Classic Brain Boards

Features

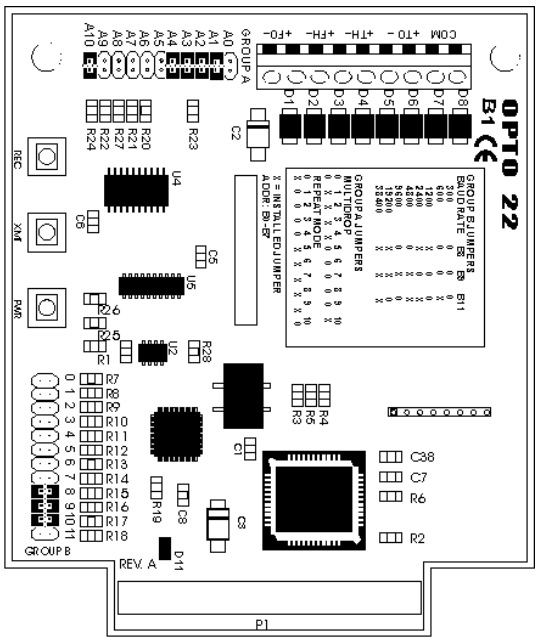
- Intelligent digital processors.
- Serial data link operates at selectable baud rates from 300 baud to 38.4 Kbaud
- Optomux units can be configured for either multidrop or repeat mode operation.

Description

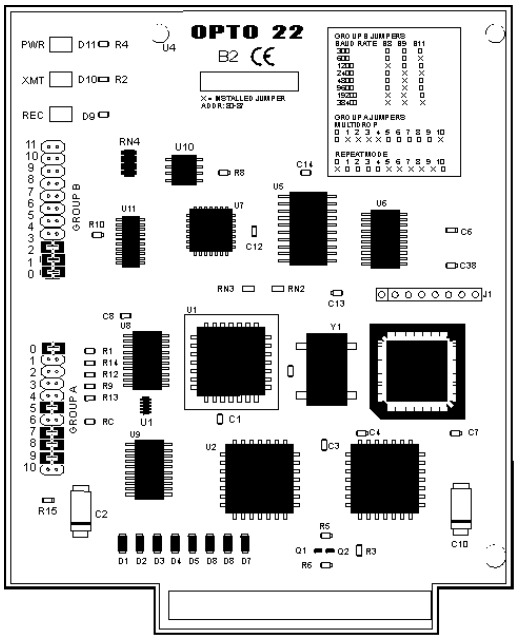
Opto 22 B1 (digital) and B2 (analog) Optomux® brain boards are intelligent digital processors that operate as slave devices to a host computer. Each brain board contains a microprocessor that provides the necessary intelligence to communicate with a host computer and also perform control functions at each channel of IO.

The B1 and B2 brain boards are designed to mount on most Opto 22 IO mounting racks that have header connectors. IO mounting racks that accept single-channel standard and G4 IO modules, Quad Pak™ IO modules, or SNAP IO™ modules—and racks that have built-in integrated IO circuitry—are all available.

B1 Digital Brain Board



B2 Analog Brain Board



Networking

B1s and B2s communicate with a host computer via an RS-422/485 serial link using twisted-pair cable that connects to each Optomux unit (brain board plus rack). The serial data link operates at selectable baud rates from 300 baud to 38.4 Kbaud.

