MISTIC 200
INSTALLATION GUIDE

Form 595-060221 — February, 2006

OPTO 22

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CHAPTER 1

System Configuration

Configuring Your System

I/O units can be installed in groups along a network. These groups can be mounted next to each other or can be separated by many feet.

To configure your overall system, you will need to determine the position and I/O brick composition of all the groups. Designing the system on paper first will help during the installation and wiring. Here are some guidelines to follow.

1. Begin your design with your controller. Name each group of I/O units for identification in ascending order as they get further away from the controlling device.
2. If you are using remote bricks or SNAP I/O, record the baud rate. The recommended baud rate is 115.2K. Baud rate selections are: 115.2K, 76.8K, 57.6K, 38.4K, 19.2K, 9600, 4800, 2400, 1200, 600, 300, 150, and 110 baud.
3. CRC-16 error detection is recommended. All I/O units can return either CRC-16 or 8-bit checksum. For more information on this, see Chapter 2 — Installation and Wiring, Brain Board Installation.
4. Binary protocol is recommended. Local bricks can only support binary protocol. See Chapter 2 — Installation and Wiring, Brain Board Installation for more information on this.
5. Record the address (0 - 255) for all I/O units. All units must have a unique address. The AC38, AC40, and analog expansion bricks are not assigned an address. Remote simple and high density units must be set to even numbers and occupy 2 address spaces. B3000 units occupy 4 address spaces and must begin at 0 or even increments of four.
6. Record the power supply type annd voltage outputs.
7. If using remote bricks, record the communication wiring method used. For more information, see Chapter 3 — Communication, Communication Wiring to Bricks in User Designed Panels.
8. Mark the unit if it is the last unit.
9. Enter the number of feet of communication cable to the next location. The maximum distance for a remote network is 3000 ft. (more if repeaters are used) and 200 ft. for a local network.

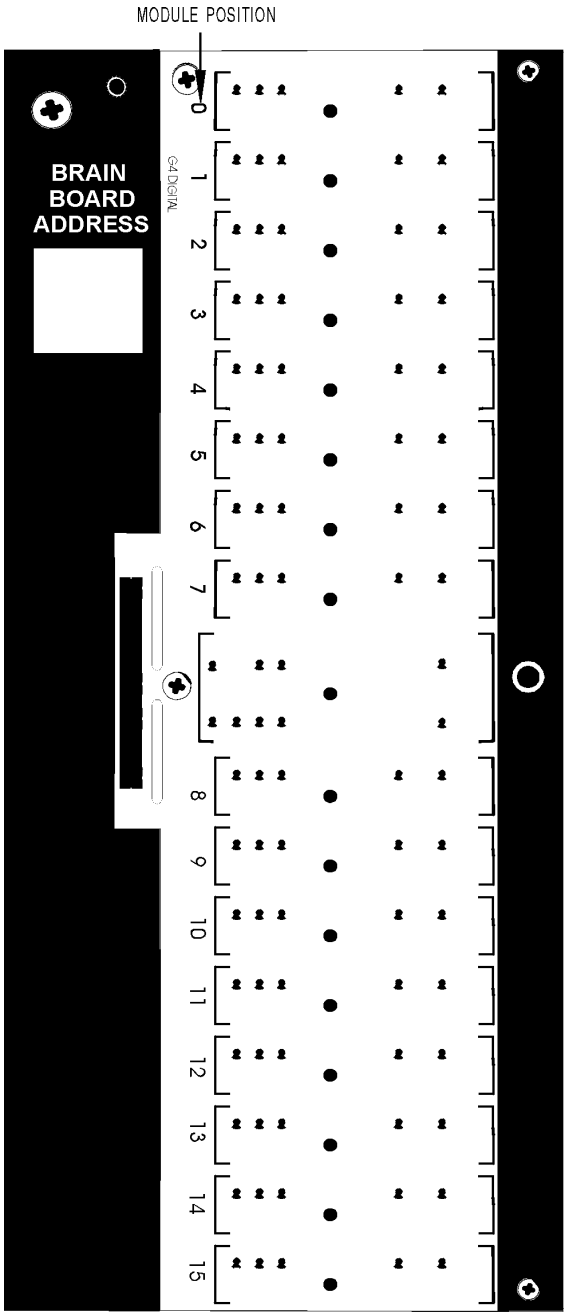
Digital Module Worksheet

Each brick in your system will need a digital or analog I/O Module Worksheet.

Fill in the Digital I/O Module Type.

Example:

Brick base terminal numbers for this module position. → | 4 | 3 | G4IDC5 |



Brick Base Terminal Numbers

MODULE TYPE

2	1
4	3
6	5
8	7
10	9
12	11
14	13
16	15
18	17
20	19
22	21
24	23
26	25
28	27
30	29
32	31

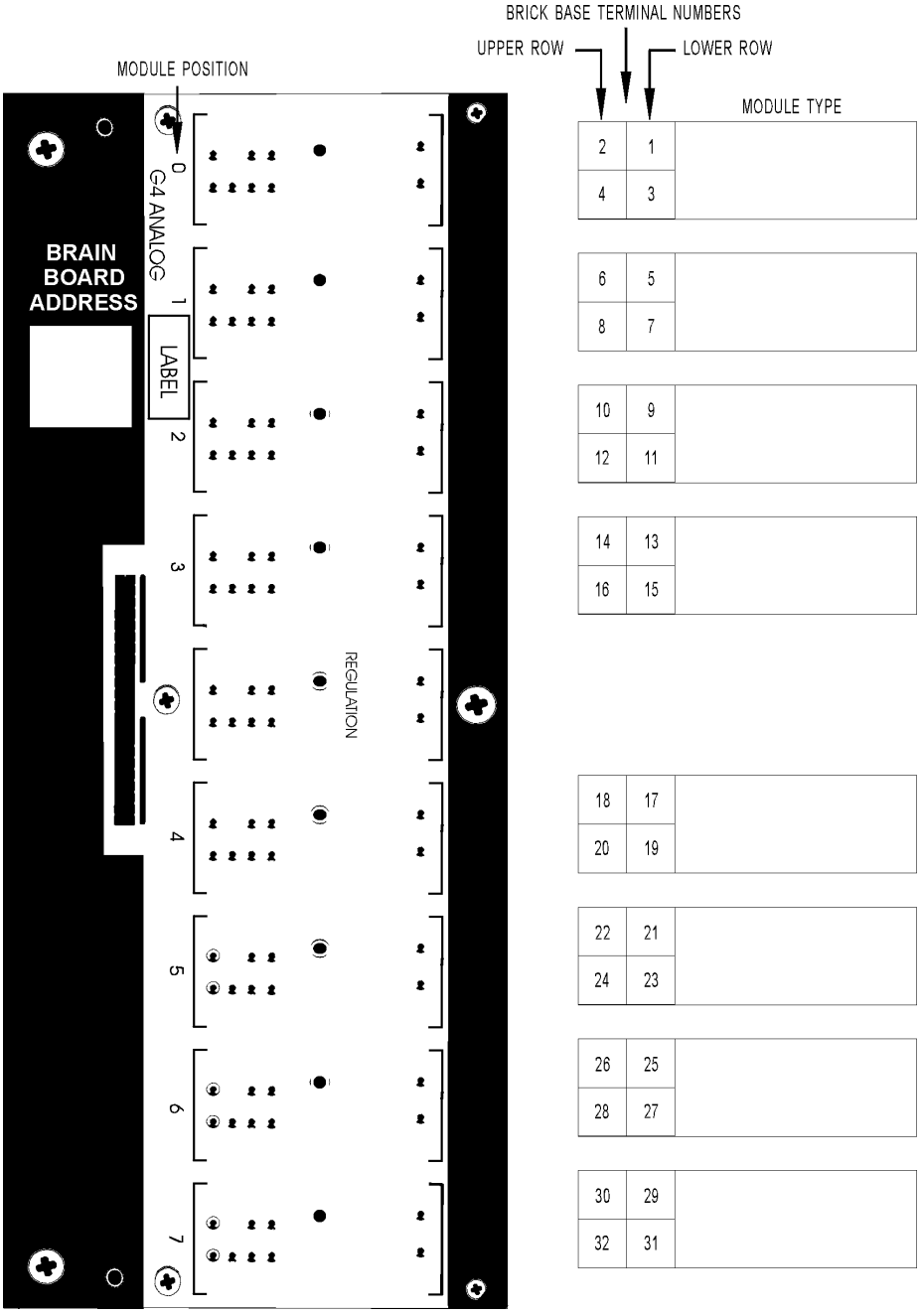
Analog Module Worksheet

Fill in Analog I/O Module Type.

Example:

Brick base terminal numbers for this module position.

14	13	G4AD8
16	15	

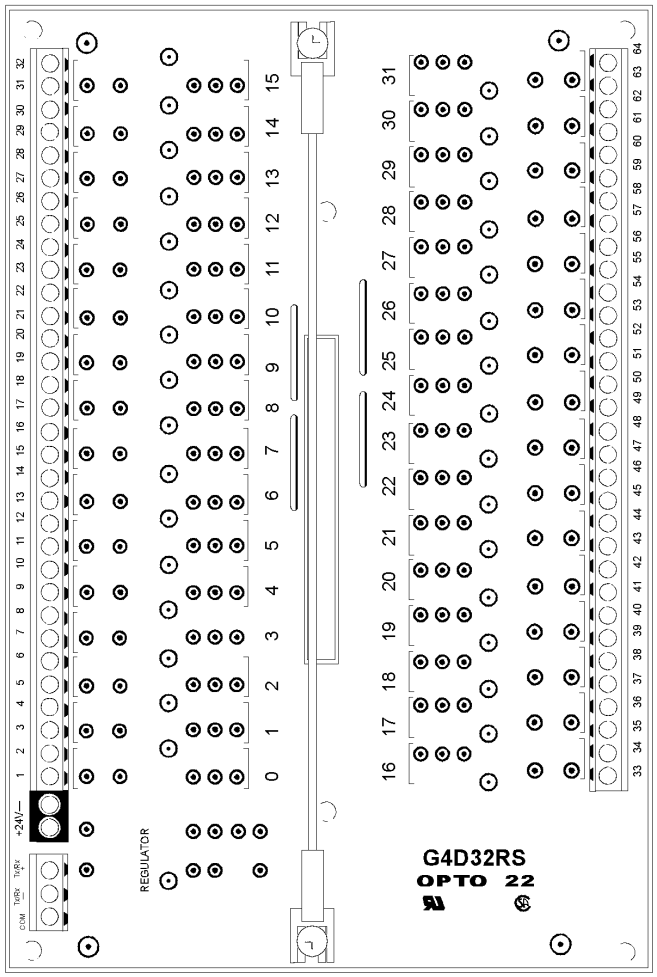


G4D32RS Worksheet

FILL IN THE G4 DIGITAL I/O MODULE TYPE
EXAMPLE:

G40DC5	15

	15
	14
	13
	12
	11
	10
	9
	8
	7
	6
	5
	4
	3
	2
	1
	0



31	
30	
29	
28	
27	
26	
25	
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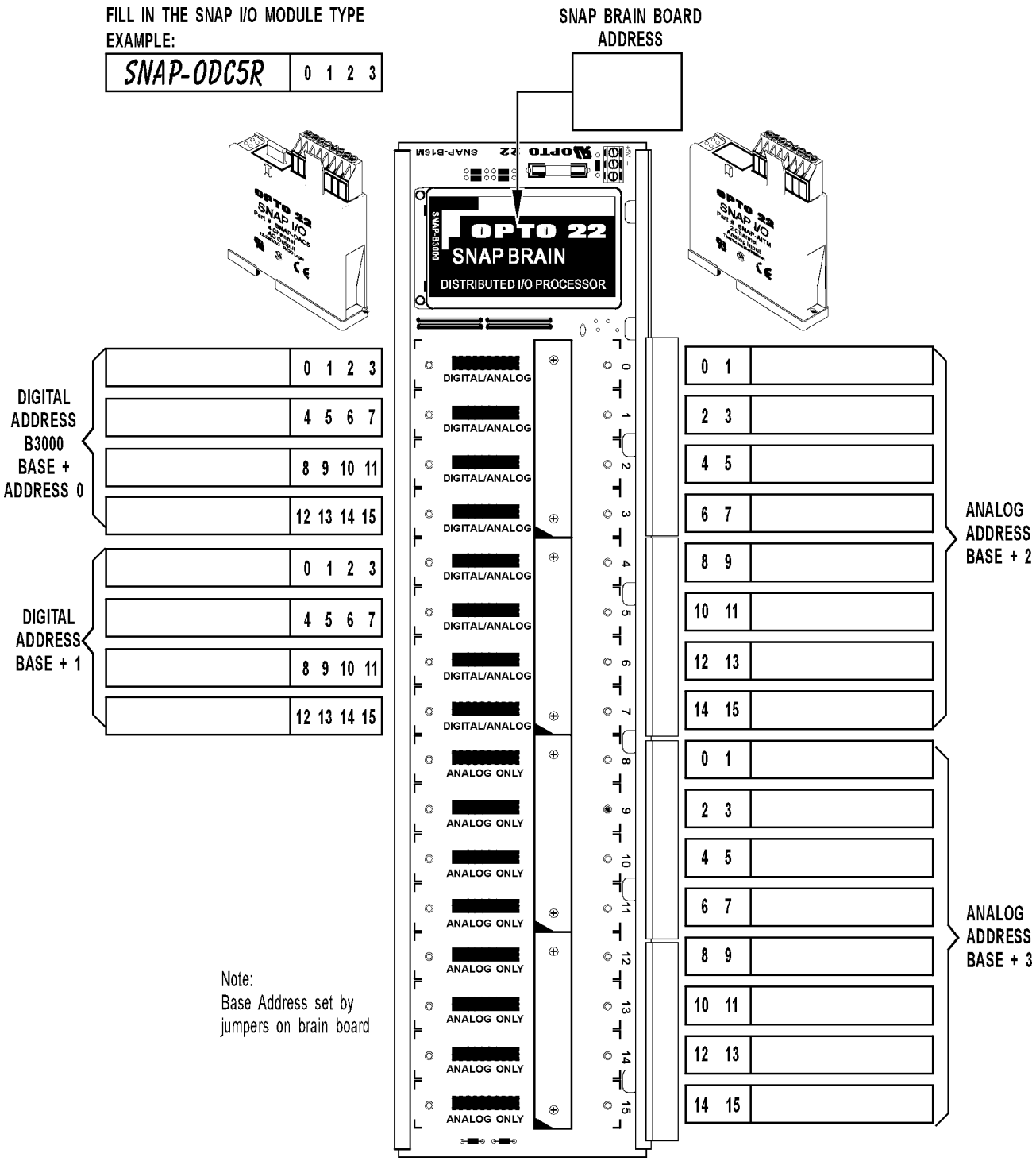
23	
22	
21	
20	
19	
18	
17	
16	

B3000 SNAP I/O Worksheet



B3000 SNAP I/O (cont.)

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 contain either single or dual channels. Both analog and digital modules can be on the same rack.

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.

CHAPTER 2

Brain Board Installation and Field Wiring

Systems In User Designed Panels

Individual applications will vary widely, but the following list of suggestions and notes are intended to help you design and layout distributed brick I/O not mounted in Mistic panels.

Local Systems

- Local I/O runs can be a maximum of 200 ft. away from the controller or host computer.
- To make your panel with the same dimensions as the Mistic panels, see Chapter 6 — Dimensional Drawings.
- A 34-conductor, flat-ribbon cable (P/N Local Cable 200) is the interconnecting brick cable used in the Mistic local panel. For information on making cables for non-Mistic panels, see Chapter 4 — Cables.
- Use the G4IOL if connecting several panels from different locations.
- Use the G4TERML on the last brick of the communication bus.

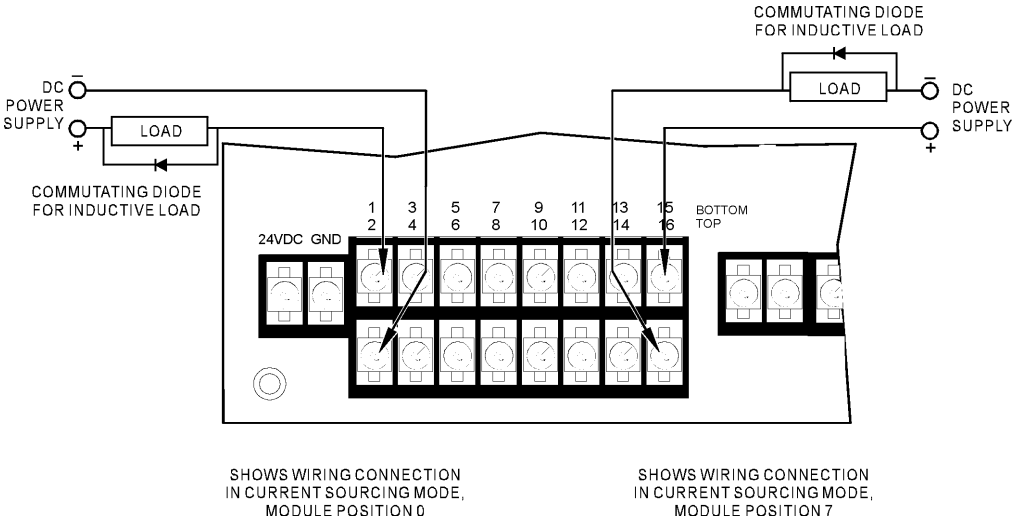
Remote Systems

- Remote I/O runs can be a maximum of 3000 ft. away from the controller or host computer.
- Communication cables must be done using shielded, twisted pair wiring. 1 pair is necessary, 2 pairs minimum if using interrupts.
- Dimensions for a panel with bricks using the SBTAs for communications wiring is shown in Chapter 6. A minimum of 2" between the wireways of vertically adjacent bases is needed for the SBTA card which extends 1 inch above the brick brain.
- A 10-conductor braided cable comes with the G4RCOMMKIT, and interconnects remote bricks in a Mistic panel. It can be used when there are fewer than 6 bricks, but excess cable should be cut off. This cable cannot be used with bricks using SBTAs for communications wiring.
- SNAP B3000 allow communication connections to be made directly on the unit.
- Use the G4RCOMMKIT if connecting several panels from different locations.
- Bricks and remote simple require 24 VDC to operate. SNAP I/O requires 5 VDC.

Field Wiring Instructions for Digital Modules

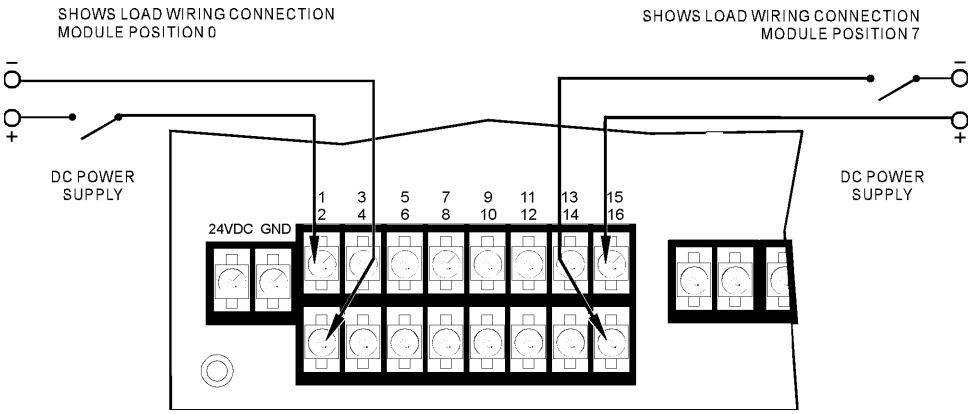
Digital – DC Outputs

G4ODC5, G4ODC5A, G4ODC5MA, G4ODC5R, G4ODC5R5, G4SWOUT



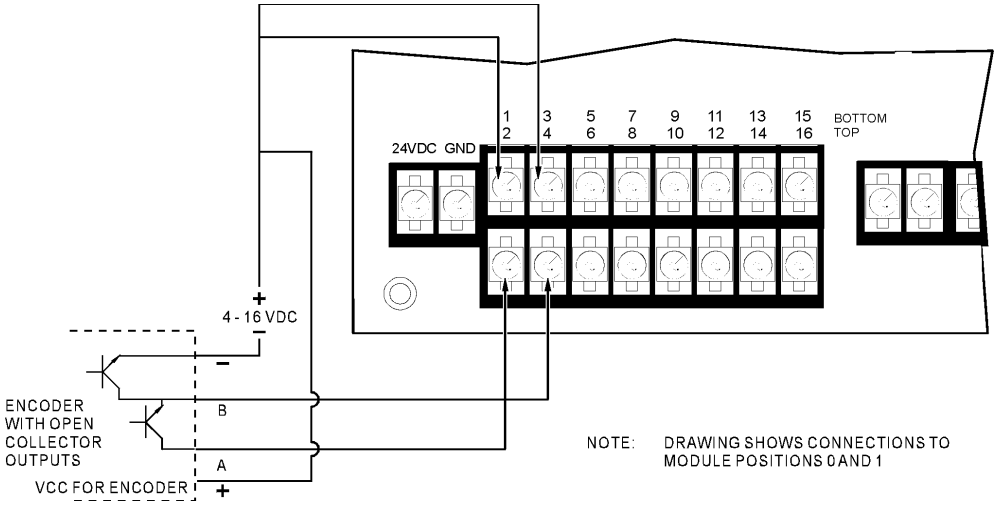
Digital – DC Inputs

G4IDC5, G4IDC5B, G4IDC5D, G4IDC5G, G4IDC5K, G4IDC5MA, G4IAC5, G4IAC5A, G4IAC5MA, G4SWIN



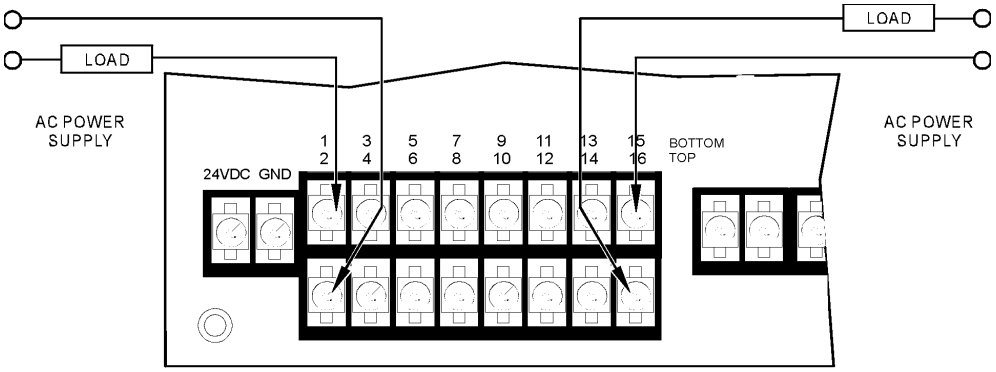
Digital – Quadrature Input

G4IDC5Q



Digital – AC Outputs

G4OAC5, G4OAC5A, G4OAC5A5, G4OAC5MA, G4ODC5R, G4ODC5R5, G4SWOUT

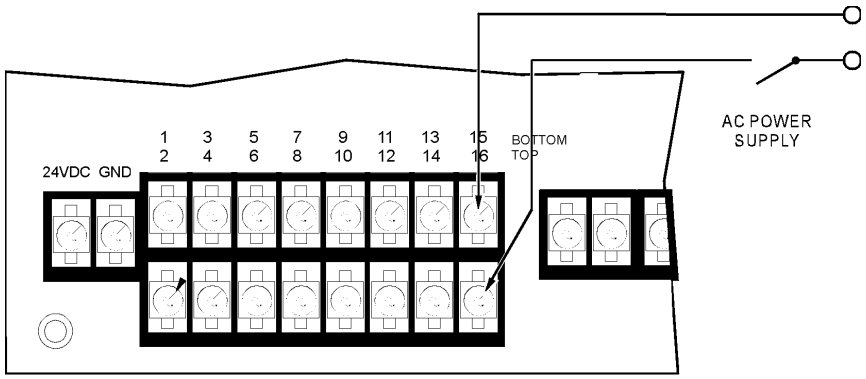


SHOWS LOAD WIRING CONNECTION MODULE POSITION 0

SHOWS LOAD WIRING CONNECTION MODULE POSITION 7

Digital – AC Inputs

G4IAC5, G4IAC5A, G4IAC5MA, G4IDC5, G4IDC5G, G4IDC5MA, G4SWIN, G4IDC5B

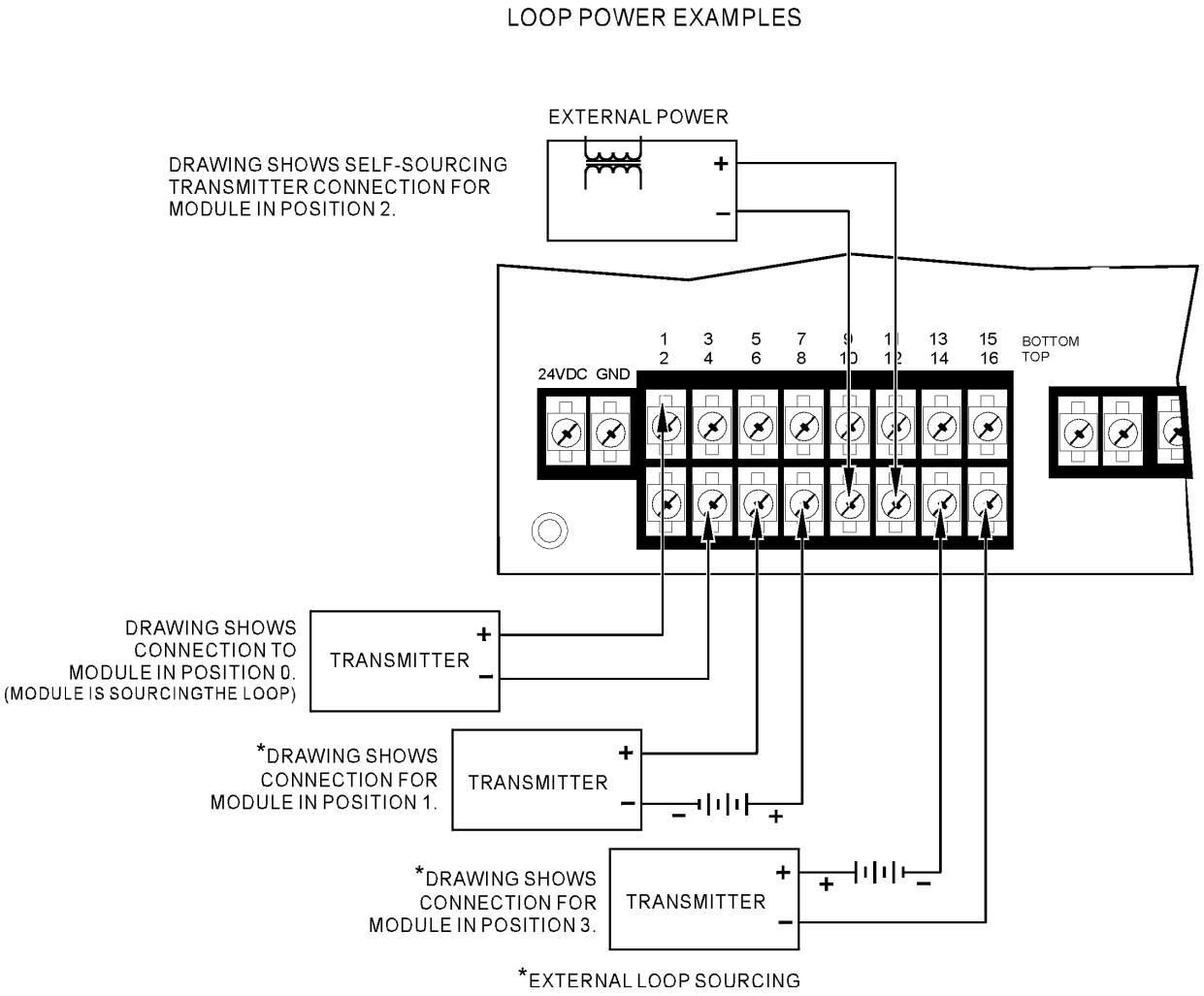


INPUT DEVICE MAY BE IN SERIES WITH EITHER LINE. SHOWS WIRING CONNECTION FOR MODULE POSITION 7.

Field Wiring Instructions Analog Modules

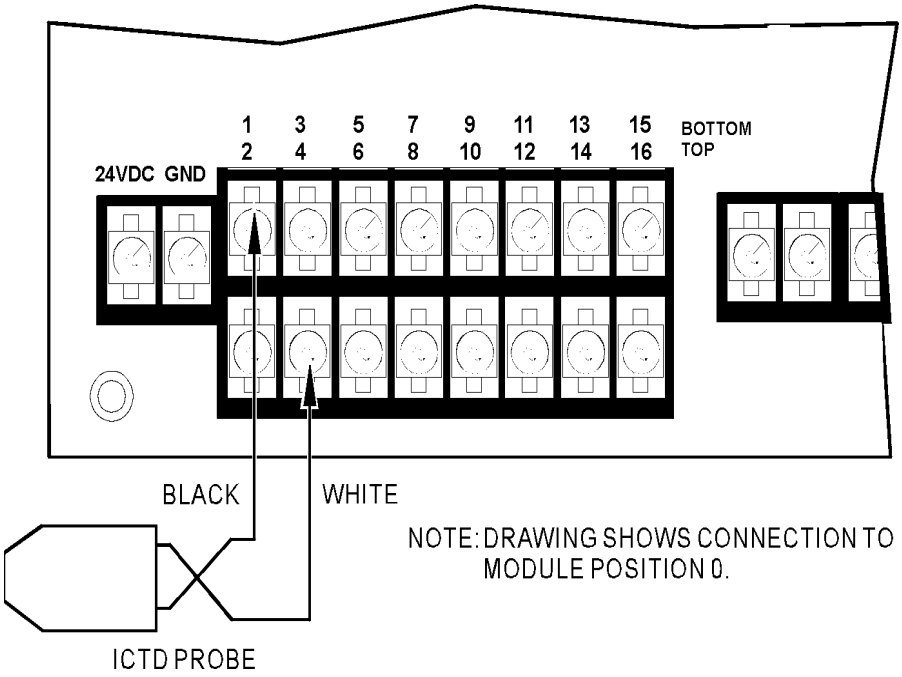
Analog – Current Input

G4AD3

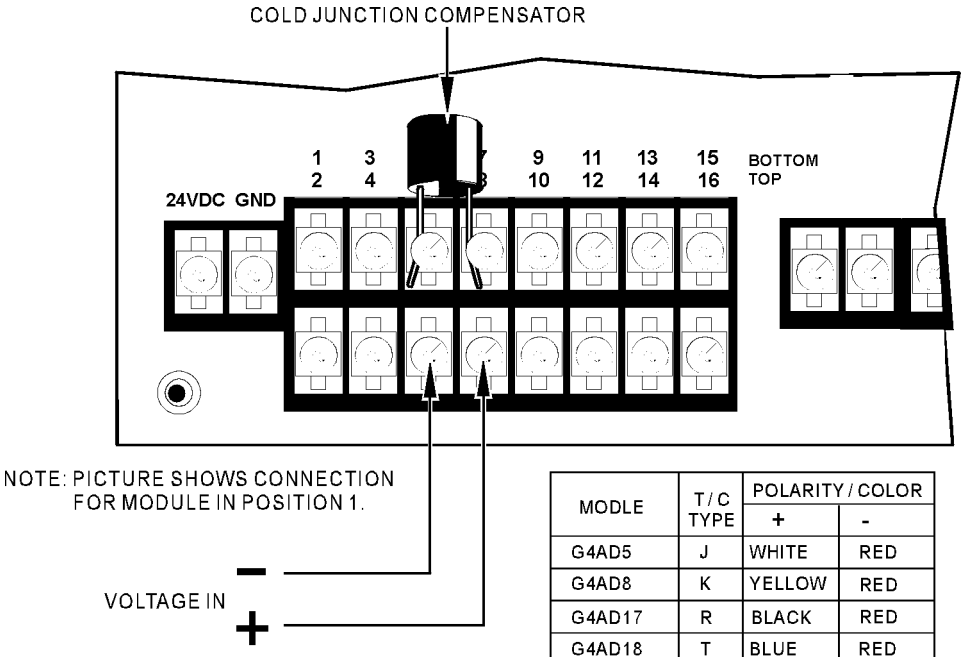


Analog – ICTD Temperature Input

G4AD4



Analog – Thermocouple Input

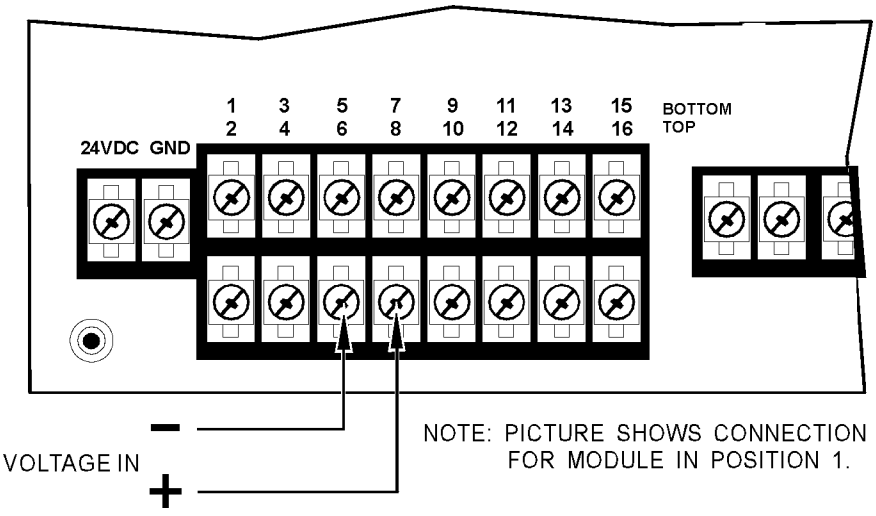


MODLE	T/C TYPE	POLARITY / COLOR	
		+	-
G4AD5	J	WHITE	RED
G4AD8	K	YELLOW	RED
G4AD17	R	BLACK	RED
G4AD18	T	BLUE	RED
G4AD19	E	PURPLE	RED
G4AD23	S	BLACK	RED
G4AD24**	B	GREY	RED

** G4AD24 DOES NOT REQUIRE A COLD JUNCTION COMPENSATOR

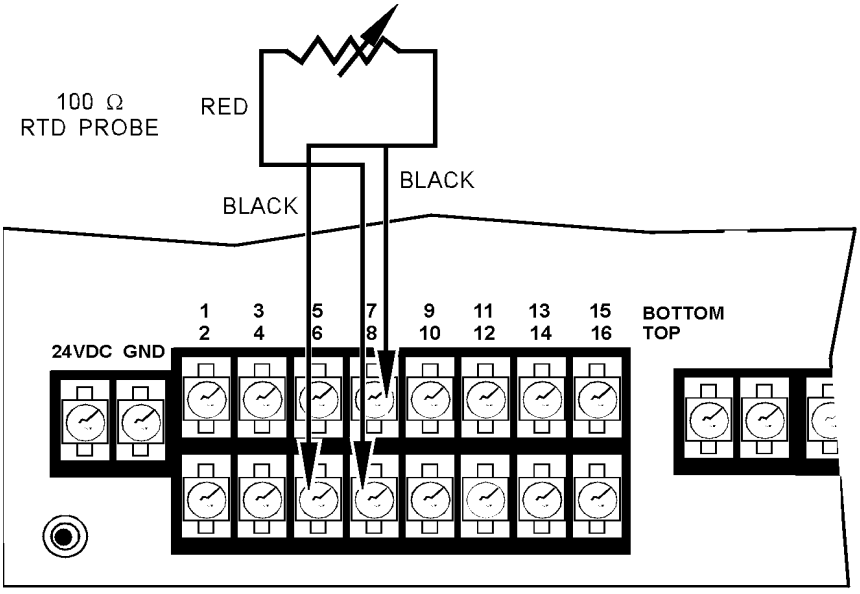
Analog – Voltage Inputs

G4AD6, G4AD6HS, G4AD7, G4AD7HS, G4AD9, G4AD11, G4AD12, G4AD13, G4AD22, G4AD25



Analog – RTD Input

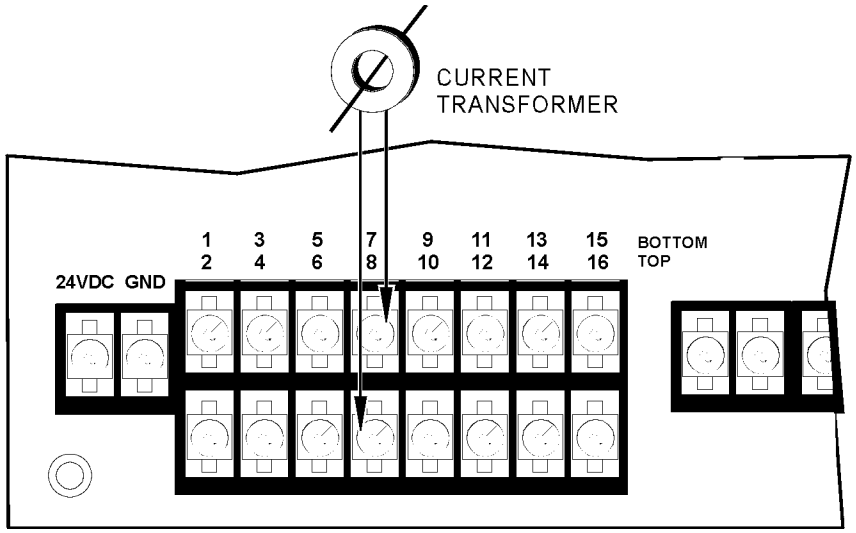
G4AD10



NOTE: PICTURE SHOWS CONNECTION FOR MODULE IN POSITION 1.

Analog – AC/DC Current Input

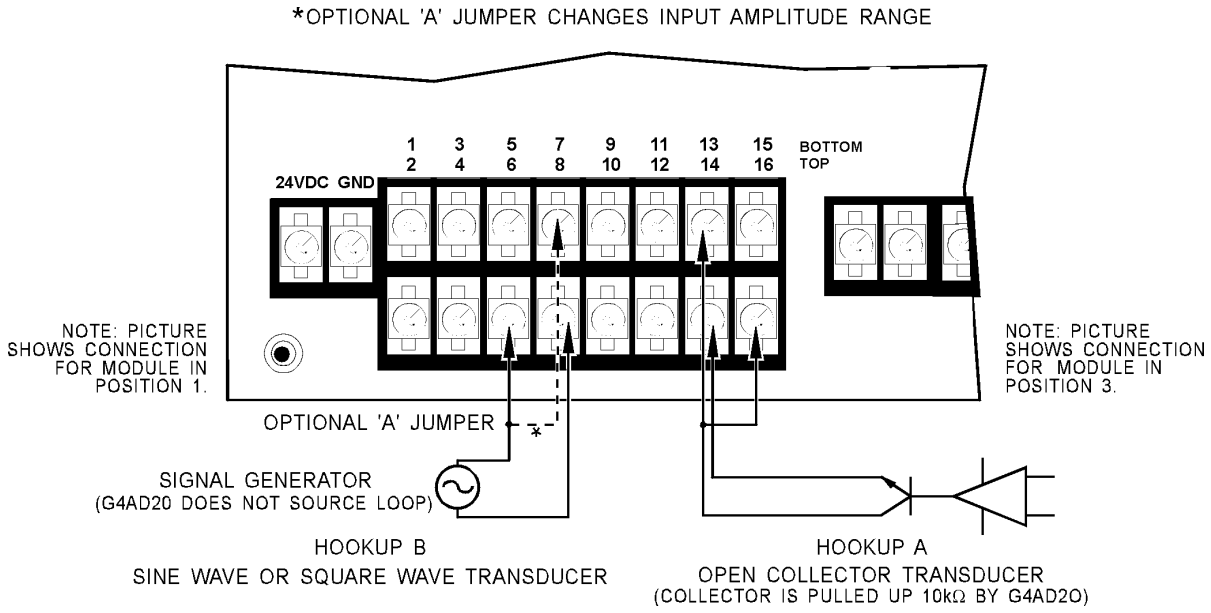
G4AD16



NOTE: PICTURE SHOWS CONNECTION FOR MODULE IN POSITION 1 ON ANALOG BRICK.

