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

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)
- SNAP Motion Control breakout boards (SNAP-SCM-BB4)
- OptoMotion command set

The **SNAP-SCM-MCH16** motion control host module is a serial communication module that links up to four SNAP-SCM-BB4 motion control breakout boards with a SNAP PAC I/O unit. When mounted on an I/O unit and connected to a breakout board, a single 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 ½-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 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.

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 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	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

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When 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[1] 500 mA[2]
Number of ports per module	1
Maximum number of modules per rack	8[1]
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	4 in-lb (0.45 N-m)
Torque, connector screws	5.26 in-lb (0.6 N-m)
Agency Approvals	UL, CE, RoHS, DFARS
Warranty	30 months

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

Module LEDs

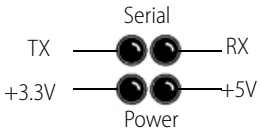
LED	Indicates
1	Program LED
2	TX
3	Power Supply Fault
4	RX

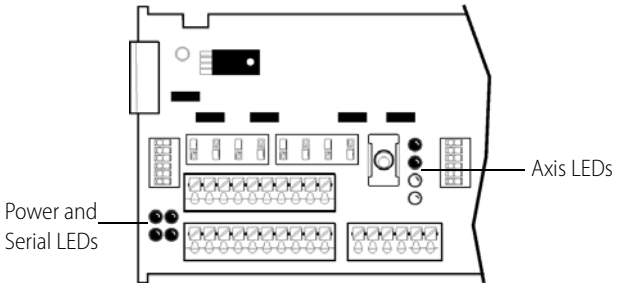
Breakout Board Specifications

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, CE, RoHS, DFARS
Warranty	30 months

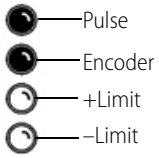
Breakout Board LEDs

Power and Serial LEDs





Axis LEDs



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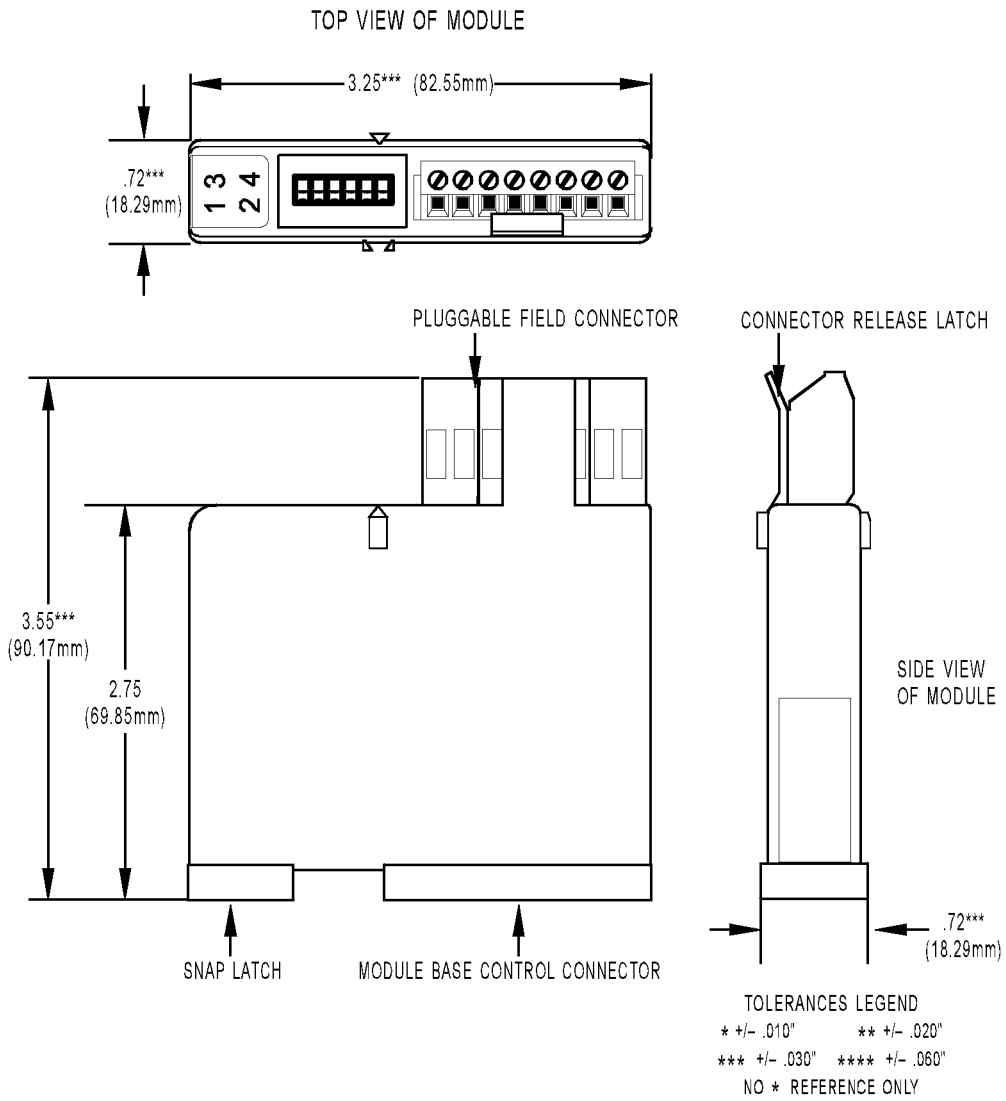
Dimensional Drawings

