy tab)
- Visit our website (www.opto22.com) and click the Products tab to order online (available in the U.S. and Canada only)

- Contact Opto 22 Sales: 1-800-321-6786 or 1-951-695-3000 (email: sales@opto22.com)

For help configuring a system or for technical information on Opto 22 products, contact an Opto 22 pre-sales engineer:

Phone (toll-free): 1-800-321-6786
(Local or outside the U.S.): 1-951-695-3000

Email: systemseng@opto22.com

Product Support

If you have problems installing or using the SNAP PAC System and cannot find the help you need in this guide or the related guides on our website, contact Opto 22 Product Support.

Phone: 800-TEK-OPTO (835-6786)
951-695-3080
(Hours are Monday through Friday,
7 a.m. to 5 p.m. Pacific Time)

Fax: 951-695-3017

Email: support@opto22.com

Opto 22 website: www.opto22.com

NOTE: Email messages and phone calls to Opto 22 Product Support are grouped together and answered in the order received.

When calling for technical support, be prepared to provide the following information about your system to the Product Support engineer:

- Software and version being used
- Brain and controller firmware versions (available through PAC Manager)
- PC configuration (type of processor, speed, memory, and operating system)
- A complete description of your hardware and operating systems, including:
 - IP addresses and net masks for Ethernet devices on the system
 - serial communication parameters (address, baud rate, etc.) for serial devices
 - type of power supply
 - third-party devices installed (for example, barcode readers)
- Specific error messages seen