Motion Controller

MXC Series Multi-Axis Motion Controller

Compact Motion Controller with up to 6 Axes of Control

Allied Motion's MXC motion controller is a very compact, multi-axis servo and/or step motor motion controller, capable of coordinating the motions of up to 6 axes.

The MXC is a modular, stand-alone unit consisting of a power base and chassis that includes a master control module and up to 6 axis drive modules. Axis drive modules are available in 5 A and 15 A continuous output current versions and with a bus voltage range of from 12 up to 80 VDC to accommodate a broad range of motors.

A combination of both 5 A and 15 A axis drive modules can be mixed in MXC chassis to suit application needs.

Special function or I/O expansion cards can be substituted for one or more of the axis drive cards. Allied Motion can work with you to define and develop these auxiliary cards to suit your specific application requirements.

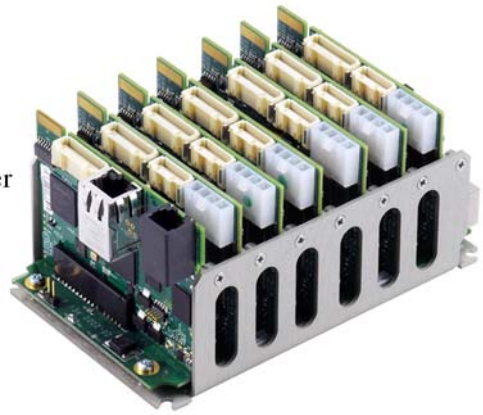
The master control card handles all higher level motion control operations and feeds command information to the axis drive cards. It also handles all communication with a host controller or PC, if present.

The master control in the MXC and the individual axis drives are interconnected via a local high speed, deterministic IEEE 802.3-based bus. This bus is dedicated exclusively to communication between the master and the axis cards. This local bus achieves very precise cycle times of 250 micro seconds with low jitter.

The master control is equipped with an Ethernet port, enabling high speed communication with a system controller or host PC.

The MXC is also able to run in stand-alone mode without the need for a host connection. The multi-tasking, pre-emptive, run-time environment is capable of running several program blocks (called POBs) simultaneously. POBs can be downloaded and executed on-the-fly, or recalled and run from non-volatile storage at power-up. The run-time environment also features an extensive, programmable event-driven mechanism for starting and stopping program blocks based upon such factors as a change of I/O state or a reaction to a fieldbus message.

Allied Motion provides *IN Control* software with the MXC. *IN Control* is a Windows-based development and control software application for use with the MXC and other Allied Motion drive and controller products. *IN Control* enables you to easily set-up and configure the MXC. It provides a four-channel oscilloscope tool that provides data logging of system registers in real time. It also provides the required tools for system setup, analysis, diagnostics, I/O and event/response configuration.



- Compact, modular multi-axis motion controller capable of controlling up to 6 servo axes
- Each drive module can deliver up to 1000 W of continuous power
- *IN Control* software makes it easy to set-up, configure and program the MXC motion controller

