SNAP HIGH-DENSITY DIGITAL MODULE USER'S GUIDE

SNAP-IAC-16
SNAP-IAC-A-16
SNAP-IAC-K-16
SNAP-IDC-16
SNAP-IDC-HT-16
SNAP-IDC-32
SNAP-IDC-32-FM
SNAP-IDC-32N
SNAP-IDC-32D
SNAP-IDC-32DN
SNAP-ODC-32-SRC
SNAP-ODC-32-SRC-FM
SNAP-ODC-32-SNK
SNAP-ODC-32-SNK-FM

Form 1547-111205—December 2011

OPTO 22

43044 Business Park Drive • Temecula • CA 92590-3614
Phone: 800-321-OPTO (6786) or 951-695-3000
Fax: 800-832-OPTO (6786) or 951-695-2712
www.opto22.com

Product Support Services
800-TEK-OPTO (835-6786) or 951-695-3080
Fax: 951-695-3017
Email: support@opto22.com
Web: support.opto22.com

SNAP High-Density Digital Module User's Guide
Form 1547-111205—December 2011

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 later 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. These products include, but are not limited to, OptoTerminal-G70, OptoTerminal-G75, and Sony Ericsson GT-48; see the product data sheet for specific warranty information. Refer to Opto 22 form number 1042 for complete warranty information.

Table of Contents

1: Installation and Testing

Introduction

SNAP high-density digital modules from Opto 22 provide 16 or 32 channels (also referred to as *points*) on one compact SNAP input or output module.

These modules are ideal for OEMs and others who have applications with high point counts, or for any application requiring a large number of digital points on one SNAP I/O rack.

Several high-density digital modules are available:

- **SNAP-IDC-32** and **SNAP-IDC-32-FM** digital input modules, with 32 input points, can be used to sense on/off status for 10–32 VDC inputs from sources such as proximity switches, limit switches, push buttons, and pilot switches (PNP or sourcing type).
- The **SNAP-IDC-32N** is similar, but its input range is -10 to -32 VDC and its common connections are positive rather than negative, making it ideal for NPN or sinking type inputs.
- The **SNAP-IDC-32D** has an input range of 2.5 to 12 VDC.
- The **SNAP-IDC-32DN** offers a -2.5 to -12 VDC input range and has positive common connections, also suited to NPN (sinking) inputs.
- The **SNAP-IDC-16** digital input module offers 16 points with channel-to-channel isolation. It can sense on/off status for 10–32 VDC/VAC loads.
- The **SNAP-IDC-HT-16** leakage tolerant digital input module is used with proximity switches. It offers channel-to-channel isolation for 16 points and senses on/off status for loads of 15–28 VDC/VAC.

SNAP-IDC-16

SNAP-ODC-32-SNK

- **SNAP-IAC-16**, **SNAP-IAC-A-16**, and **SNAP-IAC-K-16** digital input modules each have 16 points with channel-to-channel isolation. These modules sense on/off status for 90–140 VAC (SNAP-IAC-16), 180–280 VAC (SNAP-IAC-A-16), or 70–130 VAC (SNAP-IAC-K-16).
- **SNAP-ODC-32-SRC**, **SNAP-ODC-32-SRC-FM**, **SNAP-ODC-32-SNK**, and **SNAP-ODC-32-SNK-FM** digital output modules have 32 points and can switch on and off 5–60 VDC loads, either sourcing or sinking.

Module part numbers ending in -FM are Factory Mutual approved.

Hardware Compatibility

SNAP high-density digital (HDD) modules are part of the SNAP PAC System. They are designed to mount on a SNAP PAC rack with a SNAP PAC brain or R-series controller (either a standard wired controller or a Wired+Wireless™ model). Analog, serial, and 4-channel digital modules can be mounted on the same rack to provide the mix of signals and density needed at any distributed location.

(For information on using HDD modules with older processors or racks, see "Notes on Legacy Hardware and Software" on page 23.)

Interface Terminal for HDD Modules

The optional **OptoTerminal-G20** operator interface terminal (available separately) is recommended for commissioning and troubleshooting. It plugs into a connector on the top of the module. The OptoTerminal-G20 displays the status of a high-density digital module's points on a two-line LCD display and can also be used to turn output points on and off.

For Help

If you have problems and cannot find the help you need in this guide or on our website, contact Opto 22 Product Support.

Phone:	800-TEK-OPTO (835-6786) 951-695-3080 (Hours are Monday through Friday, 7 a.m. to 5 p.m. Pacific Time)
Fax:	951-695-3017
Email:	support@opto22.com
Opto 22 website:	www.opto22.com

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

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

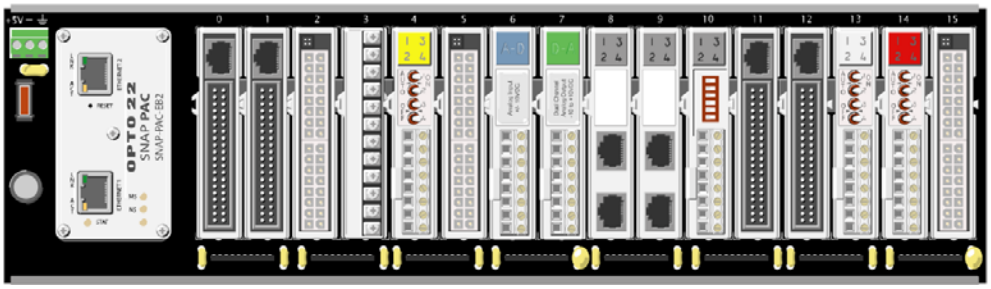
- Software and version being used
- PC configuration (type of processor, speed, memory, and operating system)
- A complete description of your hardware and operating systems, including:
  - loader and firmware versions for the processor (available through PAC Manager)

  - IP addresses and subnet masks for devices on the system
  - type of power supply
  - third-party devices installed (for example, barcode readers)
- Specific error messages seen

Installing Modules

As shown below, high-density digital (HDD) modules can be mixed with other modules and placed in any position on a SNAP PAC rack. (For information on using HDD modules with other Opto 22 mounting racks, see "Notes on Legacy Hardware and Software" on page 23.)

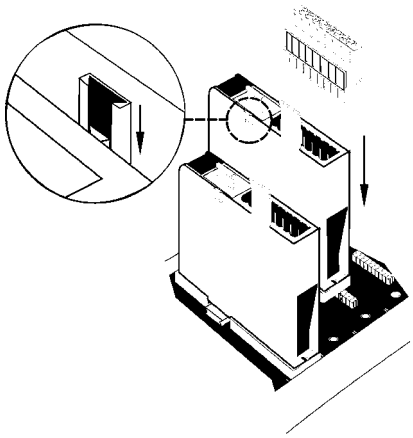
SNAP high-density digital modules can be mixed on the rack with SNAP 4-channel digital, analog, and serial



Follow these steps to install modules.

1. Turn off power to the rack.
2. Remove the module from its packaging.
3. Position the module over the connector on the rack, aligning the small slot at the base of the module with the retention bar on the rack. If it is next to another module, make sure the male and female module keys are aligned, as shown at right.
4. Push straight down on the module to snap it into position.

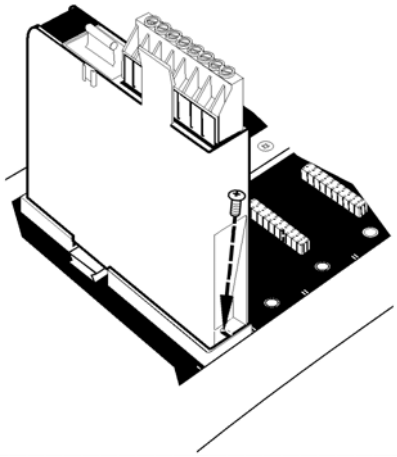
   The module snaps securely into place and requires a special tool (provided) to remove it. To remove a module, see below.



5. (Optional) As shown at right, use standard 4-40 x 1/4 truss-head Phillips hold-down screws to secure both sides of each module.

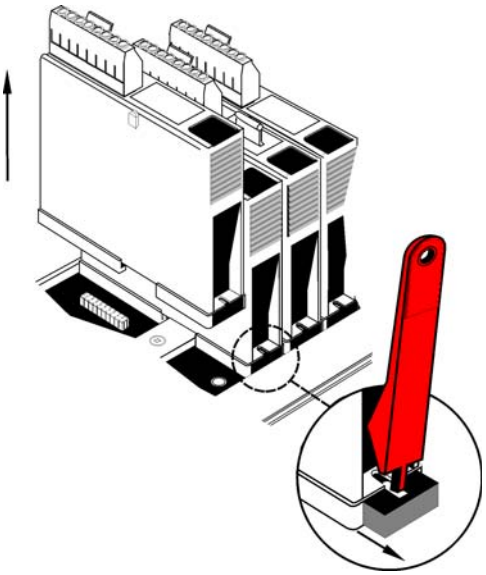
   CAUTION: *Do not over-tighten screws. Recommended torque: 4 in-lb (0.45 N-m)*

6. Continue with "Attaching the Cable" on page 5.



Removing Modules

1. If the modules are held in place with screws, remove them.
2. As shown in the illustration, insert the SNAP module tool (provided) 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.



Wiring the Module

Cables and breakout boards are available separately to make field wiring easier. Cables plug into the wiring connector(s) on the top of the module and have flying leads that can go directly to field devices or connect through breakout boards or a barrier strip. Breakout boards provide fusing and convenience.

The following table shows the available options for wiring field devices to HDD modules. Look in the left column for the module you have. Breakout boards for the module are listed in the right column headings. Compatible cables are shown in the center table cells. The last column shows the appropriate cable if you are not using a breakout board.

<table>
<tr><th rowspan="2">Module</th><th colspan="5">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></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></td><td></td><td></td><td>SNAP-HD-ACF6</td></tr>
<tr><td>SNAP-IDC-32
SNAP-IDC-32-FM
SNAP-IDC-32N
SNAP-IDC-32D
SNAP-IDC-32DN</td><td>SNAP-HD-CBF6</td><td>SNAP-HD-CBF6
(2 boards/module)</td><td></td><td>SNAP-HD-BF6</td><td></td><td>SNAP-HD-CBF6</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></td><td rowspan="2">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></td></tr>
</table>

Specifications for cables and breakout boards are in Opto 22 form 1756, the *SNAP TEX Cables and Breakout Boards Data Sheet*, available on our website at www.opto22.com.

Attaching the Cable

Cables (wiring harness assemblies) are sold separately. You need one cable per module. If you are making your own cables, see page 22.

