OPTO 22

These products are obsolete.

SNAP PAC BRAINS

Features

> Multi-protocol communications and I/O processor

> Handles analog, digital, and serial SNAP I/O™ modules all on one mounting rack

> Distributed intelligence for your SNAP PAC System

> Choose models with Ethernet or serial network connections

> Ethernet-based brains are UL approved

SNAP-PAC-EB1 Brain

DESCRIPTION

NOTE: *Due to the unavailability of essential parts, all SNAP PAC brains have reached their end of life. Instead of Ethernet-based brains, use a SNAP-PAC-R1 controller/brain; it has all the same features plus additional power (and programmability, if you need it). For serial brain options, contact Opto 22 Product Support.*

SNAP PAC brains are powerful and versatile I/O and network communications processors for your SNAP PAC System™. They are designed primarily to work in distributed systems controlled by a SNAP PAC programmable automation controller, but SNAP PAC Ethernet brains can also be used as intelligent remote I/O in an Allen-Bradley® RSLogix®-based PLC system or a *groov* EPIC system, or as PC-based I/O.

All SNAP PAC brains provide local intelligence that frees the controller for supervisory tasks. For example, each brain independently handles functions such as latching, counting, thermocouple linearization, watchdog timers, and PID loop control. These functions continue to work on the brain even if communication with the controller is lost.

SNAP PAC brains can also be used independently for standalone I/O processing and communication.

SNAP PAC brains use Ethernet or serial networks:

• SNAP PAC **EB** brains communicate over a standard 10/100 Mbps Ethernet network.

• SNAP PAC **SB** brains communicate over an RS-485 serial network, 2-wire or 4-wire, using a binary protocol.

EB Series Brains (EOL as of March 1, 2022)

SNAP PAC Ethernet Brains include the **SNAP-PAC-EB1** and the **SNAP-PAC-EB2**. These brains are identical in their functions and features except that the SNAP-PAC-EB1 provides high-speed digital functions for use with 4-channel digital I/O. The SNAP-PAC-EB2 does not offer high-speed digital functions. For a complete list of brain features, see .

Each SNAP PAC EB brain is equipped with two switched Ethernet network interfaces. Because these interfaces share a single IP address and act just like an Ethernet switch, SNAP PAC brains can be installed not only in a standard star configuration, but optionally in a multi-drop configuration, extending the control network without the expense of additional Ethernet network hardware.

Part Numbers

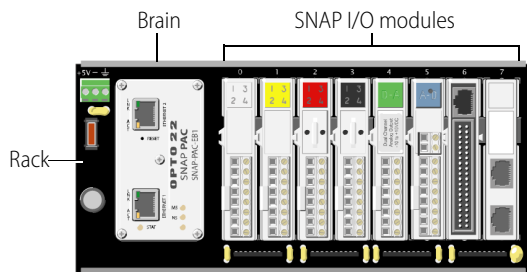| Part	Description
SNAP-PAC-EB1 **[Obsolete]**	**[Obsolete]** Ethernet-based analog, digital, and serial I/O and communications processor, with two switched Ethernet network interfaces and high-speed digital functions
SNAP-PAC-EB1-FM **[Obsolete]**	**[Obsolete]** Ethernet-based analog, digital, and serial I/O and communications processor, with two switched Ethernet network interfaces and high-speed digital functions
SNAP-PAC-EB2 **[Obsolete]**	**[Obsolete]** Ethernet-based analog, digital, and serial I/O and communications processor, with two switched Ethernet network interfaces
SNAP-PAC-EB2-FM **[Obsolete]**	**[Obsolete]** Ethernet-based analog, digital, and serial I/O and communications processor, with two switched Ethernet network interfaces
SNAP-PAC-SB1 **[Obsolete]**	**[Obsolete]** Serial-based analog and digital I/O and communications processor, with high-speed digital functions
SNAP-PAC-SB2 **[Obsolete]**	**[Obsolete]** Serial-based analog and digital I/O and communications processor

MADE IN THE USA

SB Series Brains (EOL as of February 1, 2023)

The two SNAP PAC Serial Brains are the **SNAP-PAC-SB1** and the **SNAP-PAC-SB2**. Like the EB brains, the two SB brains are identical except that the SNAP-PAC-SB1 provides high-speed digital functions for use with 4-channel digital I/O. The SNAP-PAC-SB2 does not offer high-speed digital functions. See page 5 for a comparison of brain features.

I/O Processing

Each SNAP PAC brain mounts on a SNAP PAC rack with up to 4, 8, 12, or 16 SNAP I/O modules.

View from top

Brain

SNAP I/O modules

Rack

SNAP PAC EB brains support all SNAP analog, digital, and serial input and output modules. SNAP PAC SB brains support all SNAP analog and digital modules.