Issued: September 24, 2015

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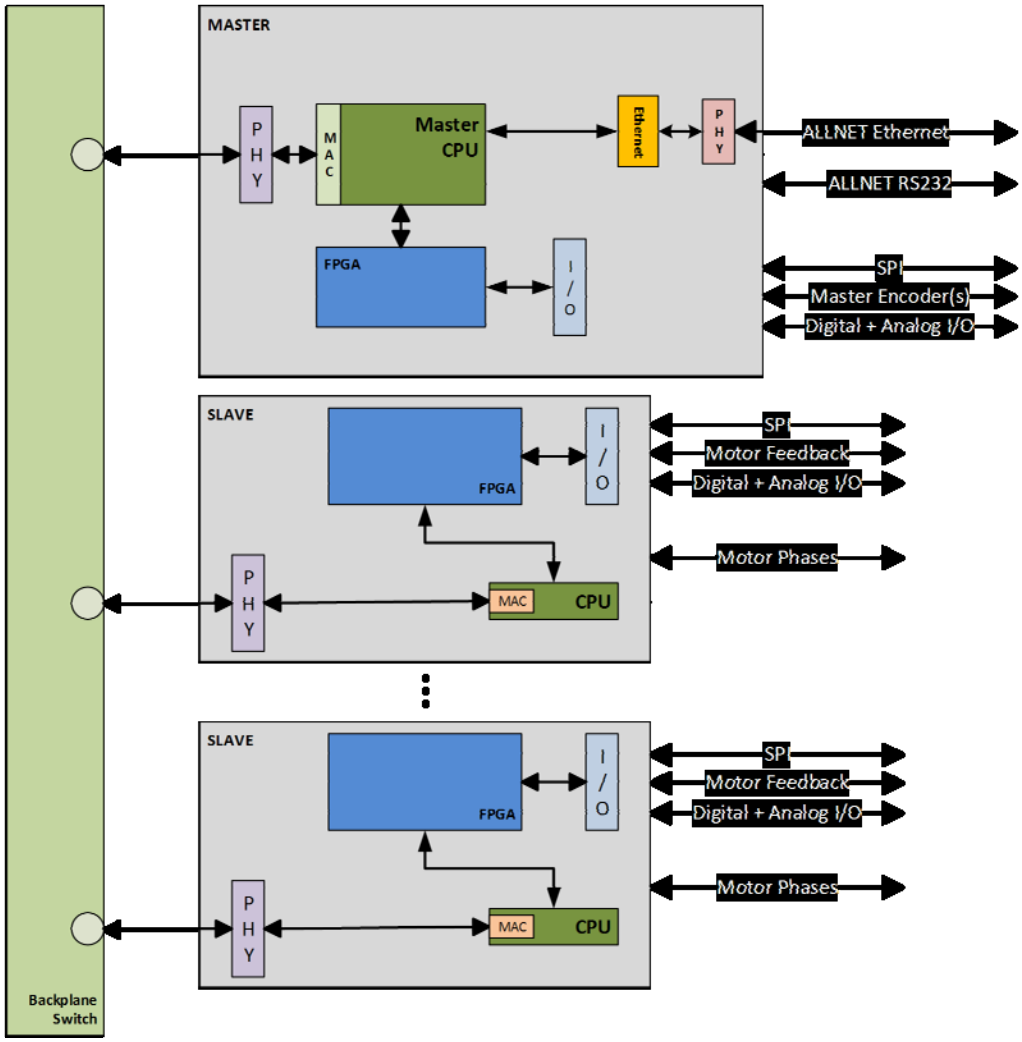
MXC Series Modular Motion Controller

ARCHITECTURE



Key Features

Control Modes: Position (torque and velocity modes available during commissioning)

Motor Types Accommodated: Brushless, brush, stepper

Auto Run: Execute stored programs from flash

***IN Control* Software**: Set-up and programming software that includes digital oscilloscope and frequency analysis tools

Axis Drive Current: 5 A or 15 A peak

Axis Drive Voltage: 12 to 80 VDC

Digital I/O Master and Axis Cards:

- 6 isolated inputs
- Up to 4 high speed differential pairs configurable as inputs or outputs
- 2 isolated outputs
- 1 non-isolated output (open-collector)

Analog I/O:

- 2 differential inputs, ±10V, 10 bits (Master), 12 bits (Axis)
- 1 analog output, 0 - 5 V, 12 bits (Axis)

Power Inputs: Main DC power input and separate auxiliary “keep alive” input

Encoders Accommodated: Single-ended, differential, incremental analog (interpolation to 16,384 times), EnDat 2.2 (up to 3), BISS-C (up to 3)

Size: Very compact 5.3¨ x 3.4¨ x 2.5¨ (134.6 mm x 86.36 mm x 63.5 mm)

