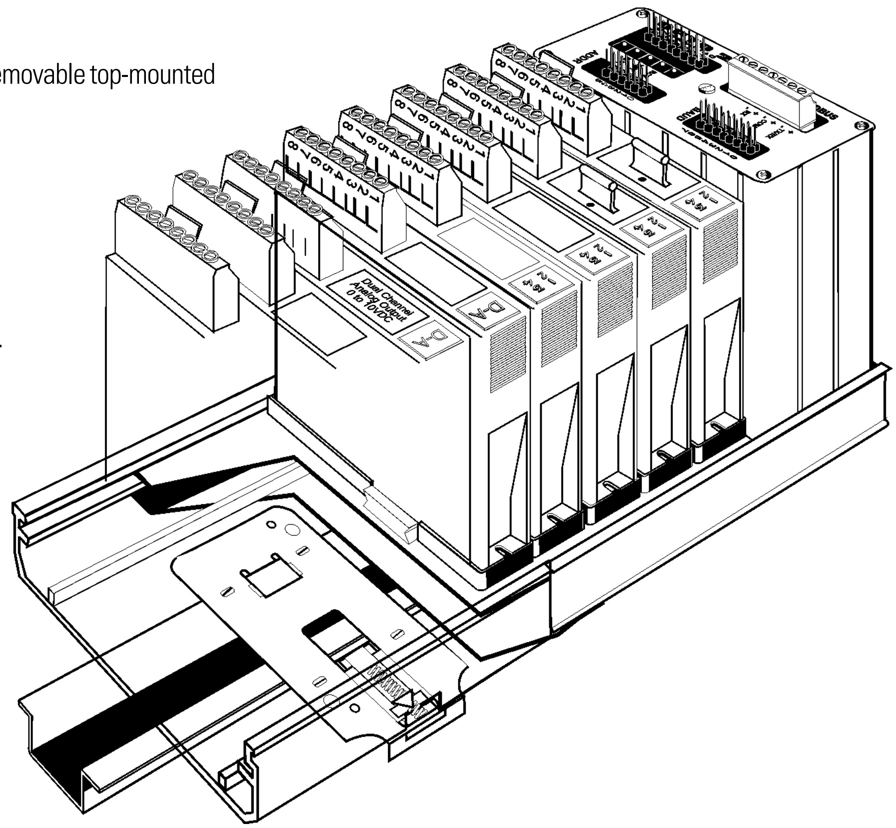
DATA SHEET

Form 787-080304

Part Number	Description
B3000	SNAP Analog/Digital Brain Mistic/Optomux Protocol

Features

- Convenient pluggable connector for removable top-mounted field wiring.
- Ready access to standard fuses.
- Versatile DIN-rail or panel mounting.
- Single distributed brain does it all - analog, digital, or mixed I/O.
- Highly visible LED status indicator for each channel.
- Digital I/O (four channels per module).
- Mix analog and digital modules on the same rack.
- Software-configurable, dual-channel, intelligent analog I/O.
- Quick and easy installation - modules "SNAP" securely on racks; no screws required.
- Factory Mutual approved



Description

The B3000 is a high-performance brain used to remotely control a mix of both analog and digital I/O modules using Opto 22's SNAP "B Series" I/O mounting racks. The B3000 can be used with either an Opto 22 controller or a host computer. On-board intelligence enables many distributed control functions.

Since SNAP analog and digital modules have the same footprint, the B3000 brain can be combined with SNAP"B Series" racks to provide a powerful I/O handling system. Please note that some newer SNAP modules are not compatible with the B3000 brain. See the module's data sheet for compatibility information.

The B3000 communicates with a host processor serially over RS-485 twisted-pair wiring and supports both the *mistic*® protocol and the industry-standard Optomux® protocol. Both protocols can support high-speed communication (115 Kbaud).

Utilizing the mistic protocol, advanced I/O processing—including PID calculations (100 millisecond update), pulse width duration measurements (100 microsecond resolution), and high-speed counting (20,000 Hz)—can all be accomplished on separate channels of the same I/O mounting rack. See page 3 for a complete list of mistic functions.

Opto 22 • 43044 Business Park Drive • Temecula, CA 92590-3614 • Phone: (951) 695-3000 • (800) 321-OPTO • Fax: (951) 695-3095 • www.opto22.com
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In addition to providing input and output capability, the Optomux protocol also has the ability to perform count, latch, and pulse duration on digital input channels, as well as frequency and pulse functions on digital outputs. The Optomux protocol is also capable of providing input averaging and output waveform functions on analog channels. See page 4 for a complete list of Optomux functions.

The B3000 is compatible with the classic B1 and B2 brains, with a few exceptions. The B3000 adds the ability to communicate with either a 2-wire or 4-wire configuration, at speeds of 115 Kbaud. Classic brains were restricted to 4-wire communications at up to 38.4 Kbaud. The B3000 supports only the standard 2-pass method of communication with the Optomux protocol.

By using the B3000 with the mistic protocol and a mistic controller, SNAP I/O customers can use FactoryFloor®, Opto 22's suite of Windows® software. FactoryFloor consists of four integrated components:

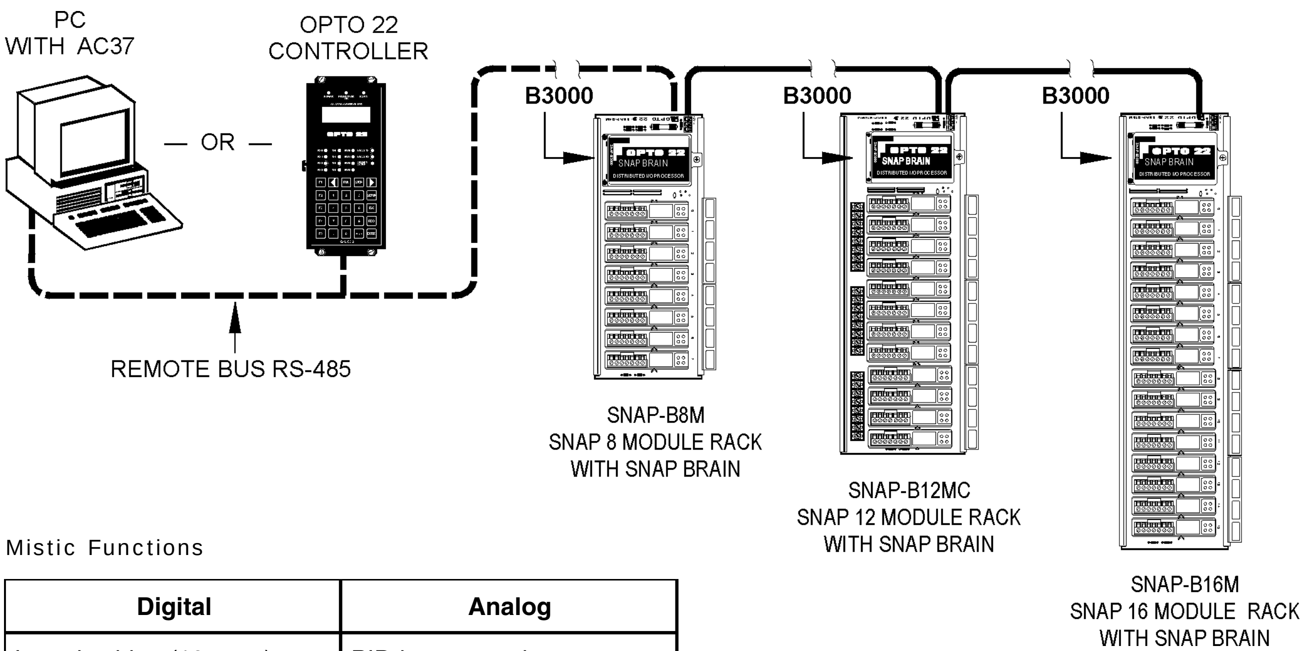
- OptoControl™, a graphical, flowchart-based development environment for control solutions
- OptoDisplay™, a graphical, multimedia operator interface package
- OptoServer™, a robust data server that connects the controller network with the PC-based FactoryFloor network.
- Plus OptoConnect™, a drag-and-drop database utility for building SQL Server and Access databases.

