

## SNAP PAC MOTION CONTROL SUBSYSTEM

### Features

- > Extensive programmability and PC functionality at the I/O level
- > Support for multiple processes, high-speed compiled code, and diverse programming languages
- > Connection accessories provided
- > Works with SNAP PAC R-series controllers and SNAP PAC EB-series brains
- > Up to eight serial modules per rack
- > Compact and rugged units suitable for deployment in harsh environments
- > UL approved



commands or the TransmitReceiveString command in OptoScript. The OptoMotion commands give you the ability to define and acquire motion process data such as position, velocity, acceleration, breakpoints, interrupts, and time intervals. In addition, you can execute motion-related actions such as smooth stops, stepping, and position adjustments.

### DESCRIPTION

The easy-to-use SNAP PAC Motion Control Subsystem provides an integrated hardware and software tool set for controlling multi-axis stepper motors. The subsystem consists of:

- SNAP Motion Control host communication modules (SNAP-SCM-MCH16)[**Obsolete**]
- SNAP Motion Control breakout boards (SNAP-SCM-BB4)
- OptoMotion command set

The **SNAP-SCM-MCH16** [**Obsolete**] motion control module is a serial communication module that links up to four SNAP-SCM-BB4 motion control breakout boards to a SNAP PAC I/O module. When mounted on an Opto 22 rack, the SNAP-SCM-MCH16 module allows a SNAP PAC controller running a PAC Control™ programming strategy to control up to 16 stepper motors. LED indicators are provided to indicate Transmit and Receive on each port. The module snaps into an Opto 22 SNAP PAC mounting rack right beside digital and analog modules. Use two 4-40 by 1/2-inch standard machine screws to hold each module securely in position on the SNAP rack.

Each **SNAP-SCM-BB4** breakout board is equipped with a Magellan™ processor chip set that outputs pulse and direction signals for up to four stepper motor systems. You can daisy-chain up to four breakout boards connected to a single module. The module's external connector provides lines to power one breakout board; additional boards require a separate power source. The SNAP-SCM-BB4 breakout board is designed to be mounted using a DIN-rail system.

The **OptoMotion** commands supports many of the Magellan™ Motion Processor commands. These commands are entered in a PAC Control strategy as text strings using the Transmit String and Receive

### CALCULATING POWER REQUIREMENTS

When you assemble a SNAP rack that includes a SNAP-SCM-MCH16, you need to calculate the power requirements to make sure that the rack's power supply is adequate for the combined current needed by the brain or controller and all the I/O modules. For more information and power requirements worksheets, see the *SNAP I/O Wiring Guide* (form #1403) as well as the wiring appendices in the *SNAP PAC Brain User's Guide* (form #1690) and the *SNAP PAC R-Series Controller User's Guide* (form #1595).

### POWERING THE BREAKOUT BOARD

**When using power from the SNAP-SCM-MCH16 module**, you can use only one breakout board. The breakout board should be connected with a cable under two meters long, and the stepper logic must be isolated from the drive output. If you are uncertain how to achieve this, consider using an auxiliary power supply instead.

### Part Numbers

Part	Description
SNAP-SCM-MCH16 [ <b>Obsolete</b> ]	[ <b>Obsolete</b> ] Single channel RS-422 (four wire) motion control communication module
SNAP-SCM-BB4	SNAP Motion Control Breakout Board, 4 axes, Stepper
SNAP-RACKDIN	SNAP rack DIN-rail adapter clip
SNAP-RACKDINB	SNAP rack DIN-rail adapter clip, 25-pack

If using an auxiliary power supply, you can choose either the 5 VDC auxiliary input or the 8 to 32 VDC auxiliary input on the breakout board.

Module Specifications

Baud rates	115,200
Parity	Even
Data bits	8 only
Logic supply voltage	5.0 to 5.2 VDC
Logic supply current	250 mA <sup>1</sup> 500 mA <sup>2</sup>
Number of ports per module	1
Maximum number of modules per rack	8 <sup>1</sup>
Maximum cable length, multi-drop	1,000 feet at 115,200 Baud
I/O processor (brain or on-the-rack controller) compatibility	SNAP-PAC-R1, SNAP-PAC-R2, SNAP-PAC-EB1, or SNAP-PAC-EB2
Operating temperature	-20 to 70 °C
Storage temperature	-30 to 85 °C
Torque, hold-down screws	Not to exceed 1 in-lb (0.11 N-m)
Torque, connector screws	5.22 in-lb (0.59 N-m)
Agency Approvals	UL, CE, RoHS, DFARS
Warranty	30 months

Module LEDs

LED	Indicates
1	Program LED
2	TX
3	Power Supply Fault
4	RX

- 1. Each breakout board is powered by a separate power supply.
- 2. Breakout board uses power from the module.

