

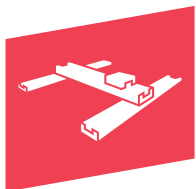


Smarter *Motion*

*Powerful Control Solutions for
Demanding Multi-Axis Machinery*

30⁺ Years of
*Smarter
Motion*

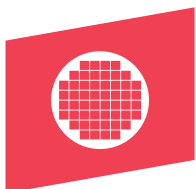
ACS
MOTION CONTROL



Motion Centric



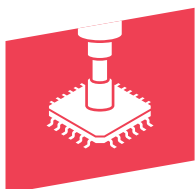
Bio Medical



Semiconductors



Medical Scanners



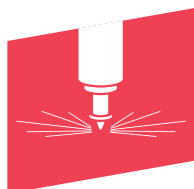
Electronic Assembly



Digital Printing



FPD



Laser Processing



better tools. effective development.

MMI Application Studio

Program
Development

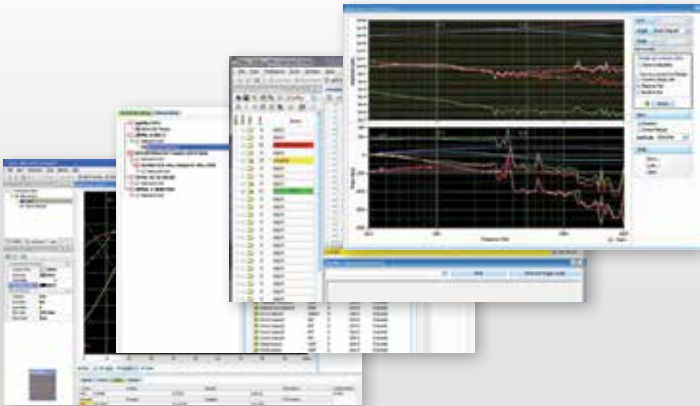
Tuning

System Setup



Diagnostics &
Monitoring

Powerful Controller Simulator



pages 8-9

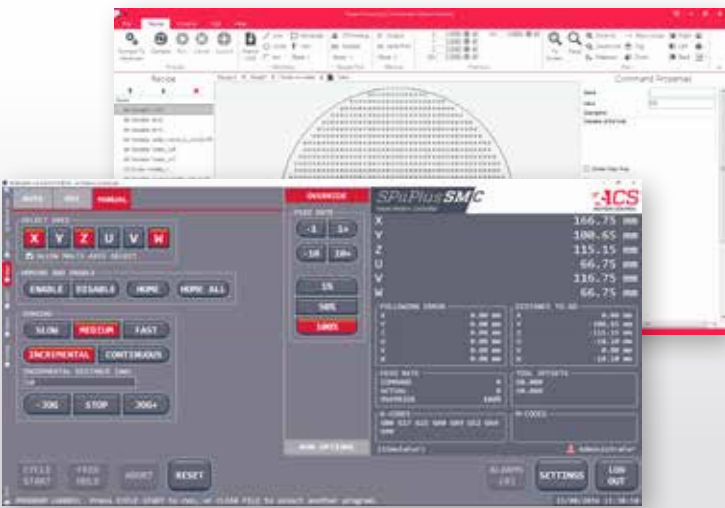
Smarter Tools for Laser Micro-machining



SPiPlusSMC
Smart Motion
Commander



SPiPlusSPC
Smart Laser Processing
Commander



pages 10-11

SOFT CONTROLLER: Use your PC to run
the Most Powerful Motion Controller

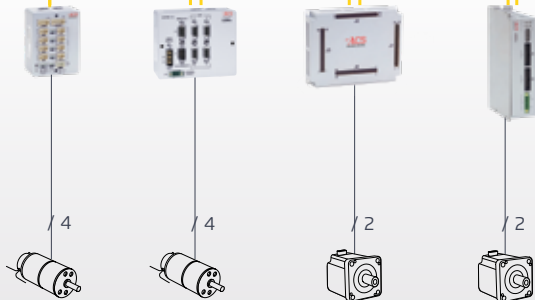
SPiPlusSC

inside a User Specified PC



page 15

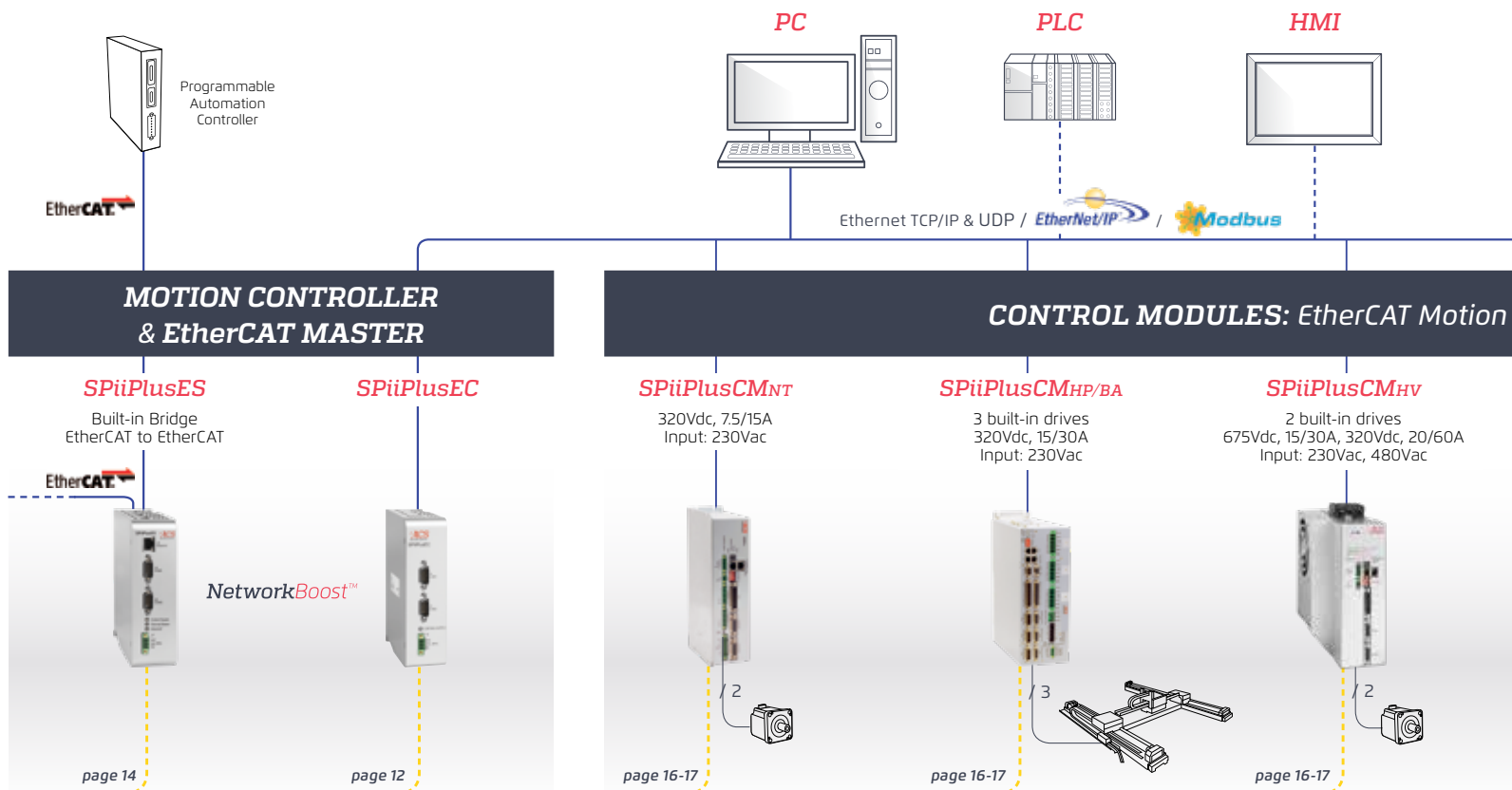
UDMLc 48Vdc, 2.5/5A **UDMSD** 48Vdc, 2.5/5A **UDMPc** 48Vdc, 10/20A **UDMNT** 80Vdc, 10/20A



pages 24-26

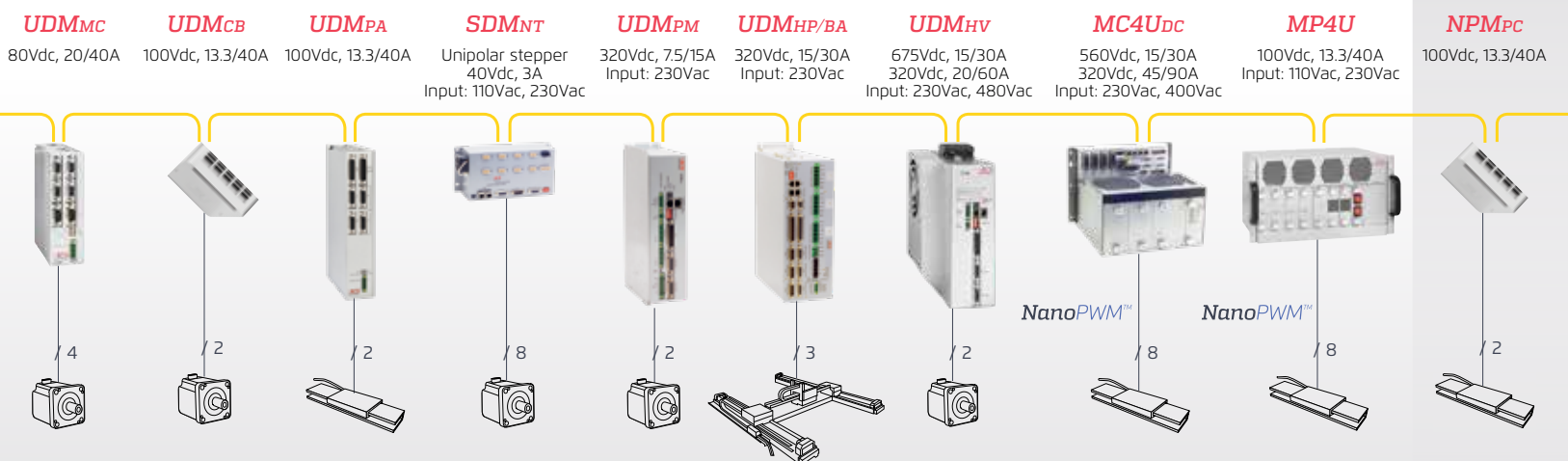


Easy Interface with a Variety of Hosts



Up to 64 axes and thousands of I/Os

UNIVERSAL DRIVE MODULES: Outstanding Move & Settle, Nanometer Jitter, Smooth Velocity



details in NanoPWM flyer

NanoPWM™



standard products. tailored solution.

Controller with Built-In Drives

MP4U

100Vdc, 13.3/40A
Input: 110Vac, 230Vac

MC4U_{NT}

560Vdc, 15/30A
320Vdc, 45/90A
Input: 230Vac, 400Vac

NanoPWM™
NetworkBoost™

page 22-23

pages 18-21

DRIVES with $\pm 10V$ Current Commutation Commands

NPAPC

100Vdc, 13.3/40A

NPAPM

100Vdc, 13.3/40A

NPARM

100Vdc, 13.3/40A
Input: 110Vac, 230Vac



DRBoost™



details in NanoPWM flyer

NanoPWM™

INTERFACES

NPM_{PM}

100Vdc, 13.3/40A

UDIHP/LT

$\pm 10V$ drives

PDM_{NT}

P/D drives

PDICL

P/D drives
with feedback

LCM

Laser Control
Module

page 27

I/O

IOM_{NT}

Digital 24V I/O

IOM_{PS}

Analog and Digital 24V I/O

page 28

Others

3rd Party
Drives
I/Os
Sensors

Products
supporting
CoE protocol

page 29

Better Support. Powerful Solutions.



ACS Motion Control is a global manufacturer of high performance machine control systems for demanding motion centric applications.

Since 1985, ACS Motion Control has provided state of the art control solutions to world leading manufacturers, such as GE, Philips, Applied Materials, Samsung and LG. ACS has its international headquarters in Israel with sales and support centers in the USA, China and South Korea.

Backed by an ISO9001-certified design and manufacturing facility with an ongoing commitment to quality control and reliability testing, ACS Motion Control works with an experienced and well trained full solution provider network that provides sales support and customer service worldwide.



Advanced System Testing Laboratory



State of the art design, assembly, test, and repair facility



Training classes offered at ACS facilities or onsite

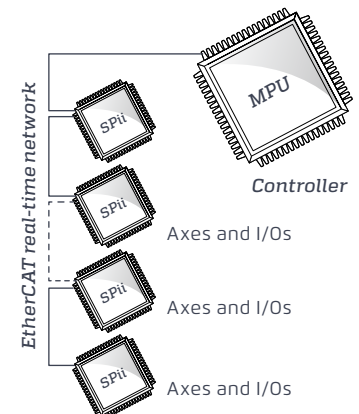
With proven technical expertise and decades of application experience, the ACS Application Development and Support team helps customers realize a true competitive advantage by optimizing the accuracy and throughput of their system.



Advanced Technology. Ultimate Performance.