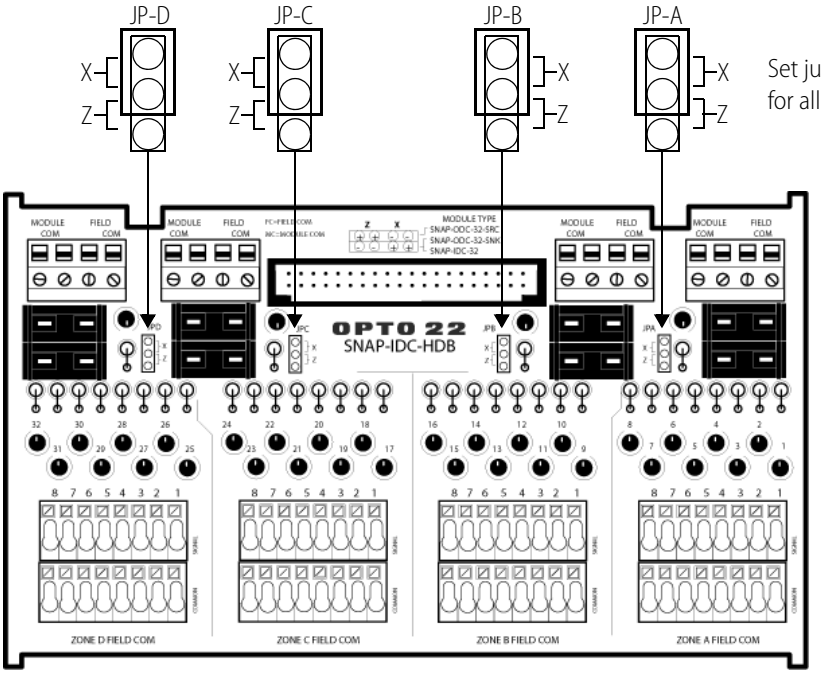
1. Plug the cable into the wiring connector(s) on the top of the module.
2. Secure the harness cable so that its weight is supported. The connector plug is not designed to support the weight of the cable.

Setting Up the Breakout Board

For ease in wiring the module to field devices, we recommend you use a breakout board or install a barrier strip in a convenient location. If you're not using a breakout board, skip to "Wiring to Field Devices" on page 8.

SNAP-IDC-HDB and SNAP-IDC-HDB-FM (for Input Modules)

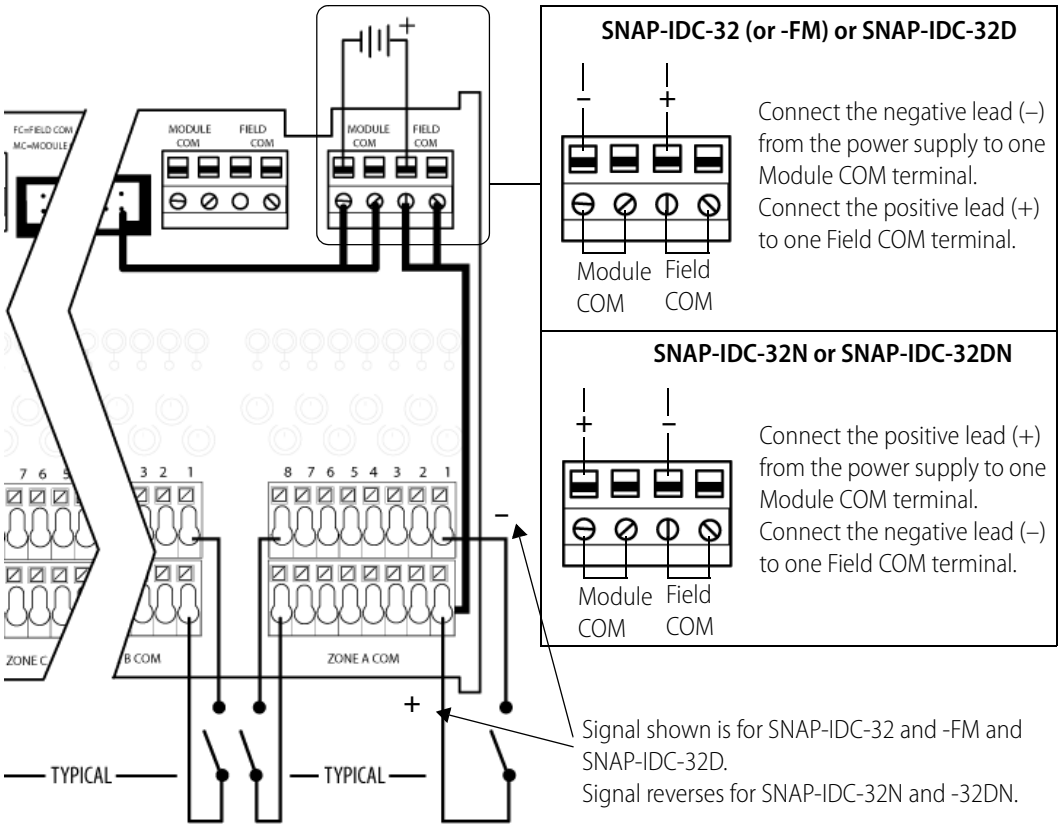
1. Set the LED jumpers for the SNAP-IDC-HDB (or -FM) breakout board to the X position. (Use the same position for SNAP-IDC-32, SNAP-IDC-32-FM, SNAP-IDC-32N, and SNAP-IDC-32DN).



Set jumpers to the X position for all input modules.

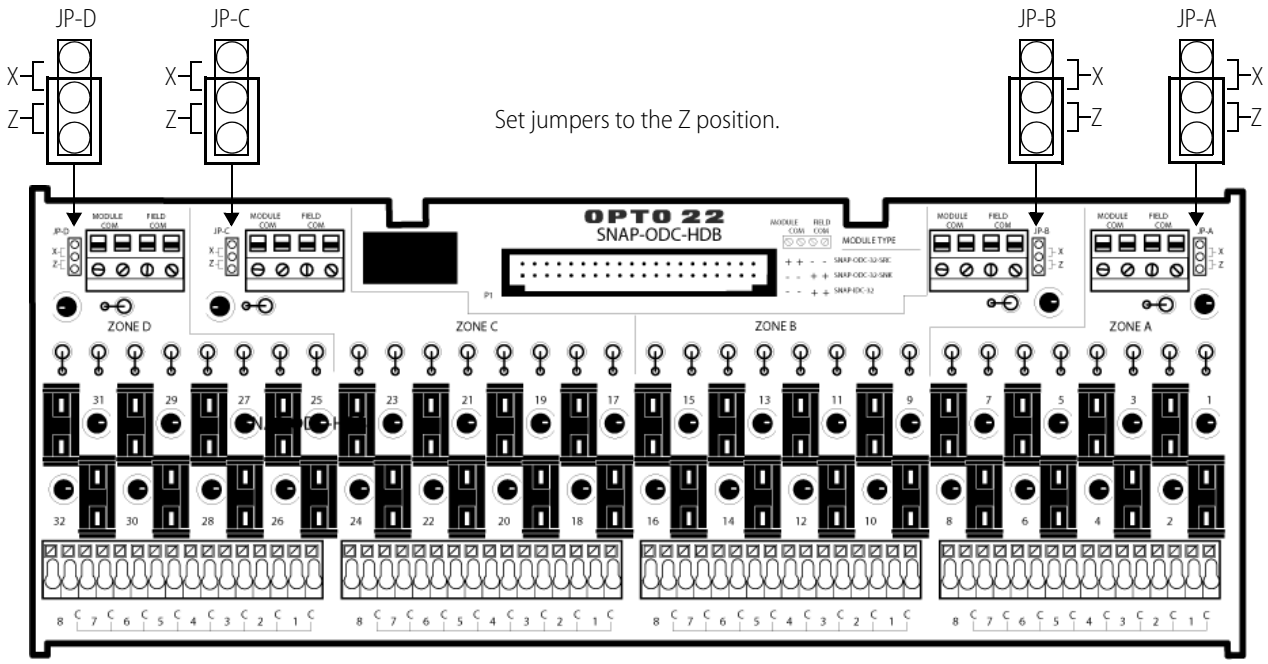
2. Connect the SNAP-HD-BF6 cable to the board following wiring diagrams starting on page 10. There are four identical zones on the rack, labeled "A" through "D".
3. Connect field devices and power supply to the breakout board as shown below.

IMPORTANT: See module technical specifications for signal voltage range.

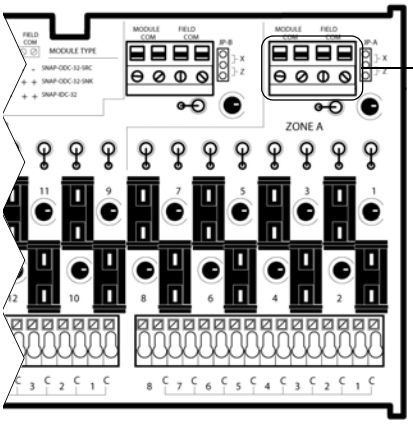


SNAP-ODC-HDB or SNAP-ODC-HDB-FM (for Output Modules)

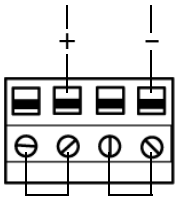
1. Set the LED jumpers for the SNAP-ODC-HDB (or -FM) breakout board to the Z position when using any SNAP-ODC-32 output module (sourcing or sinking).



2. Connect the SNAP-HD-BF6 cable to the board following wiring diagrams starting on page 10. There are four identical zones on the rack, labeled "A" through "D".
3. Connect the power supply to the SNAP-ODC-HDB output breakout board as shown here.

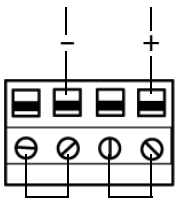


SNAP-ODC-32-SRC (or -FM)



Connect the positive lead (+) from the power supply to one Module COM terminal. Connect the negative lead (–) to one Field COM terminal.

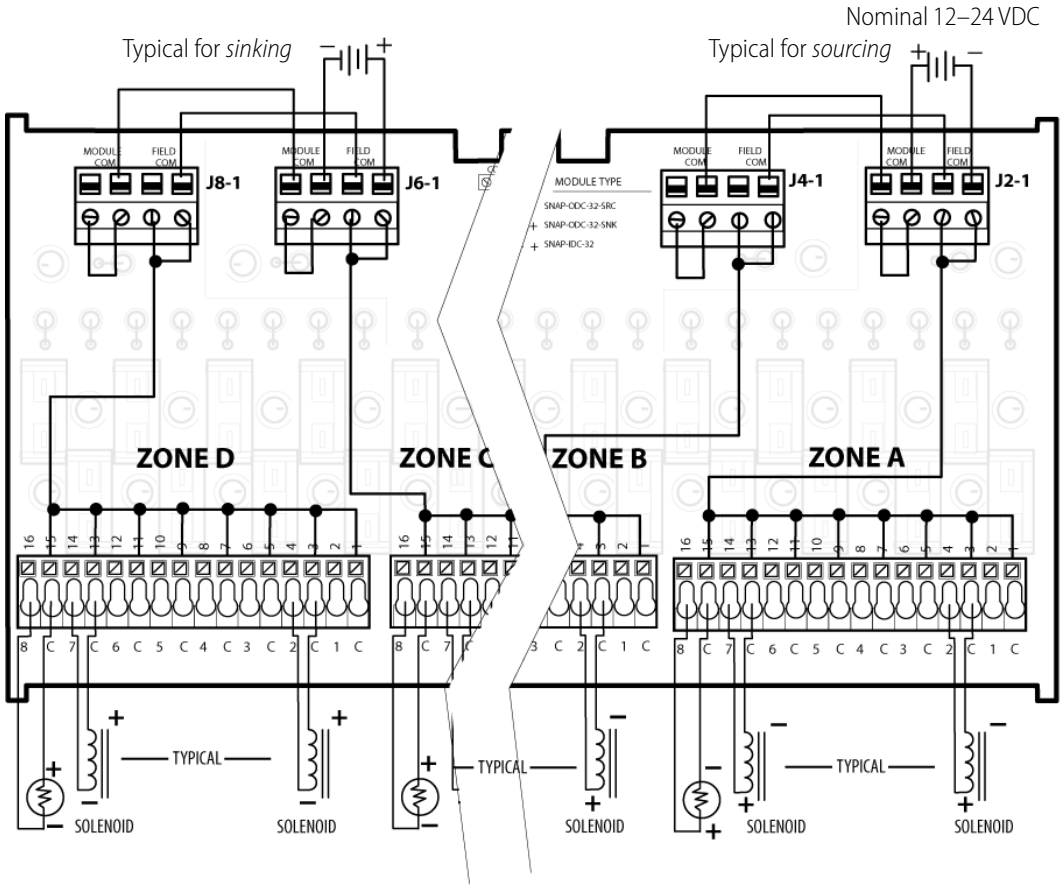
SNAP-ODC-32-SNK (or -FM)



Connect the negative lead (–) from the power supply to one Module COM terminal. Connect the positive lead (+) to one Field COM terminal.

