

Multi-Axis Controller MACS5-AMP1

The complete solution for positioning up to 6 axes

Everything included: Control unit, amplifiers, bus interfaces

The **MACS5-AMP1** is designed as a highly integrated multi-axis control unit for easy and economical positioning of motor-driven actuators, robot axes, and all types of motor-controlled work piece and tool handling.

The MACS5-AMP1 combines a modern motion control unit with encoder inputs, digital and analog I/Os, and servo amplifiers (max. 48 V, each 2 A continuous and 10A peak current) in a compact housing. Each MACS5-AMP1 can control up to six brush-type or four brushless motors using incremental or absolute encoders, glass scales, or analog potentiometers as position feedback devices.

Bus interfaces like EtherCAT, CAN, Ethernet, USB, and RS232 enable an open and efficient data exchange with PCs and PLCs. The MACS5-AMP1 can be integrated in PLC networks as a DS402 multi axis slave.

An easy but very efficient programming language combined with powerful motion control commands is the key for stand-alone control of simple machines and devices (without the need of a PC or PLC at all).

Application Range

- ◆ Automation of adjustable mechanical stops in all types of machines.
- ◆ Work piece and tool positioning, e.g. in a revolving transfer machine.
- ◆ Coordination and accurate control and movement of axes in small robots and handling devices.
- ◆ Standalone control of devices and simple machines.
- ◆ Speed and flow control of small pump systems.



zub Standards

- ◆ **Control functions:** Interrupts reacting on inputs, position data, bus bits, timer, etc.; arithmetic and bit handling; conditional branches and loops.
- ◆ **Closed loop control:** Position and speed control, current control and current limitation.
- ◆ **Positioning functions:** Absolute and relative positioning, configurable homing, configurable speed profiles.
- ◆ **Synchronization Functions:** Velocity synchronization, position / angle synchronization, Synchronization including correction depending on slave / master marker.
- ◆ **Free programmability** by the extensive automation software APOSS®-win and license free Motion Control Library.
- ◆ **Interactive graphic editors** like CAM-, Array- and Path-Editor.
- ◆ **Debugging & Optimization:** Smart-Oscilloscope and integrated graphic CAM-Editor.
- ◆ **State-Machine Support:** APOSS® supports the automatic execution of hierarchic State Machines.

Bus Functions

CANopen master slave functionality, EtherCAT® slave, and optional EtherCAT® master functionality.

Prospects / Advantages

- ◆ Compact multi-axis solution with integrated power amplifiers.
- ◆ Configurable for brush-type and brushless motors from 1W – 100 W continuous power and up to 500 W peak power.
- ◆ MACS5-AMP1 can serve as a stand-alone control unit.
- ◆ MACS5-AMP1 can be integrated into CANopen and EtherCAT networks as a fully featured DS402 multi axis slave device.
- ◆ No hidden additional costs: All motion control features, servo amplifiers, encoder inputs, bus interfaces, and development tools are inclusive.

Electrical Data

Control Unit: Supply voltage / Current	24 V DC \pm 25 %	200 mA	without I/O load
Each group of three integrated servo amplifiers has its own supply circuit with a fuse:			
Amplifier 1-3: Supply voltage / Fuse	12 – 50 V DC	20A (plug-in fuse)	Fuse can be adapted to motor power
Amplifier 4-6: Supply voltage / Fuse	12 – 50 V DC	20A (plug-in fuse)	Fuse can be adapted to motor power

CPU & Memory

Microprocessor	DSP TI C28346	300 MHz	
Workspace and program memory	1 Mbyte SRAM	4 Mbyte Flash	Application & data

Closed loop Controls

Number of drives and control type	6	Position, Speed, Current	Closed loop control
Position control	1 kHz	1 ms cycle time	PID control plus feed forward
Speed control	1 kHz	1 ms cycle time	PI control
Current / torque control	8 kHz	125 μ s cycle time	PI control plus current limitation

Internal Servo Amplifiers

Quantity and type of motors	6 x brush-type or 4 x brushless or 3 steppers or mixed operation		
Amplifier type / chopping frequency	4Q-PWM / 24 kHz		
Max. output current (configurable)	2 A continuous current / 10 A peak current (max. 5 seconds) per servo amplifier		

Motion Control Features

Free programmable velocity, position, synchronization and process control.
 Highly accurate position control by single or duplex evaluation of encoders mounted on the motor shaft and moved load.
 Optional "DS402 Multi-Axis Drive" functionality for the integration of a MACS5-AMP1 as a CANopen or EtherCAT slave of a PLC.