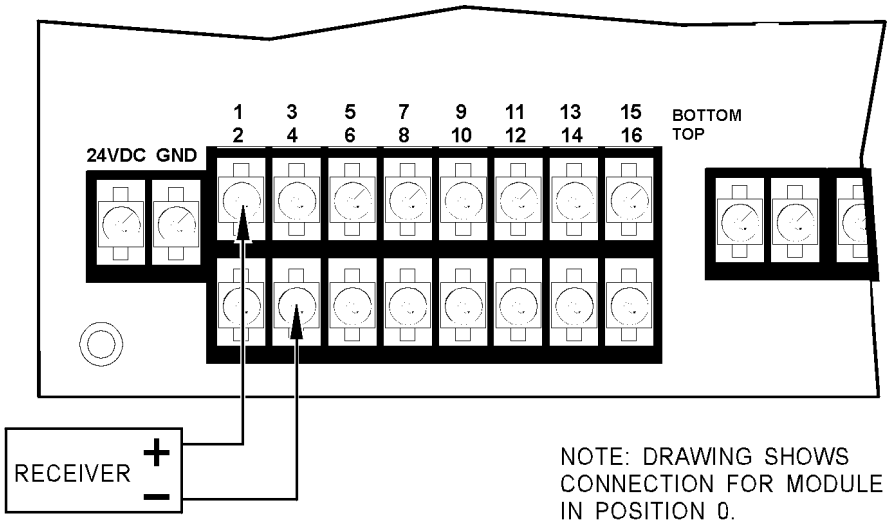
Analog – Rate Input

G4AD20

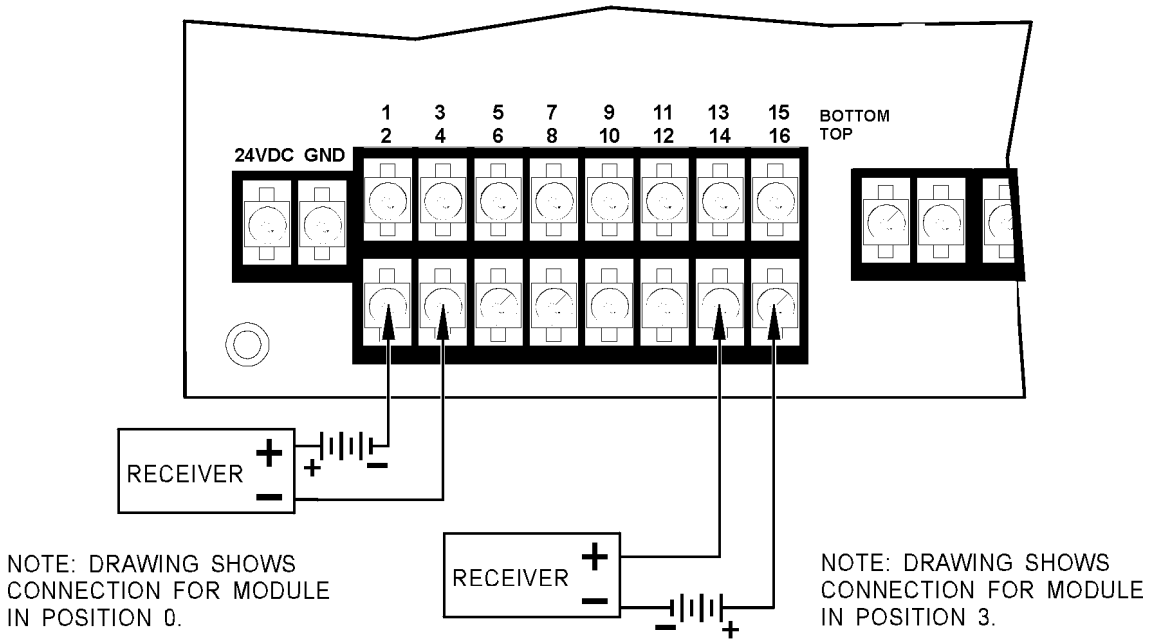


Analog – Current Outputs

G4DA3, G4DA8



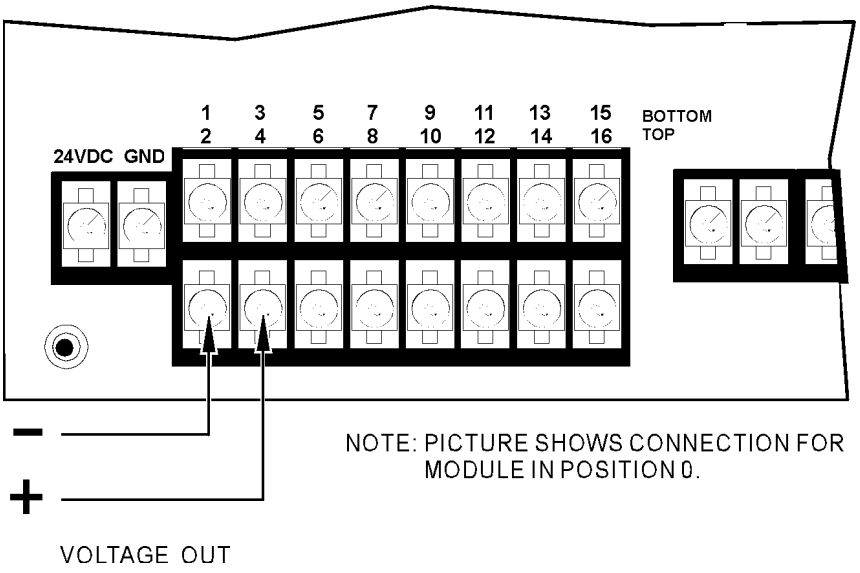
LOOP SOURCING BY MODULE



EXTERNAL LOOP POWER

Analog – Voltage Output

G4DA4, G4DA5, G4DA6, G4DA7



Field Wiring Instructions for the G4AITM

Caution: **Turn OFF all power before wiring to the brick.**

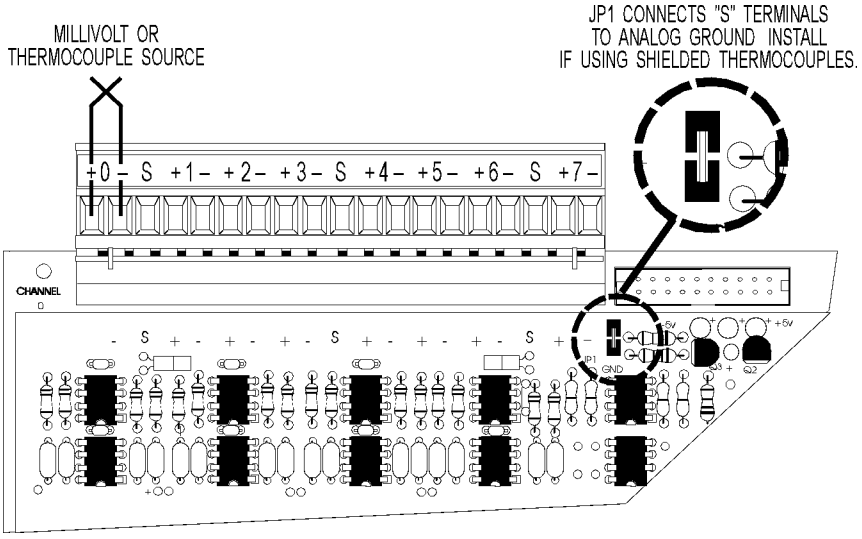
1. Connect the thermocouple "+" wire to the channel "+" terminal, the "-" thermocouple wire to the channel "-" terminal. Refer to the following table for polarity and wire colors.

Table 2-1: Thermocouple Wiring

Thermocouple	Polarity/Color	
	+	–
J	White	Red
K	Yellow	Red
R/S	Black	Red
T	Blue	Red
E	Purple	Red
B	Gray	Red
N	Orange	Red
G	White/Blue	Red
C	White/Red	Red
D	White/Yellow	Red

2. Thermocouples with a third wire are connected to the "S" terminal. All "S" terminals are tied together.

NOTE: No external cold junction compensator is required



Field Wiring Instructions for the G4AIVA

Caution: **Turn OFF all power before wiring to the brick.**

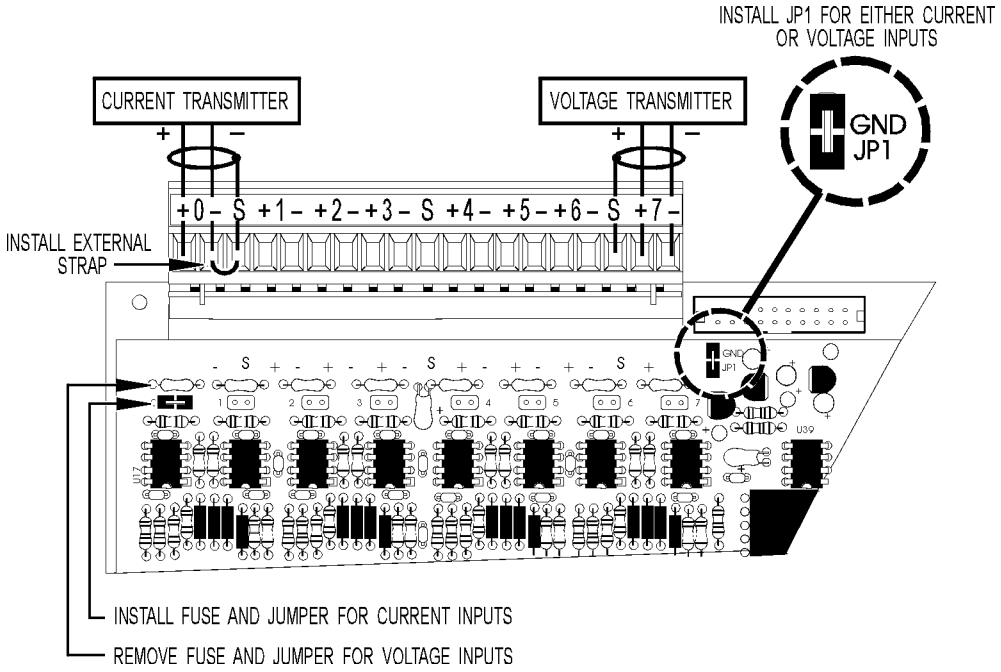
Voltage Inputs

1. Connect the transmitter 's"+" wire to the channel's "+" terminal; the transmitter's "-" wire to the "-" terminal.
2. If the wire pair has a shield, connect the shield to the "S" terminal.
3. Configure the I/O channel as a voltage input by removing the Voltage/Current Input jumper.

Current Inputs

1. Connect the transmitter's "+" wire to the channel's "+" terminal; the transmitter's "-" wire to the "-" terminal.
2. If the wire pair has a shield, connect the shield to the "S" terminal.
3. Configure the I/O channel as a current input by installing the Voltage/Current Input jumper and the 1/8 amp fuse. The corresponding I/O channel number is printed next to it.

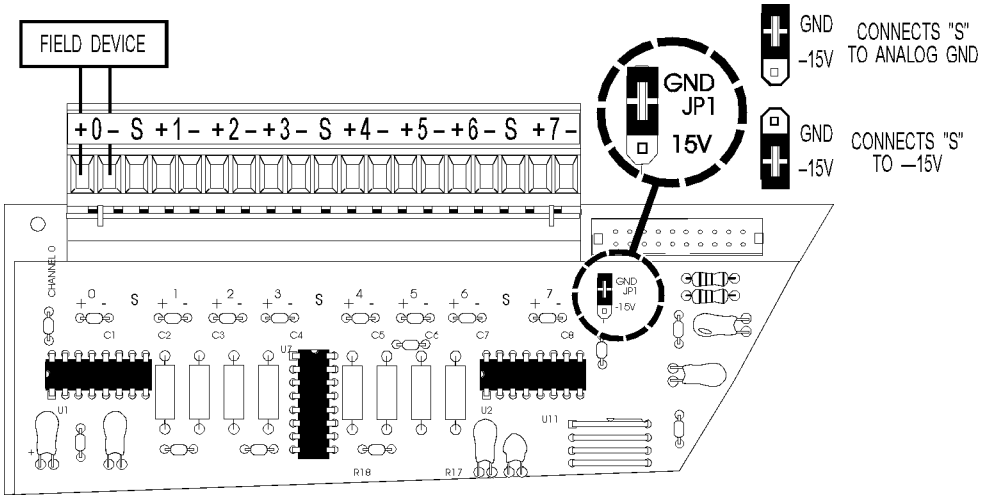
Caution: **Do not apply voltage to a channel jumpered as a current input.**



Field Wiring Instructions for the G4AOV

Caution: **Turn OFF all power before wiring to the brick.**

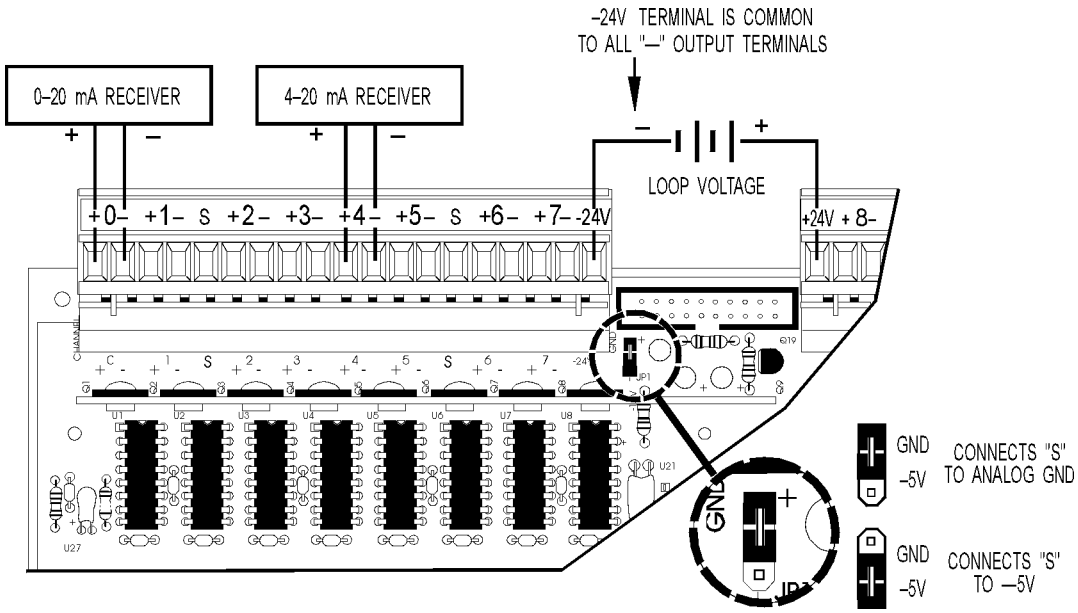
1. Connect the device "+" wire to the channel "+" terminal; the device "-" wire to the channel "-" terminal.
2. Connect devices with a third wire (GND) to terminal "S".



Field Wiring Instructions the G4AOA

Caution: **Turn OFF all power before wiring to the brick.**

1. Connect the receiver "+" wire to the channel "+" terminal; the receiver "-" wire to the channel "-" terminal.
2. Apply loop voltage between the +24V and -24V.
3. Connect devices with a third wire (GND) to terminal "S".



Field Wiring Instructions for G4D32RS

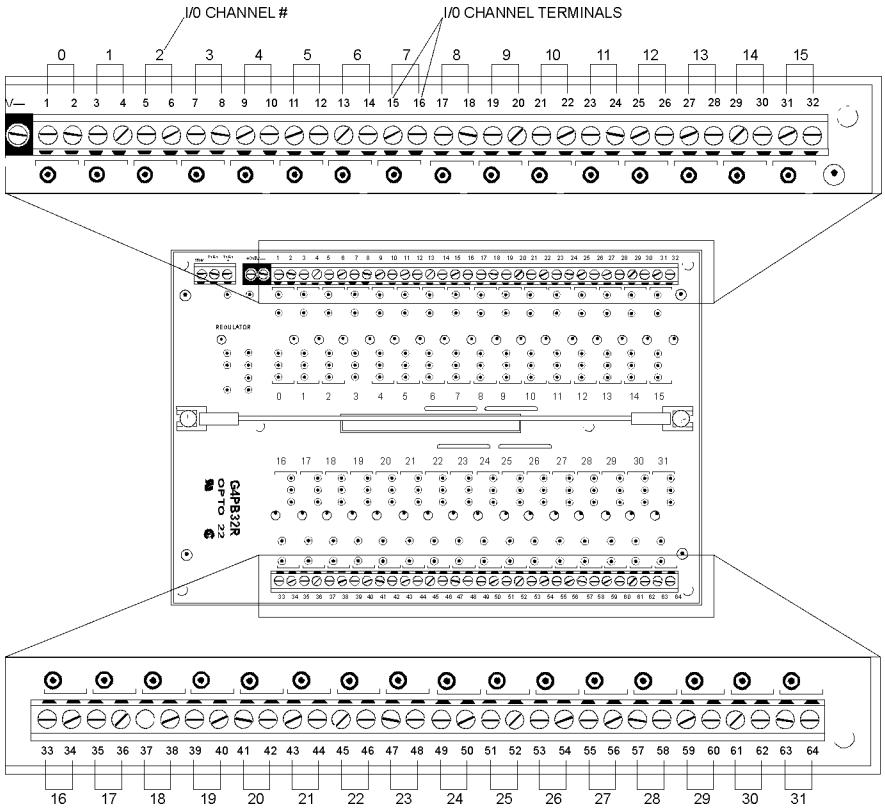
Caution: **Turn OFF all power before wiring to the brick.**

The figure below shows the location of the field wiring terminals on the G4D32RS and the layout of the terminal points as they correspond to each channel. Field wiring terminals accept up to 10 AWG wire.

Each channel has a positive (+), odd numbered terminal and a negative (–), even numbered terminal for each channel. Connect the positive wire from your field device to the channel's positive terminal, and then connect the negative wire to the negative terminal.

Bussing Points Together

Several field terminals may be bussed together by using Opto 22 P/N G4STRAP. One G4STRAP may jumper up to 16 positions. It may also be trimmed to jumper fewer points together.

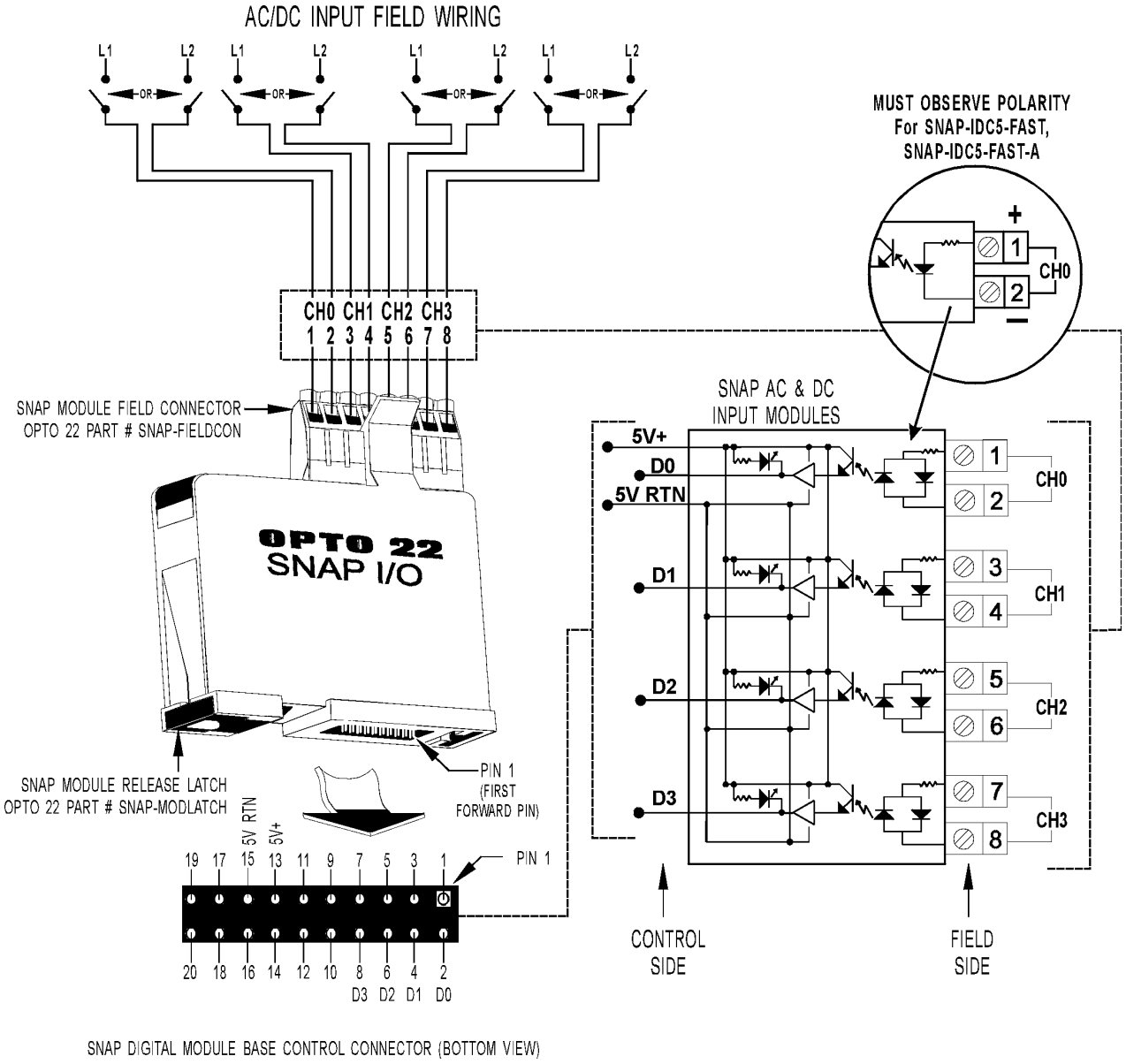


Location of terminals on the G4D32RS

Field Wiring Instructions for SNAP Digital Modules

AC and DC Input Modules

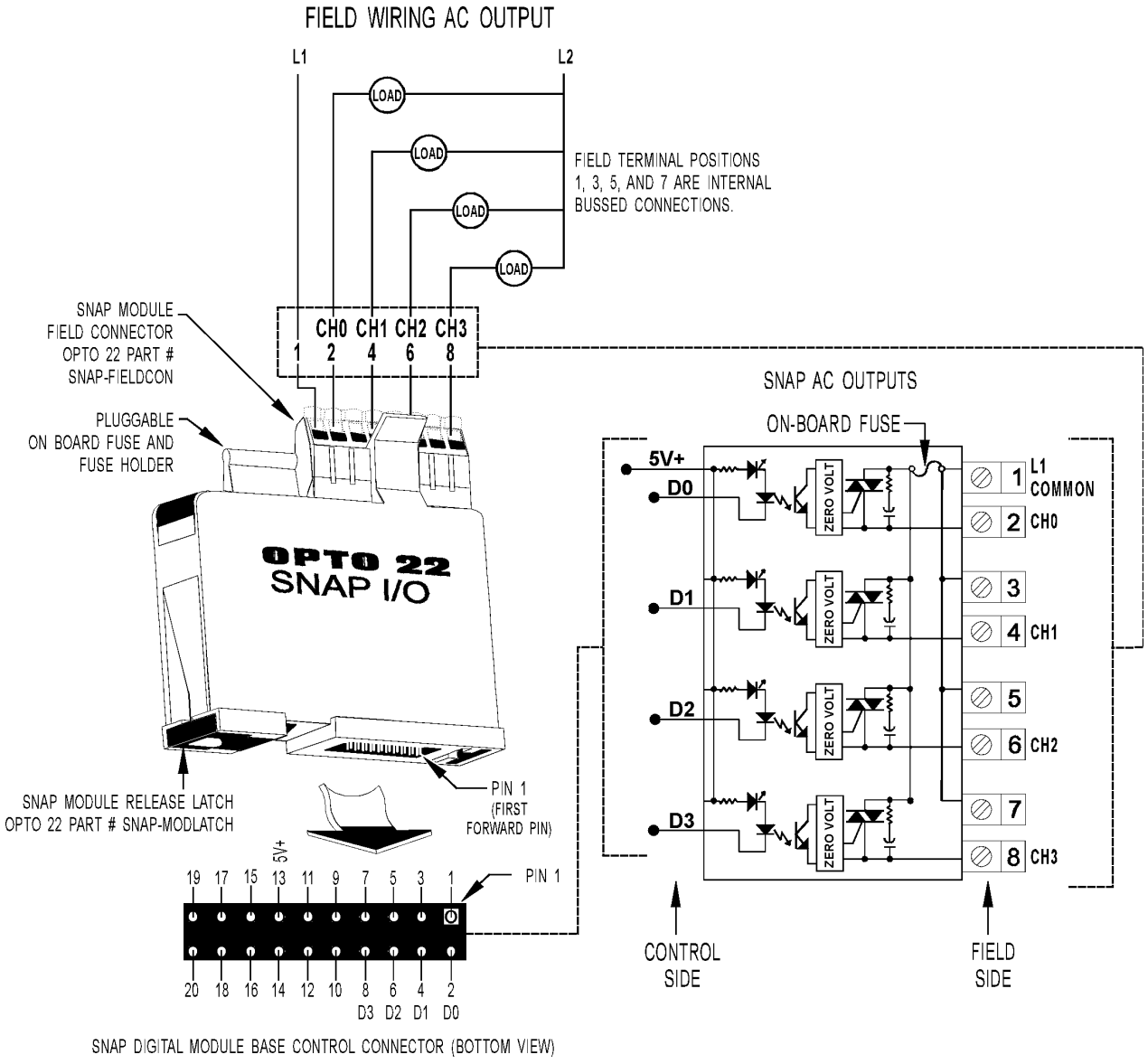
SNAP-IAC5, SNAP-IAC5A, SNAP-IDC5, SNAP-IDC5D, SNAP-IDC5FAST



SNAP DIGITAL MODULE BASE CONTROL CONNECTOR (BOTTOM VIEW)

AC Output Module

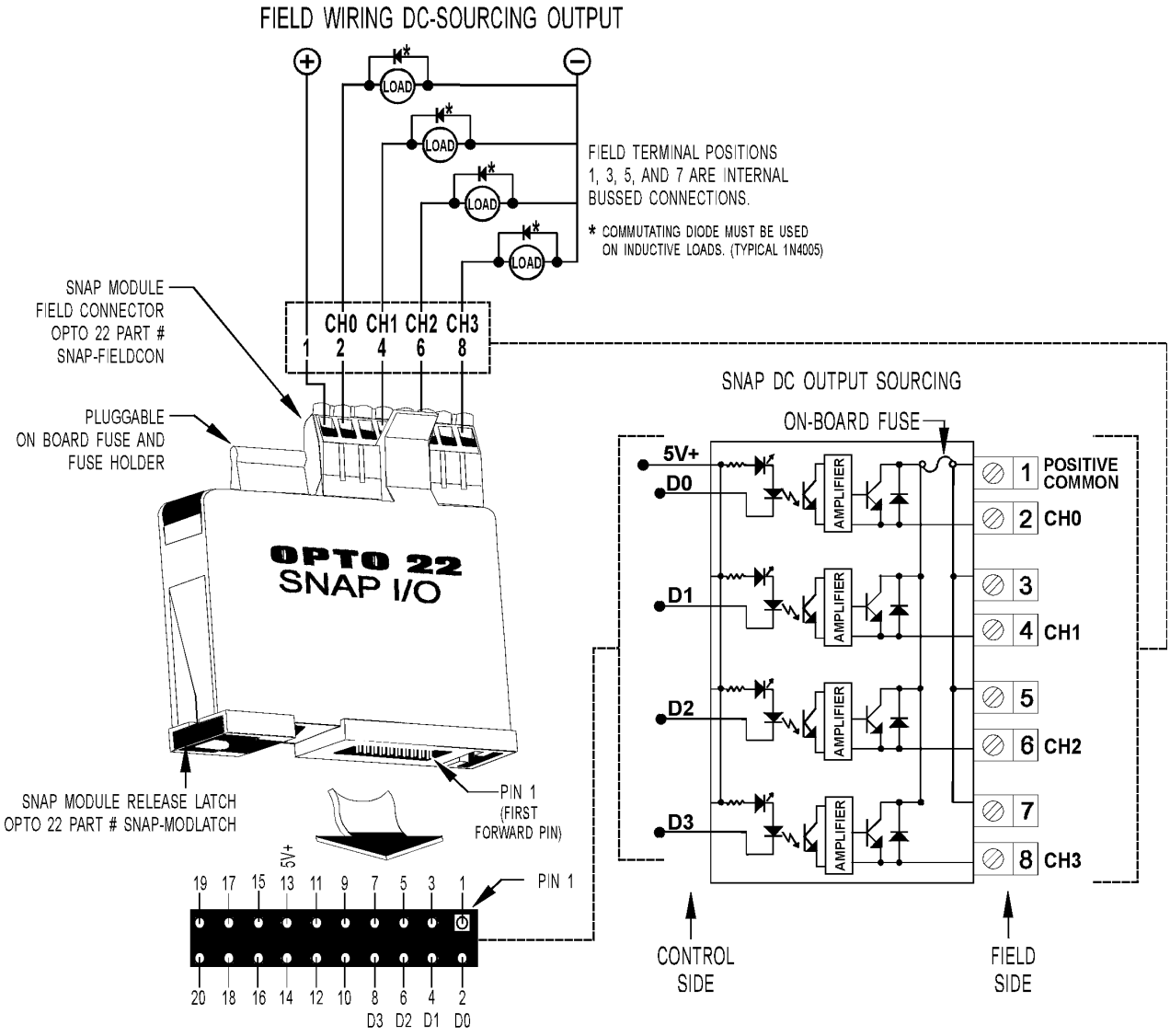
SNAP-OAC5



SNAP DIGITAL MODULE BASE CONTROL CONNECTOR (BOTTOM VIEW)

DC Output Module Sourcing

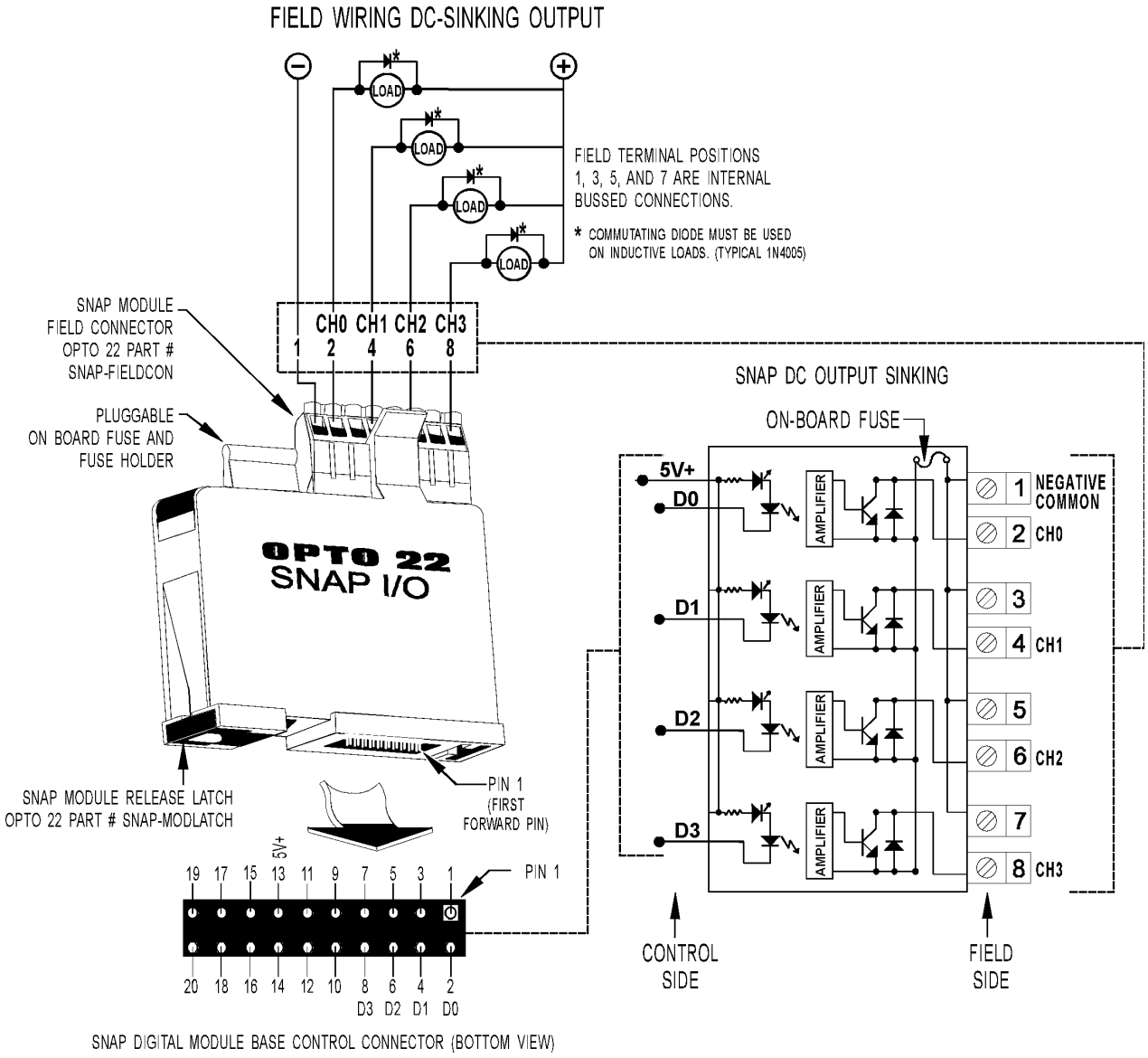
SNAP-ODC5SRC



SNAP DIGITAL MODULE BASE CONTROL CONNECTOR (BOTTOM VIEW)

DC Output Module Sinking

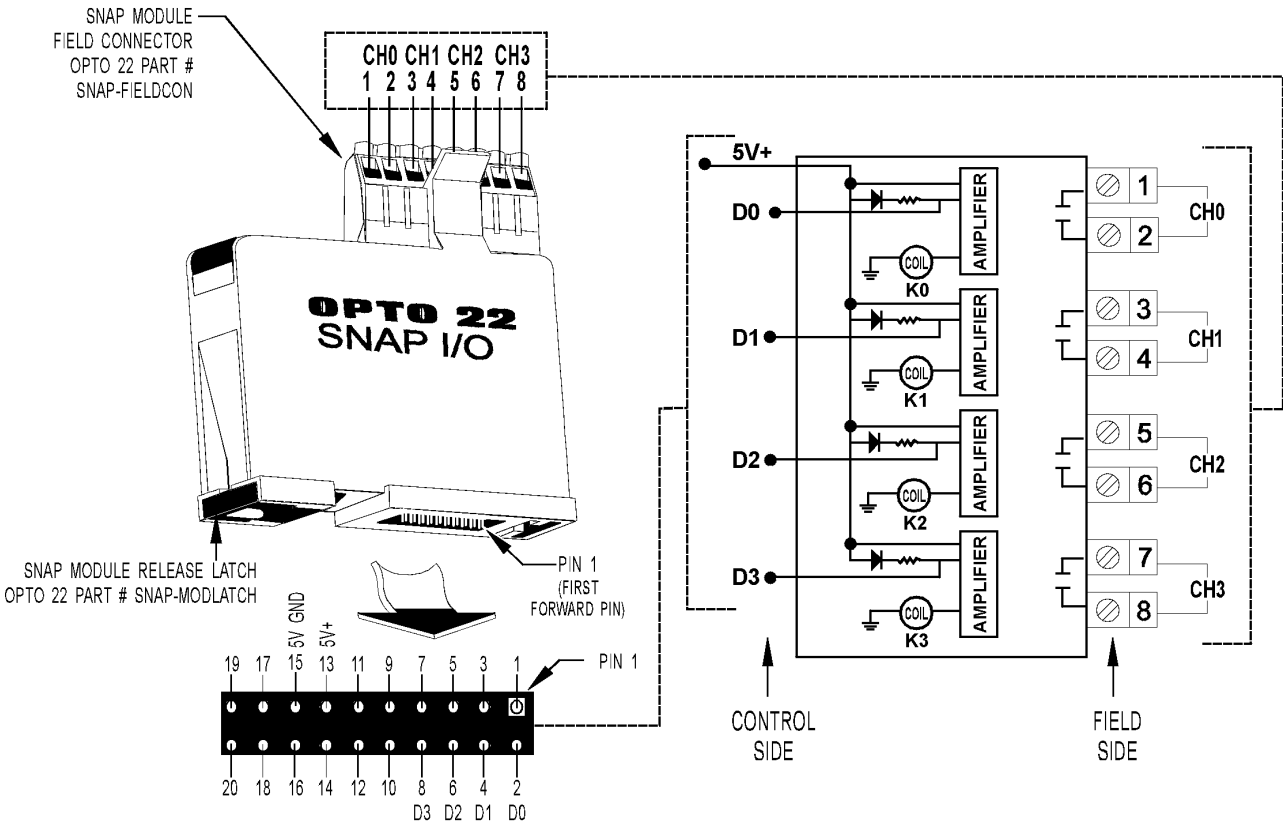
SNAP-ODC5SNK



Dry Contact Module

SNAP-ODC5R

FIELD WIRING DRY CONTACT OUTPUT

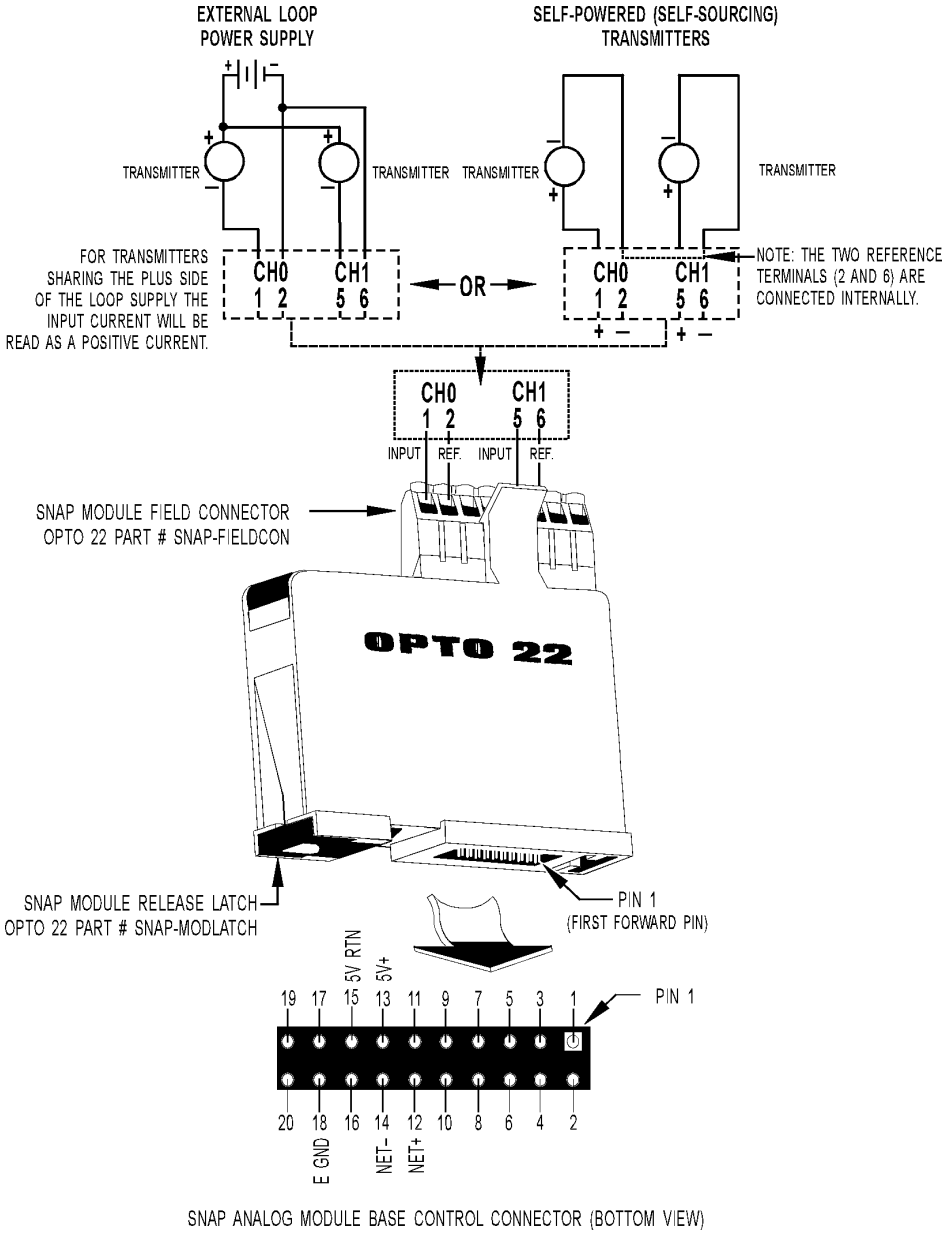


SNAP DIGITAL MODULE BASE CONTROL CONNECTOR (BOTTOM VIEW)