SNAP-SCM-MCH16 Motion Control Module



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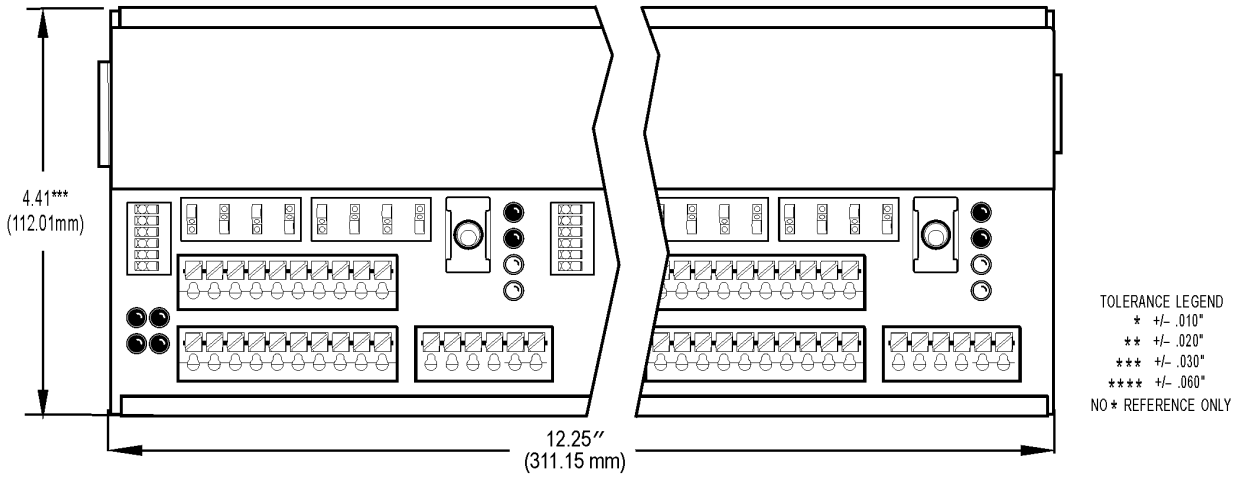
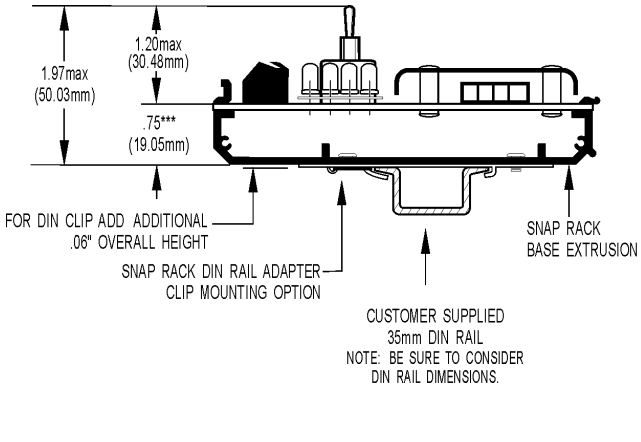
Dimensional Drawings (cont)