Encoder Inputs and Outputs

All encoder inputs configurable as feedback signal inputs of the motor control or as master signal inputs for drive synchronization.

Encoder 1 ... 3 (inputs only)	Incremental encoder	SinCos 1Vpp, max. 150kHz	Resolution: 1 Sinus = 256 qc max. 400 kHz at 25% resolution
		5 V, max. 5 MHz	
Encoder 4 ... 6 (inputs or outputs)	as above	SSI max.32Bit, 39kHz-5MHz	SSI passive or active
Output supply voltage	5 V DC, max. 200 mA each encoder, max. 1A total		
Other feedback devices	CANopen encoders (max. 1 Mbaud), analog feedback devices (e.g. linear potentiometer)		

Digital Inputs & Outputs

Digital inputs 1- 8 can be configured as marker input signal for real-time encoder position latching.

Digital inputs	16	Low: < 4,6 V / High: > 18 V	max. 45 V, max. 200 kHz
Digital outputs	8	24 V, 100 mA, 300 kHz	

Analog Inputs & Outputs

Analog standard inputs	6	0-10 V, 12 Bit, max. 5 kHz	Not available, if analog option in use
Alternatively it is possible to mount internally one of two analog option modules (replacing the standard analog inputs using X9).			
Analog option 1 (...-IO1-...)	1 analog input	\pm 10 V, 12 Bit, max. 5 kHz	\pm 10 V reference voltage, (max. 20 mA)
	3 analog outputs	\pm 10 V, 12 Bit, 20 mA, 10 kHz	
Analog option 2 (...-IO2-...)	6 analog inputs	0-10 V, 13 Bit, max. 5 kHz	\pm 10 V reference voltage (nominal 7 mA, max. 35 mA)

Interfaces

USB			Data exchange & visualization
Ethernet	Ethernet TCP/IP	max. 100 Mbaud	Data exchange & visualization
RS232	Special protocols on request		RS485 on request
CAN-Bus 1 (e.g. CANopen slave)	ISO/DIS 11898	max. 1 Mbaud (bus termination on/off switch)	2 separate CAN interfaces each with CANopen master / slave functionality
CAN-Bus 2 (e.g. CANopen master)			
EtherCAT® Slave	HW option ...-IF1-...	max. 100 Mbaud	Optional internal module required
EtherCAT® Master	SW option instead of Ethernet	max. 100 Mbaud	Just for control of external power stages and I/Os
Additional bus systems	On request from 500 pcs. onwards: Profibus, Profinet, POWERLINK, Modbus, Sercos		

LEDs

Control unit: Inp.: 16 / Outp.: 8 / Status: 3 / USB: 2 / EtherCAT: 3 Power stage: Power: 1, Fuse 1: 1, Fuse 2: 1

Mechanical Data

Type of housing and mounting	Alurail compact housing with top hat rail mounting		
Size (H x W x D) / Weight	55 x 195 x 108 mm / 1.1 kg; Total height depends of connectors in use		
Connector types	Tension spring clamps with grid 3.5 (control unit) and grid 3.5 (power stages)		
OEM versions with customized housings or connector types on request!			

Temperature Range

Operation / Storage	0...+40° C / -20...+85° C	20...80 % humidity	non-condensing
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Typical Product Versions

Part number / product name	001434: MACS5-AMP1	001435: MACS5-AMP1-IF1	
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member of maxon motor group

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