SNAP PAC SYSTEM SPECIFICATION GUIDE

Form 1696-170202—February 2017

OPTO 22
Automation made simple.

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SNAP PAC System Specification Guide
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The information in this manual has been checked carefully and is believed to be accurate; however, Opto 22 assumes no responsibility for possible inaccuracies or omissions. Specifications are subject to change without notice.

Opto 22 warrants all of its products to be free from defects in material or workmanship for 30 months from the manufacturing date code. This warranty is limited to the original cost of the unit only and does not cover installation, labor, or any other contingent costs. Opto 22 I/O modules and solid-state relays with date codes of 1/96 or newer are guaranteed for life. This lifetime warranty excludes reed relay, SNAP serial communication modules, SNAP PID modules, and modules that contain mechanical contacts or switches. Opto 22 does not warrant any product, components, or parts not manufactured by Opto 22; for these items, the warranty from the original manufacturer applies. Refer to Opto 22 form 1042 for complete warranty information.

Opto 22
Automation Made Simple.

Table of Contents

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, plus optional OPC server, database connectivity software, and software-based controller for PC-based control

SNAP PAC controllers—standalone or rack-mounted industrial controllers with networking options and a RESTful API, or a software-based controller

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

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

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

SNAP PAC System Architecture

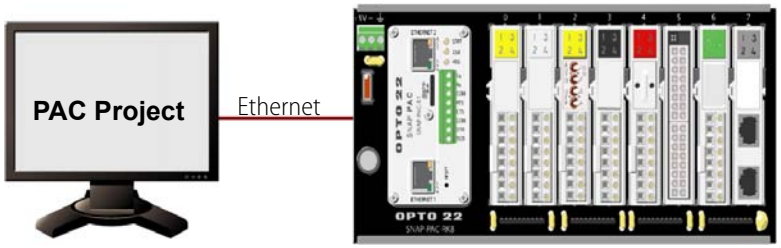
All components work together, no matter what the system's size. When your system needs to expand, investments in development time and field wiring remain largely intact; you simply add more brains and I/O. If new capabilities are required, additional software and controllers can also be added with minimal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

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

Example #1: Minimal Initial System

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

Example #1: Minimal Initial System



PC for developing PAC Control strategy and running PAC Display HMI

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

SNAP PAC hardware controllers are ready for the IIoT with a built-in RESTful API. See complete information at developer.opto22.com.

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.

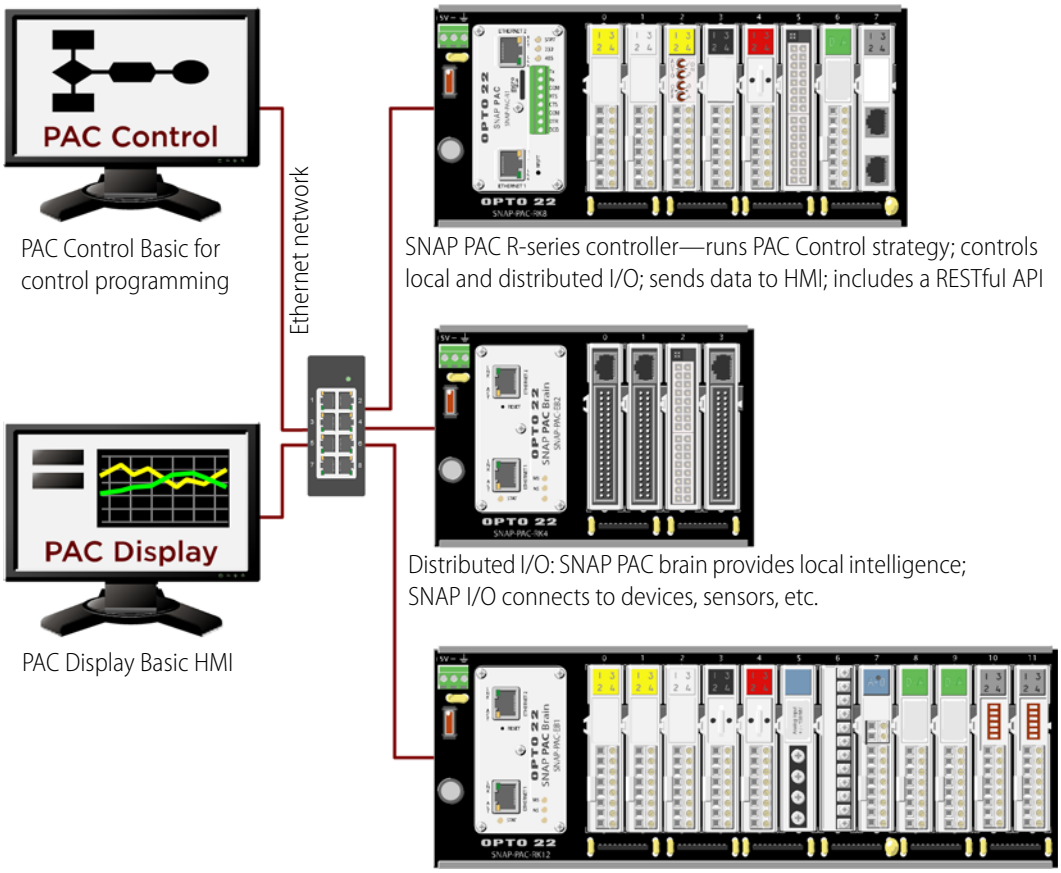
The finished HMI runs on the PC and is used by technicians and operators to monitor the control system, respond to alarms, and so on.

IIoT Ready. All hardware SNAP PACs include an HTTP/HTTPS server and a REST API (representational state transfer application programming interface), with data returned as JSON. So even with just a minimal system you can use your language of choice to securely access I/O point and variable data from the database of tags in the PAC. Your SNAP PAC System arrives ready for the Industrial Internet of Things (IIoT). Requirements: firmware R9.5a or higher and PAC Project R9.5000 or higher. Details at developer.opto22.com.

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, the free PAC Project Basic software, and the built-in RESTful API. **Free product support** and free training are included. To use the REST API, see developer.opto22.com.

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

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

If you need wireless capability, choose Wired+Wireless™ models of the controller and brains. You can use an 802.11a,b,g wireless LAN, a wired Ethernet network, or both, and you can switch between them without changing PAC Control logic, I/O modules, or field wiring. (For more, see "Using Redundant Controllers" on page 60.)

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.

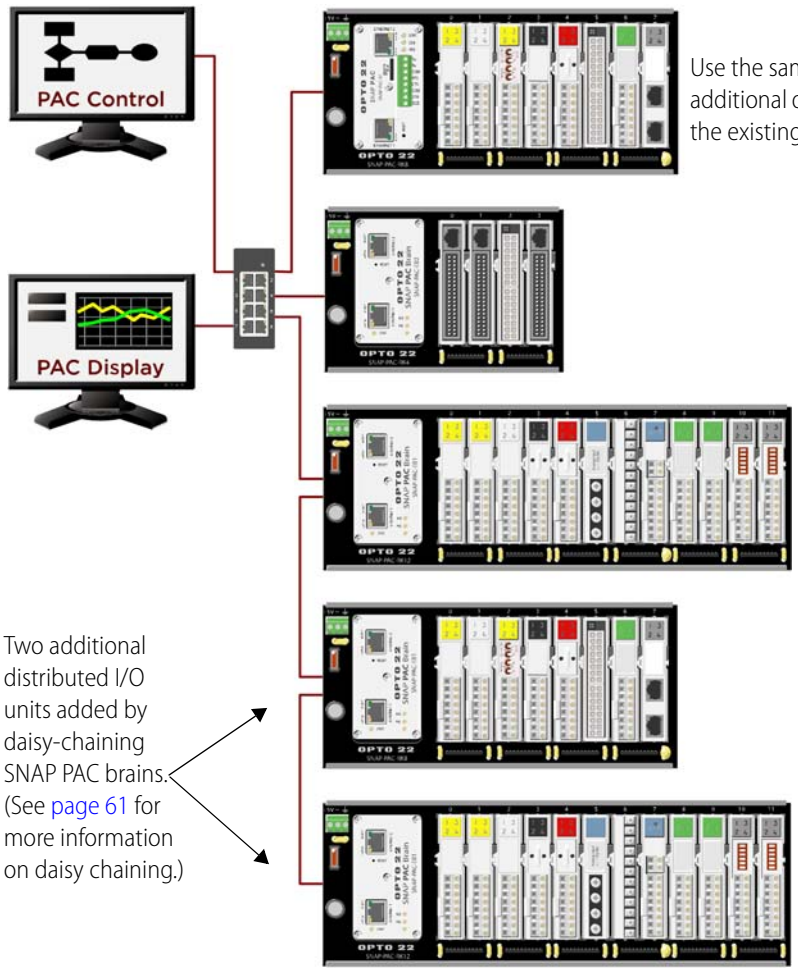
Adding More Distributed I/O

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 61.)

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.

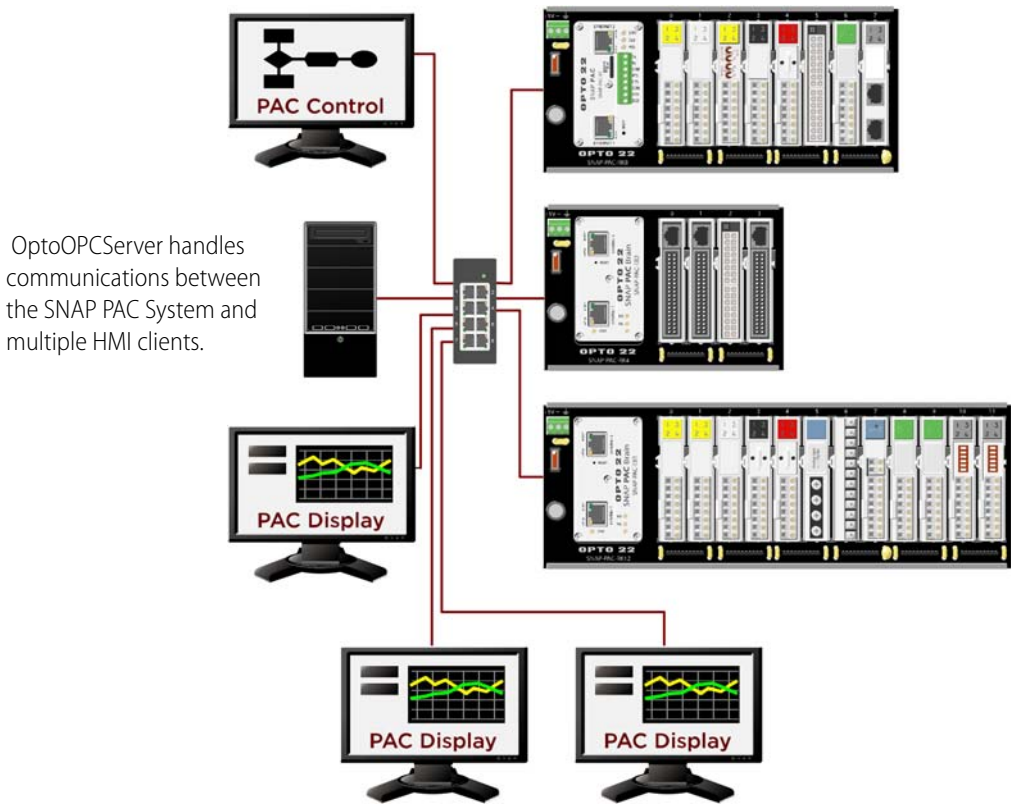
Adding More Distributed I/O



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



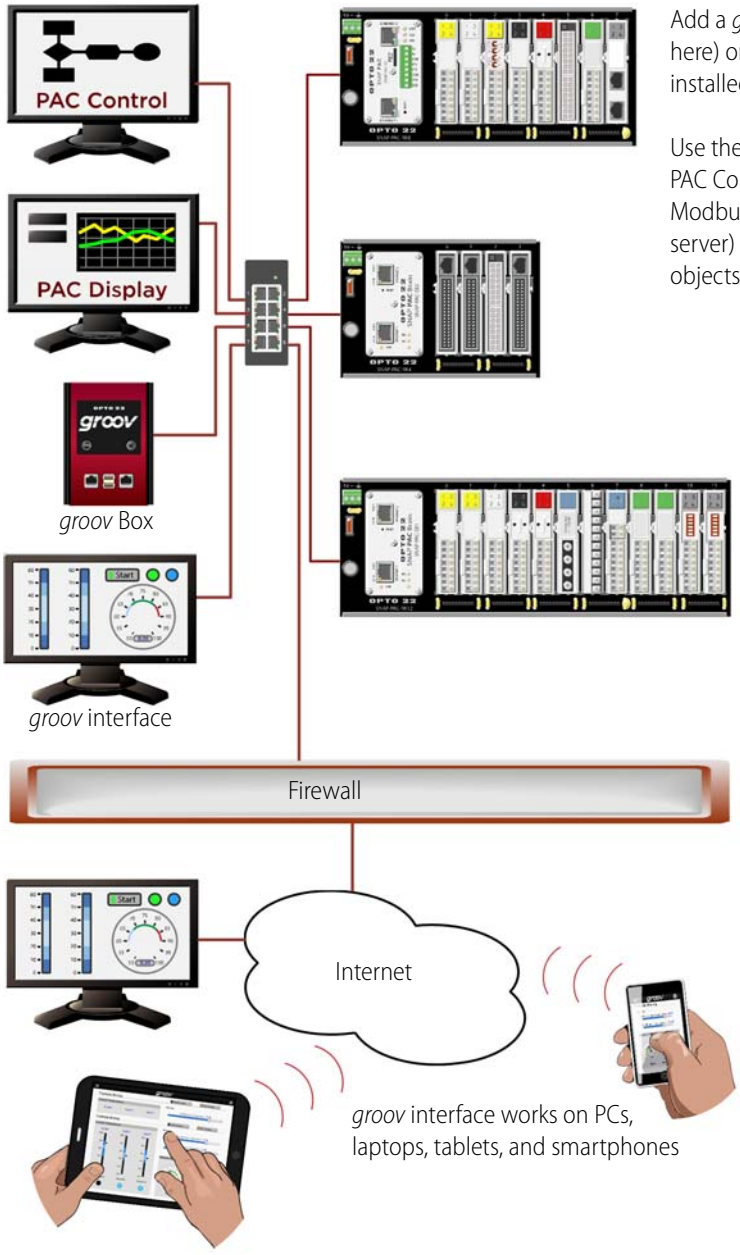
Adding Mobile Operator Interfaces

If you need to have technicians monitor or control parts of your system from a mobile device, either on premises or remotely, the easiest way to build and use mobile operator interfaces is with *groov*. Using *groov* you create a simple interface that includes only the data and controls each authorized user needs. You can add other manufacturers' systems and equipment to the same interface, if you wish. *groov* is compatible with Modbus/TCP devices and OPC UA servers in addition to Opto 22 SNAP PAC controllers.

You build your mobile interface in a web browser by dragging and dropping gadgets onto the screen and tagging them. *groov* uses the same tag database you already have. Then securely view the interface on an iOS or Android smartphone or tablet using the free *groov* View app, or on any device with a web browser. For more information on *groov*, visit groov.com.

A *groov* interface may be the only operator interface you need, or it may supplement your PAC Display or third-party HMI. To use *groov*, add to your system either the *groov* Box appliance or *groov* Server for Windows running on a PC. All software is included.

Adding Mobile Operator Interfaces



Add a *groov* Box appliance (shown here) or *groov* Server for Windows installed on a PC.

Use the same tag database you built in PAC Control (or add tags from Modbus/TCP equipment or an OPC UA server) to animate data and control objects in the interface.

Security is vital. See *groov* documentation for steps to set up networking and user permissions.
Also see *Guide to Networking groov*.

Authorized mobile devices can monitor and control from anywhere.

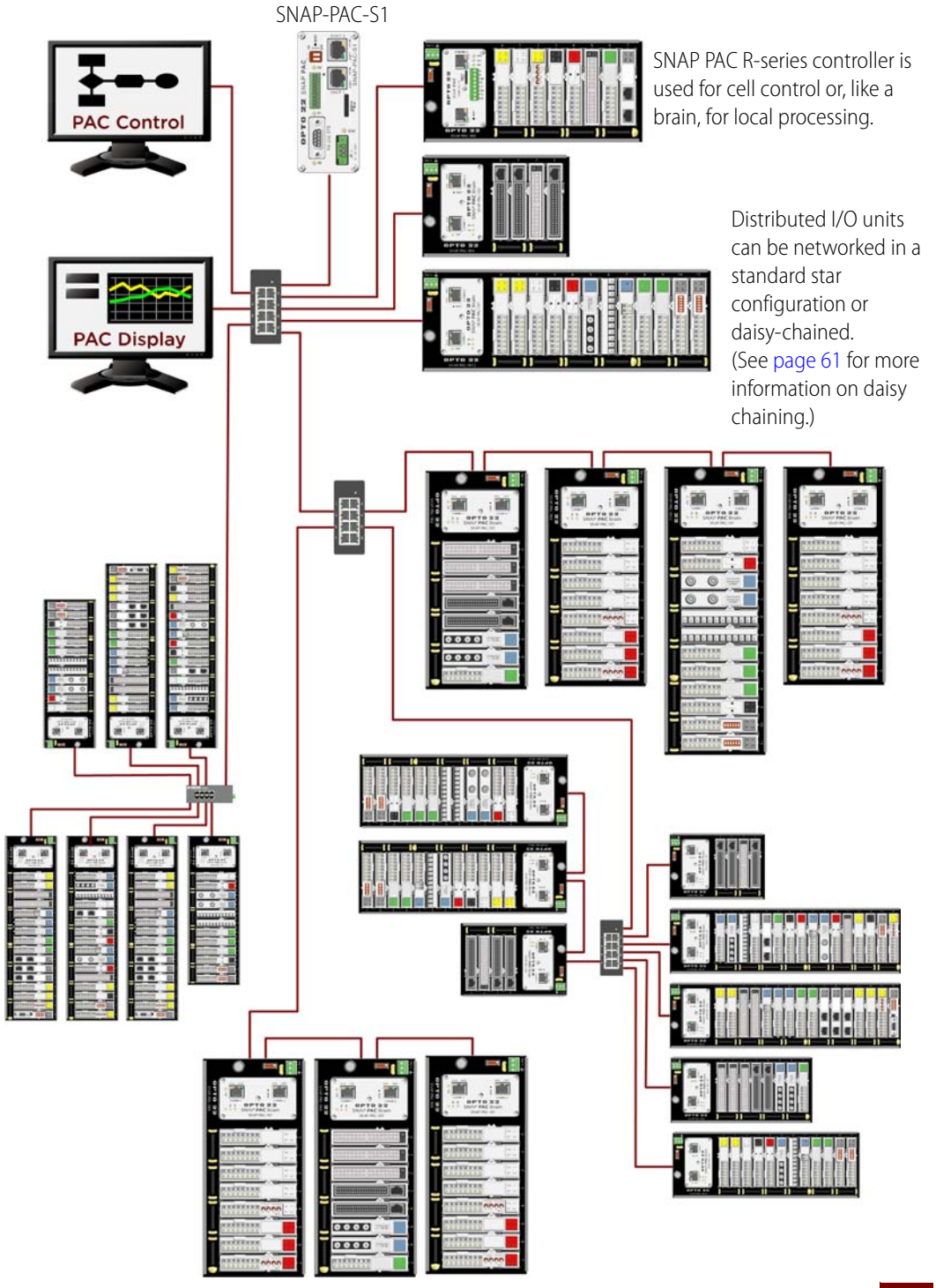
Adding Large Numbers of Additional I/O

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 more powerful SNAP PAC standalone (S-series) controller or to SoftPAC for PC-based control. SoftPAC takes advantage of PC capabilities in file storage and access. Both the S-series and SoftPAC can run many PAC Control flowcharts at once.

The investments you've already made are not lost. The PAC Control strategy runs on all controllers; just add the new I/O points and logic needed. The R-series rack-mounted controller you replaced 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. Or use SoftPAC instead of the S1 for PC-based control.



Adding Wireless Distributed I/O

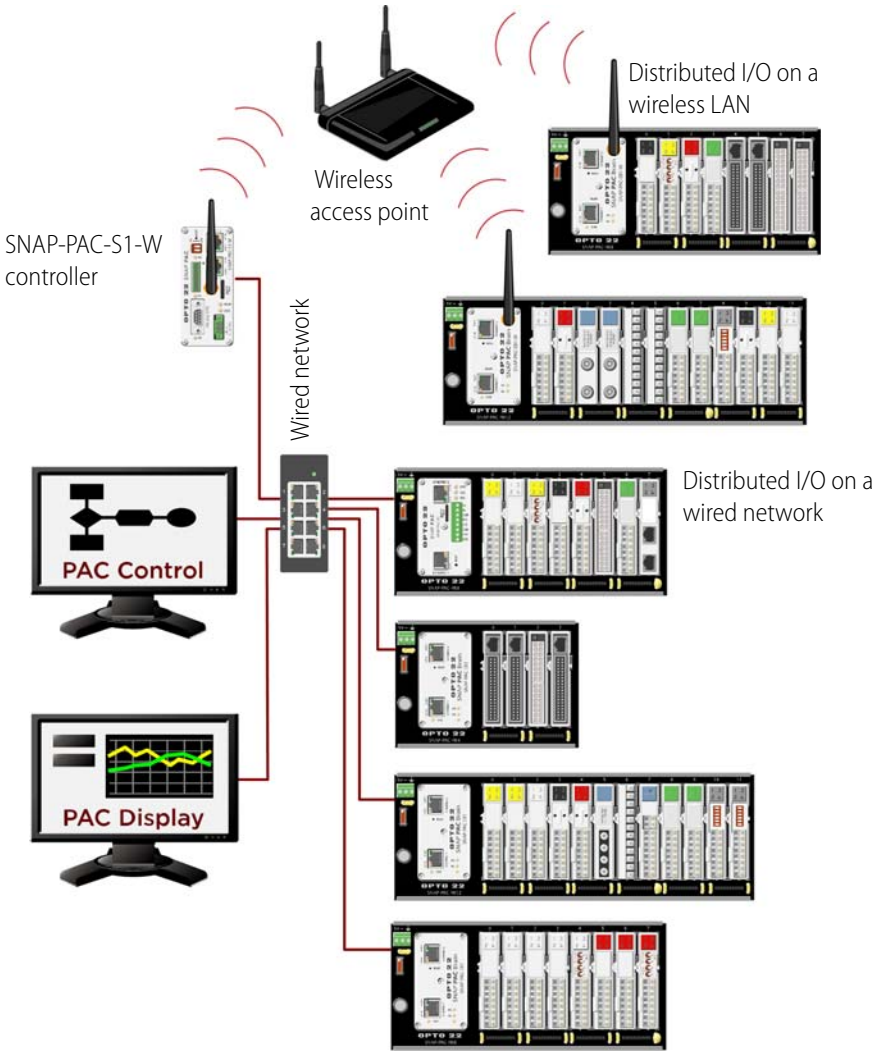
Suppose you need to control mobile machinery or monitor devices in an area where running Ethernet cable would be difficult. With Wired+Wireless controllers and brains, you can use a wireless local area network (LAN) to solve the problem.

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 60.

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.



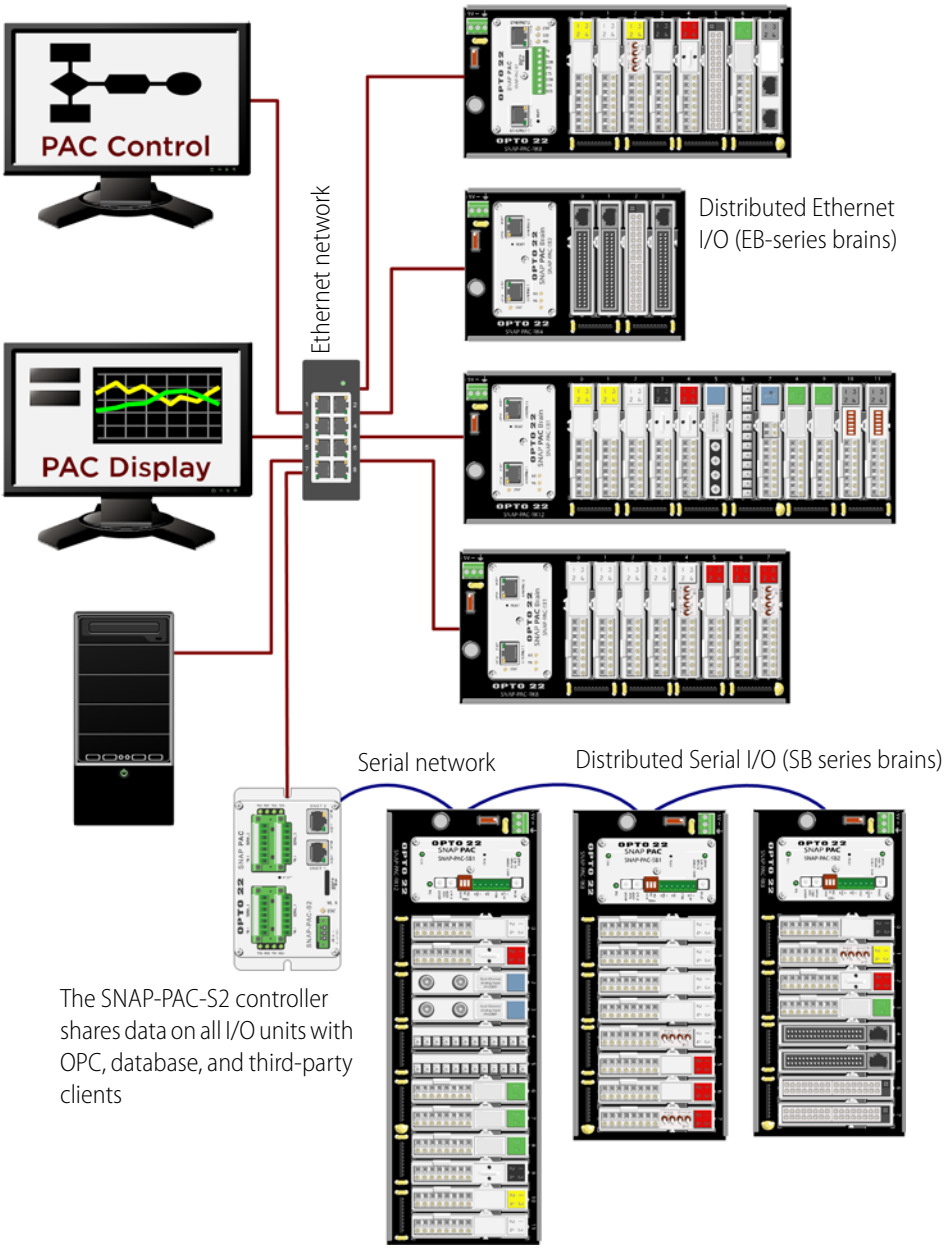
Combining Serial and Ethernet Distributed I/O

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.

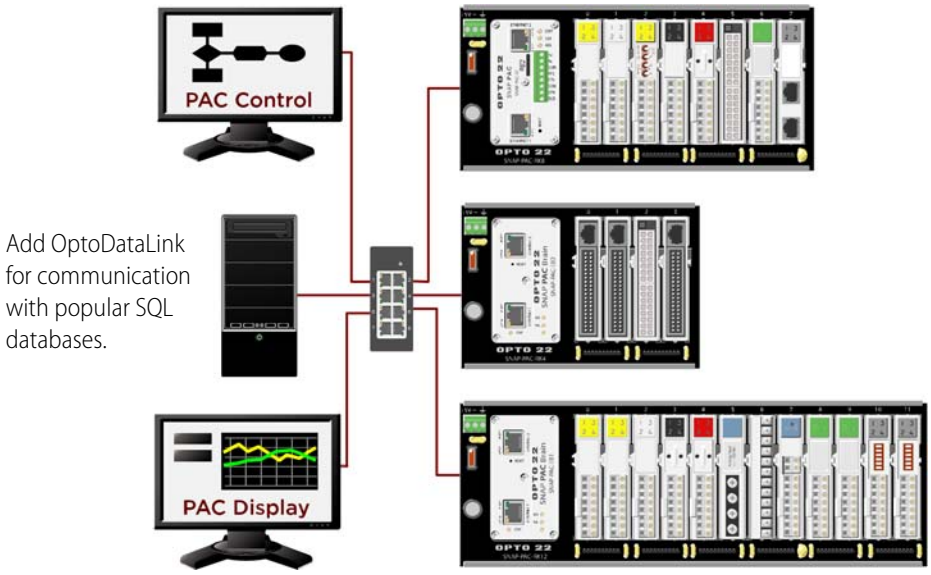


Delivering SNAP PAC System Data to Company Databases

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.

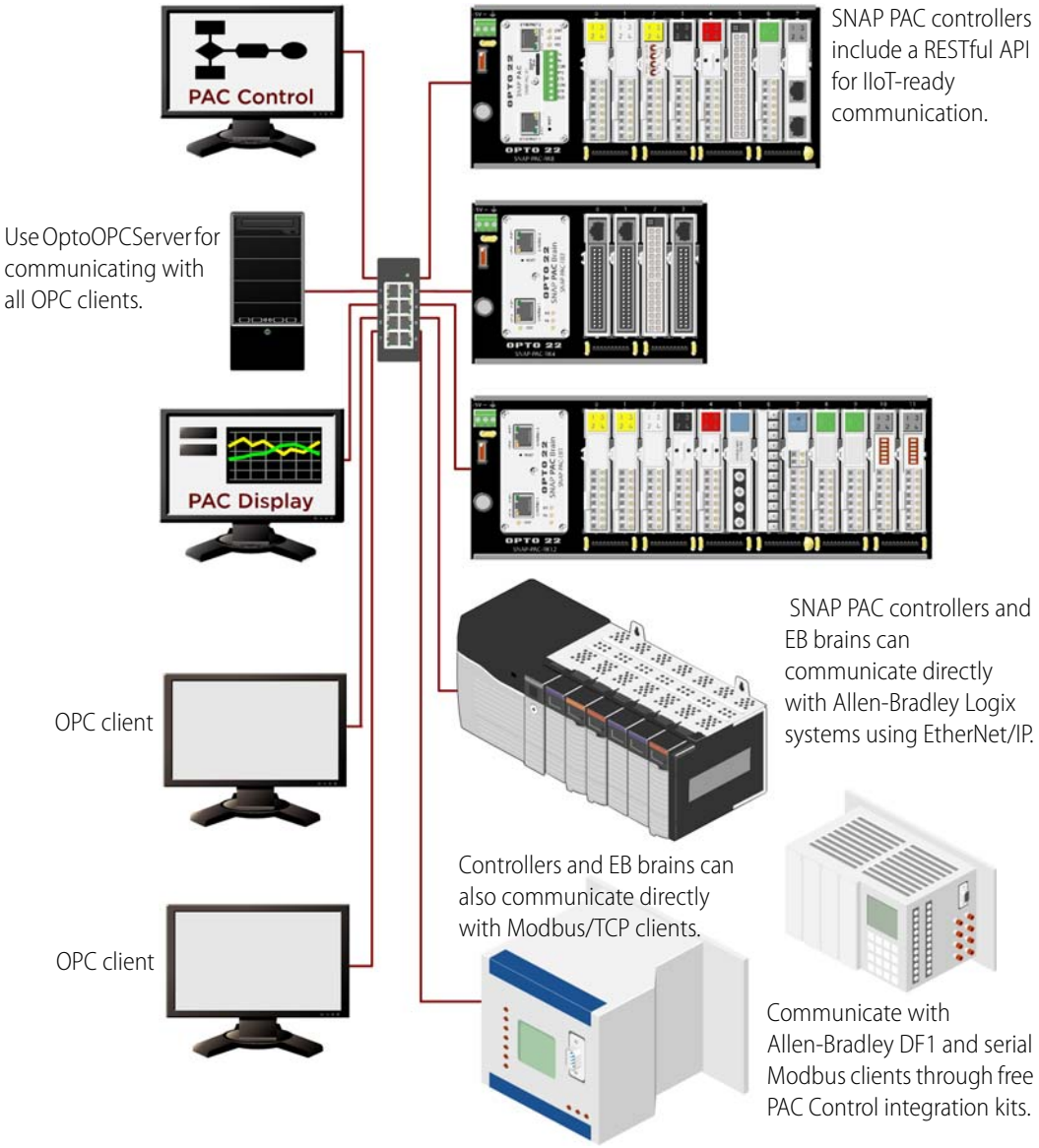
For **Allen-Bradley** PLC systems such as **CompactLogix**, **ControlLogix, MicroLogix 1100/1400,** and **SLC 5/05**, SNAP PAC controllers and brains can communicate directly using the built-in EtherNet/IP protocol. Details are in form #1909, the *IO4AB User's Guide*, and #1770, the *EtherNet/IP for 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.

A **RESTful API** is built into SNAP PAC S-series and R-series controllers, so you can exchange data easily using the architecture and languages of the Internet. Use your favorite programming

language (PHP, .NET, Node.js, Python, or others). Tag data from I/O points and controller variables is returned as JSON. For complete details, see developer.opto22.com.

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 56.

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 56.

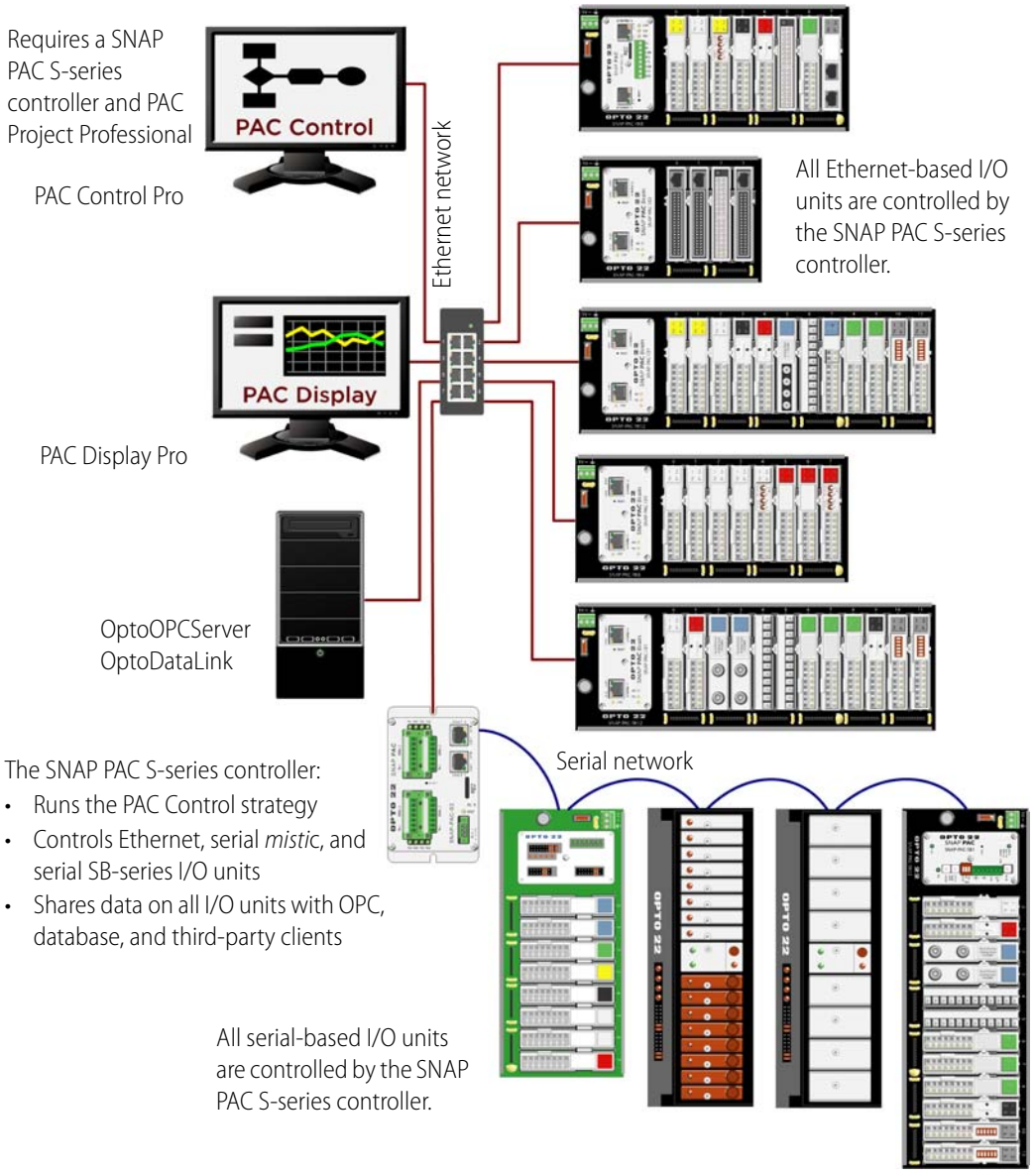
Incorporating Legacy Opto 22 Systems

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 16).

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	*PAC Project Software Suite Data Sheet*	1699
groov	*groov Data Sheet*	2060
OptoOPCServer	*OptoOPCServer Data Sheet*	1487
OptoDataLink	*OptoDataLink Data Sheet*	1662
SNAP PAC S-series controllers	*SNAP PAC S-Series Controllers Data Sheet*	1584
SNAP PAC R-series controllers	*SNAP PAC R-Series Controllers Data Sheet*	1594
SoftPAC	*SoftPAC PC-based Controller Data Sheet*	2020
SNAP PAC brains	*SNAP PAC Brains Data Sheet*	1689

For these products	See this document	Form #
SNAP PAC racks	*SNAP PAC Racks Data Sheet*	1684
SNAP power supplies	*SNAP Power Supplies Data Sheet*	1120
SNAP PAC Motion Control Subsystem	*SNAP PAC Motion Control Subsystem Data Sheet*	1672
SNAP PAC Redundancy Option Kit	*SNAP PAC Redundancy Option Kit Data Sheet*	1901
SNAP digital input modules (4-channel)	*SNAP Digital Input Modules Data Sheet*	0773
SNAP digital output modules (4-channel)	*SNAP Digital Output Modules Data Sheet*	1144
SNAP mechanical power relay output modules	*SNAP Mechanical Power Relay Output Module Data Sheet*	1967
SNAP high-density digital modules (more than 4 channels)	*SNAP High-Density Digital I/O Modules Data Sheet*	1556
SNAP analog input modules	*SNAP Analog Input Modules Data Sheet*	1065
SNAP analog input modules with channel-to-channel isolation	*SNAP Isolated Analog Input Modules Data Sheet*	1182
SNAP analog output modules	*SNAP Analog Output Modules Data Sheet*	1066
SNAP quadrature module	*SNAP Quadrature Input Module Data Sheet*	1053
SNAP-pH/ORP module	*SNAP-pH/ORP Input Module Data Sheet*	1416
SNAP load cell modules	*SNAP Load Cell Modules Data Sheet*	1590
SNAP power monitoring modules	*SNAP Power Monitoring Modules Data Sheet*	1453
SNAP I/O analog modules, HART protocol	*HART SNAP I/O Modules Data Sheet*	2080
SNAP serial communication modules	*SNAP Serial Communication Modules Data Sheet*	1184
SNAP Profibus communication module	*SNAP Profibus Module Data Sheet*	1585
SNAP Serial Synchronous Interface module	*SNAP SSI (Serial Synchronous Interface) Module Data Sheet*	1919
SNAP stepper motor module	*SNAP-SCM-ST2 Pulse Output Module Data Sheet*	1944
SNAP Controller Area Network (CAN) module	*SNAP-SCM-CAN2B Communication Module Data Sheet*	1537
SNAP Wiegand protocol module	*SNAP Wiegand Module Data Sheet*	1365
SNAP TEX cables & breakout boards	*SNAP TEX Cables & Breakout Boards Data Sheet*	1756
SNAP TEX DIN-rail kits, spare parts, and tools for mounting and wiring	*SNAP TEX Mounting/Wiring Tools and Spare Parts Data Sheet*	1772

SNAP PAC System User's Guides

For these products or uses	See this document	Form #
Develop PAC Control programs (strategies)	*PAC Control User's Guide* *PAC Control Command Reference* *PAC Control Commands Quick Reference*	1700 1701 1703
Build PAC Display HMIs	*PAC Display User's Guide*	1702
Build *groov* mobile operator interfaces	*groov User's Guide*	2027
Install/use the groov Box appliance	*groov Box User's Guide*	2104
Install/use groov Server for Windows	*groov Server User's Guide*	2078
Assign IP addresses, configure hardware	*PAC Manager User's Guide*	1704
Communicate with OPC clients	*OptoOPCServer User's Guide**	1439
Exchange data with company databases	*OptoDataLink User's Guide**	1705
Install/use SNAP PAC S-series controllers	*SNAP PAC S-Series Controller User's Guide*	1592
Install/use SNAP PAC R-series controllers	*SNAP PAC R-Series Controller User's Guide*	1595
Install/use SNAP PAC brains	*SNAP PAC Brain User's Guide*	1690
Set up redundant controllers	*SNAP PAC Redundancy Option User's Guide*	1831
Install/use SNAP PAC Motion Control Sub-system	*SNAP PAC Motion Control Subsystem User's Guide*	1673
Write custom applications for SNAP PAC controllers and brains	*OptoMMP Protocol Guide*	1465
Communicate with Modbus systems	*Modbus/TCP Protocol Guide* *Modbus/Serial Integration Kit for PAC Project* *Modbus/TCP Integration Kit for PAC Project*	1678 1660 1644
Communicate with Allen-Bradley systems	*IO4AB User's Guide* *EtherNet/IP for SNAP PAC Protocol Guide* *Allen-Bradley DF1 Integration Kit For PAC Control*	1909 1770 1706
Incorporate OptoEMU Sensor energy data into control systems and databases	*OptoEMU Sensor User's Guide* *OptoEMU Sensor Communication Guide*	1932 1958
Communicate with Profibus networks	*SNAP Profibus Module Data Sheet*	1585
Install/use SNAP high-density digital modules (more than 4 channels)	*SNAP High-Density Digital I/O Modules User's Guide*	1547
Communicate with serial devices	*SNAP Serial Communication Module User's Guide*	1191

* Not available on our website; included in product purchase

Other Useful SNAP PAC System Documents

For this purpose	See this document	Form #
Using the RESTful API in hardware PACs	developer.opto22.com	--
Comparing programmable automation controllers to PLCs	*Understanding Programmable Automation Controllers (PACs) in Industrial Automation (white paper)*	1634
Using wireless products in automation applications	*Overcoming Concerns about Wireless PACs and I/O in Industrial Automation (white paper)*	1814
Learning how to approach a PAC Project or groov application	*Opto 22 Best Practices Technical Note*	2073
Designing operator interfaces	*Building an HMI that Works: New Best Practices for Operator Interface Design*	2061
Networking SNAP PAC System and *groov*	*Guide to Networking Opto 22 Products*	1796
Energy monitoring and control	*Automation and the Smart Grid: Energy Management Today (white paper)* *Energy Monitoring for Profit: Introducing Demand Response (white paper)*	1914 1993
Integrating SNAP PAC System hardware and software with older Opto 22 systems	*SNAP PAC System Migration Technical Note* *FactoryFloor to PAC Project Migration Technical Note* *Legacy and Current Product Comparison Charts*	1688 1692 1693
	PAC Control User's Guide, Legacy Edition *PAC Control Command Reference, Legacy Edition* *PAC Control Commands Quick Reference, Legacy Ed.*	1710 1711 1713
	PAC Display User's Guide, Legacy Edition	1712
	PAC Manager User's Guide, Legacy Edition	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 (800-835-6786 toll-free in the U.S. and Canada) 951-695-3080 Monday through Friday, 7 a.m. to 5 p.m. Pacific Time	*NOTE: Email messages and phone calls to Opto 22 Product Support are grouped together and answered in the order received.*
Fax:	951-695-3017	
Email:	support@opto22.com	
Opto 22 website:	www.opto22.com	

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 21
- Controllers—see page 24
- Brains—see page 27
- I/O—see page 30. (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 40
- Wiring and mounting accessories for easier field wiring—page 42

Building a SNAP PAC System

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

Steps to Build a SNAP PAC System

Step 1: Choose software

PAC Project Basic

- PAC Control Basic
- PAC Display Basic
- PAC Manager
- PAC Utilities

PAC Project Professional

- PAC Control Professional
- PAC Display Professional
- PAC Manager
- PAC Utilities
- OptoOPCServer
- OptoDataLink
- SoftPAC

Step 2: Choose controller

SNAP PAC S-series

- Standalone
- Dual independent Ethernet interfaces; multiple serial ports
- Secure server/RESTful API
- 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
- Secure server/RESTful API
- Wired+Wireless models available
- I/O processor and communications built in
- Analog, digital, and serial I/O
- R1 includes high-speed digital functions

SoftPAC

- PC-based control in a Microsoft Windows environment
- Uses a PC's fast read and write capabilities and its greater space for data storage
- Compatible with SNAP Ethernet-based I/O units
- Communicates peer-to-peer with any SNAP PAC S-series or R-series controller on the network

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

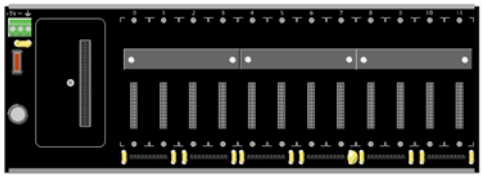
Serial: SNAP-PAC-SB1 or SNAP-PAC-SB2

- 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.

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



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.

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
- **SoftPAC**, for running control programs on a software-based programmable automation controller (PAC) designed for PC-based control. SoftPAC can also be purchased separately. (See page 24 for more information.)

All of these software applications run on 32-bit and 64-bit versions of Microsoft Windows 10 Professional, 8.1 Professional, and 7 Professional, and on Vista Business (32-bit only).

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 9.6 of PAC Project Basic™ and PAC Project Professional™. For more information about controllers, see Opto 22 form 1677, *SNAP PAC Controller and Brain Comparison Chart*.

Feature		Basic	Pro
Included software	PAC Control™ Basic	●	●
	PAC Control Professional		●
	PAC Display™ Basic	●	●
	PAC Display Professional		●
	PAC Manager™	●	●
	OptoOPCServer™		●
	OptoDataLink™		●
	SoftPAC™		●
Control software: PAC Control			
Compatible controllers	SNAP PAC S-series standalone industrial controllers	●	●
	SNAP PAC R-series on-the-rack controllers	●	●
	SoftPAC software-based controller	●	●
Compatible brains	Built-in I/O unit (in SNAP PAC R-series controllers)	●	●
	SNAP PAC brains	●	●
	G4EB2 brains	●	●
	E1 and E2 brains	●	●
	Serial *mistic*™ brains/bricks*: B3000-B, B3000, SNAP-BRS, B100, B200, G4D16R, G4D32RS, G4A8R		●
Network	*Controller to PC:* Wired Ethernet Wireless 802.11a,b,g (Wired+Wireless controller required)	●	●
	Controller to I/O: S-series—Ethernet to EB brains and serial to SB and *mistic* brains R-series—Ethernet only. Wired+Wireless controllers support wireless networking.	●	●
	Controller to third-party devices: Ethernet or serial	●	●
	Support for Ethernet link redundancy or segmented control network		●
	Support for controller redundancy (S-series only)		●

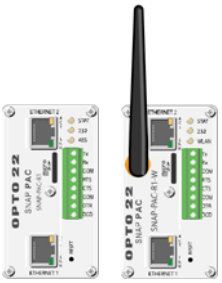
Feature		Basic	Pro
Main features	Flowchart programming	●	●
	OptoScript programming	●	●
	Subroutines (debuggable)	●	●
	Graphical debugger	●	●
	Conversion utility for OptoControl 4.1 (and higher) strategies		●
	Support for serial *mistic* I/O units*		●
	Ethernet link redundancy (with R-series I/O units)		●
	Controller redundancy*		●
Maximum charts running at once	On SoftPAC (plus host task)	64	64
	On SNAP PAC S-series (plus host task)	32	32
	On SNAP PAC R-series (plus host task)	16	16
Proportional-integral derivative (PID) loops	PID algorithms for Ethernet	4	4
	PID algorithm for *mistic* serial*	--	1
	Loops per SNAP PAC brain	96	96
	Loops per *mistic* brain/brick*	--	8
	Graphical tuner for Ethernet PID loops	●	●
	Graphical tuner for *mistic** PID loops		●
Ethernet link redundancy	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*	PAC Redundancy Manager utility		●
	Checkpoint blocks and redundant/persistent tags		●
Additional toolkits**	Modbus Integration Kit (serial and TCP)	●	●
	Controller Area Network (CAN) Integration Kit	●	●
	Other Integration Kits (Allen-Bradley DF1 Integration Kit, BACnet, TL1, DNP3, IEC60870-5)	●	●
HMI software: PAC Display			

Feature		Basic	Pro
Main features	Alarming	●	●
	Trending	●	●
	Logging	●	●
	Operator authentication and login	●	●
	3000-graphic library	●	●
	Additional graphics tools for PID and embedding web pages		●
	Data logging to MySQL, Microsoft® SQL Server, and other ODBC databases		●
	Conversion utility for OptoDisplay projects		●
	Primary and secondary IP addresses for control engine		●
	Primary and secondary scanner		●
Controllers supported	SNAP PAC controllers	●	●
	Controllers running ioProject	●	●
	Controllers running FactoryFloor on Ethernet network		●
OPC server: OptoOPCServer			
OPC version	OPC 2.0-compliant		●
Database connectivity: OptoDataLink			
Databases supported	Built-in, easy data transfer to Microsoft SQL Server, Microsoft Access, MySQL, text files	***	●
PC-based control: SoftPAC			
Compatible brains	SNAP PAC (R-series and EB-series)	●****	●
	G4EB2 brains	●****	●

* Requires SNAP PAC S-series controller(s). See also SNAP-PAC-ROK Redundancy Option Kit.
** For more information, see Opto 22 form 1820, *Communication Tools & Protocols for Opto 22 Products Technical Note*.
*** Limited options using strategy logic if the user is an expert at database programming.
**** SoftPAC must be purchased separately.

Choosing Controllers

For controllers, choose from rack-mounted (R-series) or standalone (S-series) SNAP PAC industrially hardened programmable automation controllers, or choose software-based SoftPAC for PC-based control.

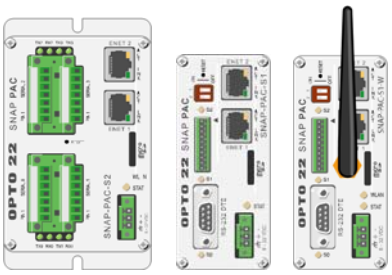


SNAP PAC R-series controllers mount right on the rack with SNAP I/O modules, and the controller includes I/O processing as well as control functions. Essentially, it is a controller and a brain in one package. The R-series is ideal for cell control or less complex distributed systems. The R-series is IIoT and developer ready with an included RESTful API (minimum firmware R9.5a and PAC Project R9.5000).

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*). These FM models also meet ATEX standards. One model, the *SNAP-PAC-R1-B,* is used for upgrading older I/O units; it fits on a legacy SNAP B-series rack instead of a SNAP PAC rack.

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 include a RESTful API for secure, easy access to data for your IIoT application or developer use (minimum firmware R9.5a and PAC Project R9.5000).

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 56). 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 60.

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 28.

SoftPAC™ is a software-based programmable automation controller (PAC) designed for PC-based control. SoftPAC gives you the choice of running your control program in a Microsoft Windows environment rather than on a standalone or rack-mounted PAC.

SoftPAC is ideal for machine builders or OEMs who may already have a PC in their product or want to use one for a new design. SoftPAC can provide significant savings in hardware costs for some applications.

SoftPAC is for Ethernet-based communication only; it does not support serial I/O units and cannot communicate through serial ports within the PC. However, SoftPAC does support SNAP serial modules on I/O racks.

SoftPAC is especially useful for applications requiring extended file storage, frequent access to files, math-intensive processes, or a large number of control flowcharts running at the same time. For example, industrial engineers working with gas density calculations, solar tracking, and encryption can greatly reduce calculation time.

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 61 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 60 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

This table compares SNAP PAC controllers and brains using version 9.5 firmware and 9.6 PAC Project software (or higher).

FEATURE		SNAP PAC Controllers										SNAP PAC Brains					
		SW	Standalone				Rack-mounted					Ethernet				Serial	
		SoftPAC	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-R1-B	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		aa	●	●	●	●	●	●	●	●	●						
Wireless LAN interface (802.11a, b, or g)		aa			●	●				●	●			●	●		
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)		64	32	32	32	32	16	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)	aa			●	●				●	●						
	Serial (RS-485)		●	●	●	●											
Controller-to-PC communication	Ethernet (TCP/IP, 10/100 Mbps)	●	●	●	●	●	●	●	●	●	●						
	Wireless LAN (802.11a, b, or g)	aa			●	●				●	●						
	PPP over dial-up modem, with hardware handshaking		●	●	●	●	●	●	●	●	●						
Brain-to-host (PC or controller) communication	Ethernet (10/100 Mbps)	n/a	n/a				n/a					●	●	●	●		
	Wireless LAN (802.11a, b, or g)													●	●		
	Serial (RS-485)															●	●
Total number of RS-232 serial ports		bb	2	4[b]	2	4[b]	1	1	1	1	1	-0-	-0-	-0-	-0-	-0-	-0-
Number of RS-232 serial ports usable for PPP (on dial-up modem)		bb	1[c]	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		bb	1	4[b]	1	4[b]	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	1	1
EtherNet/IP™ (Allen-Bradley® RSLogix® systems and others)			●	●	●	●	●	●	●	●	●	●	●	●	●		
Modbus®/TCP (slave; maximum 8 master connections)[cc]			●	●	●	●	●	●	●	●	●	●	●	●	●		
OPC driver support		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●[d]	●[d]
RESTful API			●	●	●	●	●	●	●	●	●						
HTTP/HTTPS			●	●	●	●	●	●	●	●	●						
OptoMMP memory-mapped protocol		●[e]	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
SNMP (network management)			●	●	●	●	●	●	●	●	●	●	●	●	●		
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)			●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Security for wireless network (WPA2-AES, WPA-TKIP, WEP)		aa			●	●				●	●			●	●		

FEATURE		SNAP PAC Controllers										SNAP PAC Brains					
		SW	Standalone				Rack-mounted					Ethernet				Serial	
		SoftPAC	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-R1-B	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 wired Ethernet network (IP filtering, port access)		aa	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
Realtime clock		aa	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Backup battery (recharges when brain has power)[f]			●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Physical RAM (MB) RAM available for Strategy (MB) Battery-backed RAM (MB) Flash memory (MB)		aa 64 8 g	32 16 8 16		128 64 8 16		16 4 2 8				32 10 2 8		16 -- -- 8						
32-bit processor		aa	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Floating-point unit (FPU)		aa	●	●	●	●	●	●	●	●	●	●							
Removable data storage (microSD card slot)		aa	32 GB max.[h]				32 GB max.[h]												
Power requirements		aa	8–32 VDC[i] 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 Storage Temperature in degrees C		aa	-20 to 60 -40 to 85				-20 to 60 -40 to 85						-20 to 60 -40 to 85						
Humidity (non-condensing)		aa	0–95%				0–95%						0–95%						
Uses SNAP PAC mounting rack (4, 8, 12, or 16 modules)		n/a	n/a				●		●	●	●	●	●	●	●	●	●	●	●
Uses SNAP B-series 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		n/a					●[l]	●[l]	●	●	●	●	●	●	●	●	●	●[m]	●[m]
Digital I/O point features	Input latching	n/a	n/a				●	●	●	●	●	●	●	●	●	●	●	●	●
	On/off status						●	●	●	●	●	●	●	●	●	●	●	●	●
	Watchdog timer						●	●	●	●	●	●	●	●	●	●	●	●	●
	High-speed counting (up to 20 kHz)[n]						●	●		●		●		●		●		●	
	Quadrature counting[o]						●	●		●		●		●		●		●	
	On-pulse & off-pulse measurement[n]						●	●		●		●		●		●		●	
	Frequency & Period measurement[n]						●	●		●		●		●		●		●	
	TPO (time-proportional output)						●	●	●	●	●	●	●	●	●	●	●	●	●
	Digital totalizing[n]						●	●	●	●	●	●	●	●	●	●	●	●	●
	Pulse generation (continuous square wave, N pulses, on-pulse, off-pulse)						●	●	●	●	●	●	●	●	●	●	●	●	●
Analog I/O point features	Thermocouple linearization (32-bit floating point for linearized values)	n/a	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]						●	●	●	●	●	●	●	●	●	●	●	●	●

FEATURE	SNAP PAC Controllers											SNAP PAC Brains					
	SW	Standalone				Rack-mounted						Ethernet				Serial	
	SoftPAC	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-R1-B	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
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						●	●	●	●	●	●	●	●	●		

aa As provided by the Microsoft Windows computer the software runs on.
bb SoftPAC cannot communicate through serial ports on the PC.
cc With firmware R9.4b & higher, 8 max connections. Lower firmware, 2 max. connections
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 SoftPAC includes Status Read, Status Write, and Scratch Pad memory map areas.
f Models manufactured before August 2007 and S1s with serial numbers 625653 and lower have user- replaceable backup batteries. See original user guide.
g Function of Flash memory is implemented via a file; size is limited only by disk space.
h Firmware 9.4a and loader 6.1a or newer. S-series with microSD & manufacture date older than 06/14 supports max. 2 GB microSD.
i 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, and all SNAP-PAC-R1-Bs: limited to eight 4-point digital modules per rack.
m Not supported: serial, motion control, Profibus, & Wiegand modules.
n Four-channel modules only; not on high-density modules.
o Requires a SNAP-IDC5Q quadrature input module.
p Requires a SNAP PAC controller and PAC Control commands.
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, three 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 32 show signal types and ranges, number of points, isolation, agency approvals, and more. Module specifications are in Appendix A (page 123).

Mounting rack information is on page 39.