Powerful Platform Designed for Performance

ACS' powerful platform consists of an EtherCAT Controller MPU (Motion Processor Unit) and one Servo Processor (SPii) at each EtherCAT node. The MPU can manage systems with up to 64 synchronized axes, executing all high level tasks, such as communication with an host PC, real time ACSPL+ programs, diagnostics, I/O control and profile generation. The SPii floating point processor at each node executes the real time control algorithms for up to four axes, always at a sampling and update rate of 20kHz for each and every axis. The MPU can modify and update the SPii control algorithm, inject excitation signals to the controlled plant and sample real time data, such as position error, at 20kHz. ACS has utilized a distributed processor platform for over 20 years. Adoption of EtherCAT has been a natural, smooth evolution. All safety related issues encountered when implementing a distributed control platform, the impact of one node failure on other nodes and failure of the master controller on all nodes, have been solved long ago, enabling ACS to provide the most robust and advanced EtherCAT control solutions in the industry today.



High Level Integration, Enhancing Accuracy & Throughput

Performance depends on all components - controller, software, drives, power supply, interconnection and support tools. Each of these components are designed and optimized to achieve one goal: Enhancing the performance of your machine. The complete system is tested to ensure an uncompromising level of performance.



Leverage our Know-how and Experience

ACS' control experts have many years of experience with state of the art applications in the fields of semiconductor inspection, Laser Micro-machining, digital printing, electronic assembly and other demanding systems. These highly skilled engineers will help to ensure that your entire system operation is optimized in terms of performance, robustness, stability, and sensitivity to mechanical changes, such as load, friction and component parameter deviations. If your application calls for some special needs, such as accurate force control for wire bonding or dynamic high bandwidth auto-focus, we have the knowhow and experience to implement and test the solution. ACS takes pride in its long, rich history of enabling our customers to push the boundaries of performance, accuracy and throughput.



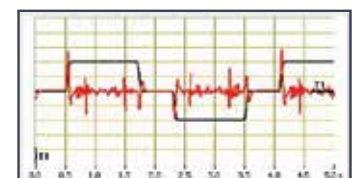
ServoBoost™ - for Unprecedented Performance

ServoBoost™ combines a unique set of control algorithms with special hardware to provide better and more consistent servo performance that is insensitive to disturbances, noise, and large changes in the controlled system. **ServoBoost™** should be considered when:

- Move and settle specifications cannot be achieved.
- Extremely high accuracy constant velocity is required.
- Standstill position jitter specifications cannot be achieved.
- There are large changes in load or system dynamics that affect performance.
- There are weakly damped resonances.
- The system is characterized by low stiffness or large inertia mismatch.



With **ServoBoost™**



Position Error (red) following a 50% load increase with standard algorithm



Nanometer Positioning and High Velocities

For systems demanding high-speed and nanometer position resolutions, till now OEMs have been limited to expensive laser interferometer feedback systems. With ACS's 10MHz Sin-Cos encoder multiplier, designers have a significant lower cost and simple alternative, using analog laser-based ultra-fast encoders.



NanoPWM™ Replaces Linear Drives

Utilizing ACS's patented technology the **NanoPWM™** drives control the motor current with an unprecedented dynamic range of 100,000 (100db!), providing the ultimate standstill jitter and velocity smoothness performance!

Compared to best in class commercially-available linear drives, the **NanoPWM™** drives offer: better motion performance (guaranteed!), significant smaller size and lower weight, fraction of heat dissipation, and more economical pricing. The **NanoPWM™** drive is the ultimate drive for 450mm and 300mm wafer handling stages, and for any application demanding high speed and acceleration, smooth velocity and sub-nanometer standstill jitter.

Using a SPiiPlus controller and **NanoPWM™** drives controlling linear stages, the following performance has been achieved:

- Standstill jitter better than $\pm 0.3\text{nm}$! (Mechanical table)
- Following error of $\pm 10\text{nm}$ at speeds of 100mm/second! (Air-bearing table)

Two lines of **NanoPWM™** drives are available:

1. **NanoPWM™** drives that are EtherCAT slaves and operate with any ACS' motion controllers. It includes: MC4U, MP4U, NPMpc, NPMpm.
2. A direct replacement for linear drives with $\pm 10\text{V}$ sine commutation commands. It includes: NPApc, NPApm, NPArm.

For more details see the **NanoPWM™** products brochure.

The Most Accurate and Flexible Gantry Control

For highly accurate gantry positioning tables, where two motors (each with its own feedback) are used to control an axis, ACS Motion Control has developed unique and powerful algorithms that provide an unprecedented level of position accuracy, speed stability, and settling time.

Gantry algorithm key features:

- MIMO Control with decoupled loops:
 - Loop controlling the longitudinal direction
 - Loop controlling the rotational (yaw) direction
- Automatic force / encoder scheduling as a function of the cross axis position
- Dynamic compensation for the yaw angle
- Suitable for both "stiff" and "flexible" gantries

Advantages:

- Higher bandwidth
- Better stability
- Minimal crosstalk
- Easy tuning
- Reliable operation



Unique capabilities for the highest performance

- 20kHz position, velocity and current sampling & update rate for all axes
- 5kHz profile generator
- Multi-axis synchronization

Powerful Laser Micro-machining

- G-code
- Sophisticated lookahead algorithm
- Corner rounding



Smarter Programming. Better Control.

The Most Advanced and Capable Motion Controller

- Up to 64 axes
- ACSPL+ multi-tasking motion programming language
- Extensive API for host programming

ACSPL+ Powerful and Simple Motion Programming

ACSPL+ is a motion control oriented multi-tasking high level language with up to 64 threads that run simultaneously. ACSPL+ simplifies implementation of highly complex motion-time events and sequences with accurate positioning and timing. G&M ("G-code") commands are an integral part of ACSPL+ and non-standard G&M commands can be defined by ACSPL+ routines.

- Multi-axis point-to-point, jog, tracking and sequential multipoint motion
- Multi-axis path made of arcs and lines with advanced look-ahead corner processing for optimal accuracy and throughput
- Arbitrary path with PVT cubic interpolation
- Third order profiles (S-curve)
- Smooth on-the-fly change of target position and motion parameters
- Inverse/Forward kinematics and coordinate transformations
- Master-slave with position and velocity locking (electronic gear/cam) and virtual master axis
- User-defined units
- 64-bit floating point arithmetic

Complex Motion. Simple Programming.

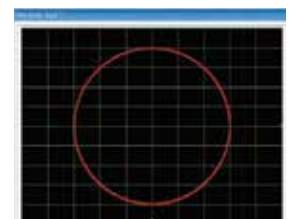
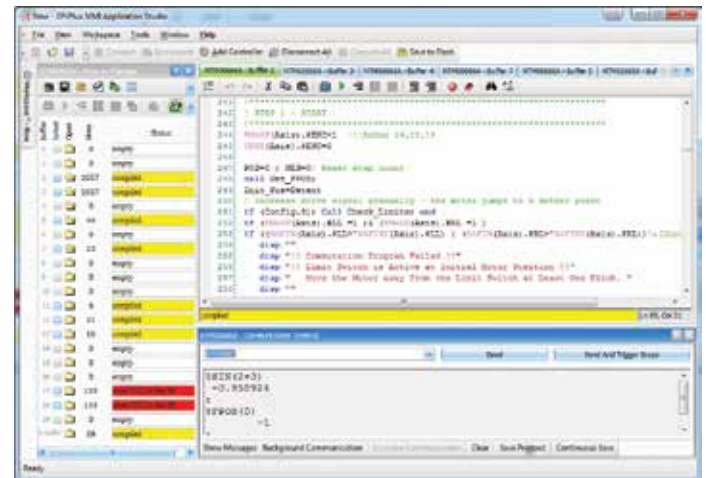
- | | | |
|--------------------------------|--|------------------|
| • GLOBAL REAL PI, RADIUS | • ENABLE (X,Y) | • GOTO STARTLOOP |
| • GLOBAL INT COUNTER, VERTICES | • STARTLOOP: | • STOP |
| • $PI=ACOS(-1)$ | • PTP/E (X,Y) | |
| • COUNTER=0 | • $RADIUS \cdot \cos(2 \cdot PI \cdot COUNTER / VERTICES)$ | |
| • VERTICES=100 | • $RADIUS \cdot \sin(2 \cdot PI \cdot COUNTER / VERTICES)$ | |
| • RADIUS=500 | • COUNTER=COUNTER+1 | |

SPiiPlus Library - API for Host Programming

The SPiiPlus library supports simultaneous communications and multi-threaded applications with up to sixteen communication channels and interrupts with callback functions. One application can communicate with several controllers or several applications can communicate with one controller. The library resolves all communication traffic issues. A comprehensive set of drivers, in conjunction with C and COM Dynamic Link Library (DLL), are provided for programming in C/ C++/C#/ .NET/Visual Basic and LabView. The library supports Windows XP, ME, Vista, 7, 8 and 10 (both 32 and 64 bit) and is continuously updated to support new versions.

MODBUS and Ethernet/IP

MODBUS TCP and Serial protocols enable various HMI operator interface terminals to interface with the controller. Ethernet/IP support provides the ability to interface directly to Rockwell PLC devices using explicit and implicit messaging.



Better Tools. Higher Productivity.



SPiiPlus ADK Suite with Powerful Simulator for Faster Setup, Development & Diagnostics

SPiiPlus
ADK Suite

The SPiiPlus ADK Suite of tools minimizes time to market while providing the flexibility to meet the specific machine requirements throughout its entire life cycle. It provides extraordinarily easy setup, fast application development, and quick diagnostics.

With the SPiiPlus real time Simulator, you can develop the entire Windows host front end application, and a full simulation of the entire machine using ACSPL+ programs to emulate real life behavior of moving axes, inputs, outputs, safety faults, errors and interaction between them.

The front end host program and on-board controller programs can then be logically tested and debugged from a desktop or laptop computer without attaching any hardware.



The SPiiPlus ADK Suite includes the SPiiPlus MMI Application Studio, the SPiiPlus Utilities for software maintenance and application management, comprehensive documentation of all ACS products and software tools, and a training program.

The latest version of the SPiiPlus ADK Suite can be downloaded from the ACS Motion Control website.



The Best Printer Requires the Best Controller

Durst Phototechnik is a market leader in the field of industrial digital printers for paper, textile ceramic tiles and more. Durst uses multiple configurations of the MC4U integrated control module.

"What I really like when using ACS Motion Control systems is the high flexibility and high performance of the controllers. You can drive a linear motor, ac servo or stepper drive on the same output and it is possible to scale the number of drives as needed but the interface is always the same. ACS Motion Control has great support, real experts and sophisticated algorithms also for tricky and challenging projects. They are always open for direct contact in case of problems and for customized adjustments of the controllers if needed."



Digital printing

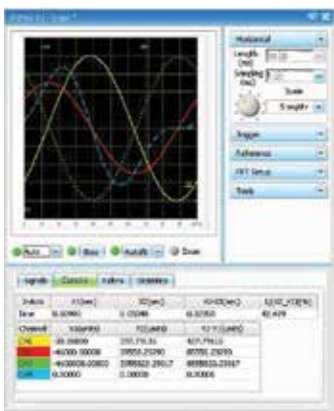
O.F., System Engineer,
Durst Phototechnik AG



SPIIPlus MMI Application Studio

The MMI provides an easy-to-use set of powerful tools for configuring, tuning, programming, monitoring and motion performance measurement and analysis. Among others, it includes:

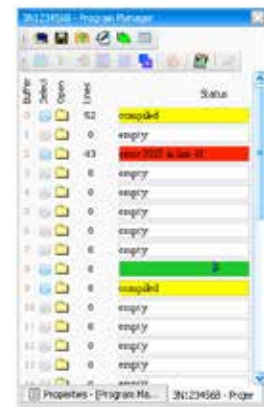
- Automatic system and EtherCAT Network configuration
- ACS Adjuster with one-parameter axis tuning
- ACSPL+ program manager and development environment
- An eight channel interactive oscilloscope with FFT capability
- A system frequency response function analyzer (FRF)
- An optional Motion Performance Analyzer (MPA)
- A communication terminal
- A motion manager
- I/O and safety setup & monitoring tool
- Application management tools



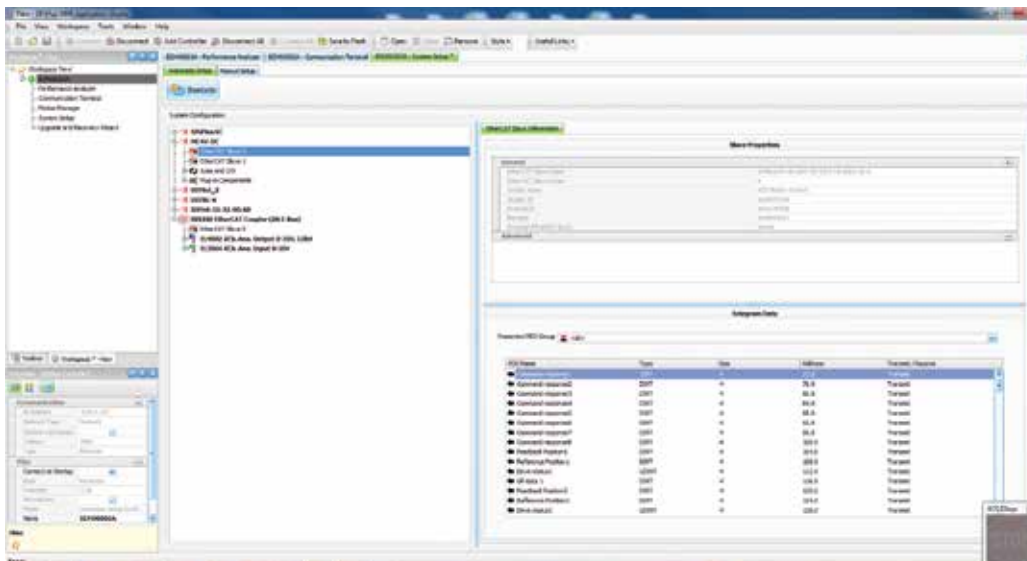
Eight channel scope with 20kHz sampling rate



Motion design and testing



Complete ACSPL+ application development and debugging environment



Simple system setup. Automatic EtherCAT network configuration.