OptoControl is the programming environment for Opto 22's FactoryFloor software. OptoControl utilizes the distributed control capability of the B3000 brain.

Opto 22's OptoDriver Toolkit™ can be used for direct communications from a host PC to the B3000. The toolkit includes 32-bit and 16-bit Windows drivers and Opto 22's classic DOS drivers. The kit also provides the files, documentation, and real-world examples needed to write Microsoft® Windows and DOS software applications. Programmers can access the Opto 22 I/O hardware using languages such as Microsoft Visual C++™ or Microsoft Visual Basic®.

Please note: FactoryFloor is a legacy product. The newer PAC Project Professional software suite supports B3000 brains with SNAP PAC S-series programmable automation controllers. See our website, www.opto22.com, for more information about PAC Project Professional.

B3000 Mistic System Architecture

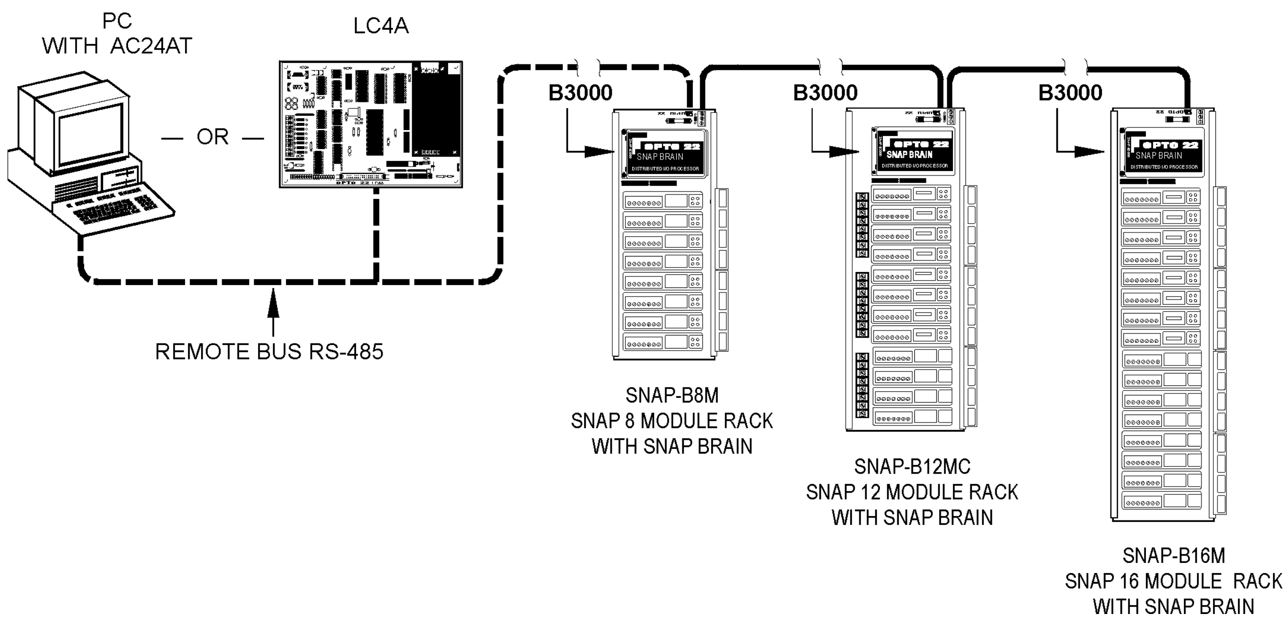


Mistic Functions

Digital	Analog
Input latching (10 µsec)	PID loop control
Timing (1 msec resolution)	High/Low limit monitoring
Counting (32 bit)	Thermocouple linearization
Totalizing	Digital filtering
Output timing (1 msec resolution)	Ramping
Pulse generation (1 msec resolution)	Waveform generation
Time proportional output (100 msec minimum period)	Programable offset and gain
Frequency measurement (up to 20 Khz)	Engineering unit scaling
Event reactions	Square root extraction
Pulse measurment	Event reactions
Period measurement	

Notes:
1. PID loops do not cross address boundaries.
2. PID loops can only be configured on analog addresses. There is a maximum of 8 PID loops per analog address.
3. Event reactions do not cross address boundaries.

B3000 Optomux System Architecture



Optomux Functions

Digital	Analog
Input latching	Input Averaging
Time Delays (10 ms resolution)	High/Low Limit Testing
Pulse Generation (10 ms resolution)	Waveform Generation
Counting (16 bit)	High/Low Limit Recording
Pulse Duration	Programmable Offset & Gain

Specifications

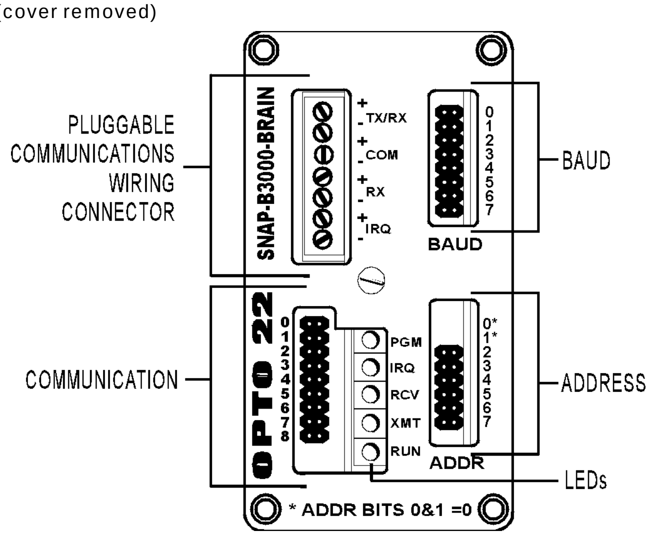
General

Operating Specifications

Power Requirements	5.0 VDC ± 0.1 VDC @ 1.0A max.
Operating Temperature	0° to 70°C, 95% humidity, non-condensing
Communications Interface	RS-485/422, 2- or 4-wire, twisted pair(s), with shield
Data Rates	300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 76800, and 115200 baud
Range: Multidrop	Unlimited. (Up to 3,000 feet or 32 stations maximum between repeaters)
LED Indicators	RUN (Power ON), RCV (Receive), XMT (Transmit), (IRQ) Interrupt, and (PGM) Program
Options: Jumper Selectable	Address Communication baud rate CRC/Checksum Binary/ASCII Mistic/Optomux Emulation

Connectors And Jumpers

Top View: B3000
(cover removed)



Specifications

Serial Communication Cables

The following cables are recommended for RS-485/422 serial communications. Although you may elect to use other cables, keep in mind that low capacitance (less than 15 pF/ft.) is important for high-speed digital communication links. The cables listed below are all 24-gauge, 7x32 stranded, with 100-ohm nominal impedance and a capacitance of 12.5 pF/ft.

Select from the following two-, three-, and four-pair cables, depending on your application needs. All will yield satisfactory results. It is recommended that you choose a cable with one more pair than your application requires. Use one of the extra wires, rather than the shield, for the common.