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 34. 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	ATEX	RoHS[2]			
Voltage	-10 to -32 VDC	32	●	5	SNAP-IDC-32N[4]	6		●				IM	L	Positive common High density	129
	-2.5 to -12 VDC	32	●	5	SNAP-IDC-32DN[4]	6		●				IM	L	Positive common High density	129
	2.5 to 12 VDC	32	●	5	SNAP-IDC-32D[4]	6		●				IM	L	High density	129
	2.5–16 VDC	4	●	●	SNAP-IDC5-FAST	●	●	●	●	●	●	IM	L	High speed	127
	2.5–28 VDC	4	●	●	SNAP-IDC5D	●	●	●		●		IM	L		126
	2.5–28 VDC	4	●	●	SNAP-IDC5DFM	●		●	●		●	IM	L		125
	10–32 VDC	32	●	5	SNAP-IDC-32[4]	6	●	●				IM	L	High density	129
	10–32 VDC	32	●	5	SNAP-IDC-32-FM[4]	6		●	●			IM	L	High density	129
	10–32 VDC/VAC	16	●	●	SNAP-IDC-16[4]		●	●				IM	L	High density	130
	10–32 VDC	4	●	●	SNAP-IDC5	●	●	●		●		IM	L		126
	10–32 VDC	4	●	●	SNAP-IDC5FM	●		●	●			IM	L		125
	10–32 VDC	4	●	●	SNAP-IDC5MA	●		●				IM	30	Diagnostic switches	127
	15–28 VDC/VAC	16	●	●	SNAP-IDC-HT-16[4]			●				IM	L	Leakage tolerant High density	130
	15–32 VDC	4	●	●	SNAP-IDC5-HT	●		●				IM	L	Leakage tolerant	126
	18–32 VDC	4	●	●	SNAP-IDC5-FAST-A	●	●	●		●		IM	L	High speed	127
	35–75 VDC/VAC	4	●	●	SNAP-IDC5G	●	●	●				IM	L	Telecom applica-tions	126
	70–130 VAC/VDC	16	●	●	SNAP-IAC-K-16[4]			●				IM	L	High density	130
	90–140 VAC/VDC	16	●	●	SNAP-IAC-16[4]		●	●				IM	L	High density	130
	90–140 VAC/VDC	4	●	●	SNAP-IAC5	●	●	●		●		IM	L		124
	90–140 VAC/VDC	4	●	●	SNAP-IAC5FM	●		●	●			IM	L		125
	90–140 VAC/VDC	4	●	●	SNAP-IAC5MA	●	●	●				IM	30	Diagnostic switches	124
	180–280 VAC/VDC	16	●	●	SNAP-IAC-A-16[4]		●	●				IM	L	High density	130
	180–280 VAC/VDC	4	●	●	SNAP-IAC5A	●	●	●		●		IM	L		124
	180–280 VAC/VDC	4	●	●	SNAP-IAC5AFM	●		●	●			IM	L		125
Dry Contact	Normally open	4	●		SNAP-IDC5-SW	●	●	●	●			IM	L	Self wetting	128
	Normally closed	4	●		SNAP-IDC5-SW-NC	●	●	●				IM	L	Self wetting	128
Quadrature	4–24 VDC	2	●	●	SNAP-IDC5Q	●		●	●		●	IM	L	Quadrature input (two axes)	128

1 For more information on isolation, see "About Isolation" on page 31.
2 RoHS categories: IM = Industrial Control & Monitoring Instruments; LF = lead-free
3 Warranty period: L = Lifetime; 30 = 30 months from date of manufacture
4 For wiring options, see page 45.
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 34. 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	ATEX	RoHS[2]			
Voltage (AC)	12–250 VAC	4	●		SNAP-OAC5	●	●	●		●		IM	L		131
	12–250 VAC	4	●		SNAP-OAC5FM	●		●	●			IM	L		132
	12–250 VAC	4	●	●	SNAP-OAC5-i	●	●	●				IM	L		131
	12–250 VAC	4	●	●	SNAP-OAC5-iFM	●		●	●			IM	L		132
	12–250 VAC	4	●	●	SNAP-OAC5MA	●	●	●				IM	30	Diagnostic switches	131
Voltage (DC)	5–60 VDC	32	●	4	SNAP-ODC-32-SNK[5]	6	●	●				IM	L	High density	139
	5–60 VDC	32	●	4	SNAP-ODC-32-SRC[5]	6	●	●				IM	L	High density	139
	5–60 VDC	32	●	4	SNAP-ODC-32-SNK-FM[5]	6		●	●			IM	L	High density	139
	5–60 VDC	32	●	4	SNAP-ODC-32-SRC-FM[5]	6		●	●			IM	L	High density	139
	5–60 VDC	4	●	●	SNAP-ODC5-i	●	●	●				IM	L		137
	5–60 VDC	4	●	●	SNAP-ODC5-iFM	●		●	●		●	IM	L		136
	5–60 VDC	4	●	●	SNAP-ODC5MA	●	●	●				IM	30	Diagnostic switches	137
	5–60 VDC	4	●		SNAP-ODC5SNK	●	●	●		●		IM	L		134
	5–60 VDC	4	●		SNAP-ODC5SNKFM	●		●	●			IM	L		135
	5–60 VDC	4	●		SNAP-ODC5SRC	●	●	●		●		IM	L		134
	5–60 VDC	4	●		SNAP-ODC5SRCFM	●		●	●			IM	L		135
	5–200 VDC	4	●	●	SNAP-ODC5A-i	●	●	●				IM	L		137
	5–200 VDC	4	●	●	SNAP-ODC5A-iFM	●		●	●			IM	L		136
	5–200 VDC	4	●		SNAP-ODC5ASNK	●	●	●				IM	L		137
Mechanical Relay	6 A @ 250 VAC or 30 VDC	4		●	SNAP-OMR6T-C[7]	●	●	●				IM	30	SPDT (Form C)	140
		4		●	SNAP-OMR6-C	●	●	●				IM	30	SPST (Form C)	140
Dry Contact	Normally open	4		●	SNAP-ODC5R	●		●		●		IM	30	Reed relay, ≤10 VA	134
	Normally open	4		●	SNAP-ODC5RFM	●		●	●			IM	30	Reed relay, ≤10 VA	135
	Normally closed	4		●	SNAP-ODC5R5	●		●				IM	30	Reed relay, ≤10 VA	134
	Normally closed	4		●	SNAP-ODC5R5FM	●		●	●			IM	30	Reed relay, ≤10 VA	135

Output signal		Points	Isolation[1]		Part number	LEDs	Approvals						Warranty[3]	Notes	Specs
Type	Range		Optical	Ch-ch			UL	CE	FM	CSA	ATEX	RoHS[2]			

1 For more information on isolation, see "About Isolation" on page 31.
2 RoHS categories: IM = Industrial Control & Monitoring Instruments; 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 45.
6 Status LEDs for individual points are available on a separate breakout board.
7 UL approval pending

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 38. 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	ATEX	RoHS[2]			
Current	-20 to +20 mA	32	●		●	SNAP-AIMA-32[4]	●	●					L		145
	-20 to +20 mA	32	●		●	SNAP-AIMA-32-FM[4]		●	●				L		145
	-20 to +20 mA	8	●		●	SNAP-AIMA-8		●					L		144
	-20 to +20 mA	4	●		●	SNAP-AIMA-4	●	●	●		●	IM	L		144
	-20 to +20 mA	2	●		●	SNAP-AIMA	●	●	●			IM	L		144
	-20 to +20 mA	2	●	●	●	SNAP-AIMA-i	●	●	●			IM	L		146
	-20 to +20 mA	2	●	●	●	SNAP-AIMA-iSRC		●				IM	L	Isolated loop excitation	147
	-20 to +20 mA	2	●	●	●	SNAP-AIMA-iSRC-FM		●	●			IM	L	Isolated loop excitation	147
	-1 to +1 mA	2	●	●	●	SNAP-AIMA2-i		●				IM	L		145
	4–20 mA	2	●	●	●	SNAP-AIMA-iH		●				IM	L	HART protocol	145
Voltage (mV)	2 or 3 mV/V	2	●		●	SNAP-AILC		●				IM	L	Load cell devices	142
	3 or 4 mV/V	2	●		●	SNAP-AILC-2		●					L	Load cell devices	142
	-50 to +50 mV or -25 to +25 mV	4	●		●	SNAP-AIMV2-4	●	●	●			IM	L		149
	-50 to +50 mV or -25 to +25 mV (or thermo-couple)	2	●		●	SNAP-AITM-2		●	●			IM	L		154
		2	●	●	●	SNAP-AITM2-i	●	●	●			IM	L		155
	+/-75, +/-50, or +/-25 mV (or thermocouple)	8	●		●	SNAP-AITM-8	●	●				IM	L		156
		8	●		●	SNAP-AITM-8-FM		●	●			IM	L		156
	-150 to +150 mV or -75 to +75 mV	4	●		●	SNAP-AIMV-4	●	●	●			IM	L		149
	-150 to +150 mV or -75 to +75 mV (or thermocouple)	2	●		●	SNAP-AITM		●	●			IM	L		153
		2	●	●	●	SNAP-AITM-i	●	●	●			IM	L		154

Input signal		Points	Isolation[1]			Part number	Approvals						Warranty[3]	Notes	Specs
Type	Range		Optical	Ch-ch	Transformer		UL	CE	FM	CSA	ATEX	RoHS[2]			
Voltage (V)	-10 to +10 VDC or -5 to +5 VDC	32	●		●	SNAP-AIV-32[4]	●	●					L		158
	-10 to +10 VDC or -5 to +5 VDC	32	●		●	SNAP-AIV-32-FM[4]		●	●				L		158
	-10 to +10 VDC or -5 to +5 VDC	8	●		●	SNAP-AIV-8		●					L		158
Voltage (V)	-10 to +10 VDC or -5 to +5 VDC	4	●		●	SNAP-AIV-4	●	●	●		●	IM	L		157
	-10 to +10 VDC or -5 to +5 VDC	2	●		●	SNAP-AIV	●	●	●			IM	L		157
	-10 to +10 VDC or -5 to +5 VDC	2	●	●	●	SNAP-AIV-i	●	●	●			IM	L		156
	-100 to +100 VDC	2	●	●	●	SNAP-AIV2-i		●				IM	L		157
pH/ORP	-1 to +1 V or -0.5 to +0.5 V	2	●	●	●	SNAP-pH/ORP		●					L	pH or ORP probes	163
RMS	0–10 A RMS	2	●		●	SNAP-AIARMS	●	●	●			IM	L		141
	0–10 A RMS	2	●	●	●	SNAP-AIARMS-i		●				IM	L		142
	0–10 A RMS	2	●	●	●	SNAP-AIARMS-i-FM		●	●			IM	L		142
	0–250 V RMS	2	●		●	SNAP-AIVRMS	●	●	●			IM	L		159
	0–250 V RMS	2	●	●	●	SNAP-AIVRMS-i		●				IM	L		159
	0–250 V RMS	2	●	●	●	SNAP-AIVRMS-i-FM		●	●			IM	L		159
Rate	0–25,000 Hz	2	●		●	SNAP-AIRATE	●	●	●			IM	L		148
	2 Hz to 500 kHz	2	●	●	●	SNAP-AIRATE-HFi		●				IM	L		148
Resistance	40, 20, 10, or 5 K ohms	4	●		●	SNAP-AIR40K-4	●	●	●			IM	L	Thermistor input	153
	400, 200, 100, 50, 40, 20, 10, 5, 4, 2, or 1 K Ohm; or 500 Ohm	8	●		●	SNAP-AIR400K-8	●	●					L	Thermistor input	152
	Multiple ranges from 0–8000 Ohm	8	●		●	SNAP-AIRTD-8U	●	●				IM	L	Also temperature	151
Voltage	Dual-range voltage	1	●		●	SNAP-AIV-72		●				IM	L	Aluminum industry	
Current/ voltage	85–250 VAC RMS 0–10 AC amps RMS	4[5]	●		●	SNAP-AIPM		●				IM	L	Single-phase power monitoring	160
	85–300 VAC RMS 0–5 AC amps RMS	14[5]	●		●	SNAP-AIPM-3		●				IM	L	Three-phase power monitoring	161
	85–300 VAC RMS 0–0.333 VAC (from CTs)	14[5]	●		●	SNAP-AIPM-3V		●				IM	L	Three-phase power monitoring	161

Input signal		Points	Isolation[1]			Part number	Approvals						Warranty[3]	Notes	Specs
Type	Range		Optical	Ch-ch	Transformer		UL	CE	FM	CSA	ATEX	RoHS[2]			
Tempera-ture	ICTD	8	●		●	SNAP-AICTD-8		●				IM	L		143
	ICTD	4	●		●	SNAP-AICTD-4	●	●	●			IM	L		143
	ICTD	2	●		●	SNAP-AICTD	●	●	●			IM	L		143
	100 Ohm Platinum RTD	2	●		●	SNAP-AIRTD	●	●	●			IM	L		150
	10 Ohm Copper RTD	2	●		●	SNAP-AIRTD-10		●				IM	L		150
	1000 Ohm Platinum RTD	2	●		●	SNAP-AIRTD-1K		●				IM	L		150
	1K Ohm Pt/Ni RTD, 100 Ohm Pt/Ni RTD, 120 Ohm Ni RTD, 10 Ohm Cu RTD	8	●		●	SNAP-AIRTD-8U	●	●				IM	L	Also resistance	151
	Thermocouple type B,C,D, G,N,T,R,S (or -50 to +50 mV or -25 to +25 mV)	2	●		●	SNAP-AITM-2		●	●			IM	L		154
		2	●	●	●	SNAP-AITM2-i	●	●	●			IM	L		155
	Thermocouple type B,C,D,E,G,J,K,N,R,S, T (or +/-75, +/-50, or +/-25 mV)	8	●		●	SNAP-AITM-8		●				IM	L		156
		8	●		●	SNAP-AITM-8-FM		●	●			IM	L		156
	Thermocouple type E,J,K (or -150 to +150 mV or -75 to +75 mV)	2	●		●	SNAP-AITM		●	●			IM	L		153
		2	●	●	●	SNAP-AITM-i	●	●	●			IM	L		154
	Thermocouple type B,C,D,E,G,J,K,N,R,S, T (or +/-150, +/-75, +/-50, or +/-25 mV)	4	●	●	●	SNAP-AITM-4i		●				IM	L		155

1 For more information on isolation, see "About Isolation" on page 31.
2 RoHS categories: IM = Industrial Control & Monitoring Instruments; LF = lead-free
3 Warranty period: L = Lifetime; 30 = 30 months from date of manufacture
4 For wiring options, see page 45.
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	ATEX	RoHS[2]			
Current	0–20 mA	2	●		●	SNAP-AOA-28	●	●	●		●	IM	L		166
	4–20 mA	2	●		●	SNAP-AOA-23	●	●	●			IM	L		164
	4–20 mA	2	●	●	●	SNAP-AOA-23-iSRC		●				IM	L	Isolated loop sourcing	165
	4–20 mA	2	●	●	●	SNAP-AOA-23-iSRC-FM		●	●		●	IM	L	Isolated loop sourcing	165
	4–20 mA	2	●	●	●	SNAP-AOA-23-iH		●				IM	L	HART protocol	164
	4–20 mA	1	●		●	SNAP-AOA-3	●	●				IM	L		164
Current/ Voltage	4 to 20 mA 0 to 20 mA 0 to 5 VDC 0 to 10 VDC -5 to +5 VDC -10 to +10 VDC	8	●		●	SNAP-AOVA-8		●				IM	L	Multifunction	164
Voltage	-10 to +10 VDC	2	●		●	SNAP-AOV-27	●	●	●			IM	L		169
	0–10 VDC	2	●		●	SNAP-AOV-25	●	●	●			IM	L		168
	0–10 VDC	1	●		●	SNAP-AOV-5	●	●				IM	L		168
	5–60 VDC	2	●	●	●	SNAP-AOD-29	●	●	●			IM	L	Time-proportional output[4]	167
	2.5–24 VDC	2	●	●	●	SNAP-AOD-29-HFi		●				IM	L	Time-proportional output[4]	167

1 For more information on isolation, see "About Isolation" on page 31.
2 RoHS categories: IM = Industrial Control & Monitoring Instruments; 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 ±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	●		●	●		IM	30	Optional RTS/CTS flow control	171
RS-485/422	2[4]	●	●	SNAP-SCM-485-422	●		●	●		IM	30	2-wire or 4-wire	171
RS-485/422	4	●		SNAP-SCM-MCH16	●		●			IM	30	Motion control interface	174
Profibus®	1	●	●	SNAP-SCM-PROFI	●		●			IM	30	Links to Profibus networks	172
Serial synchronous interface	2	●	●	SNAP-SCM-SSI			●			IM	30	For linear or rotary transducers used in motion control	173
Pulse & direction	2	●		SNAP-SCM-ST2	●		●			IM	30	For stepper motors	175
Controller Area Network (CAN)	1	●		SNAP-SCM-CAN2B			●	●		IM	30	Transmit and receive	176
Wiegand®	2	●	●	SNAP-SCM-W2	●		●			IM	30	Wiegand protocol for security industry	177

1 For more information on isolation, see "About Isolation" on page 31.
2 RoHS categories: IM = Industrial Control & Monitoring Instruments; 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. Use two 4-40 by ½-inch standard machine screws to hold each module securely in position on the SNAP rack. All kinds of SNAP I/O modules—analog, 4-channel and high-density digital, and serial—can be mixed together on any rack with any processor, including Wired+Wireless EB brains and R-series controllers. (*Exception:* a SNAP-PAC-R1-B controller mounts on legacy SNAP B-series racks. This controller is used to update older I/O racks to the SNAP PAC System.)

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

Processor (Brain or Rack-mounted Controller)	Power Req. (Amps)*

*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 except mechanical relay outputs (*not* high-density digital modules)		0.050	
SNAP mechanical power relay output modules		0.160	
SNAP-AICTD, AICTD-4 analog input modules High-density digital input and output modules SNAP-AIMA-32, SNAP-AIMA-iH, SNAP-AIV-32, and SNAP-AITM-4i analog input modules All analog output modules except SNAP-AOA-iSRC and SNAP-AOD-29-HFi		0.150	
SNAP-AOD-29-HFi		0.300	
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-AIRTD-8U analog input module		0.135	
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-AIR400K-8 analog input module SNAP-AIRATE analog input module		0.190	
SNAP-AIRATE-HFi analog input module		0.210	
SNAP-SCM-ST2 and SNAP-SCM-SSI serial modules		0.200	
SNAP-SCM-232, SNAP-SCM-485-422, SNAP-SCM-PROFI SNAP-SCM-MCH16 *not* powering a breakout board		0.250	
SNAP-SCM-MCH16 powering a breakout board		0.700	
Total			

Item	Quantity	X Power Req. (Amps)	Total Power Required (Amps)[1]

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 (for example, some SNAP-AIMA modules) 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 42.

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 G4 modules or mechanical relays for higher current switching. To choose the breakout boards to use with your I/O modules and cables, see the tables beginning on page 42.

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 46.

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

In the charts starting on the following page, 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-point			
SNAP-IAC5 SNAP-IAC5A SNAP-IAC5AFM SNAP-IAC5FM SNAP-IAC5MA SNAP-IDC5MA	SNAP-TEX-CBS6 *	SNAP-TEX-CBS6 *	Not used for inputs
SNAP-IDC5 SNAP-IDC5-FAST-A SNAP-IDC5-HT SNAP-IDC5D SNAP-IDC5DFM SNAP-IDC5FAST SNAP-IDC5FM SNAP-IDC5G	SNAP-TEX-CBE6 SNAP-TEX-CBO6 SNAP-TEX-CBS6	SNAP-TEX-CBO6 SNAP-TEX-CBS6	Not used for inputs
SNAP-IDC5Q	SNAP-TEX-CBS6	Not used	Not used for inputs
SNAP-IDC5-SW SNAP-IDC5-SW-NC	SNAP-TEX-CBS6	Not used	Not used for inputs
Digital output modules—4-point			
SNAP-ODC5-I SNAP-ODC5-IFM SNAP-ODC5A-I SNAP-ODC5A-IFM SNAP-ODC5MA	SNAP-TEX-CBS6 *	SNAP-TEX-CBS6 *	SNAP-TEX-CBO6 SNAP-TEX-CBS6
SNAP-OAC5-I SNAP-OAC5-IFM SNAP-OAC5MA	SNAP-TEX-CBS6 *	SNAP-TEX-CBS6 *	Not used
SNAP-ODC5SRC SNAP-ODC5SRCFM	SNAP-TEX-CBO6 SNAP-TEX-CBS6	SNAP-TEX-CBO6 SNAP-TEX-CBS6	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-TEX-CBE6 SNAP-TEX-CBO6 SNAP-TEX-CBS6	SNAP-TEX-CBO6 SNAP-TEX-CBS6	Not used
SNAP-OMR6T-C SNAP-OMR6-C	Not used	Not used	Not used

* This cable maintains channel-to-channel isolation on these modules. If channel-to-channel isolation is not important, you can also use the SNAP-TEX-CBO6 cable.
** The SNAP-TEX-32 can be used with digital outputs but has no fuses. SNAP-TEX-FB16 boards are preferable for digital outputs because they include fuses.

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-MR10-16C**
Analog input modules (not thermocouples)				
SNAP-AIARMS SNAP-AIARMS-i SNAP-AIARMS-i-FM SNAP-AICTD SNAP-AICTD-4 SNAP-AILC [a] SNAP-AILC-2 [a] SNAP-AIMA-i SNAP-AIMA-iSRC [a] SNAP-AIMA-iSRC-FM [a] SNAP-AIMA-iH SNAP-AIMA2-i	SNAP-AIRATE SNAP-AIRATE-HFi SNAP-AIRTD SNAP-AIRTD-10 SNAP-AIRTD-1K SNAP-AIV-72 SNAP-AIV-i SNAP-AIV2-i SNAP-AIVRMS SNAP-AIVRMS-i SNAP-AIVRMS-i-FM	SNAP-TEX-CBS6	Not used for analog modules	
SNAP-AIMA SNAP-AIMA-4 SNAP-AIMV2-4 SNAP-AIMV-4	SNAP-AIR40K-4 SNAP-AIV SNAP-AIV-4	SNAP-TEX-CBE6 SNAP-TEX-CBS6	Not used for analog modules	
SNAP-AIPM SNAP-AIPM-3 [b] SNAP-AIPM-3V SNAP-AITM [c] SNAP-AITM-i [c]	SNAP-AITM-2 [c] SNAP-AITM-4i [c] SNAP-AITM2-i [c] SNAP-pH/ORP	No cable available	Not used for analog modules	
Analog output modules				
SNAP-AOA-23	SNAP-AOA-28	SNAP-TEX-CBE6 SNAP-TEX-CBS6	Not used for analog modules	
SNAP-AOA-3	SNAP-AOV-5	SNAP-TEX-CBE6 SNAP-TEX-CBO6 SNAP-TEX-CBS6	Not used for analog modules	
SNAP-AOV-25	SNAP-AOV-27	SNAP-TEX-CBO6	Not used for analog modules	
SNAP-AOA-23-iH SNAP-AOA-23-iSRC [a] SNAP-AOA-23-iSRC-FM [a]	SNAP-AOD-29 SNAP-AOD-29-HFi	SNAP-TEX-CBS6	Not used for analog modules	

a Note that the SNAP-TEX-SBS6 cable does not include a connector for the 2-pin terminal on top of these modules, required for excitation voltage.
b Not recommended for use with breakout boards due to CT safety concerns.
c Do not use breakout boards with thermocouples.

High-Density Digital Modules

<table>
<tr><th rowspan="2">Module</th><th colspan="7">Breakout Board</th><th rowspan="2">Without a breakout board</th></tr>
<tr><th>SNAP-TEX-32</th><th>SNAP-TEX-FB16-H
SNAP-TEX-FB16-L</th><th>SNAP-TEX-MR10-4
SNAP-TEX-MR10-16
SNAP-TEX-MR10-16C</th><th>SNAP-IDC-HDB
SNAP-IDC-HDB-FM</th><th>SNAP-ODC-HDB
SNAP-ODC-HDB-FM</th><th>SNAP-UDC-HDB</th><th>SNAP-UDC-HDB-G4</th></tr>
<tr><td>SNAP-IAC-16
SNAP-IAC-A-16
SNAP-IAC-K-16
SNAP-IDC-16
SNAP-IDC-HT-16</td><td>SNAP-HD-ACF6 (2 modules/board)</td><td>SNAP-HD-ACF6</td><td>Not used with inputs</td><td>Not used</td><td>Not used</td><td>Not used</td><td>Not used</td><td>SNAP-HD-ACF6</td></tr>
<tr><td>SNAP-IDC-32
SNAP-IDC-32-FM
SNAP-IDC-32D</td><td rowspan="2">SNAP-HD-CBF6</td><td rowspan="2">SNAP-HD-CBF6 (2 boards/module)</td><td rowspan="2">Not used with inputs</td><td rowspan="2">SNAP-HD-BF6</td><td rowspan="2">Not used</td><td rowspan="2">SNAP-HD-BF6</td><td>Not used</td><td rowspan="2">SNAP-HD-CBF6</td></tr>
<tr><td>SNAP-IDC-32N
SNAP-IDC-32DN</td><td>SNAP-HD-BF6</td></tr>
<tr><td>SNAP-ODC-32-SNK
SNAP-ODC-32-SNK-FM</td><td rowspan="2">SNAP-HD-CBF6</td><td rowspan="2">SNAP-HD-CBF6 (2 boards/module)</td><td>Do not use</td><td>Not used</td><td rowspan="2">SNAP-HD-BF6</td><td rowspan="2">SNAP-HD-BF6</td><td>SNAP-HD-BF6</td><td rowspan="2">SNAP-HD-CBF6</td></tr>
<tr><td>SNAP-ODC-32-SRC
SNAP-ODC-32-SRC-FM</td><td>SNAP-HD-CBF6
SNAP-HD-G4F6
(MR10-16C only)</td><td>Not used</td><td>Not used</td></tr>
</table>

Analog Modules with More Than 4 Points

<table>
<tr><th rowspan="2">Module</th><th colspan="4">Breakout Board</th><th rowspan="2">Without a breakout board</th></tr>
<tr><th>SNAP-TEX-32</th><th>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</th><th>SNAP-AIMA-HDB
SNAP-AIMA-HDB-FM</th><th>SNAP-AIV-HDB
SNAP-AIV-HDB-FM</th></tr>
<tr><td>SNAP-AICTD-8
SNAP-AIMA-8
SNAP-AIR400K-8
SNAP-AIRTD-8U
SNAP-AITM-8 **
SNAP-AITM-8-FM **
SNAP-AIV-8</td><td>Can be used; no cable currently available</td><td rowspan="4">Not used with analog modules</td><td colspan="2">Not used</td><td>No cable available</td></tr>
<tr><td>SNAP-AIMA-32
SNAP-AIMA-32-FM</td><td>Not recommended</td><td>SNAP-HD-BF6</td><td>SNAP-HD-BF6*</td><td>Not recommended</td></tr>
<tr><td>SNAP-AIV-32
SNAP-AIV-32-FM</td><td>SNAP-HD-CBF6</td><td>Not used</td><td>SNAP-HD-BF6</td><td>SNAP-HD-CBF6</td></tr>
<tr><td>SNAP-AOVA-8</td><td>SNAP-HD-20F6</td><td colspan="2">Not used</td><td>SNAP-HD-20F6</td></tr>
</table>

* For specific applications. See details in wiring diagrams.
** Do not use breakout boards with thermocouples.

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-TEX-MR10-4		2 clips	SNAP-TEX-DRC10* (10 clips in package)	SNAP-TEX-REC10W* (10 in package; use 2 per rack)
SNAP-TEX-MR10-16	SNAP-TEX-MR10-16C	3 clips		
SNAP-AIMA-HDB SNAP-AIMA-HDB-FM SNAP-AIV-HDB SNAP-AIV-HDB-FM SNAP-UDC-HDB	SNAP-IDC-HDB SNAP-IDC-HDB-FM SNAP-TEX-32 SNAP-TEX-FB16-H SNAP-TEX-FB16-L	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	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.

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.

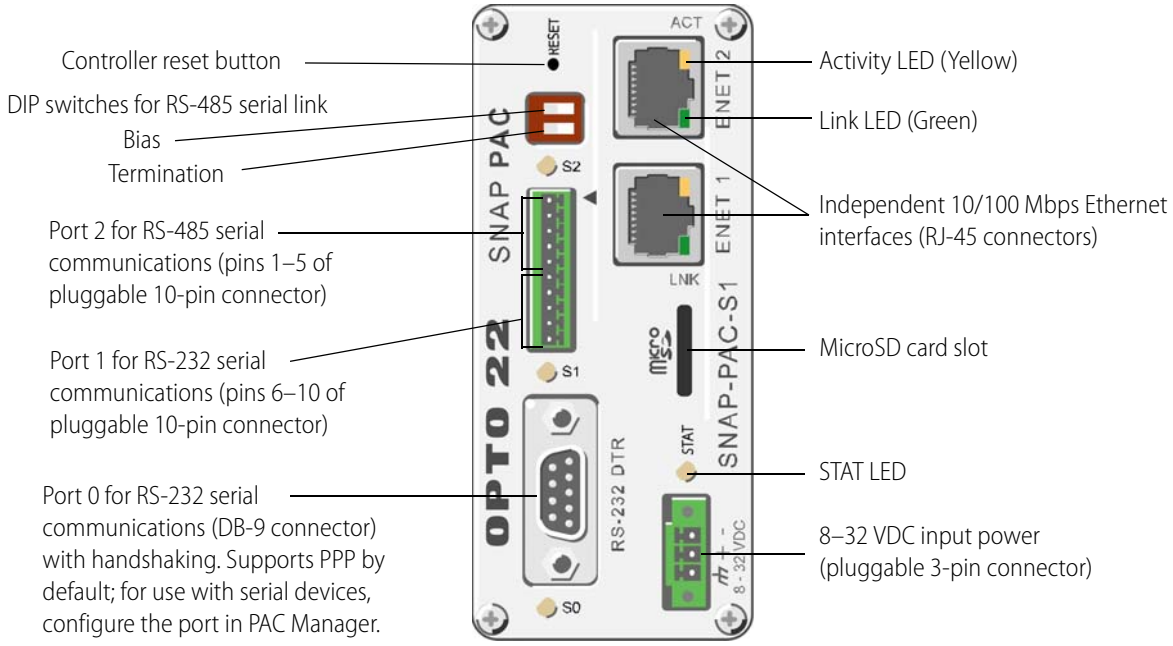
If your SNAP PAC System will be part of an existing Ethernet network or will communicate with an existing network, be sure to work closely with your system administrator before setting up the network or assigning IP addresses. For more about networking, see form 1796, *Guide to Networking Opto 22 Products*.

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

SNAP-PAC-S1 Controller—Network Interfaces and Ports

Also applies to SNAP-PAC-S1-FM. See page 49 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

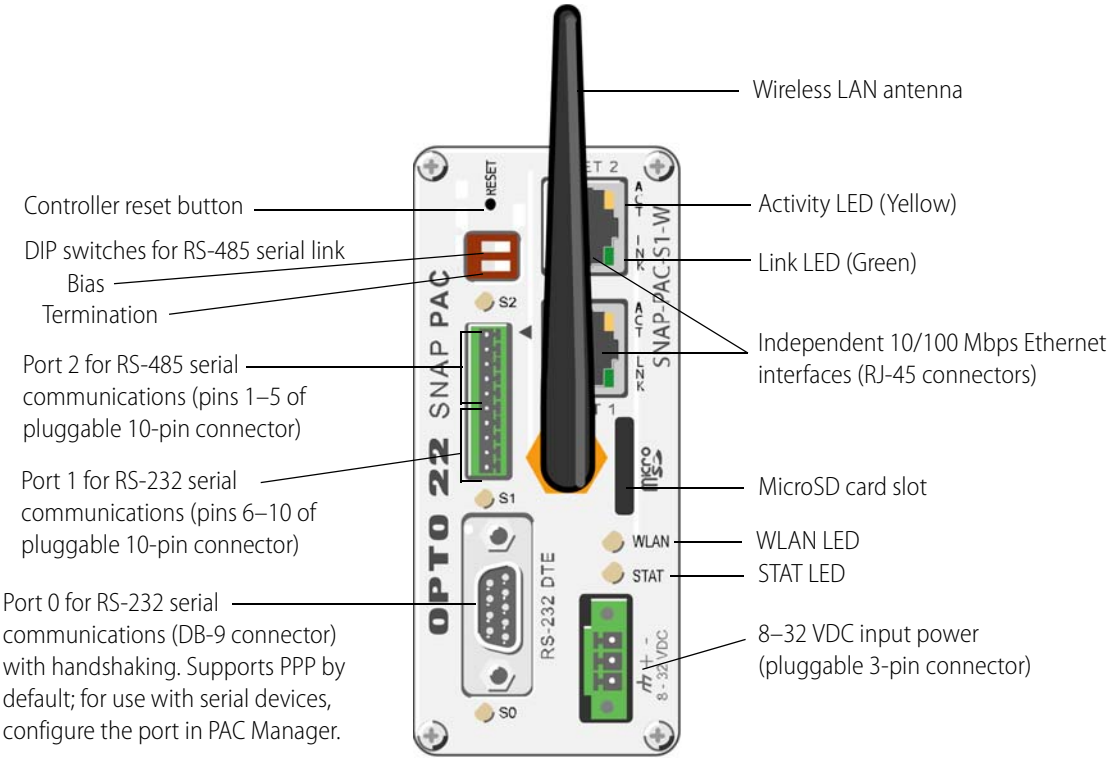
* RI signal does not occur on PACs with a microSD card slot

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

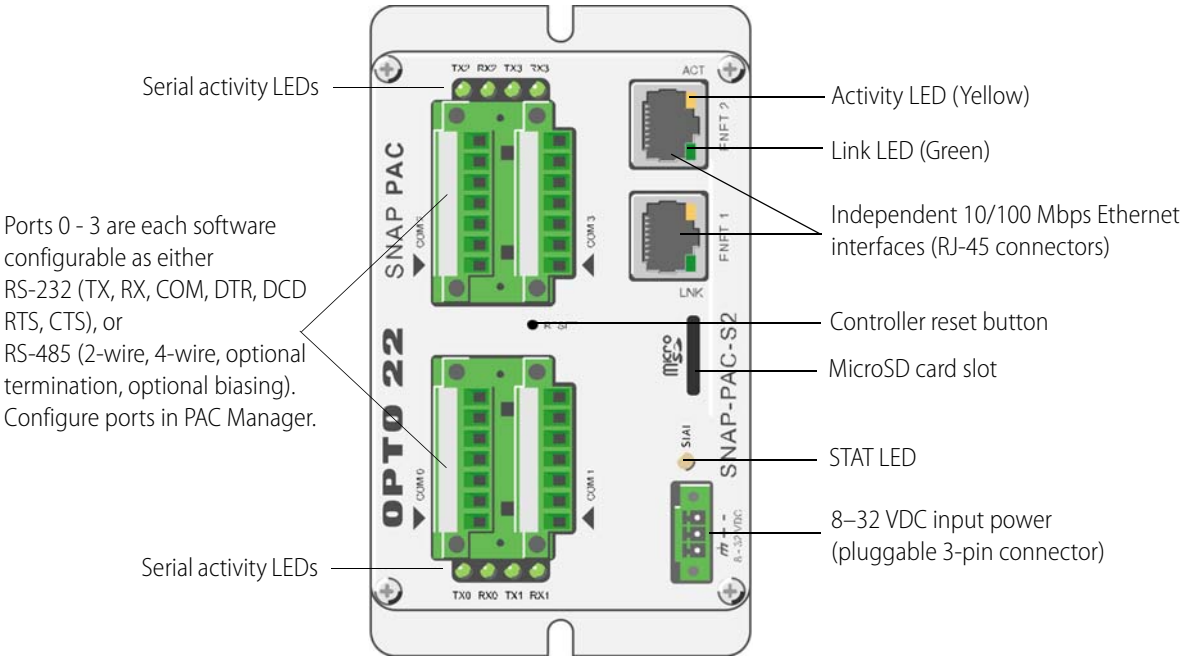
Ports 1 and 2 for RS-485 and RS-232 serial

	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 51 for the SNAP-PAC-S2-W.



RS-485 and RS-232 Ports[1]

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.)

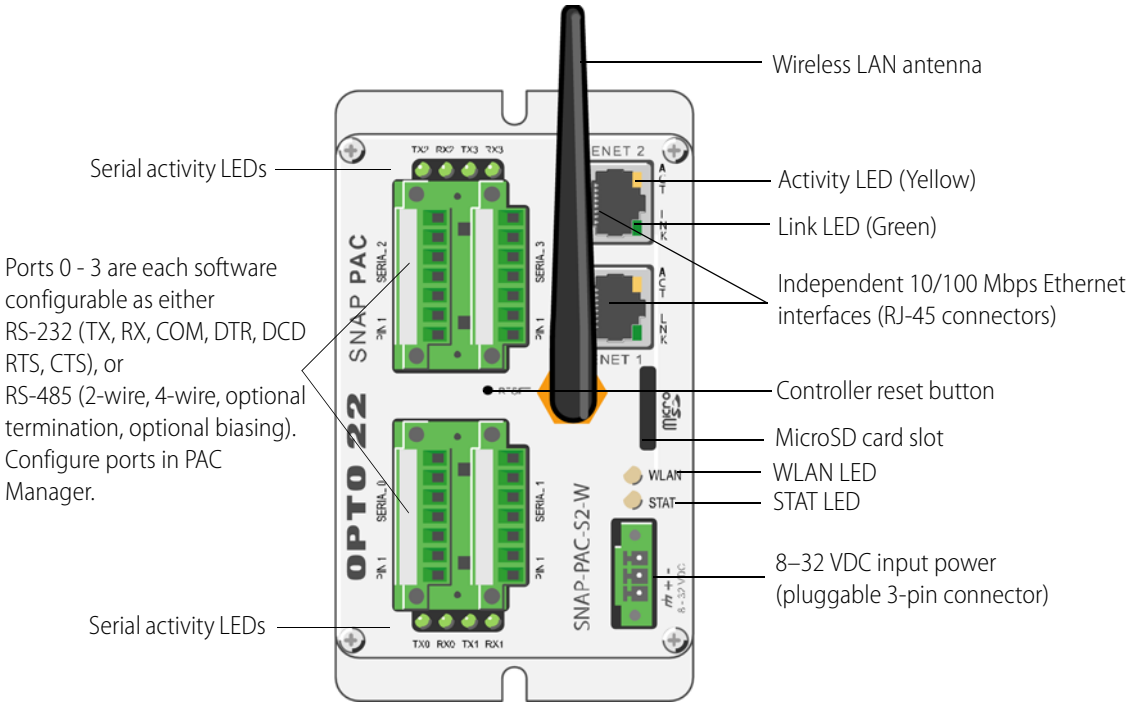
*Legacy OptoControl Controllers:

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 Ports[1]

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:

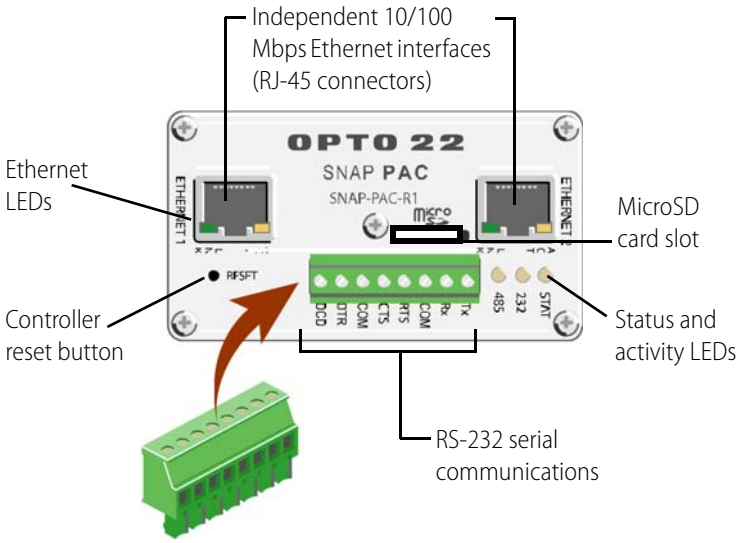
G4LC32	G4LC32ISA-LT	M4RTU
G4LC32SX	M4	SNAP-LCM4
G4LC32ISA	M4IO	SNAP-LCSX/PLUS

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 controllers except Wired+Wireless models (part numbers ending in -W). For Wired+Wireless, see page 53.



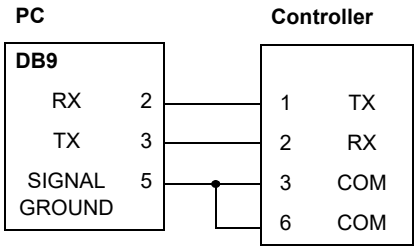
RS-232 Port (Port 0)

Pin	Description
1	TX
2	RX
3	COM
4	RTS
5	CTS
6	COM
7	DTR
8	DCD

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

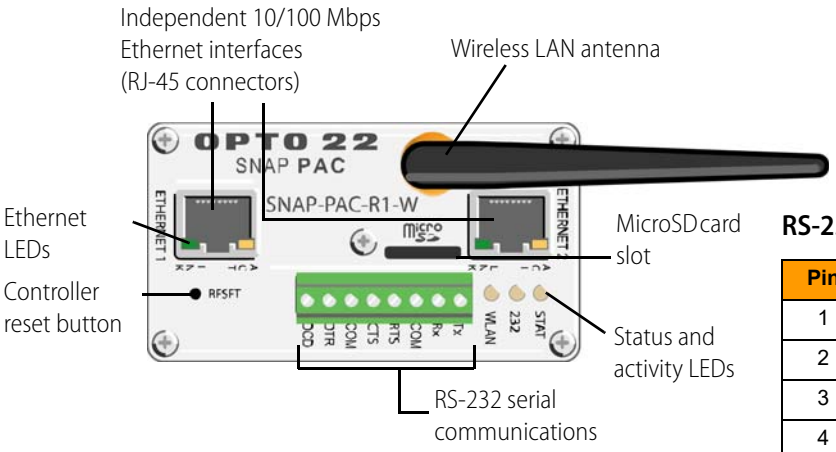
RS-232 Serial Cable Wiring*



* 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*

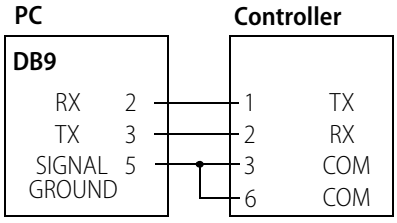
Indicator	Description
ACT	Ethernet network activity
LNK	Link established with Ethernet network
STAT	Startup status, control program operational status, MicroSD card access
232	RS-232 serial activity
WLAN	Wireless LAN status

* 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 Port (Port 0)

Pin	Description
1	TX
2	RX
3	COM
4	RTS
5	CTS
6	COM
7	DTR
8	DCD

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.

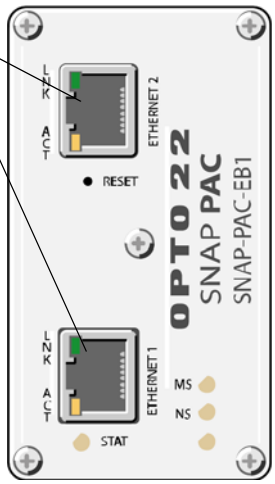
SNAP PAC EB Brains—Interfaces

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.

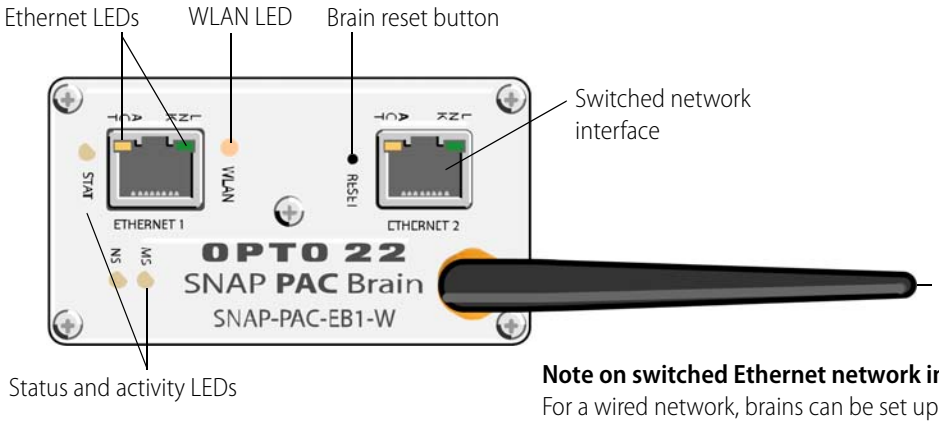


LEDs

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.

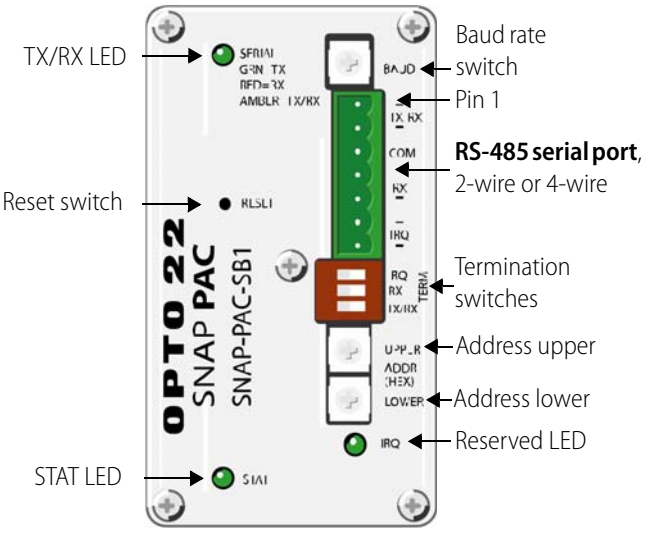
When using a daisy-chain configuration, be aware that if power to a brain is lost, all brains beyond it on the network will also lose communication. Firmware on daisy-chained brains must be updated one brain at a time.

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



Bias is always ON.

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, 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 and must be on separate networks or network subnets. 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.

For more information on networking SNAP PACs and *groov*, see *Guide to Networking Opto 22 Products*, form #1796.

Wired+Wireless Network Interfaces

As you can see by comparing the diagrams for Wired+Wireless models to those for their wired cousins (page 48 through page 54), the Wired+Wireless brains and controllers have 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 for separate networks or network subnets. Use *Ethernet 1* for initial configuration.
- **Wired+Wireless brains** have two switched wired interfaces plus an independent wireless interface. The two wired interfaces are on the same network; the wireless interface is on sa separate network or network subnet. 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.

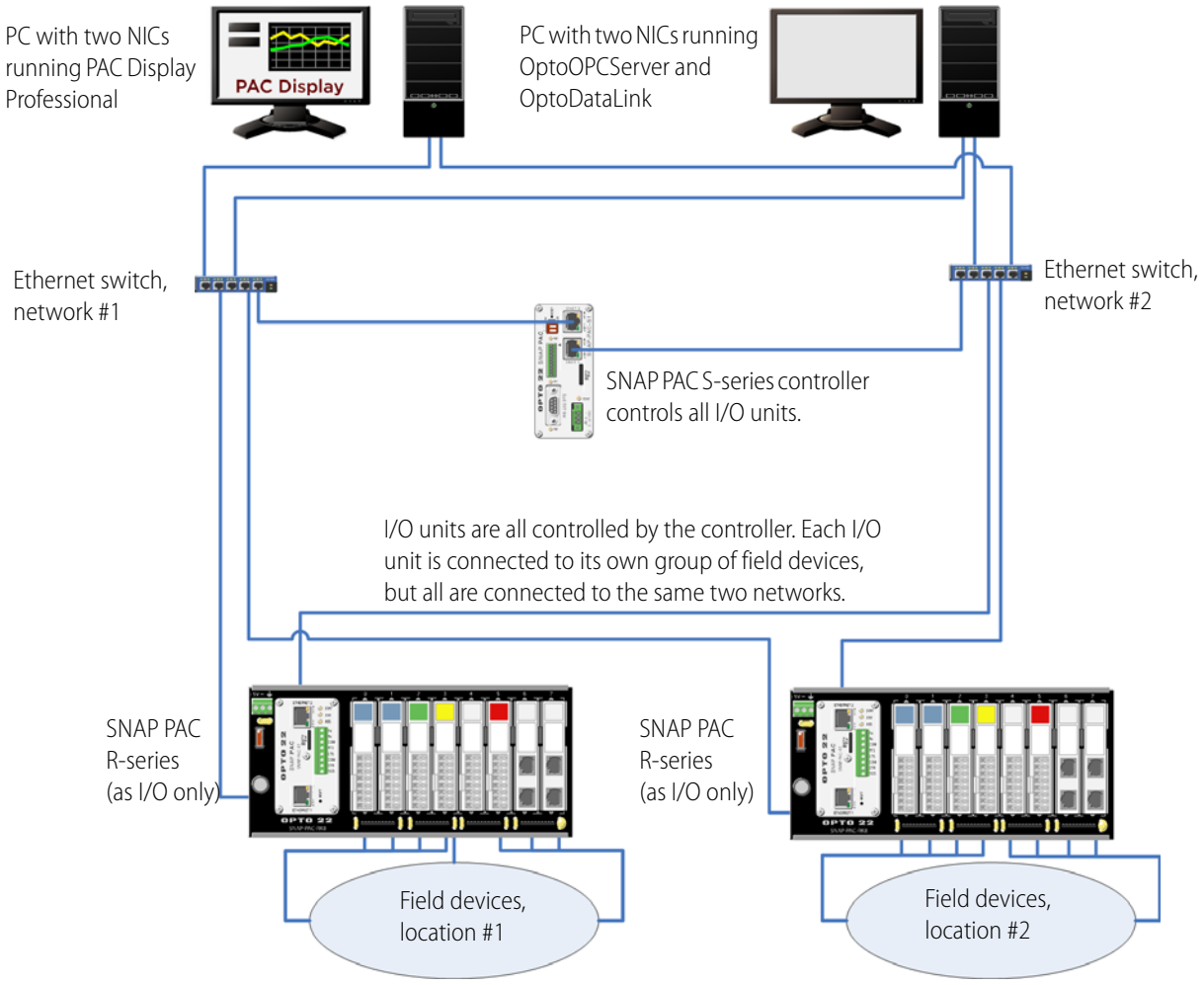
Using Redundant Ethernet Network Links

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.

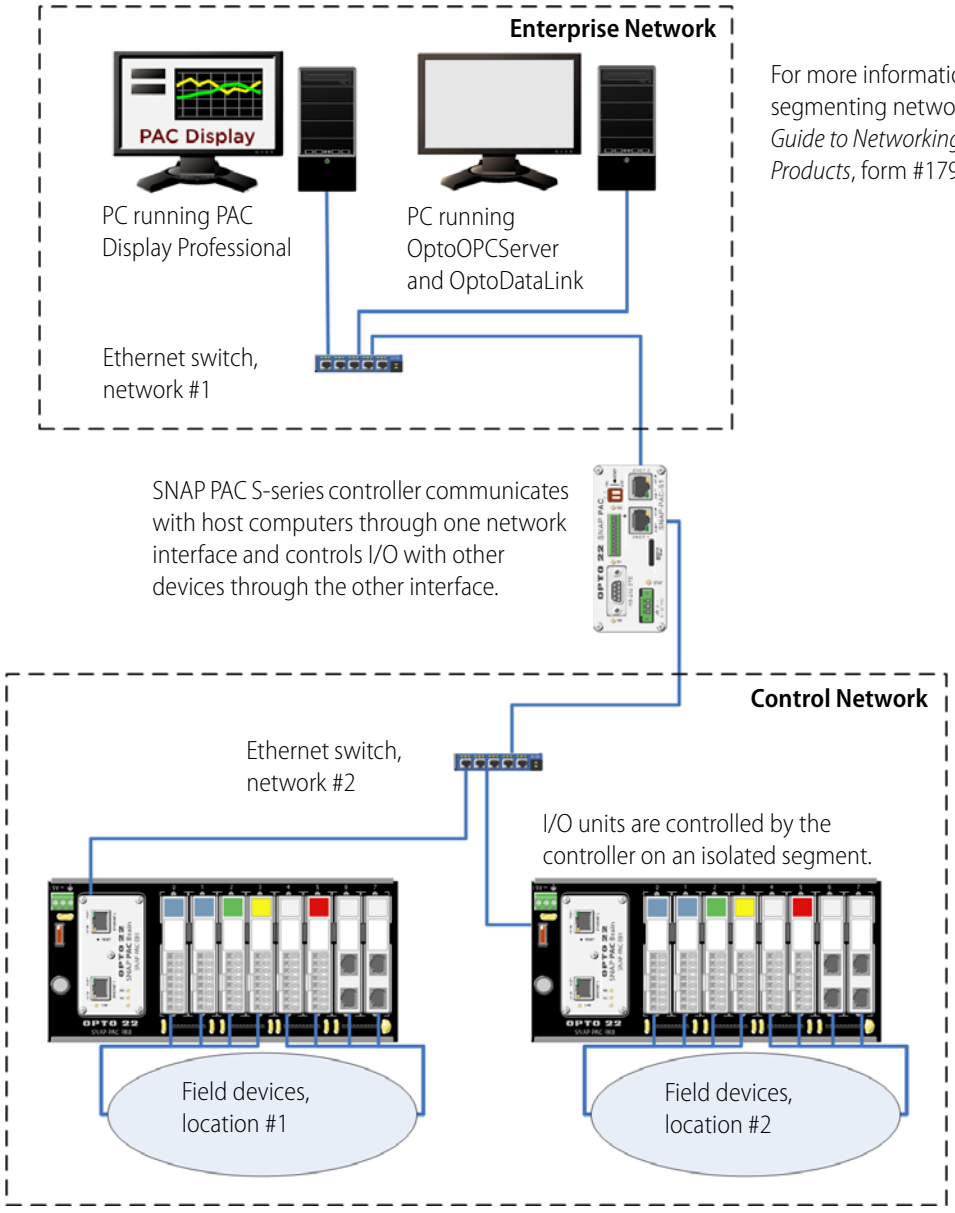
Ethernet Redundant Network



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.



For more information on segmenting networks, see *Guide to Networking Opto 22 Products*, form #1796.

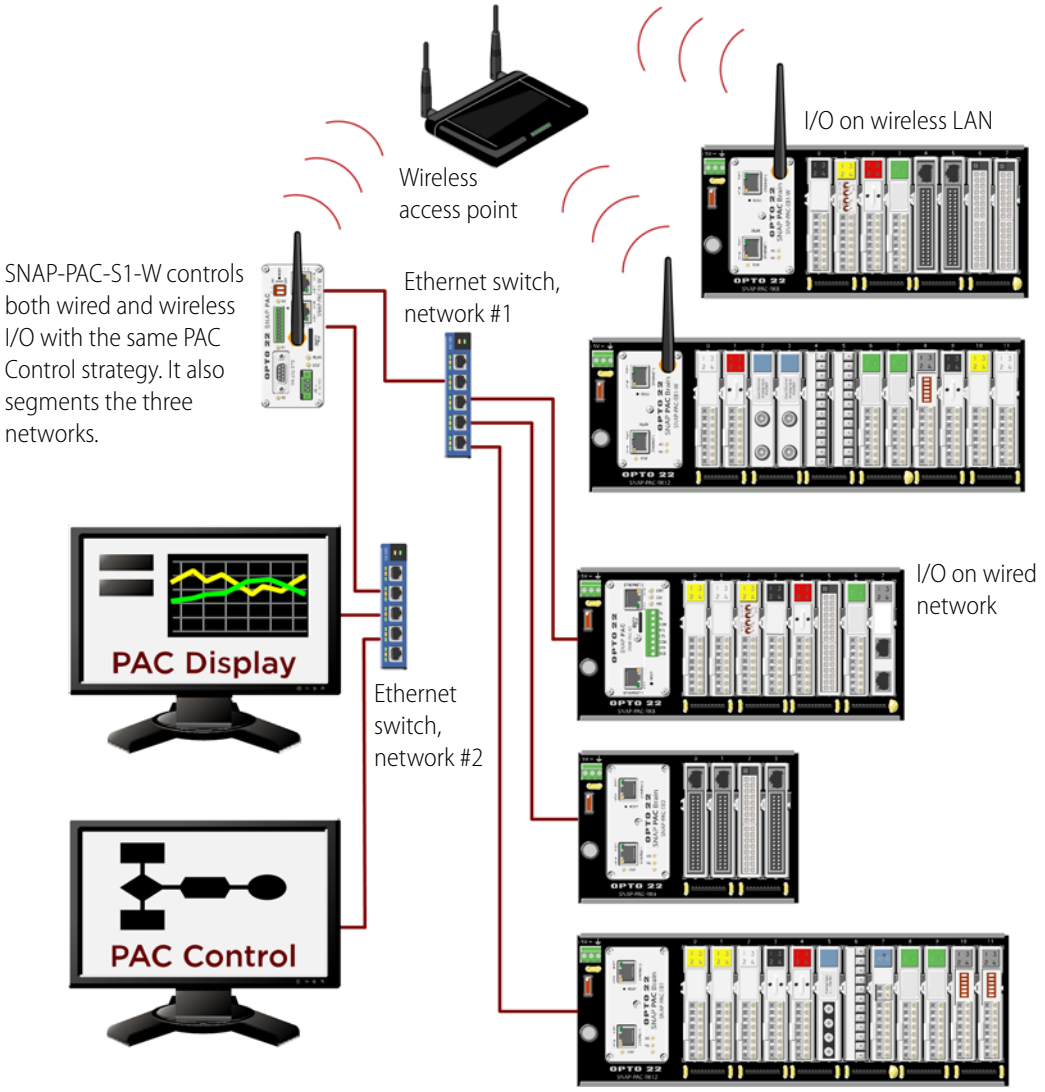
Using Wireless Networking

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.



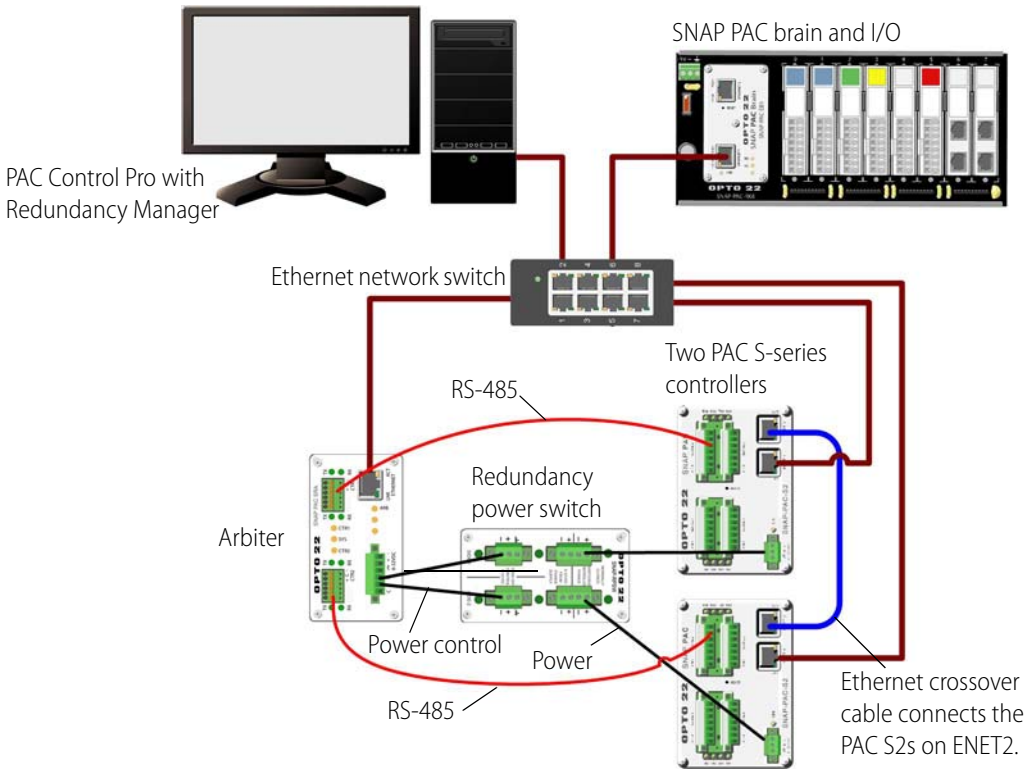
Using Redundant Controllers

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).

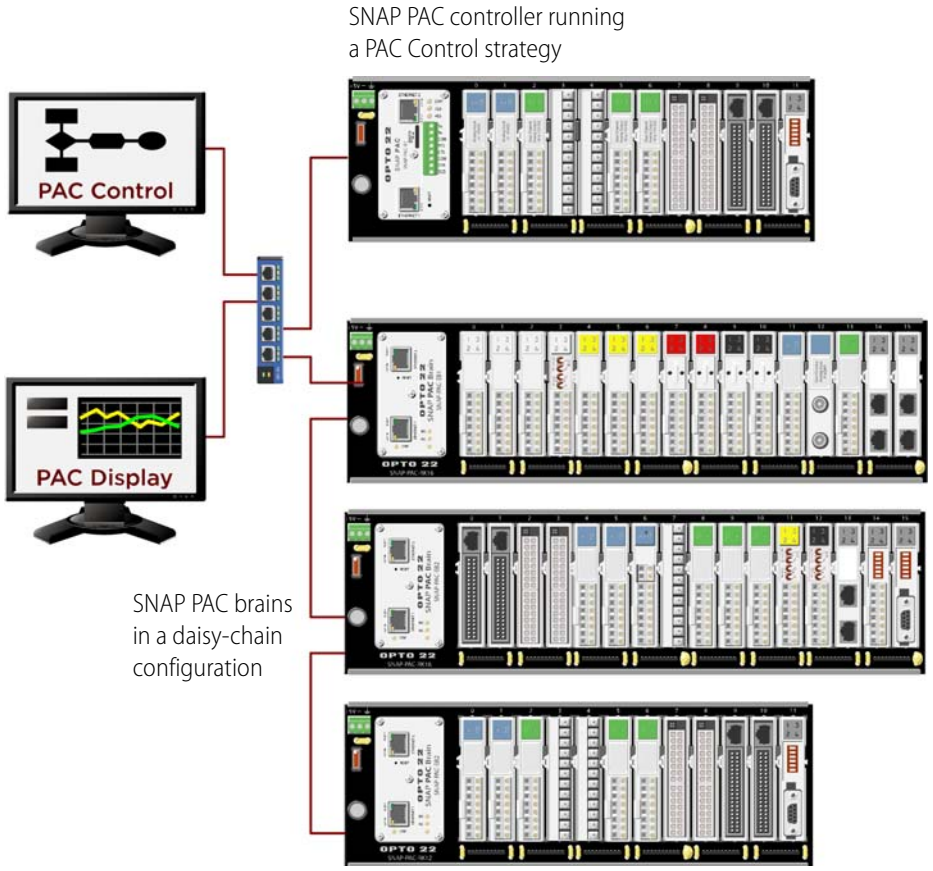


Daisy-Chaining Distributed Ethernet I/O

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.

