EtherCAT.

SPiiPlusES   UDM_MC

Controlled by
ACS

How to Optimize the Performance of Motion Platforms with ACS

UNIQUE ACS MOTION CONTROL FEATURES ENHANCE POSSIBILITIES IN INDUSTRIAL AUTOMATION

Different Markets and Applications and Their Specific Requirements

Category	Requirement	Semiconductor Inspection, Metrology, Lithography (Front End)	Semiconductor Packaging (Back End)	Flat Panel Display Inspection & Metrology	Electronics Assembly (PCB SMT / Automated Programming)	Electronics Dispensing	Laser Cutting	Laser Microprocessing	Digital / Inkjet Printing	Genome Sequencing	Medical Scanners	Additive Manufacturing / 3D Printing	Fiber Optics Packaging & Alignment
General Features	Multiple drive types in one application	•	•	•	•	•	•	•	•	•	•	•	•
	Multiple sensor types in one application	•	•	•	•	•	•	•	•	•	•	•	•
	Modular volume production	•	•	•	•	•	•	•	•	•	•	•	•
Safety / Reliability	Functional safety STO inputs	•	•	•	•	•	•	•	•	•	•	•	•
	Network redundancy		•		•								
Communication with Host	EtherCAT communication to PLC	•	•		•	•	•	•	•			•	•
	EthernetIP communication to PLC	•	•		•	•	•	•	•			•	•
	Controller processes NC files / G-Code					•	•	•				•	
	CAD to motion					•	•	•				•	
	CNC style user interface					•	•	•				•	
Controller	3rd party EtherCAT drive / IO support	•	•	•	•	•	•	•	•	•	•	•	•
Drivers	Dual loop	•	•	•	•	•	•	•	•	•	•	•	•
	Flexible encoder support (AqB, optical sin/cos, laser / interferometer sin/cos, absolute)	•	•	•	•	•	•	•	•	•	•	•	•
	Highly dynamic motion: high acceleration, high speed	•	•	•	•		•	•	•	•		•	
	Universal motor support (stepper, voice coil / DC brush servo, BLDC servo)	•	•	•	•	•	•	•	•	•	•	•	•
	High power	•	•	•	•	•	•		•		•	•	
Motion / Trajectory	Trajectories for small features / motions	•	•	•	•		•	•	•	•		•	
	Gantry control	•	•	•	•	•	•	•				•	
	Implement complex motion-time events and sequences	•	•	•	•	•	•	•	•	•	•	•	•
	Constant velocity motion smoothness	•		•					•				
	Demanding stand-still jitter	•		•					•	•			
Synchronization	Event (laser, camera, etc.) sychronization with motion - triggering or on/off control	•		•	•	•	•	•	•			•	
	Multi-axis coordinated motion (circular / spherical / 5-axis)				•	•	•	•				•	
	Multi-axis coordinated PTP motion	•	•	•	•	•	•	•	•	•	•	•	•
Easy Tuning	Demanding accuracy specifications	•	•	•	•	•	•	•	•	•	•	•	•
	High performance: load changes		•		•						•		
Vertical or Bridge Axis	High throughput laser processing - Galvo / stage motion sync	•		•					•	•			
	Autofocus height control	•	•	•			•	•	•			•	•

How ACS Features
Optimize an Automation Process

General Features

- Powerful and high bandwidth EtherCAT motion system network
- Control multiple drive, feedback and sensor types in one platform
- Expandable, modular and flexible Flexible Configuration

Communication with Host via PLC or PC

- Communicate with sophisticated Host PC User Interface applications using powerful API libraries
- Communicate with standalone and PC based PLCs/PACs via EtherCAT, EthernetIP, ModbusTCP
- EtherCAT PLC to SPiiPlusES: allows CiA402/DS402 compatible, synchronuous, asynchronuous operation, high performance motion control network
- CAD to motion: define and plan trajectory by G-Code, use Look Ahead for low error motion, develop machine with SPiiPlusSPC
- CNC HMI style user interface SPiiPlusSMC provides flexible CNC G-Code control capabilities

Safety / Reliability

- Certified machine functional safety STO inputs
- NetworkBoost for safe operation even during network device failures
- CE and UL certified products

Drives

- Universal motor support
- Supporting many common industrial encoder types (AqB, Optical / Laser SinCos, absolute...)
- Wide power range
- Industry leading update rates and control algorithms (dual loop with on the fly Encoder Switching, Multiple Encoder Channels per Axis, ServoBoost)

Controllers

- Flexible and open EtherCAT based network
- Up to 64 axes and thousands of I / Os
- Implement complex motion-time events and sequences using ACSPL+ language and PEG and LCM outputs