These modules can all be mixed on the same mounting rack and placed in any position on the rack, to accommodate the required mix of signals at any location. Each SNAP I/O module provides from 1 to 32 I/O points, depending on the module.

For more information on mounting racks, see Opto 22 form #1684, the *SNAP PAC Racks Data Sheet*. For more information on SNAP I/O modules, visit our website at www.opto22.com.

Multiple Protocol Support on Ethernet

In addition to I/O processing, SNAP PAC Ethernet brains support communication using multiple protocols running simultaneously over Ethernet, including EtherNet/IP™, Modbus®/TCP, SNMP for network management, FTP for the brain's built-in file system, SMTP (email client), and Opto 22's open memory-mapped OptoMMP protocol. Communication with OPC 2.0-compliant clients is available through OptoOPCServer (see "Software," below).

Software

SNAP PAC brains are primarily designed for use with a **SNAP PAC programmable automation controller** or a *groov* EPIC processor running a control program built with PAC Project™ software. The PAC Project software suite comes in two forms, Basic and Professional.

- **PAC Project Basic**, which is included in the purchase of a SNAP PAC or *groov* EPIC, consists of control programming, human-machine interface (HMI) creation, and configuration software.

- **PAC Project Professional** is available for purchase and adds OptoOPCServer™ for OPC connectivity, OptoDataLink™ for database communications, and additional features.

In addition to using a SNAP PAC controller with PAC Project software, you can communicate with SNAP PAC brains using the open and documented OptoMMP protocol. A free OptoMMP Communication Toolkit is available on our website, www.opto22.com. This toolkit includes ActiveX components and C++ classes, so you can use programming tools such as Visual Basic or Visual C++ to communicate with the brains. See form #1465, the *OptoMMP Protocol Guide*, for more information.

Ethernet brains can also communicate with **Allen-Bradley RSLogix®️ systems** using EtherNet/IP (see Opto 22 form #1770, the *EtherNet/IP for SNAP PAC Protocol Guide*, on our website).

In addition, Ethernet brains communicate using **Modbus/TCP**; see Opto 22 form #1678, the *Modbus/TCP Protocol Guide*, for more information.

These products are obsolete.

MADE IN THE
USA

OPTO 22 • 800-321-6786 • 1-951-695-3000 • www.opto22.com • sales@opto22.com

OPTO 22

These products are obsolete.

SPECIFICATIONS

Serial and Ethernet Brains (Obsolete)	
Power Requirements	5.0–5.2 VDC at 750 mA maximum (does not include module power requirements)
Memory	16 MB RAM
Backup battery for real-time clock	Rechargeable (recharges whenever the brain has power). 5-year life when power is off (replacement part number: SNAP-PAC-BATTERY-ML2430). (Models manufactured before August 2007 have a 3-volt CR2032 lithium battery, available in retail stores. See original user guide for replacement steps.)
Hold-down screw	Torque: 8 in-lb (0.9 N-m)
Operating Temperature	-20 to 60 °C
Storage Temperature	-40 to 85 °C
Humidity	0–95% humidity, non-condensing
Agency approvals and certifications	-EB models: UL, CE, RoHS, DFARS; UKCA -SB models: CE, RoHS, DFARS; UKCA
Warranty	30 months from date of manufacture

Ethernet Brains (EB) only (Obsolete)	
Ethernet Network Interfaces	IEEE 802.3 network, 10Base-T and 100Base-TX. Supports Auto MDI-X (crossover cable not needed). Two switched interfaces, allowing multi-drop (daisy-chain) or standard star network configuration.
Maximum Ethernet Segment Length	100 meters with Category 5 or superior UTP For 100 Mbps at this distance, use Category 5 or superior solid UTP.

Serial Brains (SB) only (Obsolete)	
Network interfaces	RS-485, 2- or 4-wire, twisted pair(s), with shield
Serial data rates	300 baud to 230.4 Kbaud
Range: Serial multidrop	32 stations maximum on a segment (including PC, controller, repeaters, and I/O units); up to 3000 ft (914 m) on a segment
Connector screw	Torque: 1.7 in-lb (0.19 N-m)

MADE IN THE USA

OPTO 22 • 800-321-6786 • 1-951-695-3000 • www.opto22.com • sales@opto22.com
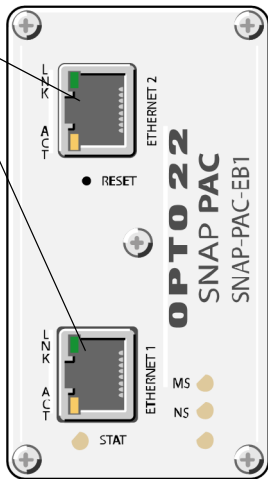
LEDs and Network Interfaces—Ethernet Brains (Obsolete)

This diagram applies to part numbers SNAP-PAC-EB1, SNAP-PAC-EB2, SNAP-PAC-EB1-FM, and SNAP-PAC-EB2-FM.