"The FRF tool is extremely helpful, I mostly spend 1 to 10 minutes max to tune an axis thanks to FRF. It could be an half hour to full day to achieve the same performance if I use other manufacturer's controller"

PI USA, Shin Bogyyoo



MMI Application Studio

Software Applications - Smarter Tools for CNC and Laser Micro-machining



SPiiPlusSPC **Smart Processing Commander** Machine Control Interface for High Precision Laser Processing Applications

The SPiiPlusSPC is user interface software for high precision laser processing equipment that provides complete machine control and easily integrates, manages, and coordinates the SPiiPlus motion control system, laser, and other potential machine peripherals (vision, galvo, etc.).

SPiiPlusSPC can be used as an 'out of the box' solution for complete machine control functionality, completely eliminating the need for user interface development.

For more complex applications developed by System Integrators and OEMs, customization options are available through ACS and it's partners, or via user created plugins.



Key Functionalities

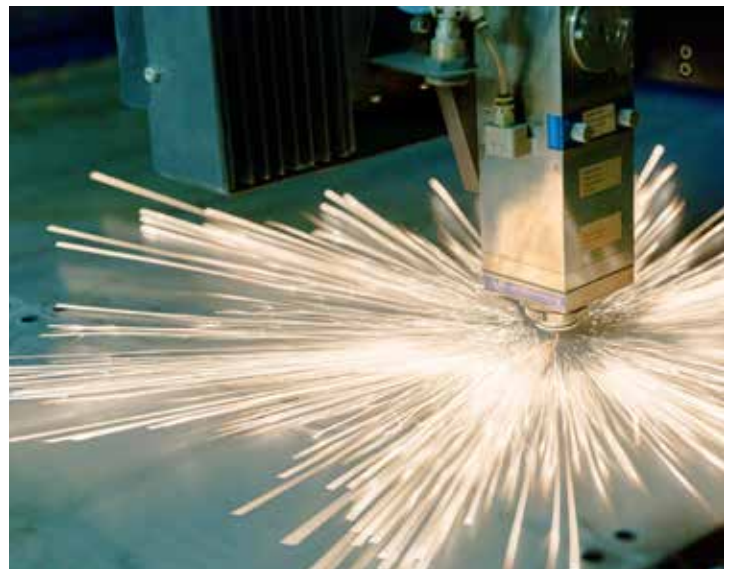
- Leverages SPiiPlus EtherCAT based motion control product line for complete machine control
- Easy to use, comprehensive environment for manual and automated machine operation
- Suitable for many 2D and 3D laser processing applications 'out of the box', with customization options available for more complex applications
- Suitable for any PC running Windows 7/8/10, optimized to require minimal Windows resources
- Control Galvo Scanner and Stage from a single interface
- Easily integrate vision components for automated alignment and calibration

Sophisticated laser control options synchronized with single and multi-axis motion via LCM laser control module and drives

- Power modulation via digital or analog signal
- Fixed distance pulse firing
- Array based pulse firing
- Axis range windowing
- Array based gating
- Combining multiple modes simultaneously

Combination of SPiiPlusSPC and SPiiPlus Motion Controller – designed to maximize process throughput and accuracy at every level

- Motion recipe planning - Optimal order of recipe execution
- Motion trajectory generation - Maximizing speed while minimizing jerkiness through corners and small geometries
- Servo performance - Ensuring motion axes follow desired path as closely as possible





SPiiPlusSMC **Smart Motion Commander**

Customizable CNC HMI Platform for High Precision Machining and Processing Applications

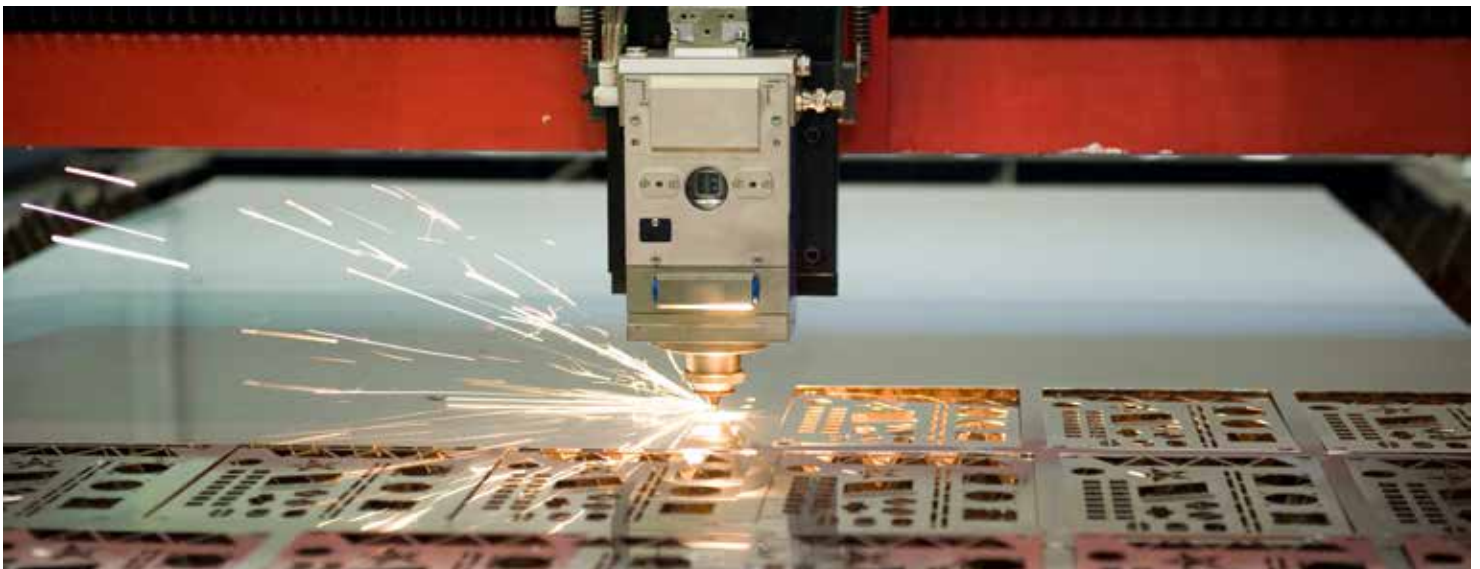
SPiiPlusSMC is a CNC HMI software platform for OEMs and system integrators of high precision machining and material processing equipment such as laser cutting / processing / Micro-machining, precision grinding, additive manufacturing, and more.

SPiiPlusSMC, which leverages a SPiiPlus EtherCAT based control system as the CNC controller, is designed primarily with flexibility and ease of customization in mind and allows the machine builder to significantly reduce effort spent on developing and maintaining HMI software. Instead the machine builder can focus on optimizing the application and improving machine performance, resulting in shorter time to market and greater machine accuracy, precision, and throughput.



Key Functionalities

- Leverages SPiiPlus EtherCAT based motion control product line for CNC control
- User-customization via MS Visual C#, customization also offered by ACS and its partners
- Integrate vision, visualization, application specific screens, etc.
- Simulation mode for highly efficient and flexible development and testing
- Accepts NC files with Standard RS-274 G & M Codes, support for User Definable G & M Codes
- Suitable for any PC running Windows 7 and newer, optimized to require minimal Windows resources



A Wide Line of EtherCAT Motion Controllers to Match Your Needs

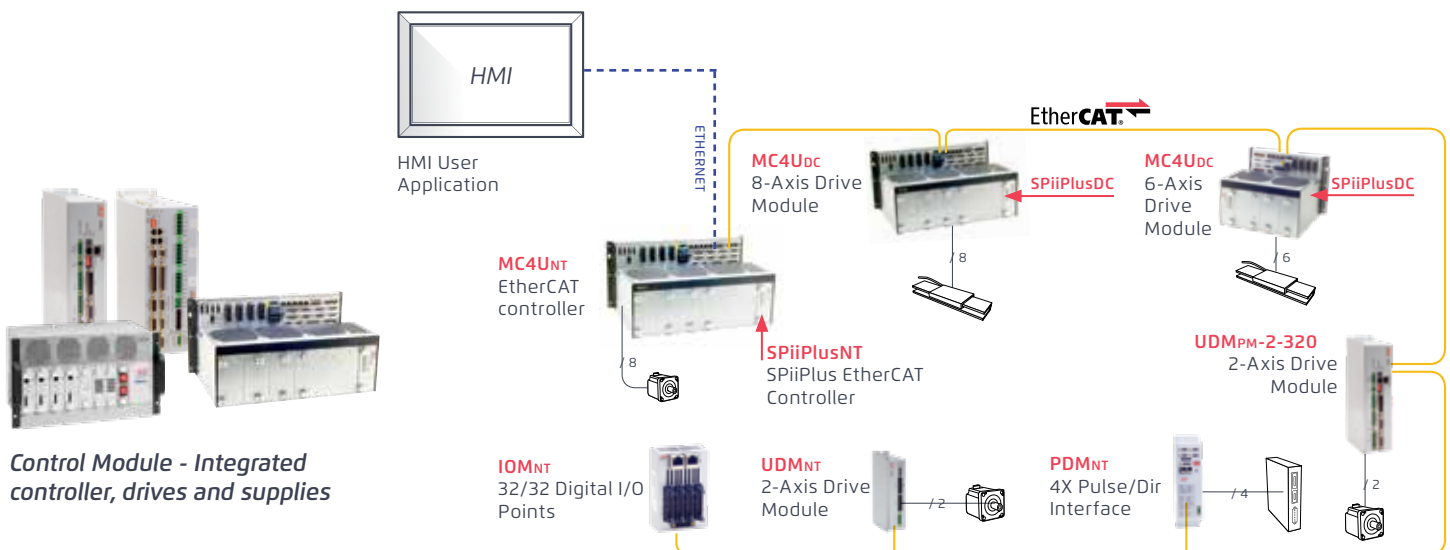


A family of Motion Controllers, One Common Architecture, One Set of Tools

- A powerful programmable multi-axis motion controller and EtherCAT Master
- Migrating from one to another involves minimal effort
- Supporting third party IO and motor drives that comply with CoE (CAN Over EtherCAT)
- One common computing platform and set of tools

Each integrated Control Module is also an EtherCAT Master Controller

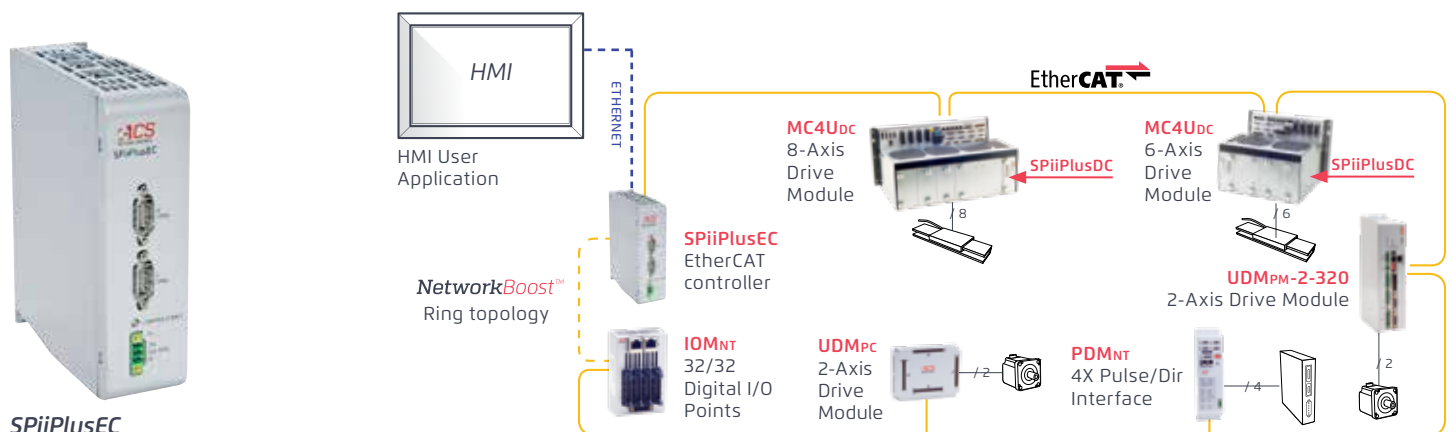
The Control Module integrates a motion controller and EtherCAT Master, one to eight motor drives and power supply. The line of SPiiPlusCMxx and the MC4UNT are powerful and economical standalone complete solutions. The integrated controller can control up to 64 axes and hundreds of IO points, providing a unique compact solution, that is flexible and scalable. The Control Module communicates with a host computer through Ethernet and RS232 communication channels (See pages 16-21 for more information).