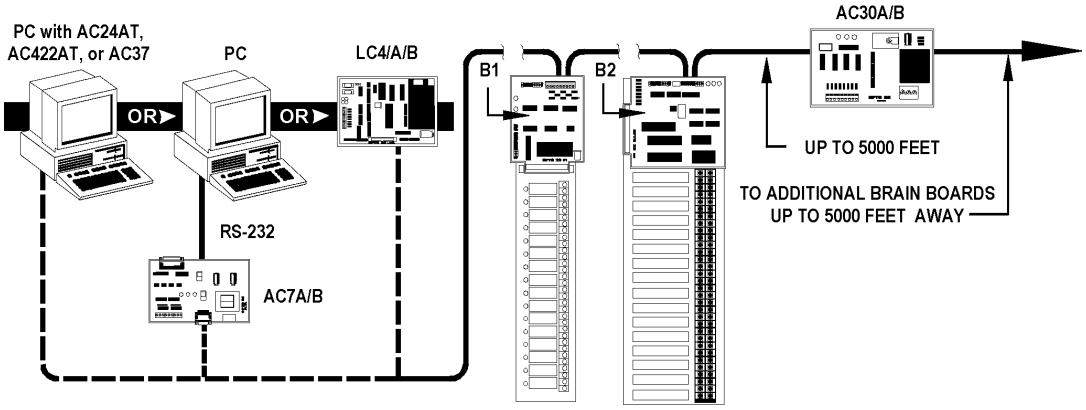
Optomux units can be configured for either multidrop or repeat mode operation. In multidrop mode, up to 32 Optomux units can be networked over a total line length of up to 5,000 feet. Additional units can be added by using a repeater. In repeat mode operation, up to 256 Optomux units can be networked with up to 5,000 feet between units.

To use Optomux I/O on an Ethernet network, use Opto 22's E1 or E2 brain boards. These boards can use both serial and Ethernet networks simultaneously, and are drop-in replacements for B1s and B2s. See the E1 and E2 data sheet (Opto 22 form 1546) for information.

Part Numbers

Part	Description
B1	16-Channel Digital Optomux Protocol Brain Board
B2	16-Channel Analog Optomux Protocol Brain Board

System Architecture



Functions

B1 (Digital) Functions	B2 (Analog) Functions
• Read Point • Write Point • Latch Point • Count • Pulse Duration • Time Delay • Pulse Generation	• Read Point • Write Point • Input Averaging • Min/Max (peak and valley) Recording • Gain and Offset Calculation • Waveform Generation

For complete information on supported Optomux commands, see Opto 22 form #1572.

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Specifications

B1 Power Requirements	5 VDC ± 0.1 V @ 0.5 amps (includes digital module requirements)
B2 Power Requirements	5 VDC ± 0.1 V @ 0.5 amps (excludes analog module requirements*)
Operating Temperature	0° C to 70° C 95% humidity, non-condensing
Interface	RS-422/485 communications 50-pin female header connector to I/O mounting rack
Data Rates	300, 600, 1200, 2400, 4800, 9600, 19200, and 38400 baud
Range: Multidrop Repeat Mode	 Up to 5,000 feet total length with up to 32 Optomux stations maximum. ** Up to 5,000 feet between stations with up to 256 Optomux stations maximum.
Communications	Full duplex, two twisted pairs, a signal common wire, and a shield
LEDs	Power, receive, and transmit
Jumper-selectable Options	Address (0 to 255) Baud rate Multidrop or repeat mode 2- or 4-pass protocol

** ±15 VDC ± 0.25 V required for the analog modules. Current depends on the number and type of modules installed. A 24 VDC power supply is required for analog modules that need a current loop source.
* Extend line length and/or number of OPTOMUX stations with the AC30A/B network adapter.

Compatible I/O

	B1 (Digital)	B2 (Analog)
SNAP	SNAP-D4M, SNAP-D4MC, SNAP-D4MC-P	none
G4	G4PB8H, G4PB16H, G4PB16HC	none
Quad	PB16HQ	none
Standard	PB4H, PB8H, PB16H, PB16HC	PB4AH, PB8AH, PB16AH
Integral I/O Racks	PB16J/K/L, PB16J/K/L	none

Installation and Wiring

Power Requirements

The B1 and B2 brain boards require +5 volts DC (± 0.1 VDC) at 0.5 amps.

Although it is possible to distribute DC from a common power supply to several locations, better noise immunity is obtained by having separate power supplies at each physical location where a rack/brain board unit is installed. The +5 VDC power supply is connected to the I/O mounting rack beneath the removable brain board portion of the digital Optomux unit.

