

SNAP PAC SYSTEM SPECIFICATION GUIDE

Form 1696-111021—October 2011

OPTO 22

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SNAP PAC System Specification Guide
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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

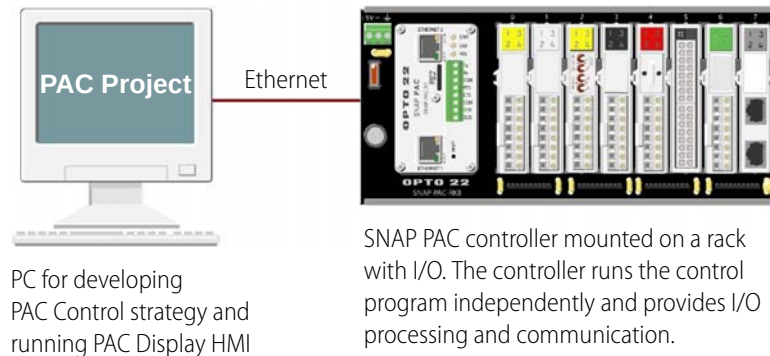
All components work together, no matter what the system's size. When your system needs to expand, investments in development time and field wiring remain largely intact; you simply add more brains and I/O. If new capabilities are required, additional software and controllers can also be added with minimal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



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.

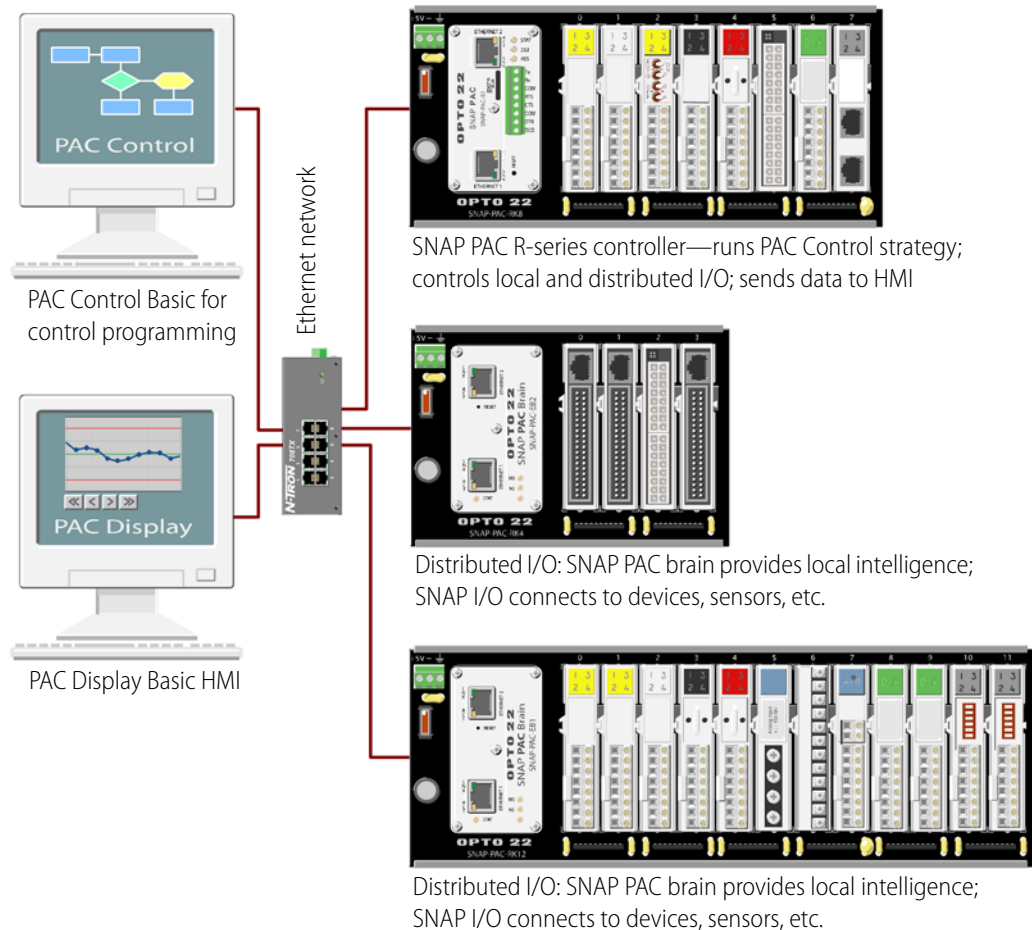
After you develop the strategy, you download it to the controller, where it runs independently from the PC to monitor and control the local I/O.

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 802.11 a,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 Redundant Controllers" on page 58.](#))

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.

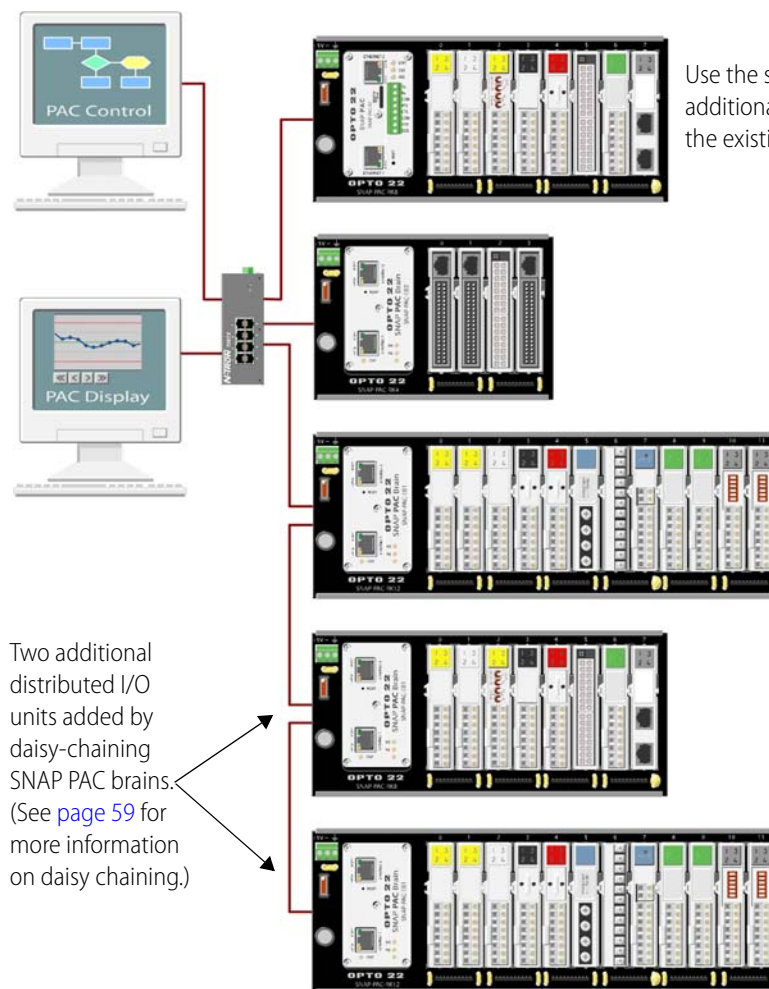
Adding More Distributed I/O

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 59](#).)

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.

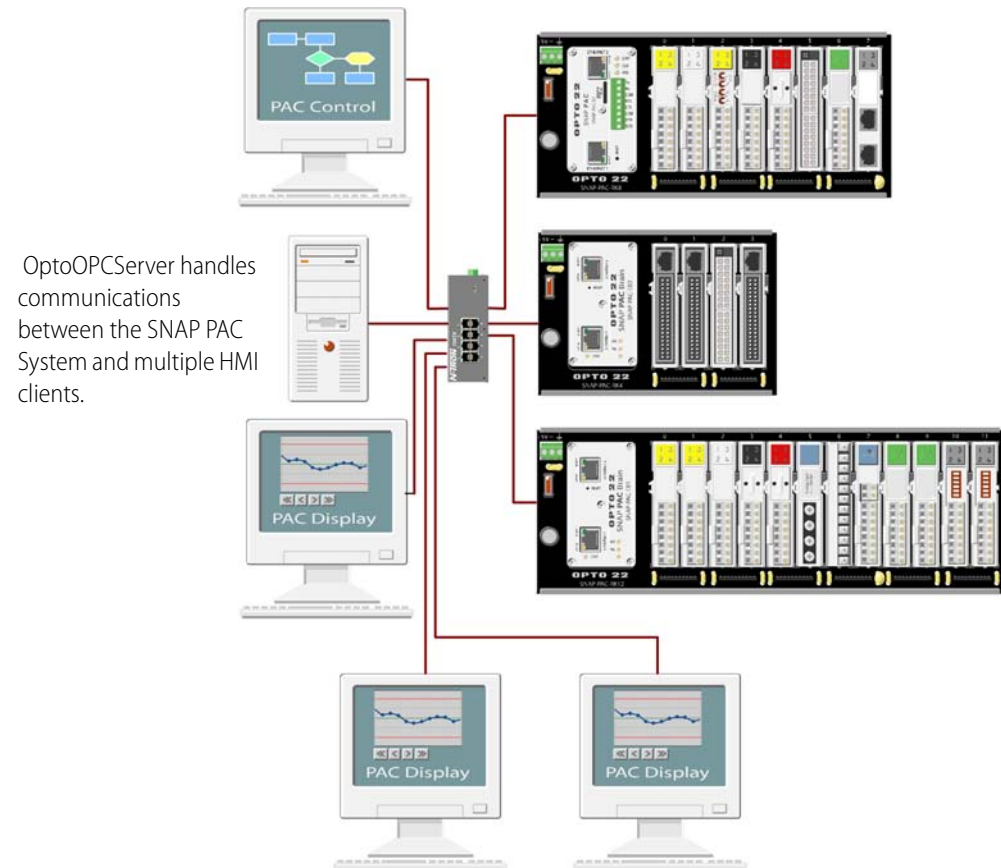
Adding More Distributed I/O



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

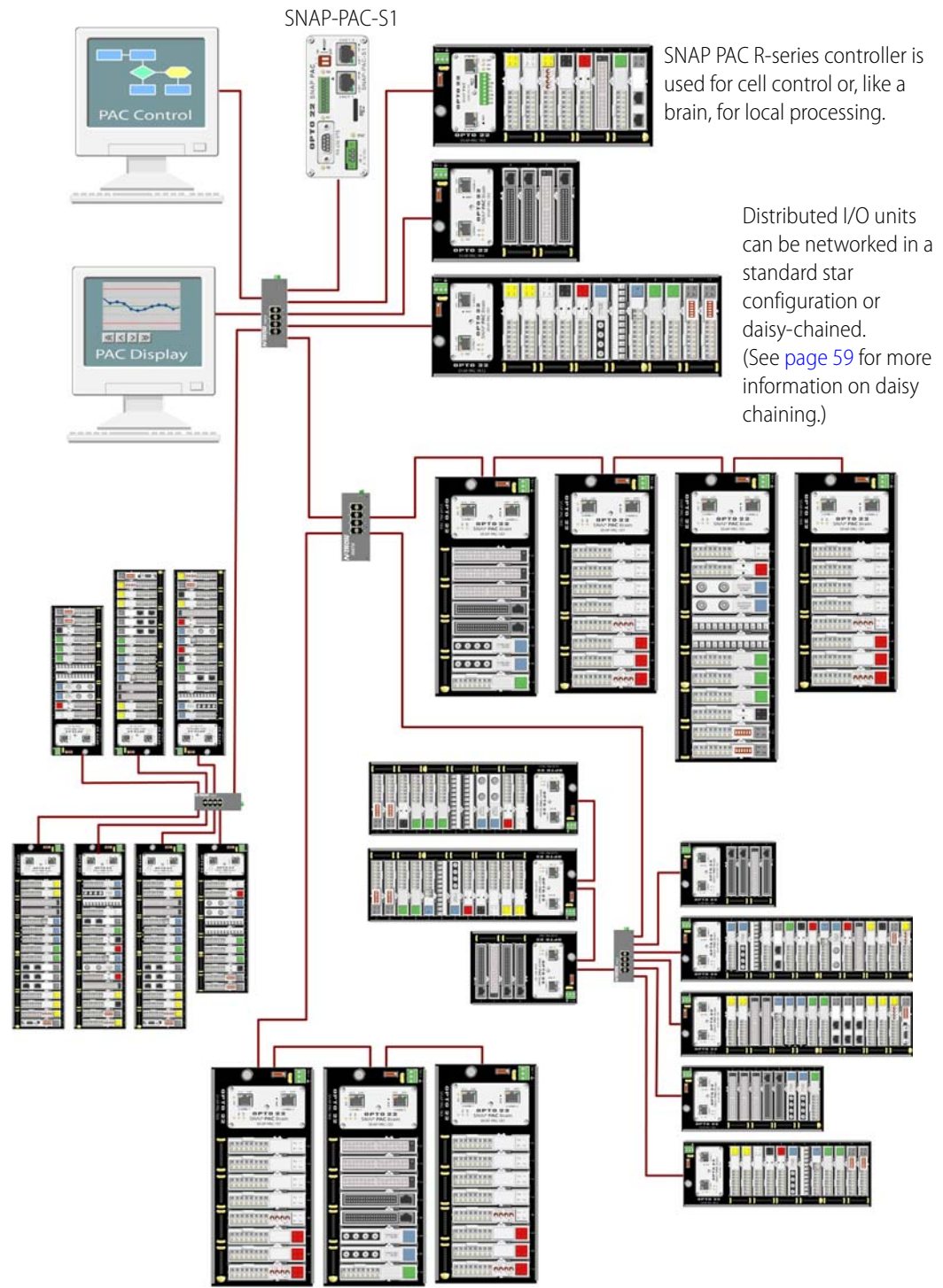
For very extensive distributed control systems, such as a traditional DCS, you'll want to move up from the rack-mounted R-series controller to a SNAP PAC standalone (S-series) controller. The S-series controller is more powerful and can run twice as many PAC Control flowcharts simultaneously.

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

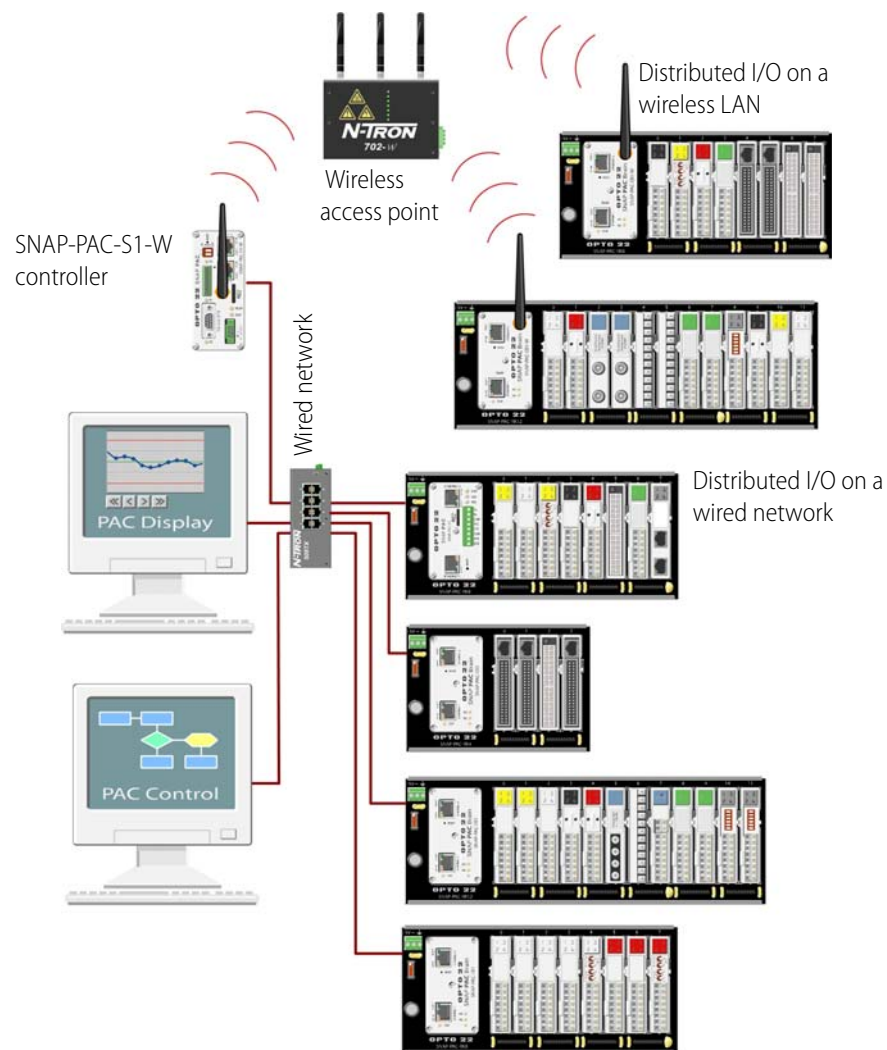
Suppose you need to control mobile machinery or monitor devices in an area where running Ethernet cable would be difficult. With Wired+Wireless controllers and brains, you can use a wireless local area network (LAN) to solve the problem.

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 any new I/O and add the logic to control it. For more information on using a wireless network, see [page 58](#).

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.



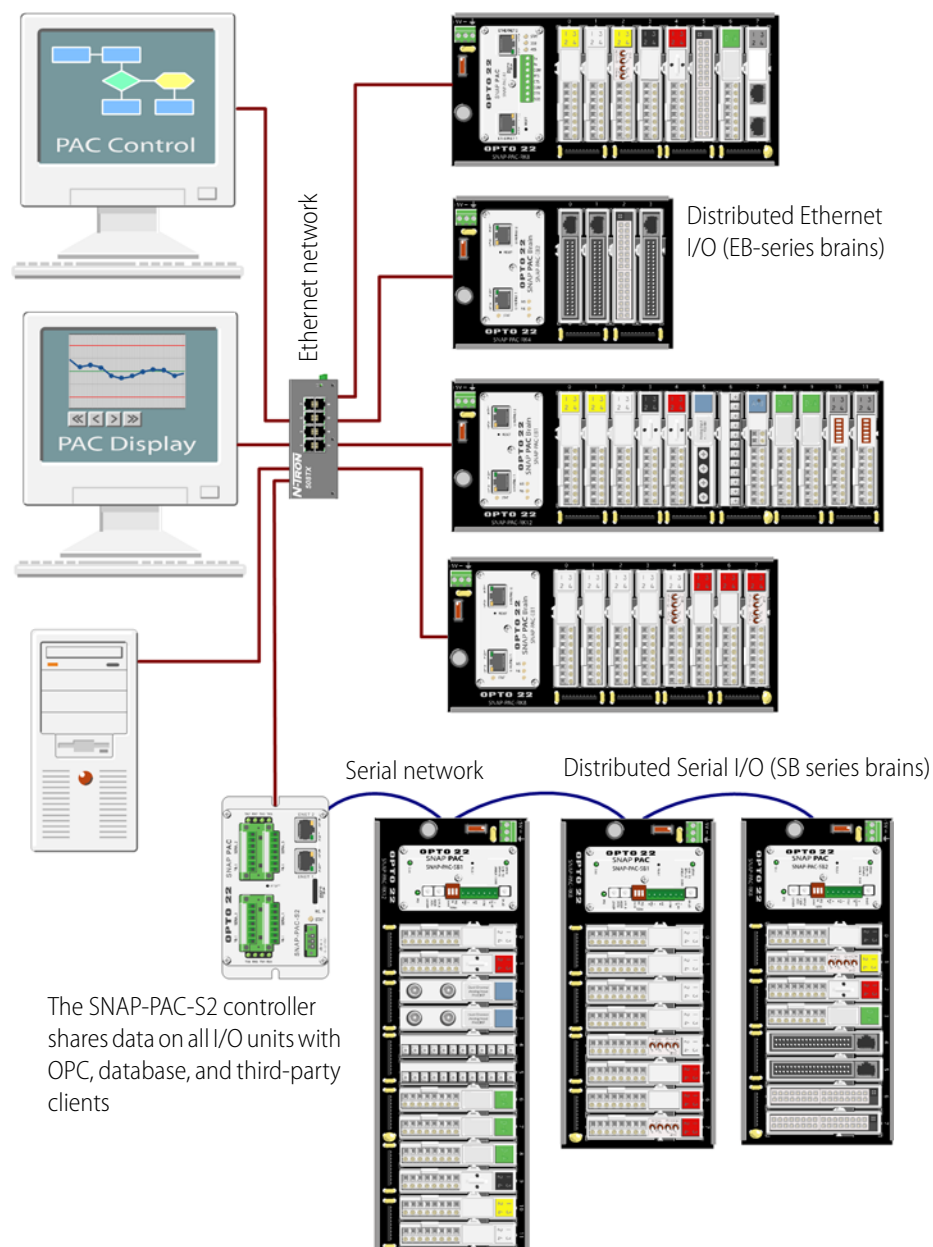
Combining Serial and Ethernet Distributed I/O

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.

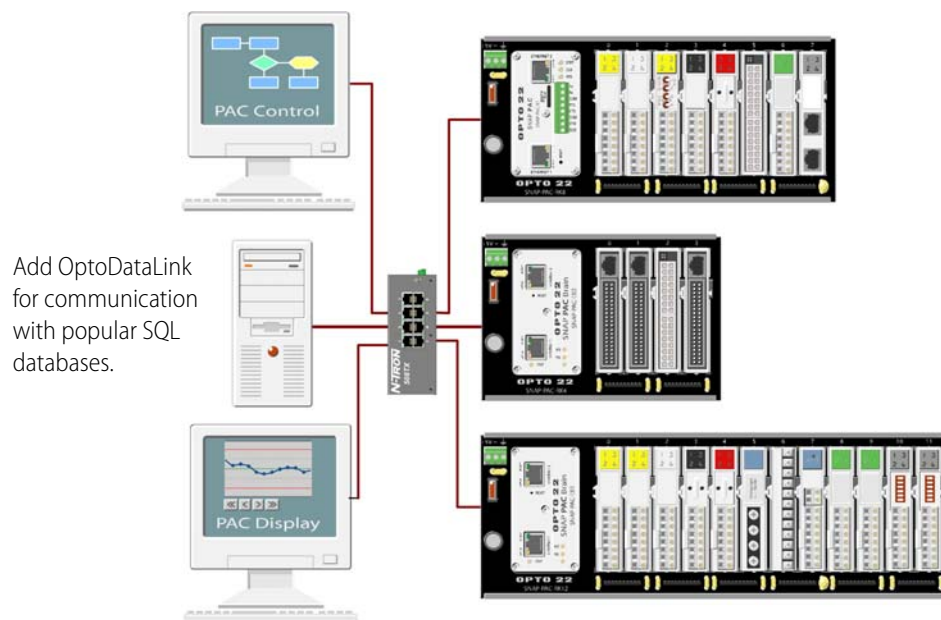


Delivering SNAP PAC System Data to Company Databases

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

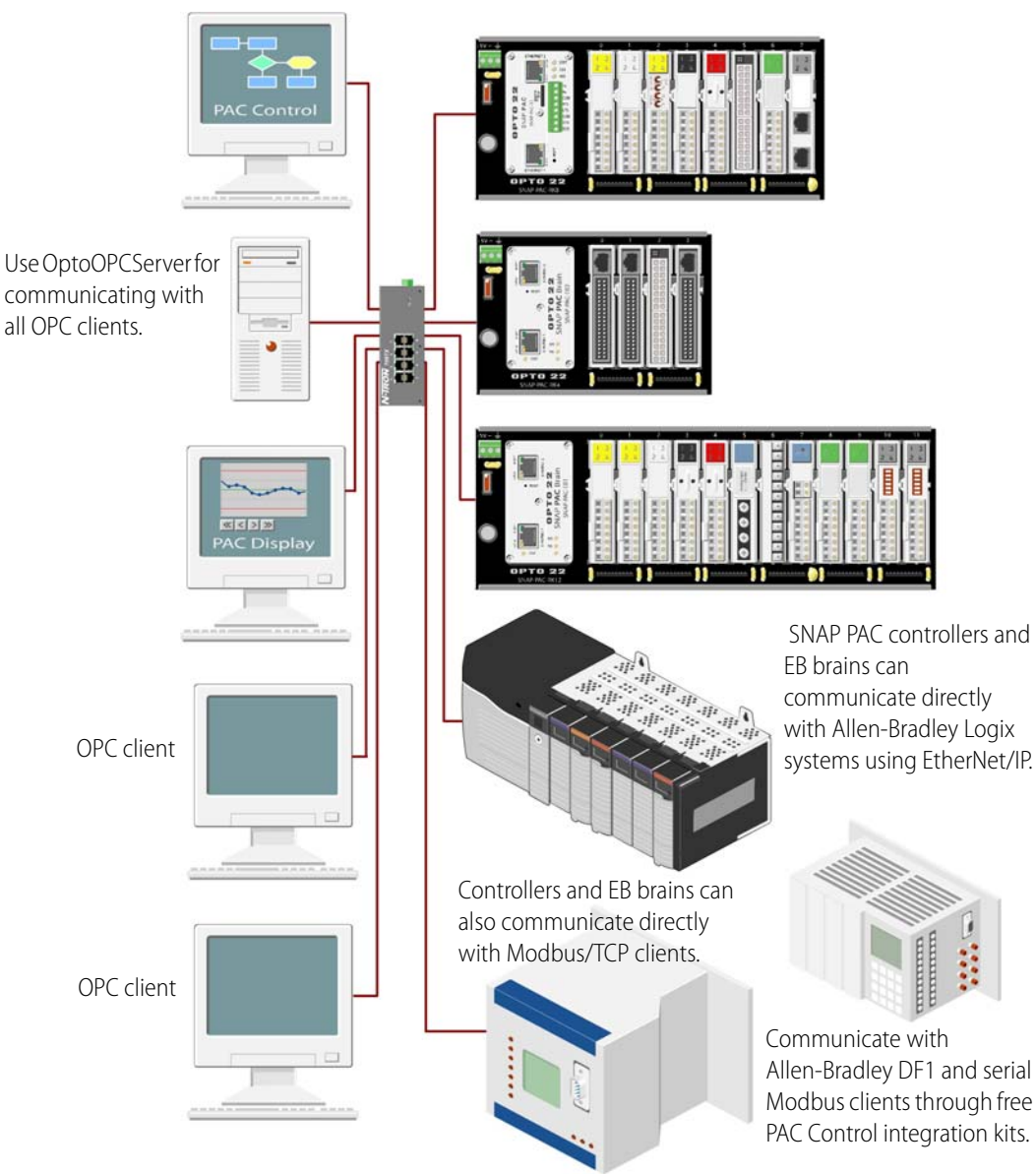
To communicate with **OPC 2.0**-compliant clients, purchase OptoOPCServer. With its efficient multi-threaded engine and report-by-exception method of communicating with clients, OptoOPCServer keeps network traffic on industrial automation and manufacturing networks to a minimum while exchanging data 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** PLC systems such as **CompactLogix**, **ControlLogix**, **MicroLogix 1100/1400**, and **SLC 5/05**, SNAP PAC controllers and brains can communicate directly using the built-in EtherNet/IP protocol. Details are in form #1909, the *IO4AB User's Guide*, and #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](#).

Using Redundant Controllers

Controller redundancy may be useful for critical processes, providing an increased level of reliability that can survive single points of failure and improve your system's mean time between failures (MTBF). In this setup, one controller actively runs the strategy while the other acts as a backup, ready to take over should the first one fail.

Using two identical SNAP PAC S-series controllers (not special controllers, but the standard models), PAC Project Professional 9.0 or newer, and the SNAP PAC Redundancy Option Kit, you can set up a system with redundant controllers. The Redundancy Option Kit (part number SNAP-PAC-ROK) includes a hardware arbiter and a redundant power switch, which work together to monitor controller status and switch controllers when required. PAC Project Pro includes the PAC Redundancy Manager, an easy-to-use utility for configuring and maintaining the system.

The control strategy you develop in PAC Control Professional is specifically designed for redundant controllers. Because you can tag specific data for redundancy and place checkpoint blocks at precise points in the logic where synchronization between the two controllers should occur, you have the programming flexibility necessary to balance redundant control and system performance.

For more information, see ["Ethernet Networking Options" on page 54](#).

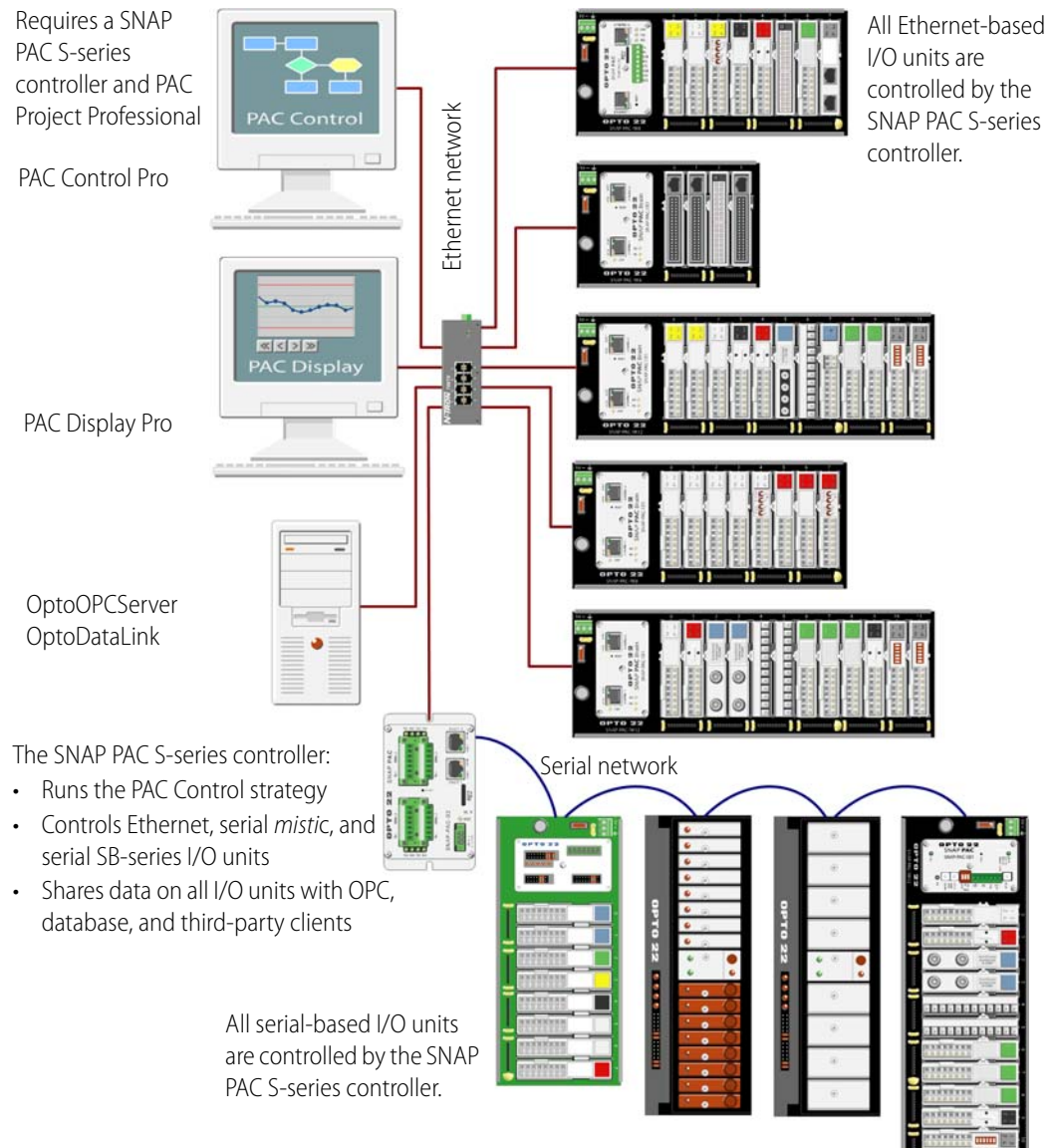
Incorporating Legacy Opto 22 Systems

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 14).

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
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 PAC Redundancy Option Kit	<i>SNAP PAC Redundancy Option Kit Data Sheet</i>	1901
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 mechanical power relay output modules	<i>SNAP Mechanical Power Relay Output Module Data Sheet</i>	1967

For these products	See this document	Form #
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 modules	<i>SNAP Power Monitoring Modules 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 Serial Synchronous Interface module	<i>SNAP SSI (Serial Synchronous Interface) Module Data Sheet</i>	1919
SNAP stepper motor module	<i>SNAP-SCM-ST2 Pulse Output Module Data Sheet</i>	1944
SNAP Controller Area Network (CAN) module	<i>SNAP-SCM-CAN2B Communication Module Data Sheet</i>	1537
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> <i>PAC Control Command Reference</i> <i>PAC Control Commands Quick Reference</i>	1700 1701 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 #
Set up redundant controllers	<i>SNAP PAC Redundancy Option User's Guide</i>	1831
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>IO4AB User's Guide</i> <i>EtherNet/IP for SNAP PAC Protocol Guide</i> <i>Allen-Bradley DF1 Integration Kit For PAC Control</i>	1909 1770 1706
Incorporate OptoEMU Sensor energy data into control systems and databases	<i>OptoEMU Sensor User's Guide</i> <i>OptoEMU Sensor Communication Guide</i>	1932 1958
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	<i>Understanding Programmable Automation Controllers (PACs) in Industrial Automation (white paper)</i>	1634
Using wireless products in automation applications	<i>Overcoming Concerns about Wireless PACs and I/O in Industrial Automation (white paper)</i>	1814
Energy monitoring and control	<i>Automation and the Smart Grid: Energy Management Today (white paper)</i>	1914
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 Project 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 Ed.</i>	1713
	<i>PAC Display User's Guide, Legacy Edition</i>	1712
	<i>PAC Manager User's Guide, Legacy Edition</i>	1714

For Help

For sales or service, give us a call or email us. We're happy to help. Pre-sales engineering and product support are both free.

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.

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 36](#)
- Wiring and mounting accessories for easier field wiring—[page 38](#)
- Network switches and wireless access points—[page 43](#)

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)
- Controller redundancy (with PAC Project Pro and option kit)



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

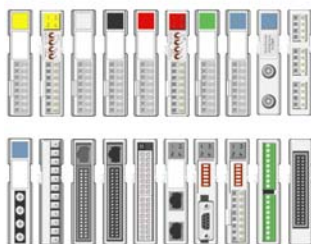
- Dual switched Ethernet interfaces
- Wired+Wireless models available
- Analog, digital, and serial I/O
- EB1 includes high-speed digital functions



Serial: SNAP-PAC-SB1 or SNAP-PAC-SB2

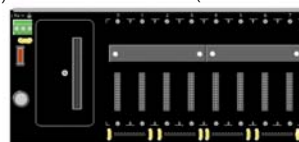
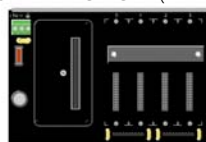
- Analog and digital I/O
- SB1 includes high-speed digital functions

Step 4: Choose I/O

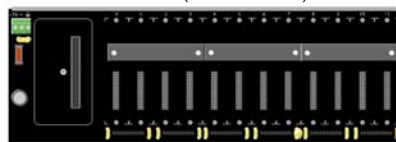


Choose from **all SNAP I/O modules**, a wide selection of analog, digital, and serial modules.

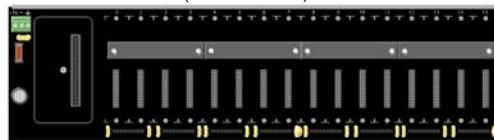
SNAP-PAC-RCK4 (4 modules) SNAP-PAC-RCK8 (8 modules)



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) 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 both Ethernet link redundancy and controller 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 in version 9.0 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	- PAC Control™ Basic - PAC Display™ Basic - PAC Manager™	- PAC Control Professional - PAC Display Professional - PAC Manager - OptoOPCServer™ - OptoDataLink™
Control software		
Name	PAC Control Basic	PAC Control Professional
Compatible controllers	- SNAP PAC S-series standalone industrial controllers - SNAP PAC R-series on-the-rack controllers	- SNAP PAC S-series standalone industrial controllers - SNAP PAC R-series on-the-rack controllers
Compatible brains	- Built-in I/O unit (in SNAP PAC R-series controllers) - SNAP PAC brains	- Built-in I/O unit (in SNAP PAC R-series controllers) - SNAP PAC brains - E1 and E2 - Serial <i>mistic</i>™ brains/bricks*: B3000-B, B3000, SNAP-BRS, B100, B200, G4D16R, G4D32RS, G4A8R
Network	<i>Controller to PC</i>: Wired Ethernet, wireless 802.11a,b,g (Wired+Wireless controller required), or PPP (dial-up modem required) <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. <i>Controller to third-party devices</i>: Ethernet or serial	<i>Controller to PC</i>: Wired Ethernet, wireless 802.11a,b,g (Wired+Wireless controller required), or PPP (dial-up modem required) <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. <i>Controller to third-party devices</i>: Ethernet or serial - Support for Ethernet link redundancy or segmented control network - Support for controller redundancy (S-series)
Main features	- Flowchart programming - OptoScript™ programming - Subroutines (debuggable) - Graphical debugger	- Flowchart programming - OptoScript programming - Subroutines (debuggable), with additional data types - Graphical debugger - Conversion utility for OptoControl strategies (version 4.1 and newer) - Support for serial <i>mistic</i> I/O units* - Ethernet link redundancy (with R-series I/O units) - Controller redundancy*
Maximum charts running at once	32 on SNAP PAC S-series (plus host task) 16 on SNAP PAC R-series (plus host task)	32 on SNAP PAC S-series (plus host task) 16 on SNAP PAC R-series (plus host task)
Proportional-integral-derivative (PID) loops	4 PID algorithms available 96 loops per SNAP PAC brain - Graphical tuner	4 PID algorithms for Ethernet 1 PID algorithm for <i>mistic</i> serial* 96 loops per SNAP PAC brain 8 loops per <i>mistic</i> brain/brick* - Graphical tuner for Ethernet and <i>mistic</i>* PID loops

Feature	PAC Project Basic	PAC Project Professional
Ethernet link redundancy	n/a	- Primary and secondary IP addresses for controllers and R-series I/O units - PAC Control commands can be used to control redundancy algorithm
Controller redundancy*	n/a	- PAC Redundancy Manager utility - Checkpoint blocks and redundant/persistent tags
Additional toolkits	- Allen-Bradley® DF1 Integration Kit - Modbus®/TCP Integration Kit - Modbus/Serial Integration Kit - OptoMMP™ Communication Toolkit	- Allen-Bradley DF1 Integration Kit - Modbus/TCP Integration Kit - Modbus/Serial Integration Kit - OptoMMP Communication Toolkit
HMI software		
Name	PAC Display Basic	PAC Display Professional
Main features	- Alarming - Trending - Operator authentication and login 3000-graphic library	- Alarming - Trending - Operator authentication and login 3000-graphic library - Conversion utility for OptoDisplay projects - Ethernet link redundancy - Scanner redundancy
Controllers supported	SNAP PAC controllers	- SNAP PAC controllers - Controllers running ioProject - Controllers running FactoryFloor on Ethernet network
Ethernet link redundancy	n/a	- Primary and secondary IP addresses for control engine - Primary and secondary scanner
OPC server		
Name	Not included; purchase separately. (OptoOPC-Server supports PAC Project Basic and is strongly recommended for multiple seats of PAC Display.)	OptoOPCServer
OPC version	n/a	OPC 2.0-compliant
Database connectivity		
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(s)

** 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 controller redundancy or network link redundancy (see [page 54](#)). 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 from date of manufacture.

All PAC controllers are also 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 58](#).

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 from date of manufacture.

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 59](#) 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 58](#) 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 9.1b firmware and 9.1 PAC Project software.

FEATURE	SNAP PAC Controllers								SNAP PAC Brains					
	Standalone				Rack-mounted				Ethernet				Serial	
	SNAP-PAC-S1 SNAP-PAC-S1-FM	SNAP-PAC-S2	SNAP-PAC-S1-W	SNAP-PAC-S2-W	SNAP-PAC-R1 SNAP-PAC-R1-FM	SNAP-PAC-R2 SNAP-PAC-R2-FM	SNAP-PAC-R1-W	SNAP-PAC-R2-W	SNAP-PAC-EB1 SNAP-PAC-EB1-FM	SNAP-PAC-EB2 SNAP-PAC-EB2-FM	SNAP-PAC-EB1-W	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 ^a	SNAP PAC EB brains	●	●	●	●	●	●	●						
	SNAP PAC SB brains	●	●	●	●									
	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)	●	●	●	●									
Controller-to-PC communication	Ethernet (TCP/IP, 10/100 Mbps)	●	●	●	●	●	●	●						
	Wireless LAN (802.11a, b, or g)			●	●		●	●						
	PPP over dial-up modem, with hardware handshaking	●	●	●	●	●	●	●						
Brain-to-host (PC or controller) communication	Ethernet (10/100 Mbps)	n/a				n/a				●	●	●	●	
	Wireless LAN (802.11a, b, or g)											●	●	
	Serial (RS-485)												●	●
Total number of RS-232 serial ports	2	4 ^b	2	4 ^b	1	1	1	1	-0-	-0-	-0-	-0-	-0-	-0-
Number of RS-232 serial ports usable for PPP (on dial-up modem)	1 ^c	1 ^c	1 ^c	1 ^c	1 ^c	1 ^c	1 ^c	1 ^c	-0-	-0-	-0-	-0-	-0-	-0-
Total number of RS-485 serial ports	1	4 ^b	1	4 ^b	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	1	1
EtherNet/IP™ (Allen-Bradley® RSLogix® systems and others)	●	●	●	●	●	●	●	●	●	●	●	●		
Modbus®/TCP (slave)	●	●	●	●	●	●	●	●	●	●	●	●		
OPC driver support	●	●	●	●	●	●	●	●	●	●	●	●	● ^d	● ^d
OptoMMP memory-mapped protocol	●	●	●	●	●	●	●	●	●	●	●	●	●	●
SNMP (network management) ^e	●	●	●	●	●	●	●	●	●	●	●	●		
FTP server, file system	●	●	●	●	●	●	●	●	●	●	●	●		
FTP client	●	●	●	●	●	●	●	●						
PPP (for use with dial-up modems)	●	●	●	●	●	●	●	●						
Email (SMTP client with authentication and attachments)	●	●	●	●	●	●	●	●	●	●	●	●		
Scratch Pad area for peer-to-peer data (bits, floats, 32-bit integers, 64-bit integers, and strings)	●	●	●	●	●	●	●	●	●	●	●	●	●	●

FEATURE		SNAP PAC Controllers								SNAP PAC Brains							
		Standalone				Rack-mounted				Ethernet				Serial			
		SNAP-PAC-S1 SNAP-PAC-S1-FM	SNAP-PAC-S2	SNAP-PAC-S1-W	SNAP-PAC-S2-W	SNAP-PAC-R1 SNAP-PAC-R1-FM	SNAP-PAC-R2 SNAP-PAC-R2-FM	SNAP-PAC-R1-W	SNAP-PAC-R2-W	SNAP-PAC-EB1 SNAP-PAC-EB1-FM	SNAP-PAC-EB2 SNAP-PAC-EB2-FM	SNAP-PAC-EB1-W	SNAP-PAC-EB2-W	SNAP-PAC-SB1	SNAP-PAC-SB2		
Security for wireless network (WPA2-AES, WPA-TKIP, WEP)				●	●			●	●			●	●				
Security for wired Ethernet network (IP filtering, port access)		●	●	●	●	●	●	●	●	●	●	●	●				
Realtime clock		●	●	●	●	●	●	●	●	●	●	●	●	●	●		
Backup battery (recharges when brain has power) ^f		●	●	●	●	●	●	●	●	●	●	●	●	●	●		
RAM		32 MB		128 MB		16 MB		32 MB		16 MB							
Battery-backed RAM		8 MB		8 MB		2 MB		2 MB		--							
Flash memory		16 MB		16 MB		8 MB		8 MB		8 MB							
32-bit processor		●	●	●	●	●	●	●	●	●	●	●	●	●	●		
Floating-point unit (FPU)		●	●	●	●	●	●	●	●								
Removable data storage (microSD card slot)		2 GB max.				2 GB max.											
Power requirements		8–32 VDC ^h 10 W–11.3 W max ^k				5.0 to 5.2 VDC @ 1.2–1.5 A ^k				5.0 to 5.2 VDC @ 750 mA–1.0 A ^k							
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, and 8 serial						● ^l	●	●	●	●	●	●	●	●	● ^m	● ^m	
Digital I/O point features	Input latching	n/a				●	●	●	●	●	●	●	●	●	●		
	On/off status					●	●	●	●	●	●	●	●	●	●		
	Watchdog timer					●	●	●	●	●	●	●	●	●	●		
	High-speed counting (up to 20 kHz) ⁿ					●		●		●		●		●			
	Quadrature counting ^o					●		●		●		●		●			
	On-pulse and off-pulse measure- ment ^{n,p}					●		●		●		●		●			
	Frequency & Period measurement ^{n,p}					●		●		●		●		●			
	TPO (time-proportional output) ^p					●	●	●	●	●	●	●	●	●	●	●	
	Digital totalizing ^{n,p}					●	●	●	●	●	●	●	●	●	●	●	●
	Pulse generation (continuous square wave, N pulses, on-pulse, off-pulse) ^p					●	●	●	●	●	●	●	●	●	●	●	●

FEATURE		SNAP PAC Controllers						SNAP PAC Brains						
		Standalone				Rack-mounted		Ethernet				Serial		
		SNAP-PAC-S1 SNAP-PAC-S1-FM	SNAP-PAC-S2	SNAP-PAC-S1-W	SNAP-PAC-S2-W	SNAP-PAC-R1 SNAP-PAC-R1-FM	SNAP-PAC-R2 SNAP-PAC-R2-FM	SNAP-PAC-R1-W	SNAP-PAC-R2-W	SNAP-PAC-EB1 SNAP-PAC-EB1-FM	SNAP-PAC-EB2 SNAP-PAC-EB2-FM	SNAP-PAC-EB1-W	SNAP-PAC-EB2-W	SNAP-PAC-SB1
Analog I/O point features	Thermocouple linearization (32-bit floating point for linearized values)	n/a	●	●	●	●	●	●	●	●	●	●	●	●
	Minimum/maximum values		●	●	●	●	●	●	●	●	●	●	●	●
	Offset and gain		●	●	●	●	●	●	●	●	●	●	●	●
	Scaling		●	●	●	●	●	●	●	●	●	●	●	●
	TPO (Time-proportional output) ^q		●	●	●	●	●	●	●	●	●	●	●	●
	Output clamping		●	●	●	●	●	●	●	●	●	●	●	●
	Filter weight		●	●	●	●	●	●	●	●	●	●	●	●
	Watchdog timer		●	●	●	●	●	●	●	●	●	●	●	●
	Analog totalizing ^p		●	●	●	●	●	●	●	●	●	●	●	●
	Ramping ^p		●	●	●	●	●	●	●	●	●	●	●	●
PID logic (maximum 96 PID loops per controller or brain)		n/a	●	●	●	●	●	●	●	●	●	●	●	●
Data logging			●	●	●	●	●	●	●	●	●	●	●	●
Digital events, alarm events, serial events			●	●	●	●	●	●	●	●	●	●	● ^r	● ^r
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 and S1s with serial numbers 625653 and lower have user-replaceable backup batteries. See original user guide.

h 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.

k Higher requirement applies to -W models.

l SNAP-PAC-R1s with serial numbers lower than 600,000 are limited to eight 4-channel digital modules per rack.

m Does not support serial, motion control, Profibus, or Wiegand modules.

n Four-channel modules only; not on high-density modules.

o Requires a SNAP-IDC5Q quadrature input module.

p Available when used with PAC Control and a SNAP PAC controller.

q Requires a SNAP analog TPO module (SNAP-AOD-29).

r 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 [Appendix A \(page 119\)](#).

Mounting rack information is on [page 35](#).

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 ¹		Part number	LEDs	Approvals					Warranty ³	Notes	Specs
Type	Range		Optical	Ch-ch			UL	CE	FM	CSA	RoHS ²			
Voltage	-10 to -32 VDC	32	●	5	SNAP-IDC-32N ⁴	6		●			C9	L	Positive common High density	125
	-2.5 to -12 VDC	32	●	5	SNAP-IDC-32DN ⁴	6		●			C9	L	Positive common High density	125
	2.5–16 VDC	4	●	●	SNAP-IDC5FAST	●	●	●	●	●	C9	L	High speed	123
	2.5–28 VDC	4	●	●	SNAP-IDC5D	●	●	●		●	C9	L		122
	2.5–28 VDC	4	●	●	SNAP-IDC5DFM	●		●	●		C9	L		121
	10–32 VDC	32	●	5	SNAP-IDC-32 ⁴	6	●	●			C9	L	High density	125
	10–32 VDC	32	●	5	SNAP-IDC-32-FM ⁴	6		●	●		C9	L	High density	125
	10–32 VDC/VAC	16	●	●	SNAP-IDC-16 ⁴		●	●			C9	L	High density	126
	10–32 VDC	4	●	●	SNAP-IDC5	●	●	●		●	C9	L		122
	10–32 VDC	4	●	●	SNAP-IDC5FM	●		●	●		C9	L		121
	10–32 VDC	4	●	●	SNAP-IDC5MA	●		●			C9	30	Diagnostic switches	123
	15–28 VDC/VAC	16	●	●	SNAP-IDC-HT-16 ⁴			●			C9	L	Leakage tolerant High density	126
	15–32 VDC	4	●	●	SNAP-IDC5-HT	●		●			C9	L	Leakage tolerant	122
	18–32 VDC	4	●	●	SNAP-IDC5-FAST-A	●	●	●		●	C9	L	High speed	123
	35–75 VDC/VAC	4	●	●	SNAP-IDC5G	●	●	●			C9	L	Telecom applications	122
	70–130 VAC/VDC	16	●	●	SNAP-IAC-K-16 ⁴			●			C9	L	High density	126
	90–140 VAC/VDC	16	●	●	SNAP-IAC-16 ⁴		●	●			C9	L	High density	126
	90–140 VAC/VDC	4	●	●	SNAP-IAC5	●	●	●		●	C9	L		120
	90–140 VAC/VDC	4	●	●	SNAP-IAC5FM	●		●	●		C9	L		121
	90–140 VAC/VDC	4	●	●	SNAP-IAC5MA	●	●	●			C9	30	Diagnostic switches	120
	180–280 VAC/VDC	16	●	●	SNAP-IAC-A-16 ⁴		●	●			C9	L	High density	126
	180–280 VAC/VDC	4	●	●	SNAP-IAC5A	●	●	●		●	C9	L		120
	180–280 VAC/VDC	4	●	●	SNAP-IAC5AFM	●		●	●		C9	L		121
Dry Contact	Normally open	4	●		SNAP-IDC5-SW	●	●	●	●		C9	L	Self wetting	124
	Normally closed	4	●		SNAP-IDC5-SW-NC	●	●	●			C9	L	Self wetting	124
Quadrature	4–24 VDC	2	●	●	SNAP-IDC5Q	●		●	●		C9	L	Quadrature input (two axes)	124

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 from date of manufacture

⁴ For wiring options, see [page 41](#).

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 ¹		Part number	LEDs	Approvals					Warranty ³	Notes	Specs
Type	Range		Optical	Ch-ch			UL	CE	FM	CSA	RoHS ²			
Voltage (AC)	12–250 VAC	4	●		SNAP-OAC5	●	●	●		●	C9	L		127
	12–250 VAC	4	●		SNAP-OAC5FM	●		●	●		C9	L		128
	12–250 VAC	4	●	●	SNAP-OAC5-i	●	●	●			C9	L		127
	12–250 VAC	4	●	●	SNAP-OAC5-iFM	●		●	●		C9	L		128
	12–250 VAC	4	●	●	SNAP-OAC5MA	●	●	●			C9	30	Diagnostic switches	127
Voltage (DC)	5–60 VDC	32	●	4	SNAP-ODC-32-SNK ⁵	6	●	●			C9	L	High density	134
	5–60 VDC	32	●	4	SNAP-ODC-32-SRC ⁵	6	●	●			C9	L	High density	134
	5–60 VDC	32	●	4	SNAP-ODC-32-SNK-FM ⁵	6		●	●		C9	L	High density	134
	5–60 VDC	32	●	4	SNAP-ODC-32-SRC-FM ⁵	6		●	●		C9	L	High density	134
	5–60 VDC	4	●	●	SNAP-ODC5-i	●	●	●			C9	L		133
	5–60 VDC	4	●	●	SNAP-ODC5-iFM	●		●	●		C9	L		132
	5–60 VDC	4	●	●	SNAP-ODC5MA	●	●	●			C9	30	Diagnostic switches	133
	5–60 VDC	4	●		SNAP-ODC5SNK	●	●	●		●	C9	L		130
	5–60 VDC	4	●		SNAP-ODC5SNKFM	●		●	●		C9	L		131
	5–60 VDC	4	●		SNAP-ODC5SRC	●	●	●		●	C9	L		130
	5–60 VDC	4	●		SNAP-ODC5SRCFM	●		●	●		C9	L		131
	5–200 VDC	4	●	●	SNAP-ODC5A-i	●	●	●			C9	L		133
	5–200 VDC	4	●	●	SNAP-ODC5A-iFM	●		●	●		C9	L		132
	5–200 VDC	4	●		SNAP-ODC5ASNK	●	●	●			C9	L		133
Mechanical Relay	6 A @ 250 VAC or 30 VDC	4			SNAP-OMR6-C	●		●			C9	30	SPDT (Form C)	135
		4			SNAP-OMR6-A	●		●			C9	30	SPST (Form A)	135
Dry Contact	Normally open	4		●	SNAP-ODC5R	●		●		●	C9	30	Reed relay, ≤10 VA	130
	Normally open	4		●	SNAP-ODC5RFM	●		●	●		C9	30	Reed relay, ≤10 VA	131
	Normally closed	4		●	SNAP-ODC5R5	●		●			C9	30	Reed relay, ≤10 VA	130
	Normally closed	4		●	SNAP-ODC5R5FM	●		●	●		C9	30	Reed relay, ≤10 VA	131

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 from date of manufacture

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 41.

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 34. Detailed specifications are shown on the page in the *Specs* column.

Input signal		Points	Isolation ¹			Part number	Approvals					Warranty ³	Notes	Specs
Type	Range		Optical	Ch-ch	Transformer		UL	CE	FM	CSA	RoHS ²			
Current	-20 to +20 mA	32	●		●	SNAP-AIMA-32 ⁴	●	●				L		140
	-20 to +20 mA	32	●		●	SNAP-AIMA-32-FM ⁴		●	●			L		140
	-20 to +20 mA	8	●		●	SNAP-AIMA-8		●				L		139
	-20 to +20 mA	4	●		●	SNAP-AIMA-4	●	●	●		C9	L		139
	-20 to +20 mA	2	●		●	SNAP-AIMA	●	●	●		C9	L		139
	-20 to +20 mA	2	●	●	●	SNAP-AIMA-i	●	●	●		C9	L		141
	-20 to +20 mA	2	●	●	●	SNAP-AIMA-iSRC		●			C9	L	Isolated loop excitation	141
	-20 to +20 mA	2	●	●	●	SNAP-AIMA-iSRC-FM		●	●		C9	L	Isolated loop excitation	141
	-1 to +1 mA	2	●	●	●	SNAP-AIMA2-i		●			C9	L		140
Voltage (mV)	2 or 3 mV/V	2	●		●	SNAP-AILC		●			C9	L	Load cell devices	137
	3 or 4 mV/V	2	●		●	SNAP-AILC-2		●				L	Load cell devices	137
	-50 to +50 mV or -25 to +25 mV	4	●		●	SNAP-AIMV2-4	●	●	●		C9	L		143
	-50 to +50 mV or -25 to +25 mV (or thermocouple)	2	●		●	SNAP-AITM-2		●	●		C9	L		146
		2	●	●	●	SNAP-AITM2-i	●	●	●		C9	L		146
	+/-75, +/-50, or +/-25 mV (or thermocouple)	8	●		●	SNAP-AITM-8	●	●			C9	L		148
		8	●		●	SNAP-AITM-8-FM		●	●		C9	L		148
	-150 to +150 mV or -75 to +75 mV	4	●		●	SNAP-AIMV-4	●	●	●		C9	L		142
	-150 to +150 mV or -75 to +75 mV (or thermocouple)	2	●		●	SNAP-AITM		●	●		C9	L		145
		2	●	●	●	SNAP-AITM-i	●	●	●		C9	L		145
Voltage (V)	-10 to +10 VDC or -5 to +5 VDC	32	●		●	SNAP-AIV-32 ⁴	●	●				L		150
	-10 to +10 VDC or -5 to +5 VDC	32	●		●	SNAP-AIV-32-FM ⁴		●	●			L		150
	-10 to +10 VDC or -5 to +5 VDC	8	●		●	SNAP-AIV-8		●				L		150

Input signal		Points	Isolation ¹			Part number	Approvals					Warranty ³	Notes	Specs
Type	Range		Optical	Ch-ch	Transformer		UL	CE	FM	CSA	RoHS ²			
Voltage (V)	-10 to +10 VDC or -5 to +5 VDC	4	●		●	SNAP-AIV-4	●	●	●		C9	L		149
	-10 to +10 VDC or -5 to +5 VDC	2	●		●	SNAP-AIV	●	●	●		C9	L		149
	-10 to +10 VDC or -5 to +5 VDC	2	●	●	●	SNAP-AIV-i	●	●	●		C9	L		148
	-100 to +100 VDC	2	●	●	●	SNAP-AIV2-i		●			C9	L		149
pH/ORP	-1 to +1 V or -0.5 to +0.5 V	2	●	●	●	SNAP-pH/ORP		●				L	pH or ORP probes	155
RMS	0–10 A RMS	2	●		●	SNAP-AIARMS	●	●	●		C9	L		136
	0–10 A RMS	2	●	●	●	SNAP-AIARMS-i		●			C9	L		137
	0–10 A RMS	2	●	●	●	SNAP-AIARMS-i-FM		●	●		C9	L		137
	0–250 V RMS	2	●		●	SNAP-AIVRMS	●	●	●		C9	L		151
	0–250 V RMS	2	●	●	●	SNAP-AIVRMS-i		●			C9	L		151
	0–250 V RMS	2	●	●	●	SNAP-AIVRMS-i-FM		●	●		C9	L		151
Rate	0–25,000 Hz	2	●		●	SNAP-AIRATE	●	●	●		C9	L		143
Temperature	ICTD	8	●		●	SNAP-AICTD-8		●			C9	L		138
	ICTD	4	●		●	SNAP-AICTD-4	●	●	●		C9	L		138
	ICTD	2	●		●	SNAP-AICTD	●	●	●		C9	L		138
	100-Ohm Platinum RTD	2	●		●	SNAP-AIRTD	●	●	●		C9	L		144
	10-Ohm Copper RTD	2	●		●	SNAP-AIRTD-10		●			C9	L		144
	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		146
		2	●	●	●	SNAP-AITM2-i	●	●	●		C9	L		146
	Thermocouple type B,C,D,E,G,J,K,N,R,S, T (or +/-75, +/-50, or +/-25 mV)	8	●		●	SNAP-AITM-8		●			C9	L		148
		8	●		●	SNAP-AITM-8-FM		●	●		C9	L		148
	Thermocouple type E,J,K (or -150 to +150 mV or -75 to +75 mV)	2	●		●	SNAP-AITM		●	●		C9	L		145
		2	●	●	●	SNAP-AITM-i	●	●	●		C9	L		145
	Thermocouple type B,C,D,E,G,J,K,N,R,S, T (or +/-150, +/-75, +/-50, or +/-25 mV)	4	●	●	●	SNAP-AITM-4i		●			C9	L		147

Input signal		Points	Isolation ¹			Part number	Approvals					Warranty ³	Notes	Specs
Type	Range		Optical	Ch-ch	Transformer		UL	CE	FM	CSA	RoHS ²			
Resistance	40, 20, 10, or 5 K ohms	4	●		●	SNAP-AIR40K-4	●	●	●		C9	L	Thermistor input	142
Voltage	Dual-range voltage	1	●		●	SNAP-AIV-72		●			C9	L	Aluminum industry	
Current/ voltage	85–250 VAC RMS 0–10 AC amps RMS	4 ⁵	●		●	SNAP-AIPM		●			C9	L	Single-phase power monitoring	152
	85–300 VAC RMS 0–5 AC amps RMS	14 ⁵	●		●	SNAP-AIPM-3		●			C9	L	Three-phase power monitoring	153
	85–300 VAC RMS 0–0.333 VAC (from CTs)	14 ⁵	●		●	SNAP-AIPM-3V		●			C9	L	Three-phase power monitoring	153

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 from date of manufacture

4 For wiring options, see [page 41](#).

5 Two points of physical input (current and voltage) per phase, plus calculated data points (true power, 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 ¹			Part number	Approvals					Warranty ³	Notes	Specs
Type	Range		Optical	Ch-ch	Transformer		UL	CE	FM	CSA	RoHS ²			
Current	0–20 mA	2	●		●	SNAP-AOA-28	●	●	●		C9	L		158
	4–20 mA	2	●		●	SNAP-AOA-23	●	●	●		C9	L		156
	4–20 mA	2	●	●	●	SNAP-AOA-23-iSRC		●			C9	L	Isolated loop sourcing	157
	4–20 mA	2	●	●	●	SNAP-AOA-23-iSRC-FM		●	●		C9	L	Isolated loop sourcing	157
	4–20 mA	1	●		●	SNAP-AOA-3	●	●			C9	L		156
Voltage	-10 to +10 VDC	2	●		●	SNAP-AOV-27	●	●	●		C9	L		160
	0–10 VDC	2	●		●	SNAP-AOV-25	●	●	●		C9	L		160
	0–10 VDC	1	●		●	SNAP-AOV-5	●	●			C9	L		160
	5–60 VDC	2	●	●	●	SNAP-AOD-29	●	●	●		C9	L	Time-proportional output ⁴	159

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 from date of manufacture

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 ¹		Part number	LEDs	Approvals					Warranty ³	Notes	Specs
		Optical	Ch-ch			UL	CE	FM	CSA	RoHS ²			
RS-232	2	●	●	SNAP-SCM-232	●		●	●		C9	30	Optional RTS/CTS flow control	161
RS-485/422	2 ⁴	●	●	SNAP-SCM-485-422	●		●	●		C9	30	2-wire or 4-wire	161
RS-485/422	4	●		SNAP-SCM-MCH16	●		●			C9	30	Motion control interface	162
Profibus®	1	●	●	SNAP-SCM-PROFI	●		●			C9	30	Links to Profibus networks	162
Serial synchronous interface	2	●	●	SNAP-SCM-SSI			●			C9	30	For linear or rotary transducers used in motion control	163
Pulse & direction	2	●		SNAP-SCM-ST2	●		●			C9	30	For stepper motors	165
Controller Area Network (CAN)	1	●		SNAP-SCM-CAN2B			●	●		C9	30	Input only, no output	165
Wiegand®	2	●	●	SNAP-SCM-W2	●		●			C9	30	Wiegand protocol for security industry	166

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 from date of manufacture

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—analogue, 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.

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) ¹
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) except SNAP-AITM-4i		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, SNAP-AITM-4i analog input modules All analog output modules except SNAP-AOA-iSRC		0.150	
SNAP mechanical power relay output modules		0.160	
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, SNAP-AIPM-3V power monitoring modules		0.100	
SNAP-AILC and AILC-2 load cell modules		0.120	
SNAP-SCM-ST2 and SNAP-SCM-SSI serial modules		0.200	
SNAP-SCM-232, SNAP-SCM-485-422, SNAP-SCM-PROFI SNAP-SCM-MCH16 <i>not</i> powering a breakout board		0.250	
SNAP-SCM-MCH16 powering a breakout board		0.700	
Total			

¹ 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 39](#).

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 39](#).

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 42](#).

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 SNAP-TEX-MR10-16C
Digital input modules—4-channel			
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
Digital output modules—4-channel			
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
SNAP-OMR6-A SNAP-OMR6-C			

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 SNAP-TEX-MR10-16 C
Analog input modules (not thermocouples)			
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-AIRTD-10 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-AIPM-3V	SNAP-TEX-CBS6	Not used for analog modules	
SNAP-AILC SNAP-AILC-2 SNAP-pH/ORP SNAP-AIMA-iSRC SNAP-AIMA-iSRC-FM SNAP-AIPM-3* SNAP-AITM-j ** SNAP-AITM2-i ** SNAP-AITM ** SNAP-AITM-2 **	No cable available	Not used for analog modules	
Analog output modules			
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	

* Not recommended for use with breakout boards due to CT safety concerns.

** 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-TEX-MR10-16C	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-IDC-32DN	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 SNAP-HD-G4F6 (MR10-16C only)			

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-TEX-MR10-16C	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

For these SNAP products		Clips needed	Use this adapter clip	Use this end cap
Power Supplies				
SNAP-PS5 SNAP-PS24	SNAP-PS5-24DC	1 kit	SNAP-PSDIN	N/A
SNAP-PS5U	SNAP-PS24U	1 kit	SNAP-PSUDIN	N/A
Controllers				
SNAP-PAC-S1 SNAP-PAC-S1-W	SNAP-PAC-S1-FM	1 kit	SNAP-PSDIN	N/A
SNAP-PAC-S2	SNAP-PAC-S2-W	1 kit	SNAP-S2DIN	N/A
Mounting Racks				
SNAP-PAC-RCK4	SNAP-PAC-RCK4-FM	2 clips	SNAP-TEX-DRC10* (10 clips in package)	SNAP-TEX-REC10W* (10 in package; use 2 per rack)
SNAP-PAC-RCK8 SNAP-PAC-RCK8-FM	SNAP-PAC-RCK12 SNAP-PAC-RCK12-FM	3 clips		
SNAP-PAC-RCK16	SNAP-PAC-RCK16-FM	4 clips		
Breakout Boards				
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	2 clips	SNAP-TEX-DRC10* (10 clips in package)	SNAP-TEX-REC10N* (10 in package; use 2 per board)
SNAP-ODC-HDB SNAP-ODC-HDB-FM	SNAP-SCM-BB4 SNAP-TEX-MR10-16	3 clips		
Other SNAP Devices				
SNAP-PAC-SRA	SNAP-RPSW	1 kit	SNAP-ROKDIN	N/A

* Requires the black plastic extrusion that comes with new racks and boards. Older racks and boards have a light-colored plastic extrusion. The black plastic extrusion is not sold separately. It is included with a new board or rack.

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 Base TX 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

3: Networking Options

Introduction

You should already be familiar with TCP/IP and Ethernet networking before you set up your SNAP PAC System. If you're using Wired+Wireless controllers and brains, you should already be familiar with wireless networking; and if you are using serial I/O, you should know about serial networking. If you are not familiar with these subjects, we strongly suggest you consult some of the many commercially available resources to learn about them.

If your SNAP PAC System will be part of an existing Ethernet network or will communicate with an existing network, be sure to work closely with your system administrator before setting up the network or assigning IP addresses.

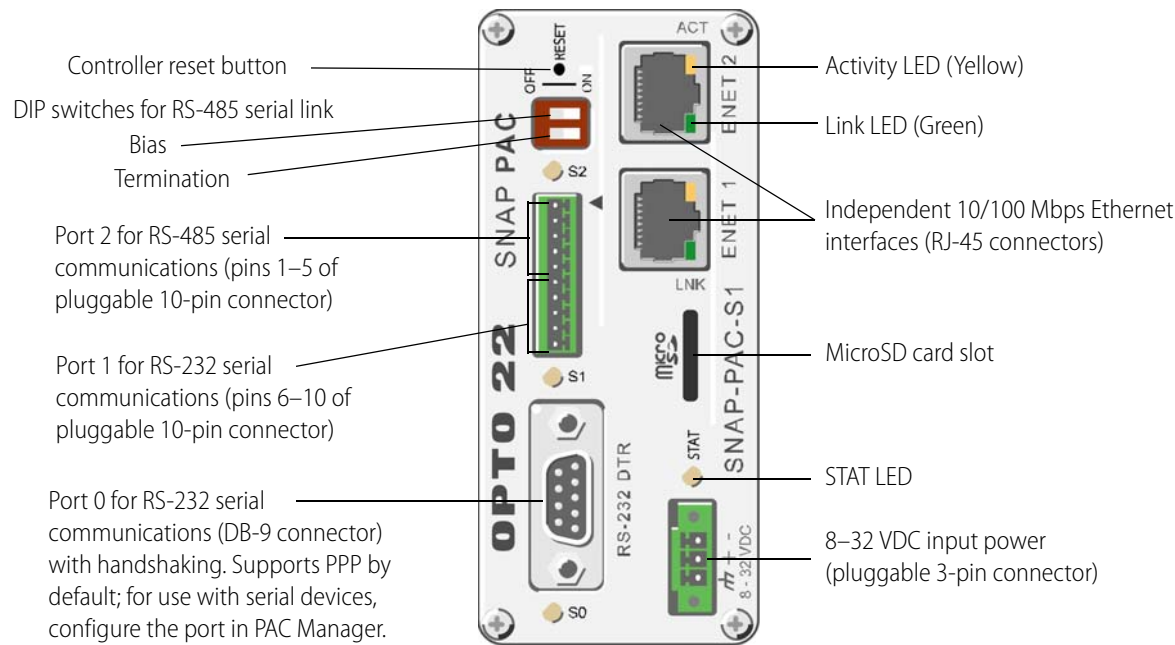
This chapter discusses some optional Ethernet and serial networking arrangements for the SNAP PAC System., including the following:

Network interfaces on SNAP PAC controllers and brains	See below
Using redundant Ethernet network links	See page 54
Segmenting Ethernet networks	See page 56
Using wireless networking	See page 57
Using redundant controllers	See page 58
Daisy-chaining distributed Ethernet I/O	See page 59
Communicating with Modbus/TCP® systems	See page 61
Communicating with Allen-Bradley® PLC systems	See page 62
Incorporating OptoEMU Sensor energy data	See page 63
Using distributed serial I/O	See page 64
Connecting directly to serial devices	See page 64
Communicating with Profibus systems	See page 64
Communicating with a remote host using a modem	See page 65
Communicating with legacy serial <i>mistic</i> I/O	See page 66

Network Interfaces on SNAP PAC Controllers and Brains

SNAP-PAC-S1 Controller—Network Interfaces and Ports

Also applies to SNAP-PAC-S1-FM. See [page 47](#) for the SNAP-PAC-S1-W.