SPiiPlusEC Powerful Motion Controller and EtherCAT® Network Manager

The SPiiPlusEC is specifically designed to extend the capabilities of the SPiiPlus line of controllers and EtherCAT master, to address the needs of modern machinery for cost effective high performance multi-axis, scalable and distributed control of motion centric applications. The SPiiPlusEC open architecture operates in conjunction with ACS' line of EtherCAT servo and step motor drives and I/Os modules, as well as with any certified EtherCAT module that complies with CAN over EtherCAT (CoE) protocol.

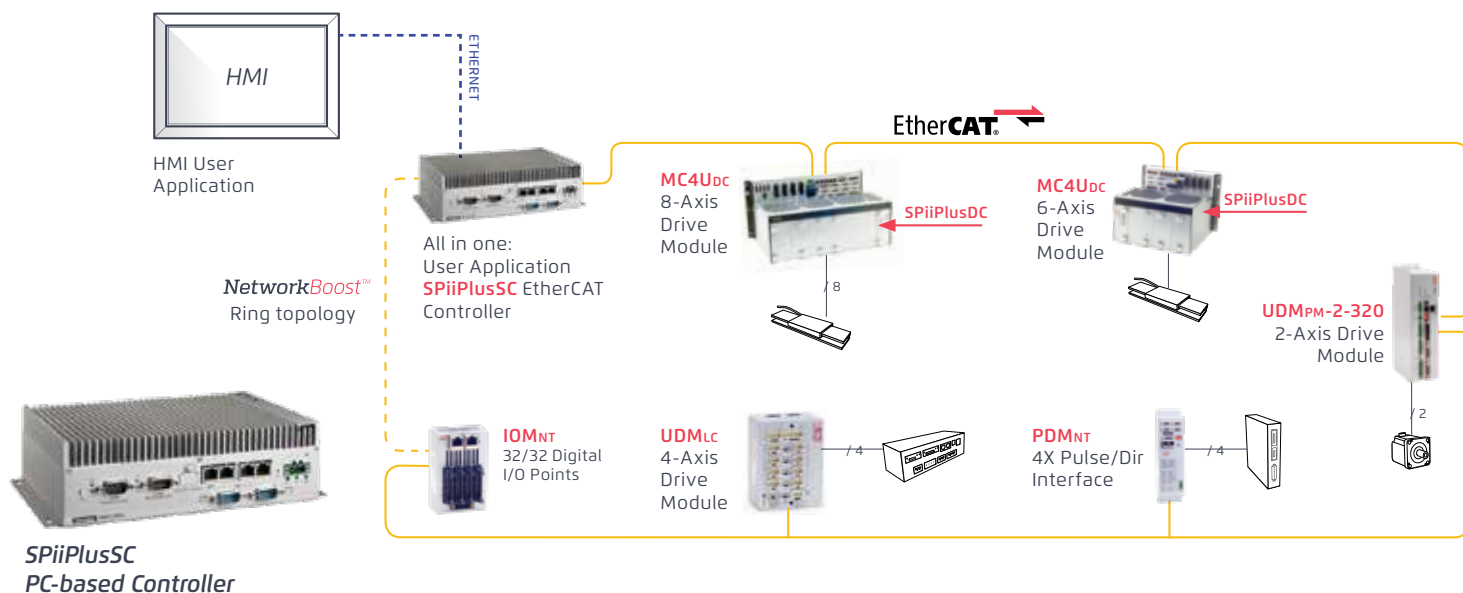
The SPiiPlusEC controls up to 64 axes and thousand of I/Os and supports cycle and profile generation rates of 1 to 5kHz. The SPiiPlusEC (as well as the SPiiPlusSC) support the unique **NetworkBoost™** optional feature that increases machines' uptime by using ring topology based redundancy to continue operation upon a network failure.





SPiiPlusSC PC-based EtherCAT Motion Controller

The SPiiPlusSC Controller & EtherCAT converts your standard PC into the most powerful motion and machine controller at the lowest price. (See pages 15 for more information).



State-of-the-art SMT assembly system uses the most advanced EtherCAT based control system

Assembléon provides Pick & Place solutions for the electronics manufacturing industry. The iFlex SMT assembly system places up to 70,000 parts per hour. It has up to 40 axes of motion and hundreds of I/Os. The SPiiPlusSC soft EtherCAT motion controller manages the entire system. It controls the ACS servo and stepper drives, I/Os, and non-ACS drives. Assembléon implemented all real time functionality in the ACSPL+ controller programming language.

"ACSPL+ provided the real-time environment and the parallelism we needed, enabling us to make changes and test them easily. This, together with the Simulator, which all our software developers use heavily to test their software, saved us a lot of development time. With the SPiiPlusSC that runs on the host PC and communicates with the Windows environment through fast shared memory, there is no communication limitation when you have a host-based application program that requires intensive and fast communication with the controller. When we started this project, EtherCAT was new to us. Without ACS' know-how, flexibility, and support, it would have taken us much more time to complete the project"

R.v.d.B, Motion Architect, Assembléon



Electronic Assembly

SPIiPlusES - Leverage on All ACS Powerful Capabilities With Any EtherCAT Automation Controller



- Combines the powerful SPIiPlusEC Motion Controller and an high speed EtherCAT_to_EtherCAT bridge
- Adds the powerful motion control capabilities of the SPIiPlusEC to any Automation Controller using EtherCAT and DS402
- The clocks of the two EtherCAT networks can be synchronized

SPIiPlusES as a node

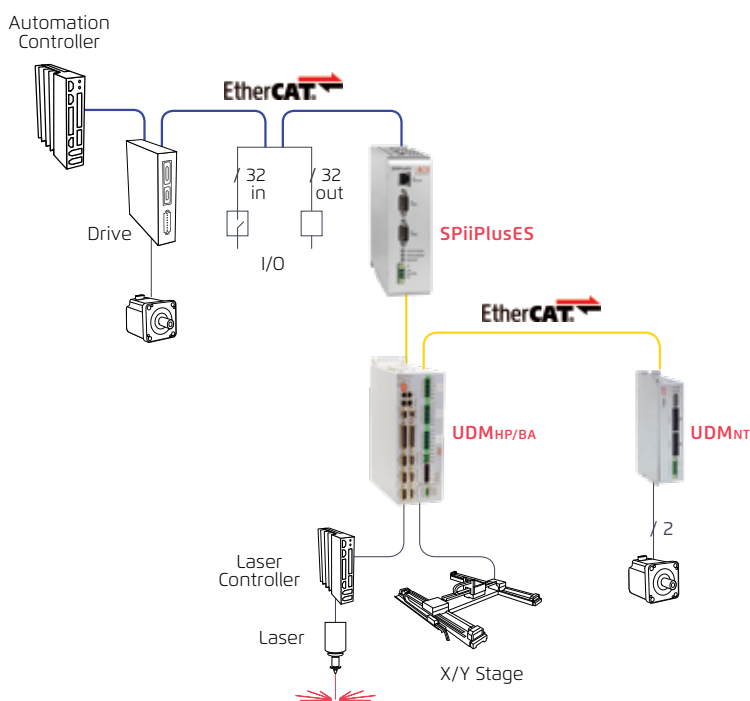
- Can be managed by any EtherCAT Automation Controller with DS402 protocol
- Standard support for up to 8 axes
- Support for up to 64 axes using manufacturer's specific commands
- 1, 2, 4 & 5kHz EtherCAT cycle rates

SPIiPlusES as an EtherCAT Master

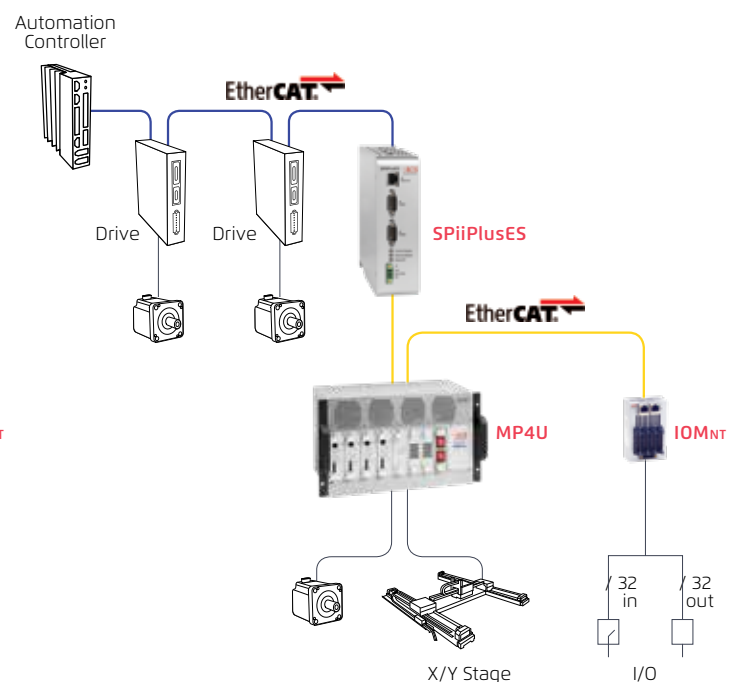
- Identical to SPIiPlusEC, the most powerful Motion Controller & EtherCAT Master
- Up to 64 axes and many I/Os
- 1,2,4 & 5kHz EtherCAT cycle rates
- **NetworkBoost™** cable failure detection and recovery

Adds ACS' unique capabilities to enhance accuracy and throughput in the field of Semiconductors, Laser micro-machining, digital printing and more.

Laser Micro-machining



Wafer Metrology





The SPiiPlusSC Turns Your Standard PC Into the Most Advanced EtherCAT Motion Controller

Powerful Motion Controller and PLC...

- Up to 64 fully synchronized axes and thousands of I/O points
- High-speed Host-Controller communication over shared RAM
- Programming by ACSPL+ powerful multi-tasking motion language
- Full API for Windows based host programming
- Open architecture - supports ACS and other vendors' qualified EtherCAT components
- **NetworkBoost™** - enhancing machine uptime using ring topology to continue operation when a network cable fails

The Best Control Solution for Motion-Centric Applications

The SPiiPlusSC PC-based Soft Controller provides demanding machinery with the highest performance possible at the most affordable price, leveraging on the processing power of modern PC technology and on the simple connectivity of EtherCAT network. Now, a standard PC with Windows can run your machine application, the Graphical User Interface (GUI), and the SPiiPlusSC motion controller, and PLC without adding any hardware. The SPiiPlusSC includes its own real-time operating system, which runs on one of the cores of a multi-core PC. It communicates with the host applications through shared RAM and virtual TCP/IP. It manages the EtherCAT network using one of the Ethernet ports of the PC. The result - the highest performance and most flexible controller at the best price. The SPiiPlusSC is also a more cost effective, state of the art replacement for standalone motion controllers and PLCs. It is more powerful and it simplifies connectivity of the entire system by eliminating the dedicated controller hardware. The SPiiPlusSC (as well as the SPiiPlusEC standalone controller) support the unique **NetworkBoost™** optional feature that increases machines' uptime by using ring topology based redundancy to continue operation upon a network failure. The controller is available in two versions: The SPiiPlusSC-HP for complex and performance demanding applications with up to 64 axes, and the SPiiPlusSC-LT, an economical version that addresses the needs of one to eight axes cost sensitive applications. Both versions provide the same uncompromising servo and motion performance. The table on the right depicts the differences between the two.

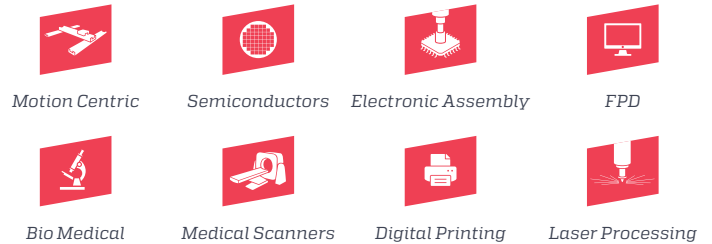
The Most Efficient Host-Controller Communication

The SPiiPlusSC communicates with the host applications over virtual TCP/IP and over the 100kByte of shared RAM (HP version only) with Inter-Processor Interrupt (IPI) based Callbacks. Communication over the shared RAM guarantees that your machine throughput will not be affected by any communication bottlenecks. The user defines the variables that reside in the shared RAM. Once defined, both the controller and the host application have instantaneous access to such variables.