Analog racks also require +15 VDC and -15 VDC (± 0.25 VDC) to power the analog I/O modules. The amount of power required depends on the type and number of analog I/O modules that are plugged into the Optomux unit. See the data sheets for your modules; power requirements for each module are included in the module specifications.

Analog racks also provide terminals for a separate +24 volt supply that can be used for powering a 4–20 mA current loop using 4–20 mA analog I/O modules. For this type of application, the +24 volt supply is required in addition to the supplies mentioned above. Refer to the module's data sheet for information on wiring 4–20 mA modules with a loop supply.

The current requirements given for the output modules are only for the modules. To determine what size power supply is needed, add the load requirements for each module to determine total power supply requirements.

NOTE: Use only isolated supplies with Optomux products. Isolated supplies reduce the risk of ground loops in the communication wiring. Do not connect the power supply's DC common to earth ground. Linear power supplies are recommended.

Connecting the Power Supply

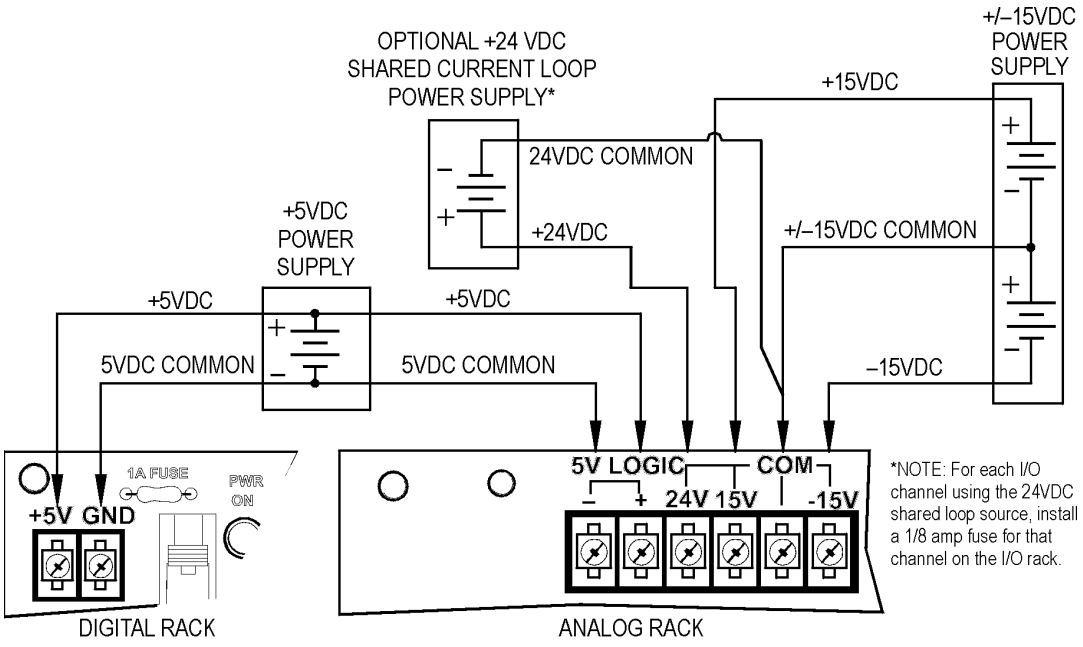
The diagram below shows how to connect the power supply.

Connect 5-volt power to the barrier strip connectors marked "+ 5V" and "GND" on the mounting rack. If the + 5-volt supply is used by more than one unit or by other devices, make sure the voltage at each rack is 5 VDC (± 0.1 V).

The +5-volt and ±15-volt wires should be routed away from any high-voltage field wires. There should only be one "earth" ground connection per network, typically at the host site. If the ground connection is at the host site, make sure none of the power supplies is grounded. This method prevents ground loop problems due to offset voltages appearing between multiple ground points.

If an Opto 22 PBSA/B/C power supply is used with the digital racks, the + 5 VDC logic connection is made by the supply when it is screwed to the rack. In this case, the only connection required

Power Supply Wiring



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is the 120 VAC (220 VAC or 10–28 VDC depending on supply type) connection to the PBSA (or PBSB or PBSC) supply.