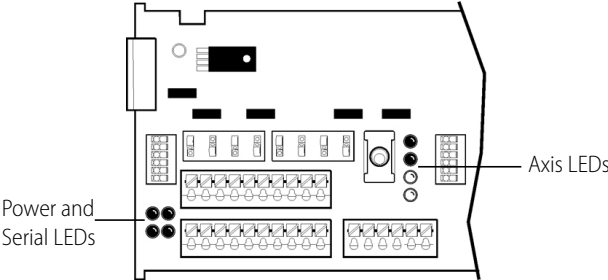
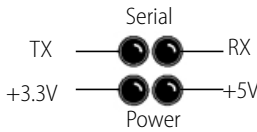
Breakout Board Specifications

Power Requirements	8.0 to 32.0 VDC @ 250mA 5.00 to 5.20 VDC @ 500mA
Operating Temperature	-20 to 70 °C

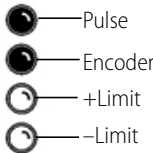
Relative Humidity	95%, non-condensing
Agency Approvals	UL, DFARS
Warranty	30 months

Breakout Board LEDs

Power and Serial LEDs

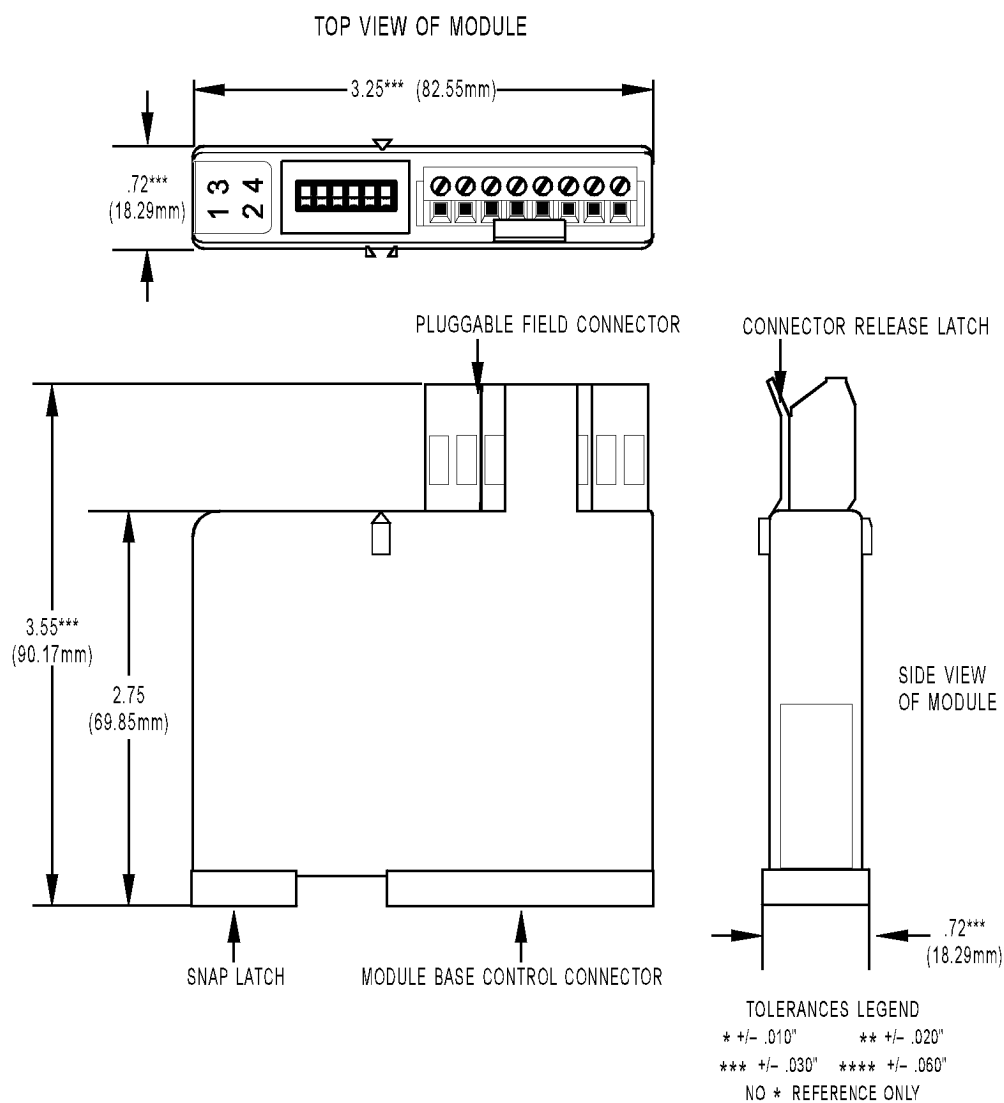


Axis LEDs



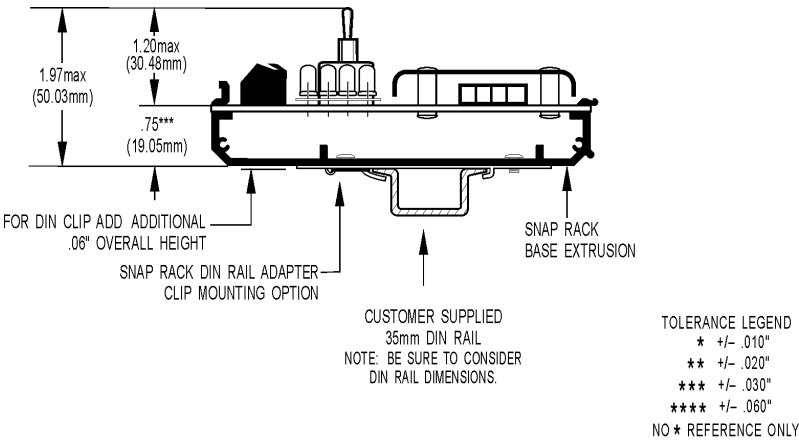
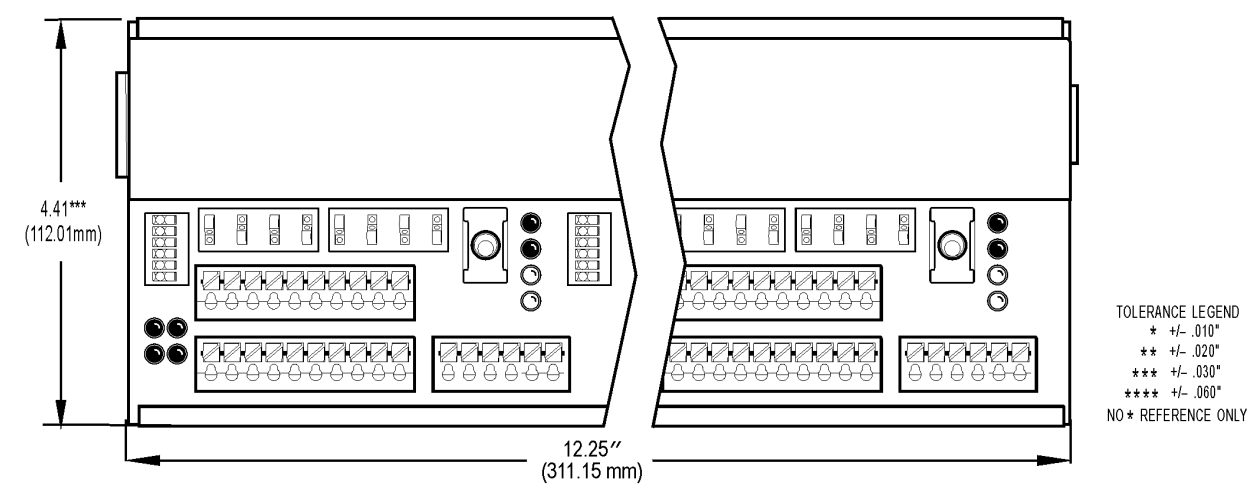
## DIMENSIONAL DRAWINGS