Status and Activity LEDs

Indicator	Description
S0	RS-232 serial activity on port 0
S1	RS-232 serial activity on port 1
S2	RS-485 serial activity
STAT	Startup status and control program operational status
ACT	Ethernet network activity
LINK	Link established with Ethernet network

Port 0 for RS-232 serial (DB-9 connector)

Pin	Description	Signal Direction
1	DCD	In
2	RX	In
3	TX	Out
4	DTR	Out
5	COM	
6	DSR	In
7	RTS	Out
8	CTS	In
9	RI*	In

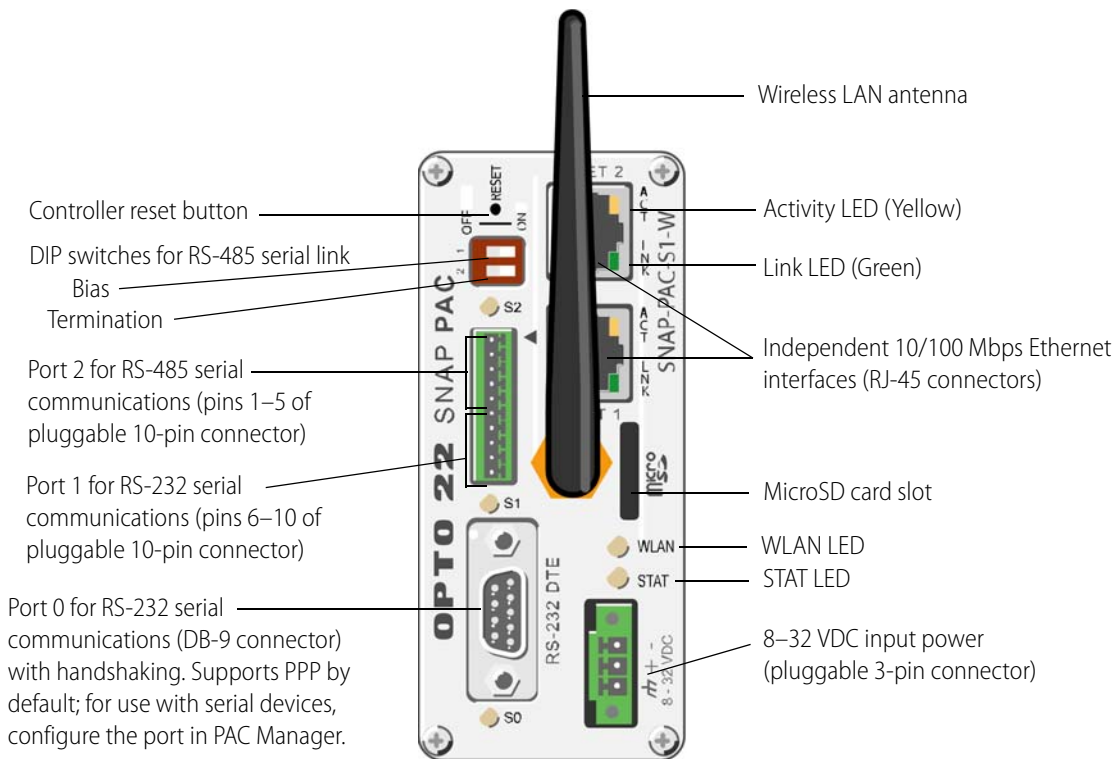
* RI signal does not occur on PACs with a microSD card slot

Ports 1 and 2 for RS-485 and RS-232 serial

	Pin	Description	Signal Direction
Port 2 for RS-485 serial (2-Wire)	1	TX/RX+	In/Out
	2	TX/RX–	In/Out
	3	SIG COM*	
	4	IRQ+	In
	5	IRQ–	In
Port 1 for RS-232 serial	6	TX	Out
	7	RX	In
	8	GND	
	9	RTS	Out
	10	CTS	In

* Isolated ground

SNAP-PAC-S1-W Controller—Network Interfaces and Ports



Status and Activity LEDs

LED	Description
S0	RS-232 serial activity on port 0
S1	RS-232 serial activity on port 1
S2	RS-485 serial activity
STAT	Startup status and control program operational status
ACT	Ethernet network activity
LINK	Link established with Ethernet network
WLAN	Wireless LAN status

Port 0 for RS-232 serial (DB-9 connector)

Pin	Description	Signal Direction
1	DCD	In
2	RX	In
3	TX	Out
4	DTR	Out
5	COM	
6	DSR	In
7	RTS	Out
8	CTS	In
9	NC*	

* No connection

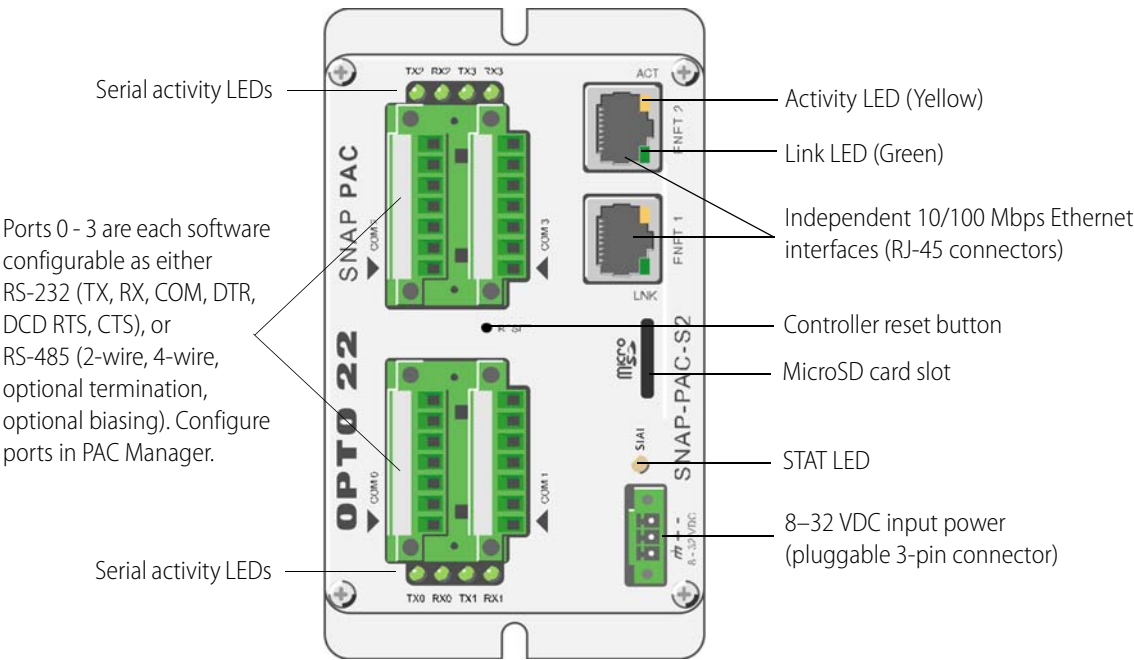
Ports 1 and 2 for RS-485 and RS-232 serial

	Pin	Description	Signal Direction
Port 2 for RS-485 serial (2-Wire)	1	TX/RX+	In/Out
	2	TX/RX–	In/Out
	3	SIG COM*	
	4	IRQ+	In
	5	IRQ–	In
Port 1 for RS-232 serial	6	TX	Out
	7	RX	In
	8	GND	
	9	RTS	Out
	10	CTS	In

* Isolated ground

SNAP-PAC-S2 Controller—Network Interfaces and Ports

See [page 49](#) for the SNAP-PAC-S2-W.



RS-485 and RS-232 Ports¹

Pin	RS-232	Signal Direction	RS-485	Signal Direction
1	TX	Out	TX/RX+	In/Out
2	RX	In	TX/RX-	In/Out
3	COM ²		COM ²	
4	RTS	Out	RX+ (4 wire)	In
5	CTS	In	RX- (4 wire)	In
6	DTR	Out	IRQ+	In
7	DCD	In	IRQ-	In

¹ **CAUTION: Do not use communication port connectors from a legacy OptoControl controller*.** Legacy connectors will fit in a SNAP-PAC-S2, but the pin orientation is different. Instead, use the connectors supplied with the SNAP-PAC-S2 controller.

² Isolated ground. (Each channel is isolated from the others.)

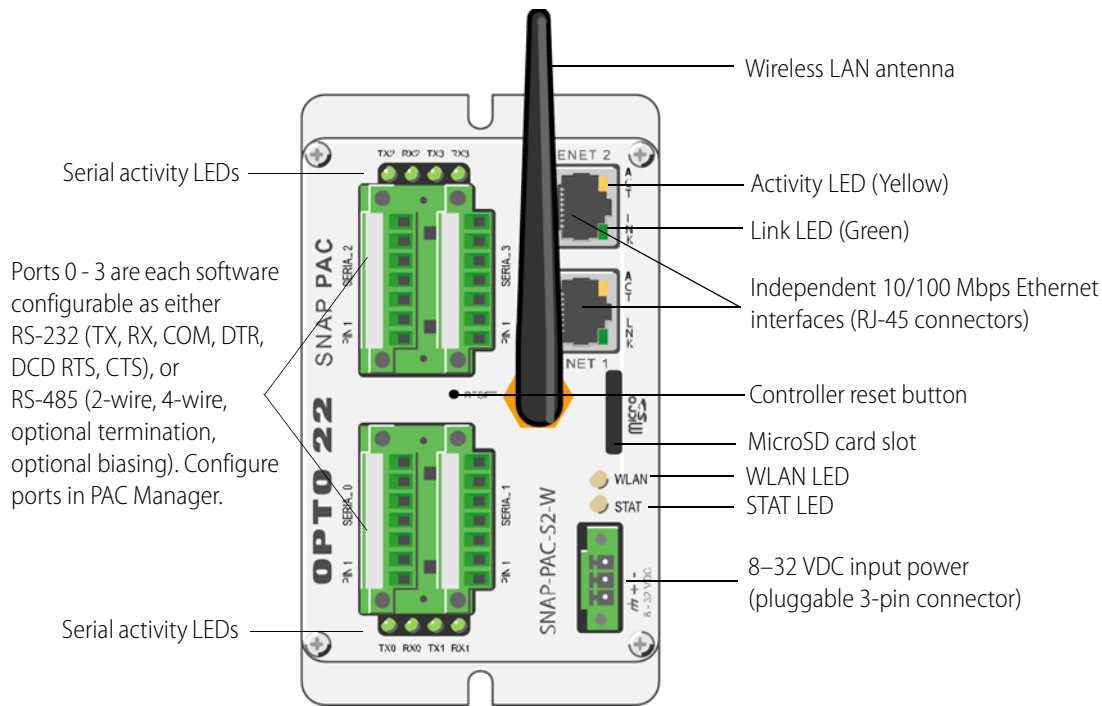
*Legacy OptoControl Controllers:

G4LC32	G4LC32ISA-LT	M4RTU
G4LC32SX	M4	SNAP-LCM4
G4LC32ISA	M4IO	SNAP-LCSX/PLUS

Status and Activity LEDs

Indicator	Description
TX0/RX0	Serial activity on port 0
TX1/RX1	Serial activity on port 1
TX2/RX2	Serial activity on port 2
TX3/RX3	Serial activity on port 3
STAT	Startup status and control program operational status
ACT	Ethernet network activity
LINK	Link established with Ethernet network

SNAP-PAC-S2-W Controller—Network Interfaces and Ports



RS-485 and RS-232 Ports¹

Pin	RS-232	Signal Direction	RS-485	Signal Direction
1	TX	Out	TX/RX+	In/Out
2	RX	In	TX/RX-	In/Out
3	COM ²		COM ²	
4	RTS	Out	RX+ (4 wire)	In
5	CTS	In	RX- (4 wire)	In
6	DTR	Out	IRQ+	In
7	DCD	In	IRQ-	In

¹ **CAUTION:** Do not use communication port connectors from a legacy OptoControl controller*. Legacy connectors will fit in a SNAP-PAC-S2, but the pin orientation is different. Instead, use the connectors supplied with the SNAP-PAC-S2 controller.

² Isolated ground. (Each channel is isolated from the others.)

*Legacy OptoControl Controllers:

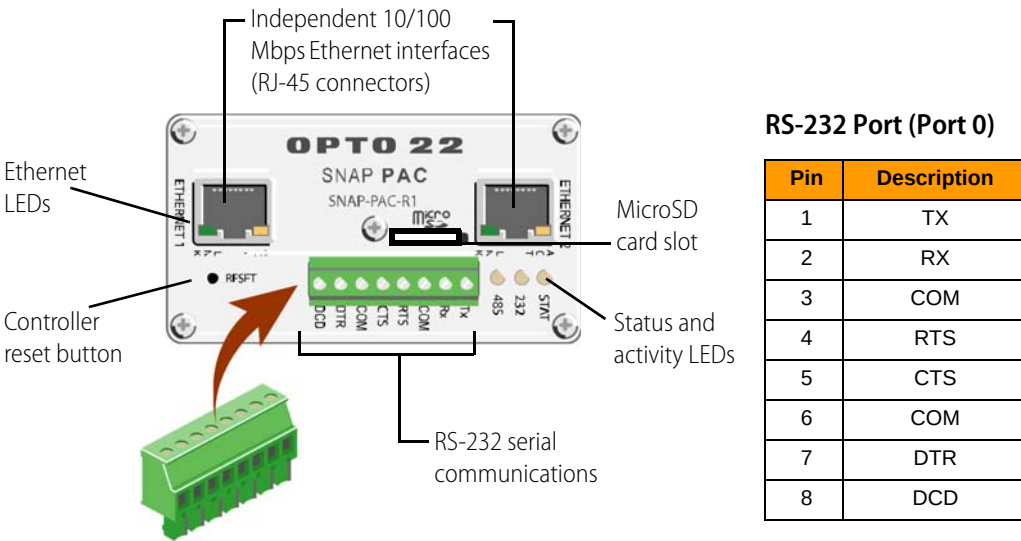
G4LC32	G4LC32ISA-LT	M4RTU
G4LC32SX	M4	SNAP-LCM4
G4LC32ISA	M4IO	SNAP-LCSX/PLUS

Status and Activity LEDs

Indicator	Description
TX0/RX0	Serial activity on port 0
TX1/RX1	Serial activity on port 1
TX2/RX2	Serial activity on port 2
TX3/RX3	Serial activity on port 3
STAT	Startup status and control program operational status
ACT	Ethernet network activity
LINK	Link established with Ethernet network
WLAN	Wireless LAN status

SNAP PAC R-Series Controllers—Network Interfaces and Ports

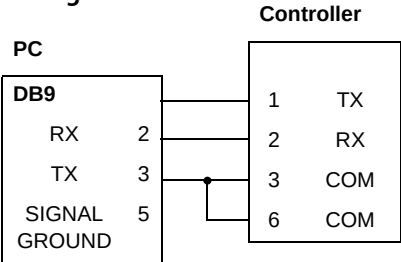
The following diagram applies to all SNAP PAC R-series on trollers except Wired+Wireless models (part numbers ending in -W). For Wired+Wireless, see [page 51](#).



Status and Activity LEDs

Indicator	Description
ACT	Ethernet network activity
LNK	Link established with Ethernet network
STAT	Startup status, control program operational status, MicroSD card access
232	RS-232 serial activity
PPP	PPP status

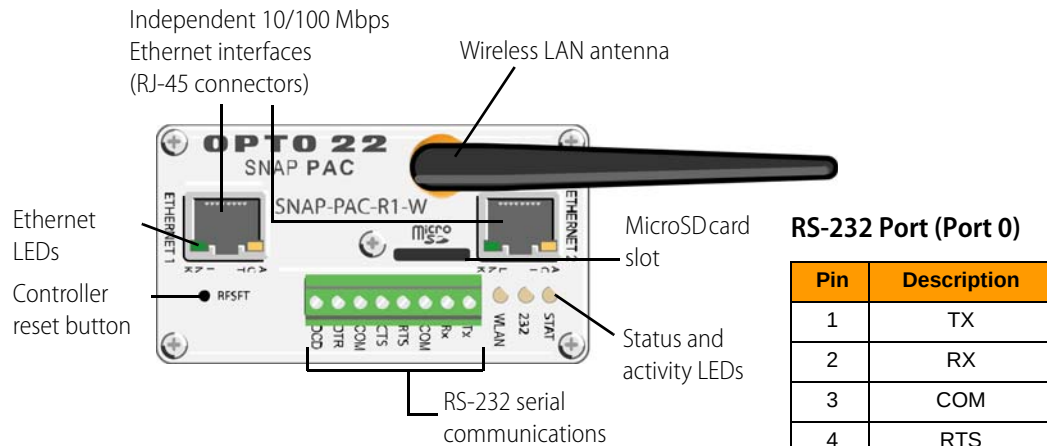
RS-232 Serial Cable Wiring*



* Minimum requirements for an RS-232 connection. To connect the controller to a modem, see form #1595, the *SNAP PAC R-Series Controllers User’s Guide*, for all eight pin connections.

SNAP PAC Wired+Wireless R-Series Controllers—Network Interfaces and Ports

The following diagram applies to SNAP-PAC-R1-W and SNAP-PAC-R2-W controllers.

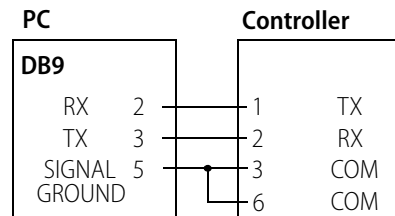


LEDs*

Indicator	Description
ACT	Ethernet network activity
LNK	Link established with Ethernet network
STAT	Startup status, control program operational status, MicroSD card access
232	RS-232 serial activity
WLAN	Wireless LAN status

* The WLAN LED replaces the PPP LED on -W models. These models can still communicate using PPP even though they do not have the indicator.

RS-232 Serial Cable Wiring**



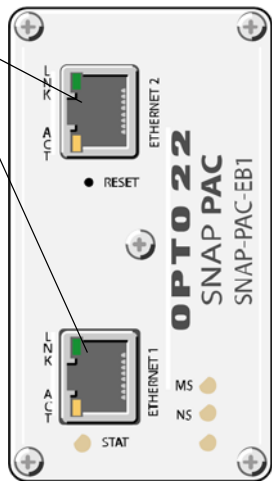
** Minimum requirements for an RS-232 connection. To connect the controller to a modem, see form #1595, the *SNAP PAC R-Series Controllers User's Guide*, for all eight pin connections.

SNAP PAC EB Brains—Interfaces

Also applies to -FM versions of EB brains. For -W models, see below.

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.

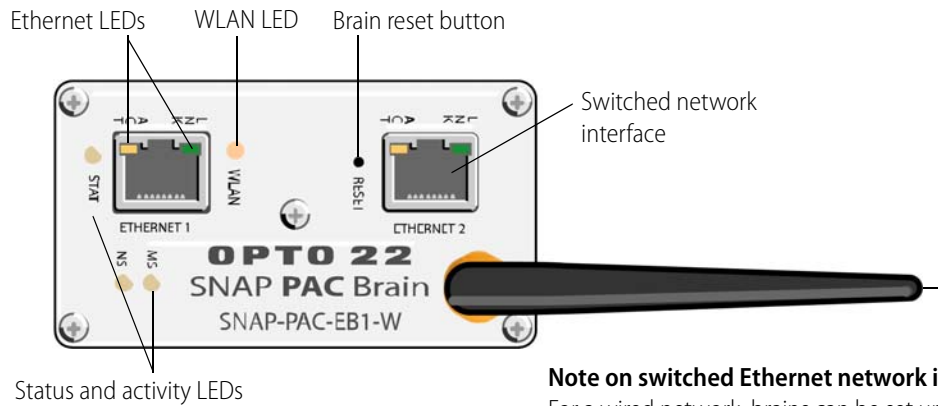
NOTE: When using a daisy-chain configuration, be aware that if power to a brain is lost, all brains beyond it on the network will also lose communication. Firmware on daisy-chained brains must be updated one at a time.



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

SNAP PAC Wired+Wireless EB Brains—Interfaces

Applies to SNAP-PAC-EB1-W and SNAP-PAC-EB2-W.



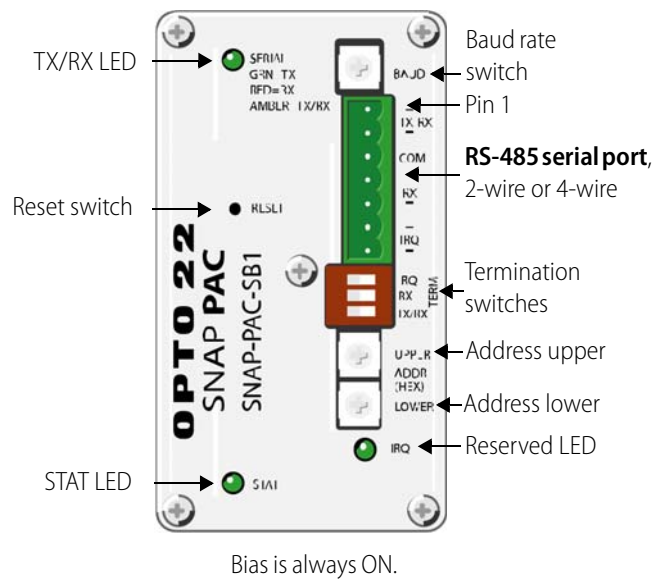
LEDs	
LED	Indicates
LNK	Link established with Ethernet network
ACT	Activity on Ethernet network
STAT	Brain status
MS	EtherNet/IP Module status
NS	EtherNet/IP Network status
WLAN	Wireless LAN status

Note on switched Ethernet network interfaces
For a wired network, brains can be set up in a daisy-chain configuration or a standard star configuration using either the Ethernet1 or Ethernet2 network interface. Both interfaces use the same IP address.
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 brain at a time.
The WLAN interface does not provide access to other brains in a daisy-chain configuration, as this interface has a separate IP address.

SNAP PAC SB Brains—Ports

LEDs

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



Ethernet Networking Options

Standard Ethernet Network Usage

In an Ethernet network, SNAP PAC System controllers and EB brains can be used just like any other device, and they are subject to exactly the same rules for physical connections and communication. SNAP PAC System devices communicate using TCP/IP and UDP/IP over standard Ethernet networks. (They can also communicate using Modbus[®]/TCP; for more information, see Opto 22 form #1678, the *Modbus/TCP Protocol Guide*.)

Most devices used on an Ethernet network have one network interface, usually with an RJ-45 connector. But as shown in the previous diagrams, SNAP PAC controllers and EB brains each have two interfaces—two RJ-45 connectors. However, the two interfaces on controllers and brains are set up differently.

- **SNAP PAC Controllers**—The two interfaces on a SNAP PAC S-series or R-series controller are *independent* interfaces that have separate IP addresses. To use the controller like any other Ethernet device, plug a Category 5 or newer cable into the connector marked *Ethernet 1*. You must use Ethernet 1, not Ethernet 2, because the controller sends a BootP request for an IP address from Ethernet 1 only.
- **SNAP PAC Brains**—The two interfaces on SNAP PAC EB brains are *switched* interfaces that use the same IP address. To use the brain like any other device, plug a Cat 5 or newer cable into either connector. It doesn't matter which one you use.

Wired+Wireless Network Interfaces

As you can see by comparing the diagrams for Wired+Wireless models to those for their wired cousins ([page 46](#) through [page 52](#)), the Wired+Wireless brains and controllers have exactly the same RJ-45 connectors, but in addition, they have an independent wireless LAN interface—the antenna.

Because a Wired+Wireless brain or controller sends its BootP requests for an IP address only through its wired interface, you must first connect to it on a wired network. You can then assign IP addresses for use on both the wired and wireless networks.

- **Wired+Wireless controllers** have *three* independent interfaces—two wired and one wireless—each with a separate IP address. Use *Ethernet 1* for initial configuration.
- **Wired+Wireless brains** have two switched wired interfaces plus an independent wireless interface. Use either wired interface for initial configuration.

Alternatives to Standard Usage

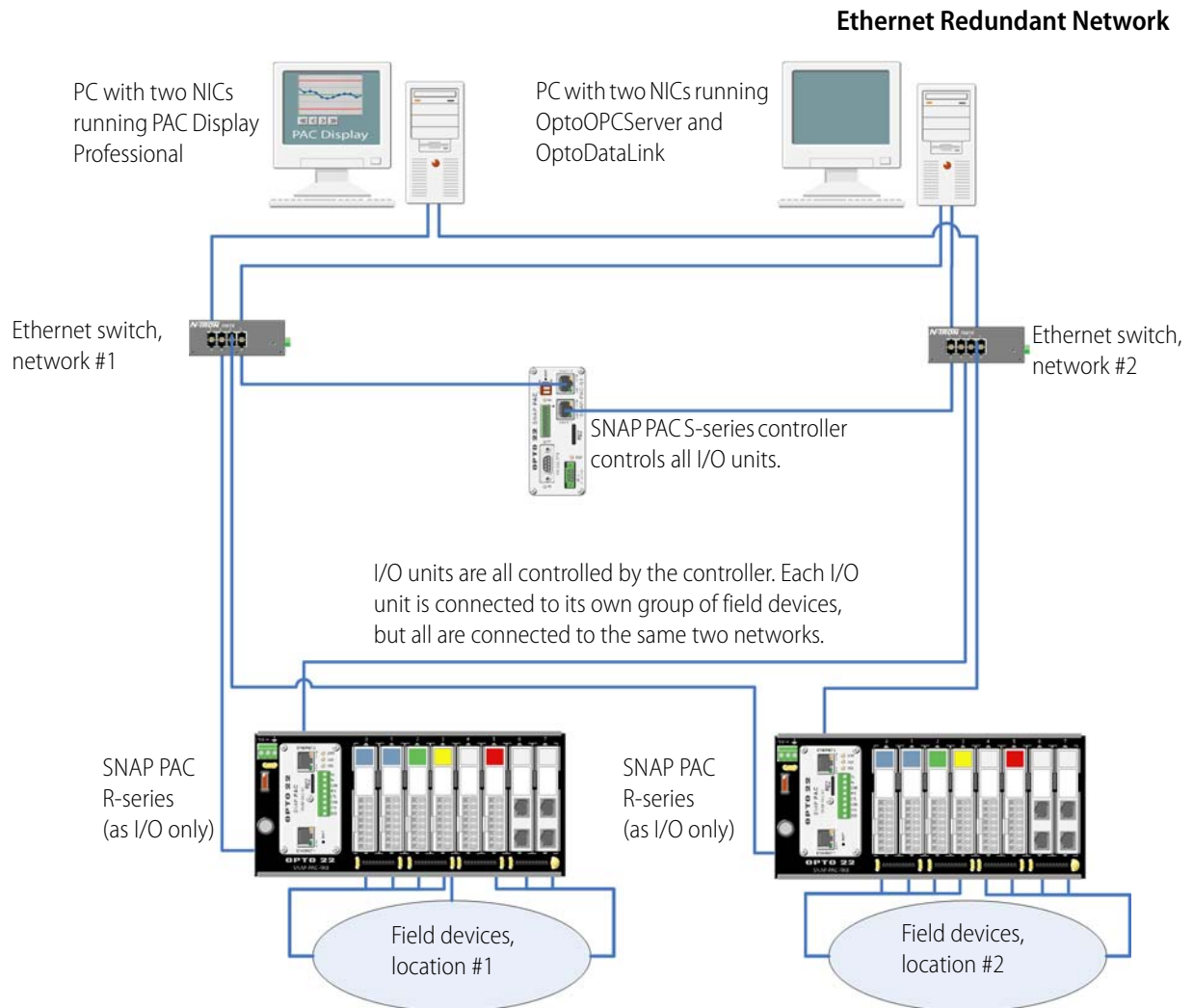
While SNAP PAC controllers and brains can be networked as described using only one Ethernet interface—just like any other Ethernet device—their dual (or triple) interfaces also offer options for network design, which you may choose to use. In addition, SNAP PAC controllers and brains can communicate with both Modbus/TCP and Allen-Bradley[®] Logix[®] systems using EtherNet/IP. The SNAP PAC System can network with OptoEMU Sensors to acquire and use energy data as well. All these options are discussed in the following sections.

Using Redundant Ethernet Network Links

Redundant network links help address the concern that an Ethernet network may fail or need maintenance, leaving the controller, the I/O units, and PCs (running PAC Display, OptoOPCServer, and OptoDataLink) unable to communicate.

SNAP PAC S-series and R-series controllers, used with PAC Project Professional, offer an option to address this concern. Each SNAP PAC controller has two independent Ethernet network interfaces. Because they are independent, each interface has a separate IP address. Redundant Ethernet links can be created using both interfaces on each device.

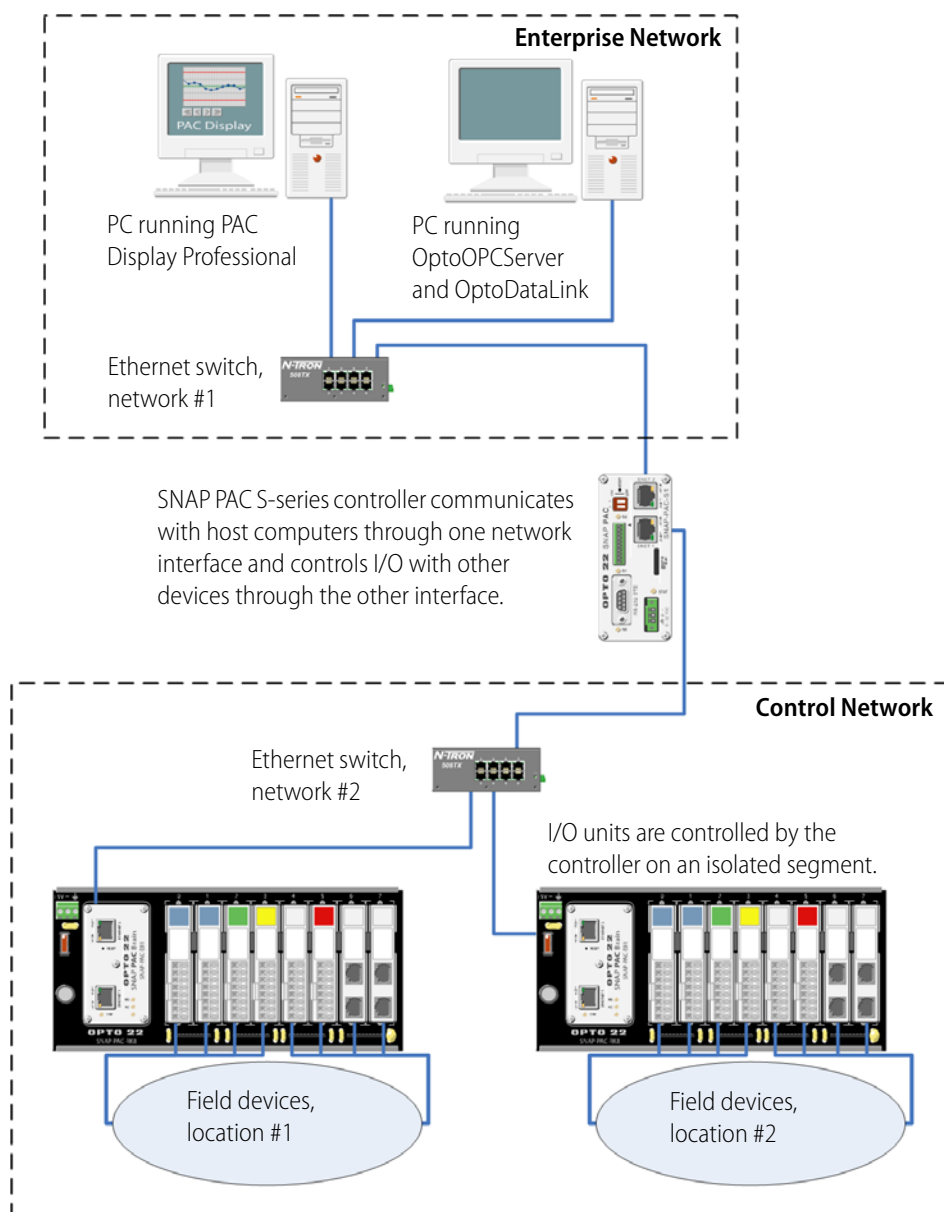
The following diagram shows an example. The SNAP PAC S-series controller is the main controller of the system, with SNAP PAC R-series controllers acting as distributed I/O processors. Each SNAP PAC controller is connected to two separate Ethernet network links, and each PC has two network interface cards (NICs) connected to the same links. In this configuration, if one link goes down, devices can still communicate on the other.



Segmenting Ethernet Networks

Another concern with using Ethernet networks may be mixing control networks with enterprise computer networks. One answer may be to segment the two so that they are not directly connected.

Either a SNAP PAC S-series or R-series controller can be used for this purpose, since both have two (or three) independent Ethernet network interfaces with separate IP addresses. One interface can be connected to the computer network and provide communication with PCs running PAC Display, OptoOPCServer, or OptoDataLink. The other network interface can be connected to I/O units to provide communication and control to the control network, as shown in the following diagram.



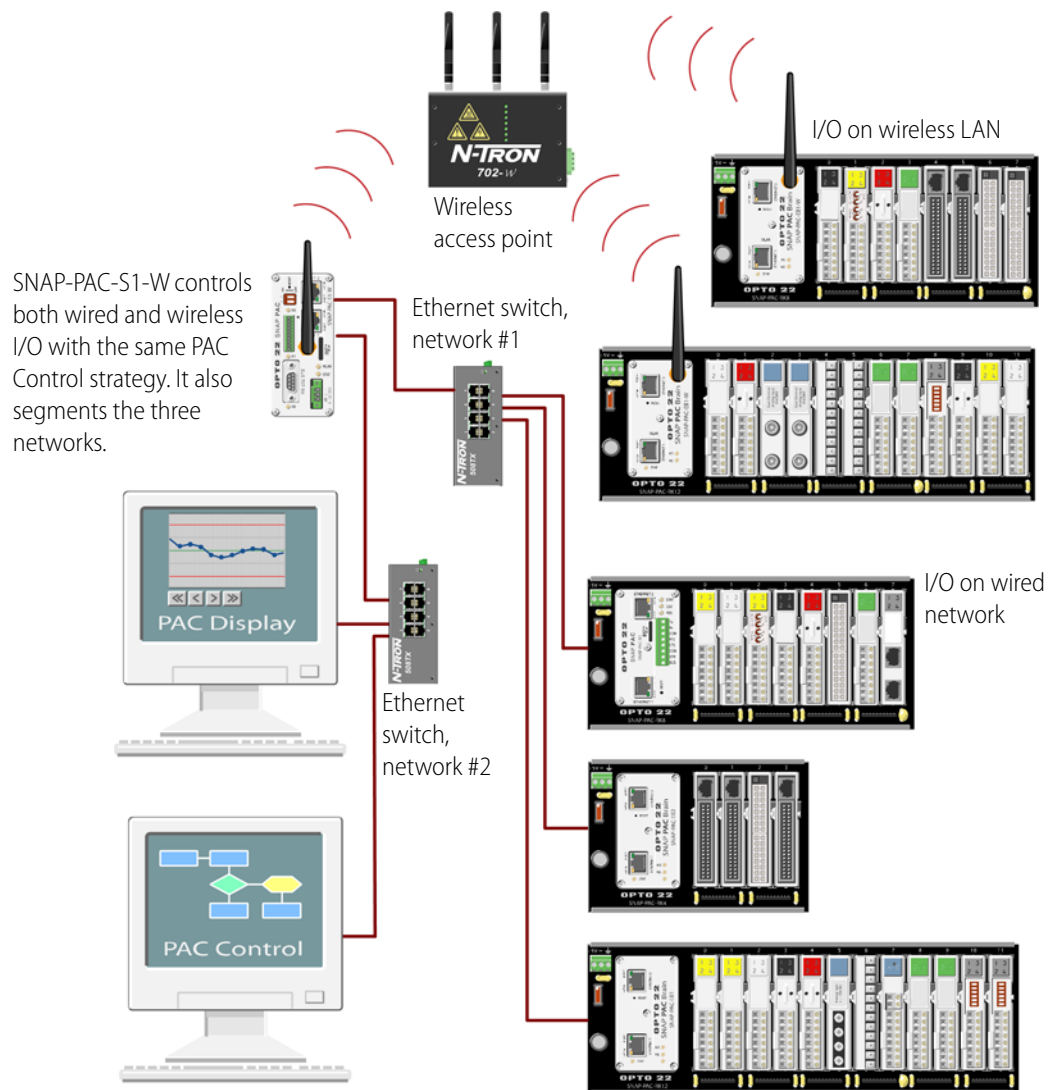
Using Wireless Networking

Wireless networking is useful for communicating with mobile equipment, like lift trucks, or devices in areas difficult to reach with Ethernet cable, such as remote tanks or pumps. Wireless can also be a good way to prototype a system addition, since it usually involves less expense than running wires.

Before you use wireless, make sure you understand the wireless standards, especially in regard to interference and security. Also, survey the area to properly set your wireless access points.

Wired+Wireless SNAP PACs and brains can be used either on a wired network, on a wireless LAN, or both. No matter how they are used, they have the same functions and run the same software—in the same way a laptop computer can be used wirelessly or plugged in, and still run Microsoft Excel, for example. All SNAP I/O modules and racks work either wired or wirelessly, and the same PAC Control strategy runs in the same way. You don't even have to change program logic.

This flexibility means you don't have to decide up front which network to use, nor purchase different or extra automation hardware. It also means you can integrate wired and wireless data. In the diagram below, the PAC controls both wired and wireless I/O and has segmented networks as well.



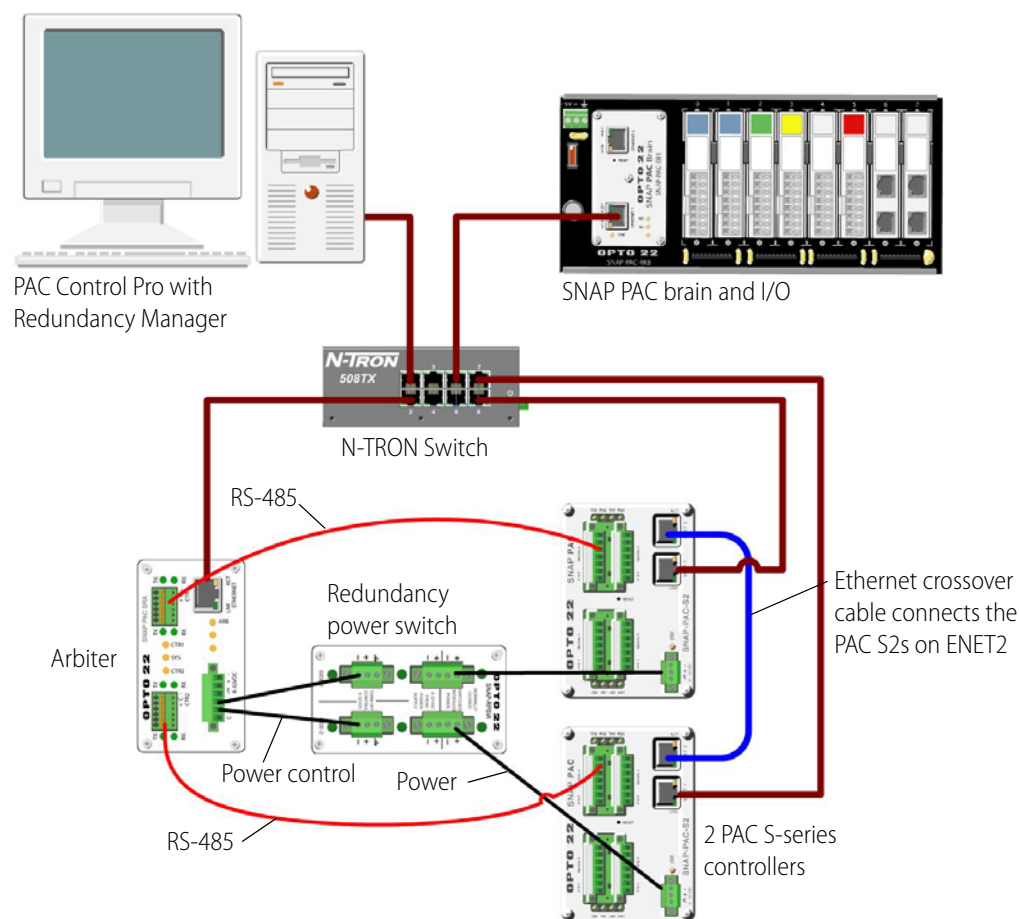
Using Redundant Controllers

The SNAP PAC System is extremely reliable, but no control system is perfect. Redundant controllers can help your system recover quickly: in the unlikely event that a controller fails, a second identically configured controller takes over with almost no down time.

Redundancy does not require special controllers, I/O, or cabling. It uses two identical SNAP PAC S-series controllers (both the same part number), standard Ethernet and RS-485 cabling, and the same SNAP PAC brains and SNAP I/O as any other system.

It does require PAC Project Professional (version 9.0 or newer) and the SNAP PAC Redundancy Option Kit, part number SNAP-PAC-ROK. The kit includes two additional pieces of hardware, the arbiter and the redundant power switch, plus a user's guide to help you set up your system and develop a control strategy. You'll also use the PAC Redundancy Manager, a utility included with PAC Project Pro, for configuring and maintaining the redundant system.

A simplified system is shown below. For more information, see the *SNAP PAC Redundancy Option Data Sheet* (form 1901) and the *SNAP PAC Redundancy Option User's Guide* (form 1831).

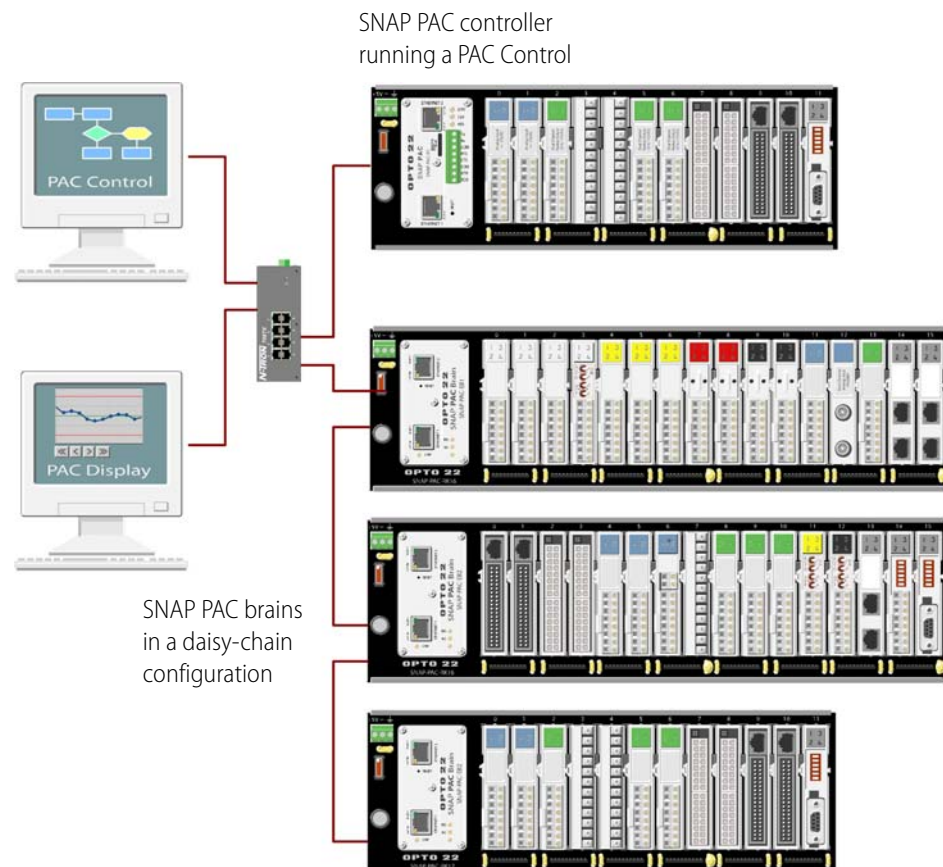


Daisy-Chaining Distributed Ethernet I/O

Standard networking for Ethernet devices is in a star configuration, with an Ethernet switch or router as the center of the star. Another option is offered by SNAP PAC EB brains: a daisy-chain configuration, similar to serial networks. SNAP PAC EB brains give you this option because of their two switched Ethernet network interfaces, which share the same IP address and work just like an Ethernet switch. For a standard star configuration, you use just one interface. For daisy-chaining, you use both to link I/O units without the need for a separate switch.

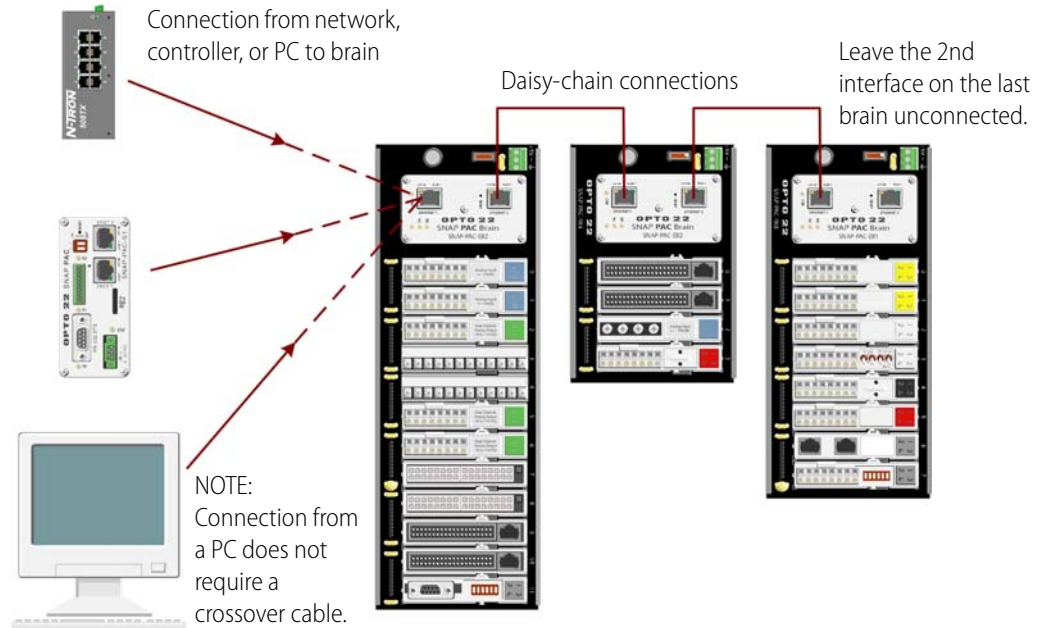
Daisy-chaining offers advantages and disadvantages. The primary advantage is the reduced expense, because you don't need to purchase Ethernet switches. The primary disadvantage is that, as in a serial network, if you lose communication with a brain, all the brains after that one in the chain are also unreachable.

The following diagram shows a SNAP PAC System with brains connected by daisy-chaining.



IMPORTANT: If you choose a daisy-chain configuration, make certain that the brains are connected correctly. Incorrect connections can produce major problems on the network. Make sure that daisy-chain connections are made in a simple open-ended chain, as shown in the diagram on the following page.

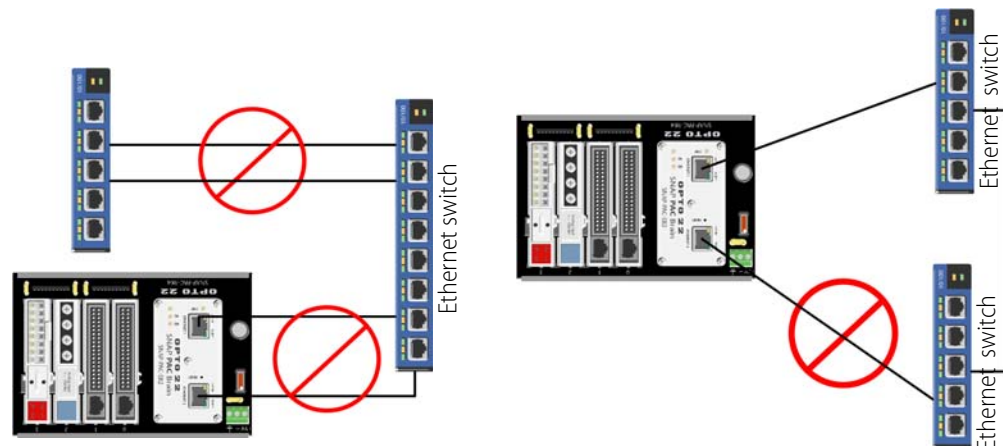
Correct Connections for Daisy-Chaining



Never connect SNAP PAC brains in a loop or ring. For example, do not connect both ends of the chain to the same switch, nor to different switches on the same network. As a rule, do not connect the second Ethernet interface on the last brain in the chain to any other device.

NOTE: There is one exception to this rule: you can connect the network in a loop if at least one switch in the loop supports STP/RSTP (Spanning Tree Protocol/Rapid Spanning Tree Protocol) and has that feature enabled.

Incorrect Network Connections

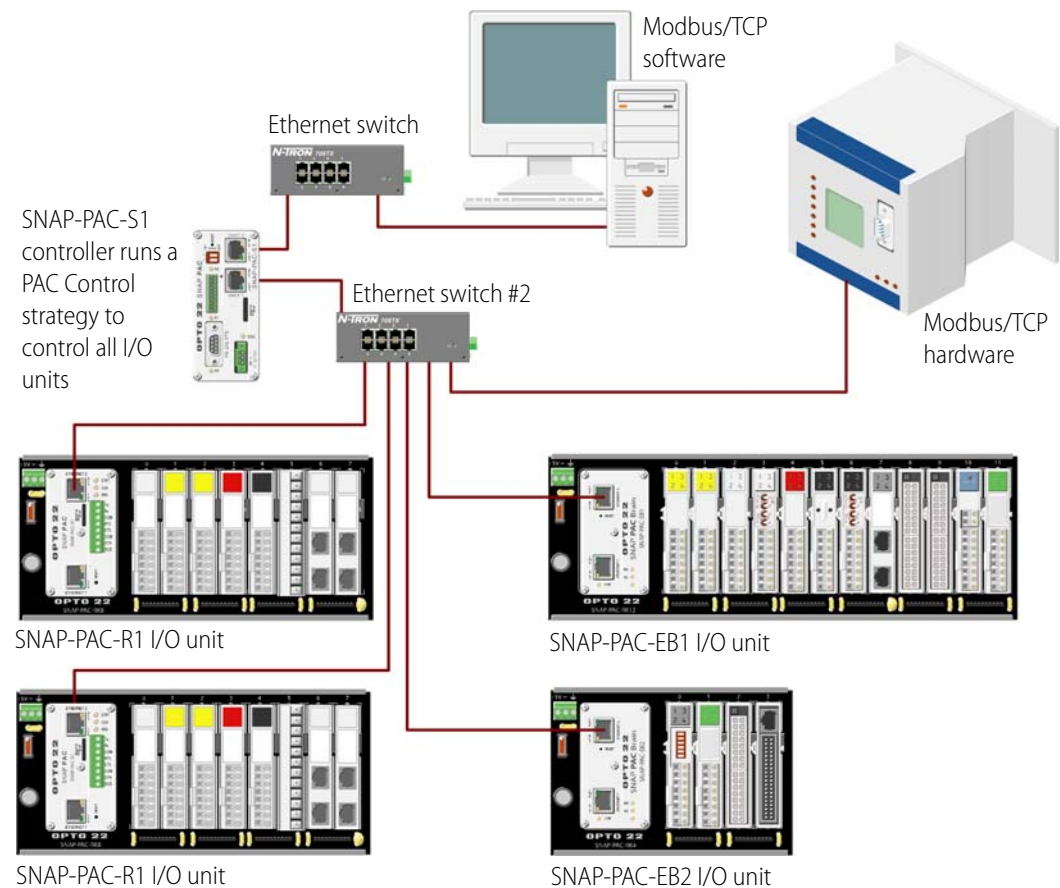


Communicating with Modbus/TCP Systems

All SNAP PAC controllers and brains can communicate natively using Modbus/TCP, a protocol for Modbus hardware and software on an Ethernet network.

The following diagram shows an Opto 22 system communicating with a Modbus system. In this example, the SNAP-PAC-S1 standalone controller runs a PAC Control strategy to monitor and control the I/O. Simultaneously, the Modbus system exchanges data with the Opto 22 system.

This example shows the Opto 22 control network segmented from the computer network: the PC is attached to Ethernet switch #1 and the control network is on Ethernet switch #2. Because the Modbus/TCP hardware is also on switch #2, it can send data to and from every I/O unit shown. The Modbus software running on the PC, attached to switch #1, can access data only from the controller; for instance, it might access data placed in the controller's Scratch Pad by the PAC Control strategy. The Scratch Pad is a large area within the controller's memory that stores binary data, floats, integers, and strings for peer-to-peer data exchange.



This is just one example; many other configurations are possible. If you are not using PAC Control, Modbus/TCP hardware or software on the same network segment as I/O units can provide full control for I/O points.

For details about communicating with Modbus/TCP systems, see Opto 22 form #1678, the *Modbus/TCP Protocol Guide*.

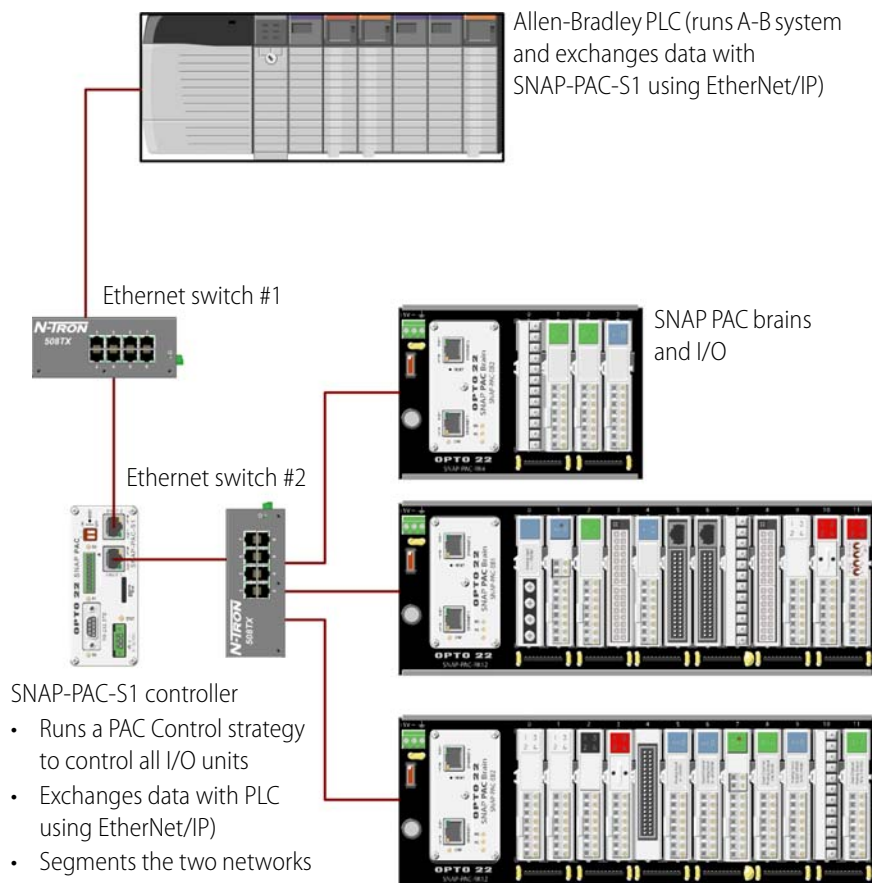
Communicating with Allen-Bradley PLC Systems

SNAP PAC controllers and brains can also communicate natively with Allen-Bradley PLC systems based on the EtherNet/IP® protocol, including ControlLogix®, CompactLogix®, MicroLogix 1100/1400, and SLC 5/05. This means:

- You can extend a PLC system using Opto 22 brains and I/O as intelligent, distributed I/O. In this case the brains provide distributed control, but supervisory control is left up to the PLC. See the white paper, *Expanding Allen-Bradley Systems with Distributed, Intelligent I/O* (form #1785).
- You can exchange data between the SNAP PAC System and an Allen-Bradley system, as shown below. Any SNAP PAC controller running a PAC Control strategy can move variables and values to and from its Scratch Pad, and an A-B PLC system can read from or write to the Scratch Pad using EtherNet/IP. The Scratch Pad is a large area in the controller's memory that stores binary data, floats, integers, and strings for peer-to-peer data exchange.

In this example, the SNAP PAC is segmenting the two networks. Note that the N-TRON switches provide IGMP snooping, which is required for effective network traffic on EtherNet/IP.

Exchanging data between an A-B PLC system and a SNAP PAC System



For detailed information on configuring I/O and communicating with A-B systems, see Opto 22 form #1909, the *IO4AB User's Guide*, and #1770, the *EtherNet/IP Protocol Guide*.

Incorporating OptoEMU Sensor Energy Data

The OptoEMU Sensor from Opto 22 is an appliance that monitors the energy usage in your facility and sends real-time, detailed energy data to online data services, control systems, and SQL databases. You can view the data online , analyze usage patterns, control energy usage, and reduce costs.

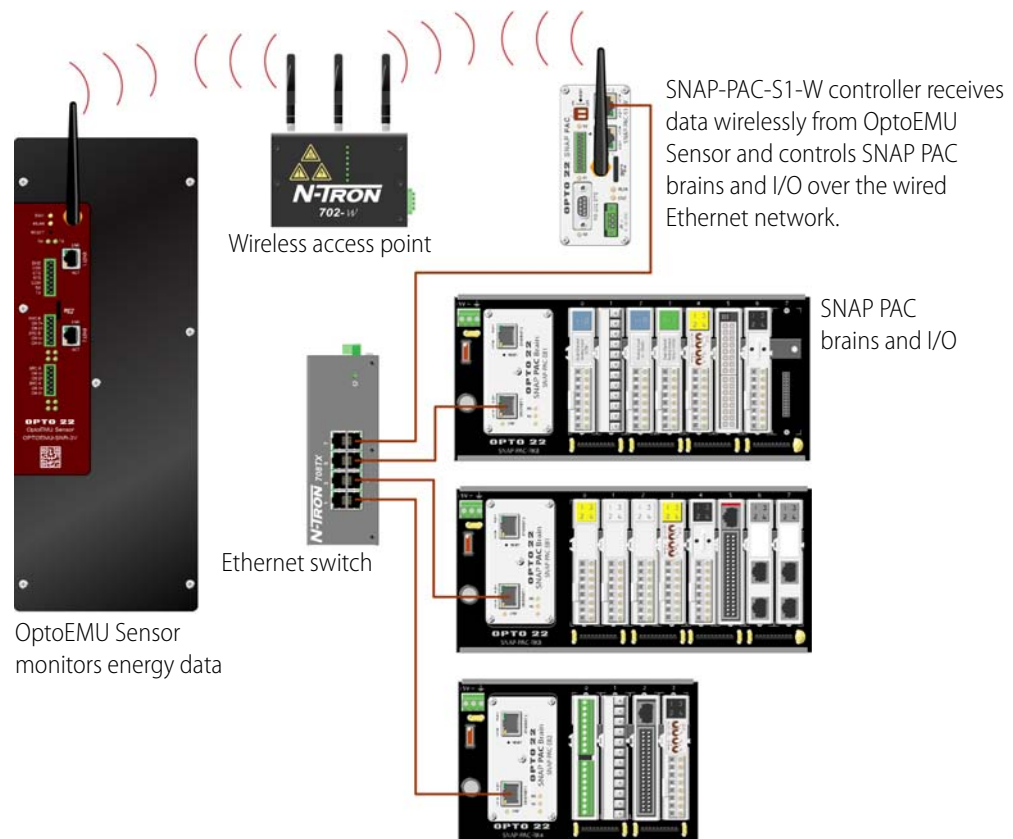
OptoEMU Sensors are fully compatible with the SNAP PAC System; the energy data they track can be used in your PAC Control strategy, sent to a PAC Display HMI, sent to an OPC client using OptoOPCServer, shared with a Modbus/TCP system, or sent to a SQL database using OptoDataLink.

For more information on the OptoEMU Sensor, see these documents on the Opto 22 website:



For this information	See this document	Form #
Description, specifications, diagrams	OptoEMU Sensor Data Sheet	1936
Installation, configuration, maintenance, viewing data online	OptoEMU Sensor User's Guide	1932
Sending data to control systems and databases	OptoEMU Sensor Communication Guide	1958

In this example, the OptoEMU Sensor sends data to the SNAP-PAC-S1-W controller wirelessly. The controller uses the data in strategy logic and controls energy-related outputs in the system over one of its wired Ethernet interfaces. Alternatively, the Sensor can send data over the wired network.



Serial Network Options

Although the SNAP PAC System is an Ethernet-based control system, it provides serial network options for connecting to hosts, distributed I/O, and other serial devices.

- You can connect to distributed SNAP PAC Serial Brains and I/O ([page 64](#)).
- You can communicate with any RS-232 or RS-485 serial device, such as chart recorders, RFID and barcode readers, printers, and scales ([page 64](#)).
- You can exchange data with a Profibus system ([page 64](#)).
- You can communicate with a remote host over a modem (see [page 65](#)).
- You can connect to legacy Opto 22 serial *mistic* I/O (see [page 66](#)).

Using Distributed Serial I/O

If all or a portion of your control system needs to be on a serial link, SNAP PAC **SB** brains provide the distributed serial I/O. Note that SB brains must be used with a SNAP PAC S-series controller, which has RS-485 ports. The SNAP-PAC-S1 and SNAP-PAC-S1-FM each have one RS-485 port; the SNAP-PAC-S2 has four serial ports, any number of which can be software configured for RS-485.

Use either PAC Project Basic or Professional with the S-series controller and SB brains. Configuration and programming are the same as for Ethernet (EB) brains.

Serial communication parameters (baud rate, address, termination) for SB brains are set on the brain's top cover. See "[Setting Up Serial Networking](#)" on [page 71](#) for details.

Connecting Directly to Serial Devices

The serial ports on SNAP PAC R-series and S-series controllers can also be used for direct connection to serial devices. For types and number of ports on each controller, see the diagrams starting on [page 46](#).

Typical serial devices you might connect to include printers, scales, chart recorders, and RFID and barcode systems. Using the controller's ports, you can control, monitor, and collect data from these types of devices using the PAC Control strategy (either Basic or Professional).

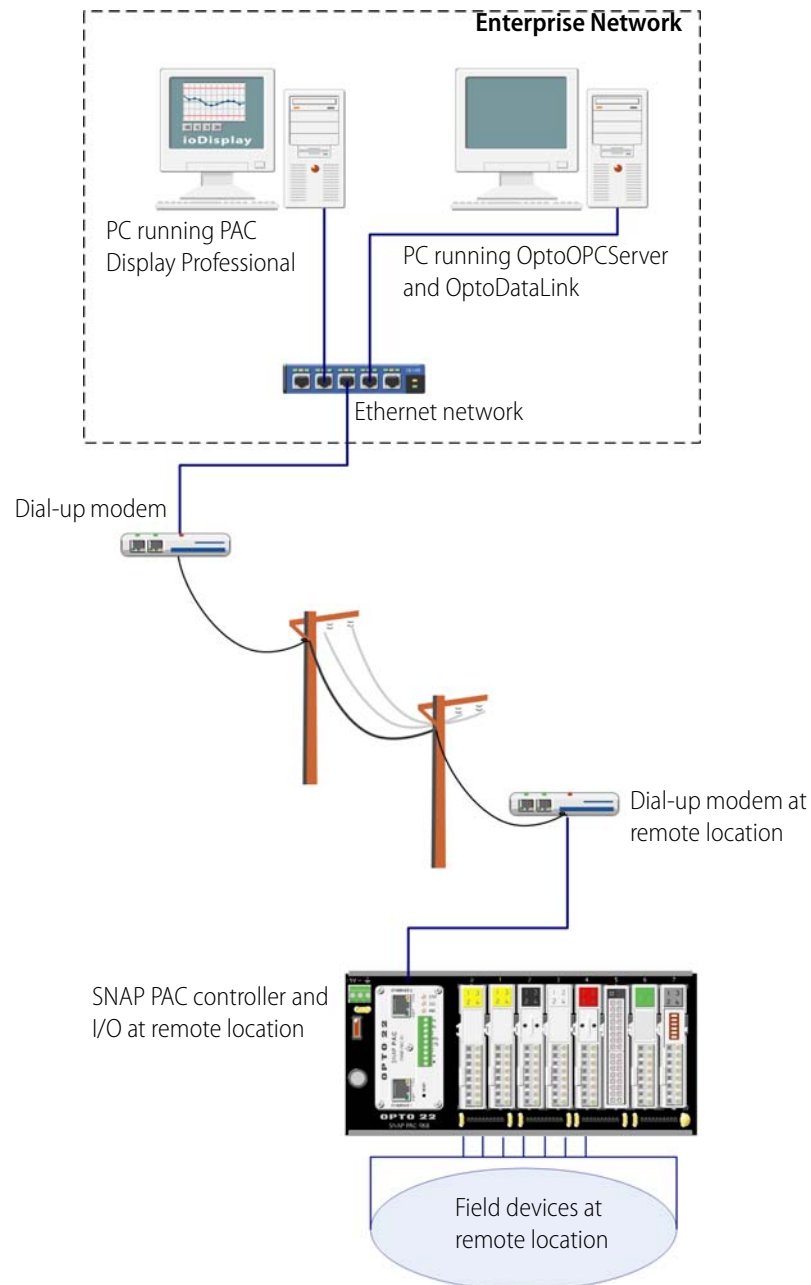
For locations away from the controller, you can use SNAP serial communication modules on distributed I/O. Serial modules snap on a mounting rack alongside analog and digital modules to provide the serial connections needed at distributed locations. RS-232 modules include RTS/CTS. RS-485 modules offer either 2-wire or 4-wire mode. Each module offers two serial ports (one port if you use an RS-485 in 4-wire mode). Up to eight serial modules can be placed on a single rack.

Communicating with Profibus Systems

The SNAP PAC System can communicate with Profibus[®] systems through a serial-based Profibus module, part number SNAP-SCM-PROFI. The Profibus module plugs into the mounting rack alongside other modules to provide a standard electrical interface between the SNAP PAC System and PROFIBUS DP[®] networks.

Communicating with a Remote Host Using a Modem

For remote monitoring and control, you can use an RS-232 serial port on a SNAP PAC R-series or S-series controller to connect to a remote host such as a PC using a dial-up link. Like a remote telemetry unit (RTU), the controller communicates over a modem, as shown on the following page, using the Point-to-Point Protocol (PPP).

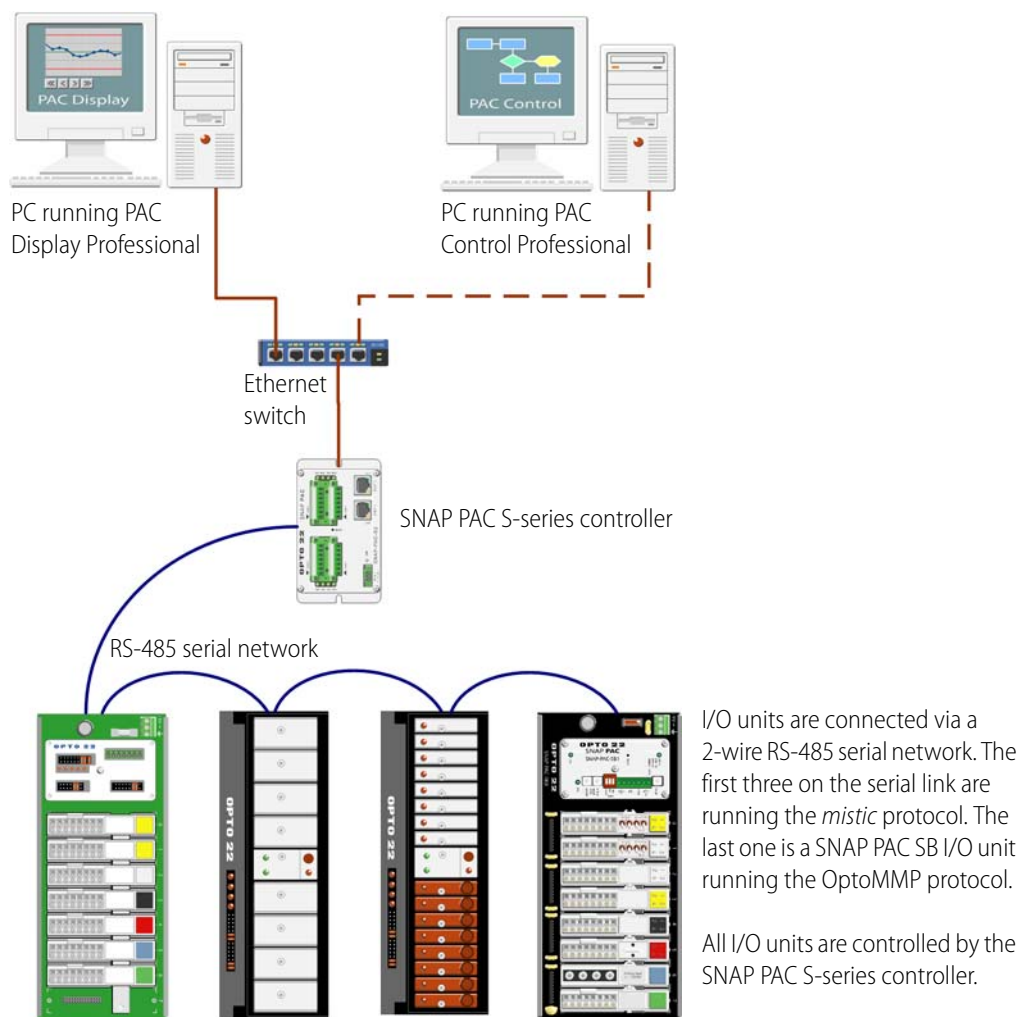


Communicating with Legacy Serial *mistic* I/O Units

Using a SNAP PAC S-series controller and PAC Project Professional, you can incorporate older serial *mistic* systems into the SNAP PAC System, simultaneously communicating with legacy serial I/O units (such as serial B3000 brains and *mistic* bricks), as well as serial and Ethernet SNAP PAC I/O units.