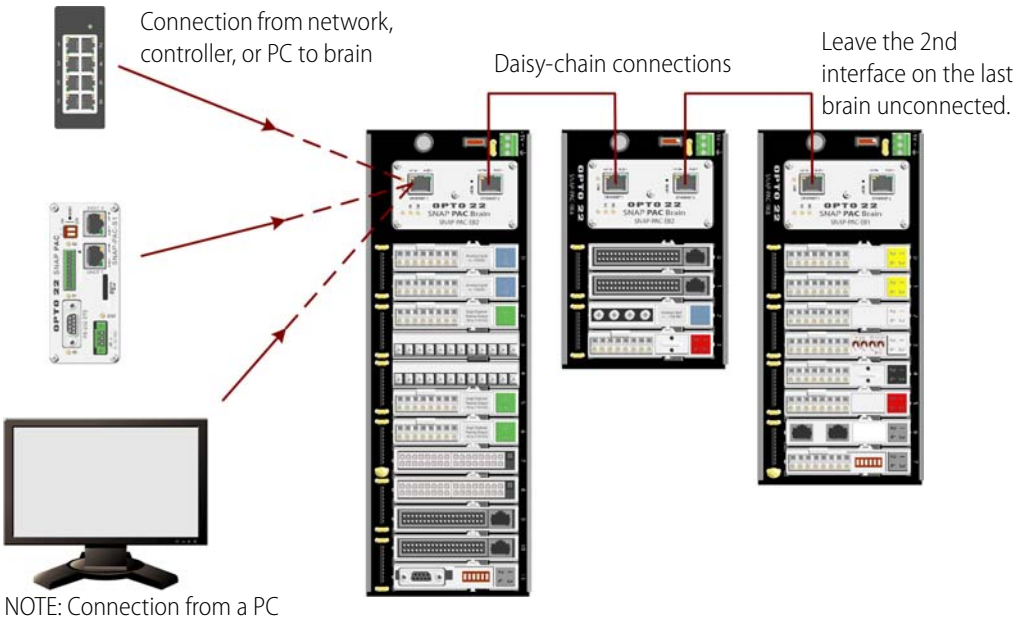
Daisy-chaining offers advantages and disadvantages. The primary advantage is the reduced expense, because you don't need to purchase Ethernet switches. The primary disadvantage is that, as in a serial network, if you lose communication with a brain, all the brains after that one in the chain are also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

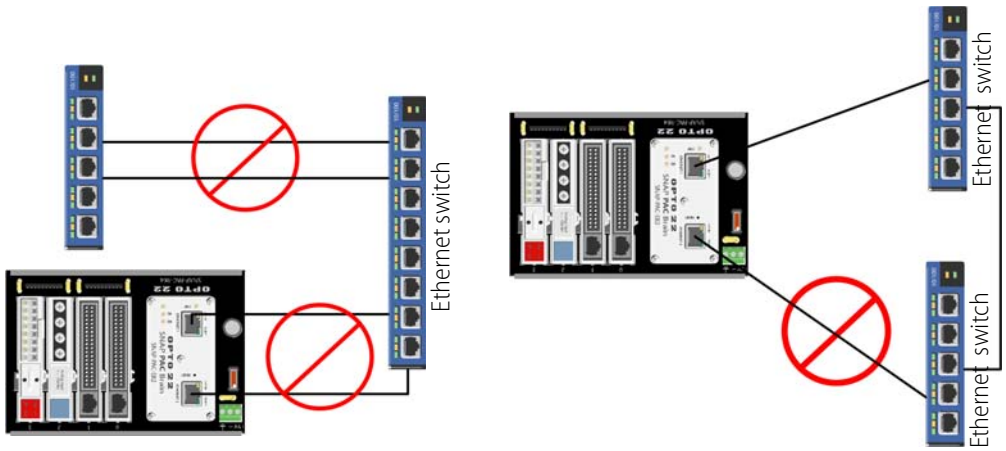


NOTE: Connection from a PC does not require a crossover cable.

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

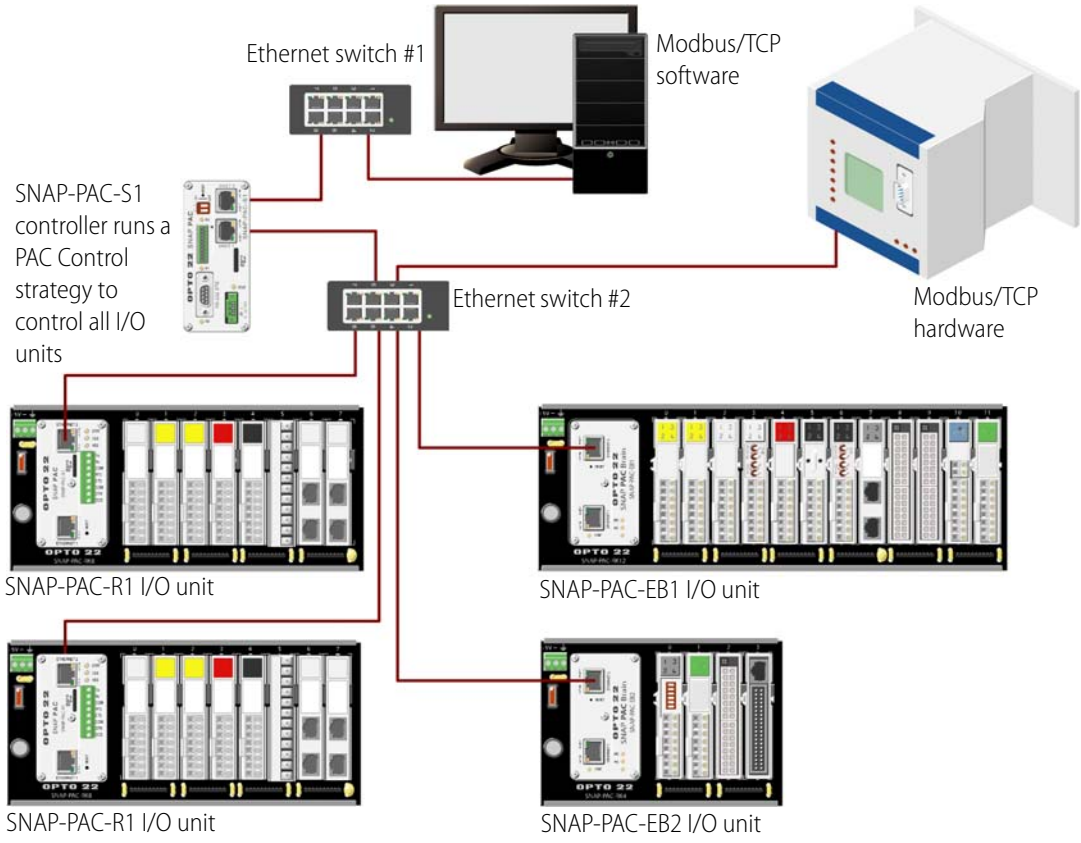


Communicating with Modbus/TCP Systems

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*.

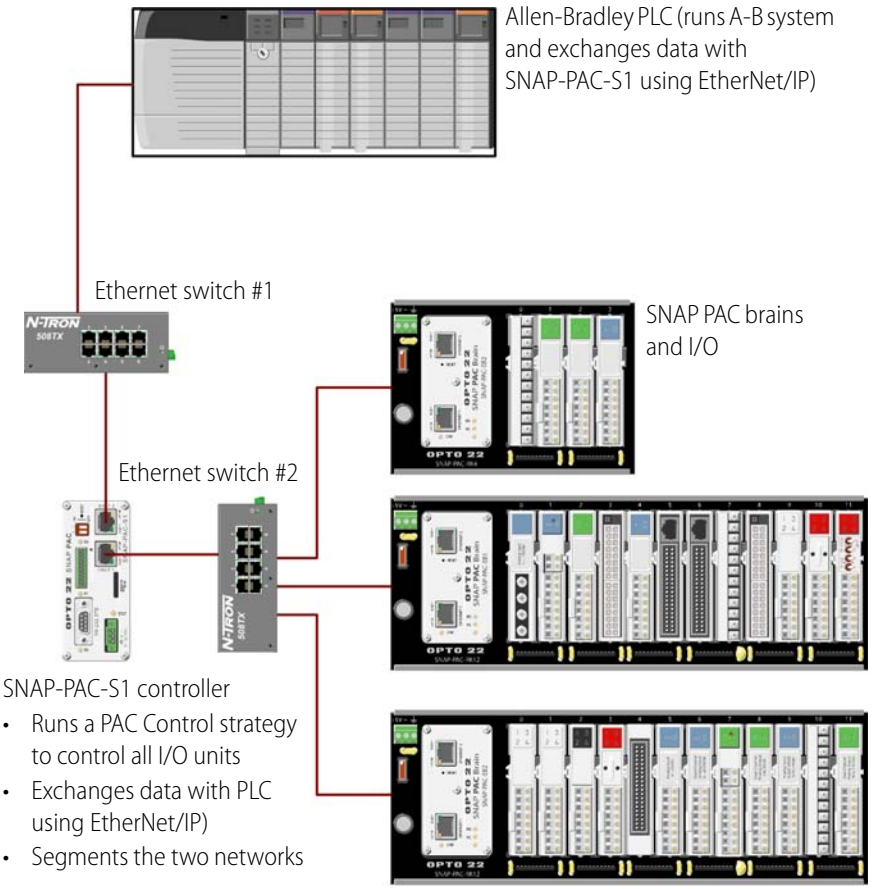
Communicating with Allen-Bradley PLC Systems

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

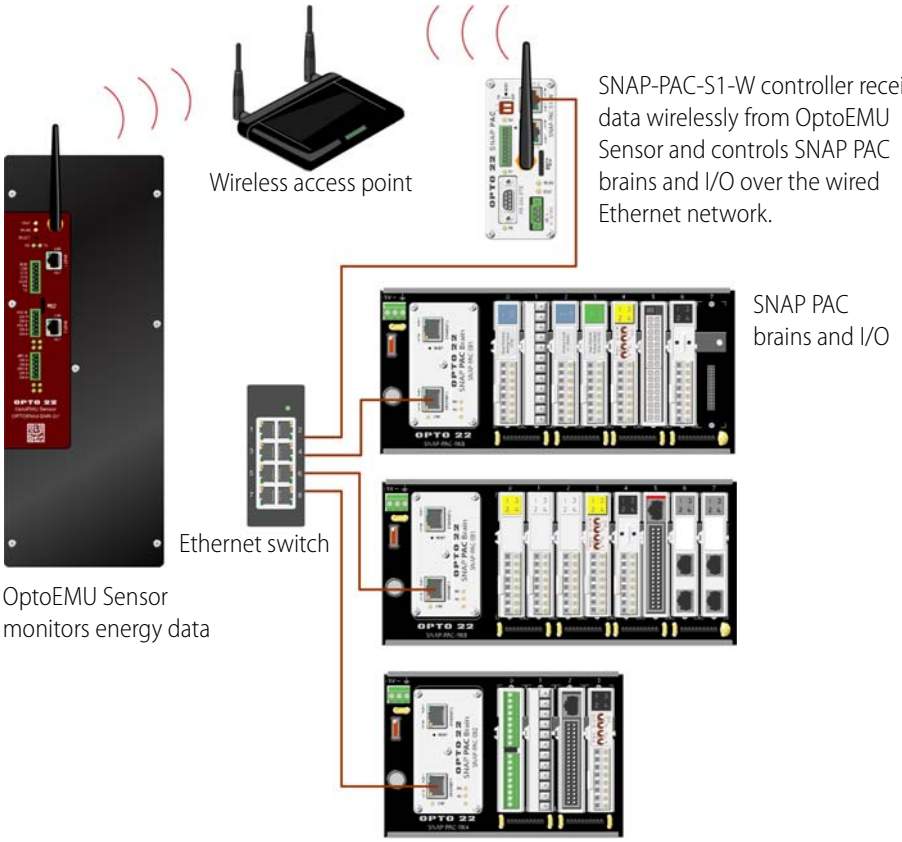
The OptoEMU Sensor from Opto 22 monitors the energy usage in your facility and sends real-time, detailed energy data to online data services, control systems, and SQL databases. You can view and analyze the data online, control energy usage, reduce costs, and even turn energy into a revenue producer with demand response programs from your energy provider.

OptoEMU Sensors are fully compatible with the SNAP PAC System; the energy data they track can be used in your PAC Control strategy or custom program, 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, see these documents on the Opto 22 website:

For this information	See this document	Form #
Description, specifications, diagrams	*OptoEMU Sensor 3V Data Sheet* *OptoEMU Sensor DR Data Sheet*	1936 1990
Installation, configuration, and maintenance	*OptoEMU Sensor User's Guide*	1932
Sending data to 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 66).
- You can communicate with any RS-232 or RS-485 serial device, such as chart recorders, RFID and barcode readers, printers, and scales (page 66).
- You can exchange data with a Profibus system (page 66).
- You can communicate with a remote host over a modem (see page 67).
- You can connect to legacy Opto 22 serial *mistic* I/O (see page 68).

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 73 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 48.

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).

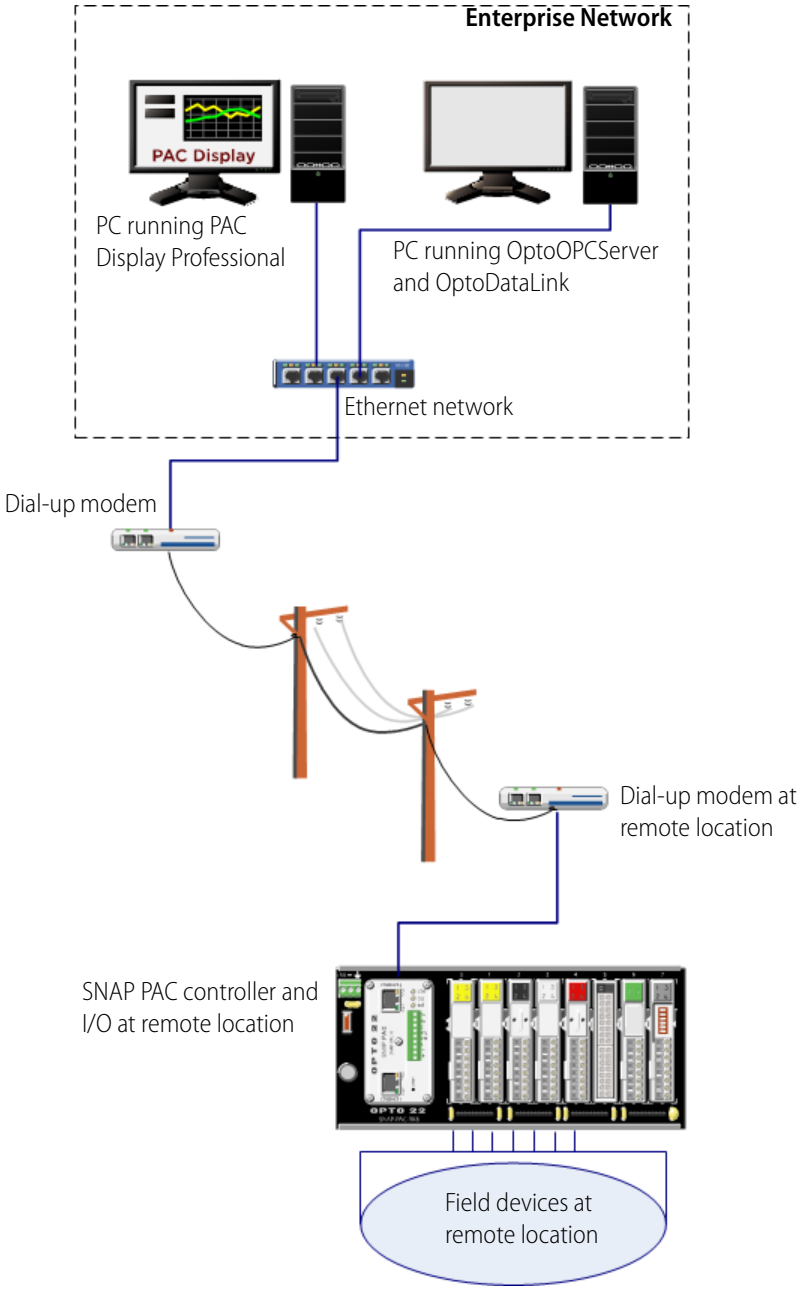
For locations away from the controller, you can use SNAP serial communication modules on distributed I/O. Serial modules snap on a mounting rack alongside analog and digital modules to provide the serial connections needed at distributed locations. RS-232 modules include RTS/CTS. RS-485 modules offer 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 below, using the Point-to-Point Protocol (PPP).

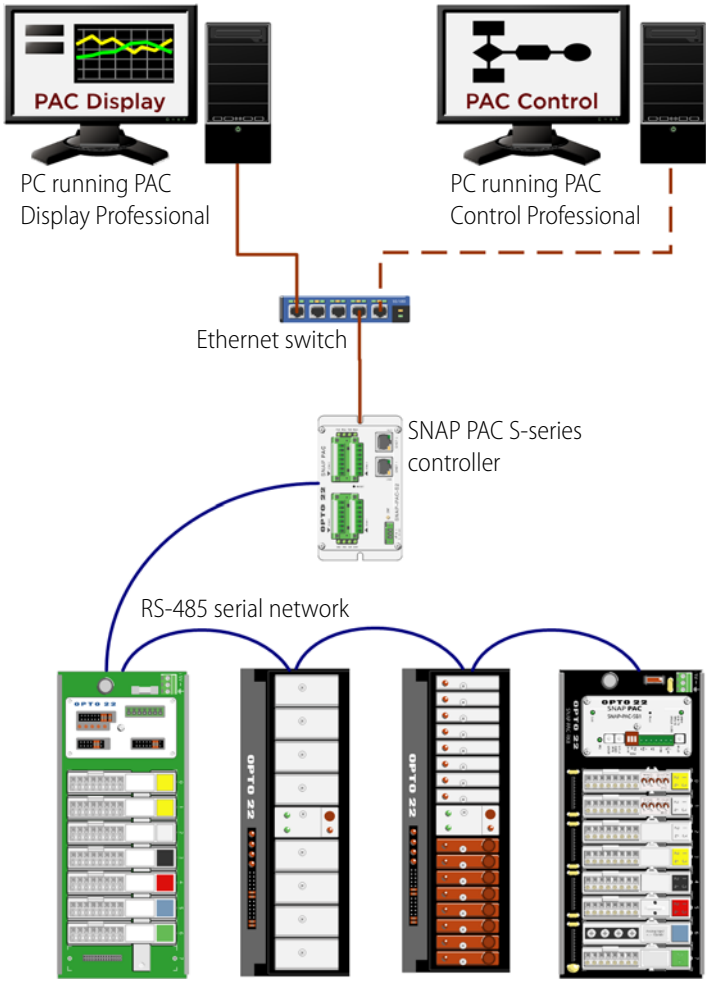


Communicating with Legacy Serial *mistic* I/O Units

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.



I/O units are connected via a 2-wire RS-485 serial network. The first three on the serial link are running the *mistic* protocol. The last one is a SNAP PAC SB I/O unit running the OptoMMP protocol.

All I/O units are controlled by the SNAP PAC S-series controller.

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. All software and documentation are included in the download.

Firmware

Make sure you use firmware for all SNAP PAC controllers and brains that matches your version of 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 46 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

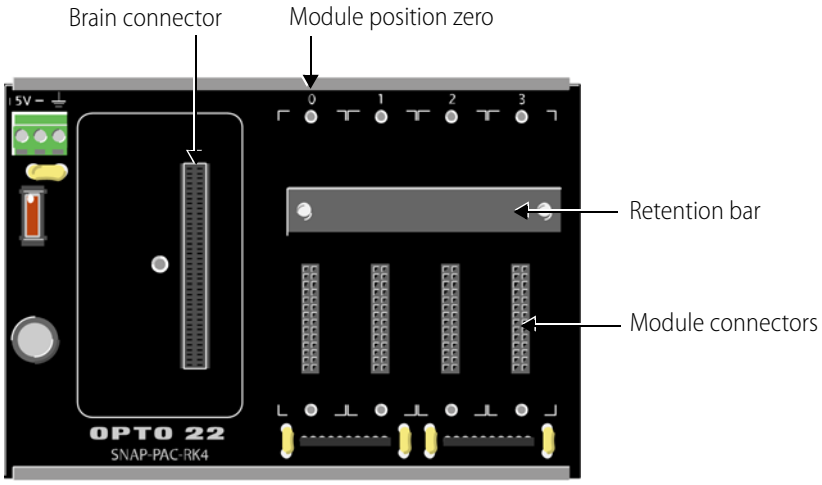
SNAP I/O modules and SNAP PAC brains and rack-mounted controllers are installed on SNAP PAC racks. Each rack mounts one processor and up to 4, 8, 12, or 16 modules. The modules can be any combination of SNAP I/O modules—analog, digital, and serial. Serial modules are limited to a maximum of 8 on any 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.

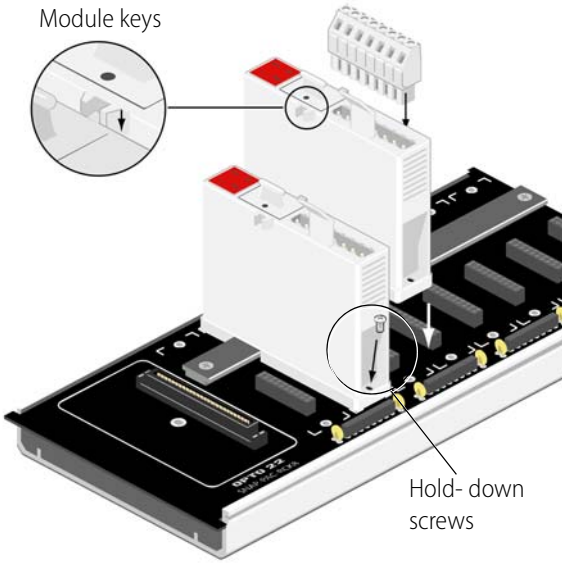
4. With the module correctly aligned over the connector, push on the module to snap it into place.

   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.

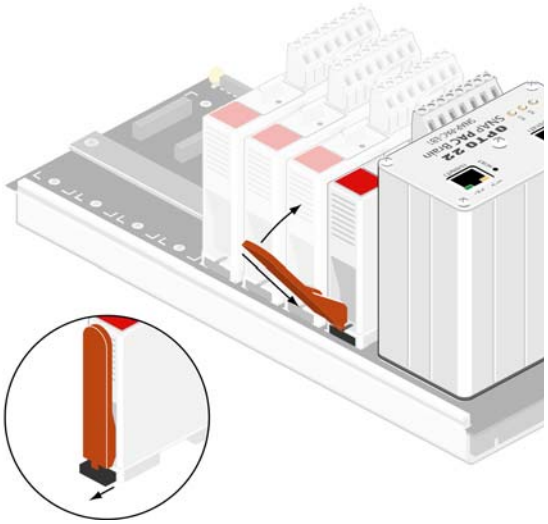
   CAUTION: Do not over-tighten screws. Recommended torque: 4 in-lb (0.45 N-m)



6. Plug the wiring connector into each module to attach modules to the devices they monitor. Follow wiring diagrams beginning on page 78 or in the module data sheets. (See page 14 for a list of data sheets.)

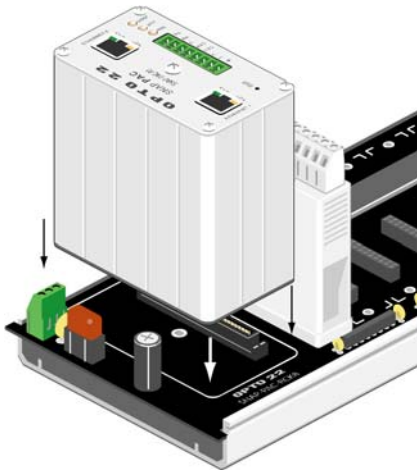
Removing a Module

1. Remove the module's two hold-down screws.
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 73.



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

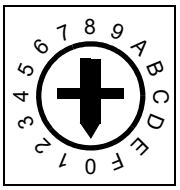
Follow the SB brain diagram on page 55and the steps below to set up serial networking for SB brains and an S-series controller.

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

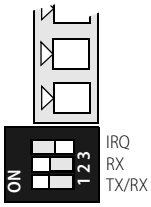
Baud rate	Switch position
4800 bps	7
2400 bps	6
1200 bps	5
600 bps	4
300 bps	3
(Reserved)	2
(Reserved)	1
(Reserved)	0

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.)

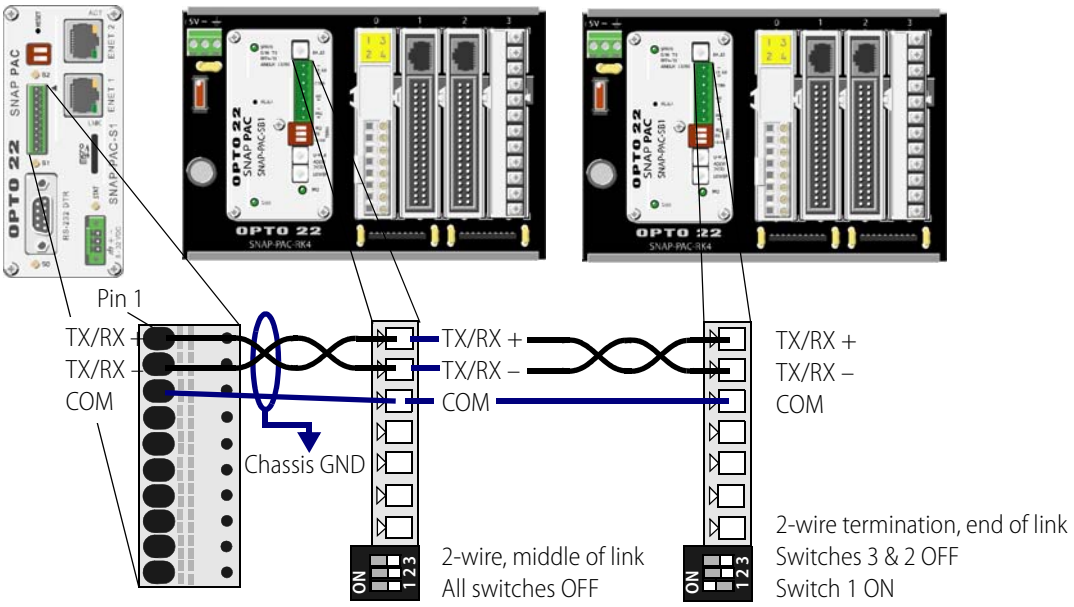
4. Use the two 16-position rotary address switches to set the unit's address.

   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.

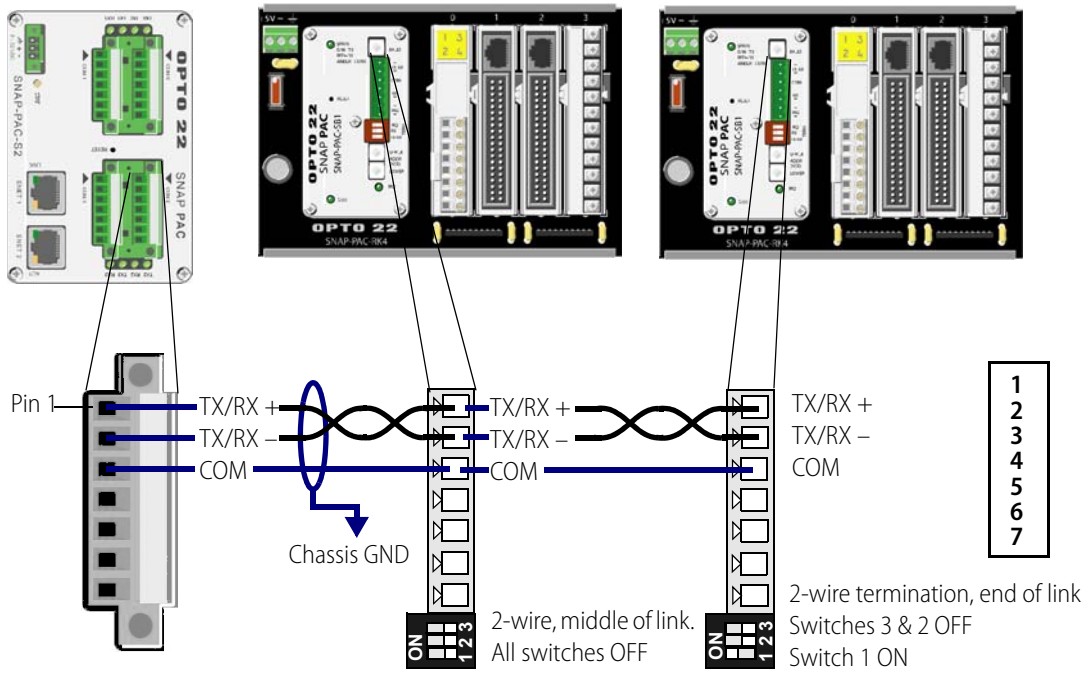
Wiring a SNAP PAC SB-Series Brain to any SNAP-PAC-S1 Controller

Two-wire

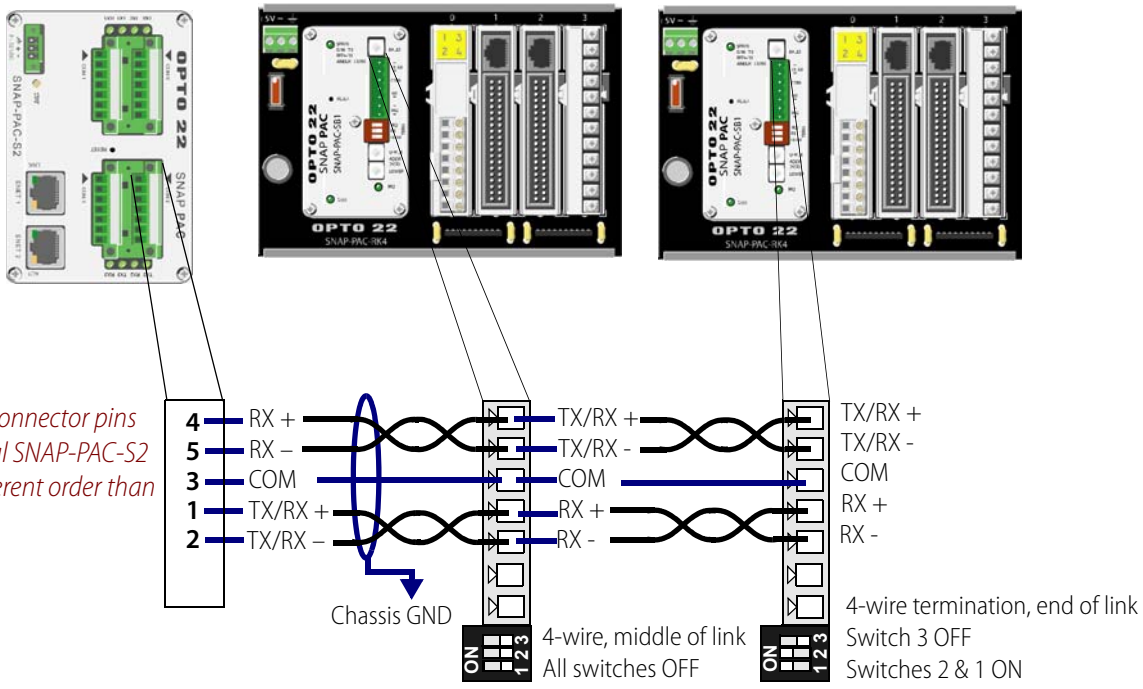


Wiring a SNAP PAC SB-Series Brain to any SNAP-PAC-S2 Controller

Two-wire



Four-wire



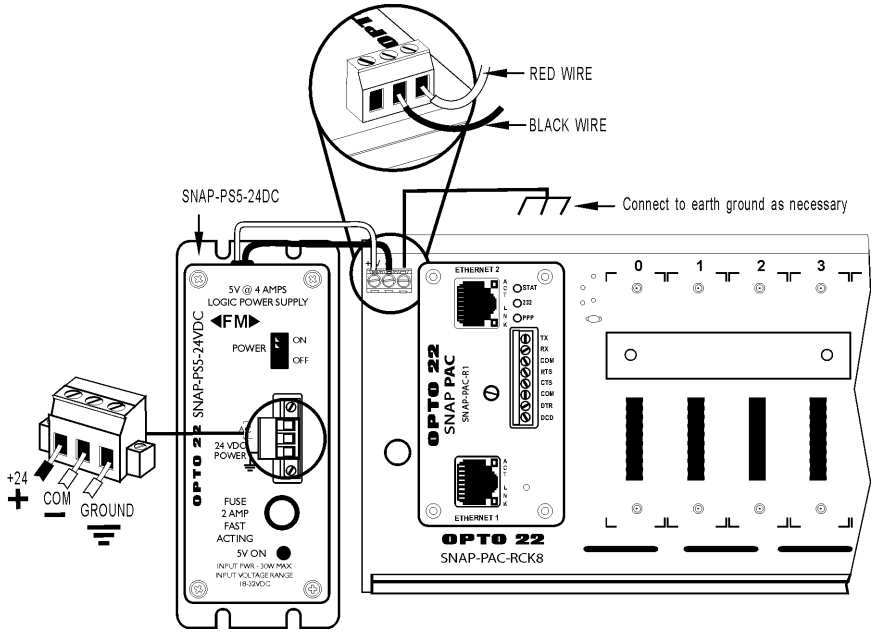
NOTE: The connector pins on an actual SNAP-PAC-S2 are in a different order than shown here.

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.

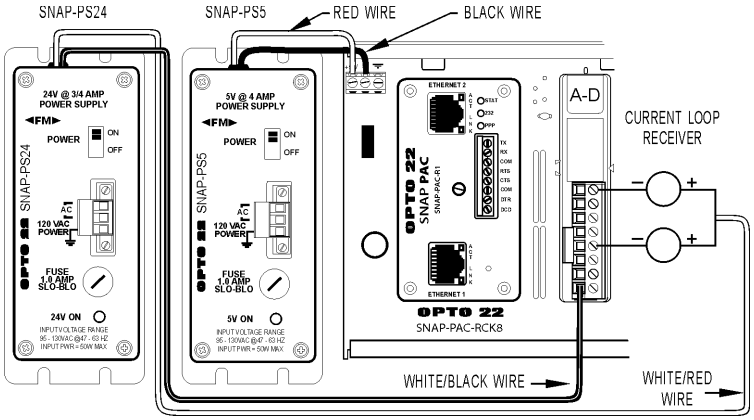
The white and red wire is the positive wire (24 VDC). The white and black wire is the negative wire (24 VDC return).

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.

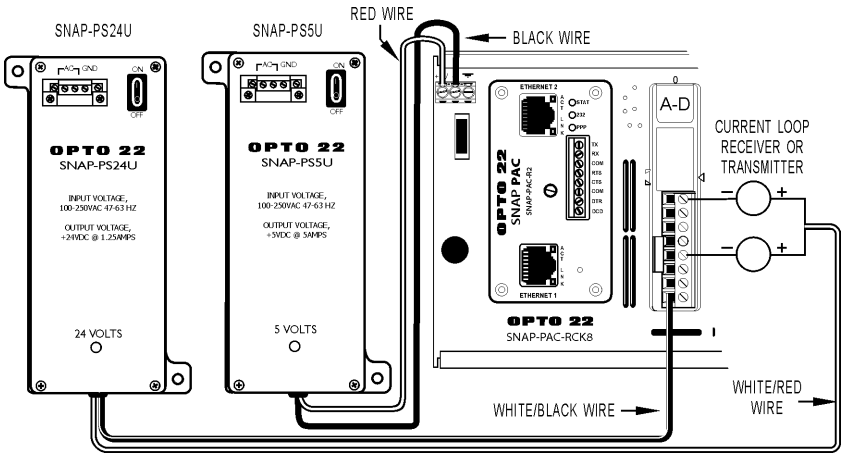
SNAP-PS24

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.



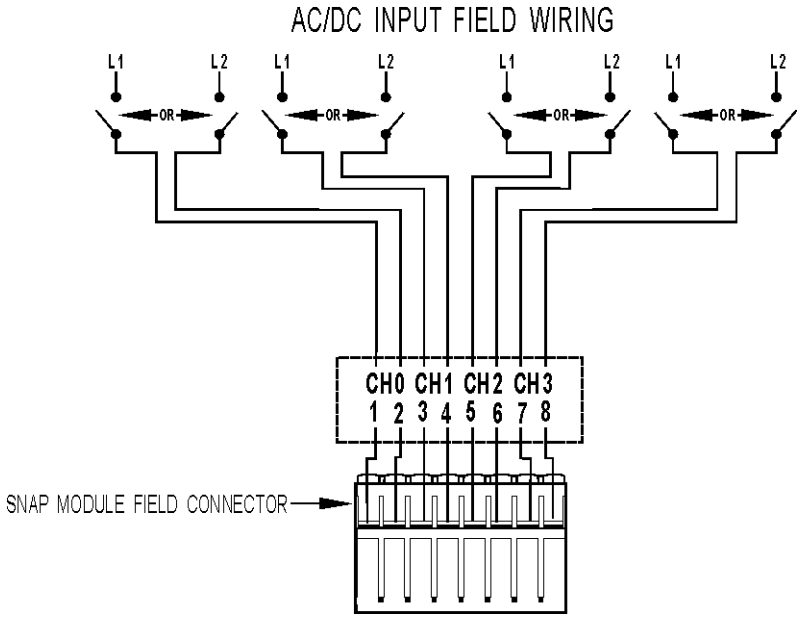
Wiring I/O Modules

See additional diagrams for wiring modules and field devices to SNAP TEX breakout boards in the *SNAP TEX Cables and Breakout Boards Data Sheet,* form 1756.

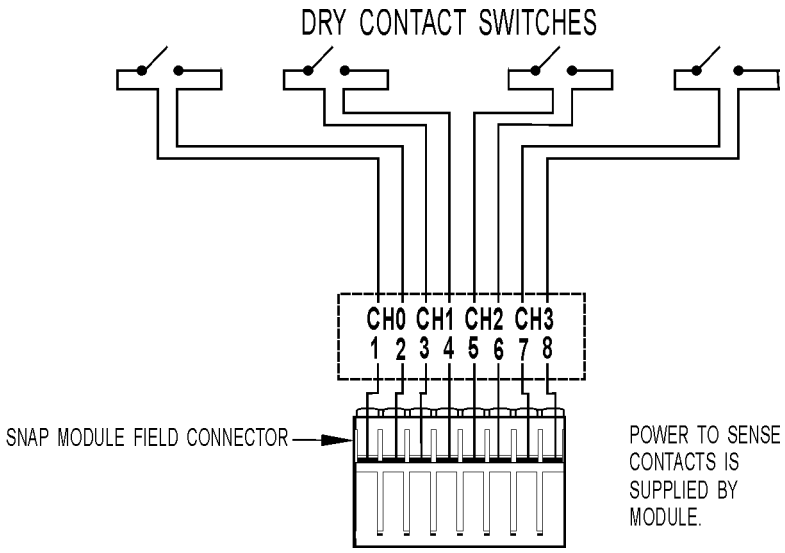
4-Channel Digital Input Modules

For high-density digital modules, see page 85.

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

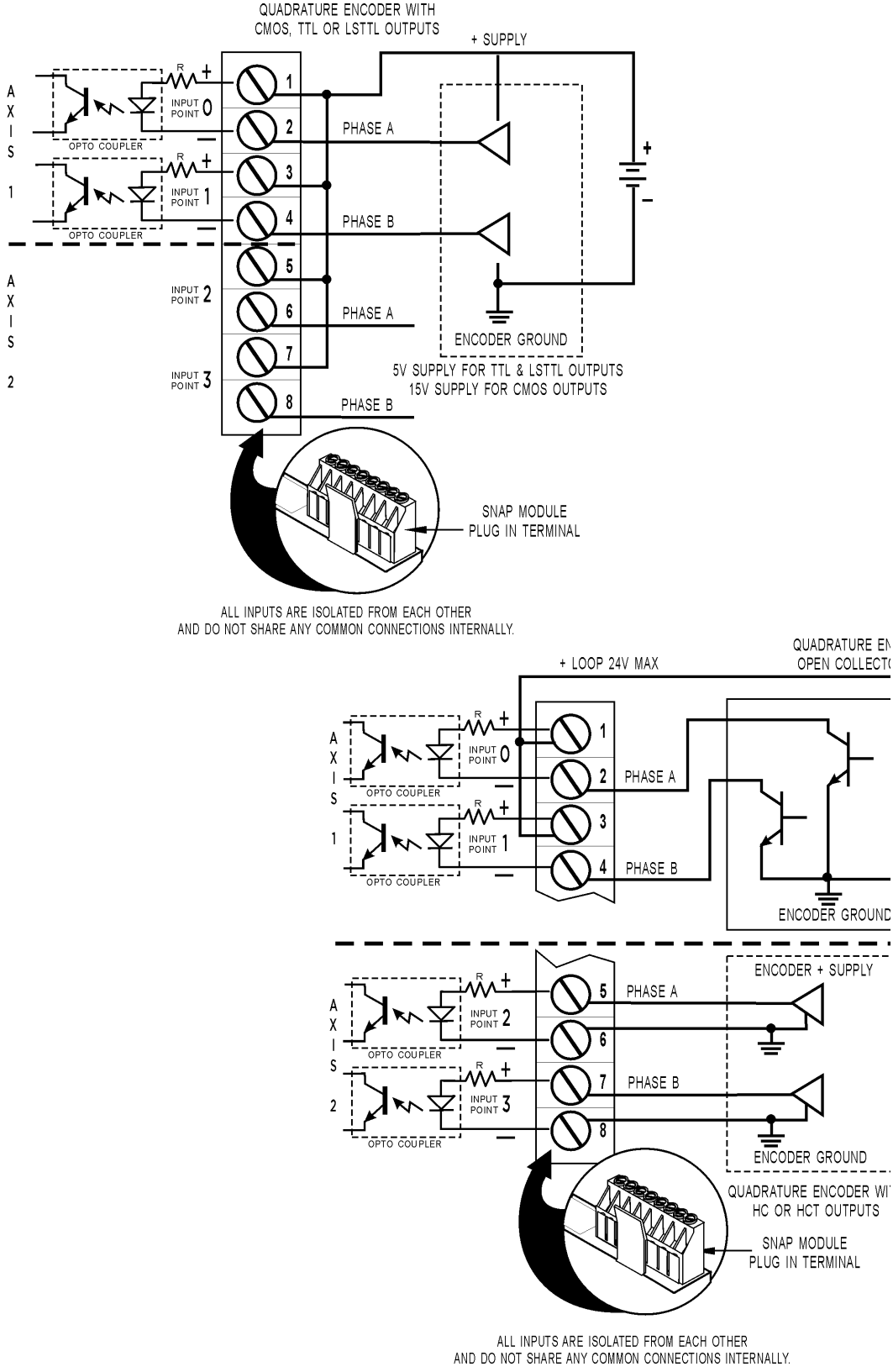


Wiring for SNAP-IDC5-SW and SNAP-IDC5-SW-NC digital input modules.



CAUTION: The SNAP-IDC5-SW and SNAP-IDC5-SW-NC inputs are not intended to be used with contacts that are connected to any external user-supplied voltage or currents.

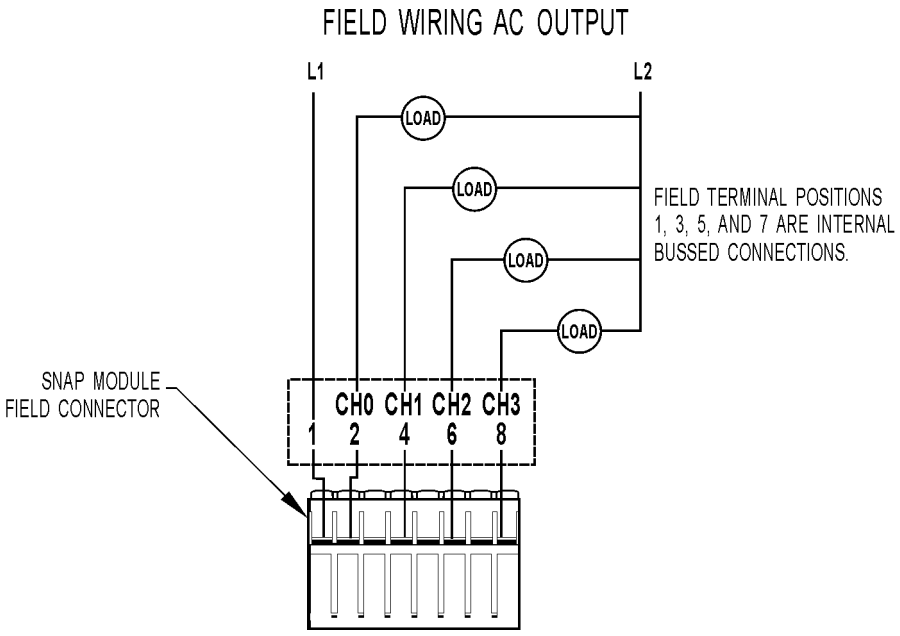
Wiring for SNAP-IDC5Q quadrature input module.



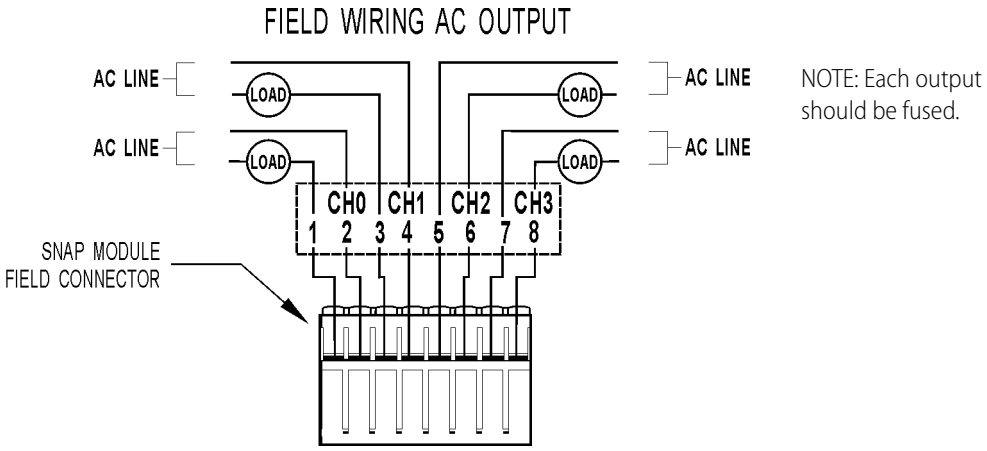
4-Channel Digital Output Modules

For high-density digital modules, see page 85.

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

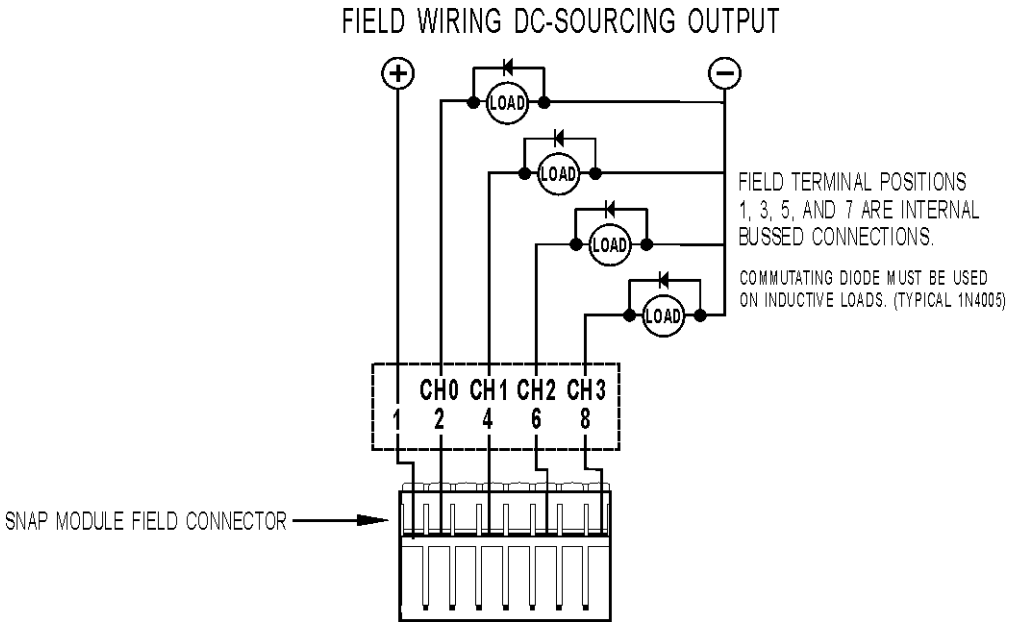


Wiring for SNAP-OAC5MA, SNAP-OAC5-i, and SNAP-OAC5-iFM digital AC output modules.

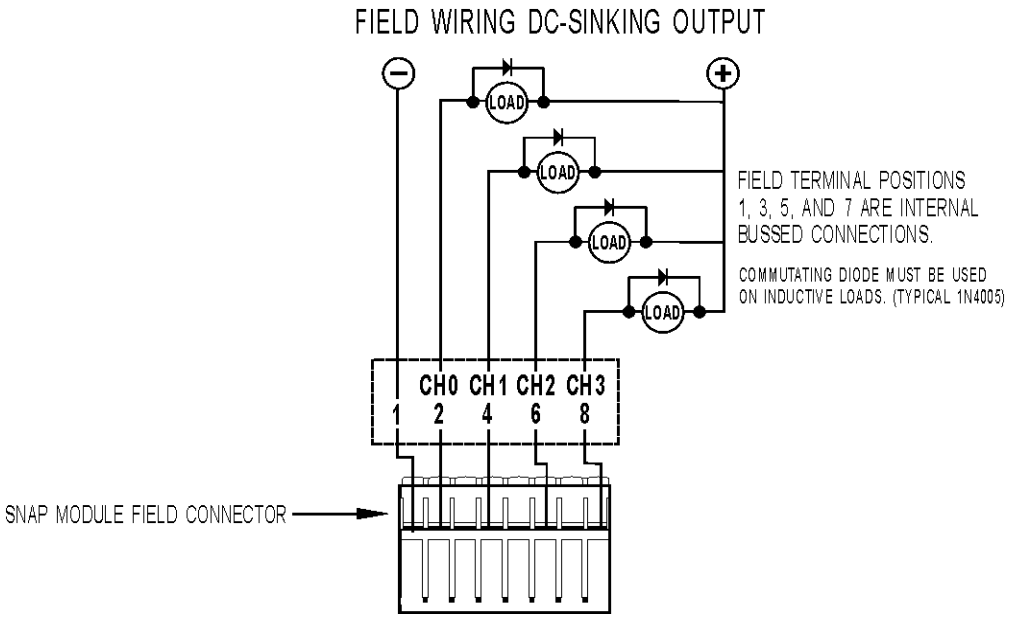


NOTE: Each output should be fused.

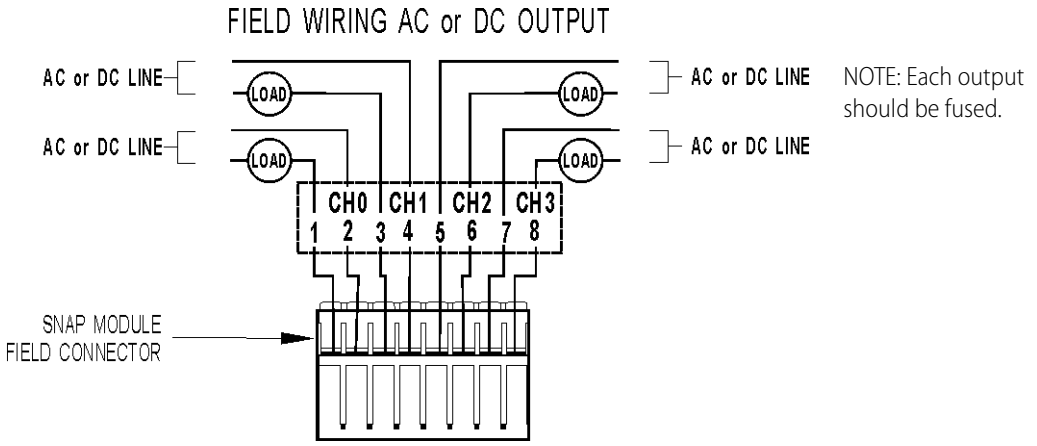
Wiring for SNAP-ODC5SRC and SNAP-ODC5SRCFM digital DC output modules.



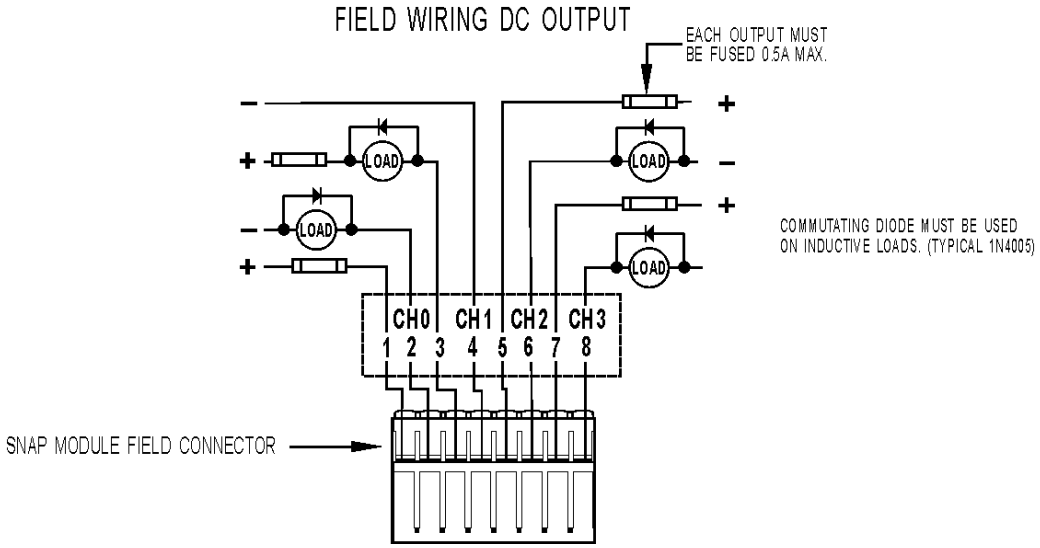
Wiring for SNAP-ODC5SNK, SNAP-ODC5ASNK, and SNAP-ODC5SNKFM digital DC output modules.



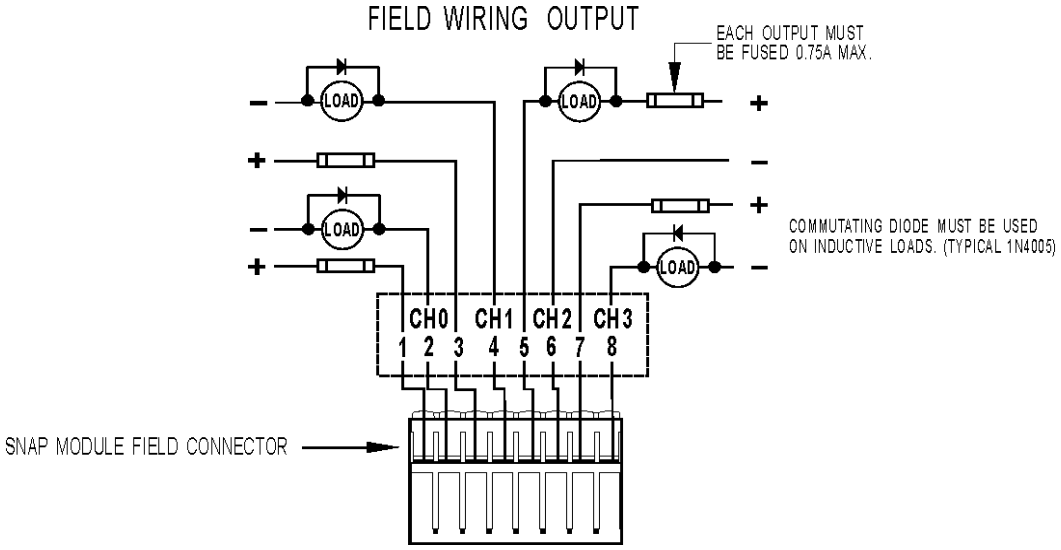
Wiring for SNAP-ODC5R, SNAP-ODC5R5, SNAP-ODC5RFM, and SNAP-ODC5R5FM dry contact output modules.



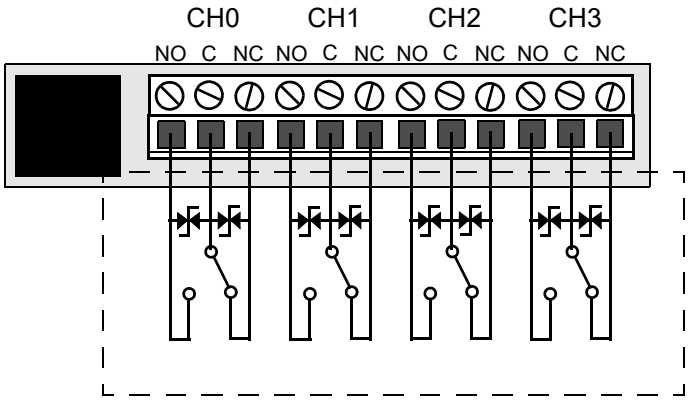
Wiring for SNAP-ODC5MA digital DC output module with manual/auto switches.



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



Wiring for SNAP-OMR6T-C mechanical power relay output modules.

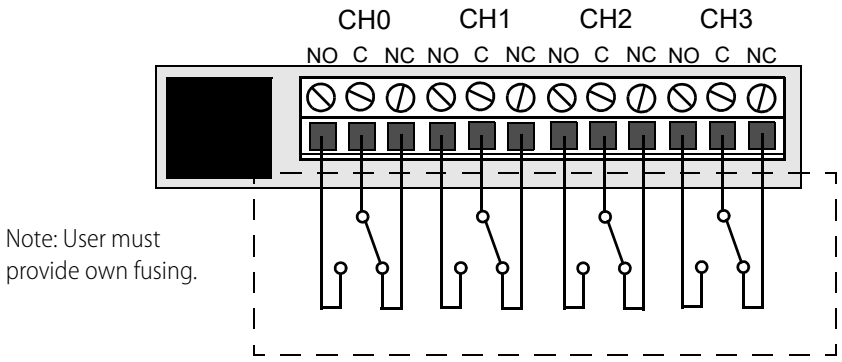


Note: User must provide own fusing.

NOTE: External transient protection is recommended for highly inductive loads.

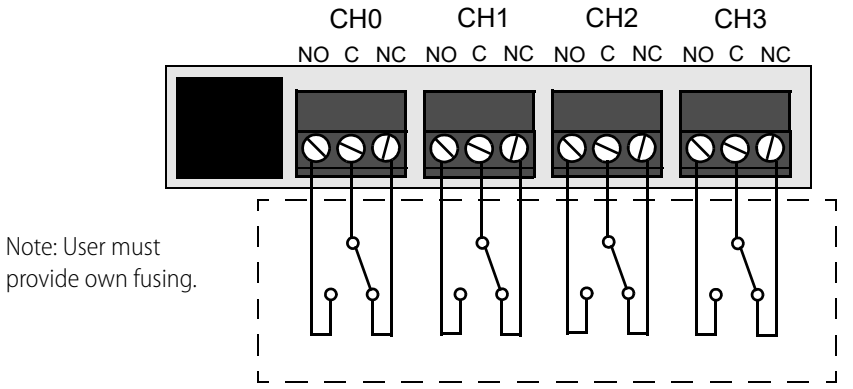
Wiring for SNAP-OMR6-C mechanical power relay output modules.

SNAP-OMR6-C Field Connections: Newer Terminal (gray)



NOTE: Transient protection is recommended for inductive loads.
NOTE: For DC loads, install a reverse-biased diode, such as an 1N4005 (or equivalent) at the load.

