

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

Description

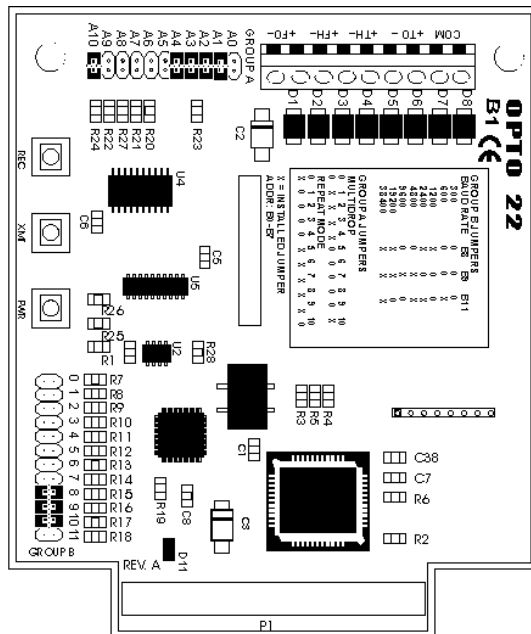
The B1 digital and B2 analog Optomux brain boards are intelligent digital processors that operate as slave devices to a host computer. Each brain board contains a microprocessor that provides the necessary intelligence to communicate with a host computer and also perform control functions at each channel of I/O.

The B1 and B2 brain boards are designed to mount on most Opto 22 I/O mounting racks that have header connectors. I/O mounting racks that accept single-channel standard and G4 I/O modules, Quad Pak I/O modules, or SNAP I/O modules—and

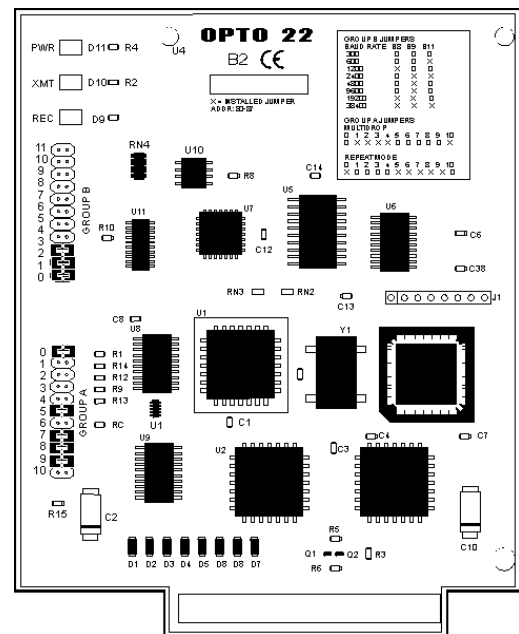
racks that have built-in integrated I/O circuitry—are all available.

Communication with a host computer is 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.

