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MANUFACTURER DATA SHEET

PLC

Manufacturer:

Giddings & Lewis

Model Number:

MMC

Several sections not required have been removed

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MMC™

Hardware Manual

Part Number 108-31050-00
Version 11.0

Giddings & Lewis

Giddings & Lewis
Controls, Measurement and Sensing

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Machine and Motion Control (MMC)

This document contains information for the MMC hardware. Block I/O information can be found in the PiC900 Hardware Manual. Software information can be found in the PiCPro Software Manual, the Function/Function Block Reference Guide or on-line.

General Precautions

READ AND UNDERSTAND THIS SECTION IN ITS ENTIRETY BEFORE UNDERTAKING INSTALLATION OR ADJUSTMENT OF MMC CONTROL EQUIPMENT

The advice contained in this section will help users to operate and maintain the equipment in a safe manner at all times.

PLEASE REMEMBER THAT SAFETY IS EVERYONE'S RESPONSIBILITY

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The basic rules of safety set forth in this section are intended as a guide for the safe operation of equipment. This general safety information, along with explicit service, maintenance and operational materials, make up the complete instruction set. All personnel who operate, service or are involved with this equipment in any way should become totally familiar with this information prior to operating.

User Responsibility

It is the responsibility of the user to ensure that the procedures set forth here are followed and, should any major deviation or change in use from the original specifications be required, appropriate procedures should be established for the continued safe operation of the system. It is strongly recommended that you contact your OEM to ensure that the system can be safely converted for its new use and continue to operate in a safe manner.

Safety Instructions

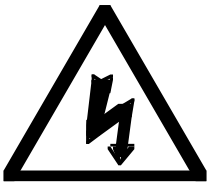
1. Do not operate your equipment with safety devices bypassed or doors removed.
2. Only qualified personnel should operate the equipment.
3. Never perform service or maintenance while automatic control sequences are in operation.
4. To avoid shock or serious injury, only qualified personnel should perform maintenance on the system.
5. ATTENTION - DANGER TO LIFE
   Do not touch the main power supply fuses or any components internal to the power modules while the main power supply switch is ON. Note that when the main power switch is OFF, the incoming supply cable may be live.
6. GROUNDING (Protective Earth)
   The equipment must be grounded (connected to the protective earth connection) according to OEM recommendations and to the latest local regulations for electrical safety. The grounding (protective earth) conductor must not be interrupted inside or outside the equipment enclosures. The wire used for equipment grounding (connection to protective earth) should be green with a yellow stripe.
7. If there is any doubt at all as to the safety of the equipment, you should set the main power switch to OFF and contact your OEM for advice.

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Safety Signs

The purpose of a system of safety signs is to draw attention to objects and situations which could affect personal or plant safety. It should be noted that the use of safety signs does not replace the need for appropriate accident prevention measures. Always read and follow the instructions based upon the level of hazard or potential danger.

Warning Labels



Danger Electric
Shock Risk

Hazard warning. When you see this safety sign on a system, it gives a warning of a hazard or possibility of a hazard existing. The type of warning is given by the pictorial representation on the sign plus text if used.

The safety color is black on a yellow background with a black symbol. To ignore such a caution could lead to severe injury or death arising from an unsafe practice. If voltage levels are included in the text they must indicate the maximum level of the hazard in normal or fault condition.

Danger, Warning, or Caution warning.



Symbol plus DANGER, WARNING or CAUTION: These notices provide information intended to prevent potential personal injury and equipment damage.

Hot Surface warning



Hot Surface

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Safety First

Giddings & Lewis equipment is designed and manufactured with consideration and care to generally accepted safety standards. However, the proper and safe performance of the equipment depends upon the use of sound and prudent operating, maintenance and servicing procedures by trained personnel under adequate supervision.

For your protection, and the protection of others, learn and always follow these safety rules. Observe warnings on machines and act accordingly. Form safe working habits by reading the rules and abiding by them. Keep these safety rules handy and review them from time to time to refresh your understanding of them.