4. Connect field devices to the breakout board as shown below.

IMPORTANT: See module technical specifications for signal voltage range. Maximum: 32 VDC.



Wiring to Field Devices

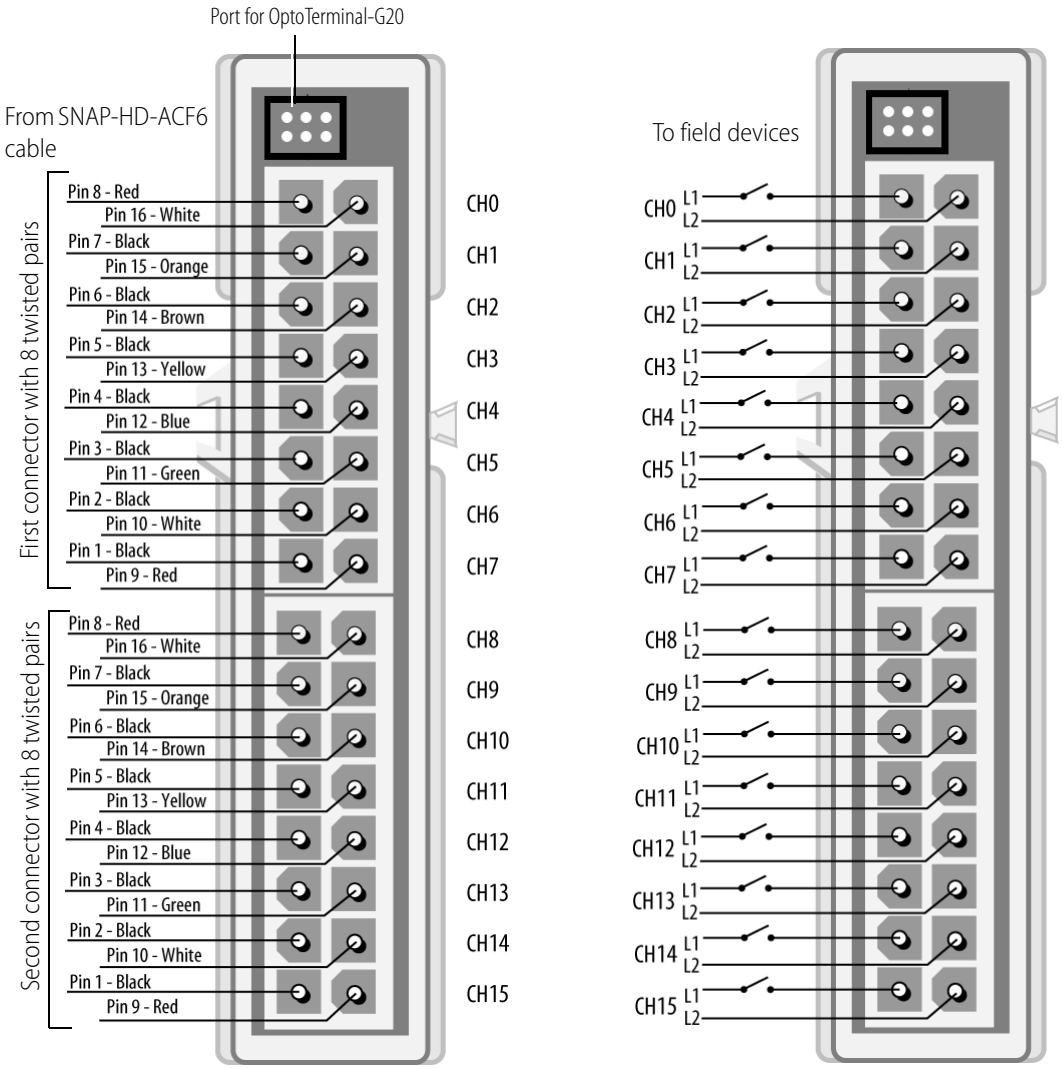
For 16-channel modules, see page 9.

For 32-channel modules, see page 10.

CAUTION: For output modules, you must install fuses between the wiring harness and field devices. If you use a fused breakout rack (such as SNAP-ODC-HDB or SNAP-TEX-FB16-H), fusing is already done for you. If not, follow the diagram on page 13 to either fuse the common for each set of wires or fuse individual pinouts for each point.

16-Channel Modules—Wiring and Pinouts

The following diagrams show wiring from the SNAP-HD-ACF6 cable to a 16-channel module (left) and pinouts to field devices (right). The small six-pin connector on the top of the module connects to the optional OptoTerminal-G20 using a special adapter cable, included with the OptoTerminal.



NOTE: The connectors on these modules are not polarity-specific. 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.

32-Channel Modules—Wiring and Pinouts

The following table shows wiring from the SNAP-HD-CBF6 cable to 32-channel modules. Wires from the cable are grouped into four sets. Each set contains color-coded wires.

Set A		
Wires		Point
A0	Gray	0
A1	Blue	1
A2	Yellow	2
A3	Red	3
A4	White	4
A5	Violet	5
A6	Green	6
A7	Orange	7
A	Black Brown	COM

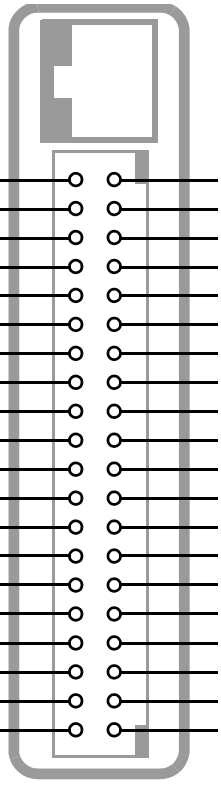
Set B		
Wires		Point
B0	Gray	8
B1	Blue	9
B2	Yellow	10
B3	Red	11
B4	White	12
B5	Violet	13
B6	Green	14
B7	Orange	15
B	Black Brown	COM

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
C	Black Brown	COM

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

The four sets relate to point numbers on the module as shown below. Pinouts for input modules are shown on page 11. Pinouts for output modules are on page 13.

Harness Wire Color	Pin Number	Signal
Gray	40	A0
Blue	38	A1
Yellow	36	A2
Red	34	A3
Black	32	ACOM
Gray	30	B0
Blue	28	B1
Yellow	26	B2
Red	24	B3
Black	22	BCOM
Gray	20	C0
Blue	18	C1
Yellow	16	C2
Red	14	C3
Black	12	CCOM
Gray	10	D0
Blue	8	D1
Yellow	6	D2
Red	4	D3
Black	2	DCOM

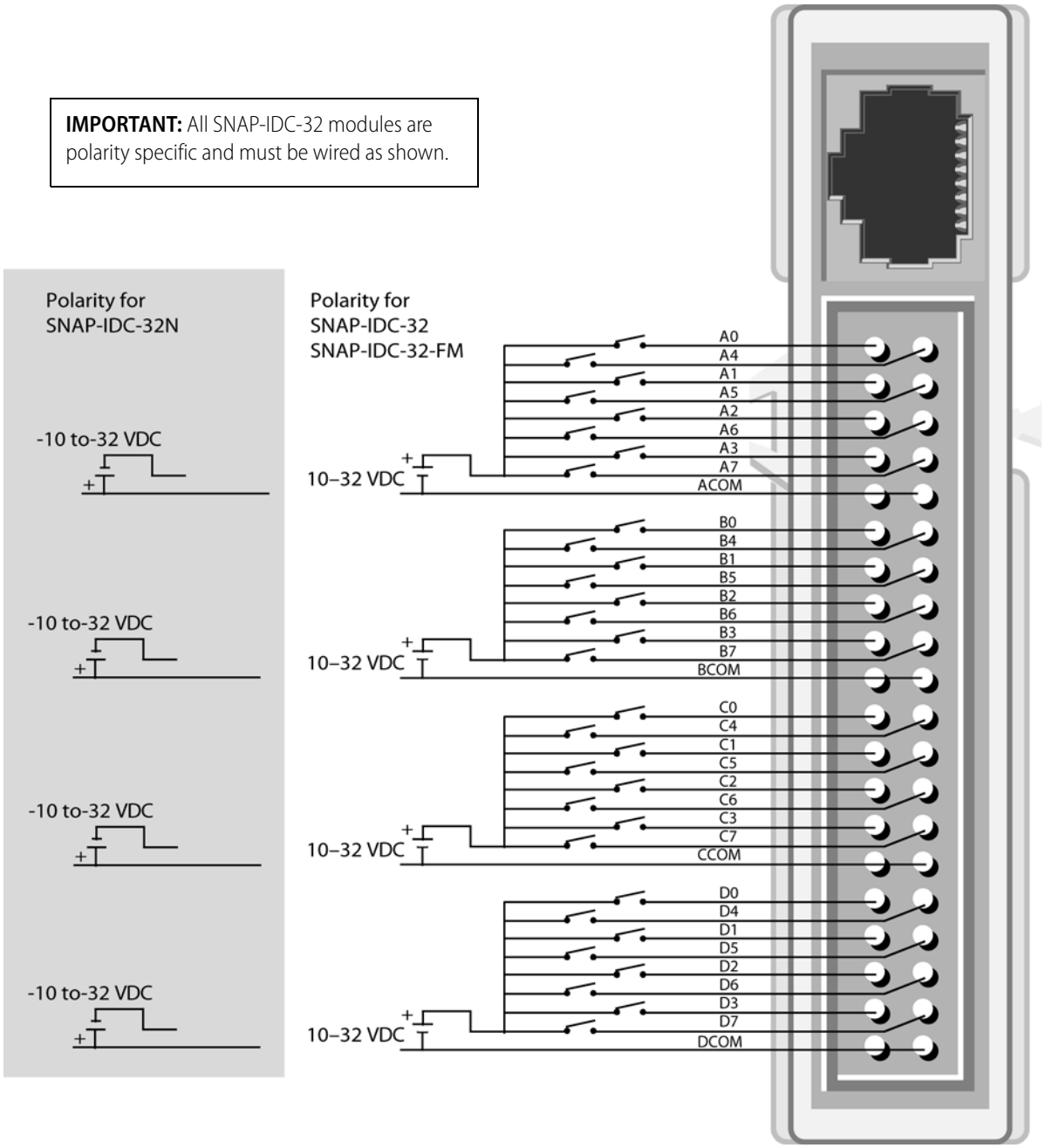


Signal	Pin Number	Harness Wire Color
A4	39	White
A5	37	Violet
A6	35	Green
A7	33	Orange
ACOM	31	Brown
B4	29	White
B5	27	Violet
B6	25	Green
B7	23	Orange
BCOM	21	Brown
C4	19	White
C5	17	Violet
C6	15	Green
C7	13	Orange
CCOM	11	Brown
D4	9	White
D5	7	Violet
D6	5	Green
D7	3	Orange
DCOM	1	Brown