SNAP-SCM-BB4 Breakout Board





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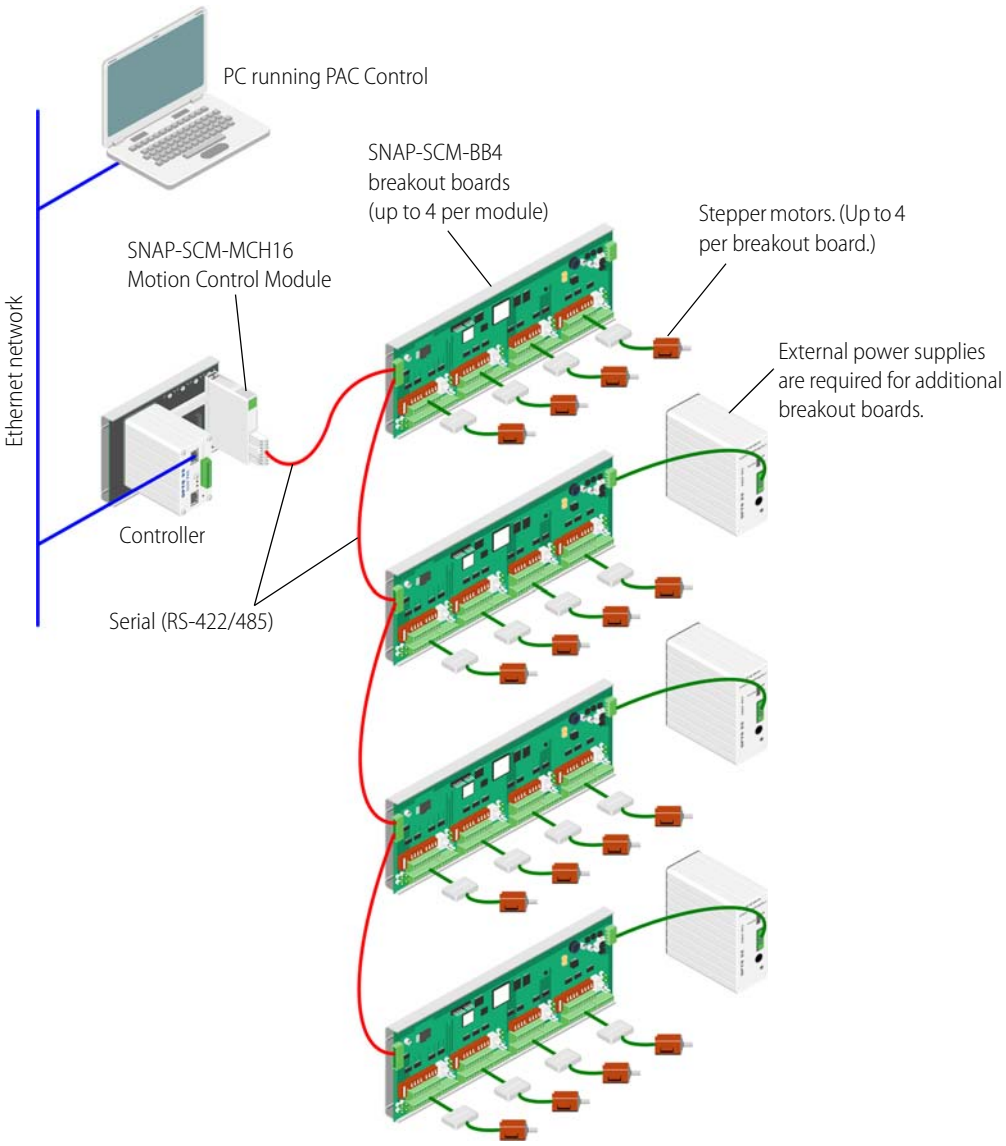
SNAP PAC Motion Control Subsystem

