

# 2: Choosing System Components

## Introduction

This chapter helps you choose the components needed for your application. It describes system components and compares products.

As described in the first chapter, the SNAP PAC System consists of four integrated components:

- Software—see [page 19](#)
- Controllers—see [page 22](#)
- Brains—see [page 23](#)
- I/O—see [page 27](#). (For more detailed information, also see [Appendix A: I/O Specifications](#) for input/output module specifications.)

The following accessories for your system may also be useful:

- Power supplies—[page 35](#)
- Wiring and mounting accessories for easier field wiring—[page 37](#)
- Network switches and wireless access points—[page 42](#)

## Building a SNAP PAC System

With a few choices, summarized in the diagram on the following page, you can build a SNAP PAC System to do just what you need.

## Steps to Build a SNAP PAC System

### Step 1: Choose software



- PAC Project Basic**
- PAC Control Basic
  - PAC Display Basic
  - PAC Manager
  - PAC Utilities



- PAC Project Professional**
- PAC Control Professional
  - PAC Display Professional
  - PAC Manager
  - PAC Utilities
  - OptoOPCServer
  - OptoDataLink

### Step 2: Choose controller



- SNAP PAC S-series**
- Standalone
  - Dual independent Ethernet interfaces; multiple serial ports.
  - Wired+Wireless models available.
  - Large distributed systems
  - *mistic* serial support (with PAC Project Pro)



- SNAP PAC R-series**
- Rack mounted (see racks below)
  - Dual independent Ethernet interfaces.
  - Wired+Wireless models available.
  - I/O processor and communications built in
  - Analog, digital, and serial I/O
  - R1 includes high-speed digital functions

### Step 3: Choose brains

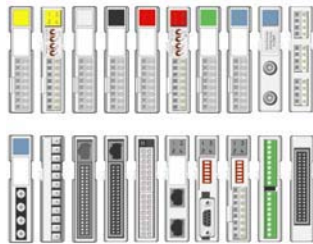


- Ethernet: SNAP-PAC-EB1 or SNAP-PAC-EB2**
- Dual switched Ethernet interfaces.
  - Wired+Wireless models available.
  - Analog, digital, and serial I/O
  - EB1 includes high-speed digital functions



- Serial: SNAP-PAC-SB1 or SNAP-PAC-SB2**
- Analog and digital I/O
  - SB1 includes high-speed digital functions

### Step 4: Choose I/O

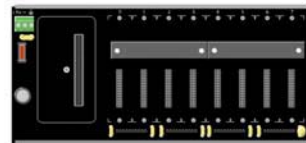


Choose from **all SNAP I/O modules**, a wide selection of analog, digital, and serial modules.

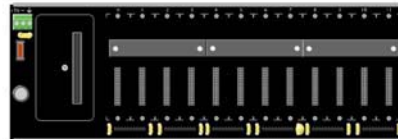
SNAP-PAC-RCK4 (4 modules)



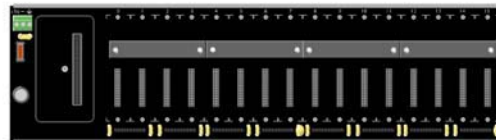
SNAP-PAC-RCK8 (8 modules)



SNAP-PAC-RCK12 (12 modules)



SNAP-PAC-RCK16 (16 modules)



**NOTE:** If you need Factory Mutual approval, many SNAP PAC System parts are available in an FM-approved version.

Brain or rack-mounted controller and modules snap onto **SNAP PAC racks**.

## Choosing Software

For software, choose between two forms of the PAC Project Software Suite: PAC Project Basic and PAC Project Professional.

**PAC Project Basic** is free. It can be downloaded from our website ([www.opto22.com](http://www.opto22.com)) and is also included on a CD with your purchase of any SNAP PAC controller. PAC Project Basic includes everything you need for most control and monitoring applications: control programming, HMI creation, and I/O configuration software.

**PAC Project Professional** is available for purchase. The Pro version adds OPC communication, database connectivity, and support for Ethernet link redundancy. Legacy hardware is also supported, with a SNAP PAC S-series controller.

Both PAC Project Basic and PAC Project Pro include the following:

- **PAC Control**, for developing control applications to run on an Opto 22 SNAP PAC controller
- **PAC Display**, for developing human-machine interface applications (HMIs) for technicians and operators
- **PAC Manager**, for configuring and inspecting Opto 22 SNAP PAC controllers, brains, and I/O

In addition, PAC Project Professional adds:

- **OptoOPCServer**, for OLE for Process Control (OPC) communication with OPC 2.0 clients
- **OptoDataLink**, for sharing SNAP PAC System data with ODBC-compliant databases

All of these software applications run on Microsoft Windows 2000, XP, and Vista Business workstations.

Individual software components of PAC Project Pro are also available for separate purchase. For example, if you need OPC connectivity but not the other Pro features, you can use PAC Project Basic and purchase only OptoOPCServer.

The comparison chart on the following page details the differences between PAC Project Basic and PAC Project Pro.

## PAC Project Basic and Professional Comparison Chart

The following table compares the features of PAC Project™ Basic and PAC Project Professional. See Opto 22 form #1677, the *SNAP PAC Controller and Brain Comparison Chart*, for more details on controllers.

Feature	PAC Project Basic	PAC Project Professional
Included software	<ul style="list-style-type: none"> <li>• PAC Control™ Basic</li> <li>• PAC Display™ Basic</li> <li>• PAC Manager™</li> </ul>	<ul style="list-style-type: none"> <li>• PAC Control Professional</li> <li>• PAC Display Professional</li> <li>• PAC Manager</li> <li>• OptoOPCServer™</li> <li>• OptoDataLink™</li> </ul>
Control software		
Name	PAC Control Basic	PAC Control Professional
Compatible controllers	<ul style="list-style-type: none"> <li>• SNAP PAC S-series standalone industrial controllers</li> <li>• SNAP PAC R-series on-the-rack controllers</li> </ul>	<ul style="list-style-type: none"> <li>• SNAP PAC S-series standalone industrial controllers</li> <li>• SNAP PAC R-series on-the-rack controllers</li> </ul>
Compatible brains	<ul style="list-style-type: none"> <li>• Built-in I/O unit (in SNAP PAC R-series controllers)</li> <li>• SNAP PAC brains</li> </ul>	<ul style="list-style-type: none"> <li>• Built-in I/O unit (in SNAP PAC R-series controllers)</li> <li>• SNAP PAC brains</li> <li>• E1 and E2</li> <li>• Serial <i>mistic</i>™ brains/bricks*: B3000, SNAP-BRS, B100, B200, G4D16R, G4D32RS, G4A8R</li> </ul>
Network	<ul style="list-style-type: none"> <li>• <i>Controller to PC</i>: Wired Ethernet, wireless 802.11a,b,g (Wired+Wireless controller required), or PPP (dial-up modem required)</li> <li>• <i>Controller to I/O</i>: S-series—Ethernet to EB brains and serial to SB brains; R-series—Ethernet only. Wireless with Wired+Wireless controllers.</li> <li>• <i>Controller to third-party devices</i>: Ethernet or serial</li> </ul>	<ul style="list-style-type: none"> <li>• <i>Controller to PC</i>: Wired Ethernet, wireless 802.11a,b,g (Wired+Wireless controller required), or PPP (dial-up modem required)</li> <li>• <i>Controller to I/O</i>: S-series—Ethernet to EB brains and serial to SB and <i>mistic</i> brains; R-series—Ethernet only. Wireless with Wired+Wireless controllers.</li> <li>• <i>Controller to third-party devices</i>: Ethernet or serial</li> <li>• Support for Ethernet link redundancy or segmented control network</li> </ul>
Main features	<ul style="list-style-type: none"> <li>• Flowchart programming</li> <li>• OptoScript™ programming</li> <li>• Subroutines (debuggable)</li> <li>• Graphical debugger</li> </ul>	<ul style="list-style-type: none"> <li>• Flowchart programming</li> <li>• OptoScript programming</li> <li>• Subroutines (debuggable), with additional data types</li> <li>• Graphical debugger</li> <li>• Conversion utility for OptoControl strategies (version 4.1 and newer)</li> <li>• Support for serial <i>mistic</i> I/O units*</li> <li>• Ethernet link redundancy (with R-series I/O units)</li> </ul>
Maximum charts running at once	<ul style="list-style-type: none"> <li>• 32 on SNAP PAC S-series (plus host task)</li> <li>• 16 on SNAP PAC R-series (plus host task)</li> </ul>	<ul style="list-style-type: none"> <li>• 32 on SNAP PAC S-series (plus host task)</li> <li>• 16 on SNAP PAC R-series (plus host task)</li> </ul>
Proportional-integral derivative (PID) loops	<ul style="list-style-type: none"> <li>• 4 PID algorithms available</li> <li>• 96 loops per SNAP PAC brain</li> <li>• Graphical tuner</li> </ul>	<ul style="list-style-type: none"> <li>• 4 PID algorithms for Ethernet</li> <li>• 1 PID algorithm for <i>mistic</i> serial*</li> <li>• 96 loops per SNAP PAC brain</li> <li>• 8 loops per <i>mistic</i> brain/brick*</li> <li>• Graphical tuner for Ethernet and <i>mistic</i>* PID loops</li> </ul>
Ethernet link redundancy	n/a	<ul style="list-style-type: none"> <li>• Primary and secondary IP addresses for controllers and R-series I/O units</li> <li>• PAC Control commands can be used to control redundancy algorithm</li> </ul>