Switched Ethernet network interfaces

Brains can be networked in a daisy-chain configuration or in a standard star configuration using either Ethernet interface. Both interfaces use the same IP address.

NOTE: When using a daisy-chain configuration, be aware that if power to a brain is lost, all brains beyond it on the network will also lose communication. Firmware on daisy-chained brains must be updated one at a time.
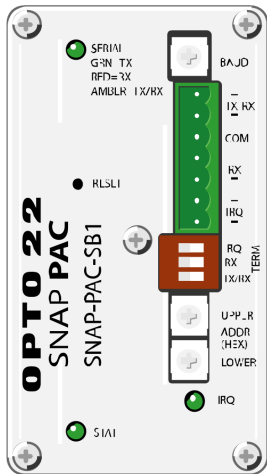
LEDs

LED	Indicates
LNK	Link established with Ethernet network
ACT	Activity on Ethernet network
STAT	Brain status
MS	EtherNet/IP Module Status
NS	EtherNet/IP Network Status
Unnamed	Reserved for future use

LEDs and Network Interfaces—Serial Brains (Obsolete)

LEDs

LED	Indicates
SERIAL	Green = Transmit Red = Receive Amber = Transmit/Receive
STAT	Brain status
IRQ	Reserved for future use

Serial port

On a serial brain, the port is RS-485, either 2-wire or 4-wire. Baud rate, termination, and address are set using the switches on the brain's top cover.

See form #1690, the *SNAP PAC Brains User's Guide*, for serial cable recommendations and wiring.

NOTE: IRQ connections and LED are reserved for future use.

These products are obsolete.

MADE IN THE USA

OPTO 22

These products are obsolete.

FEATURES

This table compares SNAP PAC brains with firmware R8.5 or newer. **All SNAP PAC brains are obsolete.**

FEATURE		SNAP-PAC-EB1	SNAP-PAC-EB1-FM	SNAP-PAC-EB2	SNAP-PAC-EB2-FM	SNAP-PAC-SB1	SNAP-PAC-SB2
Serial networking (RS-485, 2-wire or 4-wire)						●	●
Ethernet networking with two switched Ethernet network interfaces (one IP address)		●	●	●	●		
Ethernet network security (IP filtering, port access)		●	●	●	●		
Digital I/O point features	On/off status	●	●	●	●	●	●
	Input latching	●	●	●	●	●	●
	Watchdog timer	●	●	●	●	●	●
	High-speed counting (up to 20 kHz)[2]	●	●			●	
	Quadrature counting[3]	●	●			●	
	On-pulse and off-pulse measurement[2,4]	●	●			●	
	Frequency and Period measurement[4]	●	●			●	
	TPO (time-proportional output)[4]	●	●	●	●	●	●
	Digital totalizing[4]	●	●	●	●	●	●
	Pulse generation (N pulses, continuous square wave, on-pulse, and off-pulse)[4]	●	●	●	●	●	●
Analog I/O point features	Thermocouple linearization (32-bit floating point for linearized values)	●	●	●	●	●	●
	Minimum/maximum values	●	●	●	●	●	●
	Offset and gain	●	●	●	●	●	●
	Scaling	●	●	●	●	●	●
	Time-proportional output[5]	●	●	●	●	●	●
	Output clamping	●	●	●	●	●	●
	Filter weight	●	●	●	●	●	●
	Watchdog timer	●	●	●	●	●	●
	Analog totalizing[4]	●	●	●	●	●	●
	Ramping[4]	●	●	●	●	●	●
I/O modules supported	Digital (4–32 channels per module)	●	●	●	●	●	●
	Analog (2–32 channels per module)	●	●	●	●	●	●
	Serial (RS-232, RS-485, motion control, Profibus®, Wiegand®)	●	●	●	●		
Maximum number of modules allowed per I/O unit (with largest rack): Any mix of 16 digital, 16 analog, 8 serial or special-purpose		●	●	●	●	●[1]	●[1]
PID logic on the brain (96 PID loops per brain)		●	●	●	●	●	●
Scratch Pad area for peer-to-peer data (bits, floats, integers, strings)		●	●	●	●	●	●

