

# SPiiPlus HP Series High Performance Motion Controllers



## SPiiPlus 3U

### Advanced 2, 4, 6, 8 Axes Motion Controller

The SPiiPlus 3U, a rack mounted controller, meets the motion control requirements of the utmost demanding applications such as semiconductors manufacturing, wafers inspection and Flat Panel Display assembly and testing. The SPiiPlus 3U provides outstanding smooth motion, programmability, ease of use, sub-nanometer resolution and high speed without compromising accuracy and throughput. SPiiPlus 3U meticulous and accurate motion control is obtained using a 20kHz sampling rate, customized control algorithms, gantry control, 0.25MHz or fast 2.5MHz Sin-Cos encoder interpolation, real-time registration and position compare outputs, software commutation and ACSPL+ multi-tasking application language. A powerful suite of software tools provides high speed host communication via multiple channels and a quick application development, system setup and analysis.

## Specifications

### Axes

See table on next page.

### Profile Generation

Trajectory Calculation Rate: programmable 0.5, 1 (default) or 2kHz.

Position Range:  $\pm 4 \times 10^{15}$  counts.

Velocity:  $160 \times 10^9$  counts/second.

Acceleration: up to  $4 \times 10^{15}$  counts/second<sup>2</sup>.

### Control

Position (P) loop + velocity loop (PI, 2<sup>nd</sup> order low-pass and Notch filters).

Sampling Rate: 20 kHz.

Accuracy:  $\pm 1$  count.

Dual Loop: see table below.

Note: each Dual Loop consumes another axis, which should be defined as a dummy.

### Feedback

Feedback types: incremental digital encoders, normal or fast Sin-Cos encoders (optional) or analog inputs.

Note: encoders require external supply.

#### Incremental Digital Encoder:

One per axis, A&B,I; UP/DN,I;  
CLK/DIR,I. Type: RS-422.  
Max. rate: 30 million encoder counts/sec.

**Sin-Cos Analog Encoder** (optional): one per axis. Each Sin-Cos encoder consumes two analog inputs. Type: see Analog Inputs, Sin-Cos encoder inputs. Programmable multiplication factor:  $x4 - x65,536$ . Sin-Cos offset compensation: programmable,  $\pm 0.5V$ , 16 bit resolution. Rate: up to 0.25MHz or 2.5MHz (see How To Order section) sine periods/second. Maximum acceleration with Sin-Cos encoder:  $10^8$  sine periods/second<sup>2</sup>.

### Drive Interface

**Analog commands:** see table on next page. One (torque command) or two (commutation commands) per axis. Type: see Analog Outputs, drive commands section. Offset compensation: programmable, 0.3mV resolution.

**Pulse-Direction Commands:** see table on next page.

Type: single-ended, opto-isolated, TTL. Up to 4 million pulse/sec.

**Drive enable output:** Quantity: one per axis. Type: single ended, opto-isolated, sink only. Up to 24V/7mA, active low.

**Drive Fault Input:** Quantity: one per axis. Type: single-ended, opto-isolated, sink only. Input circuit current:  $<7mA$ .

### Digital I/O

**Safety Inputs:** requires an external supply - see Controller & Power Supply section.

#### Emergency stop input:

Quantity: one. Type: two-terminal, sink or source, opto-isolated.

#### Left and right limit inputs:

Quantity: pair per axis. Type: single-ended, sink (default) or source, opto-isolated. Safety inputs voltage: single-ended, 5V or 24V. Input circuit current:  $<15mA$ .

**Digital Inputs:** requires an external supply - see Controller & Power Supply section.

#### General purpose inputs:

Quantity: eight. Type: single-ended, 5V or 24V, sink (default) or source, opto-isolated. Input circuit current:  $<15mA$ .

#### Mark (position capture) inputs:

Quantity: see table on next page. Type: RS-422. Propagation delay:  $<0.1 \mu sec$ .

**Digital Outputs:** requires an external supply - see Controller & Power Supply section.

#### General purpose outputs:

Quantity: eight. Type: single-ended, 5V or 24V, sink (default) or source, opto-isolated, 50mA per output.

#### Mechanical Brake Outputs:

Quantity: one per axis. Type: single-ended, 5V, source only, opto-isolated, 7mA per output.

