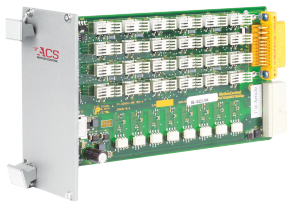


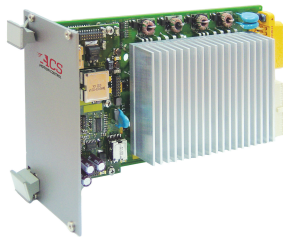
MC4U

PWM Drives



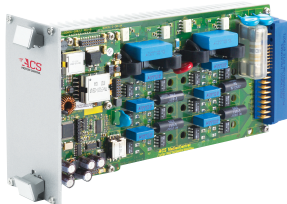
DDM3U-4-60V

Up to 4 Universal Drives per Card, 60V, 5A peak, 0.3kW



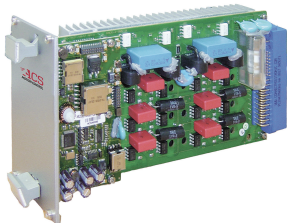
DDM3U-4-320V-1A
DDM3U-4-320V-2A
DDM3U-4-320V-3A

Up to 4 Universal Drives per Card, 320V, up to 6A peak, 0.75kW



DDM3U-2-320V-5A
DDM3U-2-320V-10A
DDM3U-2-320V-20A
DDM3U-1-320V-30A-SR
DDM3U-1-320V-45A-SR

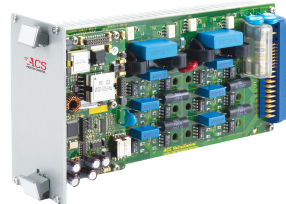
2 / 1 Universal Drives per Card, 320V, up to 90A peak, 19.1kW



DDM3U-2-560V-5A
DDM3U-2-560V-10A
DDM3U-2-560V-15A

2 Universal Drives per Card, 560V, up to 30A peak, 6kW

NanoPWM™ Drives



DDM3U-1-100V-15A-NP
DDM3U-1-320V-15A-NP

One Axis **NanoPWM™** universal Drive per Card, 100V and 320V, 30A peak, 8.2kW

- Low noise for the best position jitter and velocity smoothness
- Optimal solution for large Gantry tables
- Wide power range - 100W to 6kW
- Digital control for easy setup and diagnostics - 100W to 19kW
- Wide range of motors, such as- AC Servo (DC brushless), DC Brush, AC Induction
- Open and closed loop step motor control with high resolution micro-steps
- **NanoPWM™** Drive - Sub-nanometer standstill jitter, nanometer tracking error and optimal velocity smoothness

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.