Field Wiring Instructions for SNAP Analog Modules

Current Input Module

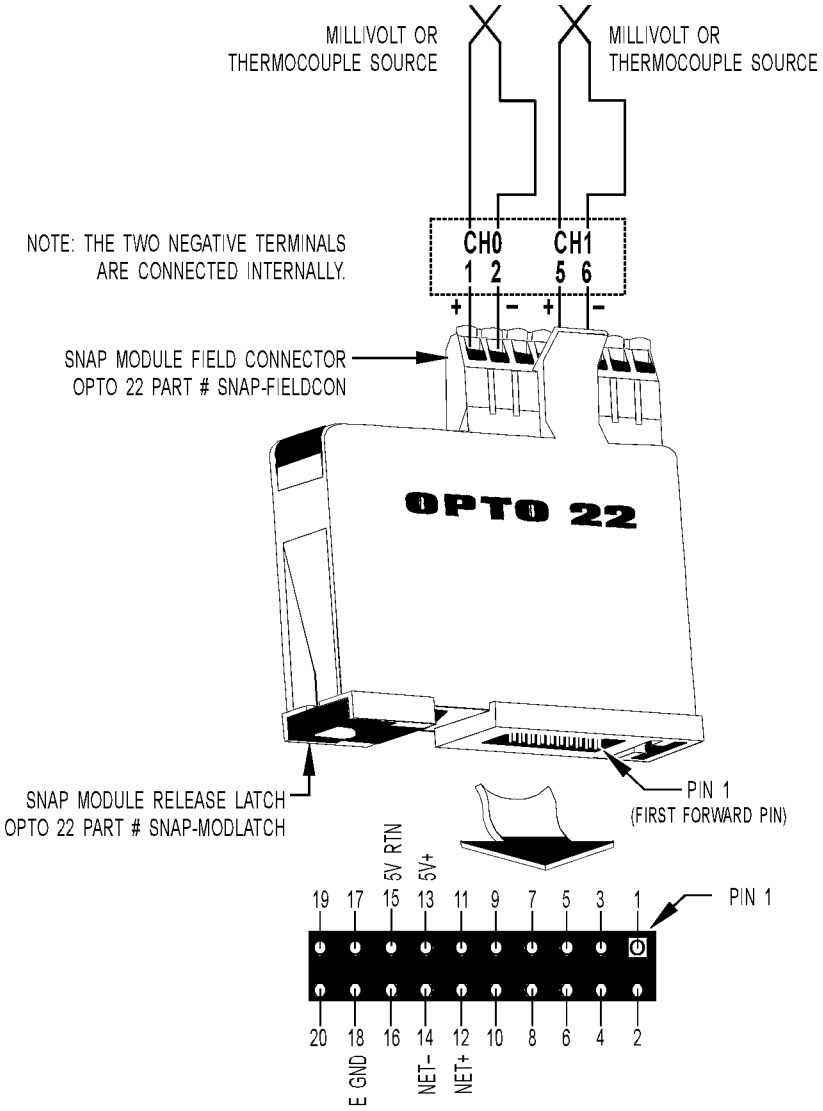
SNAP-AIMA



SNAP ANALOG MODULE BASE CONTROL CONNECTOR (BOTTOM VIEW)

Thermocouple/Millivolt Input Module

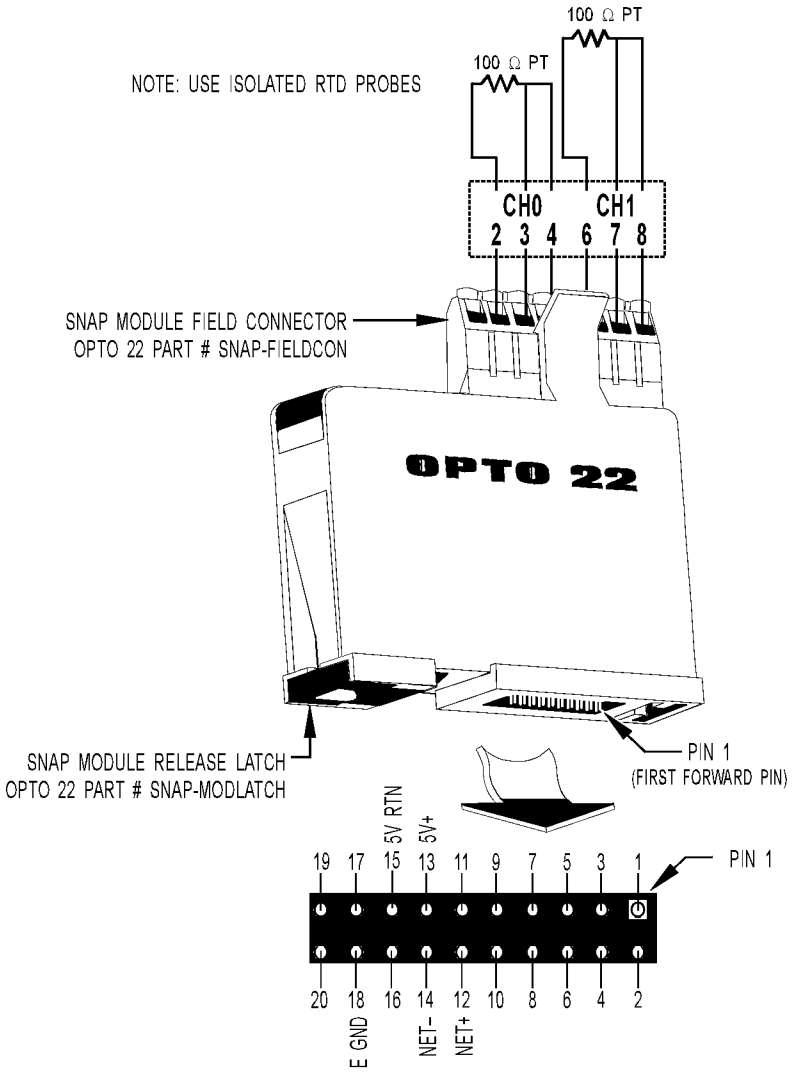
SNAP-AITM-2



SNAP ANALOG MODULE BASE CONTROL CONNECTOR (BOTTOM VIEW)

RTD Input Module

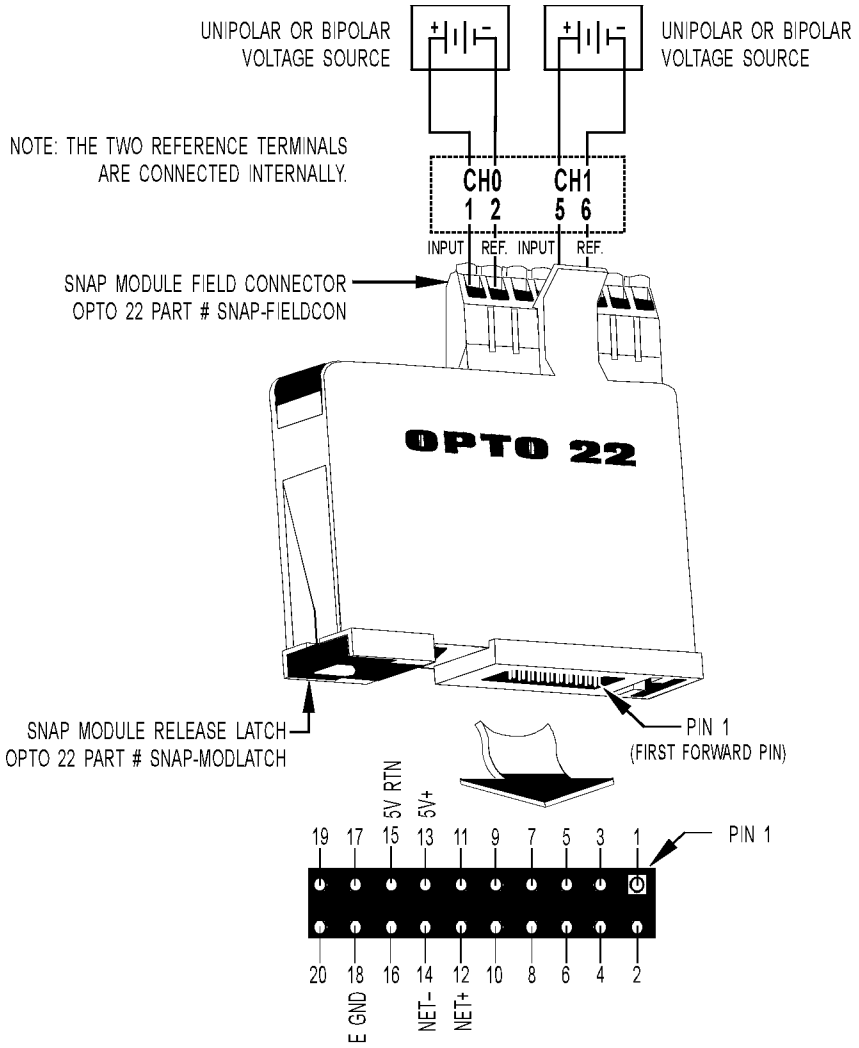
SNAP-AIRTD



SNAP ANALOG MODULE BASE CONTROL CONNECTOR (BOTTOM VIEW)

Voltage Input Module

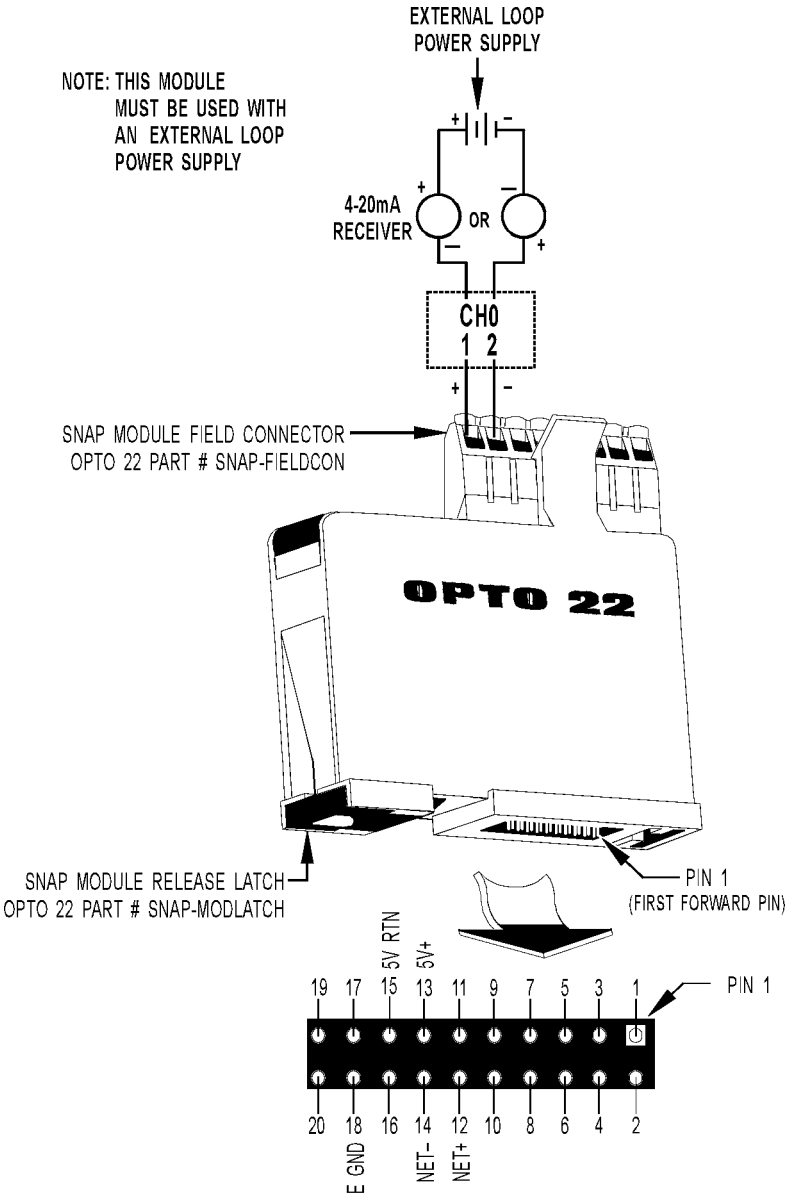
SNAP-AIV



SNAP ANALOG MODULE BASE CONTROL CONNECTOR (BOTTOM VIEW)

Current Output Module

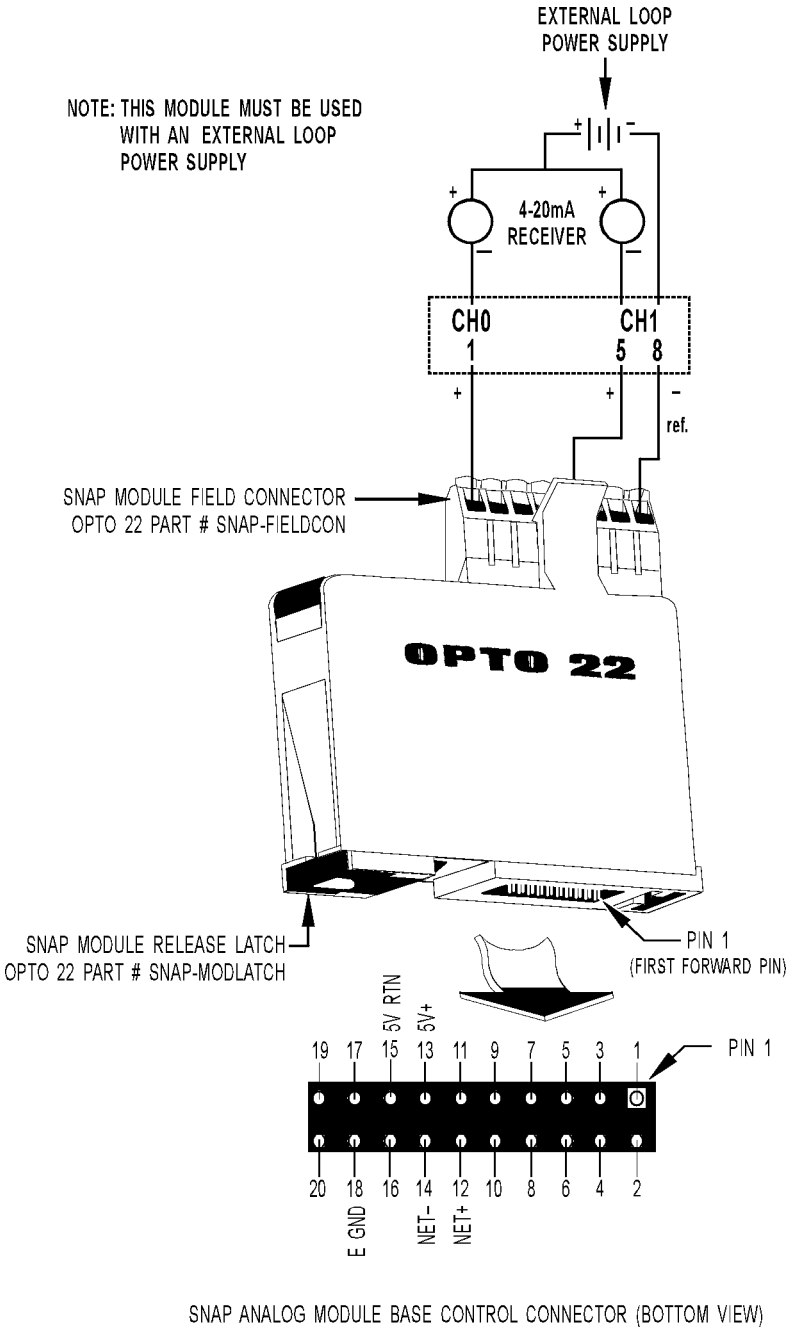
SNAP-AOA-3



SNAP ANALOG MODULE BASE CONTROL CONNECTOR (BOTTOM VIEW)

Dual Current Output

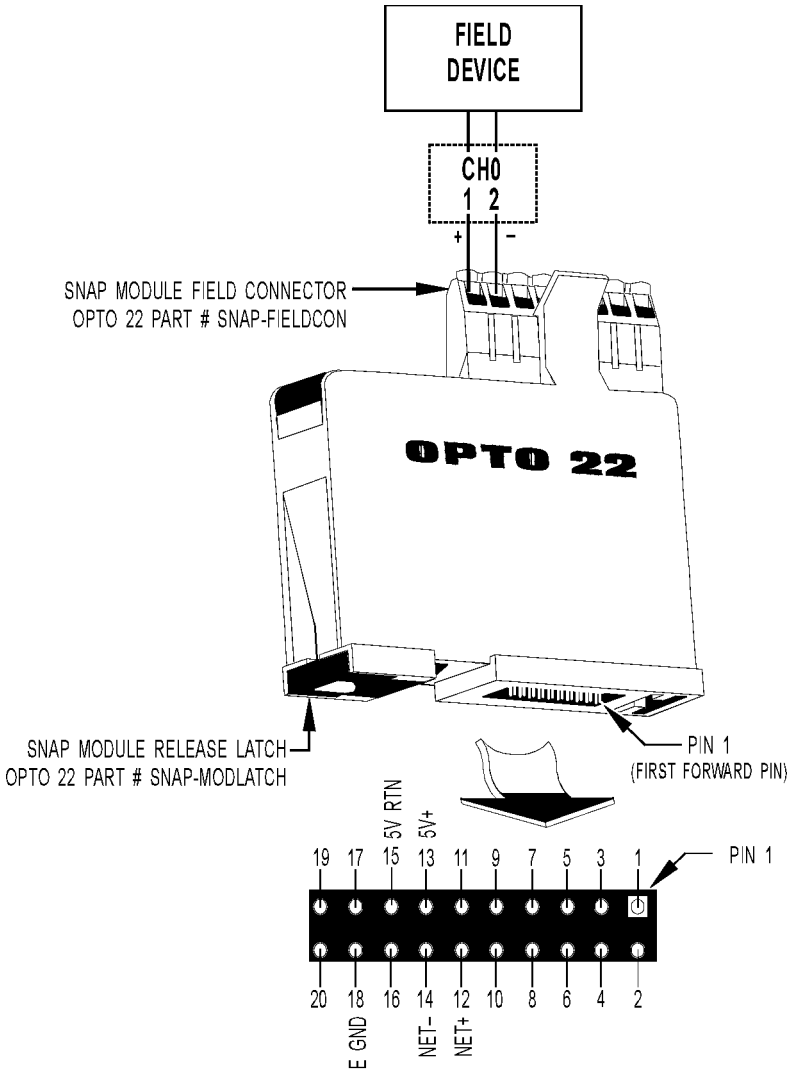
SNAP-AOA-23



SNAP ANALOG MODULE BASE CONTROL CONNECTOR (BOTTOM VIEW)

Voltage Output Module

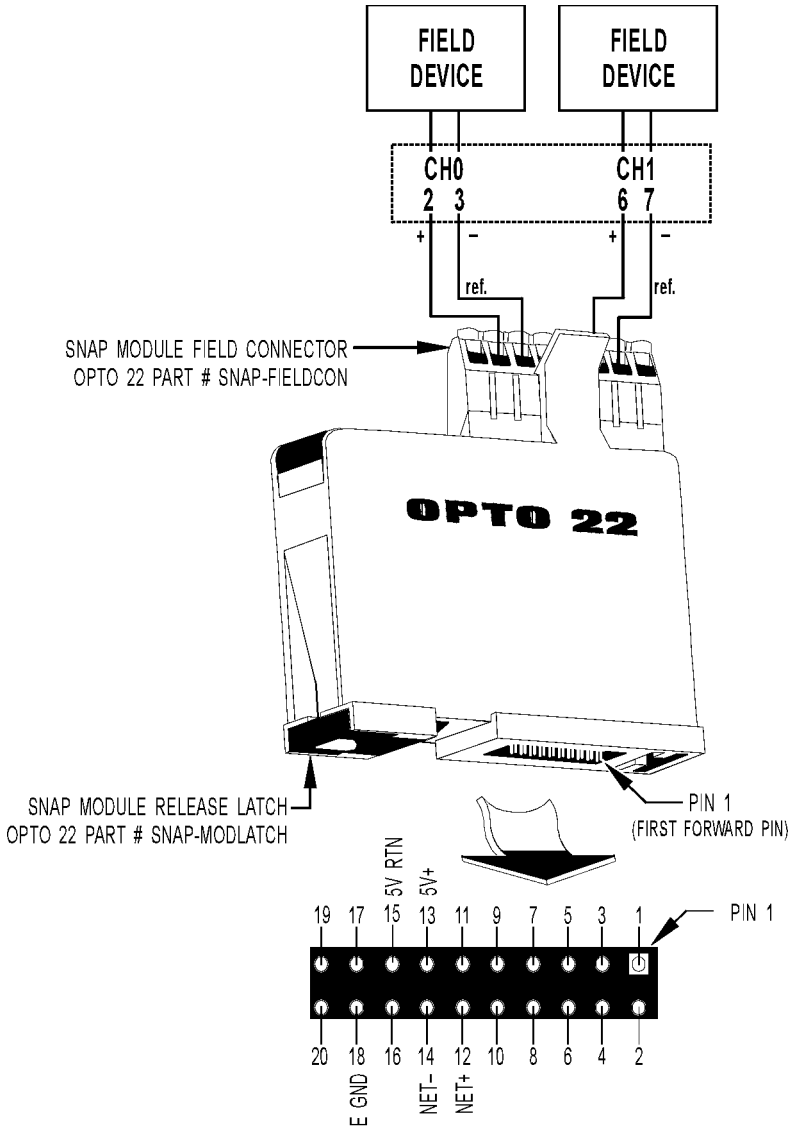
SNAP-AOV-5



SNAP ANALOG MODULE BASE CONTROL CONNECTOR (BOTTOM VIEW)

Voltage Output Module

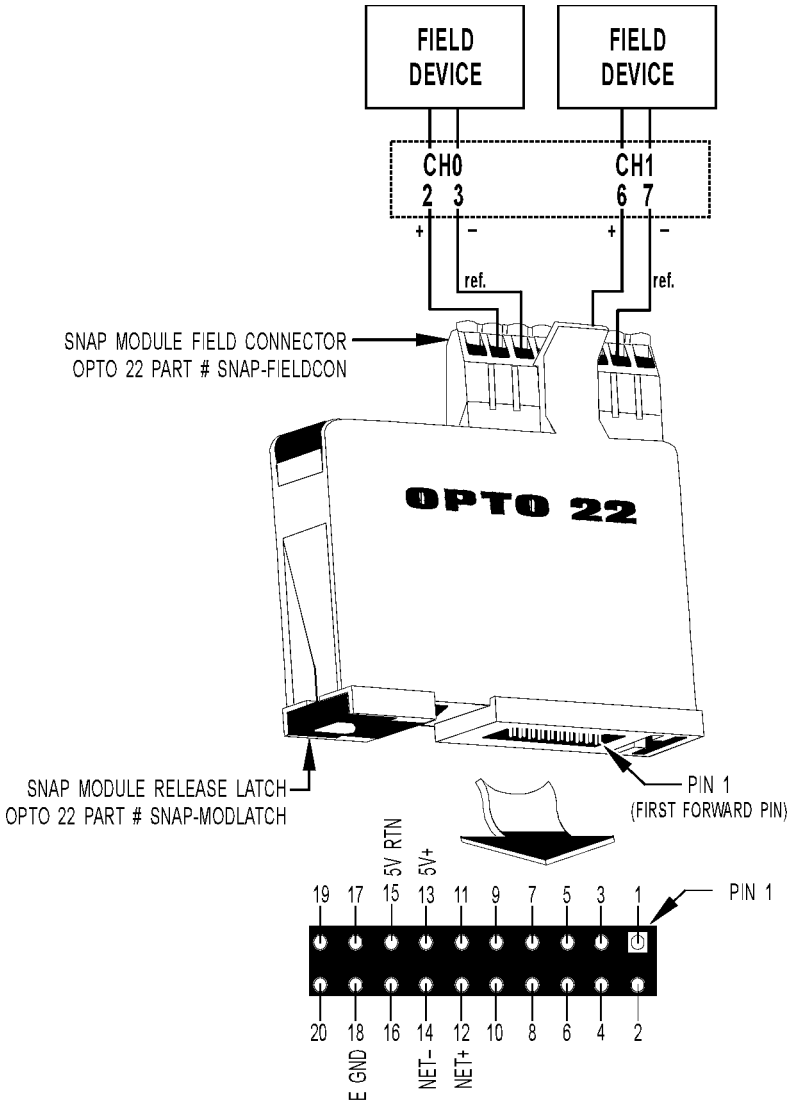
SNAP-AOV-25



SNAP ANALOG MODULE BASE CONTROL CONNECTOR (BOTTOM VIEW)

Voltage Output Module

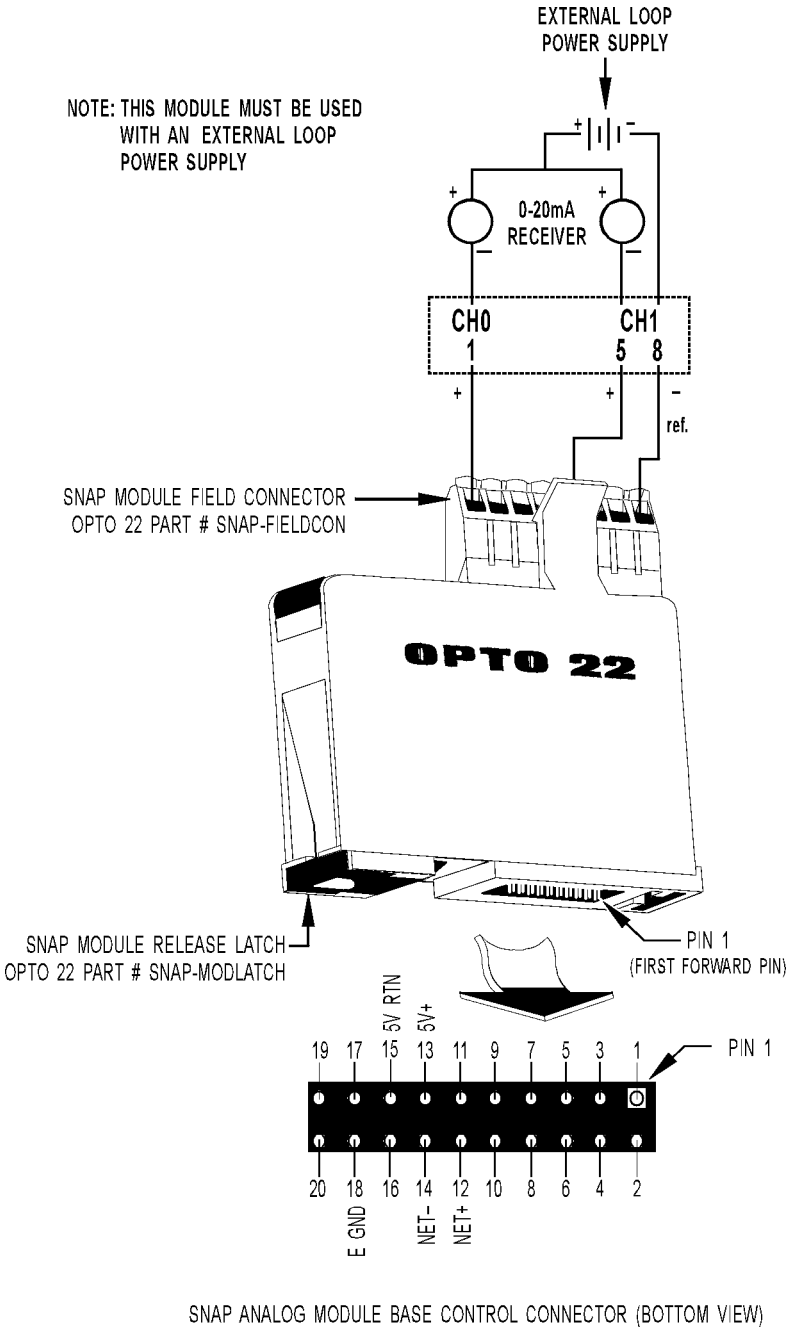
SNAP-AOV-27



SNAP ANALOG MODULE BASE CONTROL CONNECTOR (BOTTOM VIEW)

Dual-Channel Current Output Module

SNAP-AOA-28



SNAP ANALOG MODULE BASE CONTROL CONNECTOR (BOTTOM VIEW)

G4D16R/G4A8R Baud/Address Jumpers, LED Descriptions

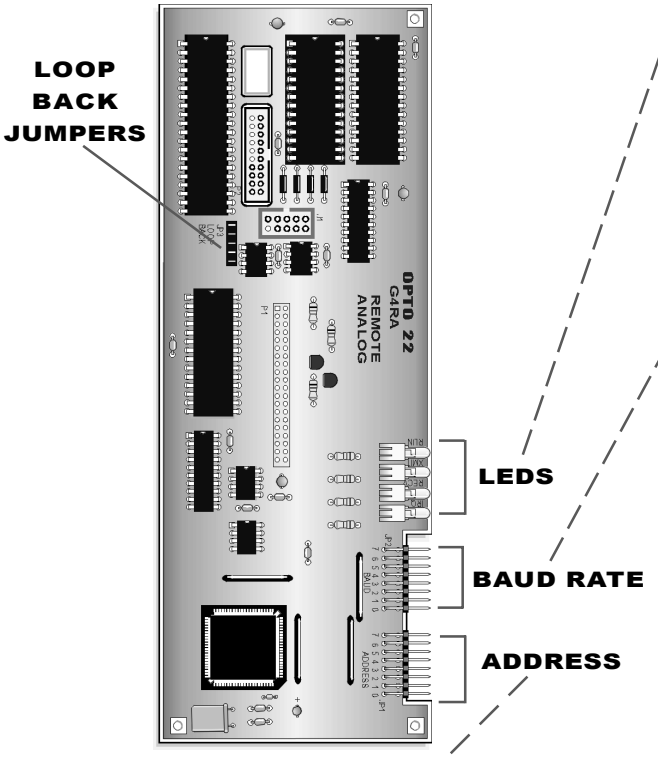


Table 2-2: LED Description Table

LED	DESCRIPTION
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

Table 2-3: Baud Rate Jumpers

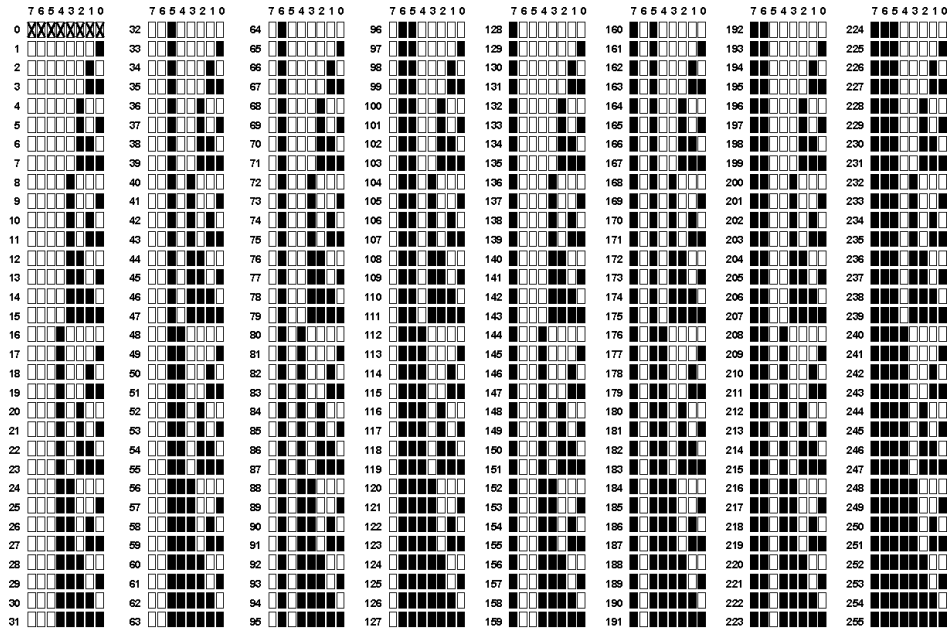
BAUD RATE	JUMPER POSITION 3	2	1	0
115.2 KBaud (factory default setting)	■	■	■	□
76.8 KBaud	■	■	□	■
57.6 KBaud	■	■	□	□
38.4 KBaud	■	□	■	■
19.2 KBaud	■	□	■	□
9600 Baud	■	□	□	■
4800 Baud	■	□	□	□
2400 Baud	□	■	■	■
1200 Baud	□	■	■	□
600 Baud	□	■	□	■
300 Baud	□	■	□	□

Baud 4
Binary ■ (Default)
ASCII □

Baud 5 Data verification
CRC16 ■ (Default)
Checksum Modulo 256 □

■ =JUMPER INSTALLED

Table 2-4: Address Table



■ = JUMPER INSTALLED □ = NO JUMPER

G4D32RS Baud/Address Jumpers, LED Descriptions

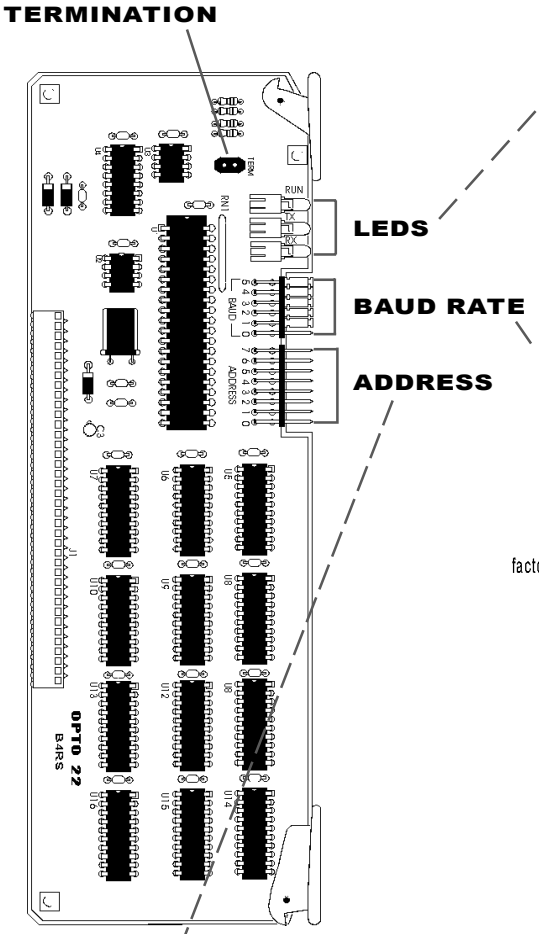


Table 2-5: LED Description Table

LED	DESCRIPTION
RUN	Power on Processor
TX	Processor is currently transmitting data on communication line.
RX	Processor is currently receiving data on communication line.

Table 2-6: Baud Rate Jumpers

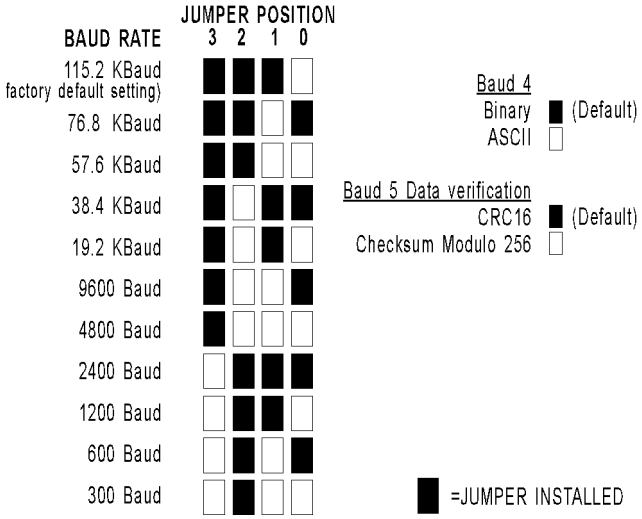
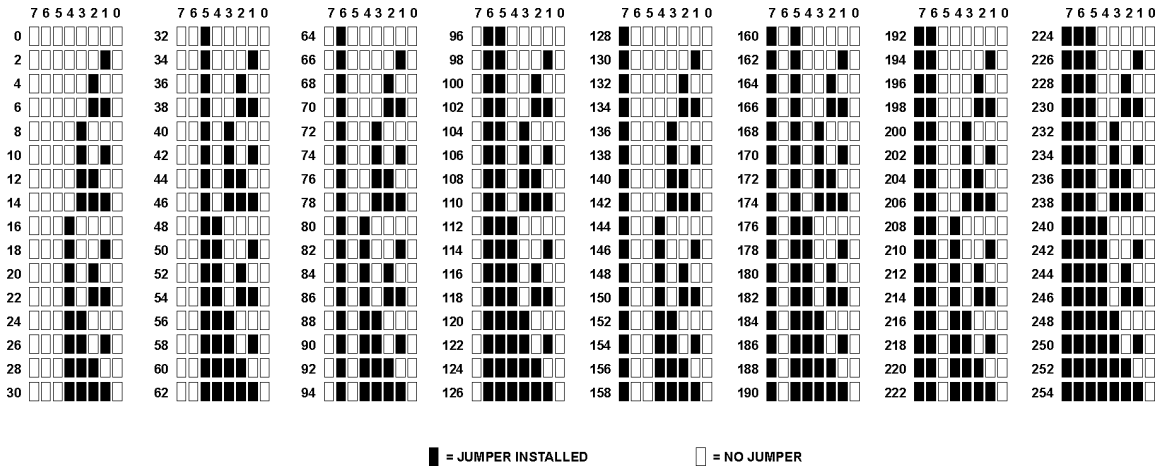


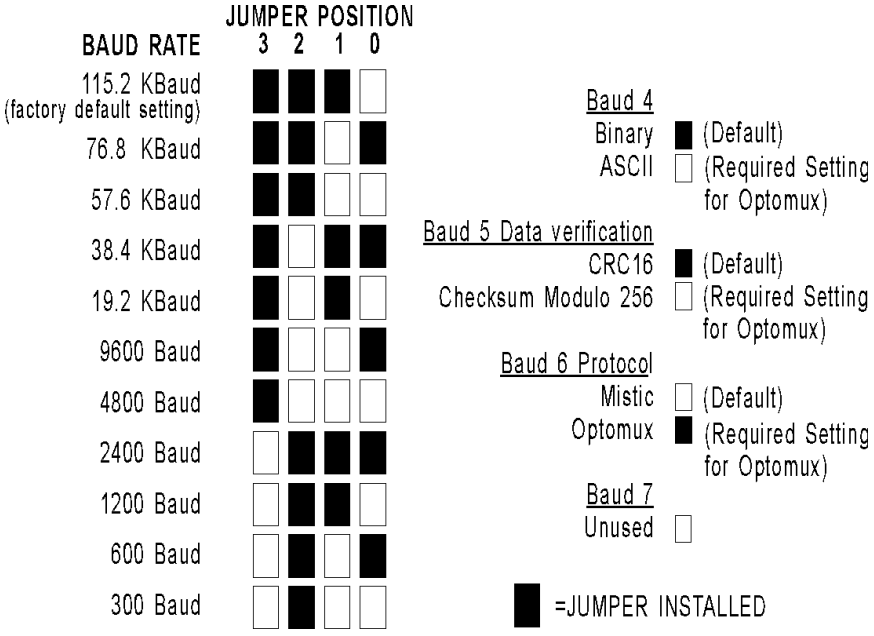
Table 2-7: Address Table



Baud Jumpers (Remote Bricks Only)

Examples:

- If you are using the Mistic controllers with Cyrano or OptoControl software, install jumpers 4 and 5. This selects binary protocol and CRC-16 data verification.
- If you are using a host computer and Misticware software to control bricks, you can select either type of protocol and data verification format. Make sure software driver command selections are the same as jumper selections.
- If a third party software package is used to control the bricks from a host computer (no controller), consult their manual to find out what protocol and data verification method is supported.



B3000 Baud/Address Jumpers, LED Descriptions

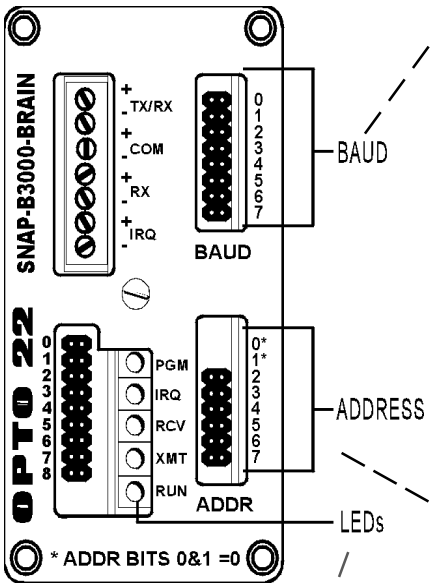


Table 2-8: Baud Rate Jumpers (0 - 3)

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 Settin for Optomux)

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

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

Baud 7
Unused □

■ =JUMPER INSTALLED

Table 2-9: Address Table

	7 6 5 4 3 2		7 6 5 4 3 2		7 6 5 4 3 2		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

Address Configuration Notes:
1. Jumper positions 0 and 1 have no provision to install jumpers. These jumper positions are always set open by default.

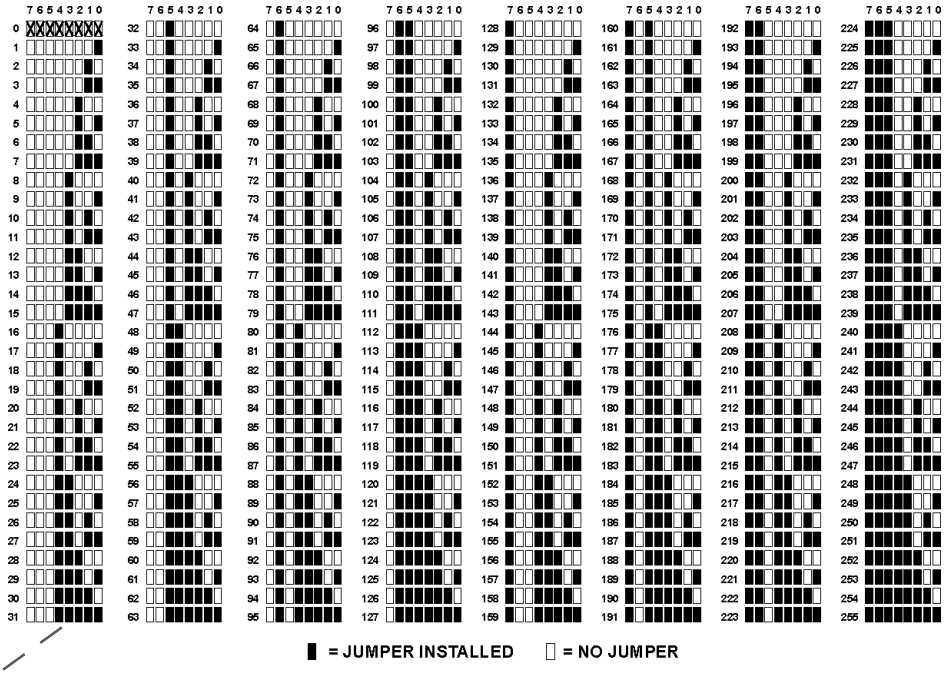
Table 2-10: LED Description Table

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)

B100 Baud/Address Jumpers, LED Descriptions

Address Jumpers (ADDRESS 0-7)
Use these jumpers to select an 8-bit address from 0 to 255 (0 to FF hexadecimal). The factory default is 0 (all jumpers out). The most significant bit is 7 and the least significant bit is 0.