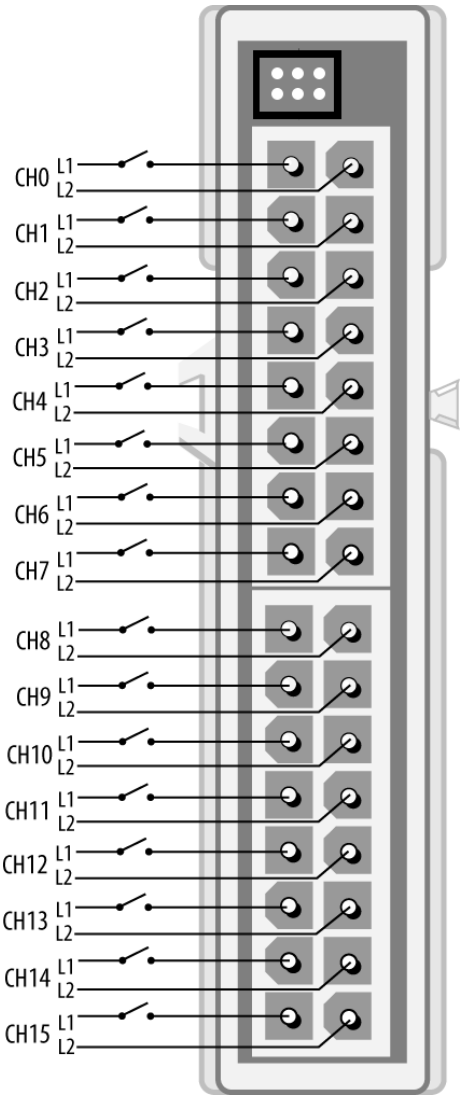
SNAP-OMR6-C Field Connections: Older Terminals (black)



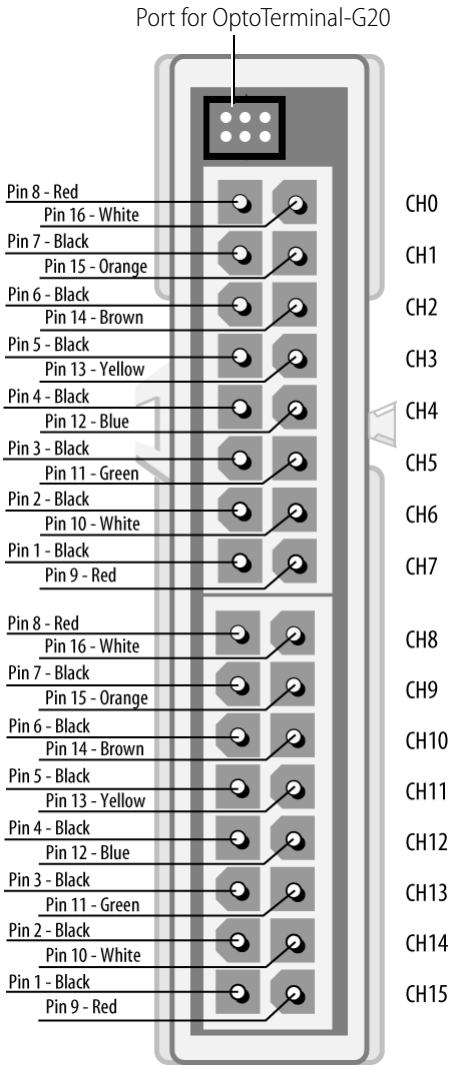
NOTE: Transient protection is recommended for inductive loads.
NOTE: For DC loads, install a reverse-biased diode, such as an 1N4005 (or equivalent) at the load.

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.

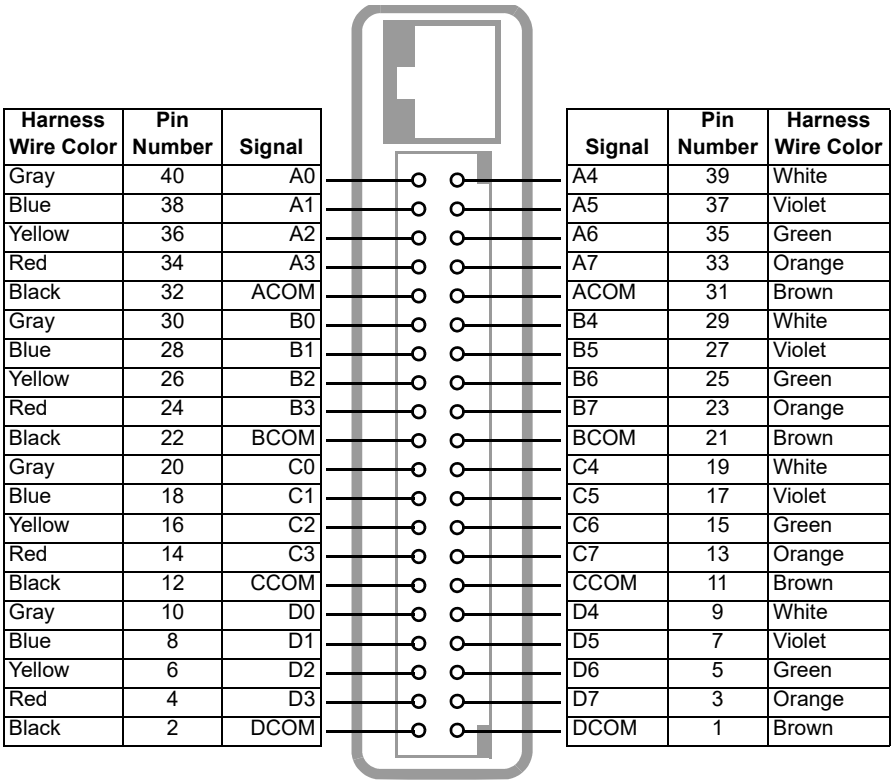


NOTES: The small four-pin connector on the top of the 16-point module connects to the optional OptoTerminal-G20 using a special adapter cable, included with the OptoTerminal.

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.



Harness Wire Color	Pin Number	Signal	Signal	Pin Number	Harness Wire Color
Gray	40	A0	A4	39	White
Blue	38	A1	A5	37	Violet
Yellow	36	A2	A6	35	Green
Red	34	A3	A7	33	Orange
Black	32	ACOM	ACOM	31	Brown
Gray	30	B0	B4	29	White
Blue	28	B1	B5	27	Violet
Yellow	26	B2	B6	25	Green
Red	24	B3	B7	23	Orange
Black	22	BCOM	BCOM	21	Brown
Gray	20	C0	C4	19	White
Blue	18	C1	C5	17	Violet
Yellow	16	C2	C6	15	Green
Red	14	C3	C7	13	Orange
Black	12	CCOM	CCOM	11	Brown
Gray	10	D0	D4	9	White
Blue	8	D1	D5	7	Violet
Yellow	6	D2	D6	5	Green
Red	4	D3	D7	3	Orange
Black	2	DCOM	DCOM	1	Brown

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		
Wires		Ch
A0	Gray	0
A1	Blue	1
A2	Yellow	2
A3	Red	3
A4	White	4
A5	Violet	5
A6	Green	6
A7	Orange	7

Set B		
Wires		Point
B0	Gray	8
B1	Blue	9
B2	Yellow	10
B3	Red	11
B4	White	12
B5	Violet	13
B6	Green	14
B7	Orange	15

Set C		
Wires		Point
C0	Gray	16
C1	Blue	17
C2	Yellow	18
C3	Red	19
C4	White	20
C5	Violet	21
C6	Green	22
C7	Orange	23

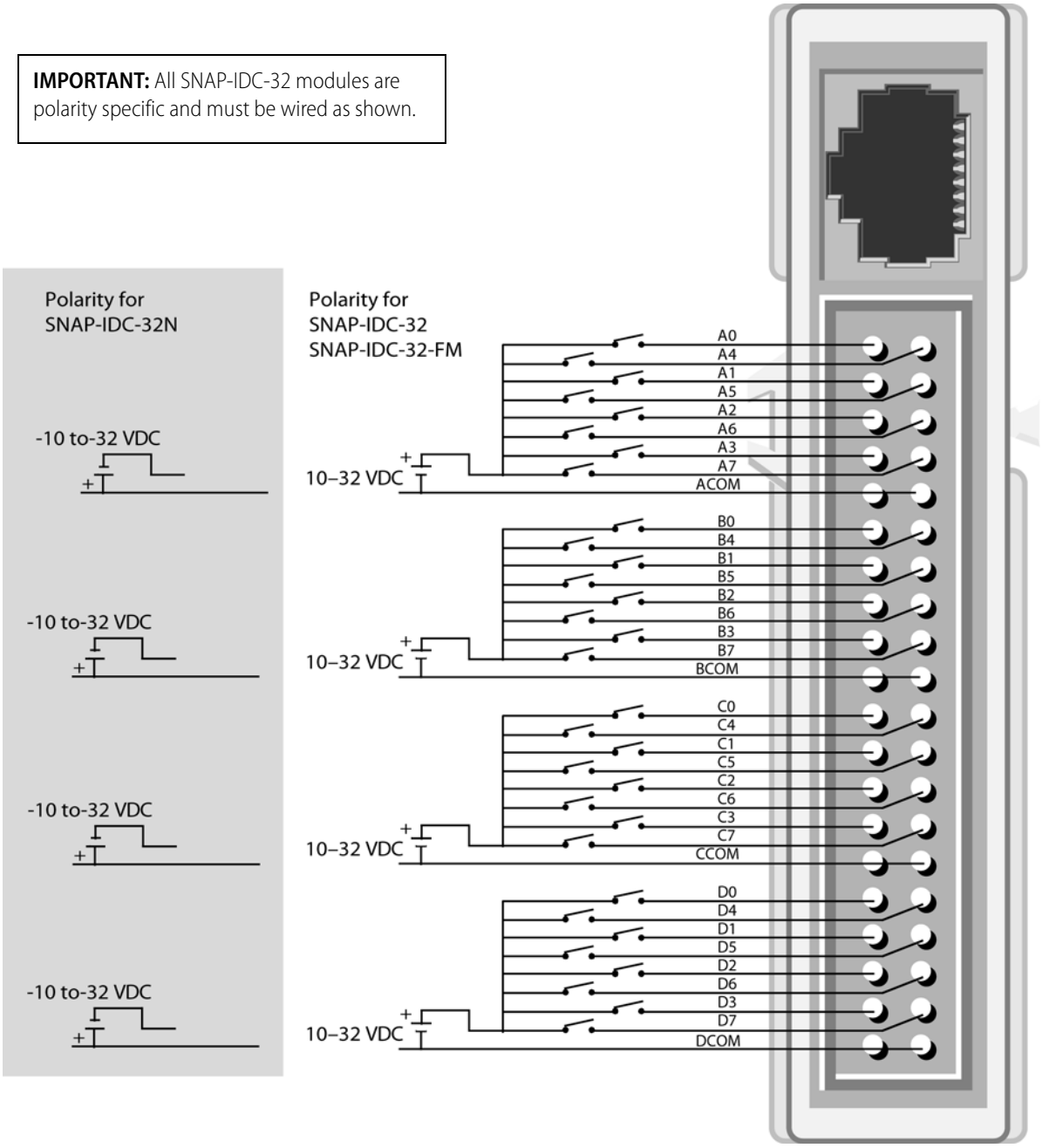
Set D		
Wires		Ch
D0	Gray	24
D1	Blue	25
D2	Yellow	26
D3	Red	27
D4	White	28
D5	Violet	29
D6	Green	30
D7	Orange	31

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

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

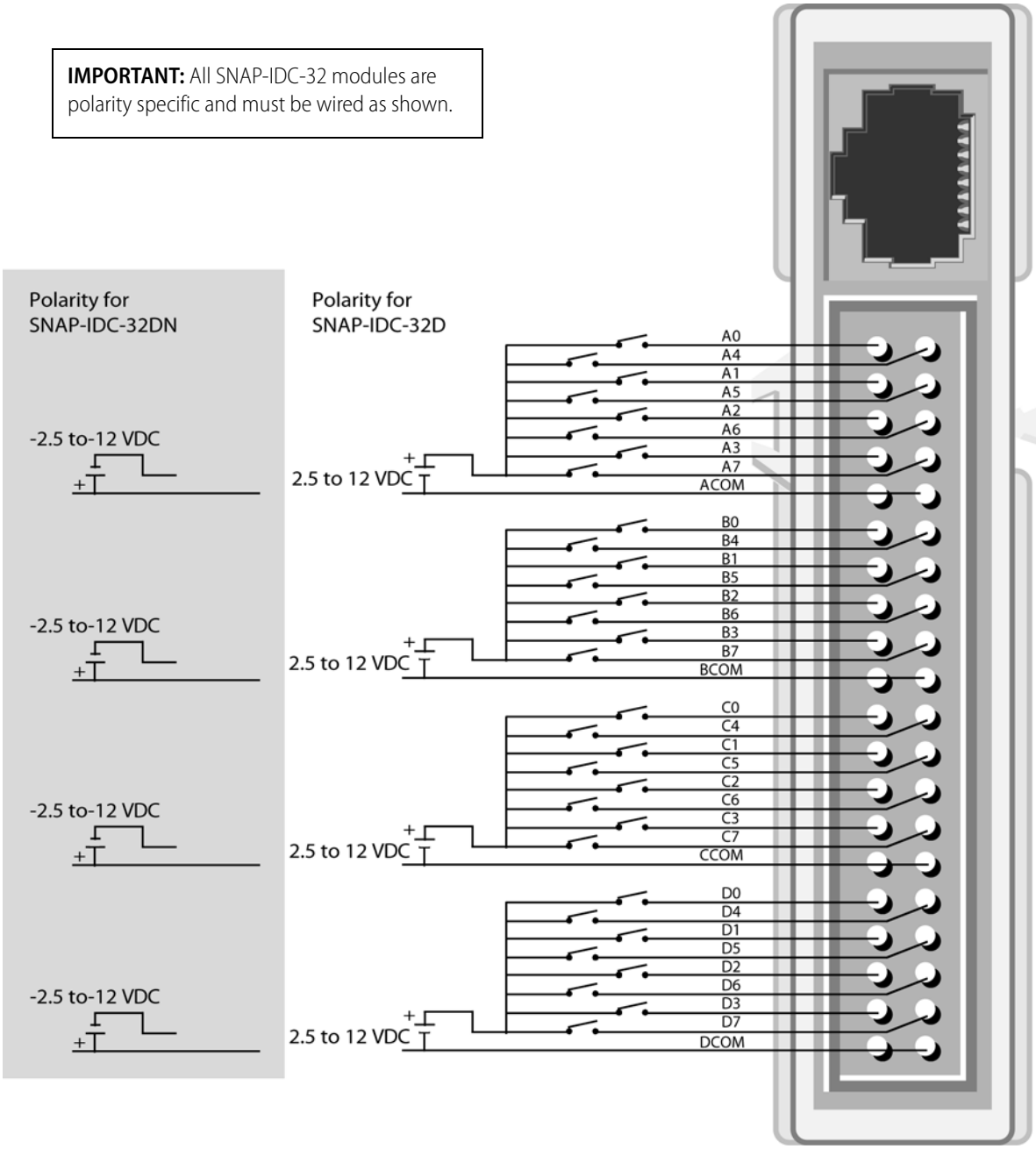
Also see wiring for connector on page 87.

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



Wiring for SNAP-IDC-32D and SNAP-IDC-32DN high-density digital inputs .
Also see wiring for connector on page 87.

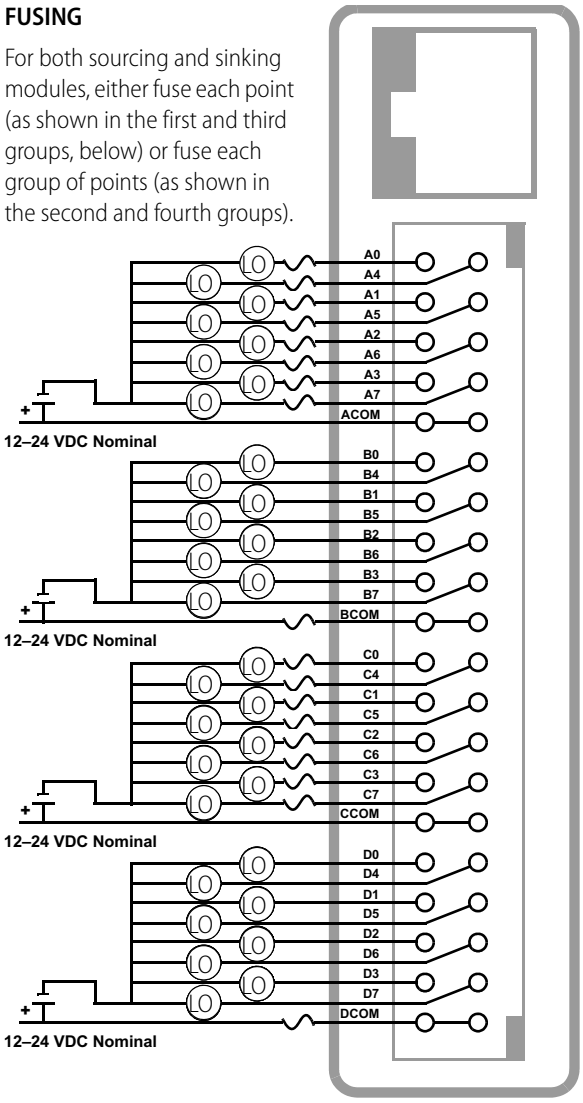
IMPORTANT: All SNAP-IDC-32 modules are polarity specific and must be wired as shown.



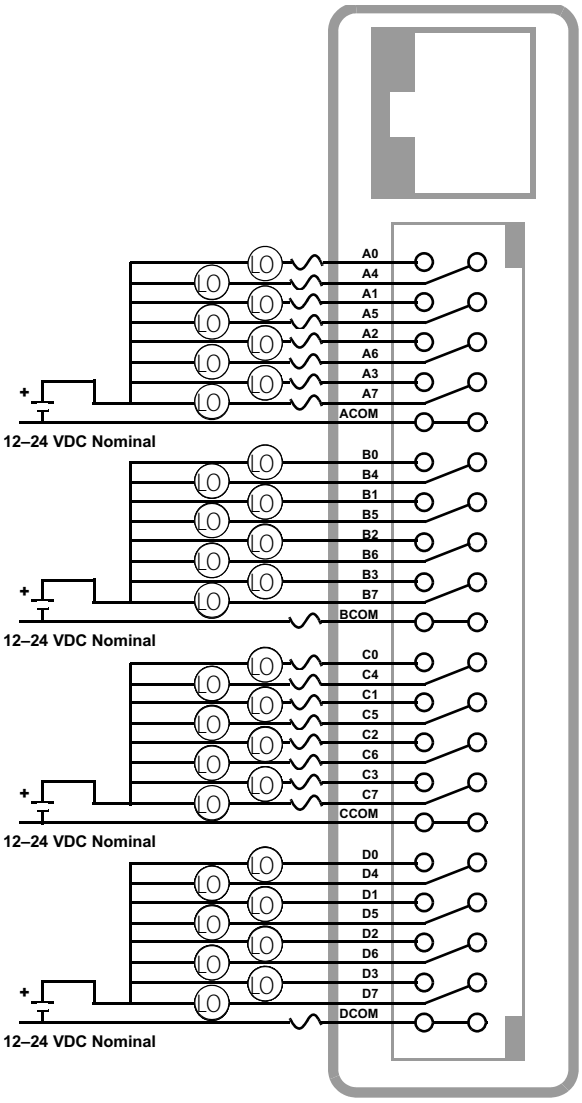
Wiring for SNAP-ODC-32-SNK and SNAP-ODC-32-SRC high-density digital outputs .
Also applies to SNAP-ODC-32-SNK-FM and SNAP-ODC-32-SRC-FM.
Also see wiring for connector on page 87.

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)

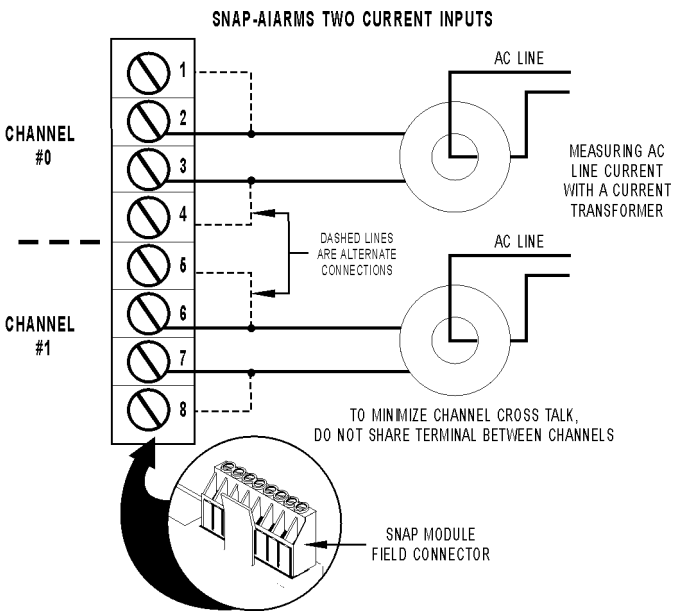


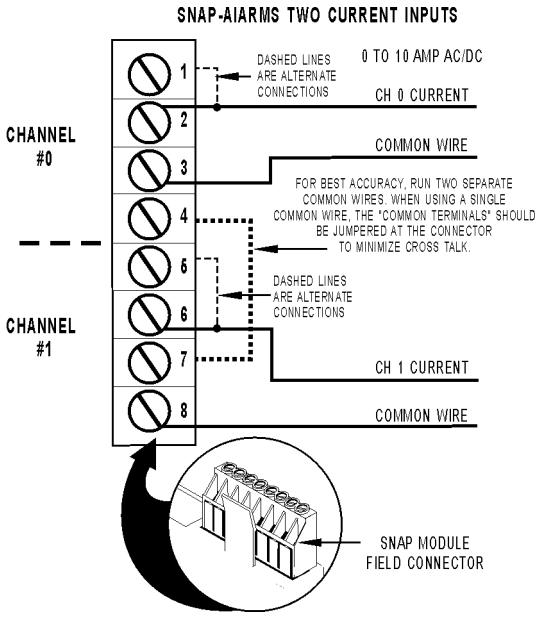
SNAP-ODC-32-SNK
Load Sinking Module
(Top view of module)

Analog Input Modules

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

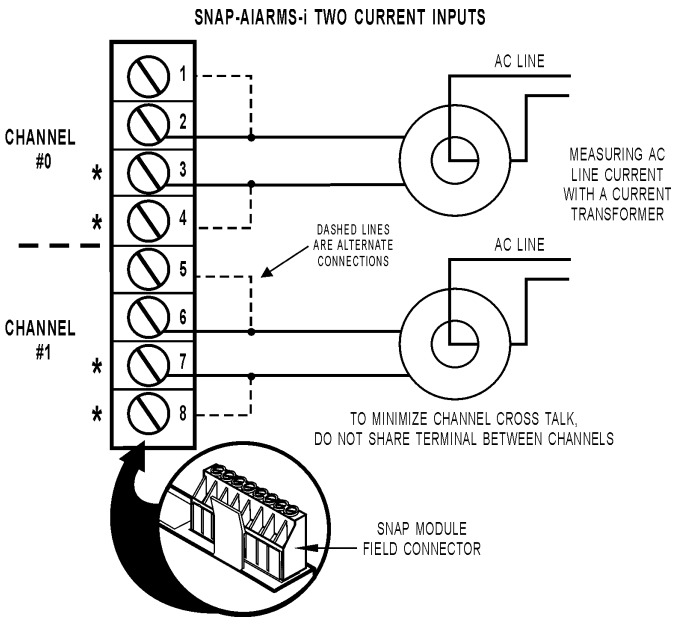
Two possible wiring diagrams are shown.
Terminals 3, 4, 7, and 8 share a common connection inside the module. **Make sure you observe polarity** when connecting the second channel. To avoid a potentially hazardous short, double-check wiring before turning on the current to be monitored.

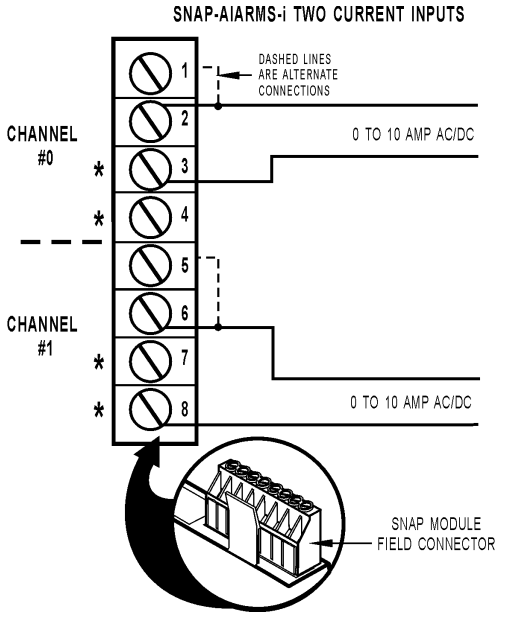




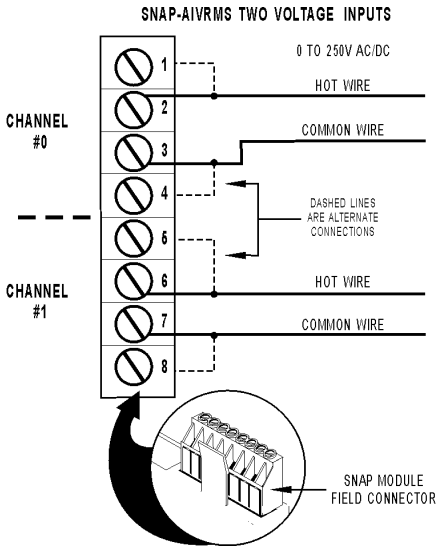
Wiring for SNAP-AIARMS-i and SNAP-AIARMS-i-FM isolated analog amps RMS AC/DC inputs.

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



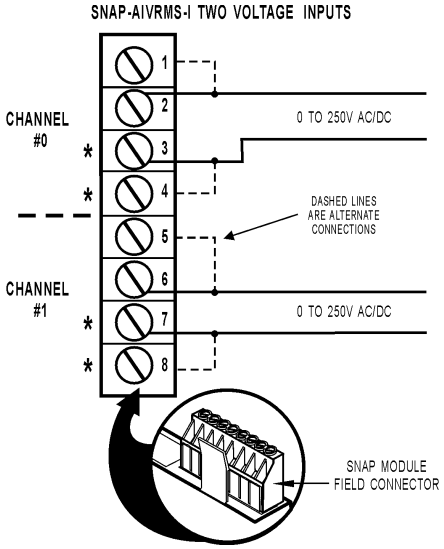


Wiring for SNAP-AIVRMS analog volts RMS AC/DC input.



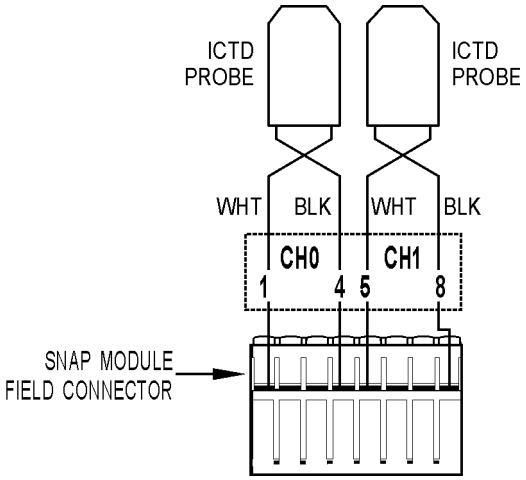
Terminals 3, 4, 7, and 8 share a common connection inside the module. **Make sure you observe polarity** when connecting the second channel. To avoid a potentially hazardous short, double-check wiring before turning on the voltage to be monitored.

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

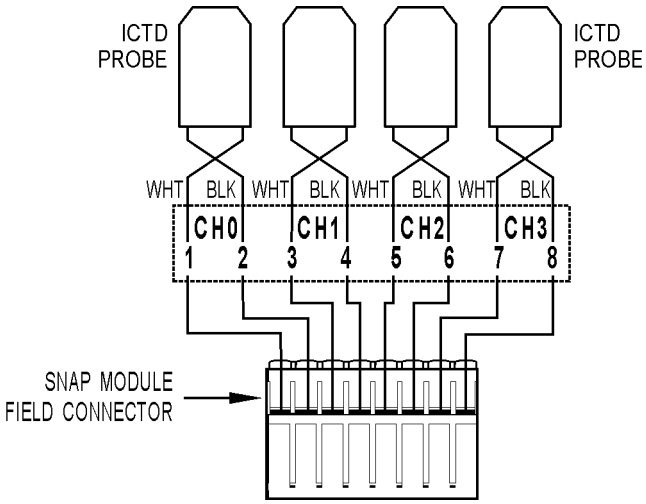


The two points on these modules are isolated from each other.

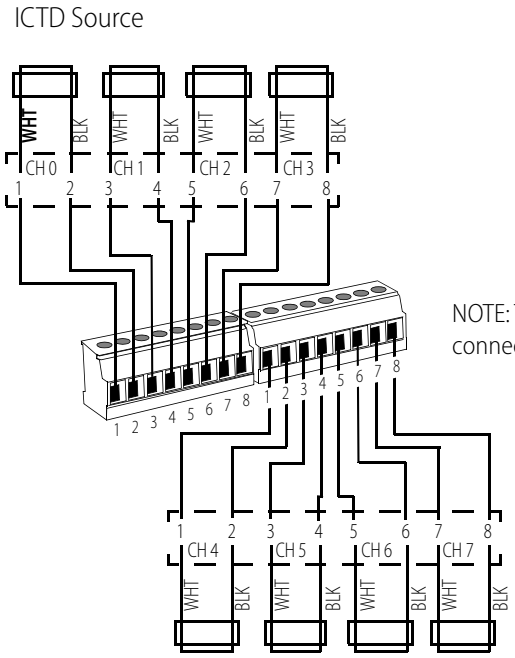
Wiring for SNAP-AICTD two-channel analog temperature input.



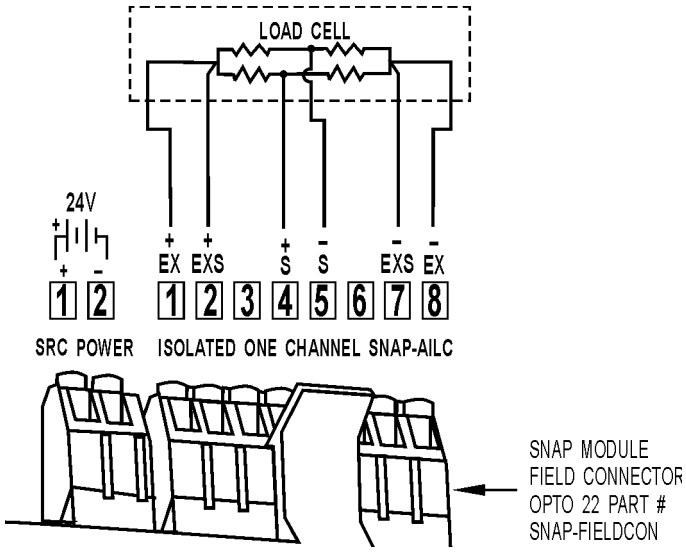
Wiring for SNAP-AICTD-4 four-channel analog temperature input.



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

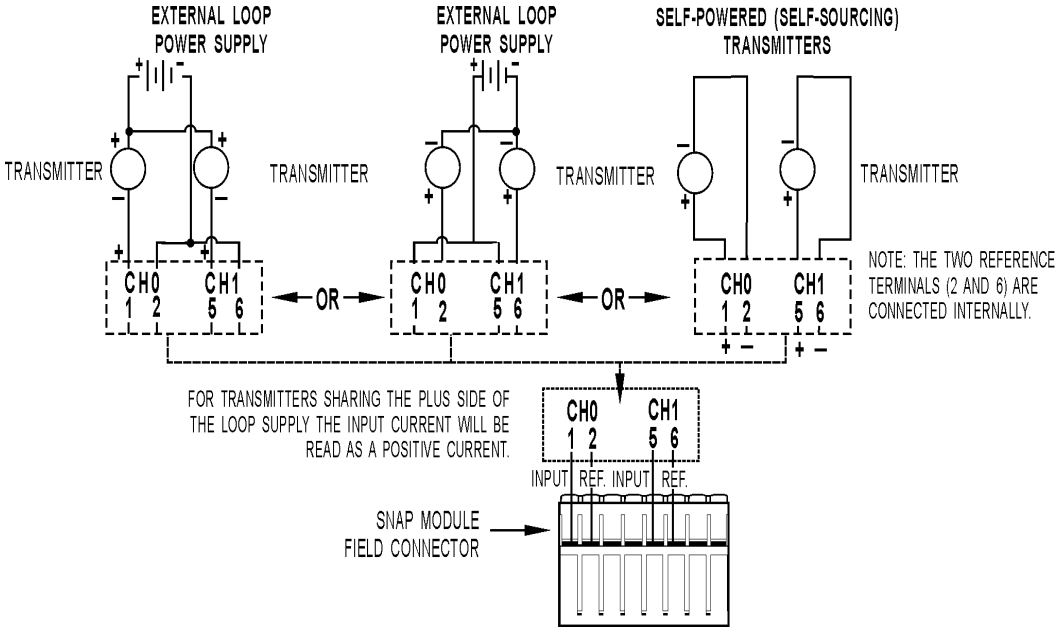


Wiring for SNAP-AILC and SNAP-AILC-2 load cell inputs.



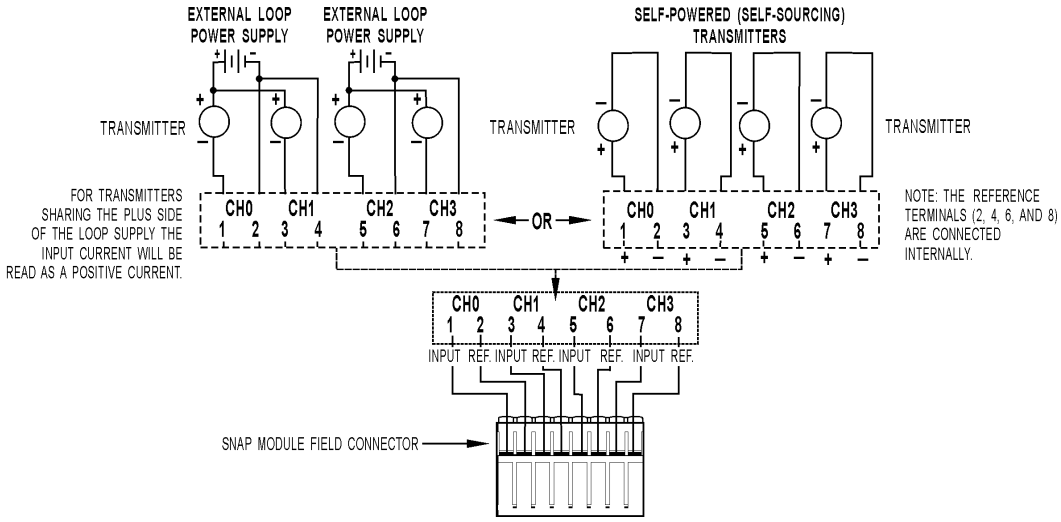
Wiring for SNAP-AIMA two-channel analog current input.

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.



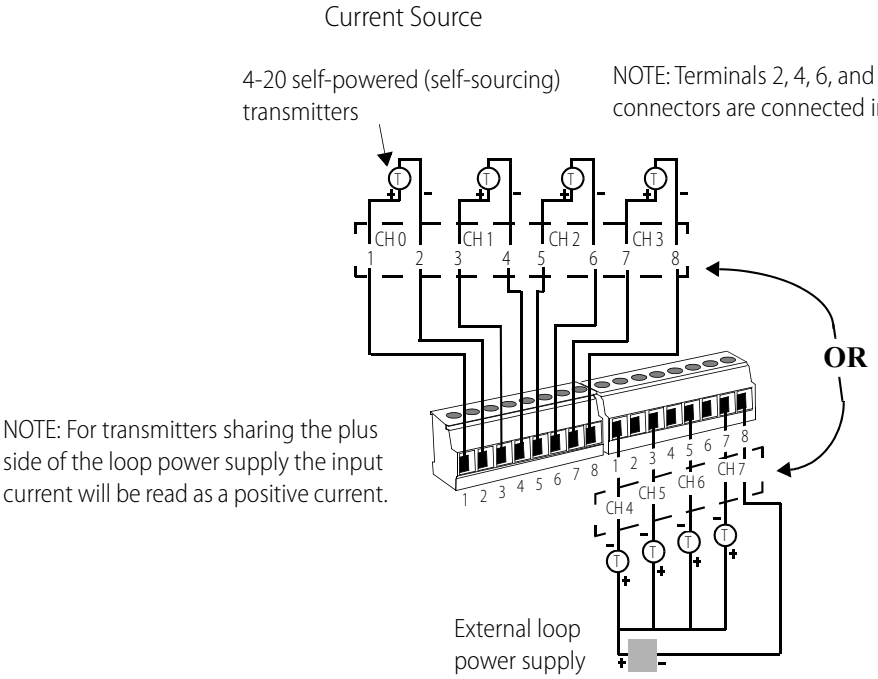
Wiring for SNAP-AIMA-4 four-channel analog current input.

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.



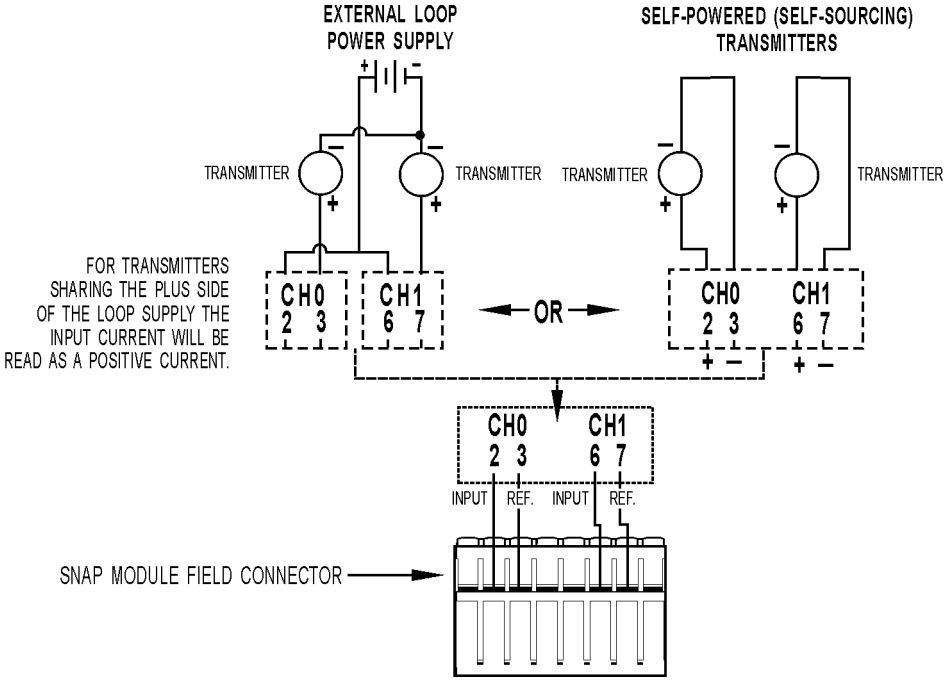
Wiring for SNAP-AIMA-8 eight-channel analog current input.

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.



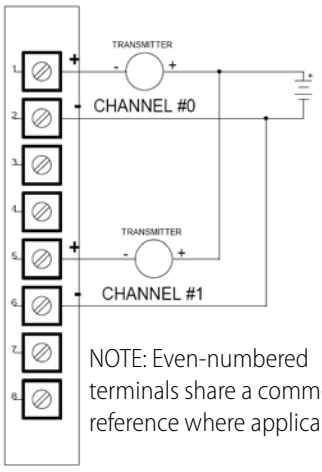
Wiring for SNAP-AIMA-i and SNAP-AIMA2-i isolated two-channel analog current inputs.

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



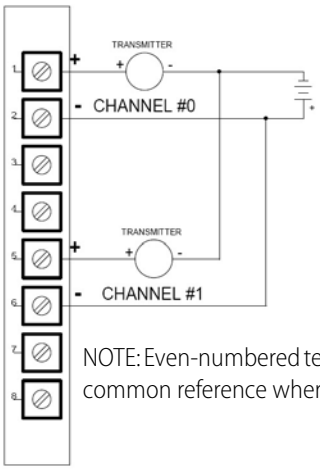
SNAP-AIMA Wiring: Positive Common vs. Negative Common Connections.

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



NOTE: Even-numbered terminals share a common reference where applicable.

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



NOTE: Even-numbered terminals share a common reference where applicable.

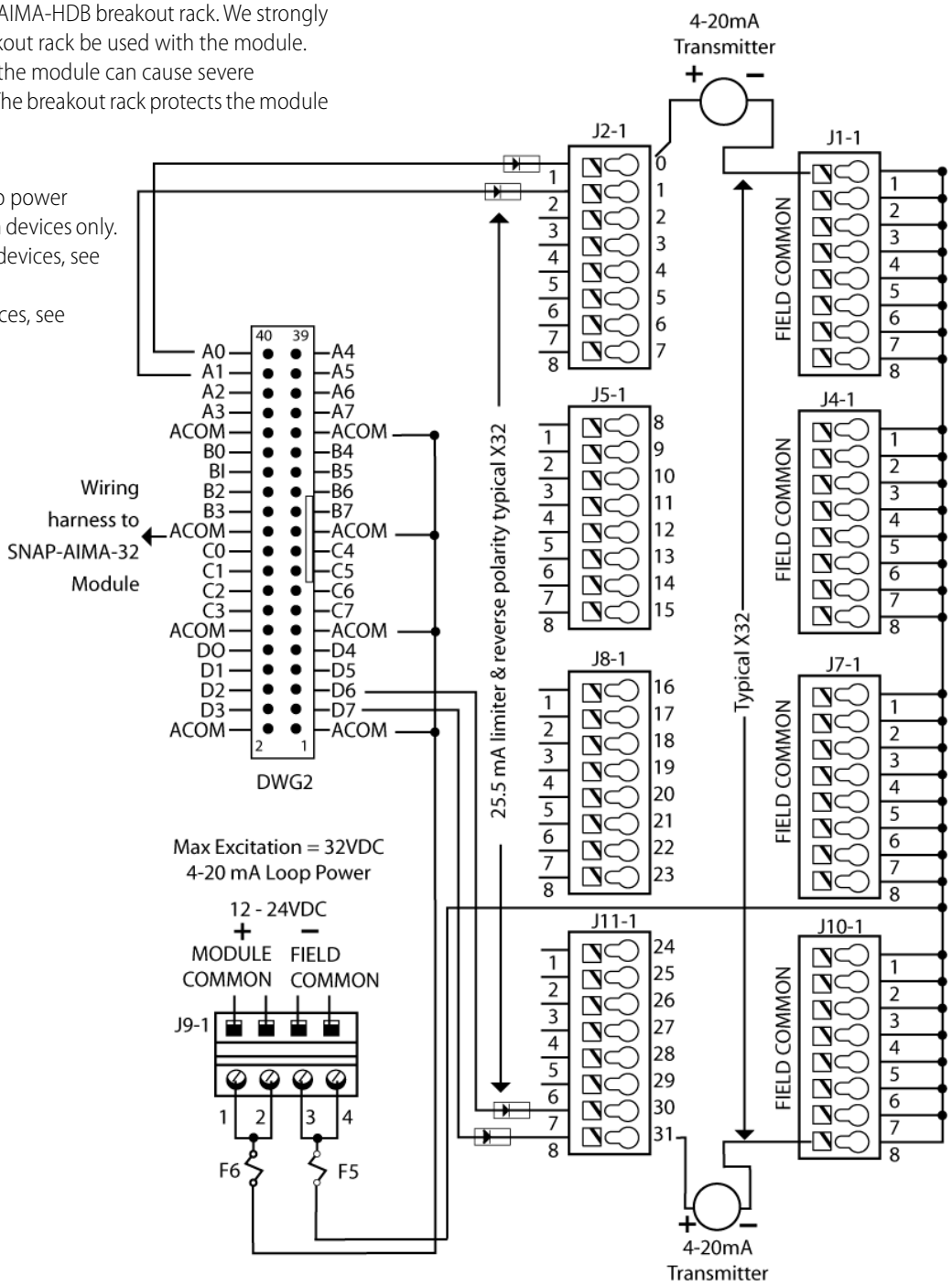
SNAP-AIMA
For transmitters sharing the minus side of the loop supply. Note that input current will be read as a negative current.

Wiring for SNAP-AIMA-32 and SNAP-AIMA-32-FM thirty-two-channel analog current input.

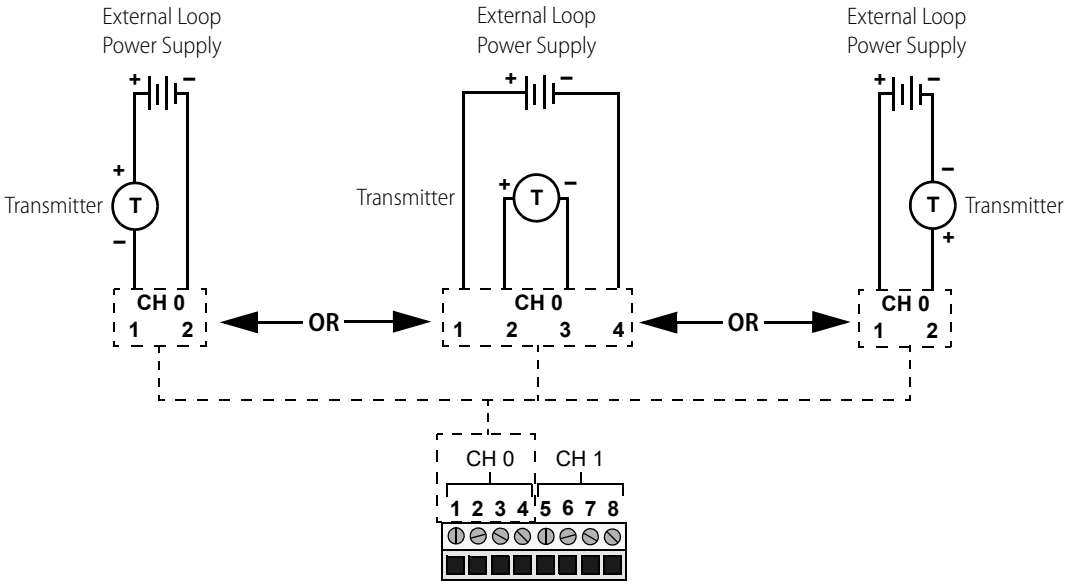
This module does NOT supply loop excitation current.
Since all inputs share a common reference, the module must be installed at the beginning or end of a typical 4–20 mA loop. If you are using both standard and self-sourcing transmitters, either put the transmitters on different modules or use different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

Use this diagram with loop power (2-wire) negative common devices only.
For self-powered (4-wire) devices, see page 110.
For positive common devices, see page 111.

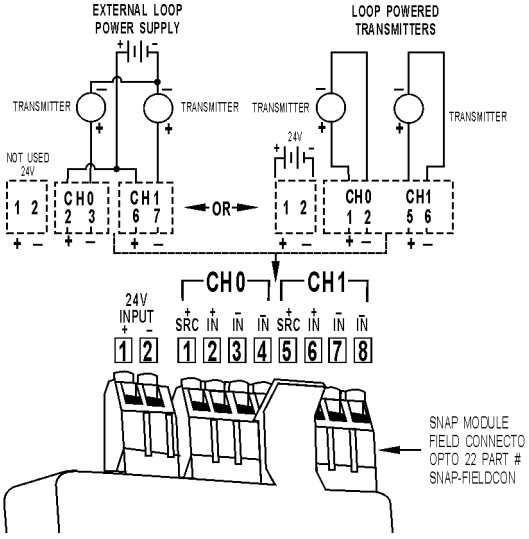
NOTE: if you are using the module with loop power (2-wire) devices, connect to the SNAP-AIMA-HDB or SNAP-AIMA-HDB-FM rack. If you are using the module with self-powered devices (4-wire) or with devices that share a common positive connection, do not use the SNAP-AIMA-HDB (or -FM) boards, which have a current limiting diode. Instead, wire to the SNAP-AIV-HDB (page 110 or page 111).



Wiring for SNAP-AIMA-iH isolated two-channel analog current input, HART protocol.

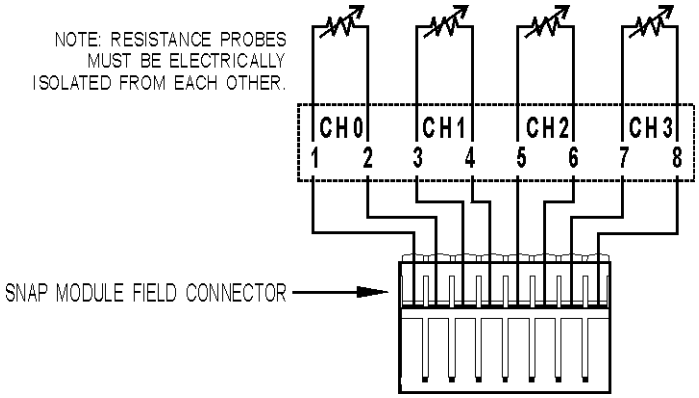


Wiring for SNAP-AIMA-iSRC and SNAP-AIMA-iSRC-FM isolated two-channel analog current inputs.

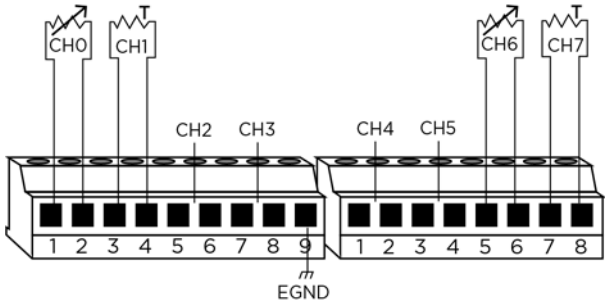


The two channels are isolated from each other. This module DOES supply loop excitation current.

Wiring for SNAP-AIR40K-4 analog thermistor input.



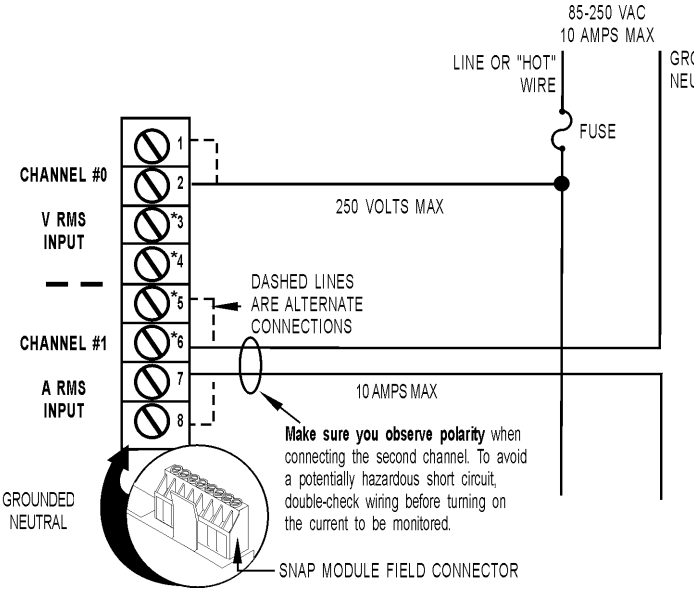
Wiring for SNAP-AIR400K-8 analog thermistor input.



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.

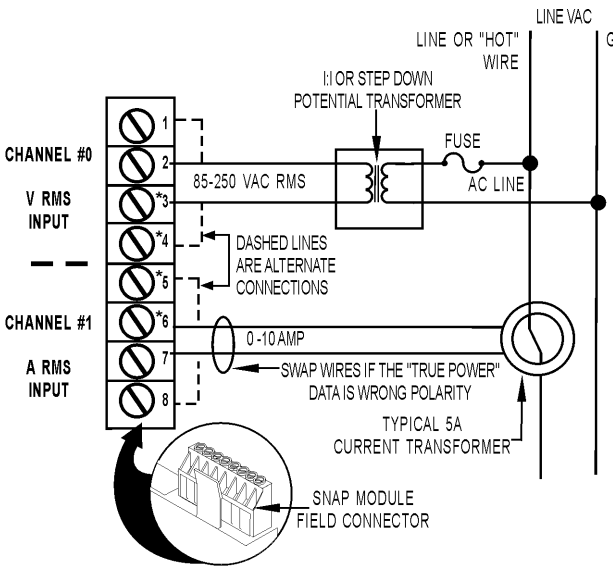
CAUTION: These terminals share a common connection inside the module. **Make sure you observe polarity** when connecting the second channel. To avoid a potentially hazardous short, double-check wiring before turning on the current to be monitored.

Standard Wiring Diagram



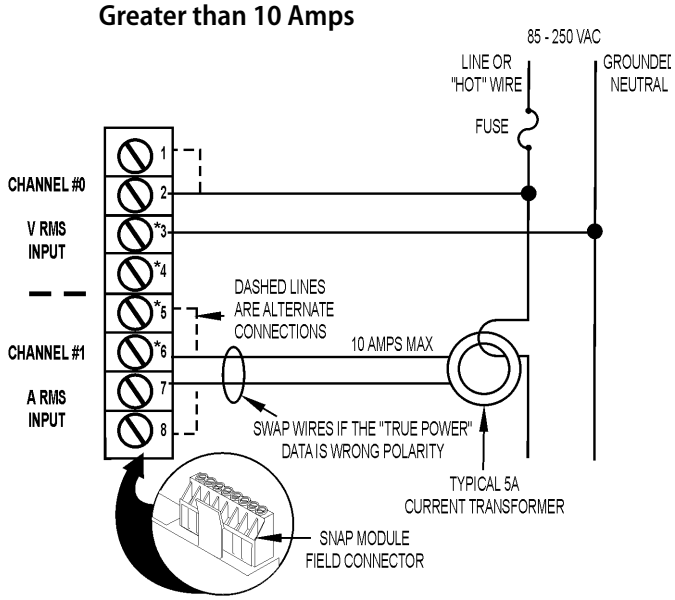
* Pin 3, 4, 5, and 6 are internally connected.

Measuring AC Line Current with a Current Transformer



* Pin 3, 4, 5, and 6 are internally connected.

Measuring AC Line Current Greater than 10 Amps



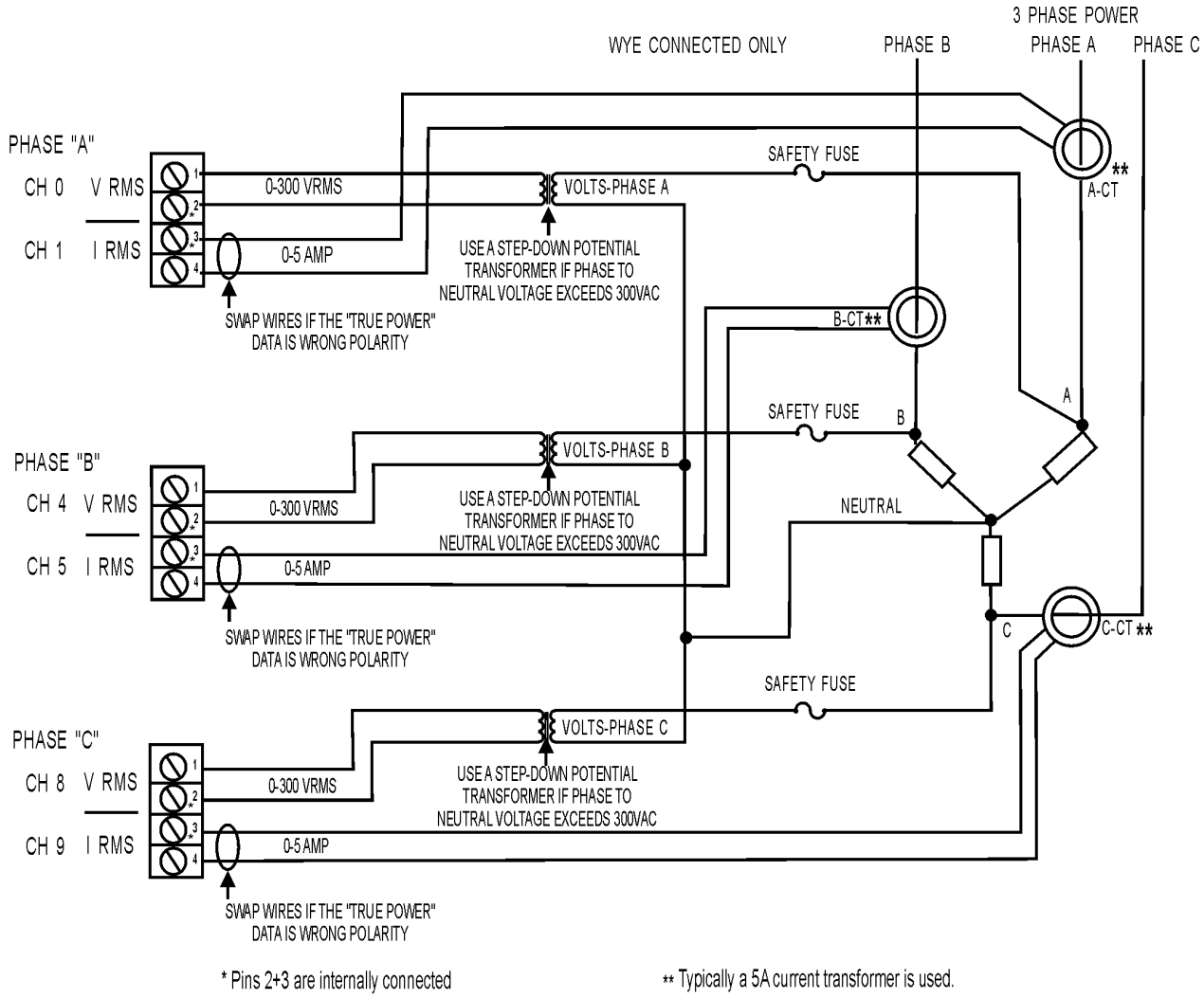
Wiring for SNAP-AIPM-3 analog 3-phase power monitoring input.

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.



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

• Individual phase to neutral voltage • Individual phase and load current • Individual phase power • Individual phase volt-amps	• 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

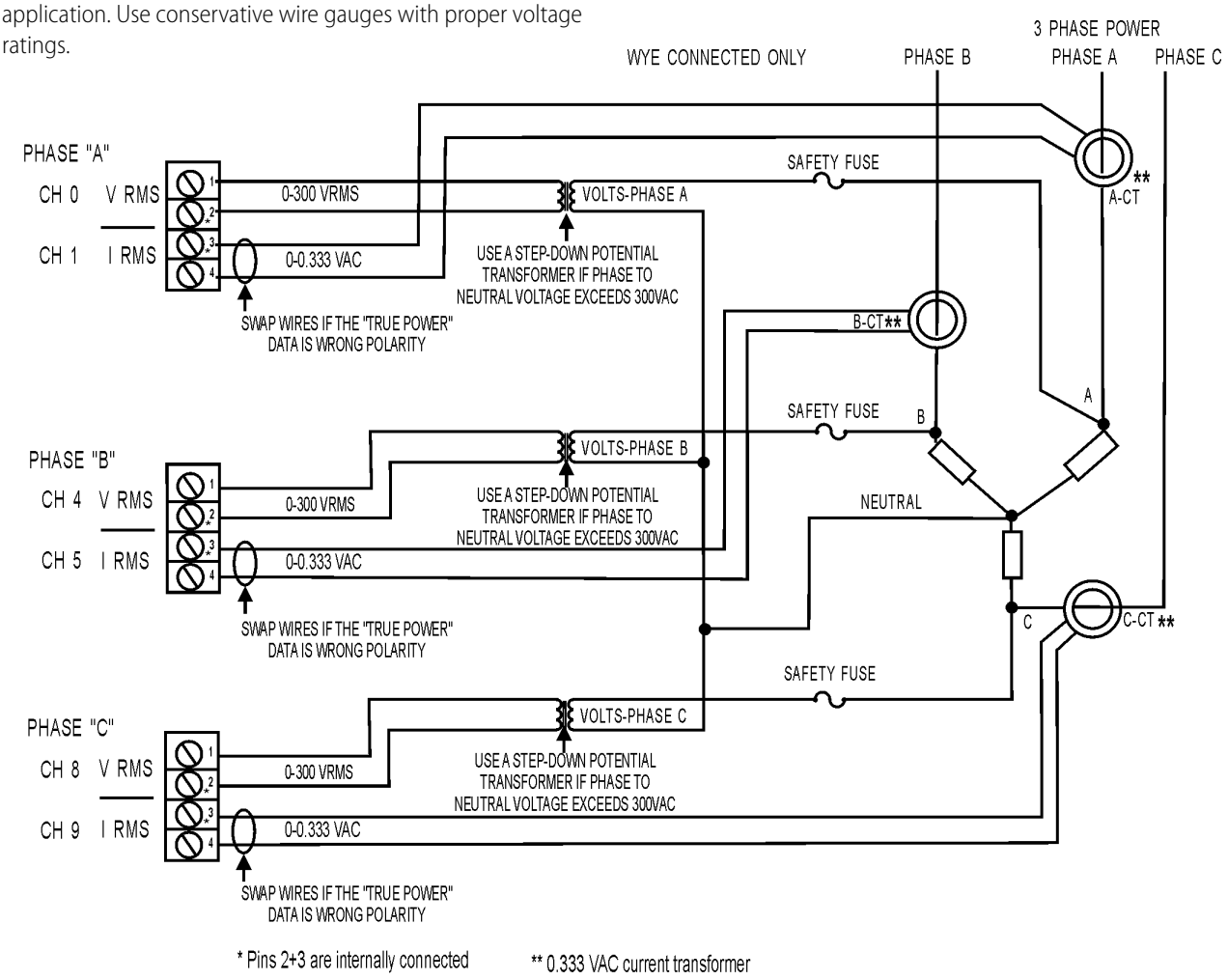
Voltage and current transformers: www.crmagnetics.com

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:

• Individual phase to neutral voltage • Individual phase and load current • Individual phase power • Individual phase volt-amps	• 3-phase sum of 1 sec.—signed energy (watt seconds) • 3-phase sum of 1 sec.—unsigned energy (watt sec)

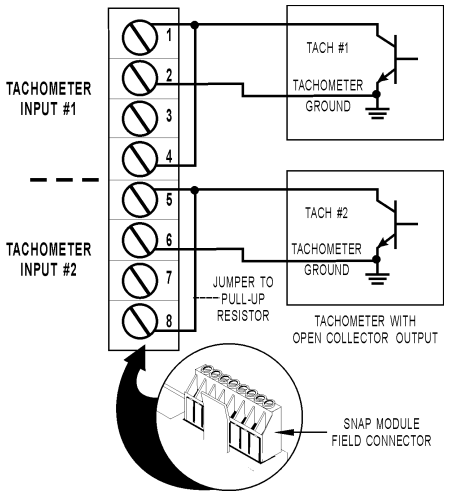
Suitable **current transformers (CTs)** for use with the SNAP-AIPM-3V are available from Opto 22. See form #1938, the Split-Core Current Transformers Data Sheet.