Just a Standard PC With No Special Requirements

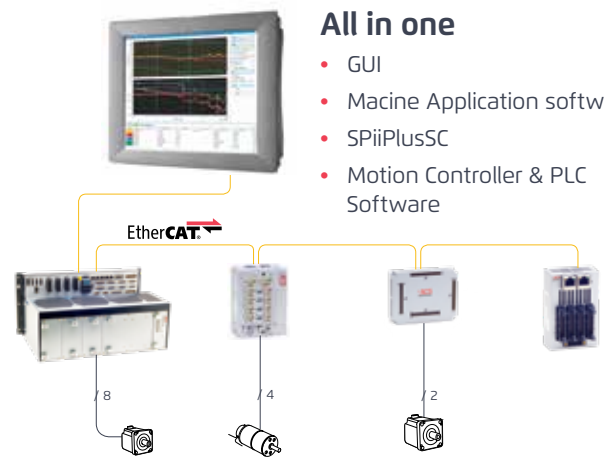
Any PC with the following minimal requirements can host the SPiiPlusSC: Dual (or more)-core Intel, 1 GB RAM, a Network Interface Controller (NIC) for EtherCAT communication, hard drive or flash disk, standard communication interfaces, Windows 7 or newer, 7 embedded, XP and XP Embedded. No need for any Windows real-time extension.

for Demanding Applications



All in one

- GUI
- Machine Application software
- SPiiPlusSC
- Motion Controller & PLC Software



SPiiPlusSC	LT	HP
Maximum Number of Axes	8	64
ACSPL+ buffers (threads)	8	64
Host application interface	TCP/IP	Shared RAM+TCP/IP
EtherCAT Cycle rate	1 kHz	Up to 5kHz
Control loops update rate	20 kHz	

Shared RAM R/W operations	Microseconds
Read/Write single value	8
Read/Write of 200 values	26
Read/Write of 2000 values	226
Callback Round-Trip Time	100+(Cycle-time)/2

Average execution time, statistics over 100,000 samples

Control Modules - Integrated EtherCAT Motion Controller & Drives



A Wide Line of Ready-made Solutions, Now Scalable

ACS' Control Modules combine a powerful EtherCAT motion controller, with up to 8 universal motor drives and a power supply all contained in a compact enclosure. The type of motor - rotary or linear, DC or AC, single, two or three phase is programmable. Now every Control Module, as an EtherCAT Controller, can control up to 32 axes and thousands of IO points!

Each controller manages and generates the motion profile for up to 32 axes. The EtherCAT network scanning rate is up to 2kHz. All drives are highly synchronized by a distributed clock with accuracy better than 0.1 microsecond, and execute the control algorithms at a 20kHz rate.

Each control module is powered by an AC input (rectified internally to generate a Vac x 1.4 motor bus voltage) and by a separate 24Vdc control supply that keeps all logic signals alive during emergency conditions. They support a wide range of incremental, both digital as well as analog Sin-Cos, and absolute position feedback devices.

The line of Control Modules consists of the following:



MC4UNT up to 8 built-in drives, wide range of voltages and currents

A modular system that allows you to mix and match controllers, high voltage drivers and supplies to meet your specific needs. See pages 18-21.



MP4U up to 8 integrated drives, up to 100Vdc and wide range of currents

A modular system that allows you to mix and match controllers, **NanoPWM™** and economical low voltage (48, 96Vdc) drivers and supplies to meet your specific needs. See pages 22,23.



270 x 157 x 67 mm³

SPiiPlusCMNT 2 built-in drives, up to 320Vdc, 7.5A/15A

An economical line of EtherCAT and multi-axis machine and motion controllers with two built-in universal drives. It is designed to address the needs of cost sensitive applications such as digital printers and PCB automatic optical inspection systems.

The SPiiPlusCMNT is fed by a single phase AC voltage of 85 to 230Vac and is offered with the following current levels: 2.5A/5A (cont./peak), 5/10A and 7.5A/15A. Optional Safe Torque Off (STO) cuts the power to the motor without removal of the power source to comply with SIL-3 and PLe safety levels. It supports the following position feedback devices: incremental digital (total of 4) and analog (Sin-Cos) encoders, absolute encoders and resolvers.



324 x 249 x 120 mm³

SPiiPlusCMHP/BA 3 built-in drives, up to 320Vdc, 15A/30A

A line of EtherCAT network controllers and multi-axis machine and motion controllers with up to three built-in universal drives. The SPiiPlusCMHP addresses high accuracy demanding applications, and the SPiiPlusCMBA addresses cost sensitive applications. The modules are fed by a single or 3-phase AC voltage in the range of 85 to 230Vac and are offered with three current levels: 5A/10A (cont./peak), 10/20 and 15/30A.

It supports the following position feedback devices: incremental digital (total of 4) and analog (Sin-Cos) encoders, absolute encoders.

Optional built-in LC1 Laser control interface and PDM Pulse/Direction interface to four step motor drives are available.



260 x 246 x 120 mm³

SPiiPlusCM_{HV} 2 built-in drives, up to 480V, 15/30A or 230V, 20/60A

The SPiiPlusCM_{HV} EtherCAT motion controller includes two high power universal drives. It is designed to address the needs of large positioning tables with high dynamics and accuracy requirements, such as FPD (Flat Panel Display) handling systems, large industrial printers and medical scanners.

The SPiiPlusCM_{HV} is offered with the following voltage and current levels:

230-480V with currents of 5/10A, 10/20A, 15/30A for both drives or with 20/20A for one drive and 5/10A for the second drive.

230V with 10/30A, 15/45A, and 20/60A for both drives.

Optional Safe Torque Off (STO) cuts the power to the motor without removal of the power source to comply with SIL-3 and PLe safety levels. It supports the following position feedback devices: incremental digital (total of 4) and analog (Sin-Cos) encoders, absolute encoders and resolvers.

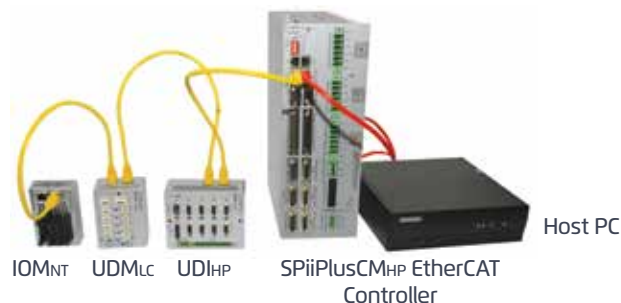
The following table describes the main characteristics of each type:

Product	Built in drives	Motor Supply voltage [Vin]	Current Cont./ Peak Sine amp [A]	In	Out	Ana. In	Ana. Out	Special Inputs	Special Outputs	Feedback	Dimensions [mm ³]
MC4U _{NT}	2 to 8	85-400 Vac	Up to 45/90	8	8	Up to 4	Up to 4	Up to 8 MARK STO E-stop	7 PEG up to 8 brake	1 per axis: incremental digital Sin-Cos encoders (optional) Absolute (optional) 3 hall inputs per axis	See page 20
MP4U	2 to 8	100-240 Vac	Up to 13.3/40	See (*)	See (*)	Up to 16	Up to 16	Up to 16 MARK STO	8 PEG up to 8 brake	2 per axis: incremental digital Up to 2 Sin-Cos encoders per axis (optional) Up to 2 Absolute encoders per axis (optional) 3 hall inputs per axis	436x261x266
SPiiPlusCM _{NT}	1,2	85-230 Vac	Up to 7.5/15	8	8	4	2	4 MARK STO E-stop	4 PEG 2 brake	Up to 4 incremental digital 0, 1, 2 Sin-Cos encoders (optional) 0, 1, 2 Absolute (optional) 0, 1, 2 Resolvers 3 hall inputs per axis	270x157x67
SPiiPlusCM _{HP/BA}	2,3	85-230 Vac	Up to 15/30	8	8	Up to 6	2	4 MARK E-stop	10 PEG 3 brake	Up to 4 incremental digital 0, 1, 2, 3 Sin-Cos encoders (optional) 0, 1, 2, 3 Absolute (optional) 3 hall inputs per axis	324x249x120
SPiiPlusCM _{HV}	1,2	230-480 Vac	Up to 15/30	8	8	4	2	4 MARK STO E-stop	4 PEG 2 brake	Up to 4 incremental digital 0, 1, 2 Sin-Cos encoders (optional) 0, 1, 2 Absolute (optional) 0, 1, 2 Resolvers 3 hall inputs per axis	260x246x120
		230 VAC	Up to 20/60								

* Special inputs/outputs can also be assigned for use as general purpose I/O.

** Each unit is powered also by a 24Vdc logic supply.
The internal motor DC bus voltage is Vacx1.4.

*** Absolute encoders supported: EnDat2.1(Digital) / 2.2, Tamagawa Smart-Abs, Panasonic, Hiperface (except SPiiPlusCM_{HP/BA}), BiSS-A/B/C, SSI



MC4U - Modular Control solution With High Power & Voltage Drives



MC4U: Customized Multi-axis Control Using Standard Components

- Integrated motion & machine controller, 8 universal built-in drives and power supply
- Units can be networked together to create a fully integrated solution for up to 64 axes and hundreds of I/Os
- Wide power range of motor drives - from 100W to 10kW
- High axis density
- Short lead time for a fully custom-tailored application
- Shorter development time, reduced risk, lower cost
- ACS field proven robustness and reliability
- **NanoPWM™** drives that replace linear drives, delivering higher performance and higher power, enhanced reliability at smaller size and at better price.

The MC4U is a unique modular complete solution that addresses the tailor-made, flexible machine and motion control needs of OEMs. The MC4U's high performance, Lego-like system combines an EtherCAT controller (for MC4UNT) or drive controller (for MC4UDC), up to 8 universal motor drives, and power supplies with networking to provide a complete machine and motion control solution to demanding motion centric machine automation. Built from standard plug-in components, the MC4U addresses all machine control needs, resulting in shorter development cycle time, reduced risk, small footprint and lower costs.

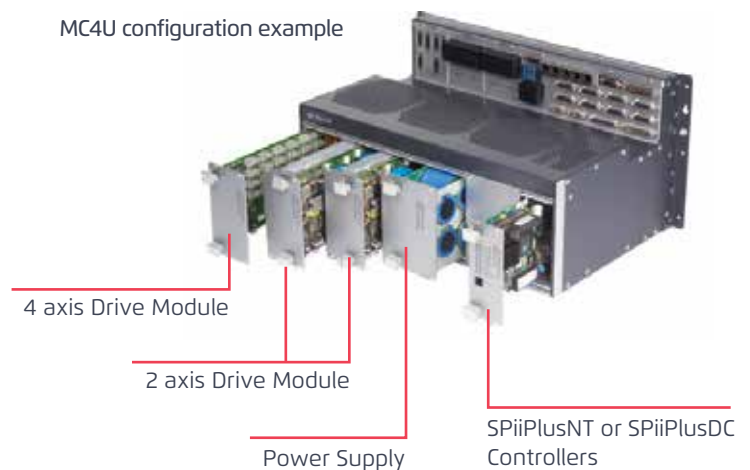
High performance stems from the fine balance and interaction of the controller software, its hardware interfaces, the drives, the power supplies and the precise integration of all components. Each and every component is designed to deliver performance and the system is tested as a whole to ensure that your most demanding specifications can be achieved. Now many MC4U units and additional ACS and third party EtherCAT components can be networked together, thus creating a single highly integrated system with up to 64 axes and hundreds more I/Os.

The Upright Piano Enclosure - Simple Connectivity, the Right Size

Different enclosure sizes are available to provide the minimum size and volume needed to meet your power and number of axes needs.

Enclosure dimensions				
Enclosure	22"	19"	11"	9"
Height	221.5 ±1			
Width [mm]				
With front brackets	---	483 ±1	---	---
With rear brackets	542 ±1	476 ±1	316.7±1	251±1
With no brackets	502 ±1	436 ±1	276.7±1	211±1
Depth [mm]				
With extractors	292 ±1	292 ±1	287.3±1	287.3±1
Without extractors	279 ±1	279 ±1	273.8±1	273.8±1
Net weight [Kg]	4.9	4.3	2.6	2

MC4U configuration example





Modularity & Scalability by Design

The MC4U can be configured to meet the needs of your system with regards to number of axes, power, features and performance. For your specific application you select:

1. The proper controller - One that is also an EtherCAT Controller (SPiiPlusNT) or just a Drive Controller (SPiiPlusDC) to be managed by an EtherCAT Controller; a high performance one with extensive set of advanced features (HP) or an economical one that reduces the cost (LT).
2. The set of drives to meet your exact motor type and power needs.
3. The power supply to meet the motor drives power needs.
4. The proper enclosure that optimizes footprint.

Powerful Motion and EtherCAT Controllers or Drives Controllers

The SPiiPlusNT/DC family of multi-axis EtherCAT controllers (NT) and Drive Controllers (DC) is designed to address the control requirements of the most demanding motion centric applications, such as semiconductors manufacturing, electronic assembly, wafer inspection, Flat Panel Display assembly and testing equipment. The SPiiPlusNT/DC provides outstanding motion performance, sub-nanometer resolution, high speed for maximum throughput, smooth velocity, ease of use, and excellent scalability using an EtherCAT network. The SPiiPlusNT can manage a network of up to 32 axes. (If more axes are needed, then the SPiiPlusNTM or SPiiPlusSC can be used). For distributed systems with additional EtherCAT nodes, one unit, designated MC4UNT acts as the EtherCAT controller, using a SPiiPlusNT. supports fast analog Sin-Cos encoders with raw frequencies up to 5MHz. This enables running stages using high resolution laser encoders with sub-nanometer resolution at more than 1 meter/second.