MADE IN THE USA

OPTO 22 • 800-321-6786 • 1-951-695-3000 • www.opto22.com • sales@opto22.com

FEATURE	SNAP-PAC-EB1	SNAP-PAC-EB1-FM	SNAP-PAC-EB2	SNAP-PAC-EB2-FM	SNAP-PAC-SB1	SNAP-PAC-SB2
Realtime clock (RTC)	●	●	●	●	●	●
OPC driver support	●	●	●	●	●[8]	●[8]
OptoMMP memory-mapped protocol	●	●	●	●	●	●
EtherNet/IP™ (Allen-Bradley® Logix systems and others)	●	●	●	●		
Modbus®/TCP (slave; maximum two Modbus Master connections)	●	●	●	●		
SNMP (network management)[7]	●	●	●	●		
FTP server, file system	●	●	●	●		
Email (SMTP client)	●	●	●	●		
UDP Streaming	●	●	●	●		
Digital events, Alarm events, Serial events	●	●	●	●	●[9]	●[9]
Event messaging	●	●	●	●		
Data logging in the brain	●	●	●	●		

[1] Does not support serial, motion control, Profibus, or Wiegand modules.

[2] Four-channel digital modules only; not available on high-density digital modules.

[3] Requires a SNAP quadrature input module (SNAP-IDC5Q).

[4] Available when used with PAC Control Pro R8.2 (or higher) or PAC Control Basic R9.0 (or higher) and a SNAP PAC controller; or when used as remote intelligent I/O with a *groov* EPIC processor or an Allen-Bradley® PLC system.

[5] Requires a SNAP analog TPO module (SNAP-AOD-29).

[6] Digital I/O modules can be placed only in the first 8 slots on the rack.

[7] Currently available on all types of modules except analog modules with more than 4 points.

[8] Available when used with OptoOPCServer and PAC Control, through a SNAP PAC S-series controller.

[9] Does not support serial events.

These products are obsolete.

SYSTEM ARCHITECTURE

SNAP PAC brains are ideally suited for use as local I/O, logic, and communication processors in distributed systems.

The system shown below is controlled by a SNAP PAC S-series standalone controller running a PAC Control strategy. Some of the distributed I/O units are on an Ethernet network using EB brains, and some are on a serial network using SB brains. The controller handles all I/O on both networks.

SNAP PAC Ethernet brains can also be used as intelligent remote I/O with *groov* EPIC processors and Allen-Bradley Logix PLC systems.
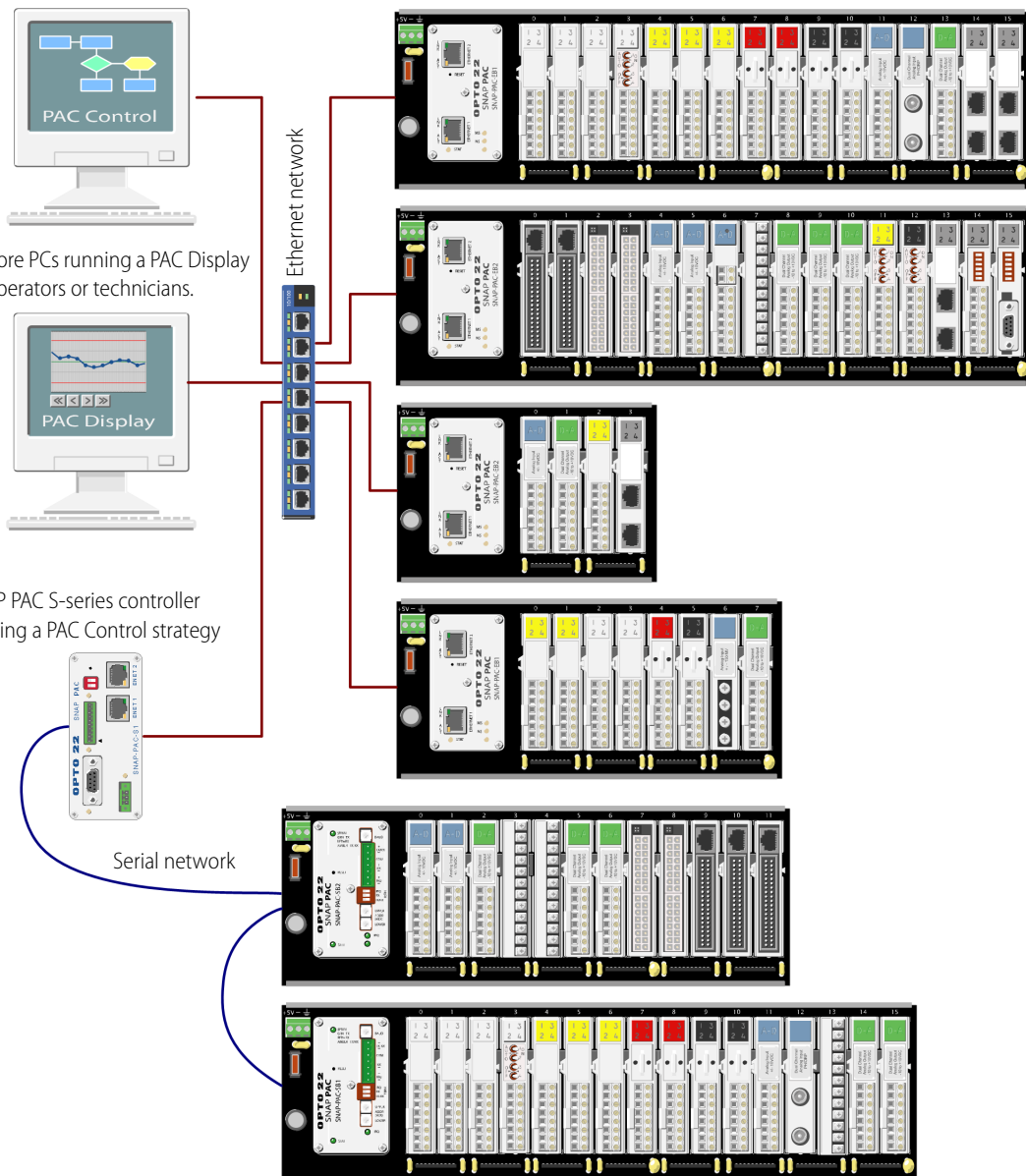
While the controller provides overall direction to the control system, each SNAP PAC brain locally handles counting, latching, thermocouple linearization, PID loop control, and other functions for the I/O modules on the racks. These local functions continue even if the controller loses communication with the brains.

