The MC4U line of universal digital PWM drive modules are specifically designed to provide high performance and cost effective solution for demanding multi-axis applications. The drives are optimized for low noise, providing the best possible stand still jitter and velocity smoothness and are fully programmable for easy setup and diagnostics.

The NanoPWM™ drives are the most advanced servo drives available today. It is based on the proprietary and unique NanoPWM™ technology that exceeds stand still jitter and tracking error performance that until now has been achieved only with linear drives, with reduced cost of ownership. The low power modules include up to four drives and high power modules include two drives for optimal costs and performance.

The MC4U drive modules support linear and rotary motors covering a wide power range of 100W to 19kW. Each drive can be programmed to control any type of single, two or three phase motor.
## Drive Characteristics

<table>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of axes</strong></td>
<td>2 or 4</td>
<td>1</td>
<td>1 or 2</td>
<td>1 or 2</td>
<td>1</td>
<td>1</td>
<td>2 or 4</td>
<td>2 or 4</td>
<td>2 or 4</td>
<td>2 or 4</td>
<td>1 or 2</td>
</tr>
<tr>
<td><strong>Bus Voltage, range [Vdc] ± 10%</strong></td>
<td>18-60</td>
<td>24-100</td>
<td>24-320</td>
<td>24-560</td>
<td>24-320</td>
<td>24-560</td>
<td>24-320</td>
<td>24-560</td>
<td>24-320</td>
<td>24-560</td>
<td>24-560</td>
</tr>
<tr>
<td><strong>Phase Current (Cont./Peak), sine amplitude [A]</strong></td>
<td>4/5</td>
<td>15/30</td>
<td>5/10</td>
<td>10/20</td>
<td>15/30</td>
<td>20/40</td>
<td>30/60</td>
<td>45/90</td>
<td>1/2</td>
<td>2/4</td>
<td>3/6</td>
</tr>
<tr>
<td><strong>Phase Current (Cont./Peak), RMS [A]</strong></td>
<td>2.8/3.6</td>
<td>10.6/21.2</td>
<td>3.6/7.1</td>
<td>7.1/14.2</td>
<td>10.6/21.2</td>
<td>14.2/28.3</td>
<td>21.2/42.4</td>
<td>31.8/63.6</td>
<td>0.7/1.4</td>
<td>1.4/2.8</td>
<td>2.1/4.2</td>
</tr>
<tr>
<td><strong>Peak current time [sec]</strong></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Maxi. drive output voltage (phase to phase) @ max bus voltage and nominal current, sine amplitude [V]</td>
<td>For a given Bus Motor Supply Voltage [VM-DC]</td>
<td></td>
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<tr>
<td>VM-DC x 88%</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Input power @ full output (Cont./Peak) power at specified voltage [kW]</td>
<td>0.6/1.2 @ 51Vdc</td>
<td>1.1/2.2 @ 100Vdc</td>
<td>2.8/5.6 @ 320Vdc</td>
<td>5.6/11@ 320Vdc</td>
<td>3.6/7.3 @ 320Vdc</td>
<td>8.3/13.4 @ 320Vdc</td>
<td>7.0/13.4 @ 320Vdc</td>
<td>10.2/19.1 @ 320Vdc</td>
<td>11.2/3 @ 320Vdc</td>
<td>2.2/4 @ 320Vdc</td>
<td>3.4/6.8 @ 320Vdc</td>
</tr>
<tr>
<td>Max. output power @ nominal bus voltage Cont./Peak [kW] For 1 axis</td>
<td>0.15/ 0.3</td>
<td>1.0 / 2.0</td>
<td>1.36 / 2.7</td>
<td>2.7 / 5.4</td>
<td>3.5 / 7.0</td>
<td>5.4 / 10.8</td>
<td>6.8 / 12.8</td>
<td>9.9 / 18.2</td>
<td>0.26 / 0.52</td>
<td>0.5 / 1.0</td>
<td>0.75 / 1.5</td>
</tr>
<tr>
<td>Total for 2 axes</td>
<td>0.3 / 0.6</td>
<td>–</td>
<td>2.7 / 5.4</td>
<td>5.4 / 10.8</td>
<td>–</td>
<td>8.2 / 21.8</td>
<td>–</td>
<td>–</td>
<td>0.52 / 1.0</td>
<td>1.0 / 2.1</td>
<td>1.5 / 3</td>
</tr>
<tr>
<td>Total for 4 axes</td>
<td>0.6 / 1.2</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>1.0 / 2.1</td>
<td>2.1 / 4.2</td>
<td>3.6</td>
</tr>
<tr>
<td>Min. load Inductance, at specified bus voltage [mH] At lower bus voltage the minimum inductance value can be reduced proportionally. (Consult factory for using inductance with lower values)</td>
<td>0.25 @ 51Vdc</td>
<td>0.5 @ 100Vdc</td>
<td>0.5 @ 320 Vdc</td>
<td>0.5 @ 320 Vdc</td>
<td>0.5 @ 320 Vdc</td>
<td>0.5 @ 320 Vdc</td>
<td>0.5 @ 320 Vdc</td>
<td>0.5 @ 320 Vdc</td>
<td>0.5 @ 320 Vdc</td>
<td>0.5 @ 320 Vdc</td>
<td>0.5 @ 320 Vdc</td>
</tr>
<tr>
<td>Weight [gram]</td>
<td>290</td>
<td>1,110</td>
<td>840</td>
<td>1,110</td>
<td>800</td>
<td>840</td>
<td>1,110</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Standards</td>
<td>CE, UL, RoHS</td>
<td>UL, RoHS</td>
<td>CE, UL, RoHS</td>
<td>UL, RoHS</td>
<td>CE, UL, RoHS</td>
<td>CE, UL, RoHS</td>
<td>CE, UL, RoHS</td>
<td>CE pending, UL, RoHS</td>
<td></td>
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</tbody>
</table>
**Common Characteristics**
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