Two-Pair:

- Belden P/N 8102 (with overall shield)
- Belden P/N 9729 (individually shielded)
- Belden P/N 8162 (individually shielded with overall shield)
- Manhattan P/N M3475 (individually shielded with overall shield)
- Manhattan P/N M39249 (individually shielded with overall shield)

Three-Pair:

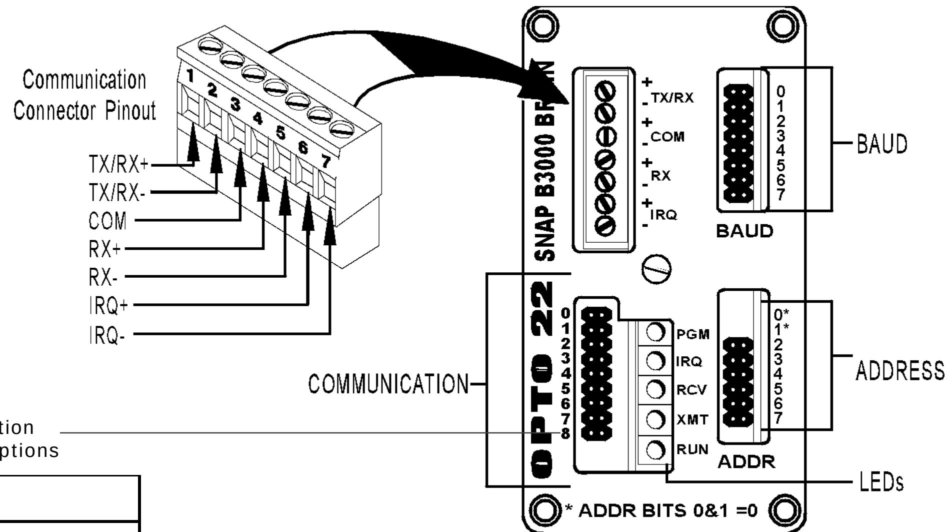
- Belden P/N 8103 (with overall shield)
- Belden P/N 9730 (individually shielded)
- Belden P/N 8163 (individually shielded with overall shield)
- Manhattan P/N M3476 (individually shielded with overall shield)
- Manhattan P/N M39250 (individually shielded with overall shield)

Four-Pair:

- Belden P/N 8104 (with overall shield)
- Belden P/N 9728 (individually shielded)
- Belden P/N 8164 (individually shielded with overall shield)
- Manhattan P/N M3477 (individually shielded with overall shield)
- Manhattan P/N M39251 (individually shielded with overall shield)

Specifications

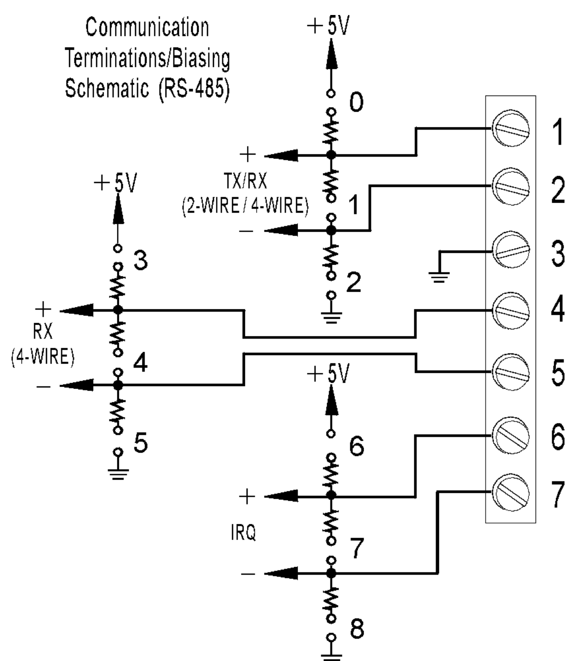
Communication Jumpers/Wiring



Communication
Jumper Descriptions

Jumper	Description
0	Pull-up for TX/RX+
1	Terminator for TX/RX
2	Pull-down for TX/RX-
3	Pull-up for RX+
4	Terminator for RX line
5	Pull-fown for RX line
6	Pull-up for IRQ+
7	Terminator for IRQ
8	Pull-down for IRQ-

Note: When changing jumper settings, the new settings will not take effect until the next time the unit is powered up.



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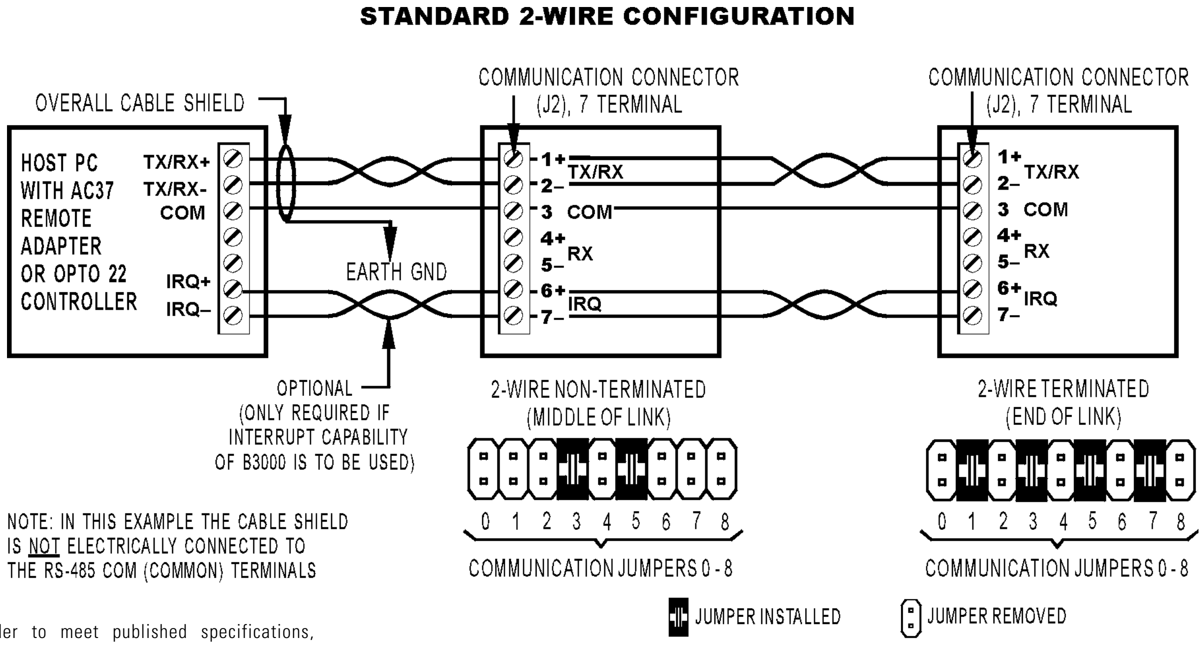
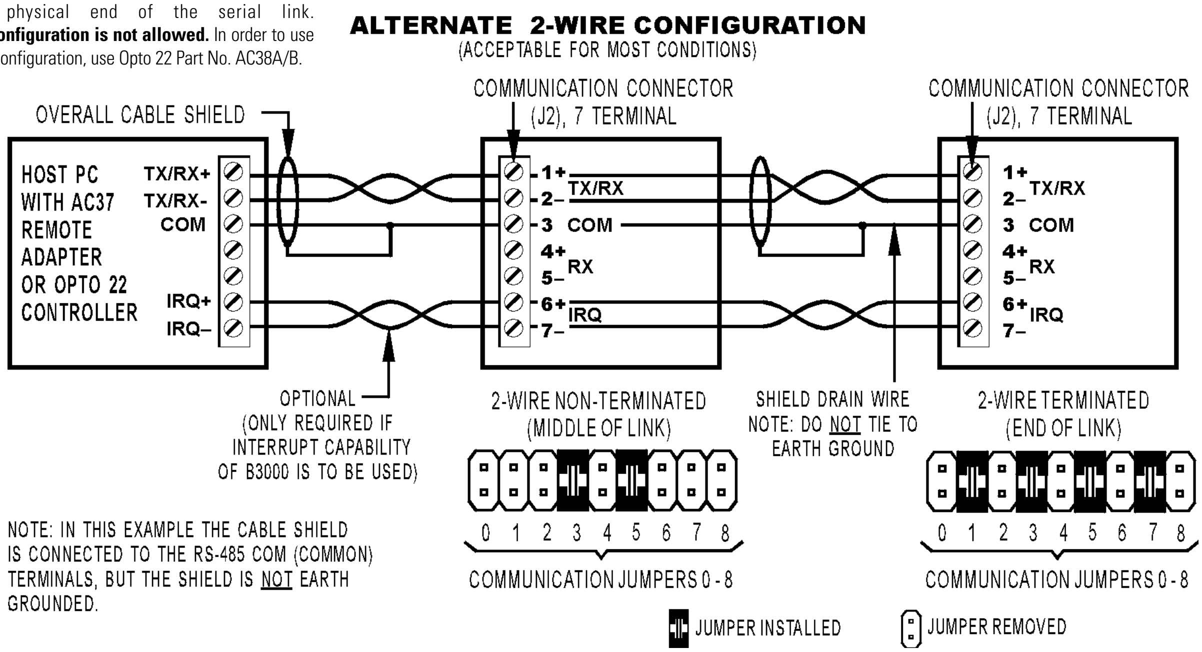
Mistic Communication Jumpers/Wiring

