

# SPiiPlusCM<sub>HV</sub>



## Control Module with 480Vac drives and EtherCAT® master

- Two built-in drives 230 - 480Vac with up to 15A continuous and 30A peak currents and 230Vac with up to 20A continuous and 60A peak currents
- Integrated EtherCAT master with one or two built-in drives Up to 32 axes and thousands of I/O
- Exceptional Servo Performance: High accuracy, move & settle time, smooth velocity, stability and robustness
- Two feedback inputs per axis
- STO: Safe Torque Off (optional)
- Digital I/O: 8 + 8 or 10 + 6
- Analog I/O: 4 + 2, Inputs resolution 12 bit, Outputs resolution 10 bit
- A rich set of tools for application development, set up, tuning and diagnostics
- Powerful ACSPL+ multitasking motion and IEC-61131-3 PLC programming languages

The SPiiPlusCM<sub>HV</sub> is a state of the art line of EtherCAT network multi-axis machine and motion controllers with one or two built-in universal drives. It is specifically designed to extend the capabilities of the SPiiPlusCM line of control modules to address the needs of modern machinery for high voltage, up to 480Vac, high power, economical and scalable distributed control for motion centric applications.

The SPiiPlusCM<sub>HV</sub> controls and generates the motion profile for up to 32 axes at 1KHz, and up to 16 axes at 2KHz. Its 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, and provides a comprehensive and cost effective control solution for demanding machinery.

The SPiiPlusCM<sub>HV</sub> is complemented by the SPiiPlusNT suite of software tools with built-in simulator. The tools are designed to minimize time to market while providing the flexibility to meet the specific machine requirements throughout its life cycle.

It provides easy setup, fast host and embedded application development, and quick diagnostics, reducing efforts and costs. The SPiiPlusCM<sub>HV</sub> is powered by AC input and by a 24Vdc control supply that keeps all low voltage signals alive during emergency conditions.

The SPiiPlusCM<sub>HV</sub> is offered with the following currents (cont./peak): 5A/10A, 10A/20A, 15A/30A, 20A/20A + 5A/10A with 230-480Vac, and 10A/30A, 15A/45A, 20A/60A with 230Vac.

When a 230-Vac 480Vac module is operated below 400Vac, the cont. & peak output current levels increase by 25%.

Optional Safe Torque Off (STO) module cuts the power to the motor without removal of the power source to comply with SIL-3 and PLe safety levels.

**CE, UL** (Pending)

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**ACS**  
MOTION CONTROL

## Specifications

Product X - number of Axes YY - Other configuration options	SPiiPlusCM <sub>HV</sub> X-A-YY	SPiiPlusCM <sub>HV</sub> X-B-YY	SPiiPlusCM <sub>HV</sub> X-C-YY	SPiiPlusCM <sub>HV</sub> X-D-YY	SPiiPlusCM <sub>HV</sub> X-E-YY	SPiiPlusCM <sub>HV</sub> X-F-YY	SPiiPlusCM <sub>HV</sub> X-G-YY	SPiiPlusCM <sub>HV</sub> X-H-YY
Number of axes	1 or 2							
Control voltage input [Vdc]	24 +/- 10%							
Motor voltage input range [Vac]	3 phase, 230 – 480				3 phase, 230			
Motor voltage input range [Vdc]	320 – 670				320			
PWM frequency [KHz]	10				20			
Phase Current per axis Cont./Peak sine amplitude at Vmax 480V [A]	5/10	10/20	15/30	20/20 + 5/10	-	-	-	-
Phase Current per axis Cont./Peak sine amplitude at Vmax 400V [A]	6.25/12.5	12.5/25	18.75/37.5	25/25 + 6.25/12.5	-	-	-	-
Phase Current per axis Cont./Peak sine amplitude at Vmax 230V [A]	6.25/12.5	12.5/25	18.75/37.5	25/25 + 6.25/12.5	5/15	10/30	15/45	20/60
Peak current time [sec]	1							
Max. output voltage to motor phase-to-phase [Vrms]	(Vac in) x 95%				(Vac in) x 88%			
Max. input continuous power @ 480 Vac [kVA]	7.6	15.1	22.7*	19	-	-	-	-
Max. input continuous power @ 400 Vac [kVA]	7.7	15.4	19.3*	19.3*	-	-	-	-
Max. input continuous power @ 230 Vac [kVA]	4.3	8.8	11.1*	10.9*	3.5	6.7	10.2	13.4
Min. load Inductance, at maximum motor voltage [mH]	0.05							
Max. output power (cont./peak) per axis @ 480 Vac [KW]	2.6/4.9	5.1/9.9	7.7/14.8	10.4+2.6/ 10.3+5.1	-	-	-	-
Max. output power (cont./peak) per axis @ 400 Vac [KW]	2.6/5	5.2/10	7.9/15.2	10.6+2.6/ 10.4+5.2	-	-	-	-
Max. output power (cont./peak) per axis @ 230 Vac [KW]	1.5/2.8	2.9/5.7	4.4/8.5	5.8+1.5/ 5.8+2.9	1.2/3.3	2.2/6.3	3.5/9.7	4.5/12.7
Max. Heat dissipation per axis @ 480 Vac [W]	50	102	156	211+50	-	-	-	-
Max. Heat dissipation per axis @ 400 Vac [W]	54	111	172	235+54	-	-	-	-
Max. Heat dissipation per axis @ 230 Vac [W]	36	75	117	162+36	48	98	84	114
Weight [Kg]	5.3							
Dimensions [mm³]	260 x 246 x 120							
Standards	CE, UL (Pending)							

