

# MP4U



## 8-Axis Modular EtherCAT Master Controller and Drive Module

- > Three primary use cases:
  - > MP4Unt configuration: an EtherCAT master controller with up to 8 integrated drives
  - > MP4Unt configuration with internal EtherCAT bridge: both an EtherCAT DS402 drive subsystem under any EtherCAT master controller and an EtherCAT master controller with integrated drives
  - > MP4Udc: an EtherCAT multi-axis drive subsystem under an ACS EtherCAT master controller
- > High performance and economical type of drives
  - > **NanoPWM™** drives for nanometer level jitter and following errors
  - > PWM for less demanding axes
- > Wide range of current and voltage
  - > Current: 3.3/10A to 13.3/40A (cont/peak)
  - > Voltage: 48Vdc and 96Vdc
- > 1.6 kW and 3.2 kW power supply with AC input
  - > 96Vdc/32A
  - > 48Vdc/32A or 48Vdc/ 64A
  - > Both 96Vdc/32A and 48Vdc/32A
- > Safe Torque Off (STO) option
- > All connectors are located on the back of the enclosure
- > Built-in fans with air flow from the front to the back of the enclosure
- > ACS field proven robustness and reliability

The MP4U is an 8-axis modular EtherCAT master controller and drive module that enables the user to tailor the specific drive for each axis. Different drives can be selected for each pair of axes as well as the power supplies. Two types of drive module can be specified: The **NanoPWM™** (NPM3U) drives for the highest performance of position jitter and following error demanding axes, and the more economical PWM (UDM3U) drives for the less demanding axis. Each module (two or one axis) can be specified for 3.3/10A (cont/peak) to 13.3/40A and can be connected to either 96Vdc or 48Vdc. The power supply is made of one or two plug-in modules, each fed by a single phase AC input and generating 48Vdc/32A output. The system can be ordered with one supply module providing 48Vdc/32A or two modules, connected either in parallel and providing 48Vdc/64A, or connected in series and thus providing 96Vdc/32A as well as 48V/32A. For each of the four drive modules it can be specified by which voltage it is fed (when both 48Vdc and 96Vdc voltages are available). Each drive is available with optional motor shortening relays, absolute encoder, as well as 500kHz SIN-COS encoder interfaces. The **NanoPWM™** is also available with a 10MHz SIN-COS encoder interface for laser type encoders. STO is an option that is specified for either none or for all drives.

The basic configuration consists of a power management module, which includes a logic supply that is fed by a dedicated AC input connector, and a regeneration module.

The user can select the power supply configuration, the type of each of the four drive modules, its current and which voltage (48Vdc or 96Vdc) to feed it and a motion controller and EtherCAT master. Consult ACS for availability.



2-axis drive module



Regeneration module



Power supply module



Power management module



Motion controller module

### Dimensions

#### 19" Enclosure

Height [mm]	260 (6U)
Width [mm]	
With no ears	440
With ears	483
Depth [mm]	
Without handles	266
With handles	306

### Weight [Kg]

4-axes: 11.8  
8-axes: 13.3

### Accessories

MP4U-ACC1: 4-axes mating connectors kit  
MP4U-ACC2: 8-axes mating connectors kit

## Plug-in Modules

### Motion Controller Module

#### Supported EtherCAT Slaves (for MP4Unit configurations):

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 options.

#### Motion Processor Unit (MPU)

Processor Type: Multi-core Intel Atom CPU (model depends on controller configuration)  
RAM: 1GB  
Flash: 2GB

#### EtherCAT Ports

Communication with an External EtherCAT Master:  
EtherCAT In & EtherCAT Out, RJ45 connectors  
DS402 protocol (if built-in bridge feature is selected)  
As an EtherCAT Master:

EtherCAT In & EtherCAT Out, RJ45 connectors

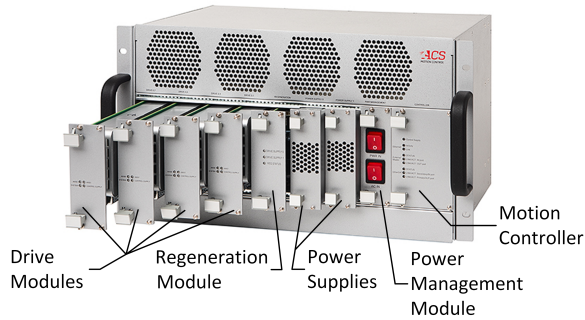
**NetworkBoost™** (optional) - Automatic network failure detection and recovery using ring topology and redundancy

#### Additional Host Communication Ports

Serial: two RS-232. Up to 115,200 bps  
Ethernet: One, 100/1000 Mbps

#### 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.



### Power Management Module

The MP4U is fed by two separate AC inputs.  
DRIVE SUPPLY to feed the selected drive supplies and CONTROL SUPPLY to feed the built-in 24V control supply.