### SNAP-SCM-MCH16 Motion Control Module [Obsolete]

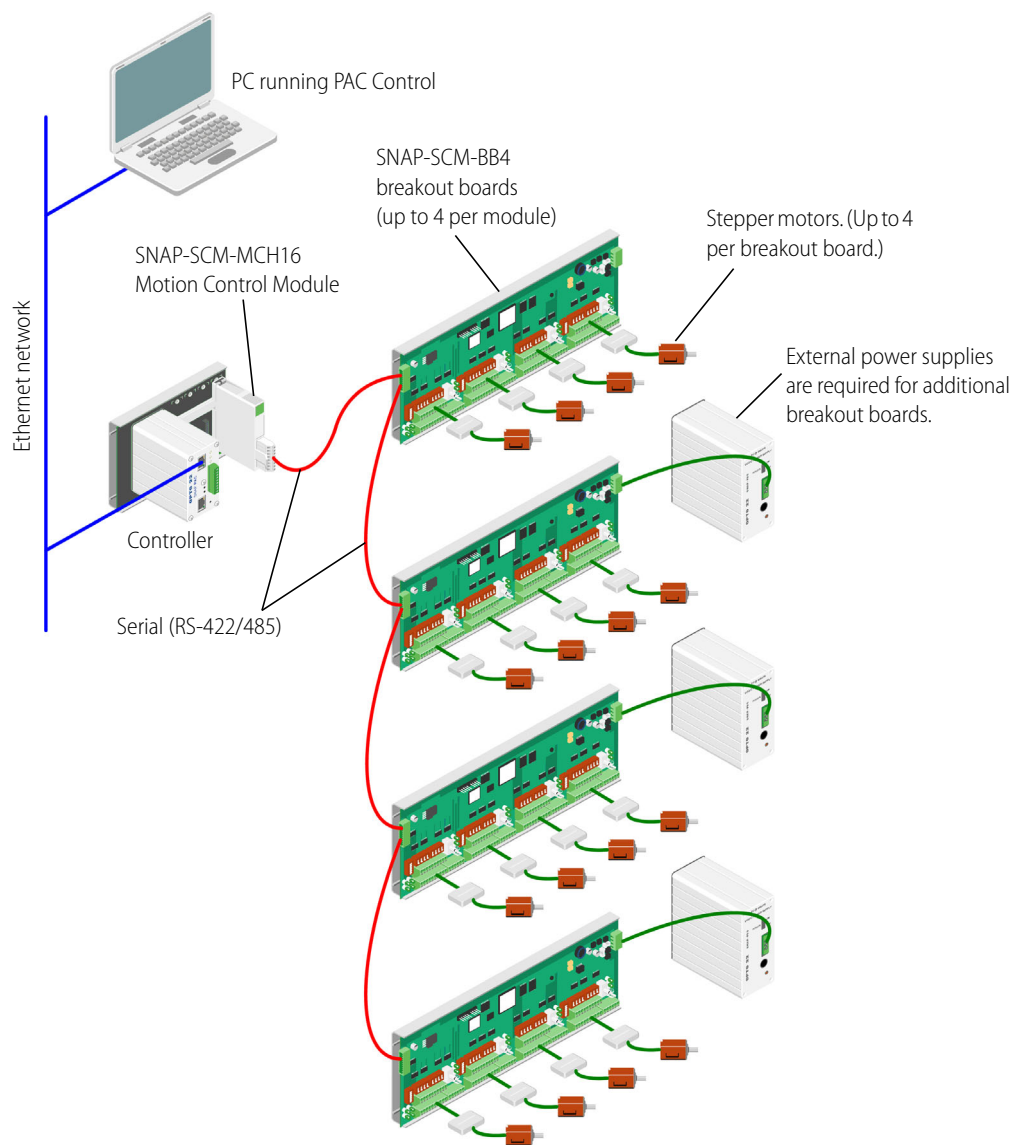


DIMENSIONAL DRAWINGS (CONT)