\* Phase input current is limited to 27.8Arms

### Servo

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

- Advanced PIV cascaded structure
- Loop shaping filters
- Gain Scheduling
- Gantry MIMO control
- Dual feedback / loop control
- Disturbance rejection control

### Drives

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

Current ripple frequency: 20 kHz for A, B, C, D drivers and 40KHz for

E, F, G, H drivers 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:** Short current (phase-to-phase or phase to ground), Over current, Over temperature

### Supply

The module is fed by two power sources. A drive AC supply and a 24Vdc control supply

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

#### Drive Supply

Range: 230 to 480Vac, or 230Vac, see 'ordering options' for the different configurations.

Current rating should be calculated based on actual load

#### Control Supply

Range: 24Vdc ± 10% Maximum input current / power: 4A / 100W

Note: The module consumes 2A (50W) Additional 2A are needed when the motor brake feature is used.

### Regeneration

Internal and external options

Internal: 150Ω/300W for 230 - 480Vac modules

50Ω/300W for 230Vac modules

External: 50Ω/300W for 230Vac, 150Ω/300W for 480Vac

(see ordering options field 16)

### Motor Type

DC Brushless (AC Servo) ,DC brush motors, AC Induction

### Feedback

Up to 4 feedback devices. The following are supported:

#### Incremental Digital Encoder

Up to four, two per axis, AqB,I; Clk/Dir,I

RS-422. Max. rate: 50 million encoder counts/ sec.

Protection: Encoder error, not connected

#### Sin-Cos Analog Encoder (optional)

Up to two, one per axis.1Vptp, differential

Multiplication factor: From x4, to- x4,096, frequency: 250kHz.

Automatic compensation of Offset, Phase and Amplitude. Squared Sin-Cos output option

Maximum acceleration: 10<sup>8</sup> million sine periods/ sec<sup>2</sup>.

Protection: Encoder error, not connected

#### Absolute Encoder (optional)

Up to two, EnDat 2.1(Digital)/2.2, Smart-Abs, Panasonic, Hiperface, Biss-C, SSI

#### Resolver

Two, 12b resolution (4,096 counts/rev)

#### Hall inputs for initial commutation

One set of three per axis, Single-ended, 5V, source, opto-isolated.

Input current: <7mA

## Digital I/O

### General Purpose Inputs

Eight, Single-ended, 24V±20%, opto-isolated, source.  
(optional 5V & sink configuration upon order) Input current: 14mA

### Safety Inputs

Left + right limit per axis, Single-ended, 24V±20%, opto-isolated, source.  
optional 5V & sink configuration upon order, Input current: 14mA.  
E-Stop: Opto-isolated, floating two-terminal

### MARK (High Speed Position Capture)

Four. Two are RS422 with dedicated inputs and can be used as GP inputs.  
Two share General Purpose Inputs 6,7

### General Purpose Outputs

Eight, Single-ended, 24V±20%, opto-isolated, source. 0.5A per output with  
up to 3A for all outputs

### Motor Brake outputs

One per axis, 24V, 1A, opto-isolated.  
Powered by the 24V Control Supply

### PEG (Position Event Generator)

Two PEG Pulse and two PEG State, RS422.  
Flexible axis assignment. Can be used as GP outputs.  
Two general purpose opto-isolated outputs can be programmed to  
be used as the PEG Pulse outputs. Pulse width with RS422 outputs:  
26nSec to 1.75mSec.  
Maximum rate with RS422 outputs: 10MHz  
Pulse width with GP outputs: 0.75mSec to 1.75mSec.  
Maximum rate with GP outputs: 1kHz