PC used to develop a PAC Control strategy. Once developed, the strategy runs independently on the SNAP PAC controller.

SNAP PAC brains and I/O (distributed units). The top four are on an Ethernet network; the bottom two are on a serial network.

One or more PCs running a PAC Display HMI for operators or technicians.

Ethernet network

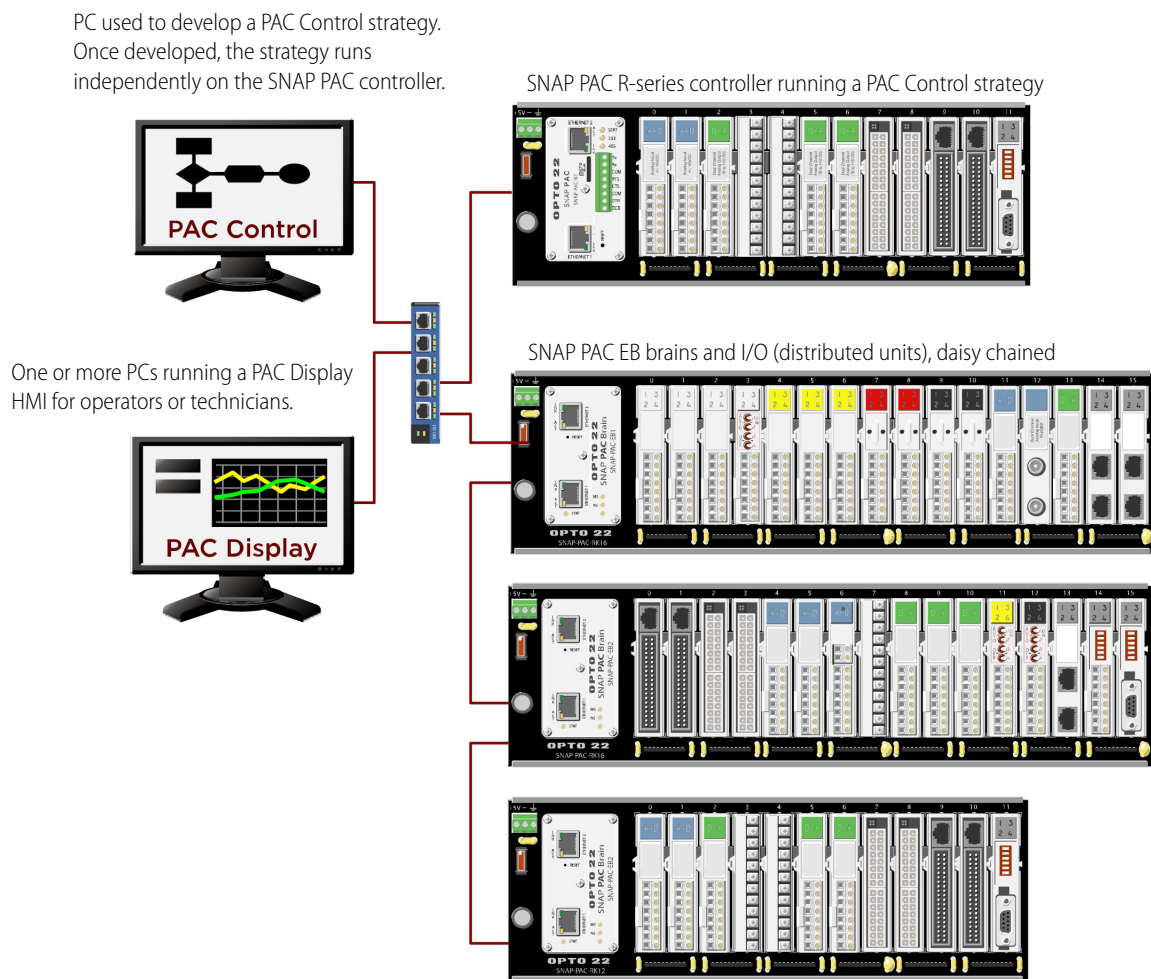SNAP PAC S-series controller running a PAC Control strategy