Feature	PAC Project Basic	PAC Project Professional
Additional toolkits	<ul style="list-style-type: none"> <li>Allen-Bradley® DF1 Integration Kit</li> <li>Modbus®/TCP Integration Kit</li> <li>Modbus/Serial Integration Kit</li> <li>OptoMMP™ Communication Toolkit</li> </ul>	<ul style="list-style-type: none"> <li>Allen-Bradley DF1 Integration Kit</li> <li>Modbus/TCP Integration Kit</li> <li>Modbus/Serial Integration Kit</li> <li>OptoMMP Communication Toolkit</li> </ul>
<b>HMI software</b>		
Name	PAC Display Basic	PAC Display Professional
Main features	<ul style="list-style-type: none"> <li>Alarming</li> <li>Trending</li> <li>Operator authentication and login</li> <li>3000-graphic library</li> </ul>	<ul style="list-style-type: none"> <li>Alarming</li> <li>Trending</li> <li>Operator authentication and login</li> <li>3000-graphic library</li> <li>Conversion utility for OptoDisplay projects</li> <li>Ethernet link redundancy</li> <li>Scanner redundancy</li> </ul>
Controllers supported	SNAP PAC controllers	<ul style="list-style-type: none"> <li>SNAP PAC controllers</li> <li>Controllers running ioProject</li> <li>Controllers running FactoryFloor on Ethernet network</li> </ul>
Ethernet link redundancy	n/a	<ul style="list-style-type: none"> <li>Primary and secondary IP addresses for control engine</li> <li>Primary and secondary scanner</li> </ul>
<b>OPC server</b>		
Name	Not included; purchase separately. (OptoOPCServer supports PAC Project Basic and is strongly recommended for multiple seats of PAC Display.)	OptoOPCServer
OPC version	n/a	OPC 2.0-compliant
Ethernet link redundancy	n/a	PAC Display primary and secondary IP addresses for control engine
<b>Database connectivity</b>		
Name	Not included; purchase separately.	OptoDataLink
Databases supported	**	Built-in, easy data transfer to Microsoft® SQL Server. Microsoft Access, MySQL, text files

\* Requires SNAP PAC S-series controller

\*\* Limited options using strategy logic if the user is an expert at database programming

## Choosing Controllers

For controllers, choose between a rack-mounted (R-series) or standalone (S-series) SNAP PAC programmable automation controller.

**SNAP PAC R-series controllers** mount right on the rack with SNAP I/O modules, and the controller includes I/O processing as well as control functions. Essentially, it is a controller and a brain in one package. The R-series is ideal for cell control or less complex distributed systems.

Choose the *SNAP-PAC-R1* if you need high-speed digital functions. Choose the *SNAP-PAC-R2* if you don't need high-speed digital. Otherwise, the two R-series controllers are identical. Factory Mutual-approved versions of both controllers are available; part numbers end in -FM (*SNAP-PAC-R1-FM* and *SNAP-PAC-R2-FM*).

**SNAP PAC S-series controllers** are standalone industrial controllers suitable for any size system, even as large or complex as a traditional DCS. S-series controllers are more powerful than the R-series and can run twice as many PAC Control flowcharts simultaneously.

Use S-series controllers if you have serial I/O:

- The *SNAP-PAC-S1* has three serial ports: one RS-485 for serial I/O, one RS-232 for modem/PPP use, and one RS-232 for other serial devices. The *SNAP-PAC-S1-FM* is a Factory Mutual-approved version.
- The *SNAP-PAC-S2* has four flexible serial ports, all software configurable for RS-485 or RS-232.

Used with PAC Project Professional, S-series controllers offer additional options. They can be used for network link redundancy (see [page 54](#)), and they also offer a migration path for customers with legacy serial *mistic* I/O units, as they can communicate with and control this older hardware using PAC Project Professional.

**Both S-series and R-series** controllers carry a 30-month warranty.

**All PAC controllers** are available in Wired+Wireless models (part numbers ending in -W). These models add a third network interface for an 802.11a,b, or g wireless local area network (LAN). Choose these if you anticipate communicating with computers or I/O wirelessly. Wired+Wireless models can communicate over either a wired or wireless network or over both at once. See more about wireless networking on [page 57](#).

For a detailed comparison of SNAP PAC R-series and S-series controller features, see the “[SNAP PAC Controller and Brain Comparison Chart](#)” on [page 24](#).

## Choosing Brains

For distributed I/O, choose among four SNAP PAC brains, depending on whether you need Ethernet or serial connections and whether your application requires high-speed digital functions.

### Ethernet Brains

The *SNAP-PAC-EB1* offers high-speed counting (up to 20 KHz), quadrature counting, and frequency, period, and pulse measurement.

The *SNAP-PAC-EB2* does not include high-speed digital functions.

Factory Mutual-approved versions of both brains are available, with part numbers ending in -FM (*SNAP-PAC-EB1-FM* and *SNAP-PAC-EB2-FM*).

Both EB brains provide processing for SNAP analog, serial, 4-channel digital, and high-density digital I/O modules. They also include PID loop control (up to 96 loops per brain) and several communication capabilities, including Modbus/TCP, SNMP (Simple Network Management Protocol), SMTP (email), and FTP (File Transfer Protocol). Both brains have a 30-month warranty.

Both EB brains have two switched Ethernet network interfaces. The two interfaces act just like a network switch, which means you can connect them either in a standard Ethernet star configuration or in a daisy-chain configuration. Daisy-chaining brains can significantly reduce the number of network devices you would otherwise need to purchase. See [page 58](#) for more information.

Both EB brains are also available as Wired+Wireless models, with an additional network interface for an 802.11a,b, or g wireless LAN. These brains can communicate over a wired network, over wireless, or both. See [page 57](#) for more about wireless networking.

### Serial Brains

The *SNAP-PAC-SB1* offers high-speed counting (up to 20 KHz), quadrature counting, digital time-proportional output (TPO), and pulse generation and measurement.

The *SNAP-PAC-SB2* does not include high-speed digital functions.

Both SB brains provide processing for SNAP analog, 4-channel digital, and high-density digital I/O modules. They also include PID loop control (up to 96 loops per brain). SB brains communicate over an RS-485 2-wire or 4-wire serial link, with baud rates from 300 baud to 230.4 Kbaud. Both brains carry a 30-month warranty.

### Comparing SNAP PAC Controllers and Brains

Many I/O and communication features of SNAP PAC brains overlap with R-series controllers, but there are also some significant differences. We've put all the SNAP PAC controllers and brains into the comparison chart below, so you can choose the processors you need more easily.

## SNAP PAC Controller and Brain Comparison Chart

The following table compares SNAP PAC controllers and brains using version 8.5 firmware and PAC Project software.

