

SPiiPlusCM_{XA}

EtherCAT[®] Master Control Module With 1, 2, or 3 Integrated Universal Motor Drives



- > Supports up to 64 axes and thousands of I/O
- > Advanced Profile Generation and Servo Control Algorithms for Maximum Motion Performance
 - > **ServoBoost**
 - > **LearningBoost**
 - > **MotionBoost**
 - > Multi-axis Lookahead and Corner Rounding
 - > SmoothPath
 - > MIMO Gantry Control
 - > Cascaded Dual Loop Control
 - > Customized Algorithms (Contact ACS)
- > Universal Motor and Encoder Support for Maximum Flexibility
- > Max Drive Current: 15/30A Per Axis
- > Drive Supply Input: 85-265Vac
- > Built-In 4-Axis Pulse/Direction (PDMnt) Interface
- > Functional Safety: STO, SS1
- > 12 or 16 bit SinCos and Analog Input Resolution
- > Feedback Channels: 4 (AqB, SinCos, or Absolute)
- > Digital I/O
 - > 4 High-Speed Position Capture (MARK) Inputs
 - > 8 Limit Sensor Inputs
 - > 3 Brake Outputs
 - > 3 High-Speed Position Event Generation (PEG) Engines with up to 10 Configurable Outputs
 - > 8 General Purpose Digital Inputs
 - > 8 General Purpose Digital Outputs
- > Analog I/O
 - > 6 General Purpose Analog Inputs (shared with SinCos)
 - > 2 General Purpose Analog Outputs

The SPiiPlusCMxa is a member of ACS Motion Control's SPiiPlus series of products and is designed to meet the needs of OEMs with demanding multi-axis motion control applications. Its unique multi-processor architecture leverages powerful profile generation and servo control algorithms to maximize motion performance, while its universal motor and encoder technology provides the system designer flexibility to control most any type of motor or stage. As an EtherCAT master it can control ACS products within the SPiiPlus Motion Control Platform as well as 3rd party EtherCAT products.

The SPiiPlusCMxa is highly configurable and supported by many advanced servo tuning and application development tools available in MMI Application Studio. Users can control and generate motion profiles for up to 64 axes. Configure the SPiiPlusCMxa to include 1, 2, or 3 built in drives with one of three current levels: 5/10A, 10/20A, or 15/30A.

The SPiiPlusCMxa is a drop-in replacement for the SPiiPlusCMba or SPiiPlusCMhp offering improved jitter and noise performance and STO and SS1 functional safety features.

Communication Channels

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

Ethernet: One, TCP/IP, 10/100/1000 Mbs

Simultaneous communication through all channels is fully supported. Modbus as client or server is supported over Ethernet and serial channels.

Ethernet/IP protocol as adapter is supported over Ethernet channel.

Programming

- > ACSPL+ powerful motion language
 - > Real-time program(s) execution
 - > Up to 64 simultaneously running programs
- > NC programs (G-code)
- > C/C++, .NET and other high-level languages via host programming libraries

Motion Types

- > Multi-axis point-to-point, jog, tracking and sequential multi-point motion
- > Multi-axis segmented motion with look-ahead
- > Arbitrary path with PVT cubic interpolation
- > Third order profiles (S-curve)
- > Smooth on-the-fly change of target position or velocity
- > Inverse/Forward kinematics and coordinate transformations (at application level)
- > Master-slave with position and velocity locking (electronic gear/cam)

Motion Processor Unit (MPU)

Processor Type: Multi-core Intel Atom CPU (model depends on controller configuration)

RAM: 1GB
Flash: 2GB

EtherCAT Ports

Two ports, Primary and Secondary

Protocols: CoE and FoE

NetworkBoost (optional) - Automatic network failure detection and recovery using ring topology and redundancy

MPU/EtherCAT Cycle Rate

The following options are available for MPU Cycle Rate:

For Maximum Number of Axes = 2, 4, or 8: 2 kHz (default), 4 kHz, 5 kHz

For Maximum Number of Axes = 16 or 32: 2 kHz (default), 4 kHz

For Maximum Number of Axes = 64: 1 kHz (default), 2 kHz

NetworkBoost and Segmented Motion (XSEG) features functionality can be limited as a function of MPU Cycle Rate and Number of Axes. Please refer to Software Documentation or contact ACS for more details.