System Communication: Ethernet (100 Mbs) to host or PC, plus RS232

SPI Interface: Enables connection of peripheral devices such as cameras

Operating Temperature: Wide temperature operating range of -20 to +40 °C

Compliance: RoHS

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SPECIFICATIONS

Architecture	DC powered, modular multi-axis motion controller with master module, slave drive modules, optional expanded I/O module
DC Power Input	12 to 80 VDC at up to 40 A continuous total per controller system rack
Keep-Alive Power Input	12 to 80 VDC to maintain logic power during main power shut off
Axis Drives	From 1 to 6 axis drive modules per system base
Axis Current	Up to 15 A continuous, 15 A peak (rack limit of 40 A continuous must be observed)
Axis Control Types	Position, velocity, torque (current) control, 20 kHz torque loop update rate, 4 kHz veloicity and position loop update rates; PID + feed-forward, user-configurable digital filters (e.g., notch, low pass), set-point streaming
Memory	Flash memory for user programs, parameters, miscellaneous storage
Motor Compatibility	Brushless servomotors (linear or rotary), sinusoidal or trapezoidal commutation; step motors
Position Feedback	Encoder: 30 MHz digital, 1 MHz sin-cos, sin-cos interpolation up to 16,384-times
Position Modes	Absolute, incremental
Motion Types	Point-to-point, target position with velocity/acceleration/jerk limits
Acceleration Profiles	Third order position, velocity/acceleration/jerk limiting, independent acceleration and deceleration, blended motion
Acceleration Ramp	Rate, time, or distance, independent acceleration and deceleration
Programming	.NET framework, AML (Allied Motion Language for Motion Control)
Programming Interface	RS232 or Ethernet bus from host PC to master card; host PC running Vista/7/8 OS and Allied Motion's *IN Control* application software
Command Execution Modes	• Auto: Program runs on startup • Single: Step, step over, step into program lines • Immediate: Command executed on entry • Remote: Control by remote host interface to master card
Execution Rate	Up to 4 AML statements per position loop update
Inputs/Outputs	Master and each axis card: 6 isolated inputs, 2 isolated outputs, 1 non-isolated output, up to 4 high speed differential input or output pairs, 2 analog differential inputs, 1 analog output
Motor Feedback Inputs	EnDat 2.1 (support of EnDat 2.2 command set), BiSS, analog sin-cos, digital incremental, custom
Communications	RS232, Ethernet
Output Current	Axis drive models with 5A or 15A[1] continuous
Maximum Axis Output	340 W continuous for 5 A axis drive; 1000 W continuous for 15 A axis drive; total output power from all axes must be < 2900 W
Axis Drive Efficiency	> 92% at 30 °C
Current Loop	PI, 50 μs loop delay
Velocity Loop	PID/PDF, 250 μs loop delay
Position Loop	P with feed forward, 250 μs loop time
Protection Features	• Over voltage detection • Under voltage detection • Over current • Full short-circuit protection • Over temperature shutdown
Operating Temperature	-20 to +40 °C ambient
Storage Temperature	-40 to +100 °C ambient
Dimensions	W × H × D: 135 mm X 87 mm X 54 mm (5.3 in X 3.4 in X 2.5in)
Weight	0.37 kg (0.82 lb) max., all slots filled

1. Unit ambient air must remain below 50 ºC

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IN CONTROL SOFTWARE

IN Control™ is Windows-based application software for the MX family of motion controllers. It is a companion product for Allied Motion controllers designed to assist you with the following:

- Motor set-up and configuration
- I/O set-up and configuration
- Motor verification and performance analysis

IN Control also includes an integrated Help system that is easily accessible within the application. It provides detailed documentation that fully describes the operation of the MX controller. In addition, background information is provided related to setup and mechanical configuration, the command set, and detailed operation within each functional block of the controller.

IN Control can be used with or without a physical connection to the MX controller. By operating in virtual mode, you are able to access all documentation and help functions, access and set up all parameter settings and save to a file for later use.

A built-in, multi-channel oscilloscope allows you to visually monitor results on the PC while adjusting tuning parameters.

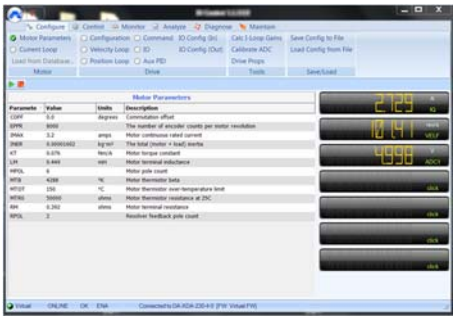
IN Control is capable of automatically determining the resistance and inductance of a motor in order to set up current loop compensation. In addition, it will automatically determine the motor's start-up parameters.