For large numbers of serial I/O, use a SNAP-PAC-S2 controller, which has four serial ports that are all software configurable for RS-485.

In the following diagram, a SNAP PAC controls multiple Opto 22 serial-based I/O units over an RS-485 serial network. The controller also communicates with a separate enterprise Ethernet network to provide process data to a PC running Opto 22's PAC Display HMI software.



4: Installing and Wiring System Components

Introduction

This chapter shows you how to install SNAP PAC System components and connect them to field devices. This chapter includes basic information; always consult the component's user guide or data sheet for more details on installation and wiring.

Downloading and Installing Software

The software used with the SNAP PAC System is the PAC Project software suite. The suite can be downloaded from our website, www.opto22.com. All PAC Project software, both Basic and Professional, is in one single download, and full documentation is included in Adobe Acrobat PDF format.

You can install the Basic version right away to get started. Once you've downloaded the file from our website, just double-click the file to open it and run the installer.

To install PAC Project Professional or any title within the suite, first purchase the product through our distribution channel, online, or by calling Opto 22 Sales at (800) 321-6786 or (951) 695-3000. When you have your password, run the installation again. Choose PAC Project Professional or the software titles you purchased, and enter your password. A CD and complete printed documentation will be shipped to you.

Firmware

Make sure you use the most recent firmware for all SNAP PAC controllers and brains that will be used with PAC Project software applications. Firmware is updated often to match new software versions or support new modules.

The most recent firmware is always available on our website. Simply download the firmware file and follow instructions in the *PAC Manager User's Guide* (form #1704) to install it.

Mounting Controllers

SNAP PAC S-series controllers can be either panel mounted or DIN-rail mounted. For DIN-rail mounting, purchase the optional DIN-rail mounting kit (see [page 42](#) for compatible kits). Follow directions in the controller user's guide to mount it.

SNAP PAC R-series controllers mount on a SNAP PAC rack with the I/O modules. For mounting instructions, see the next section.

Installing Brains or Rack-Mounted Controllers and I/O Modules

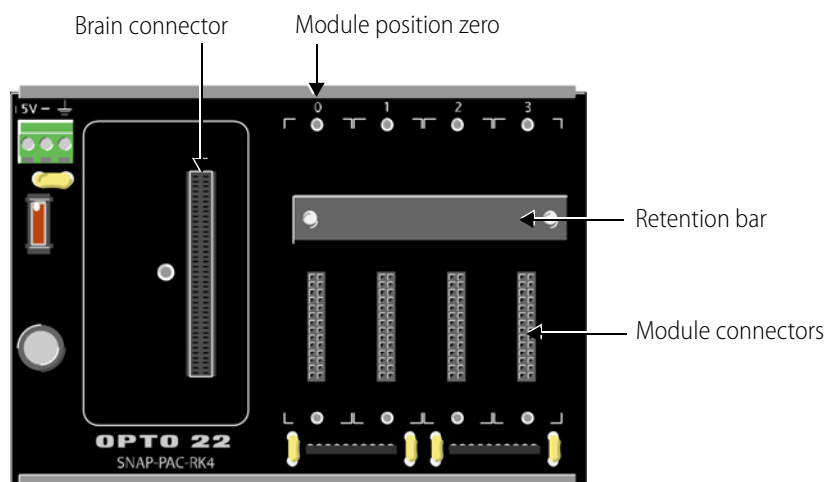
SNAP I/O modules and SNAP PAC brains and rack-mounted controllers are installed on SNAP PAC racks. Each rack mounts one processor and up to 4, 8, 12, or 16 modules. The modules can be any combination of SNAP I/O modules—analogue, digital, and serial. Serial modules are limited to a maximum of 8 on any one rack and cannot be used with serial brains.

Installing I/O Modules

Modules snap into place in the row of connectors on the rack. Each module connector has a number.

1. Assemble the rack according to the directions that came with it.
2. Place the rack so that the module connector numbers are right-side up, with zero on the left.

A four-module rack is shown below as an example.



3. Position the module over the module connector, aligning the small slot at the base of the module with the retention bar on the rack.

4. With the module correctly aligned over the connector, push on the module to snap it into place.

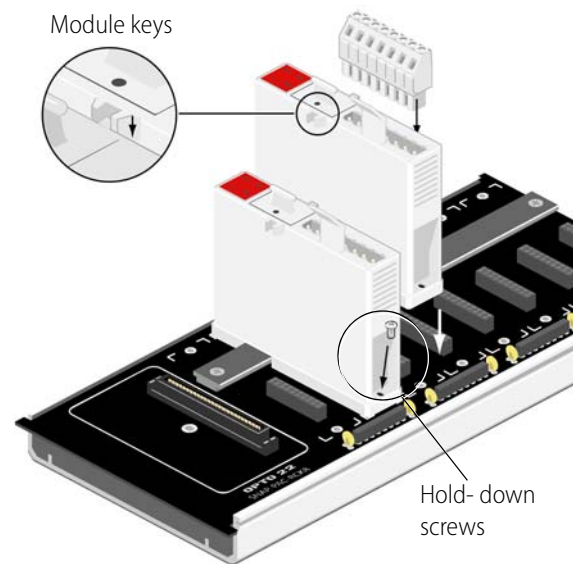
When positioning modules next to each other, be sure to align the male and female module keys (shown in the detailed view in the illustration at right) before snapping a module into position.

Modules snap securely into place and require a special tool (provided) for removal. To remove a module, see the next section.

5. Use standard 4-40 x 1/2 truss-head Phillips hold-down screws to secure both sides of each module.

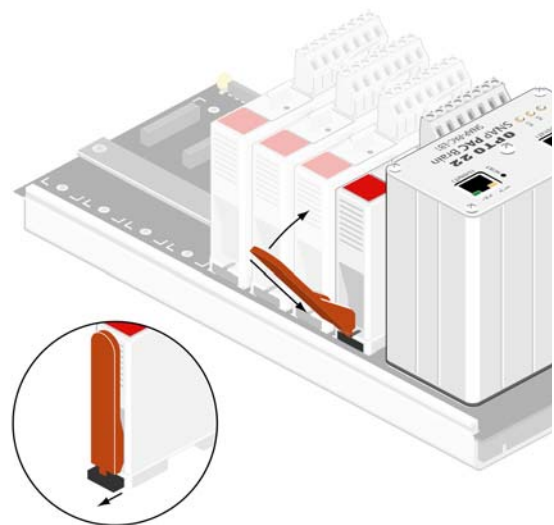
CAUTION: Do not over-tighten screws.

6. Plug the wiring connector into each module to attach modules to the devices they monitor. Follow wiring diagrams beginning on [page 77](#) or in the module data sheets. (See [page 13](#) for a list of data sheets.)



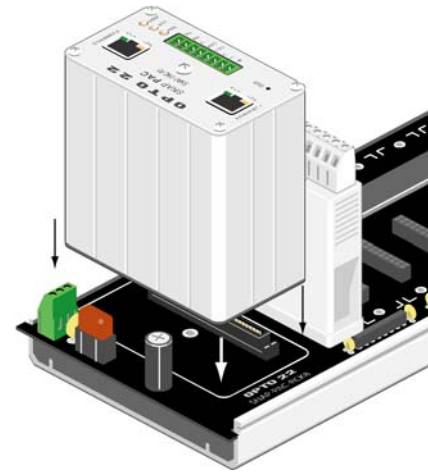
Removing a Module

1. If the modules are held in place with screws, remove them.
2. Holding the SNAP module tool (provided) as shown in the illustration at right, insert it into the notch at the base of the module.
3. Squeeze the module tool against the module to open the release latch, and pull straight up on the module to remove it.



Installing the Brain or Rack-Mounted Controller

1. Remove the processor from its packaging.
2. Turn off power to the rack assembly.
3. Align the processor's connector with the mating connector on the mounting rack.
4. Seat the processor onto the connector and use the hold-down screw to secure it in position. Do not overtighten.
5. To attach network cabling and configure addressing, skip to one of the following:
 - “Setting Up Ethernet Networking,” below.
 - “Setting Up Serial Networking” on page 71.



Setting Up Ethernet Networking

NOTE for Wired+Wireless models: These devices have a wireless LAN interface as well as wired interfaces, but they send a BootP only on the wired interface. First, follow the steps below to connect to them over a wired network and assign their primary IP address. Later, you can configure the wireless interface.

1. For an R-series controller or an EB brain, use Category 5 or superior solid unshielded twisted-pair cable to connect the processor in one of the following ways:
 - (Recommended for initial configuration) Connect to a PC directly. Use an Ethernet crossover cable for R-series controllers; use any Ethernet cable for SNAP PAC brains.
 - Connect to a standard 10BASE-T or 100BASE-TX Ethernet network that has a PC on the same subnet as the brain and does NOT have a Dynamic Host Configuration Protocol (DHCP) server.

Maximum cable or segment length is 100 meters; minimum cable length is one meter.

2. Before turning on power to the processor, read instructions in the *PAC Manager User's Guide* and assign the IP address.

Setting Up Serial Networking

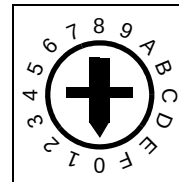
Follow the SB brain diagram on [page 53](#) and the steps below to set up serial networking for SB brains and an S-series controller.

1. Attach an RS-485 serial cable to the serial port.
2. Rotate the baud rate switch to set the desired baud rate:

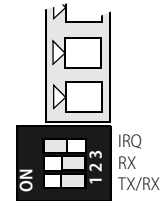
Baud rate	Switch position
(Reserved)	F
230400 bps	E
115200 bps	D
76800 bps	C
57600 bps	B
38400 bps	A
19200 bps	9
9600 bps	8

Baud rate	Switch position
4800 bps	7
2400 bps	6
1200 bps	5
600 bps	4
300 bps	3
(Reserved)	2
(Reserved)	1
(Reserved)	0

Baud Rate Switch



3. Use the three tiny termination switches to set termination:
 - For half-duplex termination (2-wire 485), move switch 1 (TX/RX) to ON and switch 2 (RX) to OFF.
 - For full-duplex termination (4-wire 485), move switch 1 to ON and switch 2 to ON (illustrated at right)



NOTE: Bias on a SNAP PAC SB brain is always ON.

(Switch 3 is reserved.)

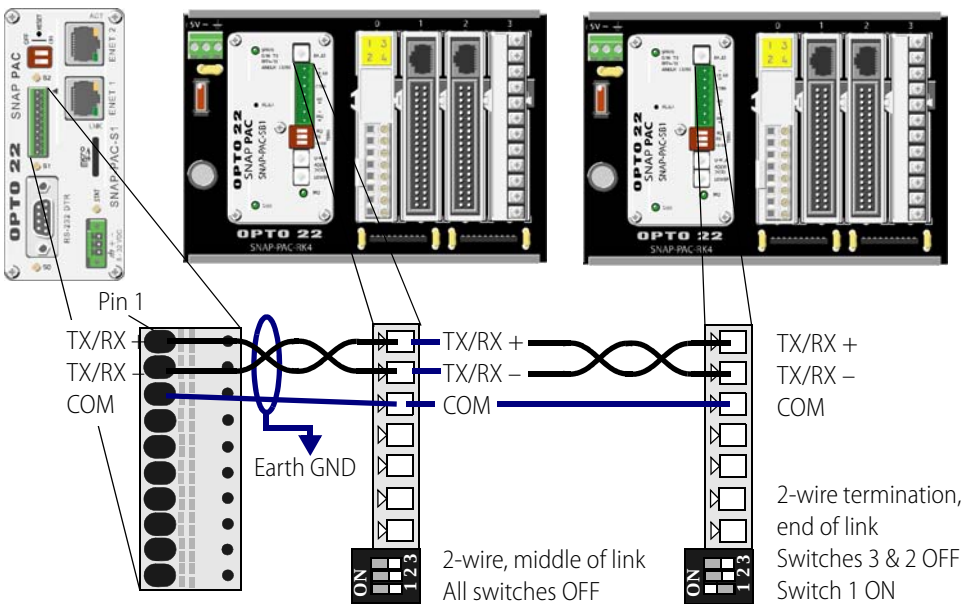
4. Use the two 16-position rotary address switches to set the unit's address.

There are 256 possible addresses, 0–255. If you need help setting the address switches, see the brain user's guide.

5. Wire and terminate the serial link as shown in the following diagrams.

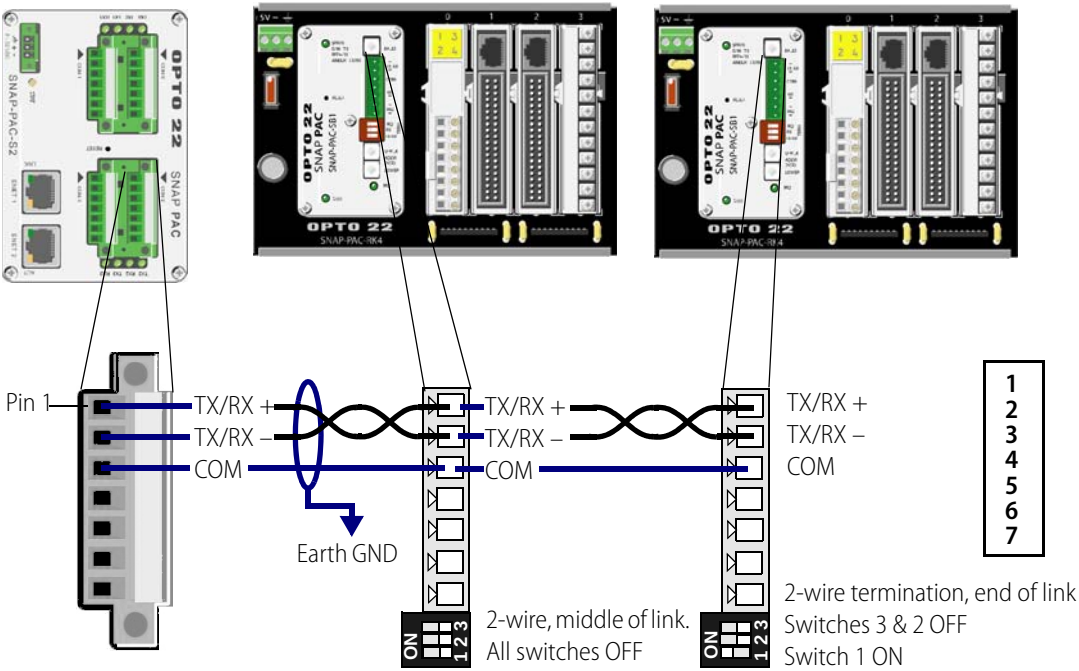
Wiring a SNAP PAC SB-Series Brain to any SNAP-PAC-S1 Controller

Two-wire

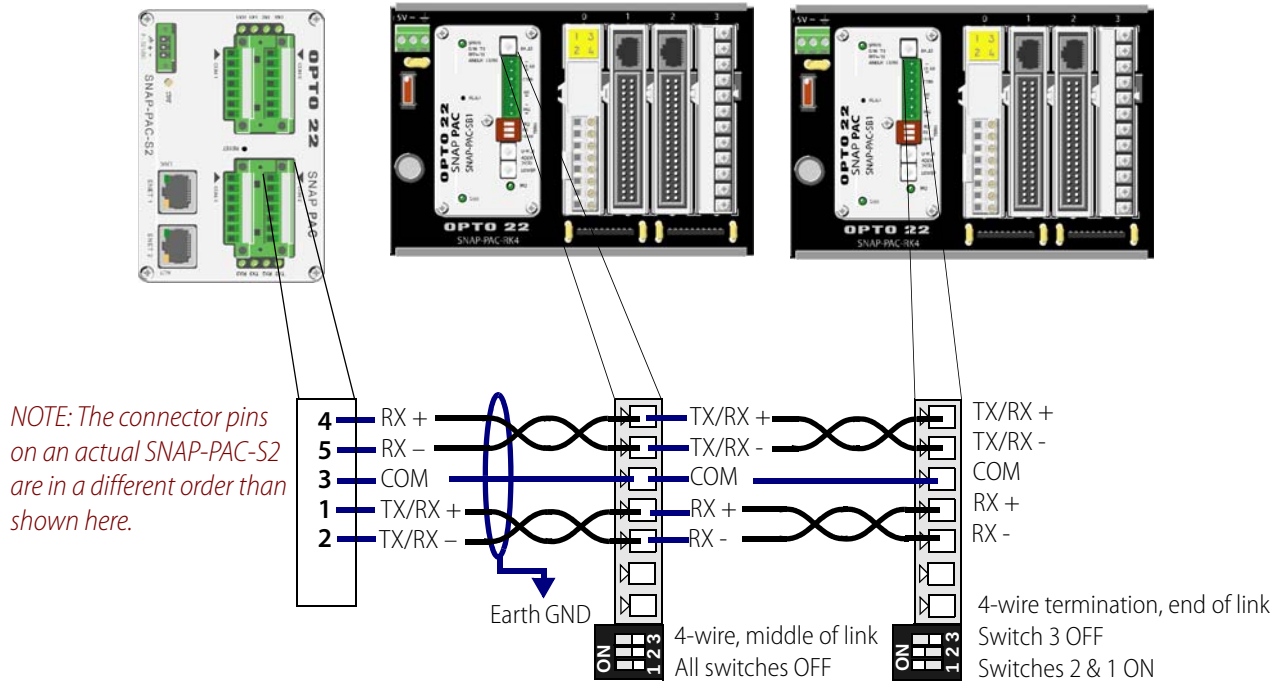


Wiring a SNAP PAC SB-Series Brain to any SNAP-PAC-S2 Controller

Two-wire



Four-wire

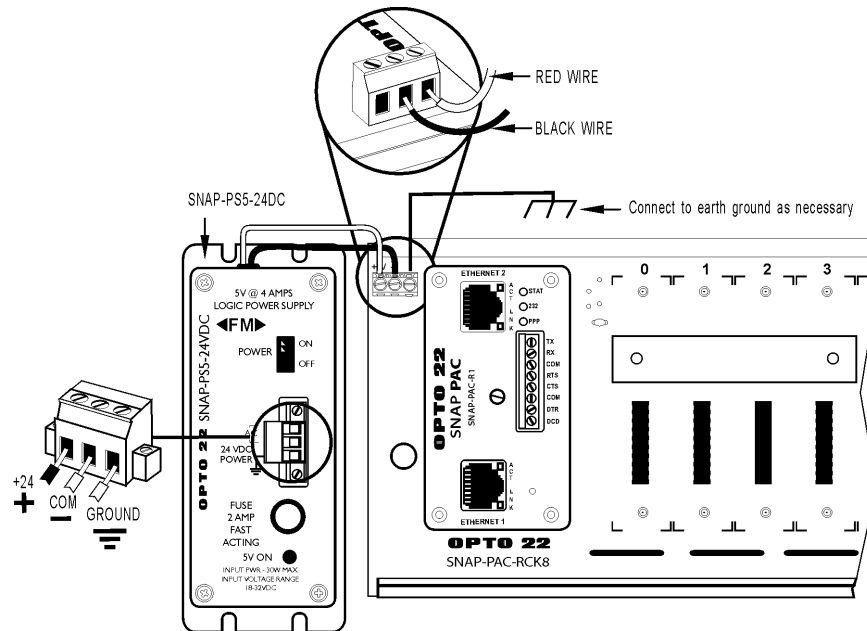


Wiring Power Supplies

Primary Power Supply

Use one power supply per I/O unit. Use 14 AWG wire.

1. Mount the SNAP-PS5 or SNAP-PS5-24DC power supply so that the attached red and black power wires will reach the + and – power terminals on the SNAP mounting rack.
2. Using the power terminals on the SNAP PAC rack, attach the red wire to the + terminal and the black wire to the – terminal. Connect the ground terminal on the rack to ground.
3. For the **SNAP-PS5** (not illustrated): Using the removable input power connector on top of the power supply, apply 120 volts AC power between the two terminals marked “AC.” Connect the ground terminal to ground.
4. For the **SNAP-PS5U** (not illustrated): Using the removable input power connector on top of the power supply, apply 240 or 120 volts AC power between the two terminals marked “AC.” Connect the ground terminal to ground.
5. For the **SNAP-PS5-24DC** (illustrated below): Using the removable input power connector on top of the power supply, apply 24 volts DC power between the two terminals marked “±DC.” Connect the ground terminal to ground.



Loop Power Supply

Some analog modules (such as the SNAP-AIMA 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. Follow these steps to wire these power supplies.

1. Mount the SNAP-PS24 or SNAP-PS24U power supply in a location where the attached output power wires will reach the field connector for SNAP analog modules.

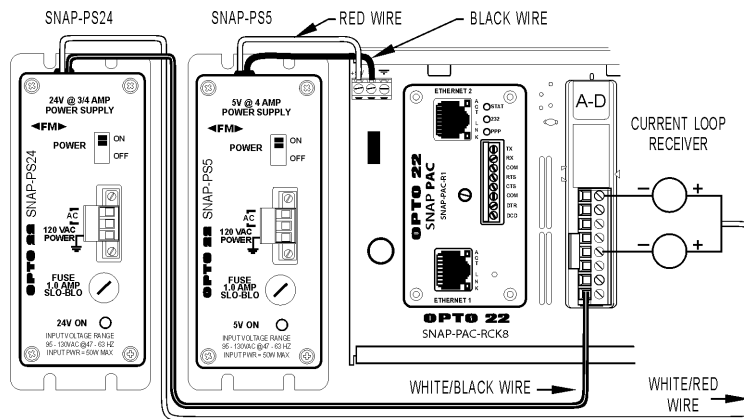
The white and red wire is the positive wire (24 VDC). The white and black wire is the negative wire (24 VDC return).

2. If you are wiring directly to the module, see the wiring diagram for the specific module you are using.

Examples for an input module are shown in the following diagrams.

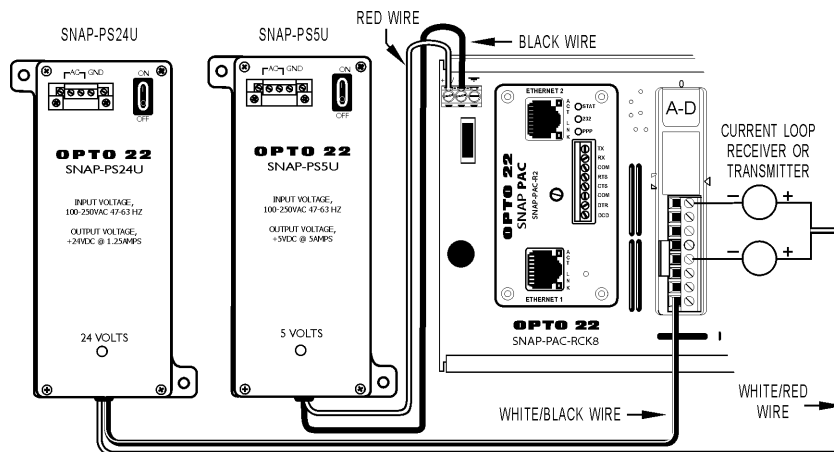
SNAP-PS24

In this diagram, the SNAP-PS24 power supply supplies power directly to the input module. The SNAP-PS5 supplies power to the rack.



SNAP-PS24U

Here, the SNAP-PS24U power supply supplies power directly to the input module. The SNAP-PS5U supplies power to the rack.



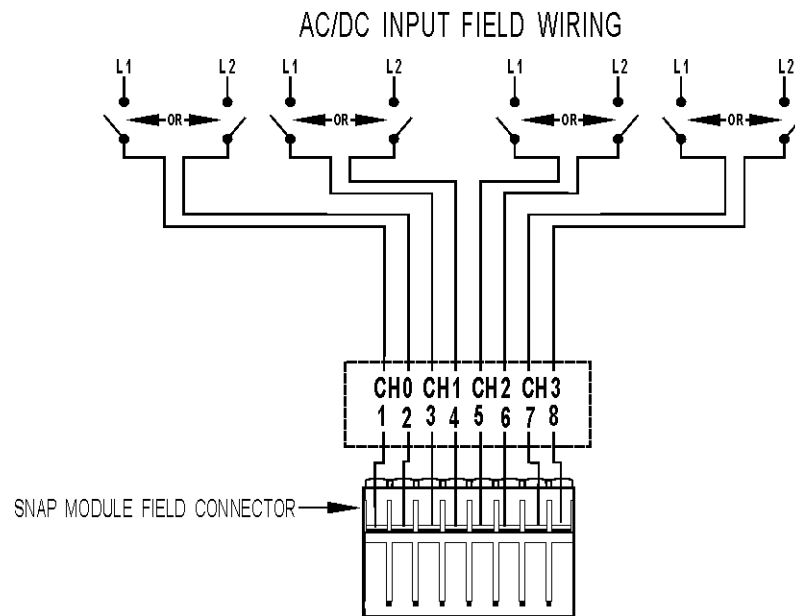
Wiring I/O Modules

See additional diagrams for wiring modules to SNAP TEX breakout boards, starting on [page 115](#).

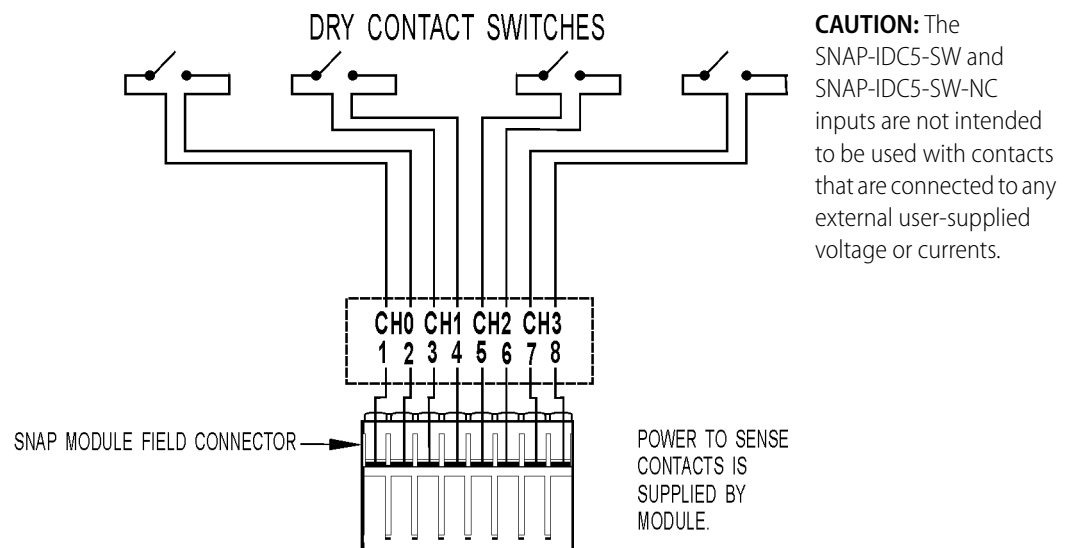
4-Channel Digital Input Modules

For high-density digital modules, see [page 83](#).

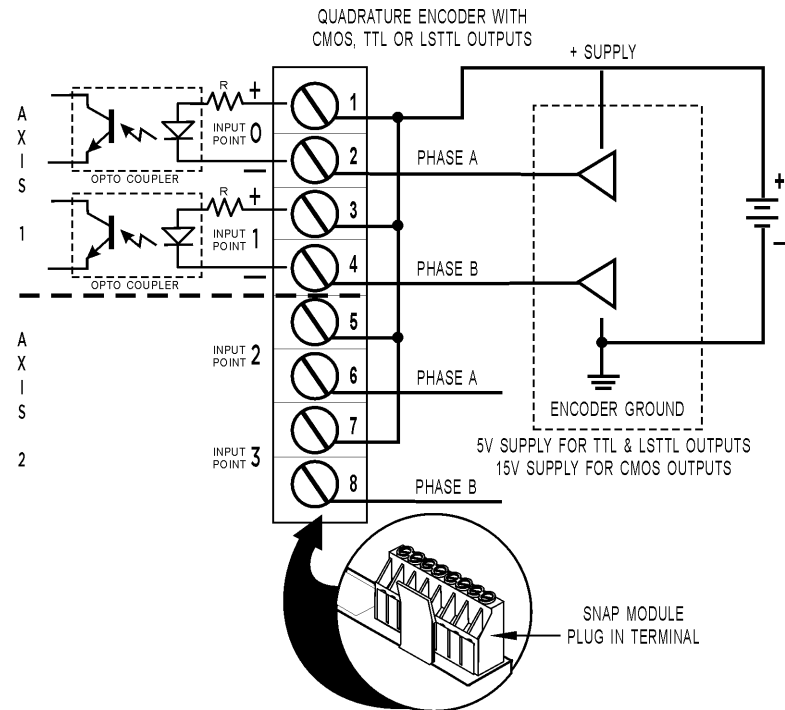
Wiring for most 4-channel digital input modules (except SNAP-IDC5-SW and SNAP-IDC5-SW-NC).



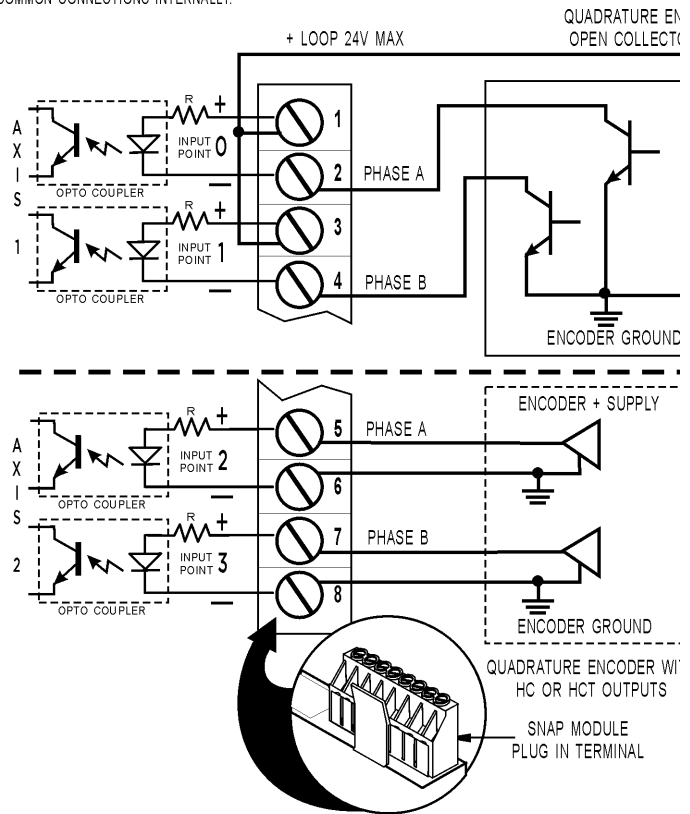
Wiring for SNAP-IDC5-SW and SNAP-IDC5-SW-NC digital input modules.



Wiring for SNAP-IDC5Q quadrature input module.



ALL INPUTS ARE ISOLATED FROM EACH OTHER
AND DO NOT SHARE ANY COMMON CONNECTIONS INTERNALLY.

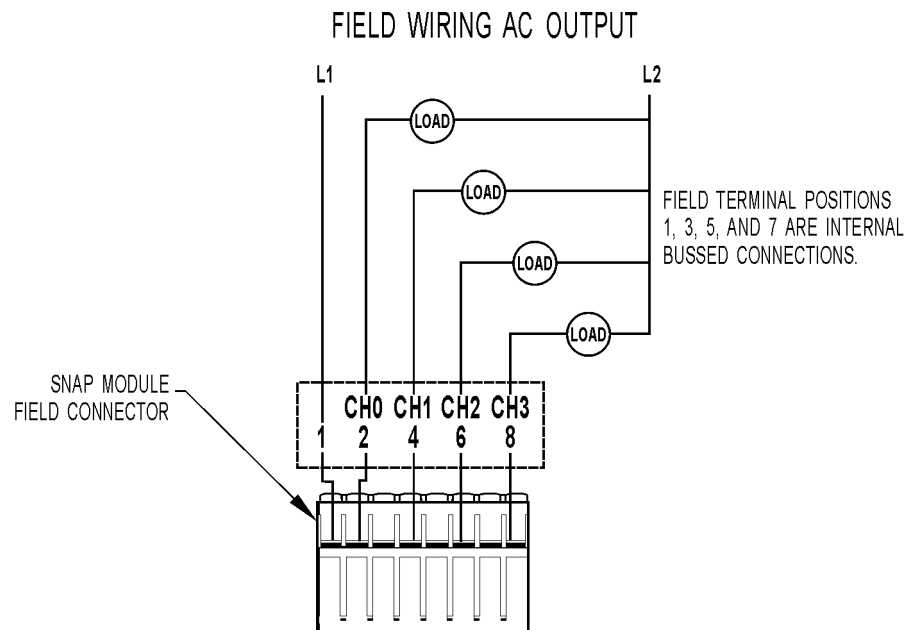


ALL INPUTS ARE ISOLATED FROM EACH OTHER
AND DO NOT SHARE ANY COMMON CONNECTIONS INTERNALLY.

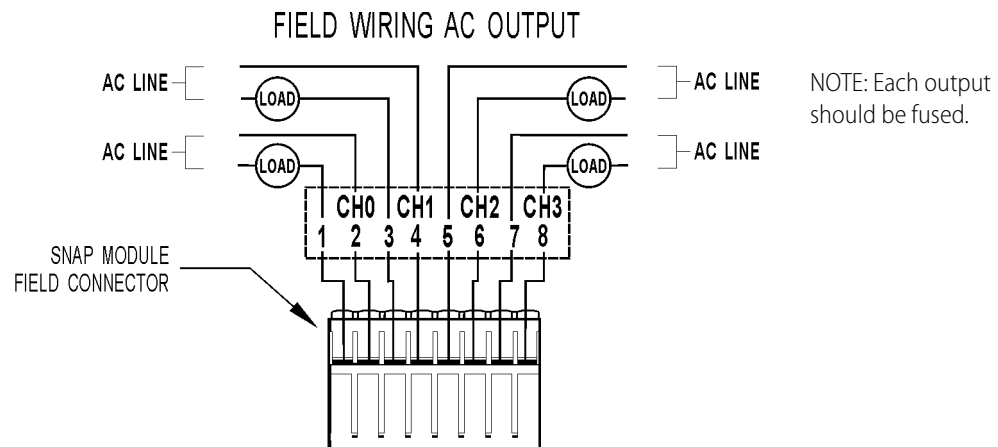
4-Channel Digital Output Modules

For high-density digital modules, see [page 83](#).

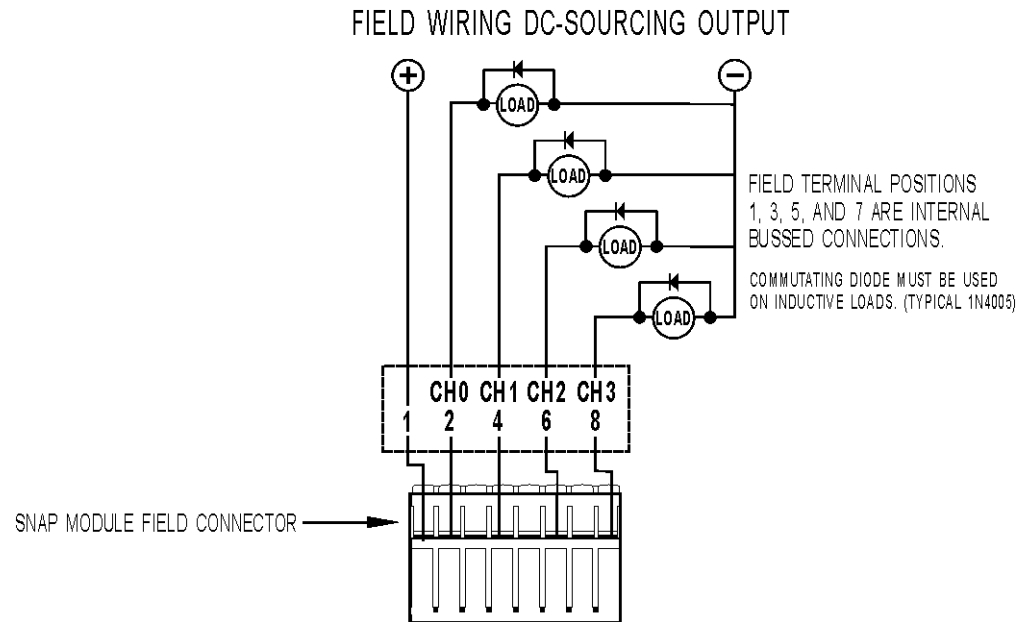
Wiring for SNAP-OAC5 and SNAP-OAC5FM digital AC output modules.



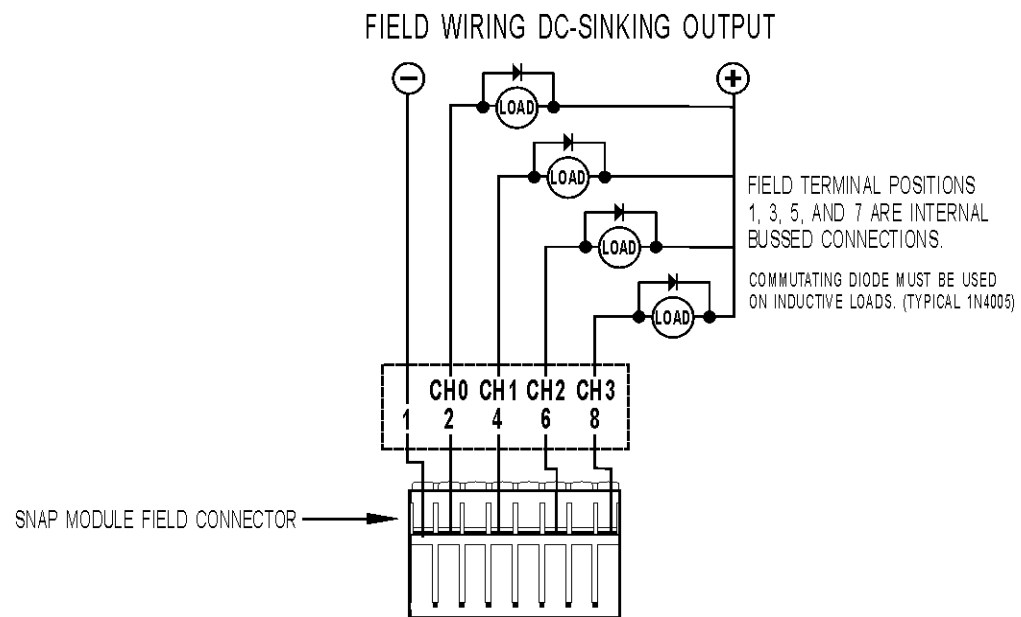
Wiring for SNAP-OAC5MA, SNAP-OAC5-i, and SNAP-OAC5-iFM digital AC output modules.



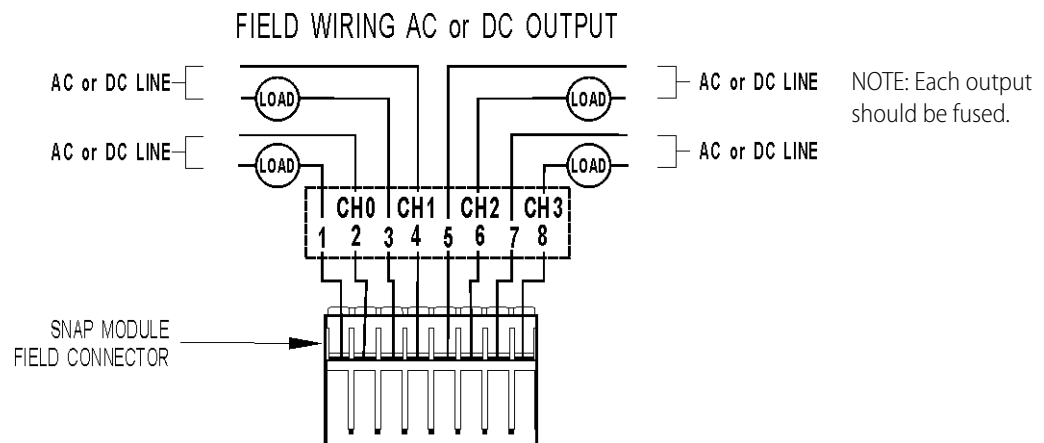
Wiring for SNAP-ODC5SRC and SNAP-ODC5SRCFM digital DC output modules.



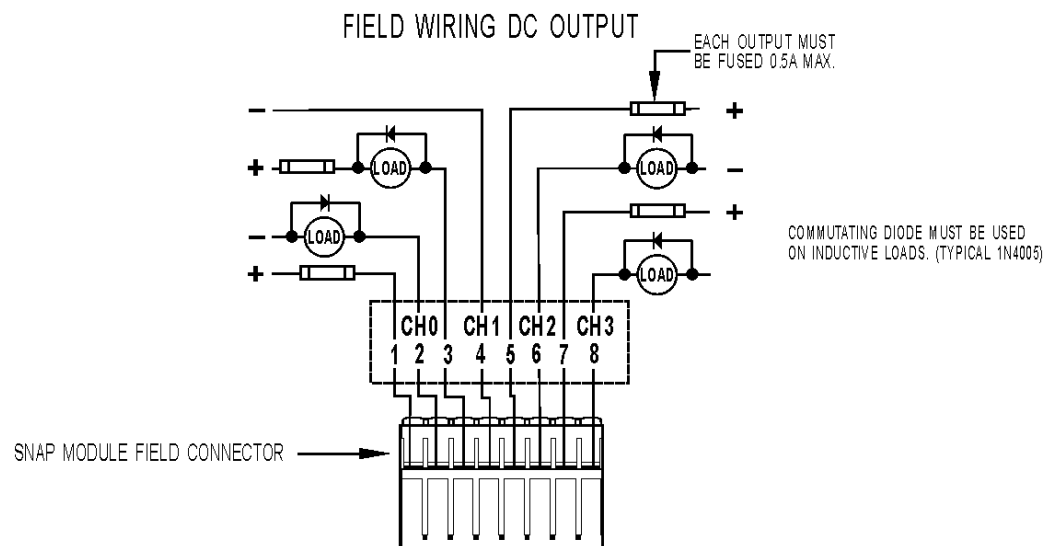
Wiring for SNAP-ODC5SNK, SNAP-ODC5ASNK, and SNAP-ODC5SNKFM digital DC output modules.



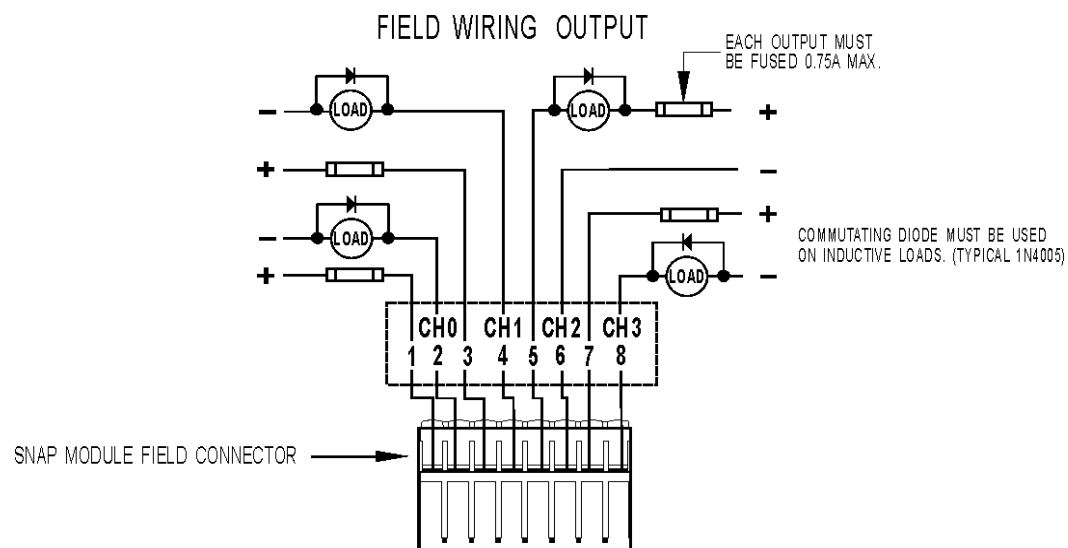
Wiring for SNAP-ODC5R, SNAP-ODC5R5, SNAP-ODC5RFM, and SNAP-ODC5R5FM dry contact output modules.



Wiring for SNAP-ODC5MA digital DC output module with manual/auto switches.



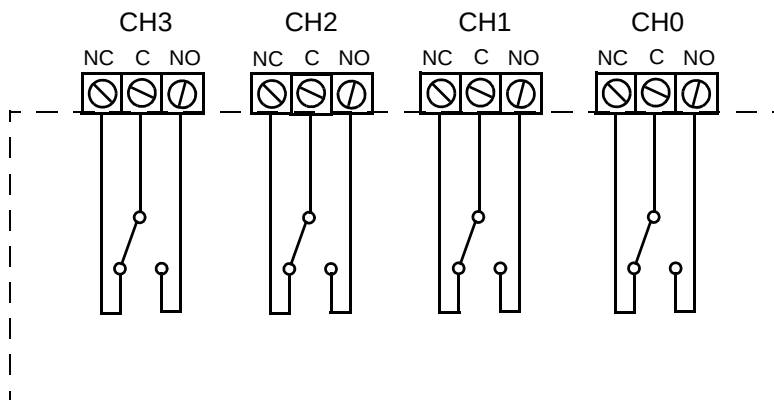
Wiring for SNAP-ODC5-i, SNAP-ODC5A-i, SNAP-ODC5-iFM, and SNAP-ODC5A-iFM isolated digital DC output modules.



Wiring for SNAP-OMR6-C and SNAP-OMR6-A mechanical power relay output modules.

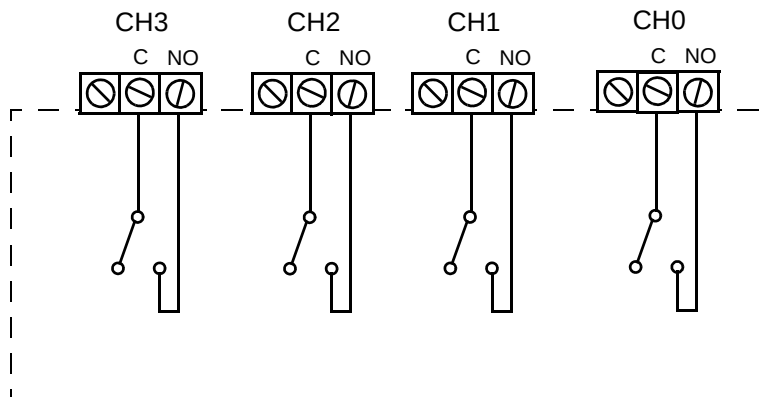
SNAP-OMR6-C

User must provide own fusing.



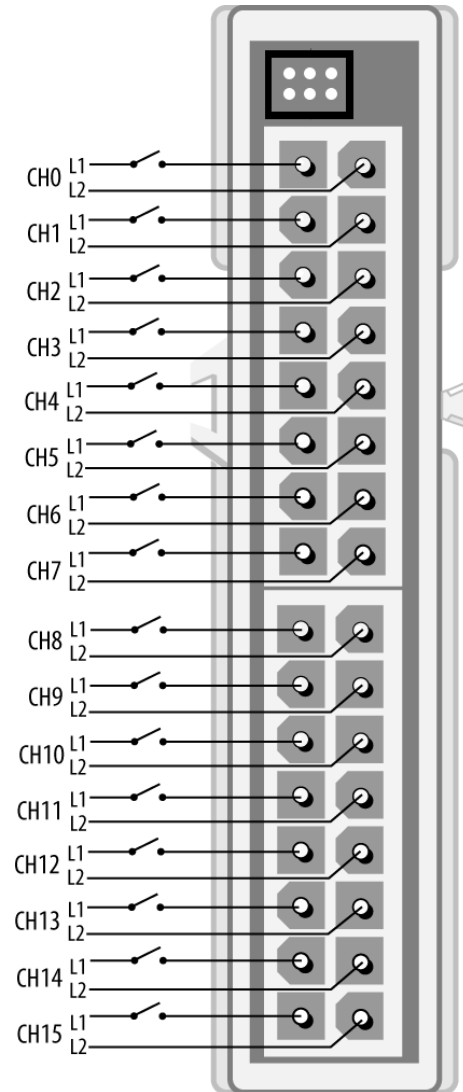
SNAP-OMR6-A

User must provide own fusing.

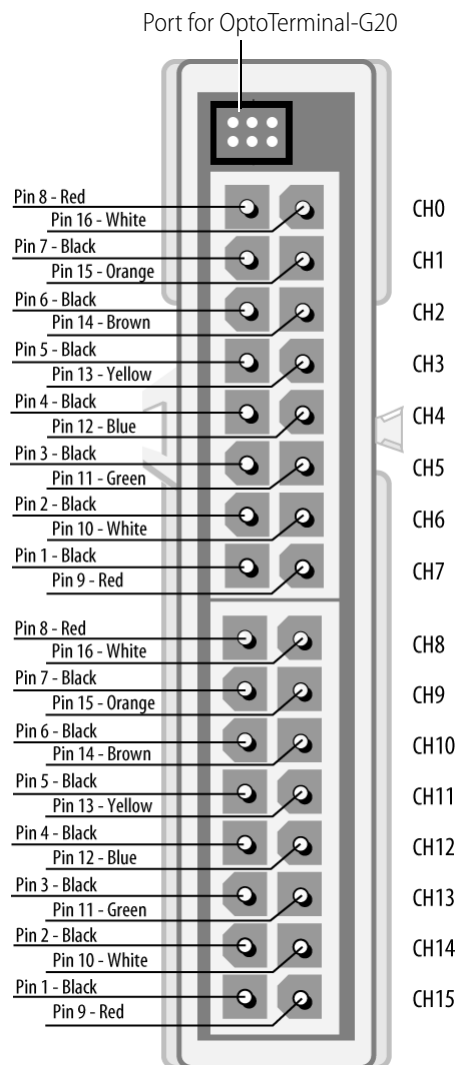


High-Density Digital Modules

Wiring for SNAP-IDC-16, SNAP-IDC-HT-16, SNAP-IAC-16, SNAP-IAC-A-16, and SNAP-IAC-K-16 digital input modules.



NOTE: The connectors on these modules are not polarity-sensitive. You can connect the positive lead (+) for each channel (or point) to either L1 or L2, and this can vary from point to point on the module.

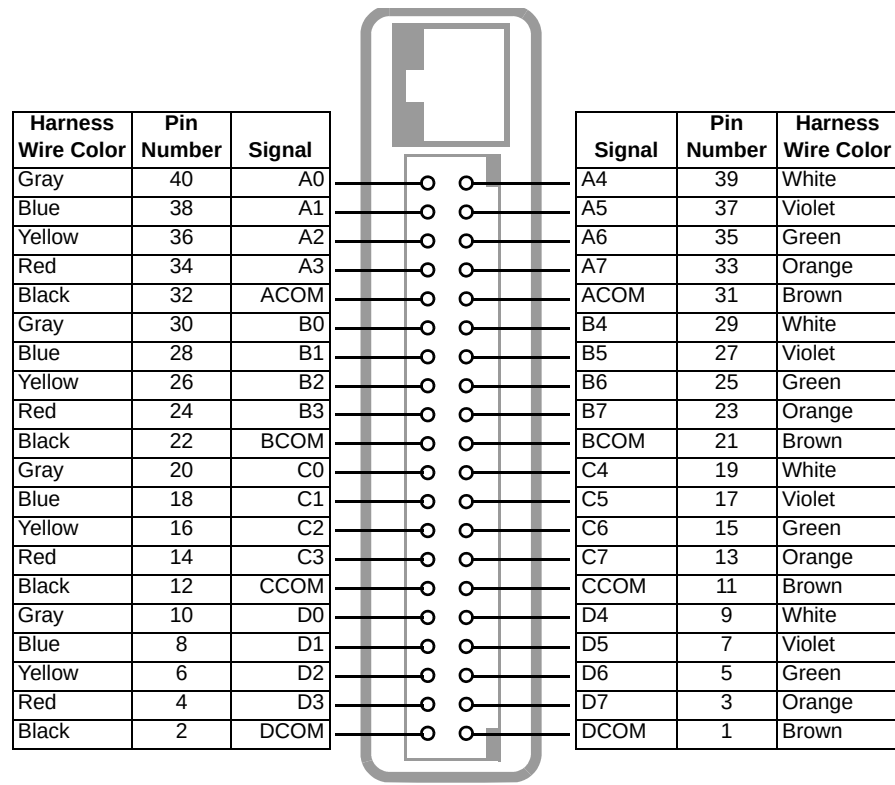


NOTES: The small four-pin connector on the top of the 16-point module connects to the optional OptoTerminal-G20 using a special adapter cable, included with the OptoTerminal.

The connectors on these modules are not polarity-sensitive. You can connect the positive lead (+) for each channel (or point) to either L1 or L2, and this can vary from point to point on the module.

See Opto 22 form 1547, the *SNAP High-Density Digital Module User's Guide*, for breakout rack wiring and jumper settings for the SNAP-IDC-HDB and SNAP-ODC-HDB and their -FM versions.

Wiring for high-density digital connector used with 32-channel input and output modules.



Connector wiring for SNAP-ODC-32-SNK, SNAP-ODC-32-SRC, SNAP-IDC-32, -FM versions, SNAP-IDC-32N, and SNAP-IDC-32DN (top view of module)

The following table shows 32-channel module connector wiring for the **SNAP-HD-CBF6** wiring harness. Wires from the wiring harness are grouped into four sets of color-coded wires. Use this table with the diagram above..

Set A			Set B			Set C			Set D		
Wires		Ch	Wires		Point	Wires		Point	Wires		Ch
A0	Gray	0	B0	Gray	8	C0	Gray	16	D0	Gray	24
A1	Blue	1	B1	Blue	9	C1	Blue	17	D1	Blue	25
A2	Yellow	2	B2	Yellow	10	C2	Yellow	18	D2	Yellow	26
A3	Red	3	B3	Red	11	C3	Red	19	D3	Red	27
A4	White	4	B4	White	12	C4	White	20	D4	White	28
A5	Violet	5	B5	Violet	13	C5	Violet	21	D5	Violet	29
A6	Green	6	B6	Green	14	C6	Green	22	D6	Green	30
A7	Orange	7	B7	Orange	15	C7	Orange	23	D7	Orange	31

For additional information, see form #1547, the *SNAP High-Density Digital Module User's Guide*.

Wiring for SNAP-IDC-32, SNAP-IDC-32-FM, SNAP-IDC-32N, and SNAP-IDC-32DN high-density digital inputs.

Also see wiring for connector on [page 85](#).

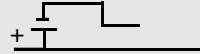
IMPORTANT: SNAP-IDC-32 modules are polarity specific and must be wired as shown.

**Polarity for
SNAP-IDC-32N (-10 to -32 V)
SNAP-IDC-32DN (-2.5 to -12 V)**

-10 to -32 VDC or
-2.5 to -12 VDC



-10 to -32 VDC or
-2.5 to -12 VDC



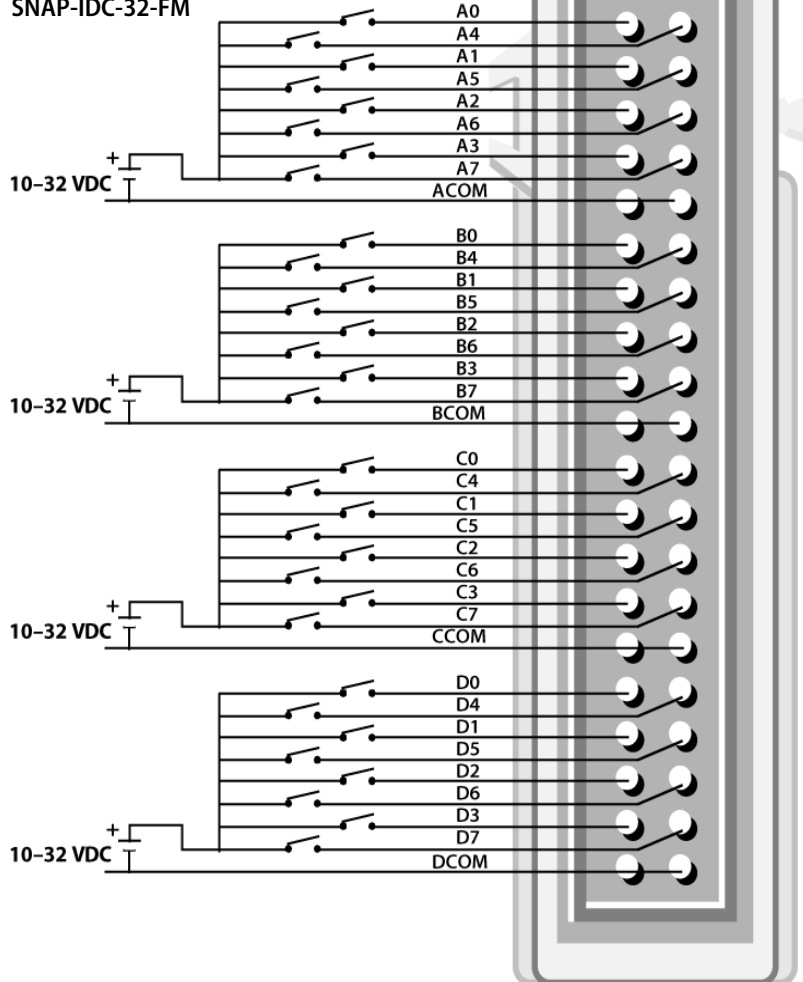
-10 to -32 VDC or
-2.5 to -12 VDC



-10 to -32 VDC or
-2.5 to -12 VDC



**Polarity for
SNAP-IDC-32
SNAP-IDC-32-FM**



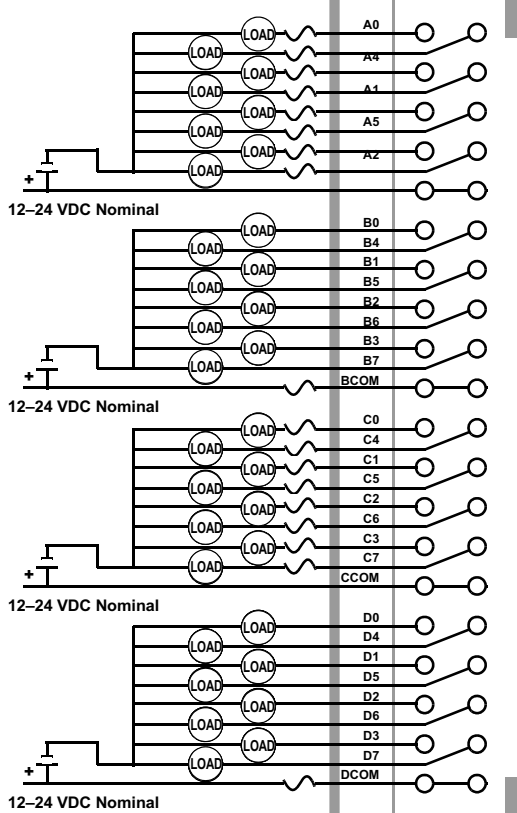
Wiring for SNAP-ODC-32-SNK and SNAP-ODC-32-SRC high-density digital outputs.

Also applies to SNAP-ODC-32-SNK-FM and SNAP-ODC-32-SRC-FM.

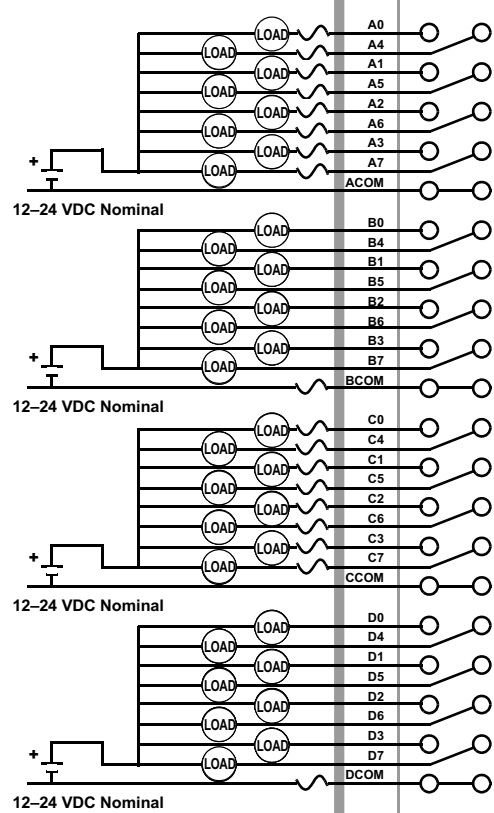
Also see wiring for connector on [page 85](#).

FUSING

For both sourcing and sinking modules, either fuse each point (as shown in the first and third groups, below) or fuse each group of points (as shown in the second and fourth groups).



SNAP-ODC-32-SRC
Load Sourcing Module
(Top view of module)



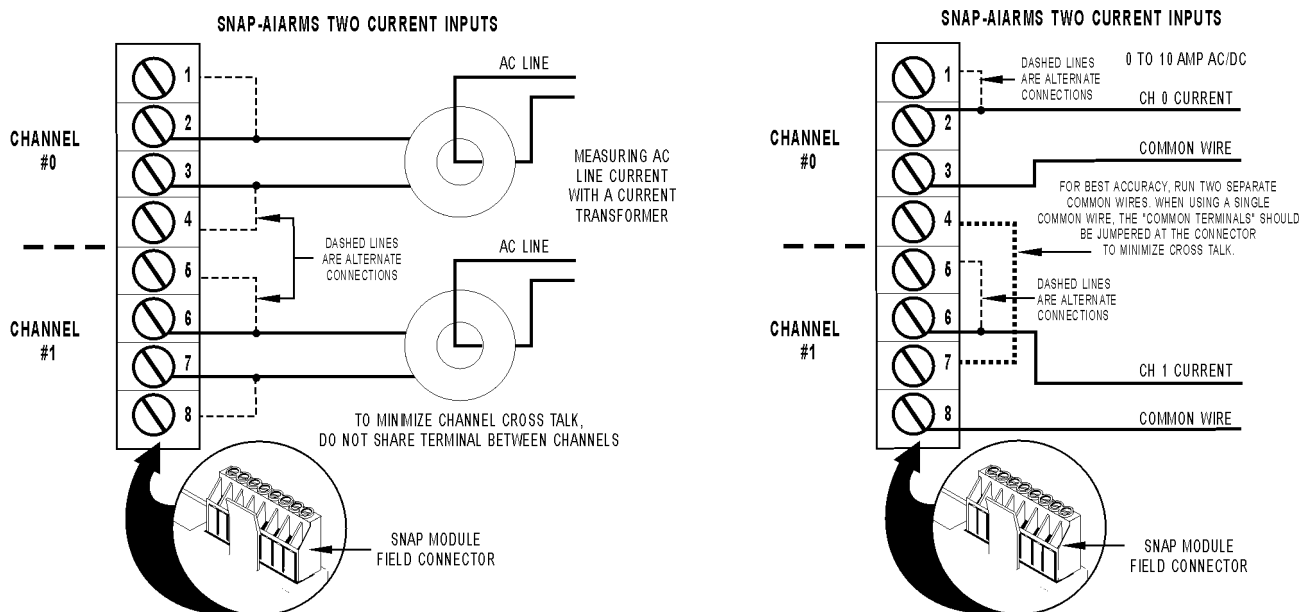
SNAP-ODC-32-SNK
Load Sinking Module
(Top view of module)

Analog Input Modules

Wiring for SNAP-AIARMS analog amps RMS AC/DC input.

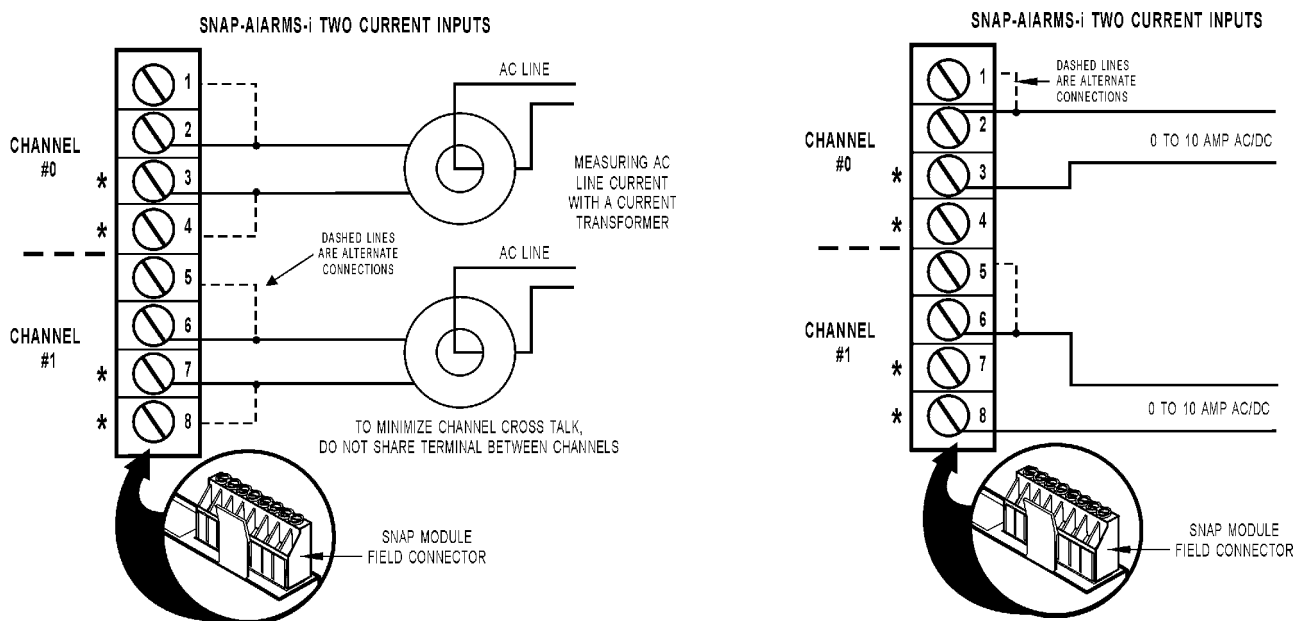
Two possible wiring diagrams are shown.

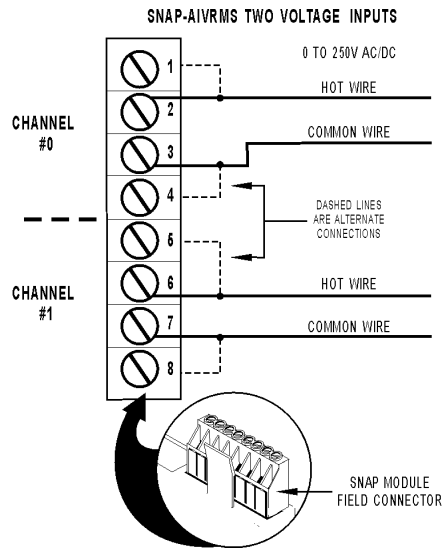
Terminals 3, 4, 7, and 8 share a common connection inside the module. **Make sure you observe polarity** when connecting the second channel. To avoid a potentially hazardous short, double-check wiring before turning on the current to be monitored.



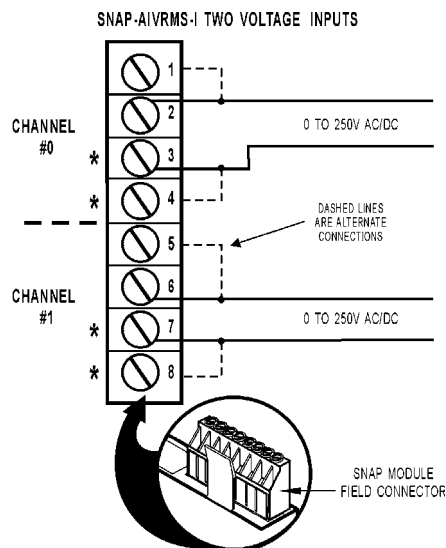
Wiring for SNAP-AIARMS-i and SNAP-AIARMS-i-FM isolated analog amps RMS AC/DC inputs.