Separate or combined + 5 VDC (± 0.1 VDC) and ± 15 VDC (± 0.25 VDC) supplies can be used to provide power to analog racks. When using a multiple-output supply, make sure that the 5 VDC RETURN line is separate from the 15-volt COMMON line. Otherwise, the analog modules will not be isolated.

CAUTION: Check polarities of all power supply connections before applying power. Incorrect polarity will damage the brain board and I/O modules.

Use a consistent color code from the power supply to all brain boards to prevent wiring errors. Size 18 AWG or larger is recommended for power supply wiring.

The high cost of electrical wiring and the susceptibility of analog signals to noise make it desirable to place the brain board as close as possible to the controlled device.

The default communication mode for the B1 and B2 brain boards is multidrop. When wiring a multidrop communications cable, keep in mind that the cable is a high-speed data-transmission line. To reduce reflections, make sure the line is terminated properly at both ends and that all stubs are less than three inches long.

Repeat mode is a jumper-selectable option. In this configuration, each brain board acts as a repeater, allowing up to 5,000 feet between units. Since a power failure at any unit breaks the communications link, battery backup is recommended. Note that you cannot mix units operating in repeat mode and units operating in multidrop mode on the same network.

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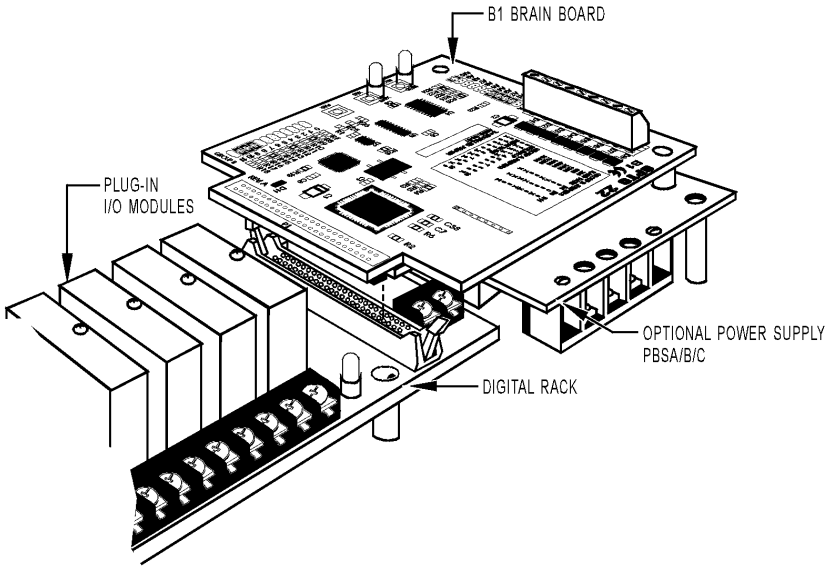
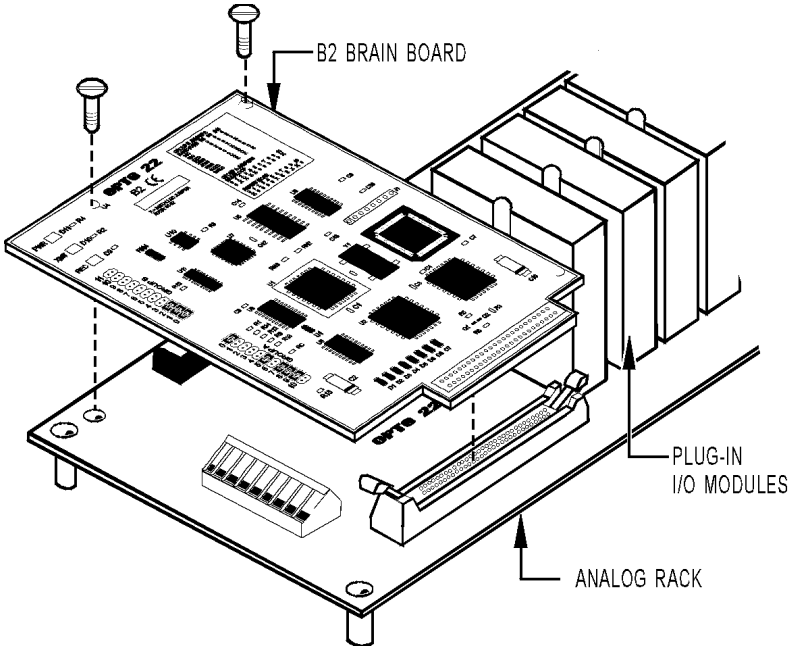
Installing the Brain Board on the Mounting Rack