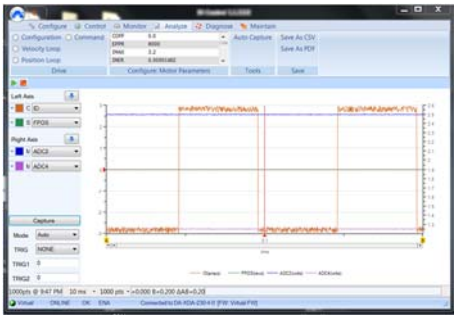
Features

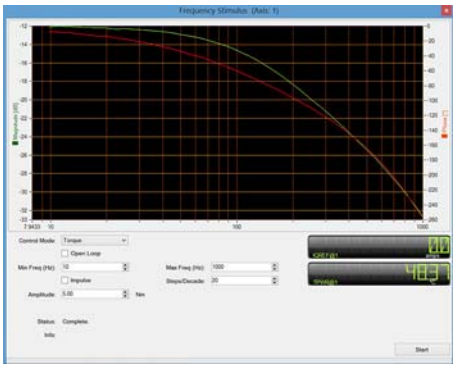
- *IN Control* is a Windows Vista/7/8 application designed to assist the user in tuning, configuring and programming the MX controller.
- *IN Control* commands are sent to the controller via the communication interface.
- Quickly set up, tune and program the MX.
- Built-in oscilloscope tool to data log system registers in real-time
- Auto-calculation of optimum current loop settings for any compatible motor
- Performs cyclic motion to exercise system axes
- Enables viewing and setting of inputs
- Includes a motor verification tool

Key *IN Control* Modules

- Windows Configuration and Diagnostics
- Motor and System Tuning
- 4-channel Oscilloscope views
- Graphical Configuration of I/O
- Diagnostic and Error displays
- Parameter Configuration file creation
- Firmware download and update







PROGRAMMING

Allied Motion Programmability Standard (AMPS)

The MX series utilizes Allied Motion's Programmability Standard (AMPS), which is a universal language and associated run-time engine used on all Allied Motion programmable drives and controllers.

AMPS is:

- One or more "program organizational blocks" (POBs) written in a C-like, text-based programming language (AML)
- A translator that converts project POBs to a series of opcodes ("operation codes") suitable to be executed by the firmware-based run-time
- A virtual machine run-time (VM) that schedules POB execution as well as interpreting and executing the opcodes.

POBs are the components that make up a user program. They operate independently and may be thought of as tasks in a multi-tasking environment.

POBs have priority. Foreground POBs are scheduled to run in conjunction with the trajectory generator, whereas background POBs are periodically scheduled and run independently of the control loops.

POBs can be started based upon an event such as when an input changes state from off to on.

When a POB is active, a single AML statement is executed before relinquishing control to the next active POB. The user can override this behavior by using an AML construct known as an atomic block.

Allied Motion Language (AML)

AML is a C-like language designed for motion control. It contains constructs, such as variables and arrays that have type and scope.

AML is similar to a standard programming language and has common program flow constructs such as assignment, if/then/else, repeat, while and the like. It differs from other programming languages in that it also includes motion and control oriented statements, such as for causing the motor to move an incremental distance or pulsing an output for a period of time.

The programming architecture of the run-time engine is flexible in order to meet a wide variety of use case scenarios such as:

- **Stand-alone**: The user edits POBs using AML in *IN Control* and downloads them to controller non-volatile memory. The controller then runs the main POB upon power-up (which in turn starts others).
- **Stand-alone, triggered:** Similar to stand-alone, but a user application starts and stops stored POBs through fieldbus commands.
- **On-the-fly:** A user application sends translated POBs for immediate execution using a fieldbus.
- **Combined Stored:** Non-volatile POBs are used in conjunction (possibly triggered over a fieldbus) with translated POBs sent over the fieldbus.

Allied Motion provides a series of .NET assemblies. These thread-safe assemblies isolate the user from dealing with and developing their own communication methods and the like. Simple methods are provided in the assemblies to interrogate the drive status, change a control parameter or user variable or to translate, download and run a POB.