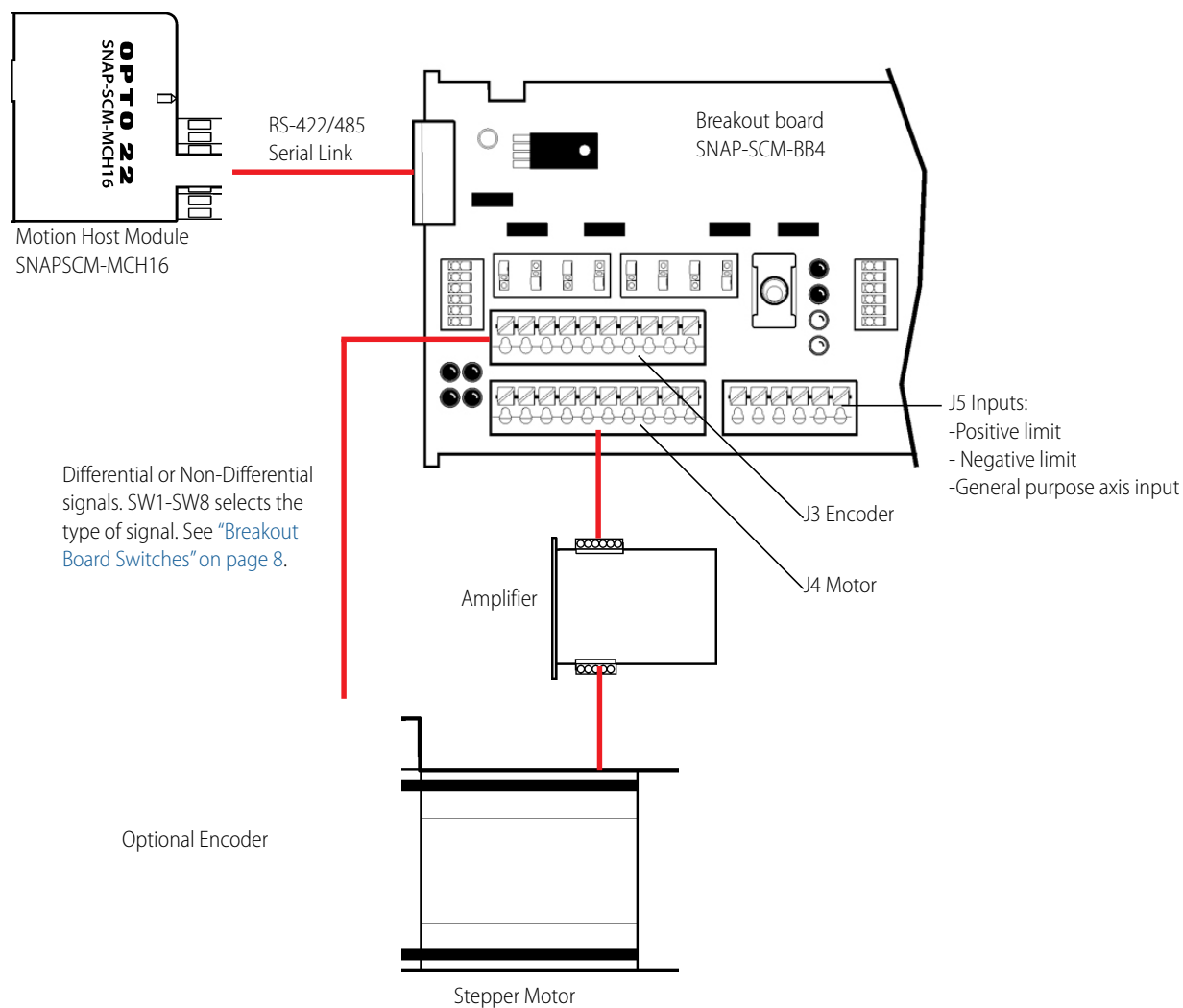
SNAP-SCM-BB4 Breakout



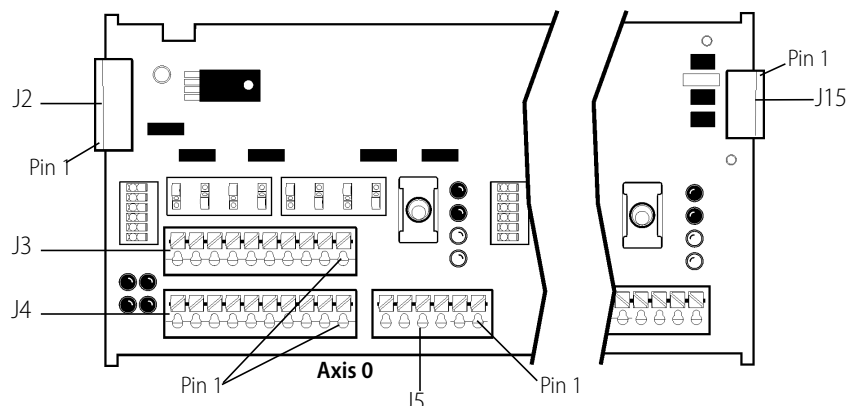
## SNAP SCM MOTION CONTROL COMMUNICATION DIAGRAM



## SCM-MOTION COMMUNICATION DIAGRAMS (CONT.)



## BREAKOUT BOARD CONNECTOR PINS



J15: Auxiliary Power Input

Pin	Description
1	Aux +5Vin
2	Aux +8-24vin
3	GND
4	Chassis GND

J2: Serial Connector

Pin	Description
1	ToHost+
2	ToHost-
3	GND
4	FromHost+
5	FromHost-
6	Chassis GND
7	Vmod
8	VMod
9	GND
10	GND

J4 (and J7, J10, & J13): Stepper Motor Outputs

Pin	Description
1	Pulse+
2	Pulse-
3	GND
4	Direction+
5	Direction-
6	AtRest+
7	AtRest-
8	GND
9	AxisOut+
10	AxisOut-