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)

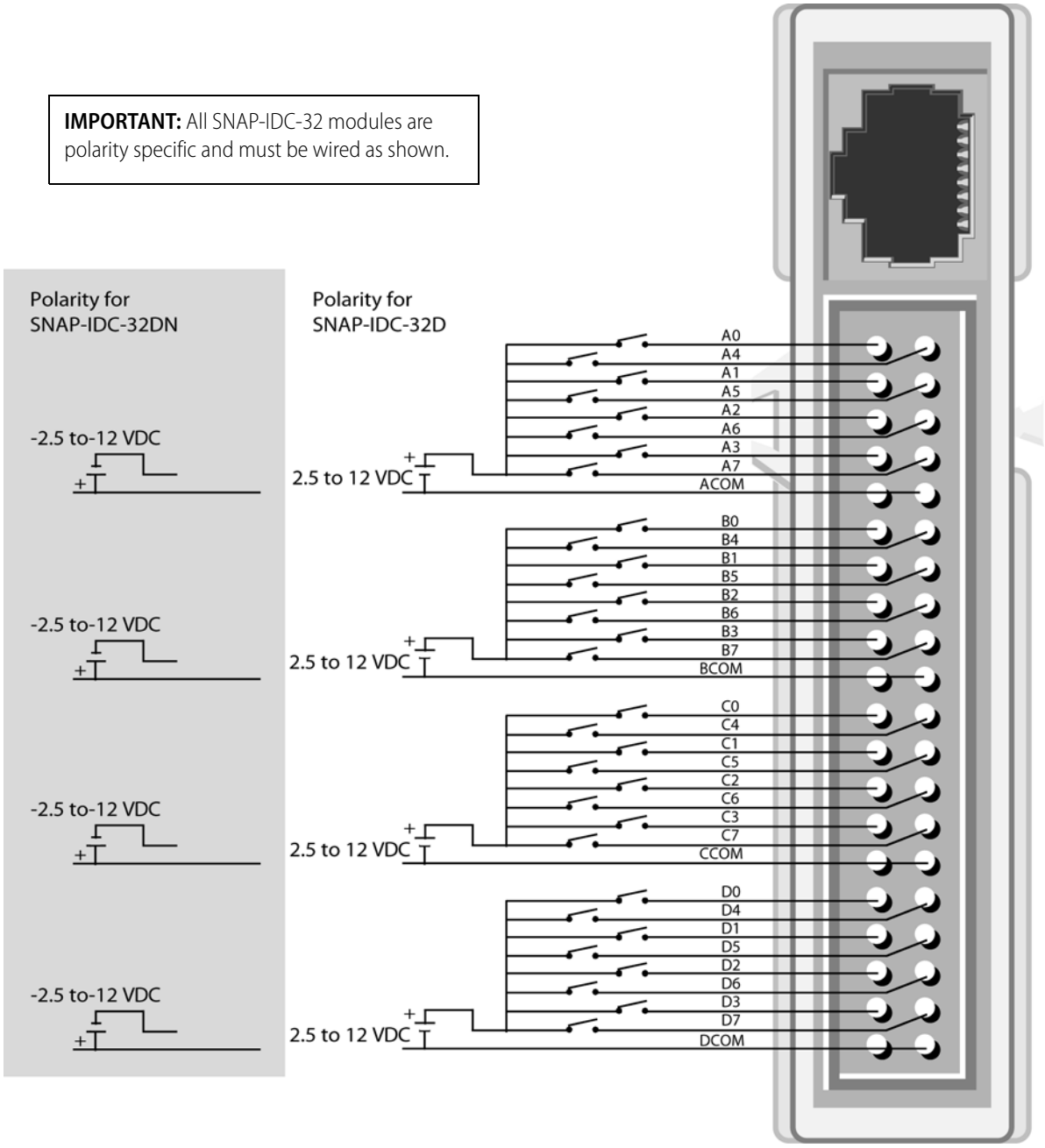
Pinouts—SNAP-IDC-32, SNAP-IDC-32-FM, and SNAP-IDC-32N 32-Channel Input Modules

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



Pinouts—SNAP-IDC-32D and SNAP-IDC-32DN 32-Channel Input Modules

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

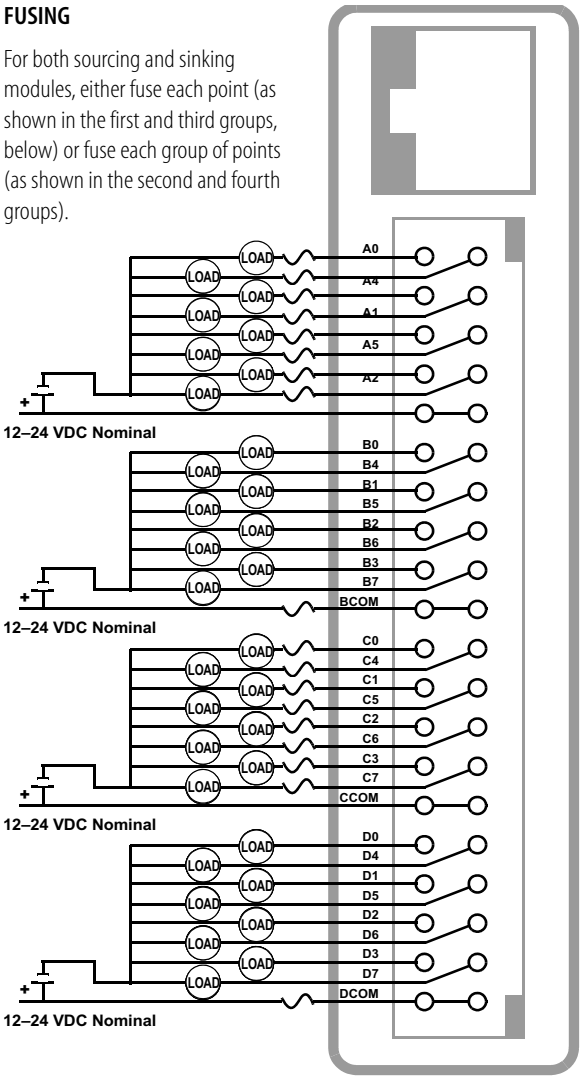


Pinouts—32-Channel Digital Output Modules

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

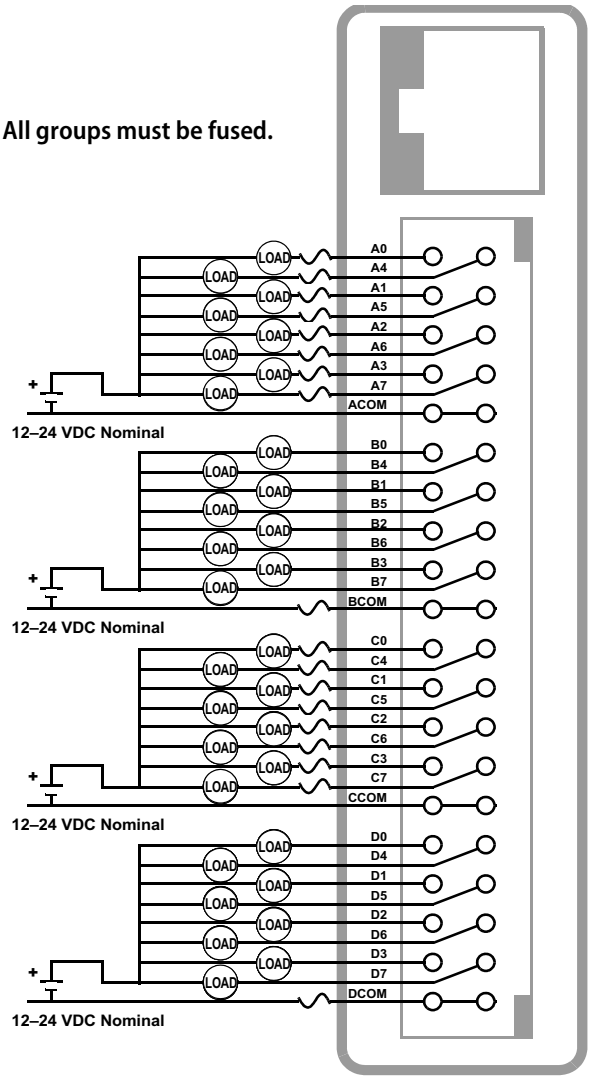
FUSING

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)

All groups must be fused.



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

Testing Field Connections

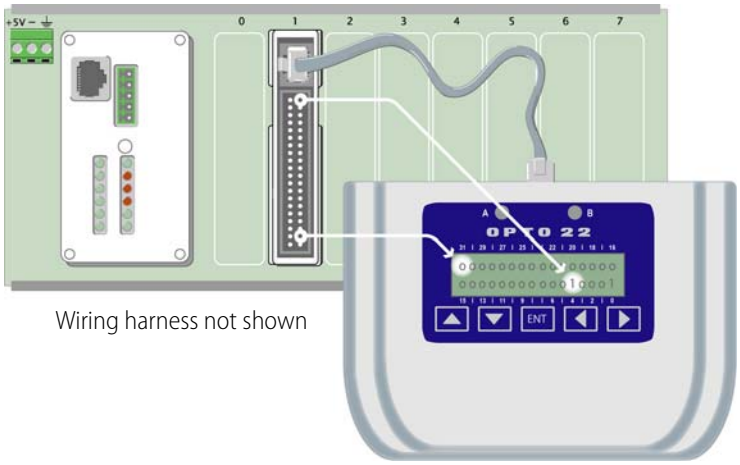
The OptoTerminal-G20 (sold separately) is recommended for testing field wiring locally. For input and output modules, you can use it to read point states; for output modules, you can also use it to write to individual output points.

CAUTION: The OptoTerminal-G20 is for use with SNAP high-density modules only, and is the only display device intended for use with these modules. Any use of the display device on other equipment, or the use of another display device with a high-density digital module, may damage your equipment.

Reading Point States

1. Turn on power to the rack.
2. Use the correct cable to connect the OptoTerminal-G20 to the RJ-45 connector on a 32-channel module or the 6-pin connector on a 16-channel module (match up the keying dots).