#### PEG (Position Event Generator) pulse outputs:

Quantity: see table on next page. Type: RS-422. Propagation delay:  $<0.1 \mu sec$ . PEG pulse width: 25nsec to 1.6msec. PEG position accuracy:  $\pm 1$  count at up to 5,000,000 counts/sec.

#### PEG states outputs:

Quantity: three per X axis. Type: RS-422. Propagation delay:  $<0.1 \mu sec$ .

**HSSI Expansion Channels:** see table on next page. Each channel provides 64 input bits and 64 output bits per channel, sampled and updated at 20KHz.

Type: RS-422. Up to additional 64/63 I/Os via each HSSI using HSSI-IO16 modules.

### Analog I/O

#### Analog Inputs:

**Sin-Cos encoder 1Vptp or general purpose analog inputs:**

Quantity: see note \*1 in the table on next page. Type: 1Vptp, differential, 14-bit resolution.

**General purpose  $\pm 10V$  analog inputs:** When axes C and/or D Sin-Cos encoders are not used, these inputs can be used for general purpose. Quantity: see note \*2 in the table on next page. Type:  $\pm 10V$ , differential, 14-bit resolution.

#### Analog Outputs:

**Drive commands or general purpose  $\pm 10V$  analog outputs:** Quantity: see note \*3 in the table on next page. Type:  $\pm 10V$ , differential, 16-bit resolution.

**General purpose only  $\pm 10V$  analog outputs:** Quantity: see note \*4 in the table on next page. Type:  $\pm 10V$ , differential, 16-bit resolution.

Signal-to-noise ratio of all analog I/O:  $\geq 72dB$  (3 sigma).

### Communication Channels

Serial: two RS-232. Up to 115,200bps.

Ethernet: TCP/IP, 10/100 Mb/s/sec.

Simultaneous communication through all channels is fully supported. Modbus protocol as master or slave is supported via Ethernet or Serial channels.

### Controller & Power Supply

User Memory: RAM: 13Mb. Flash: 13Mb.

Powerup Time: 25sec.

Power Supply Voltage/Current: +5Vdc ( $-0\%$  to  $+10\%$ )/4A, -5Vdc ( $+0\%$  to  $-10\%$ )/0.5A,  $\pm 12Vdc$  ( $\pm 5\%$ )/0.6A.

I/O Supply Voltage/Current: +5Vdc ( $\pm 10\%$ )/1A, or 24Vdc ( $\pm 20\%$ )/1A.

Safety Supply Voltage/Current: +5Vdc ( $\pm 10\%$ )/1A, or 24Vdc ( $\pm 20\%$ )/1A.

Six LEDs on the front panel indicate the status of all above power supplies.

### Environment

Operating Temperature:  $0^{\circ}C$  to  $55^{\circ}C$ .

Storage Temperature:  $-40^{\circ}C$  to  $70^{\circ}C$ .

Humidity: 90%RH, non-condensing.



## Axes and I/O Functionality

Product	Axes and Supported Features				I/O				
	Axes with $\pm 10V$ Drive Command/s	Axes with P-D Drive Commands	Axes Supporting Dual Loop	G.P. Digital I/O	Axes with PEG Pulse Output	Position Registration MARK Inputs	Analog Inputs	Analog Outputs	HSSI Channels
SPiiPlus 3U-2...	2 (XA)	1 (A)	1 (X)	8/8	1 (X)	2 per X	4(*1)	2(*5)+2(*3)	1
SPiiPlus 3U-4...	4 (XAYB)	2 (AB)	2 (XY)	8/8	2 (XY)	2 per X, 1 per Y	8(*1)	4(*5)+4(*3)	2
SPiiPlus 3U-6...	6 (XAYBZC)	3 (ABC)	3 (XYZ)	8/8	3 (XYZ)	2 per X, 1 per Y, Z	12(*1),2(*2)	6(*5)+6(*3)+2(*4)	3
SPiiPlus 3U-8...	8 (XAYBZCTD)	4 (ABCD)	4 (XYZT)	8/8	4 (XYZT)	2 per X, 1 per Y, Z, T	16(*1),4(*2)	8(*5)+8(*3)+4(*4)	3

Comments: \*1: Sin-Cos encoder 1Vtp or general purpose analog inputs

\*2: General purpose only  $\pm 10V$  analog inputs, available when axes C and/or D Sin-Cos encoders are not used.