Two possible wiring diagrams are shown. The module's two points are isolated from each other.

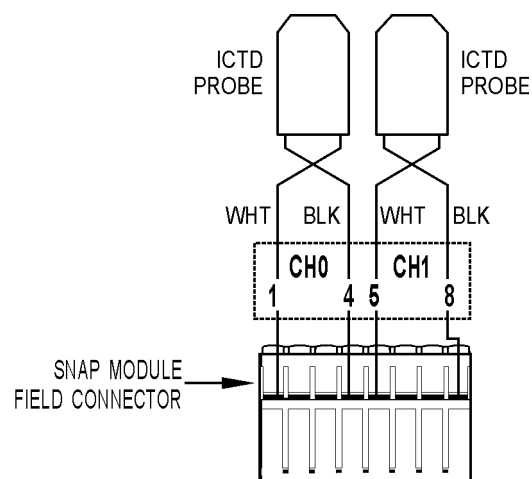
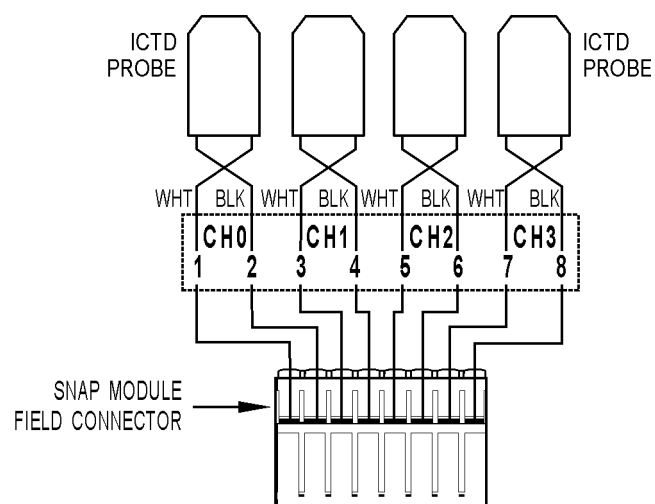


Wiring for SNAP-AIVRMS analog volts RMS AC/DC input.

Terminals 3, 4, 7, and 8 share a common connection inside the module. **Make sure you observe polarity** when connecting the second channel. To avoid a potentially hazardous short, double-check wiring before turning on the voltage to be monitored.

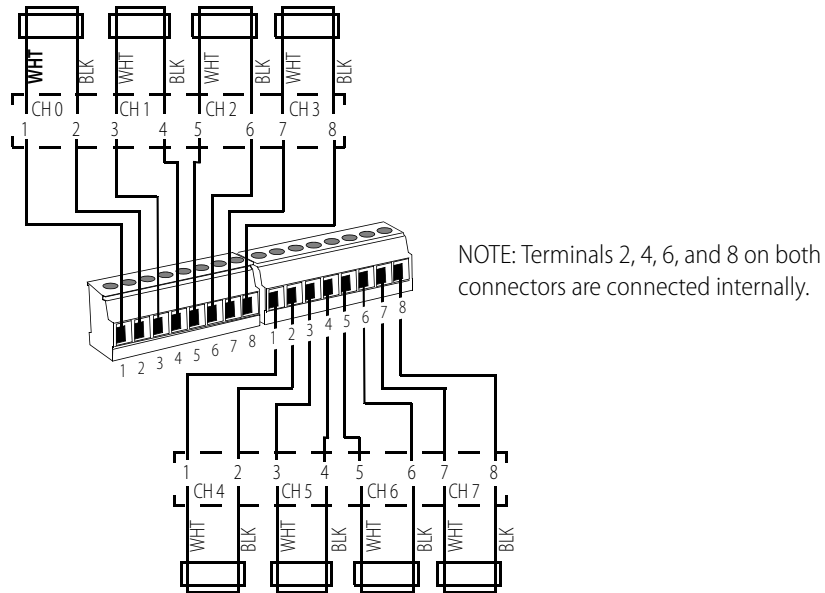
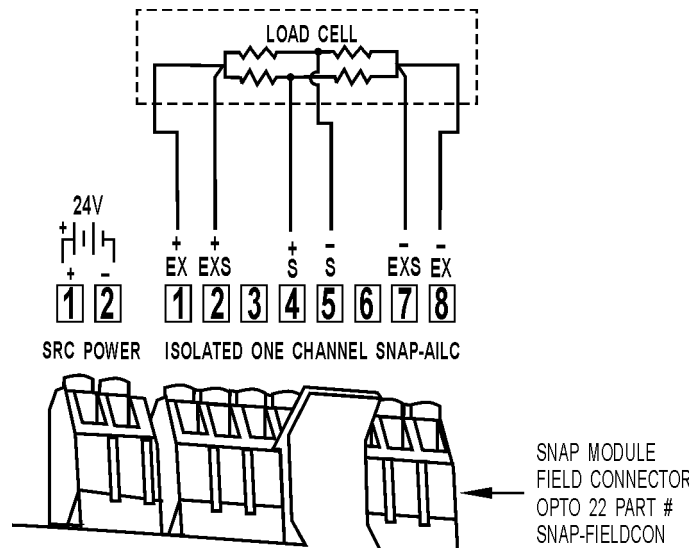
Wiring for SNAP-AIVRMS-i and SNAP-AIVRMS-i-FM isolated analog volts RMS AC/DC inputs.

The two points on these modules are isolated from each other.

Wiring for SNAP-AICTD two-channel analog temperature input.**Wiring for SNAP-AICTD-4 four-channel analog temperature input.**

Wiring for SNAP-AICTD-8 eight-channel analog temperature input.

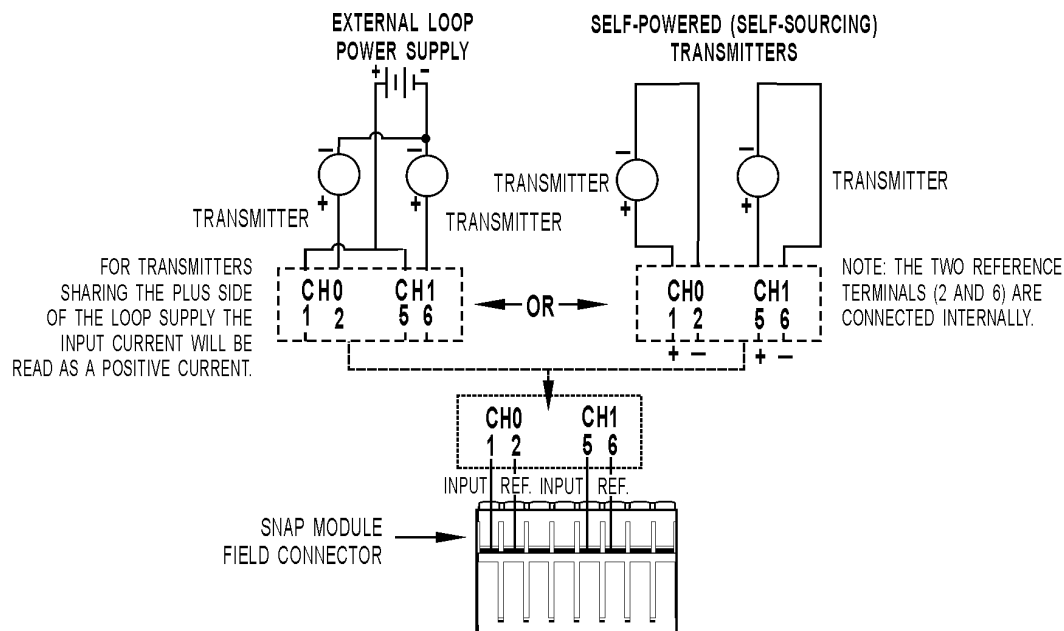
ICTD Source

**Wiring for SNAP-AILC and SNAP-AILC-2 load cell inputs.**

Wiring for SNAP-AIMA two-channel analog current input.

Since all inputs share a common reference, the module must be installed at the beginning or end of a typical 4–20 mA loop. If you are using both standard and self-sourcing transmitters, either put the transmitters on different modules, or use different power supplies. Do not use standard and self-sourcing transmitters on the same module.

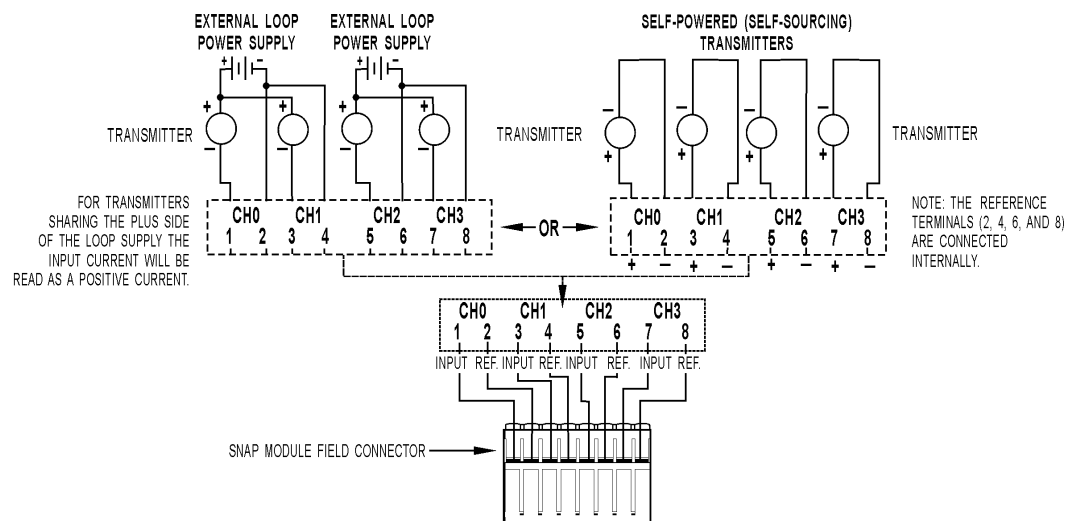
This module does NOT supply loop excitation current.



Wiring for SNAP-AIMA-4 four-channel analog current input.

Since all inputs share a common reference, the module must be installed at the beginning or end of a typical 4–20 mA loop. If you are using both standard and self-sourcing transmitters, either put the transmitters on different modules, or use different power supplies. Do not use standard and self-sourcing transmitters on the same module.

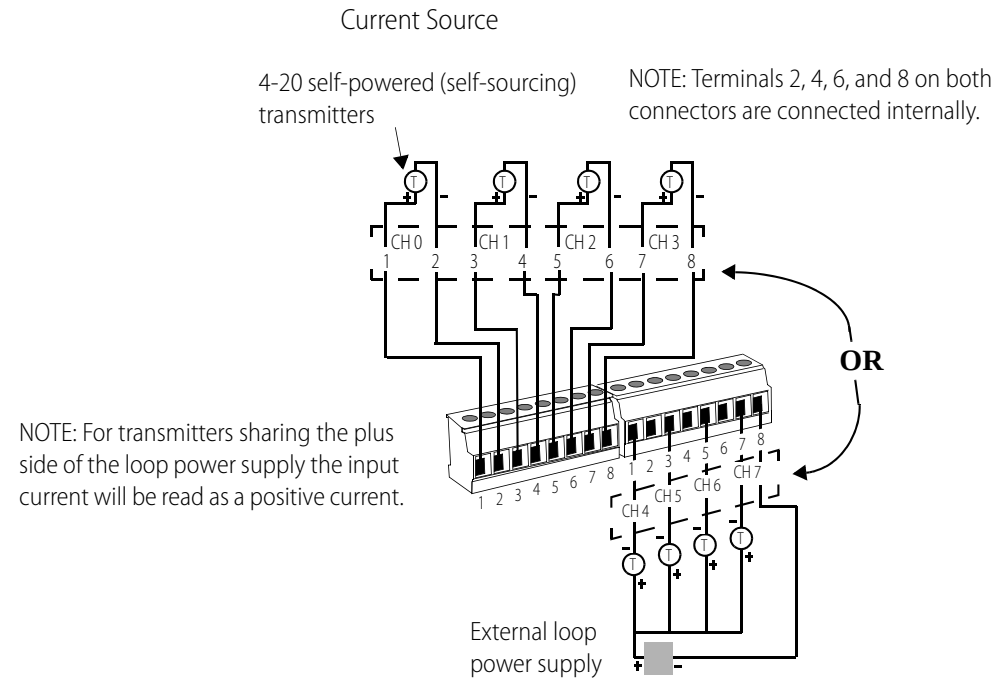
This module does NOT supply loop excitation current.



Wiring for SNAP-AIMA-8 eight-channel analog current input.

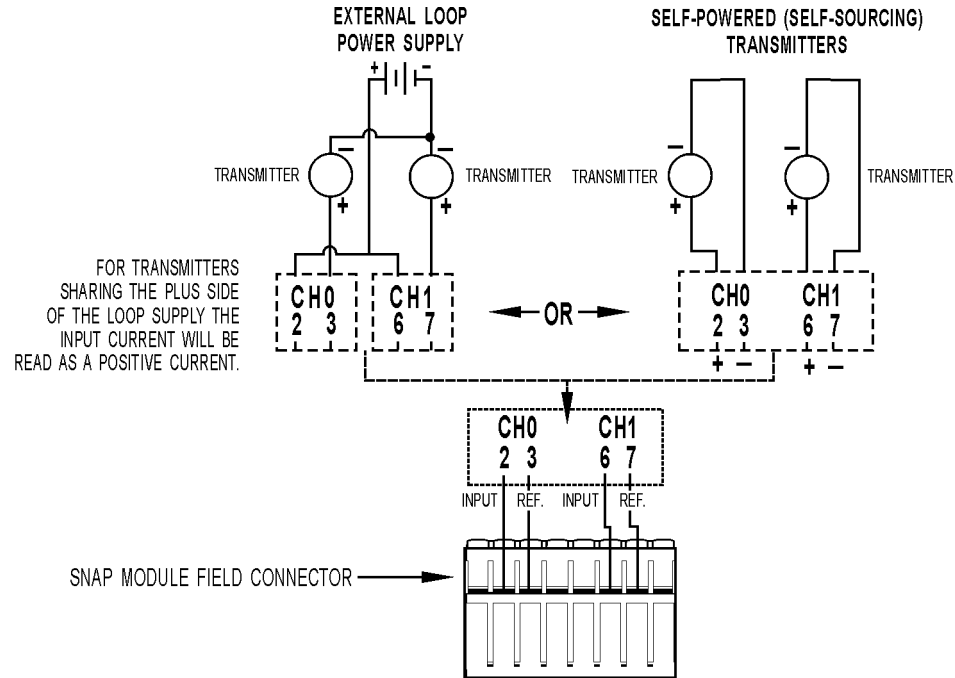
Since all inputs share a common reference, the module must be installed at the beginning or end of a typical 4–20mA loop. If you are using both standard and self-sourcing transmitters, either put the transmitters on different modules, or use different power supplies. Do not use standard and self-sourcing transmitters on the same module.

This module does NOT supply loop excitation current.



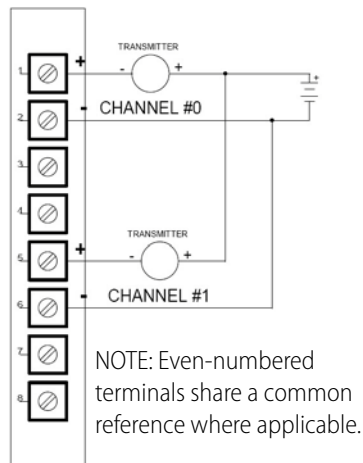
Wiring for SNAP-AIMA-i and SNAP-AIMA2-i isolated two-channel analog current inputs.

The two channels are isolated from each other.
This module does NOT supply loop excitation current.

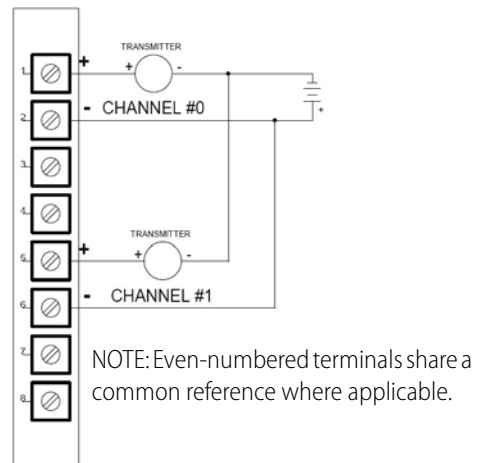


SNAP-AIMA Wiring: Positive Common vs. Negative Common Connections.

The following diagrams apply to SNAP-AIMA-2, SNAP-AIMA-4, and SNAP-AIMA-8 modules.



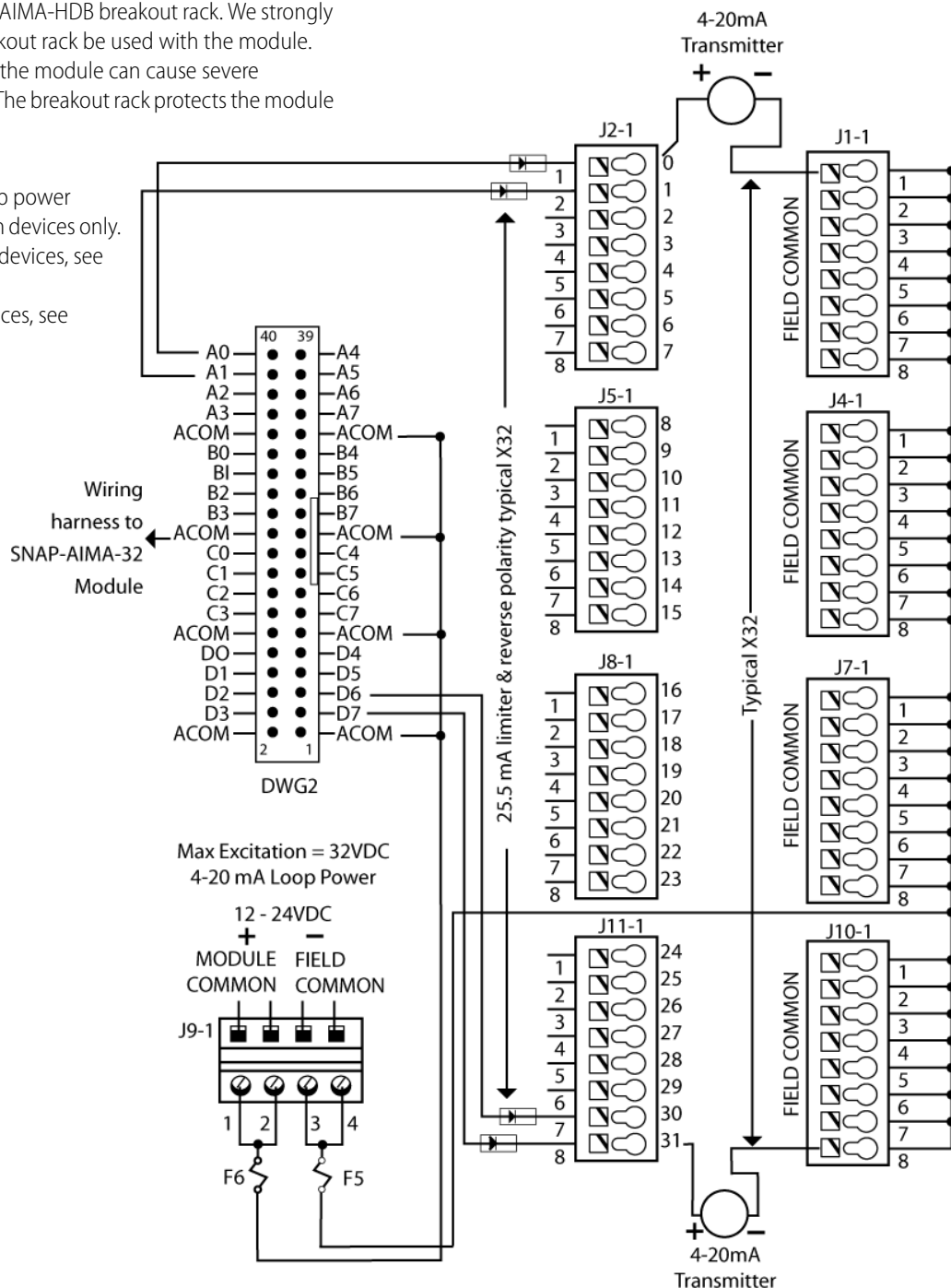
SNAP-AIMA
For transmitters sharing the plus side of the loop supply. Note that input current will be read as a positive current.



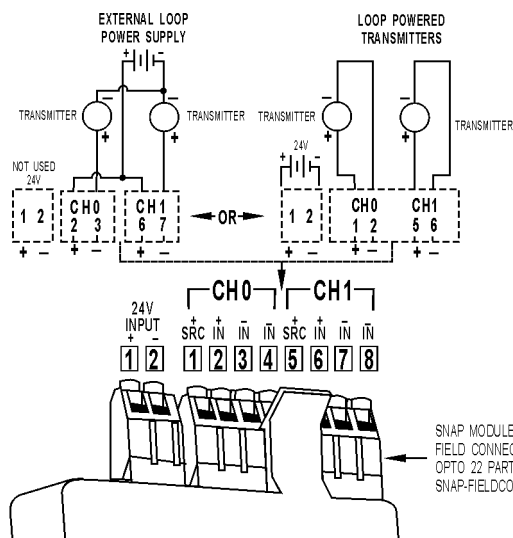
SNAP-AIMA
For transmitters sharing the minus side of the loop supply. Note that input current will be read as a negative current.

This module does NOT supply loop excitation current. NOTE: if you are using the module with loop

The following diagram shows wiring from the SNAP-AIMA-32 (or -FM) module to the SNAP-AIMA-HDB breakout rack. We strongly recommend that the breakout rack be used with the module. Miswiring of any point on the module can cause severe out-of-warranty damage. The breakout rack protects the module from many wiring errors.

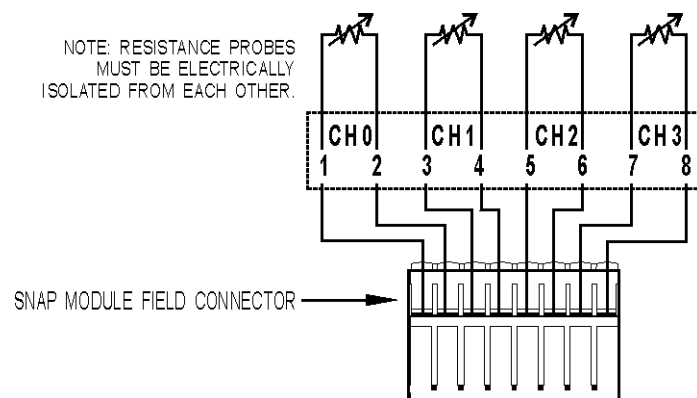


Wiring for SNAP-AIMA-iSRC and SNAP-AIMA-iSRC-FM isolated two-channel analog current inputs.



The two channels are isolated from each other. This module DOES supply loop excitation current.

Wiring for SNAP-AIR40K-4 analog thermistor input.

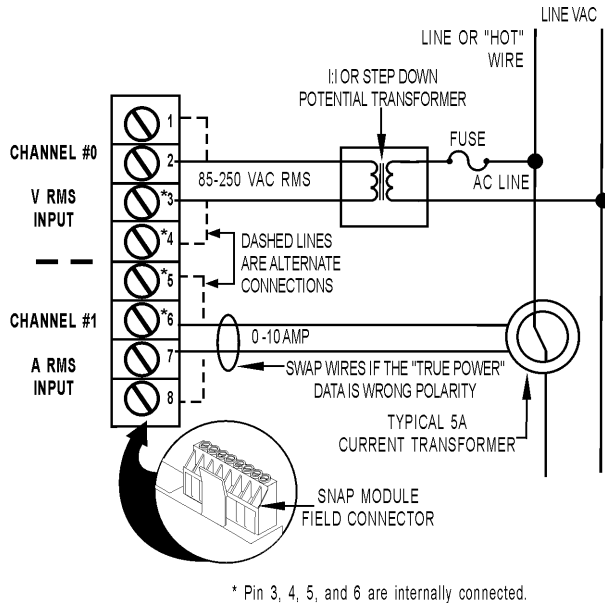


Wiring for SNAP-AIPM analog power monitoring input.

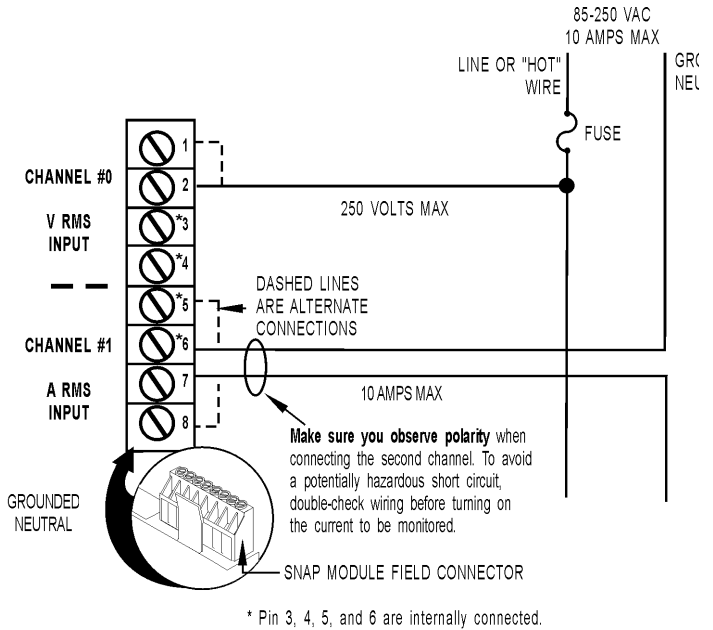
For more information about this module, see Opto 22 form #1453, the SNAP-AIPM Modules data sheet.

CAUTION: These terminals share a common connection inside the module. **Make sure you observe polarity** when connecting the second channel. To avoid a potentially hazardous short, double-check wiring before turning on the current to be monitored.

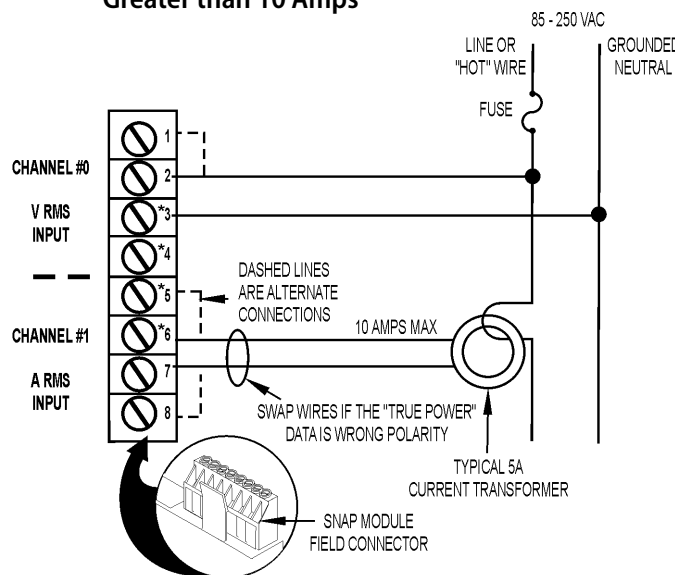
Measuring AC Line Current with a Current Transformer



Standard Wiring Diagram



Measuring AC Line Current Greater than 10 Amps



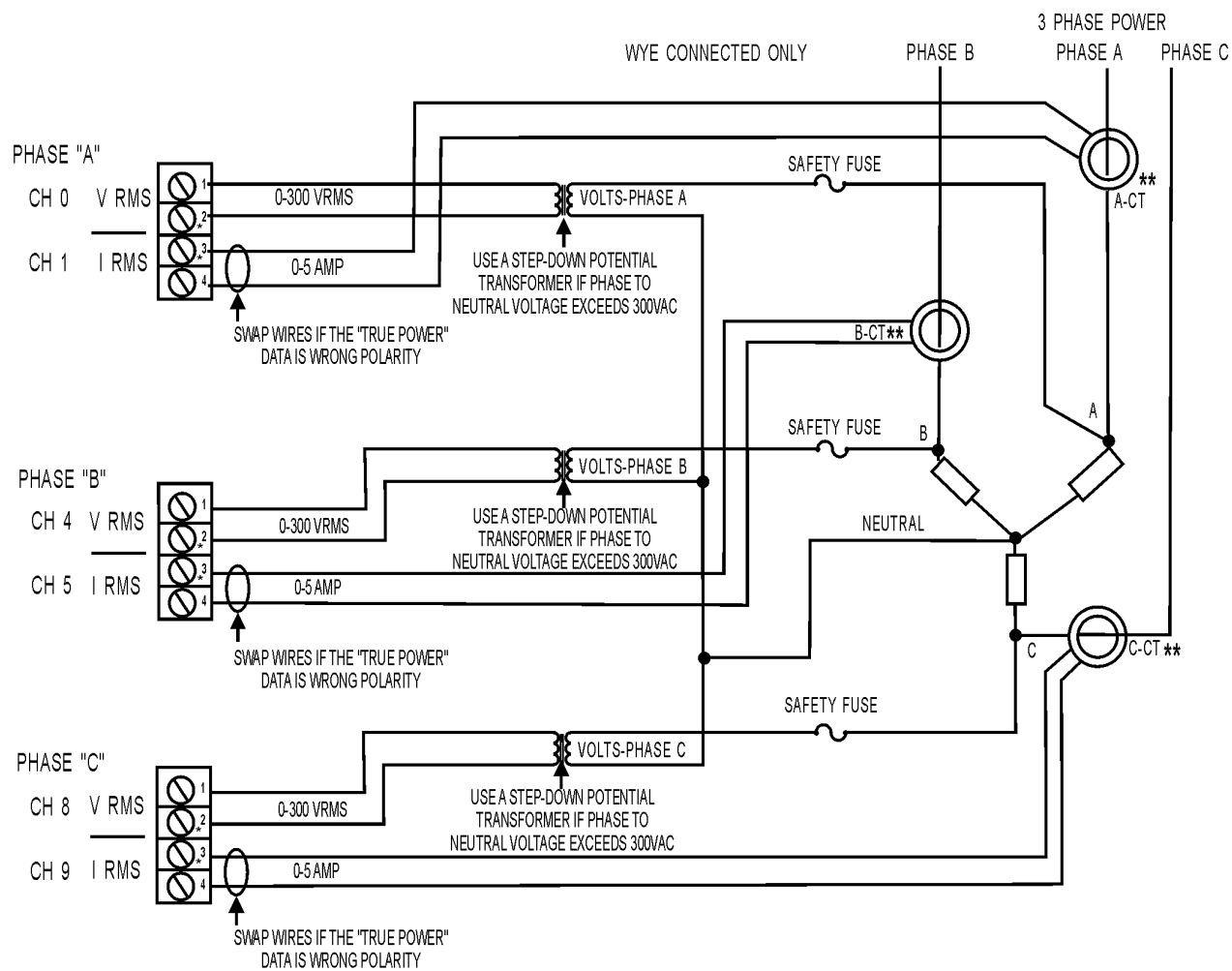
Wiring for SNAP-AIPM-3 analog 3-phase power monitoring input.

See instructions for scaling this module in form #1453, the SNAP-AIPM Modules data sheet.

CAUTION: Be very careful when connecting input channels. **Do not connect line voltage to the current input channel;** such a connection will cause **severe damage** to the module. This damage is **not covered by warranty**. Use a current transformer instead.

CAUTION: Use caution when selecting wire gauges for your application. Use conservative wire gauges with proper voltage ratings.

CAUTION: Terminals 2 and 3 share a common connection inside the module. **Make sure you observe polarity** when connecting the second channel. To avoid a potentially hazardous short circuit, double-check wiring before turning on the current to be monitored.



* Pins 2+3 are internally connected

** Typically a 5A current transformer is used.

Using this wiring, after you scale the module, the following measurements are available. All measurements are synchronously updated every second:

- | | |
|--|--|
| <ul style="list-style-type: none"> Individual phase to neutral voltage Individual phase and load current Individual phase power Individual phase volt-amps | <ul style="list-style-type: none"> 3-phase sum of 1 sec.—signed energy (watt seconds) 3-phase sum of 1 sec.—unsigned energy (watt sec) |
|--|--|

CAUTION: The SNAP-AIPM-3 module does not contain a fuse. Protect the system by adding a fuse.

Suggested vendors

Protection fuses: www.littelfuse.com
Voltage and current transformers: www.crmagnetics.com

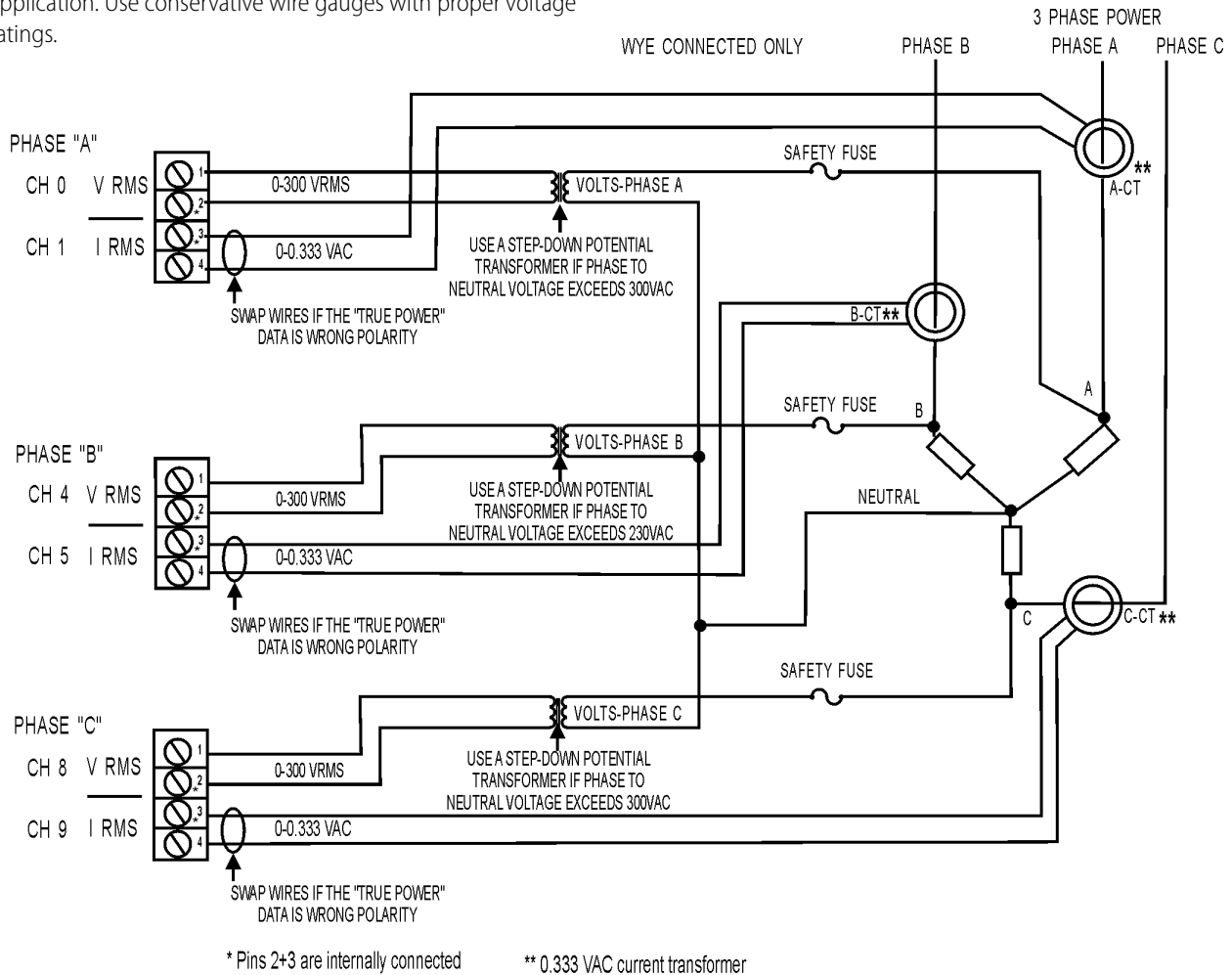
Wiring for SNAP-AIPM-3V analog 3-phase power monitoring input.

See instructions for scaling this module in form #1453, the SNAP-AIPM Modules data sheet.

CAUTION: Be very careful when connecting input channels. **Do not connect line voltage to the current input channel;** such a connection will cause **severe damage** to the module. This damage is **not covered by warranty**. Use a current transformer instead. Use identical CTs on all phases.

CAUTION: Use caution when selecting wire gauges for your application. Use conservative wire gauges with proper voltage ratings.

CAUTION: Terminals 2 and 3 share a common connection inside the module. **Make sure you observe polarity** when connecting the second channel. To avoid a potentially hazardous short circuit, double-check wiring before turning on the current to be monitored.



Using this wiring, after you scale the module, the following measurements are available. All measurements are synchronously updated every second:

- | | |
|--|--|
| <ul style="list-style-type: none"> Individual phase to neutral voltage Individual phase and load current Individual phase power Individual phase volt-amps | <ul style="list-style-type: none"> 3-phase sum of 1 sec.—signed energy (watt seconds) 3-phase sum of 1 sec.—unsigned energy (watt sec) |
|--|--|

Suitable **current transformers (CTs)** for use with the SNAP-AIPM-3V are available from Opto 22. See form #1938, the [Split-Core Current Transformers Data Sheet](#).

CAUTION: The SNAP-AIPM-3 module does not contain a fuse. Protect the system by adding a fuse.

Suggested vendors

Protection fuses:

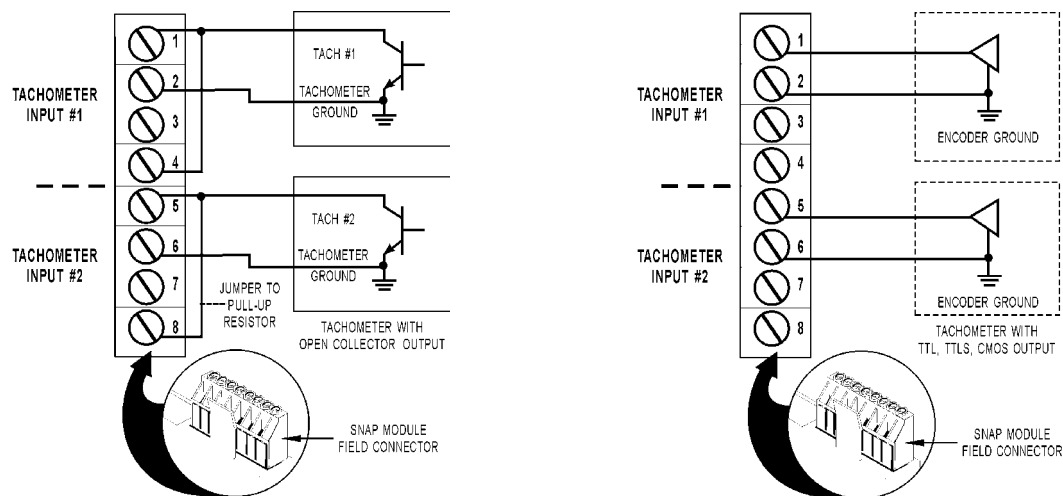
<http://www.littelfuse.com>

Voltage and current transformers:

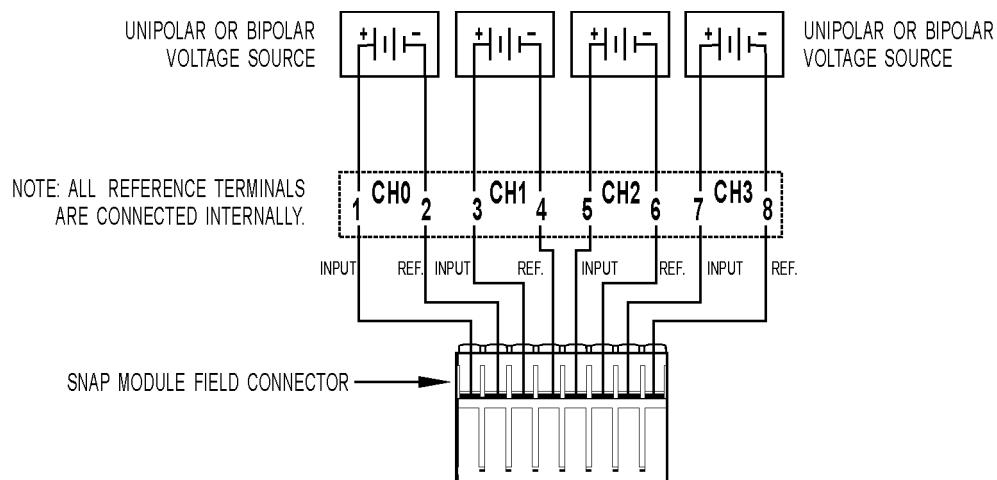
<http://www.crmagnetics.com>

Wiring for SNAP-AIRATE analog rate input.

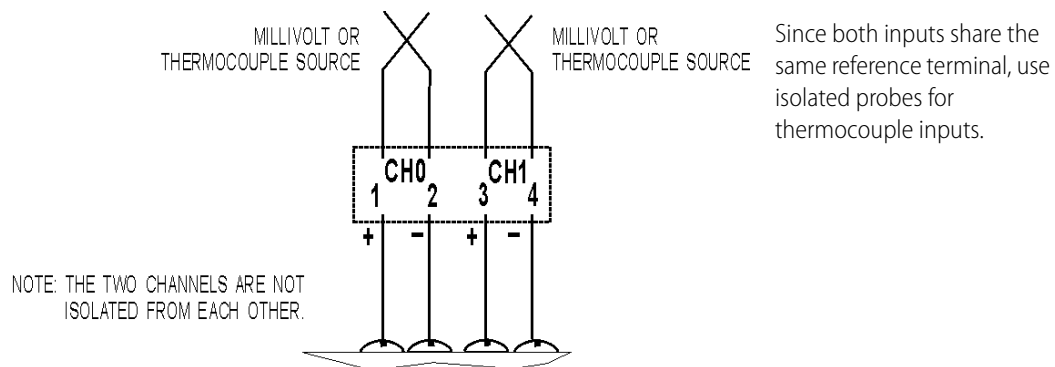
Two possible wiring diagrams are shown:



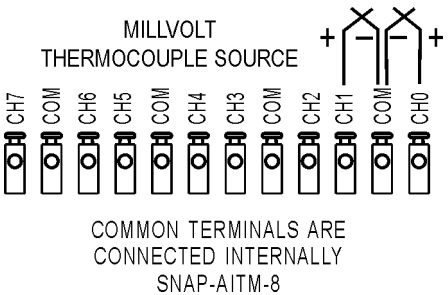
Wiring for SNAP-AIMV-4 and AIMV2-4 analog millivolt inputs.



Wiring for SNAP-AITM and SNAP-AITM-2 analog thermocouple/millivolt inputs.



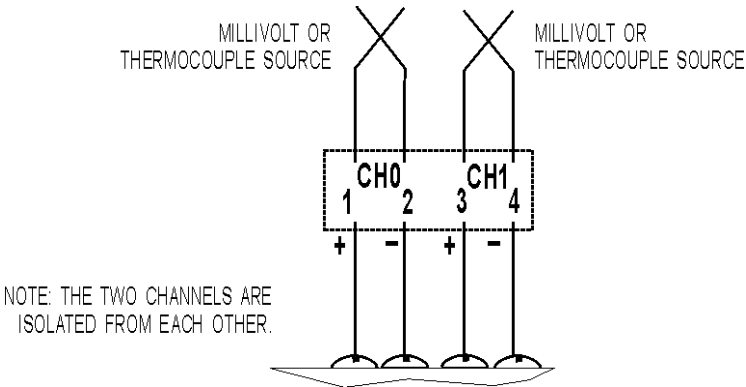
Wiring for SNAP-AITM-8 and SNAP-AITM-8-FM analog thermocouple/millivolt inputs.



NOTE: For best accuracy, wire all points before calibrating, and short all unused channels.

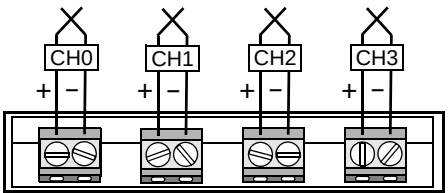
Since all inputs share the same reference terminal, use isolated probes for thermocouple inputs.

Wiring for SNAP-AITM-i and SNAP-AITM2-i isolated analog thermocouple/millivolt inputs.

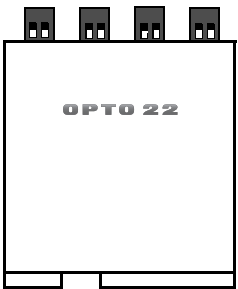


Since these channels do not share any common connections, grounded sensors and field devices may be used with them.

Wiring for SNAP-AITM-4i isolated analog thermocouple/millivolt input. .

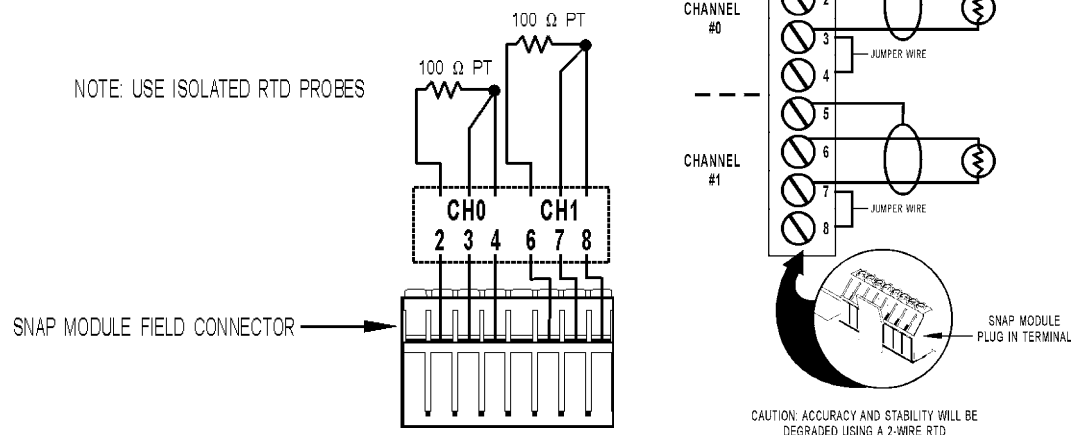


The four channels on the module are isolated from each other. Since these channels do not share any common connections, grounded sensors and field devices may be used with them.

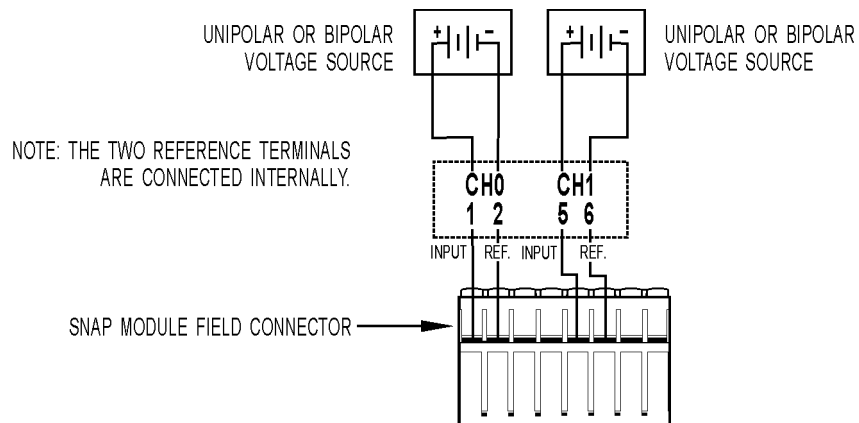


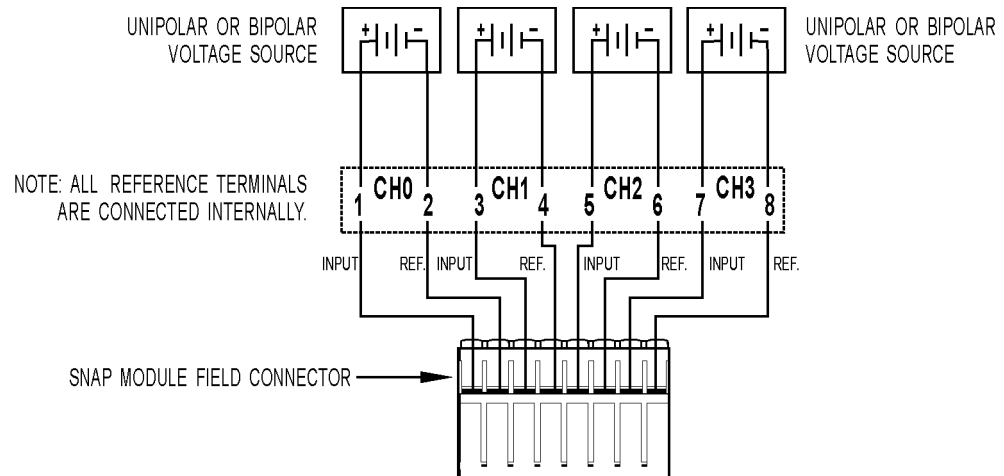
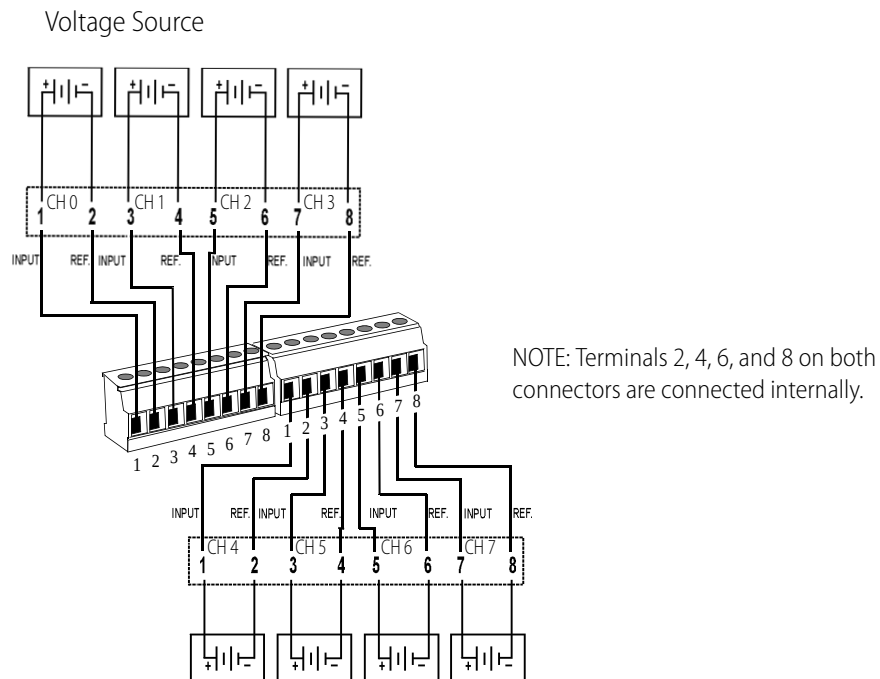
Wiring for SNAP-AIRTD analog RTD input.

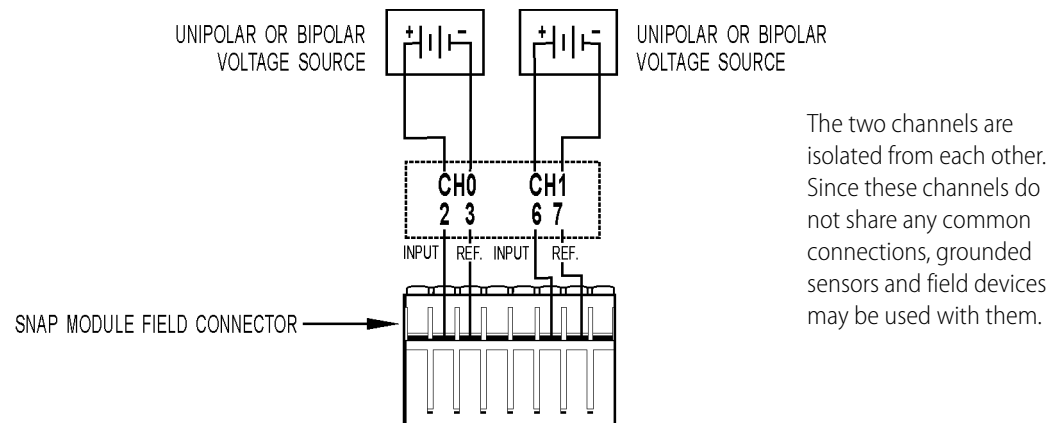
The SNAP-AIRTD is designed for three-wire connections, shown in the diagram at right.



Wiring for SNAP-AIV two-channel analog voltage input.



Wiring for SNAP-AIV-4 four-channel analog voltage input.**Wiring for SNAP-AIV-8 eight-channel analog voltage input.**

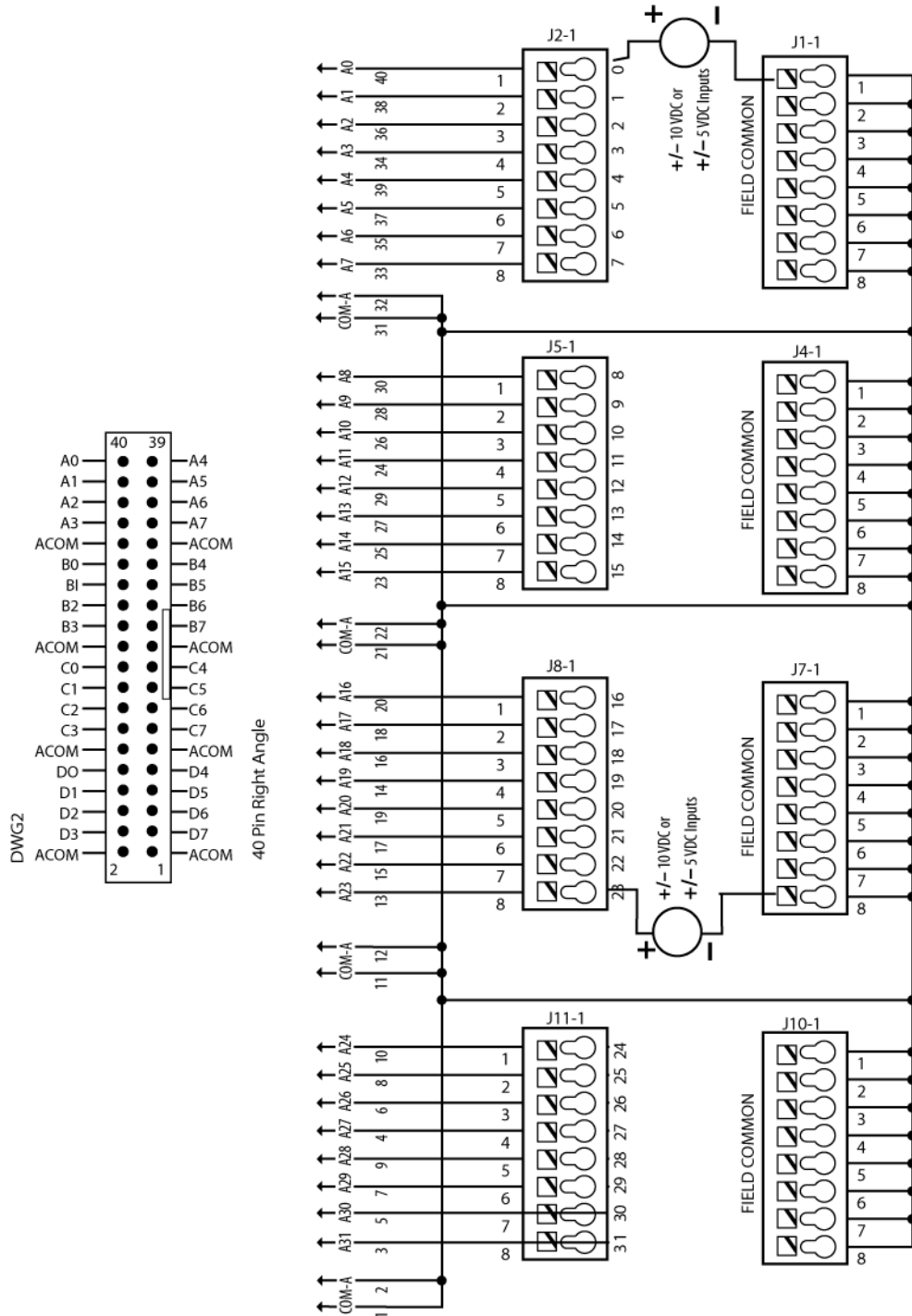
Wiring for SNAP-AIV-i and SNAP-AIV2-i isolated two-channel analog voltage input.

Wiring for SNAP-pH/ORP analog input. Input connections for the SNAP-pH/ORP are made through standard BNC connectors located on the top of the module. The two channels are isolated from each other; they do not share any field connection.

Wiring for SNAP-AIV-32 and SNAP-AIV-32-FM thirty-two-channel analog voltage inputs.

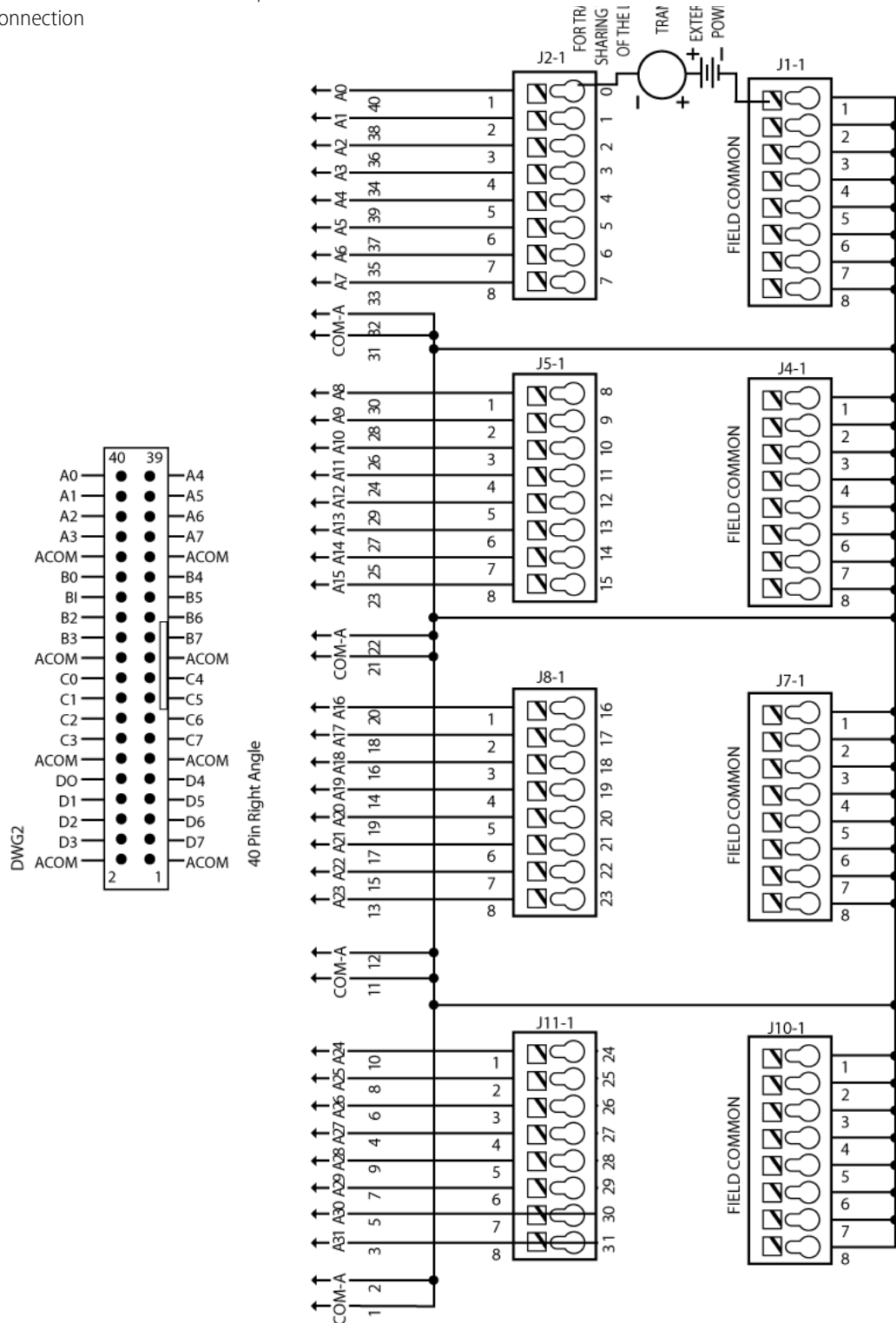
The following diagram shows wiring from the SNAP-AIV-32 or SNAP-AIV-32-FM module to the SNAP-HDB-AIV (or -FM) breakout rack. Note that all channels share a common reference terminal.

NOTE: This diagram is also used to wire the SNAP-AIV-HDB breakout rack to a SNAP-AIMA-32 or SNAP-AIMA-32-FM module, when the module connects to a self-powered (4-wire) device.



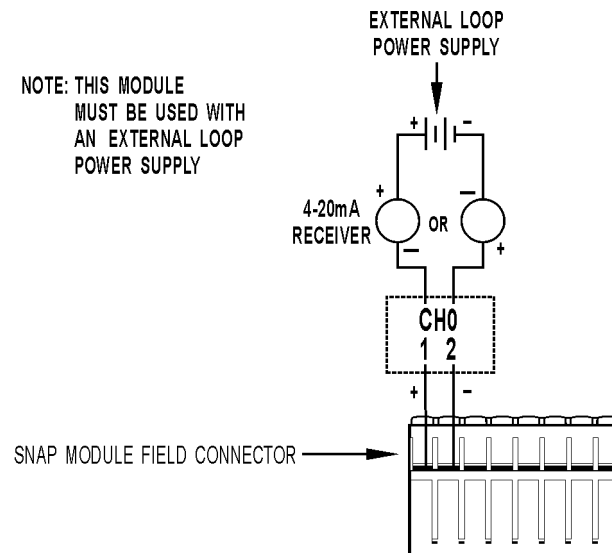
Alternate Wiring for SNAP-AIMA-32 and SNAP-AIMA-32-FM .

SNAP-AIV-HDB breakout rack to SNAP-AIMA-32 or SNAP-AIMA-32-FM module when the module connects to devices that share a positive common connection

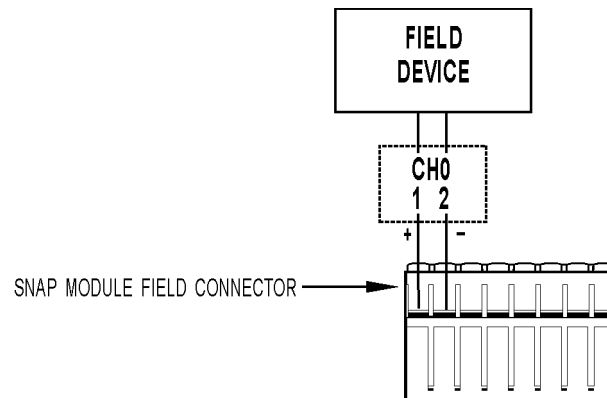


Analog Output Modules

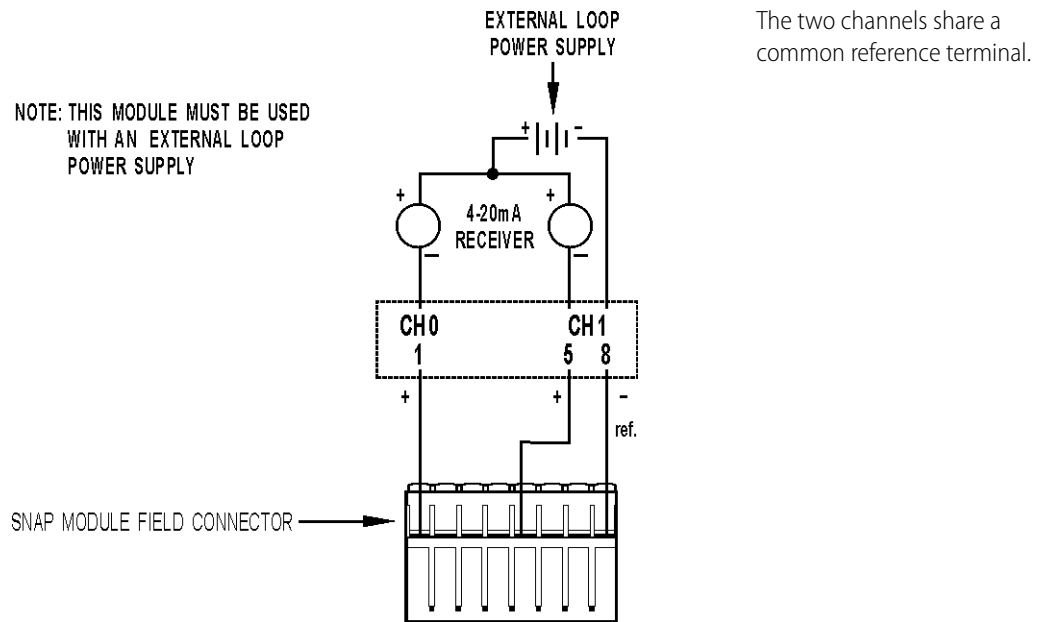
Wiring for the SNAP-AOA-3 single-channel analog current output.



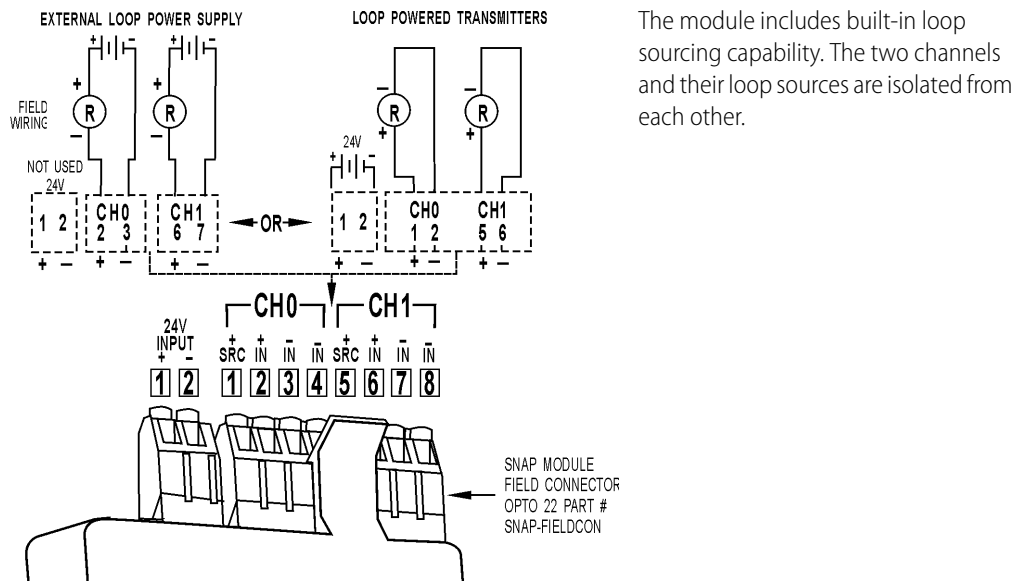
Wiring for the SNAP-AOV-5 single-channel analog voltage outputs.