Easy Tuning

- Install, configure, and tune axes quickly with an intuitive user interface
- Automated adaption to load changes ServoBoost
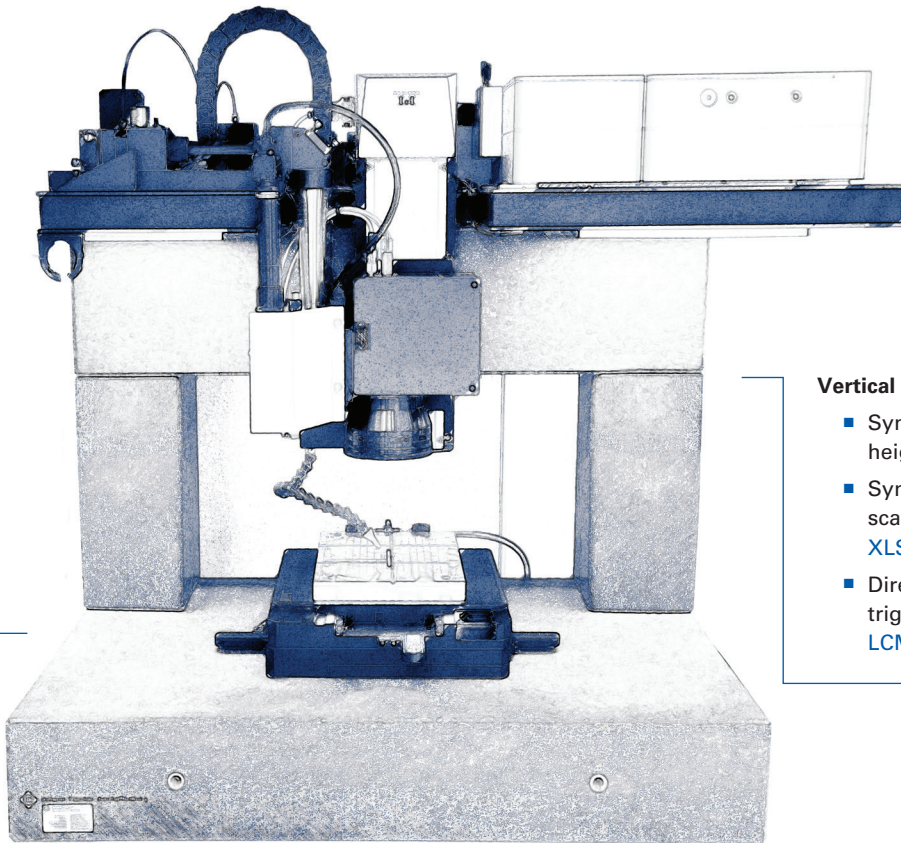
Vertical or Bridge Axis

- Synchronized autofocus height control
- Synchronization of galvo scanner and stage motion, XLScan System
- Direct laser control and triggering during motion LCM

Synchronization

- High absolute accuracy, position stability
- Multi-axis coordinated motion (circular, spherical, 5-axis) with minimum position errors Look Ahead
- Smooth motion at constant velocity ServoBoost, Encoder Switching
- Event trigger for time, position, with high resolution PEG outputs, Laser Synchronization (LCM)

Motion / Trajectory

- Miniature features require small position errors at high speed 4/5 kHz MPU Cycle
- Trajectory definition by G-Code
- Vibration cancelling Input Shaping
- Settling / standstill with minimal following error NanoPWM
- Highly dynamic motion ServoBoost
- Easy configuration, motors mapped to logical axes Gantry Algorithm
- 2D / 3D coordinated motion Corner Processing, Error Mapping

Details of ACS Features and Options

	Name	Function
Standard features of ACS systems (system = controller + drives)	ACSPL+ Programming	ACSPL+ is a motion control oriented multi-threading high level language with up to 64 threads running simultaneously. It simplifies implementation of highly complex motion-time events and sequences with accurate positioning and timing.
	API libraries	Application programing interface is a set of libraries and tools for building software applications. For example .net for Windows applications.
	Corner Processing	Increase throughput by rounding sharp corners.
	Error Mapping	Bring accuracy to level of repeatability. Requires external equipment for measuring.
	Gantry Algorithm	Much simpler tuning and configuration of gantry systems, with improved performance.
	Look Ahead	Avoids excessive accelerations and shocks to the system while maintaining high throughput and accuracy.
	Multiple Encoder Channels Per Axis	For flexible dual loop assignment. Free of charge but should be ordered in advance, not available for all products.
	PEG Outputs	For triggering external devices or data collection at specific encoder positions.
	Universal Motor Support	Each drive supports stepper motors, voice coils and linear motors as well as brush and brushless DC motors.
Options to be ordered at extra charge	4/5 kHz MPU Cycle	Higher frequency profile generation allows smoother accelerations and corner path.
	Encoder Switching	Robust handling of multiple feedbacks, allows use of very high resolution encoder only in limited process window, and lower resolution encoder over entire travel range. Custom, application specific development.
	Flexible Configuration	User can define subsystems of the network which can be operated independently e.g. during setup and production.
	G-Code	Mandatory for CNC applications, common for many Additive Manufacturing applications.
	Input Shaping	Avoid exciting resonance.
	NetworkBoost*	Enables redundancy in case of network cable / node failures which can be more likely with remotely mounted drives. Results: • Safe operation during single failure • Indication of the situation • Recoverable during operation
	ServoBoost**	Enhances servo performance, keeping actual motion closer to ideal. It provides automatic adaptation to large changes in load and system parameters and automatic compensation of disturbances, resonances, axes interaction, cogging and more. Results: • Faster settling • Better stability • Lower jitter • Better constant velocity
	STO Inputs **	Achieve certified machine safety (Safe Torque Off).
Products which extend the functionality of ACS systems	LCM for laser synchronization	A hardware module that coordinates the motion with the laser operation.
	NanoPWM line	All NanoPWM drives feature the DRBoost which results in unprecedented current control dynamic range of above 100 db.
	SPiiPlusES	This controller is a SPiiPlusEC controller with an additional external EtherCAT bridge which allows any ACS solution to act as high performance motion control subsystem under other EtherCAT master such as TwinCAT.
	SPiiPlusSMC	UI / HMI platform (software) for CNC control based machines - can save machine developer many hours / weeks of effort (vs. 'building from scratch').
	SPiiPlusSPC	Graphical UI platform (software) for laser processing / additive manufacturing machines - can save machine developer many hours/weeks of effort (vs. 'building from scratch').
	XLScan System	Extends a laser scan system's working filed by simultaneously controlling and moving a scan head and an XY-stage. Special system, must be ordered from ACS and Scanlab.

* not available for all controllers

** not available for all drives

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