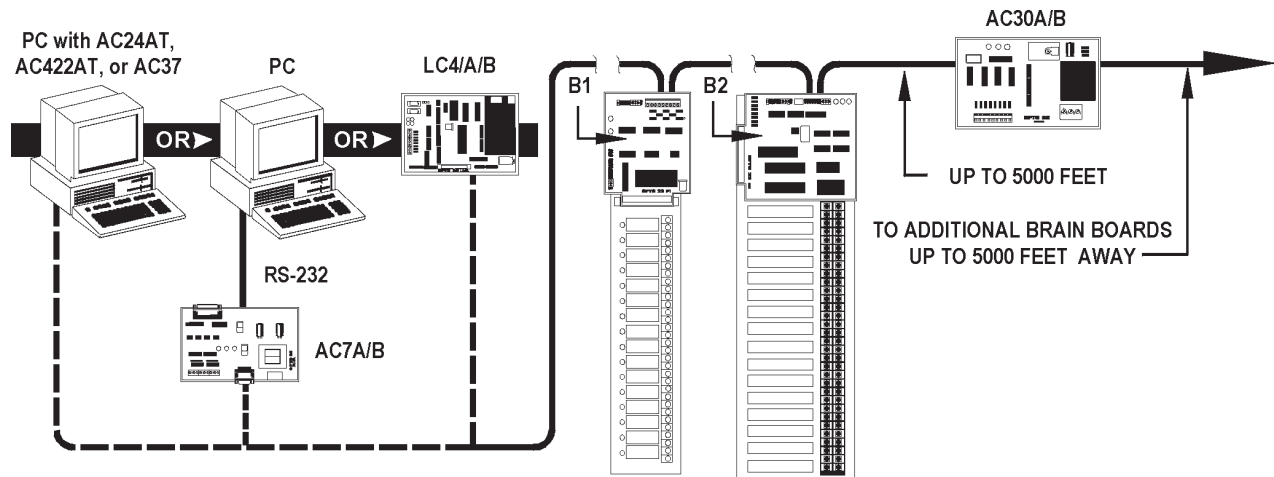
B1 Digital Brain Board



B2 Analog Brain Board



System Architecture



Functions

B1 (Digital) Functions

- Read Point
- Write Point
- Latch Point
- Count
- Pulse Duration
- Time Delay
- Pulse Generation

B2 (Analog) Functions

- Read Point
- Write Point
- Input Averaging
- Min/Max Recording
- Peak and Valley Recording
- Gain and Offset Calculation
- Waveform Generation

For complete information on supported Optomux commands, see Opto 22 form #203.

Form 463-030613

Specifications

B1 Power Requirements	5 VDC \pm 0.1 V @ 0.5 amps (includes digital module requirements)
B2 Power Requirements	5 VDC \pm 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	Up to 5,000 feet total length with up to 32 Optomux stations maximum.**
Repeat Mode	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

* \pm 15 VDC \pm 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 repeater.

Compatible I/O Racks

	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, G4PB16J/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 Opto 22 form #524, *Optomux Family Data Book*, for details. Power requirements for each of the analog modules 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 *Optomux Family Data Book* 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.

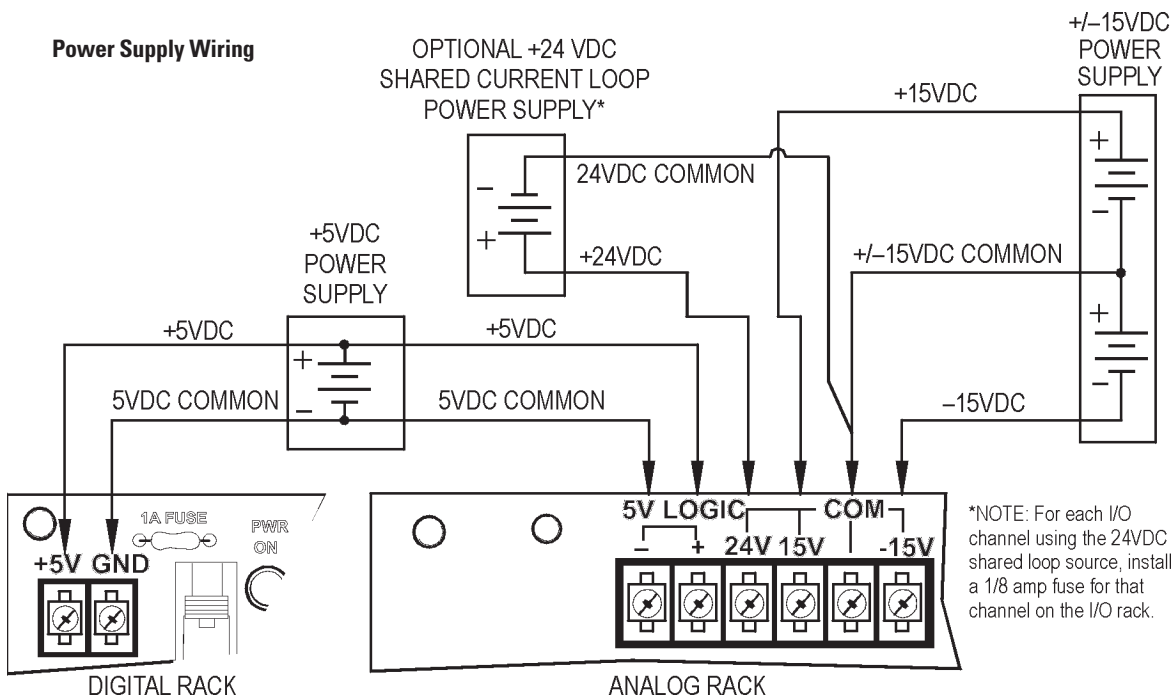
NOTE: Use only isolated supplies with Optomux products. Isolated supplies reduce the risk of ground loops in the communication wiring. Do not connect the power supply's DC common to earth ground. Linear power supplies are recommended.