Table 2-11: Address Table



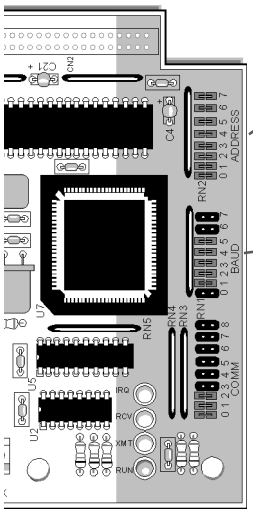


Table 2-12: Baud Rate Jumpers (0 - 3)

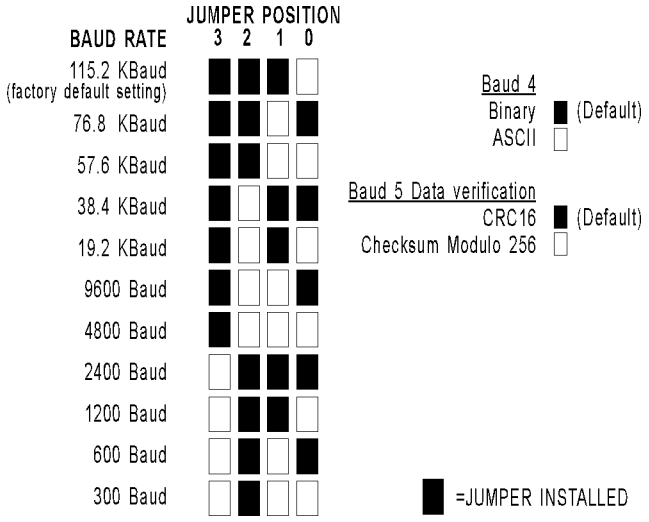


Table 2-13: LED Description Table

LED	Description
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

B200 Baud/Address Jumpers, LED Descriptions

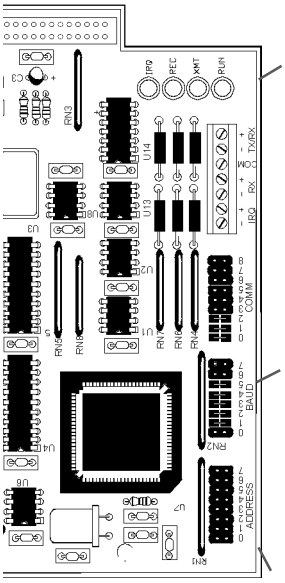


Table 2-14: LED Description Table

LED	Description
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

Table 2-15: Baud Rate Jumpers (0 - 3)

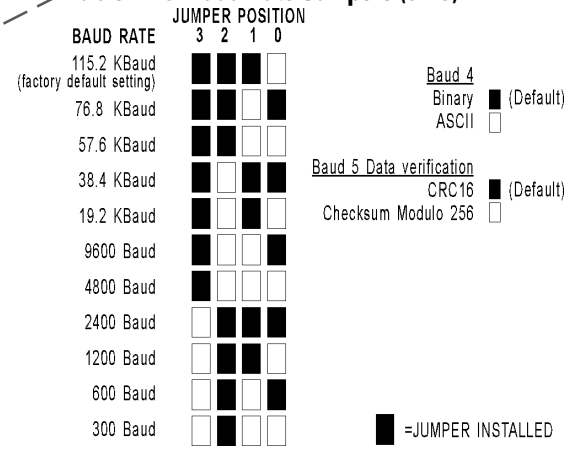
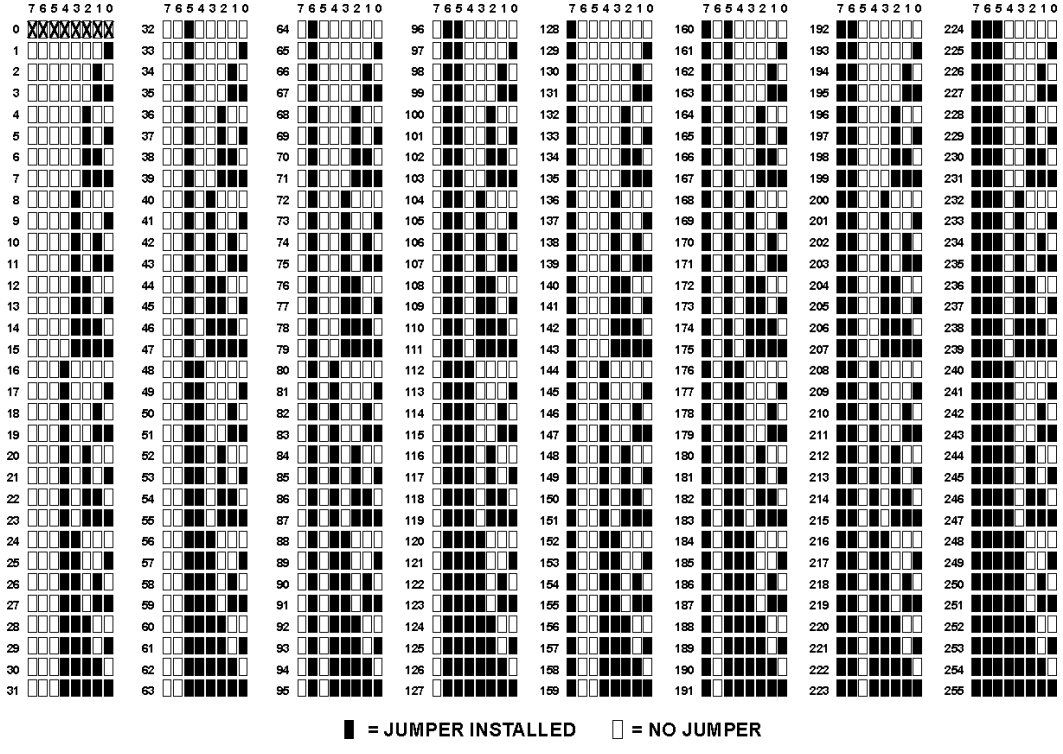


Table 2-16: Address Table



Power On Checkout

CAUTION: Do Not Apply Power to Field Devices Until All Field Wiring is Checked.

1. Apply Power. If using a Mistic power supply, turn key switch on power supply to "ON" position.
2. Check each G4REG for: 5 volt LED
   24 volt LED
3. Check that each brain board's RUN LED is ON.

If the above LED indicators are illuminated, turn off power. Installation is complete. If any LED's are not on, then:

1. If G4REG "FUSE BAD' LED is on, replace the regulator fuse with a 1 Amp fuse, P/N Fuse01G4.
2. Check the voltage of the brick rack with a voltmeter. These test points are found on either side of the brick rack jackscrew. It should be 24 volts ± 0.5 volts. If correct voltage is there, replace G4REG (LED is bad).
3. If the "RUN" LED on the brain board is blinking, remove power and verify the brain board EPROM and CPU are seated properly in their sockets. Apply power. If "RUN" LED is still blinking, replace brain board.
4. If the "RUN" LED on the brain board is not ON, remove power and check that the brain board is seated properly on the brick rack. Apply power. If "RUN" LED is still off, replace the brain board.
5. Refer to Appendix D - Troubleshooting Guide.
6. Call the factory at 1-800-835-6786 or 951-695-3080 for technical support.

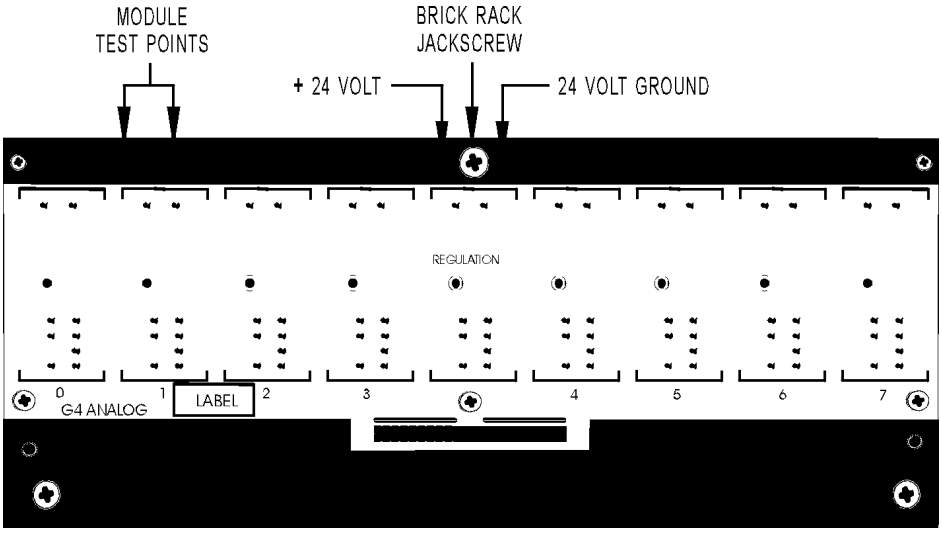


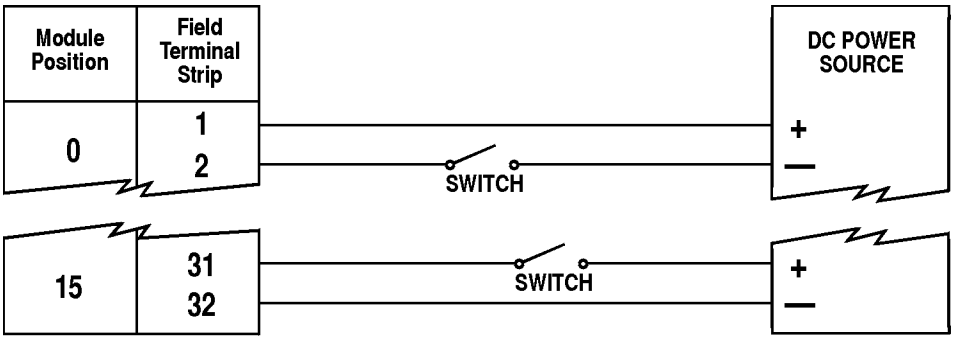
Figure 2.1: Analog Brick Rack

Field Wiring For Standard & G4 Digital Modules

Table 2-17: Inputs using DC field voltages

IDC	IAC*	G4IDC	G4IAC*
IDC5	IAC5	G4IDC5	G4IAC5
IDC5B	IAC5A	G4IDC5B	G4IAC5A
IDC5D		G4IDC5D	G4IAC5MA
IDC5G		G4IDC5G	
		G4IDC5K	
		G4IDC5MA	

**NOTE: These "AC" input modules will work with either AC or DC field voltages.*



NOTE: Positive voltage connects to the odd numbered terminals for each module position. Negative/ground connects to the even numbered terminals for each module position.

Table 2-18: Inputs using AC field voltages

IAC	IDC*	G4IAC	G4IDC*
IAC5	IDC5	G4IAC5	G4IDC5
IAC5A	IDC5G	G4IAC5A	G4IDC5G
		G4IAC5MA	G4IDC5MA

**NOTE: These "DC" input modules will work with either AC or DC field voltages.*

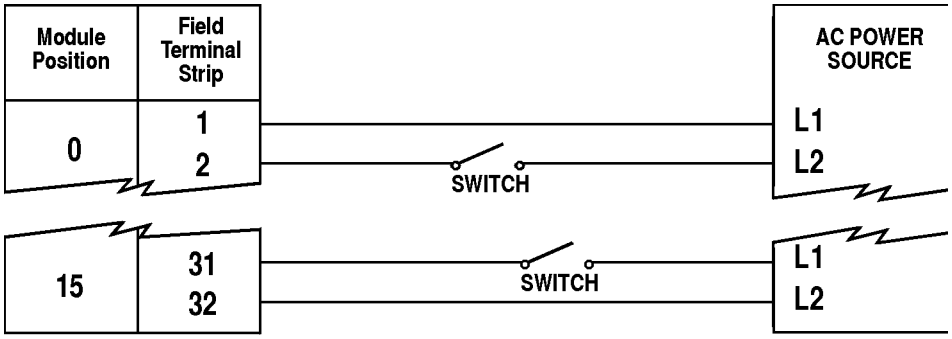


Table 2-19: Outputs using AC field voltages

OAC5	G4OAC5
OAC5A	G4OAC5A
OAC5A5	G4OAC5A5
	G4OAC5MA
	G4OAC5AMA

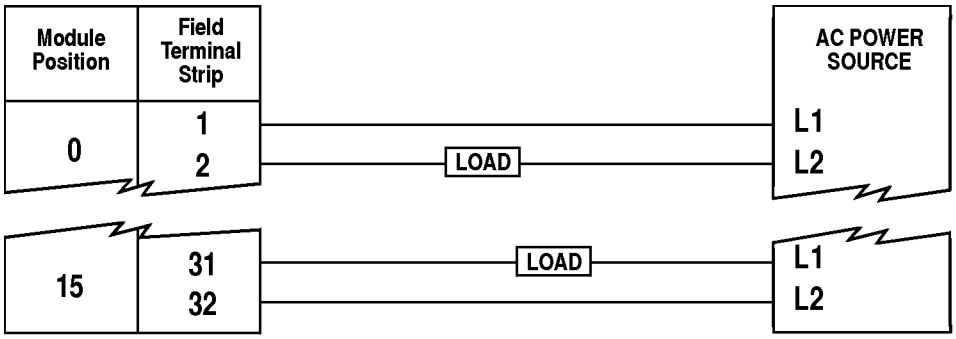
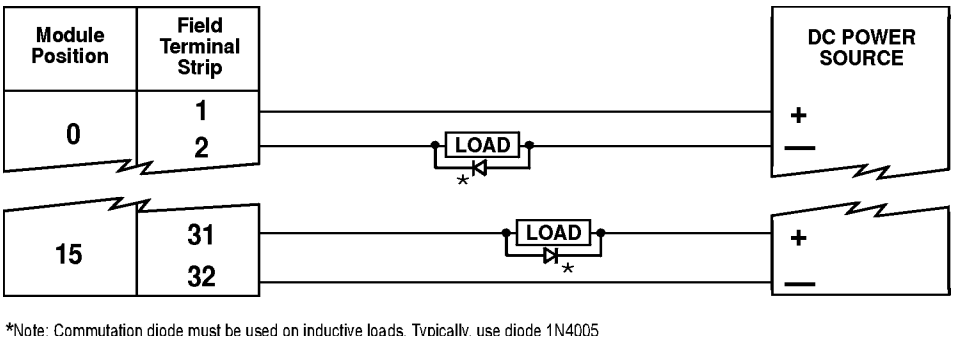


Table 2-20: Outputs using DC field voltages

ODC5	G4ODC5
ODC5A	G4ODC5A
	G4ODC5MA



**NOTE: Commutation diode must be used on inductive loads. Typically, use diode 1N4005.*

Field Wiring For Digital Quad Pak Modules

Each quad pak I/O module consists of two pairs of circuits. These circuit pairs share a common point.

A quad pak module connects to four numbered terminals and two common ("C") terminals, as follows:

- Terminal 1 and the upper C terminal correspond to a circuit in channel 0.
- Terminal 2 and the upper C terminal correspond to a circuit in channel 1.
- Terminal 3 and the lower C terminal correspond to a circuit in channel 2.
- Terminal 4 and the lower C terminal correspond to a circuit in channel 3.

For polarized modules, the positive connection goes to the C terminal and the negative connection goes to the numbered terminal.

Input Modules

Use Figure 2-2 on the following page, to wire the quad pak DC and AC input modules listed in Table 2-21. The diagram shows a DC input module wired to channels 16–19 and an AC input module wired to channels 0–3 on a PB32HQ rack.

For the quad pak input modules listed in Table 2-21, the input device may be wired to either terminal. The polarity of the power does not matter for any of the modules.

Table 2-21: DC/AC Quad Input Modules

DC Input Modules	AC Input Modules
ICD5Q	IDC5Q
IDC5BQ	IAC5Q
IAC5Q	IAC5AQ
IAC5AQ	

Output Modules

Use Figure 2-2 to wire the quad pak DC and AC output modules listed in Table 2-22. The diagram shows a DC output module wired to channels 24–27 and an AC output module wired to channels 8–11 on a PB32HQ rack.

For the quad pak output modules listed in Table 2-22, the load may be wired to either line.

Note that the 'C" terminal of DC output modules must be more positive when switching DC leads.

For DC output modules used with inductive loads, add a commutating diode (typically a 1N4005) to the circuit as shown on the channel 27 connection to the PB32HQ rack.

Table 2-22: DC/AC Quad Output Modules

DC Output Modules	AC Output Modules
ODC5Q	OAC5Q
ODC5AQ	

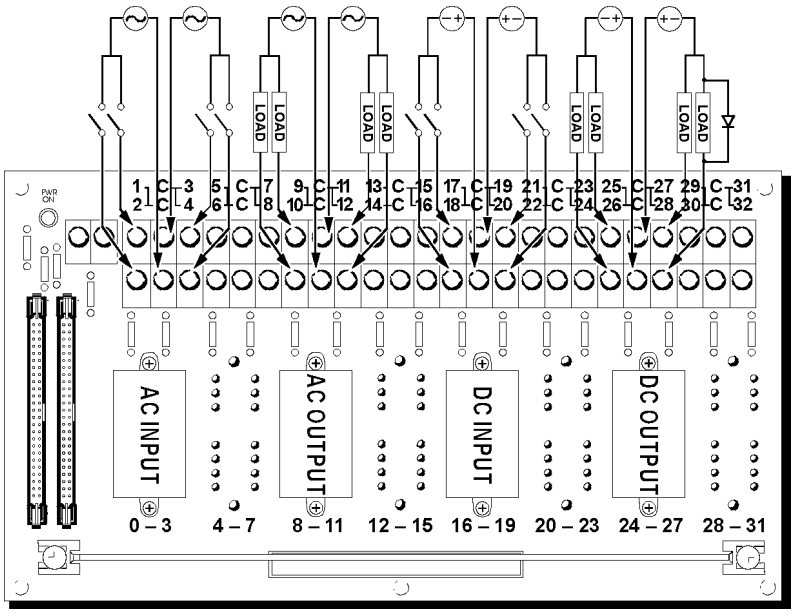


Figure 2-2: Field Wiring for Quad Modules

CHAPTER 3

Communications

Introduction

There are two communication schemes for Mistic equipment, remote and local. Remote systems are based on RS-422/485 communication protocol and local systems operate over a high speed parallel bus. Bricks are attached to the network with a communications cable. An overview is given on key differences.

Local Bus Overview

The advantage of local systems is the speed at which commands are sent over a 34-conductor ribbon cable to the I/O bricks from a host. Facts about the Mistic local bus:

- The maximum communication cable length is 200 feet from host to last brick.
- The bus speed is 1.4MHz.
- Uses 34-conductor, flat-ribbon cable.
- Has 12 active lines and 17 ground lines.
- Its address or data is selected by pin 3.
- Has open collector bus drivers.
- Its propagation delay is 1.7ns per foot.
- It automatically adjusts bus times between 200 and 700ns.
- There is no reset line.
- Only one *Mistic* controller per local bus.
- A maximum of 139 bricks connected to the bus. The number of bricks on the bus is directly related to number of bricks connected within the 200 foot bus cable length limit.
- Termination is required at beginning and end of local bus. With the Mistic controller or AC39 at beginning, the bus is automatically biased. An AC39 uses a G4TERML board for termination. The G4TERML is also used for termination on last brick brain board.

Table 3-1: Local I/O Bus Cable Pinouts

Pin	Signal Function
3	A/D master, 1 = address or 0 = data select
9	IRQ interrupt request
11	DTAK active low
15	DS active low
19	D0 data line or A0 address
21	D1 data line or A1 address
23	D2 data line or A2 address
25	D3 data line or A3 address
27	D4 data line or A4 address
29	D5 data line or A5 address
31	D6 data line or A6 address
33	D7 data line or A7 address

NOTE: All even numbered pins on the connector are connected to logic ground. In the inactive state, all lines are high.

Remote Communication Overview

Remote RS-485 systems are ideal for applications requiring a high degree of noise immunity and transmission over long distances at high baud rates. Additional information about the bus:

- Maximum communication cable length is 3000 feet from host to last I/O unit (without repeaters).
- Maximum data transmission speed is 115.2K baud.
- Use AC38 Repeater for every 32 units (controllers or I/O units) on bus.
- Up to 256 controllers on network.
- Maximum of 4096 I/O points per network.
- Communication wire type is a shielded twisted pair.
- Termination required at beginning and ending of bus, biasing required at one end only.
- Separate IRQ interrupt request line.

ARCNET Overview

ARCNET is a baseband, token-passing local area network (LAN) technology offering high reliability and throughput. As many as 255 ARCNET devices can be connected to an ARCNET network. Connections are made using either RG62A/U 93 ohm coaxial cable and standard BNC connectors or twisted pair with RJ-11 connector. Unused ports on a passive hub require 93 ohm terminators. Passive hubs typically have four ports for connections and relay signals without amplifying them. Active hubs can have as few as 4 ports and as many as 48 ports which amplify the signal, and do not require termination on unused ports. Table 3-2 lists maximum cable lengths for ARCNET configurations.

Table 3-2: Maximum ARCNET Cable Distances

Total network distance (end to end)	20,000 ft.
Active Hub to Active Hub	2,000 ft.
Active Hub to mistic controller (or to Host PC)	2,000 ft.
Active Hub to Passive Hub	100 ft.
Passive Hub to mistic controller (or to Host PC)	100 ft.

Additional ARCNET Specifications

Data transfer rate:	2.5 Mbits/sec
Address range:	1 to 255
Signal levels (normal):	20 Vpp output - 7.5 Vpp input
Signal levels (minimum):	16 Vpp output - 6.0 Vpp input
Topology:	'Star' topology

ARCNET Boards

The following ARCNET boards have been tested with Cyrano and OptoControl and are recommended.

Contempory Control Systems, Inc.

Phone No. 630-963-7070

Fax No. 630-963-0109

CoAxial Model: PCA66-CXS

Fiber Optic Model: PCA66-FOG-ST

Fiber Optic Overview

The AC40 Fiber Optic Data Link Adapter and AC42 IBM AT Fiber Optic Communications Coprocessor offer fiber optic communications to Mistic products. Fiber optic networks can be as long as 3.5 kilometers (about 11,480 feet) and offer a data link electrically-isolated and completely immune to electrical noise. Opto 22 fiber optic receivers and transmitters are optimized for 62.5/125 µm cable with 'ST' style connectors. Other fiber diameters can be used but performance specifications fall off rapidly.

Table 3-3: Fiber Optic Transmitter and Receiver Characteristics

Transmitter Characteristics (All Types)	
Optical Power Output:	-12.0dBm
Peak Emission Wavelength:	820 nm
Numerical Aperture:	0.31
Optical Port Diameter:	150 µm
Receiver Characteristics (All Types)	
Receiver Sensitivity:	-24.0 dBm
Equivalent Numerical Aperture:	0.50
Optical Port Diameter:	400 µm

G4LC32 Serial Port Pinouts

The following sections discuss pin connections for cables to serial ports on Mistic controllers.

RS–422/485 Ports

RS-422/485 connectors (COM0, COM1, COM2, COM3) on the G4LC32 use a pluggable 7-terminal block. Pinouts are:

Table 3-4: G4LC32, RS-422/485 Serial Port Pinouts

Pin	2-Wire Model	4-Wire Model
1	TX/RX+	Transmit (+), TX+
2	TX/RX-	Transmit (-),TX-
3	Common ground	Common ground
4	N/C	Receive (+), RX+
5	N/C	Receive (-) RX-
6	Interrupt (+)	Interrupt (+)
7	Interrupt (-)	Interrupt (-)

RS–232 Ports

The G4LC32 has two RS-232 ports (COM0 and COM1) with RTS/CTS handshake capability. A fused + 5 VDC, 1A supply is included. RS-232 connectors are pluggable 7-terminal blocks. Pinouts are:

Table 3-5: G4LC32, RS-232 Serial Port Pinouts

Pin	Description
1	+5VDC (1A)
2	Transmit (TX)
3	Receive (RX)
4	Request-to-Send (RTS)
5	Clear-to-Send (CTS)
6	DTR (+9 volts)
7	Ground (GND)

G4LC32SX Serial Port Pinouts

RS–422/485 Ports

RS-422/485 connectors (COM0 and COM1) on the G4LC32SX use a pluggable 7-terminal block. Pinouts are:

Table 3-6: G4LC32SX, RS-422/485 Serial Port Pinouts

Pin	2-Wire Mode	4-Wire Mode
1	Transmit/Receive Plus (TX/RX +)	Transmit Plus (TX +)
2	Transmit/Receive Minus (TX/RX -)	Transmit Minus (TX -)
3	Common Grouond (GND)	Common Ground (GND)
4	No Connection (N/C)	Receive Plus (RX +)
5	No Connection (N/C)	Receive Minus (RX -)
6	Interrupt Plus (IRQ +)	Interrupt Plus (IRQ +)
7	Interrupt Minus (IRQ -)	Interrupt Minus (IRQ -)

RS–232 Ports

The G4LC32SX has two RS-232 ports (COM0 and COM1) with RTS/CTS handshake capability. A fused + 5 VDC, 1A supply is included. RS-232 connectors are pluggable 7-terminal blocks. Pinouts are:

Table 3-7: G4LC32SX, RS-232 Serial Port Pinouts

Pin	Description
1	+5VDC (1A)
2	Transmit (TX)
3	Receive (RX)
4	Request-to-Send (RTS)
5	Clear-to-Send (CTS)
6	DTR (+9 volts)
7	Ground (GND)

M4/M4RTU Serial Port Pinouts

RS-485 COM1 Pin Connections

An RS-485 COM1 port is also built into the M4/M4RTU base unit. Table 3-8 contains descriptions for each COM1 pin for both 2-wire and 4-wire modes.

Note that the interrupt lines can be used to add interrupt capability to Opto 22 I/O units connected to the M4/M4RTU via a RS-485 serial link (remote).

Table 3-8: Pin Descriptions for the M4/M4RTU COM1 Serial Port

Pin	2-wire Mode	4-wire Mode
1	Transmit/Receive Plus (TX/RX +)	Transmit Plus (TX +)
2	Transmit/Receive Minus (TX/RX -)	Transmit Minus (TX -)
3	Common Ground (GND)	Common Ground (GND)
4	No Connection (N/C)	Receive Plus (RX +)
5	No Connection (N/C)	Receive Minus (RX -)
6	Interrupt Plus (IRQ +)	Interrupt Plus (IRQ +)
7	Interrupt Minus (IRQ -)	Interrupt Minus (IRQ -)

RS-232 COM0 Pin Connections

The M4/M4RTU has one built-in RS-232 COM0 serial port. Table 3-9 contains descriptions for each COM0 pin.

Important: *If RTS and CTS are not used, RTS must be connected to CTS (COM0 only) on the M4/M4RTU.*

Table 3-9: Pin Descriptions for the M4/M4RTU COM0 Serial Port

Pin	COM0
1	Data Carrier Detect (DCD)
2	Transmit (TX)
3	Receive (RX)
4	Request-to-Send (RTS)
5	Clear-to-Send (CTS)
6	Data Terminal Ready (DTR)
7	Ground (GND)

Wiring Local Mistic Panels

Part number ***Local Panel 200*** consists of plastic wiring duct and hardware, an aluminum plate, (2) G4IOL, a G4TERML and a Local Cable 200. The Local Cable 200 is used for connecting local I/O bricks to the Mistic controller. Find the cable end with 16.5 inches between the first two connectors. This is the start of the cable. The opposite end of the cable has 4.5 inches between the last two connectors.

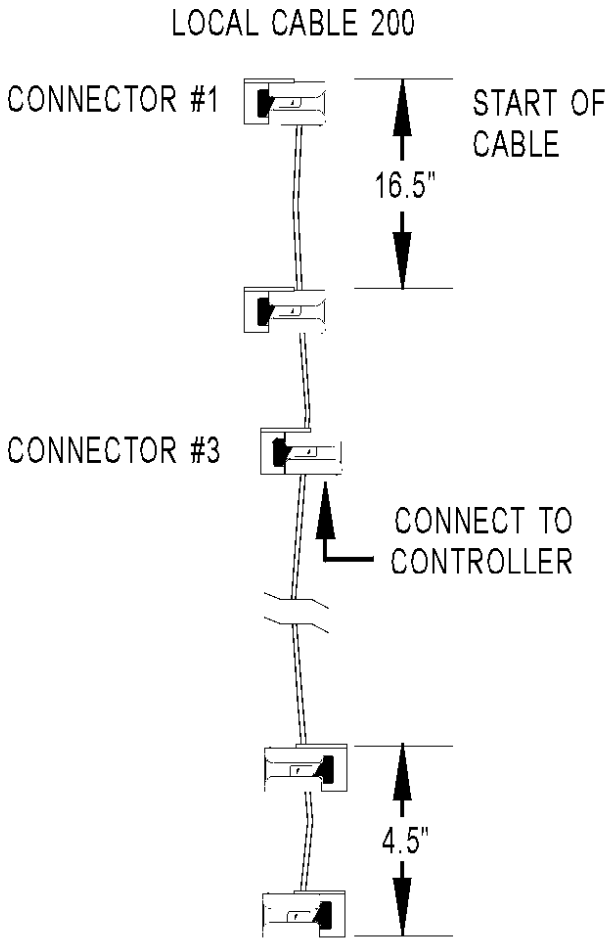


Figure 3.1: Local Cable 200

Panel Wiring With a Controller

1. Attach the third connector to the Mistic controller and cut off the first two connectors. See Figure 3-2.
2. Attach the remaining connectors into their corresponding bricks.
3. If the panel is complete and there are no additional panels or I/O bricks, cut off all excess connectors. Install a G4TERML on the last brick of the last panel in the network. See Figure 3-4.
4. If the panel is complete and there are additional panels or I/O bricks, attach the last connector to the right G4IOL board. See Figure 3-2.

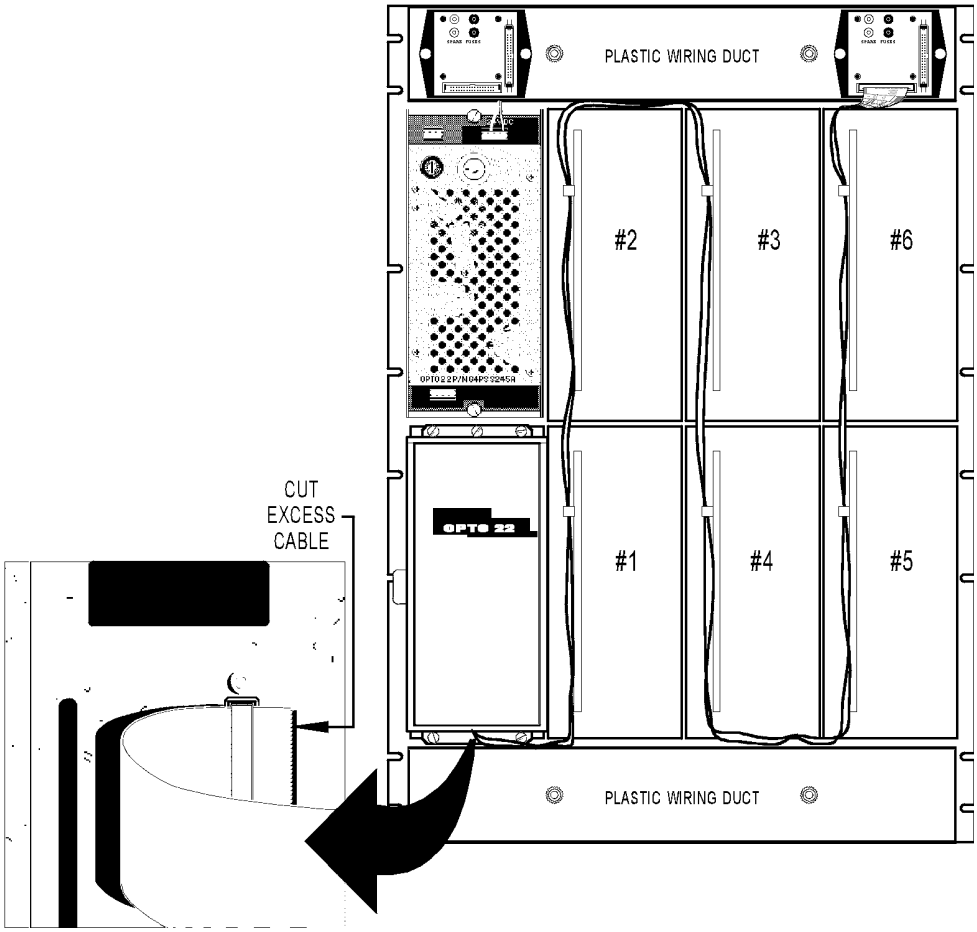


Figure 3-2: Local Bus Wiring for Panels with a Mistic Controller

Wiring Without a Controller, Multiple Panels

1. Attach connector #1 to the left G4IOL board. Attach connector #2 to the brain board at location #1. Attach the remaining connectors into their corresponding bricks. Connector #3 will remain unused in this panel. See Figure 3-3.
2. If the panel is complete and there are additional panels or I/O bricks, attach the last connector to the right G4IOL board. See Figure 3-3.

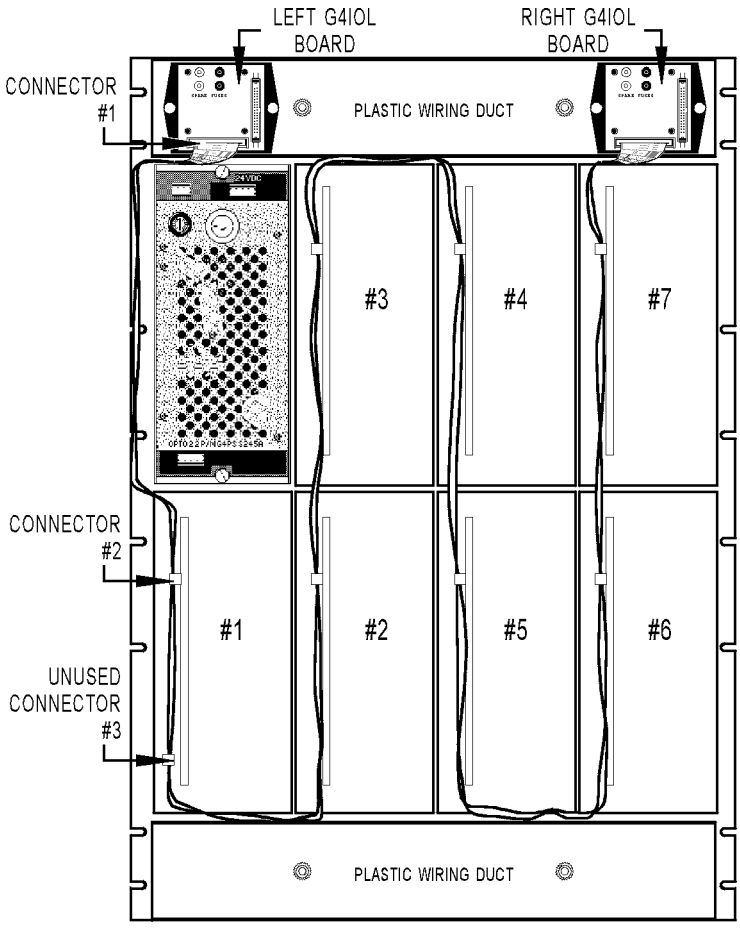


Figure 3-3: Local Bus Wiring for Multiple Panels without a Mistic Controller

Partial Panel Wiring

1. Attach the third connector to the Mistic controller and cut off the first two connectors. See Figure 3-2.
2. Attach the remaining connectors into their corresponding bricks.
3. If the panel is complete and there are no additional panels or I/O bricks, cut off all excess connectors. Install a G4TERML on the last brick of the last panel in the network. See Figure 3-4.

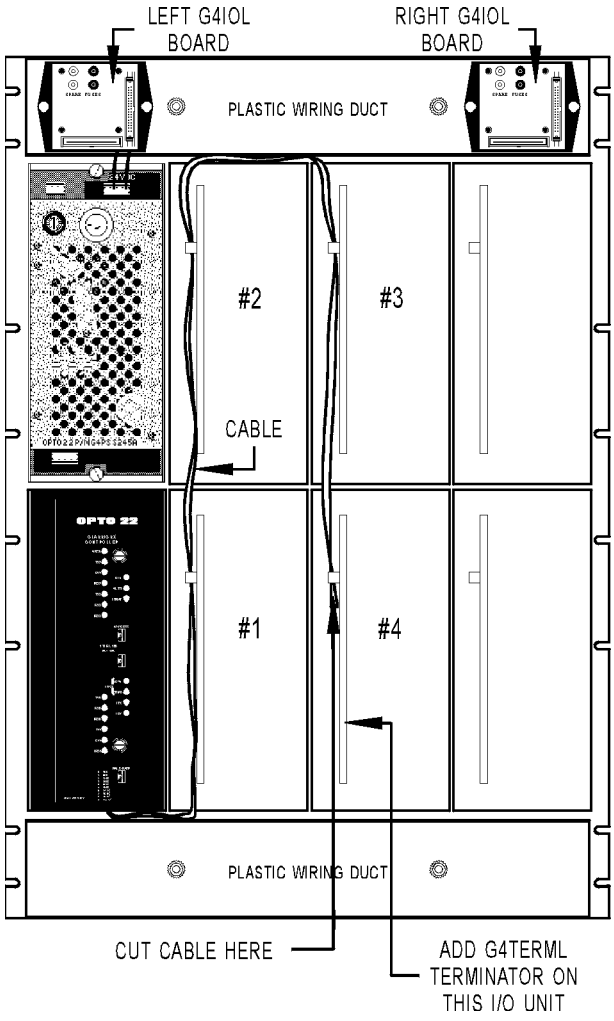


Figure 3-4: Mistic Controller Local Bus Wiring for Partial Panels

Wiring Remote Mistic Panels

Part number Remote Panel 200 consists of the following items:

- Plastic wiring duct and hardware
- Aluminum plate
- G4IOR and G4TERMR
- 10-conductor cable

Use the remote data cable to connect remote I/O bricks to the Mistic controller.

Find the cable end where the wires come into the connector on the same side as the key. This is the start of the cable. See Figure 3-5.

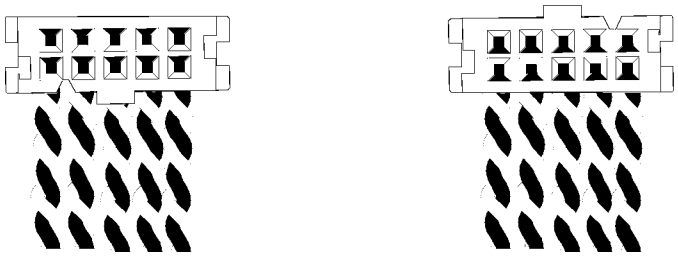


Figure 3-5: Start of Cable (left drawing) and End of Cable (right drawing)

Panel Wiring With a Controller

1. Attach connector #1 to the G4IOR board. Attach connector #3 to the first remote I/O brick. Attach the remaining connectors to their corresponding remote brick, then cut off all excess connectors. See Figure 3-6.
2. Install the **LOOPBACK JUMPERS** on the last brick of the remote data cable.
3. If the panel is complete and there are additional panels or I/O bricks, continue wiring from the right set of terminals on the G4IOR to the next remote panel or G4IOR.
4. If the panel is complete and there are no additional panels or I/O bricks. Install a G4TERMR in the right set of terminals on the G4IOR.

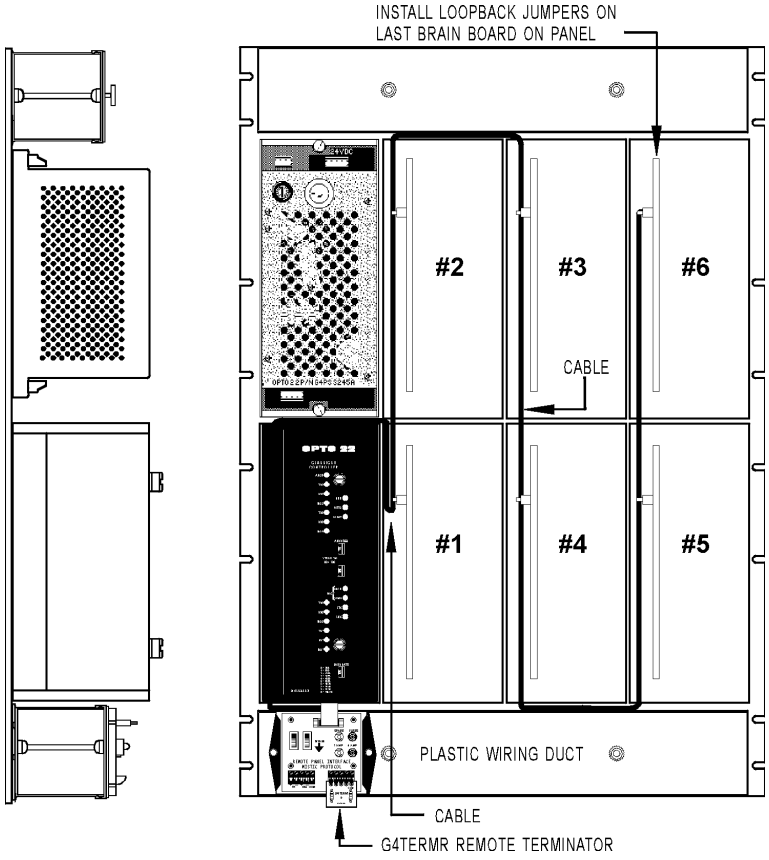


Figure 3-6: G4LC32SX Remote Bus Wiring - Single Panel

5. Wire the Mistic controller to the left set of terminals on the G4IOR. See Standard and Alternate 2-wire configuration for wiring instructions.