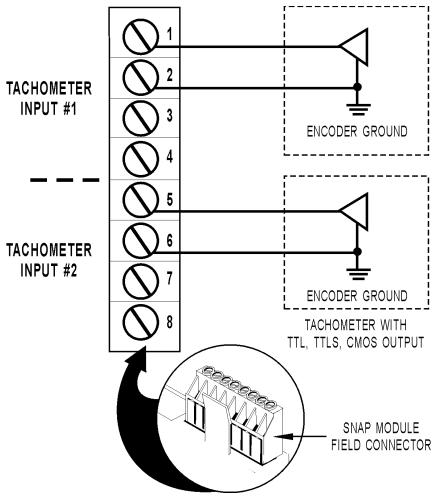
CAUTION: The SNAP-AIPM-3 module does not contain a fuse. Protect the system by adding a fuse.

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:

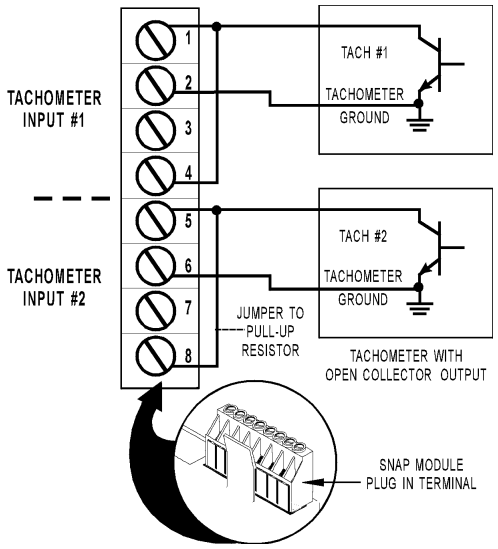


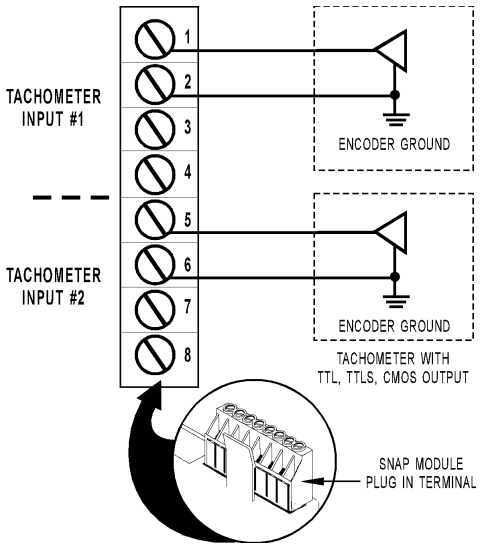


Wiring for SNAP-AIRATE-HFi analog rate input.

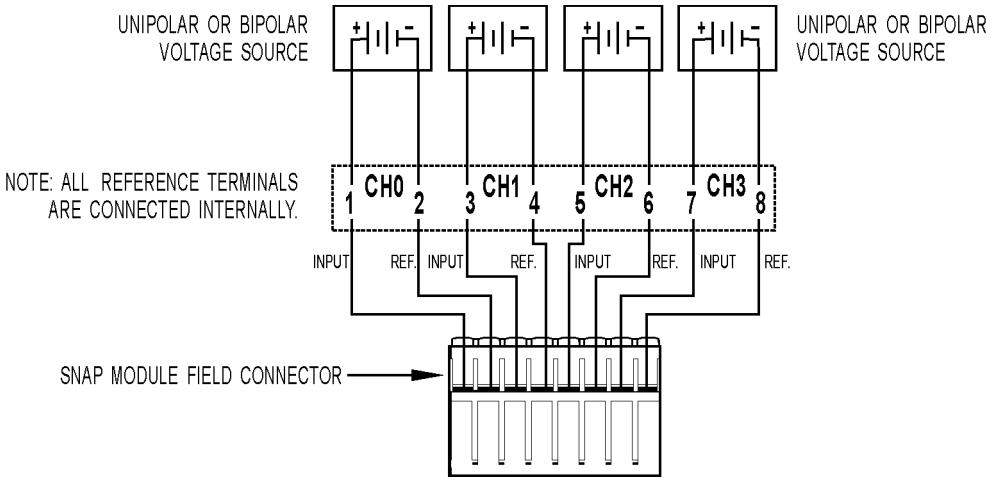
Two possible wiring diagrams are shown.

The two 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.

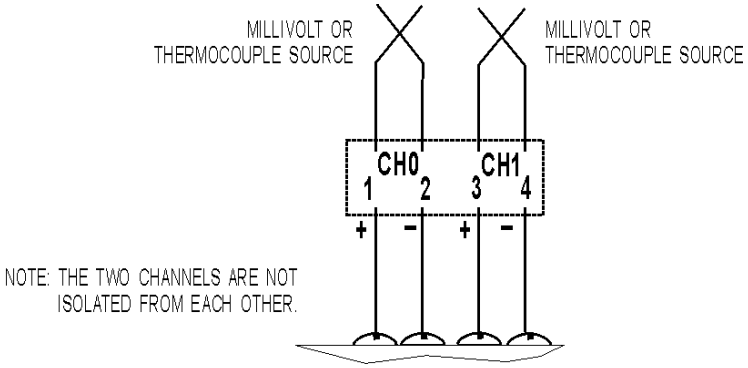




Wiring for SNAP-AIMV-4 and AIMV2-4 analog millivolt inputs.

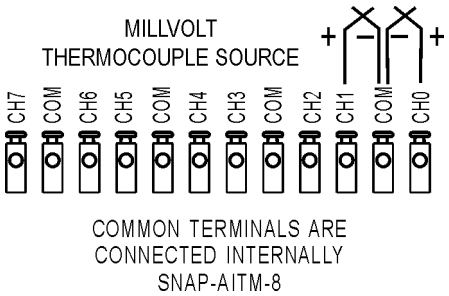


Wiring for SNAP-AITM and SNAP-AITM-2 analog thermocouple/millivolt inputs.



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

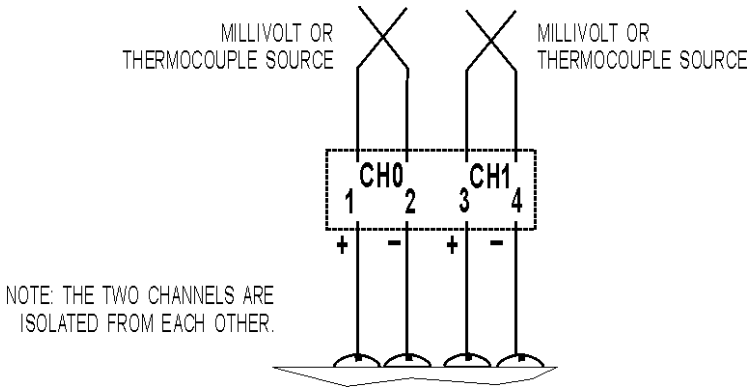
Wiring for SNAP-AITM-8 and SNAP-AITM-8-FM analog thermocouple/millivolt inputs.



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

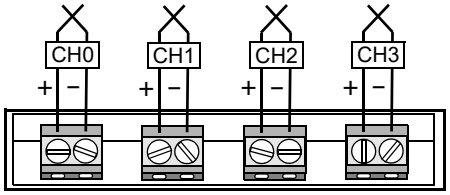
Since all inputs share the same reference terminal, use isolated probes for thermocouple inputs.

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

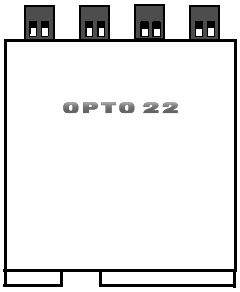


Since these channels do not share any common connections, grounded sensors and field devices may be used with them.

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

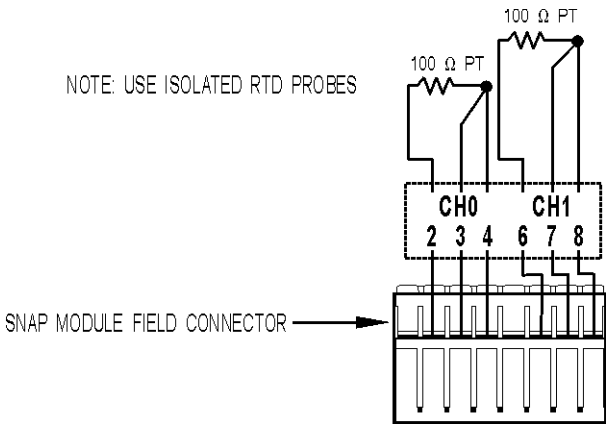


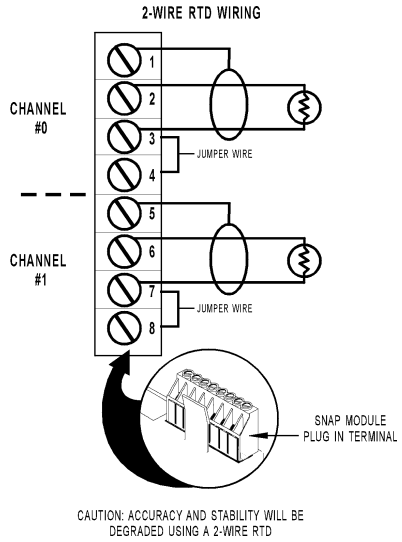
The four channels on the module are isolated from each other. Since these channels do not share any common connections, grounded sensors and field devices may be used with them.



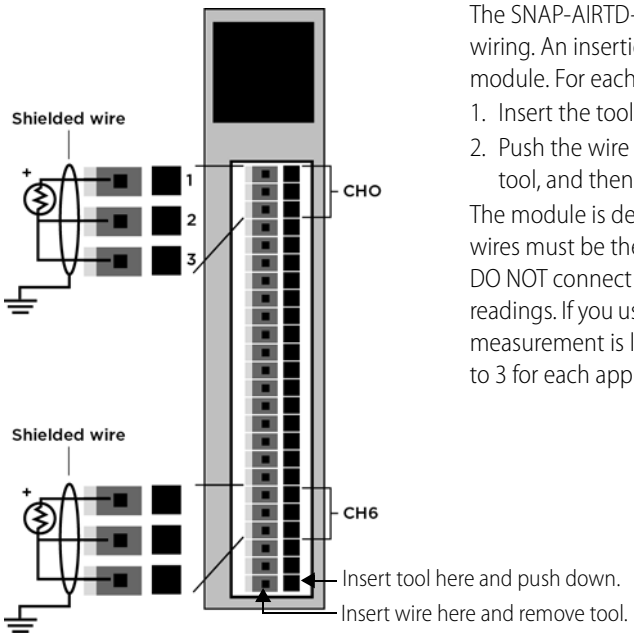
Wiring for SNAP-AIRTD, SNAP-AIRTD-10, and SNAP-AIRTD-1K analog RTD inputs.

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





Wiring for SNAP-AIRTD-8U analog RTD/resistance inputs.

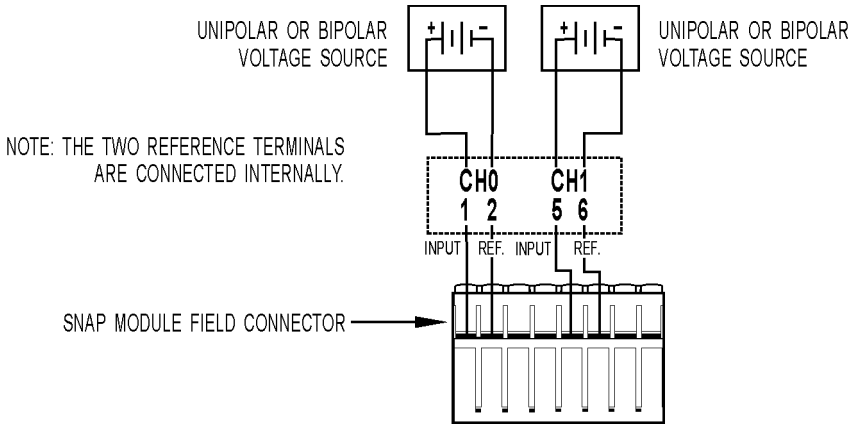


The SNAP-AIRTD-8U has spring-clamp connectors for easy wiring. An insertion tool is provided in the box with the module. For each connection:

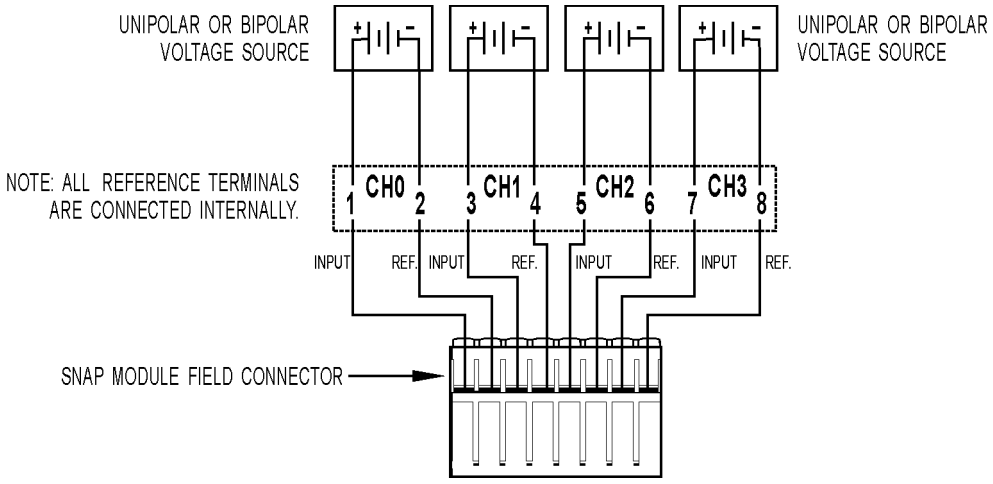
1. Insert the tool in the small square hole and push down.
2. Push the wire firmly into the rectangular hole below the tool, and then remove the tool.

The module is designed for 3-wire RTDs, shown below. All wires must be the same size. If you use a 4-wire connection, DO NOT connect the fourth wire, as it will cause errors in the readings. If you use 2-wire RTDs (not recommended because measurement is less accurate), you must jumper terminal 2 to 3 for each applicable RTD channel.

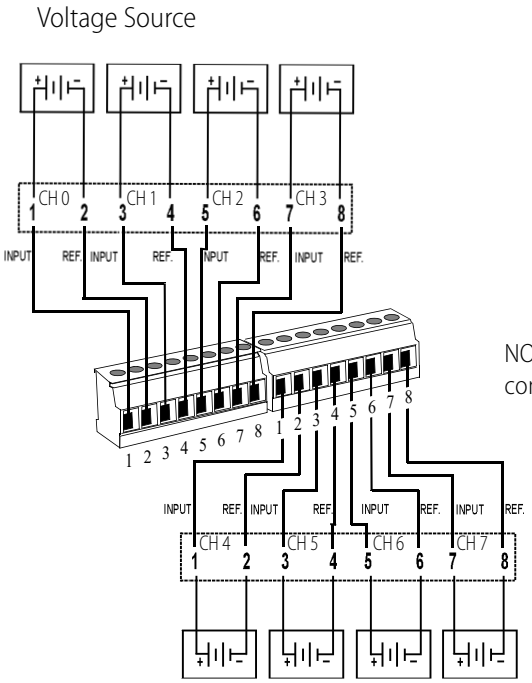
Wiring for SNAP-AIV two-channel analog voltage input.



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

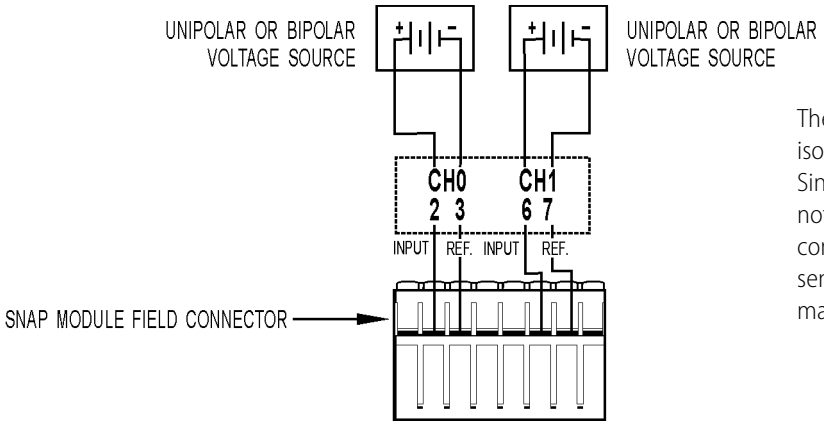


Wiring for SNAP-AIV-8 eight-channel analog voltage input.



NOTE: Terminals 2, 4, 6, and 8 on both connectors are connected internally.

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



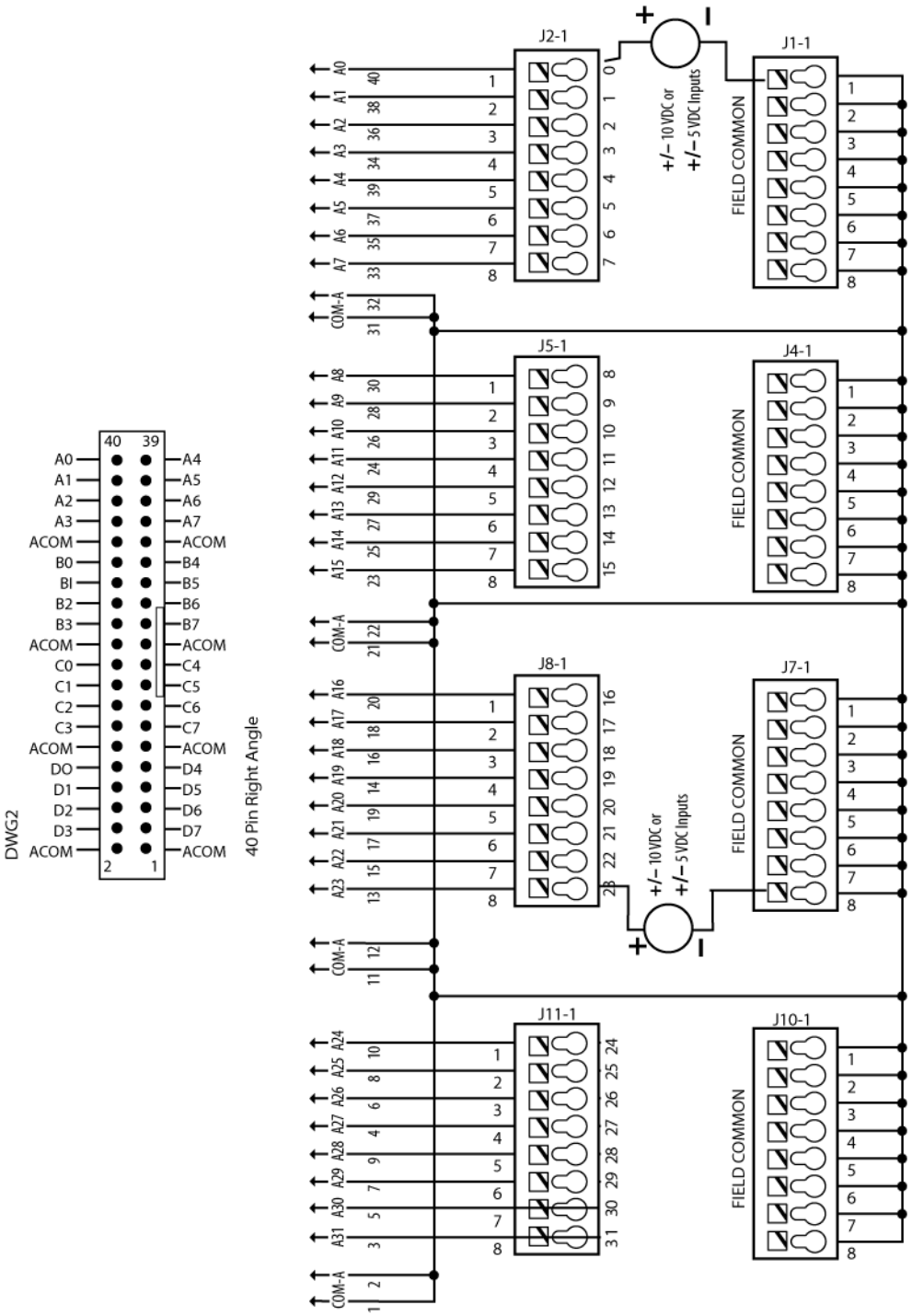
The two channels are isolated from each other. Since these channels do not share any common connections, grounded sensors and field devices may be used with them.

Wiring for SNAP-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.

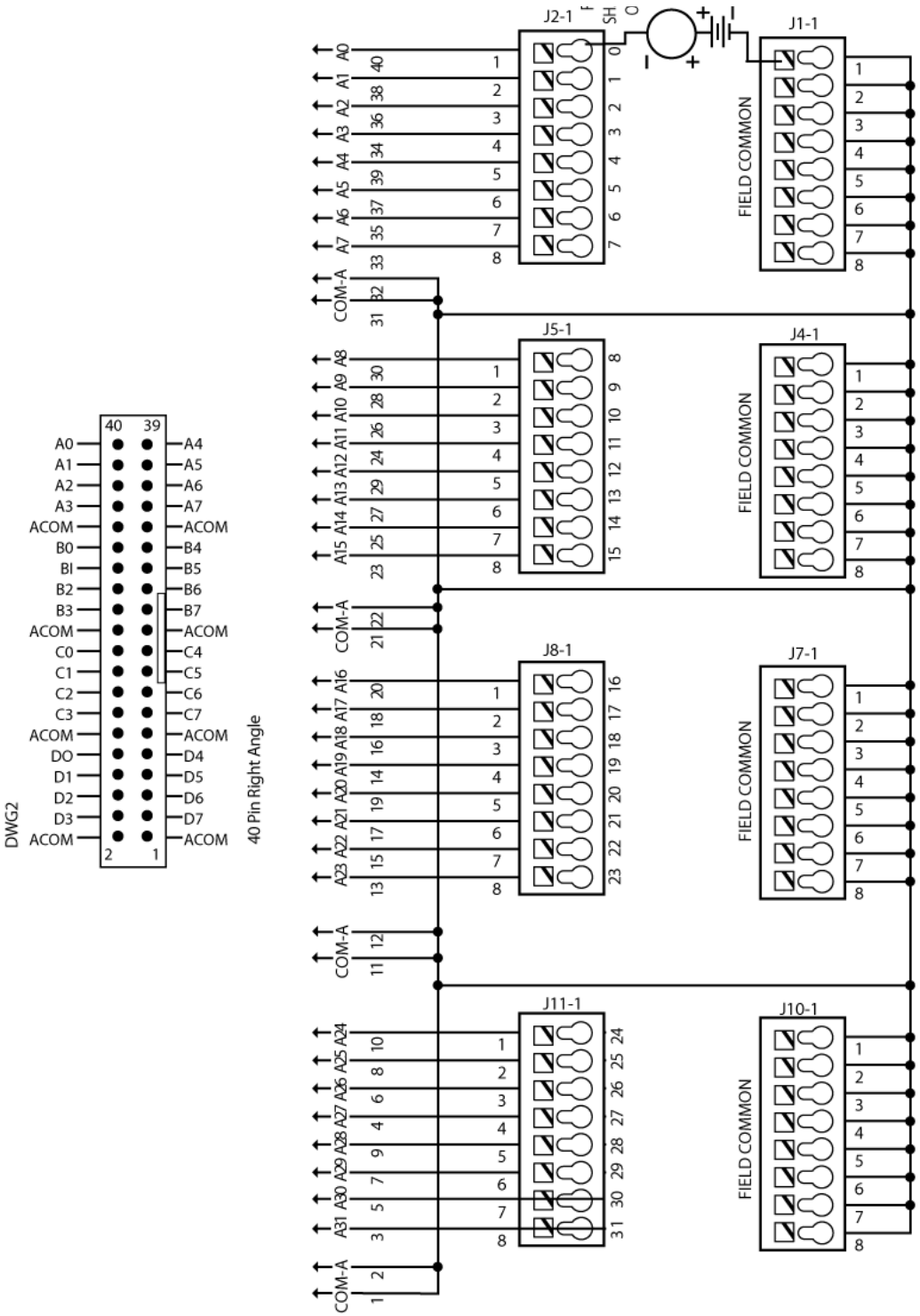
The following diagram shows wiring from the SNAP-AIV-32 or SNAP-AIV-32-FM module to the SNAP-HDB-AIV (or -FM) breakout rack. Note that all channels share a common reference terminal.

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.



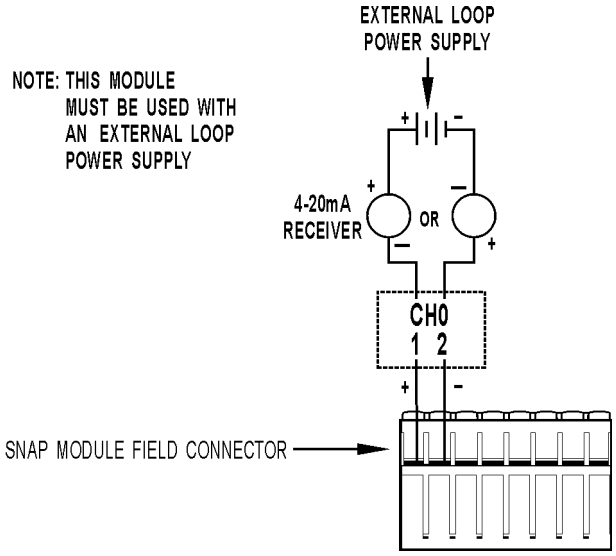
Alternate Wiring for SNAP-AIMA-32 and SNAP-AIMA-32-FM .

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

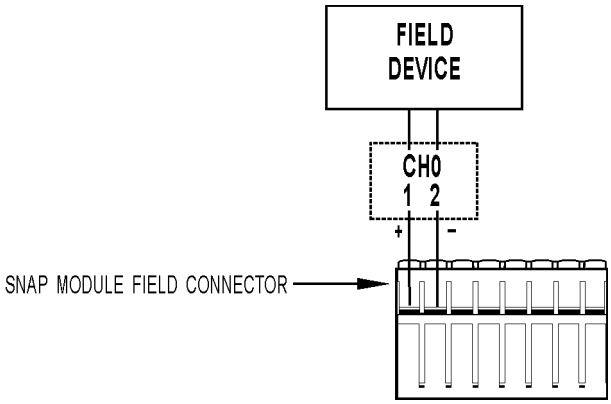


Analog Output Modules

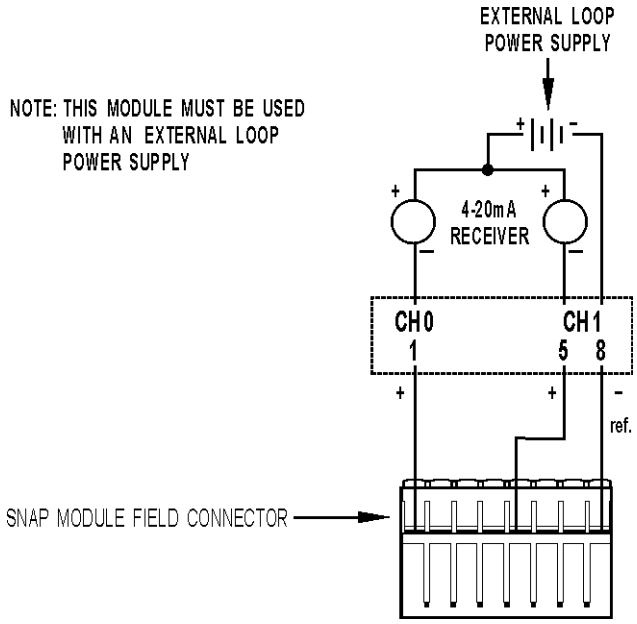
Wiring for the SNAP-AOA-3 single-channel analog current output.



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

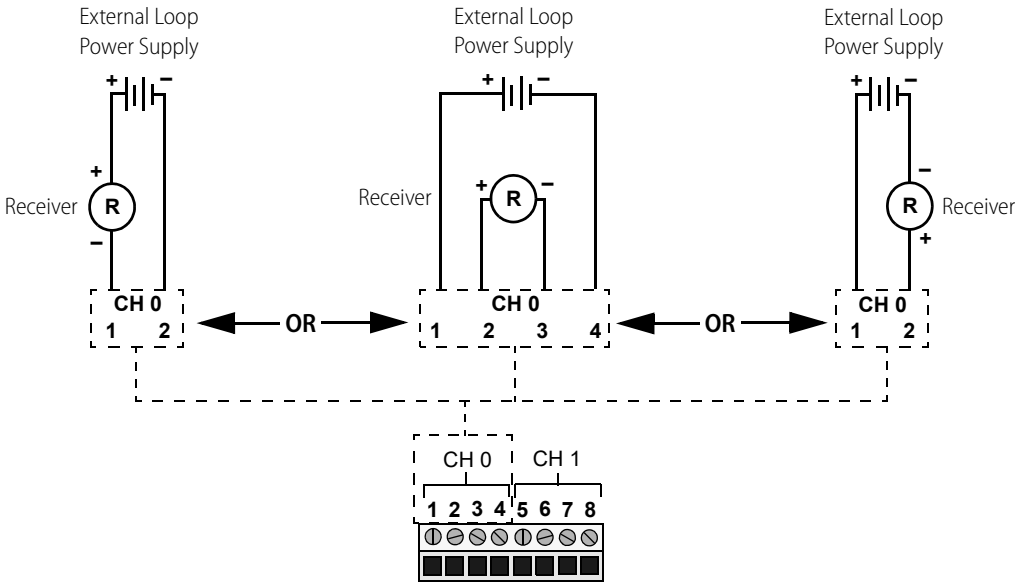


Wiring for the SNAP-AOA-23 dual-channel analog current output.

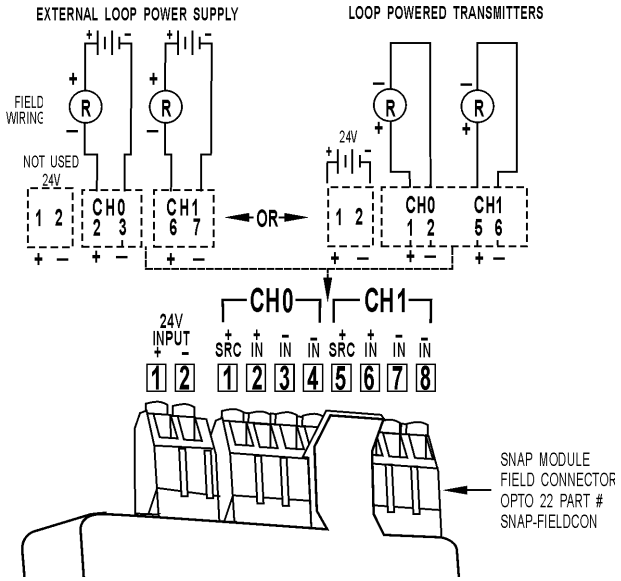


The two channels share a common reference terminal.

Wiring for the SNAP-AOA-23-iH isolated dual-channel analog current output, HART protocol.

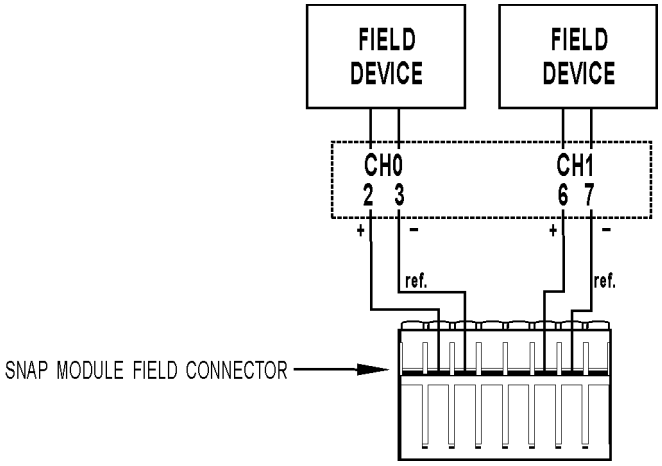


Wiring for the SNAP-AOA-23-iSRC and SNAP-AOA-23-iSRC-FM isolated dual-channel analog current outputs.



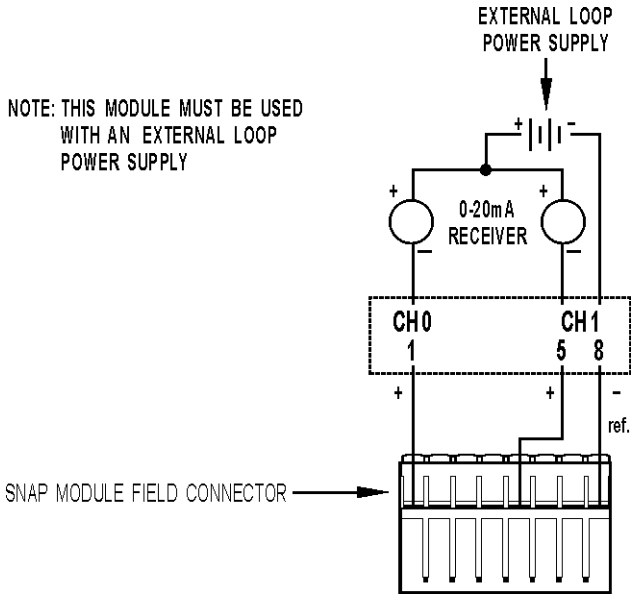
The module includes built-in loop sourcing capability. The two channels and their loop sources are isolated from each other.

Wiring for the SNAP-AOV-25 and SNAP-AOV-27 dual-channel analog voltage output.



The two channels share a common reference terminal.

Wiring for the SNAP-AOA-28 dual-channel analog current output.

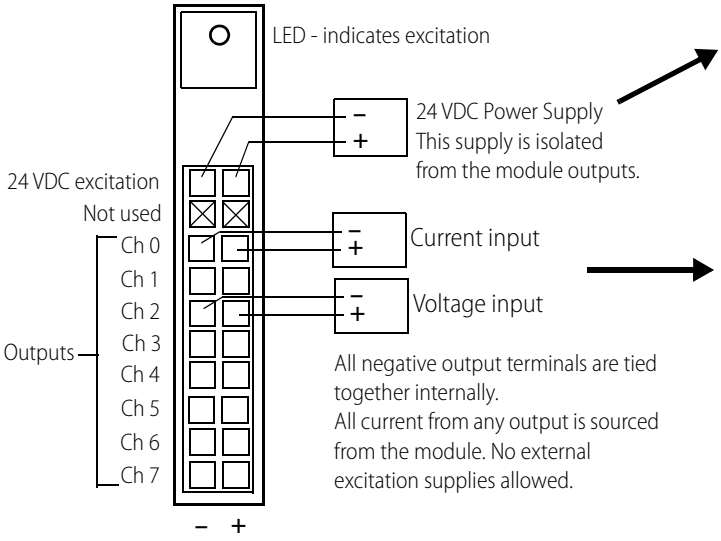


The two channels share a common reference terminal.

Wiring for the SNAP-AOVA-8 eight-channel analog multifunction output.

This module requires a SNAP-HD-20F6 cable.

SNAP-AOVA-8 Module (from top)



For more information on the SNAP-HD-20F6 cable, see form 1756, the *SNAP TEX Cables & Breakout Boards Data Sheet.*

SNAP-HD-20F6 Cable

Wire colors - Excitation

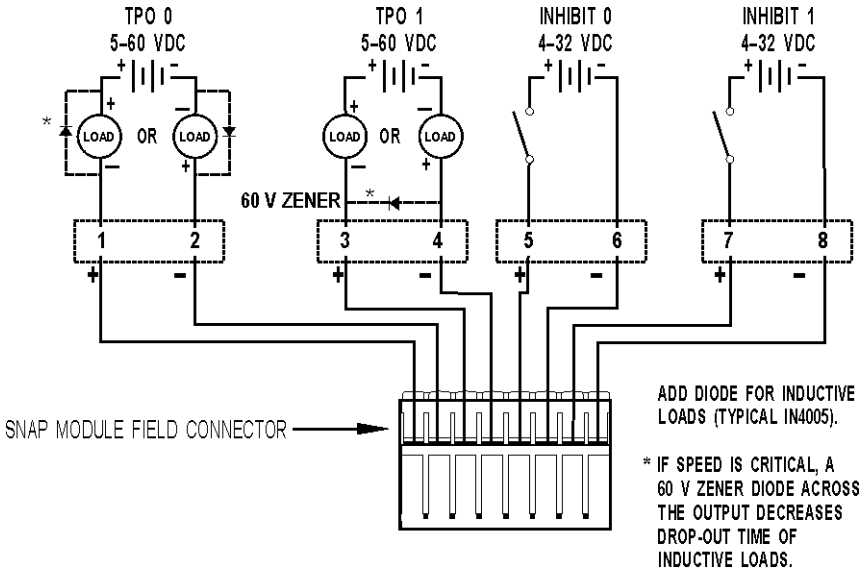
24 VDC	Color
–	Black
+	White with Black

Wire colors - Output points

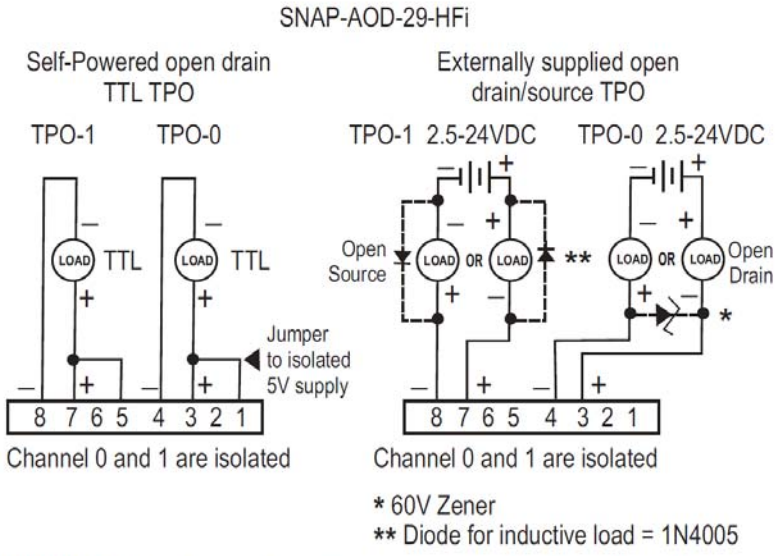
Ch	–/+	Color
0	–	Blue
	+	White with Blue
1	–	Pink
	+	White with Pink
2	–	Gray
	+	White with Gray
3	–	Green
	+	White with Green
4	–	Orange
	+	White with Orange
5	–	Red
	+	White with Red
6	–	Purple
	+	White with Purple
7	–	Yellow
	+	White with Yellow

NOTE: Yellow with purple and purple with yellow wires are not used.

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



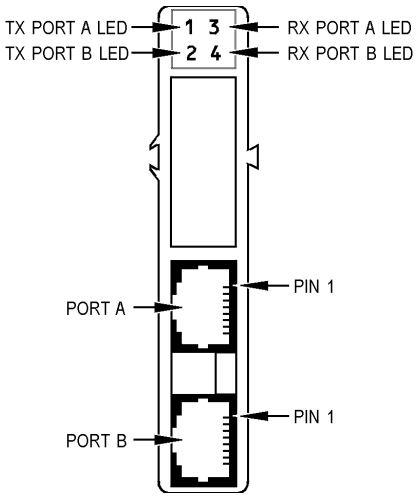
Wiring for the SNAP-AOD-29-HFi dual-channel analog time-proportional digital output.



WARNING: Do not remove or replace connectors or cards while circuit is live unless area is known to be nonhazardous.

Serial Communication Modules

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

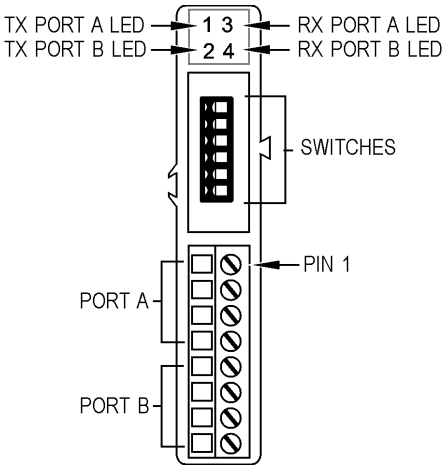


Pinouts for RJ-45 connectors on the SNAP-SCM-232:

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

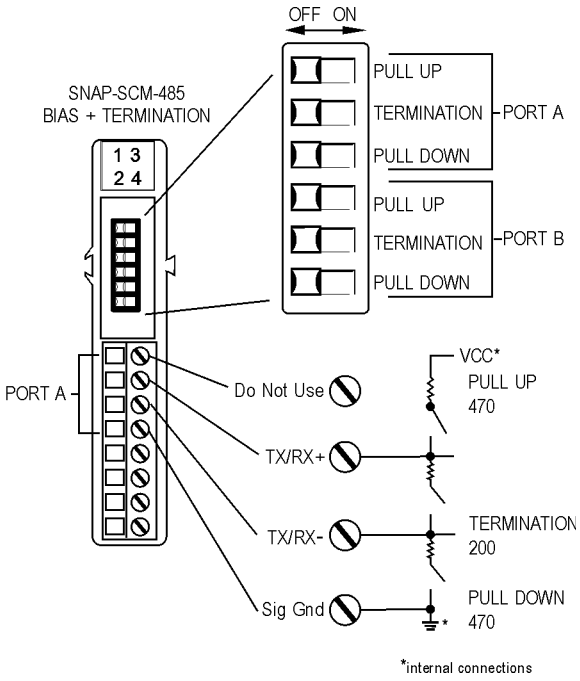
Pin	Port	Description
1	A	Vcc
2	A	TX +
3	A	TX -
4	A	Sig Gnd
5	A	Vcc
6	A	RX +
7	A	RX -
8	A	Sig Gnd

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.

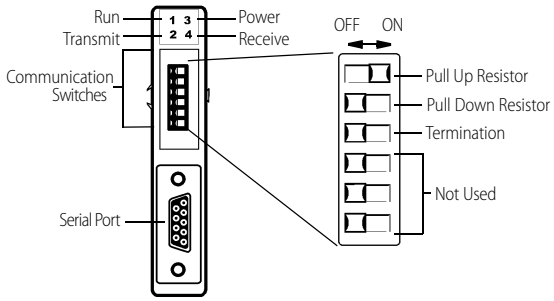
The SNAP-SCM-MCH16 module is part of the SNAP Motion Control Subsystem. Wiring, bias and termination, and other settings may depend on your system. For instructions, see Opto 22 form #1673, the *SNAP PAC Motion Control User's Guide.*

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.

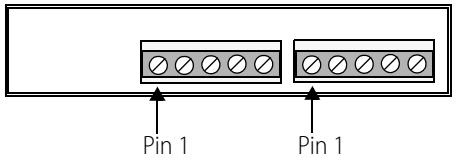
SNAP-SCM-PROFI Top View.



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.



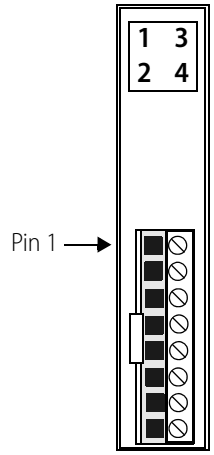
Pins for Each Port

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.



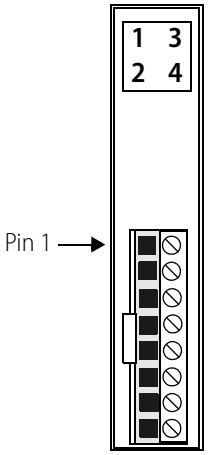
Pinouts

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

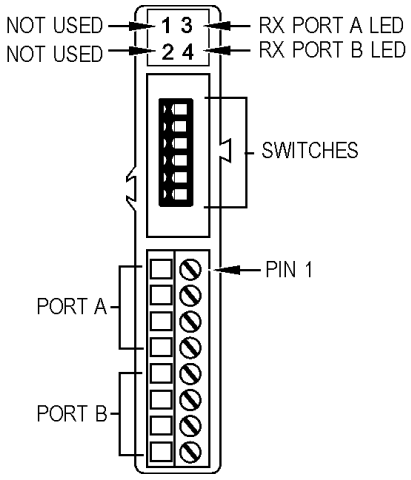
Pins 1-4 are in parallel to pins 5-8.
V+ is not used by the module.

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

A: I/O Specifications

Introduction

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

Digital Input Module Specifications

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

	SNAP-IAC5	SNAP-IAC5A	SNAP-IAC5MA
Key Feature	--	--	Diagnostic switches
Wire size	22 to 14 AWG	22 to 14 AWG	22 to 14 AWG
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	-20 °C to 70 °C, operating -40 °C to 85 °C, storage	-20 °C to 70 °C, operating -40 °C to 85 °C, storage	-20 °C to 70 °C, operating -40 °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
Wire size	22 to 14 AWG	22 to 14 AWG	22 to 14 AWG	22 to 14 AWG
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	-20 to 70 °C, operating -40 to 85 °C, storage	-20 to 70 °C, operating -40 to 85 °C, storage	-20 to 70 °C, operating -40 to 85 °C, storage	-20 to 70 °C, operating -40 to 85 °C, storage
Agency Approvals	CE, FM, RoHS, DFARS	CE, FM, RoHS, DFARS	CE, FM, RoHS, DFARS	CE, FM, ATEX, 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
Wire size	22 to 14 AWG	22 to 14 AWG	22 to 14 AWG	22 to 14 AWG
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	-20 to 70 °C, operating -40 to 85 °C, storage	-20 to 70 °C, operating -40 to 85 °C, storage	-20 to 70 °C, operating -40 to 85 °C, storage	-20 to 70 °C, operating -40 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-IDC5-FAST, SNAP-IDC5-FAST-A, and SNAP-IDC5MA

	SNAP-IDC5-FAST*	SNAP-IDC5-FAST-A**	SNAP-IDC5MA
Key Feature	High-speed	High-speed	Diagnostic switches
Wire size	22 to 14 AWG	22 to 14 AWG	22 to 14 AWG
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 ± 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	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	-20 °C to 70 °C, operating -40 °C to 85 °C, storage	-20 °C to 70 °C, operating -40 °C to 85 °C, storage	-20 °C to 70 °C, operating -40 °C to 85 °C, storage
Agency Approvals	UL, CE, ATEX, 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	-20 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, ATEX, 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 closed; LED off) @ 2 mA sinking 2.7 V min. (switch open; LED on) @ 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
Wire size	22 to 14 AWG
Torque, hold-down screws	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)
Temperature	-20 °C to 70 °C, operating -40 °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, SNAP-IDC-32D, and SNAP-IDC-32DN

	SNAP-IDC-32 SNAP-IDC-32-FM	SNAP-IDC-32N	SNAP-IDC-32D	SNAP-IDC-32DN
Input Range	10 to 32 VDC	-10 to -32 VDC	2.5 to 12 VDC	-2.5 to -12 VDC
Nominal Voltage Range	24 VDC	-12 to -24 VDC	2.5 VDC	-2.5 VDC
Input Resistance	20 K ohms	20 K ohms	3 K ohms	3 K ohms
Logic Voltage and Current	5 VDC ± 0.1 @ 150 mA		5 VDC ± 0.1 @ 150 mA	
Maximum Operating Common Mode Voltage	250 V	250 V	250 V	250 V
Isolation: Field to Logic	1500 V	1500 V	1500 V	1500 V
Input Arrangement	32 input channels; 4 groups of 8 inputs each		32 input channels; 4 groups of 8 inputs each	
Common connection	Points in each group share a common **negative** connection.	Points in each group share a common **positive** connection.	Points in each group share a common **negative** connection.	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	
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)	
Maximum Number of HDD Modules on One Mounting Rack	16	16	16	16
Indicators	None; use optional OptoTerminal-G20 diagnostic display or breakout rack.			
ON Voltage	10 VDC @ 0.5 mA	-10 VDC @ 0.5 mA	2.5 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	-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]	2–30 ms typical[2]
Input Turn-On/Off Time	6 ms	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	0–50 Hz @ 50% duty cycle
Operating Temperature	-20 to 70 °C	-20 to 70 °C	-20 to 70 °C	-20 to 70 °C
Storage Temperature	-40 to 85 °C	-40 to 85 °C	-40 to 85 °C	-40 to 85 °C
Agency Approvals	UL, CE, RoHS, DFARS FM (-FM model only)	CE, RoHS, DFARS	CE, RoHS, DFARS	CE, RoHS, DFARS
Warranty	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.

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 ± 0.1 @ 150 mA	5 VDC ± 0.1 @ 150 mA	5 VDC ± 0.1 @ 150 mA	5 VDC ± 0.1 @ 150 mA	5 VDC ± 0.1 @ 150 mA
Input Arrangement	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		
Maximum Operating Common Mode Voltage	250 V	250 V	250 V	250 V	250 V
Isolation: Field to Logic	1500 V	1500 V	1500 V	1500 V	1500 V
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.		
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
Operating Temperature	-20 to 70 °C	-20 to 70 °C	-20 to 70 °C	-20 to 70 °C	-20 to 70 °C
Storage Temperature	-40 to 85 °C	-40 to 85 °C	-40 to 85 °C	-40 to 85 °C	-40 to 85 °C
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	12–250 VAC	12–250 VAC	12–250 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 fusing.	Has four isolated channels. User must provide own fusing.
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	-20 ° to 70 °C, operating -40 ° to 85 °C, storage	-20 ° to 70 °C, operating -40 ° to 85 °C, storage	-20 ° to 70 °C, operating -40 ° to 85 °C, storage
Wire size range	22 to 14 AWG	22 to 14 AWG	22 to 14 AWG
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	12–250 VAC	12–250 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 ± 0.25 VDC	5 VDC ± 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	-20 ° to 70 °C, operating -40 ° to 85 °C, storage	-20 ° to 70 °C, operating -40 ° to 85 °C, storage
Wire size range	22 to 14 AWG	22 to 14 AWG
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	-20 to 70 °C, operating -40 to 85 °C, storage	-20 to 70 °C, operating -40 to 85 °C, storage
Wire size range	22 to 14 AWG	22 to 14 AWG
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 ± 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	-20 to 70 °C, operating -40 to 85 °C, storage	-20 to 70 °C, operating -40 to 85 °C, storage
Wire size range	22 to 14 AWG	22 to 14 AWG
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 ± 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	-20 ° to 70 °C, operating -40 ° to 85 °C, storage	-20 ° to 70 °C, operating -40 ° to 85 °C, storage
Wire size range	22 to 14 AWG	22 to 14 AWG
Agency Approvals	CE, FM, ATEX, 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	-20 to 70 °C, operating -40 to 85 °C, storage	-20 to 70 °C, operating -40 to 85 °C, storage	-20 to 70 °C, operating -40 to 85 °C, storage	-20 to 70 °C, operating -40 to 85 °C, storage
Wire size range	22 to 14 AWG	22 to 14 AWG	22 to 14 AWG	22 to 14 AWG
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 ± 0.1 @ 150 mA	5 VDC ± 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.
Maximum Operating Common Mode Voltage	250 V	250 V
Isolation: Field to Logic	1500 V	1500 V
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
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)
Operating Temperature	-20 to 70 °C	-20 to 70 °C
Storage Temperature	-40 to 85 °C	-40 to 85 °C
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
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-OMR6T-C

	SNAP-OMR6-C	SNAP-OMR6T-C
Field Side Ratings (each channel)		
Contact Configuration	Form C (SPDT, normally open or closed)	Form C (SPDT, normally open or closed)
Line Voltage - Range	0–250 VAC or 5–30 VDC	0–250 VAC or 5–30 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
Leakage Current	none	< 1 microamp @ 250 VAC
Clamping Voltage (for transient suppression)	External transient suppression required	440 V nominal
Duty Cycle	-- Not applicable --	1 Hz
Switching Power	1500 VA / 144 W (DC)	1500 VA / 144 W (DC)
Peak Blocking Voltage	250 VAC @ 360 V_{pk}	250 VAC @ 360 V_{pk}
Channel-to-channel isolation	300 VAC (1500 Vtransient)	300 VAC (1500 Vtransient)
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	Single gray connector: 5.26 in-lb (0.6 N-m) Black connectors: 1.7 in-lb (0.2 N-m)	5.26 in-lb (0.6 N-m)
Temperature	-20 to 70 °C, operating -30 to 85 °C, storage	-20 to 70 °C, operating -30 to 85 °C, storage
Agency Approvals	UL, CE, RoHS, DFARS	UL, 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	-20 °C to 70 °C
Storage Temperature	-40 °C to 85 °C
Wire size	22 to 14 AWG
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	 -20 °C to 70 °C -40 °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)
Wire size range	22 to 14 AWG
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 (± 6,400,000 counts = ± 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	 ± 0.05% (= 3,200 counts out of 6,400,000, out of box) ± 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 (±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	 -20 to 70 °C -40 to 85 °C
Wire size	22 to 14 AWG
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	-20 °C to 70 °C
Storage Temperature	-40 °C to 85 °C
Wire size	22 to 14 AWG
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	-20 °C to 70 °C
Storage Temperature	-40 °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 tme)	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	-20 °C to 70 °C
Storage Temperature	-40 °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)
Wire size	22 to 14 AWG
Agency Approvals	UL, FM, CE, RoHS, DFARS ATEX (SNAP-AIMA-4 only)
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	-20 °C to 70 °C
Storage Temperature	-40 °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	-20 °C to 70 °C
Storage Temperature	-40 °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
Data Freshness	11 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	 -20 °C to 70 °C -40 °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)
Wire size range	22 to 14 AWG
Agency Approvals	CE, RoHS, DFARS
Warranty	Lifetime

SNAP-AIMA-iH

Input Range Nominal Full	 4 to 20 mA 3.2 to 24 mA
Maximum Survivable Input	40 V or 160 mA
Impedance	230 Ohms nominal
Resolution	0.8 microamps
Accuracy	+/- 10 microamps
Response Time (% of span/delta I/delta time)	99.9%/20.7mA/10 ms
Gain Temperature Coefficient	30 ppm/ °C
Offset Temperature Coefficient	15 ppm/ °C
DC Common Mode Rejection	>-120 dB
AC Common Mode Rejection	>-120 dB @ 60 Hz
Maximum Operating Common Mode Voltage	250 V continuous 1500 V transient (1 s)
Isolation: Channel-Channel	250 V continuous 1500 V transient (1 s)
Power Requirements	5 VDC (+/- 0.15) @ 150 mA
Ambient Temperature: Operating Storage	 -20 °C to 70 °C -40 °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-AIMA-i

Input Range	-20 mA to +20 mA
Maximum Over Range	± 10% (= ± 27500 counts)
Resolution	0.8 µA
Input Response Time (% of span/delta I/delta time)	99.9 %/19.9 µA/10 mS
Data Freshness	11 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 µA)
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	 -20 °C to 70 °C -40 °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)
Wire size range	22 to 14 AWG
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	± 10% (= ± 27500 counts)
Resolution	0.8 µA
Input Response Time (% of span/delta I/delta time)	99.9 %/19.9 mA/10 ms
Data Freshness	11 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 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
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
LED on top of module	Indicates that there is power to the 24v source supply 2-pin connector
Input Resistance	200 ohms (each channel)
Ambient Temperature: Operating Storage	 -20 °C to 70 °C -40 °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)
Wire size range	22 to 14 AWG
Agency Approvals	CE, RoHS, DFARS FM (SNAP-AIMA-iSRC-FM only)
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 Common Mode Voltage	250 V
Accuracy (% full scale)	±4 Hz or ±0.5% of the input frequency (whichever is greater)
Drift: Gain Temperature Coefficient	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	-20 °C to 70 °C
Storage Temperature	-40 °C to 85 °C
Wire size	22 to 14 AWG
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-HFi

Input Range	2 Hz - 500 kHz at 1.0 s Data Freshness 20 Hz - 500 kHz at 0.1 s Data Freshness
Input Voltage Range Sine wave >= 2000 Hz Sine wave at 200 Hz Sine wave at 20 Hz Sine wave at 2 Hz Square wave Maximum survivable	 3.0 V to 48 V_{p-p} 4.0 V to 48 V_{p-p} 5.0 V to 48 V_{p-p} 17 V to 48 V_{p-p} 3.0 V to 48 V_{p-p} 110 V_{p-p}
Input Impedance	55 kOhms
Input Coupling	Single-ended AC
Pull-up Voltage	6 to 9 VDC
Pull-up Resistor	3.6 kOhm
Minimum Pulse Width	1 microsecond
Data Freshness*	100 ms at 20 Hz - 500 kHz 1.0 s at 2 Hz to 500 kHz
Resolution (Hz)	*f* / (48,000,000 * Data Freshness), where *f* is the current frequency measurement
Accuracy (at 1.0 s Data Freshness)	+- 0.005% of input for input greater than 500 Hz +- 0.005% of input plus an additional +- 0.006 Hz for input less than 500 Hz
Maximum Operating Common Mode Voltage	250 V Continuous 1500 V Transient
DC Common Mode Rejection	> -120 dB
AC Common Mode Rejection	> -120 dB at 60 Hz
Isolation: Channel to Channel	250 V Continuous 1500 V Transient
Power Consumption	1.05 W (210 mA @ 5 V)
Ambient Temperature Operating Storage	 -20 to 70 °C -40 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)
Wire size range	22 to 14 AWG
Agency Approvals	CE, RoHS, DFARS
Warranty	Lifetime

* User selectable. Default is 0.1 seconds.