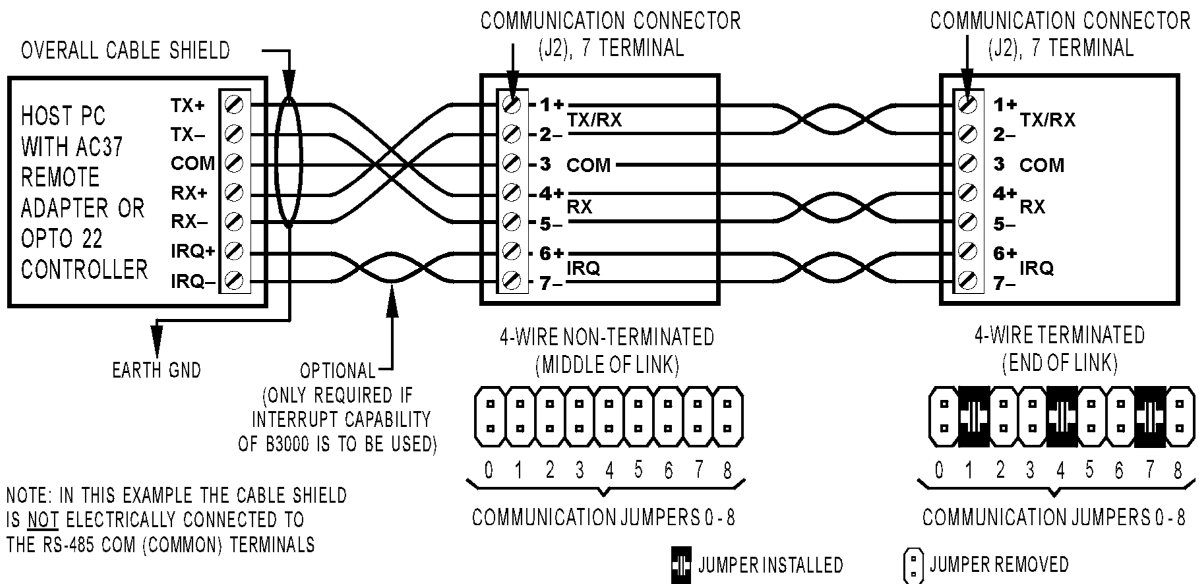


In order to meet published specifications, the RS-485 serial link requires two terminations, one at each physical end of the serial link. **Star configuration is not allowed.** In order to use a star configuration, use Opto 22 Part No. AC38A/B.



Mistic Communication Jumpers/Wiring (Continued)

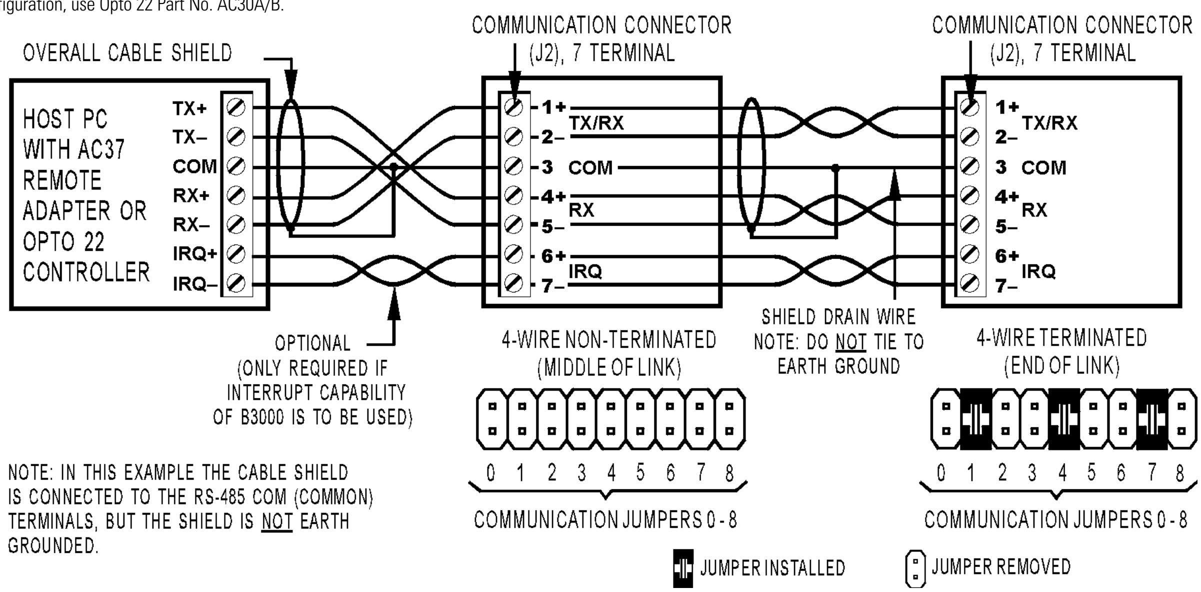
STANDARD 4-WIRE CONFIGURATION



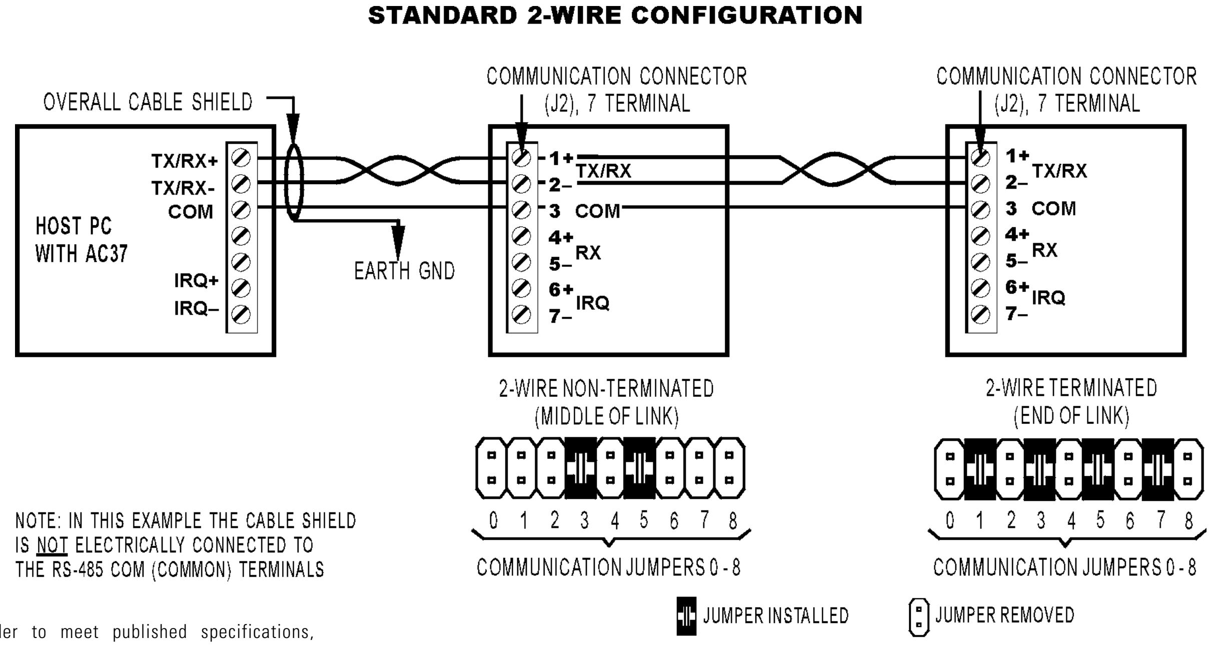
In order to meet published specifications, the RS-485 serial link requires two terminations, one at each physical end of the serial link. **Star configuration is not allowed.** In order to use a star configuration, use Opto 22 Part No. AC30A/B.