Wiring Without a Controller, Multiple Panels

1. Attach connector #1 to the G4IOR board. Attach connector #3 to the first remote I/O brick. Attach the remaining connectors to their corresponding remote brick. See Figure 3-6.
2. Install the **LOOPBACK JUMPERS** on the last brick of the remote data cable.
3. If the panel is complete and there are additional panels or I/O bricks, continue wiring from the right set of terminals on the G4IOR to the next remote panel or G4IOR.

Partial Panel Wiring

1. If wiring a group of 1 or 2 bricks, see the section on "Wiring Custom Remote Panels". Do not use the G4RPANEL kit.
2. Attach connector #1 to the G4IOR board. Attach connector #3 to the first remote I/O brick. Attach the remaining connectors to their corresponding remote brick, then cut off all excess connectors. See Figure 3-6.
3. Install the **LOOPBACK JUMPERS** on the last brick of the remote data cable.
4. If the panel is complete and there are no additional panels or I/O bricks. Install a G4TERMR in the right set of terminals on the G4IOR.

Wiring Custom Remote Panels

Wiring to Mistic Bricks

- For wiring Mistic bricks that are not on Mistic panels, use the SBTA adapters. The SBTA converts the 10-pin communications connector on the brain board to a screw terminal connection.
- The SBTA includes mounting hardware to secure it to the brain board. See Figure 3-7.
- Use the G4TERMR with the SBTA adapter when the brick is placed at the end of a communication link.

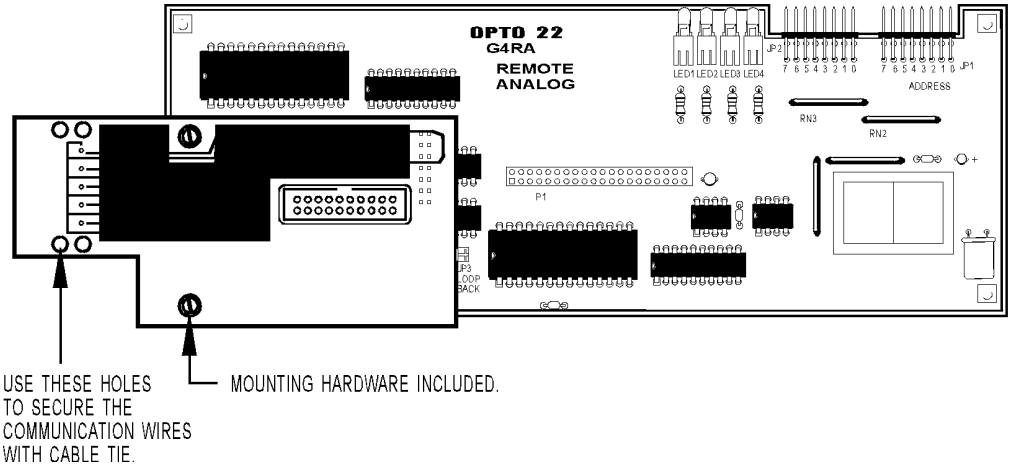


Figure 3-7: SBTA Installation and Wiring

Wiring to Remote Simples

- Remote simple I/O units do not require the SBTA converter. The wiring is connected directly to the board.
- Wiring to the remote simple brain boards must be done using a 2-wire configuration.
- Remote simple brain boards do not support the use of IRQ lines.
- The remote simple brain boards have a termination jumper when using the board at the end of a communication link.

Standard and Alternate 2-Wire

Standard 2-wire consists of using 2 twisted shielded pairs of wire. An optional third pair may be used if using the IRQ feature. Use either the standard or alternate configuration when connecting a Mistic controller to a G4IOR.

- One pair of wires will support the TX/RX +/- communications.
- One pair of wires will support the common connection.
- The optional third pair of wires will support the IRQ +/- communications.
- The shield will be connected to earth ground at only one location.

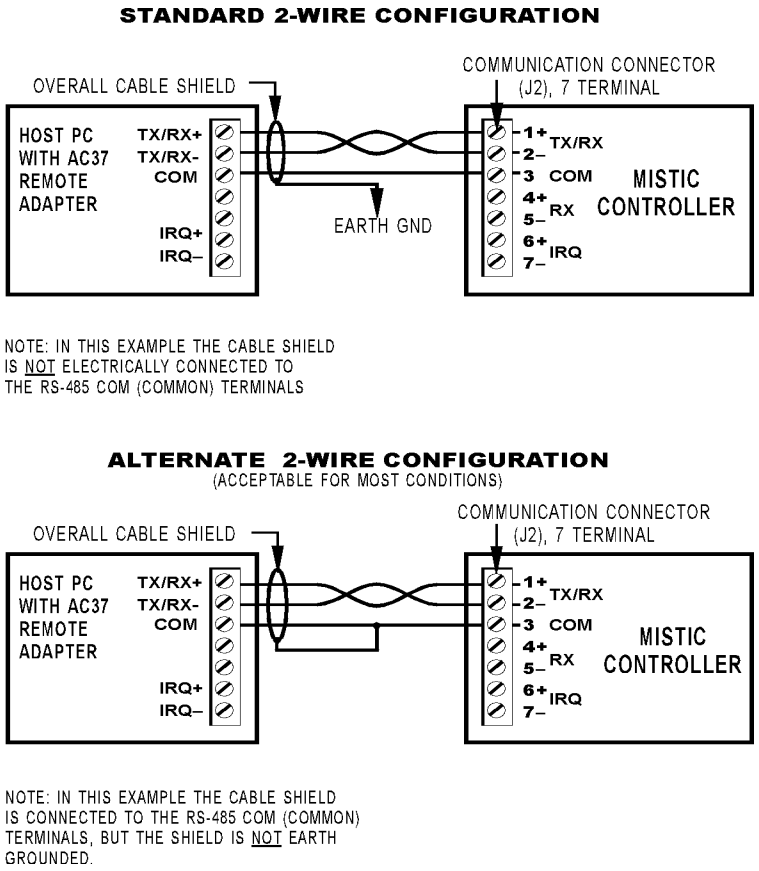


Figure 3-8: Standard and Alternate 2-Wire Configuration

Alternate 2-wire consists of using 1 twisted pair of wire. An optional second pair may be used if using the IRQ feature.

- One pair of wires will support the TX/RX +/- communications.
- The shield will be used to support the common connection. It will not be connected to earth ground.
- The optional second pair of wires will support the IRQ +/- communications.

Standard and Alternate 4-Wire

Standard 4-wire consists of using 3 twisted shielded pairs of wire. An optional forth pair may be used if using the IRQ feature.

- One pair of wires will support the TX +/- communications.
- One pair of wires will support the RX +/- communications.
- One pair of wires will support the common connection.
- The optional fourth pair of wires will support the IRQ +/- communications.
- The shield will be connected to earth ground at only one location.

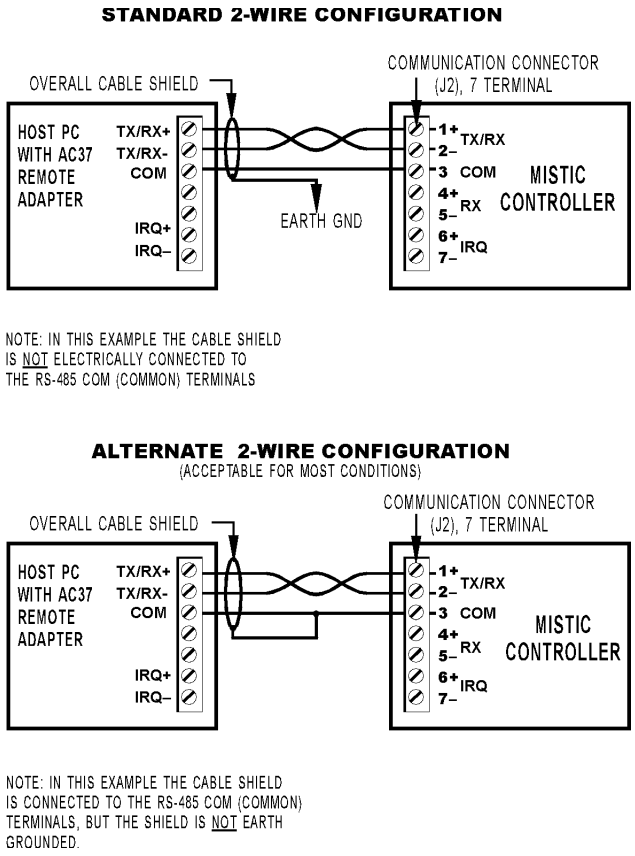


Figure 3-9: Standard and Alternate 4-Wire Configuration

Alternate 4-wire consist of using 2-twisted shielded pairs of wire. An optional third pair may be used if using the IRQ feature.

- One pair of wires will support the TX +/- communications.
- One pair of wires will support the TX+/- communications.
- The optional third pair of wires will support the IRQ +/- communications.
- The shield will be connected to earth ground at only one location.

PC To Controller Communications

RS–232 to Mistic Controller

G4LC32

1. The G4LC32 may be connected to a host computer using either COM0 or COM1 for RS-232 communications. See the following diagram for pin connections to a 9-pin RS-232 serial port.
2. Set the termination switch to **TERM YES** for the corresponding RS-485 port.
3. Set the communication mode switch to **4-WIRE** for the corresponding RS-485 port.

G4LC32SX

1. The G4LC32SX may be connected to a host computer using only COM0 for RS-232 communications. See the following diagram for pin connections to a 9-pin RS-232 port.
2. Set the termination switch to **TERM YES** for COM0.
3. Set the communication mode switch to **4-WIRE** for COM0.

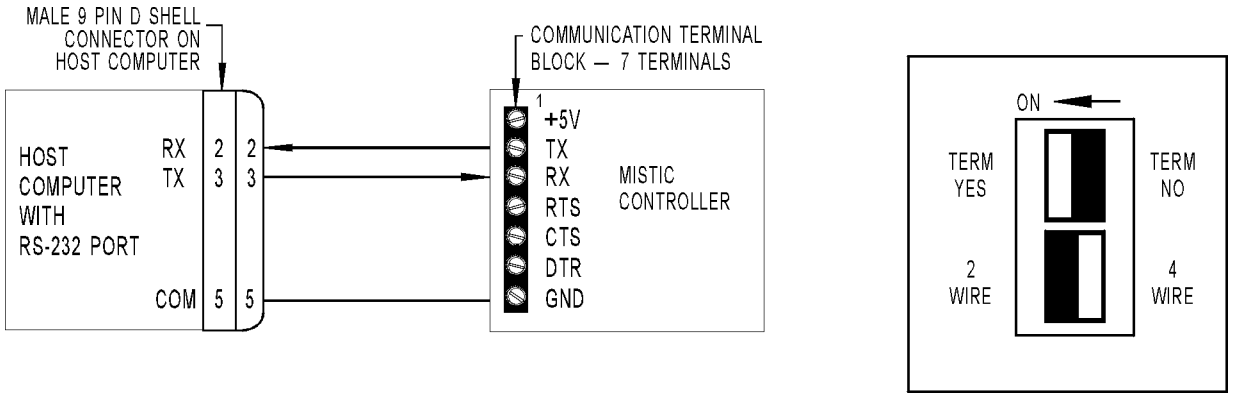


Figure 3-10: PC to G4LC32/G4LC32SX Communications

M4/M4RTU

The M4/M4RTU may be connected to a host computer using only COM0 for RS-232 communications. See the following diagram for pin connections to a 9-pin RS-232 serial port.

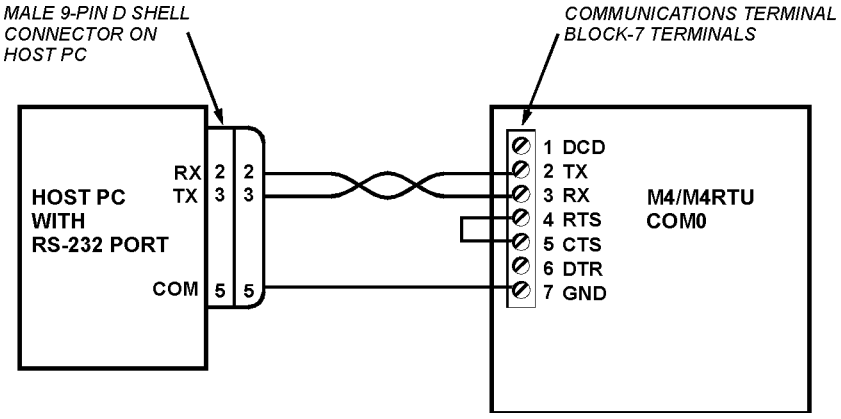


Figure 3-11: PC to M4 Communications

ARCNET to Mistic Controller

Coaxial

- Opto 22 recommends using a Contempory Controls PC ARCNET card, model PCA66-CXS for coaxial connections.
- RG62A/U cable with BNC style connectors must be used for all connections.
- A star topology is required.
- Active hubs can be used to extend cable distances up to 20,000 ft. Refer to the "ARCNET Overview" section for more details on cable distance.
- 93 ohm termination is required on unused passive hub ports.

Fiber

- Opto 22 recommends using a Contemporary Controls PC ARCNET card, model PCA66-FOG-ST for fiber connections.
- Fiber cable with 62.5/125µm fiber size and "ST" style connectors is required.
- Fiber can be used with a star and multidrop topology.
- Active hubs can be used to extend cable distances up to 256,000 ft. Refer to the "Fiber Overview" section for more details on cable distance.

AC37 to Mistic Controller

2–Wire Communication

The AC37 may be used to communicate to a Mistic controller over extended distances. It can operate in either a 2-wire or 4-wire communication mode. The 2-wire mode should follow the same wiring scheme as described in the section "Wiring Custom Remote Panels: Standard and Alternate 2-Wire", without the optional IRQ lines. In addition to configuring the "A" jumpers for the port settings, the GROUP C jumpers on the AC37 should be configured as shown in Figure 3-12.

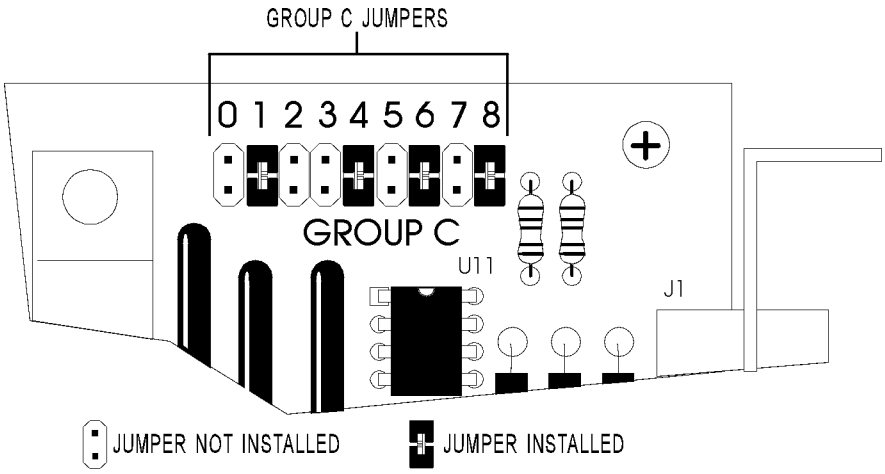


Figure 3-12: AC37 Group C Jumpers in 2-Wire Mode

G4LC32SX

1. The G4LC32SX may be connected to a host computer using only COM0 for RS-485 communications.
2. Set the termination switch to **TERM YES** for COM0.
3. Set the communication mode switch to **2-WIRE** for COM0.

G4LC32

1. The G4LC32 may be connected to a host computer using either COM0 or COM1 for RS-485 communications.
2. Set the termination switch to **TERM YES** for the corresponding RS-485 port.
3. Set the communication mode switch to **2-WIRE** for the corresponding RS-485 port.

M4/M4RTU

1. The M4/M4RTU may be connected to a host computer using only COM1 for RS-485 communications.
2. Set the termination switch to **TERM IN**.
3. Set the communication mode switch to **2W**.

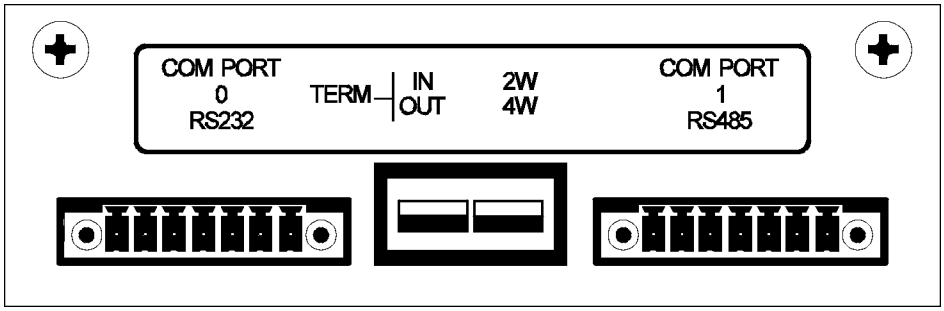


Figure 3-13: M4/M4RTU 2-Wire Communiation

4–Wire Communication

4-wire communication should follow the same wiring scheme as described in the section "Wiring Custom Remote Panels: Standard and Alternate 4-Wire", without the optional IRQ lines.

In addition to configuring the "A" jumpers for the port settings, the GROUP C jumpers on the AC37 should be configured as shown in Figure 3-14.

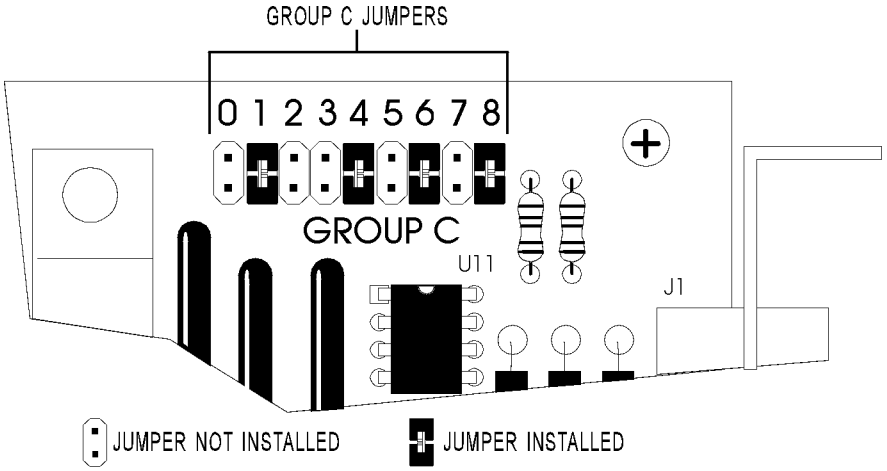


Figure 3-14: AC37 Group C Jumpers in 4-Wire Mode

4–Wire Communication

G4LC32

1. The G4LC32 may be connected to a host computer using either COM0 or COM1 for RS-485 communications.
2. Set the termination switch to **TERM YES** for the corresponding RS-485 port.
3. Set the communication mode switch to **4-WIRE** for the corresponding RS-485 port.

G4LC32SX

1. The G4LC32SX may be connected to a host computer using only COM0 for RS-485 communications.
2. Set the termination switch to **TERM YES** for COM0.
3. Set the communication mode switch to **4-WIRE** for COM0.

M4/M4RTU

1. The M4/M4RTU may be connected to a host computer using only COM1 for RS-485 communications.
2. Set the termination switch to **TERM IN**.
3. Set the communication mode switch to **4W**.

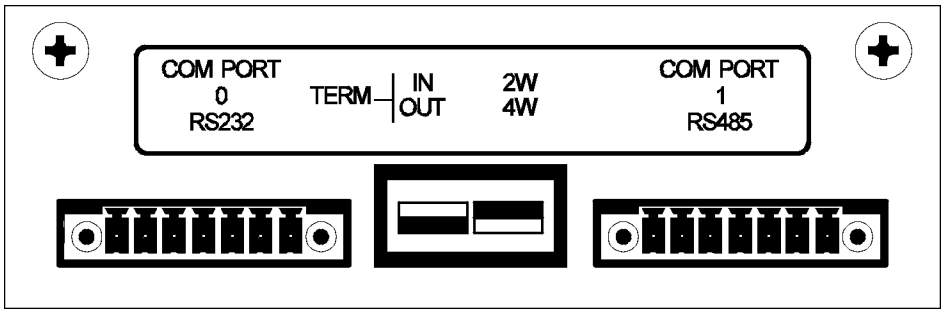


Figure 3-15: Serial Port Switches on the M4/M4RTU/M4 I/O

Modem Wiring

Most standard external PC modems can be used with the Mistic controller. However, a custom or special communications cable must be used between the modem and the Mistic controller. A wiring diagram for this cable is shown below:

M4/M4RTU

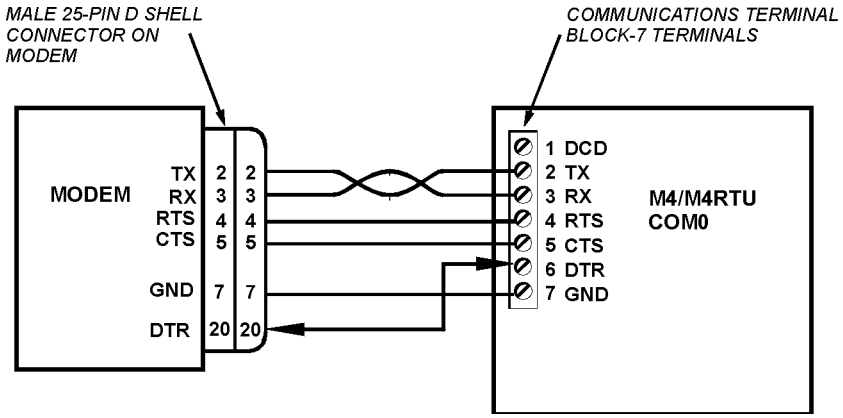


Figure 3-16: Modem wiring for the M4/M4RTU

PC to I/O Unit Communications

AC37 Wiring

This section is designed to assist users who communicating directly to Mistic I/O using a AC37. This section is **NOT** for those users with a Mistic controller.

- The AC37 should be used in a 2-wire configuration when used with Mistic I/O. IRQ line are supported and are optional. See "Wiring Custom Remote Panels: Standard and Alternate 2-Wire" for more details on wiring.
- All the GROUP C jumpers on the AC37 should be installed as shown in Figure 3-17.
- The last brain board on the communication link must have terminating resistors installed. This is usually accomplished with jumpers or the installation of a G4TERMR. Refer to the manual for your specific brain board for location of these jumpers.

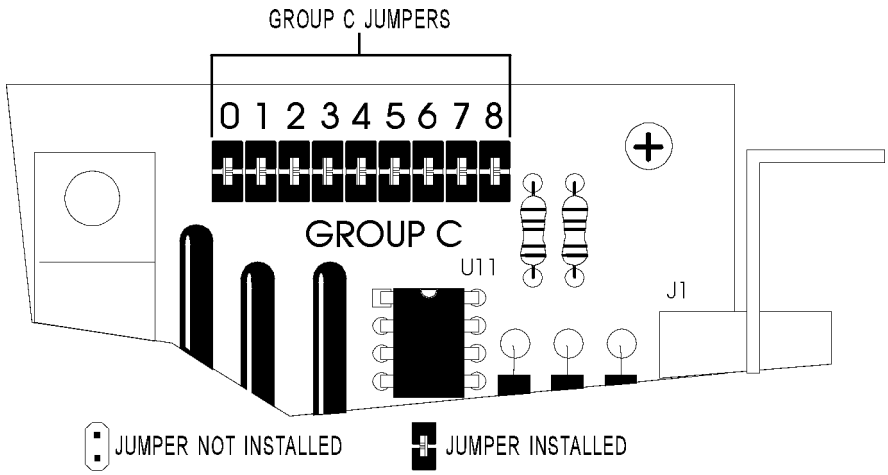


Figure 3-17: Group C Jumpers on the AC37

AC7A/B Wiring

The AC7A/B can be used as an external RS-232 to RS-485 converter to communicate to Mistic I/O. Below is a brief summary on how to set up such a system. Please refer to the AC7A/B Users Guide (Form 233) for more information on wiring.

- 2-wire mode is recommended when using the AC7A/B with Mistic I/O. IRQ lines however are not supported with this board.
- Figure 3-18 shows the proper wiring and jumper settings when using the AC7A/B with your computer's 9-pin RS-232 port.
- The last brain board on the communication link must have terminating resistors installed. This is usually accomplished with jumpers or the installation of a G4TERMR. Refer to the manual for your specific brain board for location of these jumpers.

AC7A/B Wiring (cont)

1. If you are using a 9-pin serial port on the PC, then you will need to wire these connections:

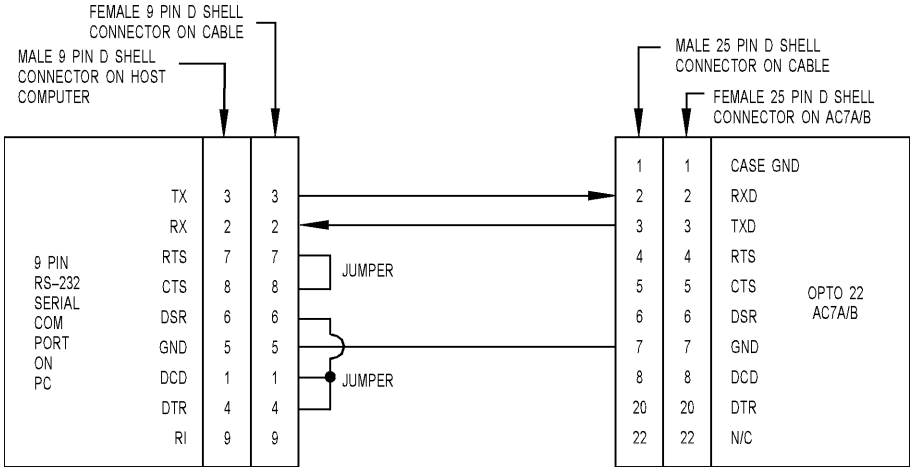


Figure 3-18: 9-Pin RS-232 Cable for AC7A/B RS-485 2-Wire Mode

2. Install the three sets of jumpers on the AC7A/B as shown below. The shaded areas indicate where jumpers need to be placed.

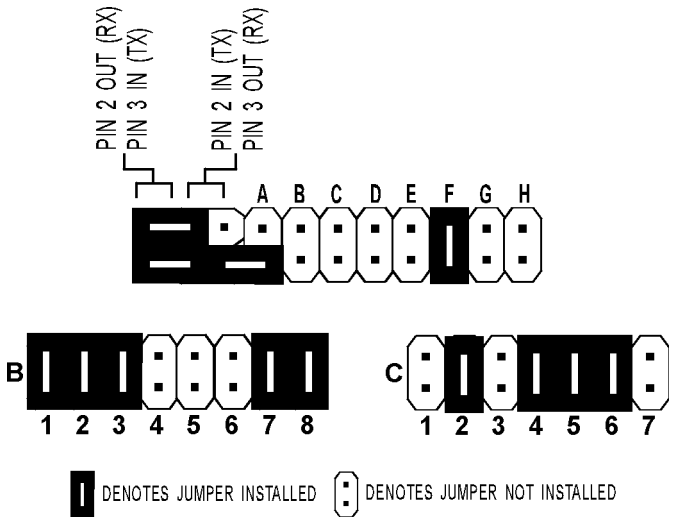


Figure 3-19: AC7A/B Jumpers A through H Schematic

AC7A/B Wiring (cont)

3. Connect FO+ to TO+, and FO- to TO- on the AC7A/B as shown below.

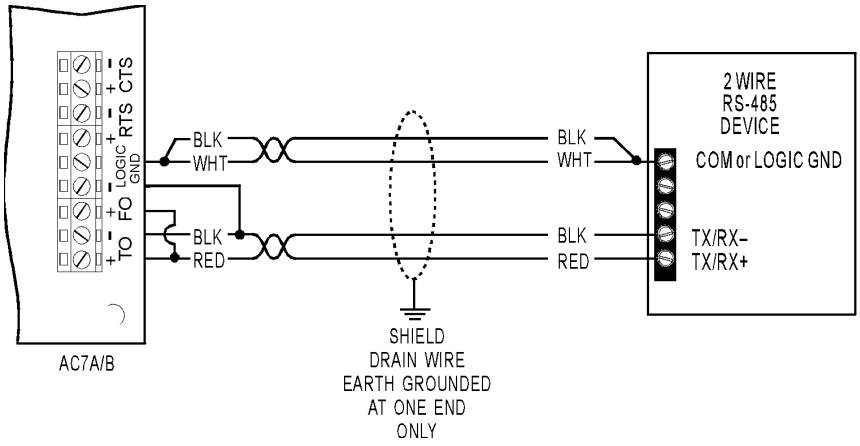


Figure 3-20: Connecting the AC7A/B to the 2-Wire RS-485 Device

CHAPTER 4

Cables

ARCNET Cables

Cable Wire and Connectors

Coax Cable:	RG62A/U 93 Ohm Coaxial Cable, Manufacturer: Belden
Connectors:	BNC Connectors
Terminators:	93 Ohm
Fiber Optic Cable:	Duplex – Belden 225812 single, 2 required
Fiber Size:	62.5/125µm
Connectors:	ST

Fiber Optic Cables

The AC40 Fiber Optic Data Link Adapter and AC42 IBM AT Fiber Optic Communications Coprocessor products offer fiber optic communications to Mistic products. Possible connections are: an AC42 in an IBM AT to an AC40 (fiber optic to fiber optic connection); an AC40 to an AC40 (fiber optic to fiber optic connection); or a RS-485 connection to an AC40 (2 or 4-wire connections).

Cable Wire and Connectors

OPTO 22 fiber optic receivers and transmitters are optimized for 62.5/125 m cable with 'ST' style connectors. Other fiber diameters can be used but performance specifications fall off rapidly. A fiber optic network run can be as long as 3.5 kilometers (about 11,480 feet), and the RS-485 network to the AC40 can be up to 3,000 feet.

Recommended fiber cable and connector manufacturers:

Belden Wire and Cable

P/N: 225811 - 62.5/125 Single Fiber

225812 - 62.5/125 Duplex (2 fibers)

AT&T Network Systems

Hewlett-Packard

Local Cables

Local I/O Bus Layout

The local I/O bus is used to connect the Mistic controller to local bricks. The local bus is a 34-conductor, flat-ribbon cable and can be a maximum of 200 feet.

Prefabricated Cables

Prefabricated cables are available from OPTO 22 for interconnecting I/O bricks within a Mistic panel and for connecting several panels together.

Table 4-1: Prefabricated Mistic 200 Local Cables

Cable P/N	Length	Purpose
Local Cable 200	106.7 in.	Connects a controller and 6 bricks, or 7 bricks in a local mistic panel.
HHG4V2	50.0 in.	Connects two local mistic panels which are mounted on top of each other.
HHG4H2	6.56 in.	Connects two local mistic panels which are mounted next to each other.

The following diagrams show the dimensional specifications for the Local Cable 200 and how the HHG4V2 and HHG4H2 would be used with the Mistic panels.

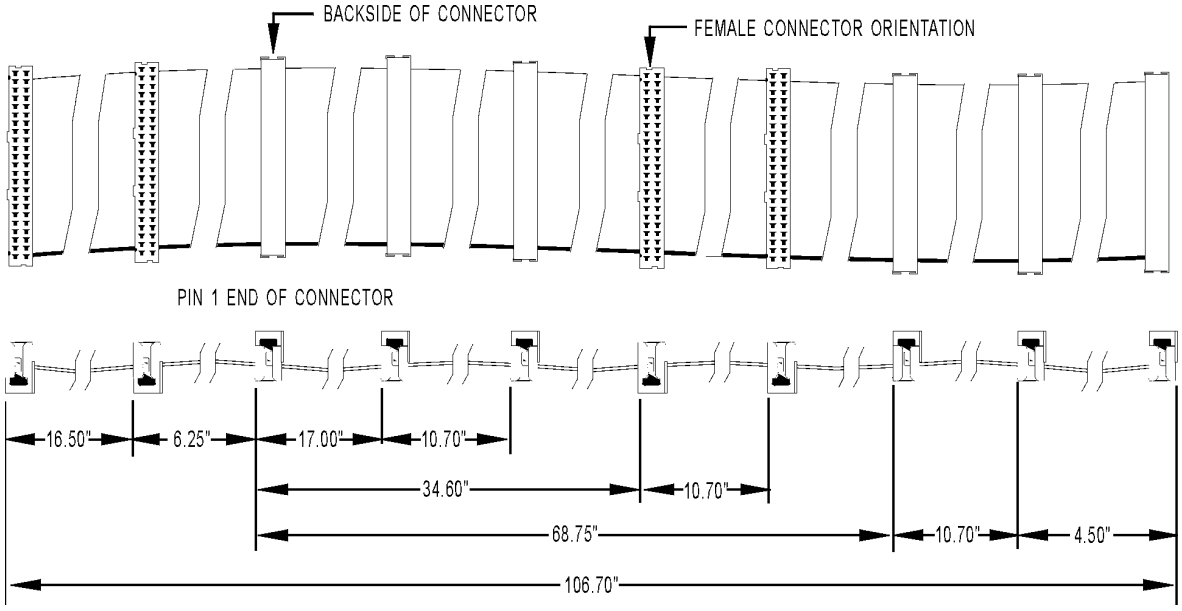


Figure 4-1: Local Cable 200 Dimensions

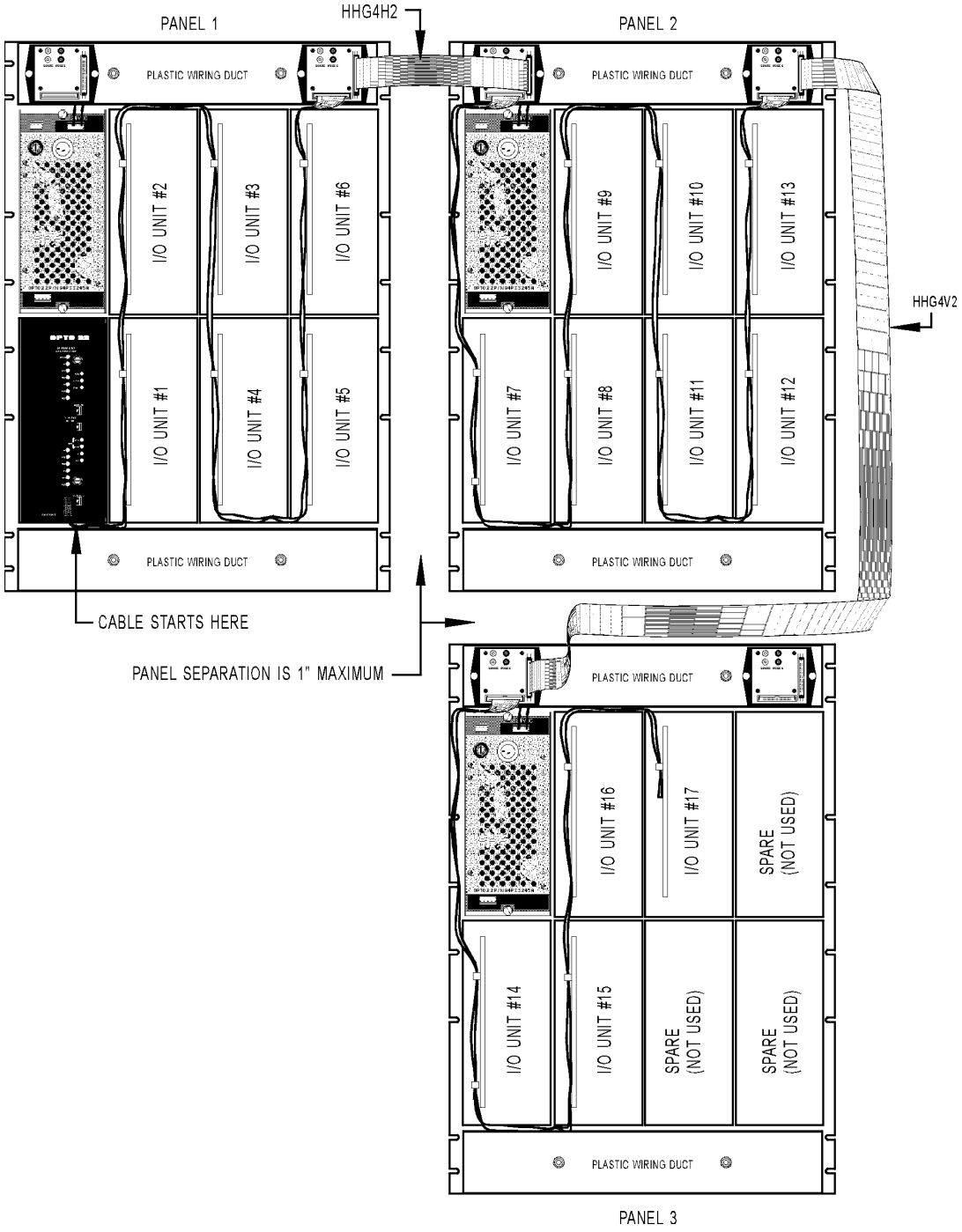


Figure 4-2: Panel Interconnection Cables, HHG4V2 and HHG4H2

Custom Cables

The next table lists parts for making custom local bus cables.

Table 4-2: parts for Custom Mistic Local Cables

Manufacturer		
Ribbon Cable	**3M P/N**	**Alpha P/N**
Regular	3365/34	3580/34 or 3583/34
	3M P/N	**Circuit Assembly**
Connectors	3414-7000	CA-34IDS-B

Remote Cables

Prefabricated Cables

The following diagram shows dimensions for the 10 conductor braided ribbon cable used to connect a controller and bricks within a Mistic remote panel.

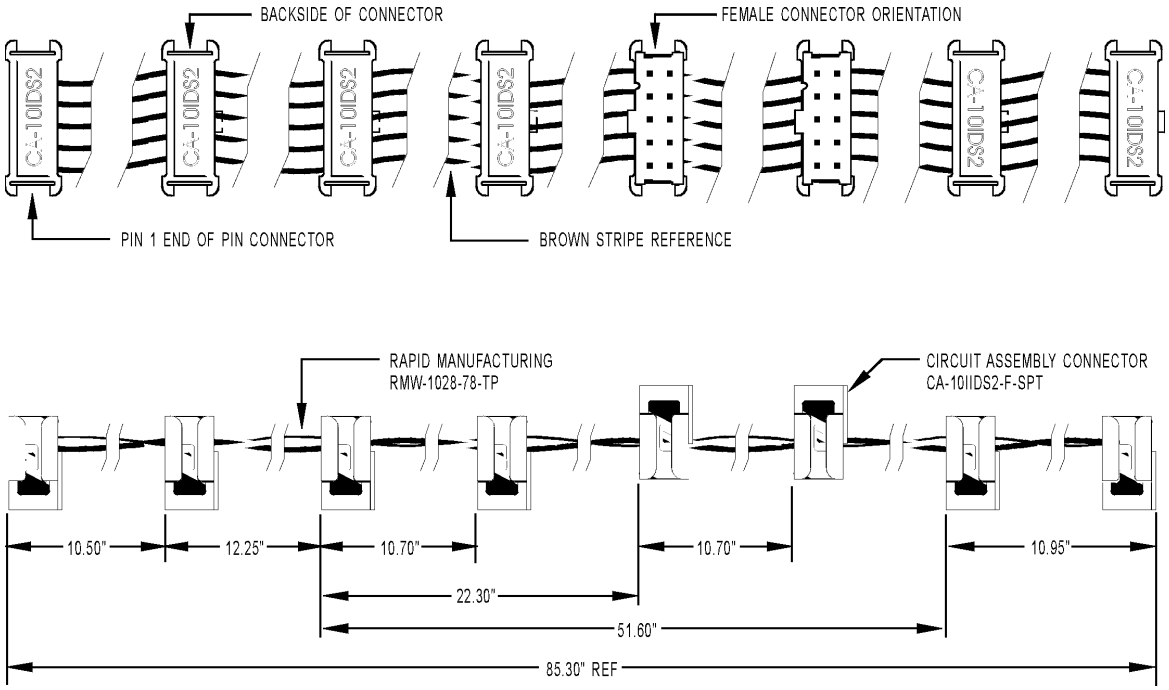


Figure 4-3: Remote Cable

Custom Cables

Cables for RS–422/485

Shielded, twisted-pair wires are recommended for the communications wiring.