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	-20 °C to 70 °C
Storage Temperature	-40 °C to 85 °C
Wire size	22 to 14 AWG
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 Common 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	-20 °C to 70 °C
Storage Temperature	-40 °C to 85 °C
Wire size	22 to 14 AWG
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-1K, SNAP-AIRTD, and SNAP-AIRTD-10

	SNAP-AIRTD-1K	SNAP-AIRTD	SNAP-AIRTD-10
3-wire RTD input	1000 ohm platinum @ 0 °C α= 0.00385 1000 ohm nickel @ 0 °C α= 0.00618 1000 ohm nickel @ 70 °F α= 0.00637	100 ohm platinum; α= 0.00385 100 ohm nickel, -60 to 250 °C 120 ohm nickel, -80 to 260 °C	10 ohm copper; α= 0.00428
Input Temperature Range	-200 °C to 850 °C (-328° to +1,582° F)	-200 °C to 850 °C (-328° to +1,582° F)	-180 °C to 260 °C (-292° to +500° F)
Input Range	0 to 4000 ohms	0 to 400 ohms	0 to 25 ohms
Over-Range Limit	to 4400 ohms	to 440 ohms	to 27.5 ohms
Resolution (average)	0.042 °C (0.16 ohms)	0.042 °C (0.016 ohms)	0.026 °C (0.001 ohms)
Input Filtering	-3 dB @ 0.1 Hz	-3 dB @ 0.1 Hz	-3 dB @ 100 Hz
Data Freshness (Max)	100 ms	100 ms	168 ms
Lead Compensation	Automatic when used with SNAP brains	Automatic when used with SNAP brains	Automatic when used with SNAP PAC brains
DC Common Mode Rejection	>-120 dB	>-120 dB	>-120 dB
AC Common Mode Rejection	>-120 dB at 60 Hz	>-120 dB at 60 Hz	>-120 dB at 60 Hz
Excitation (typical)	0.256 mA constant current	1.25 mA constant current	5.4 mA constant current
Maximum Lead Resistance	40 ohms single wire (all leads to be equal resistance)	40 ohms single wire (all leads to be equal resistance)	15 ohms single wire (all leads to be equal resistance)
Maximum Fault Voltage at Input (between any 2 field wires)	±15 V	±15 V	±15 V
Maximum Operating Common Mode Voltage	250 V	250 V	250 V
Accuracy From factory After setting gain and offset	 0.8 °C 0.6 °C	 0.8 °C 0.6 °C	 0.6 °C 0.5 °C
Isolation	1500 V	1500 V	1500 V
Power Requirements	5.00 to 5.20 VDC @ 190 mA	5.00 to 5.20 VDC @ 190 mA	5.00 to 5.20 VDC @ 190 mA
Operating Temperature	-20 °C to 70 °C	-20 °C to 70 °C	-20 °C to 70 °C
Storage Temperature	-40 °C to 85 °C	-40 °C to 85 °C	-40 °C to 85 °C
Wire size	22 to 14 AWG	22 to 14 AWG	22 to 14 AWG
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)
Agency Approvals	CE, RoHS, DFARS	UL, FM, CE, RoHS, DFARS	CE, RoHS, DFARS
Warranty	Lifetime	Lifetime	Lifetime

SNAP-AIRTD-8U

	SNAP-AIRTD-8U		
3-wire RTD input and maximum temperature table range (actual range depends on your probe)	1000 ohm platinum @ 0 °C α= 0.00385 Range: -200 to 850 °C (-328 to 1,582 °F) 1000 ohm nickel @ 0 °C α= 0.00618 Range: -60 to 170 °C (-76 to 356 °F) 1000 ohm nickel @ 70 °F α= 0.00637 Range: -46 to 148.9 °C (-50 to 300 °F)	100 ohm platinum @ 0 °C α= 0.00385 Range: -200 °C to 850 °C (-328 to 1,582 °F) 100 ohm nickel @ 0 °C α= 0.00618 Range: -60 to 250 °C (-76 to 482 °F) 120 ohm nickel @ 0 °C α= 0.00672 Range: -80 to 260 °C (-112 to 500 °F)	10 ohm copper @ 25 °C α= 0.00427 Range: -60 to 355 °C (-76 to 671 °F)
Input Range	0 to 4000 ohms	0 to 400 ohms	0 to 40 ohms
Accuracy From factory After setting gain and offset	 0.8 °C (Pt); 0.6 °C (Ni) 0.6 °C (Pt); 0.4 °C (Ni)	 0.8 °C (Pt); 0.6 °C (Ni) 0.6 °C (Pt); 0.4 °C (Ni)	 1.7 °C 1.2 °C
Excitation Current	4.28 mA	2 mA	0.325 mA
Over-Range Limit	10% overrange for all measurements in ohms		
Resolution In Ohms In RTD Temperature	The greater of: (Ohms Range / 100,000) or 1 milliohm Better than or equal to 0.05 °C (0.09 °F)		
Input Filtering Front end filtering DSP Notch filter	-15 dB @ 50 Hz, -20 dB @ 60 Hz 20 Hz (-3 DdB = 5.24 Hz)		
Data Freshness (Max)	1.2 s		
Auto-range Settle Time Step change from 10 to 8000 Step change from 8000 to 10	1.2 s to the next higher or lower range <= 10 s ranging up (channel may show overrange until settled) <= 10 s ranging down (channel will give a reading while settling)		
Total Lead Resistance	200 ohms maximum		
DC Common Mode Rejection	>-120 dB		
AC Common Mode Rejection	>-120 dB at 60 Hz		
Maximum Survivable Fault Voltage at Input (between any 2 field wires)	±8 V		
Maximum Operating Common Mode Voltage	250 V field terminal to logic connector		
Isolation	1500 V field side to logic side		
Power Requirements	5.00 to 5.20 VDC @ 135 mA		
Operating Temperature	-20 °C to 70 °C		
Storage Temperature	-40 °C to 85 °C		
Maximum wire size	20 AWG		
Torque, hold-down screws	4 in-lb (0.45 N-m)		
Agency Approvals	UL, CE, RoHS, DFARS		
Warranty	Lifetime		

SNAP-AIR400K-8

Input Ranges	400 K, 200 K, 100 K, 50 K, 40 K, 20 K, 10 K, 5 K , 4 K, 2 K, 1 K, 500 Ohms, and Autorange		
Resolution	Resolution / Range 16 Ohm / 0 to 400 kOhms 8 Ohm / 0 to 200 kOhms 4 Ohm / 0 to 100 kOhms 2 Ohm / 0 to 50 kOhms	Resolution / Range 1.6 Ohm / 0 to 40 kOhms 0.8 Ohm / 0 to 20 kOhms 0.4 Ohm / 0 to 10 kOhms 0.2 Ohm / 0 to 5 kOhms	Resolution / Range 0.16 Ohm / 0 to 4 kOhms 0.08 Ohm / 0 to 2 kOhms 0.04 Ohm / 0 to 1 kOhms 0.02 Ohm / 0 to 500 Ohms
Accuracy (Ohms @ Range) 0.1% Reading + 2x Range Resolution + 1 Ohm	400 Ohms @ 400 K 200 Ohms @ 200 K 100 Ohms @ 100 K 0 Ohms @ 50 K	40 Ohms @ 40 K 20 Ohms @ 20 K 10 Ohms @ 10 K 5 Ohms @ 5 K	4 Ohms @ 4 K 2 Ohms @ 2 K 1 Ohms @ 1 K 0.5 Ohms @ 500
Data Freshness	1.61 seconds maximum		
DSP Notch Filter	20 Hz (- 3DB = 5.24 Hz)		
Excitation Current Nominal (Range & Load Watts Dissipation)	9uA (50 K–4.1 uW), (100 K–8.1 uW), (200 K–16 uW), (400 K–32 uW) 90uA (5 K–40 uW), (10 K–81 uW), (20 K–160 uW), (40 K–320 uW) 200uA (500 K–20 uW), (1 K–40 uW), (2 K–80 uW), (4 K–160 uW)		
Autorange Step Time	1.6 seconds to next higher or lower range >= 10 seconds for a 500 Ohms to 400 K Ohms step change		
Autorange Ohms Hysteresis	**Ranges** **Ohms Open > 440K** 20K between 200K & 400K 10K between 100K & 200K 5K between 50K & 100K 19K between 40K & 50K 2K between 20K & 40K 1K between 10K & 20K 500 between 5K & 10K 1.9K between 4K & 5K 200 between 2K & 4K 100 between 1K & 2K 50 between 500 & 1K		
DC Common Mode Rejection	>-120 dB		
AC Common Mode Rejection	>-120 dB @ 60 Hz		
Open Resistor Indicator	Channel resistance = 999,999.999 Ohms		
PAC Control Reads	temperature reading or -32768 Ohms if over or under range		
Maximum Operating Common Mode Voltage (Field Term to Logic Connector)	500 VDC or peak VAC		
Drift Gain Tempco Offset Tempco	 30 PPM / °C 15 PPM / °C		
Power Requirements	5 VDC (±0.15) @ 190 mA		
Operating Temperature	-20 °C to 70 °C		
Storage Temperature	-40 °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		
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	-20 °C to 70 °C
Storage Temperature	-40 °C to 85 °C
Wire size	22 to 14 AWG
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-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	 -20 °C to 70 °C -40 °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-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
From factory	±5	±4	±3
After user gain and offset commands	±3	±2	±2
Isolation	1500 V		
Power Requirements	5 VDC (±0.15) @ 170 mA		
Input Resistance	100 Megohms (each channel)		
Ambient Temperature: Operating Storage	 -20 °C to 70 °C -40 °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-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
Data Freshness	65 ms for +/- 150 mV 130 ms for +/- 75 mV 130 ms for E-, J-, and K-type thermocouples
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	 -20 °C to 70 °C -40 °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)
Wire size range	22 to 14 AWG
Agency Approvals	CE, FM, RoHS, DFARS
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
Data Freshness	65 ms for +/- 50 mV 130 ms for +/- 25 mV 130 ms for B-, R-, S-, and T-type thermocouples 65 ms for C-, D-, G-, and N-type thermocouples
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	 -20 °C to 70 °C -40 °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)
Wire size range	22 to 14 AWG
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)			
Ambient Temperature: Operating Storage	 -20 °C to 70 °C -40 °C to 85 °C			
Torque, connector screws	3 in-lb (0.34 N-m)			
Wire size range	22 to 14 AWG			
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	± 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
Data Freshness	11 ms for +/- 10 V 18 ms for +/- 5 V
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)
Ambient Temperature: Operating Storage	 -20 °C to 70 °C -40 °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)
Wire size range	22 to 14 AWG
Agency Approvals	UL, 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	 -20 °C to 70 °C -40 °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	± 10% (= ± 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/ DV / Dt)	63.2% / 6.7 V / 10 mS
Data Freshness	11 ms for +/- 100 V 18 ms for +/- 50 V
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	 -20 °C to 70 °C -40 °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)
Wire size range	22 to 14 AWG
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/ delta V / delta t)	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	 -20 °C to 70 °C -40 °C to 85 °C
Wire size	22 to 14 AWG
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	 -20 °C to 70 °C -40 °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	 -20 °C to 70 °C -40 °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	-20 °C to 70 °C
Storage Temperature	-40 °C to 85 °C
Wire size	22 to 14 AWG
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
Data Freshness	25 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	 -20 °C to 70 °C -40 °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)
Wire size range	22 to 14 AWG
Agency Approvals	CE, RoHS, DFARS
Warranty	Lifetime

SNAP-AIPM

	SNAP-AIPM
Voltage Inputs (each voltage channel)	
Recommended Input Range Scaled Input Range	85 to 250 VAC RMS 0 to 250 VAC RMS
Input Over Range	To 275 volts
Resolution	10 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%)
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)	± 8 mA plus ± 0.2% reading (at full scale = ± 28 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 Volt-Amps	 ± 0.6% reading (at full scale = ± 15 Watts) ± 0.6% reading (at full scale = ± 15 VA)
Resolution	100 mW with default scaling
AC Common Mode Rejection	> –120 dB at 60 Hz
Maximum Operating Common Mode Voltage	250 VAC
Calculated Outputs	
True Power	0–2500 W (from synchronous measurement of volts and amps)
Volt Amps	0–2500 VA (VRMS x ARMS)
General Specifications	
Power Requirements	5.0 VDC ± 0.15 VDC at 100 mA
Ambient Temperature:	

	SNAP-AIPM
Operating Storage	-20 to 70 °C -40 to 85 °C
Wire size	22 to 14 AWG
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 and SNAP-AIPM-3

	SNAP-AIPM-3	SNAP-AIPM-3V
Voltage Inputs (each voltage channel)		
Recommended Input Range Scaled Input Range	85 to 300 VAC RMS* 0 to 300 VAC RMS	85 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

	SNAP-AIPM-3	SNAP-AIPM-3V
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.
Over Range	1650 Watts true power or 16,500 counts volt-amps	Depends on CT selection
Accuracy: True Power Volt-Amps	 ± 0.6% reading (at full scale = ± 15 Watts) ± 0.6% reading (at full scale = ± 15 VA)	 ± 0.6% reading ± 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
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)**
General Specifications		
Power Requirements	5.0 VDC ± 0.15 VDC at 100 mA	5.0 VDC ± 0.15 VDC at 100 mA
Ambient Temperature: Operating Storage	 -20 to 70 °C -40 to 85 °C	 -20 to 70 °C -40 to 85 °C
Agency Approvals	CE, RoHS, DFARS	CE, RoHS, DFARS
Warranty	Lifetime	Lifetime

*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 µV when configured -1.00 V to +1.00 V 20 µV 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	±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/°C
Offset Temperature Coefficient	15 PPM/°C
Power Requirements	5 VDC (±0.15) at 170 mA
Input Resistance (Differential)	>10 Tera Ohms (each channel)
Ambient Temperature: Operating Storage	 -20 to 70 °C -40 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

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	 -20 °C to 70 °C -40 °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)
Wire size range	22 to 14 AWG
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 1050 1450 8V 12V 15V 24V 32V
Max. Loop Resistance formula	$\frac{\text{(Loop Voltage - 3)}}{0.02}$
Ambient Temperature: Operating Storage	 -20 °C to 70 °C -40 °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)
Wire size range	22 to 14 AWG
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	 -20 °C to 70 °C -40 °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
LED on top of module	Indicates that there is power to the 24v source supply 2-pin connector
Agency Approvals	CE, RoHS, DFARS FM, ATEX (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)
Wire size range	22 to 14 AWG
Warranty	Lifetime

SNAP-AOA-23-iH

Output Range Nominal Full	 4 to 20 mA 3.2 to 24 mA
External Loop Voltage Range Nominal	12-36 VDC 24 VDC
Maximum Load Resistance at Specified Loop Voltage 12 VDC 24 VDC 36 VDC	 300 Ohms 850 Ohms 1350 Ohms
Resolution	5 microamps
Accuracy	+/- 20 microamps
Response Time (% of span/delta I/delta time)	99.9%/20.7 mA/400 ms
Gain Temperature Coefficient	-50 ppm/ °C
Offset Temperature Coefficient	-25 ppm/ °C
DC Common Mode Rejection	>-120 dB
AC Common Mode Rejection	>-120 dB @ 60 Hz
Maximum Operating Common Mode Voltage	250 V continuous 1500 V transient (1 s)
Common Mode Resistance	>1000 megohms
Isolation: Channel-Channel	250 V continuous 1500 V transient (1 s)
Power Requirements	5 VDC (+/- 0.15) @ 150 mA
Ambient Temperature: Operating Storage	 -20 °C to 70 °C -40 °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-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	250 450 650 1050 1450 8V 8V 12V 24V 32V
Max. Loop Resistance formula	$\frac{\text{(Loop Voltage - 5)}}{0.02}$
Ambient Temperature: Operating Storage	 -20 °C to 70 °C -40 °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)
Wire size range	22 to 14 AWG
Agency Approvals	UL, CE, ATEX, 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 Coefficient	50 PPM/°C
Power Requirements	5 Volts DC (±0.15) @ 150 mA
Ambient Temperature: Operating Storage	 -20 °C to 70 °C -40 °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)
Wire size range	22 to 14 AWG
Agency Approvals	UL, FM, CE, RoHS, DFARS
Warranty	Lifetime

SNAP-AOD-29-HFi

Switched Output	2.5 to 24 VDC at 100 mA supplied externally
Maximum Survivable Switch Voltage	60 VDC
Peak Current	1.0 A (t < 10 milliseconds)
Period Range	0.00001 sec to 64.25 sec
Percent Range	0-100%
Period Resolution	20.8 nanoseconds
Percent Resolution	0.024% (12-bit)
Period Accuracy	+- 0.005% of period
Pull-up Voltage	4.5 to 5.0 VDC
Pull-up Resistor	200 Ohm
Minimum Output Pulse Width	1 microsecond
Maximum Operating Common Mode Voltage	250 V Continuous
Isolation: Channel to Channel	250V Continuous 1500V Transient
Power Consumption	1.5 W (300 mA @ 5 V)
Ambient Temperature: Operating Storage	 -20 °C to 70 °C -40 °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)
Wire size range	22 to 14 AWG
Agency Approvals	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 Continuous	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	 -20 °C to 70 °C -40 °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)
Wire size range	22 to 14 AWG
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	 -20 °C to 70 °C -40 °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)
Wire size range	22 to 14 AWG
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	 -20 °C to 70 °C -40 °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)
Wire size range	22 to 14 AWG
Agency Approvals	UL, CE, FM, RoHS, DFARS
Warranty	Lifetime

SNAP-AOVA-8

Excitation Range	18 TO 32 VDC
Excitation Current Required	200mA @ 32VDC, 250mA @ 24VDC, 350mA @ 18VDC
24V Excitation Fault Recovery Time	15 mS nominal
Power Requirement (from the rack)	5 VDC (±0.15) @ 150 mA
Maximum Operating Common Mode Voltage	250 volts
Isolation	1500 V (transient)
DC Common Mode Rejection	>-120 dB
AC Common Mode Rejection	>-120 dB @ 60 Hz
Data Refresh Time	9 mS nom (update 1 ch/ms)
Ambient Temperature: Operating Storage	 -20 to 70 °C -40 °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)
Wire size range	22 to 14 AWG
Agency Approvals	UL, CE, RoHS, DFARS
Warranty	Lifetime

Voltage Outputs	
Output Range (Resolution)	0 to 5 VDC (1.22 mV) 0 to 10 VDC (2.44 mV) -5 to +5 VDC (2.44 mV) -10 to +10 VDC (4.88 mV)
Load Current	+/-10 mA min. each voltage output channel)
Short Circuit Current	16 mA Typ.
Accuracy	0.1% of span
Drift: Gain Temperature Coefficient Offset Temperature Coefficient	 30 PPM / °C 15 PPM / °C
Current Outputs	
Output Range (Resolution)	4 to 20 mA (4 microamps) 0 to 20 mA (5 microamps)
Maximum Loop Resistance	750 Ohms (each current output channel)
Open Circuit Volts	27 VDC max. (24 VDC typical)
Accuracy	0.1% of span
Drift: Gain Temperature Coefficient Offset Temperature Coefficient	 30 PPM / °C 15 PPM / °C

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	-20 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	UL, CE, FM, RoHS, DFARS ATEX (SNAP-SCM-485-422 only)
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	-20 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	-20 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	-20 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	UL, 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 Hz (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
Duty Cycle	Fixed at 50%
Number of Ports per Module	2
Operating Temperature Range	-20–60 °C
Storage Temperature Range	-30–85 °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

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

[2]To 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 9.2a or newer.
Operating temperature	-20 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	UL, 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	-20 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-point analog inputs/outputs; 4-point digital inputs/outputs*; 8-, 16-, or 32-point digital and analog outputs (not thermocouples)	4-point digital inputs and outputs 16- and 32-pt digital inputs/outputs	4-point digital inputs and outputs 16- and 32-pt 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. SNAP-HD-20F6 with a SNAP-AOVA-8 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-point modules	16 spring connectors; accommodates four 4-point modules	16 spring connectors; accommodates four 4-point modules
Fusing	none	1 A, 250 V, fast-acting fuse for each I/O point (16 total). Replace with Opto 22 PN FUSE01G4	1 A, 250 V, fast-acting fuse for each I/O point (16 total). Replace with Opto 22 PN FUSE01G4
Indicators	none	1 blown-fuse LED per fuse (16 LEDs total)	1 blown-fuse LED per fuse (16 LEDs total)
Bussed power	none	120–240 V	12–24 V
Agency Approvals	CE, RoHS, DFARS	UL, CE, RoHS, DFARS	UL, CE, RoHS, DFARS
Warranty	30 months	30 months	30 months

* Can be used with digital outputs but does not have fuses. SNAP-TEX-FB16 boards have fuses; they are better for digital outputs.
** **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	-20 to 70 °C
Relative Humidity	95%, non-condensing
Agency Approvals	UL, 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-point 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. Wire size for field connectors: 16-20 AWG
Indicators	1 LED for On/Off status of each signal input (32 signal LEDs total) 1 power status LED for each zone of 8 signal inputs (4 power LEDs total)
Fusing	2 fuses (Module Common, Field Common) for each zone of 8 signal inputs (8 fuses total) 1 A fuses; 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. Set jumpers to X position for digital input modules.
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-point 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. Wire size for field connectors: 16-20 AWG
Indicators	1 LED for On/Off status of 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. Set jumpers to Z position for digital output modules.
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-UDC-HDB

SNAP-UDC-HDB Breakout Rack for High-Density Digital Input and Output Modules	
Used with	SNAP-IDC-32, SNAP-IDC-32-FM SNAP-IDC-32N, SNAP-IDC-32D, SNAP-IDC-32DN SNAP-ODC-32-SNK, SNAP-ODC-32-SNK-FM SNAP-ODC-32-SRC, SNAP-ODC-32-SRC-FM
Connectors	40-pin header connects to 32-point module using SNAP-HD-BF6 cable. 64 spring-clamp terminal block provides 1 connection for each of 32 channels, 4 connections per 8-channel zone for field common, and 4 connections per 8-channel zone for module common.
Wire size	Field connector: 12-28 AWG
Indicators	1 LED status indicator for each point (32 LEDs total)
Jumpers	When using any SNAP-IDC-32 input module, install all four jumpers (JP1–JP4) in X positions. When using any SNAP-ODC-32 output module, install all four jumpers in Z positions.
Voltage	32 VDC maximum, 12–24 VDC nominal
Agency Approvals	UL, CE, RoHS, DFARS
Warranty	30 months from date of manufacture

SNAP-UDC-HDB-G4

SNAP-UDC-HDB-G4 Breakout Rack for High-Density Digital Input or Output Module	
Used with	Outputs: SNAP-ODC-32-SNK or SNAP-ODC-32-SNK-FM (all G4 modules must be the same voltage) Inputs: SNAP-IDC-32DN for 5 V G4 modules; SNAP-IDC-32N for 15 V or 24 V G4 modules
Connectors	40-pin header connects to 32-point module using SNAP-HD-BF6 cable. 64 spring-clamp terminals provide 2 connections for each of 32 channels. Additional 4 spring-clamp terminals are for logic power + and – (2 each).
Wire size	Field connector: 12-28 AWG
Indicators	1 LED for logic power; 1 LED for G4 fuse test
Jumpers	When using a SNAP-ODC-32-SNK output module, install JP1 in the negative (–) position. When using a SNAP-IDC-32 input module, install JP1 in the positive (+) position.
Voltage	32 VDC maximum, 12–24 VDC nominal
Agency Approvals	UL, 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-cable assembly; 16-pin connector at module end; 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, tinned, color-coded, 22-gauge wires	Pre-stripped, tinned, 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-IDC-32D SNAP-IDC-32DN 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): SNAP-IDC-32 to SNAP-IDC-HDB or SNAP-UDC-HD SNAP-IDC-32N to SNAP-IDC-HDB, SNAP-UDC-HDB, or SNAP-UDC-HDB-G4 SNAP-IDC-32D to SNAP-IDC-HDB or SNAP-UDC-HDB SNAP-IDC-32DN to SNAP-IDC-HDB, SNAP-UDC-HDB, or SNAP-UDC-HDB-G4 SNAP-ODC-32-SNK to SNAP-ODC-HDB, SNAP-UDC-HDB, or SNAP-UDC-HDB-G4 SNAP-ODC-32-SRC to SNAP-ODC-HDB or SNAP-UDC-HDB SNAP-AIV-32 to SNAP-AIV-HDB SNAP-AIMA-32 to SNAP-AIMA-HDB SNAP-AIMA-32 to SNAP-AIV-HDB*
Agency Approvals	CE, RoHS, DFARS	CE, RoHS, DFARS	CE, RoHS, DFARS
Warranty	30 months	30 months	30 months

* Special application; see wiring diagrams

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

Feature	SNAP-TEX-MR10-4 SNAP-TEXMR10-16	SNAP-TEX-MR10-16C
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	• For one high-density SNAP-ODC-32-SRC module, use a SNAP-HD-G4F6 cable to connect two breakout boards to one module. • For four 4-point modules, use SNAP-TEX-CBO6 (odd pins bussed) or SNAP-TEX-CBS6 (no bussing), depending on module.
Use with jumper straps	---	STRAP2Q, STRAP4Q
Relay contacts	SPDT (1 Form C) Typical life expectancy (Electrical): 1 x 10^5	SPDT (1 Form C) Typical life expectancy (Electrical): 1 x 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. Opto 22 p/n SNAP-FUSE1AC	24 V fuse for board. Opto 22 p/n SNAP-FUSE1AC
Indicators	On/Off status indicators (one for each channel) 1 fuse-blown indicator	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	UL, CE, RoHS, DFARS	UL, 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, tinned, color-coded, 18 gauge	8 pre-stripped, tinned, color-coded, 18 gauge	8 pre-stripped, tinned, color-coded, 18 gauge
Bussing	Odd-numbered pins connected	Even-numbered pins connected*	No connections
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

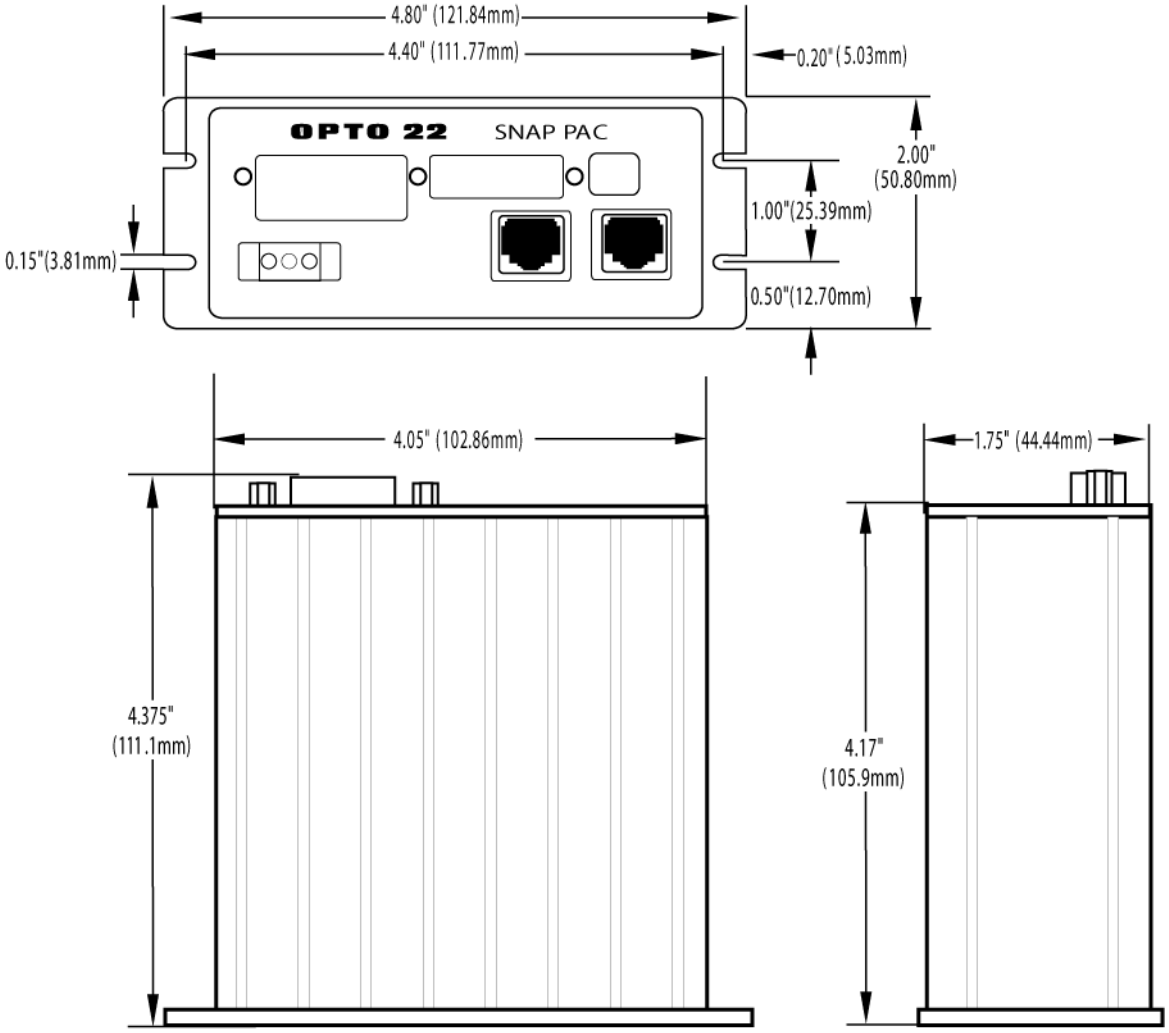
Introduction

This appendix includes dimensional diagrams for SNAP PAC System hardware:

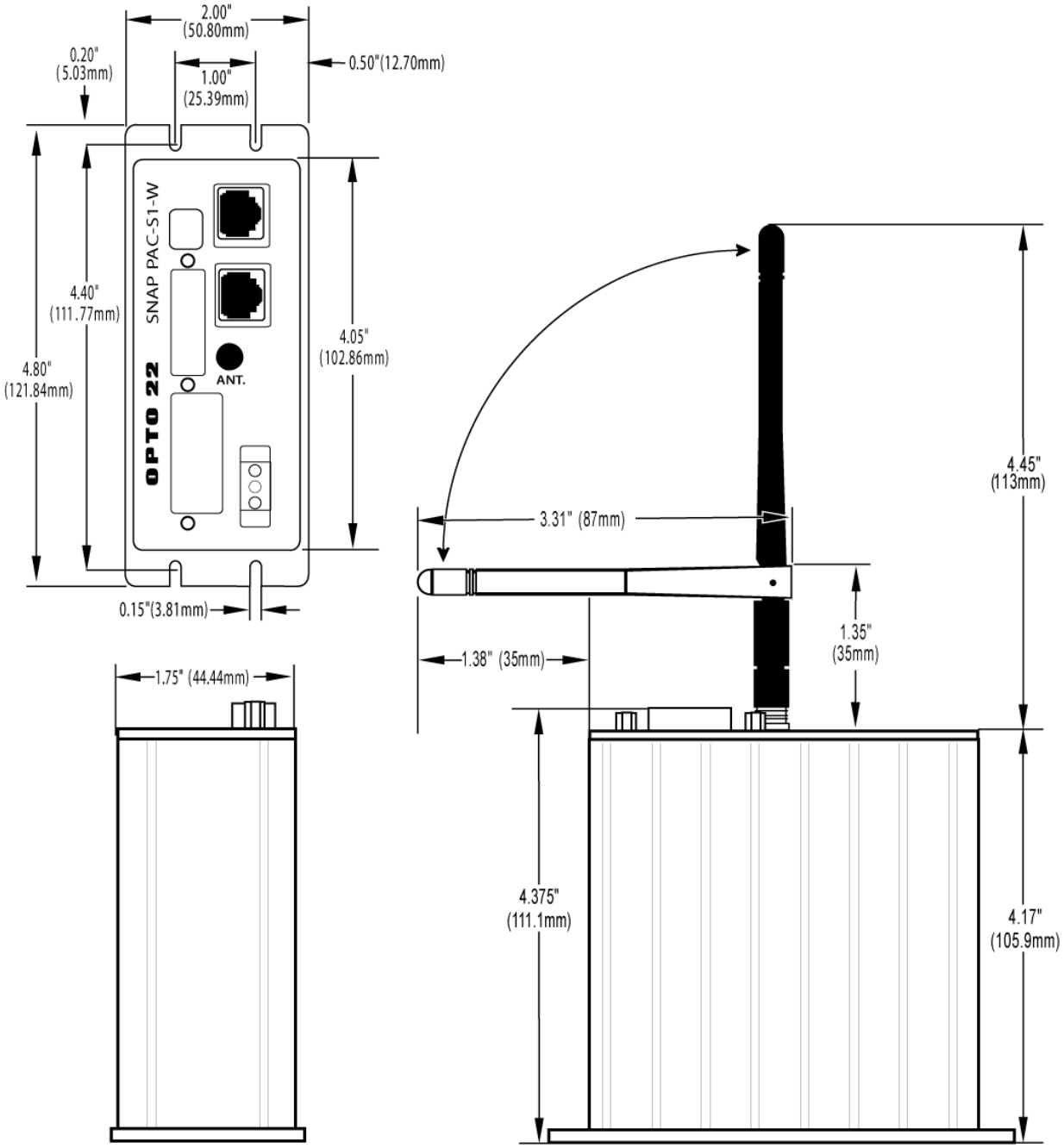
For N-TRON switch and access point dimensions, see the data sheet for the part number. Data sheets are available on our website, www.opto22.com.

SNAP PAC Controller Diagrams

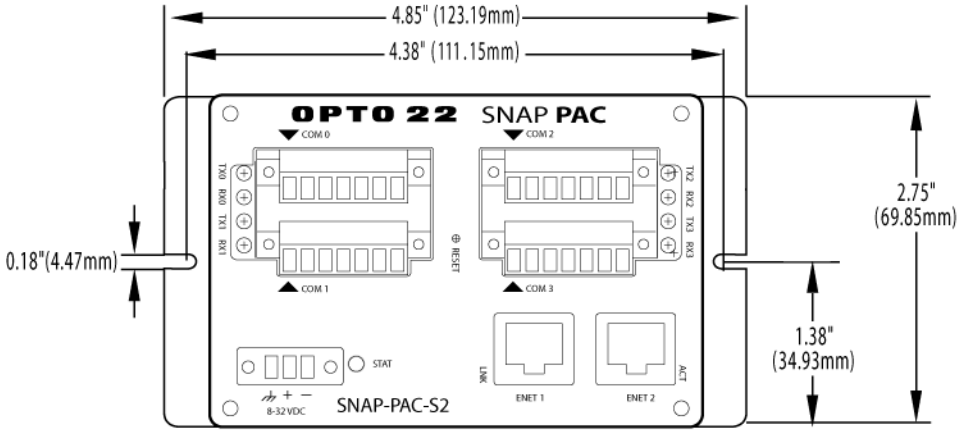
SNAP-PAC-S1 and SNAP-PAC-S1-FM Standalone Controller

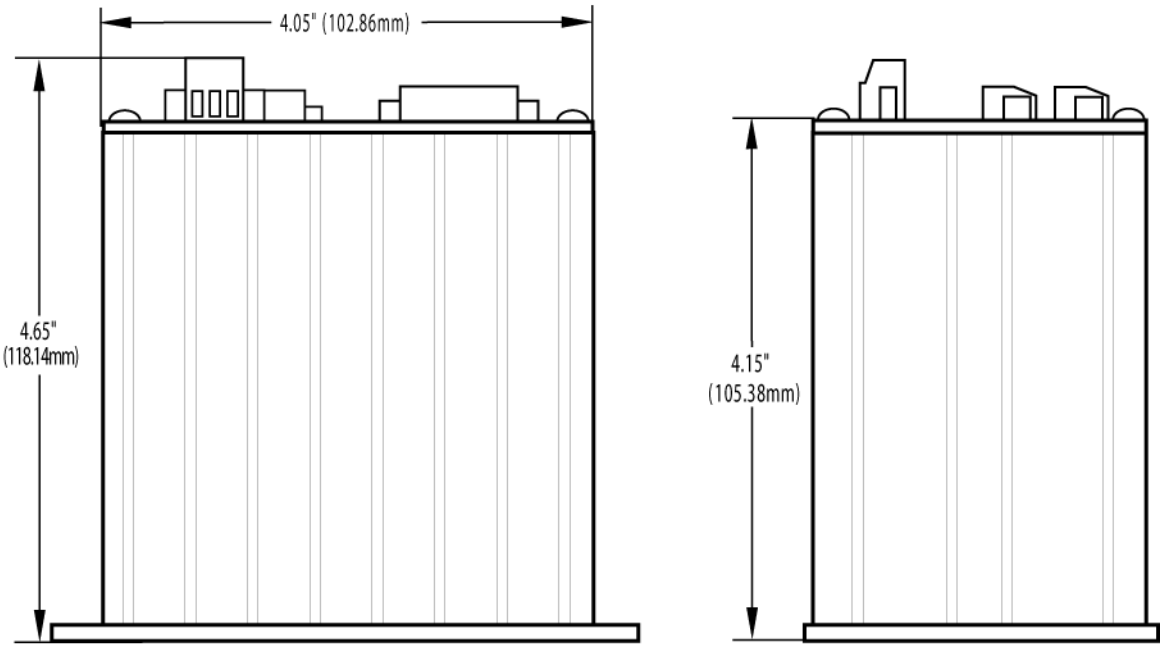


SNAP-PAC-S1-W Standalone Controller

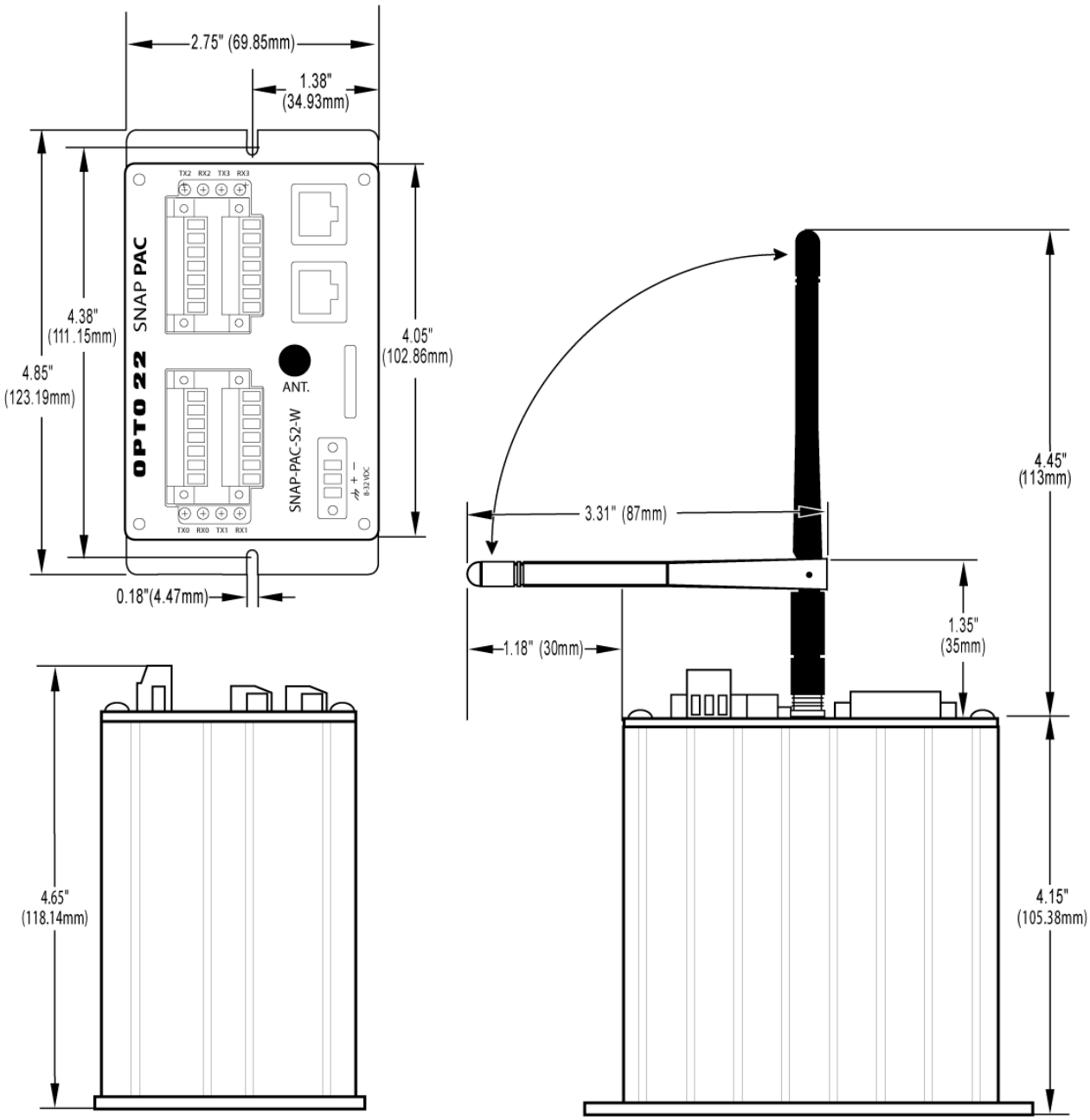


SNAP-PAC-S2 Standalone Controller

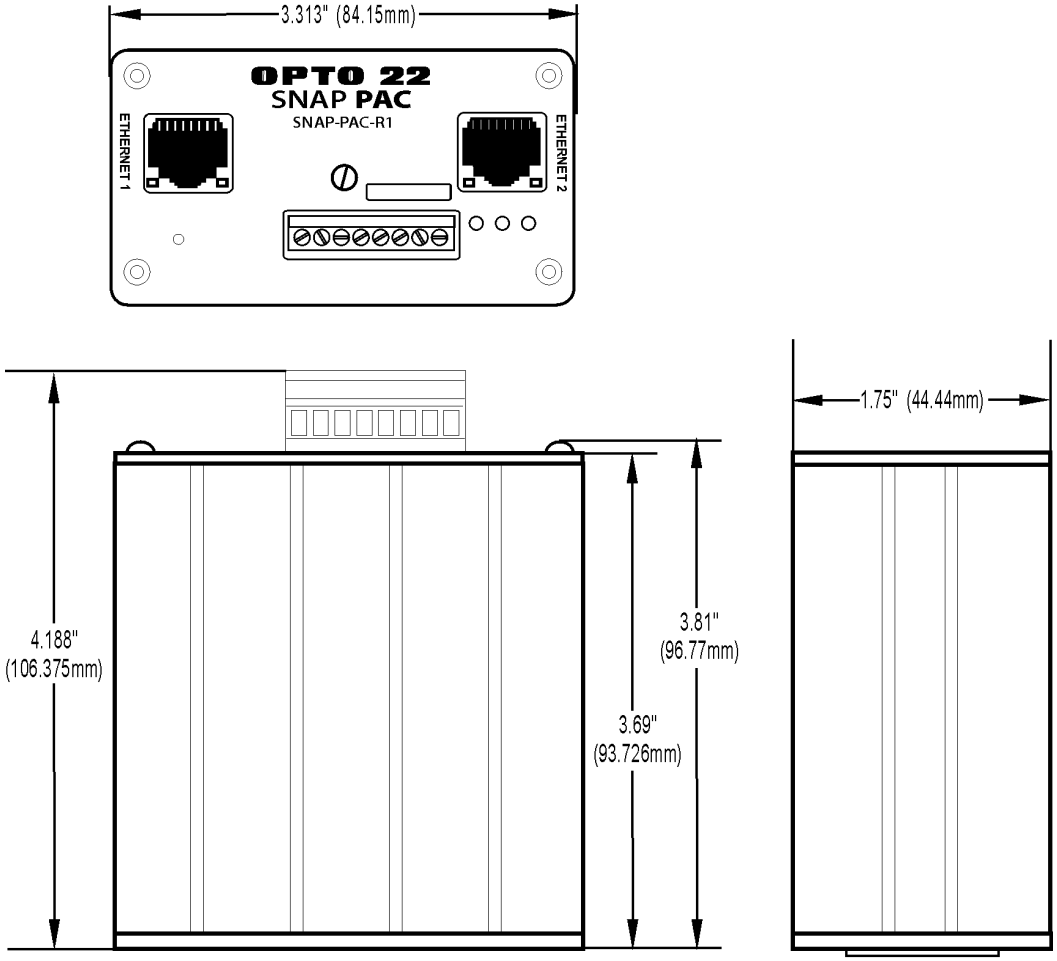




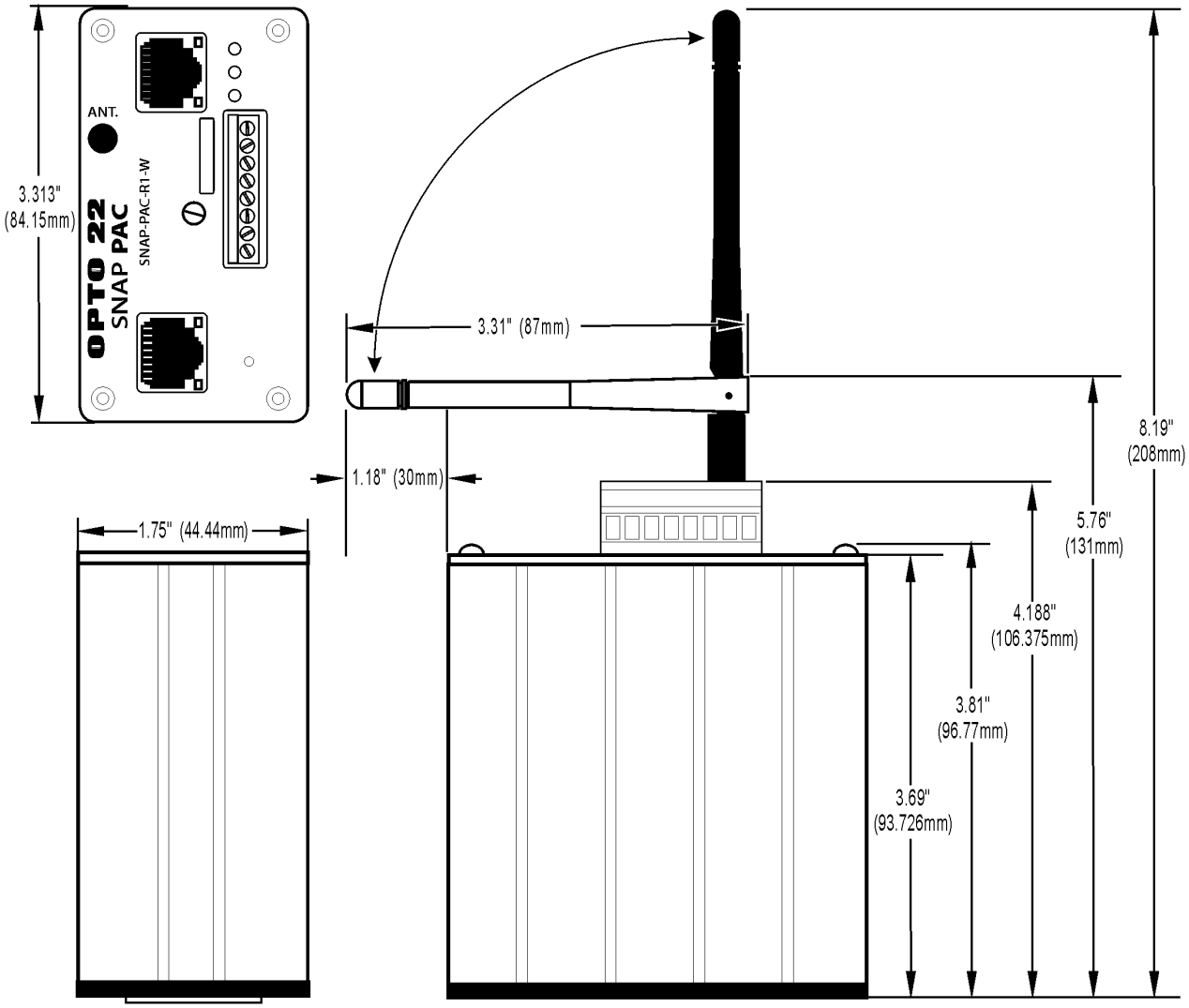
SNAP-PAC-S2-W Standalone Controller



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

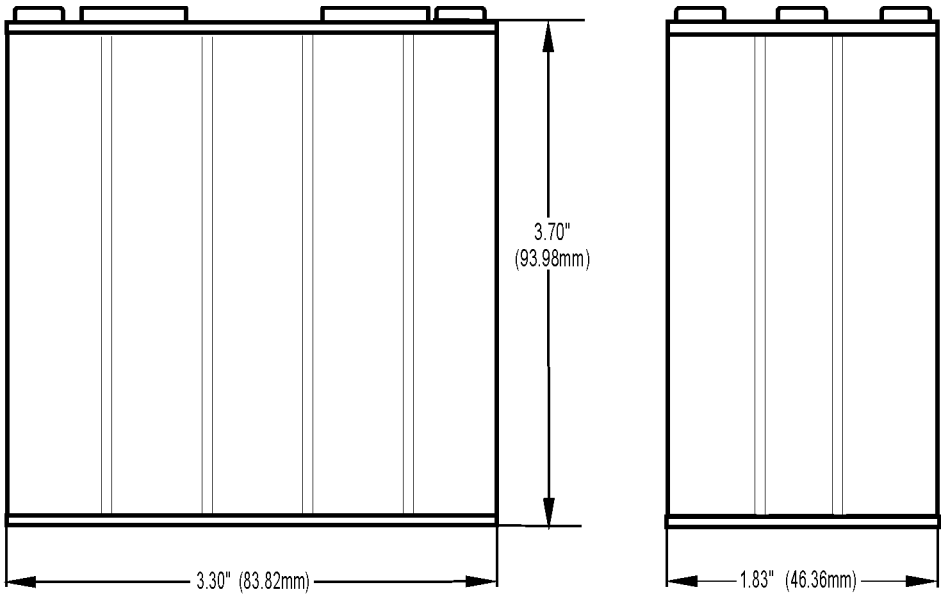


SNAP-PAC-R1-W and SNAP-PAC-R2-W Rack-mounted Controllers

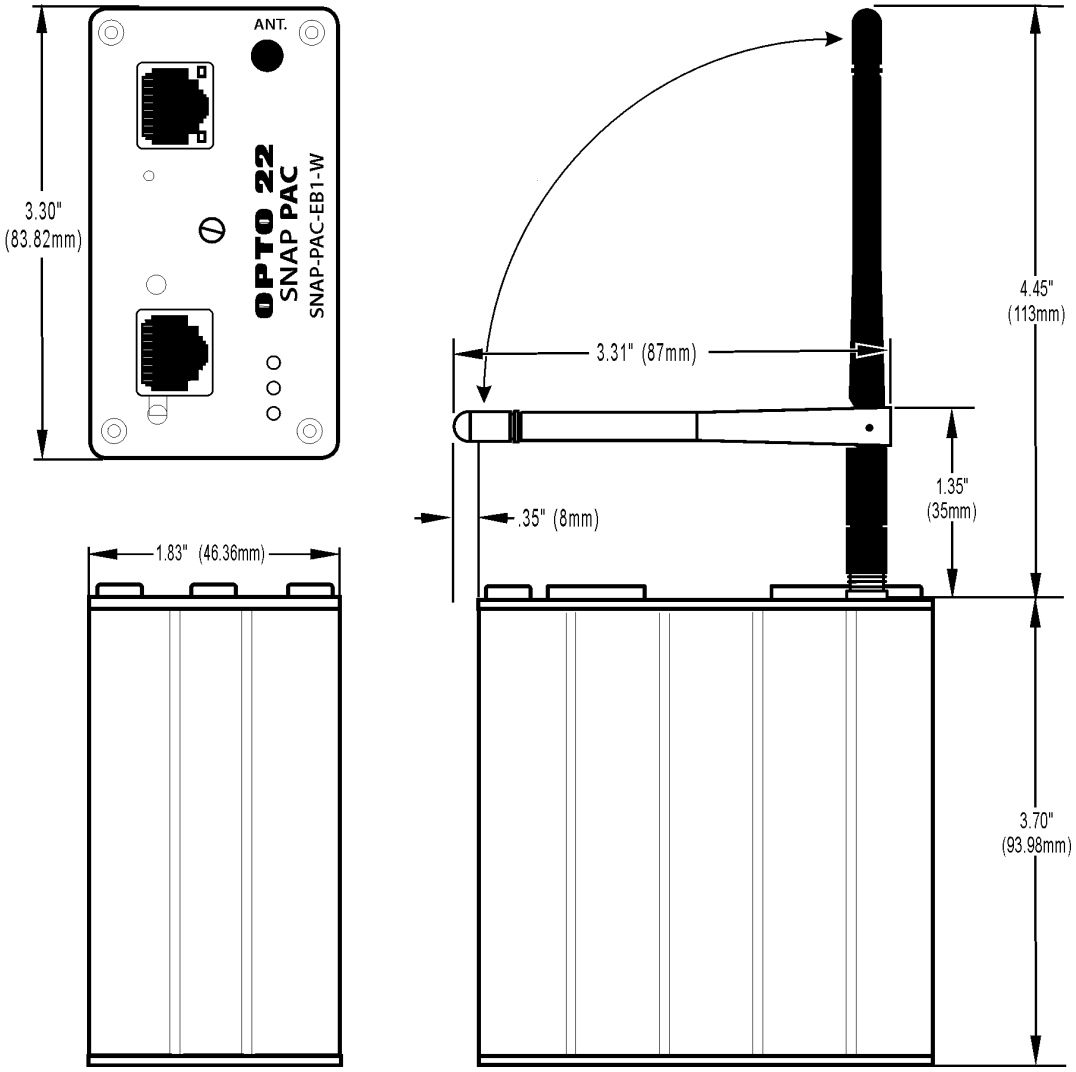


SNAP PAC Brain Diagrams

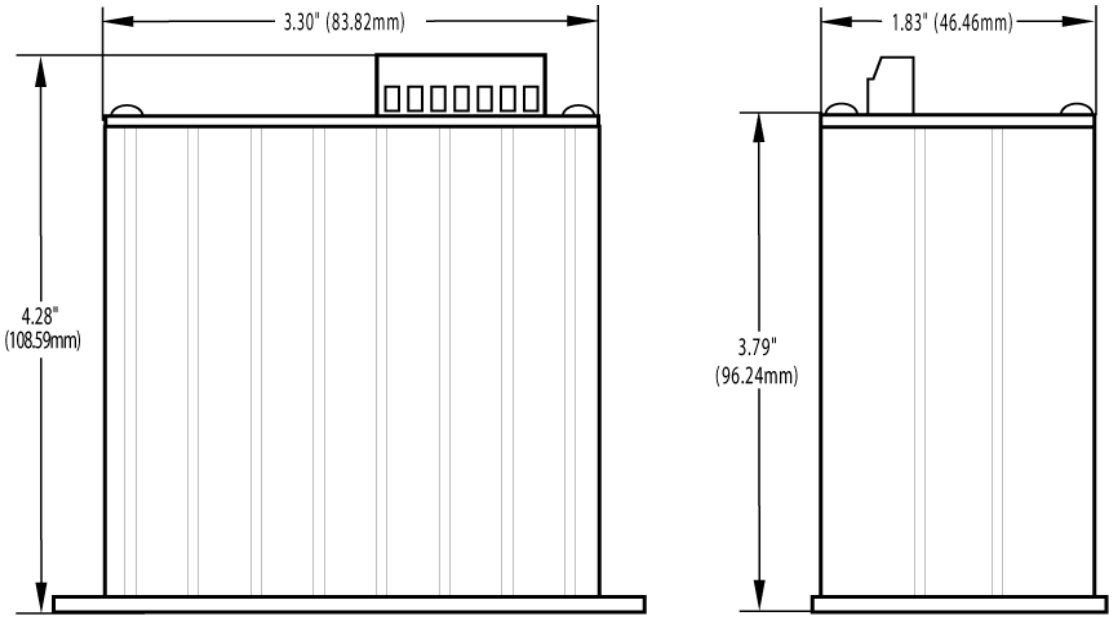
SNAP-PAC-EB1, SNAP-PAC-EB1-FM, SNAP-PAC-EB2, and SNAP-PAC-EB2-FM Ethernet Brains



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

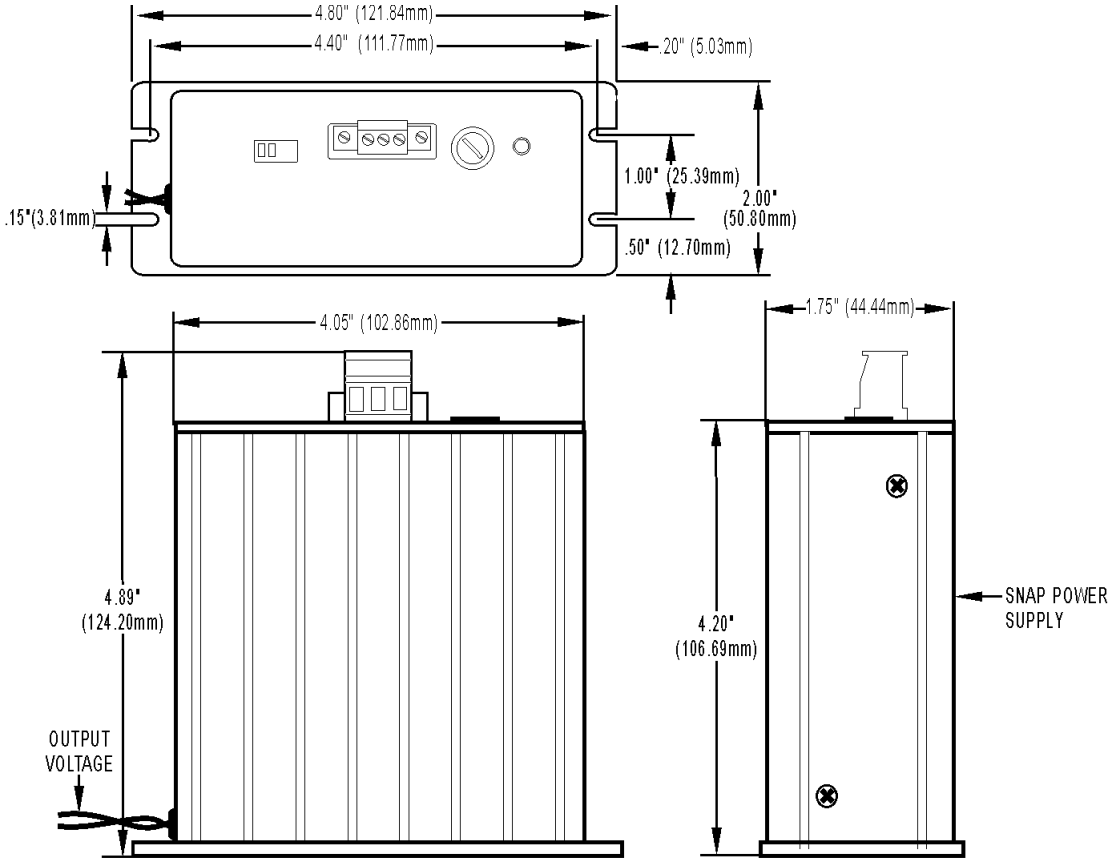


SNAP-PAC-SB1and SNAP-PAC-SB2 Serial Brains

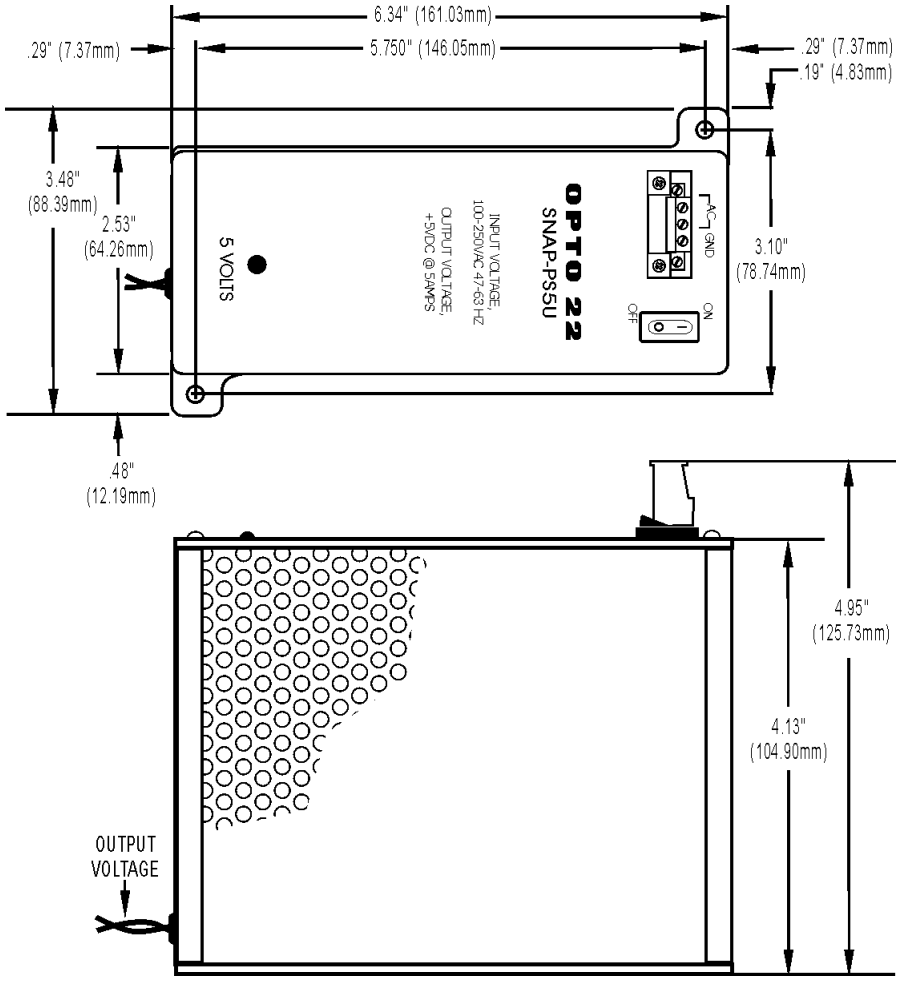


SNAP Power Supplies Diagrams

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



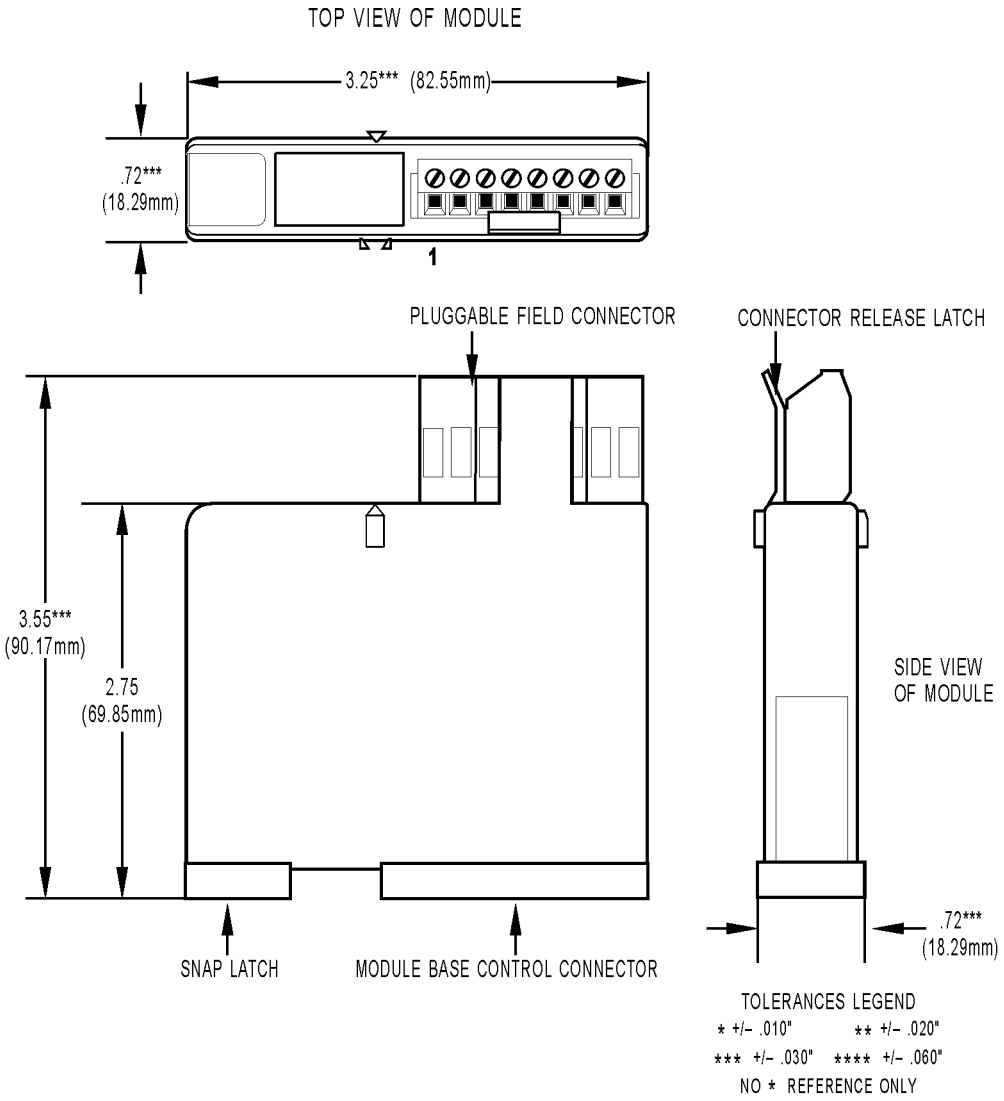
SNAP-PS5U and SNAP-PS24U



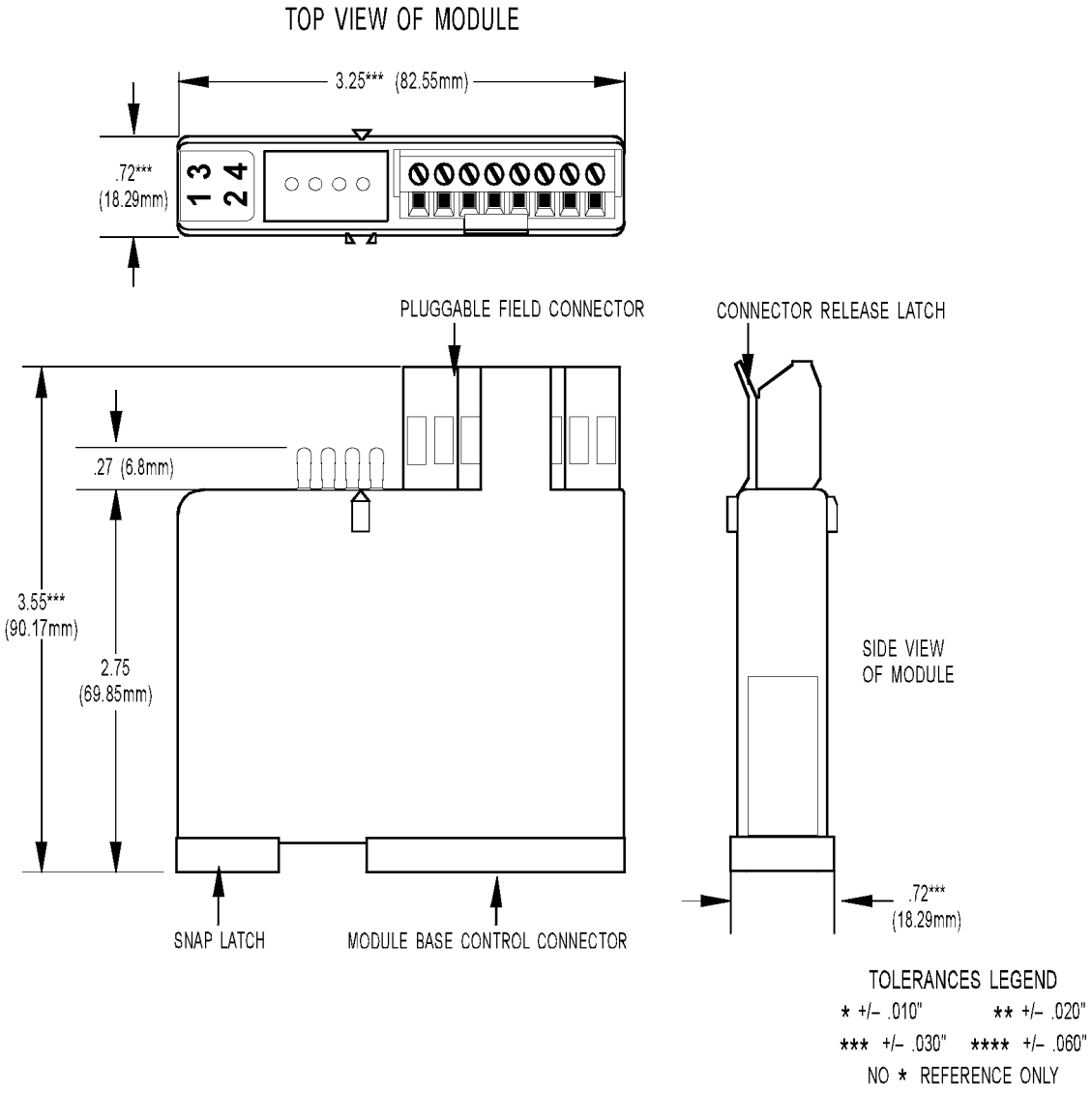
SNAP Digital I/O Modules Diagrams

SNAP Digital Input Modules—All Modules except MA

For high-density digital modules, see diagrams starting on page 200.