Serial network

SYSTEM ARCHITECTURE (CONTINUED)

SNAP PAC Ethernet Brains offer two options for networking. As shown in the diagram on page 7, they can be networked in a standard star configuration using off-the-shelf Ethernet network switches or routers.

As shown below, SNAP PAC Ethernet brains can also be networked in a daisy-chain configuration, using the two switched Ethernet interfaces on each brain.

In this diagram, a rack-mounted SNAP PAC R-series controller runs the PAC Control strategy and controls the system. The distributed brains are daisy-chained together, eliminating the expense of additional routers or switches.

PC used to develop a PAC Control strategy. Once developed, the strategy runs independently on the SNAP PAC controller.

SNAP PAC R-series controller running a PAC Control strategy

One or more PCs running a PAC Display HMI for operators or technicians.

SNAP PAC EB brains and I/O (distributed units), daisy chained

These products are obsolete.

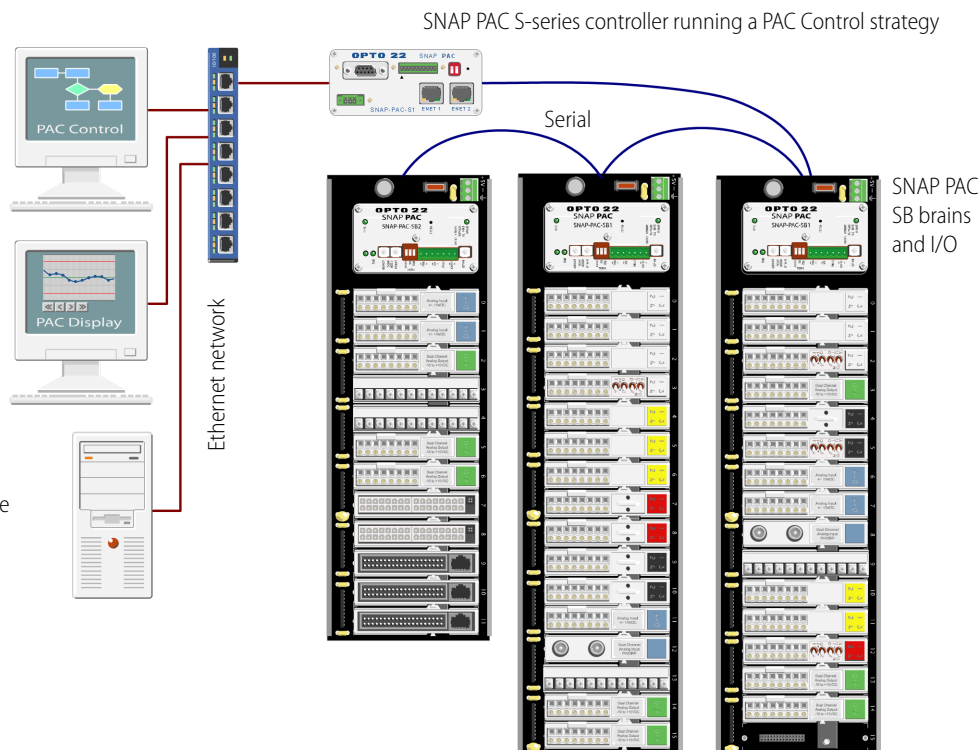MADE IN THE
USA

SYSTEM ARCHITECTURE (CONTINUED)

While SNAP PAC Ethernet brains can communicate directly with other devices using several protocols over Ethernet, **SNAP PAC serial brains** communicate with OPC clients, corporate databases, and other third parties through a SNAP PAC S-series controller.