### HSSI

One channel, RS422, Flexible assignment to both axes

### STO

Two pairs of inputs

## Analog I/O

### Analog Inputs

Four, ±10V, differential, 12 bit resolution. 20kHz sampling rate. Can be used  
as feedback to the servo loops

### Analog Outputs

Two, ±10V, differential, 10 bit resolution. Sampled at the servo sampling rate

## Controller and EtherCAT Master

Number of axes: Up to 32

MPU/EtherCAT Max. Cycle Rate: 4kHz (up to 4 axes), 2kHz (up to 16 axes),  
1kHz (up to 32 axes)

### Host Communication Ports

Ethernet: one, TCP/IP, 10/100 Mbps/sec.

Serial: One RS-232. Up to 115,200bps. Modbus protocol as master or slave  
EtherCAT ports: Two, In & Out, 100 Mbit/sec, CoE and FoE protocols

### MPU User Memory

RAM: 128Mb

Non-volatile memory (Flash): 128Mb

## Environment

Operating range: 0 to + 40°C

Storage and transportation range: -25 to +60°C

Humidity (operating range): 5% to 90% non-condensing

## Accessories

Mating Connectors Kit: PN CMhvUDMhv-ACC1

J11 mating connector +2m cable, flying leads: PN CMhvUDMhv-ACC2

Clamping Yoke: PN CMhvUDMhv-ACC3

Cover fan kit: PN HV COVER FAN ACC1

Heatsink fan kit: PN HV HEATSINK FAN ACC1

STO kit, 2 meter cable with flying leads for STO: PN STO-ACC1

STO kit, Connector Kit for STO card: PN STO-ACC2

## Ordering Options

### Example: CMhv2B24E2NA1AWNAYNNND

Field	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
PN	CMhv	2	B	2	4	E	2	N	A	1	A	W	N	A	Y	N	N	D

	Field	Example selection by user	Optional Values
Number of built-in drives	1	2	1, 2
Voltage & current rating of built-in drives (cont/peak)	2	B	(A): 230-480V, 5/10A, (B): 230-480V, 10/20A, (C): 230-480V, 15/30A, (D): 230-480V, 20/20A+5/10A, (E): 230V, 5/15A, (F): 230V, 10/30A, (G): 230V, 15/45A, (H): 230V, 20/60A
250kHz Sin-Cos encoder interface	3	2	0, 1, 2
Total number of feedback channels	4	4	2, 4
Absolute encoders type	5	E	None (N), EnDAT 2.1(digital)/2.2 (E), Smart Abs (S), Panasonic (P), Hiperface (H), Resolver (R), BiSS-C (B)
Number of Absolute encoder channels	6	2	0, 1, 2
STO	7	N	Yes (Y), No (N)
Maximum number of axes	8	A	2, 4, 8, 16(A), 32(B)
ECAT 3rd party Servo Drive	9	1	0 to 16 (0,1,2,3,...9,A,B,C,D,E,F,G)
ECAT 3rd party Step motor Drive (open & closed loop)	10	A	0 to 16 (0,1,2,3,...9,A,B,C,D,E,F,G)
ECAT 3rd party IO EtherCAT node	11	W	32 (W) FOC,64(X)
PLC (IEC-61131-3), G-Code, or both	12	N	None (N), PLC only (Y), G-code only (G), Both (B)
ServoBoost, number of axes supported	13	A	0(N), 4(A), 8(B), 12(C), 16(D), 20(E), 24(F), 28(G), 32(H)
Input shaping	14	Y	Yes (Y), No (N)
I/O configuration	15	N	(N): Inputs & limits: 24V/SOURCE (PNP), outputs: 24V/SOURCE (PNP) (S): Inputs & limits: 24V/SINK (NPN). Outputs: 24V/SOURCE (PNP) (R): Inputs & limits: 5V/SOURCE (PNP). Outputs: 24V/SOURCE (PNP) (T): Inputs & limits: 5V/SINK (NPN). Outputs: 24V/SOURCE (PNP) (U): Outputs & Inputs 24V/SOURCE (PNP), Limits 24V/SINK(NPN)
Built-in Shunt Resistor	16	N	None (N), 50Ω/300W for 230Vac (A), 150Ω/300W for 480Vac (B)
NanoPWM	17	N	No (N)
Number of ACSPL+ buffers	18	D	Default* (D), 16 (A), 32 (B)

\* Default number of ACSPL+ buffers is a function of the number of axes specified (field 8).  
Up to 8 axes - 10 buffers; 16 axes - 16 buffers; 32 axes - 32 buffers

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