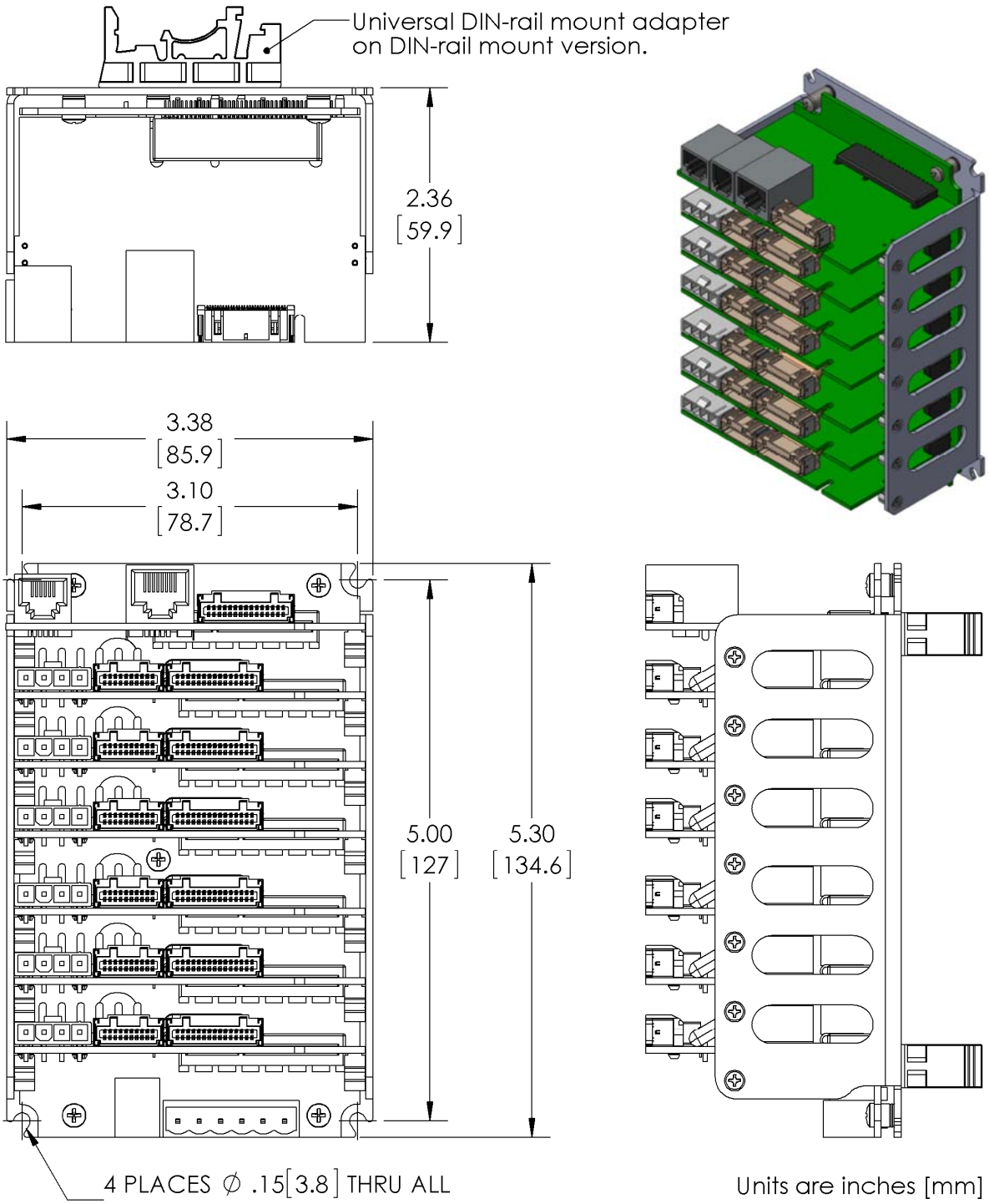
Specifically, the AMLTranslator class includes a method to translate a string of AML text into a downloadable POB form.