FEATURE	SNAP PAC Controllers								SNAP PAC Brains											
	Standalone				Rack-mounted				Ethernet				Serial							
	SNAP-PAC-S1 SNAP-PAC-S1-FM	SNAP-PAC-S1-W	SNAP-PAC-S2	SNAP-PAC-S2-W	SNAP-PAC-R1 SNAP-PAC-R1-FM	SNAP-PAC-R1-W	SNAP-PAC-R2 SNAP-PAC-R2-FM	SNAP-PAC-R2-W	SNAP-PAC-EB1 SNAP-PAC-EB1-FM	SNAP-PAC-EB1-W	SNAP-PAC-EB2 SNAP-PAC-EB2-FM	SNAP-PAC-EB2-W	SNAP-PAC-SB1	SNAP-PAC-SB2						
Two independent Ethernet network interfaces (two IP addresses) for Ethernet link redundancy or segmenting networks	●	●	●	●	●	●	●	●												
Wireless LAN interface (802.11a, b, or g)		●		●		●		●		●		●								
Two switched Ethernet network interfaces (one IP address) for multi-drop (daisy-chain) network configuration									●	●	●	●								
Works with PAC Project software	●	●	●	●	●	●	●	●	●	●	●	●	●	●						
Runs PAC Control strategies	●	●	●	●	●	●	●	●												
Maximum PAC Control charts running at once (plus host task)	32	32	32	32	16	16	16	16	n/a											
Compatible brains <sup>a</sup>	SNAP PAC EB brains				SNAP PAC SB brains															
	SNAP PAC SB brains				Onboard I/O processor (brain)															
	Onboard I/O processor (brain)																			
Controller-to-brain communication	Ethernet (UDP/IP, 10/100 Mbps)				Wireless LAN (802.11a, b, or g)										Serial (RS-485)					
	Wireless LAN (802.11a, b, or g)																			
	Serial (RS-485)																			
Controller-to-PC communication	Ethernet (TCP/IP, 10/100 Mbps)				Wireless LAN (802.11a, b, or g)										PPP over modem, with hardware handshaking					
	Wireless LAN (802.11a, b, or g)																			
	PPP over modem, with hardware handshaking																			
Brain-to-host (PC or controller) communication	Ethernet (10/100 Mbps)				Wireless LAN (802.11a, b, or g)				Serial (RS-485)											
	Wireless LAN (802.11a, b, or g)				Serial (RS-485)															
	Serial (RS-485)																			
Total number of RS-232 serial ports	2	2	4 <sup>b</sup>	4 <sup>b</sup>	1	1	1	1	-0-	-0-	-0-	-0-	-0-	-0-						
Number of RS-232 serial ports usable for PPP (on dial-up modem)	1 <sup>c</sup>	1 <sup>c</sup>	1 <sup>c</sup>	1 <sup>c</sup>	1 <sup>c</sup>	1 <sup>c</sup>	1 <sup>c</sup>	1 <sup>c</sup>	-0-	-0-	-0-	-0-	-0-	-0-						
Total number of RS-485 serial ports	1	1	4 <sup>b</sup>	4 <sup>b</sup>	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	1	1						
EtherNet/IP™ (Allen-Bradley® RSLogix® systems and others)	●	●	●	●	●	●	●	●	●	●	●	●								
Modbus®/TCP (slave)	●	●	●	●	●	●	●	●	●	●	●	●								
OPC driver support	●	●	●	●	●	●	●	●	●	●	●	●	● <sup>d</sup>	● <sup>d</sup>						
OptoMMP memory-mapped protocol	●	●	●	●	●	●	●	●	●	●	●	●	●	●						
SNMP (network management) <sup>e</sup>	●	●	●	●	●	●	●	●	●	●	●	●								
FTP server, file system	●	●	●	●	●	●	●	●	●	●	●	●								
FTP client	●	●	●	●	●	●	●	●												
PPP (for use with dial-up modems)	●	●	●	●	●	●	●	●												
Email (SMTP client)	●	●	●	●	●	●	●	●	●	●	●	●								
Scratch Pad area for peer-to-peer data (bits, floats, 32-bit integers, 64-bit integers, and strings)	●	●	●	●	●	●	●	●	●	●	●	●	●	●						
Security for wireless network (WPA2-AES, WPA-TKIP, WEP)		●		●		●		●		●		●								
Security for wired Ethernet network (IP filtering, port access)	●	●	●	●	●	●	●	●	●	●	●	●								

FEATURE	SNAP PAC Controllers								SNAP PAC Brains						
	Standalone				Rack-mounted				Ethernet				Serial		
	SNAP-PAC-S1 SNAP-PAC-S1-FM	SNAP-PAC-S1-W	SNAP-PAC-S2	SNAP-PAC-S2-W	SNAP-PAC-R1 SNAP-PAC-R1-FM	SNAP-PAC-R1-W	SNAP-PAC-R2 SNAP-PAC-R2-FM	SNAP-PAC-R2-W	SNAP-PAC-EB1 SNAP-PAC-EB1-FM	SNAP-PAC-EB1-W	SNAP-PAC-EB2 SNAP-PAC-EB2-FM	SNAP-PAC-EB2-W	SNAP-PAC-SB1	SNAP-PAC-SB2	
Realtime clock	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
Backup battery (recharges when brain has power) <sup>f</sup>	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
RAM	128 MB				32 MB				16 MB						
Battery-backed RAM	8 MB				2 MB				--						
Flash memory	16 MB				8 MB				8 MB						
32-bit processor	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
Floating-point unit (FPU)	●	●	●	●	●	●	●	●							
Power requirements	8–32 VDC <sup>g</sup> 10 W–11.3 W max <sup>h</sup>				5.0 to 5.2 VDC @ 1.2–1.5 A <sup>h</sup>				5.0 to 5.2 VDC @ 750 mA–1.0 A <sup>h</sup>						
Operating Temperature in degrees C	0 to 60				0 to 60				0 to 60						
Storage Temperature in degrees C	-40 to 85				-40 to 85				-40 to 85						
Humidity (non-condensing)	0–95%				0–95%				0–95%						
Uses SNAP PAC mounting rack (4, 8, 12, or 16 modules)	n/a				●	●	●	●	●	●	●	●	●	●	
Maximum number of modules allowed on largest rack: Any mix of 16 digital, 16 analog, 8 serial or special-purpose	n/a				● <sup>i</sup>	● <sup>i</sup>	●	●	●	●	●	●	● <sup>j</sup>	● <sup>j</sup>	
Digital I/O point features	Input latching	n/a				●	●	●	●	●	●	●	●	●	●
	On/off status	n/a				●	●	●	●	●	●	●	●	●	●
	Watchdog timer	n/a				●	●	●	●	●	●	●	●	●	●
	High-speed counting (up to 20 kHz) <sup>k</sup>	n/a				●	●			●	●			●	
	Quadrature counting <sup>l</sup>	n/a				●	●			●	●			●	
	On-pulse and off-pulse measurement <sup>k,m</sup>	n/a				●	●			●	●			●	
	Frequency & Period measurement <sup>k,m</sup>	n/a				●	●			●	●			●	
	TPO (time-proportional output) <sup>m</sup>	n/a				●	●	●	●	●	●	●	●	●	●
	Digital totalizing <sup>k,m</sup>	n/a				●	●	●	●	●	●	●	●	●	●
Pulse generation (continuous square wave, N pulses, on-pulse, off-pulse) <sup>m</sup>	n/a				●	●	●	●	●	●	●	●	●	●	
Analog I/O point features	Thermocouple linearization (32-bit floating point for linearized values)	n/a				●	●	●	●	●	●	●	●	●	●
	Minimum/maximum values	n/a				●	●	●	●	●	●	●	●	●	●
	Offset and gain	n/a				●	●	●	●	●	●	●	●	●	●
	Scaling	n/a				●	●	●	●	●	●	●	●	●	●
	TPO (Time-proportional output) <sup>n</sup>	n/a				●	●	●	●	●	●	●	●	●	●
	Output clamping	n/a				●	●	●	●	●	●	●	●	●	●
	Filter weight	n/a				●	●	●	●	●	●	●	●	●	●
	Watchdog timer	n/a				●	●	●	●	●	●	●	●	●	●
	Analog totalizing <sup>m</sup>	n/a				●	●	●	●	●	●	●	●	●	●
	Ramping <sup>m</sup>	n/a				●	●	●	●	●	●	●	●	●	●

FEATURE	SNAP PAC Controllers								SNAP PAC Brains										
	Standalone				Rack-mounted				Ethernet			Serial							
	SNAP-PAC-S1	SNAP-PAC-S1-FM	SNAP-PAC-S1-W	SNAP-PAC-S2	SNAP-PAC-S2-W	SNAP-PAC-R1	SNAP-PAC-R1-FM	SNAP-PAC-R1-W	SNAP-PAC-R2	SNAP-PAC-R2-FM	SNAP-PAC-R2-W	SNAP-PAC-EB1	SNAP-PAC-EB1-FM	SNAP-PAC-EB1-W	SNAP-PAC-EB2	SNAP-PAC-EB2-FM	SNAP-PAC-EB2-W	SNAP-PAC-SB1	SNAP-PAC-SB2
PID logic (maximum 96 PID loops per controller or brain)						●	●	●	●	●	●	●	●	●	●	●	●	●	●
Data logging						●	●	●	●	●	●	●	●	●	●	●	●	●	●
Digital events, alarm events, serial events						●	●	●	●	●	●	●	●	●	●	●	●	● <sup>o</sup>	● <sup>o</sup>
Event messaging						●	●	●	●	●	●	●	●	●	●	●	●		
UDP streaming of I/O data to host						●	●	●	●	●	●	●	●	●	●	●	●		
I/O point data mirroring and memory map copying						●	●	●	●	●	●	●	●	●	●	●	●		