ALTERNATE 4-WIRE CONFIGURATION

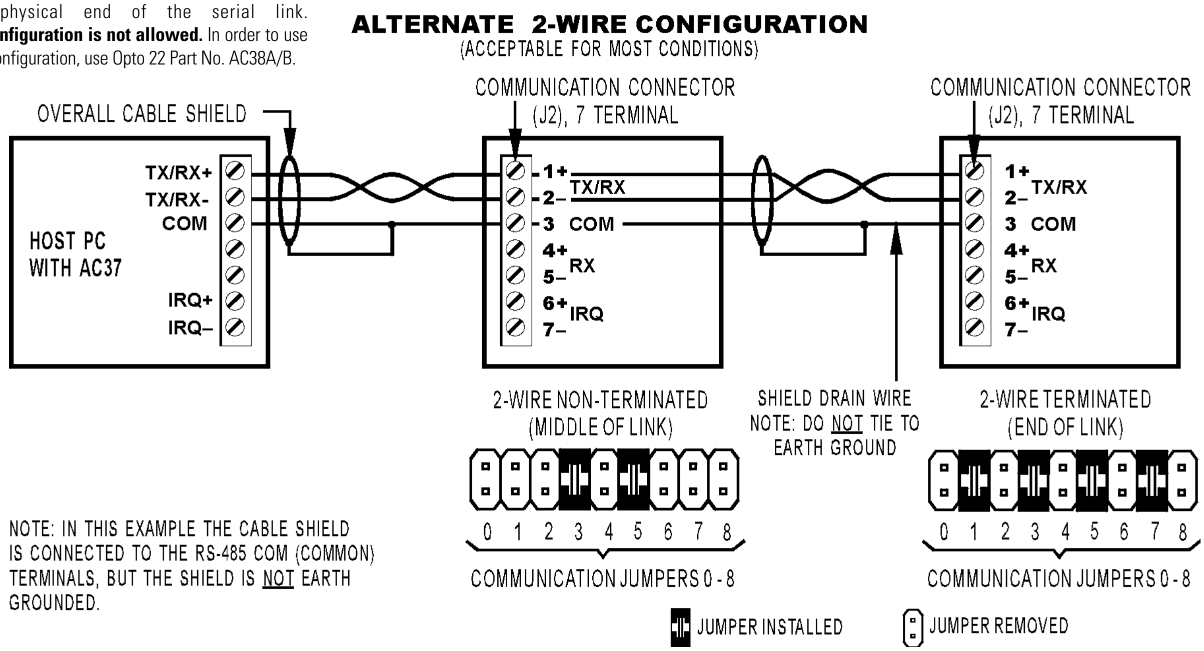
(ACCEPTABLE FOR MOST CONDITIONS)



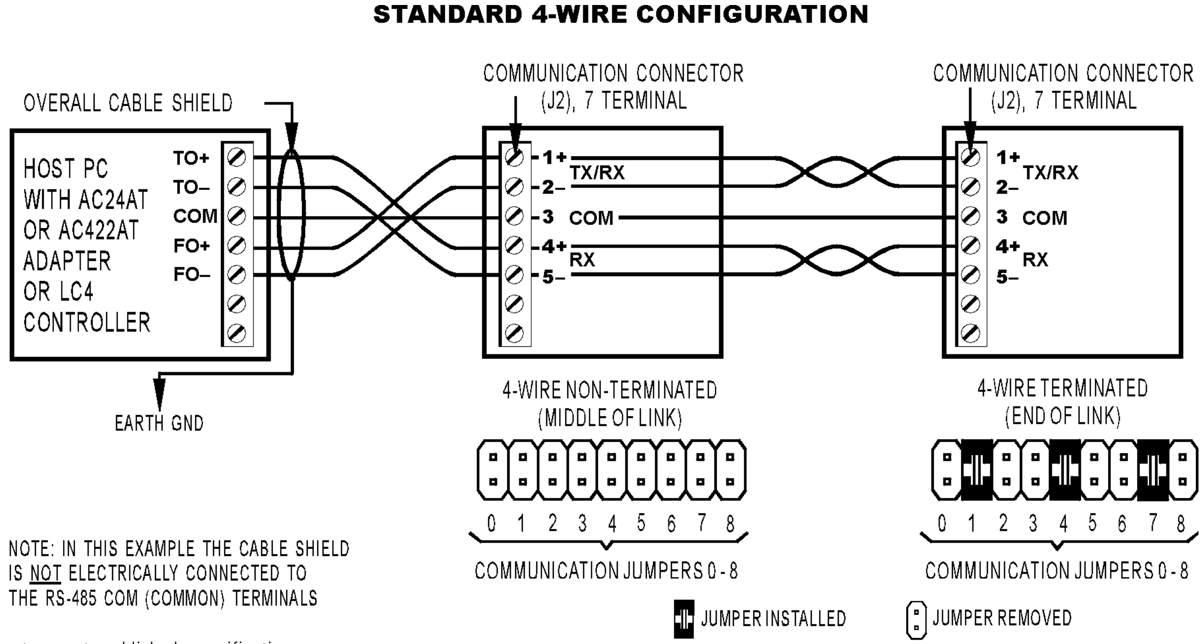
Optomux Communication Jumpers/Wiring



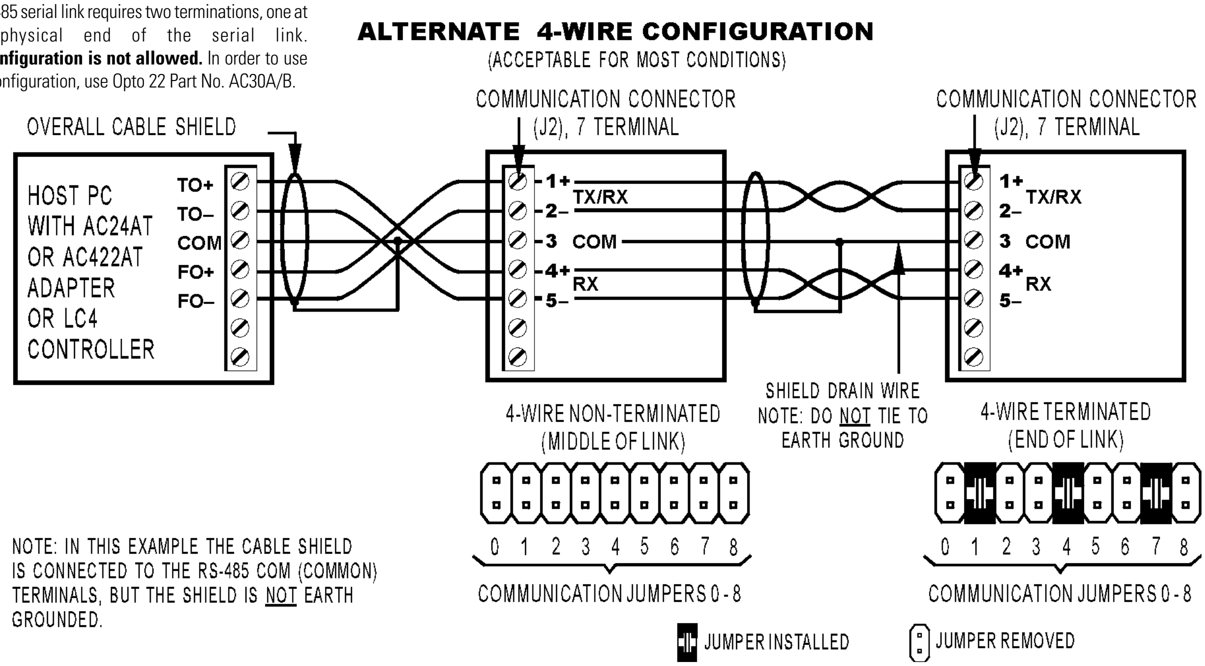
In order to meet published specifications, the RS-485 serial link requires two terminations, one at each physical end of the serial link. **Star configuration is not allowed.** In order to use a star configuration, use Opto 22 Part No. AC38A/B.