All other units, which are clusters of drives (MC4UDC), include a SPiiPlusDC Drive Controller. If a separate EtherCAT controller is used, such as the SPiiPlusNTM or the SPiiPlusSC, then all units are of MC4UDC type and each one includes a SPiiPlusDC Drive Controller.



SPiiPlusNT EtherCAT Controller
SPiiPlusDC EtherCAT Drive Controller

SPiiPlusNT Line of Motion and EtherCAT Controllers; up to 32 axes:

1. SPiiPlusNT-LT - Economical motion controller. All built-in drives are PWM.
2. SPiiPlusNT-HP - High Performance motion controller. All built-in drives are PWM.
3. SPiiPlusNT-LD - High Performance motion controller. One to four built-in drives are linear.

SPiiPlusDC line of Drive Controllers; up to 8 axes:

1. SPiiPlusDC-LT - Economical drive controller. All built-in drives are PWM.
2. SPiiPlusDC-HP - High Performance drive controller. All built-in drives are PWM.
3. SPiiPlusDC-LD - High Performance drive controller. One to four built-in drives are linear.

Choose the SPiiPlusNT/DC-HP if one of the following is needed:

- Sin-Cos analog encoders with high multiplication factor.
- Special control algorithm, such as Gantry, Input Shaping, **ServoBoost™**.
- EtherCAT / MPU cycle <1 msec.
- If in addition a linear drive is used, then choose a SPiiPlusNT/DC-LD.




MC4U - Wide Line of Drives and Matching Power Supplies




High Performance Universal PWM Drives for the Best Performance With any Type of Motor

The MC4U line of universal digital PWM drive modules is specifically designed to provide a high performance and cost effective solution for demanding multi-axis applications. The drives are optimized for low noise, providing the lowest possible jitter and velocity smoothness and are fully programmable for easy setup and diagnostics. Each drive can be programmed to control any type of single, two or three phase DC brushless motors, AC induction motors, DC brush motors, voice coils, or step motors with open or closed loop control. The MC4U drive modules support linear and rotary motors covering a wide power range of 100W to 10kW. Drive modules with up to 750W per axis, include up to four drives, and modules with up to 5kW per axis include two drives for optimal performance, cost and footprint. Modules with 30/60A (7.5kW) and 45/90A (10kW) include one drive. Drives are available with optional Safe Torque Off (STO) feature to enable machine builders to comply with SIL-3 and PLe safety levels.


PWM Drive Modules	Part Number	Number of Axes	Bus Voltage [Vdc]	Phase Current Cont./Peak [Amps]	Output Power per Axis Cont. /Peak [kW]
	DDM3U-2/4-60V-4A	2 or 4	18-60	4 / 5	0.15 / 0.3
	DDM3U-4-320V-1A	2 or 4	24-320	1 / 2	0.25 / 0.5
	DDM3U-4-320V-2A	2 or 4	24-320	2 / 4	0.5 / 1
	DDM3U-4-320V-3A	2 or 4	24-320	3 / 6	0.75 / 1.5
	DDM3U-1/2-320V-5A	1 or 2	24-320	5 / 10	1.35 / 2.7
	DDM3U-1/2-320V-10A	1 or 2	24-320	10 / 20	2.7 / 5.4
	DDM3U-1/2-320V-15A	1 or 2	24-320	15 / 30	4.1 / 8.2
	DDM3U-1/2-320V-20A	1 or 2	24-320	20 / 40	5.5 / 11
	DDM3U-1-320V-30A	1	24-320	30 / 60	7 / 14
	DDM3U-1-320V-45A	1	24-320	45 / 90	10 / 20
	DDM3U-1/2-560V-5A	1 or 2	24-560	5 / 10	1.35/2.7
	DDM3U-1/2-560V-10A	1 or 2	24-560	10 / 20	2.7/5.4
	DDM3U-1/2-560V-15A	1 or 2	24-560	15 / 30	4.1/2.8

NanoPWM™ & Digitally Controlled Linear Drives for Minimal Standstill Jitter & Maximum Velocity Smoothness

The **NanoPWM™** line of PWM drives is specifically designed for applications with demanding standstill jitter and velocity smoothness requirements. These drives provide currents up to 15A/30A (continuous/peak) at up to 320Vdc. It is the ultimate drive for 450mm and 300mm wafer handling stages, FPD and optical components processing, demanding high speed, high acceleration, smooth velocity and sub-nanometer standstill jitter and constant velocity tracking errors. The LDM line of digitally-controlled linear drives is designed for applications with demanding standstill jitter, smoothness requirements and low electrical noise. It provides currents up to 6.25A/25A (continuous/peak) at up to 55Vdc. Combining the **NanoPWM™** or LDM drives with the powerful **ServoBoost™** algorithm guarantees the lowest standstill jitter and following error at constant velocity and the best move and settle times.

LDM Linear Drives	Part Number	Motor Supply (Vm) min./max. (Vdc)	Motor Phase Current sine amplitude, cont./peak [A]	Maximum output power [W]
	LDM3U-28V-8A-D	24-32	4/8	81/162
	LDM3U-28V-16A-D	24-32	4/16	81/324
	LDM3U-55V-8A-D	45-60	4/8	166/333
	LDM3U-55V-16A-D	45-55	4/16	150/600
	LDM3U-55V-16A-S	45-55	4/16	173/693
	LDM3U-55V-25A-S	45-55	6.25/25	271/1083




NanoPWM™ Drives	Model No	Number of Axes	Bus Voltage [Vdc]	Phase Current Cont./Peak [Amps]	Output Power Per Axis Cont./Peak [kW]
	DDM3U-1-100V-15A-NP	1	24 – 100	15/30	1.07/1.98
	DDM3U-1-320V-15A-NP	1	24 – 320	15/30	4.1/8.2

* for other current ratings contact ACS.

A Line of Matching Power Supplies

A wide range of power supplies is available to match the motor drives with bus voltages ranging from 28Vdc to 560Vdc. An MC4U configuration can include two supplies in a single enclosure to support two voltages or enhance power. The high voltage supplies include a shunt regulator and a 100W regeneration resistor. If additional regeneration capability is needed, an external 600W shunt resistor is available.

Power Supply Modules	Part Number	Input Voltage [Vac]	Output Voltage [Vdc]	Nominal Power
	PSM3U-28V-0.5kW	85-265 ¹	28	500W
	PSM3U-48V-0.7kW	85-265 ¹	48	700W
	PSM3U-48V-1.4kW	85-265 ¹	48	1400W
	PSM3U-320V-4kW	85-265 ²	120-320	4kW
	PSM3U-320V-8kW	85-265 ²	120-320	8kW
	PSM3U-320V-10kW	85-265 ²	120-320	10kW
	PSM3U-320V-11kW	85-265 ²	120-320	11kW
	PSM3U-320V-20kW	85-265 ²	120-320	20kW
	PSM3U-320/48V-0.7/8kW	85-265 ²	48, 120-320 ⁴	8kW
	PSM3U-560-7kW	360-440 ³	500-560	7kW
	PSM3U-100V-3kW	30-70 ⁵	44-100	3kW

¹ Single phase; ² Single or three phase; ³ Three phase; ⁴ Features dual bus voltage outputs of 48Vdc and up to 320Vdc; ⁵ To achieve the best jitter and smoothness when powering a **NanoPWM™** or LDM drive, it is recommended to feed this supply from an external, well regulated DC power source.

Wafer Inspection with Nanometer Performance Level

Hermes Microvision Inc. (HMI) develops the most advanced E-beam Inspection (EBI) tools and solutions for leading semiconductor companies.

"HMI has been using ACS controller for more than 12 years. It is a reliable and high performance controller. The MMI software is versatile and user friendly for both the development and field engineering. Tech support is timely, responsive, and effective. ACS has excellent knowledge of motion control engineering and is able and willing to customize for special applications. It enables us to have the most advanced control solution to meet our special needs.

The ServoBoost™ control algorithm demonstrated its superior function in improving our demanding motion performance."

B.C., Mechanical Engineer, HMI



Semiconductors

MP4U - Modular Control Solution for the Most Demanding Applications With up to 100V Drives



MP4U: Highest Performance & Cost Effective

- Integrated 8 universal drives, power supplies and an optional Motion Controller & EtherCAT Master
- A wide range of high performance **NanoPWM™** drives and economical drives
 - NPM3U **NanoPWM™** drives for sub nanometer jitter an following errors
 - UDM3U – Economical drives
- Current range of 3.3A / 10A (cont/peak) to 13.3A/40A
- Flexible motor supply with AC input
 - 96Vdc/32A
 - 48Vdc with 32A or 64A
 - Both 96Vdc/32A and 48Vdc/32A
- Short lead time for a fully custom-tailored application
- Shorter development time, reduced risk, lower cost
- ACS field proven robustness and reliability

The MP4U is a unique modular complete solution that addresses the motion control needs of OEMs. This high performance,

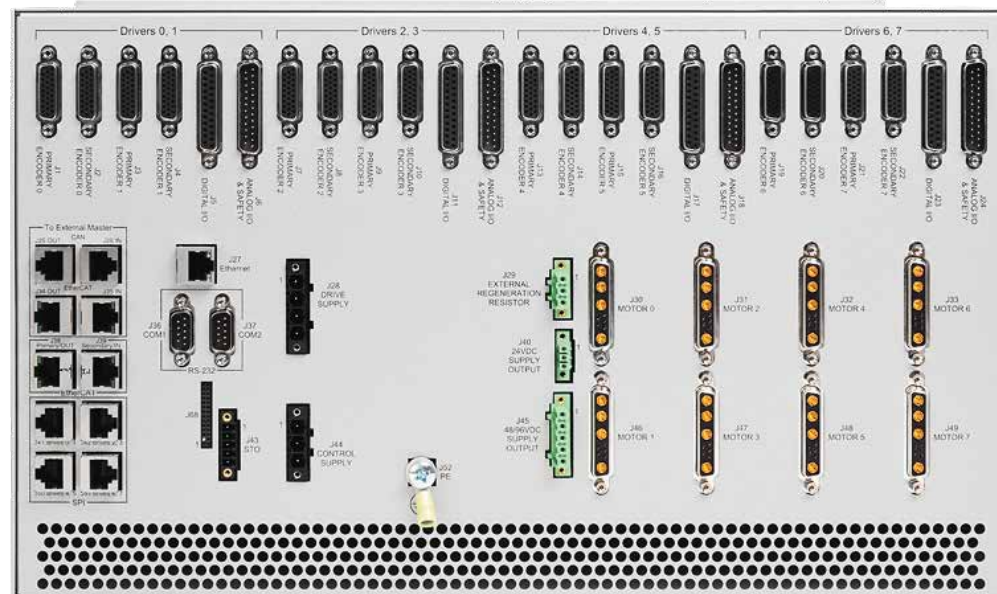
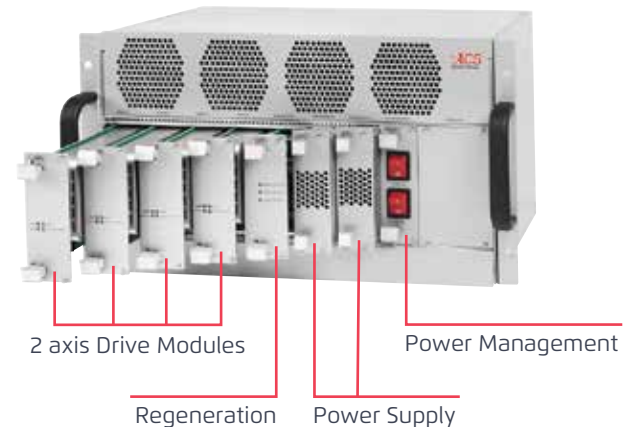
Lego-like system combines high performance **NanoPWM™** (NPM) drives as well as UDM economical drives, a 96V and/or 48V motor power supply and an optional EtherCAT motion controller. The MP4U drives are EtherCAT slaves that may be managed by either an external motion controller, such as the SPiiPlusEC, or by an internal one. The internal controller is functionally identical to the SPiiPlusEC., Optionally it may include a powerful high speed EtherCAT_to_EtherCAT bridge that enables to connect the entire system as a node in an EtherCAT network managed by any Automation controller supporting DS402 protocol.

Completely self-contained, 19" Rack-mounted Chassis

All connectors and interfaces are placed at the back.

Built-in fans draw air from the front and extract it from the back.

Enclosure dimensions	
Enclosure	19"
Height	260 (6U)
Width [mm]	
With no ears	440
With ears	483
Depth [mm]	
Without handles	266
With handles	306
Net weight [Kg]	4-axis: 11.8 (Kg). 8-axis: 13.3(Kg).