**Supplies**
The drive must be supplied by two power sources
A drive supply and a control 24Vdc supply
The drive supply is generated by the MC4U PSM3U modules
During emergency conditions there is no need to remove the control 24Vdc source

**Control Supply Specification**
Control supply input voltage: 24Vdc ± 10%
Maximum input power: 11.4W
Input current: Maximum: 0.6A @ 19V; Nominal: 0.48A @ 24V

**Motor Types**
Single phase motors: DC Brush, Voice coil
2 or 3 phase AC synchronous motor
3 phase, asynchronous motor
2 and 3 phase step motor (always using microstepping control)

**Drive Protection**
- Over voltage
- Supply missing
- 24 Vdc control supply missing
- Phase-to-phase short circuit
- Short to ground
- Over current
- Over temperature protection

**Drive Faults Reported**
- Power supply under voltage
- Power supply missing
- Short circuit
- Over current
- Temperature too high

**Ambient Temperature**
Operating range: 0 to + 40°C
Storage and transportation range: -25 to +60°C
Humidity (operating range): 5% to 90% non-condensing

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**MC4U configuration example**

![MC4U configuration example diagram](image-url)
The SPiiPlusNT (NT - Network Controller) is designed for incorporation in the MC4U. Once plugged into an MC4U, the MC4U becomes also an EtherCAT master designated MC4Unt. It manages the EtherCAT network with up to 64 axes of motion and countless number of I/Os and sensor modules. The SPiiPlusNT also includes Servo Processors for controlling local drives that reside within the same MC4Unt enclosure.

Like all SPiiPlus products, the SPiiPlusNT uses the same ACSPL+ high level programming language and is supported by the same set of software tools such as the SPiiPlus MMI Application Studio and API for host application development.

The SPiiPlusDC (DC - Drive Controller) is also designed for incorporation in the MC4U. Once plugged into an MC4U, the MC4U becomes an EtherCAT slave designated MC4Udc. The MC4Udc is a drive module with up to 8 drives.

The SPiiPlusNT Master generates the motion trajectories for all the axes, transmitting the data over the EtherCAT network, and the SPiiPlusDC executes the real-time control of the drives and axes.

NetworkBoost™ (optional) - Network failure detection and recovery with ring topology.