Drive Supply

100 to 240Vac, single-phase, 50-60Hz

Control Supply

100 to 240Vac, single phase, 50-60Hz

### Power Supply Module

- > 48V/32A
- > 48V/64A
- > 96V/32A
- > Both 96Vdc/32A and 48Vdc/32A

### Regeneration Module

Regeneration control circuit with built-in regeneration 12Ω/100W resistor  
An external regeneration resistor with high power can be connected. It must be with a minimum 12Ω resistance  
The circuit is short circuit and over-temperature protected

Feature	Description			
Input voltage range [Vrms] Single-phase	100 - 240			
Input frequency, nominal [Hz]	50 - 60			
Configuration	48Vdc / 32A	48Vdc / 64A	96Vdc / 32A	48Vdc & 96Vdc
Minimum continuous/peak output voltage [Vdc]	46.14 / 45.54	46.14 / 45.54	93.18 / 92.58	46.14 / 45.54 & 93.18 / 92.58
Maximum continuous/peak output current @100Vac supply [Adc]	15.13 / 24	30.29 / 48	15.13 / 2	Total not to exceed 15.13 / 24A
Maximum continuous/peak output current @240Vac supply [Adc]	32 / 32	64 / 64	32 / 32	Total not to exceed 32 32
Maximum continuous/peak input current @100 Vac supply [Arms]	16 / 25.83			
Maximum continuous/peak input current @240 Vac supply [Arms]	13.97 / 13.97			
Efficiency [%] with 100Vac input	90 - 92			
Efficiency [%] with 240Vac input	93 - 95			
Maximum continuous/peak output power with 100Vac input [W]	1410 / 2222			
Maximum continuous/peak output power with 240Vac input [W]	2962 / 2962			
Maximum continuous/peak input power with 100Vac input [VA]	1600 / 2583			
Regeneration circuit	Regeneration control with built-in regeneration resistor, 12Ω, 100W, 1.5KW peak Protection Over temperature for the built-in regeneration resistor Regeneration resistor short circuit			

### Field Upgrades

For controllers ordered from the factory with Maximum Number of Axes equal to 32 or less and Maximum MPU Cycle Rate of 2kHz (default), the following field upgrade options are available:

Maximum Number of Axes	Maximum MPU Cycle (kHz)
2	4, 5
4	4, 5
8	4
16	4
32	2

It is not possible to field upgrade a controller ordered with 32 axes or less to 64 axes.

For controllers ordered from the factory with Maximum Number of Axes equal to 64 and Maximum MPU Cycle Rate of 1kHz (default), the following field upgrade options are available:

Maximum Number of Axes	Maximum MPU Cycle (kHz)
64	2

## Drive Module

Each plug-in drive module includes one or two identical drives. Both high performance **NanoPWM™** drives (NPM3U) as well as PWM economical (UDM3U) are available. When both 96Vdc and 48Vdc are present, then it can be specified for each plug-in module by which voltage it is fed.

Per drive	NPM3U / UDM3U drive module			
Number of axes	1 or 2			
Drive voltage input range [Vdc]	48 or 96			
Continuous / peak current Sine amplitude [A]	3.3/10	6.6/20	10/30	13.3/40
Maximum continuous / peak output power per axis @48Vdc [W]	111/317	222/633	336/950	447/1266
Maximum continuous / peak output power per axis @96Vdc [W]	229/675	459/1350	695/2025	924/2700
Maximum continuous / peak output voltage 48Vdc drive supply [Vrms]	27.47/25.85			
Maximum continuous / peak output voltage 96Vdc drive supply [Vrms]	56.74/55.12			
Peak current time [sec]	1			
Minimum load inductance at 96Vdc [μH]	50			
Per module				
Drive voltage input range [Vdc]	48 or 96			
Continuous / peak current Sine amplitude [A]	3.3/10	6.6/20	10/30	13.3/40
Maximum continuous input current per plug-in drive module (i=1 or 2 number of drives) [Arms]	i x 2.5	i x 4.9	i x 7.5	i x 10.0
Maximum heat dissipation per plug-in drive module (i=1 or 2 number of drives) [W]	7 + i x 0.9	7 + i x 2.1	7 + i x 3.7	7 + i x 5.6
Maximum heat dissipation by the drive supply per plug-in drive module (i = 1 or 2 number of drives) [W]	i x 12	i x 24	i x 37	i x 49
Maximum total output power continuous / peak with 100Vac input (all axes operating) [W]	1371/2144 @ 48Vdc drive supply 1395/2201 @ 96Vdc drive supply			
Maximum total output power continuous / peak with 240Vac input (all axes operating) [W]	2931/2931 @ 48Vdc drive supply 2931/2931 @ 96Vdc drive supply			