\*3: Drive commands or general purpose (set by DCOM command)  $\pm 10V$  analog outputs

\*4: General purpose only  $\pm 10V$  analog outputs (set by AOUT10,11,14,15 command)

\*5: Drive commands only.

For further information about analog I/O comments, see Analog I/O Specifications section

## Layout & Dimensions

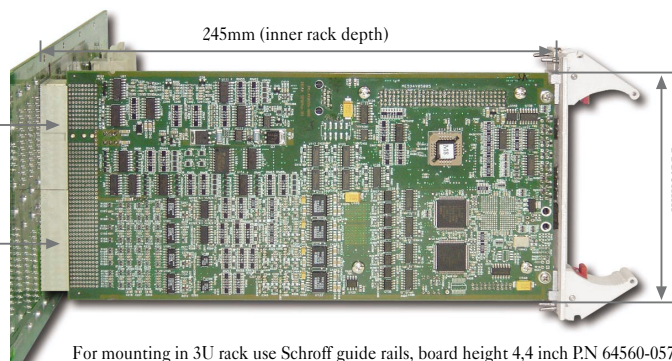
### Connectors:

Upper:

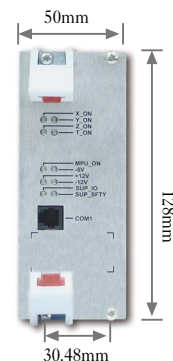
ERNI 104415 176-pin female RA connector (use ERNI 104152 mating connector on motherboard).

Lower:

ERNI 104416 200-pin female RA connector (use ERNI 104153 mating connector on motherboard).



For mounting in 3U rack use Schroff guide rails, board height 4,4 inch P/N 64560-057 (or similar).



## How To Order

### SPiiPlus 3U Controller and Software

#### • SPiiPlus 3U Controller

Example: **SPiiPlus 3U - 8 - E - M6 - F4 - I**

Number of axes: [2] - Two axes controller [6] - Six axes controller  
[4] - Four axes controller [8] - Eight axes controller

Communication channels:  
[E] - two RS-232 and one Ethernet 10/100 Mbts/sec.

Number of total Sin-Cos encoder multipliers:  
[M0] - no multipliers, [M1] ... [M8] - up to a total of eight multipliers

Optional field - Number of fast 2.5MHz Sin-Cos encoder multipliers (out of the total):  
[F1] - One, [F2] - Two, [F3] - Three, [F4] - Four

Optional field - Convolve Input Shaping @ algorithm to reduce vibration and settling time:  
[I ] - Input Shaping @ enabled

Each SPiiPlus 3U controller is provided with:

- One communication cable (37cm/14.1"), provides RS-232 channels via two D-sub, male, 9-pin connectors.
- One CD with SPiiPlus ADK (Advanced Development Kit) for programmers who develop ACSPL+ based applications and host based programs. The SPiiPlus ADK is free to download from our website | Download & Support | SPiiPlus Downloads | Software Installation section. The SPiiPlus ADK includes:

- **SPiiPlus MMI** - for axis configuration, servo tuning, programming and viewing parameters
- **SPiiPlus C and COM Libraries** - for host programming in C/C++ or Visual Basic™
- **SPiiPlus Utilities** - for upgrading firmware and recovering from errors
- **SPiiPlus Simulator** - for fast application development and debugging
- **SPiiPlus FRF** - for analyzing motion frequency response
- Hardware & setup, software and programming guides in PDF format
- ACSPL+, C/C++ and COM training files and programming examples

### Supported Motors:

$\pm 10V$ Commands	AC Servo/DC Brushless
	DC Brush
	Nanomotion Piezo-ceramic
P-D Commands	Step motor
	Servo motor



## Warranty

The warranty of this product is according to the Terms and Conditions of Sale and is effective for one year from date of shipment from ACS Motion Control. Copyright© August 2006 ACS Motion Control. All rights reserved. Version 1.6.

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For the most updated information please refer to [www.acsMotionControl.com](http://www.acsMotionControl.com)