SNAP SCM Motion Control Communication Diagram



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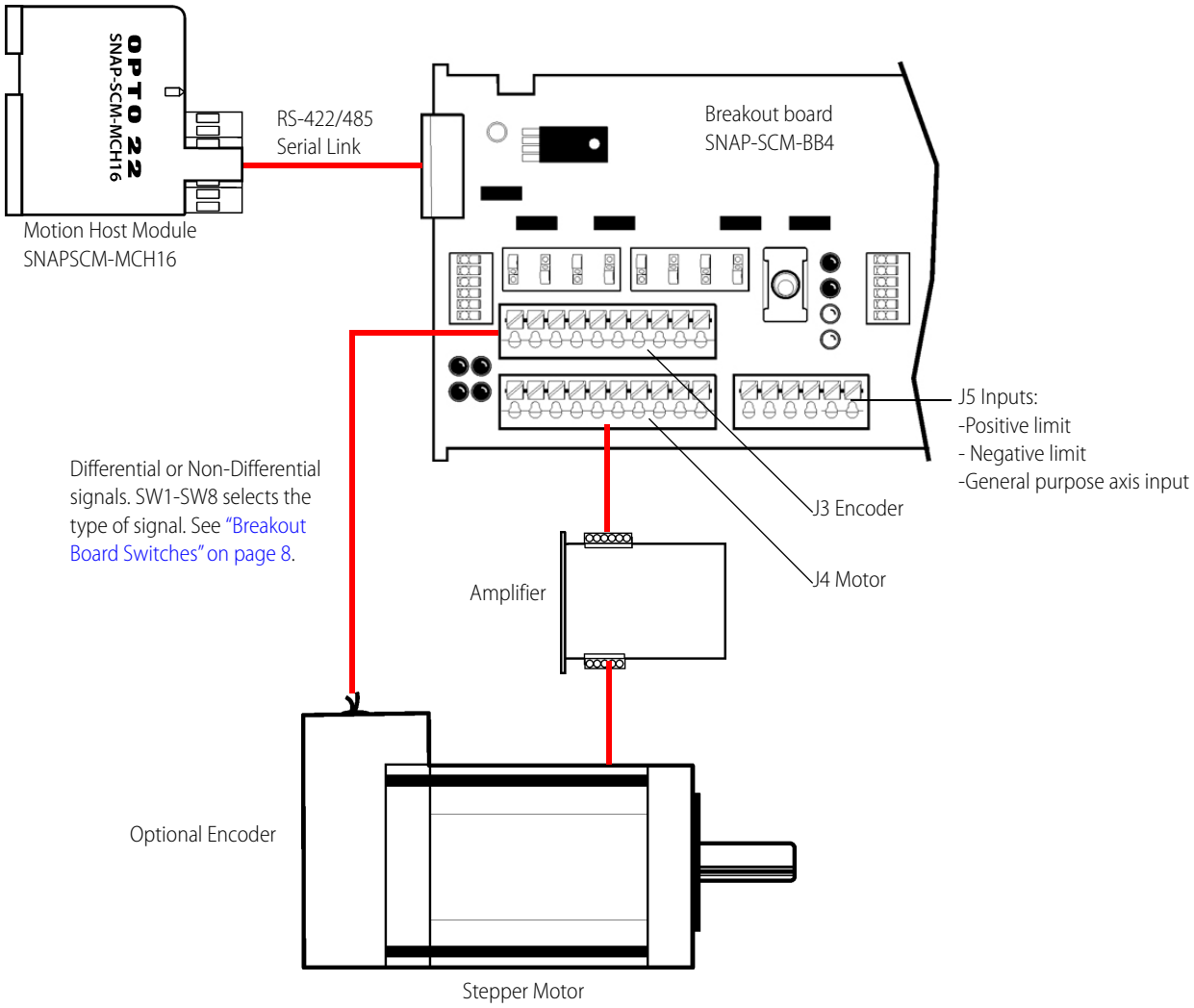
SCM-Motion Communication Diagrams (cont.)