### Drives

Up to 4 3U plug-in drive modules can be installed in a MP4U enclosure  
Up to 8 drives with two drives per one 3U plug-in driver module  
The two motor drives on a 3U drive module must drive the same type of motor  
Type: three-phase bridge  
Switching method: Advanced unipolar PWM  
Protections: Short current, over current, over temperature, over voltage, under voltage  
Built-in motor phase shortening relays (optional): disconnects the motor phases from the drive and shortens the phases of the motor

### Digital I/O

Limit inputs  
One left and one right limit per axis  
Single-ended, 5/24V, sink/source\*  
Default: 24V, source, Opto-isolated, Input current: 4-14mA  
MARK / General Purpose Inputs  
Two per axis (one primary and one secondary)  
Two terminals, 5/24V\*, opto-isolated, Default: 24V  
Can be used as general purpose digital input  
Motor Brake / General Purpose Outputs  
One per axis, Opto-isolated, 0.1A per output  
Single-ended, 5/24V, sink/source\*, Default: 24V, source  
Protection: short circuit  
PEG (Position Event Generation) / General Purpose Outputs  
One per axis, PEG Pulse or PEG State  
Differential, RS-422  
Max. rate: RS422: 10MHz  
Programmable pulse width: 26nSec - 1.75msec  
Can be used as general purpose outputs

### STO (optional)

Two inputs, 24Vdc, 2A supply output for the external drives  
Standards (NPM3U): IEC61800-5-2:2016, EN 62061:2005, EN ISO 13849-1:2008

### Certification

CE: Pending  
Electrical Safety: Pending  
EMC: EN 61800-3  
UL Certification: UL 61800-5-1  
Functional Safety: IEC 61800-5-1, IEC 61800-5-2 (drive modules)

### 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)

### Feedback

The following feedback types are supported:  
Incremental Digital Encoder  
Two per axis (one primary and one secondary), AqB, I and Clk/Dir, I  
RS-422  
Maximum input frequency: 50 million encoder counts/ sec  
Protections: Encoder error, not connected  
Incremental Analog SIN-COS Encoder (optional)  
Two per axis (one primary and one secondary)  
1Vptp, analog differential, 16-bit resolution  
Maximum speed – NPM3U: two options: 500kHz or 10MHz  
– UDM3U: 500kHz  
Protections: Encoder error, not connected  
Squared SIN-COS output  
One per axis, RS-422  
Sharing pins with the corresponding incremental primary incremental encoder  
Absolute Encoder (optional)  
One per axis, RS-485  
Type: EnDat 2.2 & 2.1 digital only, Smart-Abs, Panasonic, Biss-A/B/C, SSI, Sanyo Denki  
ABS  
Hall inputs  
One set of three per axis, 5V, source, isolated  
Input current: <7mA

### Analog I/O

Inputs: Four per drive module, ±10V, differential, 12 bit resolution, maximum input frequency 1KHz  
Outputs: Four per drive module, ±10V, differential, 16 bit resolution

\*Contact ACS for ordering options for the different configurations.

## A Complete System Tailored to Your Exact Needs

Contact ACS to order from the options specified in the table that follows.

Component / Feature	Options
Motion Controller	Y - Yes, N - No
Number of axes	A - 2, B - 4, C - 8, D - 16, E - 32, F - 64
<b>ServoBoost™</b> , number of axis 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)	1kHz (up to 64 axes), 2kHz (up to 64 axes)*, 4kHz (up to 32 axes), 5kHz (up to 8 axes)
<b>NetworkBoost™</b> , 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
Power supply	A - 48V, 32A, B - 48V, 64A, C - 96V, 32A, D - 96V & 48V



For each drive slot 1, 2, 3, 4,  
select from all of the available feature options that follow.

Drive module	N - None, 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
Connected voltage	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, U - User selectable, 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

\*Only relevant for controllers with Max Number of Axes = 64