CE, UL

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ACS
MOTION CONTROL

Drive Characteristics

Part Number Where X represents number of axes	DDM3U-X- 60V-4A	DDM3U-1- 100V-15A- NP	DDM3U-X- 320V-5A	DDM3U-X- 320V-10A	DDM3U-1- 320V-15A- NP	DDM3U-X- 320V-20A	DDM3U-1- 320V-30A	DDM3U-1- 320V-45A	DDM3U-X- 320V-1A	DDM3U-X- 320V-2A	DDM3U-X- 320V-3A	DDM3U-X- 320V-5A	DDM3U-X- 560V-10A	DDM3U-X- 560V-15A
Number of axes	2 or 4	1	1 or 2	1 or 2	1	1 or 2	1	1	2 or 4	2 or 4	2 or 4	1 or 2	1 or 2	1 or 2
Bus Voltage, range [Vdc] $\pm 10\%$	18-60	24-100	24-320									24-560		
Phase Current (Cont./ Peak), sine amplitude [A]	4/5	15/30	5/10	10/20	15/30	20/40	30/60	45/90	1/2	2/4	3/6	5/10	10/20	15/30
Phase Current (Cont./ Peak), RMS [A]	2.8/3.6	10.6/21.2	3.6/7.1	7.1/14.2	10.6/21.2	14.2/28.3	21.2/42.4	31.8/63.6	0.7/1.4	1.4/2.8	2.1/4.2	3.6/7.1	7.1/14.2	10.6/21.3
Peak current time [sec]	1													
Maxi. drive output voltage (phase to phase) @ max bus voltage and nominal current, sine amplitude [V] For a given Bus Motor Supply Voltage [VM-DC]	VM-DC x 88%													
Input power @ full output (Cont./ Peak) power at specified voltage [kW]	0.6/1.2 @ 51Vdc	1.1/2.2 @ 100Vdc	2.8/5.6 @ 320Vdc	5.6/11.1 @ 320Vdc	3.6/7.3 @ 320Vdc	8.3/11.1 @ 320Vdc	7.0/13.4 @ 320Vdc	10.2/19.1 @ 320Vdc	1.1/2.3 @ 320Vdc	2.2/4.4 @ 320Vdc	3.4/6.8 @ 320Vdc	4.1/8.0 @ 560Vdc	8.0/15.2 @ 560Vdc	11.7/21.8 @ 560Vdc
Max. output power @ nominal bus voltage	@ 51Vdc	@ 100Vdc	@ 320Vdc	@ 320Vdc	@ 320Vdc	@ 320Vdc	@ 320Vdc	@ 320Vdc	@ 320Vdc	@ 320Vdc	@ 320Vdc	@ 560Vdc	@ 560Vdc	@ 560Vdc
Cont./ Peak [kW] For 1 axis	0.15 / 0.3	1.0 / 2.0	1.36 / 2.7	2.7 / 5.4	3.5 / 7.0	5.4 / 10.8	6.8 / 12.8	9.9 / 18.2	0.26 / 0.52	0.5/1.0	0.75 / 1.5	2.0 / 4.0	4.0 / 7.9	5.9 / 11.7
Total for 2 axes	0.3 / 0.6	–	2.7 / 5.4	5.4 / 10.8	–	8.2 / 21.8	–	–	0.52 / 1.0	1.0 / 2.1	1.5 / 3	4.0 / 7.9	7.9 / 15.2	11.7 / 21.8
Total for 4 axes	0.6 / 1.2	–	–	–	–	–	–	–	1.0 / 2.1	2.1/4.2	3 / 6	–	–	–
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)	0.25 @ 51Vdc	0.5 @ 100Vdc	0.5 @ 320 Vdc									1 @ 560 Vdc		
Heat dissipation at full cont. power [W]	25	73	68	105	116	160	235	346	25	45	62	75	120	200
Weight [gram]	290	1,110	840		1,110					800			840	1,110
Standards	CE, UL, RoHS	UL, RoHS	CE, UL, RoHS		UL, RoHS	CE, UL, RoHS				CE pending, UL, RoHS				

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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 $\pm$ 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

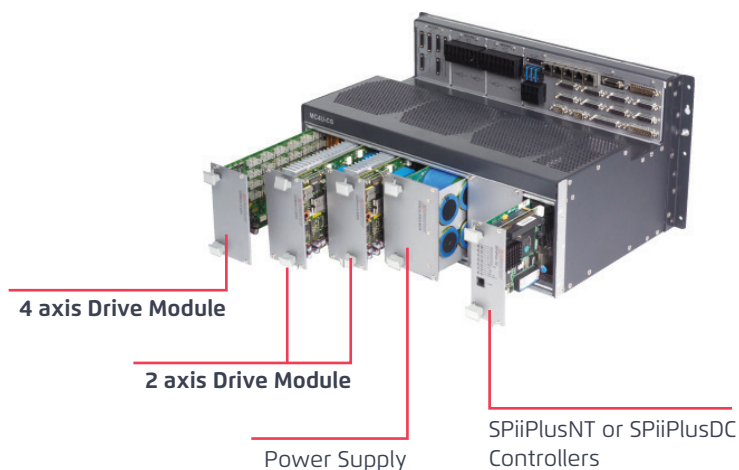
Drive Faults Reported

- 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

MC4U configuration example



MC4U

EtherCAT® Master and Drive Controllers



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

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Profile Generation

Motion Profile generation rate: 1,2,4 or 5kHz (see HW guide for details)

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

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:

One per axis, A&B,I; UP/DN,I; CLK/DIR,I.