A Complete System Tailored to Your Exact Needs

You may select:

- The controller and its set of features
- The drives: type, voltage, current and additional features
- The motor power supply

Component / Feature	Options
Motion Controller	Y - Yes, N - No
Maximum number of axes	B - 4, C - 8, D - 16, E - 32, F - 64
ServoBoost, number of axes supported	N - 0, A - 4, B - 8, C - 12, P - 60, Q - 64
Number of ACSPL+ buffers	A - 10, B - 16, C - 32, D - 64
Maximum MPU cycle rate (kHz)	1 - 1kHz (64 axes), 2 - 2kHz (up to 32 axes), 4 - 4kHz (up to 16 axes), 5 - 5kHz (up to 8 axes)
NetworkBoost, Flexible configuration	N - None, A - NetworkBoost, B - Flexible configuration, C - Both
Input shaping	Y - Yes, N - No
EtherCAT Master-To-Master Bridge	Y - Yes, N - No
G-Code	Y - Yes, N - No
STO	Y - Yes, N - No
Limit switches	A - 5V, Source/PNP B - 5V, Sink/NPN C - 24V, Source/PNP D - 24V, Sink/NPN
Digital Inputs	A - 5V, Two-terminal B - 24V, Two-terminal
Digital Outputs	A - Source/PNP, 5V & 24V B - Sink/NPN, 5V & 24V
Motor Power Supply	A - 48V, 32A, 48V, B - 64A, 96V, C - 32A, D - 96V&48V
Drive Module per slots 1 - 4	U - UDM, P - NPM
Number of drives	1, 2
Current	A - 3.3/10A, B - 6.6/20A, C - 10/30A, D - 13.3/40A
Voltage connected to	A - 48V, B - 96V
500kHz SIN-COS encoder interface	For UDM: 0, 1, 2 For NPM: 0, 1, 2, 3, 4
10MHz SIN-COS encoder interface	For UDM: 0 For NPM: 0, 1, 2, 3, 4
Absolute encoders type	N - None, E - EnDat 2.2 & 2.1 digital only, S - Smart Abs, P - Panasonic, B - BiSS-A/B/C, I - SSI, A - Sanyo ABS
Number of Absolute encoders interface	0, 1, 2
Motor relays	Y - Yes, N - No

A Wide Range of EtherCAT Universal Motor Drives to Address Your Needs



A wide line of high performance universal drive modules are available. These drives are designed for industry-leading performance, ranging from 10W up to 10kW, with motor DC bus voltages ranging from 12Vdc to 680Vdc.

The drives can be operated only with ACS EtherCAT controllers. The drives are optimized for low noise, providing the lowest possible jitter and velocity smoothness, and are fully programmable for easy setup and diagnostics. Drives can be programmed to control any type of motor (single, two or three phase, DC brushless, AC induction, DC brush, step), with open or closed loop control and dual feedback control. Many types of feedback devices are supported, such as incremental optical and Laser encoders (both digital and analog Sin-Cos), absolute encoders and resolvers. In addition, the modules provides general purpose and specific I/O functionality, such as PEG (Position Event Generation), Position Registration Mark and motor brake controls.

Product	Built In drives	Motor Supply voltage (Vin)	Logic supply voltage	Motor bus voltage	Current Cont./ Peak Sine amp. [A]	Ana. In	Ana. Out	Feedback	Dimensions [mm ³]
UDMLC	2,4	12-48Vdc	12-48Vdc	Vin	Up to 5/10 (in 2 axes configuration)	-	-	2 or 4 Incremental Digital 0, 1, 2 Absolute (optional), Hall*	100x75x48
UDMPC	1,2	5-48Vdc	24Vdc	Vin	Up to 10/20	4	2	Up to 4 Incremental Digital 0, 1, 2 Sin-Cos encoders (optional) 0, 1, 2 Absolute (optional), Hall*	112x87x20
UDMNT	1,2	12-80 Vdc	24Vdc	Vin	Up to 10/20	2	1	1, 2 Incremental Digital 0, 1, 2 500 kHz Sin-Cos (optional) 0, 1, 2 10 MHz Sin-Cos (optional) 0, 1, 2 Absolute (optional), Hall*	162x113x38
UDMMC	2,4	12-80 Vdc	24Vdc	Vin	Up to 20/40	-	-	Up to 4 Incremental Digital Up to 4 Absolute (optional), Hall*	152x138x48
UDMCB	2	12-100 Vdc	24Vdc	Vin	Up to 13.3/40	2	2	1, 2 Incremental Digital 0, 1, 2 500 kHz Sin-Cos (optional) 0, 1, 2 Absolute (optional), Hall*	155x85x30
UDMPA	2	12-100 Vdc	24Vdc	Vin	Up to 13.3/40	2	2	1, 2 Incremental Digital 0, 1, 2 500 kHz Sin-Cos (optional) 0, 1, 2 Absolute (optional), Hall*	257x155x51
UDMHV	1,2	230-480Vac	24Vdc	Vin x 1.4	Up to 15/30	4	2	Up to 4 Incremental Digital 0, 1, 2 Sin-Cos encoders (optional) 0, 1, 2 Absolute (optional) 0, 1, 2 Resolvers, Hall*	260x246x120
		230Vac			Up to 20/60				
UDMHP/BA	2,3	85-230Vac	24Vdc	Vin x 1.4	Up to 15/30	Up to 6	2	Up to 4 Incremental Digital 0, 1, 2, 3 Sin-Cos encoders (optional) 0, 1, 2, 3 Absolute (optional), Hall*	324x249x120
UDMPM	1,2	85-230Vac	24Vdc	Vin x 1.4	up to 7.5/15	4	2	Up to 4 Incremental Digital 0, 1, 2 Sin-Cos encoders (optional) 0, 1, 2 Absolute (optional) 0, 1, 2 Resolvers, Hall*	270x157x67
MC4UDC	2 to 8	85-400Vac	24Vdc	Up to 560Vdc	Up to 45/90	Up to 4	Up to 4	1 per axis: Incremental Digital Sin-Cos encoders (optional) Absolute (optional), Hall*	See page 16
MP4U	2 to 8	100-240Vac	100-240Vac	48 or 96Vdc	Up to 13.3/40	Up to 16	Up to 16	16 Incremental Digital, 16 Sin-Cos encoders (optional) 8 Absolute (optional), 8 Hall*	See page 22
SDMNT for step motors	4, 8	85-230Vac or 40Vdc	24Vdc	40Vdc	3A	-	-	-	290x130x90

* A set of 3 Hall inputs per axis

	Total Available Inputs	Total Available Outputs	General Purpose Inputs	General Purpose Outputs	MARK Inputs	PEG Outputs (+ state)	Emergency Stop Input	STO Input	Limits *	Motor Brake Outputs
UDMLC	13	5	-	-	4	1	1	-	8	4
UDMPC	13	10	8	4	2	2	1	√	-	-
UDMNT	8	4	4	2	4	2	-	-	4	-
UDMMC	14	5	-	-	4	1	-	√	8	4
UDMCB	8	4	4	2	4	2	-	√	4	2
UDMPA	8	4	4	2	4	2	-	√	4	2
UDMHV	15	12	8	8	2	2	1	√	4	2
UDMHP/BA	19	14	8	8	4	3	1	-	6	3 + 1 **
UDMPM	15	12	8	8	2	2	1	√	4	2
MC4UDC (Max. configuration)	37	15	8	8	4	7	1	-	16	-
MP4U	32	16	-	-	16	8	-	√	16	8
SDMNT	6	6	6	6	-	-	-	-	-	-
UDI	17	5	4	-	4	1	1	-	8	4
PDMNT	16	8	8	8	-	-	-	-	8	-
PDI _{CL}	17	5	4	-	4	1	1	-	8	4

* According to number of axes, 2 per axis

** Additional 1 output with 100mA

Special inputs/outputs can also be assigned for use as general purpose I/O.

• All ACS' drives and interfaces work only with ACS' motion controllers and EtherCAT masters. See specific product data sheet for full specifications.



UDMLC 4 drives, up to 48Vdc, 5A/10A

A line of compact EtherCAT drive modules with four and two universal drives of up to 200W. It addresses the needs of applications that require many motors, such as inspection heads and table top motion stages, where space is limited. The UDM_{LC} is fed by a DC voltage of 12 to 48Vdc and is offered with the following current levels: 1.25/2.5A, 2.5A/5A (cont./peak) and for the two-axis version also 5/10A. It supports the following position feedback devices: incremental digital (total of 4) and absolute encoders (a total of 2).



UDMSD 4 drives, up to 48Vdc, 2.5/5A

A line of compact EtherCAT drive modules with four and two universal drives of up to 100W. It provides the functionality of the UDM_{LC}, utilizing Sub-D type connectors. It is offered with the following current levels: 1.25/2.5A, 2.5A/5A (cont./peak).



UDMPC 2 drives, up to 48Vdc, 10A/20A

A line of PCB mounted EtherCAT drive modules with two universal drives of up to 400W each. It addresses the needs of applications that require high performance with demanding move & settle, smooth velocity and stand still jitter.. It supports STO, is fed by a DC voltage of 12 to 48Vdc and is offered with the following current levels: 2.5A/5A (cont./peak), 5/10A and 10/20A. It supports STO and the following position feedback devices: incremental digital (total of 4) or analog Sin-Cos (total of 2) and absolute encoders (a total of 2). The unit can be ordered assembled on the UDM_{PC} 2 - 048-BOB carrier for prototyping purposes.



UDMNT 2 drives, up to 80Vdc, 10A/20A

A line of compact EtherCAT drive modules with one or two universal drives of up to 700W. The UDM_{NT} is fed by a DC voltage of 12 to 80Vdc and is offered with the following current levels: 2.5/5A (cont./peak), 5A/10A and 10/20A. It supports the following position feedback devices: incremental digital and analog Sin-Cos (total of 2) and absolute encoders (a total of 2). The Sin-Cos interface supports also laser based encoders with rates of up to 10MHz.



UDMMC 4 drives, up to 80Vdc, 20A/40A

A line of powerful EtherCAT drive modules with four and two universal drives of up to 1400W. The UDM_{MC} supports STO, is fed by a DC voltage of 12 to 80Vdc, and is offered with the following current levels: 5/10A (cont./peak), 10A/20A and 20/40A. The four-axis units are also offered with a mixed current levels of 2 x 5A & 2 x 10A, 2 x 5A & 2 x 20A and 2 x 10A & 2 x 20A. It supports the following position feedback devices: incremental digital (total of 4) and absolute encoders (a total of 4).



UDMCB 2 drives, up to 100Vdc, 13.3/40A

A line of compact PCB mounted EtherCAT drive modules with one or two universal drives of up to 1.3kW. The UDM_{CB} is fed by a DC voltage of either 12 to 60Vdc or 12 to 100Vdc and is offered with the following current levels: 3.3/10A, 6.6/20A, 10/30A and 13.3/40A. It supports the following position feedback devices: incremental digital, analog Sin-Cos (total of 2) and absolute encoders (a total of 2).



UDMPA 2 drives, up to 100Vdc, 13.3/40A

The UDM_{PA} is a panel mounted version of the UDM_{CB}, utilizing high quality metal connectors.





UDM_{PM} 2 drives, up to 320Vdc, 7.5/15A

A line of cost effective EtherCAT drive modules with one or two universal drives of up to 1.6kW. The UDM_{PM} is fed by a AC voltage of 85 to 230Vac and is offered with the following ratings: 2.5/5A, 5/10A and 7.5/15A. It supports the following position feedback devices: incremental digital (4) and analog Sin-Cos (2) and absolute encoders (2) and resolvers (2).



270 x 157 x 67 mm³

UDM_{HP/BA} 3 drives, up to 320Vdc, 15A/30A

A line of EtherCAT modules with up to 3 universal drives. The UDM_{HP} addresses high accuracy demanding applications. The UDM_{BA} is a more economical version. The modules are fed by a AC voltage of 85 to 230Vac and offered with the following ratings: 5A/10A (cont./ peak), 10/20A and 15/30A. It supports the following position feedback devices: incremental digital (total of 4), analog Sin-Cos (3), and absolute encoders (3).



324 x 249 x 120 mm³

UDM_{HV} 2 drives, up to 675Vdc, 15/30A or 320Vdc, 20/60A

A line of powerful EtherCAT drive modules with one or two universal drives of up to 9kW. The UDM_{HV} is fed by a AC voltage of up to 480Vac and is offered with the following ratings: 230-480V and 5/10A, 10/20A, 15/30A, and a two-axis with 20/20A+5/10A. 230V and 5/15A, 10/30A, 15/45A and 20/60A. It supports the following position feedback devices: incremental digital (4) and analog Sin-Cos (2) and absolute encoders (2) and resolvers (2).



260 x 246 x 120 mm³

MC4U_{DC} 8 drives, wide range of voltages and currents

A comprehensive line of EtherCAT modules with 2 to 8 drives each, with 100W to 10kW per drive. The MC4U is a unique modular complete solution that addresses the tailor-made, flexible machine and motion control needs of OEMs. Built from standard plug-in components, the MC4U addresses all machine control needs, resulting in shorter development cycle time, reduced risk, small footprint and lower costs. See pages 18-19 for full details.



SDM_{NT} Unipolar Stepper, 8 drives, up to 40Vdc, 3A

A line of EtherCAT modules with open loop step motor drives that are specifically designed to address the needs for economical solutions for machines with many step motors operating as part of an EtherCAT network. It is available in 4 and 8 axis versions, with or without built-in motor power supply. Each unit includes one bipolar drive with up to 40Vdc, 3A. All other drives are unipolar with up to 40Vdc, 3A. The current level is individually programmable for each drive and can be set to the following levels: 1A, 1.5A, 2A and 3A. The step resolution is individually programmable for each drive and can be set to the following levels: full step, 1/2, 1/4, 1/8 and 1/16 step. The SDM_{NT} includes two sets of Pulse/Dir inputs and two sets of Pulse/Dir outputs for Master-Slave operation. There are 6 & 6 general purpose inputs and outputs. Modules with 40Vdc, 240W built-in motor supply are fed by 110Vac to 230Vac. The 40Vdc is also available as an output to power additional units. Modules without built-in motor supply are fed by a 12Vdc to 40Vdc input.