- a For compatibility with legacy Opto 22 hardware, see form #1693.
- b Serial ports are software configurable for RS-232 or RS-485.
- c One port on SNAP-PAC-S1 supports DTR, DSR, and CD signals and bidirectional flow control on RTS and CTS. All ports on SNAP-PAC-S2 support DTR and DCD signals and bidirectional flow control on RTS and CTS. The port on SNAP-PAC-R1 and -R2 supports DTR and CD signals, and bidirectional flow control on RTS and CTS.
- d Available with OptoOPCServer and PAC Control, through a SNAP PAC controller.
- e Not available for I/O points on analog I/O modules with more than 4 points.
- f Models manufactured before August 2007 have user-replaceable backup batteries. See original user guide.
- g Units with serial numbers lower than 500,000 have an 8–24 VDC input voltage rating. *Verify voltage on the unit's faceplate before applying power.*

- h Higher requirement applies to -W models.
- i SNAP-PAC-R1s with serial numbers lower than 600,000 are limited to eight 4-channel digital modules per rack.
- j Does not support serial, motion control, Profibus, or Wiegand modules.
- k Four-channel modules only; not on high-density modules.
- l Requires a SNAP-IDC5Q quadrature input module.
- m Available when used with PAC Control Professional and a SNAP PAC controller.
- n Requires a SNAP analog TPO module (SNAP-AOD-29).
- o Does not support serial events.

## Choosing I/O

Up to this point, your choices have been easy: just two possible software suites, two basic types of controllers, and four brains. Now the choices suddenly expand to include the full range of SNAP I/O: digital, analog, and serial input and output modules that directly connect to the devices, sensors, actuators, and machines you need to monitor and control.

One thing makes your choice easier: *all* SNAP I/O modules work with *all* EB brains and R-series controllers, even Wired+Wireless models. And all SNAP I/O modules except serial modules work with SB brains.

To choose I/O, take a look at the signals produced and received by everything you will monitor and control. Determine the combination of signals and the number of input and output points required at each physical location. Also look at the amount of wall or cabinet space available for the distributed I/O; if space is limited, you may want to use higher-density modules.

The next few sections include data to help you choose the I/O you need.

Module charts beginning on [page 28](#) show signal types and ranges, number of points, isolation, agency approvals, and more. Module specifications are in the Appendix ([page 111](#)).

Mounting rack information is on [page 34](#).

### About Isolation

Opto 22 SNAP I/O modules provide various types of isolation to protect your system. Check the module charts and specifications to see which modules have which types. Here are the types of isolation and what they mean:

**Optical isolation**—Optical isolation on all solid-state modules provides 4,000 volts of transient (4000 V for 1 ms) protection for sensitive control electronics from industrial field signals. Optically isolated modules are isolated from all other modules on the same rack and from the I/O processor.

**Channel-to-channel isolation**—Channel-to-channel isolation (sometimes called “galvanic” isolation) provides isolation between points within the same module. On modules with this type of isolation, a measurement of the resistance between any terminal of one channel and any terminal of another channel will show infinite resistance. Modules that do not have channel-to-channel isolation have points that share a connection of the field signal (typically the common) inside the module.

**Transformer isolation**—Transformer isolation on analog modules helps prevent ground loop currents from flowing between field devices and causing noise that produces erroneous readings. Ground loop currents are caused when two grounded field devices share a connection, and the ground potential at each device is different. Analog modules provide 1500 volts of transformer isolation.

## Digital Input Modules

The following table compares SNAP digital input modules. For usage information, see “SNAP Digital Q&A” on page 30. Detailed specifications are shown on the page in the *Specs* column.

Input signal		Points	Isolation <sup>1</sup>		Part number	LEDs	Approvals					Warranty <sup>3</sup>	Notes	Specs
Type	Range		Optical	Ch-ch			UL	CE	FM	CSA	RoHS <sup>2</sup>			
Voltage (AC)	90–140 VAC/DC	16	●	●	SNAP-IAC-16 <sup>4</sup>			●				L	High density	118
	90–140 VAC/DC	4	●	●	SNAP-IAC5	●	●	●		●	C9	L		112
	90–140 VAC/DC	4	●	●	SNAP-IAC5FM	●	●	●	●		C9	L		113
	90–140 VAC/DC	4	●	●	SNAP-IAC5MA	●		●			C9	30	Diagnostic switches	112
	180–280 VAC/DC	16	●	●	SNAP-IAC-A-16 <sup>4</sup>			●				L	High density	118
	70–130 VAC/VDC	16	●	●	SNAP-IAC-K-16 <sup>4</sup>			●				L	High density	118
	180–280 VAC/DC	4	●	●	SNAP-IAC5A	●	●	●		●	C9	L		112
	180–280 VAC/DC	4	●	●	SNAP-IAC5AFM	●	●	●	●		C9	L		113
Voltage (DC)	10–32 VDC	32	●	<sup>5</sup>	SNAP-IDC-32 <sup>4</sup>	<sup>6</sup>		●				L	High density	117
	10–32 VDC	32	●	<sup>5</sup>	SNAP-IDC-32-FM <sup>4</sup>	<sup>6</sup>		●	●			L	High density	117
	-10 to -32 VDC	32	●	<sup>5</sup>	SNAP-IDC-32N <sup>4</sup>	<sup>6</sup>		●				L	Positive common High density	117
	10–32 VDC/VAC	16	●	●	SNAP-IDC-16 <sup>4</sup>			●				L	High density	118
	15–28 VDC/VAC	16	●	●	SNAP-IDC-HT-16 <sup>4</sup>			●				L	Leakage tolerant High density	118
	10–32 VDC	4	●	●	SNAP-IDC5	●	●	●		●	C9	L		114
	10–32 VDC	4	●	●	SNAP-IDC5FM	●	●	●	●		C9	L		113
	10–32 VDC	4	●	●	SNAP-IDC5MA	●		●			C9	30	Diagnostic switches	115
	15–32 VDC	4	●	●	SNAP-IDC5-HT	●		●			C9	L	Leakage tolerant	114
	18–32 VDC	4	●	●	SNAP-IDC5-FAST-A	●	●	●		●	C9	L	High speed	115
	2.5–16 VDC	4	●	●	SNAP-IDC5FAST	●	●	●	●	●	C9	L	High speed	115
	2.5–28 VDC	4	●	●	SNAP-IDC5D	●	●	●		●	C9	L		114
	2.5–28 VDC	4	●	●	SNAP-IDC5DFM	●	●	●	●		C9	L		113
35–75 VDC/AC	4	●	●	SNAP-IDC5G	●		●			C9	L	Telecom applica- tions	114	
Dry Contact	Normally open	4	●		SNAP-IDC5-SW	●	●	●	●		C9	L	Self wetting	116
	Normally closed	4	●		SNAP-IDC5-SW-NC	●	●	●			C9	L	Self wetting	116
Quadrature	4–24 VDC	2	●	●	SNAP-IDC5Q	●		●	●		C9	L	Quadrature input (two axes)	116

1 For more information on isolation, see “About Isolation” on page 27.

2 RoHS categories: C9 = Category 9; LF = lead-free

3 Warranty period: L = Lifetime; 30 = 30 months.

4 For wiring options, see page 40.

5 Each group of 8 points is isolated from the other groups on the same module. Points within a group are not isolated from each other.

6 Status LEDs for individual points are available on a separate breakout board.

## Digital Output Modules

The following table compares SNAP digital output modules. For usage information, see “SNAP Digital Q&A” on page 30. Detailed specifications are shown on the page in the *Specs* column.