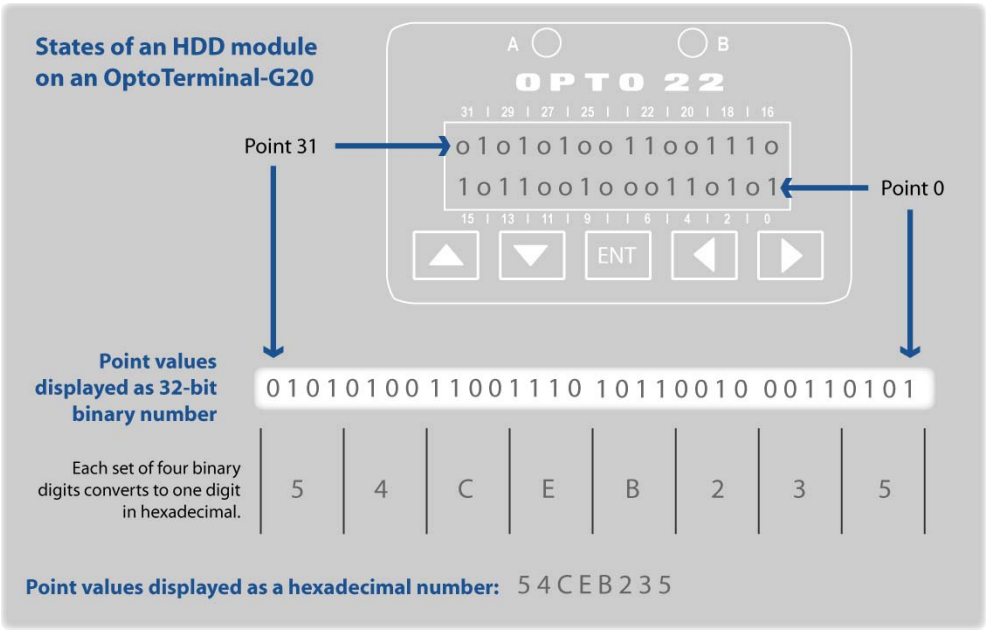
   As shown in the diagram below, the OptoTerminal-G20 displays the current state of all points on the module.



Wiring harness not shown

Point states are displayed as a bitmask. Each binary digit represents the state of one point, either on (1) or off (o). The top row shows points 31–16 and the bottom row shows points 15–0.

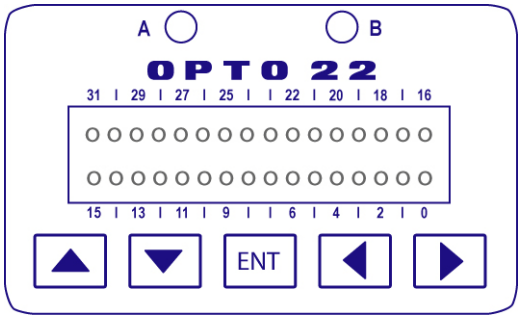
In the following example, points 0, 2, 4, 5, 9, 12, 13, 15, 17, 18, 19, 22, 23, 26, 28, and 30 are on, and the remaining points are off. The terminal displays the bitmask in binary format; the hexadecimal equivalent of the bitmask is shown for reference only.



Writing to Output Points

1. Turn off power to the rack.
2. Remove the SNAP brain or controller from the rack to prevent it from overwriting commands from the OptoTerminal-G20. (Commands from the display device have the lowest priority.)
3. Turn on power to the rack.
4. Plug the OptoTerminal-G20 into the RJ-45 connector on top of the output module.

   The terminal shows the current state of output points. In this example, all points are off:



5. Press the arrow keys to select the point you want to turn on or off.

Up and down arrows move the cursor between rows.

Left and right arrows move the cursor to select a point.

6. When you have selected the point, press ENT.

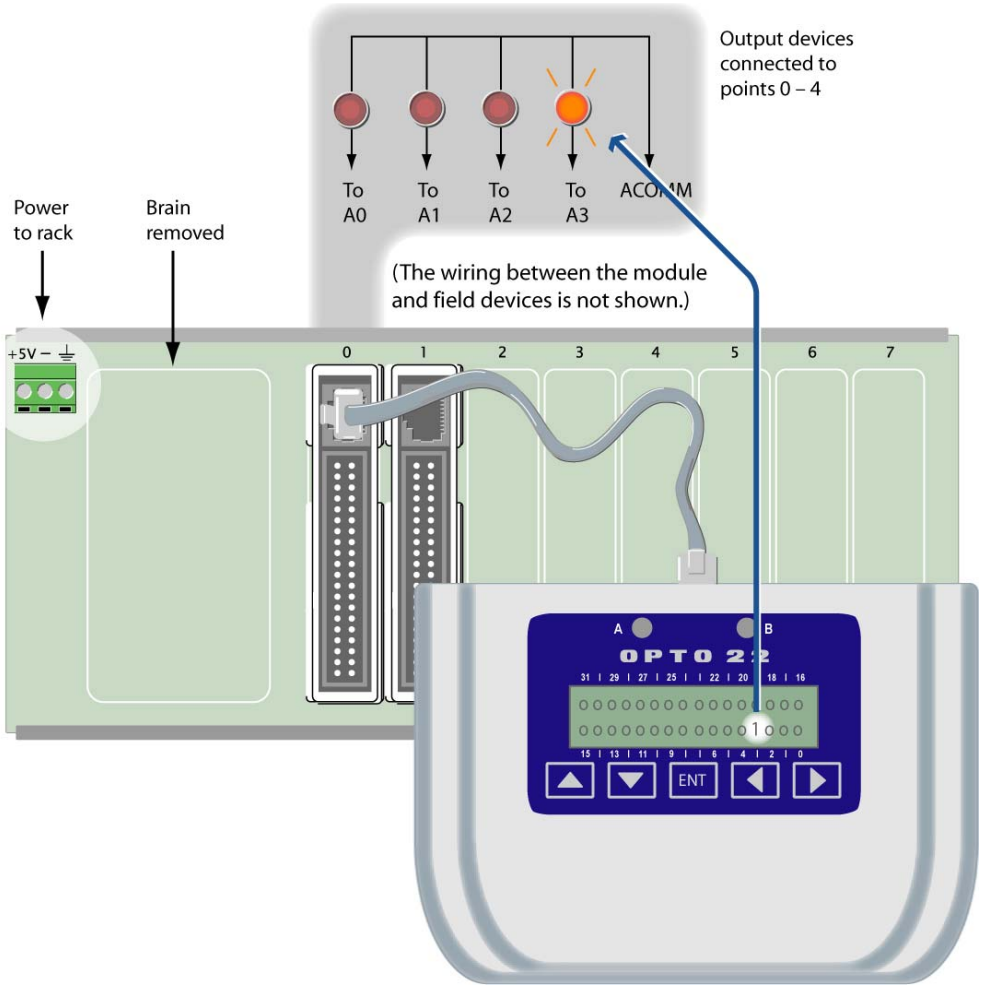
7. To turn a point on, press the up or down arrow to select a 1. To turn a point off, press the up or down arrow to select a 0.

   NOTE: The OptoTerminal-G20 displays 1 and o for On and Off. A zero is displayed when the value of zero is selected to be written to a point.

8. Press ENT to send the Turn On or Turn Off command.

   If you don't press ENT, the unfinished command is cancelled after 10 seconds, and the display is reset.

9. Watch the output device to make sure it responds.



After the command is sent, the display shows the changed value.

What's Next?

Once you have installed and tested the high-density digital (HDD) module, it is ready for use. Configuration, reading, and writing using PAC Project are similar to 4-channel modules. For differences, see "Comparing High-Density and 4-Channel Digital Modules" on page 19.

You'll find the following guides useful for the information listed. All guides are available on the Opto 22 website, www.opto22.com. The easiest way to locate one is to search on its form number.

For this information	See this guide	Form #
Installing and using the I/O processors (brains and rack-mounted controllers) that support high-density modules	*SNAP PAC Brain User's Guide*	1590
	SNAP PAC R-Series Controller User's Guide	1595
Reading and writing to HDD modules using PAC Control strategies	*PAC Control User's Guide*	1700
	PAC Control Command Reference	1701
	PAC Control Commands Quick Reference	1703
One-time reads and writes to high-density modules	*PAC Manager User's Guide*	1704
Reading and writing to HDD modules from an Allen-Bradley® Logix PLC system	*EtherNet/IP for SNAP PAC Protocol Guide*	1770
Reading and writing to HDD modules from a Modbus/TCP system	*Modbus/TCP Protocol Guide*	1678
Reading and writing to HDD modules using a custom program you develop	*OptoMMP Protocol Guide*	1465

2: Usage Notes and Specifications

This chapter contains the following information:

Comparing High-Density and 4-Channel Digital Modules

SNAP high-density digital modules differ in several ways from 4-channel SNAP digital modules. A few important differences are discussed below; see the table on the next page for more.

Communication with the Processor

One of the main differences between 4-channel and high-density modules is in how the processor (brain or on-the-rack controller) communicates with them on the mounting rack. Four-channel SNAP digital modules communicate with the processor through direct wiring; but SNAP high-density modules communicate as analog and serial modules do, over an internal bus built into the rack and using the processor's analog scanner.

This different communication method means that:

- Communication with the processor (*update time*) is generally slower.
- Communication speed is affected by how "busy" the processor is—that is, how many modules it talks to and how many Ethernet communications the processor is handling at the same time.

Counting

Another difference between 4-channel and high-density digital modules is in counting. For 4-channel SNAP digital input modules, counting is done on the processor. We refer to it as "high-speed" counting because it can be up to 20 KHz, depending on the speed of the module.

For high-density SNAP digital modules, however, the module itself does the counting. The module uses a 16-bit counter (which goes up to 65,535), but the processor used with the module accumulates counts to 32 bits (4,294,967,295) by periodically getting and clearing the module's counts and adding each new count to what it already has for each point. Update time varies based on the number of modules on the rack and Ethernet communication demands placed on the processor.

Counting speed for high-density digital modules is up to 50 Hz at a 50% duty cycle. This rate is useful for applications that require counting at lower speeds—for example, rotating shafts, flow meters that generate pulses, and electrical meters tuned to slower speeds.

Because counting is done in the module rather than in the processor, you can get counts for HDD modules used with SNAP-PAC-R2 controllers and SNAP-PAC-EB2 and SNAP-PAC-SB2 brains—processors that don't have high-speed counting capability.

4-Channel Digital Counting	High-density Digital Counting
Counters must be started. Counters can be: • Started • Stopped • Read • Read & Cleared Counting is supported on 1-series processors only (R1, EB1, SB1).	Counters are always counting. Counters can be: • Read • Read & Cleared Counters cannot be started or stopped. Counting is done on the module. HDD input counting is supported on all processors (R1, R2, EB1, EB2, SB1, SB2)

Use in PAC Control

In PAC Control, **1-series processors** (SNAP-PAC-R1, SNAP-PAC-EB1, and SNAP-PAC-SB1, including -FM and -W models) configure and use high-density digital modules much like 4-channel digital modules. However, because of the differences in counters shown in the table above, only the commands Get Counter, Get & Clear Counter, and Clear Counter will have an effect. Since counting is automatic and continuous on the high-density module, be sure you clear the counter each time before starting to use it, so you know it's starting from zero.