The IALLNET class provides methods to:

- Start stored POBs or to stop active POBs
- Store a POB into non-volatile memory for later execution
- Send and immediately run a POB
- Read/write user variables and control parameters
- Query status and fault state
- Capture data

Issued: September 24, 2015

DIMENSIONS



CONNECTIONS - MASTER CARD & CHASSIS

Master Ethernet Connector J1 Standard RJ-45

Power Connector J1 On Shore Technology OSTOQ047151: 5mm Pluggable 20A Mate: OST OSTTJ047150 Screw Type		
Pin	**Function**	**Description**
1	DC Bus +	Motor power
2	DC Bus +	Motor power
3	Aux Supply +	Logic keep-alive power
4	Aux Supply -	Logic keep-alive power return
5	DC Bus -	Motor power return
6	DC Bus -	Motor power return

Master I/O Connector J4 Molex Duo-Clasp Dual Row 1.25mm: 502046-3070 Mate: Molex 503110-3000		
Pin	**Name**	**Description**
1	Din 1	Isolated discrete input 1 (can be either active high or active low)
2	Dout 1C	Isolated discrete output 1 collector
3	Din 2	Isolated discrete input 2 (can be either active high or active low)
4	Dout 2C	Isolated discrete output 2 collector
5	In COM	Isolated input common
6	Dout 1E	Isolated discrete output 1 emitter
7	Din 3	Isolated discrete input 3 (can be either active high or active low)
8	Din 4	Isolated discrete input 4 (can be either active high or active low)
9	Din 5	Isolated discrete input 5 (can be either active high or active low)
10	Din 6	Isolated discrete input 6 (can be either active high or active low)
11	Dout 3	Un-isolated output 3 (open-collector up to 60 V 100 mA)
12	Dout 2E	Isolated discrete output 2 emitter
13	+5V Ext	+5V external supply voltage; up to 500 mA (I/O and motor combined)
14	COM	Return voltage for +5V Ext and un-isolated output
15	HS7+	Discrete input / output 7 +, high speed differential 0 – 5 V, programmable
16	HS7-	Discrete input / output 7 -, high speed differential 0 – 5 V, programmable
17	HS8+	Discrete input / output 8 +, high speed differential 0 – 5 V, programmable
18	HS8-	Discrete input / output 8 -, high speed differential 0 – 5 V, programmable
19	HS9+	Discrete input / output 9 +, high speed differential 0 – 5 V, programmable
20	HS9-	Discrete input / output 9 -,high speed differential 0 – 5 V, programmable
21	HS10+	Discrete input / output 10 +, high speed differential 0 – 5 V, programmable
22	HS10-	Discrete input / output 10 -,high speed differential 0 – 5 V, programmable
23	COM	Return voltage for +5 V Ext, un-isolated inputs and outputs
24	COM	Return voltage for +5 V Ext, un-isolated inputs and outputs
25	-	N/C
26	CHAS	Chassis ground connection
27	An In 1 +	Differential analog input 1, positive input
28	An In 2 +	Differential analog input 2, positive input
29	An In 1 -	Differential analog input 1, negative input
30	An In 2 -	Differential analog input 2, negative input

CONNECTIONS - AXIS CARD

Axis Motor Connector J1
Molex Minifit 0039303047
Mate: 0039014041
16 to 24 AWG wire

Pin	Name	Description
1	PHASE A	Motor phase A connection
2	PHASE B	Motor phase B connection
3	PHASE C	Motor phase C connection
4	CHAS	Motor shield connection

Axis Motor Feedback Connector J3
Molex Duo-Clasp Dual Row 1.25mm: 502046-2070
Mate: Molex 503110-2000

Pin	Name	Description
1	En A +	Incremental encoder channel A +
2	En A -	Incremental encoder channel A -
3	En B +	Incremental encoder channel B +
4	En B -	Incremental encoder channel B -
5	En Z +	Incremental encoder channel Z +
6	En Z -	Incremental encoder channel Z -
7	+5V Ext	+5V external supply voltage: up to 500 mA (I/O and motor combined)
8	COM	Return for +5V Ext, Hall-effect sensors, and encoder
9	HALL A	Motor Hall A input: internal 1k pull-up
10	HALL B	Motor Hall B input: internal 1k pull-up
11	HALL C	Motor Hall C input: internal 1k pull-up
12	COM	Return for +5V Ext, Hall-effect sensors, and encoder
13	SIN +	sin-cos encoder SIN + input: +/- 1V p-p
14	SIN -	sin-cos encoder SIN - input: +/- 1V p-p
15	COS +	sin-cos encoder COS + input: +/- 1V p-p
16	COS -	sin-cos encoder COS - input: +/- 1V p-p
17	MOT TH	Motor thermistor Input
18	CHAS	Chassis ground connection
19	Brake +	Motor holding brake control
20	Brake -	Motor holding brake control