Output signal		Points	Isolation <sup>1</sup>		Part number	LEDs	Approvals					Warranty <sup>3</sup>	Notes	Specs
Type	Range		Optical	Ch-ch			UL	CE	FM	CSA	RoHS <sup>2</sup>			
Voltage (AC)	12–250 VAC	4	●		SNAP-OAC5	●	●	●		●	C9	L		<a href="#">118</a>
	12–250 VAC	4	●		SNAP-OAC5FM	●	●	●	●		C9	L		<a href="#">120</a>
	12–250 VAC	4	●	●	SNAP-OAC5-i	●	●	●			C9	L		<a href="#">118</a>
	12–250 VAC	4	●	●	SNAP-OAC5-iFM	●	●	●	●		C9	L		<a href="#">120</a>
	12–250 VAC	4	●	●	SNAP-OAC5MA	●	●	●			C9	30	Diagnostic switches	<a href="#">118</a>
Voltage (DC)	5–60 VDC	32	●	4	SNAP-ODC-32-SNK <sup>5</sup>	6		●				L	High density	<a href="#">125</a>
	5–60 VDC	32	●	4	SNAP-ODC-32-SRC <sup>5</sup>	6		●				L	High density	<a href="#">125</a>
	5–60 VDC	32	●	4	SNAP-ODC-32-SNK-FM <sup>5</sup>	6		●	●			L	High density	<a href="#">125</a>
	5–60 VDC	32	●	4	SNAP-ODC-32-SRC-FM <sup>5</sup>	6		●	●			L	High density	<a href="#">125</a>
	5–60 VDC	4	●	●	SNAP-ODC5-i	●	●	●			C9	L		<a href="#">124</a>
	5–60 VDC	4	●	●	SNAP-ODC5-iFM	●	●	●	●		C9	L		<a href="#">123</a>
	5–60 VDC	4	●	●	SNAP-ODC5MA	●	●	●			C9	30	Diagnostic switches	<a href="#">124</a>
	5–60 VDC	4	●		SNAP-ODC5SNK	●	●	●		●	C9	L		<a href="#">121</a>
	5–60 VDC	4	●		SNAP-ODC5SNKFM	●	●	●	●		C9	L		<a href="#">122</a>
	5–60 VDC	4	●		SNAP-ODC5SRC	●	●	●		●	C9	L		<a href="#">121</a>
	5–60 VDC	4	●		SNAP-ODC5SRCFM	●	●	●	●		C9	L		<a href="#">122</a>
	5–200 VDC	4	●	●	SNAP-ODC5A-i	●	●	●			C9	L		<a href="#">124</a>
	5–200 VDC	4	●	●	SNAP-ODC5A-iFM	●	●	●	●		C9	L		<a href="#">123</a>
5–200 VDC	4	●		SNAP-ODC5ASNK	●	●	●			C9	L		<a href="#">124</a>	
Dry Contact	Normally open	4		●	SNAP-ODC5R	●		●		●	C9	30	Reed relay, ≤10 VA	<a href="#">121</a>
	Normally open	4		●	SNAP-ODC5RFM	●		●	●		C9	30	Reed relay, ≤10 VA	<a href="#">122</a>
	Normally closed	4		●	SNAP-ODC5R5	●		●			C9	30	Reed relay, ≤10 VA	<a href="#">121</a>
	Normally closed	4		●	SNAP-ODC5R5FM	●		●	●		C9	30	Reed relay, ≤10 VA	<a href="#">122</a>

1 For more information on isolation, see “About Isolation” on page 27.

2 RoHS categories: C9 = Category 9; LF = lead-free

3 Warranty period: L = Lifetime; 30 = 30 months

4 Each group of eight points is isolated from the other groups. Points within a group are not isolated from each other.

5 For wiring options, see page 40.

6 Status LEDs for individual points are available on a separate breakout board.

## SNAP Digital Q&A

### **Q: What is the difference between the SRC and SNK digital DC output modules?**

A: SRC and SNK stand for SouRCing and SiNKing, respectively. Because one fuse is used for all output channels on the module, Opto 22 designed two different varieties. The selection of the module type depends on which side of the load the module is placed on. Typically, a SRC module is used between the + terminal and the load, while a SNK module would be used between the load and the –, ground, or common terminal. Please note that if the wrong module is used in the wrong place, all channels will effectively become common and all loads will be activated if any one channel is turned on.

### **Q: Why is there only one digital AC output module when there are two DC modules?**

A: Only one AC module design is required, because unlike the transistors used in the DC modules, the switching devices used in the AC module are non-polar. So as long as all channels on the module are wired in the same way, the AC module can be used for sourcing or sinking.

### **Q: Is there any way to get more than 0.75 A current capacity out of each channel on the 4-channel digital output module?**

A: Yes. SNAP 4-channel digital output modules are not rated on a channel-to-channel basis; instead, the entire module is rated for a maximum of 3 A. Any one channel on the module can carry up to 3 A, as long as the total current being carried by the module is 3 A or less. Thus, two of four channels can be used to carry 1.5 A each, with two channels unused.

### **Q: Can I wire the channels on a SNAP digital output module in parallel to obtain a higher current rating?**

A: This question is related to the question above. There really isn't a need to wire channels in parallel, because each channel can carry up to 3 A; just be certain that the total current passing through the module is 3 A or less. Wiring the channels in parallel will not make any difference as far as performance goes; one channel will likely activate before the others and thus take up the entire load itself anyway. Parallel wiring does allow for some automatic fallback redundancy in case one channel fails open, however.

### **Q: Is there a SNAP digital input module for DC voltages over 32 V?**

A: Yes. SNAP AC input modules may be used for DC input up to their voltage rating. For example, a SNAP-IAC5 can be used to read 125 VDC input signals. Most SNAP input modules use a full-wave rectifier on the input, allowing the module to be used as an AC or DC input and making it resistant to reversed-polarity installations.

### **Q: Is there a way to read low-voltage AC signals with a SNAP input module?**

A: Yes. In the same way that SNAP AC modules can be used for DC, some SNAP DC modules can be used to take low-voltage AC signals, such as the 24 VAC commonly used in HVAC systems. This is allowable with all SNAP DC modules containing a full-wave rectifier.

## Analog Input Modules

The following table compares SNAP analog input modules. For resolution information, see “SNAP Analog Q&A” on page 33. Detailed specifications are shown on the page in the *Specs* column.

Input signal		Points	Isolation <sup>1</sup>			Part number	Approvals					Warranty <sup>3</sup>	Notes	Specs
Type	Range		Optical	Ch-ch	Transformer		UL	CE	FM	CSA	RoHS <sup>2</sup>			
Current	-20 to +20 mA	32	●		●	SNAP-AIMA-32 <sup>4</sup>		●				L		<a href="#">130</a>
	-20 to +20 mA	32	●		●	SNAP-AIMA-32-FM <sup>4</sup>		●	●			L		<a href="#">130</a>
	-20 to +20 mA	8	●		●	SNAP-AIMA-8		●				L		<a href="#">129</a>
	-20 to +20 mA	4	●		●	SNAP-AIMA-4	●	●	●		C9	L		<a href="#">129</a>
	-20 to +20 mA	2	●		●	SNAP-AIMA	●	●	●		C9	L		<a href="#">129</a>
	-20 to +20 mA	2	●	●	●	SNAP-AIMA-i	●	●	●		C9	L		<a href="#">131</a>
	-20 to +20 mA	2	●	●	●	SNAP-AIMA-iSRC		●			C9	L	Isolated loop excitation	<a href="#">131</a>
	-20 to +20 mA	2	●	●	●	SNAP-AIMA-iSRC-FM		●	●		C9	L	Isolated loop excitation	<a href="#">131</a>
	-1 to +1 mA	2	●	●	●	SNAP-AIMA2-i		●			C9	L		<a href="#">130</a>
Voltage	-150 to +150 mV or -75 to +75 mV	4	●		●	SNAP-AIMV-4	●	●	●		C9	L		<a href="#">132</a>
	-50 to +50 mV or -25 to +25 mV	4	●		●	SNAP-AIMV2-4	●	●	●		C9	L		<a href="#">133</a>
	-10 to +10 VDC or -5 to +5 VDC	32	●		●	SNAP-AIV-32 <sup>4</sup>		●				L		<a href="#">138</a>
	-10 to +10 VDC or -5 to +5 VDC	32	●		●	SNAP-AIV-32-FM <sup>4</sup>		●	●			L		<a href="#">138</a>
	-10 to +10 VDC or -5 to +5 VDC	8	●		●	SNAP-AIV-8		●				L		<a href="#">139</a>
	-10 to +10 VDC or -5 to +5 VDC	4	●		●	SNAP-AIV-4	●	●	●		C9	L		<a href="#">138</a>
	-10 to +10 VDC or -5 to +5 VDC	2	●		●	SNAP-AIV	●	●	●		C9	L		<a href="#">138</a>
	-10 to +10 VDC or -5 to +5 VDC	2	●	●	●	SNAP-AIV-i	●	●	●		C9	L		<a href="#">137</a>
	-100 to +100 VDC	2	●	●	●	SNAP-AIV2-i		●			C9	L		<a href="#">137</a>
	2 or 3 mV/V	2	●		●	SNAP-AILC		●			C9	L	Load cell devices	<a href="#">127</a>
	3 or 4 mV/V	2	●		●	SNAP-AILC-2		●				L	Load cell devices	<a href="#">127</a>