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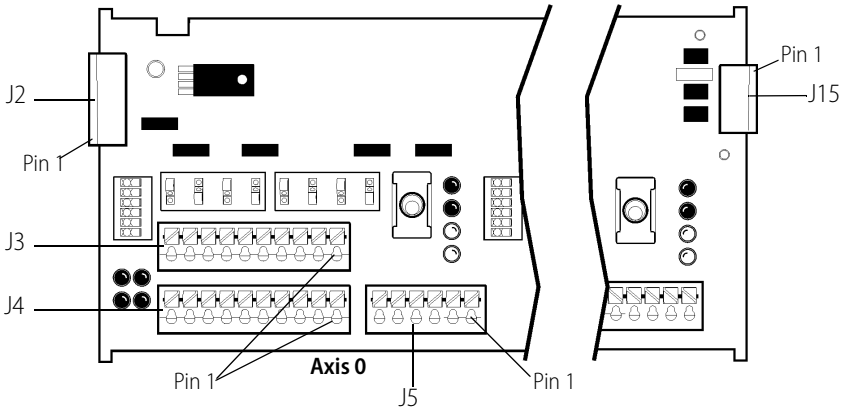
Breakout Board Connector Pins



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

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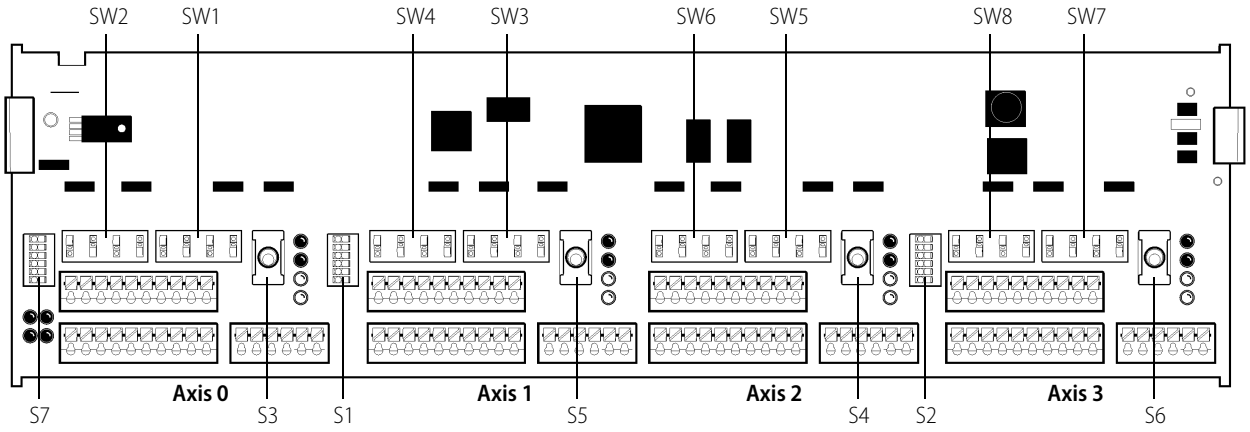
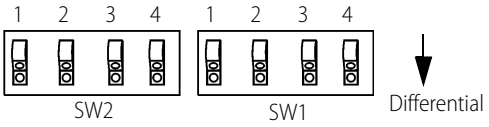
Breakout Board Switches



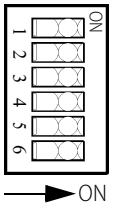
SW1 - SW8: Signal Selection for Encoder Inputs



All up=Non-differential
All down=Differential

Position	Description
SW1 (and SW3, SW5, & SW7)	
1 & 2	QuadA
3 & 4	QuadB
SW2 (and SW4, SW6, & SW8)	
1 & 2	Index
3 & 4	Home

S1 & S2: Pull-up Resistors



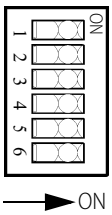
Switch	Axis	Description
S1: J5 & J8 Pull Ups		
1	0	PosLimit)
2	0	NegLimit
3	0	AxisIn
4	1	PosLimit
5	1	NegLimit
6	1	AxisIn
S2: J11 & J14 Pull Ups		
1	2	PosLimit
2	2	NegLimit
3	2	AxisIn
4	3	PosLimit
5	3	NegLimit
6	3	AxisIn