Optomux Communication Jumpers/Wiring (Continued)



In order to meet published specifications, the RS-485 serial link requires two terminations, one at each physical end of the serial link. **Star configuration is not allowed.** In order to use a star configuration, use Opto 22 Part No. AC30A/B.



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Baud/Address Jumpers, LED Descriptions

Note: When changing jumper settings, the new settings will not take effect until the next time the unit is powered up.

B3000 BRAIN

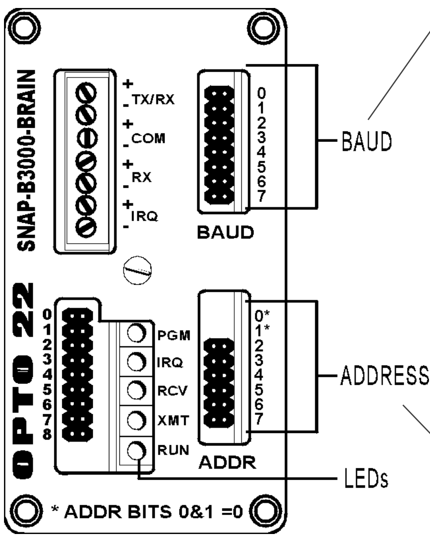


Table 1: Baud Rate Jumpers (0 - 3)

BAUD RATE	Jumper Position 3	2	1	0
115.2 KBaud (factory default setting)	■	■	■	□
76.8 KBaud	■	■	□	■
57.6 KBaud	■	■	□	□
38.4 KBaud	■	□	■	■
19.2 KBaud	■	□	■	□
9600 Baud	■	□	□	■
4800 Baud	■	□	□	□
2400 Baud	□	■	■	■
1200 Baud	□	■	■	□
600 Baud	□	■	□	■
300 Baud	□	■	□	□

Baud 4
- Binary ■ (Default)
- ASCII □ (Required Setting for Optomux)

Baud 5 Data verification
- CRC16 ■ (Default)
- Checksum Modulo 256 □ (Required Setting for Optomux)

Baud 6 Protocol
- Mistic □ (Default)
- Optomux ■ (Required Setting for Optomux)

Baud 7
- Unused □

■ =JUMPER INSTALLED

Table 2: Address Table

Addr	7 6 5 4 3 2	Addr	7 6 5 4 3 2	Addr	7 6 5 4 3 2	Addr	7 6 5 4 3 2
0	□□□□□□	64	□■□□□□	128	■□□□□□	192	■■□□□□
4	□□□□□■	68	□■□□□■	132	■□□□□■	196	■■□□□■
8	□□□□■□	72	□■□□■□	136	■□□□■□	200	■■□□■□
12	□□□□■■	76	□■□□■■	140	■□□□■■	204	■■□□■■
16	□□□■□□	80	□■□■□□	144	■□□■□□	208	■■□■□□
20	□□□■□■	84	□■□■□■	148	■□□■□■	212	■■□■□■
24	□□□■■□	88	□■□■■□	152	■□□■■□	216	■■□■■□
28	□□□■■■	92	□■□■■■	156	■□□■■■	220	■■□■■■
32	□□■□□□	96	□■■□□□	160	■□■□□□	224	■■■□□□
36	□□■□□■	100	□■■□□■	164	■□■□□■	228	■■■□□■
40	□□■□■□	104	□■■□■□	168	■□■□■□	232	■■■□■□
44	□□■□■■	108	□■■□■■	172	■□■□■■	236	■■■□■■
48	□□■■□□	112	□■■■□□	176	■□■■□□	240	■■■■□□
52	□□■■□■	116	□■■■□■	180	■□■■□■	244	■■■■□■
56	□□■■■□	120	□■■■■□	184	■□■■■□	248	■■■■■□
60	□□■■■■	124	□■■■■■	188	■□■■■■	252	■■■■■■

■ = JUMPER INSTALLED □ = NO JUMPER

Table 3: LED Description Table

LED	Description
PGM	LED will be on during Flash memory upgrade. Noramally LED is off.
IRQ	Processor interrupt request currently active.
RCV	Processor is currently receiving data on communication line.
XMT	Processor is currently transmitting data on communication line.
RUN	Power on Processor (at least 4.75 VDC)

Address Configuration Notes:

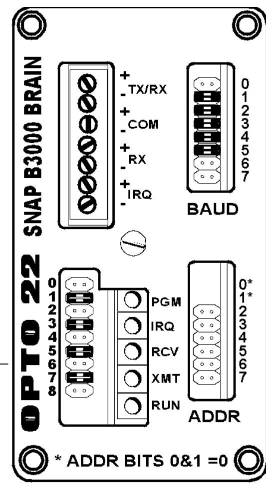
1. Jumper positions 0 and 1 have no provision to install jumpers. These jumper positions are always set open by default.
2. See Figure 1-1 on page 14 for B3000 SNAP I/O mapping.

Jumper Examples - Mistic & Optomux

Note: When changing jumper settings, the new settings will not take effect until the next time the unit is powered up.

Jumper Settings When Used As Mistic Brain

Mistic
2-wire
115.2 Kbaud
CRC-16
Binary
Address 0



0-3 = 115.2 Kbaud
4 = Binary
5 = CRC 16
6 = Mistic protocol

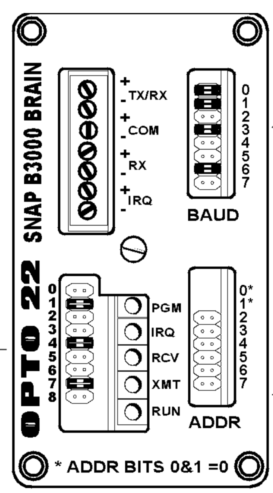
Address 0

2-wire mode
This is the last unit on the communication link.

JUMPER INSTALLED JUMPER REMOVED

Jumper Settings When Used As Optomux Brain

Optomux
4-wire
38.4 kbaud
checksum 256
Ascii
address 0



0-3 = 38.4 Kbaud
4 = ASCII
5 = Checksum 256
6 = Optomux protocol
* Optomux protocol requires ASCII and checksum 256.

Address 0

4-wire mode
This is the last unit on the communication link.