290 X 130 X 90 mm³

NPM_{PM}, NPA_{PM}



NPM_{PC}, NPA_{PC}



NPA_{RM}



A comprehensive line of **NanoPWM™** EtherCAT drive modules as well as drives with $\pm 10V$ commutation command interface for the highest accuracy and resolution.

For more details see **NanoPWM™** brochure.

NanoPWM™



UDI_{HP/LT} - Commanding Closed Loop Motor Drives with $\pm 10V$ Interface

The UDI (UDI - Universal Drive Interface) is a compact EtherCAT module that controls up to 4 motor drivers with $\pm 10V$ analog interface. It supports both torque commands (single $\pm 10V$ differential signal per axis) and sinusoidal commutation current commands (two $\pm 10V$ differential signals per axis). It includes 4 incremental encoder and 2 absolute encoder interfaces, safety limit inputs, 4 registration inputs, 4 24Vdc/0.2A brake control outputs and one PEG (Position Event Generator) output. The servo update and sampling rate is always 20kHz.

The UDI is available in two versions:

- UDI_{HP} - high performance version
- UDI_{LT} - economical version

The UDI_{LT} utilizes a 10 bit DAC to generate the $\pm 10V$ commands and supports digital encoders only (both incremental and absolute). The UDI_{HP} utilizes a 16 bit DAC to generate the $\pm 10V$ commands and it also supports fast analog Sin-Cos encoders with raw frequencies up to 5MHz. This enables running stages using high resolution laser encoders with sub-nanometer resolution at more than 1 meter/second.



121 X 100 X 48 mm³

PDI_{CL} - Commanding Motor Drives with Pulse/Direction and feedback Interface

The PDI_{CL} (Pulse-direction Drive Interface) provides the ability to connect step motor drives and servo motor drives with Pulse-Direction interface to EtherCAT networks that are controlled by ACS' motion controller and EtherCAT master.

The PDI_{CL} includes incremental and absolute digital encoder interfaces for position verification and closed loop control. It can be used also as a general purpose EtherCAT incremental and absolute encoder interface.



121 X 100 X 48 mm³

PDM_{NT} - Commanding Motor Drives with Pulse/Direction Interface

The PDM_{NT} controls up to four open loop step motor and servo motor drives with Pulse/Dir interface. It includes also safety limit inputs and 8/8 general purpose I/O points.

The maximum pulse rate is 4MHz. The module can also be used by a SPiPlus EtherCAT controller to control laser generators with a dynamically programmable pulse rates.



264 X 75 X 25 mm³

LCM - High Precision Laser Micro-machining

The LCM Laser Control Module adds the ability to operate a laser and to synchronize it with motion for high precision Micro-machining.

It supports the popular modes of digital control of laser power and provides one comprehensive and flexible mechanism of laser control, fully synchronized with the motion.

The unit provides additional functionalities, such as P/D to AqB conversion that enables generating an encoder output that represents a virtual axis. This makes the product useful also for non-laser related applications.



264 X 75 X 25 mm³

UDI, PDM_{NT}, PDI_{CL} & LCM interfaces operate only with ACS EtherCAT master controllers.

EtherCAT® I/O Modules and Accessories



IOM_{NT} - Compact and Powerful EtherCAT Digital I/O Modules

The IOM_{NT} line of EtherCAT digital I/O modules offers an economical and compact design with up to 32 inputs and 32 outputs (24Vdc/0.5A each) with minimal power dissipation. There are four 20-pin connectors, one per 16 I/O channels. It enables secure connection of plug connectors using insulation displacement contact, such as ribbon cables, thus significantly simplifying the wiring of many I/Os. 64 LEDs display the logical states of the inputs and outputs.

The SPiiPlus IOM_{NT} line includes the following modules:

IOM_{PS}

The IOM_{PS} is a line of EtherCAT digital and analog I/O modules which offer an economical and compact design, with up to 32 inputs and 32 outputs and minimal power dissipation.

The IOM_{PS} enables secure connection of plug connectors using insulation displacement contact thus significantly simplifying the wiring of many I/Os.

- Powerful Digital and Analog I/O Modules For EtherCAT Network
- Up to 32 Inputs and 32 Outputs
- Compact and cost effective
- Easy to use



101 X 65.5 X 59 mm³



Digital In/out
100x97x55 mm³



Analog Input
100x97x40.1 mm³



Analog Output
100x97x40.1 mm³

Filters for Improved Motor Performance

For applications with demanding standstill jitter requirements or applications utilizing sensors that are sensitive to the electromagnetic noise, the MC4U-MF-CD three-phase motor filter reduces the noise induced by the PWM drive's high current switching.



140 x 127 x 52 mm³

Regeneration Shunt Resistor

If the power supply built-in regeneration resistor is not enough, the external MC4U-REGEN 600W shunt resistor can be used to absorb higher energy ratings.

Regeneration Module

An active shunt resistor designed to absorb excessive energy coming from the motor during motor deceleration or immediate stop.

The module monitors the drive supply continuously and in cases where the drive supply crosses the defined level (due to energy generated by the motor) a powerful resistor, which is connected in parallel to the drive supply, dissipates the excessive energy.

A 300 watt module is available.



114 x 221 x 113 mm³

EM64 - Sin-Cos Encoder Multiplier and splitter for sub-count PEG and MARK



To generate Position Events and MARK capture position when using analog Sin-Cos encoders, with resolutions below one quarter encoder cycle. Programmable multiplication of up to 64 counts per encoder cycle. Two output connectors, each comprises of both the original analog encoder signals (buffered) and the RS422 digital post multiplication signals.

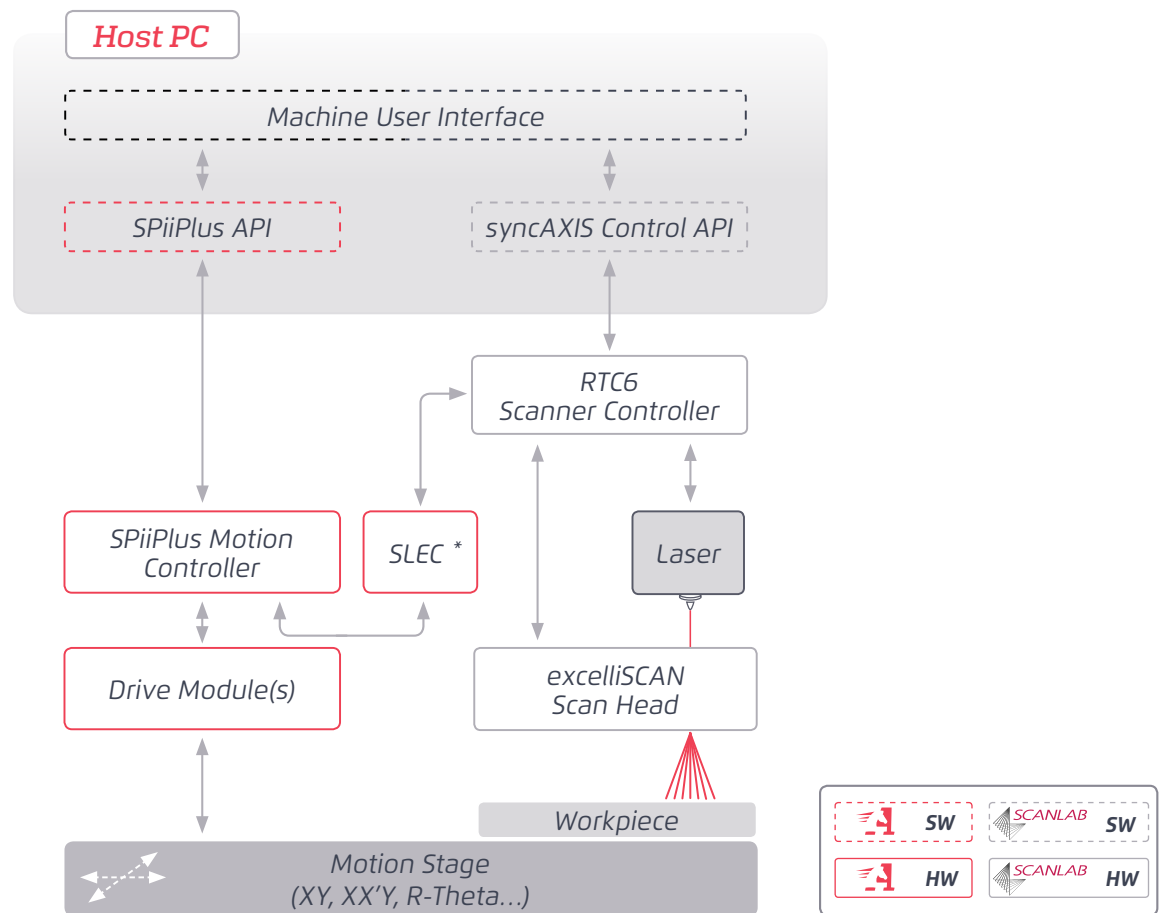


30x45x90 mm³



XLSCAN

- A unique and revolutionary eXtra Large **SCAN** machining solution co-developed by  and 
- Best in class galvo scanner solution + Best in class motion control solution = Significantly increased throughput for machining of large workpieces with the highest possible accuracy
- Key Advantages of Simultaneous Motion
 - › Very large field of view
 - › Major throughput increase (up to 40% more compared with conventional systems)
 - › No stitching errors for enhanced accuracy
 - › Smooth processing with high dynamics and no stage vibrations
- Scalable to support multiple scan heads
- Processing of three-dimensional workpieces supported through integration of excelliSHIFT Z-scanner



* EtherCAT to SL2-100 Synchronization Node

Customers Testimonials



Control Solutions for FPD and AOI

Orbotech is a leading provider for PCB AOI and FPD inspection systems. Orbotech uses a variety of Control Modules, such as the MC4U, a wide line of Universal Drive Modules (UDM) and I/O modules.

"Orbotech has been using ACS Motion Control solutions for over 20 years. ACS is always listening to our needs and is providing first rate support. ACS' wide line of controllers, EtherCAT universal drives and I/O modules enable us to implement complex inspection systems, with 30 and more axes and hundreds of I/O points in the most efficient way.

The unique level of performance achieved with ACS solutions contributes to increased throughput and inspection quality."

D.K. Control Engineer, Orbotech



FPD

Better Control for Unique Assembly Systems

IXMATION NORTH AMERICA designs and builds unique assembly systems for customers in the Medical, Electronics, Consumer goods, and Automotive industries. IXMATION uses a variety of ACS' SPiiPlus controllers.

"In multi-axis motion controllers, the top three characteristics we look for are technical support, performance and features.

ACS offers superior quality and service in all these categories. It is typical to get a direct connection with an ACS application engineer who is extremely knowledgeable, not only with ACS products, but with general motion and closed-loop control to help solve technical issues in a timely manner. ACS's ability to remotely connect and take control of our PC to help examine mechanical performance or tuning has been extremely valuable in keeping our projects moving forward.

The unique SPiiPlus simulator allows our engineers to develop and test motion routines with surprising simulated performance before the equipment is actually built. As users of Allen-Bradley PLCs, the Ethernet/IP connectivity is a must for our applications.

The ACS' implementation of the Ethernet/IP is easy to setup and use and provides flexible Read/Write access to low-level controller parameters as well as to user defined variables."

J.S. Senior Controls Engineer / Group Leader, IXMATION North America



Motion Centric



International Headquarters

ACS Motion Control Ltd.

Ramat Gabriel Industrial Park
1 Hataasia St.,
Migdal HaEmek, 2307037
POB 984. Israel
Phone: +972-4-6546440
Fax: +972-4-6546443
sales@acsmotioncontrol.com
support@acsmotioncontrol.com

North American Office

ACS Motion Control

7300 Metro Blvd. Suite 590
Edina, MN 55439, USA
Phone: +763-559-7669
sales-usa@acsmotioncontrol.com
support@acsmotioncontrol.com

ACS Motion Control Europe

Auf der Roemerstrasse 1,
76228 Karlsruhe, Germany
Phone: +49 721 941846-02
Fax: +49 721 941846-04
sales-eu@acsmotioncontrol.com
support@acsmotioncontrol.com

ACS Motion Control Korea

Digital Empire Building II, 101-1404
88 Sinwon Rd., Yeongtong-gu, Suwon-si
Gyeonggi-do, South Korea, 443-734
Phone: +82-70-7167-8608
Fax: +82-70-7016-2628
sales@prestosolution.co.kr

ACS Motion Control China

Room 301, No.798, Zhaojiabang Rd,
Shanghai, 200030, China
Phone: +86-21-54830819
Fax: +86-21-64453191
Cell: +86-13601639842
jjimingt@acsmotioncontrol.com
support@acsmotioncontrol.com