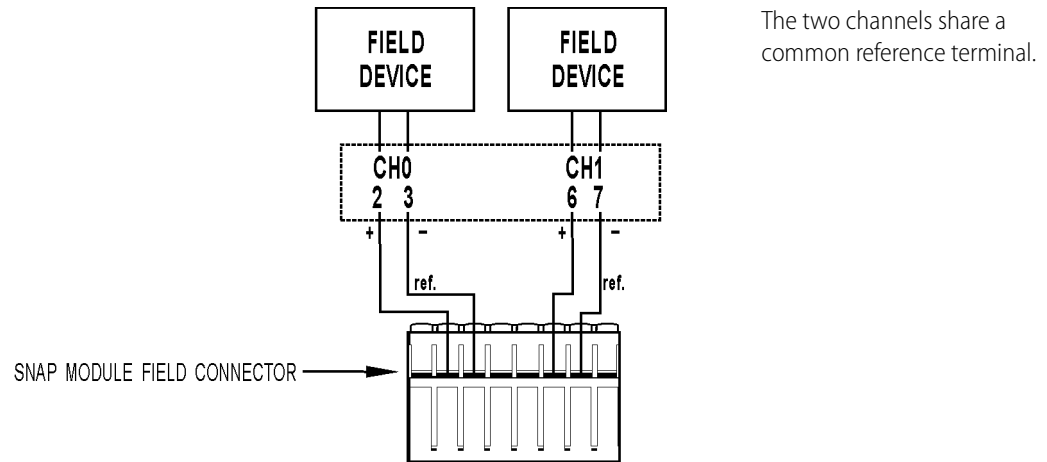
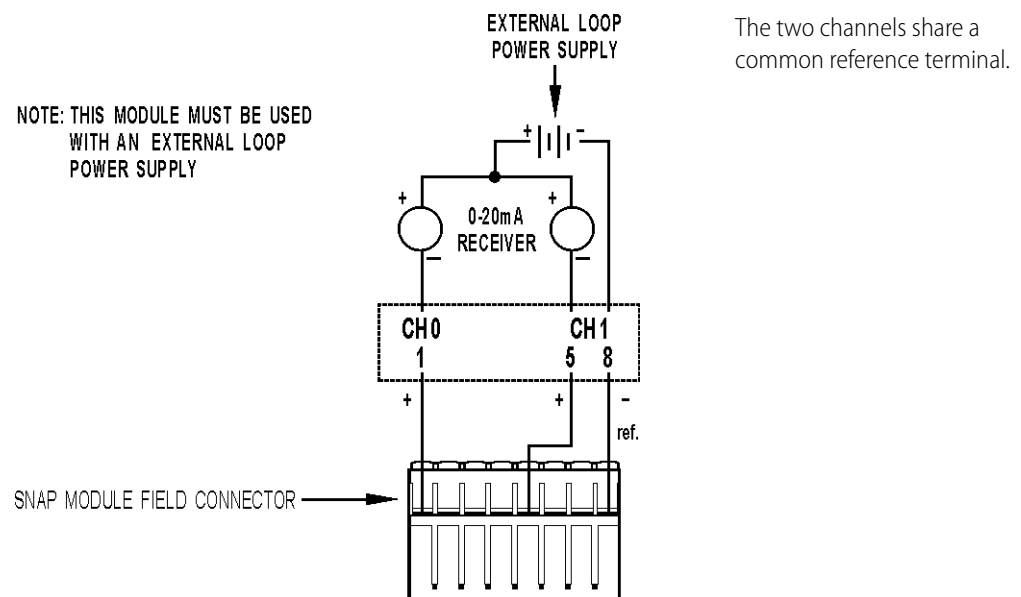


Wiring for the SNAP-AOA-23 dual-channel analog current output.

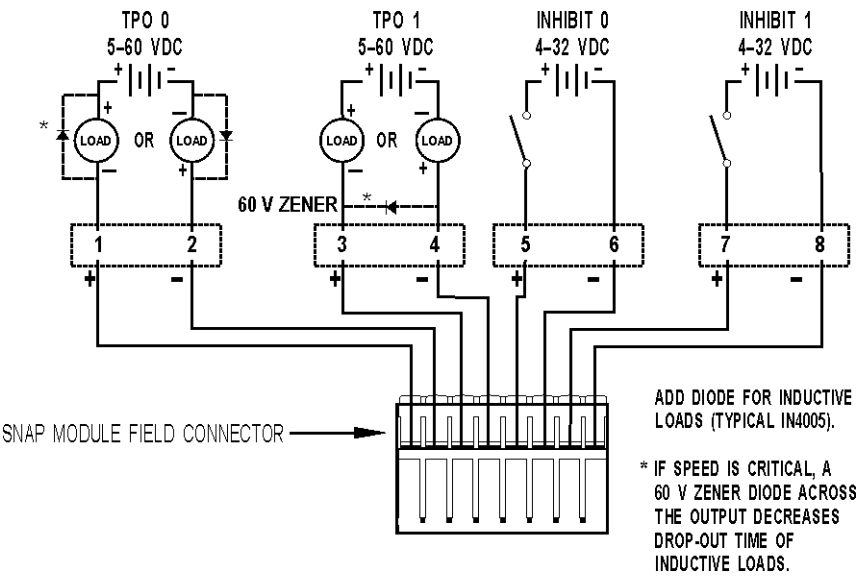


Wiring for the SNAP-AOA-23-iSRC and SNAP-AOA-23-iSRC-FM isolated dual-channel analog current outputs.



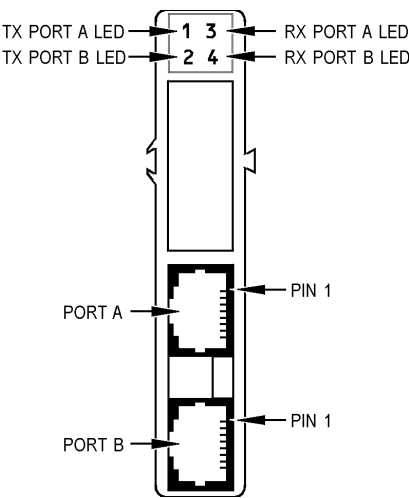
Wiring for the SNAP-AOV-25 and SNAP-AOV-27 dual-channel analog voltage output.**Wiring for the SNAP-AOA-28 dual-channel analog current output.**

Wiring for the SNAP-AOD-29 dual-channel analog time-proportional digital output.



Serial Communication Modules

Wiring for the SNAP-SCM-232 serial communication module.

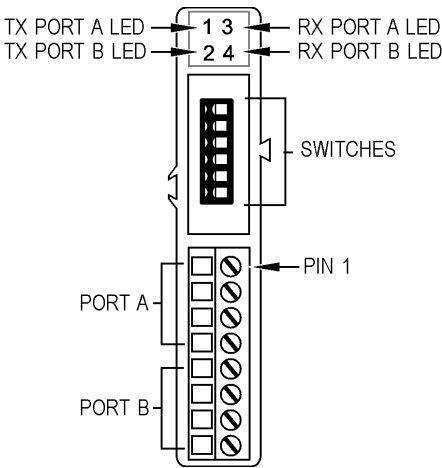


Pinouts for RJ-45 connectors on the SNAP-SCM-232:

1	Not used
2	RX (receive data)
3	TX (transmit data)
4	RTS (request to send)
5	GND (signal ground)
6	Not used
7	Not used
8	CTS (clear to send)

Refer to Opto 22 form #1191, the *SNAP Serial Communication Module User's Guide*, for more information.

Wiring for the SNAP-SCM-485-422 serial communication module.



**Pinouts for Two-Wire
SNAP-SCM-485**

Pin	Port	Description
1	A	Vcc
2	A	TX/RX +
3	A	TX/RX -
4	A	Sig Gnd
5	B	Vcc
6	B	TX/RX +
7	B	TX/RX -
8	B	Sig Gnd

**Pinouts for Four-Wire
SNAP-SCM-485**

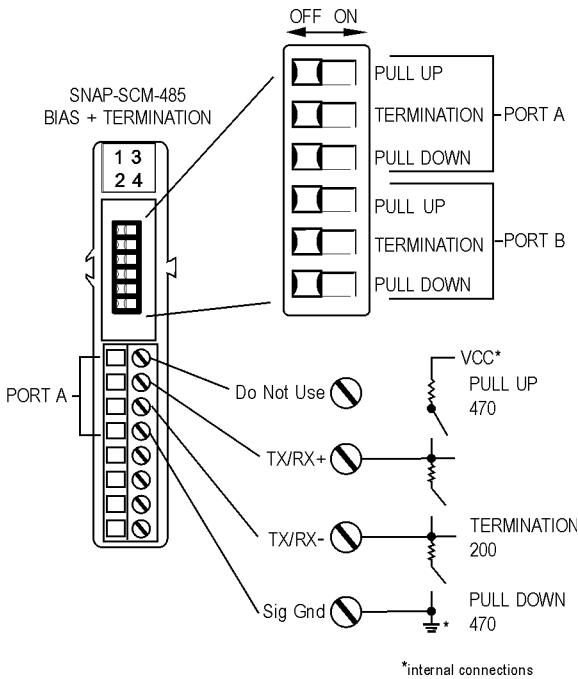
Pin	Port	Description
1	A	Vcc
2	A	TX +
3	A	TX -
4	A	Sig Gnd
5	A	Vcc
6	A	RX +
7	A	RX -
8	A	Sig Gnd

NOTE: Vcc on the SNAP-SCM-485 is 5 VDC and is supplied by the module itself. Do not use this voltage to power another device, as it can interfere with normal module operation.

Use the small switches on the top of the module to provide bias or termination on the RS-485 network as required. If the port is physically the first or last device on the RS-485 network, provide termination by moving the Term switch to ON. Also provide bias at one point on the network by moving both the Up and Down switches to ON.

Bias and termination switches are shown in the diagram at right.

Refer to Opto 22 form #1191, the *SNAP Serial Communication Module User's Guide*, for more information.



NOTE: Vcc on the SNAP-SCM-485 is 5 VDC and is supplied by the module itself. Do not use this voltage to power another device, as it can interfere with normal module operation.

Wiring for the SNAP-SCM-MCH16 motion control module.

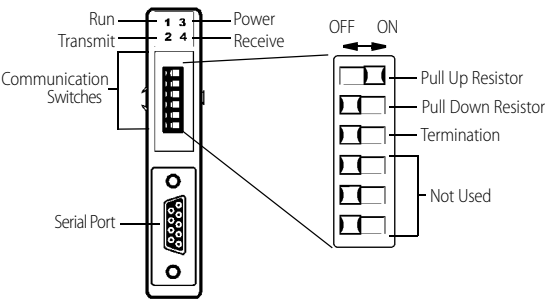
The SNAP-SCM-MCH16 module is part of the SNAP Motion Control Subsystem. Wiring, bias and termination, and other settings may depend on your system. For instructions, see Opto 22 form #1673, the *SNAP PAC Motion Control User's Guide*.

Wiring for the SNAP-SCM-PROFI serial communication module.

Communication switches are shown in the diagram at right. If you are using an official PROFIBUS cable, termination is provided in the cable; therefore, switch the termination to ON in the cable and move the Term switch to OFF in the SNAP-SCM-PROFI module.

See the *SNAP Serial Communication Module User's Guide* (form #1191) for more information.

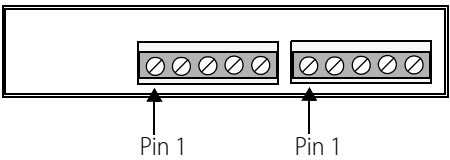
SNAP-SCM-PROFI Top View.



Wiring for the SNAP-SCM-SSI serial communication module.

NOTE: Use with SNAP PAC R-series controllers and SNAP PAC EB brains only.

SNAP-SCM-ST2 Top View.



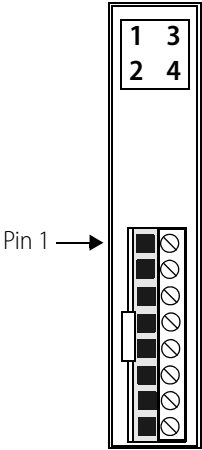
Pins for Each Port

Pin	Use
1	Clock +
2	Clock –
3	Data –
4	Data +
5	Excitation common

Wiring for the SNAP-SCM-ST2 serial communication module.

NOTE: Use with SNAP PAC R-series controllers and SNAP PAC EB brains only.

SNAP-SCM-ST2 Top View.



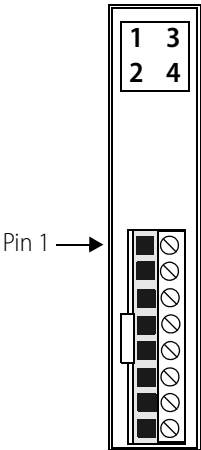
Pinouts

Pin	Use	Description
1	Pulse	Frequency output. Channel A.
2	Ground	Isolated from logic side
3	Direction	+5 VDC when asserted, 0 VDC when deasserted. Channel A.
4	Ground	Isolated from logic side
5	Pulse	Frequency output. Channel B.
6	Ground	Isolated from logic side
7	Direction	+5 VDC when asserted, 0 VDC when deasserted. Channel B.
8	Ground	Isolated from logic side

Wiring for the SNAP-SCM-CAN2B serial communication module.

NOTE: Use with SNAP PAC R-series controllers and SNAP PAC EB brains only.

SNAP-SCM-CAN2B Top View.



Pinouts for SNAP-SCM-CAN2B

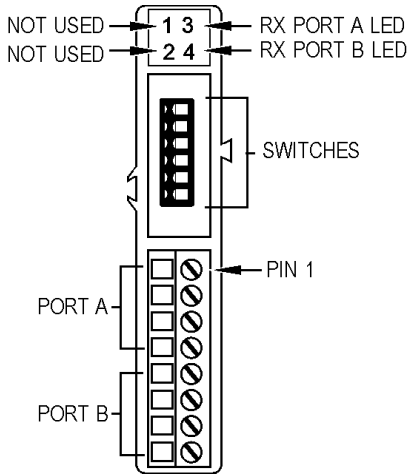
Pins 1-4 are in parallel to pins 5-8.
V+ is not used by the module.

Pin	Use
1,5	V +
2,6	CAN +
3,7	CAN -
4,8	GND

Wiring for the SNAP-SCM-W2 serial communication module.

NOTE: Use with SNAP PAC R-series, SNAP Ethernet, or SNAP Ultimate only.

SNAP-SCM-W2 Top View.



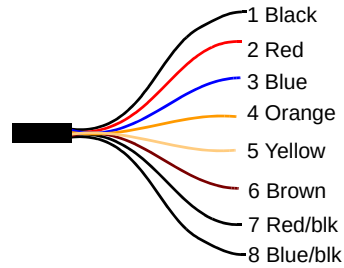
Pinouts for SNAP-SCM-W2

Pin	Port	Color	Description
1	A	Black	Common
2	A	White	Data One
3	A	Green	Data Zero
4	A	--	Not used
5	B	Black	Common
6	B	White	Data One
7	B	Green	Data Zero
8	B	--	Not used

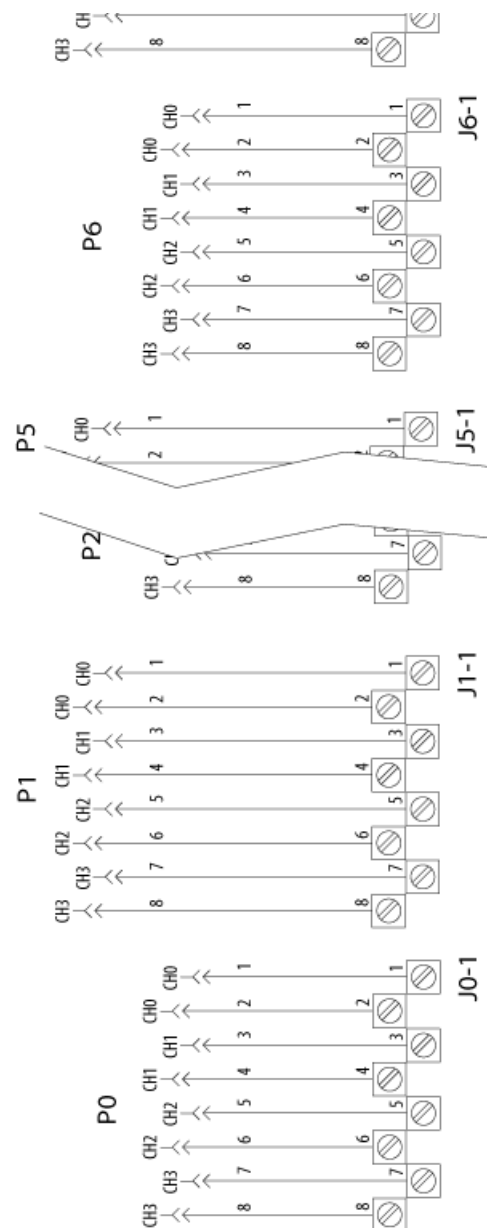
Wiring SNAP TEX Cables and Breakout Boards

Use these diagrams together with wiring diagrams for individual I/O modules on the previous pages.

Wiring for SNAP-TEX-32 Breakout Board.



This diagram shows wiring with a SNAP-TEX cable going to a 4-channel module. If you are using the breakout board with other cables going to 16- or 32-channel modules, see the cable's data sheet for wire colors and wiring details.

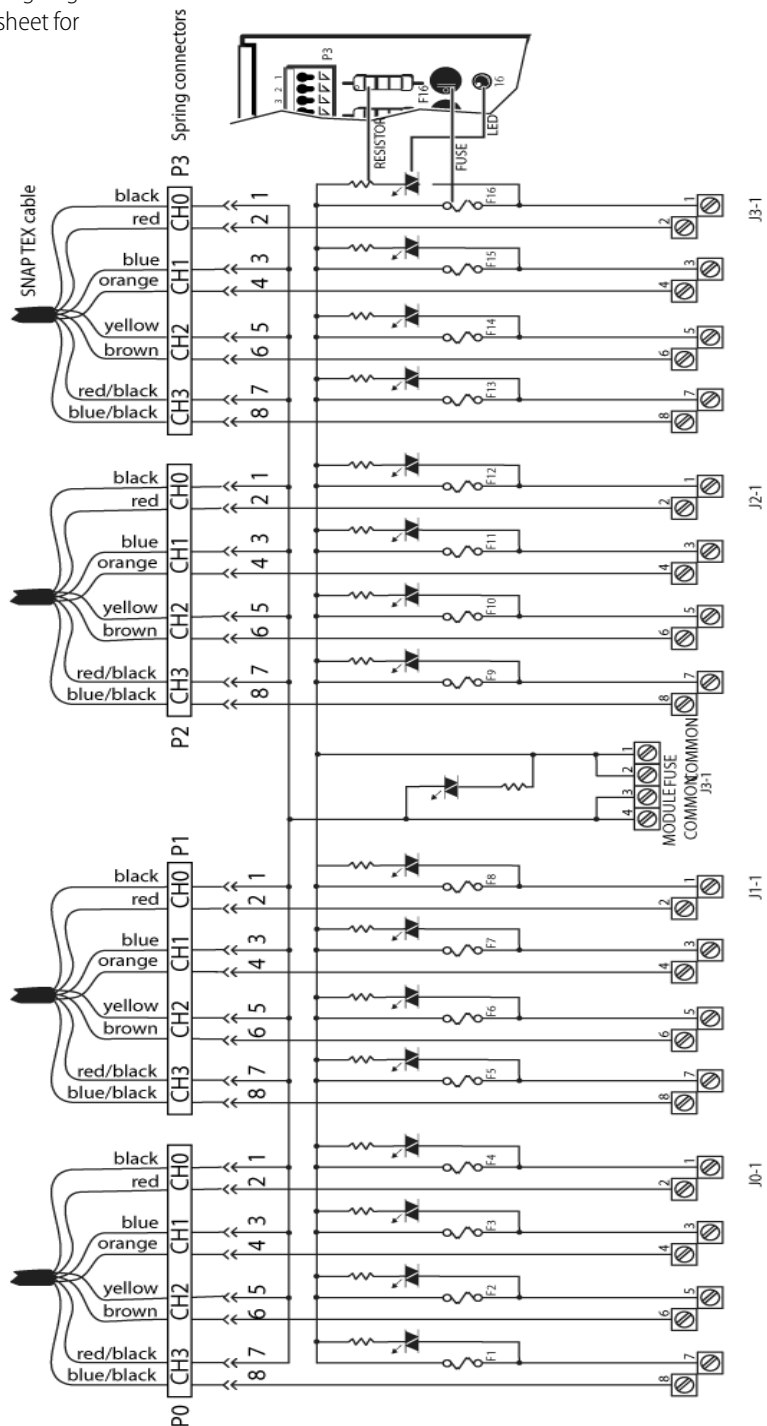


For use with SNAP OAC5, OAC5-i, ODC5-i, ODC5, IAC(s) and IDC(s)
For use with all 2, 4, 16, 32 CH SNAP analog except thermocouples

Wiring for SNAP-TEX-FB16-H and SNAP-TEX-FB16-L Breakout Boards.

This diagram shows wiring with **SNAP-TEX-CBS6** or **SNAP-TEX-CBO6** cables going to 4-channel modules. If you are using the breakout board with other cables going to 16- or 32-channel modules, see the cable's data sheet for wire colors and wiring details.

CAUTION: Do NOT use the SNAP-TEX-CBE6 (even pins commoned) cable with this board. The board has odd pins commoned.

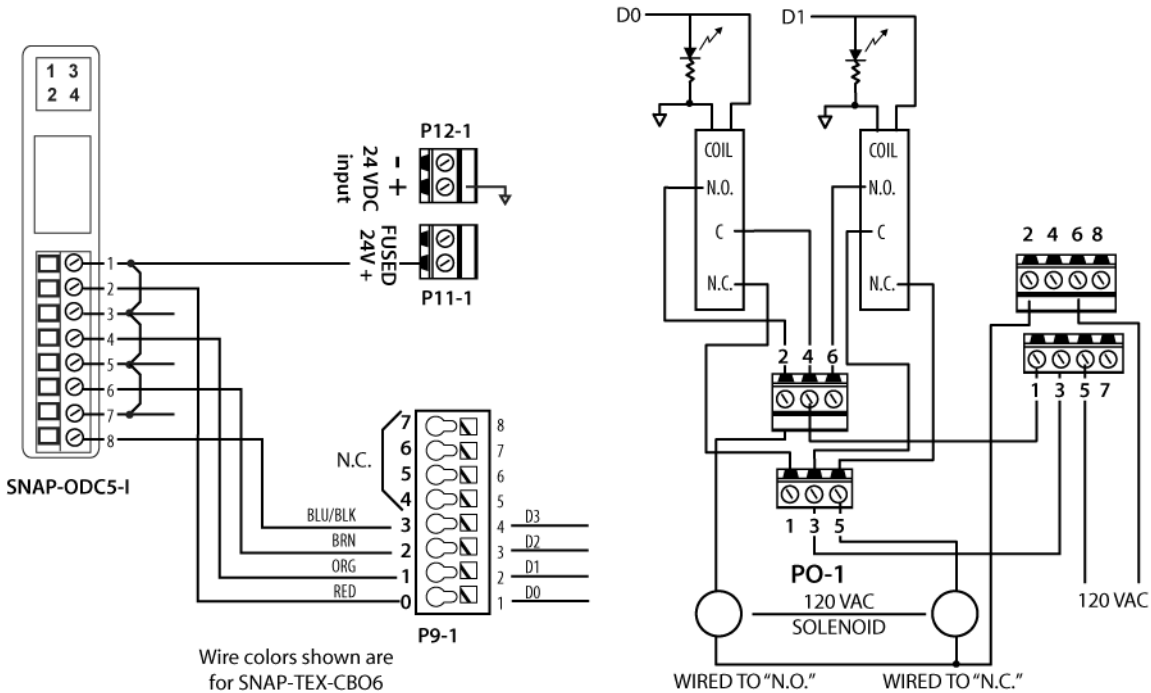


For use with SNAP OAC5, OAC5-i, ODC-i, IAC(s) and IDC(s)
 Use 4.7K 1W for low voltage and 47K 2W for 120-240VAC
 Use straight-through cable or odd pins bussed

Wiring for SNAP-TEX-MR10-4 and SNAP-TEX-MR16-10 Breakout Boards.

The example below shows wiring from the first two points of a SNAP-ODC5-i output module to a SNAP-TEX-MR10-4 board. Wire colors shown are for a SNAP-TEX-CBO6 cable. Wiring is similar for a SNAP-TEX-MR10-16 board, which has 16 channels rather than four.

These boards can also be used with other modules and cables; see the compatibility tables starting on [page 39](#).



A: I/O Specifications

Introduction

This appendix includes specifications for the following SNAP PAC System I/O modules:

Digital input modules	page 120
Digital output modules	page 125
Analog input modules	page 136
Analog output modules	page 156
Serial modules	page 161
Breakout boards and cables	page 167

Digital Input Module Specifications

SNAP-IAC5, SNAP-IAC5A, and SNAP-IAC5MA

	SNAP-IAC5	SNAP-IAC5A	SNAP-IAC5MA
Key Feature	--	--	Diagnostic switches
Torque, hold-down screws	4 in-lb (0.45 N-m)	4 in-lb (0.45 N-m)	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)	5.26 in-lb (0.6 N-m)	5.26 in-lb (0.6 N-m)
Field Side Ratings (each channel)			
Nominal Input Voltage	120 VAC/VDC	240 VAC/VDC	120 VAC/VDC
Channel-to-channel isolation	300 VAC (1,500 V transient)	300 VAC (1,500 V transient)	300 VAC (1,500 V transient)
Input Voltage Range	90–140 VAC/VDC	180–280 VAC/VDC	90–140 VAC/VDC
Turn-on Voltage	90 VAC/VDC	180 VAC/VDC	90 VAC/VDC
Turn-off Voltage	35 VAC/VDC	35 VAC/VDC	35 VAC/VDC
Input Resistance	169 K ohms (nominal)	305 K ohms (nominal)	169 K ohms (nominal)
Logic Side Ratings			
Logic Output Voltage	<.5 V max. (on) @ 2 mA sinking 2.7 V min. (off) @ 400 mA sourcing	<.5 V max. (on) @ 2 mA sinking 2.7 V min. (off) @ 400 mA sourcing	<.5 V max. (on) @ 2 mA sinking 2.7 V min. (off) @ 400 mA sourcing
Logic Supply Voltage*	5 VDC ± 0.25 VDC	5 VDC ± 0.25 VDC	5 VDC ± 0.25 VDC
Logic Supply Current	50 mA maximum	50 mA maximum	50 mA maximum
Negative True Logic Output Drive	TTL 74 Series = 1 UL TTL 74LS Series = 5 UL	TTL 74 Series = 1 UL TTL 74LS Series = 5 UL	TTL 74 Series = 1 UL TTL 74LS Series = 5 UL
Module Ratings			
Number of Channels Per Module	4	4	4
Turn-on Time	30 msec	30 msec	30 msec
Turn-off Time	30 msec	30 msec	30 msec
Optical Isolation, Field to Logic	4,000 volts (transient)	4,000 volts (transient)	4,000 volts (transient)
Temperature	0 °C to 70 °C, operating -30 °C to 85 °C, storage	0 °C to 70 °C, operating -30 °C to 85 °C, storage	0 °C to 70 °C, operating -30 °C to 85 °C, storage
Agency Approvals	UL, CE, CSA, RoHS, DFARS	UL, CE, CSA, RoHS, DFARS	UL, CE, RoHS, DFARS
Warranty	Lifetime	Lifetime	30 months

* When used with an I/O processor (brain or on-the-rack controller), the processor requires 5.0 to 5.2 VDC.

SNAP-IAC5FM, SNAP-IAC5AFM, SNAP-IDC5FM, and SNAP-IDC5DFM

	SNAP-IAC5FM	SNAP-IAC5AFM	SNAP-IDC5FM	SNAP-IDC5DFM
Key Feature	Factory Mutual approved	Factory Mutual approved	Factory Mutual approved	Factory Mutual approved
Torque, hold-down screws	4 in-lb (0.45 N-m)	4 in-lb (0.45 N-m)	4 in-lb (0.45 N-m)	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)	5.26 in-lb (0.6 N-m)	5.26 in-lb (0.6 N-m)	5.26 in-lb (0.6 N-m)
Field Side Ratings (each channel)				
Nominal Input Voltage	120 VAC/VDC	240 VAC/ VDC	24 VAC/VDC	5 VDC
Channel-to-channel isolation	300 VAC (1,500 V transient)	300 VAC (1,500 V transient)	300 VAC (1,500 V transient)	300 VAC (1,500 V transient)
Input Voltage Range	90–140 VAC/VDC	180–280 VAC/VDC	10–32 VAC/VDC	2.5–28 VDC
Turn-on Voltage	90 VAC/VDC	180 VAC/VDC	10 VAC/VDC	2.5 VDC
Turn-off Voltage	35 VAC/VDC	35 VAC/VDC	3 VAC/VDC	1 VDC
Input Resistance	169 K ohms (nominal)	305 K ohms (nominal)	15 K ohms (nominal)	3 K ohms (nominal)
Logic Side Ratings				
Logic Output Voltage	<.5 V max. (on) @ 2 mA sinking 2.7 V min. (off) @ 400 mA sourcing	<.5 V max. (on) @ 2 mA sinking 2.7 V min. (off) @ 400 mA sourcing	<.5 V max. (on) @ 2 mA sinking 2.7 V min. (off) @ 0.4 mA sourcing	<.5 V max. (on) @ 2 mA sinking 2.7 V min. (off) @ 0.4 mA sourcing
Logic Supply Voltage*	5 VDC ± 0.25 VDC	5 VDC ± 0.25 VDC	5 VDC ± 0.25 VDC	5 VDC ± 0.25 VDC
Logic Supply Current	50 mA maximum	50 mA maximum	50 mA maximum	50 mA maximum
Negative True Logic Output Drive	TTL 74 Series=1 UL TTL 74LS Series=5 UL	TTL 74 Series=1 UL TTL 74LS Series=5 UL	TTL 74 Series=1 UL TTL 74LS Series=5 UL	TTL 74 Series=1 UL TTL 74LS Series=5 UL
Module Ratings				
Number of Channels Per Module	4	4	4	4
Turn-on Time	30 msec	30 msec	5 msec	1 msec
Turn-off Time	30 msec	30 msec	15 msec	1 msec
Optical Isolation (Field Side to Logic Side)	4,000 volts (transient)	4,000 volts (transient)	4,000 volts (transient)	4,000 volts (transient)
Temperature	0 °C to 70 °C, operating -30 °C to 85 °C, storage	0 °C to 70 °C, operating -30 °C to 85 °C, storage	0 °C to 70 °C, operating -30 °C to 85 °C, storage	0 °C to 70 °C, operating -30 °C to 85 °C, storage
Agency Approvals	CE, FM, RoHS, DFARS	CE, FM, RoHS, DFARS	CE, FM, RoHS, DFARS	CE, FM, RoHS, DFARS
Warranty	Lifetime	Lifetime	Lifetime	Lifetime

*When used with an I/O processor (brain or on-the-rack controller), the processor requires 5.0 to 5.2 VDC.

SNAP-IDC5, SNAP-IDC5D, SNAP-IDC5G, and SNAP-IDC5HT

	SNAP-IDC5	SNAP-IDC5D	SNAP-IDC5G	SNAP-IDC5-HT
Key Feature	--	--	--	Leakage-tolerant
Torque, hold-down screws	4 in-lb (0.45 N-m)	4 in-lb (0.45 N-m)	4 in-lb (0.45 N-m)	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)	5.26 in-lb (0.6 N-m)	5.26 in-lb (0.6 N-m)	5.26 in-lb (0.6 N-m)
Field Side Ratings (each channel)				
Nominal Input Voltage	24 VAC/VDC	5 VDC	48 VAC/VDC	24 VAC/VDC
Channel-to-channel isolation	300 VAC (1,500 V transient)	300 VAC (1,500 V transient)	300 VAC (1,500 V transient)	300 VAC (1,500 V transient)
Input Voltage Range	10–32 VAC/VDC	2.5–28 VDC	35–75 VAC/VDC	15–32 VAC/VDC
Turn-on Voltage	10 VAC/VDC	2.5 VDC	35 VAC/VDC	15 VAC/VDC
Turn-off Voltage	3 VAC/VDC	1 VDC	7 VAC/VDC	8 VAC/VDC
Input Resistance	15 K ohms (nominal)	3 K ohms (nominal)	64 K ohms (nominal)	3 K ohms (nominal)
Logic Side Ratings				
Logic Output Voltage	<.5 V max. (on) @ 2 mA sinking 2.7 V min. (off) @ 0.4 mA sourcing	<.5 V max. (on) @ 2 mA sinking 2.7 V min. (off) @ 0.4 mA sourcing	<.5 V max. (on) @ 2 mA sinking 2.7 V min. (off) @ 0.4 mA sourcing	<.5 V max. (on) @ 2 mA sinking 2.7 V min. (off) @ 0.4 mA sourcing
Logic Supply Voltage***	5 VDC ± 0.25 VDC	5 VDC ± 0.25 VDC	5 VDC ± 0.25 VDC	5 VDC ± 0.25 VDC
Logic Supply Current	50 mA maximum	50 mA maximum	50 mA maximum	50 mA maximum
Negative True Logic Output Drive	TTL 74 Series = 1 UL TTL 74LS Series = 5 UL	TTL 74 Series = 1 UL TTL 74LS Series = 5 UL	TTL 74 Series = 1 UL TTL 74LS Series = 5 UL	TTL 74 Series = 1 UL TTL 74LS Series = 5 UL
Module Ratings				
Number of Channels Per Module	4	4	4	4
Turn-on Time	5 msec	1 msec	5 msec	20 msec
Turn-off Time	15 msec	1 msec	15 msec	25 msec
Optical Isolation (Field Side to Logic Side)	4,000 volts (transient)	4,000 volts (transient)	4,000 volts (transient)	4,000 volts (transient)
Temperature	0 °C to 70 °C, operating -30 °C to 85 °C, storage	0 °C to 70 °C, operating -30 °C to 85 °C, storage	0 °C to 70 °C, operating -30 °C to 85 °C, storage	0 °C to 70 °C, operating -30 °C to 85 °C, storage
Agency Approvals	UL, CE, CSA, RoHS, DFARS	UL, CE, CSA, RoHS, DFARS	UL, CE, RoHS, DFARS	CE, RoHS, DFARS
Warranty	Lifetime	Lifetime	Lifetime	Lifetime

* At 20kHz, 5Vp-p square wave input, 50% duty cycle.

** At 20kHz, 28Vp-p square wave input, 50% duty cycle.

*** When used with an I/O processor (brain or on-the-rack controller), the processor requires 5.0 to 5.2 VDC.

SNAP-IDC5FAST, SNAP-IDC5-FAST-A, and SNAP-IDC5MA

	SNAP-IDC5FAST*	SNAP-IDC5-FAST-A**	SNAP-IDC5MA
Key Feature	High-speed	High-speed	Diagnostic switches
Torque, hold-down screws	4 in-lb (0.45 N-m)	4 in-lb (0.45 N-m)	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)	5.26 in-lb (0.6 N-m)	5.26 in-lb (0.6 N-m)
Field Side Ratings (each channel)			
Nominal Input Voltage	5 VDC	28 VDC	24 VAC/VDC
Channel-to-channel isolation	300 VAC (1,500 V transient)	300 VAC (1,500 V transient)	300 VAC (1,500 V transient)
Input Voltage Range	2.5–16 VDC	18–32 VDC	10–32 VAC/VDC
Turn-on Voltage	2.5 VDC	18 VDC	10 VAC/VDC
Turn-off Voltage	1 VDC	5 VDC	3 VAC/VDC
Input Resistance	440 ohms (nominal)	8 K ohms (nominal)	15 K ohms (nominal)
Logic Side Ratings			
Logic Output Voltage	<0.5 V max. (on) @ 2 mA sinking 2.7 V min. (off) @ 0.4 mA sourcing	<0.5 V max. (on) @ 2 mA sinking 2.7 V min. (off) @ 0.4 mA sourcing	<0.5 V max. (on) @ 2 mA sinking 2.7 V min. (off) @ 400 mA sourcing
Logic Supply Voltage***	5 VDC $\pm$ 0.25 VDC	5 VDC $\pm$ 0.25 VDC	5 VDC $\pm$ 0.25 VDC
Logic Supply Current	50 mA maximum	50 mA maximum	50 mA maximum
Negative True Logic Output Drive	TTL 74 Series = 1 UL TTL 74LS Series = 5 UL	TTL 74 Series = 1 UL TTL 74LS Series = 5 UL	TTL 74 Series = 1 UL TTL 74LS Series = 5 UL
Module Ratings			
Number of Channels Per Module	4	4	4
Turn-on Time	0.025 msec*	0.025 msec**	5 msec
Turn-off Time	0.025 msec*	0.025 msec**	15 msec
Optical Isolation (Field Side to Logic Side)	4,000 volts (transient)	4,000 volts (transient)	4,000 volts (transient)
Temperature	0 °C to 70 °C, operating -30 °C to 85 °C, storage	0 °C to 70 °C, operating -30 °C to 85 °C, storage	0 °C to 70 °C, operating -30 °C to 85 °C, storage
Agency Approvals	UL, CE, FM, CSA, RoHS, DFARS	UL, CE, CSA, RoHS, DFARS	CE, RoHS, DFARS
Warranty	Lifetime	Lifetime	30 months

* At 20kHz, 5Vp-p square wave input, 50% duty cycle.

** At 20kHz, 28Vp-p square wave input, 50% duty cycle.

*** When used with an I/O processor (brain or on-the-rack controller), the processor requires 5.0 to 5.2 VDC.

SNAP-IDC5Q

Logic Voltage	5 VDC
Operating Ambient Temperature	0 to 70 °C
Isolation input-to-output	4,000 Vrms
Input Voltage Range	4–24 VDC
Input Resistance	1K ohms @ 4 V 560 ohms @ 24 V
Input Allowed for No Output	1 V
Logic Supply Current @ 5 VDC	120 mA
Maximum Input Frequency, 50% Duty Cycle	25 kHz for SNAP PAC brains and controllers with high-speed digital functions Legacy brains vary*
Maximum Reverse Input Voltage	–21 V
Torque, hold-down screws	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)
Agency Approvals	CE, FM, RoHS, DFARS
Warranty	Lifetime

* The SNAP-IDC5Q supports an encoder input frequency of 25 kHz. However, legacy I/O brains have limited quadrature counting capability. The following limits apply to them:
 2.5 kHz for SNAP-B3000-ENET brains
 4 kHz for SNAP-UP1-ADS brains
 5 kHz for other legacy brains with high-speed counting

SNAP-IDC5-SW and SNAP-IDC5-SW-NC

Field Side Ratings (each channel)	
Open Circuit Voltage (Switch Open)	15 VDC typical
Short Circuit Current (Switch Closed)	7 milliamps nominal
Minimum Off Resistance	>20 K ohms
Maximum Allowable On Resistance (Wire + Contact Resistance)	500 ohms
Logic Side Ratings	
Logic Output Voltage for SNAP-IDC5-SW (normally open)	<0.5 V max. (switch closed; LED on) @ 2 mA sinking 2.7 V min. (switch open; LED off) @ 0.4 mA sourcing
Logic Output Voltage for SNAP-IDC5-SW-NC (normally closed)	<0.5 V max. (switch open; LED on) @ 2 mA sinking 2.7 V min. (switch closed; LED off) @ 0.4 mA sourcing
Maximum Operating Common Mode Voltage (Field Term to Logic Connector)	250 V
Power Requirements	5 VDC (±0.25) @ 200 mA
Module Ratings	
Number of Channels Per Module	4
Turn-on Time	5 msec
Turn-off Time	25 msec
Channel-to-channel Isolation	None
Input-to-output Isolation	1500 V AC/DC
Torque, hold-down screws	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)
Temperature	0 °C to 70 °C, operating –30 °C to 85 °C, storage
Agency Approvals	UL, CE, RoHS, DFARS FM (SNAP-IDC5SW only)
Warranty	Lifetime

SNAP-IDC-32, SNAP-IDC-32-FM, SNAP-IDC-32N, and SNAP-IDC-32DN

	SNAP-IDC-32 SNAP-IDC-32-FM	SNAP-IDC-32N	SNAP-IDC-32DN
Input Range	10 to 32 VDC	-10 to -32 VDC	-2.5 to -12 VDC
Nominal Voltage Range	24 VDC	-12 to -24 VDC	-2.5 VDC
Input Resistance	20 K ohms	20 K ohms	3 K ohms
Logic Voltage and Current	5 VDC $\pm$ 0.1 @ 150 mA	5 VDC $\pm$ 0.1 @ 150 mA	5 VDC $\pm$ 0.1 @ 150 mA
Input Arrangement	32 input channels; 4 groups of 8 inputs each (Points in each group share a common negative connection.)	32 input channels; 4 groups of 8 inputs each (Points in each group share a common positive connection.)	32 input channels; 4 groups of 8 inputs each (Points in each group share a common positive connection.)
Channel-to-Channel Isolation	No channel-to-channel isolation; 100 V group-to-group isolation	No channel-to-channel isolation; 100 V group-to-group isolation	No channel-to-channel isolation; 100 V group-to-group isolation
Hold-down screws Connector screws	Torque: 4 in-lb (0.45 N-m) Torque: 5.26 in-lb (0.6 N-m)	Torque: 4 in-lb (0.45 N-m) Torque: 5.26 in-lb (0.6 N-m)	Torque: 4 in-lb (0.45 N-m) Torque: 5.26 in-lb (0.6 N-m)
Maximum Number of HDD Modules on One Mounting Rack	16	16	16
Indicators	None; use optional Opto-Terminal-G20 diagnostic display or breakout rack.	None; use optional Opto-Terminal-G20 diagnostic display or breakout rack.	None; use optional Opto-Terminal-G20 diagnostic display or breakout rack.
ON Voltage	10 VDC @ 0.5 mA	-10 VDC @ 0.5 mA	-2.5 VDC @ 0.5 mA
OFF Voltage	3 VDC @ 0.1 mA	-3 VDC @ 0.1 mA	-1 VDC @ 0.1 mA
Polling time from I/O processor to module ¹	2–30 ms typical ²	2–30 ms typical ²	2–30 ms typical ²
Input Turn-On/Off Time	6 ms	6 ms	6 ms
Counting Frequency (DC input)	0–50 Hz @ 50% duty cycle	0–50 Hz @ 50% duty cycle	0–50 Hz @ 50% duty cycle
Agency Approvals	UL, CE, RoHS, DFARS FM (-FM model only)	CE, RoHS, DFARS	CE, RoHS, DFARS
Warranty	Lifetime	Lifetime	Lifetime

¹ Affects turn-on and turn-off determination

² Time varies based on the SNAP PAC I/O processor (brain or on-the-rack controller), processor configuration, and Ethernet host communication activity.

SNAP-IDC-16, SNAP-IDC-HT-16, SNAP-IAC-16, SNAP-IAC-A-16, and SNAP-IAC-K-16

	SNAP-IDC-16	SNAP-IDC-HT-16	SNAP-IAC-16	SNAP-IAC-A-16	SNAP-IAC-K-16
Input Range	10–32 VDC/VAC	15–28 VDC/VAC	90–140 VAC/VDC	180–280 VAC/VDC	70–130 VAC/VDC
Nominal Voltage Range	24 VDC	24 VDC	120 VAC	240 VAC	100 VAC
Input Resistance	44 K ohms	4 K ohms	300 K ohms	940 K ohms	220 K ohms
Logic Voltage and Current	5 VDC $\pm$ 0.1 @ 150 mA	5 VDC $\pm$ 0.1 @ 150 mA	5 VDC $\pm$ 0.1 @ 150 mA	5 VDC $\pm$ 0.1 @ 150 mA	5 VDC $\pm$ 0.1 @ 150 mA
Input Arrangement	16 isolated input channels	16 isolated input channels	16 isolated input channels	16 isolated input channels	16 isolated input channels
Channel-to-Channel Isolation	250 V steady-state, 1500 V transient	250 V steady-state, 1500 V transient	250 V steady-state, 1500 V transient	250 V steady-state, 1500 V transient	250 V steady-state, 1500 V transient
Maximum Number of HDD Modules on One Mounting Rack	16	16	16	16	16
Indicators	None; use optional OptoTerminal-G20 diagnostic display.	None; use optional OptoTerminal-G20 diagnostic display.	None; use optional OptoTerminal-G20 diagnostic display.	None; use optional OptoTerminal-G20 diagnostic display.	None; use optional OptoTerminal-G20 diagnostic display.
ON Voltage	10 VDC @ 0.230 mA	15 VDC @ 3.50 mA	90 VAC/VDC @ 0.3 mA	180 VAC/VDC @ 0.191 mA	70 VAC/VDC @ 0.3 mA
OFF Voltage	3 VDC @ 0.05 mA	9 VDC @ 2.0 mA	40 VAC/VDC @ 0.135 mA	40 VAC/VDC @ 0.043 mA	30 VAC/VDC @ 0.135 mA
Torque, hold-down screws	4 in-lb (0.45 N-m)	4 in-lb (0.45 N-m)	4 in-lb (0.45 N-m)	4 in-lb (0.45 N-m)	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)	5.26 in-lb (0.6 N-m)	5.26 in-lb (0.6 N-m)	5.26 in-lb (0.6 N-m)	5.26 in-lb (0.6 N-m)
Polling time from I/O processor to module ¹	2–30 ms typical ²	2–30 ms typical ²	2–30 ms typical ²	2–30 ms typical ²	2–30 ms typical ²
Input Turn-On/Off Time	15 ms turn-on time 20 ms turn-off time	20 ms turn-on time 25 ms turn-off time	15 ms turn-on time 20 ms turn-off time	15 ms turn-on time 20 ms turn-off time	15 ms turn-on time 20 ms turn-off time
Counting Frequency (DC input)	0–25 Hz @ 50% duty cycle	0–15 Hz @ 50% duty cycle	0–25 Hz @ 50% duty cycle	0–25 Hz @ 50% duty cycle	0–25 Hz @ 50% duty cycle
Agency Approvals	UL, CE, RoHS, DFARS	CE, RoHS, DFARS	UL, CE, RoHS, DFARS	UL, CE, RoHS, DFARS	CE, RoHS, DFARS
Warranty	Lifetime	Lifetime	Lifetime	Lifetime	Lifetime

1 Affects turn-on and turn-off determination

2 Time varies based on the SNAP PAC I/O processor (brain or on-the-rack controller), processor configuration, and Ethernet host communication activity.

Digital Output Module Specifications

SNAP-OAC5, SNAP-OAC5MA, and SNAP-OAC5-i

	SNAP-OAC5	SNAP-OAC5MA	SNAP-OAC5-i
Key Feature	--	Diagnostic switches Four isolated channels	Four isolated channels
Torque, hold-down screws	4 in-lb (0.45 N-m)	4 in-lb (0.45 N-m)	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)	5.26 in-lb (0.6 N-m)	5.26 in-lb (0.6 N-m)
Field Side Ratings (each channel)			
Line Voltage - Range	24–250 VAC	24–250 VAC	24–250 VAC
Line Voltage - Nominal	120/240 VAC	120/240 VAC	120/240 VAC
Current Rating 0 °C to 70 °C Ambient	3 amps per module	3 amps per module	3 amps per module
One Cycle Surge	80 amps peak (50/60 Hz)	80 amps peak (50/60 Hz)	80 amps peak (50/60 Hz)
Minimum Load Current	20 mA	20 mA	20 mA
Output Voltage Drop	1.6 volts max.@ 0.75 amps	1.6 volts max.@ 0.75 amps	1.6 volts max.@ 0.75 amps
Off-state Leakage at Nominal Voltage - 60 Hz	2.5 mA @ 240 VAC 1.25 mA @ 120 VAC	2.5 mA @ 240 VAC 1.25 mA @ 120 VAC	2.5 mA @ 240 VAC 1.25 mA @ 120 VAC
Peak Blocking Voltage	500 V	500 V	500 V
Operating Frequency	25–65 Hz	25–65 Hz	25–65 Hz
dV/ dt - Off-state	200 volts/msec	200 volts/msec	200 volts/msec
dV/ dt - Commutating	Snubbed for rated 0.5 power factor load	Snubbed for rated 0.5 power factor load	Snubbed for rated 0.5 power factor load
Fuse (Common to all Channels)	250 VAC - 4A 5x20 mm Fast-acting Bell Fuse Part: BEL 5HF4 Opto 22 Part: SNAP-FUSE4AB	Has four isolated channels. User must provide own fus- ing.	Has four isolated channels. User must provide own fus- ing.
Channel-to-channel isolation	Not applicable	300 VAC (1500 V transient)	300 VAC (1500 V transient)
Logic Side Ratings			
Pickup Voltage	4 V @ 5.5 mA	4 V @ 5.5 mA	4 V @ 5.5 mA
Dropout Voltage	1 VDC	1 VDC	1 VDC
Control Resistance	220 ohms	220 ohms	220 ohms
Logic Supply Voltage	5 VDC ± 0.25 VDC	5 VDC ± 0.25 VDC	5 VDC ± 0.25 VDC
Logic Supply Current	50 mA maximum	50 mA maximum	50 mA maximum

	SNAP-OAC5	SNAP-OAC5MA	SNAP-OAC5-i
Module Ratings			
Number of Channels Per Module	4	4	4
Turn-on Time	0.5 cycle maximum (zero volts crossover)	0.5 cycle maximum (zero volts crossover)	0.5 cycle maximum (zero volts crossover)
Turn-off Time	0.5 cycle maximum (zero current crossover)	0.5 cycle maximum (zero current crossover)	0.5 cycle maximum (zero current crossover)
Isolation (Field Side to Logic Side)	4,000 volts (transient)	4,000 volts (transient)	4,000 volts (transient)
Temperature	0 ° to 70 °C, operating -30 ° to 85 °C, storage	0 ° to 70 °C, operating -30 ° to 85 °C, storage	0 ° to 70 °C, operating -30 ° to 85 °C, storage
Agency Approvals	UL, CE, CSA, RoHS, DFARS	UL, CE, RoHS, DFARS	UL, CE, RoHS, DFARS
Warranty	Lifetime	30 months	Lifetime

SNAP-OAC5FM and SNAP-OAC5-iFM

	SNAP-OAC5-FM	SNAP-OAC5-i-FM
Key Feature	Factory Mutual approved	Four isolated channels Factory Mutual approved
Torque, hold-down screws	4 in-lb (0.45 N-m)	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)	5.26 in-lb (0.6 N-m)
Field Side Ratings (each channel)		
Line Voltage - Range	24–250 VAC	24–250 VAC
Line Voltage - Nominal	120/240 VAC	120/240 VAC
Current Rating 0 °C to 70 °C Ambient	3 amps per module	3 amps per module
One Cycle Surge	80 amps peak (50/60 Hz)	80 amps peak (50/60 Hz)
Minimum Load Current	20 mA	20 mA
Output Voltage Drop	1.6 volts max.@ 0.75 amps	1.6 volts max.@ 0.75 amps
Off-state Leakage at Nominal Voltage - 60 Hz	2.5 mA @ 240 VAC 1.25 mA @ 120 VAC	2.5 mA @ 240 VAC 1.25 mA @ 120 VAC
Peak Blocking Voltage	500 V	500 V
Operating Frequency	25–65 Hz	25–65 Hz
dV/ dt - Off-state	200 volts/msec	200 volts/msec
dV/ dt - Commutating	Snubbed for rated 0.5 power factor load	Snubbed for rated 0.5 power factor load

	SNAP-OAC5-FM	SNAP-OAC5-i-FM
Fuse (Common to all Channels)	250 VAC - 4A 5x20 mm Fast-acting Bell Fuse Part No. BEL 5HF4 Opto 22 Part No. SNAP-FUSE4AB	Has four isolated channels. User must provide own fusing.
Channel-to-channel isolation	Not applicable	300 VAC (1500 V transient)
Logic Side Ratings		
Pickup Voltage	4 V @ 5.5 mA	4 V @ 5.5 mA
Dropout Voltage	1 VDC	1 VDC
Control Resistance	220 ohms	220 ohms
Logic Supply Voltage	5 VDC $\pm$ 0.25 VDC	5 VDC $\pm$ 0.25 VDC
Logic Supply Current	50 mA maximum	50 mA maximum
Module Ratings		
Channels Per Module	4	4
Turn-on Time	0.5 cycle maximum (zero volts crossover)	0.5 cycle maximum (zero volts crossover)
Turn-off Time	0.5 cycle maximum (zero current crossover)	0.5 cycle maximum (zero current crossover)
Isolation (Field Side to Logic Side)	4,000 volts (transient)	4,000 volts (transient)
Temperature	0 ° to 70 °C, operating -30 ° to 85 °C, storage	0 ° to 70 °C, operating -30 ° to 85 °C, storage
Agency Approvals	CE, FM, RoHS, DFARS	CE, FM, RoHS, DFARS
Warranty	Lifetime	Lifetime

SNAP-ODC5SNK, SNAP-ODC5SRC, SNAP-ODC5R, and SNAP-ODC5R5

	SNAP-ODC5SRC	SNAP-ODC5SNK
Key Feature	Load sourcing	Load sinking
Torque, hold-down screws	4 in-lb (0.45 N-m)	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)	5.26 in-lb (0.6 N-m)
Field Side Ratings (each channel)		
Line Voltage - Range	5–60 VDC	5–60 VDC
Line Voltage - Nominal	5–48 VDC	5–48 VDC
Current Rating 0 °C to 70 °C Ambient	3 amps per module	3 amps per module
Surge Current	5 amps peak for 1 second	5 amps peak for 1 second
Minimum Load	20 mA	20 mA
Output Voltage Drop	1.6 volts max.@ 0.75 amps	1.6 volts max.@ 0.75 amps
Off-state Leakage	1 mA @ 60 VDC	1 mA @ 60 VDC
Peak Blocking Voltage	60 VDC	60 VDC
Fuse (Common to all Channels)	250 VAC - 4A 5x20 mm Fast-acting Bell Fuse Part No. BEL 5HF4 Opto 22 Part SNAP-FUSE4AB	250 VAC - 4A 5x20 mm Fast-acting Bell Fuse Part No. BEL 5HF4 Opto 22 Part SNAP-FUSE4AB
Channel-to-channel isolation	Not applicable	Not applicable
Logic Side Ratings		
Pickup Voltage	4 V @ 5.5 mA	4 V @ 5.5 mA
Dropout Voltage	1 VDC	1 VDC
Control Resistance	220 ohms	220 ohms
Logic Supply Voltage	5 VDC ± 0.25 VDC	5 VDC ± 0.25 VDC
Logic Supply Current	50 mA maximum	50 mA maximum
Module Ratings		
Number of Channels Per Module	4	4
Turn-on Time	100 usec	100 usec
Turn-off Time	750 usec	750 usec
Isolation (Field Side to Logic Side)	4,000 volts (transient)	4,000 volts (transient)
Temperature	0 to 70 °C, operating -30 to 85 °C, storage	0 to 70 °C, operating -30 to 85 °C, storage
Agency Approvals	UL, CE, CSA, RoHS, DFARS	UL, CE, CSA, RoHS, DFARS
Warranty	Lifetime	Lifetime

SNAP-ODC5SNKFM, SNAP-ODC5SRCFM, SNAP-ODC5RFM, and SNAP-ODC5R5FM

	SNAP-ODC5SRCFM	SNAP-ODC5SNKFM
Key Feature	Factory Mutual approved	Factory Mutual approved
Torque, hold-down screws	4 in-lb (0.45 N-m)	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)	5.26 in-lb (0.6 N-m)
Field Side Ratings (each channel)		
Line Voltage - Range	5–60 VDC	5–60 VDC
Line Voltage - Nominal	5–48 VDC	5–48 VDC
Current Rating 0°C to 70°C Ambient	3 amps per module	3 amps per module
Surge Current	5 amps peak for 1 second	5 amps peak for 1 second
Minimum Load	20 mA	20 mA
Output Voltage Drop	1.6 volts max.@ 0.75 amps	1.6 volts max.@ 0.75 amps
Off-state Leakage	1 mA @ 60 VDC	1 mA @ 60 VDC
Peak Blocking Voltage	60 VDC	60 VDC
Fuse (Common to all Channels)	250 VAC - 4A 5x20 mm Fast-acting Bell Fuse Part No. BEL 5HF4 Opto 22 Part SNAP-FUSE4AB	250 VAC - 4A 5x20 mm Fast-acting Bell Fuse Part No. BEL 5HF4 Opto 22 Part SNAP-FUSE4AB
Logic Side Ratings		
Pickup Voltage	4 V @ 5.5 mA	4 V @ 5.5 mA
Dropout Voltage	1 VDC	1 VDC
Control Resistance	220 ohms	220 ohms
Logic Supply Voltage	5 VDC $\pm$ 0.25 VDC	5 VDC $\pm$ 0.25 VDC
Logic Supply Current	50 mA maximum	50 mA maximum
Module Ratings		
Number of Channels Per Module	4	4
Turn-on Time	100 usec	100 usec
Turn-off Time	750 usec	750 usec
Isolation (Field Side to Logic Side)	4,000 volts (transient)	4,000 volts (transient)
Temperature	0 to 70 °C, operating -30 to 85 °C, storage	0 to 70 °C, operating -30 to 85 °C, storage
Agency Approvals	CE, FM, RoHS, DFARS	CE, FM, RoHS, DFARS
Warranty	Lifetime	Lifetime

SNAP-ODC5-iFM and SNAP-ODC5A-iFM

	SNAP-ODC5-iFM	SNAP-ODC5A-iFM
Key Feature	Four isolated channels Factory Mutual approved	Four isolated channels Factory Mutual approved
Torque, hold-down screws	4 in-lb (0.45 N-m)	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)	5.26 in-lb (0.6 N-m)
Field Side Ratings (each channel)		
Line Voltage - Range	5–60 VDC	5–200 VDC
Line Voltage - Nominal	5–48 VDC	5–200 VDC
Current Rating 0°C to 70°C Ambient	3 amps per module	3 amps per module
Surge Current	5 amps peak for 1 second	5 amps peak for 1 second
Minimum Load	20 mA	20 mA
Output Voltage Drop	1.6 volts max.@ 0.75 amps	1.6 volts max.@ 0.75 amps
Off-state Leakage	1 mA @ 60 VDC	1 mA @ 60 VDC
Peak Blocking Voltage	60 VDC	200 VDC
Fuse (Common to all Channels)	Has four isolated channels. User must provide own fusing.	Has four isolated channels. User must provide own fusing.
Logic Side Ratings		
Pickup Voltage	4 V @ 5.5 mA	4 V @ 5.5 mA
Dropout Voltage	1 VDC	1 VDC
Control Resistance	220 ohms	220 ohms
Logic Supply Voltage	5 VDC $\pm$ 0.25 VDC	5 VDC $\pm$ 0.25 VDC
Logic Supply Current	50 mA maximum	50 mA maximum
Module Ratings		
Number of Channels Per Module	4	4
Turn-on Time	100 usec	100 usec
Turn-off Time	750 usec	750 usec
Isolation (Field Side to Logic Side)	4,000 volts (transient)	4,000 volts (transient)
Temperature	0 ° to 70 °C, operating -30 ° to 85 °C, storage	0 ° to 70 °C, operating -30 ° to 85 °C, storage
Agency Approvals	CE, FM, RoHS, DFARS	CE, FM, RoHS, DFARS
Warranty	Lifetime	Lifetime

SNAP-ODC5MA, SNAP-ODC5-i, SNAP-ODC5A-i, and SNAP-ODC5ASNK

	SNAP-ODC5MA	SNAP-ODC5-i	SNAP-ODC5A-i	SNAP-ODC5ASNK
Key Feature	Diagnostic switches Four isolated channels	Four isolated channels	Four isolated channels	Load sinking
Torque, hold-down screws	4 in-lb (0.45 N-m)	4 in-lb (0.45 N-m)	4 in-lb (0.45 N-m)	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)	5.26 in-lb (0.6 N-m)	5.26 in-lb (0.6 N-m)	5.26 in-lb (0.6 N-m)
Field Side Ratings (each channel)				
Line Voltage - Range	5–60 VDC	5–60 VDC	5–200 VDC	5–200 VDC
Line Voltage - Nominal	5–48 VDC	5–48 VDC	5–200 VDC	5–200 VDC
Current Rating 0 °C to 70 °C Ambient	2 amps per module 0.5 amps per channel	3 amps per module	3 amps per module	3 amps per module
Surge Current	1.5 amps peak for 1 second	5 amps peak for 1 second	5 amps peak for 1 second	5 amps peak for 1 second
Minimum Load	20 mA	20 mA	20 mA	20 mA
Output Voltage Drop	1.6 volts max.@ 0.75 amps	1.6 volts max.@ 0.75 amps	1.6 volts max.@ 0.75 amps	1.6 volts max.@ 0.75 amps
Off-state Leakage	1 mA @ 60 VDC	1 mA @ 60 VDC	1 mA @ 200 VDC	1 mA @ 200 VDC
Peak Blocking Voltage	60 VDC	60 VDC	200 VDC	200 VDC
Fuse (Common to all Channels)	Has four isolated channels. User must provide own fusing.	Has four isolated channels. User must provide own fusing.	Has four isolated channels. User must provide own fusing.	250 VAC - 4A 5x20 mm Fast-acting Bell Fuse Part: BEL 5HF4 Opto 22 Part: SNAP-FUSE4AB
Channel-to-channel isolation	300 VAC (1500 V transient)	300 VAC (1500 V transient)	300 VAC (1500 V transient)	Not applicable
Logic Side Ratings				
Pickup Voltage	4 V @ 5.5 mA	4 V @ 5.5 mA	4 V @ 5.5 mA	4 V @ 5.5 mA
Dropout Voltage	1 VDC	1 VDC	1 VDC	1 VDC
Control Resistance	220 ohms	220 ohms	220 ohms	220 ohms
Logic Supply Voltage	5 VDC ± 0.25 VDC	5 VDC ± 0.25 VDC	5 VDC ± 0.25 VDC	5 VDC ± 0.25 VDC
Logic Supply Current	50 mA maximum	50 mA maximum	50 mA maximum	50 mA maximum
Module Ratings				
Number of Channels Per Module	4	4	4	4
Turn-on Time	100 usec	100 usec	100 usec	100 usec
Turn-off Time	750 usec	750 usec	750 usec	750 usec
Isolation (Field Side to Logic Side)	4,000 volts (transient)	4,000 volts (transient)	4,000 volts (transient)	4,000 volts (transient)

	SNAP-ODC5MA	SNAP-ODC5-i	SNAP-ODC5A-i	SNAP-ODC5ASNK
Temperature	0 ° to 70 °C, operating -30 ° to 85 °C, storage	0 ° to 70 °C, operating -30 ° to 85 °C, storage	0 ° to 70 °C, operating -30 ° to 85 °C, storage	0 ° to 70 °C, operating -30 ° to 85 °C, storage
Agency Approvals	UL, CE, RoHS, DFARS	UL, CE, RoHS, DFARS	UL, CE, RoHS, DFARS	UL, CE, RoHS, DFARS
Warranty	30 months	Lifetime	Lifetime	Lifetime

SNAP-ODC-32-SRC, SNAP-ODC-32-SRC-FM, SNAP-ODC-32-SNK, and SNAP-ODC-32-SNK-FM

	SNAP-ODC-32-SRC SNAP-ODC-32-SRC-FM	SNAP-ODC-32-SNK SNAP-ODC-32-SNK-FM
Switching Voltage	5–60 VDC	5–60 VDC
Nominal Switching Voltage	12–24 VDC	12–24 VDC
Logic Voltage and Current	5 VDC $\pm$ 0.1 @ 150 mA	5 VDC $\pm$ 0.1 @ 150 mA
Maximum Off State Voltage	60 VDC	60 VDC
Output Leakage, Typical	<10 microamps per channel (60 V, 70 °C)	<10 microamps per channel (60 V, 70 °C)
Maximum Load per Point	0.25 A	0.25 A
Voltage Drop	0.15 VDC @ 0.25 A	0.15 VDC @ 0.25 A
Surge (1 sec.)	1 A	1 A
Output Arrangement	32 output channels; 4 groups of 8 outputs each. Points in each group share a common positive connection.	32 output channels; 4 groups of 8 outputs each. Points in each group share a common negative connection.
Output Turn-On/Off Time	100 microseconds	100 microseconds
Polling time from I/O processor to module ¹	2–30 ms typical ²	2–30 ms typical ²
Indicators	None; use optional OptoTerminal-G20 diagnostic display or breakout rack.	None; use optional OptoTerminal-G20 diagnostic display or breakout rack.
Maximum Number of HDD Modules on One Mounting Rack	16	16
Agency Approvals	SNAP-ODC-32-SRC: UL, CE, RoHS, DFARS SNAP-ODC-32-SRC-FM: CE, FM, RoHS, DFARS	SNAP-ODC-32-SNK: UL, CE, RoHS, DFARS SNAP-ODC-32-SNK-FM: CE, FM, RoHS, DFARS
Torque, hold-down screws	4 in-lb (0.45 N-m)	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)	5.26 in-lb (0.6 N-m)
Warranty	Lifetime	Lifetime

¹ Affects turn-on and turn-off determination

² Time varies based on the SNAP PAC I/O processor (brain or on-the-rack controller), processor configuration, and Ethernet host communication activity.