JUMPER INSTALLED JUMPER REMOVED

B3000 I/O Mapping

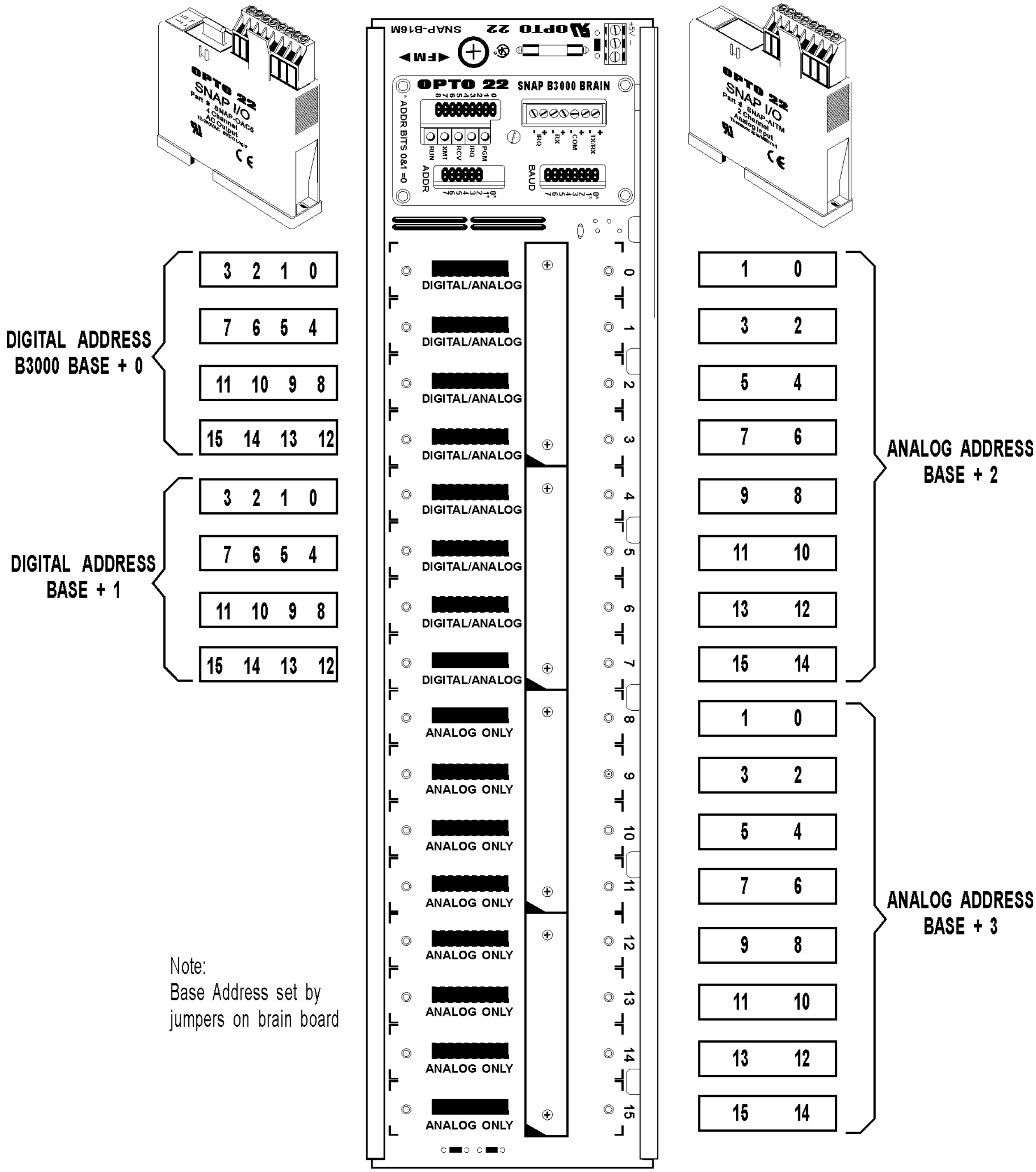


Figure 1-1: SNAP I/O Rack

B3000 I/O Mapping (Continued)

The B3000 is connected to a SNAP B Series I/O rack, which can hold either 8, 12, or 16 SNAP modules. Digital modules (either input or output) contain four channels of I/O. Analog input modules contain two channels and analog output modules currently contain two channels. Both analog and digital modules can be on the same rack. Some SNAP modules cannot be used with the B3000; consult the module's data sheet for compatibility information.

A B3000 is capable of addressing a maximum of 32 channels of digital I/O and 32 channels of analog I/O. However, the I/O mounting racks will not accommodate 32 channels of both digital and analog. The actual number of channels available depend on the combination of modules chosen. For example, the SNAP-B16M rack can mount 16 modules. Up to eight of these modules can be digital, providing 32 channels of digital I/O. The remaining eight module positions can be analog, providing up to 16 channels of analog I/O. If all 16 modules are analog, up to 32 channels of analog I/O are available.

I/O on the B3000 is divided into four addresses of I/O (two digital I/O and two analog I/O). The digital addresses are base+0 and base+1. The analog addresses are base+2 and base+3. Therefore, if a SNAP brain is configured at address 12, the digital addresses would be 12 and 13 and the analog would be 14 and 15.

First Four Module Positions (0-3):

Each position can hold either a digital or an analog module. They can be all analog, all digital, or any mix of both. These four positions constitute the 16 digital channels of digital address base + 0, and the first eight analog channels of analog address base + 2.

Second Four Module Positions (4-7):

Each position can hold either a digital or an analog module. They can be all analog, all digital or any mix of both. These four positions constitute the 16 digital channels of digital address base + 1, or the second eight analog channels of analog address base + 2.

Third Four Module Positions (8-11):

These positions can hold analog modules only. These four positions constitute the first eight analog channels of analog address base + 3.

Fourth Four Module Positions (12-15):

These positions can hold analog modules only. These four positions constitute the second eight analog channels of analog address base + 3.

The layout is illustrated in Figure 1-1 on the previous page.

OptoControl B3000 SNAP I/O Configuration

If you configure a digital module on the digital address base + 0 at the first module location, that will preclude you from configuring an analog module on analog address base + 2 at the first module location, as analog channels 0 and 1 of analog address base + 2 overlap with digital channels 0,1,2, and 3 of digital address base + 0. This fact will be indicated in OptoControl by text in the Configure I/O Points dialog, which will display information in the Name field for analog channels 0 and 1 stating that those channels are used by a SNAP digital module, and will specify the name of that I/O unit address.

Digital

When configuring the unit, select B3000 Snap Digital as the Type in the Add I/O Unit dialog.

The digital addresses are base+0 and base+1. If the SNAP brain is configured at address 12 (base), the digital addresses would be 12 and 13 .

When a point is configured, OptoControl automatically creates and configures the other three points in the module. For example, if a digital SNAP point is added at channel 5, then identical points are created at channels 4, 6, and 7. Unique names are created for these new points, based on the name entered for the original point. You can then modify the name, as well as the description, features, default, and watchdog for each channel independently. If the module type of one digital point is changed, then the module type of all other points in that module are automatically changed.

Analog

When configuring the unit, select B3000 SNAP Analog as the Type in the Add I/O Unit dialog.

The analog addresses are base+2 and base+3. If the SNAP brain is configured at address 12 (base), the analog addresses would be 14 and 15.

Inputs**:**

When an input is configured, OptoControl automatically creates and configures the other input channel on that module. The name of the other channel can then be modified, as well as the description, default, and watchdog fields. The module type and scaling cannot be modified.

Outputs:

Single-channel analog output modules use two analog channels, but they contain only one channel of output. Only the even-numbered channel is usable, e.g., 0, 2, 4, etc. The odd-numbered channel is not valid. Opto 22 also produces 2-channel analog output modules.