The B1 or B2 brain board plugs into the mounting rack using the 50-pin connector. The figures below show how to install the brain board on the mounting rack. When properly installed, the B1 (digital) brain board extends away from the rack, while the B2 (analog) brain board covers up the communications and power wiring on the rack.

The unit can be mounted in any attitude on any flat surface. Both the mounting rack and the brain board are supplied with



B1 Brain Board with Digital Mounting Rack



B2 Brain Board with Analog Mounting Rack

permanently attached standoffs. All the standoffs should be secured for maximum physical strength. Be sure to leave sufficient space between adjacent units for the I/O wiring.

Installing I/O Modules

CAUTION! Be sure that all power to unit and to the controlled devices is removed before installing or removing I/O modules.

Input and output modules can be installed in any rack position. For specifications and wiring information on modules, see the module's data sheet.

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 four-, three-, and two-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.

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)

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)

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)

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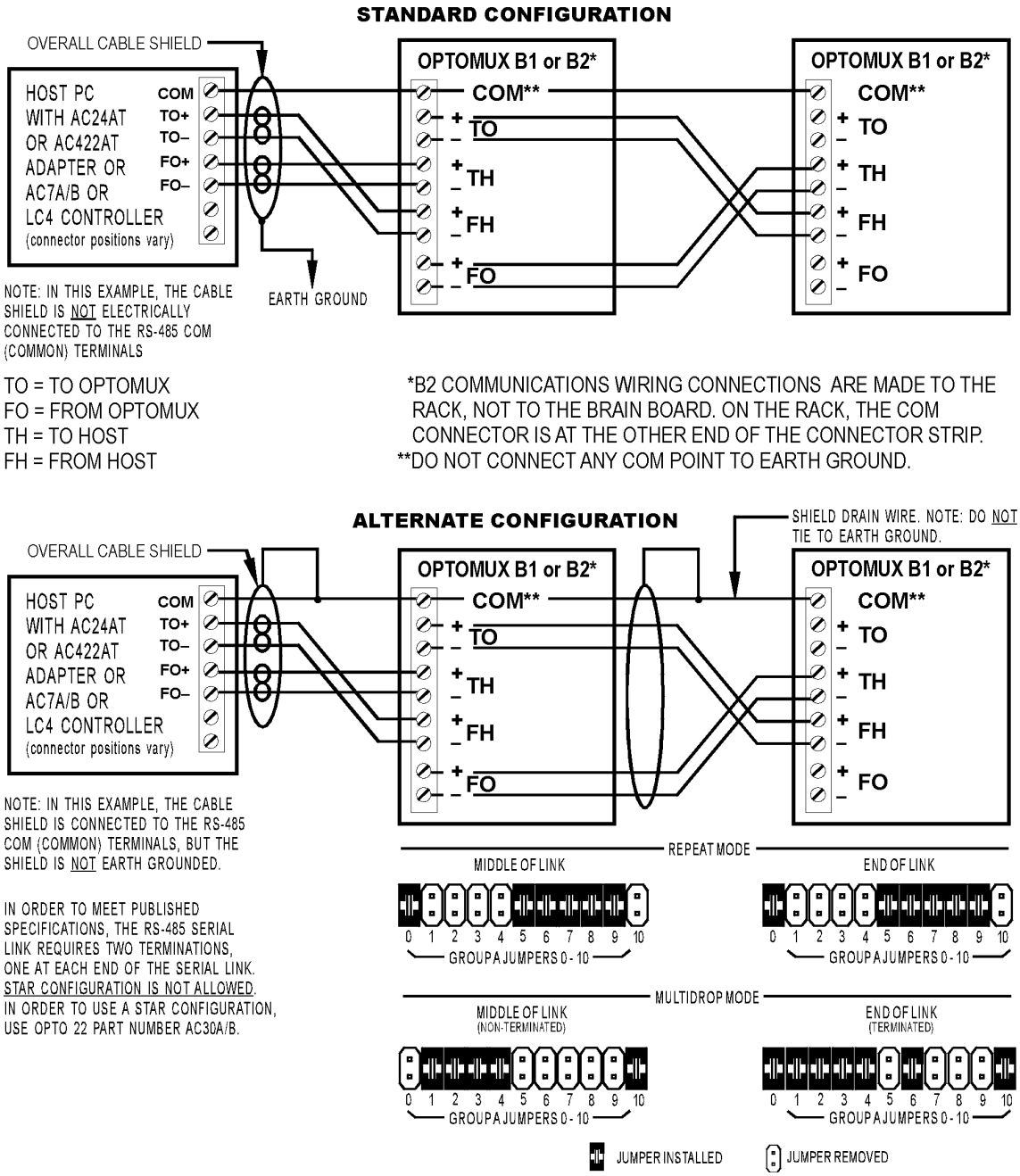
Wiring Diagrams