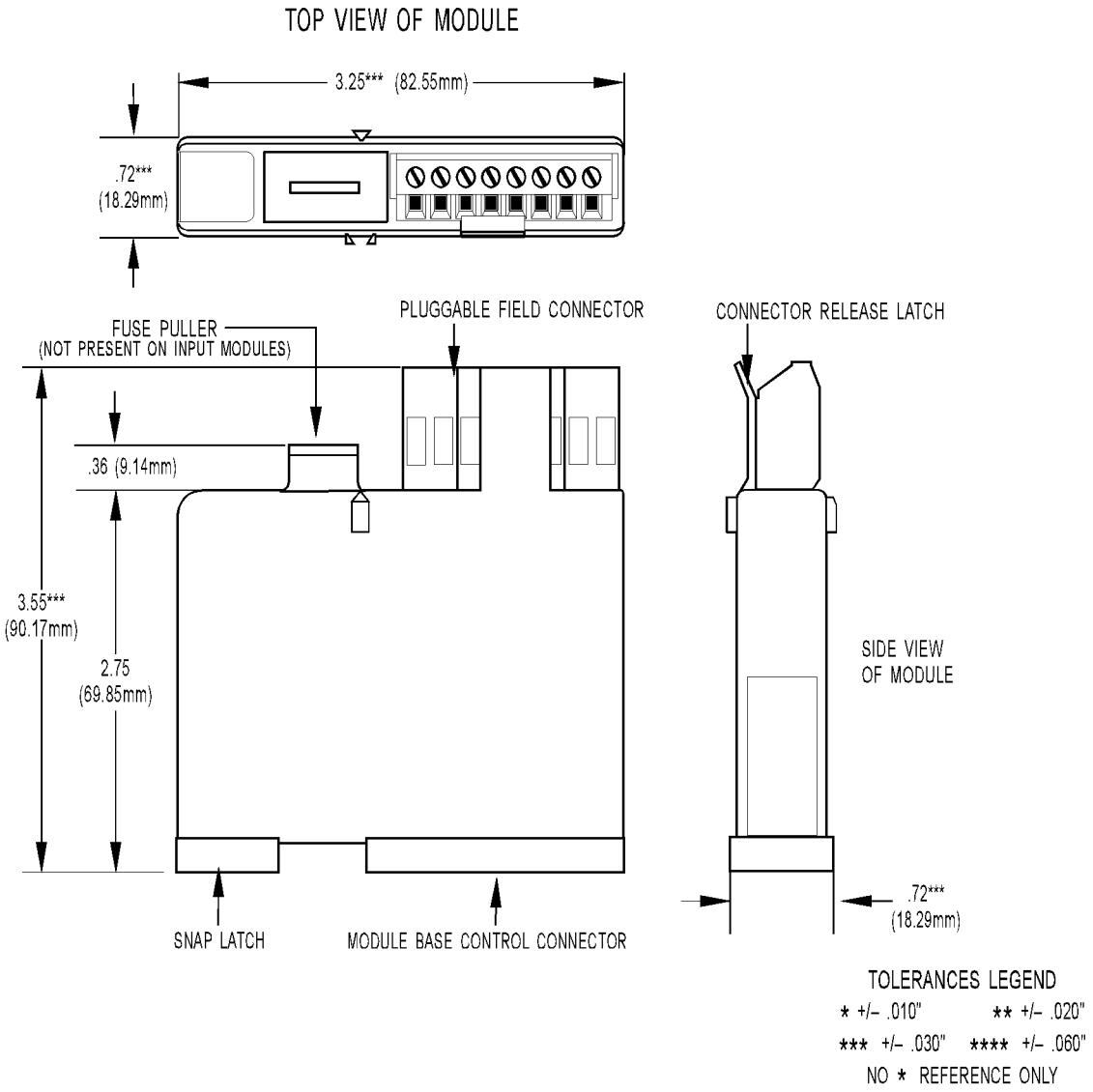


SNAP Digital Input Modules—MA Modules

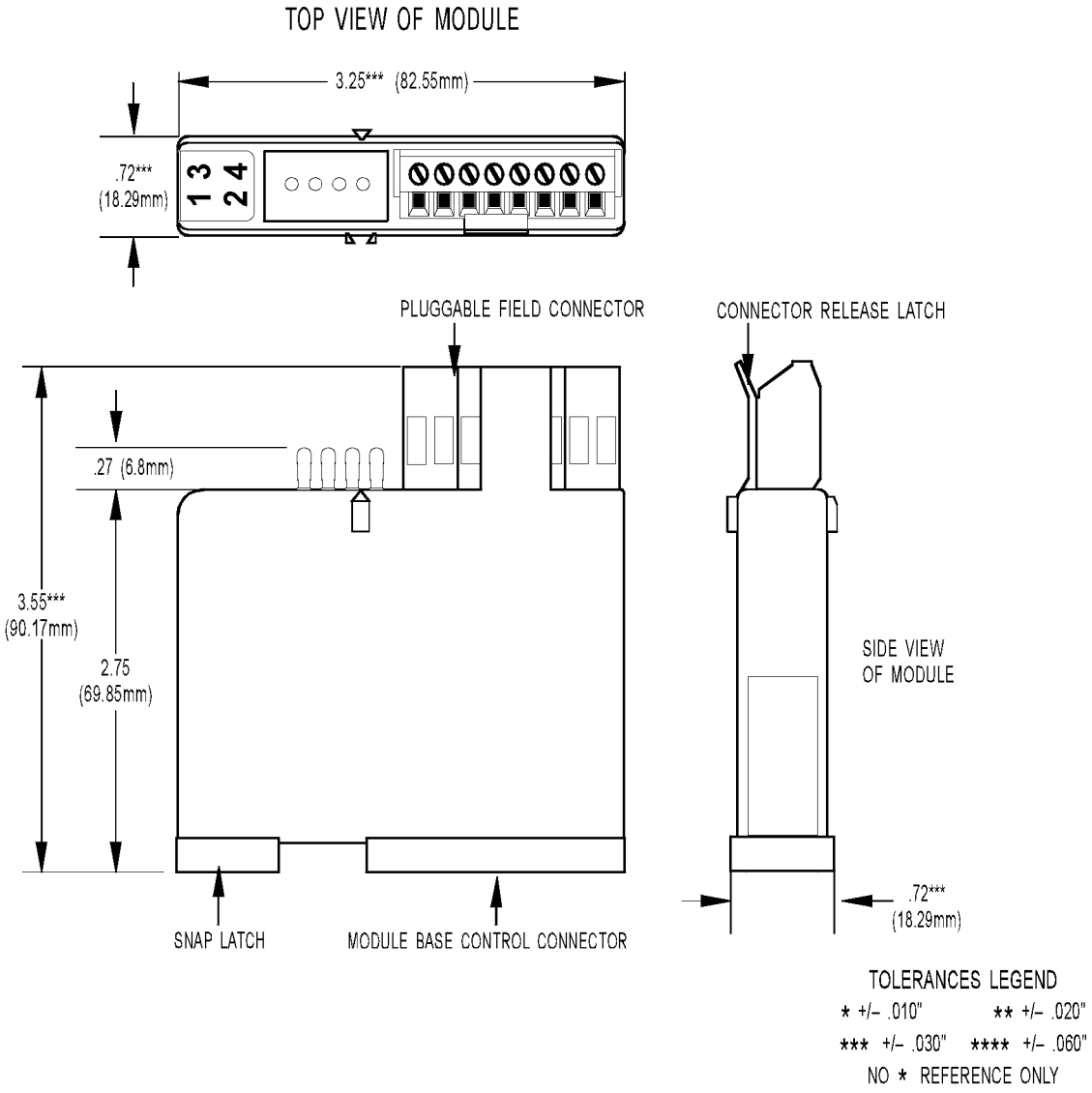


SNAP Digital Output Modules—All Modules except MA and Mechanical Power Relay

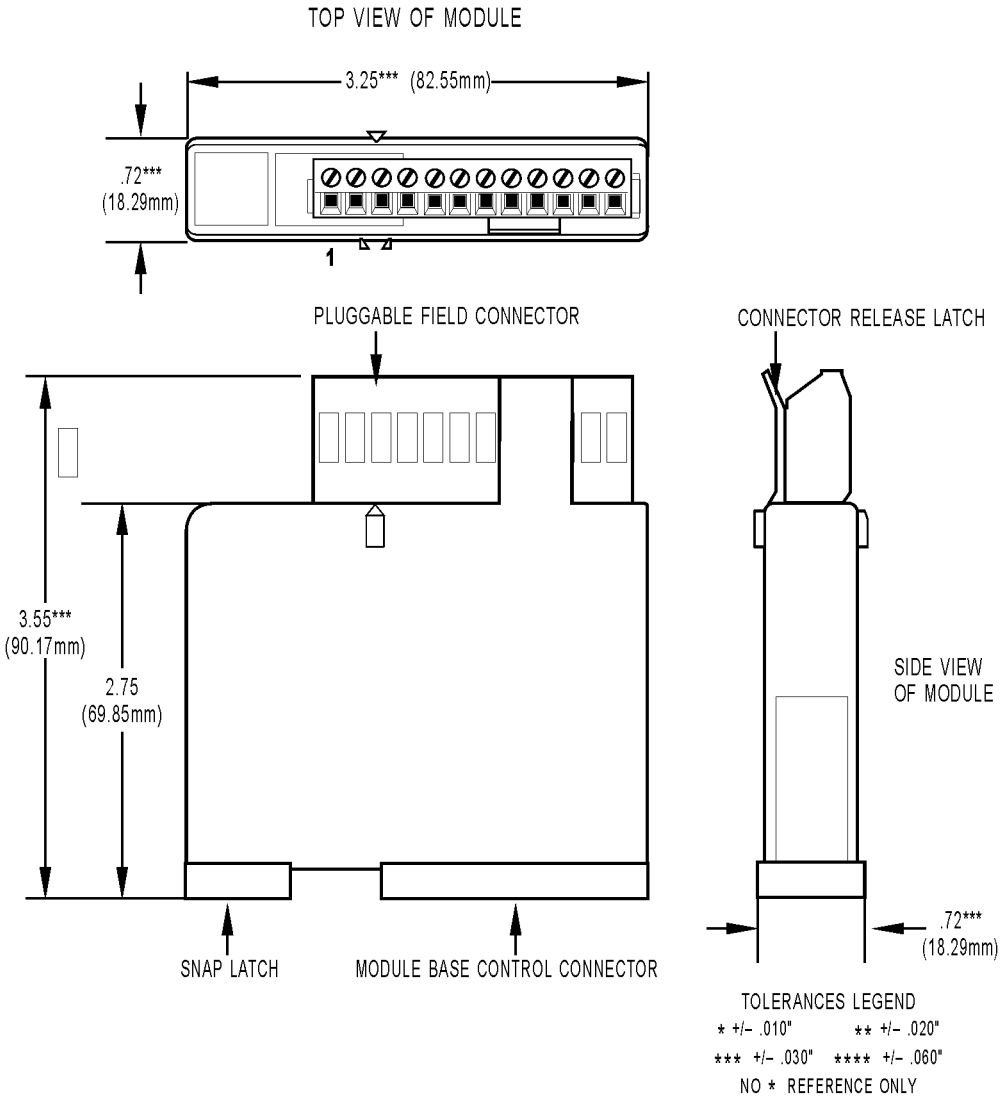
For high-density digital modules, see diagrams starting on page 200.



SNAP Digital Output Modules—MA Modules

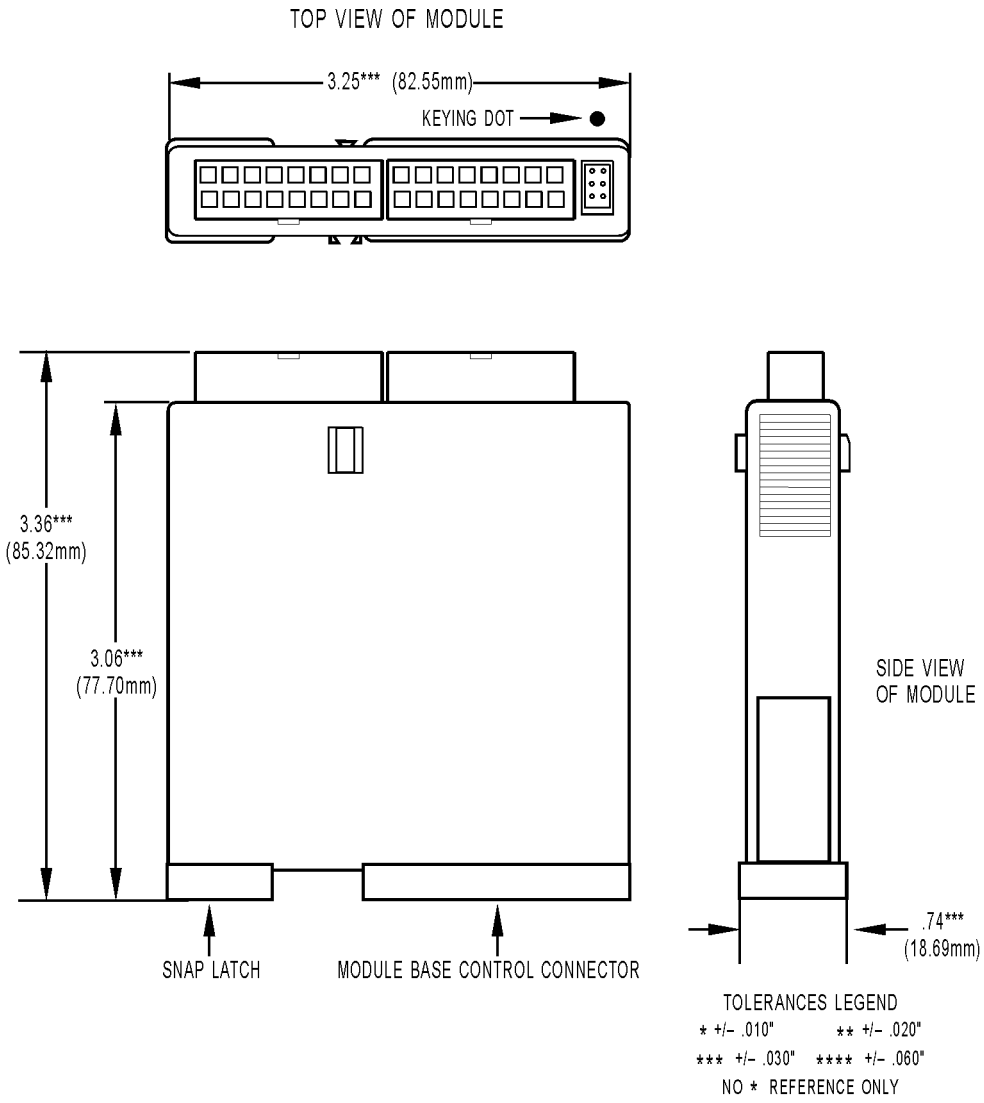


SNAP Digital Output Modules—Mechanical Power Relay

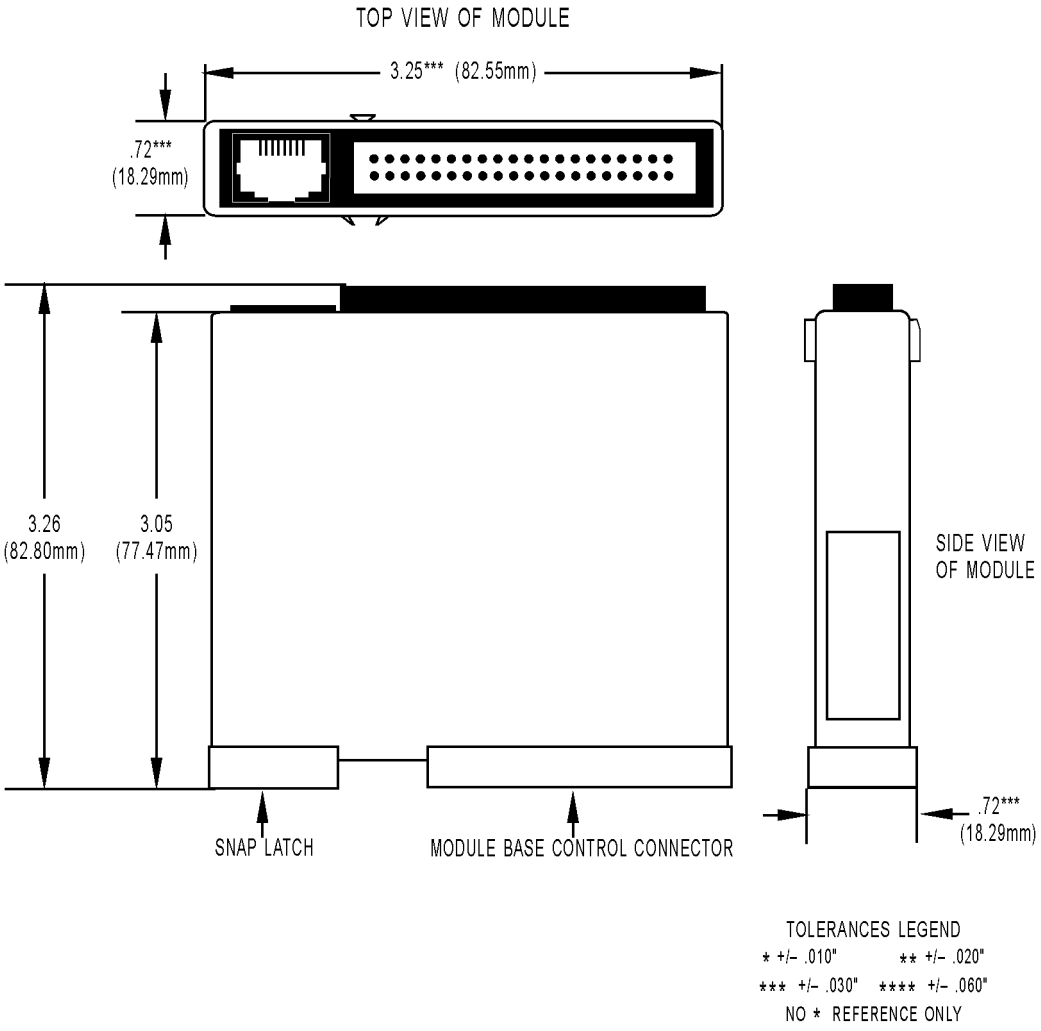


SNAP High-Density Digital Modules

SNAP 16-Point Digital Modules



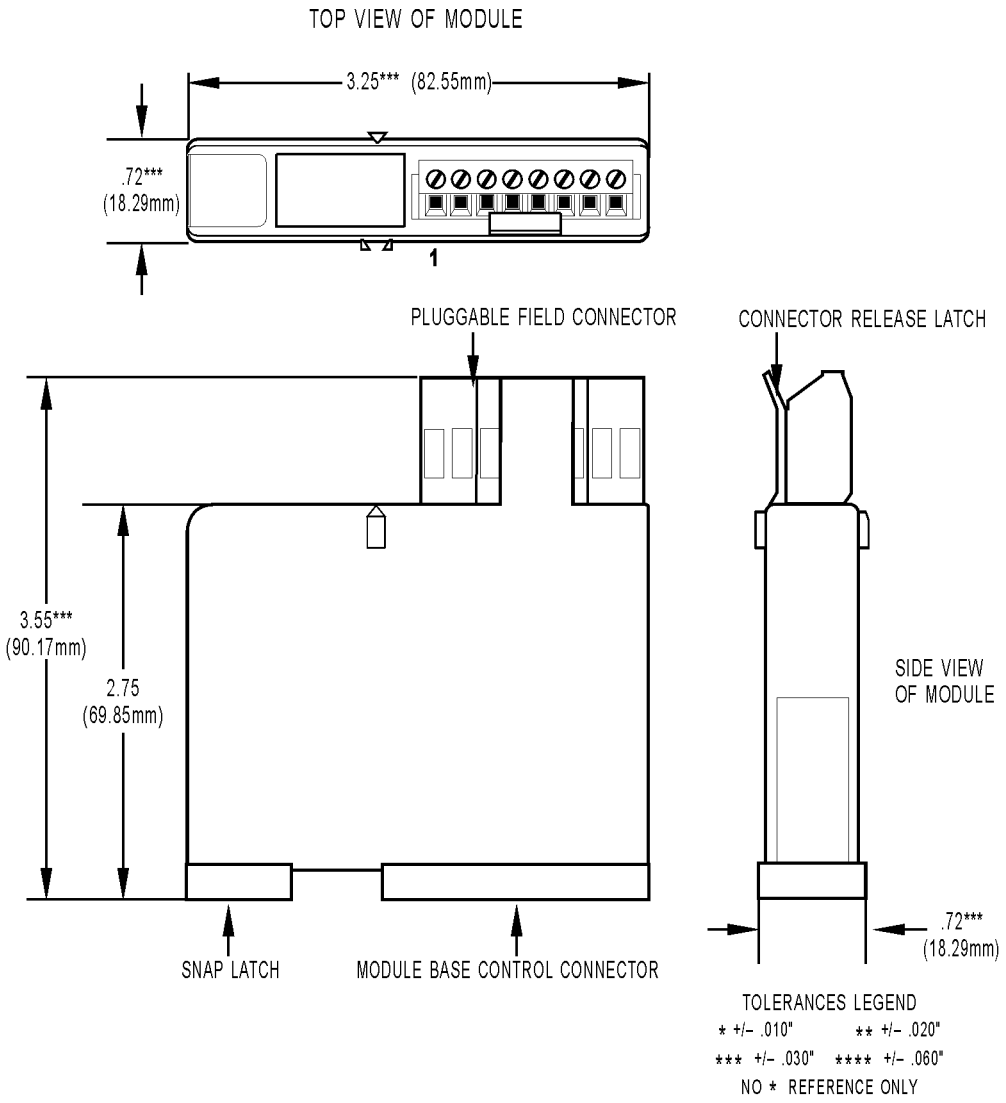
SNAP 32-Point Digital Modules



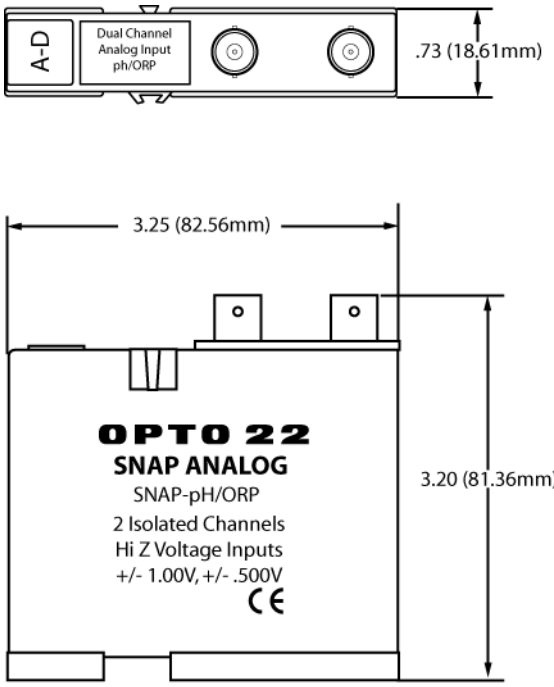
SNAP Analog I/O Modules

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

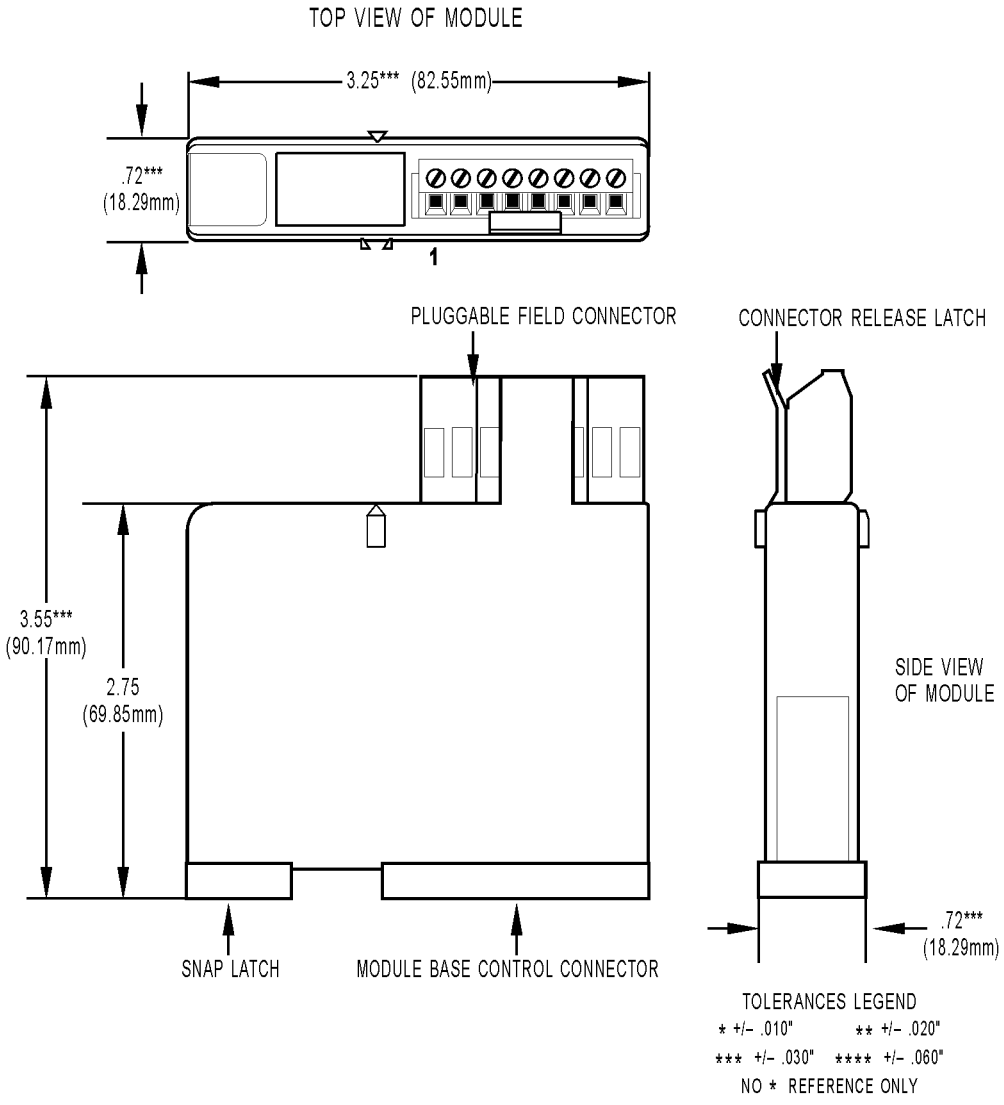
For SNAP-pH/ORP, see page 203.
For SNAP-AIPM, see page 204.
For SNAP-AIPM-3 and SNAP-AIPM-3V, see page 205.
For isolated analog input modules, see page 211.



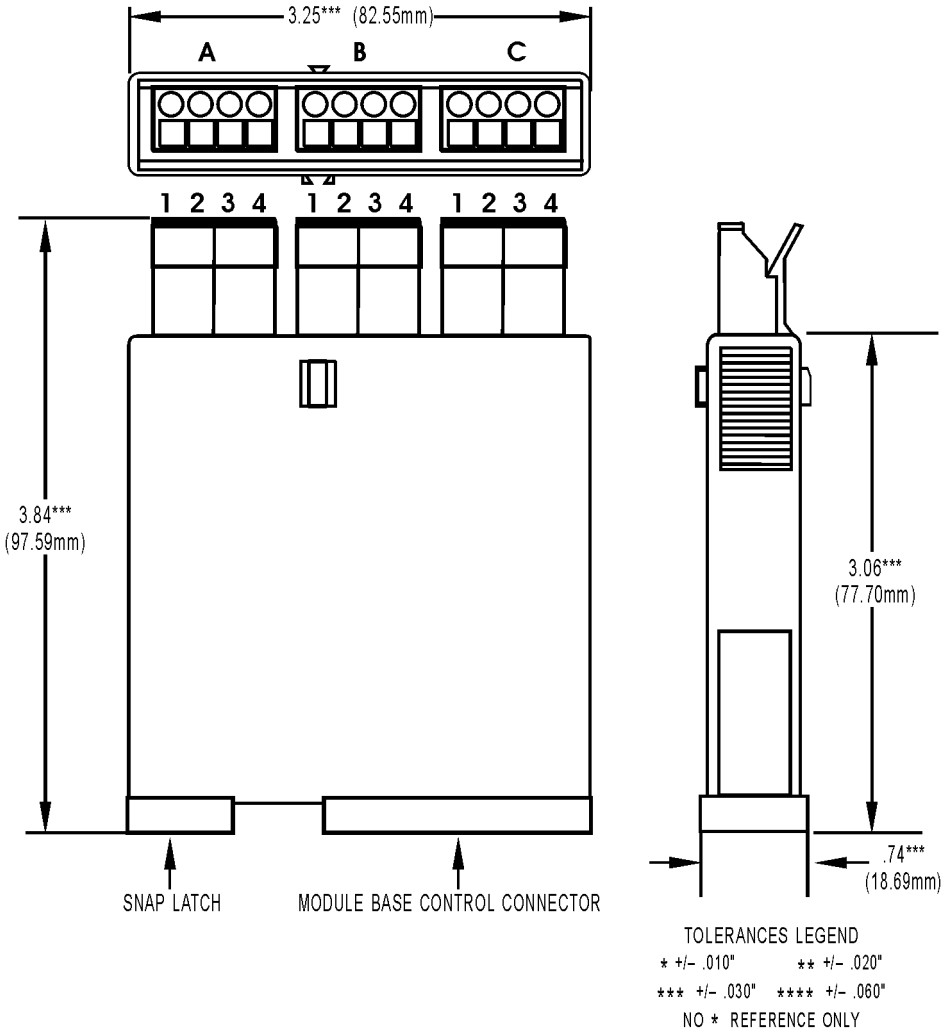
SNAP-pH/ORP Analog Input Module



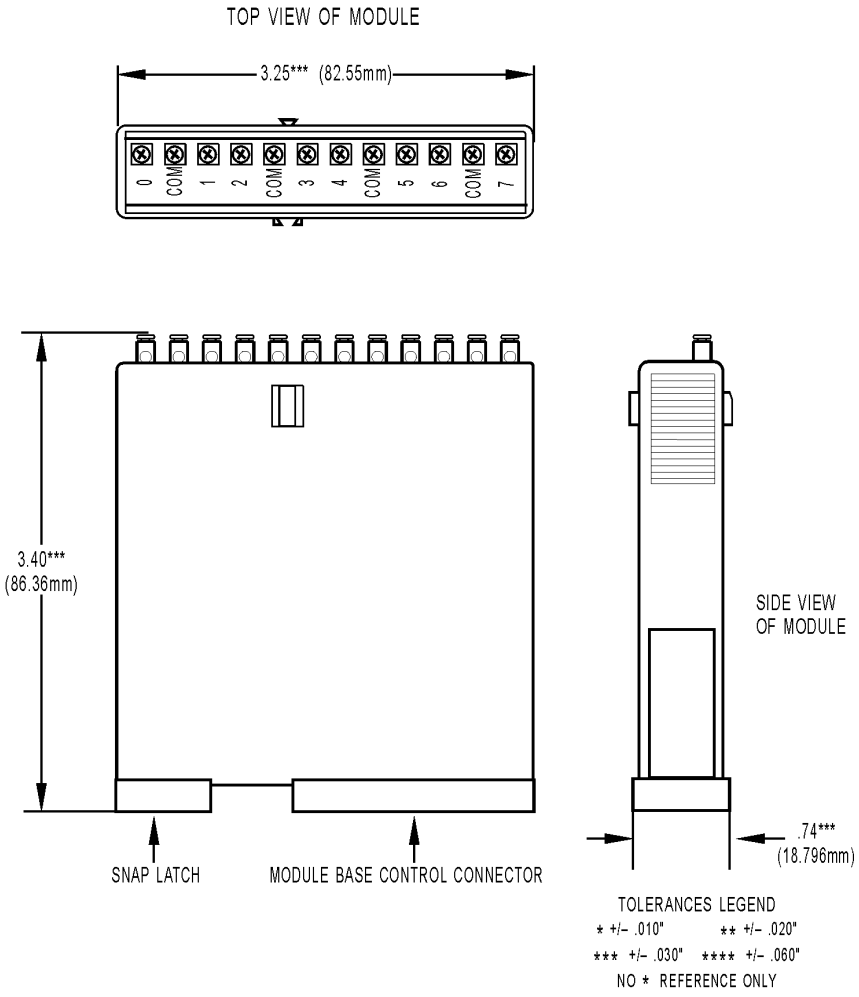
SNAP Analog Input Modules—SNAP-AIPM



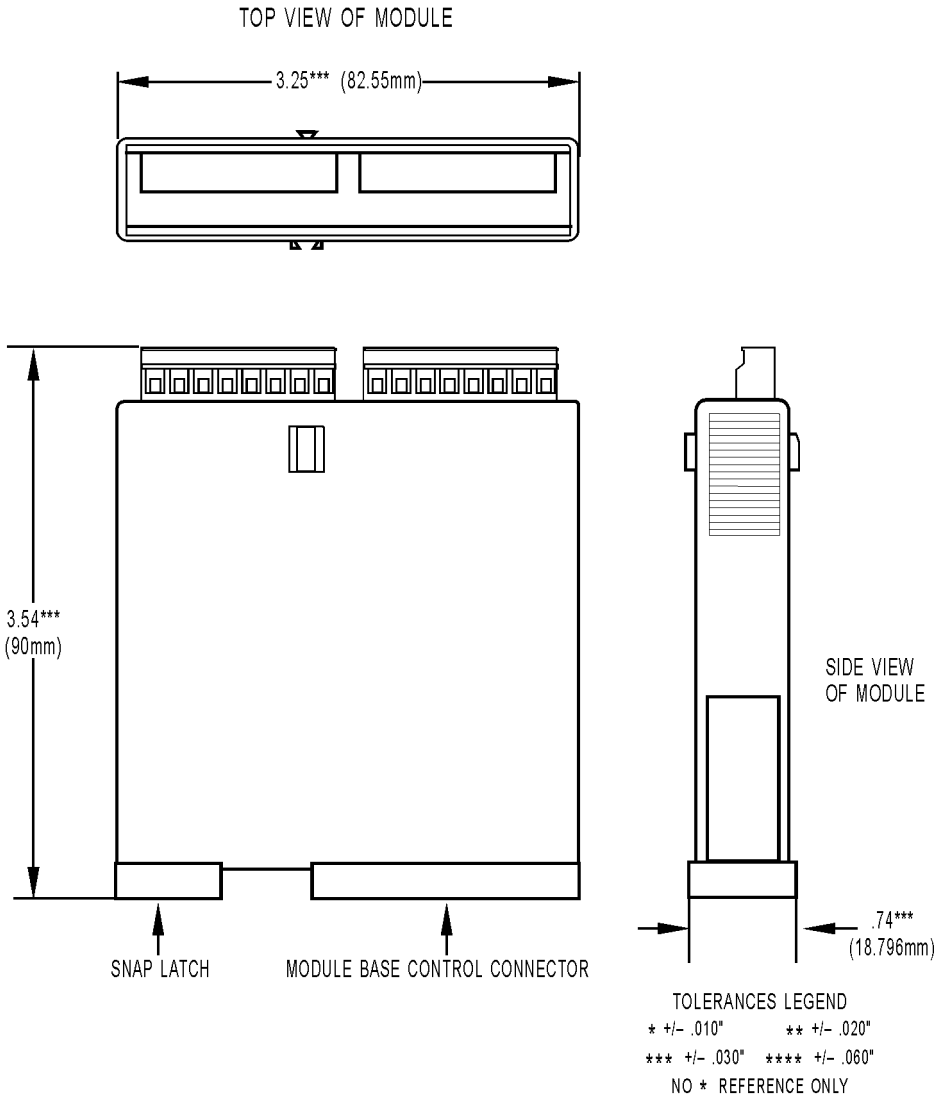
SNAP Analog Input Modules—SNAP-AIPM-3 and SNAP-AIPM-3V



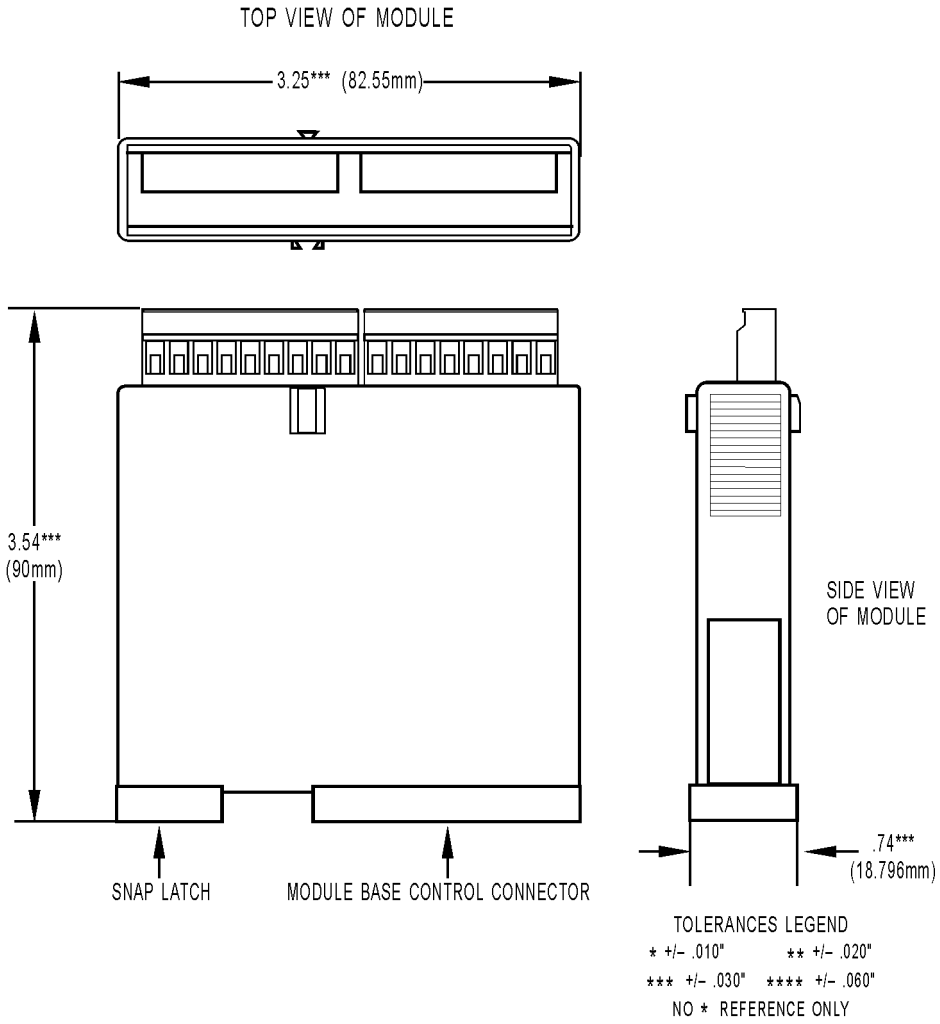
SNAP Analog Input Modules—SNAP-AITM-8 and SNAP-AITM-8-FM



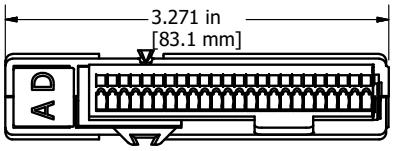
SNAP Analog Input Modules—SNAP-AICTD-8, SNAP-AIMA-8, and SNAP-AIV-8

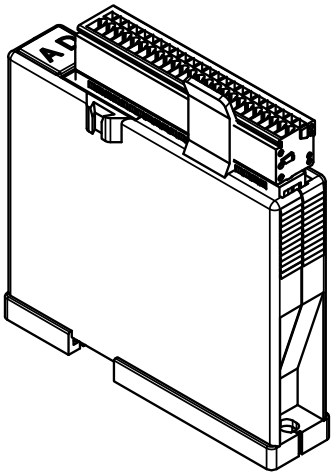


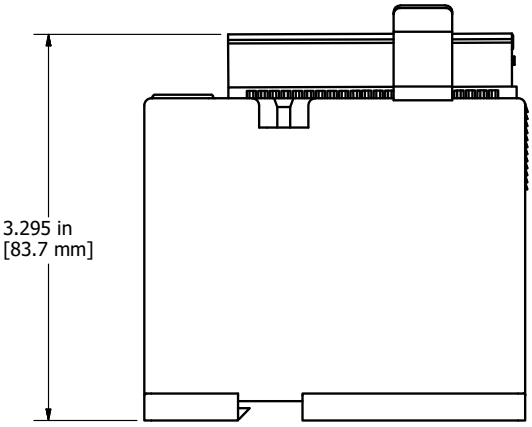
SNAP-AIR400K-8 Analog Input Module

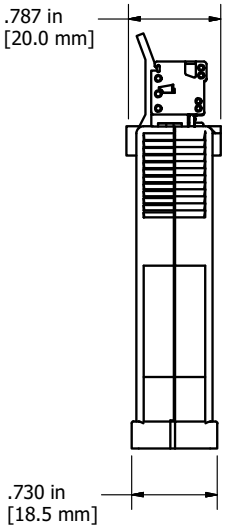


SNAP-AIRTD-8U Analog Input Module

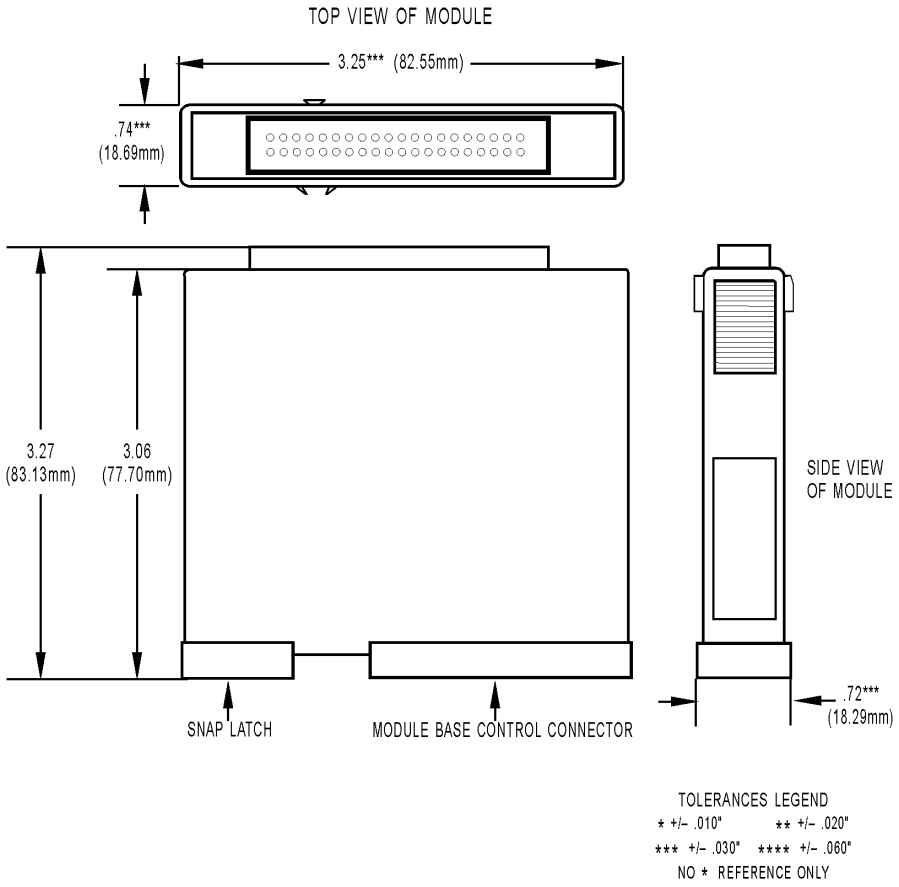






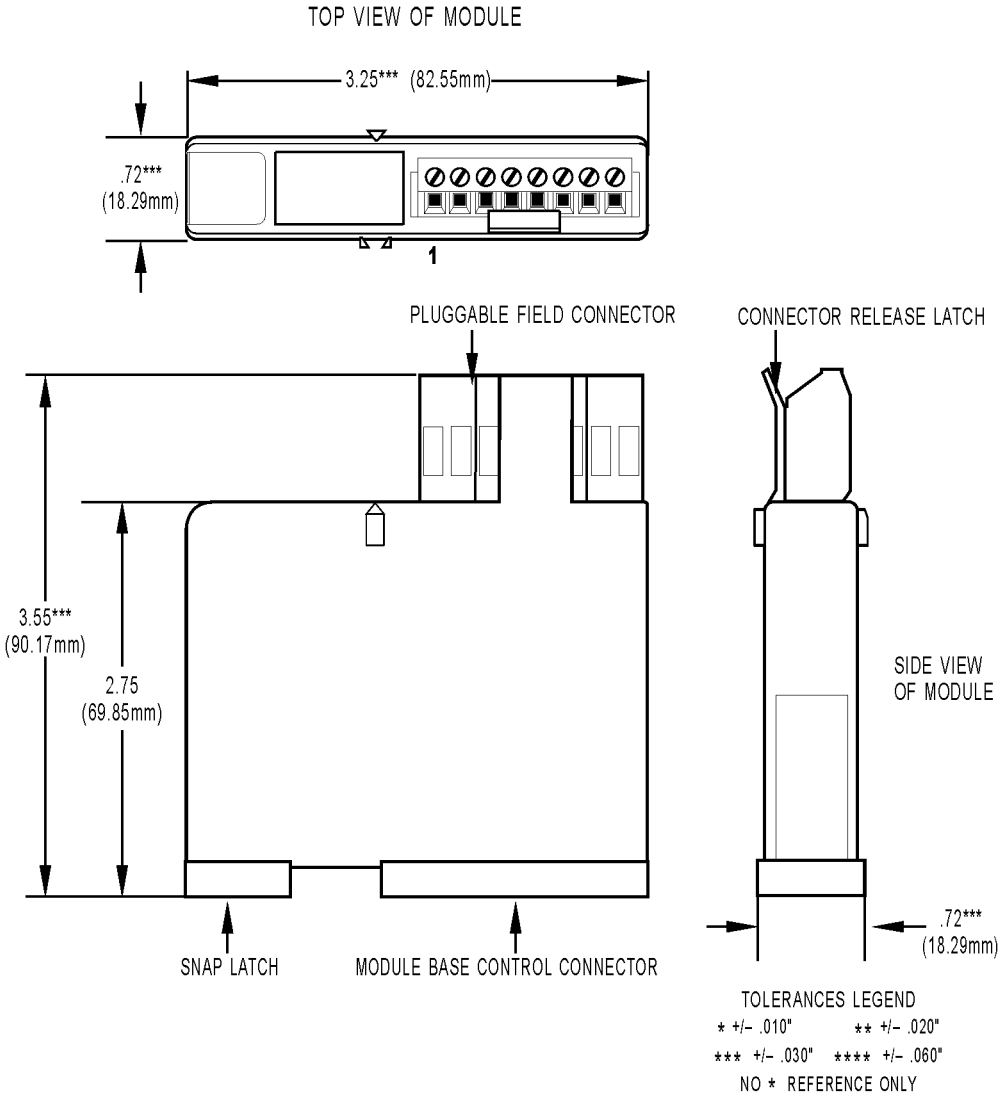


SNAP Analog Input Modules—32-Channel

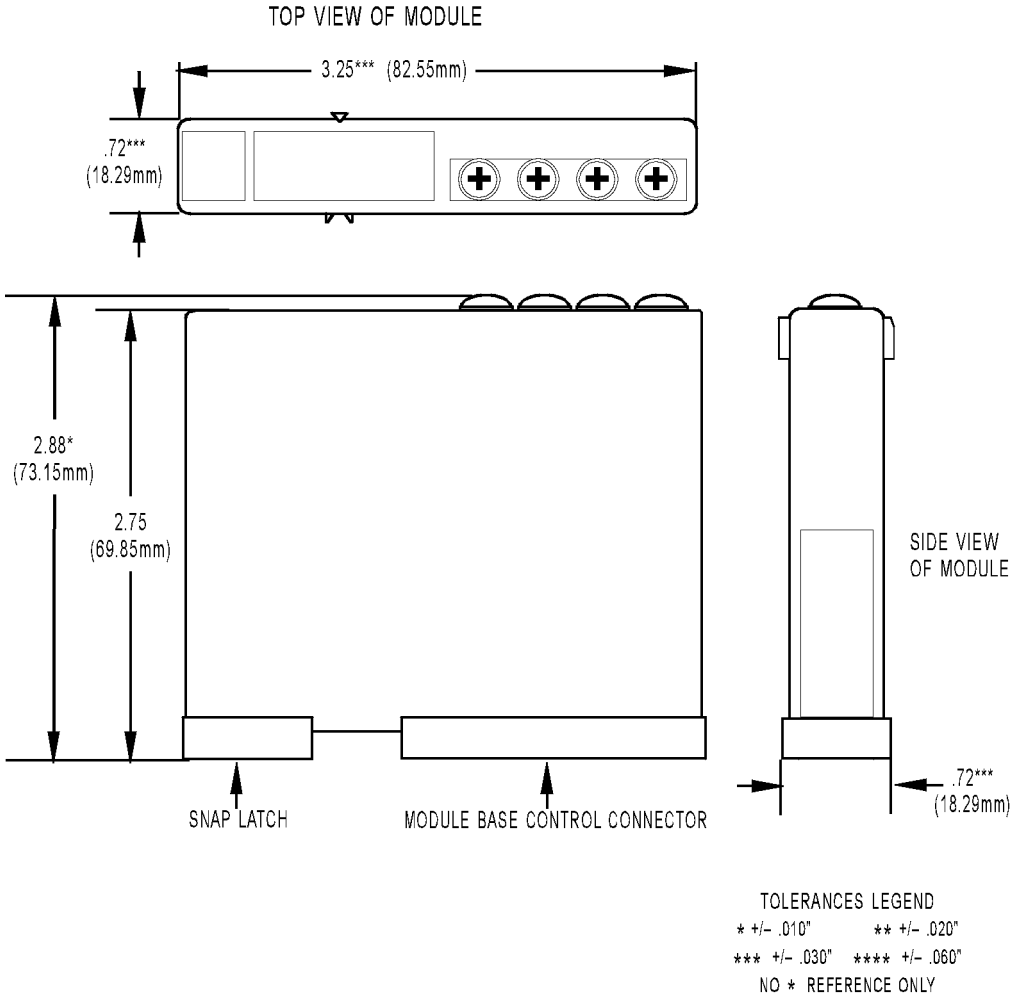


SNAP Isolated Analog Input Modules—Most Modules

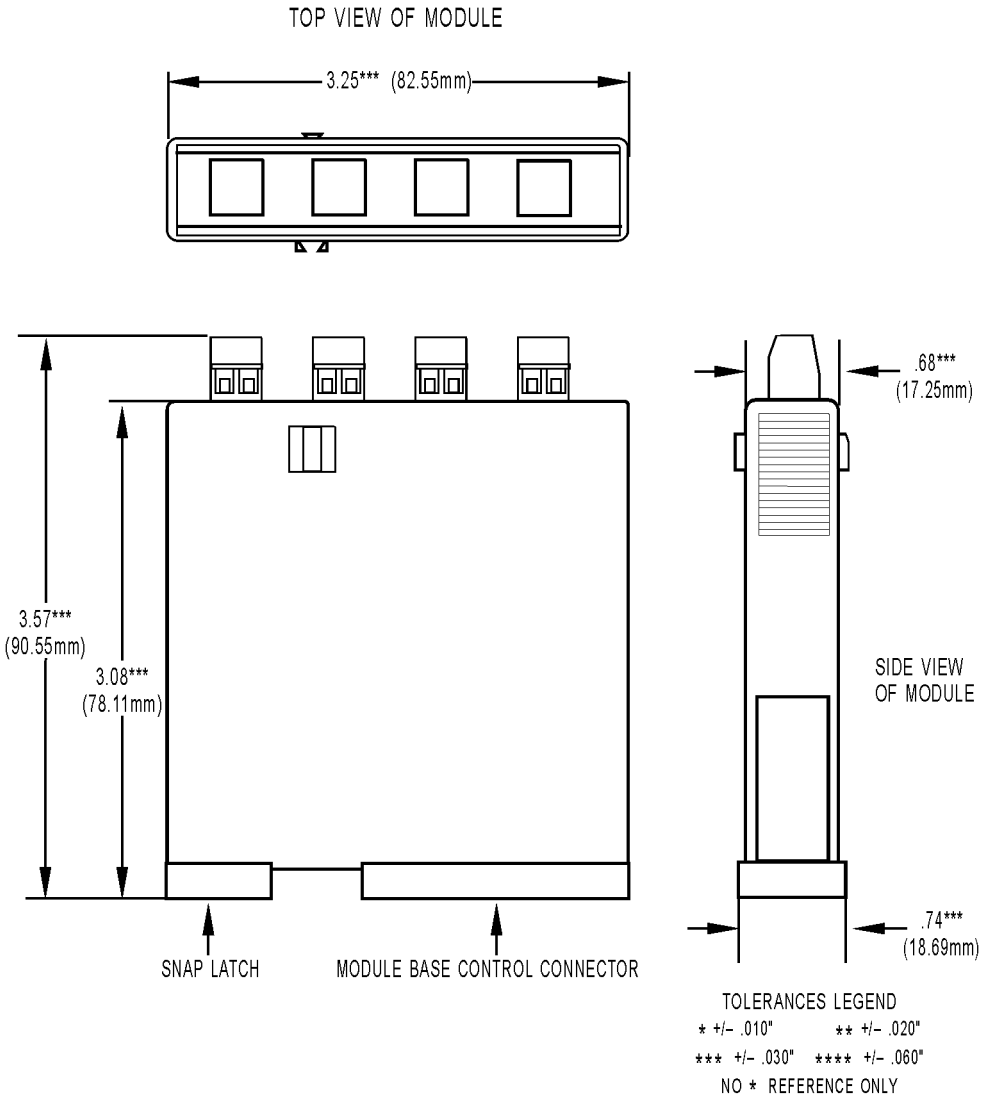
For SNAP-AITM-i and SNAP-AITM2-i, see page 212.
For SNAP-AITM-4i, see page 213.