The following versions are available:

1. **SPiiPlusNT-HP** - High Performance EtherCAT master, with 4 or 8 built in drives for applications with up to 64 network axes

2. **SPiiPlusNT-LT** - Economical EtherCAT master controller, with 4 or 8 built in drives for applications with up to 64 network axes

3. **SPiiPlusNT-LD** - High Performance EtherCAT master Linear Drive controllers, with 4 or 8 built in drives for applications with up to 64 network axes

4. **SPiiPlusDC-HP** - High Performance EtherCAT slave Drive Controllers, 4 and 8 axis versions

5. **SPiiPlusDC-LT** - Economical EtherCAT slave Drive Controllers, 4 and 8 axis versions

6. **SPiiPlusDC-LD** - High Performance EtherCAT slave Linear Drive controllers, 4 and 8 axis versions

**CE, UL**

*EtherCAT® is registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany*
Profile Generation
Motion Profile generation rate: 1.2,4 or 5kHz
(seen HW guide for details)

Servo
A standard comprehensive set of powerful algorithms to enhance accuracy, move & settle time, smooth velocity, stability and robustness:
- Advanced PV cascaded structure
- Loop shaping filters
- Gain Scheduling
- Gantry MIMO control
- Dual feedback / loop control
- Disturbance rejection control
Optional (HP version only) ServoBoost® algorithm that provides better, more consistent servo performance, insensitive to noise and large changes in the system.

Feedback
Feedback types: incremental digital encoders, Sin-Cos encoders (optional), Absolute encoders (optional) analog inputs and 3 digital hall inputs for initiating commutation.

Incremental Digital Encoder:
Type: RS-422
Max. rate: 40 million encoder counts/sec.

Sin-Cos Encoder (optional):
SPIiPlusNT-HP/LD and SPIiPlusDC-HP/LD:
Multiplication factor: From x4 to x65,536
Rate: Up to 500*10³ or (LD version) 4*10⁶ sine periods/sec
Note: Consult factory for higher rate options

Sin-Cos offset, gain, phase compensation:
Note: Consult factory for higher rate options

Absolute Encoder (optional):
Input circuit current: <7mA.
Single-ended, 5V, source, opto-isolated

Rate: Up to 500*10³ or (LD version) 4*10⁶ sine periods/sec

Multiplication factor: From x4 to x65,536

Sin-Cos Encoder
Max. rate: 40 million encoder counts/sec.

Type: RS-422

Digital Outputs:
General purpose outputs:
Quantity: eight. Type: single-ended, 5V or 24V, sink (default) or source, opto-isolated.
Input current: 4-14mA

MARK (position capture) inputs:
Quantity: Up to four. Refer to SPIiPlusNT user manual for detailed information.
Type: RS-422
Propagation delay: <0.1usec

Note: additional four MARK inputs (MARK2), single-ended and opto-isolated, are available through general purpose digital inputs IN4, IN5, IN6 and IN7

Digital Outputs:
General purpose outputs:
Quantity: eight. Type: single-ended, 5V or 24V, sink (default) or source, opto-isolated,
100mA per output

Mechanical Brake Outputs:
Quantity: one per axis. Type: single-ended, 5V or 24V, sink (default) or source, opto-isolated, 7mA per output.
By default, configured as dynamic brake.

Note: general purpose digital outputs can be configured as Mechanical Brake Outputs

PEG (Position Event Generator) pulse outputs:
For details, refer to "SPIiPlusNT PEG and MARK Operations" Application Note.
Quantity: six. Type: RS-422
Propagation delay: <0.1usec
PEG pulse width: 25nsec to 1.7msec.
PEG position accuracy: ±1 count at speeds up to 18x10³ counts/sec.
The controllers are CE (EMC), UL certified

For the latest updates visit our website at www.acsmotioncontrol.com
Linear Drives - LDM3U

• Optimal solution for demanding position jitter, high accuracy, smooth velocity and low noise
• Up to 55V, 25A peak
• Digital control for easy setup and diagnostics
• Space Vector technology for higher motor voltage
• Built in dynamic brake relays
• Applications: Semiconductor inspection positioning stages, noise sensitive systems, low inductance motors

The MC4U line of digitally controlled universal linear drives is specifically designed for applications with demanding needs for position jitter, velocity smoothness and low electrical noise.