A complete connection at each brain board consists of 10 wires: two twisted pairs and a common coming from the computer or previous brain board, and two twisted pairs and a common going to the next brain board.

The following illustration shows standard and alternate wiring diagrams. It also shows jumper settings for repeat and multidrop modes and for proper termination and biasing. When wiring a series of Optomux units, always think of the previous Optomux unit as the host.

To ensure reliable communications, we recommend the following:

- Use shielded twisted-pair wires for the communications wiring. (See recommended cables on this page.)
- Route the communication and DC power wiring separately from any high-voltage field wiring or AC power wiring.



Specifications: Jumpers

The two groups of jumpers on the B1 and B2 brain boards are labeled Group A and Group B.

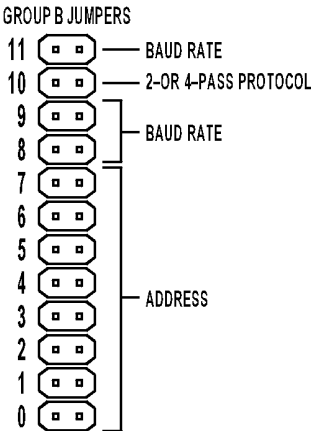
Jumpers in Group A (shown on the previous page) route wiring for repeat or multidrop mode communications and also provide proper termination and biasing. All brain boards on the same network must operate in the same mode. Jumper settings for Group A are shown with the wiring diagrams on page 7.

Jumpers in Group B set the address and baud rate and also determine the message protocol. See the following page for address jumper settings.

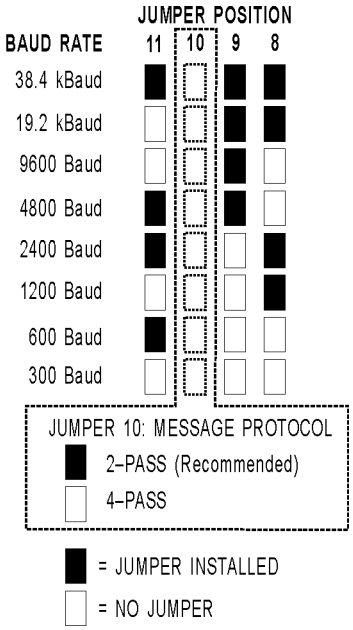
Select the baud rate using jumpers 8, 9, and 11 in Group B, according to the diagram below. All units on the same network should be set for the same baud rate.