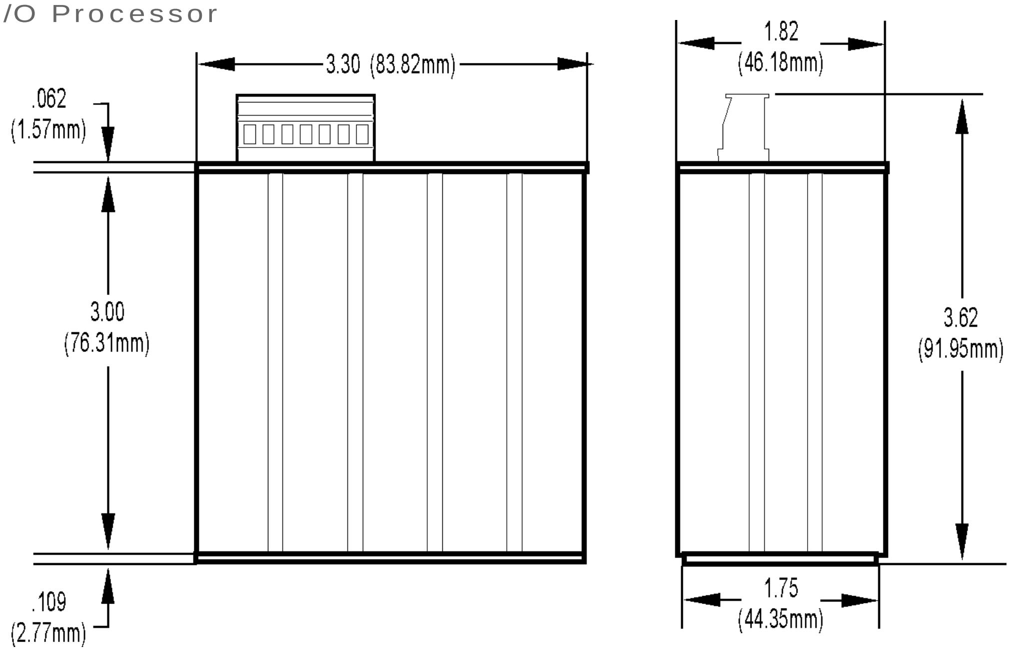
Other Notes

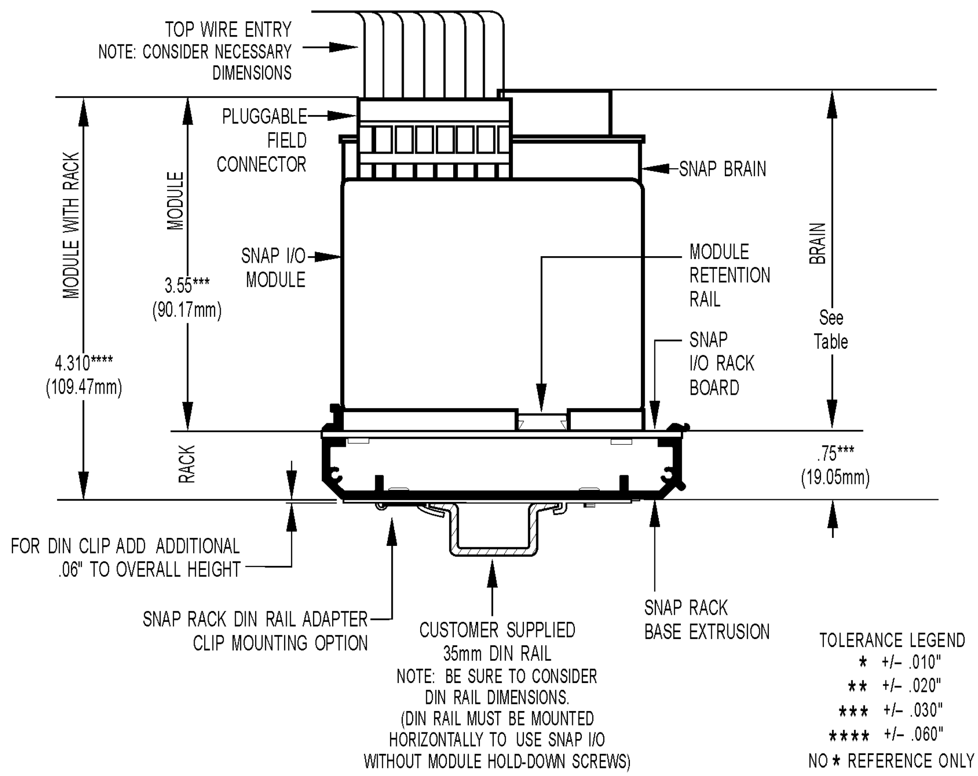
Event/reactions and PID Loops can only operate on points in the same address group. They behave just like standard I/O in this sense, and cannot cross address boundaries. For example, a PID loop cannot use an input on Address Base + 2, to control an output on Base + 3.

Up to 127 event/reactions can be configured per SNAP address.

Dimensional Drawings

B3000 I/O Processor



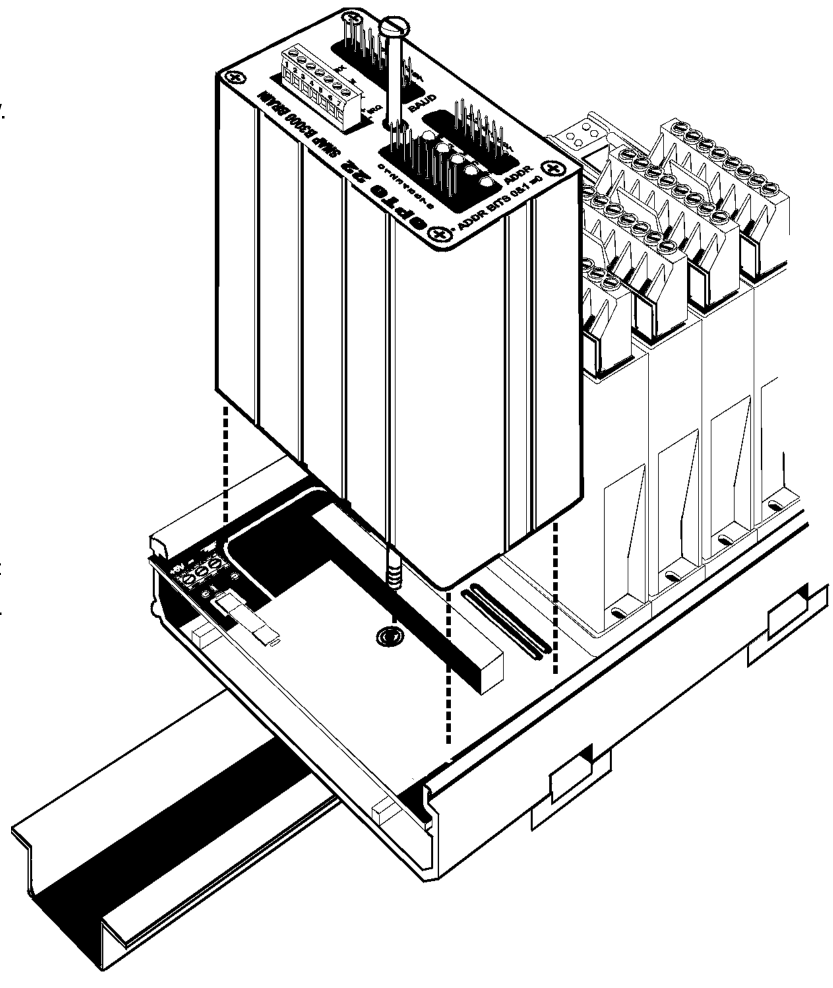


Assembly

Brain

To install brain onto B Series rack:

1. Turn off power from rack assembly.
2. Align brain connector with mating connector on rack.
3. Seat brain onto connector.
4. Use integral hold-down screw to secure in position.
   DO NOT OVERTIGHTEN!



To remove brain from B Series rack:

1. Turn off power from rack assembly.
2. Loosen integral hold-down screw on brain.
3. Pull up on brain.