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"



Installation and Wiring (continued)

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 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.

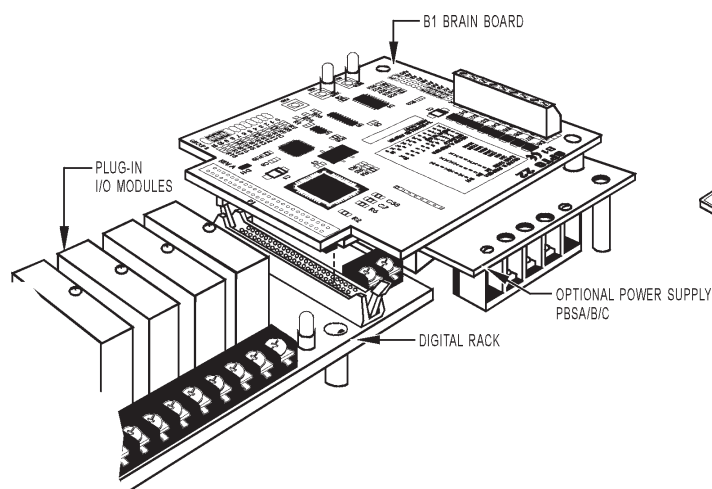
Use a consistent color code from the power supply to all brain boards to prevent wiring errors. Size 18 AWG or larger is recommended for power supply wiring.

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.

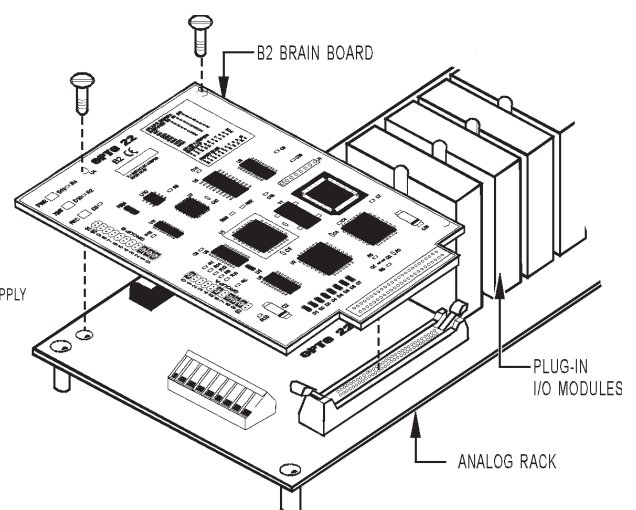
The default communication mode for the B1 and B2 brain boards is multidrop. When wiring a multidrop communications cable, keep in mind that the cable is a high-speed data-transmission line. To reduce reflections, make sure the line is terminated properly at both ends and that all stubs are less than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

B1 Brain Board with Digital Mounting Rack



B2 Brain Board with Analog Mounting Rack



Installation and Wiring (continued)

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 on the previous page 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 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 the 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 Opto 22 form #524, *Optomux Family Data Book*.