The message protocol can be set as 2-pass or 4-pass. Use 2-pass for normal operation. The 4-pass protocol may be useful during troubleshooting, because it allows the host to examine and display the command message the brain board received before the command is executed. See the diagram below for jumper settings on message protocol.

Group B Jumpers



Baud Rate and Message Protocol Jumpers



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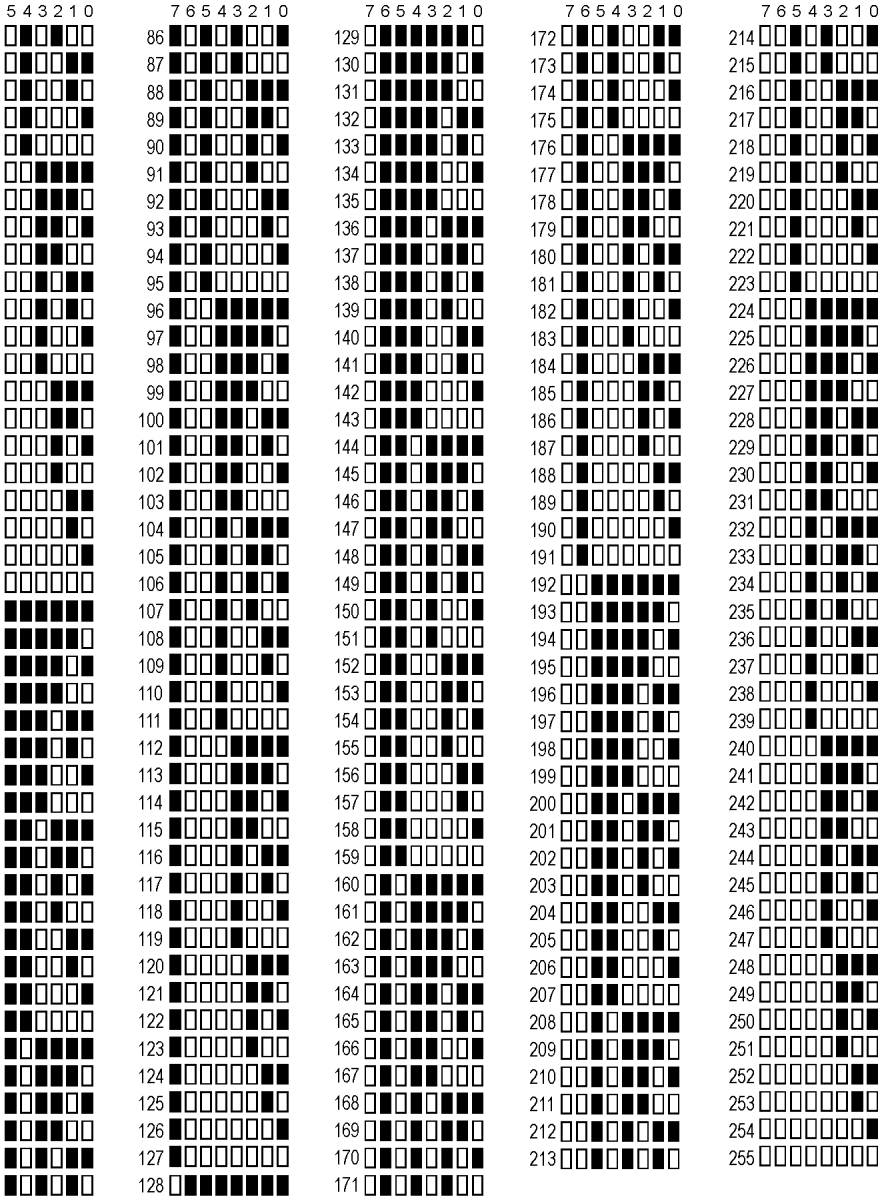
Classic Brain Boards

Address Jumpers

Set the Address jumpers (Group B, jumpers 0–7) according to the following chart. Each brain board on the same network must have a unique address. Addresses do not need to be sequential.