MotionBoost, 2-axis SmoothPath, and 2-axis NURBS are included with 4 kHz or 5 kHz (MPU cycle). For **MotionBoost** BPTP profile generation at 20kHz (SP cycle), **ServoBoost** must be ordered in addition to

MotionBoost. Contact your ACS sales representative for a quote for 3+ axis SmoothPath or 3+ axis NURBS feature.

Supported EtherCAT Slaves

All ACS SPiiPlus Platform EtherCAT slave products are supported. 3rd party EtherCAT drives can be controlled via DS402 CoE protocol in Cyclic Synchronous Position (CSP) mode.

ACS recommends qualification of 3rd party EtherCAT drives and I/O devices. Refer to ACS website for latest list of qualified devices and contact an ACS representative to discuss qualification

Servo

A standard comprehensive set of powerful algorithms to enhance accuracy, move & settle time, smooth velocity, stability and robustness.

- > **Servo Sampling and Update Rate:** 20 kHz position, 20 kHz velocity, 20 kHz current
- > Advanced PIV cascaded structure
- > Loop shaping filters
- > Gain Scheduling
- > Gantry MIMO control
- > Dual feedback / loop control
- > Disturbance rejection control

ServoBoost algorithm

Motor Types

Two- and three-phase permanent magnet synchronous (DC brushless/AC servo), DC brush, Voice coil, Two- and three-phase stepper (micro-stepping open or closed loop, AC induction*.

* Consult ACS.

Drives

Type: digital current control with field oriented control and space vector modulation.

Current ripple frequency: 40 kHz

Current loop sampling rate: 20 kHz

Programmable Current loop bandwidth:

up to 5 kHz

Commutation type: sinusoidal. Initiation with and without hall sensors

Switching method: advanced unipolar PWM

Protection: Over voltage, Phase-to-phase short circuit, Short to ground, Over current, Over temperature, motor over temperature

Feedback

Incremental Digital Encoder: Four, A&B,I; Clk/Dir,I; Electrical Interface: RS-422. Max. rate: 50 million encoder counts/sec.

Protection:

Encoder error
Not connected

Sin-Cos Analog Encoder (optional): Three.1Vptp, differential.

Max. Multiplication factor: x4096 (12 bit), x65536 (16 bit)

Maximum frequency: 500kHz

Automatic compensation of Offset, Phase and Amplitude

Protection:

Encoder error
Not connected.

Hall inputs: Three sets of three per axis.

Single-ended, 5V, source, opto-isolated.

Input current: <7mA.

Absolute encoders (optional): Three, EnDat 2.1(Digital)/2.2,

Smart-ABS, Panasonic, Biss-A/B/C, SSI.

5V feedback supply: Total current available for feedback devices: 1A

Pulse/Direction (PDMnt) Interface

Number of P/D Command Axes: 4

Type: RS-422. Up to 5 million pulse/sec.

Programmable pulse width

Range: 0.08 to 80 microseconds

Digital I/O

Limit Inputs: Eight. Left + right limit per axis

E-stop Inputs: One, software-level input

Registration Mark inputs: Four. RS422

Motor Brake Outputs: Three. 24V, 1A, optoisolated. Powered by the 24V Brake Supply.

General Purpose Outputs: Eight. Single-ended, 5VDC ($\pm 10\%$) or 24Vdc ($\pm 20\%$), opto-isolated, sink/source, 100mA

General Purpose Inputs: 8 Single-ended, 5Vdc ($\pm 10\%$) or 24Vdc ($\pm 20\%$), opto-isolated, sink/source

Position Event Generator outputs (PEG): 10, RS-422, max rate 10 MHz (incremental). Outputs are configurable for up to 3 PEG engines.

Analog I/O

Inputs: Six $\pm 10V$, differential, 20kHz sampling rate. 2 inputs are consumed per connected SinCos encoder. If all 3 SinCos encoders are connected, no analog inputs are available.

Resolution: 12 bit, 16 bit optional

Outputs: Two, Single-end, $\pm 10 V \pm 5\%$, 10 bit resolution

Functional Safety I/O

Safe Torque Off (STO) Input

Electrical Interface: Dual-channel 24V isolated

Safe Stop 1 (SS1) Feature

Deceleration time till STO activation: 110-230ms.