SNAP PAC Serial Brains with a SNAP PAC S-series Controller

SNAP PAC S-series controller running a PAC Control strategy

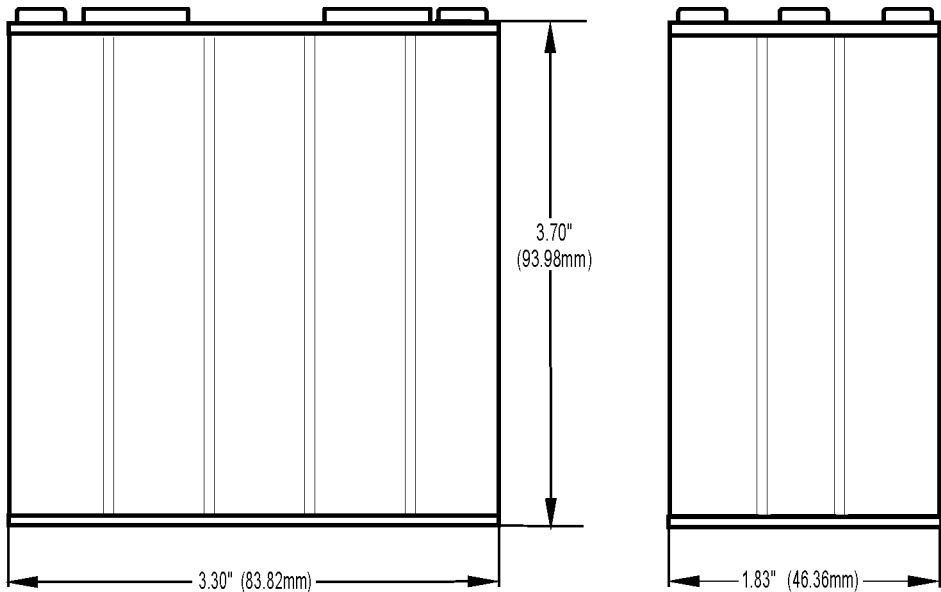PC used to develop a PAC Control strategy. Once developed, the strategy runs independently on the SNAP PAC controller.

One or more PCs running a PAC Display HMI for operators or technicians.

OptoOPCServer
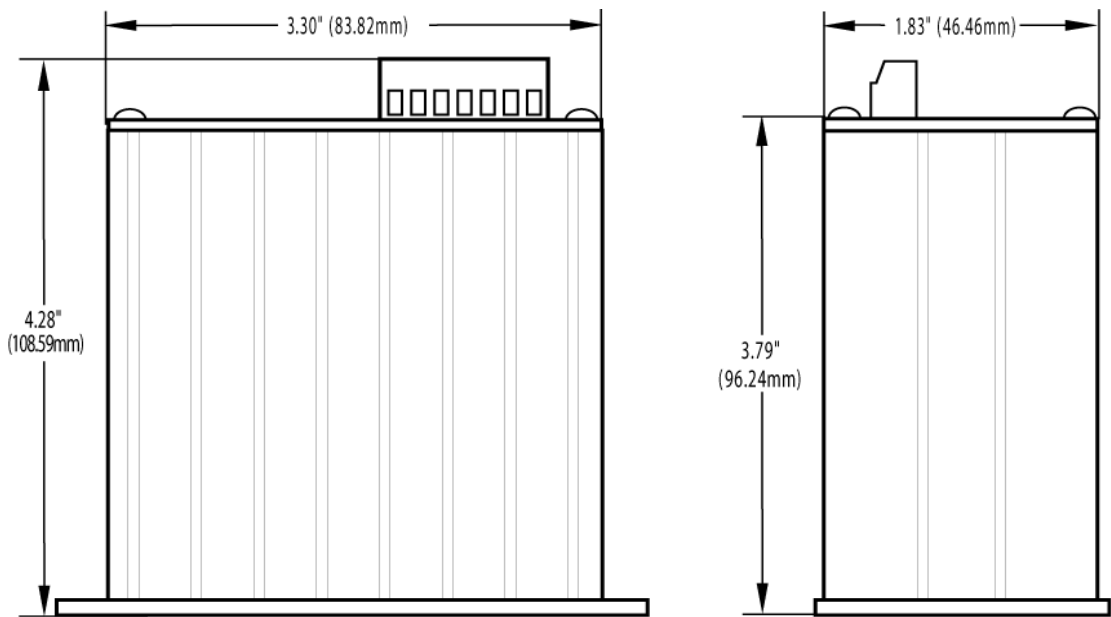OptoDataLink
Third-party software

Ethernet network

Serial

SNAP PAC SB brains and I/O

DIMENSIONAL DRAWING

Dimensions—SNAP PAC Ethernet Brains (Obsolete)

Dimensions—SNAP PAC Serial Brains (Obsolete)

These products are obsolete.