SNAP-OMR6-C and SNAP-OMR6-A

	SNAP-OMR6-C	SNAP-OMR6-A
Field Side Ratings (each channel)		
Contact Configuration	Form C (SPDT, normally open or closed)	Form A (SPST, normally open)
Line Voltage - Range	0–250 VAC or 0–30 VDC	0–250 VAC or 0–30 VDC
Current Rating	6 amps switching @ 250 VAC / 30 VDC	6 amps switching @ 250 VAC / 30 VDC
Surge Current	6 amps	6 amps
Minimum Load	5 VDC, 10 mA	5 VDC, 10 mA
Contact Resistance	≤ 100 milliohms	≤ 100 milliohms
Switching Power	1500 VA / 144 W (DC)	1500 VA / 144 W (DC)
Peak Blocking Voltage	250 VAC / 30 VDC	250 VAC / 30 VDC
Channel-to-channel isolation	300 VAC (1500 V _{transient})	300 VAC (1500 V _{transient})
Logic Side Ratings		
Pickup Voltage	1 V @ 2 mA	1 V @ 2 mA
Dropout Voltage	4 VDC	4 VDC
Control Resistance	220 ohms	220 ohms
Logic Supply Voltage	5 VDC ± 0.25 VDC	5 VDC ± 0.25 VDC
Logic Supply Current	160 mA maximum	160 mA maximum
Module Ratings		
Number of Channels Per Module	4	4
Turn-on Time	8 milliseconds	8 milliseconds
Turn-off Time	8 milliseconds	8 milliseconds
Torque, hold-down screws	4 in-lb (0.45 N-m)	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)	5.26 in-lb (0.6 N-m)
Temperature	0 to 70 °C, operating -30 to 85 °C, storage	0 to 70 °C, operating -30 to 85 °C, storage
Agency Approvals	CE, RoHS, DFARS	CE, RoHS, DFARS
Mechanical Life	10 x 10 ⁶ operations	10 x 10 ⁶ operations
Operational Life	30 x 10 ³ operations	30 x 10 ³ operations
Warranty	30 months	30 months

Analog Input Module Specifications

SNAP-AIARMS

Input Range	0 to 10 amp RMS AC/DC
Input Over-Range	To 11 amps
Input Resistance	0.005 ohms
Maximum Input	11 amps AC/DC
Accuracy (AC)	±8 mA and ±0.2% reading
Resolution	400 microamps
DC Reversal	±16 mA (0.16%)
Input Response Time (Step Change)	63.2% (158 V) in 50 mS 99% (248 V) in 75 mS
Data Freshness (Max)	32.3 ms
DC Common Mode Rejection	>-120 dB
AC Common Mode Rejection	>-120 dB at 60 Hz
Maximum Operating Common Mode Voltage	250 V
Isolation	1500 V
Power Requirements	5 VDC (±0.15 V) at 170 mA
Operating Temperature	0 °C to 70 °C
Storage Temperature	-25 °C to 85 °C
Torque, hold-down screws	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)
Agency Approvals	UL, FM, CE, RoHS, DFARS
Warranty	Lifetime

SNAP-AIARMS-i, SNAP-AIARMS-i-FM

Input Range	0 to 10 amp RMS AC/DC
Input Over Range	To 11 amps
Input Resistance	0.005 ohms
Maximum Input	11 amps AC/DC
Accuracy (AC)	±8 mA and ±0.2% reading
Resolution	400 µA
DC Reversal	±16 mA (0.16%)
Input Response Time (Step Change)	63.2% (6.32 A) in 50 ms 99% (9.92 A) in 75 ms
Data Freshness (Max)	0.025 ms
DC Common Mode Rejection	>-120 dB
AC Common Mode Rejection	>-120 dB at 60 Hz
Maximum Operating Voltage Between Channels Common Mode Voltage	250 V 250 V
Isolation: Optical	4000 V
Isolation: Transformer	1500 V
Isolation: Channel to Channel	250 V continuous (1500 V transient)
Power Requirements	5 VDC (±0.15 V) at 200 mA
Ambient Temperature: Operating Storage	0 °C to 70 °C -25 °C to 85 °C
Torque, hold-down screws	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)
Agency Approvals	CE, RoHS, DFARS FM (SNAP-AIARMS-FM only)
Warranty	Lifetime

SNAP-AILC and SNAP-AILC-2

Input Range Sensitivity: SNAP-AILC SNAP-AILC-2	2 mV/V or 3 mV/V (Over range ± 2.2 mV or ± 3.3 mV) 3 mV/V or 4 mV/V (Over range ± 3.3 mV or ± 4.4 mV)
Input Resistance	100 Megohms differential
Resolution: Analog Scale Points	>22 bits + sign ($\pm 6,400,000$ counts = $\pm 100\%$ of scale)
Response Time, Data Freshness	See the following table
DC Reversal (Input)	0.015% (± 1000 counts of reading @ 6,400,000 F.S.)
DC Common Mode Rejection	>-120 dB
AC Common Mode Rejection	>-120 dB @ 60 Hz
Maximum Survivable Input	± 15 volts across module load cell connector
Maximum Operating Common Mode Voltage	250 V
Accuracy (% Full Scale): Offset Gain	$\pm 0.05\%$ (= 3,200 counts out of 6,400,000, out of box) $\pm 0.05\%$ (= 3,200 counts out of 6,400,000, out of box)
Usable Resolution at Default Configuration (Fast)	38 nV - sign and 19 bits ($\pm 524,288$ counts @ channel 2) At filter weight 64, settles to 99.9% of final reading in 3.9 s.
DRIFT: Gain Offset	40 PPM / °C 10 PPM / °C
Isolation: Optical	4000 V
Isolation: Transformer	1500 V
Rack Power Requirements	5.00 VDC to 5.20 VDC @ 120 mA
24V Bridge Supply: Input Voltage Input Current Output Fault Current	24 VDC nominal (22 V min. to 30 V max.) 40 mA for one load cell or 115 mA for four load cells 124 mA typical (field fault—shorted bridge)
Ambient Temperature: Operating Storage	0 to 70 °C -25 to 85 °C
Torque, hold-down screws	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)
Agency Approvals	CE, RoHS, DFARS
Warranty	Lifetime

SNAP-AICTD and SNAP-AICTD-4

Input Range with ICTD Probe	-40 °C to +100 °C
Module Input Range Zero Scale Full Scale	-273 °C +150 °C
Resolution	0.017 °C
Accuracy with ICTD Probe	±0.8 °C
Sensitivity	1.0 microamps/ °C
Data Freshness (Max)	167 ms (2-channel module) 355 ms (4-channel module)
DC Common Mode Rejection	>-120 dB
AC Common Mode Rejection	>-120 dB @ 60 Hz
Maximum Operating Common Mode Voltage	250 V
Isolation	1500 V
Power Requirements	5 VDC (± .015) @ 150 mA
Operating Temperature	0 °C to 70 °C
Storage Temperature	-25 °C to 85 °C
Torque, hold-down screws	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)
Agency Approvals	UL, FM, CE, RoHS, DFARS
Warranty	Lifetime

SNAP-AICTD-8

Input Range with ICTD Probe	-40 °C to +100 °C
Module Input Range Zero Scale Full Scale	-273 °C +150 °C
Data Freshness (Max)	0.28 seconds
Resolution	0.017 °C
Accuracy with ICTD Probe	±0.8 °C
Sensitivity	1.0 mA/ °C
DC Common Mode Rejection	>-120 dB
AC Common Mode Rejection	>-120 dB @ 60 Hz
Maximum Operating Common Mode Voltage	250 V
Isolation	1500 V
Power Requirements	5 VDC (± .015) @ 170 mA
Operating Temperature	0 °C to 70 °C
Storage Temperature	-25 °C to 85 °C
Torque, hold-down screws	4 in-lb (0.45 N-m)
Torque, connector screws	1.7 in-lb (0.19 N-m)
Agency Approvals	CE, RoHS, DFARS
Warranty	Lifetime

SNAP-AIMA and SNAP-AIMA-4

Input Range	-20 mA to +20 mA
Resolution	0.8 microamps
Over-Range Limits	From -22 to +22 mA (+/-20 mA range)
Input Response Time (% of span/ $\Delta I / \Delta t$)	99.9% / 19.9 mA / 10 ms
Data Freshness (Max)	SNAP-AIMA: 11.5 ms SNAP-AIMA-4: 23 ms
DC Common Mode Rejection	>-120 dB
AC Common Mode Rejection	>-120 dB @ 60 Hz
Maximum Survivable Input	36 mA or 9 VDC
Maximum Operating Common Mode Voltage	250 V
Accuracy	0.05% (10 microamps)
DRIFT: Gain Temperature Coefficient	30 PPM/ °C
DRIFT: Offset Temperature Coefficient	15 PPM/ °C
Power Requirements	5 VDC (± 0.15) @ 170 mA
Input Resistance - Single Ended	200 ohms (each channel)
Operating Temperature	0 °C to 70 °C
Storage Temperature	-25 °C to 85 °C
Torque, hold-down screws	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)
Agency Approvals	UL, FM, CE, RoHS, DFARS
Warranty	Lifetime

SNAP-AIMA-8

Input Range	-20 mA to +20 mA
Over-Range Limits	From -22 to +22 mA (+/-20 mA range)
Resolution	0.8 microamps
Data Freshness (Max)	0.28 seconds
DC Common Mode Rejection	>-120 dB
AC Common Mode Rejection	>-120 dB @ 60 Hz
Maximum Survivable Input	36 mA or 9 VDC
Maximum Operating Common Mode Voltage	250 V
Accuracy	0.05% (10 microamps)
DRIFT: Gain Temperature Coefficient	30 PPM/ °C
DRIFT: Offset Temperature Coefficient	15 PPM/ °C
Isolation	1500 V
Power Requirements	5 VDC (± 0.15) @ 170 mA
Input Resistance - Single Ended	100 ohms (all channels share the same reference point)
Operating Temperature	0 °C to 70 °C
Storage Temperature	-25 °C to 85 °C
Torque, hold-down screws	4 in-lb (0.45 N-m)
Torque, connector screws	1.7 in-lb (0.19 N-m)
Agency Approvals	CE, RoHS, DFARS
Warranty	Lifetime

SNAP-AIMA-32, SNAP-AIMA-32-FM

Input Range	-20 mA to +20 mA
Over-Range Limits	From -22 to +22 mA (+/-20 mA range)
Resolution	0.8 microamps
Input Filtering	-3 dB @ 31 Hz
Data Freshness (Max)	1.15 s
DC Common Mode Rejection	>-120 dB
AC Common Mode Rejection	>-120 dB @ 60 Hz
Maximum Survivable Input	36 mA or 9 VDC
Maximum Operating Common Mode Voltage	250 V
Accuracy	0.1% (20 microamps)
DRIFT: Gain Temperature Coefficient	30 PPM/ °C
DRIFT: Offset Temperature Coefficient	15 PPM/ °C
Isolation	1500 V, field to logic
Power Requirements	5 VDC (±0.15) @ 150 mA
Input Resistance - Single Ended	100 ohms (each channel)
Operating Temperature	0 °C to 70 °C
Storage Temperature	-25 °C to 85 °C
Torque, hold-down screws	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)
Agency Approvals	SNAP-AIMA-32: UL, CE, RoHS, DFARS. SNAP-AIMA-32-FM: CE, FM, RoHS, DFARS
Warranty	Lifetime

SNAP-AIMA2-i

Input Range	-1 mA to +1mA
Maximum Over Range	± 10% (= ± 27500 counts)
Resolution	0.04 µA
Input Response Time (% of span/delta I/delta time)	99.9 %/19.9 µA/10 ms
DC Common Mode Rejection	>-120 dB
AC Common Mode Rejection	>-120 dB @ 60 Hz
Maximum Survivable Input	11 mA or 28 VDC
Maximum Operating Common Mode Voltage	250 V
Accuracy	0.05% (0.05 µA)
DRIFT: Gain Temperature Coefficient	30 PPM/ °C
DRIFT: Offset Temperature Coefficient	15 PPM/ °C
Isolation: Optical	4000 V
Isolation: Transformer	1500 V
Isolation: Channel to Channel	250 V continuous (1500 V transient)
Power Requirements	5 VDC (±0.15) @ 200 mA
Input Resistance	5 K ohms (each channel)
Ambient Temperature: Operating Storage	0 °C to 70 °C -25 °C to 85 °C
Torque, hold-down screws	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)
Agency Approvals	CE, RoHS, DFARS
Warranty	Lifetime

SNAP-AIMA-i

Input Range	-20 mA to +20 mA
Maximum Over Range	$\pm 10\%$ ($= \pm 27500$ counts)
Resolution	0.8 μ A
Input Response Time (% of span/delta I/delta time)	99.9 %/19.9 μ A/10 mS
DC Common Mode Rejection	>-120 dB
AC Common Mode Rejection	>-120 dB @ 60 Hz
Maximum Survivable Input	36 mA or 9 VDC
Maximum Operating Common Mode Voltage	250 V
Accuracy	0.05% (10 μ A)
Isolation: Optical	4000 V
Isolation: Transformer	1500 V
Isolation: Channel to Channel	250 V continuous (1500 V transient)
DRIFT: Gain Temperature Coefficient	30 PPM/ °C
DRIFT: Offset Temperature Coefficient	15 PPM/ °C
Power Requirements	5 VDC (± 0.15) @ 200 mA
Input Resistance - Single Ended	200 ohms (each channel)
Ambient Temperature: Operating Storage	0 °C to 70 °C -25 °C to 85 °C
Torque, hold-down screws	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)
Agency Approvals	UL, CE, FM, RoHS, DFARS
Warranty	Lifetime

**SNAP-AIMA-iSRC and
SNAP-AIMA-iSRC-FM**

Input Range	0 to +20 mA with loop sourcing -20 mA to +20 mA
Maximum Over Range	$\pm 10\%$ ($= \pm 27500$ counts)
Resolution	0.8 μ A
Input Response Time (% of span/delta I/delta time)	99.9 %/19.9 mA/10 ms
DC Common Mode Rejection	>-120 dB
AC Common Mode Rejection	>-120 dB @ 60 Hz
Maximum Survivable Input	36 mA or 9 VDC
Maximum Operating Common Mode Voltage	250 V
Accuracy	0.05% (10 μ A)
DRIFT: Gain Temperature Coefficient	30 PPM/ °C
DRIFT: Offset Temperature Coefficient	15 PPM/ °C
Isolation: Optical	4000 V
Isolation: Transformer	1500 V
Isolation: Channel to Channel	250 V continuous (1500 V transient)
Power Requirements	5 VDC (± 0.15) @ 200 mA
Power Requirements - Loop Power (Input)	From separate field connector: 24 VDC nominal (70 mA max @ 24 V input, both loops @ 20 mA), 30 VDC maximum
Loop Power (Output)	24 VDC (± 1.5 V) @ 20 mA Open loop: 30 V maximum Shorted loop: 24 mA nominal
Input Resistance	200 ohms (each channel)
Ambient Temperature: Operating Storage	0 °C to 70 °C -25 °C to 85 °C
Torque, hold-down screws	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)
Agency Approvals	CE, RoHS, DFARS FM (SNAP-AIMA-iSRC-FM only)
Warranty	Lifetime

SNAP-AIR40K-4

Input Range	0 to 40,000 Ohms 0 to 20,000 Ohms 0 to 10,000 Ohms 0 to 5,000 Ohms
Maximum Over-Range	44 K (40 K Ohms range) 22 K (20 K Ohms range) 11 K (10 K Ohms range) 5.5 K (5 K Ohms range)
Resolution	1.6 Ohm @ 40 K Ohms 0.8 Ohm @ 20 K Ohms 0.4 Ohm @ 10 K Ohms 0.2 Ohm @ 5 K Ohms
Input Filtering	-3 dB @ 3.2 Hz
Data Freshness (Max)	100 (40 K Ohms) 200 (20 K Ohms) 400 (10 K Ohms) 800 (5 K Ohms)
DC Common Mode Rejection	>-120 dB
AC Common Mode Rejection	>-120 dB @ 60 Hz
Maximum Operating Common Mode Voltage	250 V
Accuracy	0.1% ± 40 Ohms @ 40 K Ohms 0.1% ± 20 Ohms @ 20 K Ohms 0.1% ± 10 Ohms @ 10 K Ohms 0.1% ± 5 Ohms @ 5 K Ohms
DRIFT: Gain Temperature Coefficient	30 PPM/ °C
DRIFT: Offset Temperature Coefficient	15 PPM/ °C
Isolation	1500 V
Power Requirements	5 VDC (±0.15) @ 190 mA
Operating Temperature	0 °C to 70 °C
Storage Temperature	-25 °C to 85 °C
Torque, hold-down screws	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)
Agency Approvals	UL, FM, CE, RoHS, DFARS
Warranty	Lifetime

SNAP-AIMV-4

Input Range	From -150 mV to +150 mV From -75 mV to +75m V
Over-Range Limits	From -165 to +165 mV (+/-150 mV range) From -82.5 to +82.5 mV (+/-75 mV range)
Resolution	6 microvolts (-150 mV to +150 mV) 3 microvolts (-75 mV to +75 mV)
Input Filtering	-3 dB @ 7 Hz
Input Response Time (% of span/delta V/delta time)	63.2%/95 mV/23 ms
Data Freshness (Max)	335 ms (+/- 150 mV) 668 ms (+/- 75 mV)
DC Common Mode Rejection	>-120 dB
AC Common Mode Rejection	>-120 dB @ 60 Hz
Maximum Survivable Input	±15 volts
Maximum Operating Common Mode Voltage	250 V
Accuracy at Full Scale	0.06% (90 microvolts) @ 150 mV 0.1% (75 microvolts) @ 75 mV
Drift: Gain Temperature Coefficient	3 microvolts / °C
Drift: Offset Temperature Coefficient	2 microvolts / °C
Isolation	1500 V
Power Requirements	5 VDC (±0.15) @ 170 mA
Input Resistance - Single Ended	100 Megohms (each channel)
Operating Temperature	0 °C to 70 °C
Storage Temperature	-25 °C to 85 °C
Torque, hold-down screws	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)
Agency Approvals	UL, FM, CE, RoHS, DFARS
Warranty	Lifetime

SNAP-AIMV2-4

Input Range	From -50 mV to +50 mV From -25 mV to +25m V
Over-Range Limits	From -55 to +55 mV (+/-50 mV range) From -27.5 to +27.5 mV (+/-25 mV range)
Resolution	2 microvolts (-50 mV to +50 mV) 1 microvolt (-25 mV to +25 m V)
Input Filtering	-3 dB @ 2.4Hz
Input Response Time (% of span/delta V/delta time)	63.2%/31.5 mV/66 ms
Data Freshness (Max)	335 ms (+/- 50 mV) 668 ms (+/- 25 mV)
DC Common Mode Rejection	>-120 dB
AC Common Mode Rejection	>-120 dB @ 60 Hz
Maximum Survivable Input	±15 volts
Maximum Operating Com- mon Mode Voltage	250 V
Accuracy at Full Scale	0.1% (50 microvolts) @ 50m V 0.2% (50 microvolts) @ 25 mV
Drift: Gain Temperature Coefficient	3 microvolts / °C
Drift: Offset Temperature Coefficient	2 microvolts / °C
Isolation	1500 V
Power Requirements	5 VDC (±0.15) @ 170 mA
Input Resistance - Single Ended	100 Megohms (each channel)
Operating Temperature	0 °C to 70 °C
Storage Temperature	-25 °C to 85 °C
Torque, hold-down screws	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)
Agency Approvals	UL, FM, CE, RoHS, DFARS
Warranty	Lifetime

SNAP-AIRATE

Nominal Input Range	0 to 25,000 Hz
Input Over-Range	To 27,500 Hz
Resolution	1 Hz
Input Response Time(% of span / delta Hz / delta time)	10.0% / 2,500 Hz / 0.1 sec 63.2% / 15.8 K Hz / 0.9 sec 99.0% / 24.75 K Hz / 4.2 sec
Data Freshness (Max)	126 ms
DC Common Mode Rejection	> -120 dB
AC Common Mode Rejection	> -120 dB at 60 Hz
Maximum Operating Com- mon Mode Voltage	250 V
Accuracy (% full scale)	±4 Hz or ±0.5% of the input fre- quency (whichever is greater)
Drift: Gain Temperature Coef- ficient	200 ppm / °C
Drift: Offset Temperature Coefficient	50 ppm / °C
Input Coupling	Single-ended AC (capacitor coupled)
Input Amplitude Sine wave Square wave	2.5 V to 24 V p-p 0.5 V to 24 V p-p
Minimum Pulse Width	18 microseconds
Input Impedance (Inputs share the same reference point.) Pull-up Voltage Pull-up Resistor	50 K ohms AC coupled (-input to +input) 6 to 9 V 4.7 K ohms
Isolation	1500 V
Power Requirements	5 VDC (±0.15 V) at 190 mA
Operating Temperature	0 °C to 70 °C
Storage Temperature	-25 °C to 85 °C
Torque, hold-down screws	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)
Agency Approvals	UL, FM, CE, RoHS, DFARS
Warranty	Lifetime

SNAP-AIRTD

3-wire RTD input	100-ohm platinum; $\alpha=0.00385$
Input Temperature Range	-200 °C to 850 °C (-328° to +1,582° F)
Input Range	0 to 400 ohms
Over-Range Limit	to 400 ohms
Resolution (average)	0.042 °C (0.016 ohms)
Input Filtering	-3 dB @ 0.1 Hz
Data Freshness (Max)	100 ms
Input Response Time (% of span/delta temp/delta time)	63.2 %/598 °C/25 ms
Lead Compensation	Automatic when used with SNAP brains
DC Common Mode Rejection	>-120 dB
AC Common Mode Rejection	>-120 dB at 60 Hz
Excitation (typical)	1.25 mA constant current
Maximum Lead Resistance	>40 ohms single wire (all leads to be equal resistance)
Maximum Fault Voltage at Input (between any 2 field wires)	±15 V
Maximum Operating Common Mode Voltage	250 V
Accuracy From factory After setting gain and offset	0.8 °C 0.6 °C
Isolation	1500 V
Power Requirements	5 VDC (±0.15) @ 190 mA
Operating Temperature	0 °C to 70 °C
Storage Temperature	-25 °C to 85 °C
Torque, hold-down screws	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)
Agency Approvals	UL, FM, CE, RoHS, DFARS
Warranty	Lifetime

SNAP-AIRTD-10

3-wire RTD input	10-ohm copper; $\alpha=0.00428$
Input Temperature Range	-180 °C to 260 °C (-292° to +500° F)
Input Range	0 to 25 ohms
Over-Range Limit	to 27.5 ohms
Resolution (average)	0.026 °C (0.001 ohms)
Input Filtering	-3 dB @ 100 Hz
Data Freshness (Max)	168 ms
Lead Compensation	Automatic when used with SNAP PAC brains
DC Common Mode Rejection	>-120 dB
AC Common Mode Rejection	>-120 dB at 60 Hz
Excitation (typical)	5.4 mA constant current
Maximum Lead Resistance	>15 ohms single wire (all leads to be equal resistance)
Maximum Fault Voltage at Input (between any 2 field wires)	±15 V
Maximum Operating Common Mode Voltage	250 V
Accuracy From factory After setting gain and offset	0.6 °C 0.5 °C
Isolation	1500 V
Power Requirements	5 VDC (±0.15) @ 190 mA
Operating Temperature	0 °C to 70 °C
Storage Temperature	-25 °C to 85 °C
Torque, hold-down screws	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)
Agency Approvals	CE, RoHS, DFARS
Warranty	Lifetime

SNAP-AITM

Input Range	From -150 mV to +150 mV From -75 mV to +75 mV
Over-Range Limits	From -165 to +165 mV (+/-150 mV range) From -82.5 to +82.5 mV (+/-75 mV range)
Resolution	6 microvolts from -150 to +150 mV 3 microvolts from -75 to +75 mV
Cold Junction Temperature Compensation	Automatic when used with SNAP I/O processors
Input Filtering	-3 dB @ 7 Hz
Input Response Time (% of span/delta V/delta time)	63.2%/95 mV/23 mS
Data Freshness (Max)	167 ms (+/-150 mV) 334 ms (+/-75 mV)
DC Common Mode Rejection	>-120 dB
AC Common Mode Rejection	>-120 dB @ 60 Hz
Maximum Survivable Input	±15 volts
Maximum Operating Common Mode Voltage	250 V
Accuracy at Full Scale	0.06% (90 microvolts) @ 150 mV 0.1% (75 microvolts) @ 75 mV
Drift: Gain Temperature Coefficient	5 microvolts / °C
Drift: Offset Temperature Coefficient	2 microvolts / °C
Thermocouple Accuracy [°C] From factory After user gain and offset commands	± 2.0 (E, J, and K) ± 0.8
Isolation	1500 V
Power Requirements	5 VDC (±0.15) @ 170 mA
Input Resistance	100 Megohms (each channel)
Ambient Temperature: Operating Storage	0 °C to 70 °C -25 °C to 85 °C
Torque, hold-down screws	4 in-lb (0.45 N-m)
Torque, connector screws	3 in-lb (0.34 N-m)
Agency Approvals	FM, CE, RoHS, DFARS
Warranty	Lifetime

SNAP-AITM-i

Input Range	From -150 mV to +150 mV From -75 mV to +75 mV
Maximum Over Range	± 10% (= ± 27500 counts)
Resolution	6 µV from -150 mV to +150 mV 3 µV from -75 mV to +75 mV
Cold Junction Temperature Compensation	Automatic when used with SNAP brains
Input Filtering	-3 dB @ 7 Hz
Input Response Time (% of span/delta V/delta time)	63.2%/95 mV/23 mS
DC Common Mode Rejection	>-120 dB
AC Common Mode Rejection	>-120 dB @ 60 Hz
Maximum Survivable Input	±15 volts
Maximum Operating Common Mode Voltage	250 V
Accuracy	0.06% (90 µV) @ 150 mV (full scale) 0.1% (75 µV) @ 75 mV (full scale)
Drift: Gain Temperature Coefficient	5 µV / °C
Drift: Offset Temperature Coefficient	2 µV / °C
Thermocouple Accuracy [°C] From factory After user gain and offset commands	± 2.0 (E, J, and K) ± 0.8
Isolation: Optical	4000 V
Isolation: Transformer	1500 V
Isolation: Channel to Channel	250 V continuous (1500 V transient)
Power Requirements	5 VDC (±0.15) @ 200 mA
Input Resistance	100 megohms (each channel)
Ambient Temperature: Operating Storage	0 °C to 70 °C -25 °C to 85 °C
Torque, hold-down screws	4 in-lb (0.45 N-m)
Torque, connector screws	3 in-lb (0.34 N-m)
Agency Approvals	CE, FM, RoHS, DFARS
Warranty	Lifetime

SNAP-AITM-2

Input Range	From -50 mV to +50 mVDC From -25 mV to +25 mVDC		
Over-range Limits	From -55 to +55 mV (+/-50 mV range) From -27.5 to +27.5 mV (+/-25 mV range)		
Resolution	2 microvolts from -50 mV to +50 mV 1 microvolts from -25 mV to +25 mV		
Cold Junction Temperature Compensation	Automatic when used with SNAP brains		
Input Filtering	-3 dB @ 2.4 Hz		
Input Response Time (% of span/delta V/delta time)	63.2%/31.5 mV/66 ms		
Data Freshness (Max)	167 ms (+/- 50 mV) 334 ms (+/- 25 mV)		
DC Common Mode Rejection	>-120 dB		
AC Common Mode Rejection	>-120 dB @ 60 Hz		
Maximum Survivable Input	±15 volts		
Maximum Operating Common Mode Voltage	250 V		
Accuracy at Full Scale	0.1% (50 microvolts) @ 50 mV 0.2% (50 microvolts) @ 25 mV		
Drift: Gain Temperature Coefficient	5 microvolts / °C		
Drift: Offset Temperature Coefficient	2 microvolts / °C		
Thermocouple Accuracy [°C]	B, R, S	C, D, G	T, N
	±5	±4	±3
	±3	±2	±2
Isolation	1500 V		
Power Requirements	5 VDC (±0.15) @ 170 mA		
Input Resistance	100 Megohms (each channel)		
Ambient Temperature: Operating Storage	0 °C to 70 °C -25 °C to 85 °C		
Agency Approvals	FM, CE, RoHS, DFARS		
Torque, hold-down screws	4 in-lb (0.45 N-m)		
Torque, connector screws	3 in-lb (0.34 N-m)		
Warranty	Lifetime		

SNAP-AITM2-i

Input Range	From -50 mV to +50 mVDC From -25 mV to +25 mVDC		
Maximum Over Range	± 10% (= ± 27500 counts)		
Resolution	2 µV from -50 mV to +50 mV 1 µV from -25 mV to +25 mV		
Cold Junction Temperature Compensation	Automatic when used with SNAP brains		
Input Filtering	-3 dB @ 2.4 Hz		
Input Response Time (% of span/delta V/delta time)	63.2%/31.5 mV/66 ms		
DC Common Mode Rejection	>-120 dB		
AC Common Mode Rejection	>-120 dB @ 60 Hz		
Maximum Survivable Input	±15 volts		
Maximum Operating Common Mode Voltage	250 V		
Accuracy	0.1% (50 µV) @ 50 mV (full scale) 0.2% (50 µV) @ 25 mV (full scale)		
Drift: Gain Temperature Coefficient	5 µV / °C		
Drift: Offset Temperature Coefficient	2 µV / °C		
Thermocouple Accuracy [°C] From factory After user gain and offset commands	B, R, S	C, D, G	T, N
	±5	±4	±3
	±3	±2	±2
Isolation: Optical	4000 V		
Isolation: Transformer	1500 V		
Isolation: Channel to Channel	250 V continuous (1500 V transient)		
Power Requirements	5 VDC (±0.15) @ 200 mA		
Input Resistance	100 megohms (each channel)		
Ambient Temperature: Operating Storage	0 °C to 70 °C -25 °C to 85 °C		
Torque, hold-down screws	4 in-lb (0.45 N-m)		
Torque, connector screws	3 in-lb (0.34 N-m)		
Agency Approvals	CE, FM, RoHS, DFARS		
Warranty	Lifetime		

SNAP-AITM-4i

Input Range	From -150 mV to +150 mVDC From -75 mV to +75 mVDC From -50 mV to +50 mVDC From -25 mV to +25 mVDC			
Maximum Over Range	± 10% (= ± 27500 counts)			
Resolution	6 µV from -150 mV to +150 mV 3 µV from -75 mV to +75 mV 2 µV from -50 mV to +50 mV 1 µV from -25 mV to +25 mV			
Cold Junction Temperature Compensation	Automatic when used with SNAP PAC brains			
Input Filtering	-3 dB @ 5 Hz			
Data Freshness	mV input: 75 ms Thermocouple input: 140 ms			
DC Common Mode Rejection	>-120 dB			
AC Common Mode Rejection	>-120 dB @ 60 Hz			
Maximum Survivable Input	±15 volts			
Maximum Operating Common Mode Voltage	250 V			
Accuracy	0.06% (90 µV) @ 150 mV (full scale) 0.1% (75 µV) @ 75 mV (full scale) 0.1% (50 µV) @ 50 mV (full scale) 0.2% (50 µV) @ 25 mV (full scale)			
Drift: Gain Temperature Coefficient	5 µV / °C			
Drift: Offset Temperature Coefficient	2 µV / °C			
Thermocouple Accuracy [°C]	B,R,S	C,D,G	E,J,K	N,T
From factory	±5.0	±4.0	± 2.0	±3.0
After user gain and offset commands	±3.0	±2.0	± 0.8	±2.0
Isolation: Transformer	1500 V			
Isolation: Channel to Channel	250 V continuous (1500 V transient)			
Power Requirements	5 VDC (±0.15) @ 150 mA			
Input Resistance	100 megohms (each channel)			
Torque, hold-down screws	4 in-lb (0.45 N-m)			
Torque, connector screws	3 in-lb (0.34 N-m)			
Agency Approvals	CE, RoHS, DFARS			
Warranty	Lifetime			

SNAP-AIV-i

Input Range	From -10 volts to +10 volts From -5 volts to +5 volts
Maximum Over Range	$\pm 10\%$ (= ± 27500 counts)
Resolution	0.4 mV when configured -10 volts to +10 volts 0.2 mV when configured -5 volts to +5 volts
Input Filtering	-3 dB @ 64 Hz
Input Response Time (% of span/ DV / Dt)	63.2% / 6.7 V / 10 mS
DC Common Mode Rejection	>-120 dB
AC Common Mode Rejection	>-120 dB @ 60 Hz
Maximum Survivable Input	220 VAC or 300 VDC
Maximum Operating Common Mode Voltage	250 V
Accuracy	0.05%, 5 mV @ 10 VDC 2.5 mV @ 5 VDC
Gain Temperature Coefficient	30 PPM/ °C
Offset Temperature Coefficient	15 PPM/ °C
Isolation: Optical	4000 V
Isolation: Transformer	1500 V
Isolation: Channel to Channel	250 V continuous (1500 V transient)
Power Requirements	5 VDC (± 0.15) @ 200 mA
Input Resistance	1 megohms (each channel)
Torque, hold-down screws	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)
Agency Approvals	CE, FM, RoHS, DFARS
Warranty	Lifetime

SNAP-AITM-8, SNAP-AITM-8-FM

Input Range	From -75 mV to +75 mV From -50 mV to +50 mV From -25 mV to +25 mV			
Over-Range Limits	From -82.5 to +82.5 mV (+/-75 mV range) From -55 to +55 mV (+/-50 mV range) From -27.5 to +27.5 mV (+/-25 mV range)			
Resolution	3 microvolts from -75 mV to +75 mV 2 microvolts from -50 mV to +50 mV 1 microvolts from -25 mV to +25 mV			
Cold Junction Temperature Compensation	Automatic when used with SNAP I/O processors			
Input Filtering	-3 dB @ 5 Hz			
Data Freshness (Max)	2.25 s			
DC Common Mode Rejection	>-120 dB			
AC Common Mode Rejection	>-120 dB @ 60 Hz			
Maximum Survivable Input	± 15 volts			
Max Operating Common Mode Voltage	250 V			
Accuracy at Full Scale	0.1% (75 microvolts) @ 75 mV 0.1% (50 microvolts) @ 50 mV 0.2% (50 microvolts) @ 25 mV			
Drift: Gain Temperature Coefficient	5 microvolts / °C			
Drift: Offset Temperature Coefficient	2 microvolts / °C			
Thermocouple Accuracy [°C]	E, J, K	B, R, S	C, D, G	T, N
From factory	± 2.0	± 5	± 4	± 3
After user gain and offset commands	± 0.5	± 3	± 2	± 2
Isolation	1500 V			
Power Requirements	5 VDC (± 0.15) @ 200 mA			
Input Resistance	100 Megohms (each channel)			
Ambient Temperature: Operating Storage	0 °C to 70 °C -25 °C to 85 °C			
Torque, hold-down screws	4 in-lb (0.45 N-m)			
Torque, connector screws	3 in-lb (0.34 N-m)			
Agency Approvals	SNAP-AITM-8: UL, CE, RoHS, DFARS SNAP-AITM-8-FM: FM, CE, RoHS, DFARS			
Warranty	Lifetime			

SNAP-AIV2-i

Input Range	From -100 volts to +100 volts From -50 volts to +50 volts
Maximum Over Range	$\pm 10\%$ ($= \pm 27500$ counts)
Resolution	4.0 mV when configured -100 volts to +100 volts 2.0 mV when configured -50 volts to +50 volts
Input Filtering	-3 dB @ 64 Hz
Input Response Time (% of span/ ΔV / Δt)	63.2% / 6.7 V / 10 ms
DC Common Mode Rejection	>-120 dB
AC Common Mode Rejection	>-120 dB @ 60 Hz
Maximum Survivable Input	220 VAC or 300 VDC
Maximum Operating Common Mode Voltage	250 V
Accuracy	0.05%, 50 mV @ 100 VDC 25 mV @ 50 VDC
Gain Temperature Coefficient	30 PPM/ °C
Offset Temperature Coefficient	15 PPM/ °C
Isolation: Optical	4000 V
Isolation: Transformer	1500 V
Isolation: Channel to Channel	250 V continuous (1500 V transient)
Power Requirements	5 VDC (± 0.15) @ 200 mA
Input Resistance	1 megohms (each channel)
Ambient Temperature: Operating Storage	0 °C to 70 °C -25 °C to 85 °C
Torque, hold-down screws	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)
Agency Approvals	CE, RoHS, DFARS
Warranty	Lifetime

SNAP-AIV and SNAP-AIV-4

Input Range	From -10 volts to +10 volts From -5 volts to +5 volts
Over-Range Limits	From -11 to +11 volts (+/-10 V range) From -5.5 to +5.5 volts (+/-5 V range)
Resolution	0.4 mV when configured -10 to +10 volts 0.2 mV when configured -5 to +5 volts
Input Filtering	-3 dB @ 64 Hz
Input Response Time (% of span/ ΔV / Δt)	63.2% / 6.7 V / 10 ms
Data Freshness (Max)	11.5 ms (2-channel, +/- 10 VDC) 23 ms (2-channel, +/- 5 VDC) 23 ms (4-channel, +/- 10 VDC) 46 ms (4-channel, +/- 5 VDC)
DC Common Mode Rejection	>-120 dB
AC Common Mode Rejection	>-120 dB @ 60 Hz
Maximum Survivable Input	220 VAC or 300 VDC
Maximum Operating Common Mode Voltage	250 V
Accuracy	0.05%, 5 mV @ 10 VDC 2.5 mV @ 5 VDC
Gain Temperature Coefficient	30 PPM/ °C
Offset Temperature Coefficient	15 PPM/ °C
Isolation	1500 V
Power Requirements	5 VDC (± 0.15) @ 170 mA
Input Resistance	1 M ohms (each channel; both channels share the same reference point)
Ambient Temperature: Operating Storage	0 °C to 70 °C -25 °C to 85 °C
Torque, hold-down screws	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)
Agency Approvals	UL, FM, CE, RoHS, DFARS
Warranty	Lifetime

SNAP-AIV-8

Input Range	From -10 volts to +10 volts From -5 volts to +5 volts
Over-Range Limits	From -11 to +11 volts (+/-10 V range) From -5.5 to +5.5 volts (+/-5 V range)
Resolution	0.4 mV when configured -10 to +10 volts 0.2 mV when configured -5 to +5 volts
Input Filtering	-3 dB @ 64 Hz
Data Freshness (Max)	0.28 seconds
DC Common Mode Rejection	>-120 dB
AC Common Mode Rejection	>-120 dB @ 60 Hz
Maximum Survivable Input	220 VAC or 300 VDC
Maximum Operating Common Mode Voltage	250 V
Accuracy	0.05%, 5 mV @ 10 VDC 2.5 mV @ 5 VDC
Gain Temperature Coefficient	30 PPM/ °C
Offset Temperature Coefficient	15 PPM/ °C
Isolation	1500 V
Power Requirements	5 VDC (±0.15) @ 170 mA
Input Resistance	1 M ohms (all channels share the same reference point)
Ambient Temperature: Operating Storage	0 °C to 70 °C -25 °C to 85 °C
Torque, hold-down screws	4 in-lb (0.45 N-m)
Torque, connector screws	1.7 in-lb (0.19 N-m)
Agency Approvals	CE, RoHS, DFARS
Warranty	Lifetime

SNAP-AIV-32 and SNAP-AIV-32-FM

Input Range	From -10 volts to +10 volts From -5 volts to +5 volts
Over-Range Limits	From -11 to +11 volts (+/-10 V range) From -5.5 to +5.5 volts (+/-5 V range)
Resolution	0.4 mV when configured -10 to +10 volts 0.2 mV when configured -5 to +5 volts
Input Filtering	-3 dB @ 31 Hz
Data Freshness (Max)	1.1 s
DC Common Mode Rejection	>-120 dB
AC Common Mode Rejection	>-120 dB @ 60 Hz
Maximum Survivable Input	220 VAC or 300 VDC
Maximum Operating Common Mode Voltage	250 V
Accuracy	0.05%, 5 mV @ 10 VDC 2.5 mV @ 5 VDC
Gain Temperature Coefficient	30 PPM/ °C
Offset Temperature Coefficient	15 PPM/ °C
Isolation	1500 V
Power Requirements	5 VDC (±0.15) @ 150 mA
Input Resistance	1 M ohms (each channel; all channels share the same reference point)
Ambient Temperature: Operating Storage	0 °C to 70 °C -25 °C to 85 °C
Torque, hold-down screws	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)
Agency Approvals	SNAP-AIV-32: UL, CE, RoHS, DFARS SNAP-AIV-32-FM: FM, CE, RoHS, DFARS
Warranty	Lifetime

SNAP-AIVRMS

Input Range	0 to 250 V RMS AC/DC
Input Over-Range	To 275 V
Input Resistance	1 M ohms
Accuracy	±0.2 V and ±0.2% reading
Resolution	10 mV
DC Reversal	± 0.4 V (.16%)
Input Response Time (Step Change)	5% (12.5 V) in 100 mS 63.2% (158 V) in 200 mS 99% (248 V) in 1200 mS
Data Freshness (Max)	32.3 ms
DC Common Mode Rejection	>-120 dB
AC Common Mode Rejection	>-120 dB @ 60 Hz
Maximum Operating Common Mode Voltage	250 V
Isolation	1500 V
Power Requirements	5 VDC (±0.15 V) at 170 mA
Operating Temperature	0 °C to 70 °C
Storage Temperature	-25 °C to 85 °C
Torque, hold-down screws	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)
Agency Approvals	UL, FM, CE, RoHS, DFARS
Warranty	Lifetime

SNAP-AIVRMS-i, SNAP-AIVRMS-i-FM

Input Range	0 to 250 V RMS AC/DC
Input Over Range	To 275 V
Input Resistance	1 megohms
Accuracy	±0.2 V and ±0.2% reading
Resolution	10 mV
DC Reversal	± 0.2 V (0.08%)
Input Response Time (Step Change)	63.2% (158 V) in 50 ms 99% (248 V) in 75 ms
DC Common Mode Rejection	>-120 dB
AC Common Mode Rejection	>-120 dB @ 60 Hz
Maximum Operating Voltage Between Channels Common Mode Voltage	250 V 250 V
Isolation: Optical	4000 V
Isolation: Transformer	1500 V
Isolation: Channel to Channel	250 V continuous (1500 V transient)
Power Requirements	5 VDC (±0.15 V) at 200 mA
Ambient Temperature: Operating Storage	0 °C to 70 °C -25 °C to 85 °C
Torque, hold-down screws	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)
Agency Approvals	CE, RoHS, DFARS
Warranty	Lifetime

SNAP-AIPM

SNAP-AIPM	
Voltage Inputs (each voltage channel)	
Recommended Input Range	85 to 250 VAC RMS
Scaled Input Range	0 to 250 VAC RMS
Input Over Range	To 275 volts
Resolution	10 mV
Accuracy (47 to 63 Hz)	(When used within recommended range) $\pm 0.2 \text{ V}$ plus $\pm 0.2\%$ reading (at full scale = $\pm 0.7 \text{ V}$ or 0.28%)
RMS Integration Time/ Data Freshness	1000 ms (synchronous with current measurement)
Input Filtering	Time constant = 70 μs (analog front end) (-0.2 dB at 660 Hz; -3 dB at 1.89 kHz) nominal
Input Resistance – Single Ended	1 Megohm NOTE: Because both channels share the same reference terminal, polarity must be observed when connecting the current channel.
Maximum Input	300 V non-operating
Current Inputs (each current channel)	
Input Range	0 to 10 AC amps RMS
Input Over Range	To 11 amps (Reading is not reliable over 11 A.)
Input Overload	15 A continuous, non-operating
Resolution	400 μA
Accuracy (47 to 63 Hz)	$\pm 8 \text{ mA}$ plus $\pm 0.2\%$ reading (at full scale = $\pm 28 \text{ mA}$ or 0.28%)
RMS Integration Time/ Data Freshness	1000 ms (synchronous with voltage measurement)
Input Filtering	Time constant = 105 μs (analog front end) (-0.2 dB at 660 Hz; -3 dB at 1.89 kHz) nominal
Input Resistance – Single Ended	0.005 Ohm NOTE: Because both channels share the same reference terminal, polarity must be observed when connecting the voltage channel.
Maximum Input	15 A continuous, non-operating
Calculated Channels	
True Power and Volt-Amps Range	True power: 2500.0 Watts. Volt-amps: 2500.0 volt-amps (= 25,000 counts) (inputs = 250 volts and 10 amps)
Over Range	2750 Watts true power or 2750 Volt-amps (= 27,500 counts)
Accuracy:	
True Power	$\pm 0.6\%$ reading (at full scale = $\pm 15 \text{ Watts}$)
Volt-Amps	$\pm 0.6\%$ reading (at full scale = $\pm 15 \text{ VA}$)
Resolution	100 mW with default scaling
AC Common Mode Rejection	> -120 dB at 60 Hz
Maximum Operating Common Mode Voltage	250 VAC
Power Requirements	5.0 VDC $\pm 0.15 \text{ VDC}$ at 100 mA
Ambient Temperature:	
Operating	0 to 70 °C
Storage	-25 to 85 °C
Agency Approvals	CE, RoHS, DFARS

SNAP-AIPM	
Warranty	Lifetime
Calculated Outputs	
True Power	0–2500 W (from synchronous measurement of volts and amps)
Volt Amps	0–2500 VA (VRMS x ARMS)

SNAP-AIPM and SNAP-AIPM-3

	SNAP-AIPM-3	SNAP-AIPM-3V
Voltage Inputs (each voltage channel)		
Recommended Input Range	85 to 300 VAC RMS*	85 to 300 VAC RMS*
Scaled Input Range	0 to 300 VAC RMS	0 to 300 VAC RMS
Input Over Range	To 330 volts	To 330 volts
Resolution	12 mV	12 mV
Accuracy (47 to 63 Hz)	(When used within recommended range) ± 0.2 V plus ± 0.2% reading (at full scale = ± 0.7 V or 0.28%)	(When used within recommended range) ± 0.2 V plus ± 0.2% reading (at full scale = ± 0.2 V + ± 0.8 V = ± 1.0 V)
RMS Integration Time/ Data Freshness	1000 ms (synchronous with current measurement)	1000 ms (synchronous with current measurement)
Input Filtering	Time constant = 70 µs (analog front end) (–0.2 dB at 660 Hz; –3 dB at 1.89 kHz) nominal	Time constant = 70 µs (analog front end) (–0.2 dB at 660 Hz; –3 dB at 1.89 kHz) nominal
Input Resistance – Single Ended	1 Megohm NOTE: Because both channels share the same reference terminal, polarity must be observed when connecting the current channel.	1 Megohm NOTE: Because both channels share the same reference terminal, polarity must be observed when connecting the current channel.
Maximum Input	330 V non-operating	330 V non-operating
Current Inputs (each current channel)		
Input Range	0 to 5 AC amps RMS*	0 to 0.333 VAC current transformer input
Input Over Range	To 5.5 amps (Reading is not reliable over 5.5 A)	To 0.366 VAC
Input Overload	15 A continuous, non-operating	5 VAC continuous, non-operating
Resolution	200 µA	13.3 µV AC
Accuracy (47 to 63 Hz)	± 4 mA plus ± 0.2% reading (at full scale = ± 28 mA or 0.28%)	± 266 microvolts plus 0.2% of reading (at full scale = 266 µV + 667 µV = 933 µV = 0.28%)
RMS Integration Time/ Data Freshness	1000 ms (synchronous with voltage measurement)	1000 ms (synchronous with voltage measurement)
Input Filtering	Time constant = 105 µs (analog front end) (–0.2 dB at 660 Hz; –3 dB at 1.89 kHz) nominal	Time constant = 105 µs (analog front end) (–0.2 dB at 660 Hz; –3 dB at 1.89 kHz) nominal
Input Resistance – Single Ended	0.005 Ohm NOTE: Because both channels share the same reference terminal, polarity must be observed when connecting the voltage channel.	500 K Ohms NOTE: Because both channels share the same reference terminal, polarity must be observed when connecting the voltage channel.
Maximum Input	15 A continuous, non-operating	5 VAC continuous, non-operating
Calculated Channels		
True Power and Volt-Amps Range	True power: 1500.0 Watts. Volt-amps: 1500.0 volt-amps (inputs = 300 volts and 5 amps)	True power and volt-amps are calculated from 300 volts and the full-scale current input of your 0.333 VAC output CT.

	SNAP-AIPM-3	SNAP-AIPM-3V
Over Range	1650 Watts true power or 16,500 counts volt-amps	Depends on CT selection
Accuracy: True Power Volt-Amps	$\pm 0.6\%$ reading (at full scale = ± 15 Watts) $\pm 0.6\%$ reading (at full scale = ± 15 VA)	$\pm 0.6\%$ reading $\pm 0.6\%$ reading
Resolution	100 mW with default scaling	Depends on CT selection
AC Common Mode Rejection	> -120 dB at 60 Hz	> -120 dB at 60 Hz
Maximum Operating Common Mode Voltage	300 VAC	300 VAC
Power Requirements	5.0 VDC ± 0.15 VDC at 100 mA	5.0 VDC ± 0.15 VDC at 100 mA
Ambient Temperature: Operating Storage	0 to 70 °C -25 to 85 °C	0 to 70 °C -25 to 85 °C
Agency Approvals	CE, RoHS, DFARS	CE, RoHS, DFARS
Warranty	Lifetime	Lifetime
Calculated Outputs		
True Power	0–1500 W (from synchronous measurement of volts and amps)	W (from synchronous measurement of volts and amps)**
Volt Amps	0–1500 VA (VRMS x ARMS)	VA (VRMS x ARMS)**
1-second Energy Sum	0–4500 joules (true power sum ABC, signed)	Joules (true power sum ABC, signed)**
1-second abs Energy Sum	0–4500 joules (true power sum of absolute value of each A, B, and C, always positive)	Joules (true power sum of absolute value of each A, B, and C, always positive)**

*Inputs on older modules were 0–250 V and for SNAP-AIPM-3, 0–10 A. Before wiring or scaling, check printed information on the module to make sure you are using the correct voltage and current. Contact Opto 22 Product Support with any questions.

**Values depend on CT selection.

SNAP-pH/ORP

Input Range	-1.00 V to +1.00 V for ORP probes -0.50 V to +0.50 V for pH probes
Resolution	40 μ V when configured -1.00 V to +1.00 V 20 μ V when configured -0.50 V to +0.50 V
Data Freshness (Maximum)	126 ms (63 ms per channel) when configured -1.00 V to +1.00 V 251 ms (125.5 ms per channel) when configured -0.50 V to +0.50 V
Input Filtering	-3 dB @ 2.4 Hz
DC Common Mode Rejection	>-120 dB
AC Common Mode Rejection	>-120 dB at 60 Hz
Maximum Survivable Input	$\pm$ 100 VDC or peak AC
Maximum Operating Common Mode Voltage	250 VDC or peak AC
Accuracy (% full scale)	0.05% when configured -1.00 V to +1.00 V 0.05% when configured -0.50 V to +0.50 V
Gain Temperature Coefficient	30 PPM/ $^{\circ}$ C
Offset Temperature Coefficient	15 PPM/ $^{\circ}$ C
Power Requirements	5 VDC ($\pm$ 0.15) at 170 mA
Input Resistance (Differential)	>10 Tera Ohms (each channel)
Ambient Temperature: Operating Storage	0 to 70 $^{\circ}$ C -25 to 85 $^{\circ}$ C
Torque, hold-down screws	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)
Agency Approvals	CE, RoHS, DFARS
Warranty	Lifetime

Analog Output Module Specifications

SNAP-AOA-3

Input	12-bit serial data
Output	4 to 20 mA (floating)
Span	16 mA
Resolution	3.9 microamps
Response Time (% of span/delta I/ delta time)	99.9%/15.98 mA/3 mS
DC Common Mode Rejection	>-120 dB
AC Common Mode Rejection	>-120 dB @ 60 Hz
Maximum Operating Common Mode Voltage	250 V
Common Mode Resistance	>1000 M W
Accuracy	0.1% of span
Gain Temperature Coefficient	50 PPM/ °C
Offset Temperature Coefficient	20 PPM/ °C
Module Power Requirements	5 Volts DC (±0.15) @ 140 mA
Loop Power Requirements	10 Volts DC (min) to 32 Volts DC (max)
Max. Loop Resistance (Ohms) @ Loop Supply	250 350 950 1350 10V 12V 24V 32V
Max. Loop Resistance formula	$\frac{(\text{Loop Voltage} - 5)}{0.02}$
Ambient Temperature: Operating Storage	0 °C to 70 °C -25 °C to 85 °C
Torque, hold-down screws	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)
Agency Approvals	UL, CE, RoHS, DFARS
Warranty	Lifetime

SNAP-AOA-23

Input	12-bit serial data (each channel)
Outputs	4 to 20 mA (each channel)
Span	16 mA
Resolution	3.9 microamps
Response Time (% of span/delta I/ delta time)	99.9%/15.98 mA/3 mS
DC Common Mode Rejection	>-120 dB
AC Common Mode Rejection	>-120 dB @ 60 Hz
Maximum Operating Common Mode Voltage	250 V
Common Mode Resistance	>1000 Megohms
Accuracy	0.1% of Span
Gain Temperature Coefficient	50 PPM/°C
Offset Temperature Coefficient	20 PPM/°C
Module Power Requirements	5 Volts DC (±0.15) @ 150 mA
Loop Power Requirements	8 VDC (min) to 32 Volts DC (max)
Max. Loop Resistance (Ohms) @ Loop Supply	250 450 650 105 145 8V 12V 15V 24V 32V
Max. Loop Resistance formula	$\frac{(\text{Loop Voltage} - 3)}{0.02}$
Ambient Temperature: Operating Storage	0 °C to 70 °C -25 °C to 85 °C
Torque, hold-down screws	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)
Agency Approvals	UL, CE, FM, RoHS, DFARS
Warranty	Lifetime

SNAP-AOA-23-iSRC and SNAP-AOA-23-iSRC-FM

Input	12-bit serial data (each channel)
Outputs	4 to 20 mA (each channel)
Span	16 mA
Resolution	3.9 microamps
Response Time (% of span/delta I/ delta time)	99.9%/15.98 mA/3 mS
DC Common Mode Rejection	>-120 dB
AC Common Mode Rejection	>-120 dB @ 60 Hz
Maximum Operating Common Mode Voltage	250 V
Common Mode Resistance	>1000 Megohms
Accuracy	0.1% of Span
Gain Temperature Coefficient	50 PPM/°C
Offset Temperature Coefficient	20 PPM/°C
Max. Loop Resistance @ Loop Supply	950 Ohms
Ambient Temperature: Operating Storage	0 °C to 70 °C -25 °C to 85 °C
Isolation: Optical	4000 V
Isolation: Transformer	1500 V
Isolation: Channel to Channel	250 V continuous (1500 V transient)
Power Requirements	5 Volts DC (± 0.15) @ 200 mA
Power Requirements - Loop Power (Input)	From separate field connector; 24 VDC nominal (70 mA max) @ 24 V input, both loops @ 20 mA), 30 VDC maximum
Loop Power (Output)	24 VDC (± 1.5 V) @ 20 mA Open loop: 30 V maximum Shorted loop: 24 mA nominal
Agency Approvals	CE, RoHS, DFARS FM (SNAP-AOA-23-iSRC-FM only)
Torque, hold-down screws	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)
Warranty	Lifetime

SNAP-AOA-28

Input	12-bit serial data (each channel)				
Outputs	0 to 20 mA (each channel)				
Span	20 mA				
Resolution	4.9 microamps				
Response Time (% of span/delta I/ delta time)	99.9%/15.98 mA/3 mS				
DC Common Mode Rejection	>-120 dB				
AC Common Mode Rejection	>-120 dB @ 60 Hz				
Maximum Operating Common Mode Voltage	250 V				
Common Mode Resistance	>1000 Megohms				
Accuracy	0.1% of Span				
Gain Temperature Coefficient	50 PPM/°C				
Offset Temperature Coefficient	20 PPM/°C				
Module Power Requirements	5 Volts DC (± 0.15) @ 150 mA				
Loop Power Requirements	8 Volts DC (min) to 32 Volts DC (max)				
Max. Loop Resistance (Ohms) @ Loop Supply	250 8V	450 8V	650 12V	1050 24V	1450 32V
Max. Loop Resistance formula	$\frac{(\text{Loop Voltage} - 5)}{0.02}$				
Ambient Temperature: Operating Storage	0 °C to 70 °C -25 °C to 85 °C				
Torque, hold-down screws	4 in-lb (0.45 N-m)				
Torque, connector screws	5.26 in-lb (0.6 N-m)				
Agency Approvals	UL, CE, FM, RoHS, DFARS				
Warranty	Lifetime				

SNAP-AOD-29

Input	12-bit serial data (each channel)
Switched Output at 45 °C Ambient at 70 °C Ambient	5 to 60 Volts DC 0.5 A 0.2 A
TPO Resolution	12-bit Each bit = Period/4095 1 millisecond/bit default
Period Range	0.251 sec. to 64.25 sec. (0.251 sec for Ethernet-based I/O units) 0.251 seconds module default
Period Accuracy	± 0.5%
Period Resolution	.251 second
Inhibit Inputs On Off	4.0 Volts DC at 1.0 mA (32 Volts DC max. 1.0 Volt DC
Maximum Operating Common Mode Voltage	250 V
Common Mode Resistance	>1,000 Megohms
Timebase Temperature Coef- ficient	50 PPM/°C
Power Requirements	5 Volts DC (±0.15) @ 150 mA
Ambient Temperature: Operating Storage	0 °C to 70 °C -25 °C to 85 °C
Torque, hold-down screws	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)
Agency Approvals	UL, FM, CE, RoHS, DFARS
Warranty	Lifetime

SNAP-AOV-5

Input	12-bit serial data
Output	0 to +10 Volts DC (floating)
Span	10 Volt span
Resolution	2.44 mV
Response Time (% of span/delta V/delta time)	99.9%/19.98 V/3 mS
DC Common Mode Rejection	>-120 dB
AC Common Mode Rejection	>-120 dB @ 60 Hz
Maximum Operating Common Mode Voltage	250 V
Common Mode Resistance	>1000 Megohms
Load Current	10 mA (floating)
Short Circuit Current Continu- ous	125 mA (typical)
Accuracy	0.1% of span
Gain Temperature Coefficient	50 PPM/°C
Offset Temperature Coefficient	20 PPM/°C
Power Requirements	5 Volts DC @ 150 mA
Ambient Temperature: Operating Storage	0 °C to 70 °C -25 °C to 85 °C
Torque, hold-down screws	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)
Agency Approvals	UL, CE, RoHS, DFARS
Warranty	Lifetime

SNAP-AOV-25

Input	12-bit serial data (each channel)
Outputs	0 to +10 Volts DC
Span	10 Volts
Resolution	2.44 mV
Response Time (% of span/delta V/delta time)	99.9%/19.98 V/3 mS
DC Common Mode Rejection	>-120 dB
AC Common Mode Rejection	>-120 dB @ 60 Hz
Maximum Operating Common Mode Voltage	250 V
Common Mode Resistance	>1,000 Megohms
Load Current (nominal)	5 mA (each channel)
Short Circuit Output Current Continuous	40 mA per channel
Accuracy	0.1% of Span
Gain Temperature Coefficient	50 PPM/°C
Offset Temperature Coefficient	20 PPM/°C
Power Requirements	5 Volts DC (± 0.15) @ 150 mA
Ambient Temperature: Operating Storage	0 °C to 70 °C -25 °C to 85 °C
Torque, hold-down screws	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)
Agency Approvals	UL, CE, FM, RoHS, DFARS
Warranty	Lifetime

SNAP-AOV-27

Input	12-bit serial data (each channel)
Outputs	-10 to +10 Volts DC
Span	20 Volts
Resolution	4.88 mV
Response Time (% of span/delta V/delta time)	99.9%/19.98 V/3 mS
DC Common Mode Rejection	>-120 dB
AC Common Mode Rejection	>-120 dB @ 60 Hz
Maximum Operating Common Mode Voltage	250 V
Common Mode Resistance	>1,000 Megohms
Load Current (nominal)	5 mA (each channel)
Short Circuit Output Current Continuous	40 mA per channel
Accuracy	0.1% of Span
Gain Temperature Coefficient	50 PPM/°C
Offset Temperature Coefficient	20 PPM/°C
Power Requirements	5 Volts DC (± 0.15) @ 150 mA
Ambient Temperature: Operating Storage	0 °C to 70 °C -25 °C to 85 °C
Torque, hold-down screws	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)
Agency Approvals	UL, CE, FM, RoHS, DFARS
Warranty	Lifetime

Serial Module Specifications

SNAP-SCM-232 and SNAP-SCM-485-422

Baud rates	300–115,200*
Channel-to-channel isolation	750 V _{RMS}
Logic supply voltage	5.0 VDC
Logic supply current	250 mA DC
Number of ports per module	2 (1 if SNAP-SCM-485-422 in 4-wire mode)
Max. number of modules per rack**	8
Maximum cable length, point-to-point (SNAP-SCM-232)	50 feet
Maximum cable length, multidrop (SNAP-SCM-485-422)	1,000 feet at 115,200 Kbd
Processor compatibility	SNAP PAC R-series controllers and SNAP PAC EB brains, both standard wired and Wired+Wireless models. Also SNAP-B3000-ENET, SNAP-ENET-RTC, SNAP-ENET-S64, SNAP-UP1-ADS, and SNAP-UP1-M64.
Operating temperature	0 to 70 °C
Storage temperature	-30 to 85 °C
Torque, hold-down screws	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)
Agency Approvals	CE, FM, RoHS, DFARS
Warranty	30 months

* Module performance is limited by the number of serial modules on the SNAP rack. Each rack backplane provides approximately 2.5 Mbps of bandwidth.

** Maximum number of modules per rack assumes an Opto 22 SNAP power supply and SNAP rack.

SNAP-SCM-PROFI

Baud rates	9600 to 1.5 MBaud*
Channel-to-channel isolation	750 Vrms
Logic supply voltage	5.0 VDC
Logic supply current	250 mA
Number of ports per module	1
Maximum number of modules per rack*	8
Processor compatibility	SNAP PAC R-series controllers and SNAP PAC EB brains, both standard wired and Wired+Wireless models. Also SNAP-B3000-ENET, SNAP-ENET-RTC, SNAP-ENET-S64, SNAP-UP1-ADS, and SNAP-UP1-M64.
Processor firmware	Firmware 6.1c or newer required
Operating temperature Storage temperature	0 to 70 °C -30 to 85 °C
Torque, hold-down screws	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)
Agency Approvals	CE, RoHS, DFARS
Warranty	30 months

* Module performance is limited by the number of serial modules on the SNAP rack. Each rack backplane provides approximately 2.5 Mbps of bandwidth.

** With Opto 22 SNAP power supply and SNAP rack

SNAP-SCM-SSI

Maximum SSI clock frequency	2.5 MHz
Channel-to-channel isolation	1500 VAC
Logic supply voltage	5.0 VDC
Logic supply current	200 mA DC
Compatible I/O processors	SNAP PAC R-series controllers and SNAP PAC EB or SB brains with firmware 8.5c or newer
Number of ports per module	2
Max. number of modules per rack	8
Max. data resolution	24 bits
Maximum cable length	500 feet at 200kHz using twisted-pair, 24-gauge shielded cable with an additional pair for common (three pairs total)
Operating temperature	0 to 60 °C
Storage temperature	-30 to 85 °C
Torque, hold-down screws	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)
Agency approvals	CE, RoHS, DFARS
Warranty	30 months from date of manufacture

SNAP-SCM-MCH16

Baud rates	115,200
Parity	Even
Data bits	8 only
Logic supply voltage	5.0 to 5.2 VDC
Logic supply current	250 mA ¹ 500 mA ²
Number of ports per module	1
Maximum number of modules per rack	8 ¹
Maximum cable length, multi-drop	1,000 feet at 115,200 Baud
I/O processor (brain or on-the-rack controller) compatibility	SNAP-PAC-R1, SNAP-PAC-R2, SNAP-PAC-EB1, or SNAP-PAC-EB2
Operating temperature	0 to 70 °C
Storage temperature	-30 to 85 °C
Torque, hold-down screws	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)
Agency Approvals	CE, RoHS, DFARS
Warranty	30 months

1. Each breakout board is powered by a separate power supply.
2. Breakout board uses power from the module.

SNAP-SCM-ST2

Frequency Range	0.13–50,000 Hz
Pulse Width Range ¹	3.84 Sec to 10 µSec
Pulse Width Accuracy ²	0–2 Hz, 2–30 Hz, 30–50,000 Hzv (see graphs on the next page)
Output Format	CMOS/TTL Compatible
Logic Supply Voltage	5.0 VDC
Logic Supply Current	200 mA
Compatible I/O Processors	SNAP PAC R-series controllers and EB-series brains with R9.1a or newer firmware
Number of Ports per Module	2
Operating Temperature Range	0–60 °C
Storage Temperature Range	-30–85 °C
Warranty	30 months from date of manufacture

¹Pulse Width is equal to one-half the period.

²To find the frequency error in Hz:

Frequency Error (+/-) = Desired Frequency - (1 ÷ (Pulse Width Resolution + (1 ÷ Desired Frequency))).

SNAP-SCM-CAN2B

Baud rates	10–1000 Kbps*
Logic supply voltage	5.0 VDC
Logic supply current	250 mA DC
Number of ports per module	1
Max. number of modules per rack**	8
Processor compatibility	SNAP PAC R-series controllers and SNAP PAC EB brains, both standard wired and Wired+Wireless models, with firmware 9.1c or newer.
Operating temperature	0 to 70 °C
Storage temperature	-30 to 85 °C
Torque, hold-down screws	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)
Agency Approvals	CE, FM, RoHS, DFARS
Warranty	30 months from date of manufacture

* Module performance is limited by the number of serial modules on the SNAP rack. Each rack backplane provides approximately 2.5 Mbps of bandwidth.

** Maximum number of modules per rack assumes an Opto 22 SNAP power supply and SNAP rack.

SNAP-SCM-W2

Channel-to-channel isolation	250 Vrms
Logic supply voltage	5.0 VDC (± 0.15)
Logic supply current	250 mA
Number of ports per module	2
Maximum number of modules per rack*	8
Maximum cable length	See table below
Processor compatibility	SNAP PAC R-series controllers and SNAP PAC EB brains, both standard wired and Wired+Wireless models. Also SNAP-B3000-ENET, SNAP-ENET-RTC, SNAP-ENET-S64, SNAP-UP1-ADS, and SNAP-UP1-M64.
Operating Temperature Storage Temperature	0 to 70 °C operating -30 to 85 °C storage
Torque, hold-down screws	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)
Agency Approvals	CE, RoHS, DFARS
Warranty	30 months

* With Opto 22 SNAP power supply and SNAP rack

Breakout Board and Cable Specifications

SNAP-TEX-32, SNAP-TEX-FB16-H, and SNAP-TEX-FB16-L

Feature	SNAP-TEX-32	SNAP-TEX-FB16-H	SNAP-TEX-FB16-L
Use with I/O modules	2- or 4-channel analog inputs/outputs; 4-channel digital inputs/outputs *	4-channel digital inputs and outputs 16- and 32-ch digital inputs/outputs	4-channel digital inputs and outputs 16- and 32-ch digital inputs/outputs
Use with cables	SNAP-TEX-CBE6 (even pins connected), SNAP-TEX-CBO6 (odd pins connected), or SNAP-TEX-CBS6 (no connections), depending on module.	4-ch modules: SNAP-TEX-CBO6 (odd pins connected)** or SNAP-TEX-CBS6 (straight-through), depending on module. 16-ch modules: SNAP-HD-ACF6 32-ch modules: SNAP-HD-CBF6	4-ch modules: SNAP-TEX-CBO6 (odd pins connected)** or SNAP-TEX-CBS6 (straight-through), depending on module. 16-ch modules: SNAP-HD-ACF6 32-ch modules: SNAP-HD-CBF6
Connectors	32 spring connectors; accommodates eight 4-channel modules	16 spring connectors; accommodates four 4-channel modules	16 spring connectors; accommodates four 4-channel modules
Fusing	none	1 A, 250 V, fast-acting fuse for each I/O point (16 total). Replace with Opto 22 PN SNAP-FUSE1AC (Wickman PN 19373-1A)	1 A, 250 V, fast-acting fuse for each I/O point (16 total). Replace with Opto 22 PN SNAP-FUSE1AC (Wickman PN 19373-1A)
Indicators	none	1 LED per fuse (16 LEDs total)	1 LED per fuse (16 LEDs total)
Bussed power	none	120–240 V	12–24 V
Agency Approvals	CE, RoHS, DFARS	CE, RoHS, DFARS	CE, RoHS, DFARS
Warranty	30 months	30 months	30 months

* Can also be used with 8-, 16-, or 32-channel digital and analog inputs (not thermocouples).

** **IMPORTANT:** Do NOT USE the FB16 breakout boards with a SNAP-TEX-CBE6 cable. The board has odd pins connected; the cable has even pins connected.

SNAP-SCM-BB4

Power Requirements	8.0 to 32.0 VDC @ 250mA 5.00 to 5.20 VDC @ 500mA
Operating Temperature	0 to 70 °C
Relative Humidity	95%, non-condensing
Agency Approvals	CE, RoHS, DFARS
Warranty	30 months

SNAP-IDC-HDB, SNAP-IDC-HDB-FM, SNAP-ODC-HDB, and SNAP-ODC-HDB-FM

SNAP-IDC-HDB and SNAP-IDC-HDB-FM Breakout Racks for High-Density Digital Input Modules	
Used with	SNAP-IDC-32, SNAP-IDC-32-FM, SNAP-IDC-32N, and SNAP-IDC-32DN
Connectors	40-pin header connects to 32-channel input module using SNAP-HD-BF6 header cable. 32 signal input connectors; each signal connector has a corresponding common connector. For each zone of 8 signal inputs, 1 connection for either module common or field common.
Indicators	1 LED for each signal input (32 signal LEDs total) 1 power status LED for each zone of 8 signal inputs (4 power LEDs total)
Fusing	1 A fuses; 2 fuses for each zone of 8 signal inputs (8 fuses total) Replace with Pudenz 1 A automobile mini-fuse or equivalent.
Jumpers	For each zone of 8 signal inputs, 1 jumper controls whether module common or field common is used.
Voltage	32 VDC maximum, 12-24 VDC nominal
Agency Approvals	SNAP-IDC-HDB: UL, CE, RoHS, DFARS SNAP-IDC-HDB-FM: FM, CE, RoHS, DFARS
Warranty	30 months from date of manufacture
SNAP-ODC-HDB and SNAP-ODC-HDB-FM Breakout Racks for High-Density Digital Output Modules	
Used with	SNAP-ODC-32-SRC, SNAP-ODC-32-SRC-FM, SNAP-ODC-32-SNK, and SNAP-ODC-32-SNK-FM
Connectors	40-pin header; connects to 32-channel sourcing or sinking module using SNAP-HD-BF6 header cable. 32 signal output connectors; each signal connector has a corresponding common connector. For each zone of 8 signal outputs, 1 connection for either module common or field common.
Indicators	1 LED for each signal output (32 signal LEDs total) 1 power status LED for each zone of 8 signal outputs (4 power LEDs total)
Fusing	1 A fuses; 1 fuse for each signal output (32 signal fuses total) Replace with Pudenz 1 A automobile mini-fuse or equivalent.
Jumpers	For each zone of 8 signal inputs, 1 jumper controls whether module common or field common is used.
Voltage	32 VDC maximum, 12-24 VDC nominal
Agency Approvals	SNAP-ODC-HDB: UL, CE, RoHS, DFARS SNAP-ODC-HDB-FM: FM, CE, RoHS, DFARS
Warranty	30 months from date of manufacture

SNAP-HD-ACF6, SNAP-HD-CBF6, and SNAP-HD-BF6

Feature	SNAP-HD-ACF6	SNAP-HD-CBF6	SNAP-HD-BF6
Cable length	6 feet (1.8 meters)	6 feet (1.8 meters)	6 feet (1.8 meters)
Connectors	Two-connector assembly at module end, each with 16 pins; flying leads at other end	One 40-pin connector at module end; flying leads at other end	One connector at module end; one connector at breakout board end
Wires	Pre-stripped, color-coded, 22-gauge wires	Pre-stripped, color-coded, 24-gauge wires	24 gauge wires
Use with	Modules: SNAP-IAC-16 SNAP-IAC-A-16 SNAP-IAC-K-16 SNAP-IDC-16 SNAP-IDC-HT-16	Modules: SNAP-IDC-32 SNAP-IDC-32-FM SNAP-IDC-32N SNAP-ODC-32-SNK SNAP-ODC-32-SNK-FM SNAP-ODC-32-SRC SNAP-ODC-32-SRC-FM SNAP-AIV-32 SNAP-AIV-32-FM	Modules to breakout boards (regular and -FM versions of all): SNAP-IDC-32 to SNAP-IDC-HDB SNAP-IDC-32N to SNAP-IDC-HDB SNAP-ODC-32-SNK to SNAP-ODC-HDB SNAP-ODC-32-SRC to SNAP-ODC-HDB SNAP-AIV-32 to SNAP-AIV-HDB SNAP-AIMA-32 to SNAP-AIMA-HDB
Agency Approvals	CE, RoHS, DFARS	CE, RoHS, DFARS	CE, RoHS, DFARS
Warranty	30 months	30 months	30 months

SNAP-TEX-MR10-4 and SNAP-TEX-MR10-16

Feature	SNAP-TEX-MR10-4	SNAP-TEX-MR10-16
Use with I/O modules	SNAP-ODC5-i, SNAP-ODC5A-i, SNAP-ODC5SRC, SNAP-ODC-32-SRC	SNAP-ODC5-i, SNAP-ODC5A-i, SNAP-ODC5SRC, SNAP-ODC-32-SRC
Use with cables	SNAP-TEX-CBO6 (odd pins bussed), SNAP-TEX-CBS6 (no bussing), or SNAP-HD-CBF6, depending on module.	SNAP-TEX-CBO6 (odd pins bussed), SNAP-TEX-CBS6 (no bussing), or SNAP-HD-CBF6, depending on module.
Relay contacts	SPDT (1 Form C) Typical life expectancy (Electrical): 1×10^5	SPDT (1 Form C) Typical life expectancy (Electrical): 1×10^5
Switching capacity	10 A @ 240 VAC	10 A @ 240 VAC
Switch On time	7 ms nominal	7 ms nominal
Switch Off time	3 ms nominal	3 ms nominal
Fusing	24 V fuse for board	24 V fuse for board
Indicators	4 On/Off status indicators (one for each channel) 1 fuse-blown indicator	16 On/Off status indicators (one for each channel) 1 fuse-blown indicator
Power requirements (all positions On)	24 VDC @ 75 mA	24 VDC @ 300 mA
Agency Approvals	CE, RoHS, DFARS	CE, RoHS, DFARS
Warranty	30 months from date of manufacture	30 months from date of manufacture

SNAP-TEX-CBO6, SNAP-TEX-CBE6, and SNAP-TEX-CBS6

Feature	SNAP-TEX-CBO6	SNAP-TEX-CBE6	SNAP-TEX-CBS6
Cable length	6 feet (1.8 meters)	6 feet (1.8 meters)	6 feet (1.8 meters)
Connector	8 pins, 0.2 in. (5.08 mm) center-to-center	8 pins, 0.2 in. (5.08 mm) center-to-center	8 pins, 0.2 in. (5.08 mm) center-to-center
Wires	8 pre-stripped, color-coded, 18 gauge	8 pre-stripped, color-coded, 18 gauge	8 pre-stripped, color-coded, 18 gauge
Bussing	Odd-numbered pins connected	Even-numbered pins connected*	No connected
Agency Approvals	CE, RoHS, DFARS	CE, RoHS, DFARS	CE, RoHS, DFARS
Warranty	30 months	30 months	30 months

*Do NOT USE the CBE6 with a SNAP-TEX-FB16-H or -L breakout board. The FB16s have odd-numbered pins connected.