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 500×10^3 or (LD version) 4×10^6 sine periods/sec

Note: Consult factory for higher rate options

Sin-Cos offset, gain, phase compensation: programmable with automatic calibration.

Offset is hardware compensated, +/-50% of signal range.

Maximum acceleration: 4×10^8 sine periods/sec²

SPiiPlusNT-LT and SPiiPlusDC-LT:

Multiplication factor: From $x4$ to $x4,096$

Sin-Cos offset gain, phase compensation: programmable with automatic calibration.

Rate: 250×10^3 sine periods/sec

Maximum acceleration: 4×10^8 sine periods/sec²

Hall inputs:

Quantity: A set of three per axis.

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

Input circuit current: <7mA.

Absolute Encoder (optional):

EnDat 2.1/2.2 (Digital only), Smart-ABS,

Panasonic, Biss-C, SSI, Hiperface, Sanyo Denki.

Drive Interface

Analog commands (SPiiPlusNT/DC-LD only):

Two per axis

Type: $\pm 10V$, differential, 16 bit resolution.

Offset compensation: programmable, 0.3mV resolution.

PWM Drive Commands: 3 phases per axis.

Control algorithm: digital PI filters with field oriented control and space vector modulation.

PWM frequency: 40kHz on the motor.

Current loop sampling rate: 20kHz

Current feedback resolution:

SPiiPlusNT/DC-HP: 16 bit

SPiiPlusNT/DC-LT: 12 bit

SPiiPlusNT/DC-LD: 16 bit

Digital I/O

Note: It is recommended to use a dedicated supply for digital I/O. See Power Supplies section.

Safety Inputs:

Emergency stop input:

Type: two-terminal, sink or source, opto-isolated.

Left and right limit inputs:

One pair per axis

Type: single-ended, sink (default) or source, configurable by jumper, opto-isolated.

Supply: 5V or 24V

Input current: 4-14mA

Digital Inputs:

General purpose inputs:

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: <0.1 μ sec

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, optoisolated, 100mA per output

Mechanical Brake Outputs:

Quantity: one per axis. Type: single-ended, 5V, source only, 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: <0.1 μ sec.

PEG pulse width: 25nsec to 1.7msec.

PEG position accuracy: ± 1 count at speeds up to 18×10^6 counts/sec.

Refer to SPiiPlusNT user manual for detailed information.

PEG state outputs: Quantity: Up to six.

- Time base peg support

- Improved incremental PEG support

- Fast random PEG loading support

Type: RS-422. Propagation delay: <0.1 μ sec

Refer to SPiiPlusNT user manual for detailed information.

HSSI Expansion Channels: Up to three.

Each channel provides 64 input bits and

64 output bits per channel, sampled and

updated every 50 μ s

Type: RS-422

Analog I/O

Analog Inputs:

Unused Sin-Cos encoder inputs can be used as general purpose analog inputs.

Quantity: up to 16

Type: 1Vptp, differential

Resolution and SNR:

SPiiPlusNT/DC-HP/LD: 16 bit, SNR>72db

SPiiPlusNT/DC-LT: 12 bit, SNR>52db

General purpose:

SPiiPlusNT-HP/LD and SPiiPlusDC-HP/LD:

Quantity: Four dedicated general purpose inputs.

Type: $\pm 10V$, differential

Resolution: 16 bits

SPiiPlusNT-LT and SPiiPlusDC-LT:

Quantity: up to four when axes number 3 and/ or 7 Sin-Cos encoders are not used.