The LDMs (Linear Drive Module) fit into MC4U mount, up to 4 drives in 19" rack and 5 drives in 22" rack.

The line covers a wide range of power with 28V to 55V and 8A to 25A peak current.

The linear drive is ideal for noise-sensitive environments where PWM switching cannot be tolerated and EMI has to be completely eliminated.

The S version uses Space Vector technology (SVT) providing additional 15% output voltage when compared to the D version (occupies 2 axes).

The drive can be programmed to control any type of single or three phase motor. With full digital control, no need for potentiometers adjustment or capacitors.
Common Characteristics

Digital current control
Current loop sampling rate: 20 kHz
Programmable Current Loop bandwidth: Adjustable up to 5 kHz
Sinusoidal commutation: Initialization with and without Hall sensors.
Space Vector technology for additional 15% output voltage (S type only)
Dynamic brake information
Mating motherboard (when used standalone)

Motor Types

Single phase motors: DC Brush, Voice coil
3 phase AC synchronous motor (AC Servo, DC Brushless)
Upon request: 2 phase motors and steppers (S models only)

Drive Protection

- Over voltage
- Supply missing
- Phase-to-phase short circuit
- Short to ground
- Over current
- Over temperature

Drive faults reported

- Power supply too high
- Power supply missing
- Short circuit
- Over current
- Over temperature

Standards

CE (EMC, Safety) certified
RoHS compliant

Environment Specification

Operating range: 0 to +40°C
Storage and transportation range: -25 to +60°C
Humidity (operating range): 5% to 90% non-condensing

Drive Characteristics

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<tbody>
<tr>
<td>Control &amp; Logic supply (Vi) [Vdc]</td>
<td>Received from motor supply</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motor supply* (Vm) min. / max. [Vdc]</td>
<td>24-32</td>
<td>24-32</td>
<td>45-60</td>
<td>45-55</td>
<td>45-55</td>
<td>45-55</td>
</tr>
<tr>
<td>Phase current cont./peak RMS [A]</td>
<td>2.83 / 5.66</td>
<td>2.83 / 11.31</td>
<td>2.83 / 5.66</td>
<td>2.83 / 11.31</td>
<td>2.83 / 11.31</td>
<td>4.42 / 17.68</td>
</tr>
<tr>
<td>Peak current time [sec]</td>
<td>2</td>
<td>1.5</td>
<td>2</td>
<td>1.5</td>
<td>1.5</td>
<td>1</td>
</tr>
<tr>
<td>Max. drive output voltage [Vpeak]</td>
<td>22</td>
<td>22</td>
<td>43</td>
<td>43</td>
<td>49</td>
<td>49</td>
</tr>
<tr>
<td>Input power @ max. Vm &amp; cont. / peak current [W]</td>
<td>136 / 272</td>
<td>136 / 543</td>
<td>257 / 513</td>
<td>233 / 933</td>
<td>233 / 933</td>
<td>365 / 1458</td>
</tr>
<tr>
<td>Max. output power at maximum Vm &amp; cont. / peak current [W]</td>
<td>81 / 162</td>
<td>81 / 324</td>
<td>166 / 333</td>
<td>150 / 600</td>
<td>173 / 693</td>
<td>271 / 1083</td>
</tr>
<tr>
<td>Min. load Inductance [mH]</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Min. load resistance per phase [Ω]</td>
<td>0</td>
<td>0.075</td>
<td>0.45</td>
<td>0.73</td>
<td>0.73</td>
<td>0.78</td>
</tr>
<tr>
<td>Max. heat dissipation, cont / peak [W]</td>
<td>130 / 248</td>
<td>130 / 447</td>
<td>238 / 442</td>
<td>212 / 588</td>
<td>212 / 588</td>
<td>312 / 615</td>
</tr>
<tr>
<td>Dimensions: Height, Width, Length (mm)</td>
<td>128 X 46 X 246</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Weight [gr.]</td>
<td>830</td>
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</tbody>
</table>

* Motor supply is provided in the MC4U enclosure by PSM3U drive supply module

For the latest updates visit our website at www.acsmotioncontrol.com