Input signal		Points	Isolation <sup>1</sup>			Part number	Approvals					Warranty <sup>3</sup>	Notes	Specs
Type	Range		Optical	Ch-ch	Transformer		UL	CE	FM	CSA	RoHS <sup>2</sup>			
pH/ORP	-1 to +1 V or -0.5 to +0.5 V	2	●	●	●	SNAP-pH/ORP		●				L	pH or ORP probes	142
RMS	0–10 A RMS	2	●		●	SNAP-AIARMS	●	●	●		C9	L		126
	0–10 A RMS	2	●	●	●	SNAP-AIARMS-i		●			C9	L		127
	0–10 A RMS	2	●	●	●	SNAP-AIARMS-i-FM		●	●		C9	L		127
	0–250 V RMS	2	●		●	SNAP-AIVRMS	●	●	●		C9	L		140
	0–250 V RMS	2	●	●	●	SNAP-AIVRMS-i		●			C9	L		140
	0–250 V RMS	2	●	●	●	SNAP-AIVRMS-i-FM		●	●		C9	L		
Rate	0–25,000 Hz	2	●		●	SNAP-AIRATE	●	●	●		C9	L		133
Temperature	ICTD	8	●		●	SNAP-AICTD-8		●			C9	L		128
	ICTD	4	●		●	SNAP-AICTD-4	●	●	●		C9	L		128
	ICTD	2	●		●	SNAP-AICTD	●	●	●		C9	L		128
	100-Ohm Platinum RTD	2	●		●	SNAP-AIRTD	●	●	●		C9	L		134
	Thermocouple type B,C,E,G,J,K,N,R,S, T or +/-75, +/-50, or +/-25 mV	8	●		●	SNAP-AITM-8		●			C9	L		136
		8	●		●	SNAP-AITM-8-FM		●	●		C9	L		136
	Thermocouple type E,J,K or -150 to +150 mV or -75 to +75 mV	2	●		●	SNAP-AITM		●	●		C9	L		134
		2	●	●	●	SNAP-AITM-i	●	●	●		C9	L		135
	Thermocouple type B,C,D, G,N,T,R,S or -50 to +50 mV or -25 to +25 mV	2	●		●	SNAP-AITM-2		●	●		C9	L		135
2		●	●	●	SNAP-AITM2-i	●	●	●		C9	L		136	
Resistance	40, 20, 10, or 5 K ohms	4	●		●	SNAP-AIR40K-4	●	●	●		C9	L	Thermistor input	132
Voltage	Dual-range voltage	1	●		●	SNAP-AIV-72		●			C9	L	Aluminum industry	
Current/ voltage	85–250 VAC RMS 0–10 AC amps RMS	4 <sup>5</sup>	●		●	SNAP-AIPM		●			C9	L	Power monitoring	141

1 For more information on isolation, see [“About Isolation” on page 27](#).

2 RoHS categories: C9 = Category 9; LF = lead-free

3 Warranty period: L = Lifetime; 30 = 30 months

4 For wiring options, see [page 40](#).

5 Two points of physical input (current and voltage) plus two calculated data points (true power and volt-amps)

## Analog Output Modules

The following table compares SNAP analog output modules. For resolution information, see “SNAP Analog Q&A,” below. Detailed specifications are shown on the page in the *Specs* column.

Output signal		Points	Isolation <sup>1</sup>			Part number	Approvals					Warranty <sup>3</sup>	Notes	Specs
Type	Range		Optical	Ch-ch	Transformer		UL	CE	FM	CSA	RoHS <sup>2</sup>			
Current	4–20 mA	2	●		●	SNAP-AOA-23	●	●	●		C9	L		<a href="#">143</a>
	4–20 mA	2	●	●	●	SNAP-AOA-23-iSRC		●			C9	L	Isolated loop sourcing	<a href="#">144</a>
	4–20 mA	2	●	●	●	SNAP-AOA-23-iSRC-FM		●	●		C9	L	Isolated loop sourcing	<a href="#">144</a>
	0–20 mA	2	●		●	SNAP-AOA-28	●	●	●		C9	L		<a href="#">144</a>
	4–20 mA	1	●		●	SNAP-AOA-3	●	●			C9	L		<a href="#">143</a>
Voltage	0–10 VDC	2	●		●	SNAP-AOV-25	●	●	●		C9	L		<a href="#">146</a>
	-10 to +10 VDC	2	●		●	SNAP-AOV-27	●	●	●		C9	L		<a href="#">146</a>
	0–10 VDC	1	●		●	SNAP-AOV-5	●	●			C9	L		<a href="#">146</a>
	5–60 VDC	2	●	●	●	SNAP-AOD-29	●	●	●		C9	L	Time-proportional output <sup>4</sup>	<a href="#">145</a>

1 For more information on isolation, see “About Isolation” on page 27.

2 RoHS categories: C9 = Category 9; LF = lead-free

3 Warranty period: L = Lifetime; 30 = 30 months

4 SNAP-PAC brains and rack-mounted controllers with high-speed digital functions also provide TPO on digital output modules.

## SNAP Analog Q&A

### Q: What type of resolution do SNAP analog inputs provide?

A: SNAP analog input modules have a typical resolution of  $\pm 25,000$  counts. This equates to roughly 14.5-bit resolution plus sign, or 15.5-bit full-scale resolution. These odd resolutions are a result of the inherent accuracy of the input amplifiers used to buffer the analog-to-digital converter from the signal source. While the analog-to-digital converter may be capable of providing higher resolution numbers, these numbers are not useful because of the low precision level of the signal conditioning circuitry and the amount of noise inherent in any electrical signal.

### Q: What type of resolution do SNAP analog output modules achieve?

A: SNAP analog outputs are 12-bit resolution, yielding 4,095 counts from zero to full-scale.

## Serial Communication Modules

Serial communication modules can be used with all EB brains and R-series controllers. They cannot be used with SB serial brains. The following table compares SNAP serial communication modules. Detailed specifications are shown on the page in the *Specs* column.

Input/output	Ports	Isolation <sup>1</sup>		Part number	LEDs	Approvals					Warranty <sup>3</sup>	Notes	Specs
		Optical	Ch-ch			UL	CE	FM	CSA	RoHS <sup>2</sup>			
RS-232	2	●	●	SNAP-SCM-232	●		●	●		C9	30	Optional RTS/CTS flow control	<a href="#">147</a>
RS-485/422	2 <sup>4</sup>	●	●	SNAP-SCM-485-422	●		●	●		C9	30	2-wire or 4-wire	<a href="#">147</a>
RS-485/422	4	●		SNAP-SCM-MCH16	●		●				30	Motion control interface	<a href="#">149</a>
Profibus®	1	●	●	SNAP-SCM-PROFI	●		●				30	Links to Profibus networks	<a href="#">147</a>
Wiegand®	2	●	●	SNAP-SCM-W2	●		●			C9	30	Wiegand protocol for security industry	<a href="#">148</a>

1 For more information on isolation, see [“About Isolation” on page 27](#).

2 RoHS categories: C9 = Category 9; LF = lead-free

3 Warranty period: L = Lifetime; 30 = 30 months

4 Two ports if module is in 2-wire mode; one port if in 4-wire mode

## I/O Mounting Racks

SNAP PAC mounting racks hold one processor (brain or R-series controller) and up to 4, 8, 12, or 16 modules. All kinds of SNAP I/O modules— analog, 4-channel and high-density digital, and serial— can be mixed together on any rack with any processor, including Wired+Wireless EB brains and R-series controllers.

Mounting rack part numbers are:

- **SNAP-PAC-RCK4** (up to 4 modules)  
**SNAP-PAC-RCK4-FM** (Factory Mutual approved)
- **SNAP-PAC-RCK8** (up to 8 modules)  
**SNAP-PAC-RCK8-FM** (Factory Mutual approved)
- **SNAP-PAC-RCK12** (up to 12 modules)  
**SNAP-PAC-RCK12-FM** (Factory Mutual approved)
- **SNAP-PAC-RCK16** (up to 16 modules)  
**SNAP-PAC-RCK16-FM** (Factory Mutual approved)

If cabinet space for distributed I/O is limited and the capabilities fit your needs, choose higher density modules.

## Choosing Power Supplies

### Primary Power Supply

*NOTE: For a more general discussion of using power supplies with Opto 22 systems, see Opto 22 form #1271, a technical note available on our website at [www.opto22.com](http://www.opto22.com).*

SNAP racks use a 5 VDC power source (5 VDC [-0.0, +0.1] at minimum 4.0 amps recommended). For systems using AC source voltage, the SNAP-PS5 or SNAP-PS5U power supply is recommended. For DC systems, such as those using DC backup power, the SNAP-PS5-24DC offers DC-to-DC power.