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)

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.

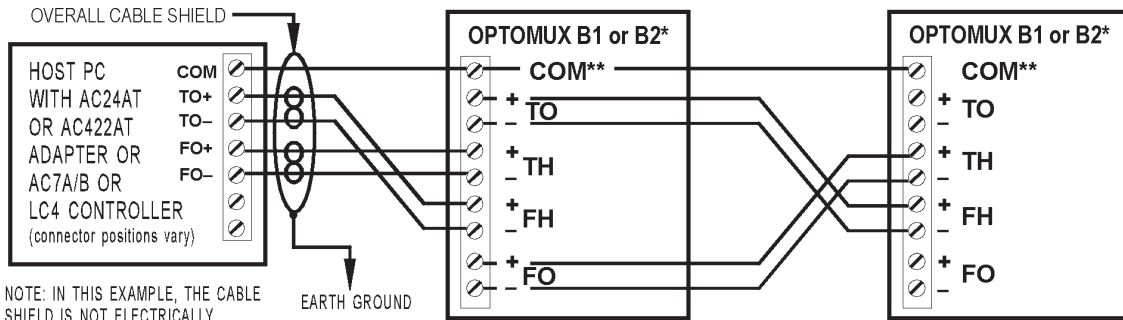
The following page shows standard and alternate wiring diagrams. It also shows jumper settings for repeat and multidrop modes and for proper termination and biasing. When wiring a series of Optomux units, always think of the previous Optomux unit as the host.

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.
- Make sure the communications COM terminals on each rack are connected.