B: Dimensional Diagrams

Introduction

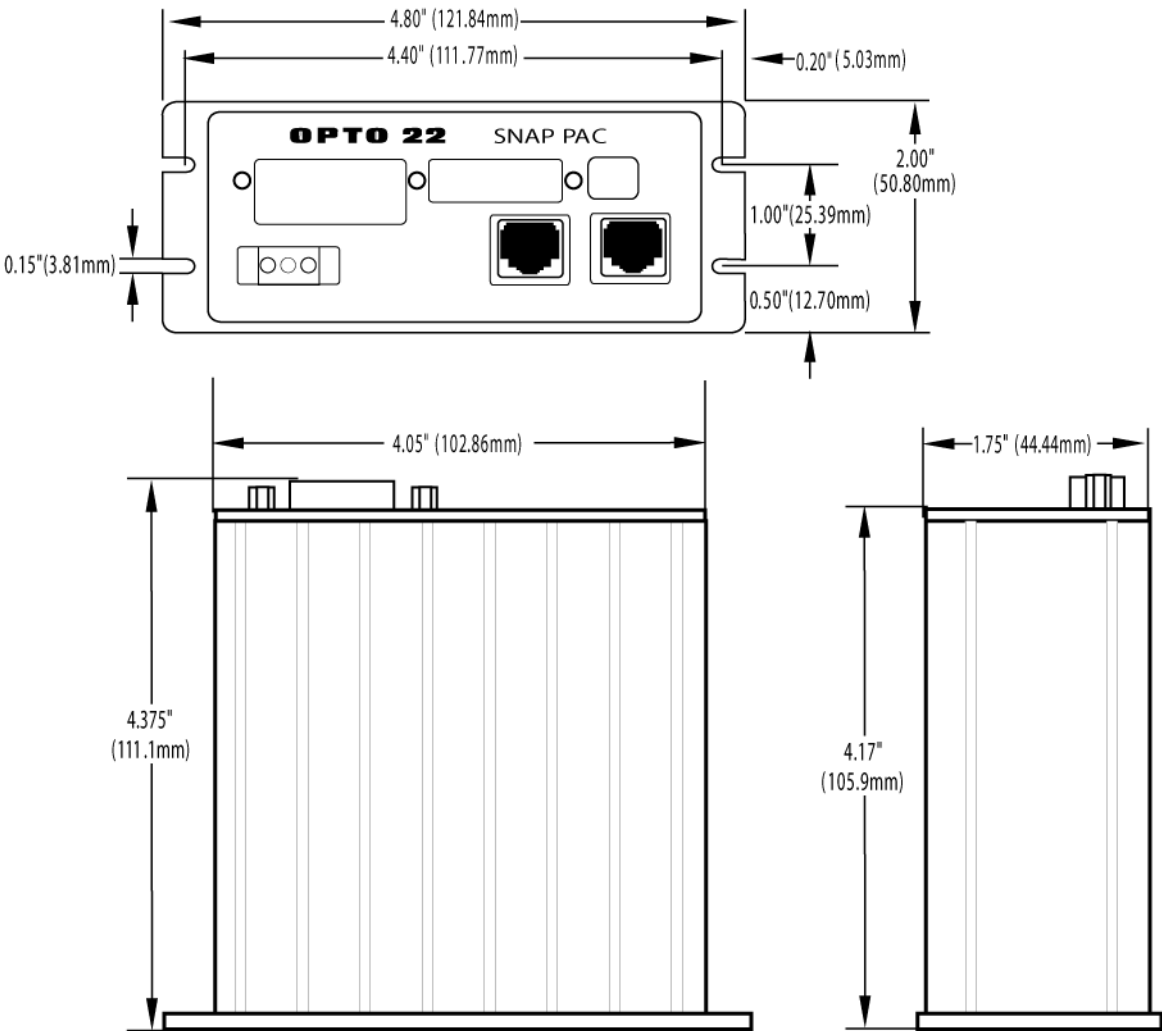
This appendix includes dimensional diagrams for SNAP PAC System hardware:

SNAP PAC controllers	page 172
SNAP PAC brains	page 178
SNAP power supplies	page 181
SNAP digital I/O modules	page 183
SNAP high-density digital modules	page 188
SNAP analog I/O modules	page 190
SNAP serial modules	page 201
Breakout boards	page 208

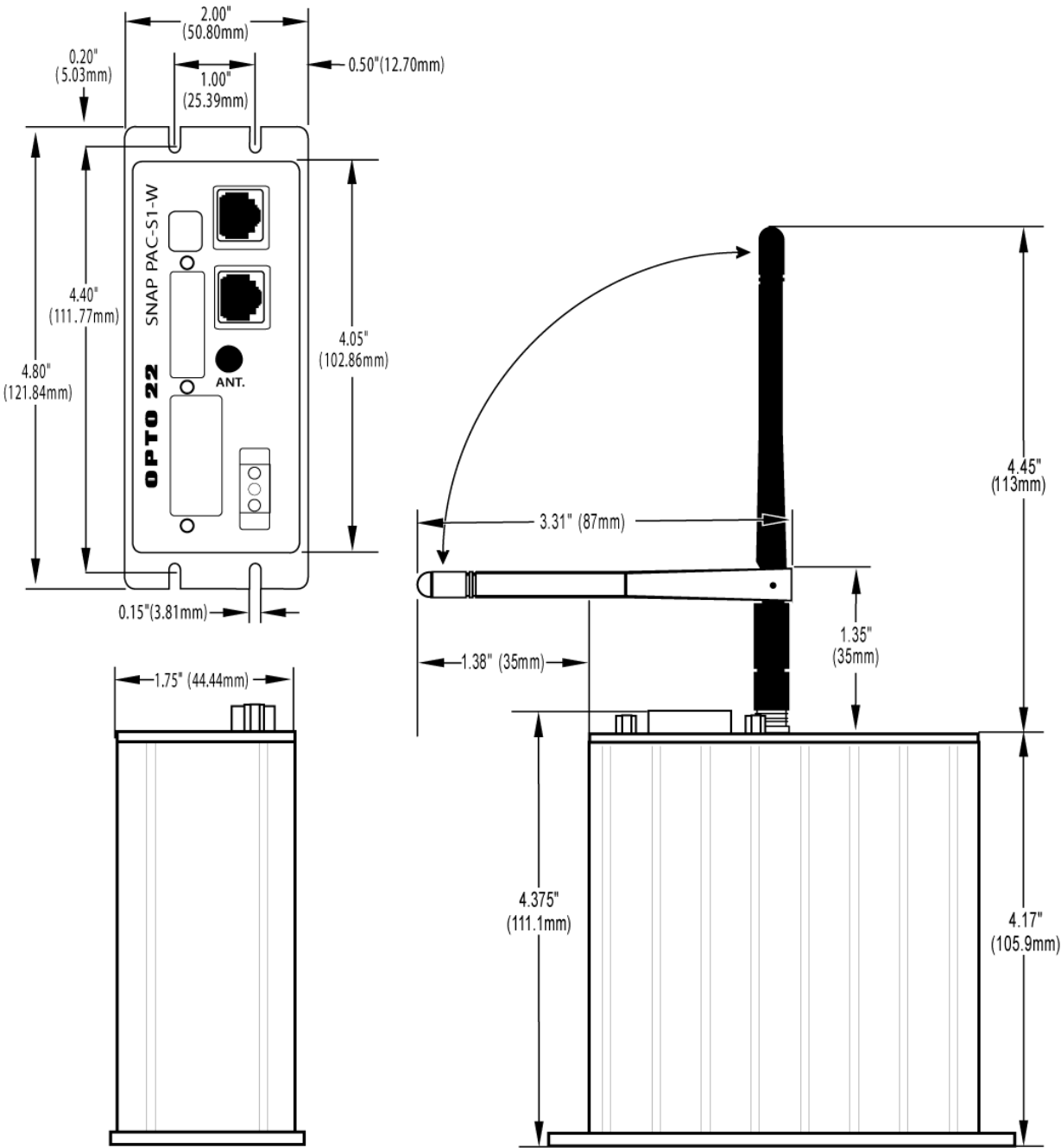
For N-TRON switch and access point dimensions, see the data sheet for the part number. Data sheets are available on our website, www.opto22.com.

SNAP PAC Controller Diagrams

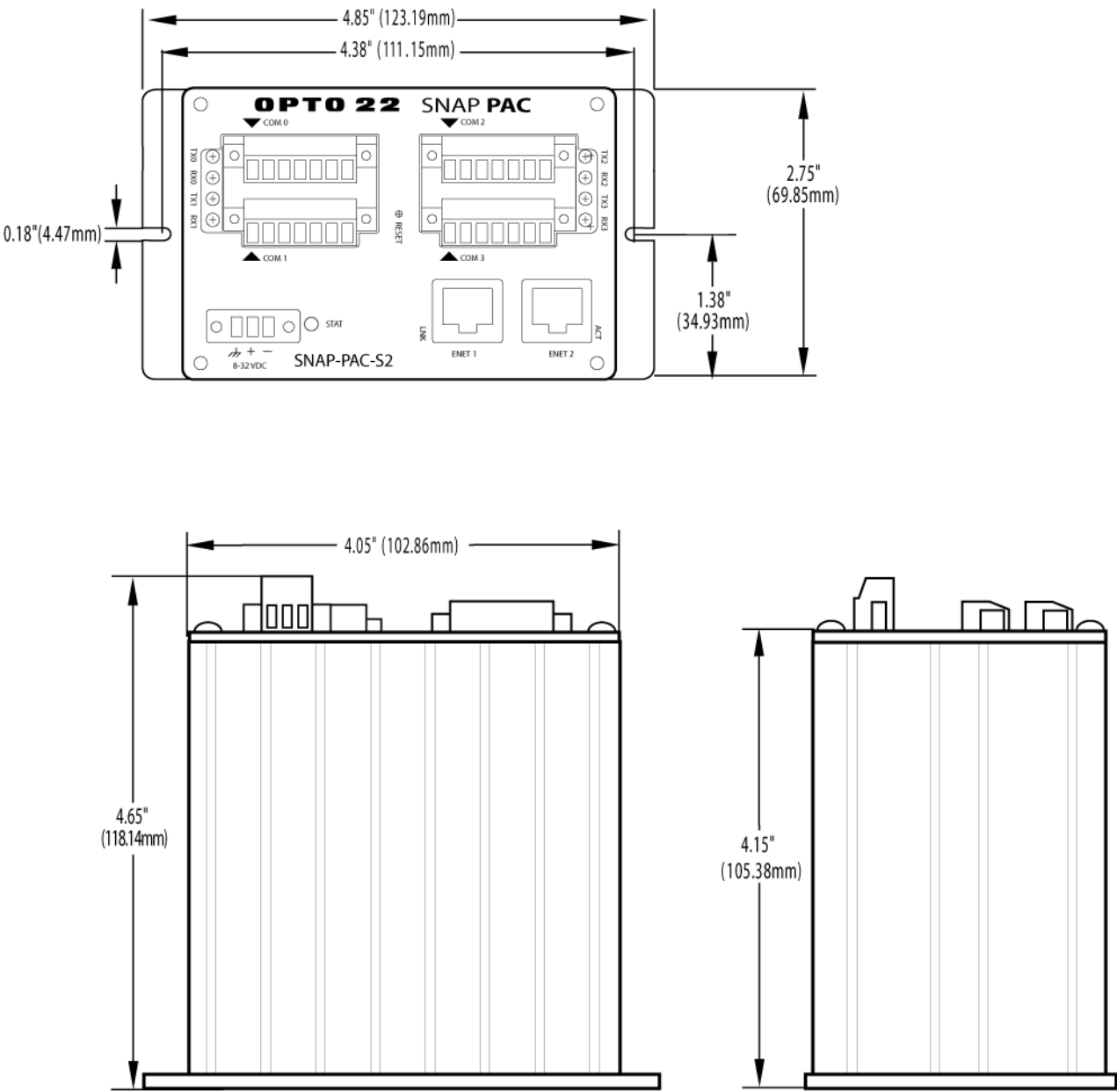
SNAP-PAC-S1 and SNAP-PAC-S1-FM Standalone Controller



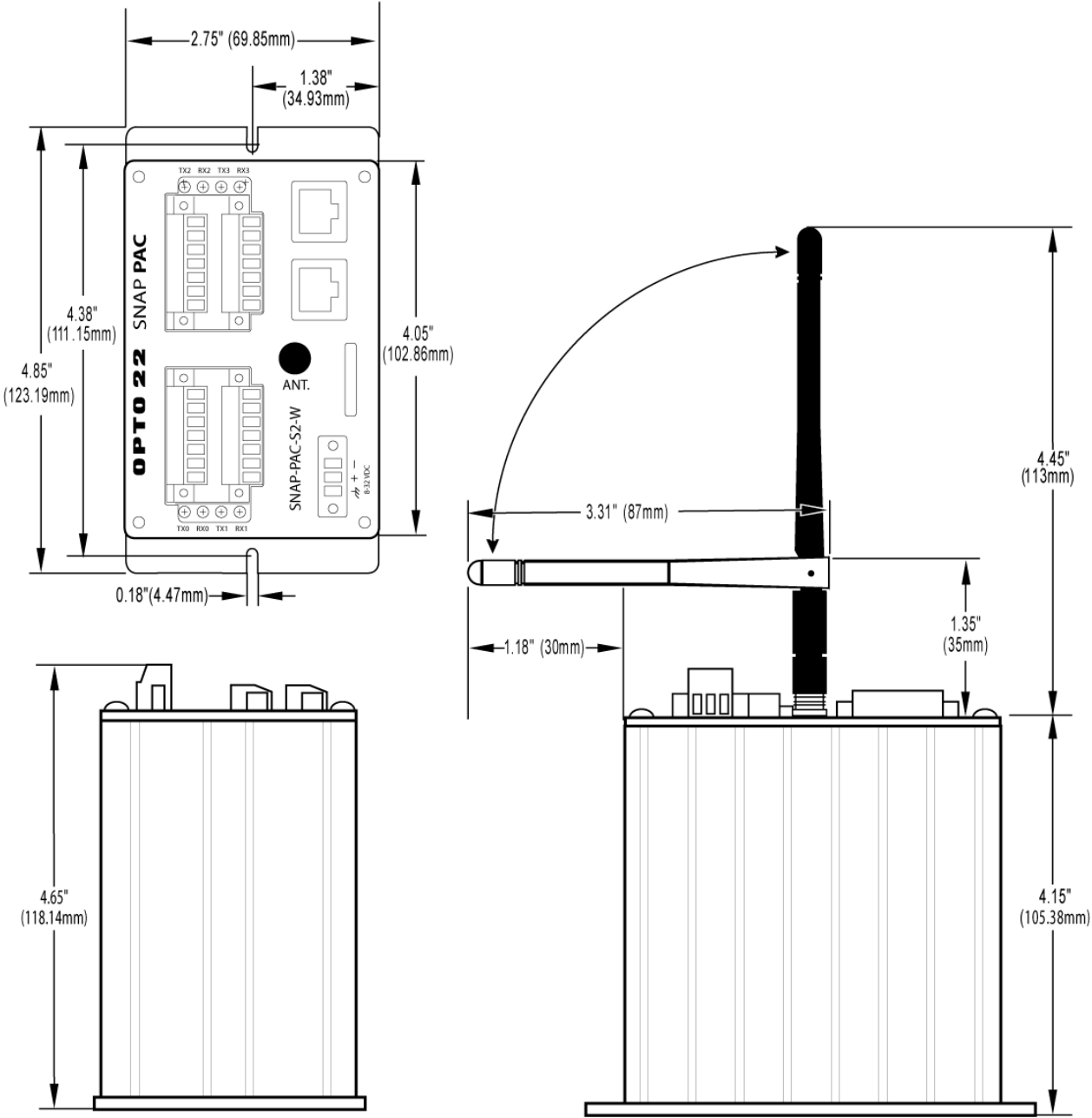
SNAP-PAC-S1-W Standalone Controller



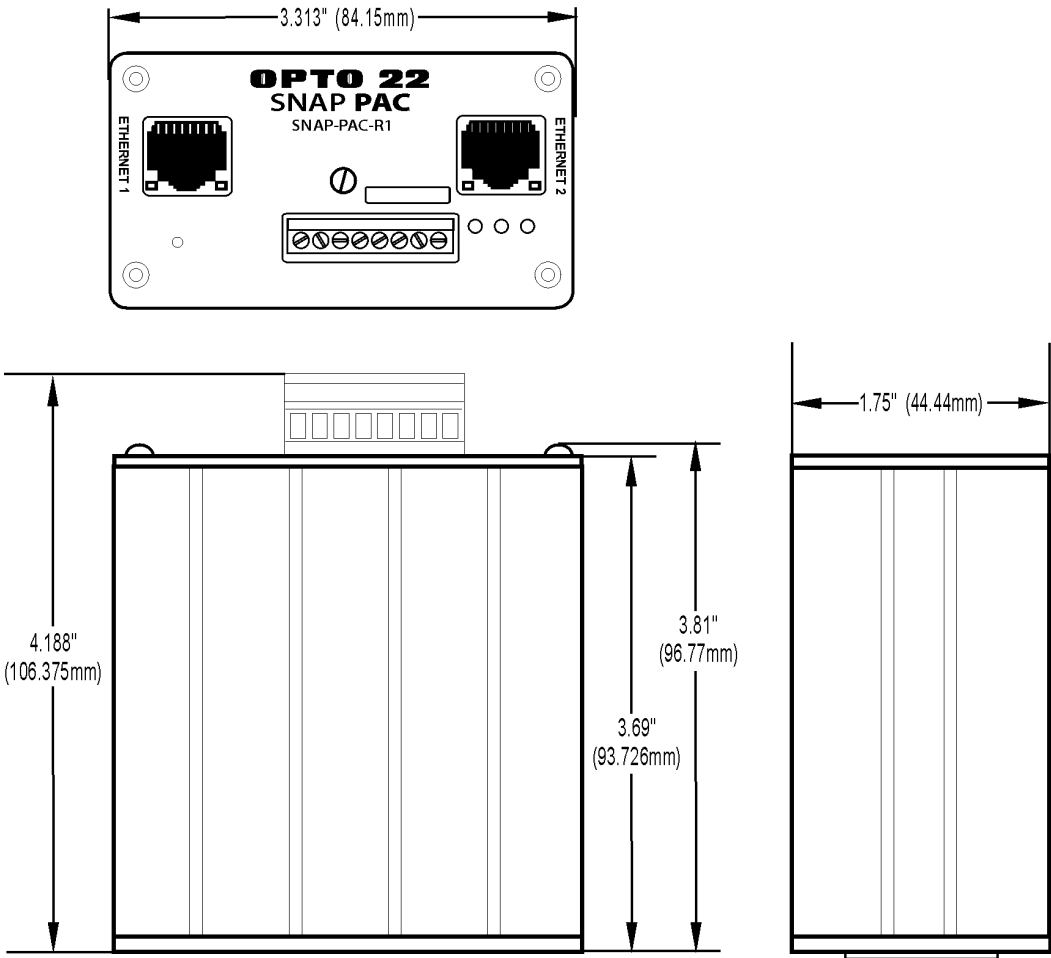
SNAP-PAC-S2 Standalone Controller



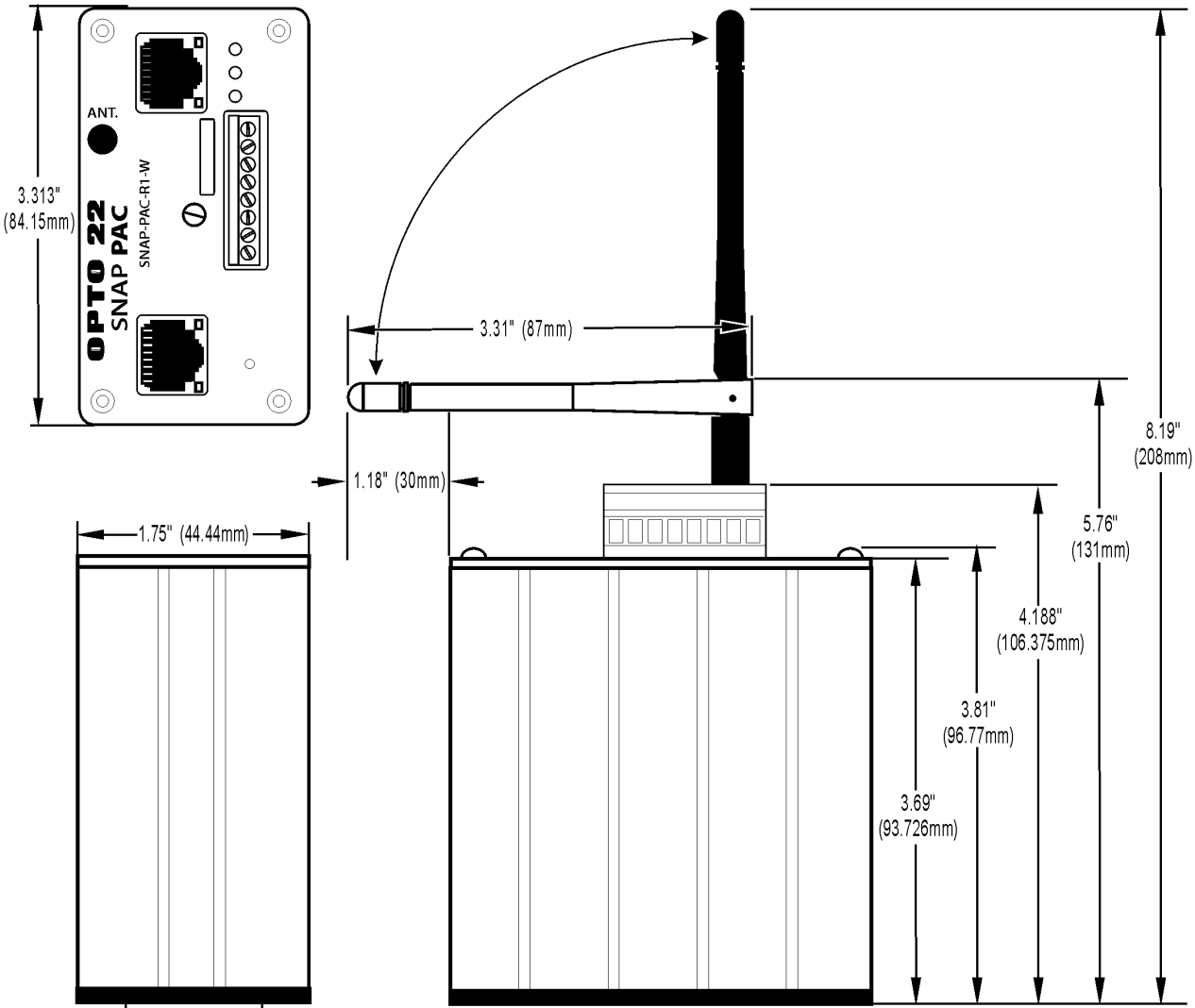
SNAP-PAC-S2-W Standalone Controller



SNAP-PAC-R1, SNAP-PAC-R1-FM, SNAP-PAC-R2, and SNAP-PAC-R2-FM
Rack-mounted Controllers

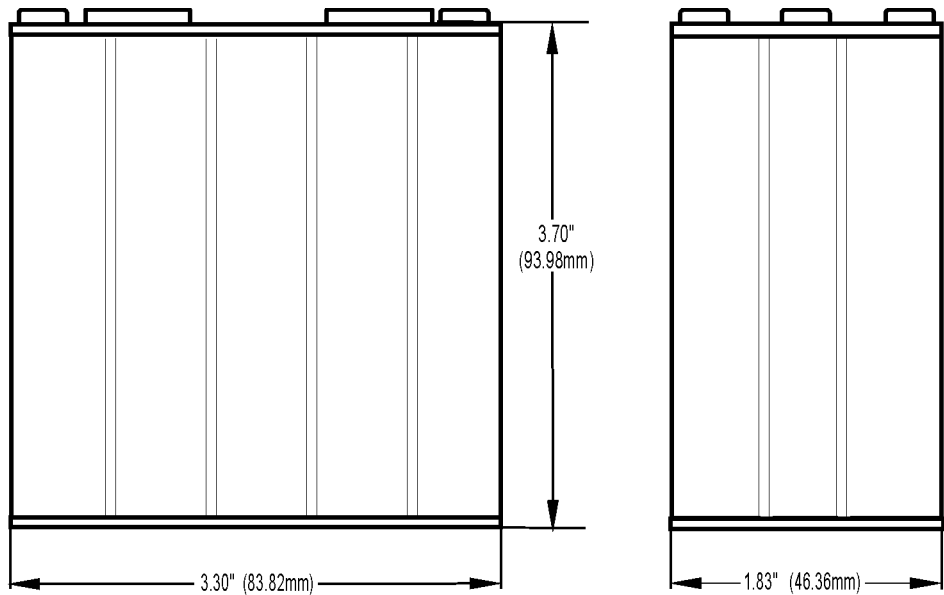


SNAP-PAC-R1-W and SNAP-PAC-R2-W Rack-mounted Controllers

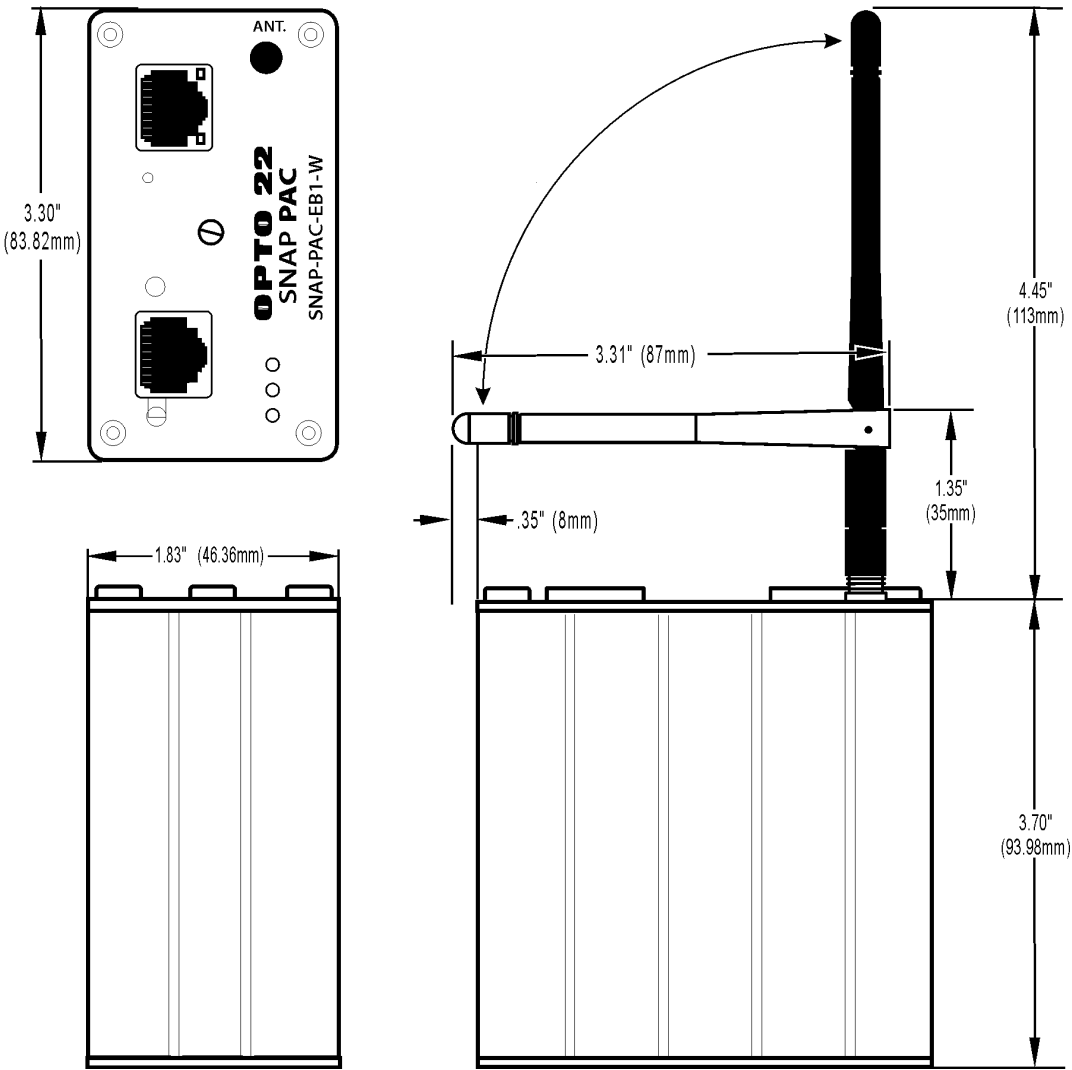


SNAP PAC Brain Diagrams

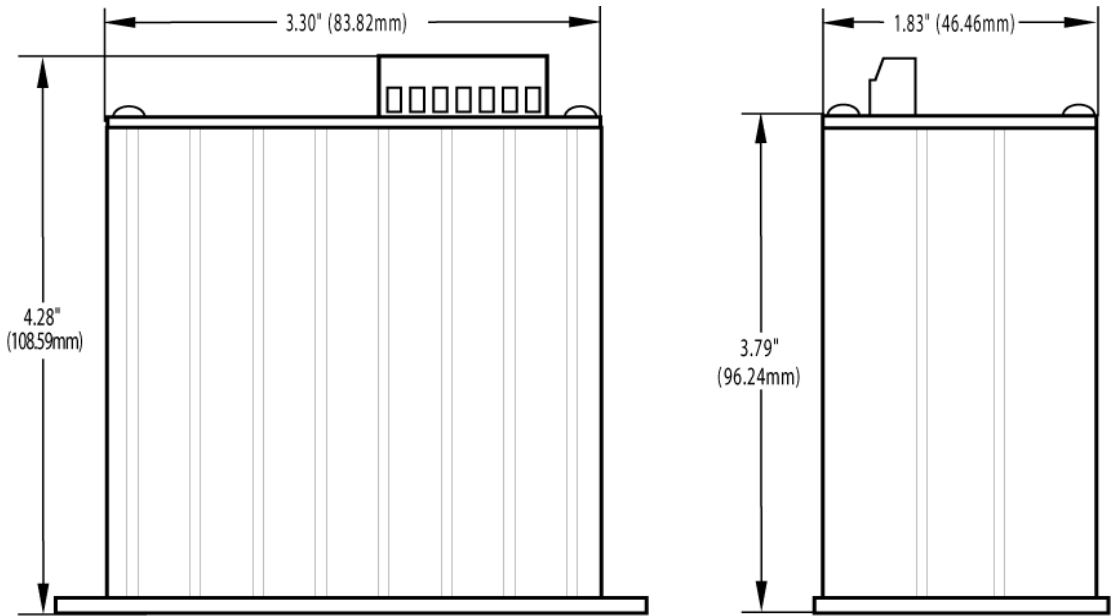
SNAP-PAC-EB1, SNAP-PAC-EB1-FM, SNAP-PAC-EB2, and SNAP-PAC-EB2-FM Ethernet Brains



SNAP-PAC-EB1-W and SNAP-PAC-EB2-W Ethernet Brains

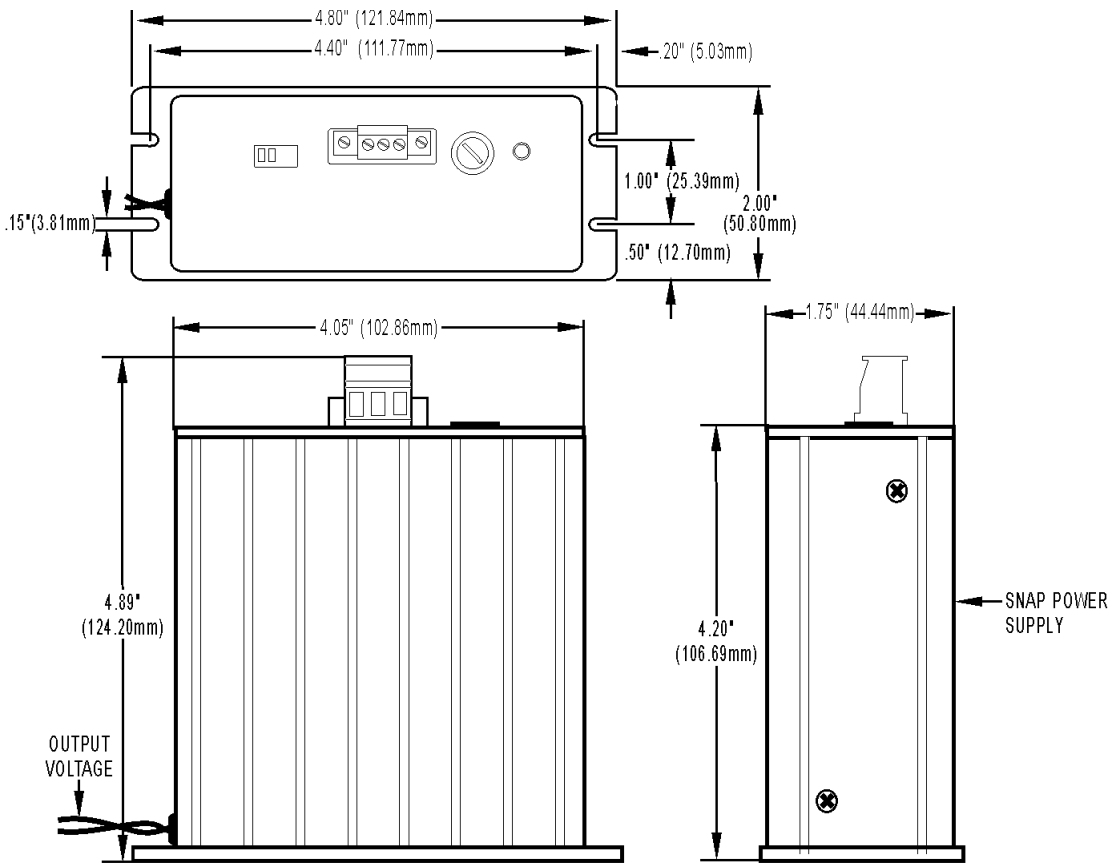


SNAP-PAC-SB1 and SNAP-PAC-SB2 Serial Brains

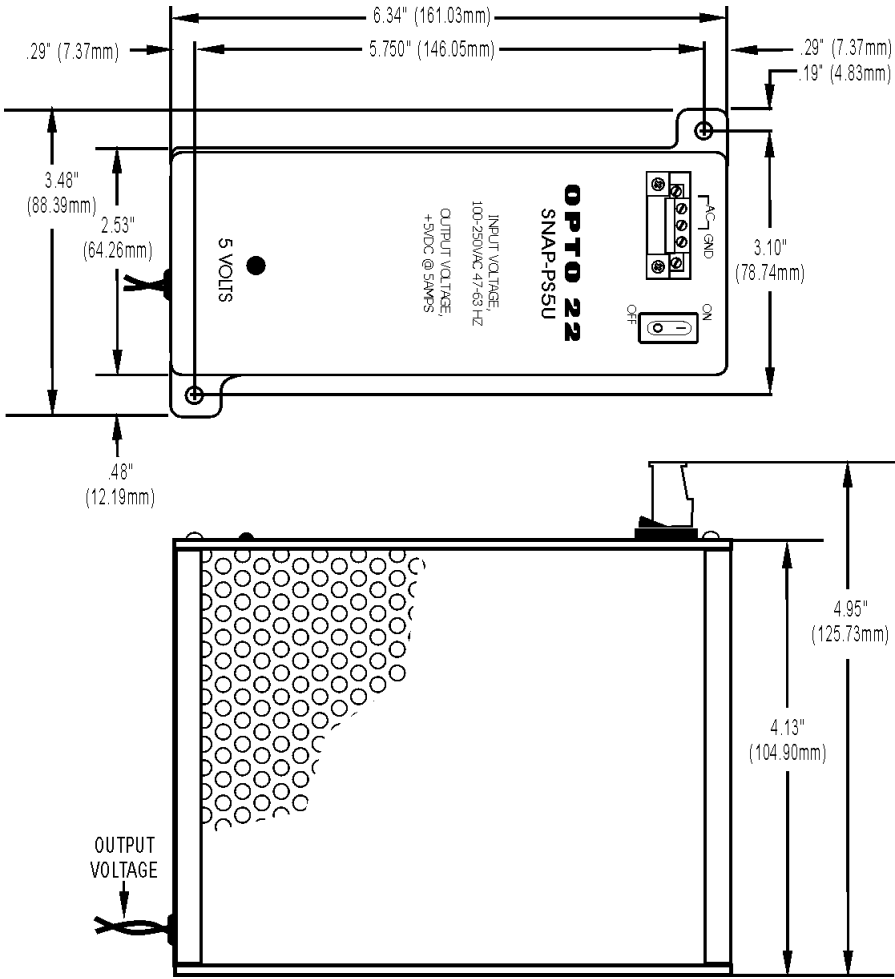


SNAP Power Supplies Diagrams

SNAP-PS5, SNAP-PS24, and SNAP-PS5-24DC

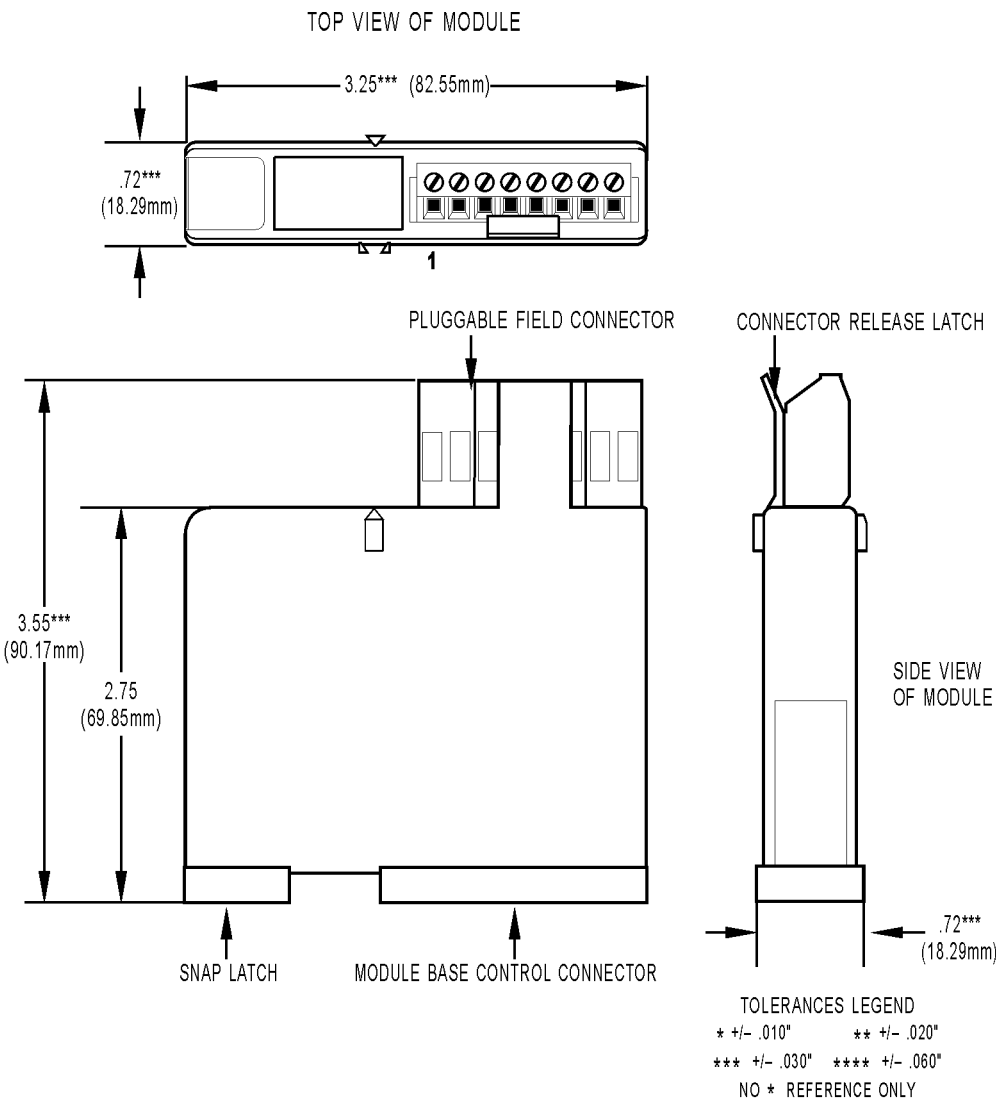


SNAP-PS5U and SNAP-PS24U

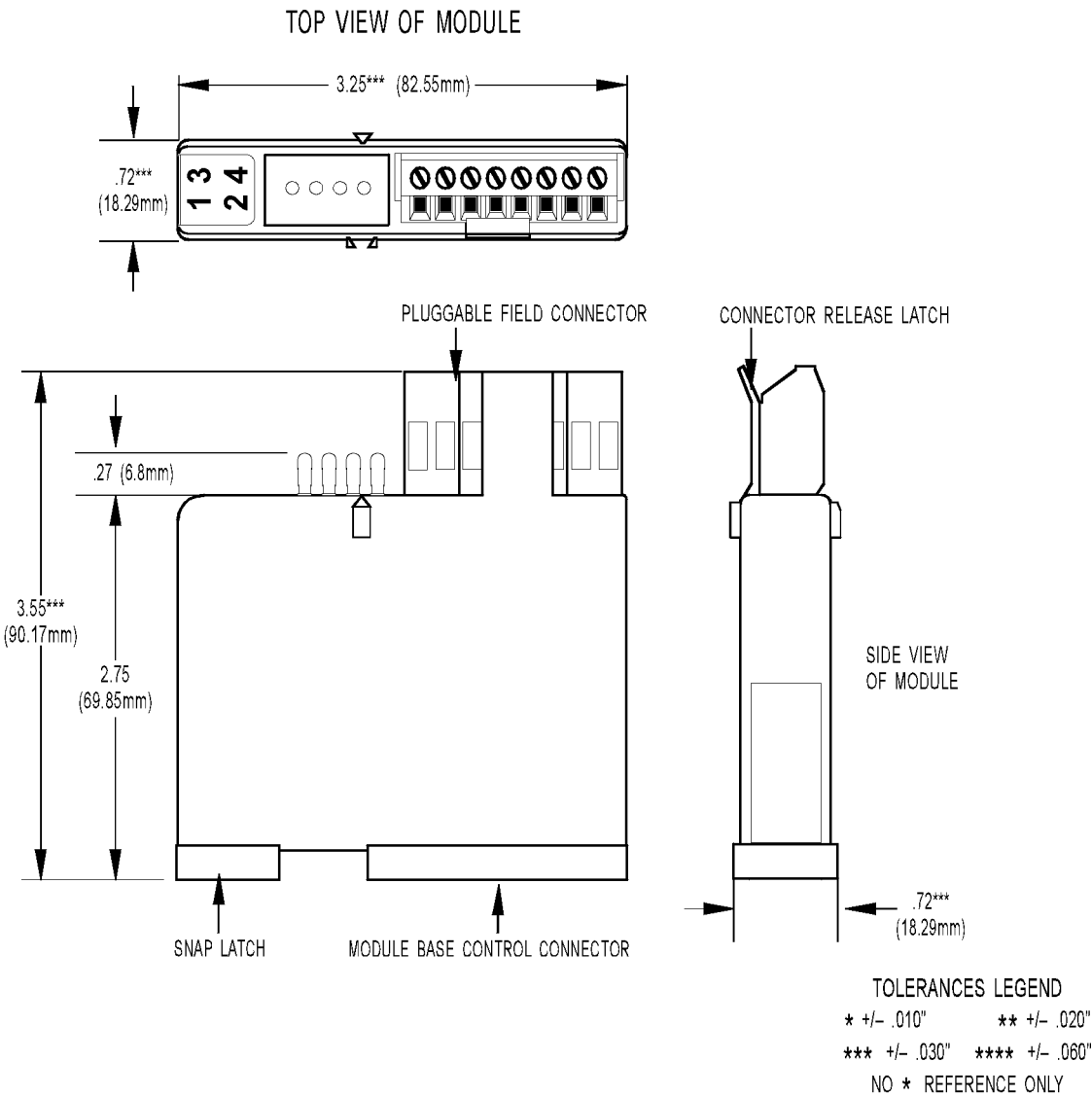


SNAP Digital I/O Modules Diagrams

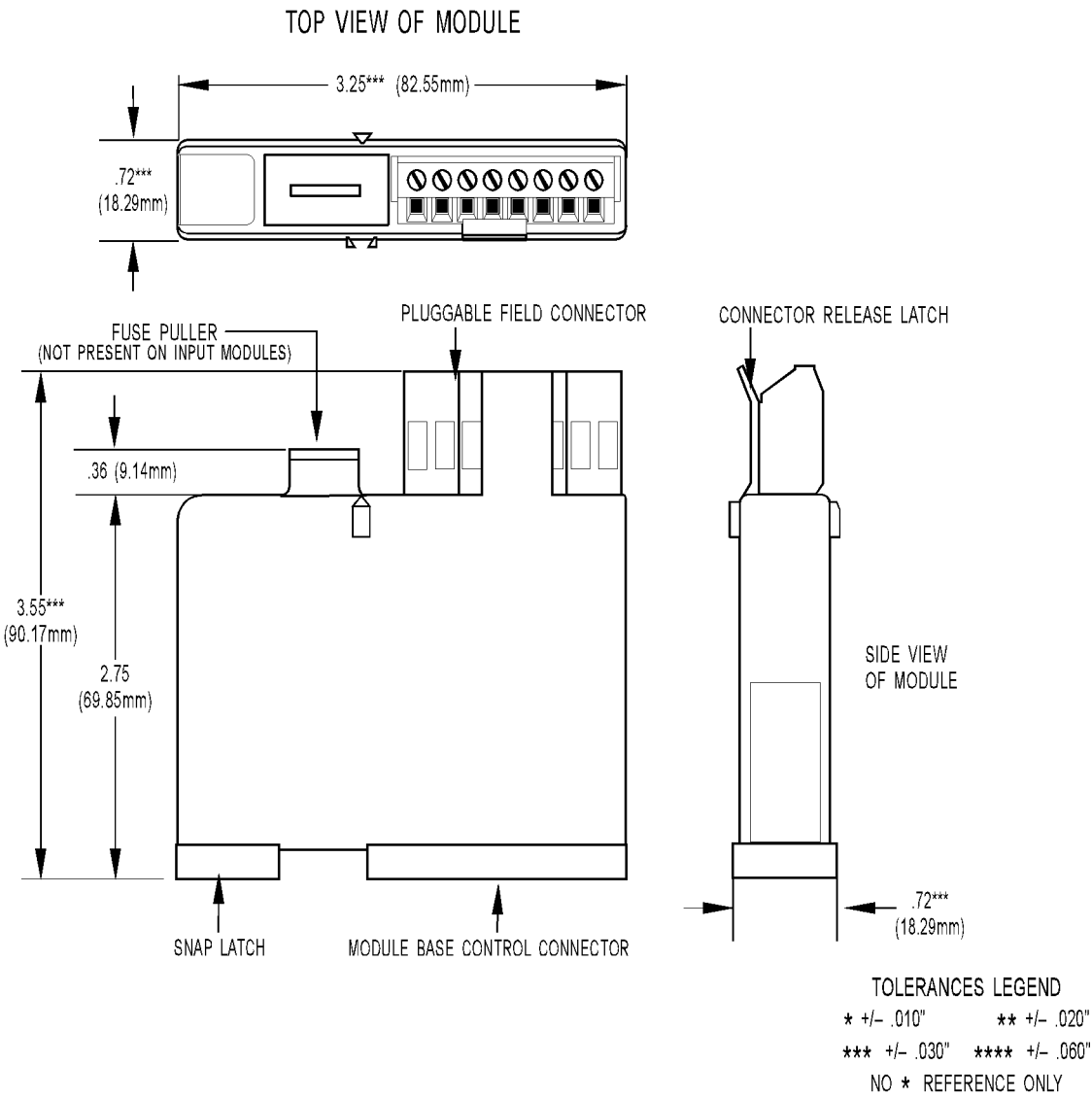
SNAP Digital Input Modules—All Modules except MA



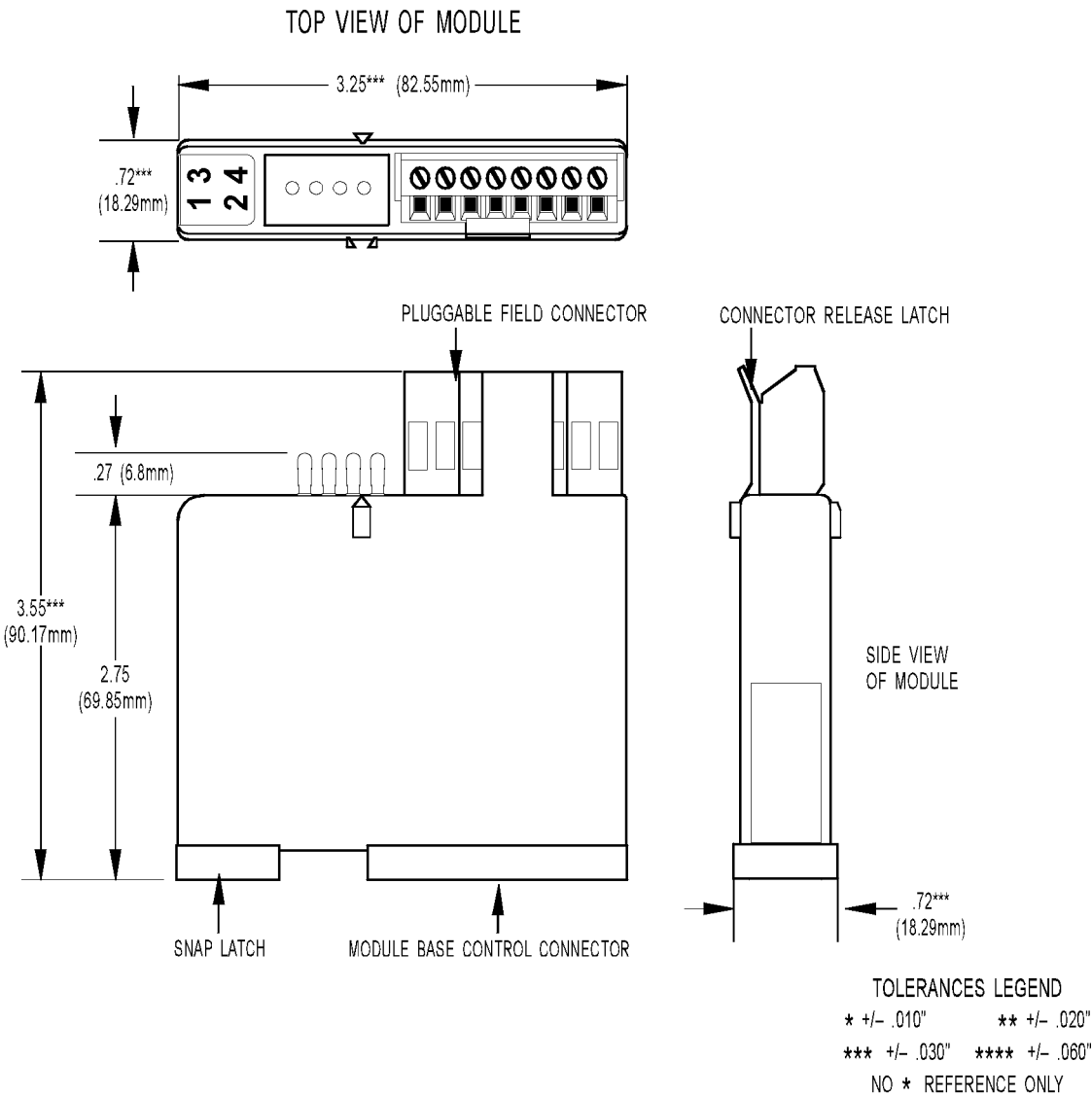
SNAP Digital Input Modules—MA Modules



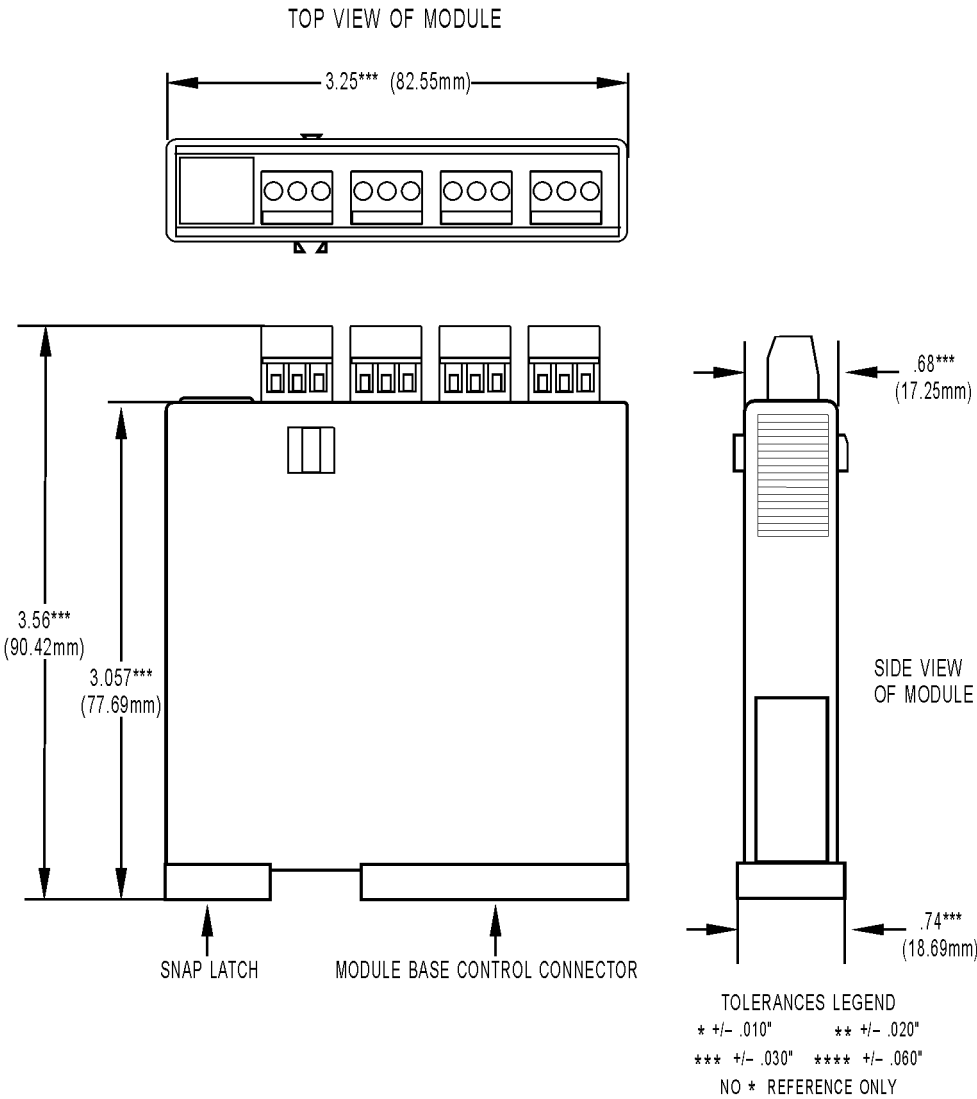
SNAP Digital Output Modules—All Modules except MA and Mechanical Power Relay



SNAP Digital Output Modules—MA Modules

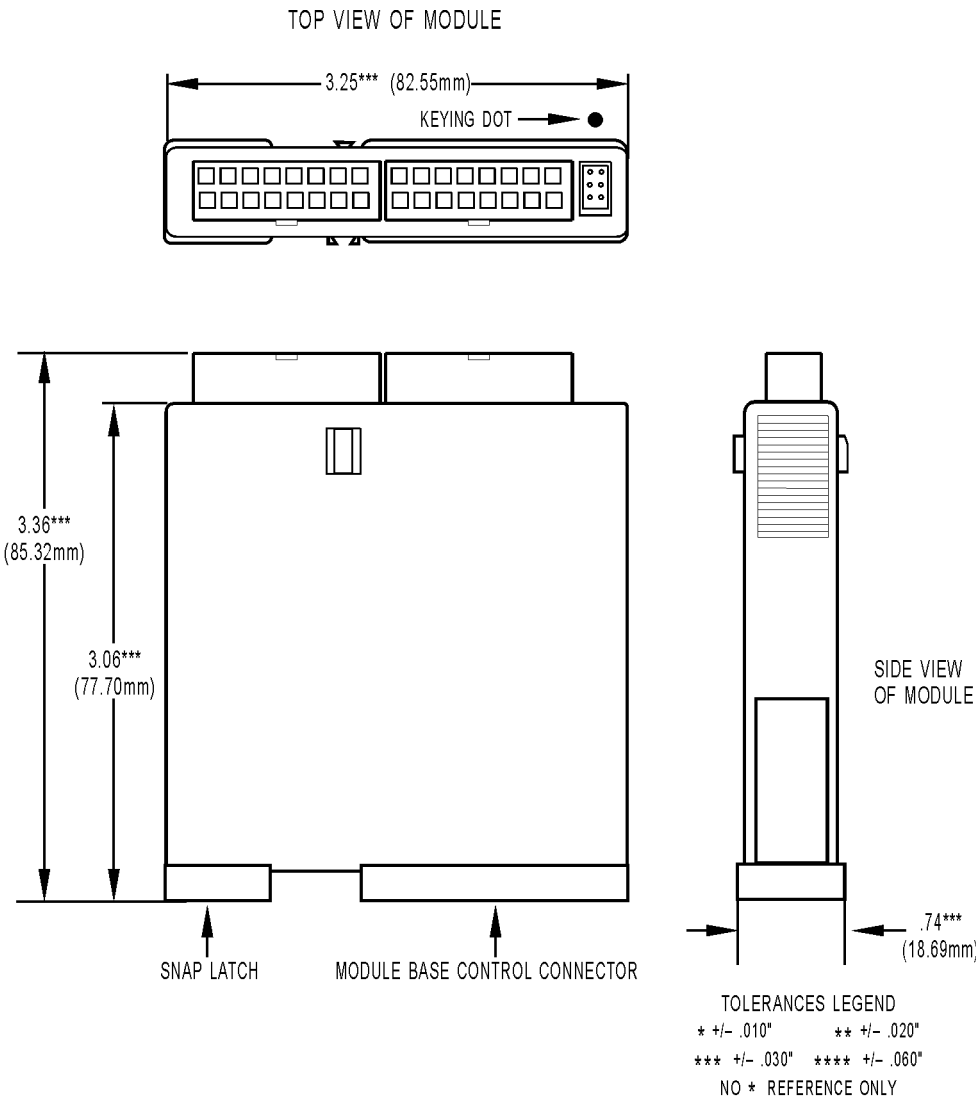


SNAP Digital Output Modules—Mechanical Power Relay

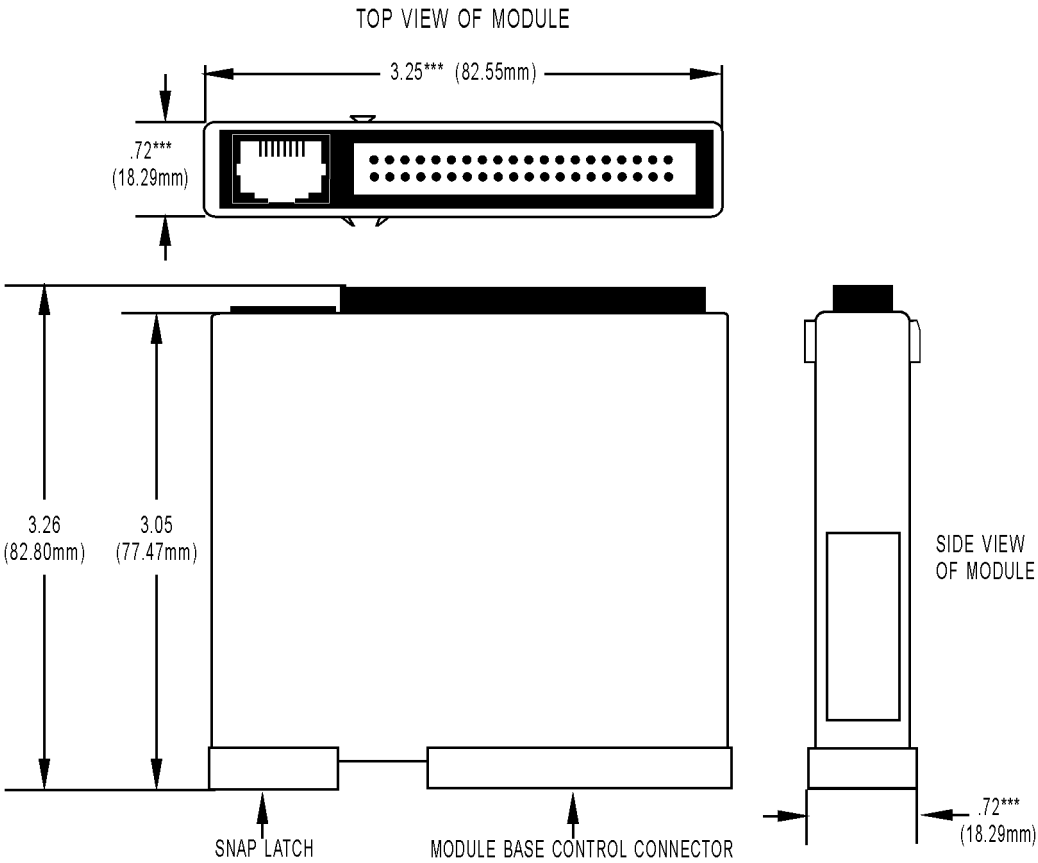


SNAP High-Density Digital Modules

SNAP 16-Point Digital Modules



SNAP 32-Point Digital Modules



TOLERANCES LEGEND

* +/- .010"	** +/- .020"
*** +/- .030"	**** +/- .060"
NO * REFERENCE ONLY	

SNAP Analog I/O Modules

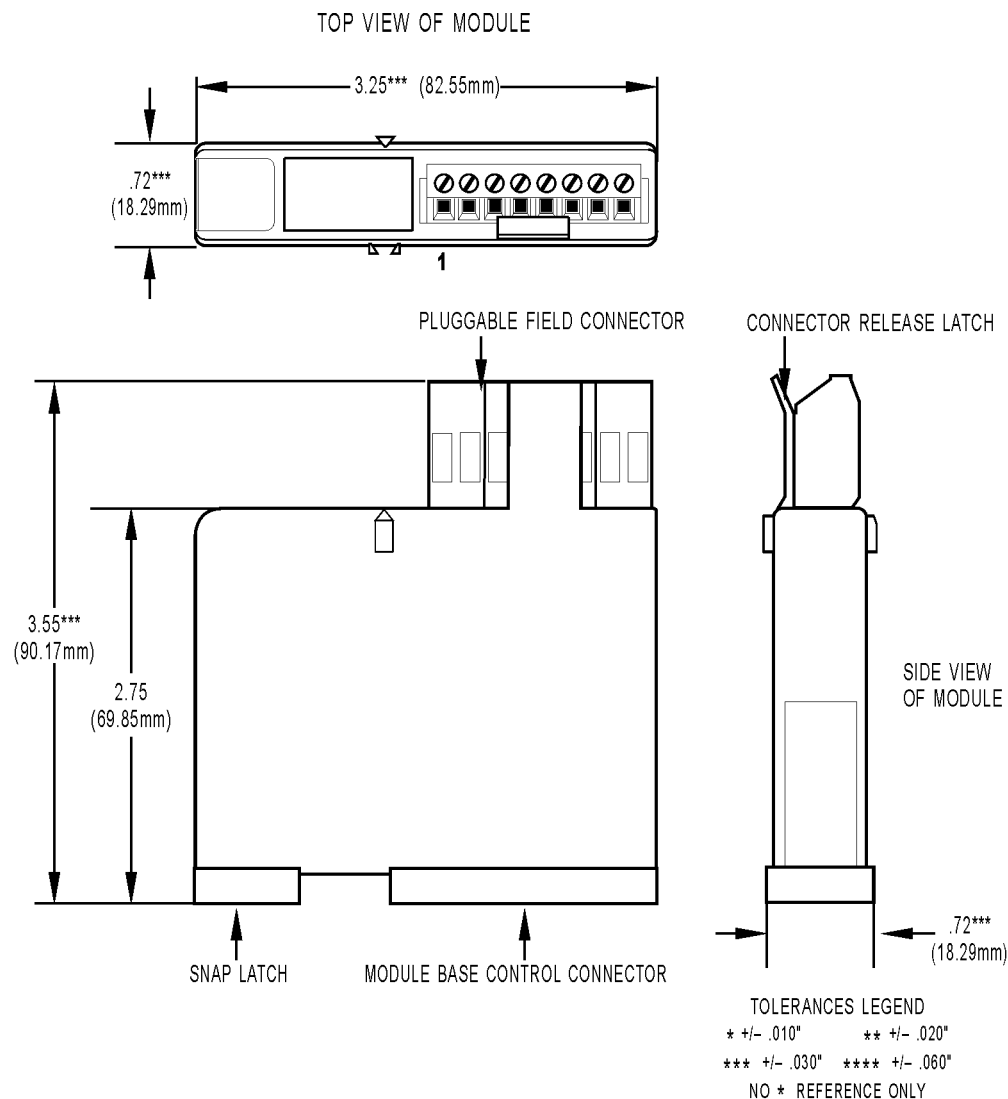
SNAP Analog Input Modules—Most Two- and Four-Channel Modules

For SNAP-pH/ORP, see [page 191](#).

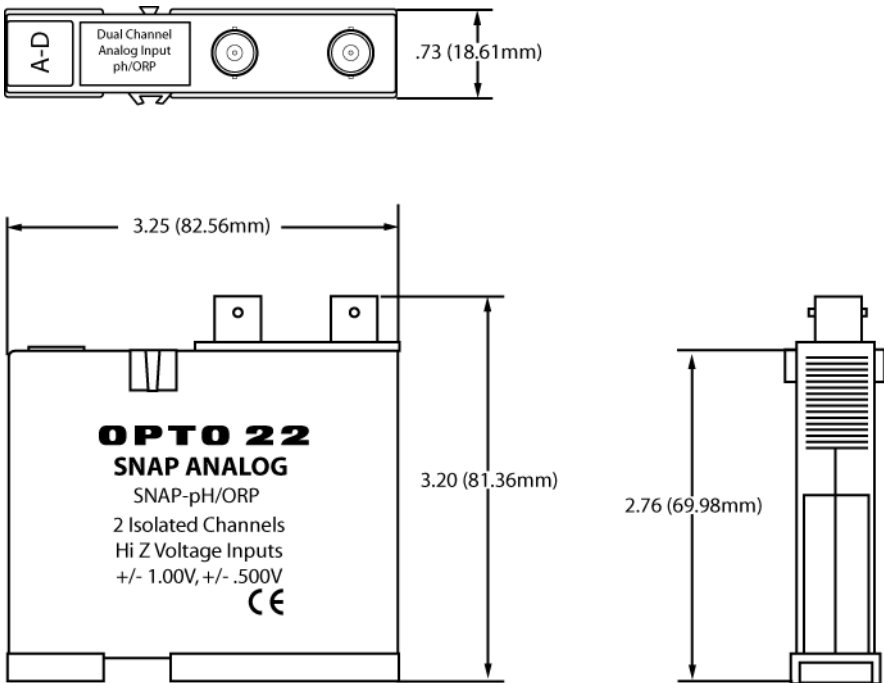
For SNAP-AIPM, see [page 192](#).

For SNAP-AIPM-3 and SNAP-AIPM-3V, see [page 193](#).