Exact deceleration time value is fixed (SS1-t functionality) and depends on product configuration (see user manual for more details)

Power Supplies

The module is fed by three power sources.

A motor AC supply, a 24VDC control supply and 24VDC motor brake supply.

During emergency conditions there is no need to remove the 24VDC control supply.

Drive Supply: 85 to 265VAC, single or three phase, or 120-375 VDC

Control Supply: 24Vdc $\pm 10\%$, 4A

Motor Brake Supply: 24Vdc $\pm 20\%$, 3A

Physical Environment

Operating: 0 to $+40^{\circ}C$. Storage : -25 to $+60^{\circ}C$ Humidity: 5% to 90% non-condensing

Standards and Certifications (Pending)

CE Electrical Safety: IEC 61800-5-1

CE EMC: IEC 61326-3-1, IEC 61800-3, EN 61500-5-2

UL Electrical Safety: UL 61800-5-1

TUV STO & SS1 Functional Safety: IEC 61800-5-1, IEC 61800-5-2

Accessory Products

CMUDMxa-ACC1: Mating connector kit

STO-ACC1: STO Breakout Cable

Specifications

Product (y - number of axes)	CMxayA...	CMxayB...	CMxayC...
Number of built-in drives	1,2,3		
Drive Supply voltage input [V]	85 - 265VAC, single or 3 phase or 120 - 375VDC		
Control voltage input [Vdc]	24±10%		
Phase current Cont./Peak Sine amplitude [A]	5 / 10	10/20	15/30
Phase current Cont./Peak RMS [A]	3.6 / 7.1	7/14	10.6/21.2
Peak current time [sec]	1		
Max. output voltage [Vdc]	(Vac in) x1.41 x 97%		
Max. RMS input current 1-phase supply [A] 3-phase supply[A]	18A for 1-phase supply 15A for 3-phase supply	18	24
Min. load Inductance, at max. motor voltage [mH]	1		
Max. Heat dissipation per axis [W]	33	67	102
Weight [gram]	5750		
Dimensions [mm ³]	324x249x120		

Ordering Options

Ordering Options	Field	Example User Selection	Values
Built-In Drive Axes	1	1	1,2,3
Current Rating	2	A	A- 5/10A B- 10/20A C- 15/30A
500 kHz SinCos Encoder Channels	3	0	0,1,2,3
Absolute Encoder Channels	4	0	0, 1, 2, 3
Functional Safety	5	N	N=None, T=STO & SS1
16-bit SinCos and Analog Inputs	6	N	N = No (12-bit), Y = Yes
Max. Number of Controller Axes	7	4	4, 8, A = 16, B = 32, C = 64
Max MPU Cycle Rate (kHz) & MotionBoost	8	D	D = Default (2kHz for 32 axes or less, 1kHz for 64 axes), 2, 4, 5
Max. Number of ACSPL+ buffers	9	D	D = Default A = 16 B = 32 C = 64 E = Default & Real-Time C Function Support Enabled F = 16 & Real-Time C Function Support Enabled G = 32 & Real-Time C Function Support Enabled H = 64 & Real-Time C Function Support Enabled
ServoBoost Number of Axes Supported	10	N	N=None, A=4, B=8, C=12, D=16...P=60, Q=64 (Use of ServoBoost on internal CMxa drives requires 16-bit SinCos and Analog Inputs = Y)
G-Code	11	N	N=None G=G-Code
Input Shaping	12	N	N=No S=Input Shaping
PDMnt Installed	13	N	N = No P = PDMnt installed (requires Max Number of Controller Axes = 8 or higher)
LearningBoost	14	N	N = No L=LearningBoost
NetworkBoost or Flexible Configuration	15	N	N = No B = NetworkBoost F = Flexible Configuration C = NetworkBoost & Flexible Configuration
Number of XL Scan scanners supported	16	0	0, 1, 2...9
Non-Linear Control	17	N	N = No C=Non-Linear Control (not supported on internal drives of the CMxa)
Reserved for Future Use	18	N	N

Example: CMxa1A00NN4DDNNNNNNN0NN Description: 1 axis 5/10A

Field	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
PN CMxa	1	A	0	0	N	N	4	D	D	N	N	N	N	N	N	0	N	N