Form 463-030613

STANDARD CONFIGURATION

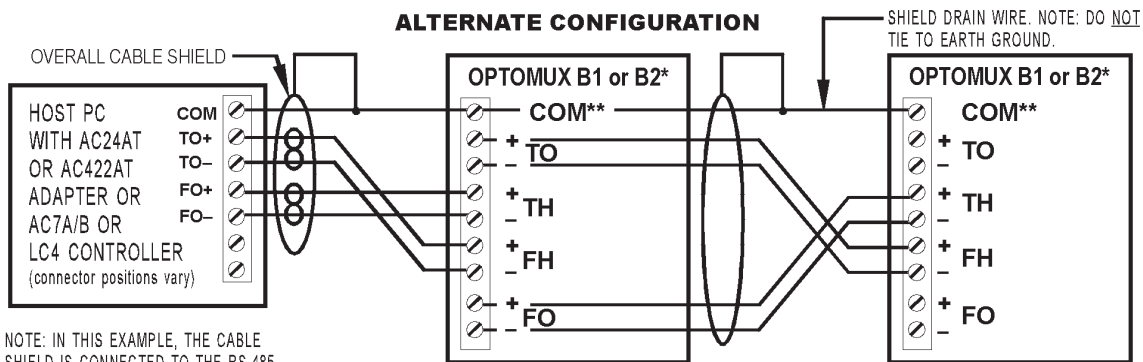


NOTE: IN THIS EXAMPLE, THE CABLE SHIELD IS NOT ELECTRICALLY CONNECTED TO THE RS-485 COM (COMMON) TERMINALS

TO = TO OPTOMUX
FO = FROM OPTOMUX
TH = TO HOST
FH = FROM HOST

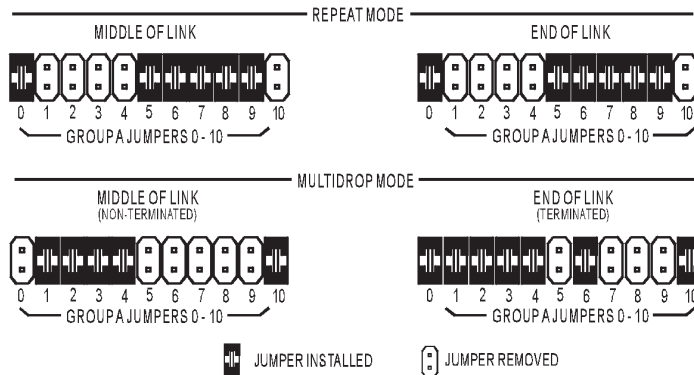
*B2 COMMUNICATIONS WIRING CONNECTIONS ARE MADE TO THE RACK, NOT TO THE BRAIN BOARD. ON THE RACK, THE COM CONNECTOR IS AT THE OTHER END OF THE CONNECTOR STRIP.
**DO NOT CONNECT ANY COM POINT TO EARTH GROUND.

ALTERNATE CONFIGURATION



NOTE: IN THIS EXAMPLE, THE CABLE SHIELD IS CONNECTED TO THE RS-485 COM (COMMON) TERMINALS, BUT THE SHIELD IS NOT EARTH GROUNDED.

IN ORDER TO MEET PUBLISHED SPECIFICATIONS, THE RS-485 SERIAL LINK REQUIRES TWO TERMINATIONS, ONE AT EACH END OF THE SERIAL LINK. STAR CONFIGURATION IS NOT ALLOWED. IN ORDER TO USE A STAR CONFIGURATION, USE OPTO 22 PART NUMBER AC30A/B.



Specifications: Jumpers

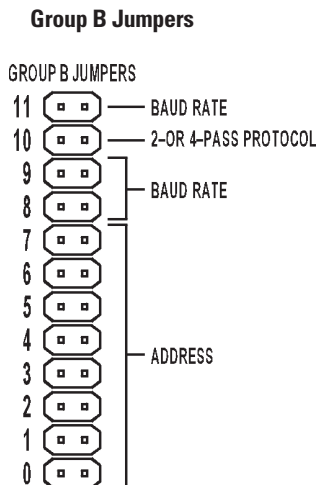
The two groups of jumpers on the B1 and B2 brain boards are labeled Group A and Group B.

Jumpers in Group A 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.

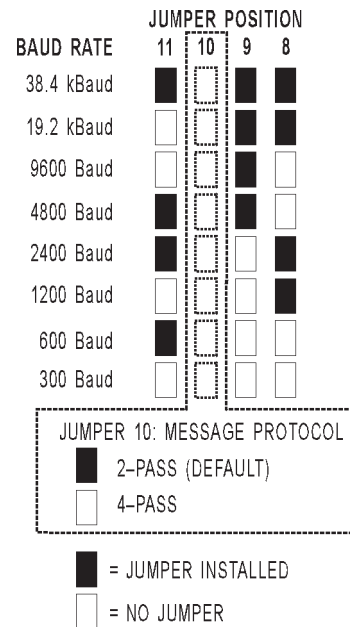
Jumpers in Group B set the address and baud rate and also determine the message protocol. See the following page for address jumper settings.

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.



Baud Rate and Message Protocol Jumpers



DATA SHEET

Form 463-030613

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.

7 6 5 4 3 2 1 0	7 6 5 4 3 2 1 0	7 6 5 4 3 2 1 0	7 6 5 4 3 2 1 0	7 6 5 4 3 2 1 0	7 6 5 4 3 2 1 0
0	43	86	129	172	214
1	44	87	130	173	215
2	45	88	131	174	216
3	46	89	132	175	217
4	47	90	133	176	218
5	48	91	134	177	219
6	49	92	135	178	220
7	50	93	136	179	221
8	51	94	137	180	222
9	52	95	138	181	223
10	53	96	139	182	224
11	54	97	140	183	225
12	55	98	141	184	226
13	56	99	142	185	227
14	57	100	143	186	228
15	58	101	144	187	229
16	59	102	145	188	230
17	60	103	146	189	231
18	61	104	147	190	232
19	62	105	148	191	233
20	63	106	149	192	234
21	64	107	150	193	235
22	65	108	151	194	236
23	66	109	152	195	237
24	67	110	153	196	238
25	68	111	154	197	239
26	69	112	155	198	240
27	70	113	156	199	241
28	71	114	157	200	242
29	72	115	158	201	243
30	73	116	159	202	244
31	74	117	160	203	245
32	75	118	161	204	246
33	76	119	162	205	247
34	77	120	163	206	248
35	78	121	164	207	249
36	79	122	165	208	250
37	80	123	166	209	251
38	81	124	167	210	252
39	82	125	168	211	253
40	83	126	169	212	254
41	84	127	170	213	255
42	85	128	171		