These inputs can be used for general purpose. Type: $\pm 10V$, differential.

Resolution: 12 bits

Analog Outputs:

General purpose:

Quantity: 2, 4

Type: $\pm 10V$, PWM filtered

Resolution: 10bit

Communication Channels

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

Ethernet: one, TCP/IP, 10/100 Mbits/sec

Simultaneous communication through all channels is fully supported. Modbus protocol as master or slave is supported via all channels

EtherCAT: SPiiPlusNT: one or two master ports, SPiiPlusDC: one input, one output, 100 Mbit/sec, supporting CoE and FoE protocols

MPU

Processor: Intel® Atom™ N2600 1.6 GHz

Memory: RAM-1GB, Flash NV memory-512MB

Powerup Time: 25-100 sec. according to system and network configuration

Power Supplies

Power Supply Voltage/Current: +5Vdc

($\pm 10\%$)/2.7A, -5Vdc ($\pm 10\%$)/0.1A, $\pm 12Vdc$

($\pm 5\%$)/0.6A. Supplied internally from the power supply module enclosed in the MC4U

configuration I/O Supply Voltage/Current:

+5Vdc ($\pm 10\%$)/1A, or 24Vdc ($\pm 10\%$)/1A

Safety Supply Voltage/Current: +5Vdc

($\pm 10\%$)/1A, or 24Vdc ($\pm 10\%$)/1A.

Six LEDs on the front panel indicate the status of all above power supplies.

Standards & Environment

Operating Temperature: 0°C to 55°C

Storage Temperature: - 40°C to 70°C

Humidity: 90%RH, non-condensing

The controllers are CE (EMC), UL certified

and RoHS compliant

MC4U



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.

CE

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ACS
MOTION CONTROL

Drive Characteristics

Part Number	LDM3U-28V-8A-D	LDM3U-28V-16A-D	LDM3U-55V-8A-D	LDM3U-55V-16A-D	LDM3U-55V-16A-S	LDM3U-55V-25A-S
Control & Logic supply (V _I) [Vdc]	Received from motor supply					
Motor supply* (V _m) min. / max. [Vdc]	24-32	24-32	45-60	45-55	45-55	45-55
Motor phase current cont./peak sine amplitude [A]	4 / 8	4 / 16	4 / 8	4 / 16	4 / 16	6.25 / 25
Phase current cont./peak RMS [A]	2.83 / 5.66	2.83 / 11.31	2.83 / 5.66	2.83 / 11.31	2.83 / 11.31	4.42 / 17.68
Peak current time [sec]	2	1.5	2	1.5	1.5	1
Max. drive output voltage [V _{peak}]	22	22	43	43	49	49
Input power @ max. V _m & cont. / peak current [W]	136 / 272	136 / 543	257 / 513	233 / 933	233 / 933	365 / 1458
Max. output power at maximum V _m & cont. / peak current [W]	81 / 162	81 / 324	166 / 333	150 / 600	173 / 693	271 / 1083
Min. load Inductance [mH]	0	0	0	0	0	0
Min. load resistance per phase [Ω]	0	0.075	0.45	0.73	0.73	0.78
Max. heat dissipation, cont / peak [W]	130 / 248	130 / 447	238 / 442	212 / 588	212 / 588	312 / 615
Dimensions: Height, Width, Length [mm]	128 X 46 X 246					
Weight [gr.]	830					

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

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

Ordering Options

Ordering options	Field	Example	Values
Bus Voltage [Vdc]	1	55V	[28V] - 28Vdc, [55V] - 55Vdc
Peak current: [A]	2	8A	[8A] - 8 Amps, [16A] - 16 Amps, [25A] - 25 Amps
Current loop control	3	D	[D] - Digital current loop, [S] - Space Vector technology

Example: LDM3U-55V-8A-D

Field		1	2	3
PN	LDM3U	55V	8A	D