Because PAC Control does not allow counting on **2-series processors** (SNAP-PAC-R2, SNAP-PAC-EB2, and SNAP-PAC-SB2, plus their -FM and -W models), you cannot configure points on HDD modules as counters. However, you can work around this limitation by simply enabling and using the legacy HDD module commands: Get HDD Module Counters, Get & Clear HDD Module Counter, and Get & Clear HDD Module Counters. See the *PAC Control User's Guide* for instructions to enable legacy commands. Remember to clear the counter each time before starting to use it, since counting is continuous.

If you not using SNAP PAC brains and controllers but are using older hardware, see "Using HDD Modules with Legacy Hardware" on page 23.)

High-Density and 4-Channel Digital Module Comparison

Item	SNAP High-Density Digital Modules	4-Channel SNAP Digital Modules
Number of points on module	16 or 32, depending on module	4
Isolation and fusing	**16-point input modules:** Each point is optically isolated from other points on the module. **32-point input and output modules:** The module is divided into four groups of eight points. Groups are isolated from each other, but points within a group are not isolated from each other. Groups must be externally fused.	**Input modules:** Each point is optically isolated from other points on the module. **Most output modules:** Points are not isolated from each other. Points share a common fuse. For isolated modules, see the *SNAP Digital Ouput Modules Data Sheet* (form #1144).
Status LEDs	None; use the handheld OptoTerminal-G20 for module diagnostics and commissioning, or for 32-point modules, connect to an optional breakout rack.	One for each point, located on top of module.
Polling time from I/O processor to module[1]	2–30 ms typical[2]	0.5–2 ms typical[2]
Module turn-on/off time[1]	16-point input modules: 15–20 ms 32-point input modules: 6 ms Output modules: 100 microseconds	Varies by module. Examples: • SNAP-IDC5-FAST: 25 microseconds • SNAP-IDC5: 5 ms turn-on, 15 ms turn-off
On/off status	Yes	Yes
Input latching	Yes	Yes
Counting on digital input modules	Counting occurs on the module.[3] Counting is available with SNAP-PAC-R1[4], SNAP-PAC-EB1[4], and SNAP-PAC-SB1 processors. Counting speeds: On 32-point modules, 0–50 Hz @ 50% duty cycle On 16-point modules, 0–25 Hz @ 50% duty cycle (Speed depends on module; see specifications for each part number.)	High-speed counting occurs on the I/O processor (brain or on-the-rack controller) and can be configured for any point. (High-speed counting is available on SNAP-PAC-R1[4], SNAP-PAC-EB1[4], and SNAP-PAC-SB1 processors.) Counting speed varies based on the processor and the speed of the module. Example: SNAP-PAC-EB1 brain with SNAP-IDC5-FAST: up to 20 KHz
Watchdog timer	Firmware 8.1 and higher, yes. Firmware 8.0 and lower, no.	Yes
Pulse generation	Yes	Yes
On-pulse, off-pulse, and Period measurement	No	Yes
Frequency	No	Yes
Totalizer	No	Yes
Digital events	Firmware 8.1 and higher, yes. Firmware 8.0 and lower, no.	Yes

1 Actual turn-on and turn-off times equal the polling time plus the module time.
2 Polling time varies based on the SNAP I/O processor (brain or on-the-rack controller), processor configuration, and Ethernet host communication activity.
3 The high-density digital module uses a 16-bit counter, but the processor used with the module accumulates counts to 32 bits by periodically getting and clearing the module's counts and adding to current values. Update time varies based on number of modules and Ethernet communication demands.
4 Including -FM (Factory Mutual approved) and -W (Wired+Wireless) models.

Building Your Own Cables

Header Cable

If you want to build your own SNAP-HD-BF6 header cable for use with either breakout rack, you will need the parts listed below. Both ends of the cable use the same connectors.

Connector: Molex 15-04-5401
Pin housing: Molex 50-57-9320
Pins: Molex p/n 16-02-0103
Cable: Alpha 5020C or Manhattan M38910 (24 AWG, 10 conductor, 4x length needed) or equivalent (UL type CM)

Wiring Harness

If you want to build your own wiring harness, you will need the parts listed below.

For SNAP-HD-ACF6:

Connector: Molex 39-01-2165
Pins: Molex 39-00-0214
Cable: Belden 8308 (22 AWG, 16 conductor, shielded) or equivalent (UL AWM style 2464)

For SNAP-HD-CBF6:

Connector: Molex 15-04-5401
Pin housing: Molex 50-57-9320
Pins: Molex p/n 16-02-0103
Cable: Alpha 5020/40c (24 AWG, 40 conductor) or equivalent (UL type CM)

Also see "32-Channel Modules—Wiring and Pinouts" on page 10.

Notes on Legacy Hardware and Software

For important information on mixing current and legacy products, see Opto 22 form #1688, the *SNAP PAC System Migration Technical Note*.

Using HDD Modules with Legacy Hardware

Most high-density digital modules can be used only with SNAP PAC brains and R-series controllers. However, the following table lists some HDD modules that can be installed on I/O units using legacy I/O processors and racks:

<table>
<tr><th>These HDD Modules...</th><th>...can be used with these legacy processors*</th><th colspan="2">...on these racks</th></tr>
<tr><td rowspan="2">SNAP-IDC-32
SNAP-ODC-32-SNK
SNAP-ODC-32-SRC</td><td>SNAP-UP1-M64
SNAP-ENET-S64</td><td>SNAP-M16
SNAP-M32</td><td>SNAP-M48
SNAP-M64</td></tr>
<tr><td>SNAP-UP1-ADS
SNAP-B3000-ENET
SNAP-ENET-RTC</td><td>SNAP-B4M
SNAP-B8M
SNAP-B8MC
SNAP-B8MC-P
SNAP-B12M</td><td>SNAP-B12MC
SNAP-B12MC-P
SNAP-B16M
SNAP-B16MC
SNAP-B16MC-P</td></tr>
</table>

*Processors must have firmware 6.1 or higher.

Support for these HDD modules on legacy hardware is limited. See form #1688, the *SNAP PAC System Migration Technical Note*, for more information.

To check processor firmware and load new firmware if required, follow instructions in the *PAC Manager User's Guide, Legacy Edition* (form #1714).

Note that SNAP high-density modules cannot be used with digital-only processors, because high-density modules communicate with the processor as an analog module communicates.

HDD modules can be placed anywhere on B-series racks, even in slots marked "Analog Only."

Using HDD Modules with Legacy Software

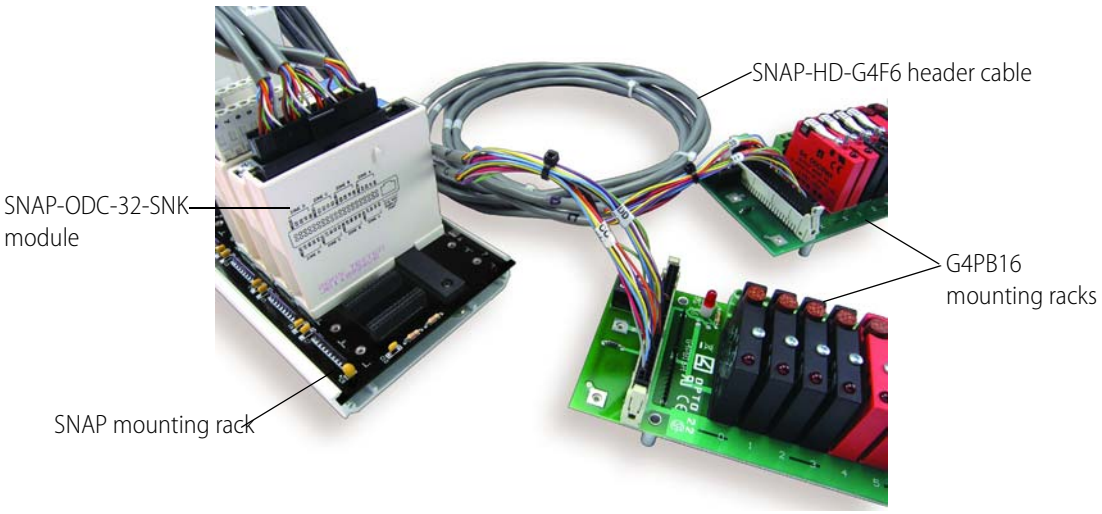
For SNAP-IDC-32, SNAP-ODC-32-SNK, and SNAP-ODC-32-SRC modules, it is best to use PAC Control 8.0 or newer. If you do, follow steps in form #1688, the *SNAP PAC System Migration Technical Note*, to enable deprecated HDD commands, and use these instead of standard digital commands. You can also use ioControl version 6.1 or newer with the SNAP-IDC-32, SNAP-ODC-32-SNK, and SNAP-ODC-32-SRC modules. Use the separate HDD commands for reading and writing.

Similarly, PAC Manager 8.0 or newer is required for the best use of HDD modules, but you can also use ioManager 6.1 or newer for one-time reads and writes to the same three modules.

If you must read and write to these three modules using ioDisplay 6.0 (not recommended; upgrade to PAC Display or at least to ioDisplay 6.1), see Opto 22 form #1561, *Using ioDisplay 6.0 with SNAP 32-channel Digital Modules Technical Note.*

For all other HDD modules, you cannot use legacy software or hardware. You must use SNAP PAC controllers and brains with the version of PAC Control that supports the specific modules.

Connecting to G4 Digital I/O



Some 32-channel HDD modules can connect to older G4 and G1 mounting racks, using a special cable, to integrate older G4 digital I/O systems with modern PAC Project software and SNAP Ethernet-based controllers. For outputs, this connection makes available the G4 module's 3-amp switching capability, which provides twelve times the 0.25 amp capability per point of the high-density digital modules themselves.

These HDD modules and cables also work with some G1 racks, and the SNAP-HD-G4F6 works with some integrated I/O racks.

For more information, see form #1756, the SNAP TEX Cables and Breakout Boards Data Sheet.

Outputs

Connect SNAP-ODC-32-SNK digital output modules to G4PB16H and G4PB16HC mounting racks using the **SNAP-HD-G4F6** header cable.

- Do not use SNAP-ODC-32-SRC modules with G4 digital.
- All G4 modules on the G4 mounting rack must be outputs and must be the same logic voltage (5, 15, or 24 VDC)

Inputs

SNAP-IDC-32N and SNAP-IDC-32DN digital input modules can connect to G4PB16H and G4PB16HC mounting racks using the **SNAP-HD-G4F6N** header cable.

- All G4 modules on the G4 mounting rack must be inputs and must be the same logic voltage (5, 15, or 24 VDC).
- For 5 volt G4 modules, use the SNAP-IDC-32DN.
- For 15 or 24 volt G4 modules, use the SNAP-IDC-32N.