Typical wire types are:

- Two-pair - Individually shielded pairs (2 pair) PVC chrome jacket Belden P/N 9729
  (#24 gauge - 7x32 stranded, 100 ohm nom. imp., 12.5 pf./ft.)
- Two-pair - Individually shielded pairs (2 pairs) and overall shield

  A. Belden P/N 8162
  (#24 gauge - 7x32 stranded, 100 ohm nom. imp., 12.5 pf./ft.)

  B. Manhattan P/N M3475
  (#24 gauge - 7x32 stranded, 100 ohm nom. imp., 12.5 pf./ft.)

  C. Manhattan P/N M39249
  (#24 gauge - 7x32 stranded, 100 ohm nom. imp., 12.5 pf./ft.)
- Four-pair - Individually shielded pairs (4 pairs) PVC chrome jacket Belden P/N 9728
  (#24 gauge - 7x32 stranded, 100 ohm nom. imp., 12.5 pf./ft.)
- Four-pair - Individually shielded pairs (4 pairs) PVC chrome jacket

  A. Belden P/N 8164
  (#24 gauge - 7x32 stranded, 100 ohm nom. imp., 12.5 pf./ft.)

  B. Manhattan P/N M3477
  (#24 gauge - 7x32 stranded, 100 ohm nom. imp., 12.5 pf./ft.)

  C. Manhattan P/N M39251
  (#24 gauge - 7x32 stranded, 100 ohm nom. imp., 12.5 pf./ft.)

Cables for RS-232

Cables suitable for RS-232 wiring are:

- Belden #8132 (4-conductor #28 gauge)
- Belden #8133 (6-conductor #28 gauge)
- Belden #8134 (8-conductor #28 gauge)
- Belden #8102 (4-conductor #24 gauge)
- Belden #8103 (6-conductor #24 gauge)
- Belden #8104 (8-conductor #24 gauge)

Connectors

Green pluggable 7 position terminal plug used for G4LC32 and G4LC32SX power connections.

Manufacturer: Phoenix Contact

P/N MVSTBW2,5/7-ST-5,08

Green pluggable 7 position terminal mini-plug used for G4LC32SX, G4LC32, M4RTU, M4, B3000, G4LC32ISA, G4LC32ISA-LT, and AC37 connections.

Manufacturer: Phoenix Contact

P/N MC1,5/7-ST-3,81

Cable and Connector Manufacturers

Alpha Wire Corporation
711 Lidgerwood Avenue
P.O. Box 711
Elizabeth, NJ 07202-0711
201-925-8000

AT & T Network Systems
505 No. 51st Avenue
Phoenix, AZ 85043
800-344-0223

Belden Wire and Cable
P.O. Box 1980
Richmond, IN 47375
800-235-3361

Cinch
1501 Morse Avenue
Elk Grove Village, IL 60007
312-981-6000

Circuit Assembly Corporation
18 Thomas Street
Irvine, CA 92718-2703
714-855-7887

Contemporary Control Systems, Inc.
2512 Wisconsin Avenue
Downers Grove, IL 60515
http://www.ccontrol.com

Hewlett-Packard
3003 Scott Blvd
Santa Clara, CA 95054
408-988-7000

Manhattan
2401 Saybrook Avenue
Los Angeles, CA 90040
213-685-5500

Phoenix Contact
P.O. Box 4100
Harrisburg, PA 17111
717-944-1300

Rapid Manufacturing
1044 W. Grove Avenue
Orange, CA 92665
714-974-2432

3M
P.O. Box 2963
Austin, TX 78769-2963
800-328-7732

CHAPTER 5

Accessory Installations

Battery Replacement for the Mistic Controller

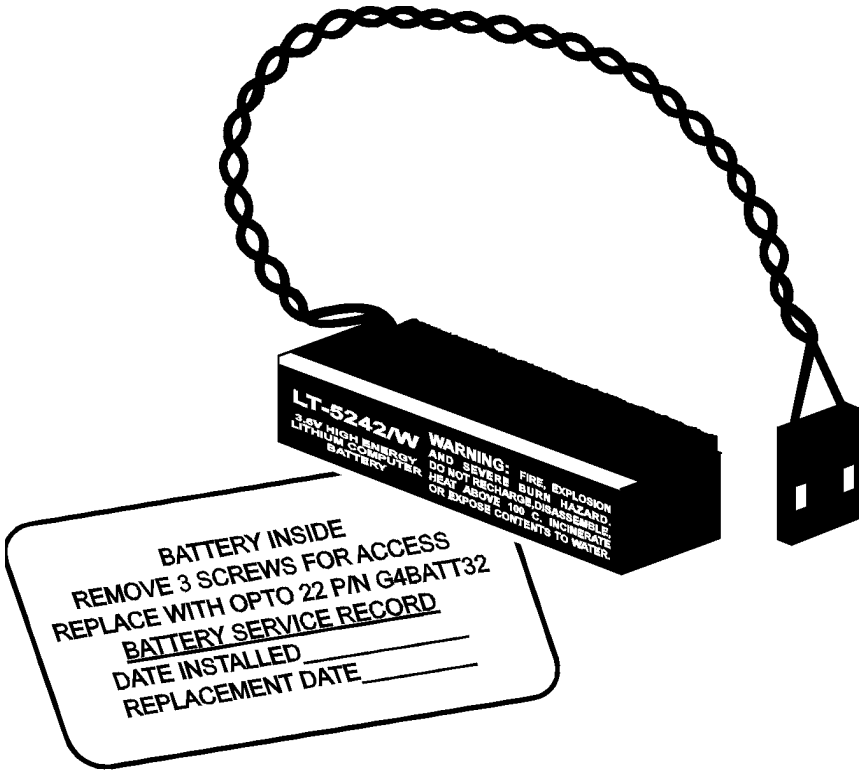


Figure 5-1: G4BATT32 Battery Replacement Kit

A battery kit is available (P/N G4BATT32) to replace the memory retention battery on Mistic controllers. The shelf life of the 3.6 volt lithium battery is 10 years and the operational life of the battery ranges from 2 to 5 years, depending on how much RAM the controller has. If it has 1/2 meg of RAM, the operational life is 5 years. If the controller has a RAM expansion kit or if the environment is damp or dusty, replace after two years.

Installation in the G4LC32 Controller

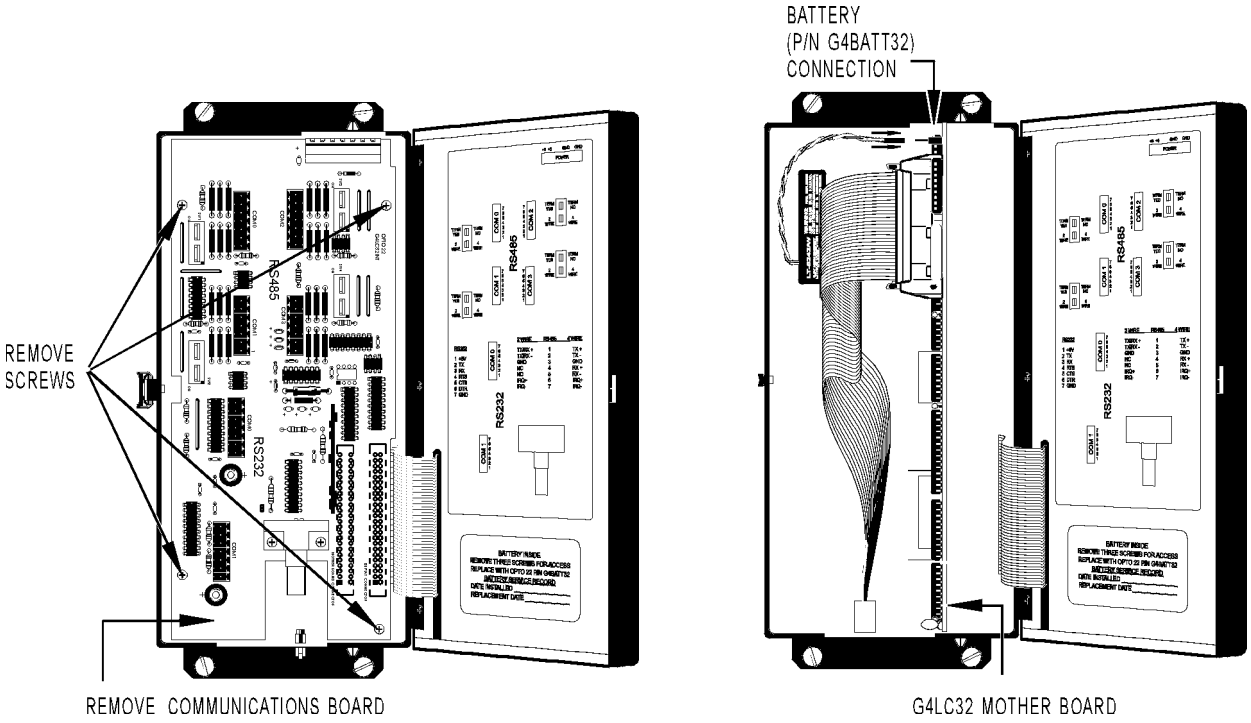


Figure 5-2: Installation of Battery

Procedure:

1. Remove the power supply and any communication cable connections.
2. Remove the four screws attaching the communications board to the controller.
3. Gently pull off the communications board to access the mother board.
4. Remove the battery connection to the mother board and replace it with the new battery.

Installing a new battery in the G4LC32SX or M4RTU is very simple however, should you encounter any difficulties, please call the Opto Product Support Department.

G4LC32SX RAM and Flash EPROM Installation

The RAM and EPROMs are found on a circuit board underneath the optional daughter board. You can expand the G4LC32SX's RAM from 256 KB to 1 MB, and the Flash EPROM size from 256 KB to 1 MB.

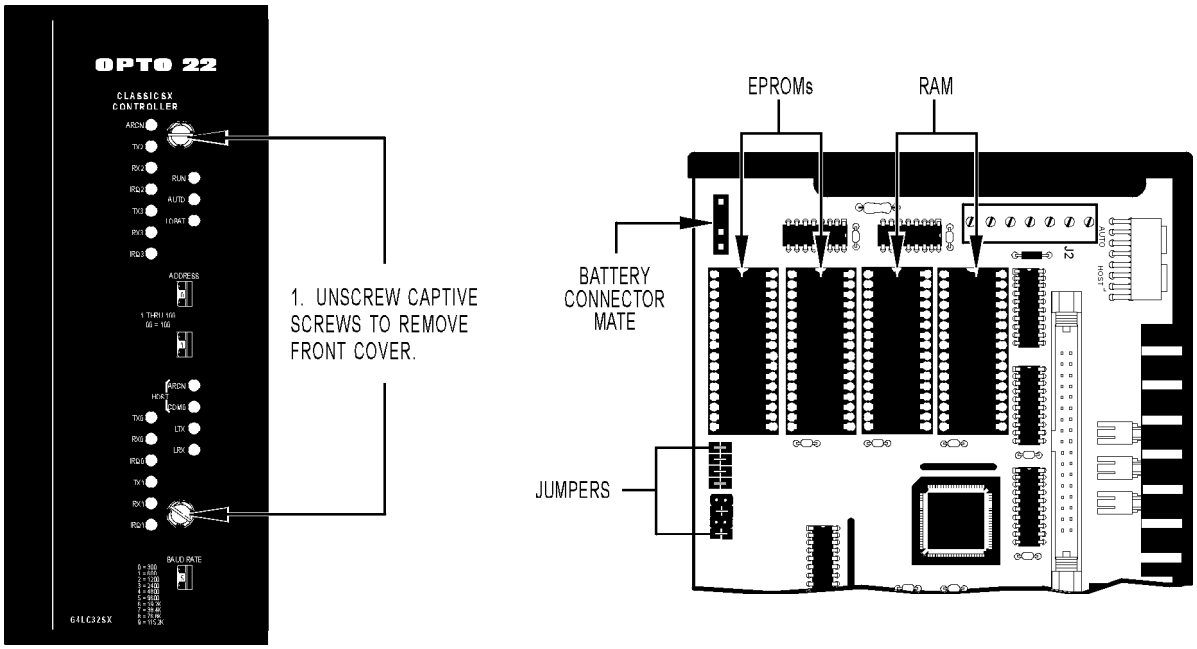


Figure 5-3: Location of RAM and Flash EPROMs

Procedure:

1. Turn off power to the controller.
2. Remove the controller's front cover.
3. Remove the optional daughter board (COM2 and COM3) if one is installed.
4. Refer to the Figure 5-3 to locate the RAM and EPROM chips.
5. Make your expansion changes on the mother board
6. Replace the daughter board if one was removed.
7. Replace the controller's front cover.
8. Apply power to the controller.

G4LC32SX Ram and Flash EPROM Jumpers

RAM Jumpers

The factory default RAM size is 256 KB.

Table 5-1: RAM Jumpers

MJ0	RAM Type
X	2 x 1 Mb (256 KB)
:	2 x 4 Mb (1 MB)

X = Jumper installed
: = Jumper not installed

EPROM Jumpers

This jumper configures the EPROM type and size. Flash or UV EPROMs may be used. The factory default is 256 KB of Flash EPROM.

Table 5-2: EPROM Jumpers

Flash	RJ0	ROM Type
X	X	27C1001 (1 Mb UV EPROM) (256 KB)
X	:	27C4001 (4 Mb UV EPROM) (1 MB)
:	X	29F040 (1 Mb Flash EPROM)(256 KB)
:	:	29F040 (4 Mb Flash EPROM)(1 MB)

G4LC32SX Daughter Board Installation

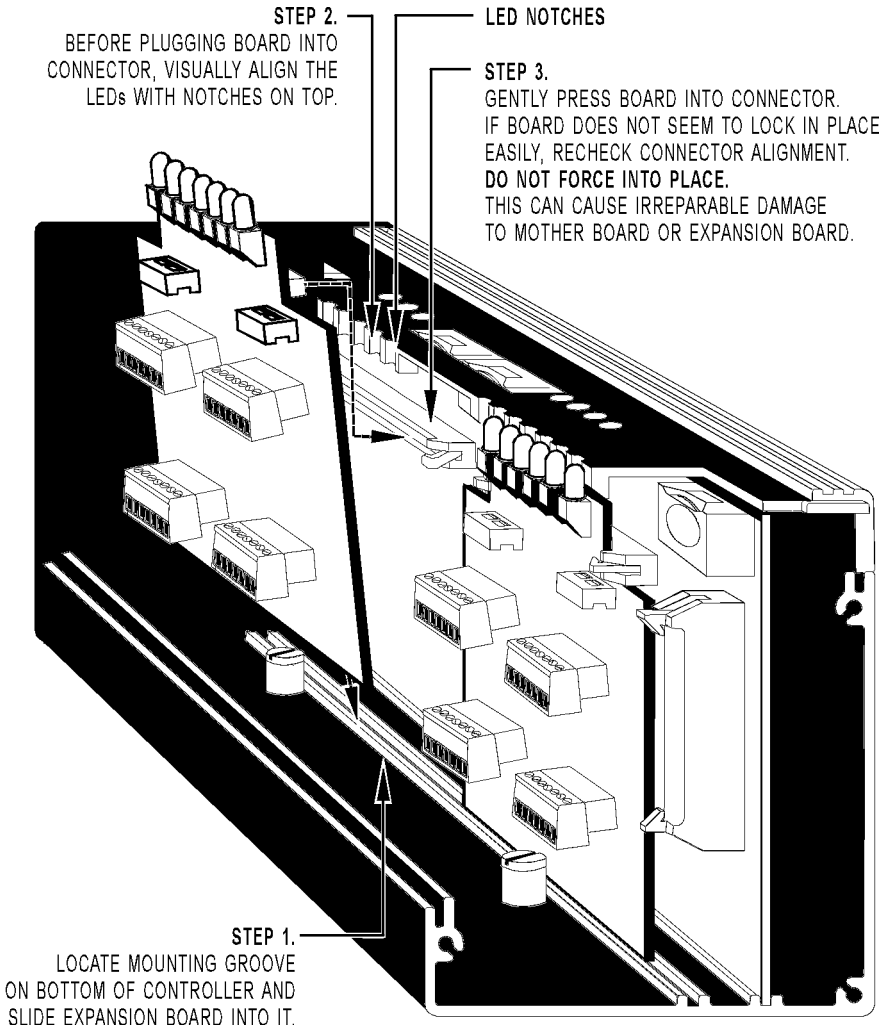


Figure 5-5: G4LC32SX Daughter Card Installation

G4LC32ISA RAM and Flash EPROM Installation

The G4LC32ISA has 256 KB of battery backed RAM and is expandable to 2 MB. It also has 256 KB of Flash EPROM and is expandable to 1 MB. The following diagram shows the RAM and Flash EPROM locations on the G4LC32ISA.

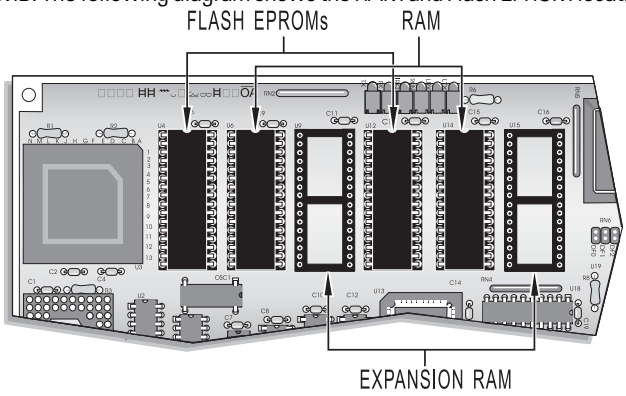


Figure 5-6: RAM Chip and Flash EPROM Locations on the G4LC32ISA

RAM Jumpers

These jumpers configure the ram size. The factory default size is 256 KB.

Table 5-3: RAM Jumpers

MJ1	MJ0	RAM Type
X	X	2 x 1 Mb (256 KB)
X	:	4 x 1 Mb (512 KB)
:	X	2 x 4 Mb (1 MB)
:	:	4 x 4 Mb (2 MB)

Flash EPROM Jumpers

These jumpers configure the Flash EPROM size. The factory default size is 256 KB.

Table 5-4: EPROM Jumpers

Flash	RJ0	ROM Type
X	X	27C1001 (1 Mb UV EPROM) (256 KB)
X	:	27C4001 (4 Mb UV EPROM) (1 MB)
:	X	29F040 (1 Mb Flash EPROM)(256 KB)
:	:	29F040 (4 Mb Flash EPROM)(1 MB)

X = Jumper Installed
: = Jumper Not Installed

G4LC32 RAM and Flash EPROM Installation

The RAM and Flash EPROMs are found on a circuit board underneath the communications board. You can expand the G4LC32's RAM from 512 KB to 4 MB, and its Flash EPROM size from 512 KB to 1 MB. To do this, use RAM and Flash EPROM chips specified in the tables on page 98. Also, two jumper groups must be configured on the board for the correct memory sizes.

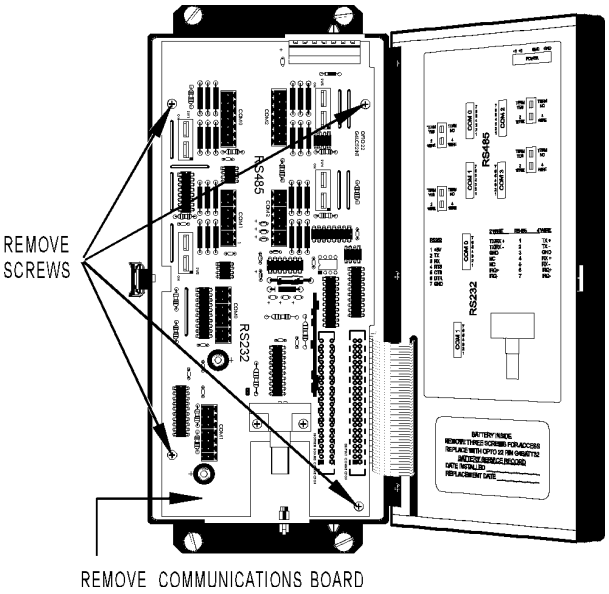


Figure 5-7: Accessing the G4LC32 Mother Board

G4LC32 RAM and Flash EPROM Installation

1. Remove the power supply and any communication cable connections.
2. Remove the four screws attaching the communications board to the controller.
3. Gently pull off the communications board to access the mother board.
4. Remove the battery connection to the mother board.
5. Remove the 34-pin ribbon cable (local cable) from the mother board by pressing down the release tabs.
6. Pull out the G4LC32 mother board.
7. The diagram on the next page shows the RAM, expansion RAM, and Flash EPROM locations on the mother board.
8. Make your expansion changes on the mother board by referring to the tables for RAM and Flash EPROM jumpers. Set the appropriate jumper setting and add or change chips.
9. Slip the mother board back into the controller.
10. Attach the battery and local cable connections.
11. Screw down the communications board to the controller.
12. Reattach communications and power connections.

The following diagram shows the locations of the RAM, expansion RAM, Flash EPROM sockets, and memory size jumper groups.

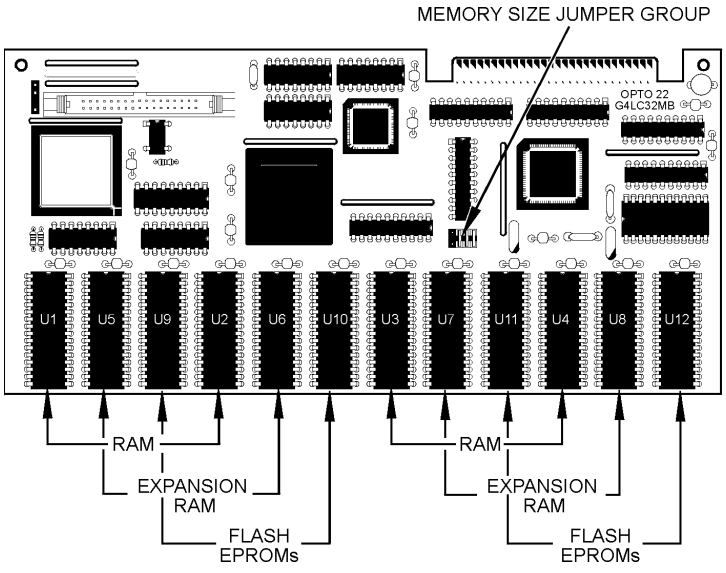


Figure 5-8: G4LC32 Mother Board

G4LC32 RAM and Flash EPROM Jumpers

The following tables describe memory size jumpering for the G4LC32.

RAM Jumpers

Jumper configure the RAM size. The factory default size is 512 KB. RAM chips go in sockets U1, U2, U3, U4, and expansion RAM chips go in sockets U5, U6, U7, and U8.

Table 5-5: RAM Jumpers

MJ	MJ0	RAM Type	Chip Location
X	X	4 x 1 Mb (512 KB)*	U1 - U4
X	:	8 x 1 Mb (1 MB)	U1 - U8
:	X	4 x 4 Mb (2 MB)	U1 - U4
:	:	8 x 4 Mb (4 MB)	U1 - U8

Flash EPROM Jumpers

Jumper configure the Flash EPROM size. The factory default size is 512 KB. Flash EPROM chips go in sockets U9, U10, U11, and U12.

Table 5-6: EPROM Jumpers

Flash	RJ0	Flash EPROM Type
X	X	27C1001 (1 Mb uvEPROM) (512 KB)
X	:	27C4001 (4 Mb uvEPROM) (1 MB)
:	X	29F010 (1 Mb Flash EPROM) (512 KB)*
:	:	29F040 (4 Mb Flash EPROM) (1 MB)

X = Jumper Installed
: = Jumper Not Installed
* Factory Default

M4RTU RAM and FLASH EPROM Installation

If the M4RTU does not have a "1 MB RAM Installed" sticker, you can expand the M4RTU RAM from 256 KB to 1 MB. You can also expand the flash EPROM from 256 KB to 1 MB. To do such an upgrade, it is necessary to remove and disassemble the M4RTU base unit to access the processor board where the RAM and flash EPROM chips are located. You can also use this process to upgrade the processor board with flash chips containing new enhanced boot loaders supporting new primary host communication hardware (e.g., fiber or Ethernet).

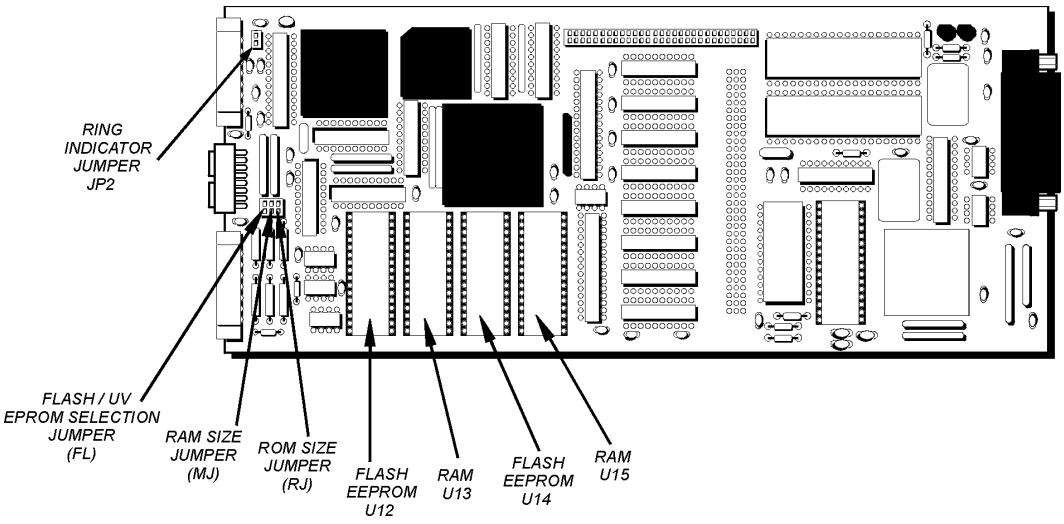


Figure 5-9: Locations of Jumpers and Chips on the M4RTU

To disassemble the M4RTU, follow these instructions:

1. Turn off the power to the M4RTU.
2. Disconnect the incoming electrical power from the power supply.
3. Remove the four screws located on the top cover of the unit. Take off the top cover. Disconnect the field wiring plug connectors.
4. Remove any communication port connectors and/or M4RTUXCAB cables.

Table 5-7 M4RTU Configuration Jumpers (factory defaults are indicated in bold)

Jumper	Description	Position	Setting
FL	EPROM Type	In	UV EPROM (not used)
		Out	**Flash EEPROM**
MJ	RAM Size	*** In**	**2 x 1Mb (256 KB)**
		*** Out**	**2 x 4 Mb (1 MB)**
RJ	EPROM Size	**In**	**1 Mb Flash EEPROM (256 KB)**
		Out	4 Mb Flash EEPROM (1 MB) (Opto 22 P/N M4RTUF1M)
JP2	Ring Indicator	**In**	**COM0 Pin 7 is ground**
		Out	COM0 Pin 7 is ring indicator

Flash Jumpers (FL)

FL identifies the TYPE of firmware EPROMS (either FLASH or UV EPROMS). FL removed indicates FLASH EPROMS. FL installed indicates UV EPROMS. The default setting is for this jumper to be removed. All M4RTU controllers have FLASH EPROMS, so this jumper should NEVER be installed.

*RAM Jumper (MJ)

MJ identifies the AMOUNT of RAM installed (and hence the TYPE of RAM chips). MJ installed indicates 256 KB (Kbytes) which is in the form of 2 chips that are 1 megabit each. MJ removed indicates 1 MB (megabyte) which is in the form of 2 chips that are 4 megabits each. If the M4RTU I/O has a "1 MB RAM Installed" sticker, the default setting is for this jumper to be removed. If the M4RTU does not have this sticker, the default setting is for this jumper to be installed.

ROM Jumper (RJ)

RJ identifies the AMOUNT of EPROM memory installed (and hence the TYPE of EPROM chips) or vice versa. RJ installed indicates 256 KB (Kbytes) which is in the form of 2 chips that are 1 megabit each. RJ removed indicates 1 MB (megabyte) which is in the form of 2 chips that are 4 megabits each. The default setting is for this jumper to be installed.

Ring Indicator Jumper (JP2)

By default, this jumper is installed, establishing a ground on COM0 Pin 7 of the M4RTU base unit. The jumper should remain installed under most circumstances.

If you need an extra programmable RS-232 input (such as a ring indicator), remove this jumper. Since this will eliminate the ground on COM0, it will be necessary to wire your RS-232 device ground to COM1 Pin 3 to prevent common mode problems and resulting damage.

Use Table 5-8 to select RAM expansion options for your controller.

Table 5-8: RAM Expansion Options

RAM Size	G4LC32		G4LC32SX		G4LC32ISA	G4LC32ISA-LT	M4RTU/M4IO/M4[3]	
	Original[2]	New[2]	Original[2]	New[2]	----------	----------	Original[3]	New[3]
256K	N/A	N/A	Base Configuration	Base Configuration	Base Configuration	Base Configuration	Base Configuration	N/A
512K	Base Configuration	Base Configuration	N/A	N/A	Buy 2 G4RAM1M	N/A	N/A	N/A
1M	G4LC32RAMEX5M	Buy 4 G4RAM1M	N/A	G4RAM4M	Buy 2 G4RAM4M	N/A	Buy 2 G4RAM4M	Base Configuration
2M	N/A	Buy 4 G4RAM4M	N/A	N/A	Buy 4 G4RAM4M	N/A	N/A	N/A
4M	G4LC32RAMEX4M	G4RAM4M	N/A	N/A	N/A	N/A	N/A	N/A

Use Table 5-9 to select EPROM expansion options for your controller.

Table 5-9: EPROM Expansion Options

Size	G4LC32		G4LC32SX		G4LC32ISA	G4LC32ISA-LT	M4RTU	M4IO	M4
	Original[2] (UV EPROM)	Current[2] (Flash)	Original[2] (UV EPROM)	Current[2] (Flash)	Flash	Flash	Flash	Flash	Flash
128K	Base Configuration	N/A	Base Configuration	N/A	N/A	N/A	N/A	N/A	N/A
256K	Buy 4 27C512-120[1]	N/A	N/A	Base Configuration	Base Configuration	Base Configuration	Base Configuration	Base Configuration	Base Configuration
512K	Buy 4 27C010-120[1]	Base Configuration	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1M	Buy 4 27C020-120[1]	G4LC32F1M	N/A	G4LC32SXF1M	G4LC32ISAF1M	N/A	M4RTUF1M	M4IOF1M	M4F1M

Notes:

- To determine which G4LC32 you have, examine the bottom of the controller. The ORIGINAL G4LC32 has two 9-pin D connectors for the RS-232 ports on the bottom. The NEW controller has two green 7-pin RS-232 connectors inside the front panel.
- To determine which G4LC32SX you have, you will need to remove the front cover and (if applicable) any optional daughter cards. Find the four chips in the upper left-hand corner of the circuit card. The two chips on the right are the RAM chips. On the ORIGINAL G4LC32SX controller, these chips are soldered to the circuit board. On the NEW G4LC32SX controller, the chips are pluggable (removable).
- New M4RTU, M4 I/O, and M4 controllers are marked with a "1MB RAM installed" sticker.
- Chips from INTEL (N/A from Opto 22).

M4/M4RTU – Installing Expansion Cards

If you purchased expansion cards, you will need to install them in the M4/M4RTU before mounting the base unit.

The general procedure for installing optional cards is as follows:

1. Remove power connector from M4/M4RTU power supply.
2. Remove the end cap for any of the three expansion slots, located below the M4/M4RTU base unit serial connectors. Each end cap is held in place by two screws located on the side panel, adjacent to each end cap. (You may also need to remove one or two additional end caps to achieve proper card alignment.)
3. Align the edges of the card with the U-channels on the sides of the expansion bus cavity. Slide the card all the way in until it seats into the M4/M4RTU bus connector.
4. Use the original screws to attach the new end cap (included with the card) to the end of the M4/M4RTU unit.

See Figure 5-10 for reference. For complete details on installing the M4SSER, see M4 Serial Adapter Card Data Sheet (form 664). For details on installing expansion cards, see the appropriate expansion card data sheet.