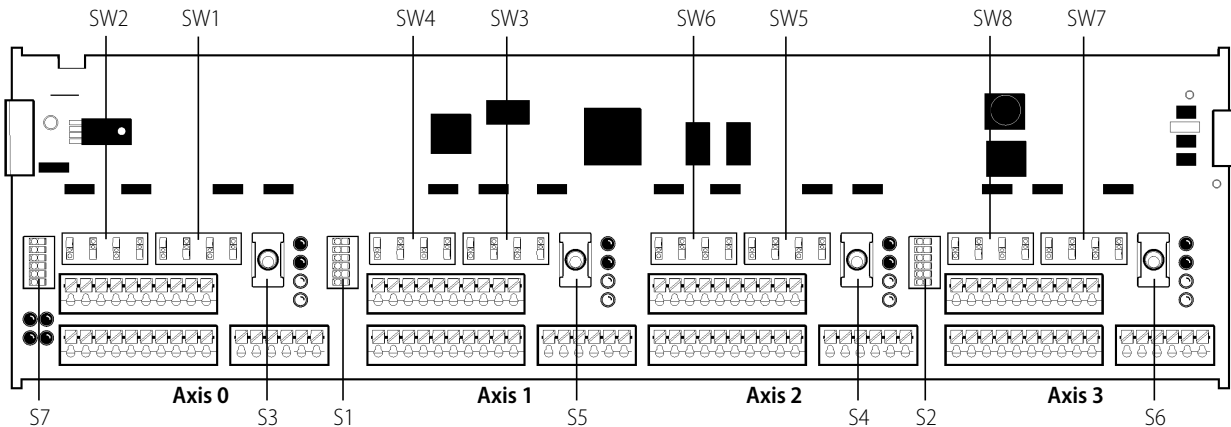
J3 (and J6, J9, & J12): Encoder Signal Inputs

Pin	Description
1	QuadA+
2	QuadA-
3	GND
4	QuadB+
5	QuadB-
6	Index+
7	Index-
8	GND
9	Home+
10	Home-

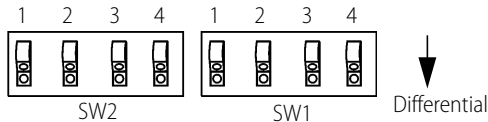
J5 (and J8, J11, & J14): Stepper Motor Inputs

Pin	Description
1	PosLimit
2	GND
3	NegLimit
4	GND
5	AxisIn
6	GND

## BREAKOUT BOARD SWITCHES



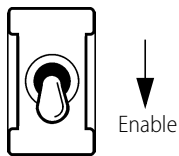
### SW1 - SW8: Signal Selection for Encoder Inputs



All up=Non-differential  
All down=Differential

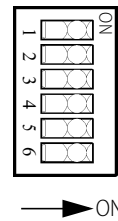
Position	Description
<b>SW1 (and SW3, SW5, &amp; SW7)</b>	
1 & 2	QuadA
3 & 4	QuadB
<b>SW2 (and SW4, SW6, &amp; SW8)</b>	
1 & 2	Index
3 & 4	Home

### S3 (and S5, S4, & S6): Enable/Disable Axis



Position	Enable/Disable
Up	Disable
Middle	Disable
Down	Enable

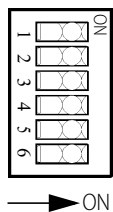
### S1 & S2: Pull-up Resistors



Switch	Axis	Description
<b>S1: J5 &amp; J8 Pull Ups</b>		
1	0	PosLimit)
2	0	NegLimit
3	0	AxisIn
4	1	PosLimit
5	1	NegLimit
6	1	AxisIn
<b>S2: J11 &amp; J14 Pull Ups</b>		
1	2	PosLimit
2	2	NegLimit
3	2	AxisIn
4	3	PosLimit
5	3	NegLimit
6	3	AxisIn

See also, "If Pull-Up Resistors Are Not Used" on page 9.

### S7: Bias & Termination, Voltage Select, Breakout Board Address



Switch	Description
1	ToHost Termination
2	FromHost Termination
3	VMod/Aux +8-24Vin Select*
4	
5	ADDR0
6	ADDR1

\* Set both switches to ON for VMod, or both to OFF for Aux +8-24Vin.

Use switches 5 and 6 to set the address as follows:

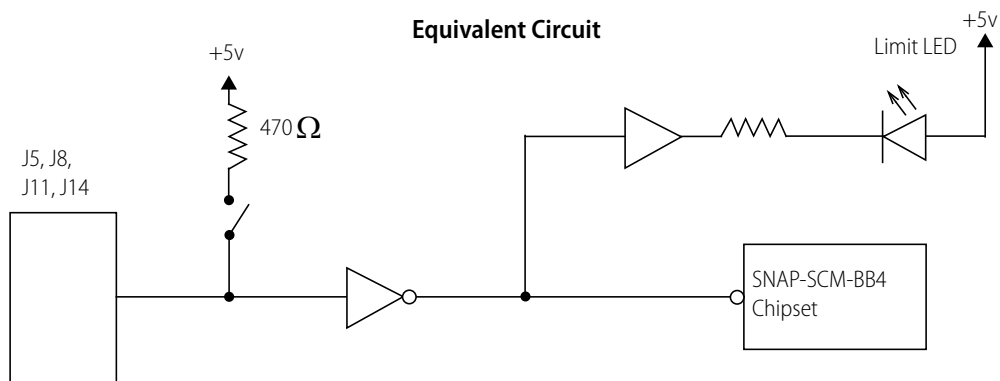
Switch 5 (ADDR0)	Switch 6 (ADDR1)	Address
OFF	OFF	0
ON	OFF	1
OFF	ON	2
ON	ON	3



## If Pull-Up Resistors Are Not Used

If pull-up resistors are not used, the inputs shown on [page 8](#) (see “[S1 & S2: Pull-up Resistors](#)”) will be floating and could cause unexpected behavior if not driven by an external source.

