SPiiPlus SA
Advanced 2, 4, 6, 8 Axes Stand Alone Motion Controller

The SPiiPlus SA meets the motion control requirements of the most demanding applications such as semiconductors manufacturing, wafers inspection and Flat Panel Display assembly and testing. The SPiiPlus SA supports high frequency Sin-Cos encoder signals of up to 2.5MHz to provide sub-nanometer resolution at high speed without compromising accuracy and throughput. The SPiiPlus SA comprises simple and convenient connectivity interface with the application's drivers, encoders, I/Os and communication bus using D-Type connectors. SPiiPlus SA accurate motion control is obtained with 20kHz sampling rate, customized control algorithms, Gantry control, 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: 160×10^9 counts/second.

Acceleration: up to 4×10^{15} counts/second^2.

Control

Position (P) loop + velocity loop (PI, 2'nd order low-pass and Notch filters).

Sampling Rate: 20 kHz.

Accuracy: ±1 count.

Dual Loop: see table on next page.

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

Feedback

Feedback types: Incremental digital encoders, optional SIN-COS & fast SIN-COS, analog inputs.

Note: internal 5Vdc supply for encoders

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: progammable, ±0.5V, 16 bit resolution. Maximum rate: 0.25MHz or 2.5MHz (fast) sine periods/second.
Maximum acceleration with Sin-Cos encoder: 10^8 sine periods/second^2.

Drive Interface

Analog commands: see table on next page. One torque/force command or two motor phases current commutation commands. Type: see Analog Outputs, drive commands section. Offset compensation: programmable, 0.3mV resolution.

Pulse-Direction Commands: see table on next page.
Type: RS-422. Up to 4 million pulse/sec.

Drive enable output:
Quantity: One per axis.
Type: two-terminal, opto-isolated, sink or source. Up to 24V/20mA

Drive Fault Input:
Quantity: One per axis.
Type: two-terminal, opto-isolated, sink or source. Input circut 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: 5V or 24V.
Input circut current: <15mA

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

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

Mark (position capture) inputs:
Quantity: see table on next page.
Type: RS-422. Propagation delay: <0.1 µsec.

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

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

PEG (Position Event Generator) pulse outputs:
Quantity: see table on next page.
Type: RS-422. Propagation delay: <0.1µsec.
PEG pulse width: 25nsec to 1.6msec.
PEG position accuracy: ±1 count at up to 5,000,000 counts/sec.

PEG states outputs:
Quantity: three per X axis. Type: RS-422.
Propagation delay: <0.1µsec.

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 port 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 ±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: ±10V, differential, 14-bit resolution.

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

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

Signal-to-noise ratio of all analog I/O: >=72dB (3 sigma).

Communication Channels

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

Ethernet: TCP/IP, 10/100 Mbits/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: 24Vdc(+/-10%)/2A.

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

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

Environment

Operating Temperature: 0°C to 40°C.

Storage Temperature: - 40°C to 70°C.

Humidity: 90%RH, non-condensing.

Axes and I/O Functionality

	Axes and Supported Features					I/O			
Product	Axes with ±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 SA-2...	2 (XA)	1 (A)	1 (X)	8/8	1 (X)	2 per X	4(*1)	2(*5)+2(*3)	1
SPiiPlus SA-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 SA-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 SA-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

*1: Sin-Cos encoder 1Vptp or general purpose analog inputs
*2: General purpose only ±10V analog inputs, available when axes C and/or D Sin-Cos encoders are not used
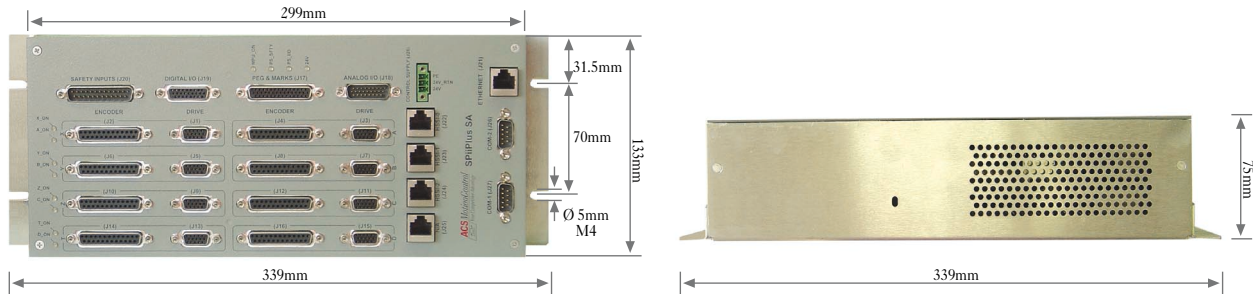*3: Drive commands or general purpose (by DCOM command) ±10V analog outputs
*4: General purpose only ±10V analog outputs (by AOUT10,11,14,15 command)
*5: Drive commands only

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

Layout & Dimensions

How To Order

SPiiPlus SA Controller and Software

- **SPiiPlus SA Controller**

Example: SPiiPlus SA - 8 - E - M8 - 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 Mbits/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 SA controller is provided with:
 - 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 tunning, 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:

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

Additional Products

- **SPiiPlus SA-ACC.** Interface kit that includes mating connectors to SPiiPlus SA panel of connectors.

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 1.2.

For the most updated information please refer to www.AcsMotionControl.com