NOTE: While not designed for this use, it is possible to connect the SNAP-IDC-32 module with G4 15 or 24 V inputs using a SNAP-HD-G4F6 cable. However, the SNAP-IDC-32 uses positive-true logic and therefore returns the inverse of the typical negative-true logic. For example, if the SNAP-IDC-32 is controlled by a PAC Control strategy, an "OFF" state from it actually indicates that the associated G4 module is turned ON.

Specifications

Input Modules

	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	16 isolated input channels	16 isolated input channels	16 isolated input channels
Channel-to-Channel Isolation	250 V steady-state, 1500 V transient	250 V steady-state, 1500 V transient	250 V steady-state, 1500 V transient	250 V steady-state, 1500 V transient	250 V steady-state, 1500 V transient
Maximum Number of HDD Modules on One Mounting Rack	16	16	16	16	16
Indicators	None; use optional OptoTerminal-G20 diagnostic display.	None; use optional OptoTerminal-G20 diagnostic display.	None; use optional OptoTerminal-G20 diagnostic display.	None; use optional OptoTerminal-G20 diagnostic display.	None; use optional OptoTerminal-G20 diagnostic display.
ON Voltage	10 VDC @ 0.230 mA	15 VDC @ 3.50 mA	90 VAC/VDC @ 0.3 mA	180 VAC/VDC @ 0.191 mA	70 VAC/VDC @ 0.3 mA
OFF Voltage	3 VDC @ 0.05 mA	9 VDC @ 2.0 mA	40 VAC/VDC @ 0.135 mA	40 VAC/VDC @ 0.043 mA	30 VAC/VDC @ 0.135 mA
Torque, hold-down screws	4 in-lb (0.45 N-m)	4 in-lb (0.45 N-m)	4 in-lb (0.45 N-m)	4 in-lb (0.45 N-m)	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)	5.26 in-lb (0.6 N-m)	5.26 in-lb (0.6 N-m)	5.26 in-lb (0.6 N-m)	5.26 in-lb (0.6 N-m)
Polling time from I/O processor to module[1]	2–30 ms typical[2]	2–30 ms typical[2]	2–30 ms typical[2]	2–30 ms typical[2]	2–30 ms typical[2]
Input Turn-On/Off Time	15 ms turn-on time 20 ms turn-off time	20 ms turn-on time 25 ms turn-off time	15 ms turn-on time 20 ms turn-off time	15 ms turn-on time 20 ms turn-off time	15 ms turn-on time 20 ms turn-off time
Counting Frequency (DC input)	0–25 Hz @ 50% duty cycle	0–15 Hz @ 50% duty cycle	0–25 Hz @ 50% duty cycle	0–25 Hz @ 50% duty cycle	0–25 Hz @ 50% duty cycle
Agency Approvals	UL, CE, RoHS, DFARS	CE, RoHS, DFARS	UL, CE, RoHS, DFARS	UL, CE, RoHS, DFARS	CE, RoHS, DFARS
Warranty	Lifetime	Lifetime	Lifetime	Lifetime	Lifetime

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

	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	
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
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.

Output Modules

	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.
Output Turn-On/Off Time	100 microseconds	100 microseconds
Polling time from I/O processor to module[1]	2–30 ms typical[2]	2–30 ms typical[2]
Indicators	None; use optional OptoTerminal-G20 diagnostic display or breakout rack.	None; use optional OptoTerminal-G20 diagnostic display or breakout rack.
Maximum Number of HDD Modules on One Mounting Rack	16	16
Agency Approvals	SNAP-ODC-32-SRC: UL, CE, RoHS, DFARS SNAP-ODC-32-SRC-FM: CE, FM, RoHS, DFARS	SNAP-ODC-32-SNK: UL, CE, RoHS, DFARS SNAP-ODC-32-SNK-FM: CE, FM, RoHS, DFARS
Torque, hold-down screws	4 in-lb (0.45 N-m)	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)	5.26 in-lb (0.6 N-m)
Warranty	Lifetime	Lifetime

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

Wiring Harnesses and Cables

See form #1756, the *SNAP TEX Cables & Breakout Boards Data Sheet*, for complete information.

Part	Description
SNAP-HD-ACF6	6 ft. (1.8 m) wiring harness assembly for SNAP 16-point digital modules
SNAP-HD-CBF6	6 ft. (1.8 m) wiring harness for SNAP 32-point digital modules

SNAP-HD-BF6	6 ft. (1.8 m) header cable for SNAP 32-point digital modules and breakout racks
SNAP-HD-G4F6	6 ft. (1.8 m) header cable for SNAP-ODC-32-SNK and G4PB16 mounting racks. *NOTE:* Do not use with SNAP-ODC-32-SRC modules.
SNAP-HD-G4F6N	6 ft. (1.8 m) header cable for SNAP-IDC-32N or SNAP-IDC-32DN modules and G4PB16 mounting racks.

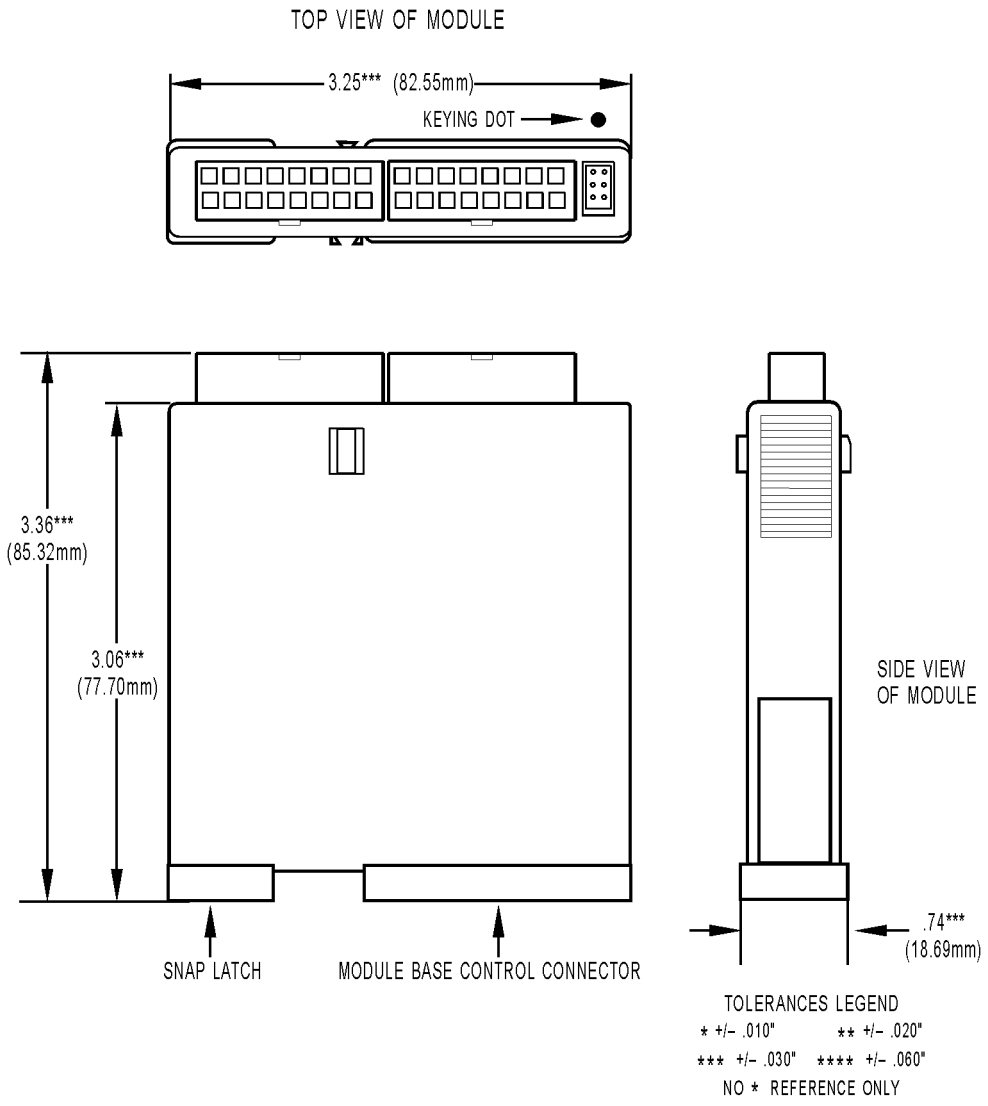
Breakout Racks

See form #1756, the *SNAP TEX Cables & Breakout Boards Data Sheet*, for complete information.

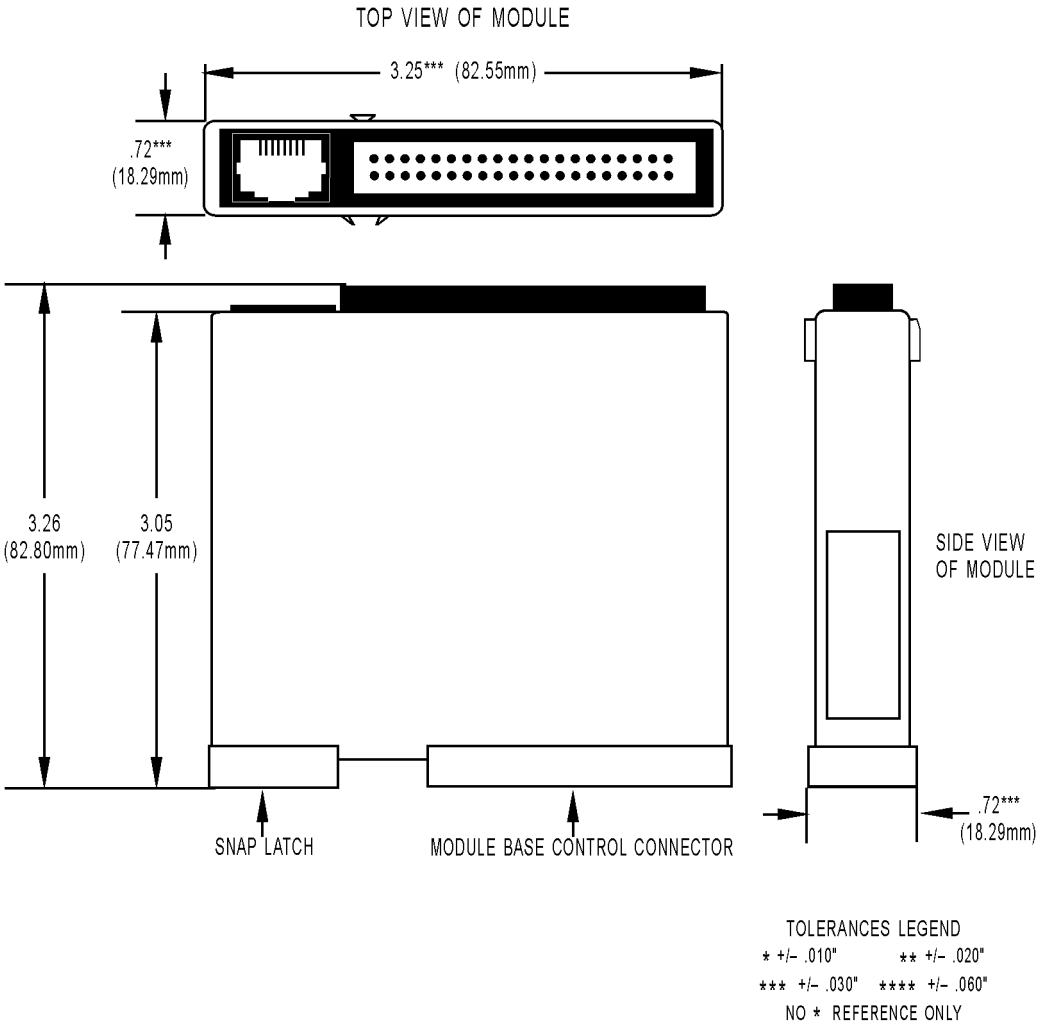
SNAP-IDC-HDB and SNAP-IDC-HDB-FM Breakout Racks for High-Density Digital Input Modules	
Used with	SNAP-IDC-32, SNAP-IDC-32-FM, SNAP-IDC-32N, and SNAP-IDC-32DN
Connectors	40-pin header connects to 32-channel input module using SNAP-HD-BF6 header cable. 32 signal input connectors; each signal connector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