Axis I/O Connector J2
Molex Duo-Clasp Dual Row 1.25mm: 502046-3070
Mate: Molex 503110-3000

Pin	Name	Description
1	Din 1	Isolated discrete input 1 (can be either active high or active low)
2	Dout 1C	Isolated discrete output 1 collector
3	Din 2	Isolated discrete input 2 (can be either active high or active low)
4	Dout 2C	Isolated discrete output 2 collector
5	In COM	Isolated input common
6	Dout 1E	Isolated discrete output 1 emitter
7	Din 3	Isolated discrete input 3 (can be either active high or active low)
8	Din 4	Isolated discrete input 4 (can be either active high or active low)
9	Din 5	Isolated discrete input 5 (can be either active high or active low)
10	Din 6	Isolated discrete input 6 (can be either active high or active low)
11	Dout 3	Un-isolated output 3 (open-collector up to 60 V 100 mA)
12	Dout 2E	Isolated discrete output 2 emitter
13	+5V Ext	+5V external supply voltage; up to 500 mA (I/O and motor combined)
14	COM	Return voltage for +5V Ext, un-isolated output
15	HS7+	Discrete input / output 7 +, high speed differential 0 – 5 V, programmable
16	HS7-	Discrete input / output 7 -, high speed differential 0 – 5 V, programmable
17	HS8+	Discrete input / output 8 +, high speed differential 0 – 5 V, programmable
18	HS8-	Discrete input / output 8 -, high speed differential 0 – 5 V, programmable
19	HS9+	Discrete input / output 9 +, high speed differential 0 – 5 V, programmable
20	HS9-	Discrete input / output 9 -,high speed differential 0 – 5 V, programmable
21	HS10+	Discrete input / output 10 +, high speed differential 0 – 5 V, programmable
22	HS10-	Discrete input / output 10 -,high speed differential 0 – 5 V, programmable
23	COM	Return voltage for +5 V Ext, un-isolated inputs and outputs
24	COM	Return voltage for +5 V Ext, un-isolated inputs and outputs
25	Analog Out 1	Analog output 1; 0 – 5 V analog output
26	CHAS	Chassis ground connection
27	An In 1 +	Differential analog input 1, positive input
28	An In 2 +	Differential analog input 2, positive input
29	An In 1 -	Differential analog input 1, negative input
30	An In 2 -	Differential analog input 2, negative input

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MODEL NUMBERING

System	Description
MXC-00000008[1]	Modular, multi-axis brushless DC motion controller; master + 2 axis drives; 12 to 80 VDC, 15A cont.
MXC-00000009[1]	Modular, multi-axis brushless DC motion controller; master + 3 axis drives; 12 to 80 VDC, 15A cont.
MXC-00000010[1]	Modular, multi-axis brushless DC motion controller; master + 4 axis drives; 12 to 80 VDC, 15A cont.
MXC-00000011[1]	Modular, multi-axis brushless DC motion controller; master + 5 axis drives; 12 to 80 VDC, 15A cont.
MXC-00000012[1]	Modular, multi-axis brushless DC motion controller; master + 6 axis drives; 12 to 80 VDC, 15A cont.
Documents / Software	
34-2100[2]	Hardware Manual: Wiring and Installation
34-2200[2]	Software Manual: *IN Control* User Guide
34-2201[2]	Software Manual: Allied Motion Programmability Standard
34-2202[2]	Software Manual: Parameters and Control Structure (PDF) + (Attachment A) Sortable Parameters and Variables List (Excel file)
— [2]	ALLNET .NET Framework software
Accessories	
AC-CB-100119	20-pin motor feedback cable with connector, flying leads, 0.5 m (1.5 ft)
AC-CB-100122	30-pin I/O cable with connector, flying leads, 0.5 m (1.5 ft) length
AC-CB-100123	Female RJ-11 to female DB-9 modular adapter with 2 m RJ-11 male-male interconnection cable
AC-CB-100124	MXC 5 / 15 A motor power cable with connector, 3 m (10 ft) length

1. Models with 5 A axis drives and with combinations of 5 A and 15 A axis drives are available; contact Allied Motion application engineering with your requirements.
2. Documentation and most software are available for download from the Allied Motion website (www.allliedmotion.com)

Issued: September 24, 2015