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

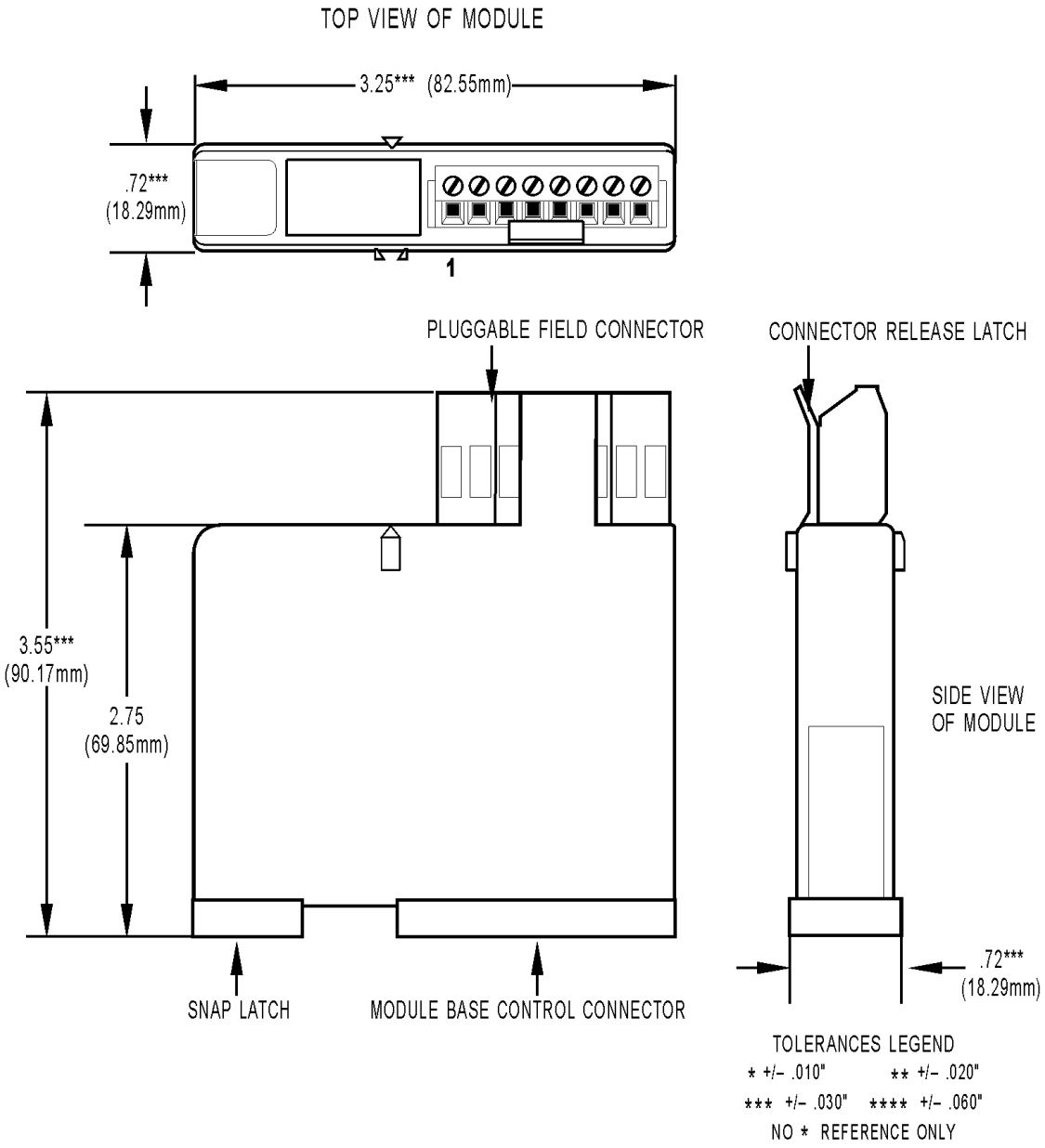


SNAP Analog Input Modules—SNAP-AITM-4i

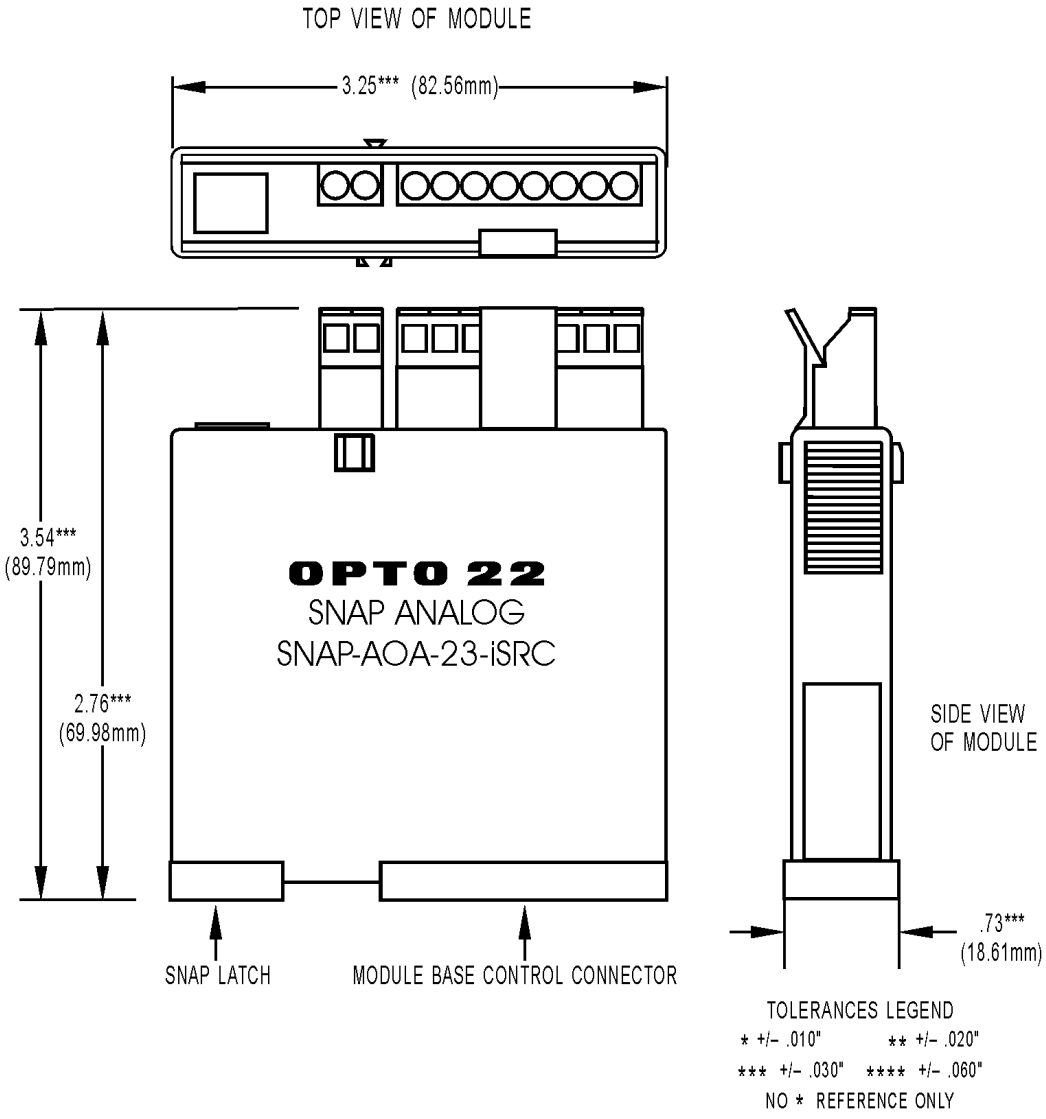


SNAP Analog Output Modules—All modules except SNAP-AOA-23-iSRC, SNAP-AOA-23-iSRC-FM, and SNAP-AOVA-8

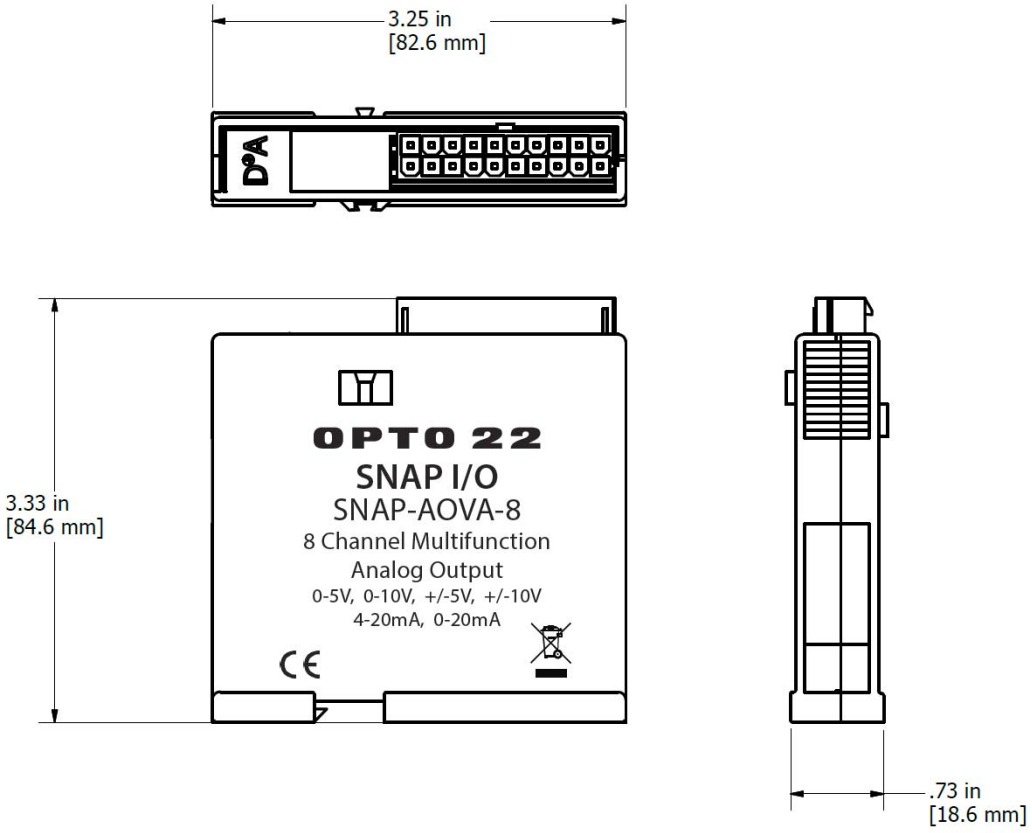
Note: The SNAP-AOD-29 time-proportional output (TPO) module has integral LEDs for monitoring and troubleshooting the module's outputs and inhibit inputs.



SNAP Analog Output Modules—SNAP-AOA-23-iSRC and SNAP-AOA-23-iSRC-FM only

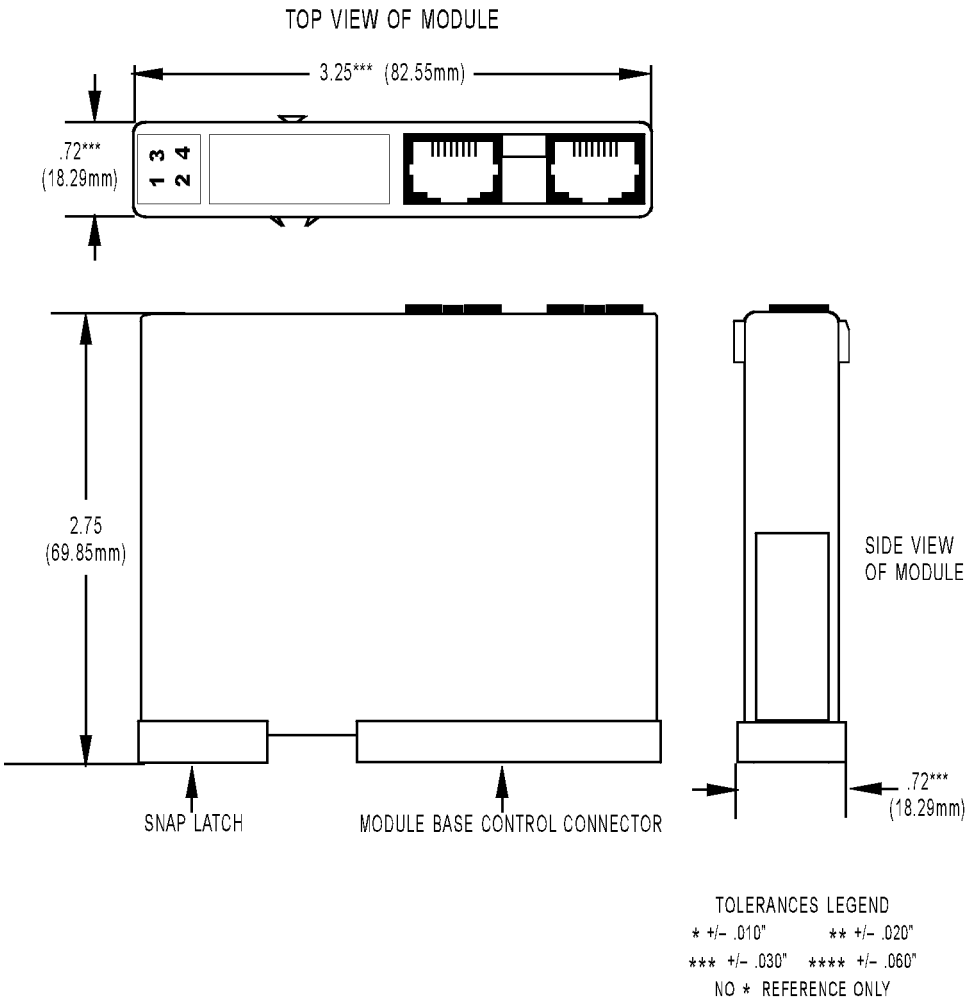


SNAP Analog Output Modules—SNAP-AOVA-8 only

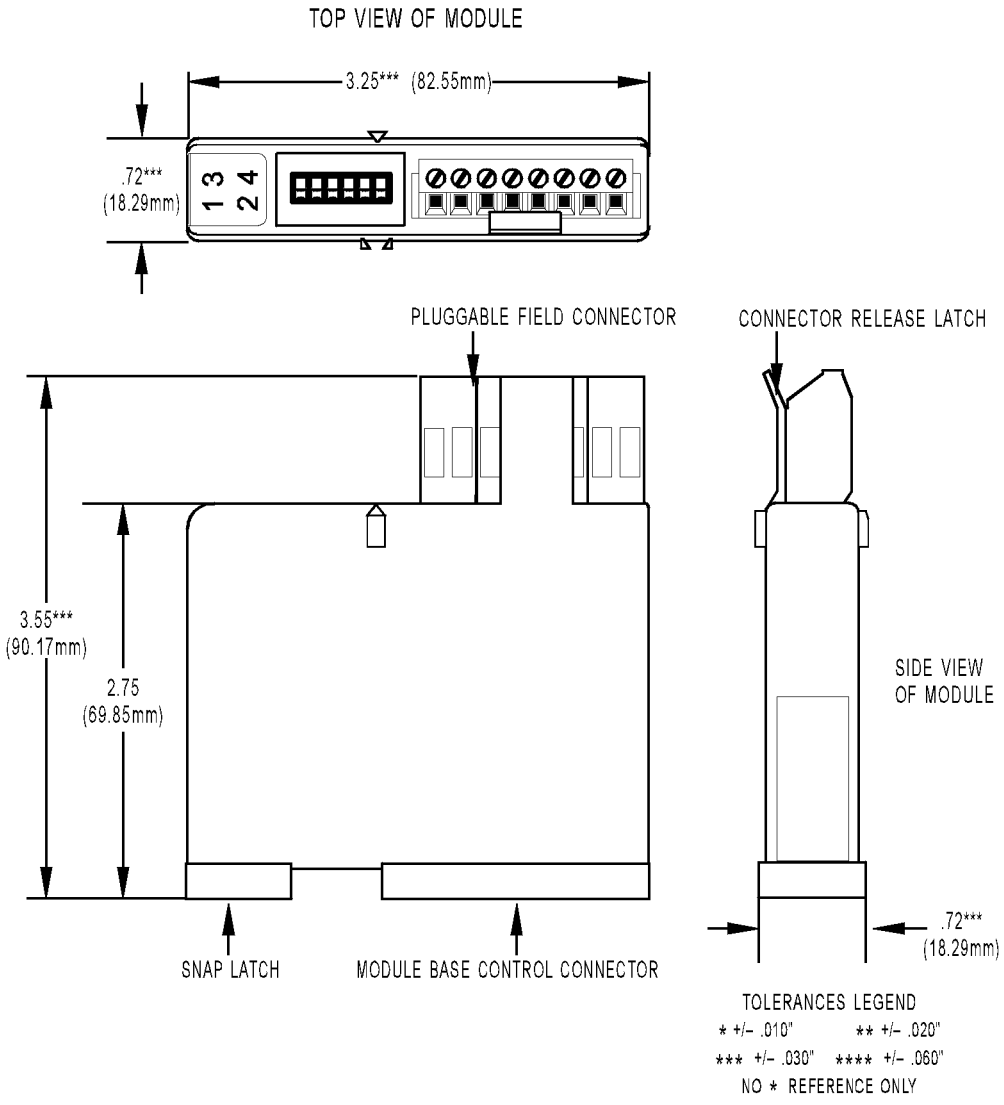


SNAP Serial Modules

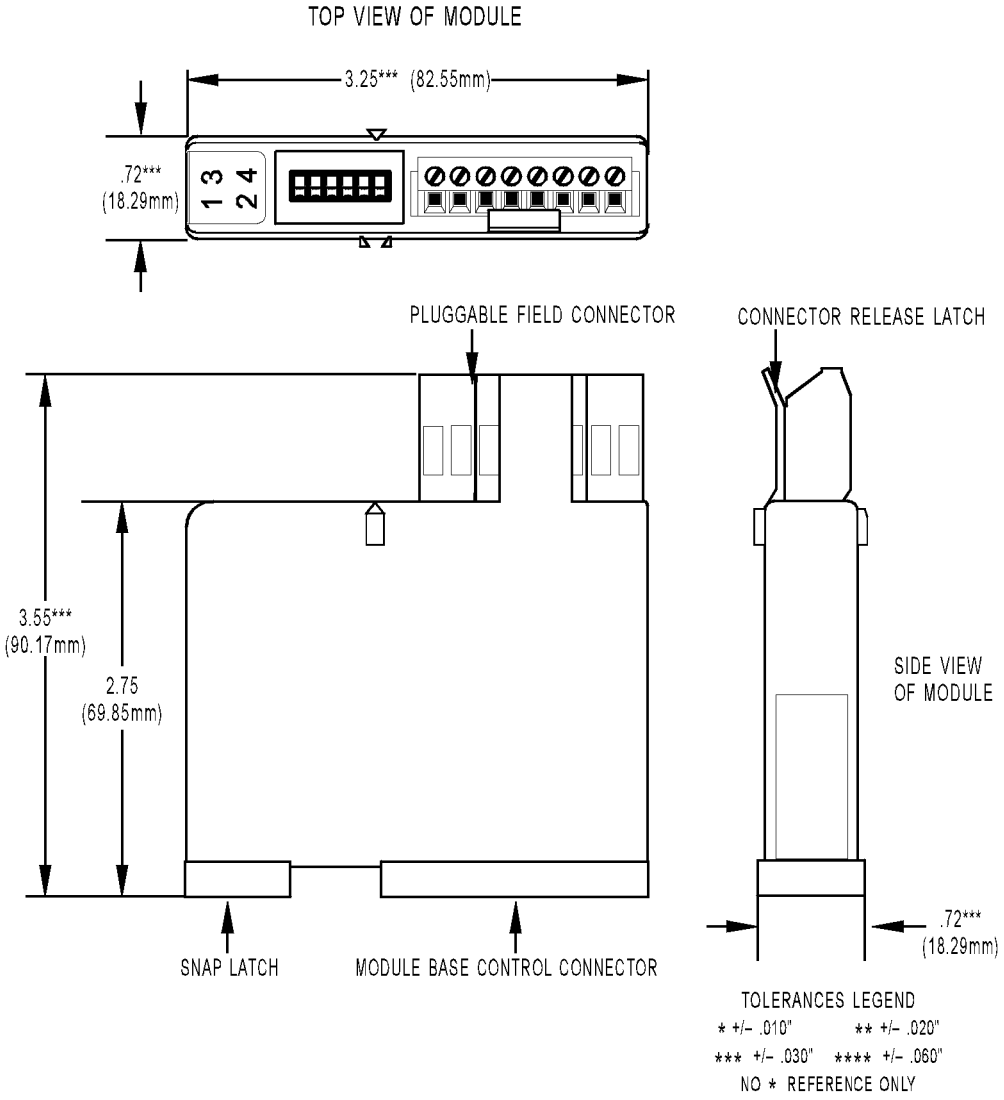
SNAP-SCM-232



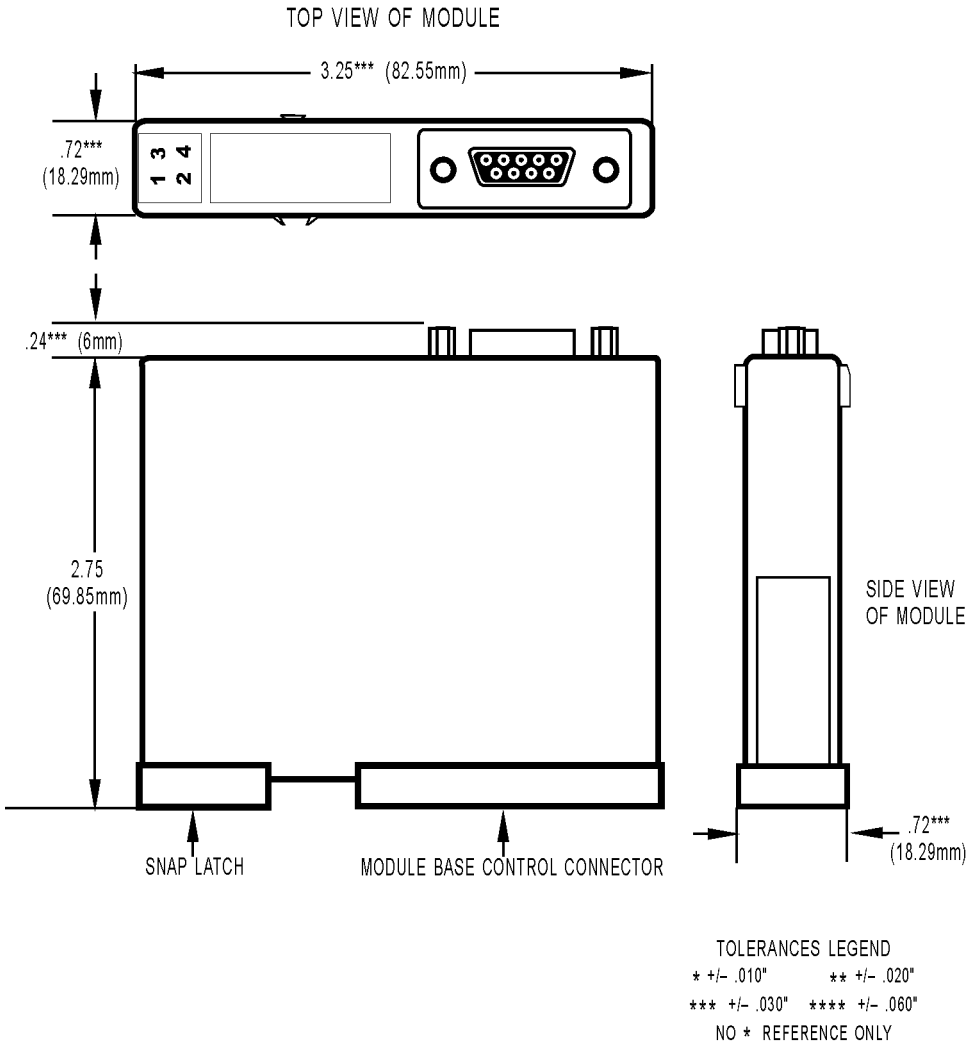
SNAP-SCM-485-422



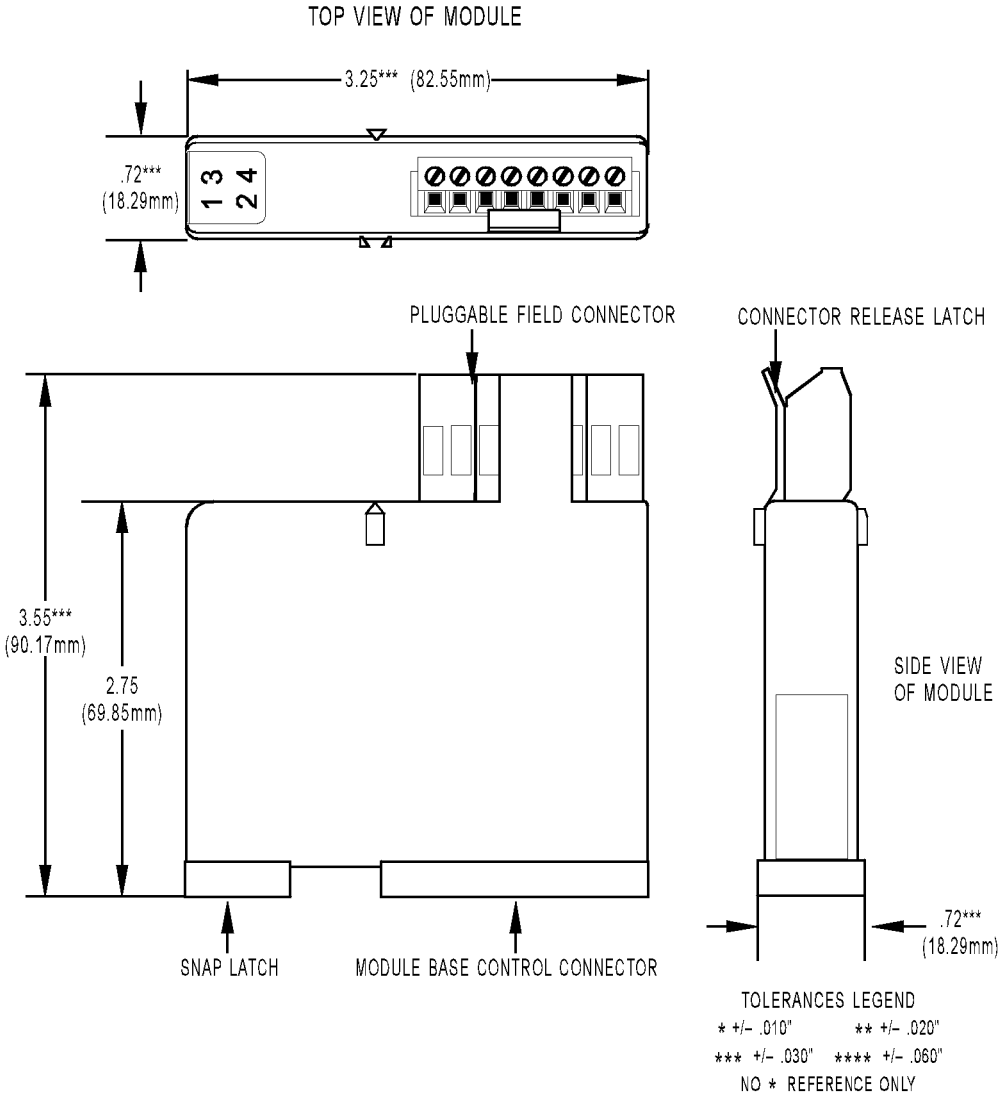
SNAP-SCM-MCH16



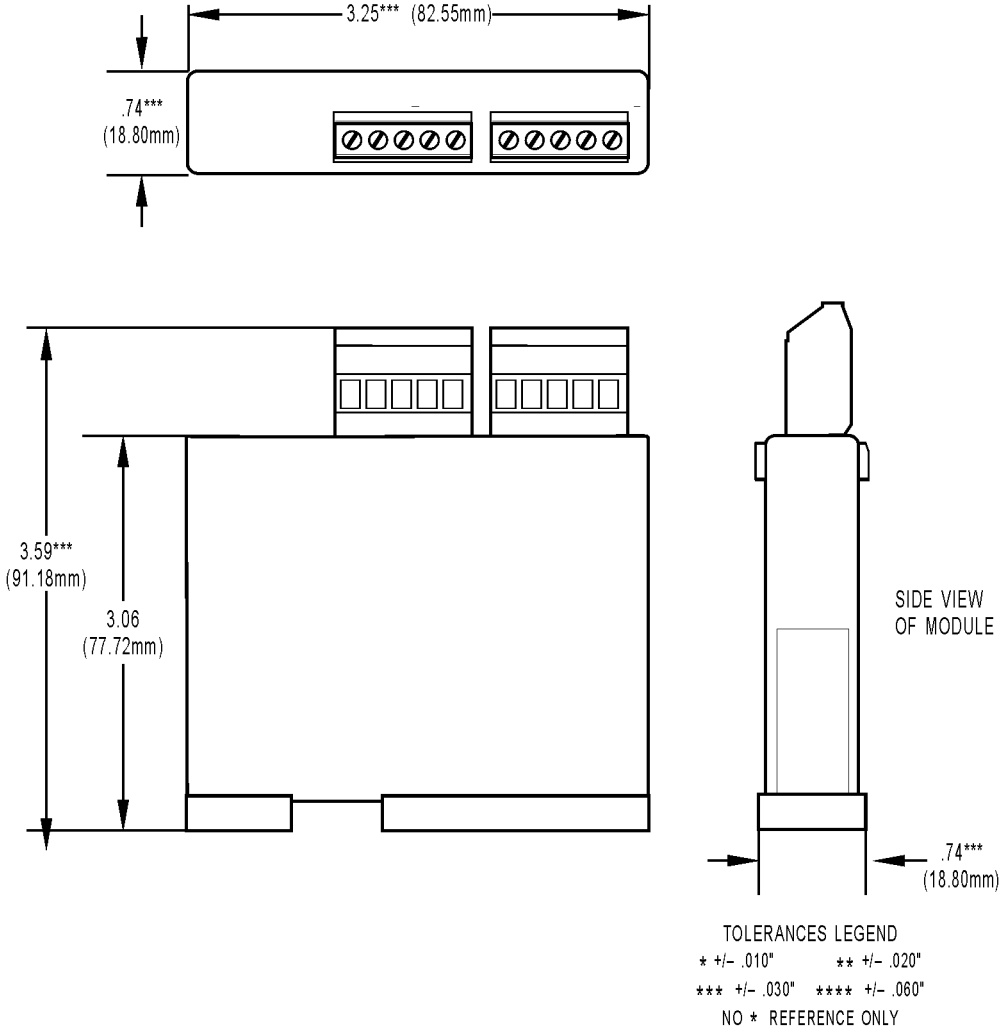
SNAP-SCM-PROFI



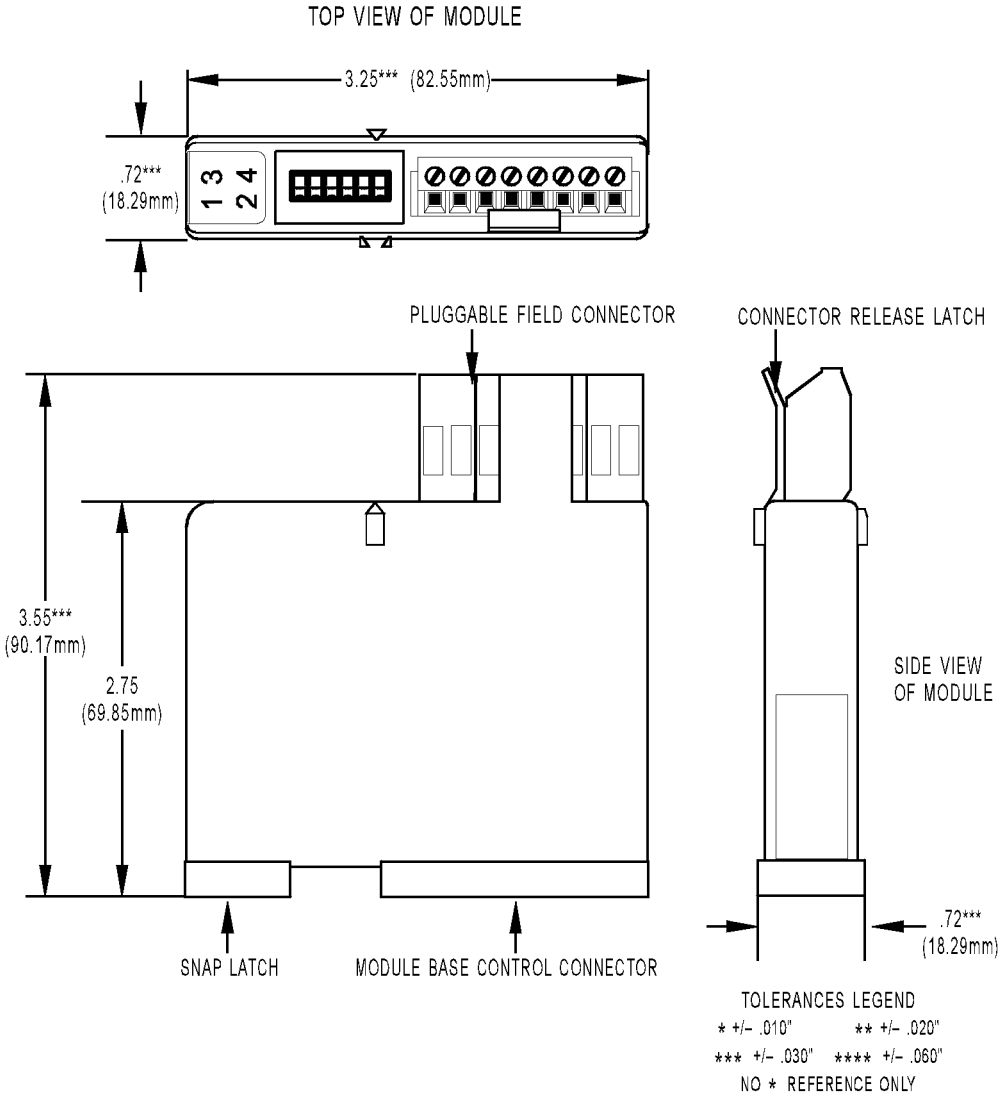
SNAP-SCM-ST2 and SNAP-SCM-CAN2B



SNAP-SCM-SSI

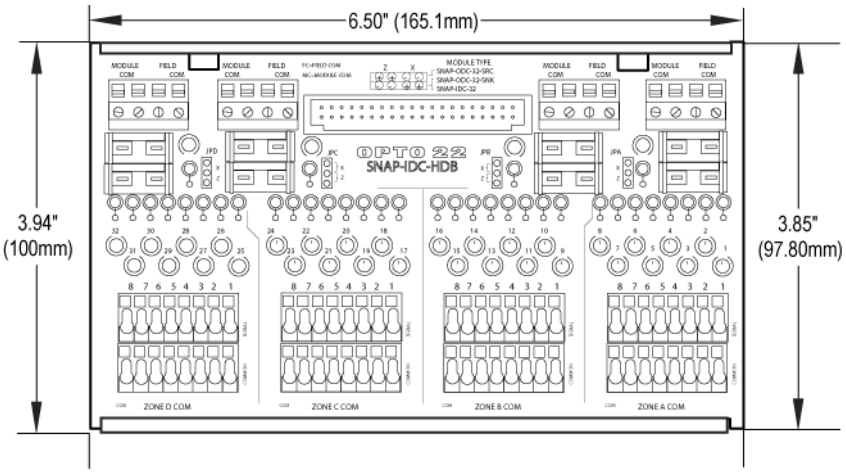

3.25*** (82.55mm)
.74***
(18.80mm)
3.59***
(91.18mm)
3.06
(77.72mm)
SIDE VIEW
OF MODULE
.74***
(18.80mm)
TOLERANCES LEGEND
* +/- .010" ** +/- .020"
*** +/- .030" **** +/- .060"
NO * REFERENCE ONLY

SNAP-SCM-W2

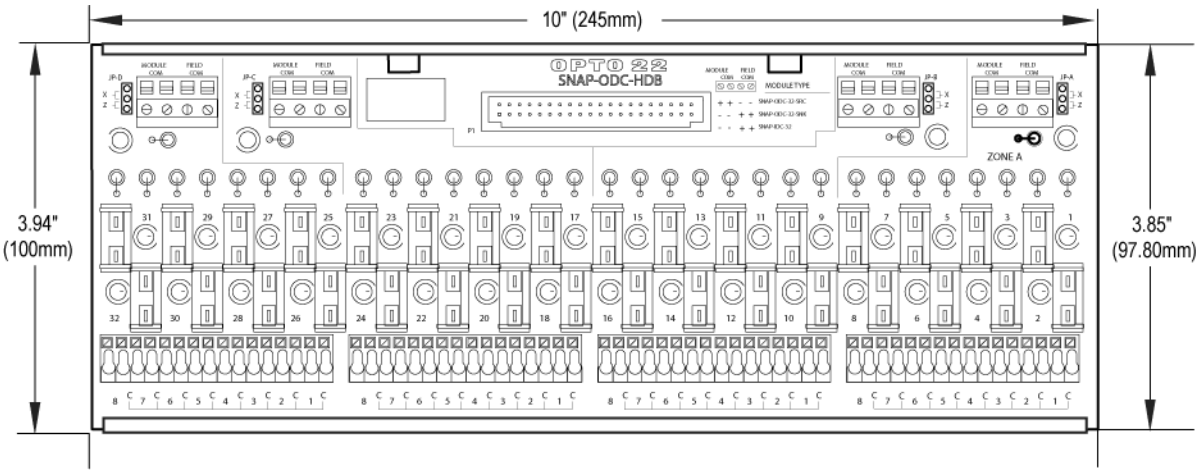

TOP VIEW OF MODULE
3.25*** (82.55mm)
.72***
(18.29mm)
1 3
2 4
PLUGGABLE FIELD CONNECTOR
CONNECTOR RELEASE LATCH
3.55***
(90.17mm)
2.75
(69.85mm)
SIDE VIEW
OF MODULE
.72***
(18.29mm)
SNAP LATCH
MODULE BASE CONTROL CONNECTOR
TOLERANCES LEGEND
* +/- .010" ** +/- .020"
*** +/- .030" **** +/- .060"
NO * REFERENCE ONLY

SNAP Breakout Boards and Racks Diagrams

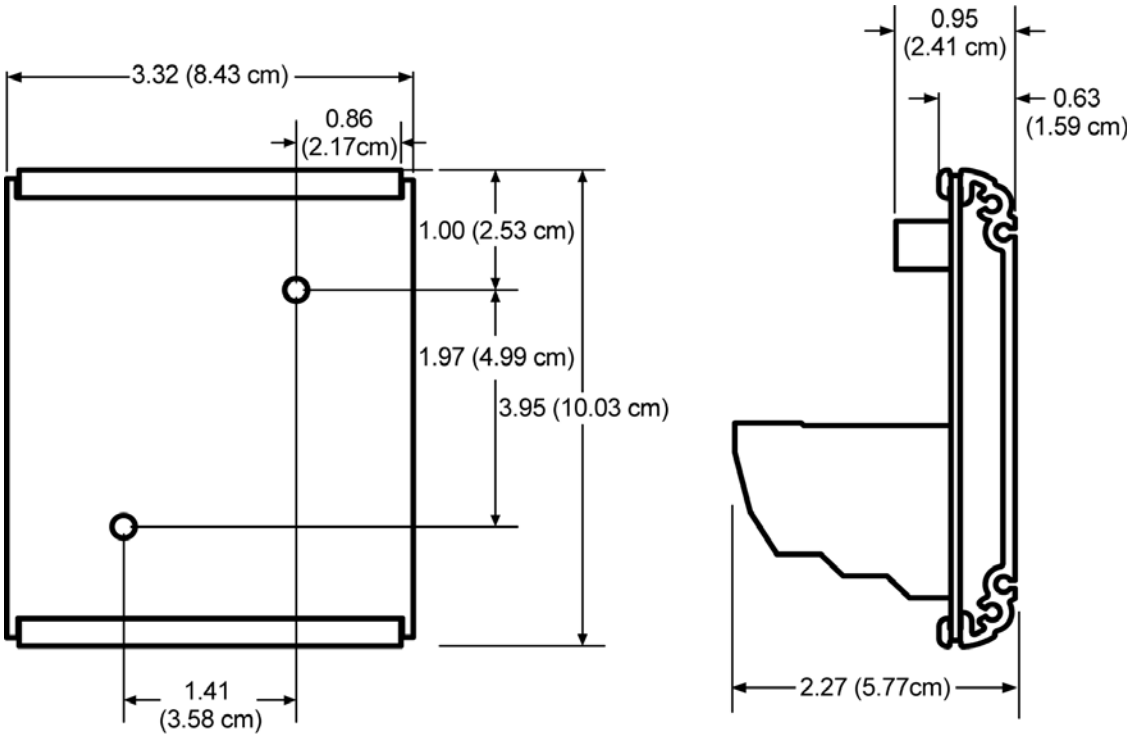
SNAP-IDC-HDB and SNAP-IDC-HDB-FM Breakout Rack



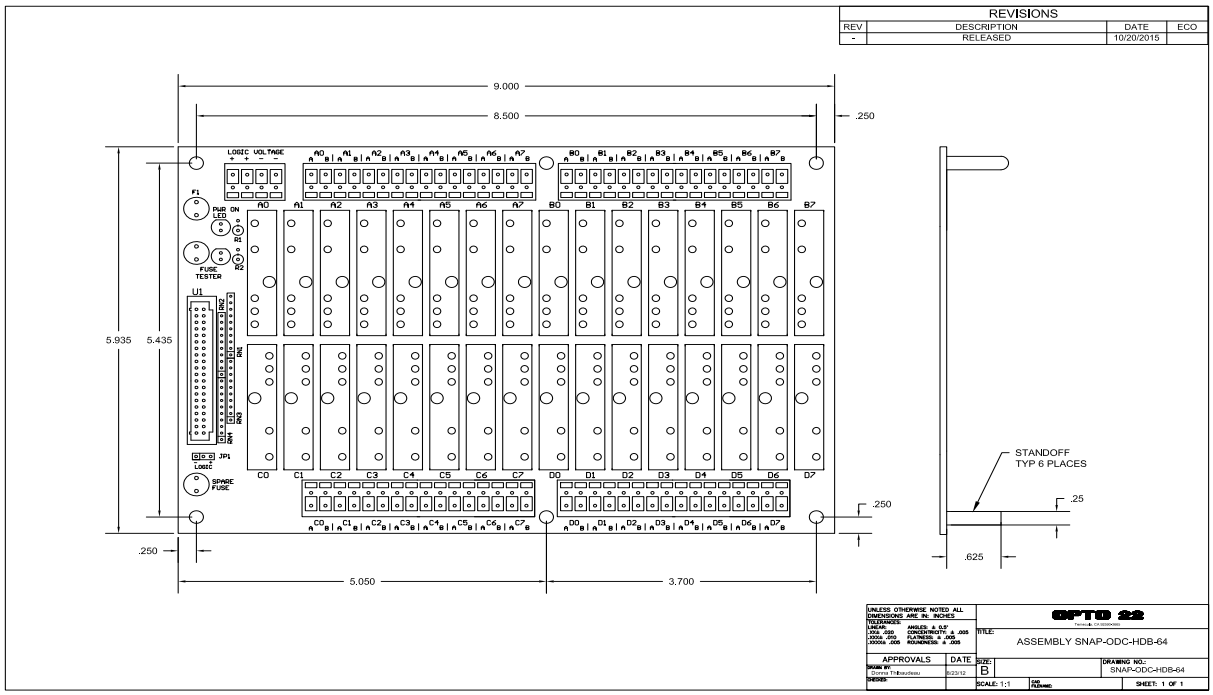
SNAP-ODC-HDB and SNAP-ODC-HDB-FM Breakout Rack



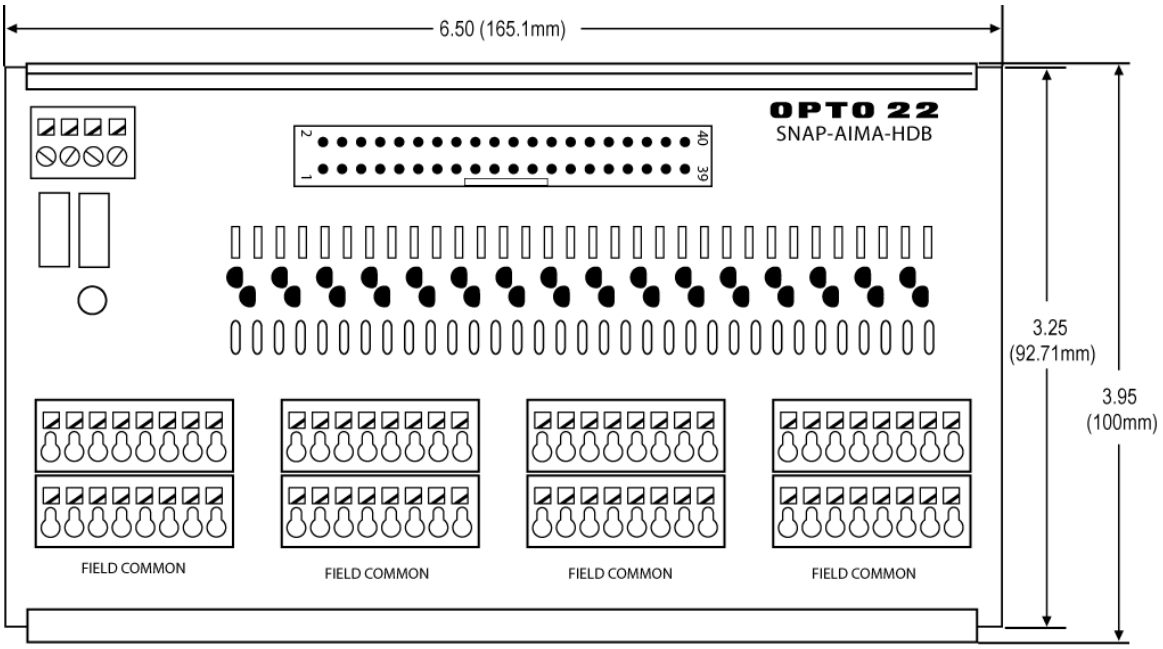
SNAP-UDC-HDB Breakout Rack



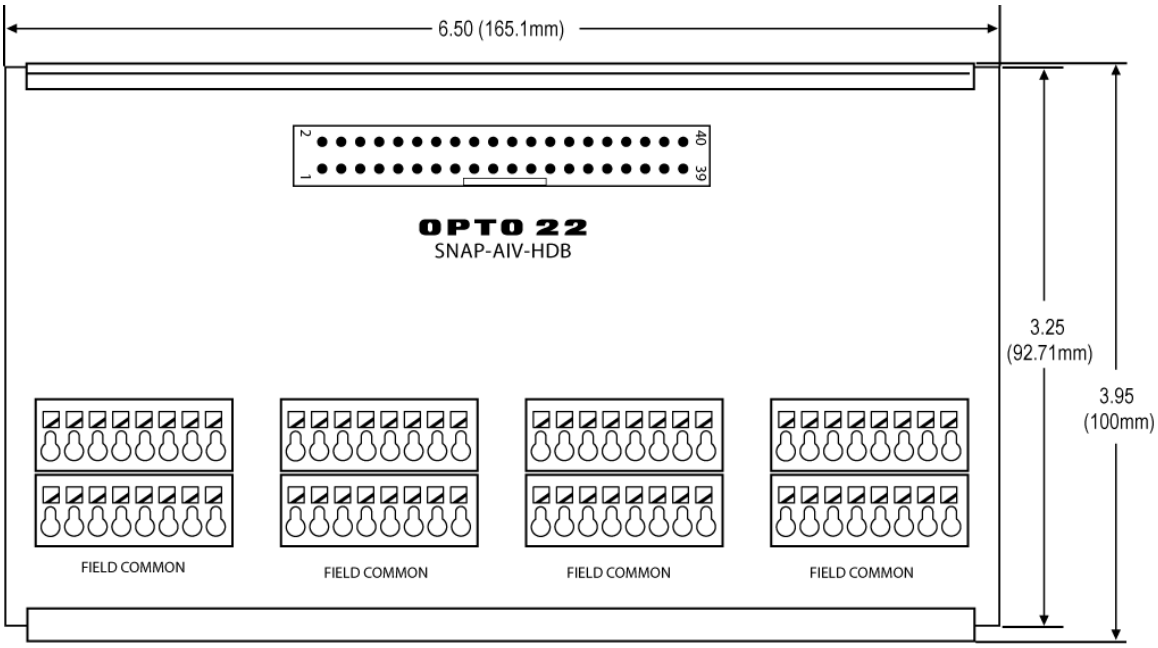
SNAP-UDC-HDB-G4 Breakout Rack



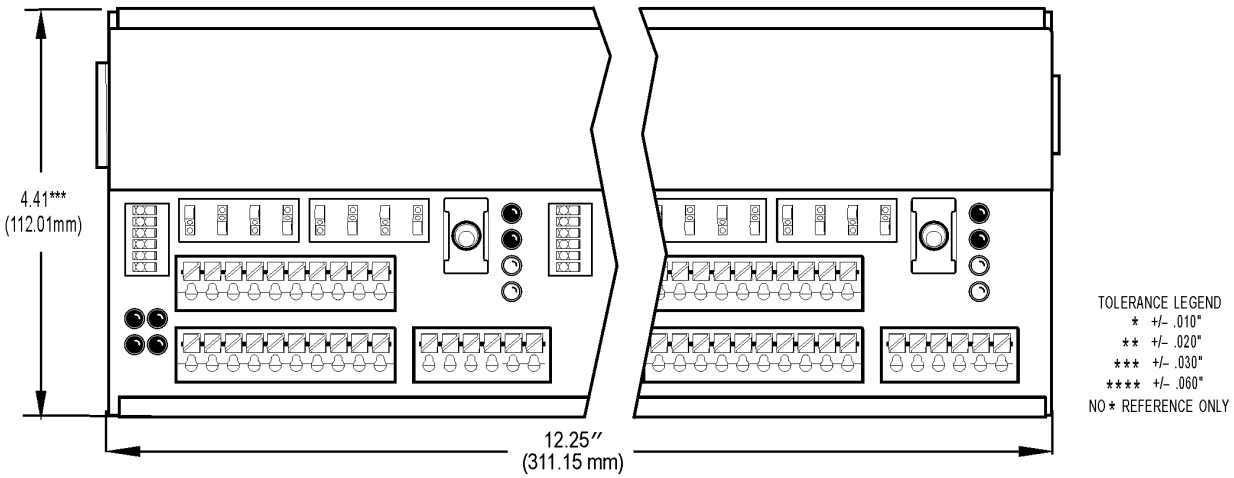
SNAP-AIMA-HDB and SNAP-AIMA-HDB-FM Breakout Racks



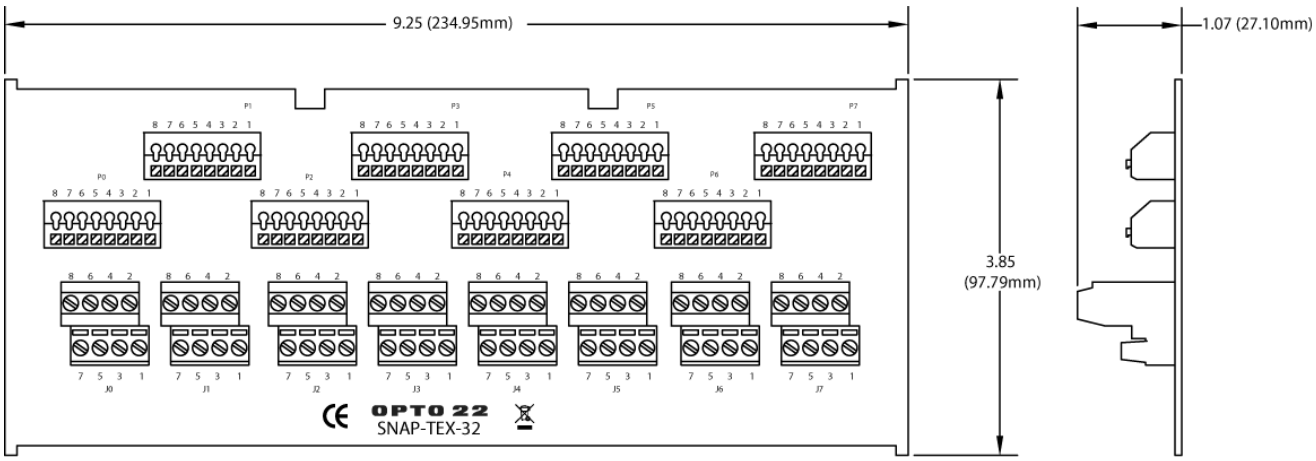
SNAP-AIV-HDB and SNAP-AIV-HDB-FM Breakout Racks



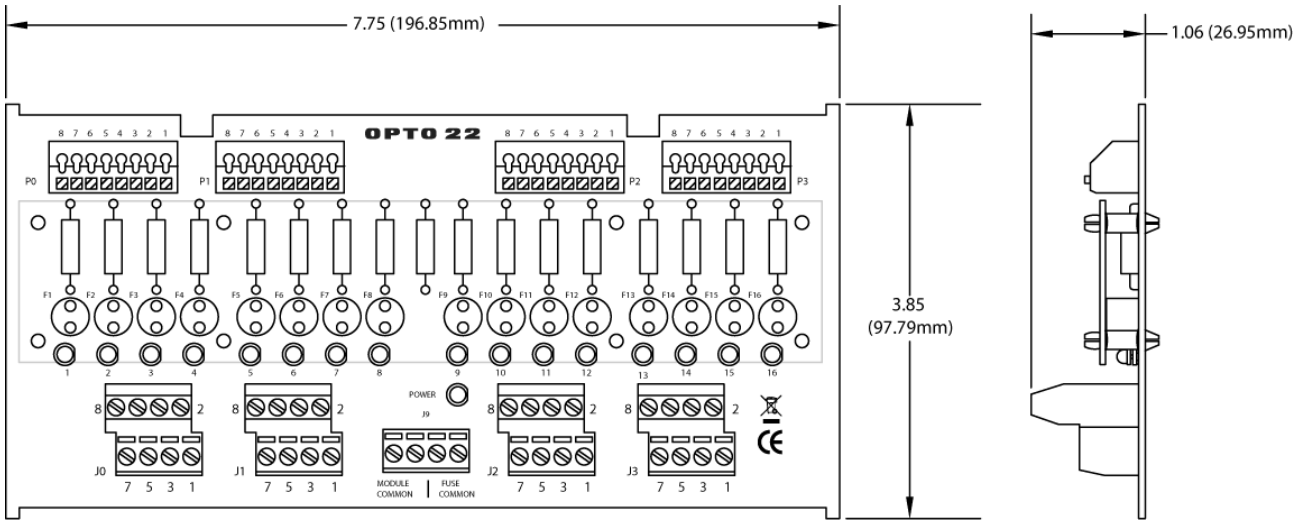
SNAP-SCM-BB4 Breakout Board



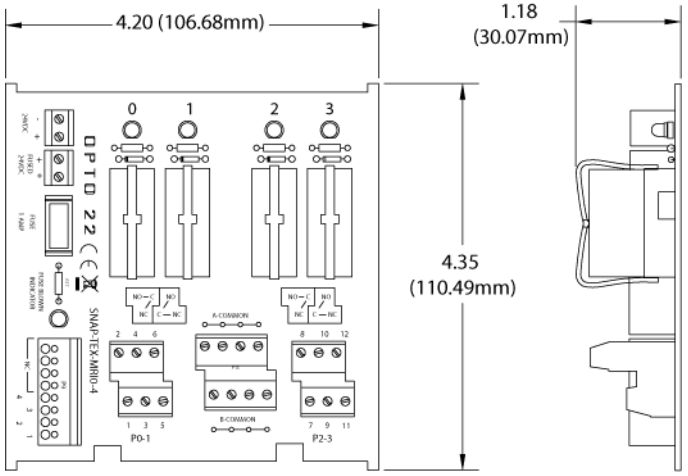
SNAP-TEX-32 Breakout Board



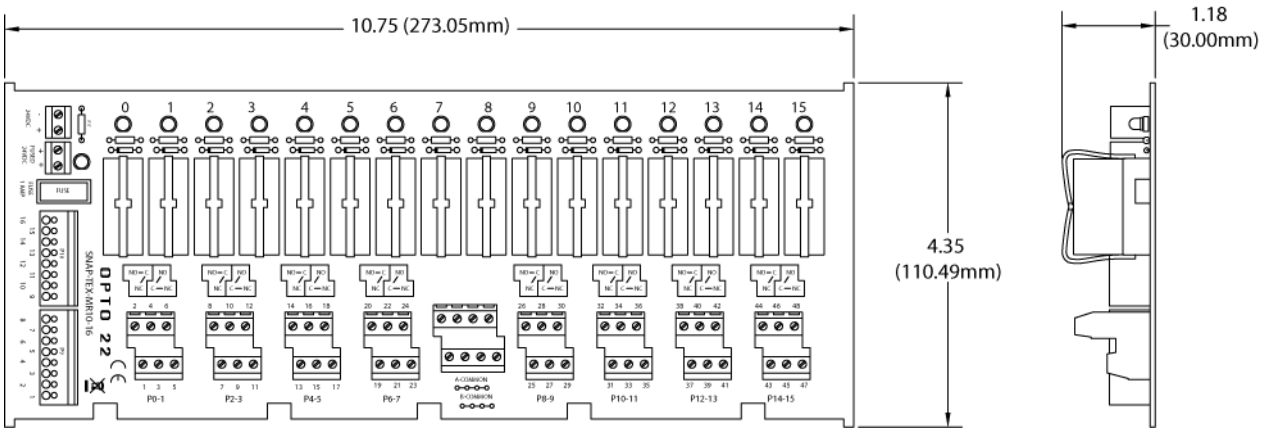
SNAP-TEX-FB160H and SNAP-TEX-FB16-L Breakout Boards



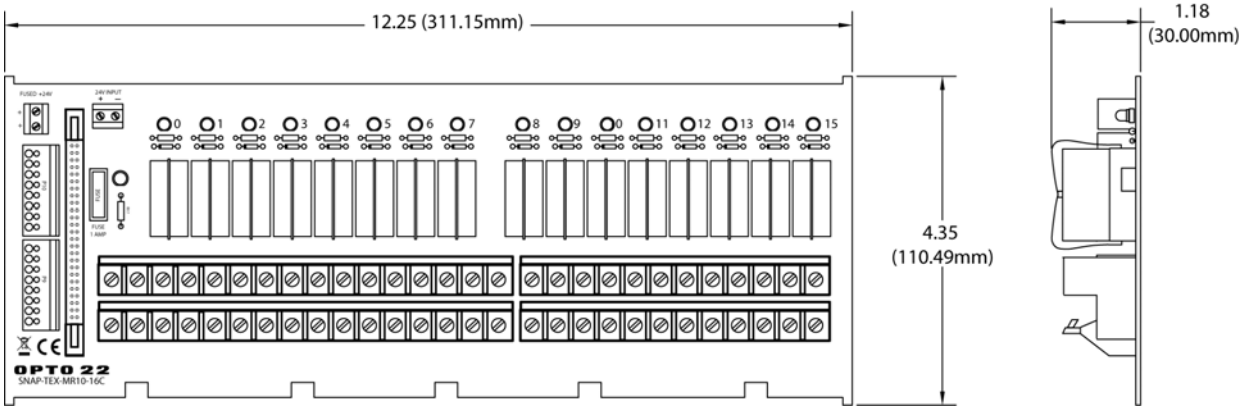
SNAP-TEX-MR10-4 Breakout Board



SNAP-TEX-MR10-16 Breakout Board



SNAP-TEX-MR10-16C Breakout Board



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