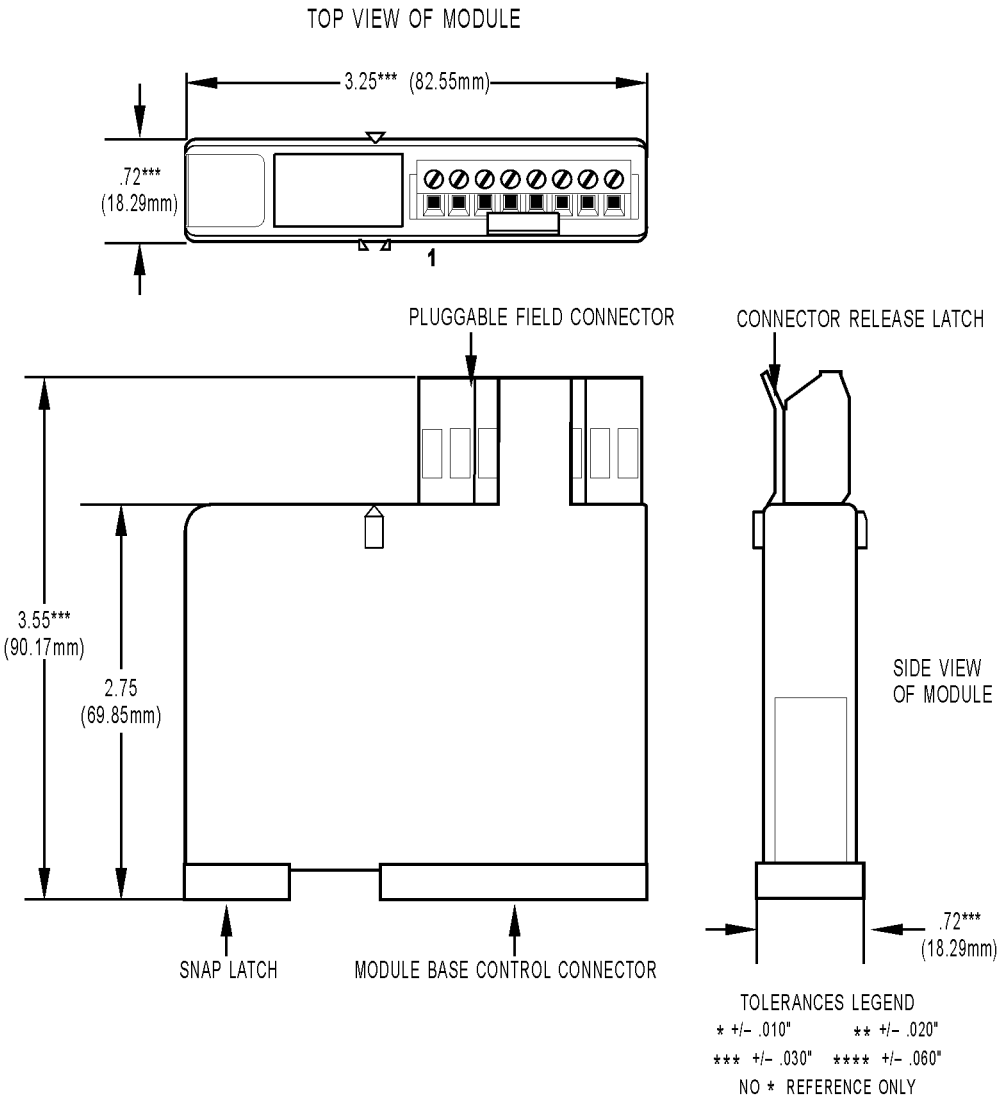
For isolated analog input modules, see [page 197](#).



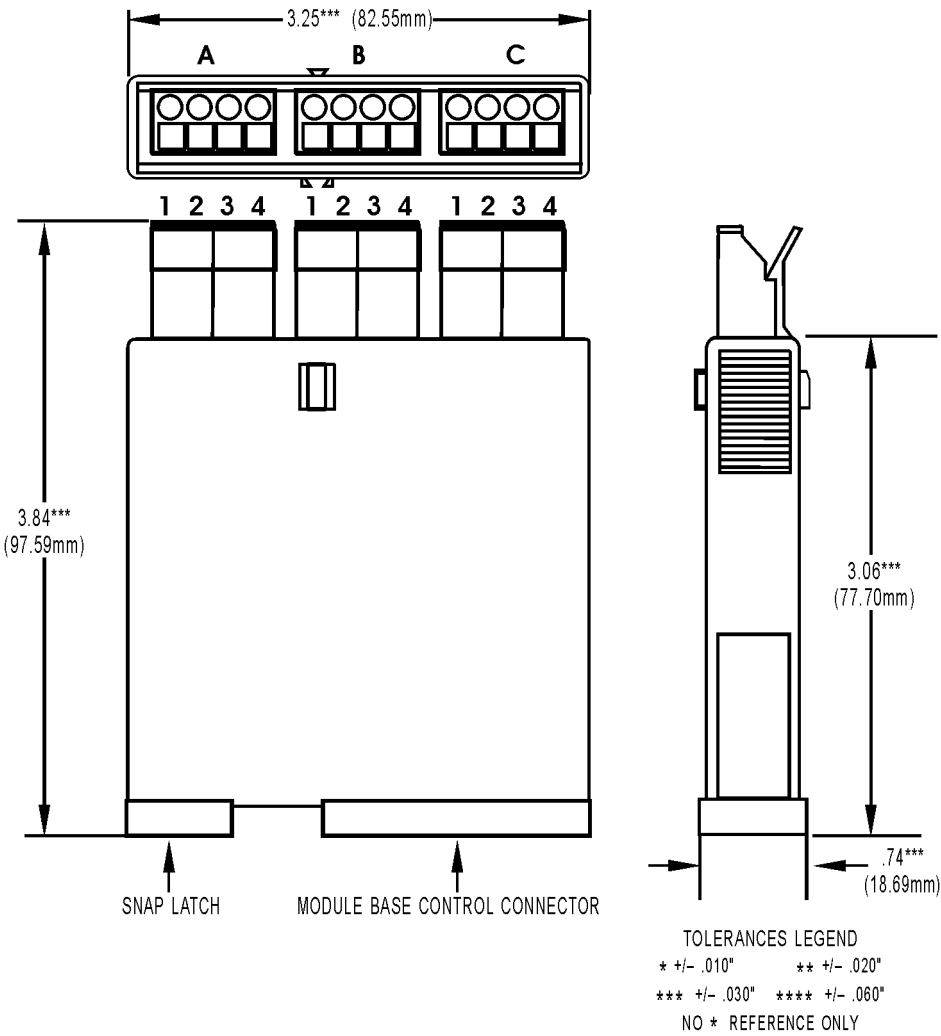
SNAP-pH/ORP Analog Input Module



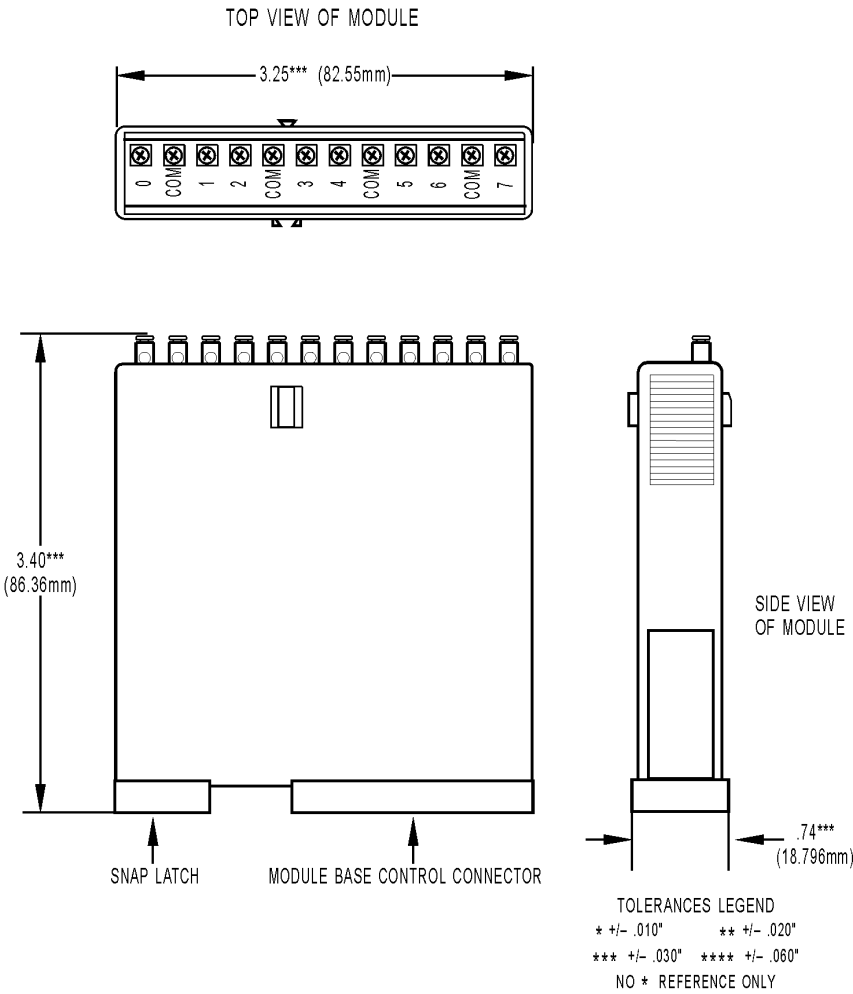
SNAP Analog Input Modules—SNAP-AIPM



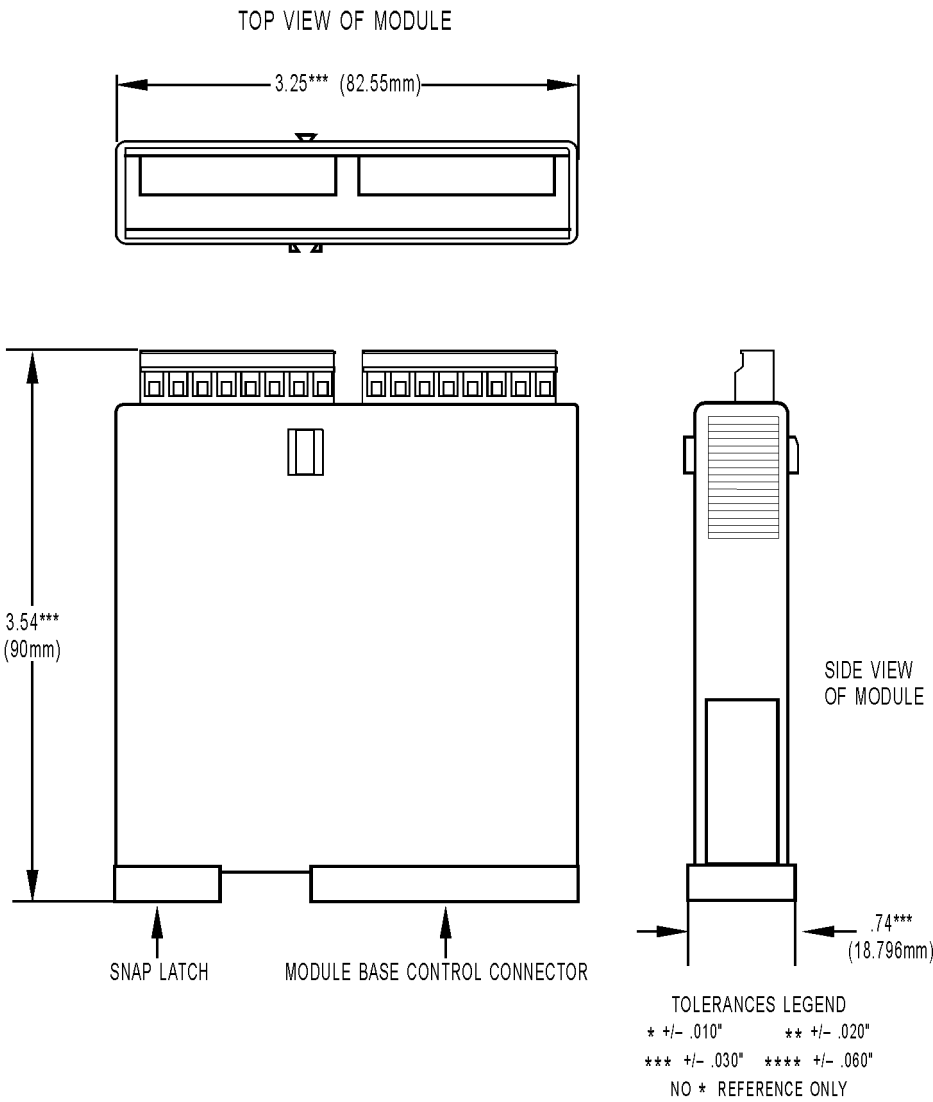
SNAP Analog Input Modules—SNAP-AIPM-3 and SNAP-AIPM-3V



SNAP Analog Input Modules—SNAP-AITM-8 and SNAP-AITM-8-FM

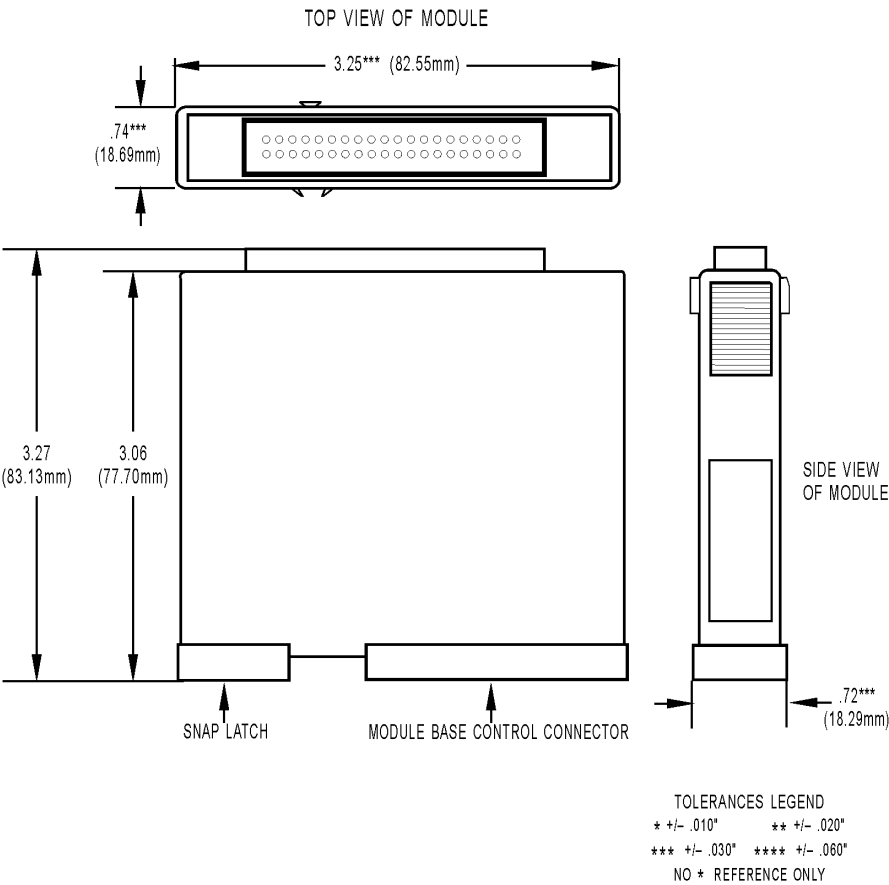


SNAP Analog Input Modules—SNAP-AICTD-8, SNAP-AIMA-8, and SNAP-AIV-8



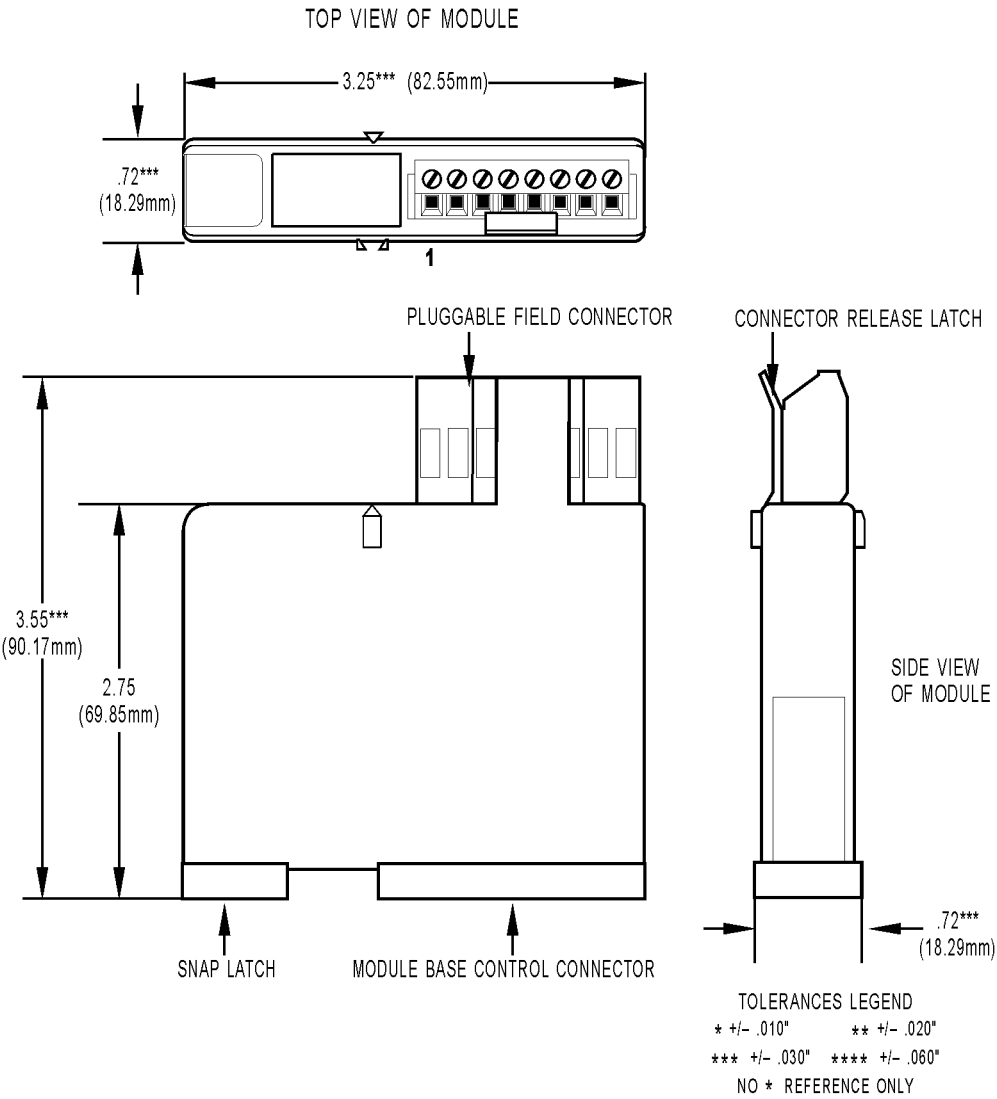
SNAP Analog Input Modules—SNAP-AIMA-32 and SNAP-AIV-32

Also applies to SNAP-AIMA-32-FM and SNAP-AIV-32-FM.

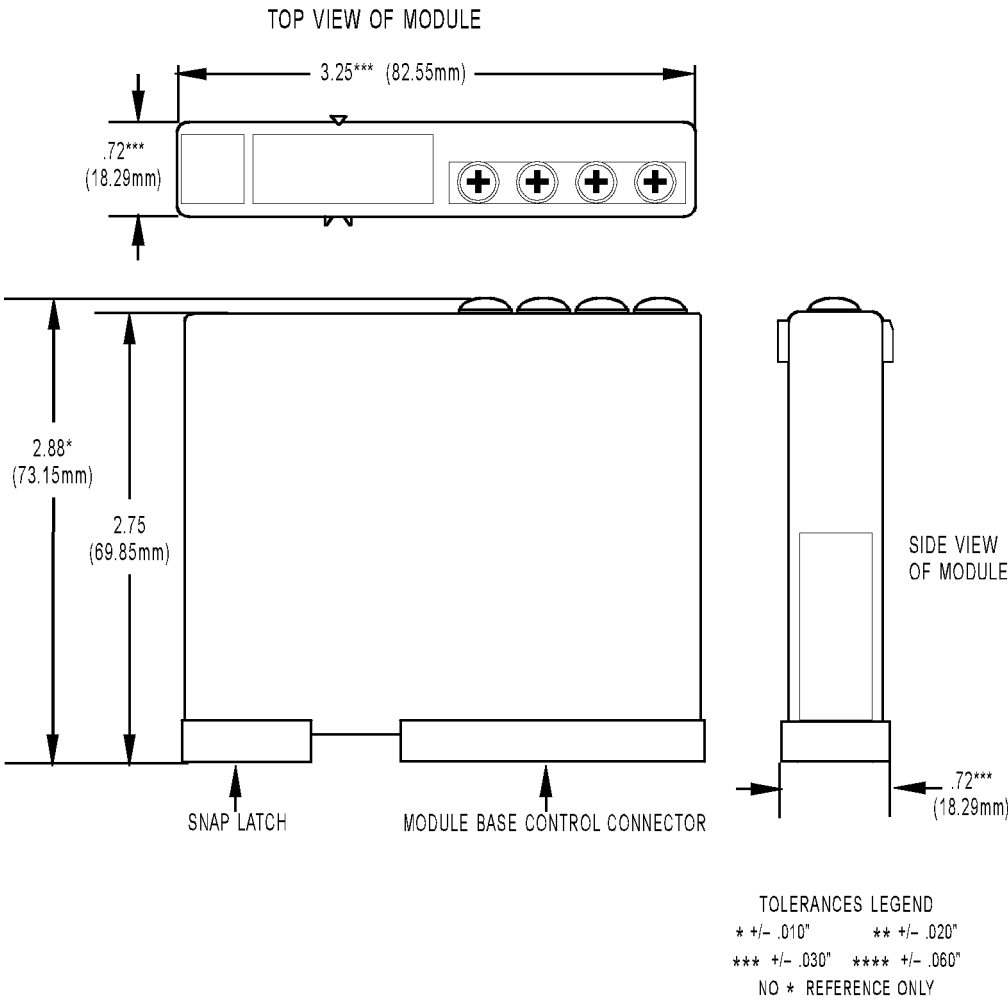


SNAP Isolated Analog Input Modules—Most Modules

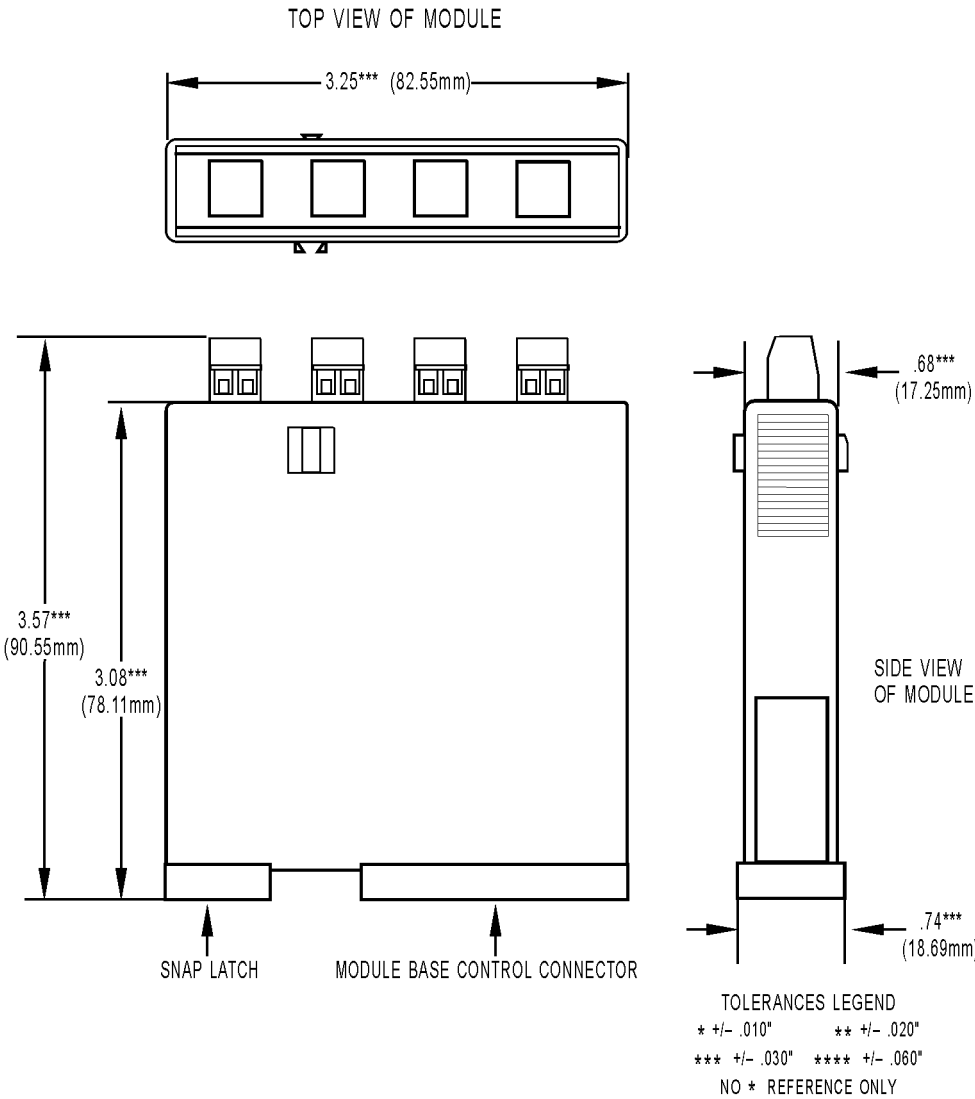
For SNAP-AITM-i and SNAP-AITM2-i, see [page 198](#).
For SNAP-AITM-4i, see [page 199](#).



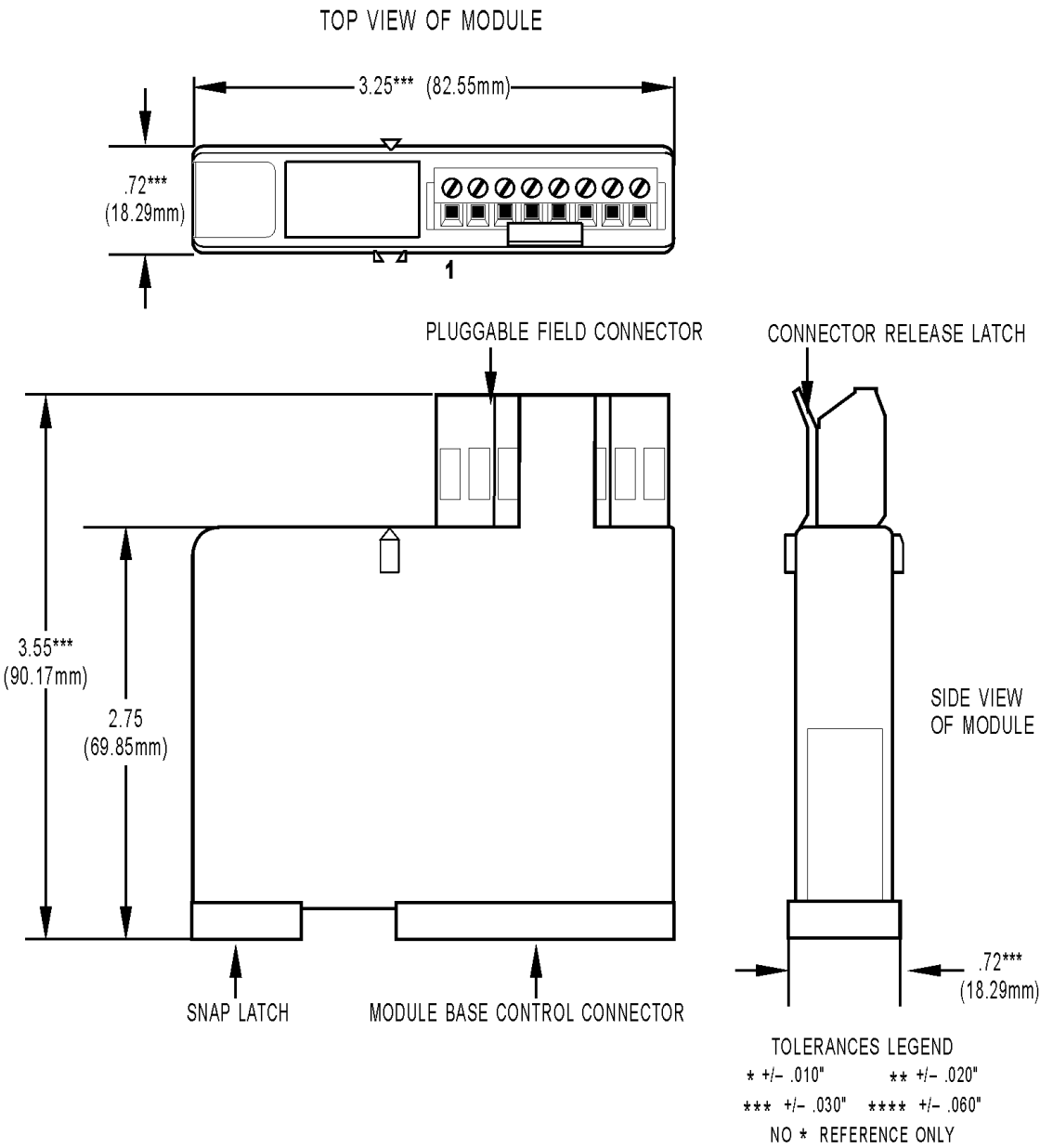
SNAP Isolated Analog Input Modules—SNAP-AITM-i and SNAP-AITM2-i



SNAP Analog Input Modules—SNAP-AITM-4i

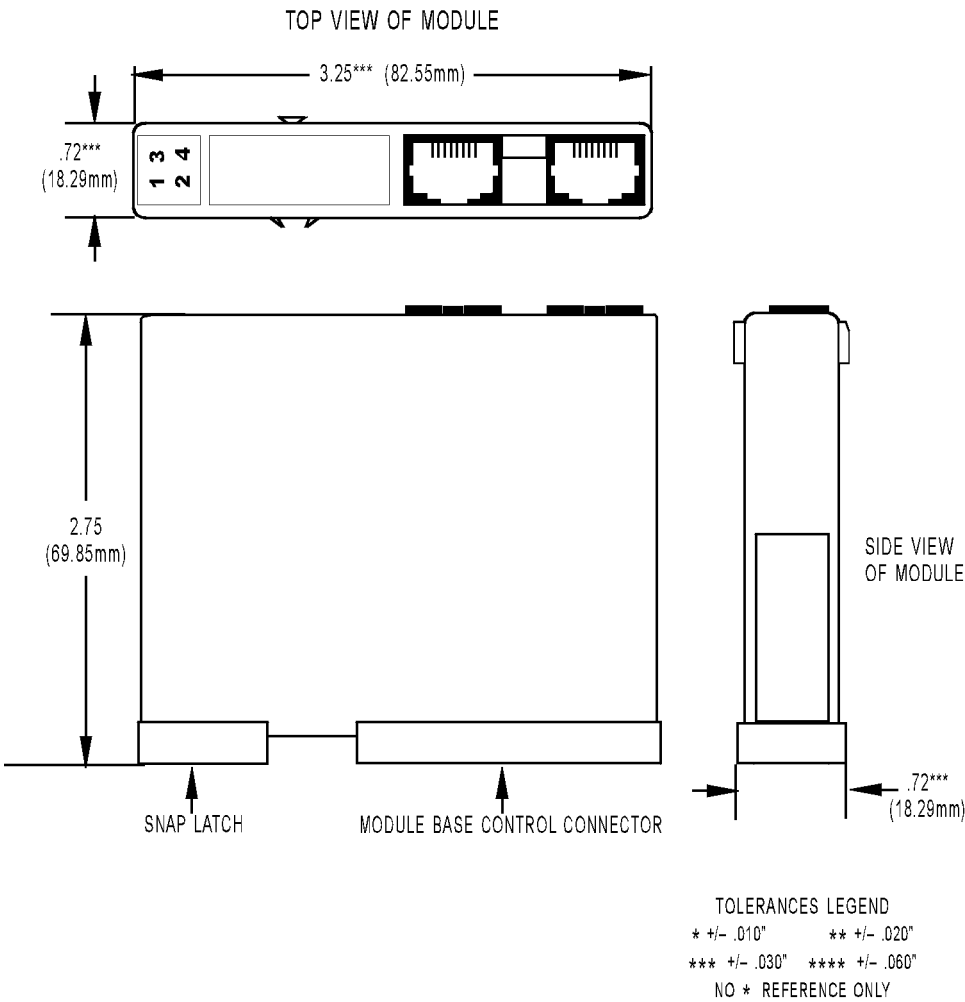


SNAP Analog Output Modules—All

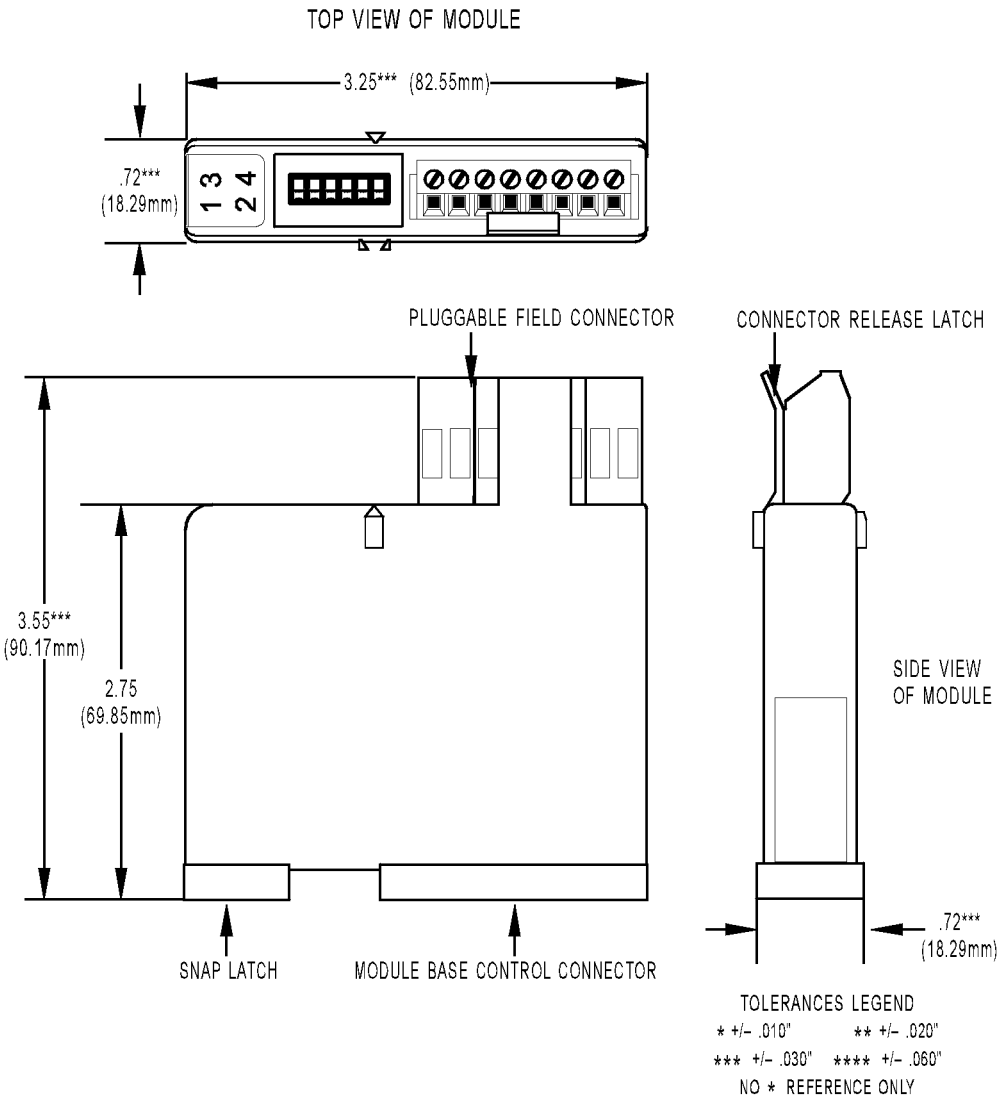


SNAP Serial Modules

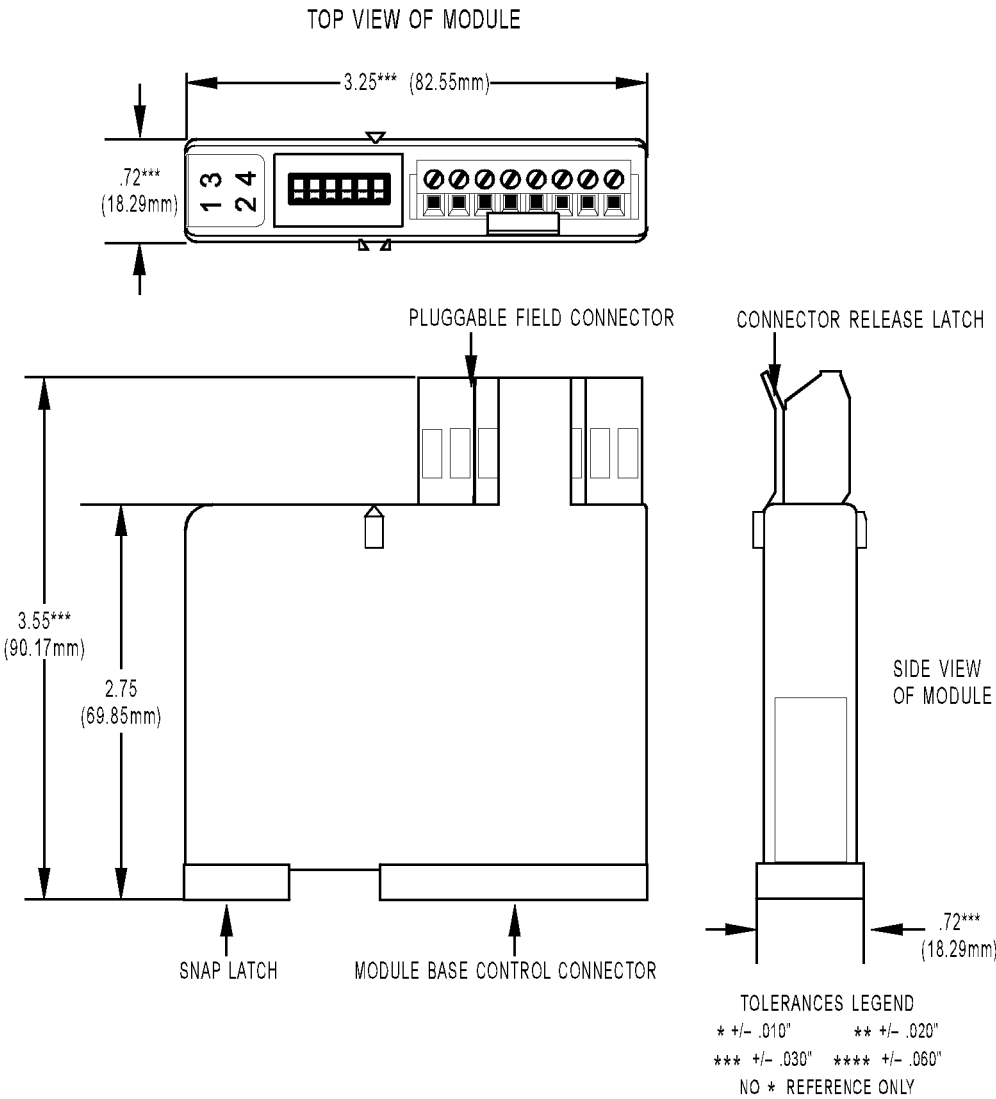
SNAP-SCM-232



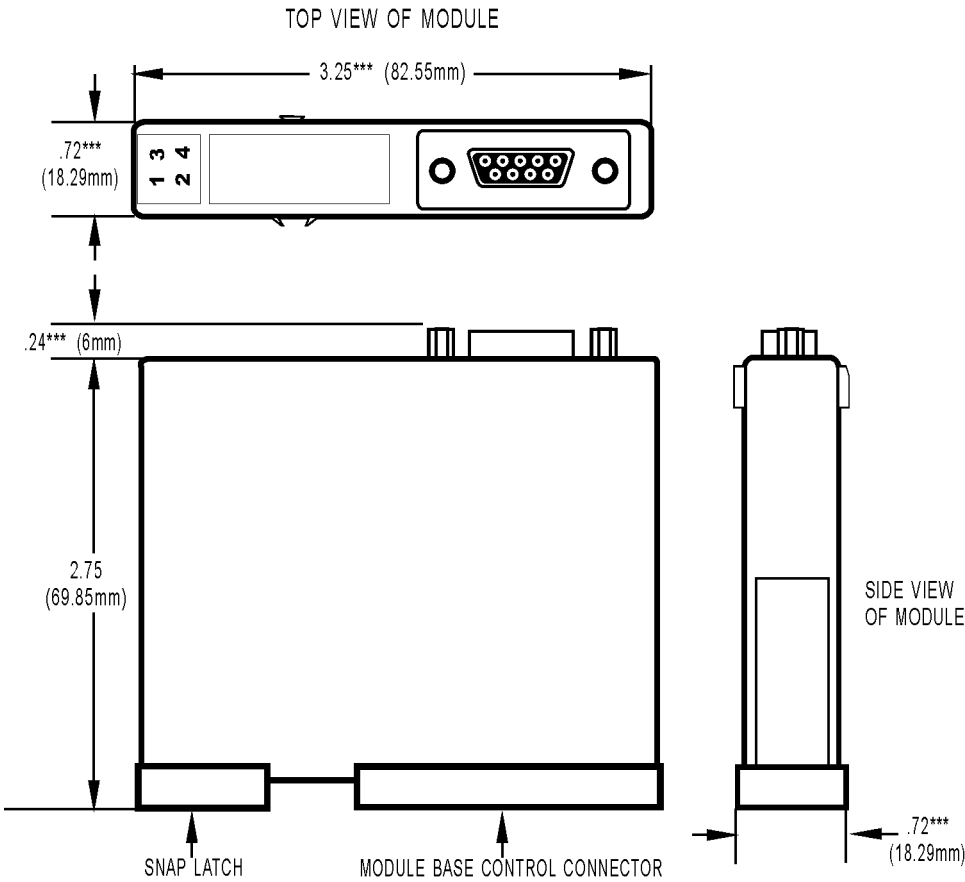
SNAP-SCM-485-422



SNAP-SCM-MCH16



SNAP-SCM-PROFI



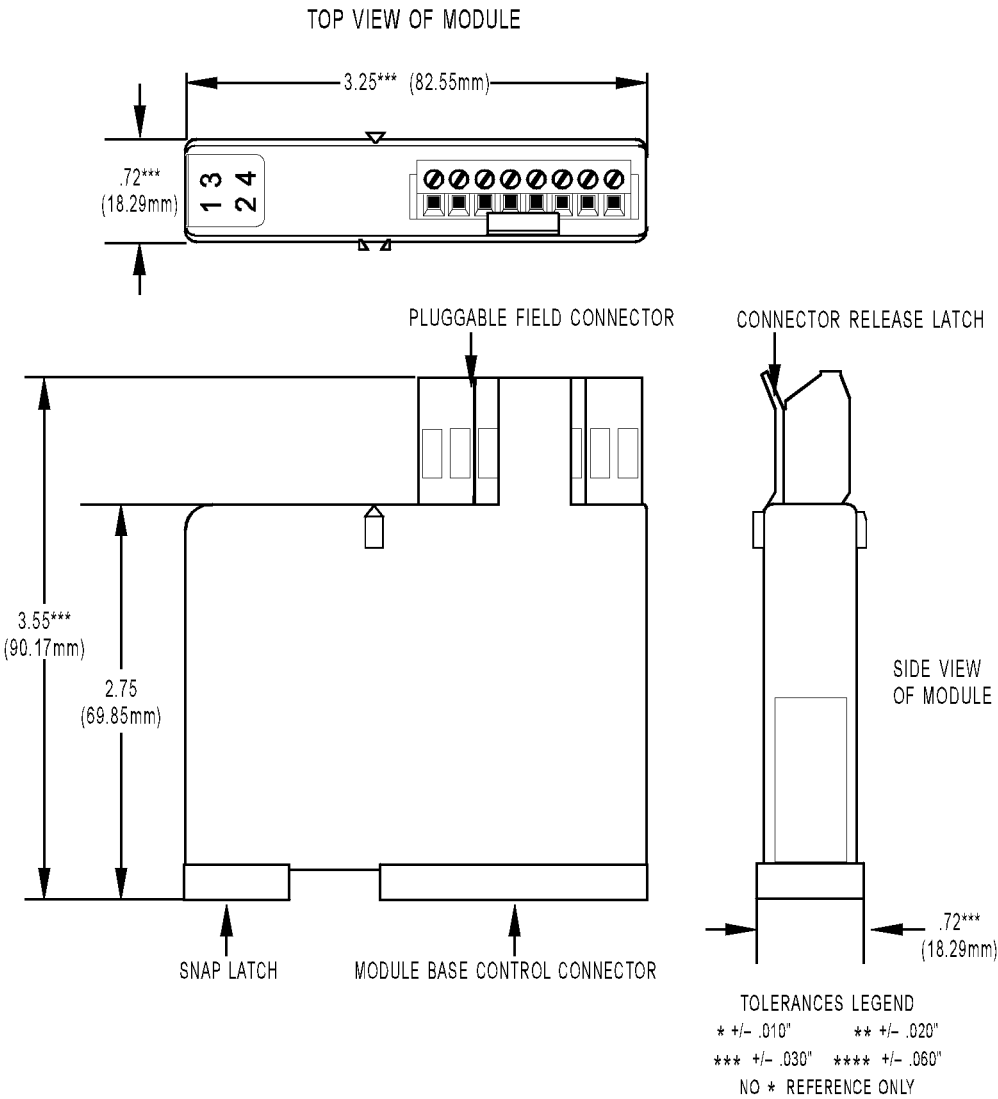
TOLERANCES LEGEND

* +/- .010" ** +/- .020"

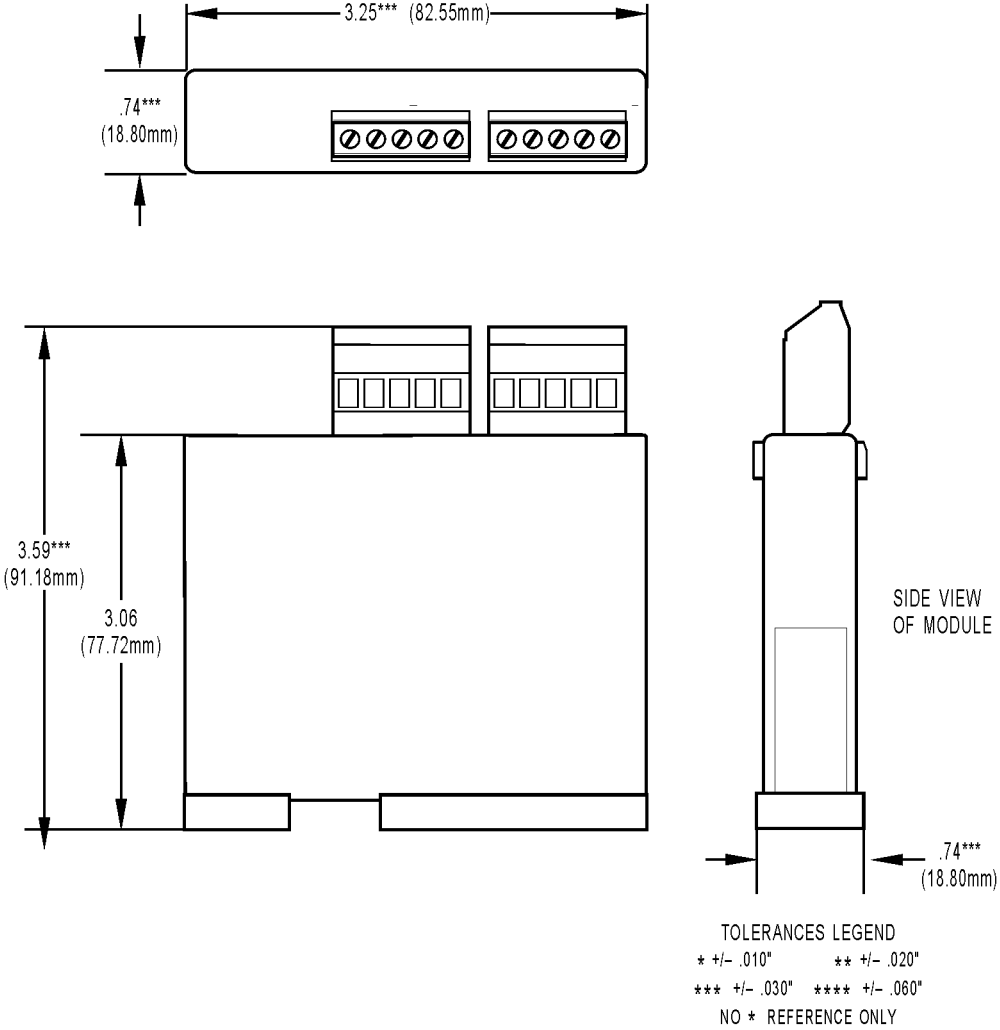
*** +/- .030" **** +/- .060"

NO * REFERENCE ONLY

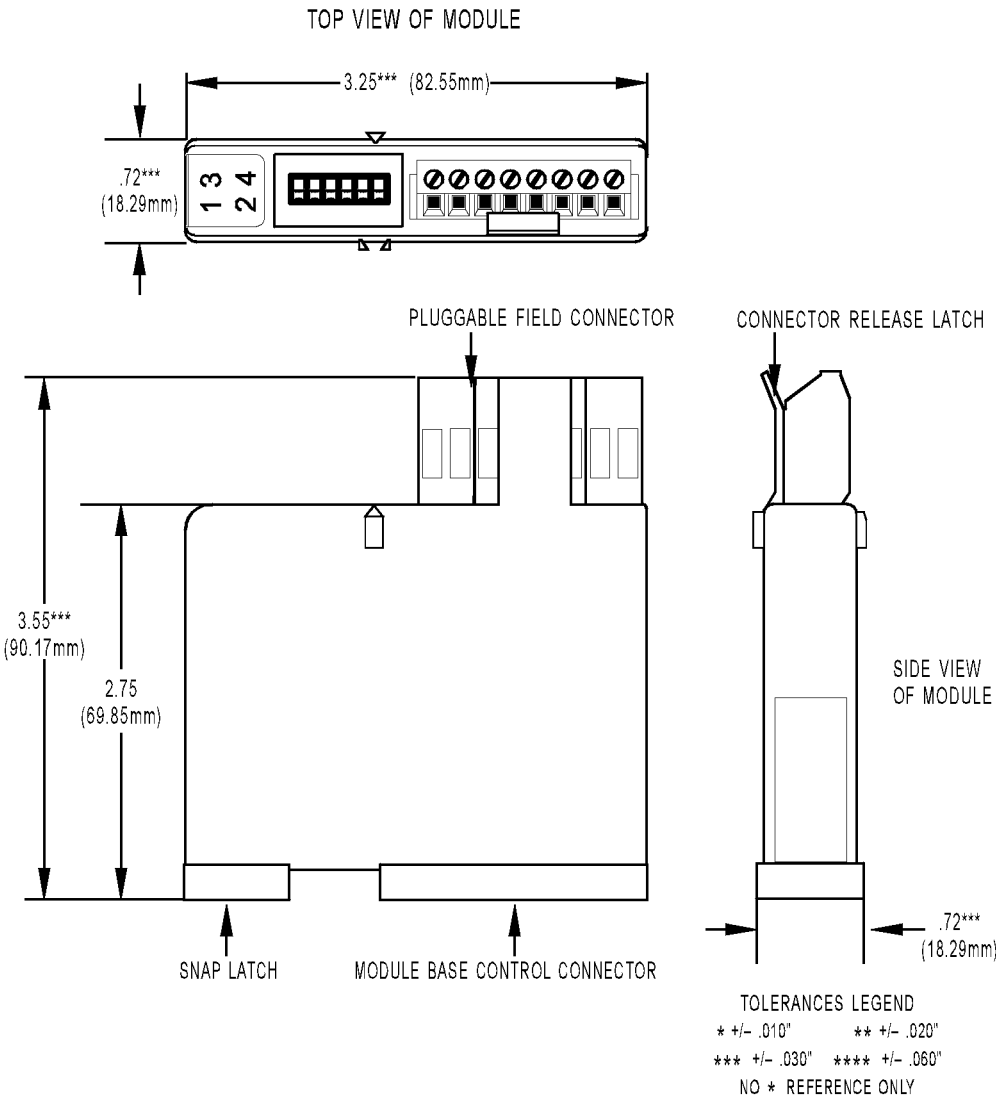
SNAP-SCM-ST2 and SNAP-SCM-CAN2B



SNAP-SCM-SSI

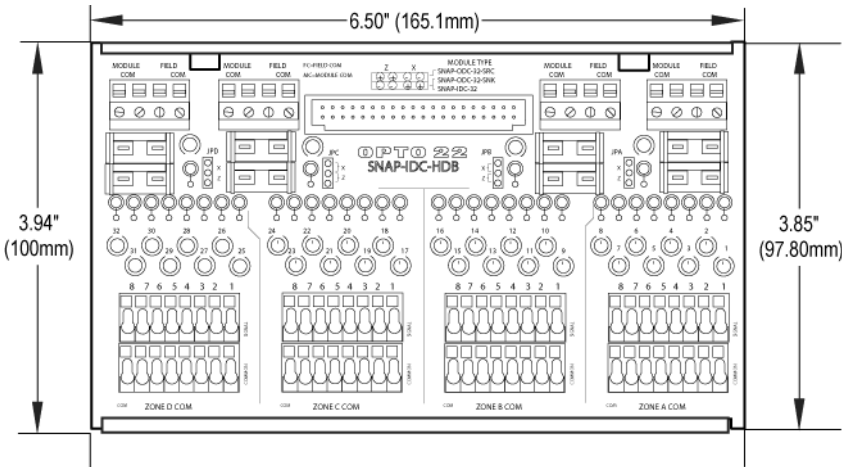


SNAP-SCM-W2

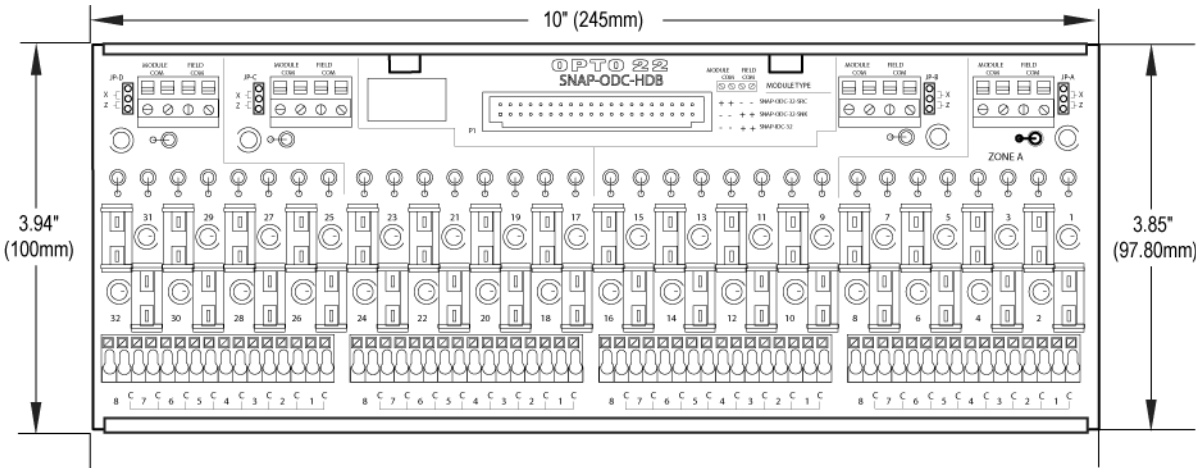


SNAP Breakout Boards and Racks Diagrams

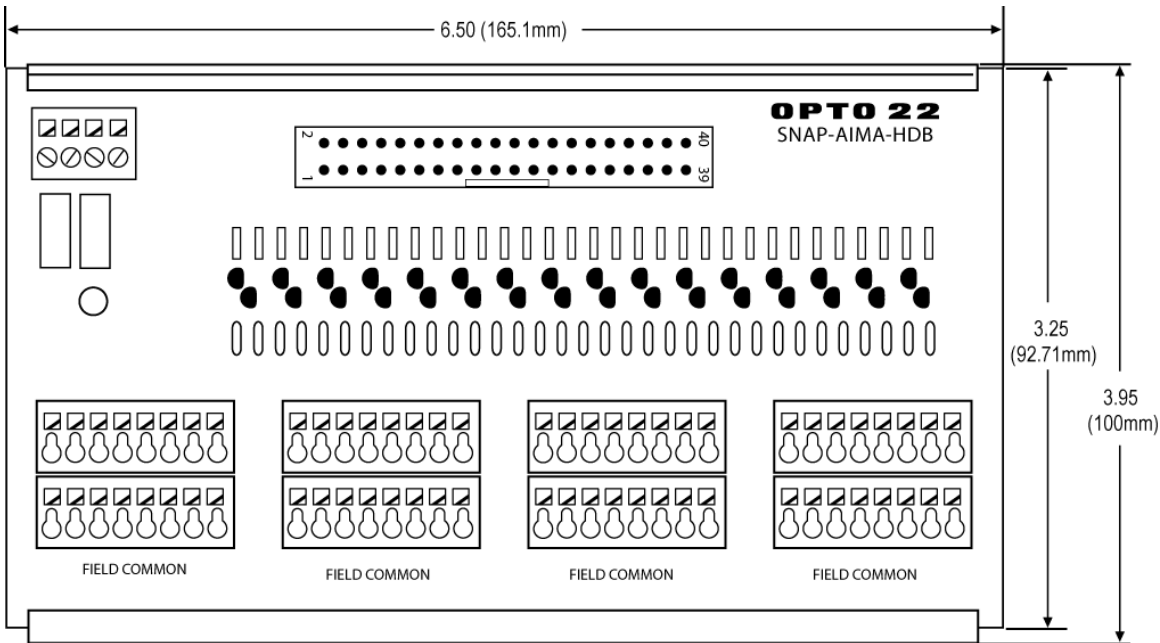
SNAP-IDC-HDB and SNAP-IDC-HDB-FM Breakout Rack



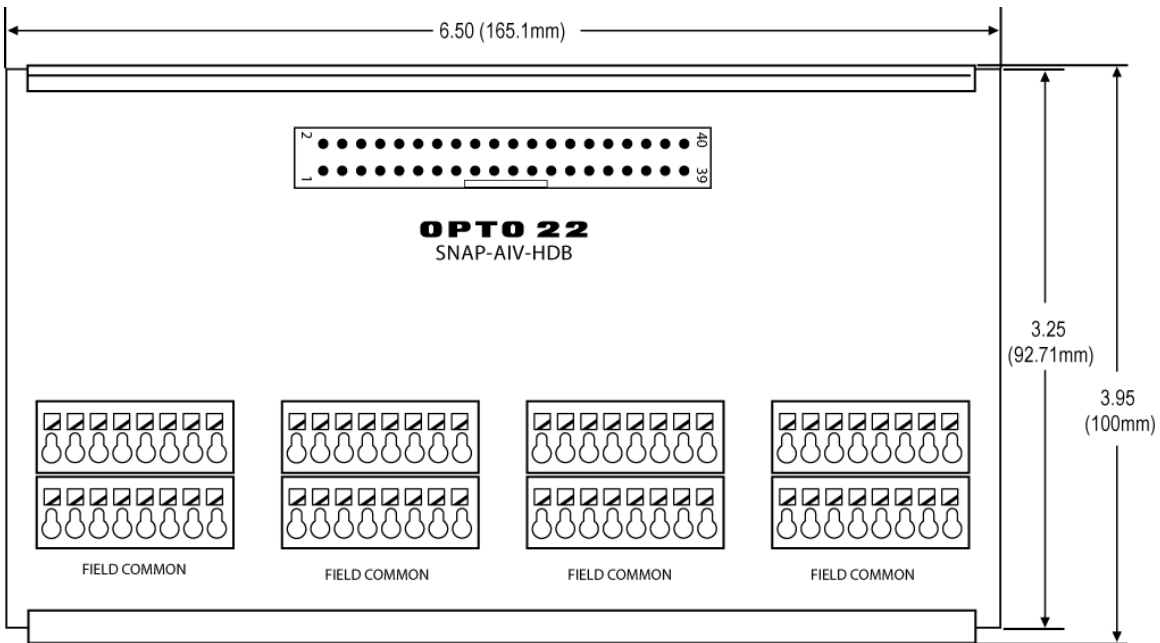
SNAP-ODC-HDB and SNAP-ODC-HDB-FM Breakout Rack



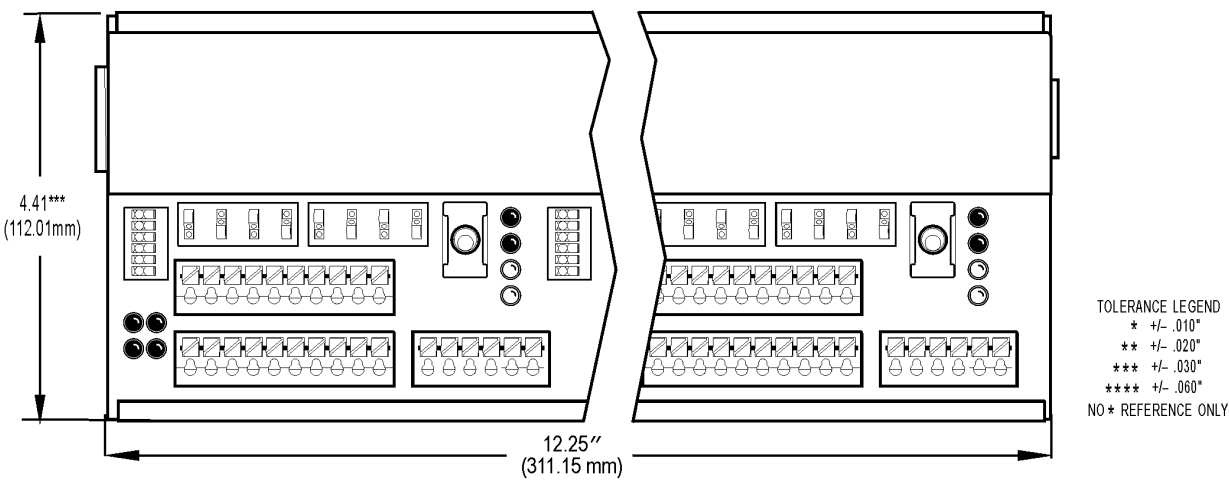
SNAP-AIMA-HDB and SNAP-AIMA-HDB-FM Breakout Racks



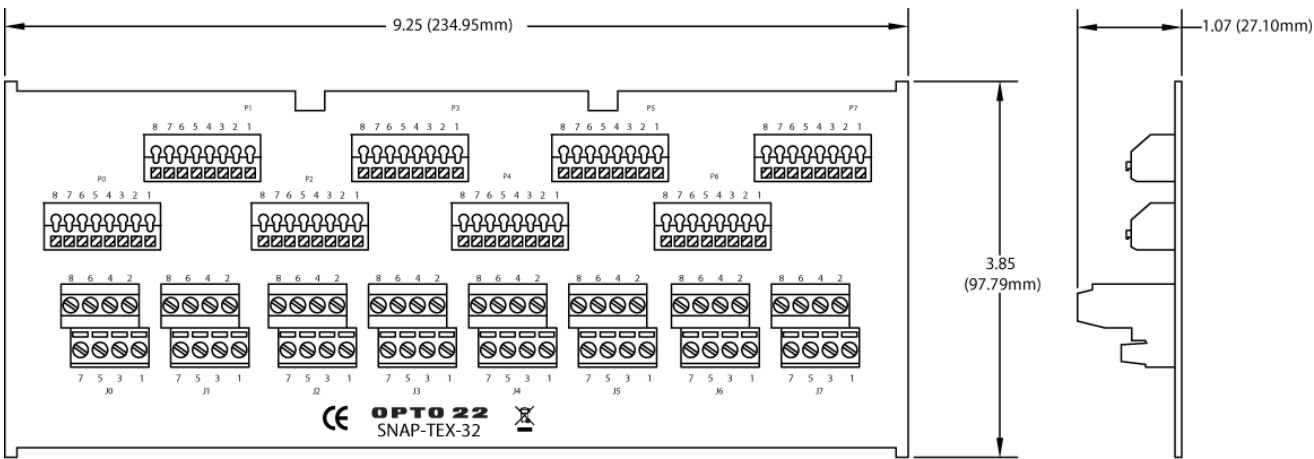
SNAP-AIV-HDB and SNAP-AIV-HDB-FM Breakout Racks



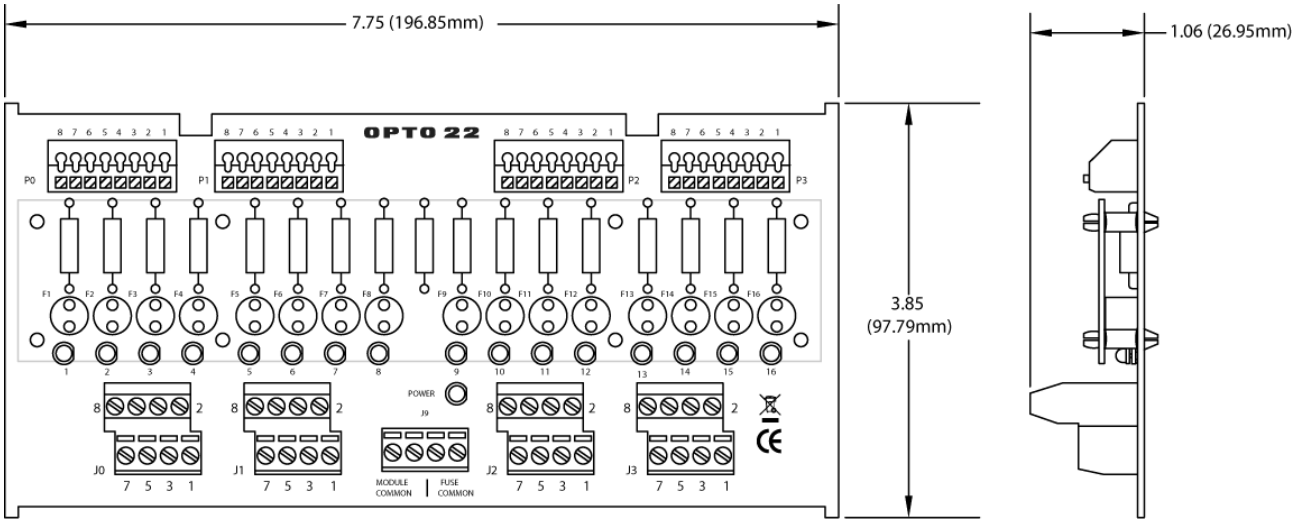
SNAP-SCM-BB4 Breakout Board



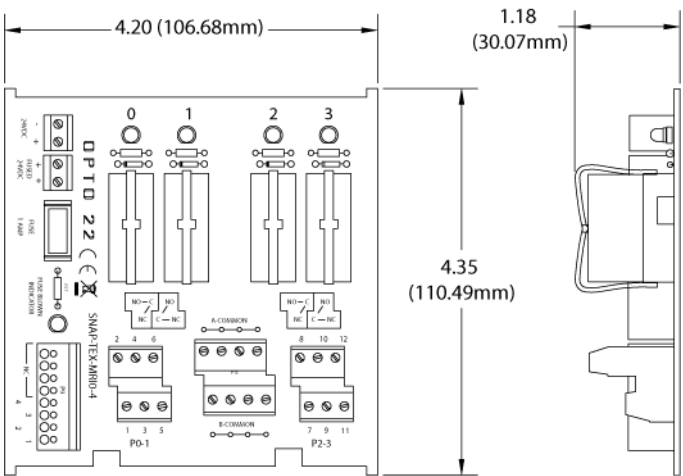
SNAP-TEX-32 Breakout Board



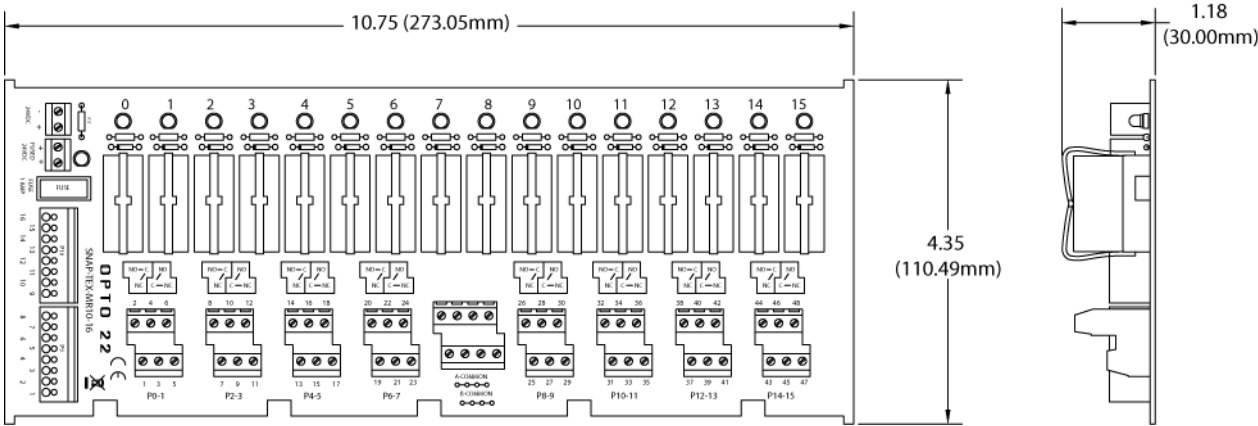
SNAP-TEX-FB160H and SNAP-TEX-FB16-L Breakout Boards



SNAP-TEX-MR10-4 Breakout Board



SNAP-TEX-MR10-16 Breakout Board



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