■ = JUMPER INSTALLED □ = NO JUMPER

Products

Opto 22 produces a broad array of reliable, flexible hardware and software for industrial automation and remote monitoring. Opto 22's diverse and complete product range allows you to buy in at any level, from solid-state relays to fully integrated control systems.

SNAP Ultimate I/O™

The most intelligent and powerful I/O system available, SNAP Ultimate I/O effectively combines I/O, control, networking, and enterprise connectivity into a single cohesive system. SNAP Ultimate I/O has the ability to communicate *directly* with enterprise systems, eliminating the need for complex middleware and the significant investments associated with it. Software and utilities for use with SNAP Ultimate I/O include ioControl™ flowchart-based control programming software and ioDisplay™, a Windows-based HMI development package.



SNAP Ethernet I/O™

Using SNAP Ethernet I/O systems, you can connect a wide variety of electronic and mechanical devices such as lights, temperature and pressure sensors, motors, and serial devices to computers via a standard Ethernet network, wireless LAN, or even the Internet.



SNAP-IT™ Systems

A packaged solution that brings industry-proven SNAP Ethernet technology to your enterprise faster and easier than ever before, SNAP-IT is a network-ready hardware appliance that connects environmental, device, and other sensors directly to your enterprise applications. The connected devices can then be controlled and real-time operational data can be collected, monitored, and delivered via a standard Ethernet, wireless LAN, or dial-up network.



Opto 22 FactoryFloor™ Software

FactoryFloor is an integrated suite of industrial control software applications designed to help you develop control automation solutions, build easy-to-use operator interfaces, and expand your manufacturing systems' connectivity.



Other Software and Hardware

Software developer kits (SDKs), diagnostic utilities, support for the Linux operating system, and a full line of SNAP industrial controllers are also available from Opto 22.



Quality

In delivering hardware and software solutions for worldwide device management and control, Opto 22 retains the highest commitment to quality.

We do no statistical testing; each product is made in the U.S.A. and is tested twice before leaving our 160,000 square-foot manufacturing facility in Temecula, California. That's why we can guarantee solid-state relays and all optically-isolated I/O modules *for life*.

Product Support

Opto 22's Product Support Group offers comprehensive technical support for Opto 22 products. The staff of support engineers represents years of training and experience, and can assist with a variety of project implementation questions. Product support is available in English and Spanish from Monday through Friday, 8 a.m. to 5 p.m. Pacific Standard Time.

Opto 22 Web Sites

www.opto22.com
www.m2m.opto22.com
www.internetio.com (live Internet I/O demo)
www.ultimateio.com (SNAP Ultimate I/O information)

Other Resources

- OptoInfo CDs
- Ongoing, up-to-date training
- Integration support
- FaxBack service: (800) 474-OPTO

About Opto 22

Founded in 1974, Opto 22 is a leading manufacturer of high-quality hardware and software solutions for connecting real-world devices with computer networks. Customer applications include enterprise management, remote monitoring and control, industrial automation, and data acquisition. Opto 22 was one of the first companies to recognize and implement solutions involving networks, computers, and real-world equipment and devices. More than 75 million devices worldwide are reliably connected to Opto 22 systems.