If driven to +5v, the Limit inputs will be asserted. If driven to GND, the Limit inputs will be de-asserted. See circuit below. If you wish to invert this logic, see the [SetSignalSense](#) command. If you wish to disable the limit inputs, see the [SetLimitSwitchMode](#) command.



## COMMANDS

The following Magellan™ Motion Processor commands are supported in PAC Control using OptoScript. In order for the SNAP-SCM-MCH16 module to convert these commands to binary for the motion processor on the breakout board, the module must be in command

mode. For information on command mode and using these commands in PAC Control, see the *SNAP PAC Motion Control Subsystem User's Guide* (form #1673).

Commands	Description
<b>Breakpoints and Interrupts</b>	
ClearInterrupt	Reset interrupt line.
Set/GetBreakPoint	Set/Get breakpoint type.
Set/GetBreakPointValue	Set/Get breakpoint comparison value.
GetInterruptAxis	Get the axes with pending interrupts.
Set/GetInterruptMask	Set/Get interrupt mask.
<b>Digital Servo Filter</b>	
ClearPositionError	Set position error to 0.
Set/GetAutoStopMode	Set/Get auto stop on position error (on or off).
GetPositionError	Get the position error.
Set/GetPositionErrorLimit	Set/Get the maximum position error limit.
<b>Encoder</b>	
AdjustActualPosition	Sums the specified offset with the actual encoder position.
Set/GetActualPosition	Set/Get the actual encoder position.
Set/GetActualPositionUnits	Set/Get the unit type returned for the actual encoder position.
GetActualVelocity	Get the actual encoder velocity.
Set/GetCaptureSource	Set/Get the capture source (home or index).
GetCaptureValue	Get the position capture value, and reset the capture.
Set/GetEncoderModulus	Set/Get the full scale range of the parallel-word encoder
Set/GetEncoderSource	Set/Get the encoder type.
Set/GetEncoderToStepRatio	Set/Get encoder count to step ratio.
<b>External RAM</b>	
Set/GetBufferLength	Set/Get the length of a memory buffer.
Set/GetBufferReadIndex	Set/Get the buffer read pointer for a particular buffer.
Set/GetBufferStart	Set/Get the start location of a memory buffer.
Set/GetBufferWriteIndex	Set/Get the buffer write pointer for a particular buffer.
ReadBuffer	Read a long word value from a buffer memory locations.
WriteBuffer	Write a long word value to a buffer memory location.
<b>Motor Output</b>	
Set/GetMotorMode	Set/Get motor loop mode.
Set/GetMotorType	Set/Get motor type for axis.
Set/GetStepRange	Set/Get the allowable range (in kHz) for step output generation.
<b>Profile Generation</b>	
Set/GetAcceleration	Set/Get acceleration limit.
GetCommandedAcceleration	Get commanded (instantaneous desired) acceleration

Commands	Description
GetCommandedPosition	Get commanded (instantaneous desired) position.
GetCommandedVelocity	Get commanded (instantaneous desired) velocity.
Set/GetDeceleration	Set/Get deceleration limit.
Set/GetGearMaster	Set/Get the electronic gear mode master axis and source (actual or target-based).
Set/GetGearRatio	Set/Get commanded electronic gear ratio.
Set/GetJerk	Set/Get jerk limit.
Set/GetPosition	Set/Get the destination position.
Set/GetProfileMode	Set/Get the profile mode (S-curve, trapezoidal, velocity-contouring, or electronic gear).
Set/GetStartVelocity	Set/Get start velocity.
Set/GetStopeMode	Set/Get stop command; abrupt, smooth, or none.
Set/GetVelocity	Set/Get velocity limit.
MultiUpdate	Forces buffered command values to become active for multiple axes.
Update	Forces buffered command values to become active.
<b>ServoLoopControl</b>	
Set/GetAxisMode	Set/Get the axis operation mode (enabled or disabled).
Set/GetLimitSwitchMode	Set/Get the limit switch mode (on or off).
Set/GetMotionCompleteMode	Set/Get the motion complete mode (target-based or actual).
Set/GetSampleTime	Set/Get servo loop sample time.
Set/GetSettleTime	Set/Get the axis-settled time.
Set/GetSettleWindow	Set/Get the settle-window boundary value.
GetTime	Get current chip set time (number of servo loops).
Set/GetTrackingWindow	Set/Get the tracking window boundary value.
<b>Status Registers and AxisOut Indicator</b>	
GetActivityStatus	Get activity status register.
Set/GetAxisOutSource	Set/Get axis out signal monitor source.
GetEventStatus	Get event status register.
GetSignalStatus	Get the signal status register.
Set/GetSignalSense	Set/Get the interpretation of the signal status bits.