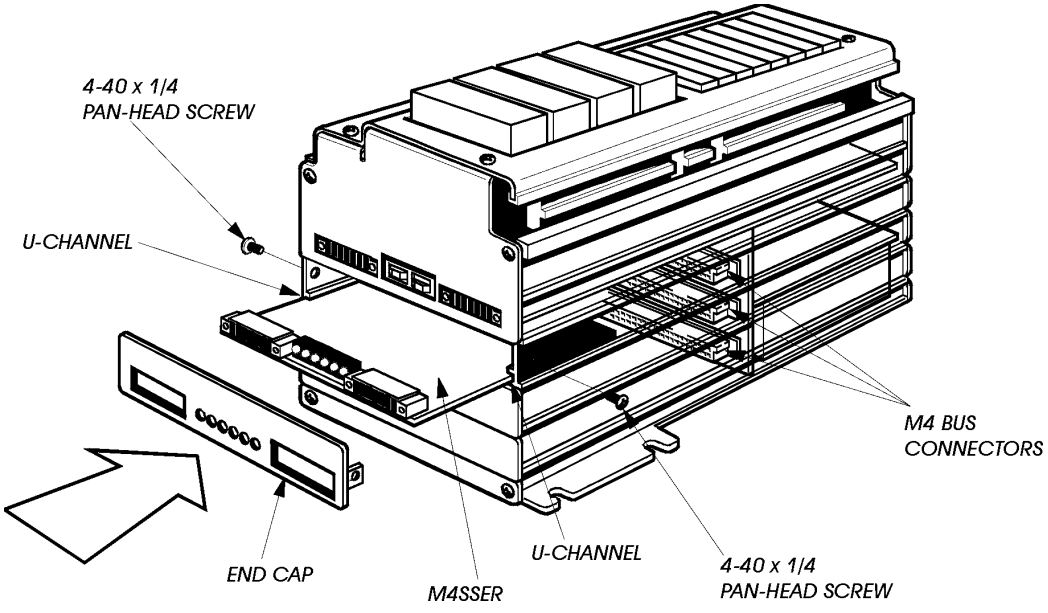


Figure 5-10: Installing an Expansion Card into the M4/M4RTU Expansion Slot

CHAPTER 6

Dimensional Drawings

G4LC32 Model 200 Processor

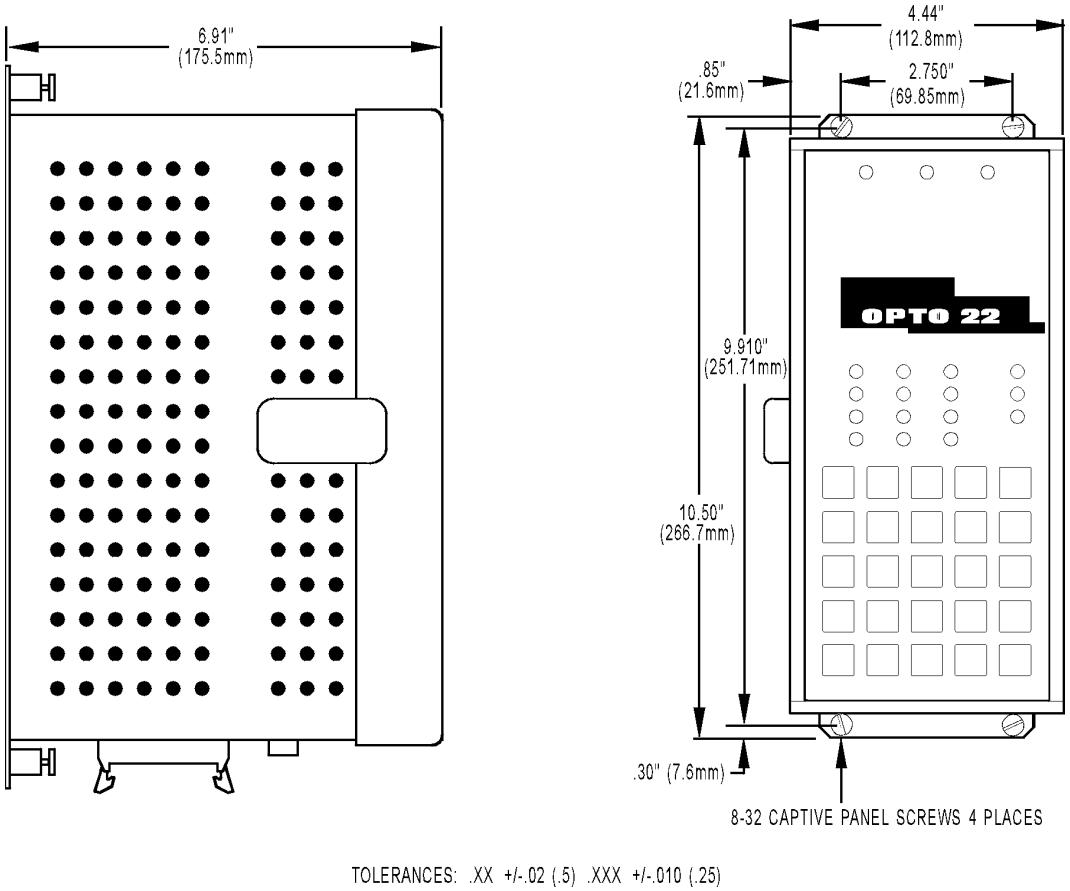


Figure 6-1: G4LC32 Model 200 Processor

G4LC32SX Model 200 Processor

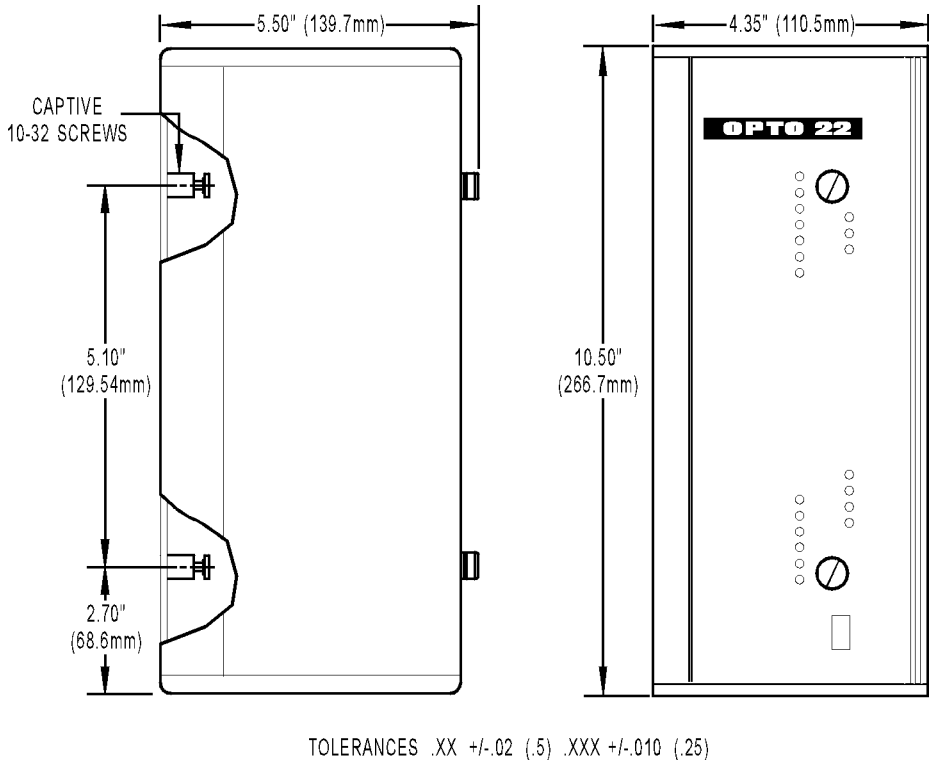


Figure 6-2: G4LC32SX Model 200 Processor

M4RTU Modular Controller

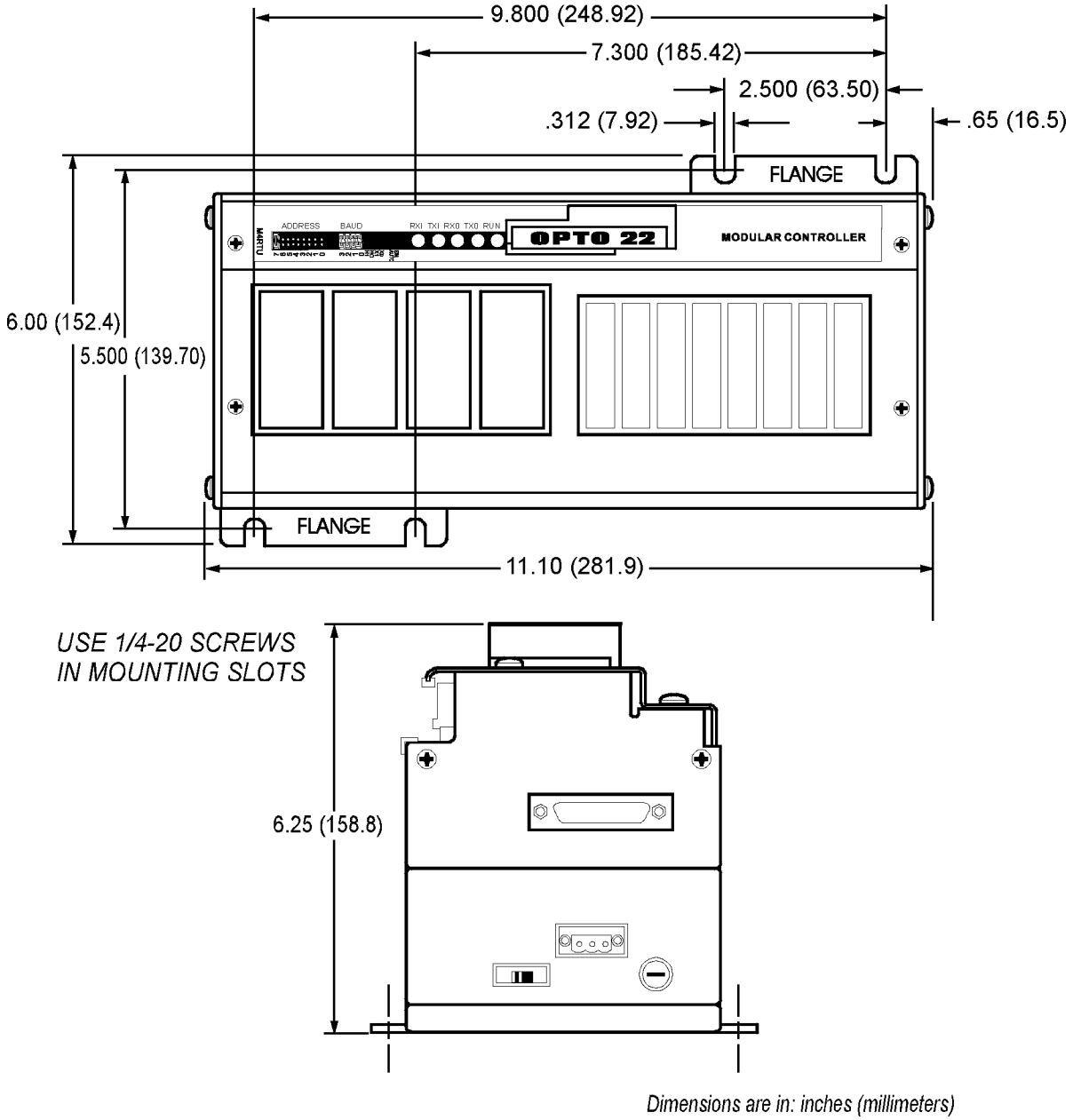


Figure 6-3: M4RTU Modular Controller

G4BASE Brick Base

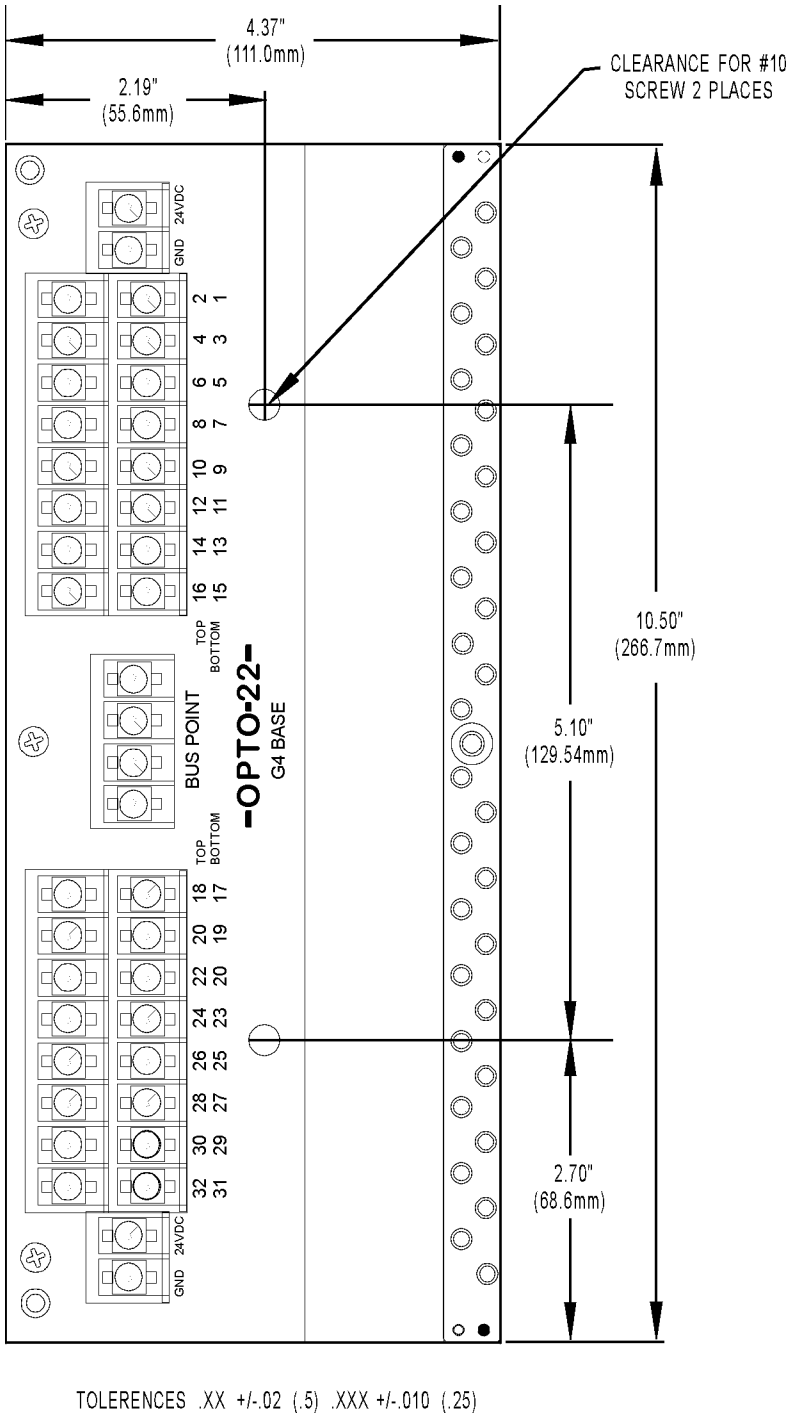


Figure 6-4: G4BASE Brick Base

Local and Remote Digital Bricks

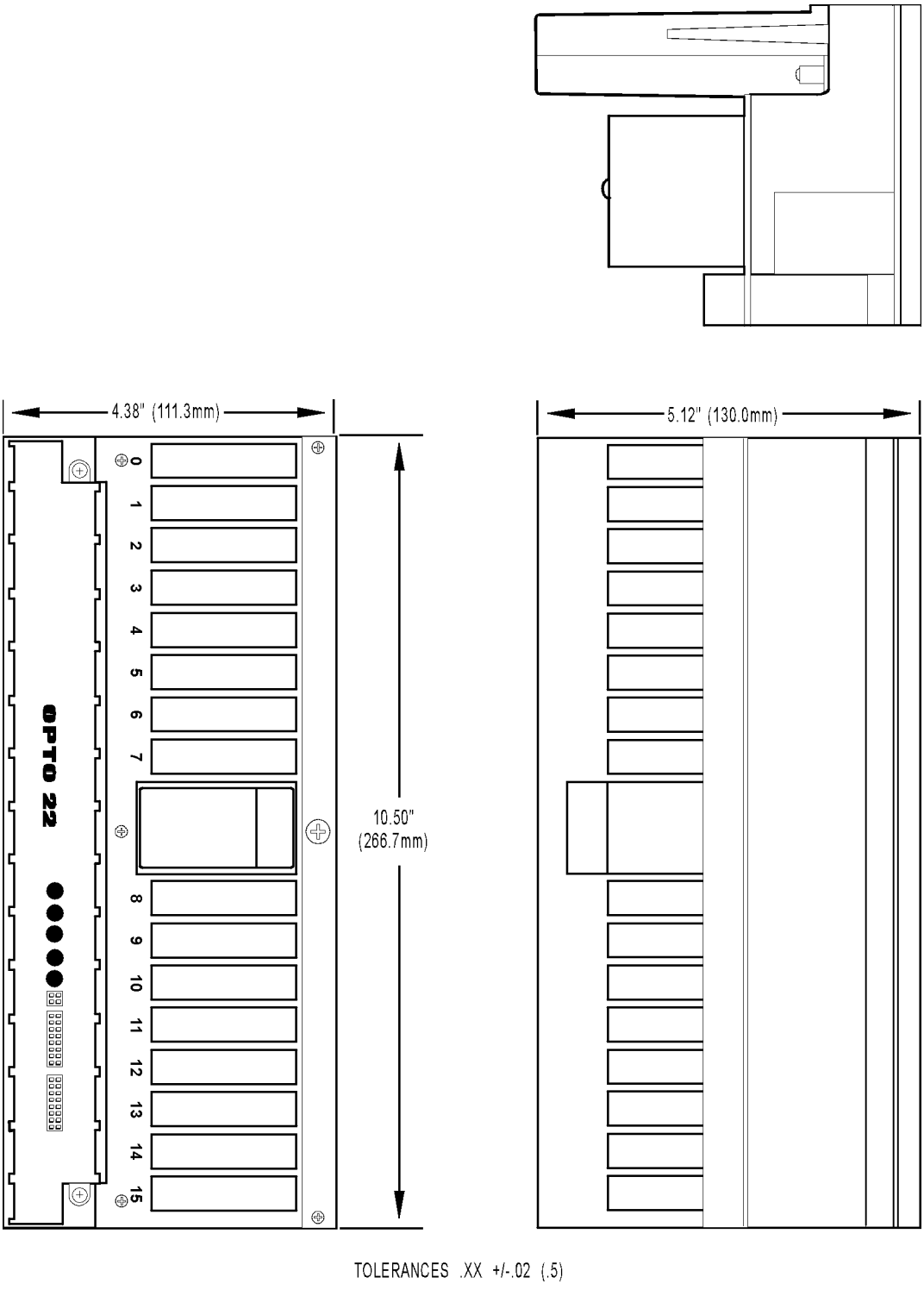


Figure 6-5: Local and Remote Digital Bricks

Local and Remote Analog Bricks

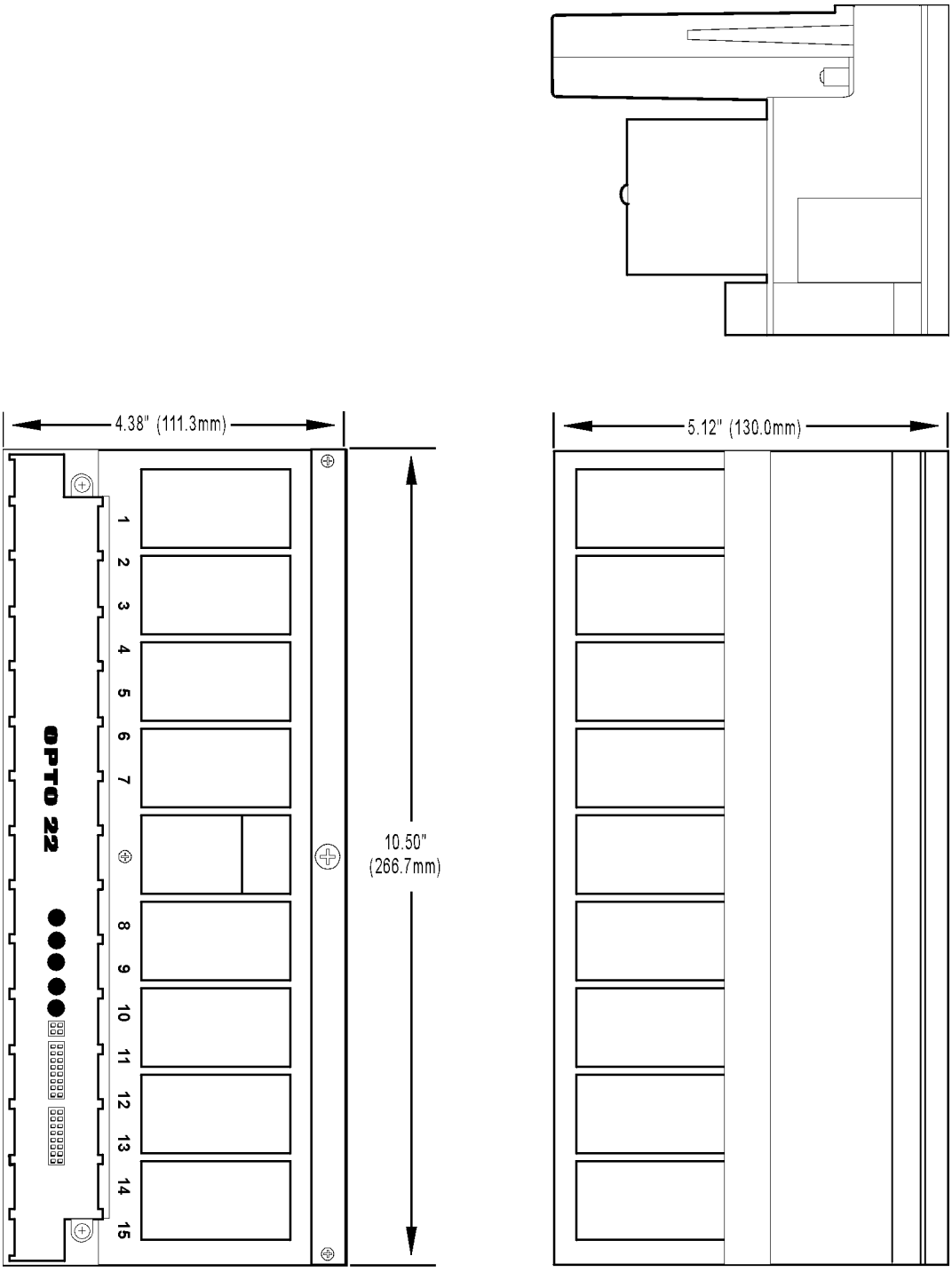


Figure 6-6: Local and Remote Analog Bricks

G4HDAL/G4HDAR I/O Units

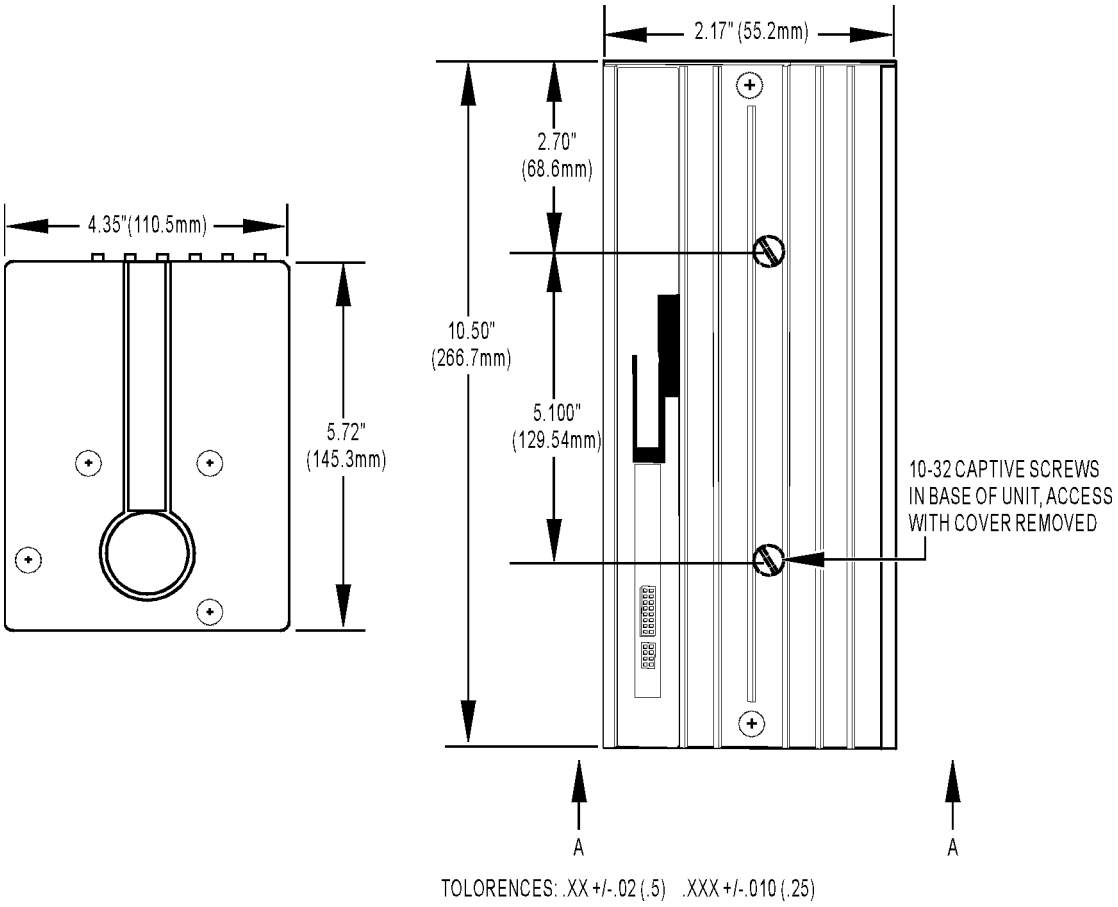


Figure 6-7: G4HDAL/G4HDAR I/O Units

G4D32RS High Density 32-Channel Brick

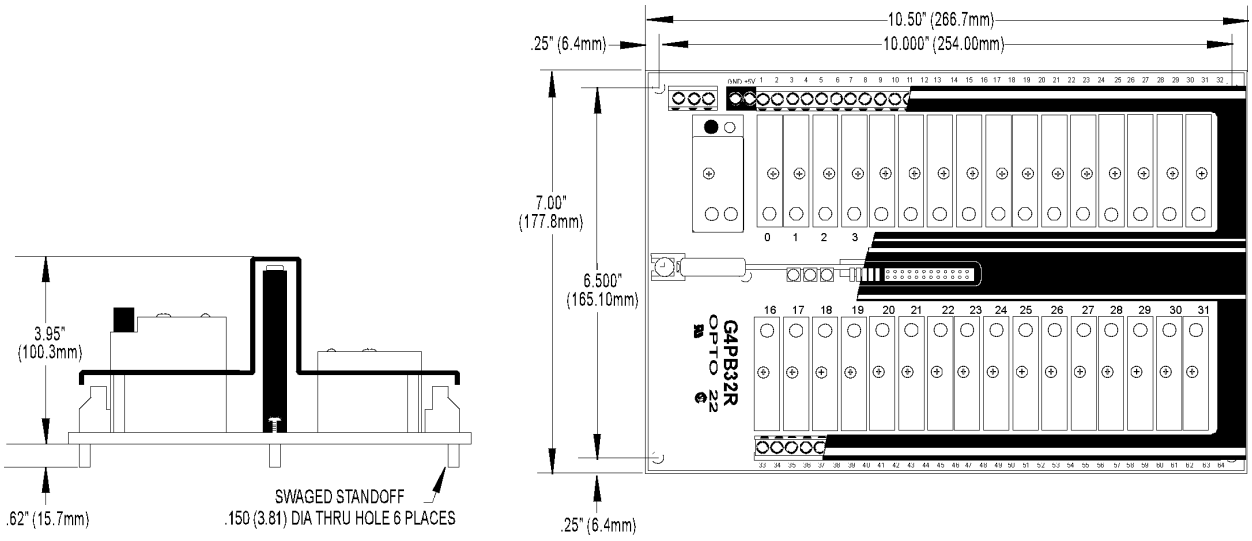


Figure 6-8: G4D32RS High-Density 32-Channel Brick

Snap B-Series Mounting Racks

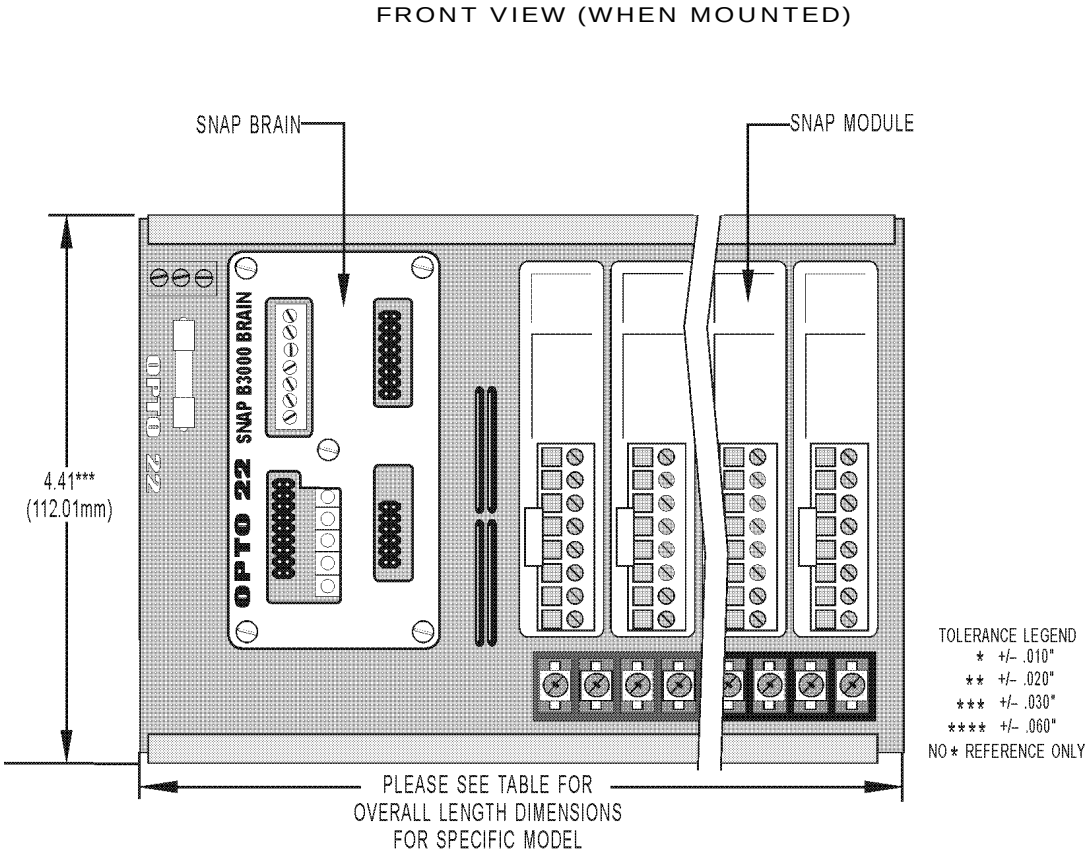
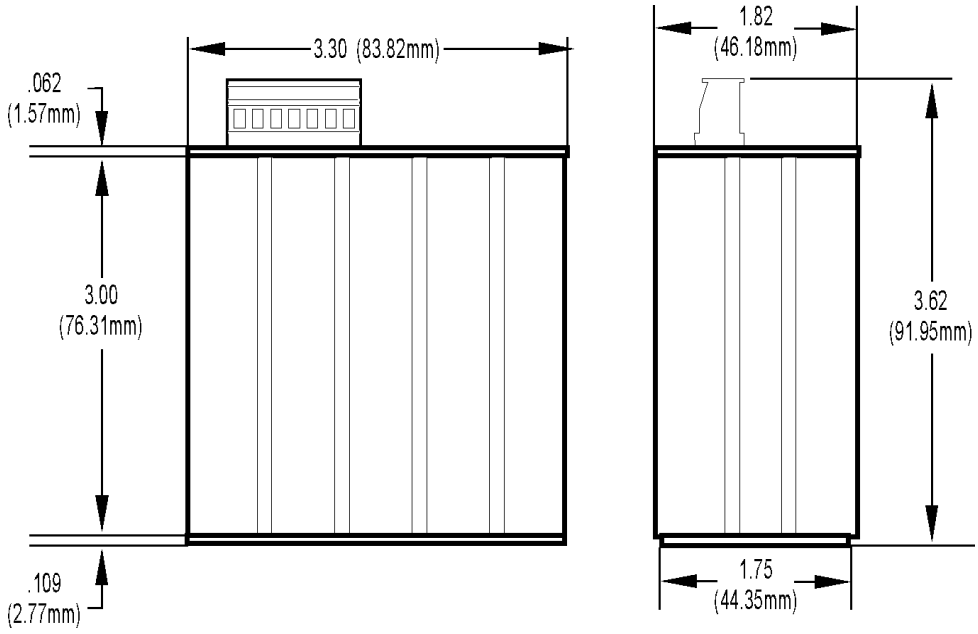


Figure 6-9: SNAP B-Series Mounting Racks

Overall Length Dimensions (All Models)

Part Numbers	Description	Length (inches)	Length (mm)
SNAP-B8M	8-module rack	9.24	234.7
SNAP-B8MC	8-module rack with extra terminal for field wiring	9.24	234.7
SNAP-B8MC-P	8-module rack with extra terminal for field wiring, pluggable	9.24	234.7
SNAP-B12M	12-module rack	12.24	310.9
SNAP-B12MC	12-module rack with extra terminal for field wiring	12.24	310.9
SNAP-B12MC-P	12-module rack with extra terminal for field wiring, pluggable	12.24	310.9
SNAP-B16	16-module rack	15.24	387.1
SNAP-B16MC	16-module rack with extra terminal for field wiring	15.24	387.1
SNAP-B16MC-P	16-module rack with extra terminal for field wiring, pluggable	15.24	387.1

B3000 and SNAP-BRS Brain Boards



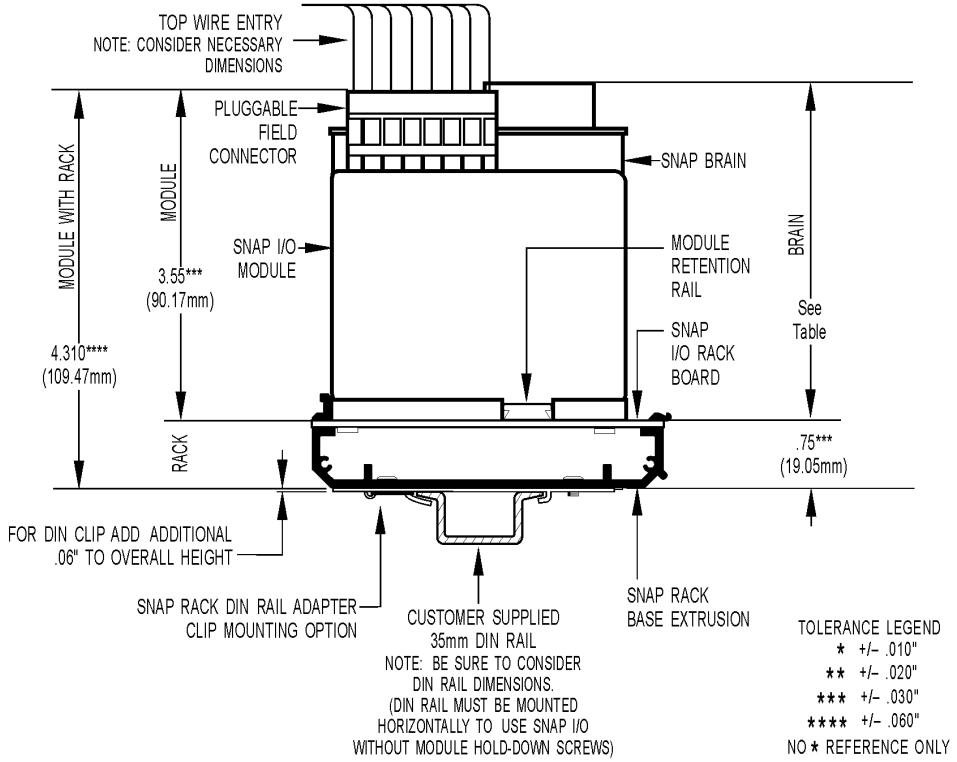


Figure 6-10: Dimensions for B3000 and SNAP-BRS

SNAP-B3000-HA and SNAP-BRS-HA Brain Boards

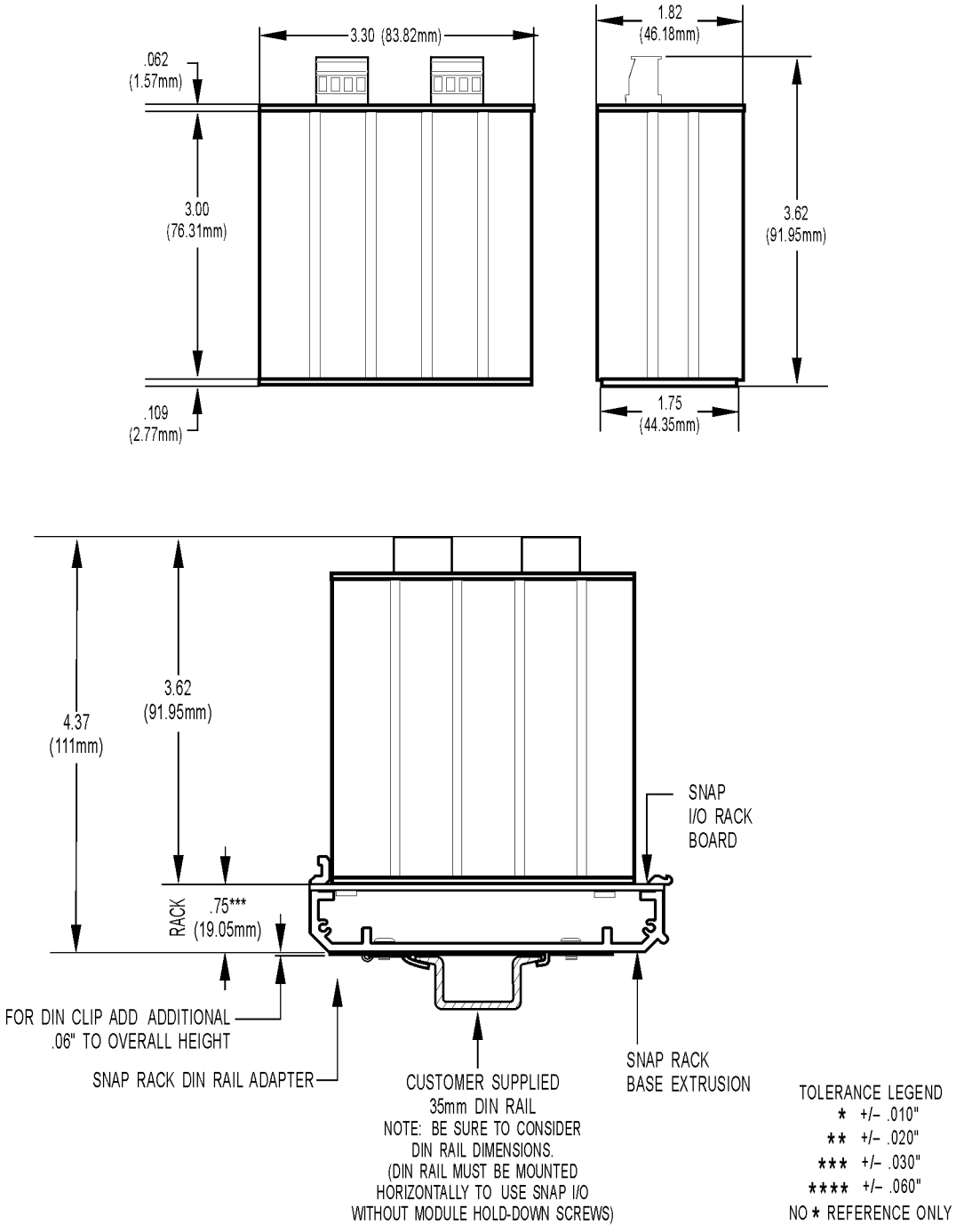


Figure 6-11: Dimensions for SNAP-B3000-HA and SNAP-BRS-HA

G4PS245A/B and G4PS24XA/B Power Supplies

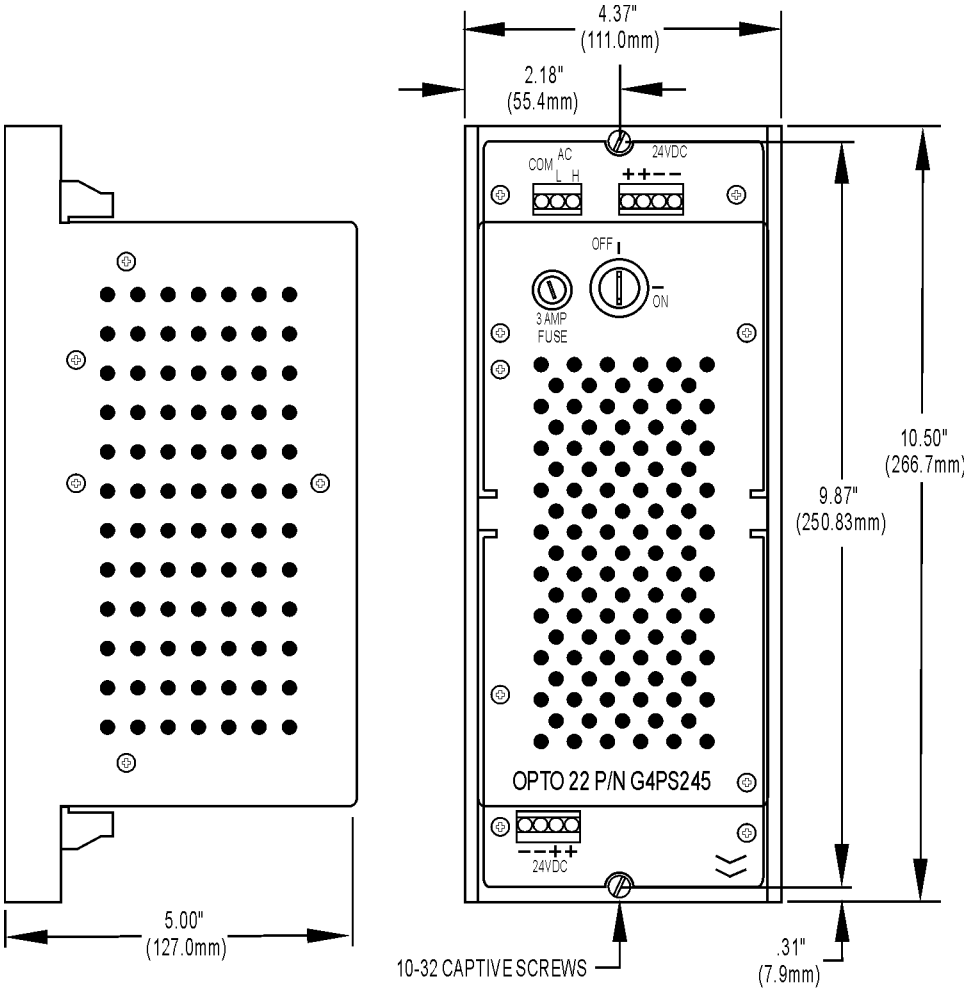


Figure 6-12: G4PS245A/B and G4PS24XA/B Power Supplies

SNAP-PS5/SNAP-PS24 Power Supplies

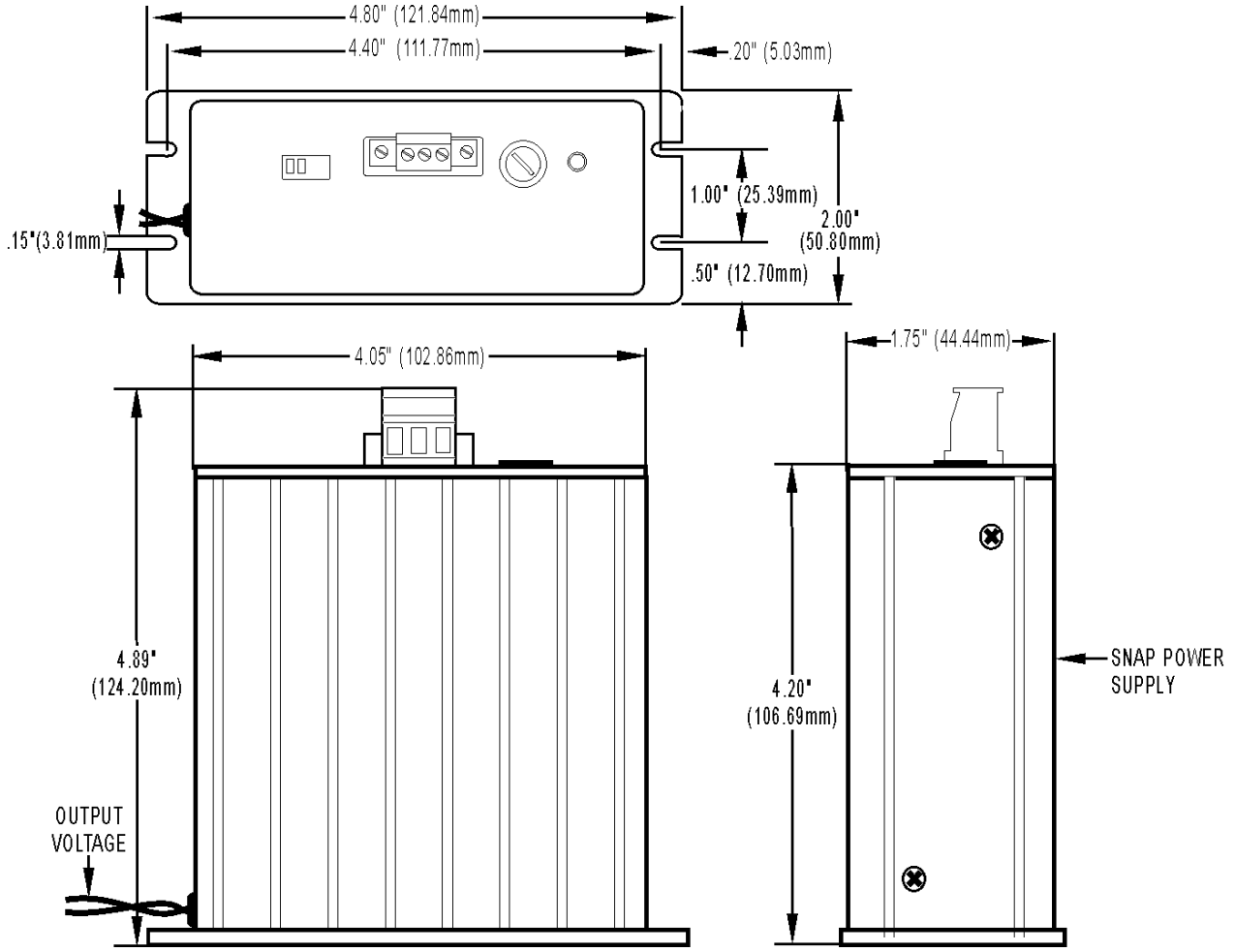


Figure 6-13: SNAP Power Supply, Panel Mounted

SNAP-PS5/SNAP-PS24 Power Supplies

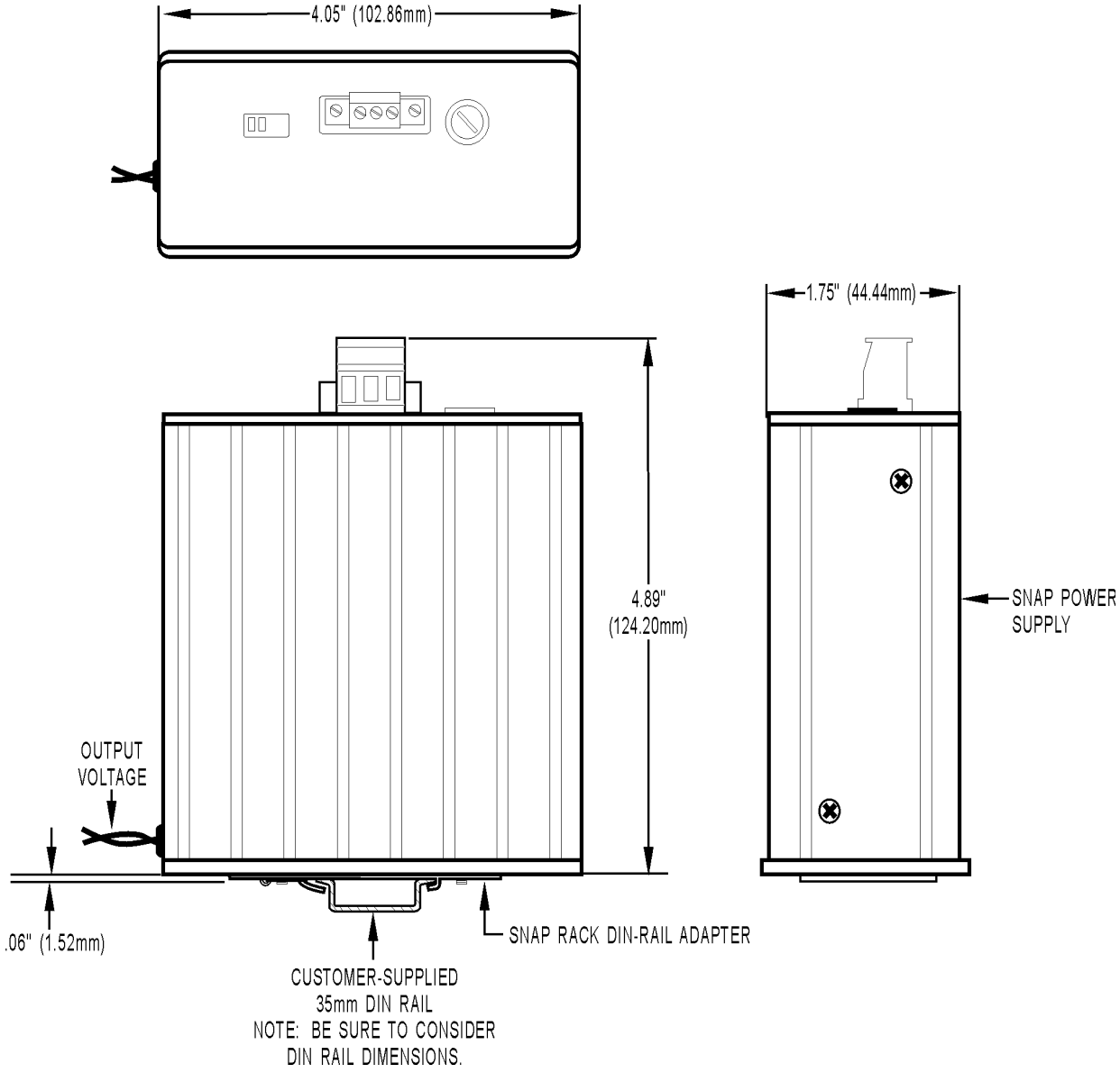


Figure 6-14: SNAP Power Supply with Din-Rail Adapter

AC38A/B Isolated High-Speed RS-485 Multidrop Repeater and AC40A/B Fiber Optic Data Link Adapter