Dimensional Drawings

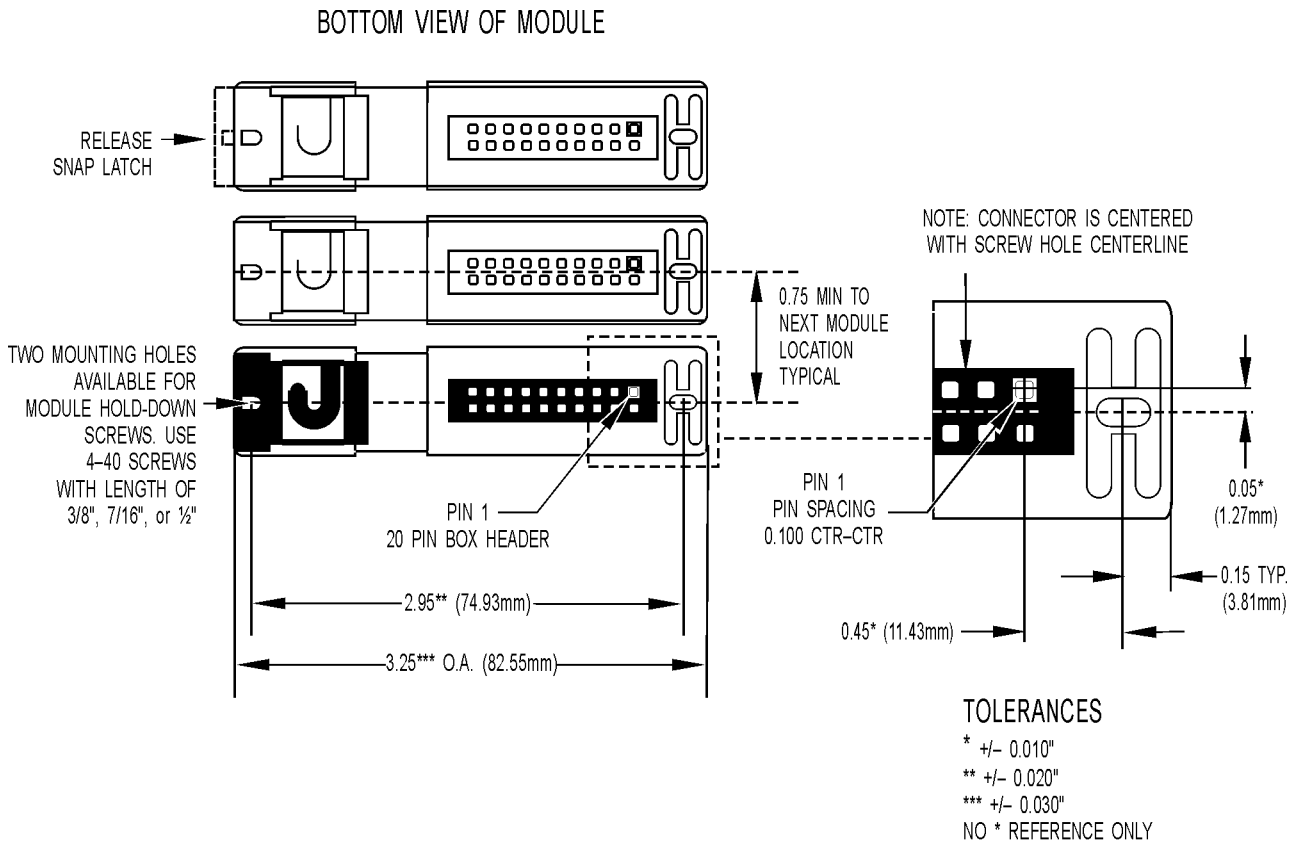
SNAP 16-Channel Digital Modules



SNAP 32-Channel Digital Modules

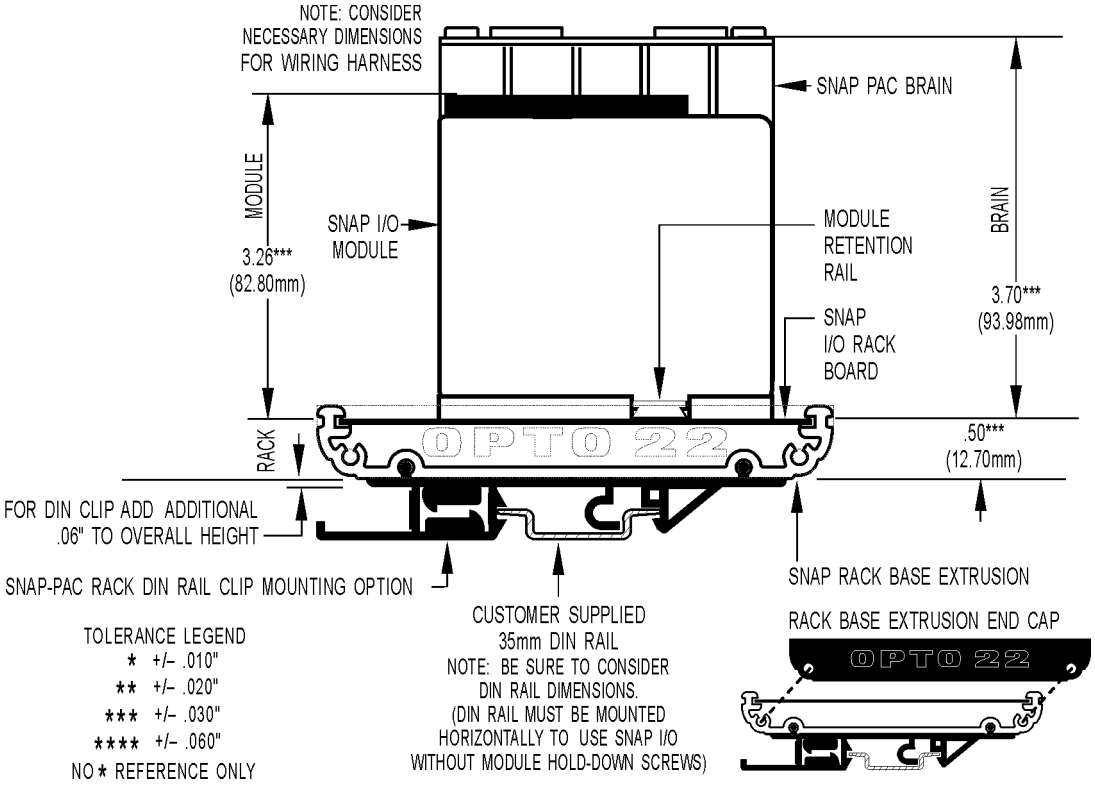


SNAP 32-Channel Digital Modules (continued)

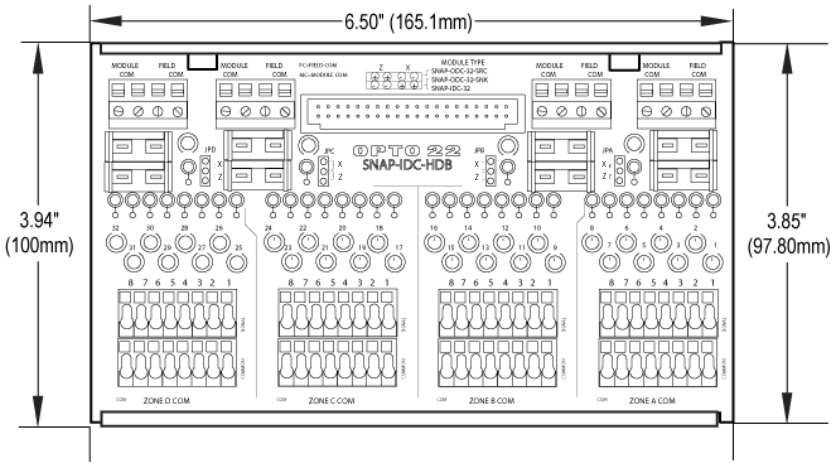


IMPORTANT: The mounting rack connector has 24 pins; the module connector has 20 pins. The extra pins on the mounting rack connector prevent misalignment of the module during installation.

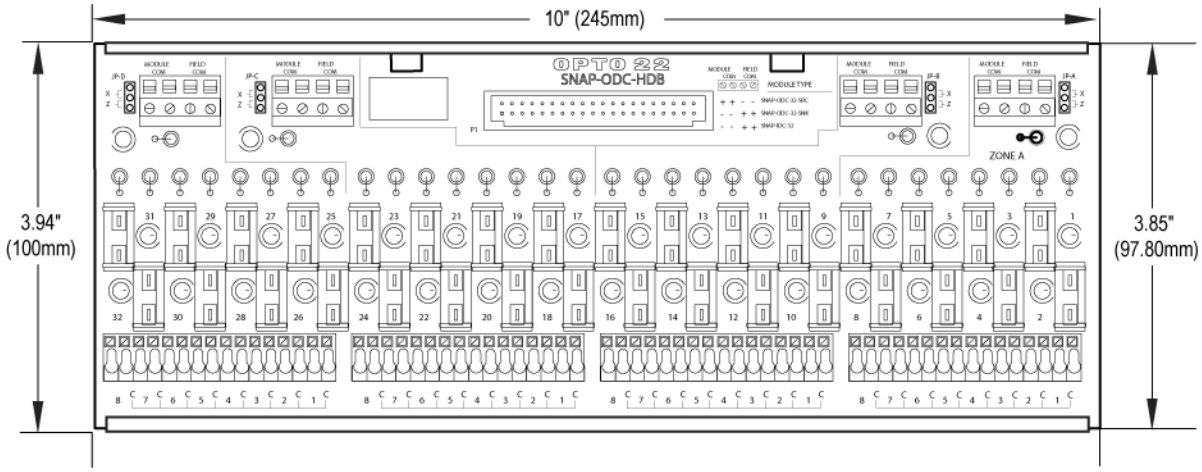
SNAP 32-Channel Digital Modules (continued)



Breakout Racks for 32-Channel Digital Modules



SNAP-IDC-HDB breakout rack



SNAP-ODC-HDB breakout rack