## PRODUCTS

Opto 22 develops and manufactures reliable, easy-to-use, open standards-based hardware and software products. Industrial automation, process control, remote monitoring, data acquisition, and industrial internet of things (IIoT) applications worldwide all rely on Opto 22.

### groov RIO®

[groov RIO edge I/O](#) offers a single, compact, PoE-powered industrial package with web-based configuration and IIoT software built in, support for multiple OT and IT protocols, and security features like a device firewall, data encryption, and user account control.

Standing alone, *groov* RIO connects to sensors, equipment, and legacy systems, collecting and securely publishing data from field to cloud. Choose a universal I/O model with thousands of possible field I/O configurations, with or without Ignition from Inductive Automation®, or a [RIO EMU energy monitoring unit](#) that reports 64 energy data values from 3-phase loads up to 600 VAC, Delta or Wye.

You can even write an IEC 61131-3 compliant control program to run on *groov* RIO, using CODESYS. You can also use *groov* RIO with a Modbus/TCP master or as remote I/O for a *groov* EPIC system.

### groov EPIC® System

Opto 22's [groov Edge Programmable Industrial Controller \(EPIC\) system](#) gives you industrially hardened control with a flexible Linux®-based processor with gateway functions, guaranteed-for-life I/O, and software for your automation and IIoT applications.

#### groov EPIC Processor

The heart of the system is the *groov* EPIC processor. It handles a wide range of digital, analog, and serial functions for data collection, remote monitoring, process control, and discrete and hybrid manufacturing.

In addition, the EPIC provides secure data communications among physical assets, control systems, software applications, and online services, both on premises and in the cloud. No industrial PC needed.

Configuring and troubleshooting I/O and networking is easier with the EPIC's integrated high-resolution color touchscreen. Authorized users can manage the system locally on the touchscreen, on a monitor connected via the HDMI or USB ports, or on a PC or mobile device with a web browser.

#### groov EPIC I/O

*groov* I/O connects locally to sensors and equipment. Modules have a spring-clamp terminal strip, integrated wireway, swing-away cover, and LEDs indicating module health and discrete channel status. *groov* I/O is hot swappable, UL Hazardous Locations approved, and ATEX compliant.

### groov EPIC Software

The *groov* EPIC processor comes ready to run the software you need:

- Programming: Choose flowchart-based PAC Control, CODESYS Development System for IEC61131-3 compliant programs, or secure shell access (SSH) to the Linux OS for custom applications
- Node-RED for creating simple IIoT logic flows from pre-built nodes
- Efficient MQTT data communications with string or Sparkplug data formats
- Multiple OPC UA server options
- HMI: *groov* View to build your own HMI viewable on touchscreen, PCs, and mobile devices; PAC Display for a

Windows HMI; Node-RED dashboard UI

- Ignition or Ignition Edge® from Inductive Automation (requires license purchase) with OPC-UA drivers to Allen-Bradley®, Siemens®, and other control systems, and MQTT communications

### Older products

From solid state relays, to world-famous G4 and SNAP I/O, to SNAP PAC controllers, older Opto 22 products are still supported and working hard at thousands of installations worldwide. You can count on us for the reliability and service you expect, now and in the future.

## QUALITY

Founded in 1974, Opto 22 has established a worldwide reputation for high-quality products. All are made in the U.S.A. at our manufacturing facility in Temecula, California.

Because we test each product twice before it leaves our factory rather than testing a sample of each batch, we can afford to guarantee most solid-state relays and optically isolated I/O modules for life.

## FREE PRODUCT SUPPORT

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

Support is always available on our website, including [free online training](#) at OptoU, how-to [videos](#), [user's guides](#), the Opto 22 KnowledgeBase, and [OptoForums](#).

## PURCHASING OPTO 22 PRODUCTS

Opto 22 products are sold directly and through a worldwide network of distributors, partners, and system integrators. For more information, contact Opto 22 headquarters at **800-321-6786** (toll-free in the U.S. and Canada) or **+1-951-695-3000**, or visit our website at [www.opto22.com](http://www.opto22.com).