In general, we recommend you **use an independent, isolated, regulated power supply locally with each rack**. Local isolated supplies offer these advantages:

- Short supply conductors, which minimize losses
- Power redundancy, so the failure of a single supply causes only a single rack failure, not a total system failure
- Fewer voltage drops and ground loops. (Voltage drops and subsequent ground loops may occur when power is distributed over a large system.)

Always **use a separate power supply for the field side of the I/O**. Using the rack supply for field actuation and monitoring defeats the isolation the I/O module offers and therefore increases the chance of a ground loop within the control system. Additionally, a sudden change of current on the field side can cause undesirable voltage fluctuations that may interfere with the computer's operation.

### Determining Power Requirements

Both the SNAP-PS5 and the SNAP-PS5-24DC power supplies provide 5 VDC power for loads up to 4 amps. The SNAP-PS5U provides 5 VDC for loads up to 5 amps. In most cases this power is sufficient for a SNAP processor, a rack, and the associated I/O modules. However, some combinations of modules, especially serial modules, may require additional power. You can use the following tables to help determine power needs for your I/O units.

#### Processor Power Requirements

Processor (Brain or Rack-mounted Controller)	Power Req. (Amps)*
SNAP PAC R-series controllers (all wired models)	1.200
SNAP PAC R-series controllers (Wired+Wireless)	1.500
SNAP PAC EB and SB brains (all wired models)	0.750
SNAP PAC EB brains (Wired+Wireless)	1.000

\*Current from 5-volt supply

**I/O Unit (Processor, Rack, and I/O Modules) Power Requirements Worksheet**

Item	Quantity	X Power Req. (Amps)	Total Power Required (Amps) <sup>1</sup>
SNAP processor (Enter Amps from Processor Power Requirements table)	1		
SNAP-IDC5-SW digital input module SNAP-IDC5-SW-NC digital input module SNAP-AITM-8 analog input module Isolated analog input and output modules (part numbers ending in -i or iSRC)		0.200	
All other 4-channel digital input and output modules ( <i>not</i> high-density digital modules)		0.050	
SNAP-AICTD, AICTD-4, analog input modules High-density digital input and output modules SNAP-AIMA-32, SNAP-AIV-32 analog input modules All analog output modules except SNAP-AOA-iSRC		0.150	
SNAP-AIARMS analog input module SNAP-AIVRMS analog input module SNAP-AICTD-8 analog input module SNAP-AIMA, AIMA-4, and AIMA-8 analog input modules SNAP-AITM and AITM-2 analog input modules SNAP-AIMV-4 and AIMV2-4 analog input modules SNAP-AIV, AIV-4, and AIV-8 analog input modules		0.170	
SNAP-AIRTD analog input module SNAP-AIR40K-4 analog input module SNAP-AIRATE analog input module		0.190	
SNAP-AIPM power monitoring module SNAP-AIPM-3 power monitoring module		0.100	
SNAP-AILC and AILC-2 load cell modules		0.120	
Serial communication and Profibus modules Motion control module <i>not</i> powering a breakout board		0.250	
Motion control module powering a breakout board		0.700	
<b>Total</b>			

<sup>1</sup> Current from 5-volt supply

**IMPORTANT:** For a SNAP-PS5 or a SNAP-PS5-24DC power supply, the total power required must not exceed 4 Amps. For a SNAP-PS5U, the total power required must not exceed 5 Amps.

**Loop Power Supply**

Some analog modules (such as the SNAP-AIMA, SNAP-AIMA-4, and SNAP-AIMA-i) also require a current loop supply, which can be provided by the SNAP-PS24 or the SNAP-PS24U. Both offer 24 volts of DC power, the SNAP-PS24 at 0.75 A and the SNAP-PS24U at 1.25 A.

## Warranty Information and Agency Approvals

The Opto 22 warranty on all SNAP power supplies is 30 months.

The SNAP-PS5, SNAP-PS24, and SNAP-PS5-24DC power supplies are Factory Mutual approved.

## Simplifying Installation with SNAP TEX Accessories

Wiring field devices to I/O can be a time-consuming and expensive process. SNAP TEX wiring and mounting accessories make it easier to install and wire your SNAP PAC System.

**SNAP TEX cables** are pre-made cables that snap into I/O modules and provide flying leads or a connector for field wiring. You can use these cables with SNAP TEX breakout boards or your own boards, or wire directly to field devices. To choose cables for your SNAP I/O modules, see the tables beginning on [page 38](#).

**SNAP TEX breakout boards** move terminals away from the crowded rack area for easier installation and maintenance. Some offer additional features such as built-in fusing, bussed power to loads, and mechanical relays for high-current switching. To choose the breakout boards to use with your I/O modules and cables, see the tables beginning on [page 38](#).

For more information on SNAP TEX cables and breakout boards, see form #1756, the *SNAP TEX Cables and Breakout Boards Data Sheet*.

**DIN-rail clips and kits** mount power supplies, controllers, and I/O mounting racks to DIN rails. To find out which DIN-rail clips to use (and how many), see the table on [page 41](#).

Mounting and wiring **tools, spare parts, jumper straps**, and **rack adapters** for use with legacy brains are also available. See form #1772, the *SNAP TEX Mounting & Wiring Tools and Spare Parts Data Sheet* for more information.

## Module, Breakout Board, and Cable Compatibility Charts

Look in the left column for the module you have. Choose the breakout board in the right columns. Compatible cables are shown in the table cells in the center.

### 4-Channel Digital Modules

Module	Breakout Board		
	SNAP-TEX-32	SNAP-TEX-FB16-H SNAP-TEX-FB16-L	SNAP-TEX-MR10-4 SNAP-TEX-MR10-16
<b>Digital input modules—4-channel</b>			
SNAP-IAC5 SNAP-IAC5A SNAP-IAC5AFM SNAP-IAC5FM SNAP-IAC5MA SNAP-IDC5 SNAP-IDC5-FAST-A SNAP-IDC5-HT SNAP-IDC5-SW SNAP-IDC5-SW-NC SNAP-IDC5D SNAP-IDC5DFM SNAP-IDC5FAST SNAP-IDC5FM SNAP-IDC5G SNAP-IDC5MA SNAP-IDC5Q	SNAP-TEX-CBE6 SNAP-TEX-CBO6 SNAP-TEX-CBS6	SNAP-TEX-CBO6 SNAP-TEX-CBS6	Not used for inputs
<b>Digital output modules—4-channel</b>			
SNAP-ODC5-I SNAP-ODC5-IFM SNAP-ODC5A-I SNAP-ODC5A-IFM	SNAP-TEX-CBS6 SNAP-TEX-CBO6 SNAP-TEX-CBE6	SNAP-TEX-CBS6 SNAP-TEX-CBO6	SNAP-TEX-CBO6
SNAP-OAC5-I SNAP-OAC5-IFM SNAP-OAC5MA SNAP-ODC5MA	SNAP-TEX-CBS6 SNAP-TEX-CBO6 SNAP-TEX-CBE6	SNAP-TEX-CBS6 SNAP-TEX-CBO6	Not used
SNAP-ODC5SRC	SNAP-TEX-CBS6 SNAP-TEX-CBO6	SNAP-TEX-CBS6 SNAP-TEX-CBO6	SNAP-TEX-CBO6 SNAP-TEX-CBS6
SNAP-OAC5 SNAP-OAC5FM SNAP-ODC5ASNK SNAP-ODC5R SNAP-ODC5R5 SNAP-ODC5R5FM SNAP-ODC5RFM SNAP-ODC5SNK SNAP-ODC5SNKFM SNAP-ODC5SRCFM	SNAP-TEX-CBS6 SNAP-TEX-CBO6	SNAP-TEX-CBS6 SNAP-TEX-CBO6	Not used

### 1-, 2-, and 4-Channel Analog Modules

Module	Breakout Board		
	SNAP-TEX-32	SNAP-TEX-FB16-H SNAP-TEX-FB16-L	SNAP-TEX-MR10-4 SNAP-TEX-MR10-16
<b>Analog input modules (not thermocouples)</b>			
SNAP-AIMV2-4 SNAP-AIV-4 SNAP-AIR40K-4 SNAP-AIMA-4 SNAP-AIMV-4	SNAP-TEX-CBS6 SNAP-TEX-CBE6	Not used for analog modules	
SNAP-AIMA SNAP-AIV-72 SNAP-AIVRMS SNAP-AIV SNAP-AIARMS SNAP-AICTD SNAP-AIRATE SNAP-AIRTD SNAP-AICTD-4 SNAP-AIMA-i SNAP-AIMA2-i SNAP-AIV-i SNAP-AIV2-i SNAP-AIARMS-i SNAP-AIARMS-i-FM SNAP-AIVRMS-i SNAP-AIVRMS-i-FM SNAP-AIPM	SNAP-TEX-CBS6	Not used for analog modules	
SNAP-AILC SNAP-AILC-2 SNAP-pH/ORP SNAP-AIMA-iSRC SNAP-AIMA-iSRC-FM SNAP-AITM-i * SNAP-AITM2-i * SNAP-AITM * SNAP-AITM-2 *	No cable available	Not used for analog modules	
<b>Analog output modules</b>			
SNAP-AOA-23 SNAP-AOA-28 SNAP-AOA-3 SNAP-AOV-25 SNAP-AOV-27 SNAP-AOV-5 SNAP-AOA-23-iSRC SNAP-AOA-23-iSRC-FM	SNAP-TEX-CBS6	Not used for analog modules	
SNAP-AOD-29	SNAP-TEX-CBS6 SNAP-TEX-CBE6	Not used for analog modules	

\* Do not use breakout boards with thermocouples.