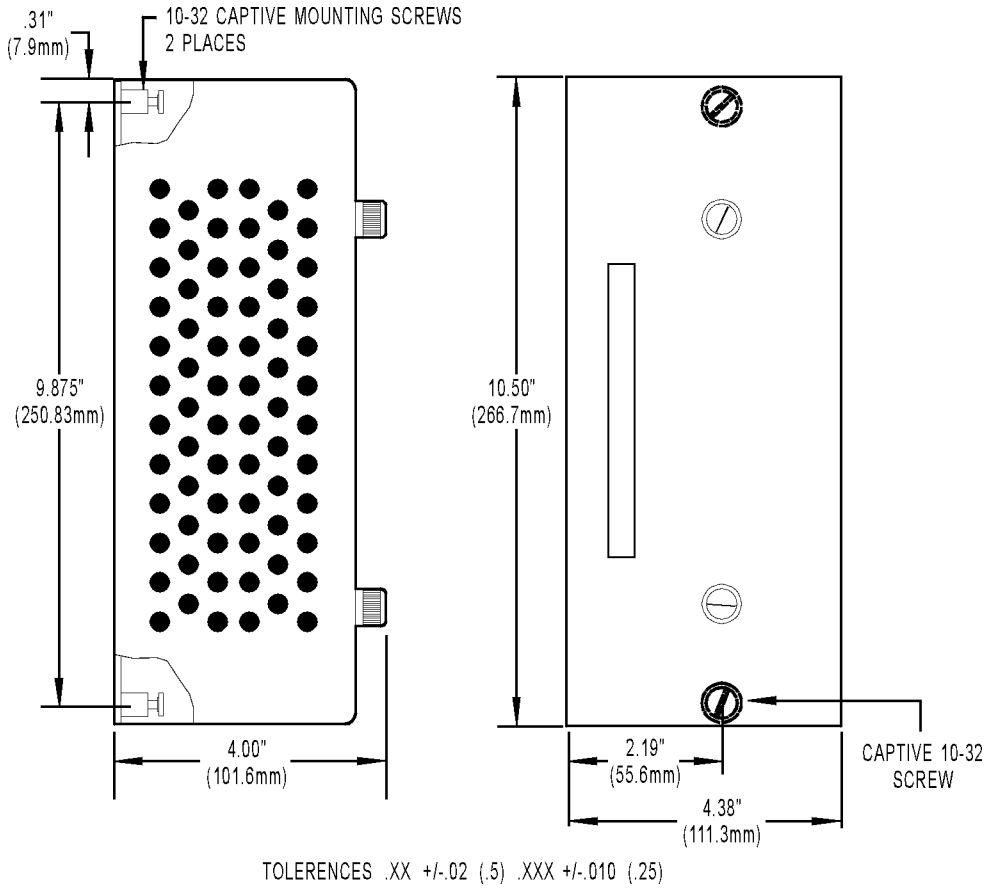


Figure 6-15: AC38A/B Isolated High-speed RS-485 Multidrop Repeater and AC40A/B Fiber Optic Data Link Adapter

G4LPANEL Local Panel

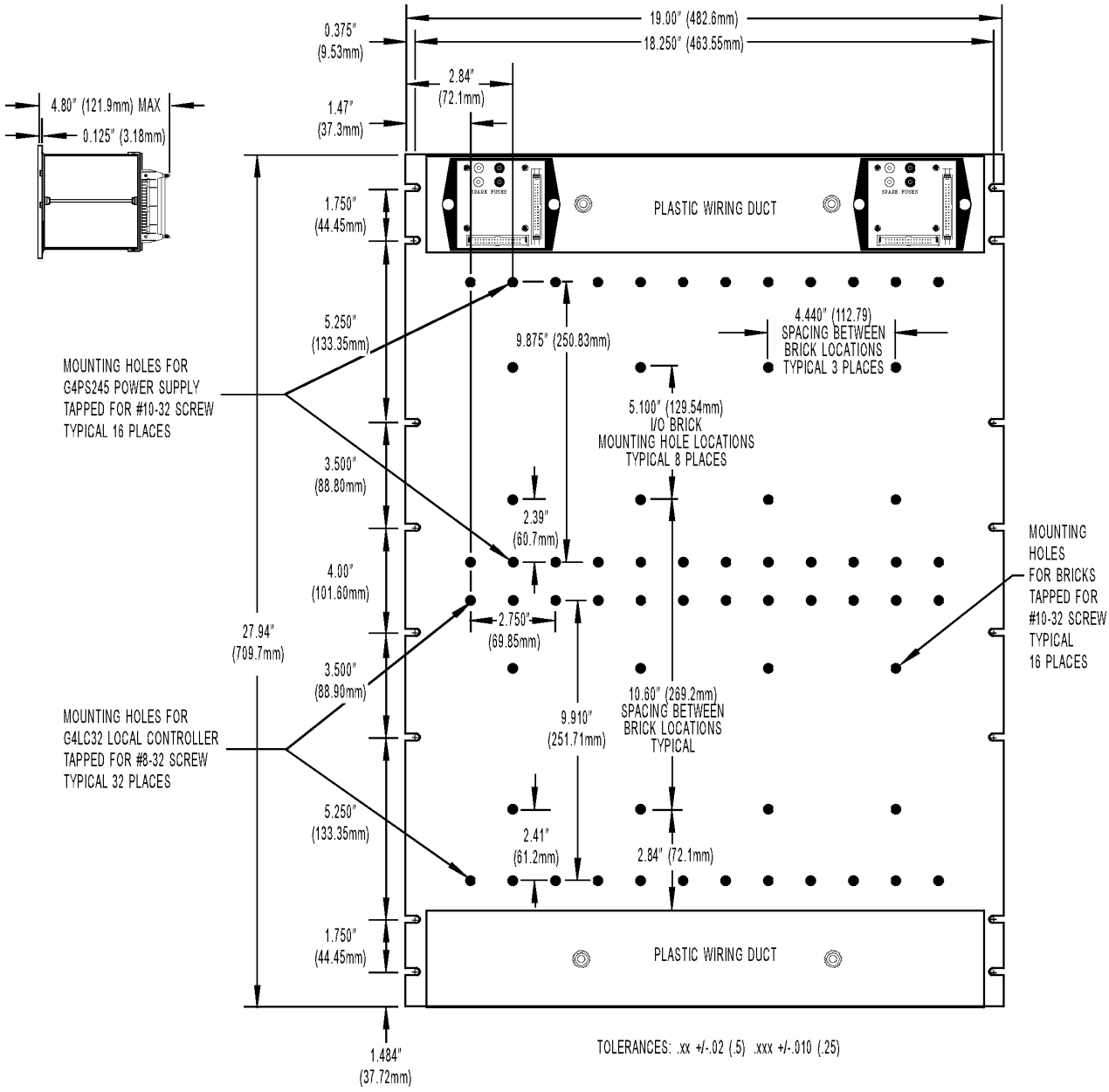


Figure 6-16: G4LPANEL Local Panel

G4RPANEL Remote Panel

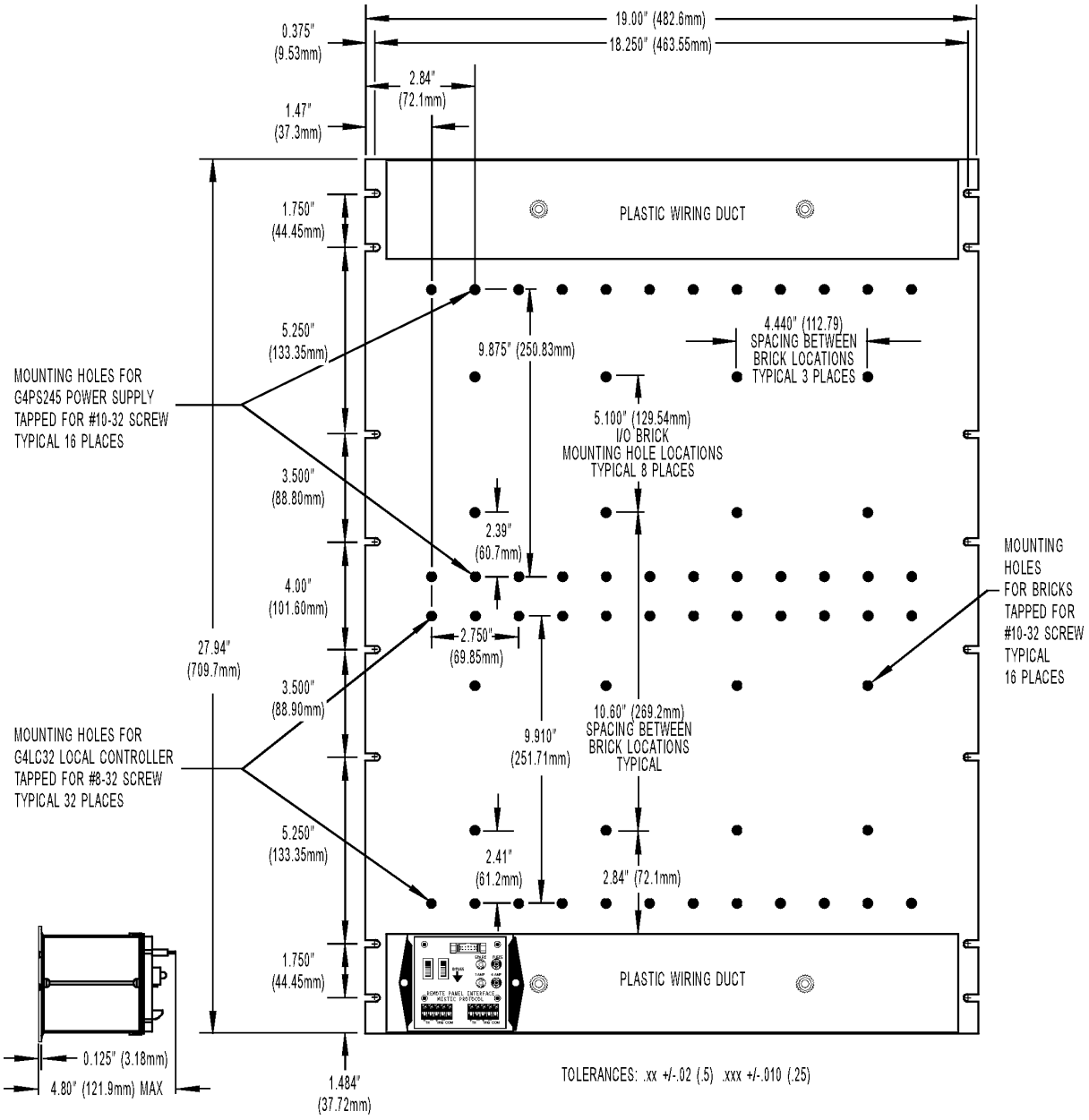


Figure 6-17: G4RPANEL Remote Panel

Panel with Bricks Using SBTAs

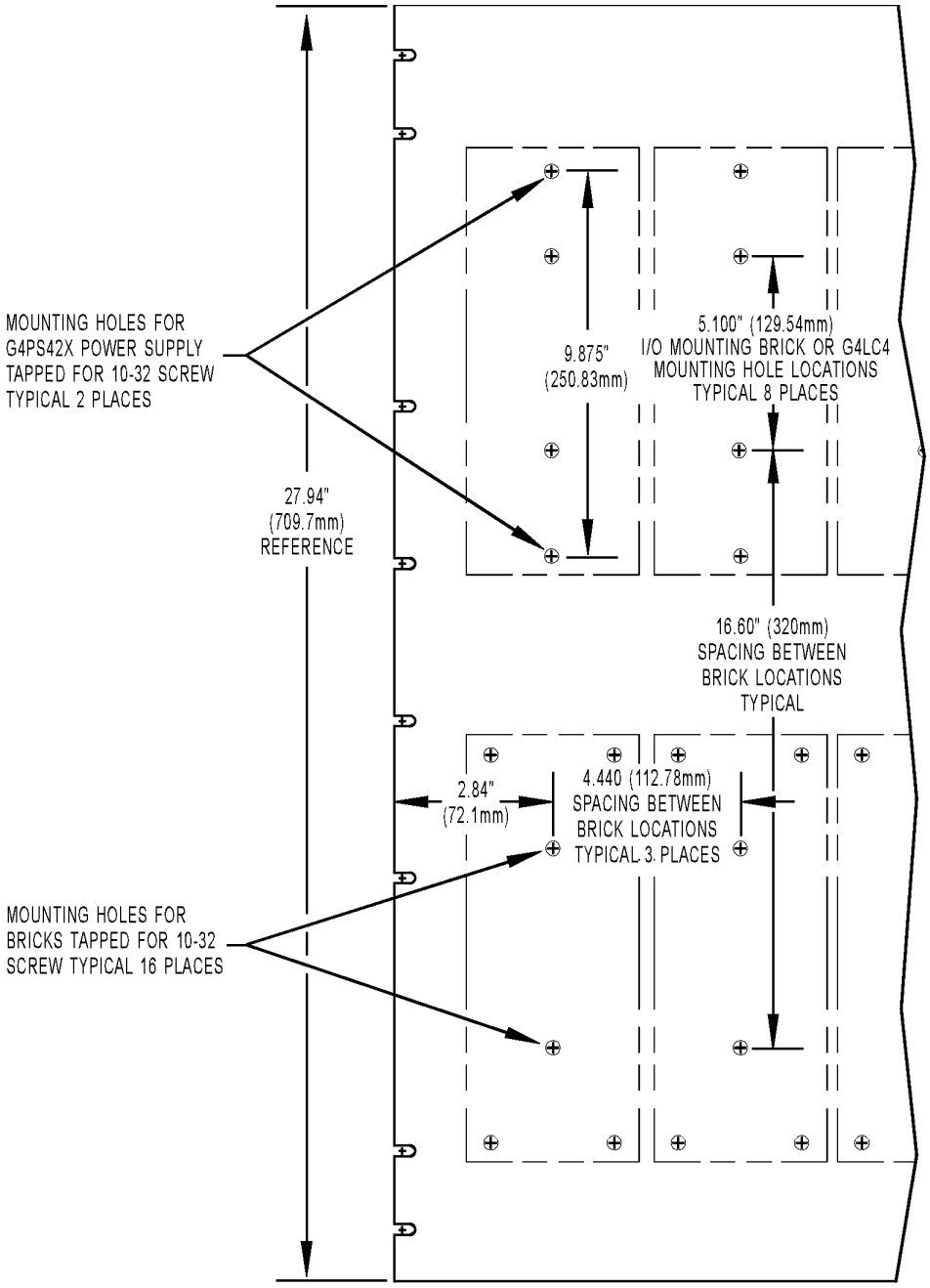


Figure 6-18: Panel with Bricks Using SBTAs

G4IOL/G4IOR Mistic 200 Interfaces

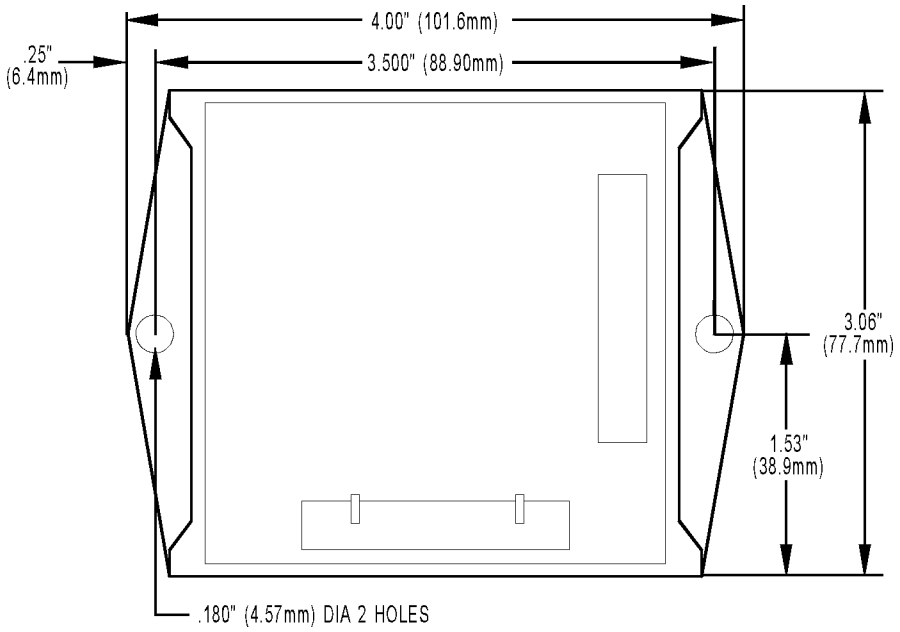


Figure 6-19: G4IOL Mistic 200 Local Interface

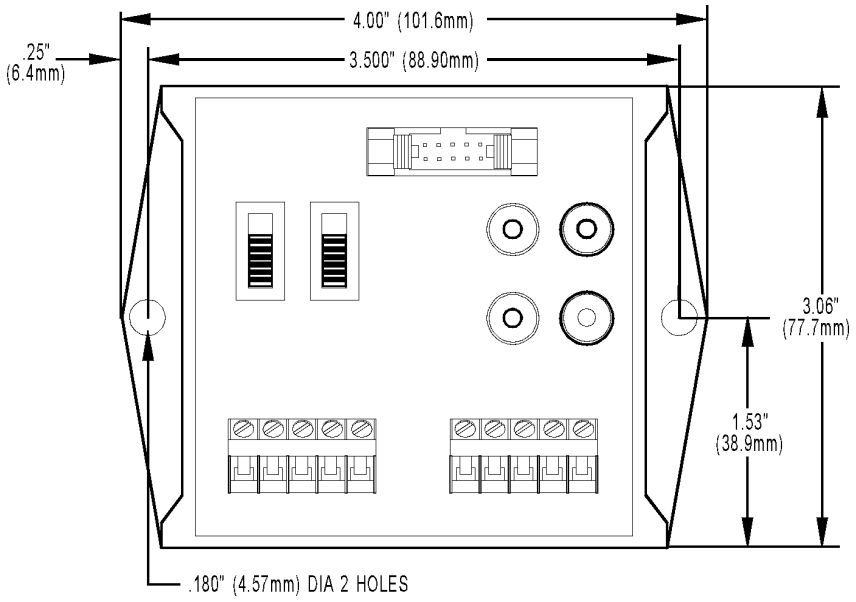


Figure 6-20: G4IOR Mistic 200 Remote Interface

SBTA Single Brick Communication Wiring Adapter

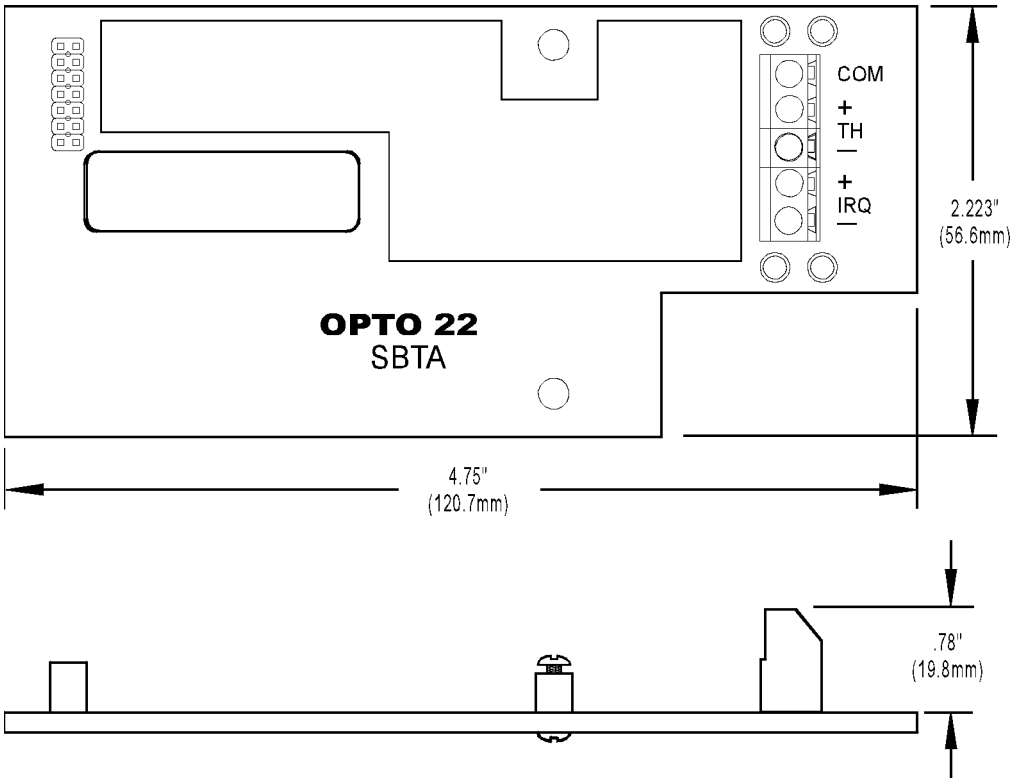


Figure 6-21: SBTA Single Brick Communication Wiring Adapter

APPENDIX A

Specifications

B3000 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

B3000-HA Specifications

Power Requirements	5.0 VDC ± 0.1 VDC at 1.0A max.
Operating Temperature	0° to 70° C, 5–95% humidity, non-condensing
CPU	16-bit Intel 80C196 I/O processor
Communications Interface	Node 0 and Node 1; twisted-pair ARCNET at 2.5 megabits per second. Either port can be used, or both ports can be used for redundant processor-to-I/O communication.
Data Rates	2.5 megabits per second; baud jumpers, although present, have no effect.
Range (Multidrop Mode):	Up to 1,000 feet with up to 17 nodes. Repeaters and conversion from Coax cable are commercially available.
Counter/Frequency Measurement	Maximum Rate: 20 kHz Minimum Pulse Width: 10 µsec
Output Pulse	Maximum Rate: 500 Hz Minimum Pulse Width: 1 msec
PID Update Rate	100 msec (for 1 to 8 PID loops)
LED Indicators	RUN (Power On), XMT (Activity), PGM (Program), and COM ports
Options: Jumper Selectable	Address, Node 0 Termination, Node 1 Termination
Cable	CAT-3 or CAT-5 UTP

SNAP Brain Boards

SNAP-BRS Specifications

Power Requirements	5.0 VDC ± 0.1 VDC @ 1.0A max.
Operating Temperature	0 to 70° C, 95% humidity, non-condensing
CPU	8-bit 8051 processor
Communications Interface	Supports 2-wire or 4-wire RS-485 using twisted pair cable with shield
Data Rates	300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 76800, and 115200 baud
Range: (Multidrop)	Up to 3,000 feet and 32 stations maximum between repeaters
LED Indicators	RUN (Power On), RCV (Receive), XMT (Transmit)
Options: Jumper Selectable	Address, communication, baud rate, CRC/Checksum, Binary/ASCI

SNAP-BRS-HA Specifications

Power Requirements	5.0 VDC ±0.1 VDC at 1.0 A max
Operating Temperature	0° to 70° C, 5–95% humidity, non-condensing
Communications	Dual, twisted-pair ARCNET ports, single or redundant
Data Rate	2.5 megabits per second, not selectable
LED Indicators	RUN (Power On), RX (not functional), and TX (Activity)
Cable	CAT-3 or CAT-5 UTP

Modular Controllers

M4 Specifications

Item	Specification
CPU	32-bit Motorola 68020 processor IEEE floating-point math
CPU clock frequency	16.67 MHz
Memory: RAM Flash EEPROM on controller	 1 MB with battery backup (user programs and data) 256 KB -1 MB (Mistic firmware and user programs)
RAM/clock battery	3.6-volt lithium, non-rechargeable
Communication: Base unit Expansion Modem support	 1 RS-232 and 1 RS-485/422 port Via daughter cards: configurable serial ports, Ethernet, ARCNET Direct, lease, and radio
Real-time clock	Clock/calendar, Epson 62421A with battery backup
Power requirements	5 VDC at 3.5 A (maximum) 24 VDC at 300 mA (maximum)
Typical operating temperature	-20° C to 70° C
Storage temperature	-40° C to 85° C
Humidity	5% to 95% relative humidity
Software	FactoryFloor (OptoControl, OptoDisplay, OptoServer, OptoConnect) Classic Software (Cyrano, Mistic MMI, MDS)
System monitors: Watchdog timers RAM battery backup low Operating temperature	 Detect communication errors from processor, I/O, etc. Detect main power supply operation Detects program corruption (checksum RAM test) Detects temperature

Modular Controllers

M4RTU and M4 I/O Specifications

CPU	32-bit Motorola 68020 processor 16-bit 80C196 I/O processor IEEE floating-point math
CPU clock frequency	16.67 MHz
Memory: RAM Flash EEPROM on controller Flash EEPROM on brain board	 1 MB with battery backup (user programs & data) 256 KB - 1 MB (firmware and user programs) 128 KB (I/O firmware)
RAM/clock battery	3.6-volt lithium, non-rechargeable
I/O Base unit Extender unit Expansion	 8 digital, 4 analog, multifunction Adds 8 digital, 4 analog, multifunction Via RS-485 ports, using Opto 22 I/O
Communication Base unit Expansion Modem support	 1 RS-232 and 1 RS-485/422 port Via daughter cards: configurable serial ports, Ethernet, and ARCNET Direct, lease, and radio
Real-time clock	Clock/calendar, Epson 62421A with battery backup
Power requirements	5 VDC at 3.5 A (maximum) 24 VDC at 300 mA (maximum)
Typical operating temperature	-20° C to 70° C
Storage temperature	-40° C to 85° C
Humidity	5% to 95% relative humidity
Software	FactoryFloor (OptoControl, OptoDisplay, OptoServer, and OptoConnect) Classic Software (Cyrano, Mistic MMI, MDS)
System monitors Host communications Watchdog timers RAM battery backup low Operating temperature	 Detect communication errors from processor, I/O, etc. Detect main power supply operation Detects program corruption (check sum RAM test) Detects temperature

Mistic 200 Controllers

G4LC32 Specifications

CPU	Motorola 68020 32-bit microprocessor
NPU	Motorola 68882 floating point math coprocessor
CPU Clock Frequency	16.67 MHz
FLASH EPROM	512 KB (expandable to 1 MB)
RAM	512 KB (expandable to 4 MB), with battery backup
Watchdog timer	Standard, hardware
Real-time Clock	Clock/calendar, Epson 62421A, with battery backup
Front panel display	4 line x 20 character backlight LCD
Front panel keyboard	25-button keypad
Communications	Two full-duplex, RS-422/485 serial ports Two full-duplex combined RS-232 or RS-422/485 serial ports One ARCNET port Local bus port
RAM/clock battery	3.6 V lithium, nonrechargeable
Battery life	Two years under normal operating conditions
Power requirements	5 VDC ± 0.1 @ 2.0 A
Operating temperature	0° C to 60° C 0° C to 50° C for LCD display
Storage temperature	- 25° C to 85° C
Humidity	5 % to 95 % relative humidity
Software	FactoryFloor (OptoControl, OptoDisplay, and OptoServer) Classic Software (Cyrano, Mistic MMI, MDS)

Mistic 200 Controllers

G4LC32SX Specifications

CPU	32-bit Motorola 68020 processor IEEE floating-point math
CPU clock frequency	16.67 MHz
Memory RAM Flash EEPROM on controller	 256 KB - 1 MB with battery backup (user programs & data) 256 KB - 1 MB (firmware and user programs)
RAM/clock battery	3.6-volt lithium, non-rechargeable
I/O	Via RS-485 ports, using Opto 22 I/O
Communication Base unit Expansion	 2 combined RS-232 or RS-485/422 port Via daughter cards: configurable serial ports, ARCNET, Local bus port
Real-time clock	Clock/calendar, Epson 62421A with battery back
Power requirements	5 VDC ± 0.1 @ 2.0 A
Typical operating temperature	0° C to 70° C
Storage temperature	0° C to 70° C
Humidity	5% to 95% relative humidity
Software	FactoryFloor (OptoControl, OptoDisplay and Optoserver) Classic Software (Cyrano, Mistic MMI, MDS)
System monitors Host communications Watchdog timers RAM battery backup low Operating temperature	 Detect communication errors from processor, I/O, etc. Detect main power supply operation Detects program corruption (check sum RAM test) Detects temperature

Mistic 200 Controllers

G4LC32ISA Specifications

CPU	Motorola 68020 32-bit microprocessor
Optional	Motorola 68882 math coprocessor
Power Requirements	5 VDC ± 0.25 V @ 1.5 A
Temperature	0° C to 70° C
CPU Clock Frequency	16.67 MHz
FLASH Memory	256 KB expandable to 1 MB
RAM	256 KB with battery backup expandable to 2 MB
Communications	One 2-wire half-duplex RS-485 port baud rate Expansion cards One Mistic Local bus port
Watchdog Timer	Hardware
Real-time Clock	Epson 62421A clock/calendar with battery backup
RAM/Clock Battery	3.6 V lithium, non-rechargeable
Software	FactoryFloor (OptoControl, OptoDisplay, and OptoServer) Classic Software (Cyrano, Mistic MMI, MDS)

Mistic 200 Controllers

G4LC32ISA-LT Specifications

CPU	32-bit Motorola 68020 processor 16-Bit External Bus IEEE floating-point math
CPU clock frequency	16.67 MHz
Memory RAM Flash EEPROM on controller	 256 KB with battery backup (user programs and data) 256 KB (firmware and user programs)
RAM/clock battery	3.6-volt lithium, non-rechargeable
I/O	Via RS-485 ports, using Opto 22 (remote) I/O
Communication	2 RS-232 or RS-485/422 ports
Real-time clock	Clock/calendar, Epson 62421A with battery backup
Power requirements	5 VDC ± 0.25V @ 1.5A (maximum)
Typical operating temperature	-20° C to 70° C
Storage temperature	-40° C to 85° C
Humidity	5% to 95% relative humidity
Software	FactoryFloor (OptoControl, OptoDisplay, and OptoServer) Classic Software (Cyrano, Mistic MMI, MDS)
System monitors Host communications Watchdog timers	 Detect communication errors from processor, I/O, etc. Detect main power supply operation

Remote Digital I/O Units

G4D16R Specifications

CPU CPU clock frequency	16-bit, Intel 80C196 processor 12 MHz processor
Communications Bus speed Cable type Maximum cable length Mode	 300 - 115.2 KBd 3 wire, twisted pair + GND, Interrupt uses 2nd wire pair 3,000 ft (more with repeaters) Binary or ASCII
Typical I/O times (includes communication transfer time) Read 16 channels Write 16 channels	 1.76 ms 2.27 ms
Counters (frequency measure) Maximum rate Data size Minimum pulse width ON Minimum pulse width OFF	 20 KHz 32 bits 10 µs 10 µs
Latching (minimum pulse width)	10 µs
Output pulse Maximum continuous rate Minimum pulse width ON Minimum pulse width OFF	 500 Hz 1 ms 1 ms
Time-proportional output (TPO) minimum period	100 ms
Typical Event/Reaction time (£16 Event/Reactions)	4 ms
*System power consumption @ 24 VDC ± 0.1V Terminated (last brick on the bus) Non-terminated (all other bricks)	 250 mA 250 mA
Temperature Operating Storage	 0°C to 70°C - 40°C to 80°C
Humidity	5% to 95% relative humidity
Software	OptoControl, Cyrano 200 and Misticware

**Note: The 24 VDC common must be tied to earth ground. When using Mistic power supplies, this is handled by the power supply as long as earth ground is connected to the AC side. See page134 for more detailed information.*

Local Digital I/O Units

G4D16L Specifications

CPU CPU clock frequency	16-bit, Intel 80C196 processor 12 MHz processor
Communications Bus speed Cable type Maximum cable length Mode	 1.4Mbps 34 conductor, ribbon 200 ft Binary
Typical I/O times (includes communication transfer time) Read 16 channels Write 16 channels	 0.68 ms 1.0 ms
Counters (frequency measure) Maximum rate Data size Minimum pulse width ON Minimum pulse width OFF	 20 KHz 32 bits 10 µs 10 µs
Latching (minimum pulse width)	10 µs
Output pulse Maximum continuous rate Minimum pulse width ON Minimum pulse width OFF	 500 Hz 1 ms 1 ms
Time-proportional output (TPO) minimum period	100 ms
Typical Event/Reaction time (≤16 Event/Reactions)	4 ms
*System power consumption @ 24 VDC ± 0.1V Terminated (last brick on the bus) Non-terminated (all other bricks)	 425 mA 375 mA
Temperature Operating Storage	 0°C to 70°C - 40°C to 80°C
Humidity	5% to 95% relative humidity
Software	OptoControl, Cyrano 200 and Misticware

**NOTE: The 24 VDC common must be tied to earth ground. When using Mistic power supplies, this is handled by the power supply as long as earth ground is connected to the AC side. See page134 for more detailed information.*

Remote Analog I/O Units

G4A8R Specifications

CPU CPU clock Frequency	16-bit, Intel 80C 196 processor 12 MHz processor
Communications Bus speed Cable type Maximum cable length Mode	 300-115.2 KBd 2 twisted pair + GND Interrupt uses 1 twisted pair 3,000 ft (more with repeaterss) Binary or ASCII
Typical I/O time (includes communication transfer time) Read 16 channels Write 16 channel	 5.53 ms 6.52 ms
Input/output update rate Input Output	 7 ms 50 ms
Analog input/output timing Analog Mistic 200 I/O units constantly update the status of their I/O. Input modules are read every 7 milliseconds and the data held in memory until requested by their host CPU. Output module data is held in memory and output to each module every 50 milliseconds.	
PID scan rate	100 ms for all 8 PIDs 4 PID loops/brick Up to 8 PID loops with brick expansion option
Typical Event/Reaction time (≤16 Event/Reactions)	4 ms
*System power consumption @ 24 VDC ± 0.1 V (excludes analog modules) Terminated (last brick on the bus) Non-terminated (all other bricks) Analog expansion brick Typical analog module	 180 mA 180 mA 65 mA 45 mA
Isolation Input to output Output to analog supply	 4,000 Vrms 4,000 Vrms
Temperature Operating Storage	 0° C to 70° C -40° C to 80° C
Humidity	5% to 95% relative humidity
Software	OptoControl, Cyrano 200, and Misticware
Expansion options G4RAX Remote analog expansion brick	Adds 8 additional analog I/O channels on a separate brick unit

**NOTE: The 24 VDC common must be tied to earth ground. When using Mistic power supplies, this is handled by the power supply as long as earth ground is connected to the AC side. See page134 for more detailed information.*

Local Analog I/O Units

G4A8L Specifications

CPU CPU clock Frequency	16-bit, Intel 80C 196 processor 12 MHz processor
Communications Bus speed Cable type Maximum cable length Mode	 1.4 Mbps 34 conductor, ribbon 200 ft Binary
Typical I/O time (includes communication transfer time) Read 16 channels Write 16 channel	 1.03 ms 2.48 ms
Input/output update rate Input Output	 7 ms 50 ms
PID scan rate	100 ms for all 8 PIDs 4 PID loops/brick Up to 8 PID loops with brick expansion option
Typical Event/Reaction time (≤16 Event/Reactions)	4 ms
*System power consumption @ 24 VDC ± 0.1 V (excludes analog modules) Terminated (last brick on the bus) Non-terminated (all other bricks) Analog expansion brick Typical analog module	 276 mA 240 mA 65 mA 45 mA
Isolation Input to output Output to analog supply	 4,000 Vrms 4,000 Vrms
Temperature Operating Storage	 0° C to 70° C -40° C to 80° C
Humidity	5% to 95% relative humidity
Software	OptoControl, Cyrano 200, and Misticware
Expansion options G4LAX Local analog expansion brick	Adds 8 additional analog I/O channels on a separate brick unit

**NOTE: The 24 VDC common must be tied to earth ground. When using Mistic power supplies, this is handled by the power supply as long as earth ground is connected to the AC side. See page134 for more detailed information.*

High Density Digital/Analog I/O Units

G4D32RS Specifications

CPU CPU clock frequency	8-bit 87C51 processor 22 MHz
Communications Bus speed Cable type Maximum cable length Mode Protocol	 300-115.2 KBd (76.8 K, 150, and 110 baud not supported) 2 twisted pair + ground (interrupts use 1 pair) 3,000 ft. (more with repeaters) Binary or ASCII RS-485, half-duplex
Typical I/O times (includes communication transfer time) Read 16 channels Write 16 channels	 1.6 ms 1.8 ms
Latching (minimum pulse width)	100 µs
Typical operating temperature Storage temperature	-20° to 70° C -40° to 85° C
Humidity	5% to 95% relative humidity
Software	OptoControl, Cyrano, and MisticWare
*Power requirements @ 24 VDC ± 0.5V with 32 modules installed Terminated (last brick on the bus) Non-terminated (all other bricks)	 220 mA 220 mA
Maximum rack field current rating (32 x G4 digital I/O)	48A

High Density Analog System Power Consumption

*System Power Consumption @ 24 VDC		
Part Number	**Without Termination**	**With Termination**
G4HDAL	250 mA	300 mA
G4HDAR	200 mA	200 mA
G4AITM	100 mA	100 mA
G4AIVA	150 mA	150 mA
G4AOV	150 mA	150 mA
G4AOA	75 mA	75 mA

**NOTE: The 24 VDC common must be tied to earth ground. When using Mistic power supplies, this is handled by the power supply as long as earth ground is connected to the AC side. See page134 for more detailed information.*

Using Power Supplies with Mistic Bricks

Opto 22 offers the following power supplies for use with Mistic bricks:

Type	Input	Output	Suggested Use
G4PS245A	95–130 @ 3.5 amps max.	24VDC (±0.5) @ 4A 5VDC (±0.1) @4A	Any mistic controller and six bricks or seven bricks and no controller.
G4PS245B	190–250 @ 3.5 amps max.		
G4PS24XA	95–130 @ 3 amps max.	24VDC (±0.5) @ 4A	Seven bricks
G4PS24XB	190–250 @ 3 amps max.		

If you are not using an Opto 22 Mistic power supply with Mistic bricks, then the following applies:

- The 24 VDC common must be tied to earth ground. If this is not done, then the G4REG on the brick may not consistently function properly. This may result in intermittent or sporatic resets of one or more Mistic bricks resulting in operational and communication problems. Typically, the symptom will be a -29 time-out error.
- The power supply used to supply the control power for Mistic bricks should not be used to supply any other equipment. Field devices must not be supplied by the same power supply used for the Mistic bricks. Not only does this bypass the optical isolation of the I/O modules, but it also causes voltage fluctuations to the brick which may result in brick resets.
- Use only good quality power supplies that offer tight voltage regulation.
- Limit the number of bricks supplied by each power supply. A maximum of eight bricks per power supply is recommended. Power wiring should be 18 AWG minimum. Wiring in a "star" configuration is best. Limit the wiring length from the power supply to the bricks.
- It is best to apply power to the bricks by turning power on to the power supply as opposed to using a breaker downstream of the power supply.

Power Supplies with Mistic Bricks

Third–Party power supply vendors:

ELPAC ELECTRONICS INC.
1562 Reynolds Avenue
Irvine, CA 92614
Phone : 714-714-476-6070
Fax: 714-476-6080
E-mail: sales@elpac.com
Internet Web site: http://www.elpac.com

LAMBDA ELECTRONICS
515 Broadhollow Road
Melville, NY 11747
Phone: 800-LAMBDA-4
Internet Web site: http://www.lambdapower.com

POWER-ONE
740 Calle Plano
Camarillo, CA 93012-8583
Phone: 805-987-8741

SOLA
199 Scott Swamp Road
Farmington, CT 06034
Phone: 800-377-4384
Internet Web site: http://www.sola-hevi-duty.com

NOTE: When specifying power supplies for powering Mistic B200 analog racks, some manufacturer's triple supplies have the +5 volts and the ±15 volts commons connected; thereby defeating the isolation. To ensure complete isolation, use separate power supplies for the +5 volts and the ±15 volts.

APPENDIX B

Product Support

If you have any questions about these products, contact Opto 22 Product Support Monday through Friday, 8 a.m. to 5 p.m. Pacific Time.

Phone:	800-TEK-OPTO (835-6786) 951-695-3080
Fax:	951-695-3017
E-mail:	support@opto22.com
Opto 22 Web site:	www.opto22.com

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
- Controller firmware version
- PC configuration
- A complete description of your hardware and operating systems, including:
  — jumper configuration
  — accessories installed (such as expansion daughter cards)
  — type of power supply
  — types of I/O units installed
  — third-party devices installed (e.g., barcode readers)
- Specific error messages seen