OPTO 22 • www.opto22.com
43044 Business Park Dr. Temecula, CA 92590-3614

SALES • sales@opto22.com
800-321-6786 • 1-951-695-3000

SUPPORT • support@opto22.com
800-835-6786 • 1-951-695-3080

MADE IN THE
USA

More about Opto 22

OPTO 22

PRODUCTS

Opto 22 develops and manufactures reliable, easy-to-use, open standards-based hardware and software products. Industrial automation, process control, remote monitoring, data acquisition, and industrial internet of things (IIoT) applications worldwide all rely on Opto 22.

groov RIO®

groov RIO edge I/O offers a single, compact, PoE-powered industrial package with web-based configuration and IIoT software built in, support for multiple OT and IT protocols, and security features like a device firewall, data encryption, and user account control.

Standing alone, *groov* RIO connects to sensors, equipment, and legacy systems, collecting and securely publishing data from field to cloud. Choose a universal I/O model with thousands of possible field I/O configurations, with or without Ignition from Inductive Automation®, or a RIO EMU energy monitoring unit that reports 64 energy data values from 3-phase loads up to 600 VAC, Delta or Wye.

You can even write an IEC 61131-3 compliant control program to run on *groov* RIO, using CODESYS. You can also use *groov* RIO with a Modbus/TCP master or as remote I/O for a *groov* EPIC system.

groov EPIC® System

Opto 22's *groov* Edge Programmable Industrial Controller (EPIC) system gives you industrially hardened control with a flexible Linux®-based processor with gateway functions, guaranteed-for-life I/O, and software for your automation and IIoT applications.

groov EPIC Processor

The heart of the system is the *groov* EPIC processor. It handles a wide range of digital, analog, and serial functions for data collection, remote monitoring, process control, and discrete and hybrid manufacturing.

In addition, the EPIC provides secure data communications among physical assets, control systems, software applications, and online services, both on premises and in the cloud. No industrial PC needed.

Configuring and troubleshooting I/O and networking is easier with the EPIC's integrated high-resolution color touchscreen. Authorized users can manage the system locally on the touchscreen, on a monitor connected via the HDMI or USB ports, or on a PC or mobile device with a web browser.

groov EPIC I/O

groov I/O connects locally to sensors and equipment. Modules have a spring-clamp terminal strip, integrated wireway, swing-away cover, and LEDs indicating module health and discrete channel status. *groov* I/O is hot swappable, UL Hazardous Locations approved, and ATEX compliant.

groov EPIC Software

The *groov* EPIC processor comes ready to run the software you need:

- Programming: Choose flowchart-based PAC Control, CODESYS Development System for IEC61131-3 compliant programs, or secure shell access (SSH) to the Linux OS for custom applications
- Node-RED for creating simple IIoT logic flows from pre-built nodes
- Efficient MQTT data communications with string or Sparkplug data formats
- Multiple OPC UA server options
- HMI: *groov* View to build your own HMI viewable on touchscreen, PCs, and mobile devices; PAC Display for a Windows HMI; Node-RED dashboard UI
- Ignition or Ignition Edge® from Inductive Automation (requires license purchase) with OPC-UA drivers to Allen-Bradley®, Siemens®, and other control systems, and MQTT communications

Older products

From solid state relays, to world-famous G4 and SNAP I/O, to SNAP PAC controllers, older Opto 22 products are still supported and working hard at thousands of installations worldwide. You can count on us for the reliability and service you expect, now and in the future.

QUALITY

Founded in 1974, Opto 22 has established a worldwide reputation for high-quality products. All are made in the U.S.A. at our manufacturing facility in Temecula, California.

Because we test each product twice before it leaves our factory rather than testing a sample of each batch, we can afford to guarantee most solid-state relays and optically isolated I/O modules for life.

FREE PRODUCT SUPPORT

Opto 22's California-based Product Support Group offers free technical support for Opto 22 products from engineers with decades of training and experience. Support is available in English and Spanish by phone or email, Monday–Friday, 7 a.m. to 5 p.m. PST.

Support is always available on our website, including free online training at OptoU, how-to videos, user's guides, the Opto 22 KnowledgeBase, and OptoForums.

PURCHASING OPTO 22 PRODUCTS

Opto 22 products are sold directly and through a worldwide network of distributors, partners, and system integrators. For more information, contact Opto 22 headquarters at **800-321-6786** (toll-free in the U.S. and Canada) or **+1-951-695-3000**, or visit our website at www.opto22.com.