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

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

Position	Enable/Disable
Up	Disable
Middle	Disable
Down	Enable

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

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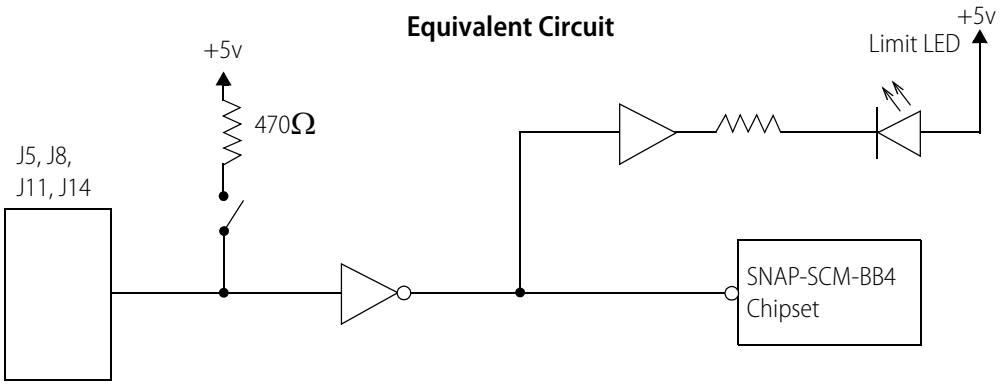
If Pull-Up Resistors Are Not Used

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.

Equivalent Circuit



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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
Breakpoints and Interrupts	
ClearInterrput	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.
Digital Servo Filter	
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.
Encoder	
AdjustActualPosition	Sums the specified offset with the actual encoder position.
Set/GetActualPosition	Set/Get the actual encoder position.
Set/GetActualPostionUnits	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.
External RAM	
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.
Motor Output	
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.
Profile Generation	
Set/GetAcceleration	Set/Get acceleration limit.
GetCommandedAcceleration	Get commanded (instantaneous desired) acceleration
GetCommandedPosition	Get commanded (instantaneous desired) position.

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Commands	Description
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.
ServoLoopControl	
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.
Status Registers and AxisOut Indicator	
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.

More About Opto 22

Products

Opto 22 develops and manufactures reliable, easy-to-use, open standards-based hardware and software products deployed worldwide.

Industrial automation, process control, building automation, industrial refrigeration, remote monitoring, data acquisition, Industrial Internet of Things (IIoT), and information technology applications all rely on Opto 22.

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Monitor and control your equipment from anywhere using your smartphone or tablet with groov. Build your own mobile app easily—just drag, drop, and tag. No programming or coding. Visit groov.com for more information and your free trial.

SNAP PAC System

Developer- and IIoT-ready, the SNAP PAC System connects physical assets to databases and applications using open standards. The SNAP PAC System consists of four integrated components:

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

SNAP PAC Controllers

SNAP PAC programmable automation controllers handle a wide range of digital, analog, and serial functions for data collection, remote monitoring, process control, and discrete and hybrid manufacturing.

For IIoT applications and easier integration with company systems, standalone and rack-mounted SNAP PACs include a built-in HTTP/HTTPS server and **RESTful API** (application program interface). The REST API gives you secure, direct access to I/O and variable data using your choice of programming languages. No middleware, protocol converters, drivers, or gateways needed.

Based on open Ethernet and Internet Protocol (IP) standards, SNAP PACs make it easier to build or extend a system without the expense and limitations of proprietary networks and protocols.

PAC Project Software Suite

Opto 22's PAC Project Software Suite offers full-featured, cost-effective control programming, HMI (human machine interface), OPC server, and database connectivity software.

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

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

SNAP PAC Brains

While SNAP PAC controllers provide central control and data distribution, SNAP PAC brains provide distributed intelligence for I/O processing and communications. Brains offer analog, digital, and serial functions, including thermocouple linearization, local PID loop control, watchdog, totalizing, and much more.

SNAP I/O

I/O provides the local connection to sensors and equipment. Opto 22 SNAP I/O offers 1 to 32 points of reliable I/O per module. Analog, digital, and serial modules are mixed on one mounting rack and controlled by a SNAP PAC brain or rack-mounted PAC.

Quality

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

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

Free Product Support

Opto 22's California-based Product Support Group offers free, comprehensive technical support for Opto 22 products 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.

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

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

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 951-695-3000, or visit our website at www.opto22.com.

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