■ = JUMPER INSTALLED □ = NO JUMPER

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Products

Opto 22 develops and manufactures reliable, flexible, easy-to-use hardware and software products for industrial automation, energy management, remote monitoring, and data acquisition applications.

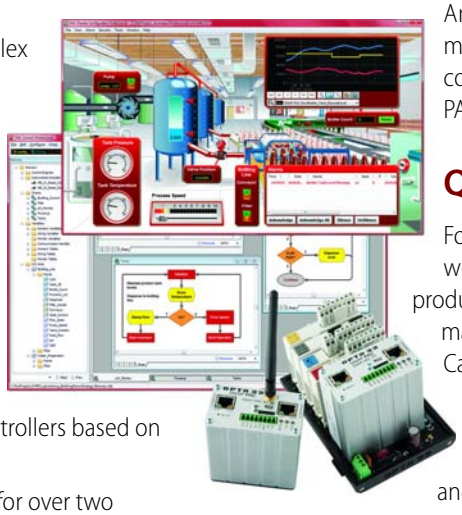
OptoEMU Energy Management System

The easy-to-use OptoEMU Sensor monitors electrical energy use in your facility and delivers detailed, real-time data you can see, analyze, and use in building and control systems. The Sensor can monitor energy data from pulsing meters, electrical panels or subpanels, and equipment. View energy data online using a software service or incorporate the data into your control system for complete energy management.

SNAP PAC System

Designed to simplify the typically complex process of selecting and applying an automation system, the SNAP PAC System consists of four integrated components:

- SNAP PAC controllers
- PAC Project™ Software Suite
- SNAP PAC brains
- SNAP I/O™



SNAP PAC Controllers

Programmable automation controllers (PACs) are multifunctional, modular controllers based on open standards.

Opto 22 has been manufacturing PACs for over two decades. The standalone SNAP PAC S-series, the rack-mounted SNAP PAC R-series, and the software-based SoftPAC™ all handle a wide range of digital, analog, and serial functions for data collection, remote monitoring, process control, and discrete and hybrid manufacturing.

SNAP PACs are based on open Ethernet and Internet Protocol (IP) standards, so you can build or extend a system easily, without the expense and limitations of proprietary networks and protocols. Wired+Wireless™ models are also available.

PAC Project Software Suite

Opto 22's PAC Project Software Suite provides full-featured, cost-effective control programming, HMI (human machine interface) development and runtime, OPC server, and database connectivity software for your SNAP PAC System.

Control programming includes both easy-to-learn flowcharts and optional scripting. Commands are in plain English; variables and I/O point names are fully descriptive.

PAC Project Basic offers control and HMI tools and is free for download on our website, www.opto22.com. PAC Project Professional, available for separate purchase, adds one SoftPAC, OptoOPCServer, OptoDataLink, options for controller redundancy or segmented networking, and support for legacy Opto 22 serial *mistic*™ I/O units.

SNAP PAC Brains

While SNAP PAC controllers provide central control and data distribution, SNAP PAC brains provide distributed intelligence for I/O processing and communications. Brains offer analog, digital, and serial functions, including thermocouple linearization; PID loop control; and optional high-speed digital counting (up to 20 kHz), quadrature counting, TPO, and pulse generation and measurement.

SNAP I/O

I/O provides the local connection to sensors and equipment. Opto 22 SNAP I/O offers 1 to 32 points of reliable I/O per module, depending on the type of module and your needs. Analog, digital, and serial modules are all mixed on the same mounting rack and controlled by the same processor (SNAP PAC brain or rack-mounted controller).

Quality

Founded in 1974, Opto 22 has established a worldwide reputation for high-quality products. All are made in the U.S.A. at our manufacturing facility in Temecula, California. Because we test each product twice before it leaves our factory, rather than only testing a sample of each batch, we can guarantee most solid-state relays and optically isolated I/O modules for life.

Free Product Support

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

Additional support is always available on our website: how-to videos, OptoKnowledgeBase, self-training guide, troubleshooting and user's guides, and OptoForums.

In addition, hands-on training is available for free at our Temecula, California headquarters, and you can register online.

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