### High-Density Digital Modules

Module	Breakout Board					Without a breakout board
	SNAP-TEX-32	SNAP-TEX-FB16-H SNAP-TEX-FB16-L	SNAP-TEX-MR10-4 SNAP-TEX-MR10-16	SNAP-IDC-HDB SNAP-IDC-HDB-FM	SNAP-ODC-HDB SNAP-ODC-HDB-FM	
SNAP-IAC-16 SNAP-IAC-A-16 SNAP-IAC-K-16 SNAP-IDC-16 SNAP-IDC-HT-16	SNAP-HD-ACF6 (2 modules/board)	SNAP-HD-ACF6				SNAP-HD-ACF6
SNAP-IDC-32 SNAP-IDC-32-FM SNAP-IDC-32N	SNAP-HD-CBF6	SNAP-HD-CBF6 (2 boards/module)		SNAP-HD-BF6		SNAP-HD-CBF6
SNAP-ODC-32-SNK SNAP-ODC-32-SNK-FM	SNAP-HD-CBF6	SNAP-HD-CBF6 (2 boards/module)	Do not use		SNAP-HD-BF6	SNAP-HD-CBF6
SNAP-ODC-32-SRC SNAP-ODC-32-SRC-FM			SNAP-HD-CBF6			

### Analog Modules with More Than 4 Points

Module	Breakout Board							Without a breakout board
	SNAP-TEX-32	SNAP-TEX-FB16-H SNAP-TEX-FB16-L	SNAP-TEX-MR10-4 SNAP-TEX-MR10-16	SNAP-IDC-HDB	SNAP-ODC-HDB	SNAP-AIMA-HDB SNAP-AIMA-HDB-FM	SNAP-AIV-HDB SNAP-AIV-HDB-FM	
SNAP-AITM-8 SNAP-AITM-8-FM SNAP-AIV-8 SNAP-AIMA-8 SNAP-AICTD-8	Can be used; no cable currently available	Not used with analog modules						
SNAP-AIV-32 SNAP-AIV-32-FM	SNAP-HD-CBF6	Not used with analog modules					SNAP-HD-BF6	SNAP-HD-CBF6
SNAP-AIMA-32 SNAP-AIMA-32-FM	Not recommended				SNAP-HD-BF6			Not recommended

## DIN-Rail Clips and Kits

Use the DIN-rail adapter for the SNAP product you have:

For these SNAP products		Use this adapter	Number needed
<b>Power Supplies</b>			
SNAP-PS5 SNAP-PS24	SNAP-PS5-24DC	SNAP-PSDIN	1 kit
SNAP-PS5U	SNAP-PS24U	SNAP-PSUDIN	1 kit
<b>Controllers</b>			
SNAP-PAC-S1	SNAP-PAC-S1-FM	SNAP-PSDIN	1 kit
SNAP-PAC-S2		SNAP-S2DIN	1 kit
<b>Mounting Racks</b>			
SNAP-PAC-RCK4 SNAP-PAC-RCK8	SNAP-PAC-RCK4-FM SNAP-PAC-RCK8-FM	SNAP-RACKDIN (1 clip) or SNAP-RACKDINB (25-pack)	2 clips
SNAP-PAC-RCK12	SNAP-PAC-RCK12-FM	SNAP-RACKDIN (1 clip) or SNAP-RACKDINB (25-pack)	3 clips
SNAP-PAC-RCK16	SNAP-PAC-RCK16-FM	SNAP-RACKDIN (1 clip) or SNAP-RACKDINB (25-pack)	4 clips
<b>Breakout Boards</b>			
SNAP-AIMA-HDB SNAP-AIMA-HDB-FM SNAP-AIV-HDB SNAP-AIV-HDB-FM SNAP-IDC-HDB	SNAP-IDC-HDB-FM SNAP-TEX-32 SNAP-TEX-FB16-H SNAP-TEX-FB16-L SNAP-TEX-MR10-4	SNAP-RACKDIN (1 clip) or SNAP-RACKDINB (25-pack)	2 clips
SNAP-ODC-HDB SNAP-ODC-HDB-FM	SNAP-SCM-BB4 SNAP-TEX-MR10-16	SNAP-RACKDIN (1 clip) or SNAP-RACKDINB (25-pack)	3 clips

## Choosing Network Infrastructure Products

As you set up your SNAP PAC System, you'll want to be sure that all parts of your network stand up to the environmental conditions in your installation. Network infrastructure devices, such as Ethernet switches and wireless access points, must be able to withstand the temperature extremes, vibration, electrical noise, and so on required by your application. You can buy Ethernet switches off the shelf at a nearby store, but they're designed primarily for office use, not industrial use, and they often fail in industrial settings.

Opto 22 has tested a number of network infrastructure products with the SNAP PAC System. We found N-TRON Ethernet switches and wireless access points to be the most reliable we tested, and

we highly recommend them for use with the SNAP PAC System. As a convenience to our customers, we resell several N-TRON switches and an access point.

### N-TRON Product Features

Designed for industrial, utility, marine, and military environments, N-TRON product features include:

- Extended operating temperature ranges (-40 to 85 °C on switches; -40 to 70 °C on the wireless access point)
- Highest shock and vibration ratings in the industry—well suited for mobile or vibrating equipment, such as compressor stations, aircraft, trains, etc.
- Coated steel enclosures for high-noise environments
- UL listed and approved for use in Class I, Division II Hazardous areas
- Very high MTBF (mean time between failure) rating: 2 million hours (over 228 years) for switches; 1 million hours for access point
- Redundant power supply inputs (10–30 VDC or 20–49 VDC) with low current requirements

### N-TRON Ethernet Switches

The following chart compares features for the N-TRON switches Opto 22 carries. For complete specifications, see the data sheet for each product (available on our website).

Part number	10/100 BaseTX copper ports	100BaseFX fiber optic ports	Manage locally	Manage remotely (SNMP & web browser)	N-View monitoring software	Virtual Local Area Network (VLAN)	Quality of Service (QoS)	Port trunking & mirroring	IGMP snooping	ESD & surge protection diodes (all ports)	Configurable alarm contact	N-Ring technology	Rapid Spanning Tree Protocol (RSTP)	Dynamic Host Configuration Protocol (DHCP)
N-TRON716TX	16	0	●	●	●	●	●	●	●	●	●	●	●	●
N-TRON716FX2-ST	14	2	●	●	●	●	●	●	●	●	●	●	●	●
N-TRON708TX	8	0	●	●	●	●	●	●	●	●	●	●	●	●
N-TRON708FX2-ST	6	2	●	●	●	●	●	●	●	●	●	●	●	●
N-TRON517FX-A-ST-S	16	1	●		●	●	●	●	●					
N-TRON516TX-A	16	0	●		●	●	●	●	●					
N-TRON508TX-A	8	0	●		●	●	●	●	●					
N-TRON508FX2-A-ST-S	6	2	●		●	●	●	●	●					
N-TRON308TX-N	8	0			●									
N-TRON306FX2-N-ST	4	2			●									
N-TRON304TX-N	4	0			●									

### N-TRON Wireless Access Point

The **N-TRON702-W** wireless access point is the best choice for a Wired+Wireless SNAP PAC System. In addition to its suitability for harsh industrial conditions, it matches or exceeds the standards used by Wired+Wireless brains and controllers:

- Wireless standards 802.11a, b, and g
- Security standards WPA2/TKIP, WPA/AES, and WEP

### N-TRON Accessories

**Media converter**—converts copper to fiber optic (multimode, with an ST connector):

N-TRON302MC-N-ST

**Panel mounting kits** for N-TRON products:

For this product	Use this kit
Wireless access point	N-TRON700-W-PM
700-series Ethernet switch	N-TRON700-PM
500-series Ethernet switch	N-TRON900-PM
300-series Ethernet switch	N-TRON900-PM