Safety Inspection

Before Starting Operations

1. Ensure that all guards and safety devices are installed and operative and all doors which carry warning labels are closed and locked.
2. Ensure that all personnel are clear of those areas indicated as potentially hazardous.
3. Remove (from the operating zone) any materials, tools or other objects that could cause injury to personnel or damage the system.
4. Make sure that the control system is in an operational condition.
5. Make certain that all indicating lights, horns, pressure gauges or other safety devices or indicators are in working order.

After Shutdown

Make certain all controlled equipment in the plant is safe and the associated electrical, pneumatic or hydraulic power is turned off. It is permissible for the control equipment contained in enclosures to remain energized provided this does not conflict with the safety instructions found in this section.

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Operating Safely

1. Do not operate the control system until you read and understand the operating instructions and become thoroughly familiar with the system and the controls.
2. Never operate the control system while a safety device or guard is removed or disconnected
3. Where access to the control system is permitted for manual operation, only those doors which provide that access should be unlocked. They should be locked immediately after the particular operation is completed.
4. Never remove warnings that are displayed on the equipment. Torn or worn labels should be replaced.
5. Do not start the control system until all personnel in the area have been warned.
6. Never sit or stand on anything that might cause you to fall onto the control equipment or its peripheral equipment.
7. Horseplay around the control system and its associated equipment is dangerous and should be prohibited.
8. Know the emergency stop procedure for the system.
9. For maximum protection when carrying out major servicing requiring the system to be powered down, the power source should be locked using a lock for which only you have the key. This prevents anyone from accidentally turning on the power while you are servicing the equipment.
10. Never operate the equipment outside specification limits.
11. Keep alert and observe indicator lights, system messages and warnings that are displayed on the system.
12. Do not operate faulty or damaged equipment. Make certain proper service and maintenance procedures have been performed.

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Electrical Service & Maintenance Safety

1. **ALL ELECTRICAL OR ELECTRONIC MAINTENANCE AND SERVICE SHOULD BE PERFORMED BY TRAINED AND AUTHORIZED PERSONNEL ONLY.**
2. It should be assumed at all times that the POWER is ON and all conditions treated as live. This practice assures a cautious approach which may prevent accident or injury.
3. To remove power:
   LOCK THE MAIN SWITCH IN THE OPEN POSITION.
   USE A LOCK TO WHICH ONLY YOU HAVE THE KEY.
4. Make sure the circuit is safe by using the proper test equipment. Check test equipment regularly
5. Capacitors take time to discharge. Care should be taken in manual discharging of capacitors
6. There may be circumstances where troubleshooting on live equipment is required. Under such conditions, special precautions must be taken:
   - Make sure your tools and body are clear of the areas of equipment which may be live.
   - Extra safety measures should be taken in damp areas.
   - Be alert and avoid any outside distractions.
   - Make certain another qualified person is in attendance.
7. Before applying power to any equipment, make certain that all personnel are clear of associated equipment.
8. Control panel doors should be unlocked only when checking out electrical equipment or wiring. On completion, close and lock panel doors.
9. All covers on junction panels should be fastened closed before leaving any job.
10. Never operate any controls while others are performing maintenance on the system.
11. Do not bypass a safety device.
12. Always use the proper tool for the job.
13. Replace the main supply fuses only when electrical power is OFF (locked out).

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Cleaning Safely

Manual cleaning Procedure

1. Do not use toxic or flammable solvents to clean control system hardware.
2. Turn off electrical power (lock out) before cleaning control system assemblies.
3. Keep electrical panel covers closed and power off when cleaning an enclosure.
4. Always clean up spills around the equipment immediately after they occur.
5. Never attempt to clean a control system while it is operating.

Never use water to clean control equipment unless you are certain that the equipment has been certified as sealed against water ingress. Water is a very good conductor of electricity and the single largest cause of death by electrocution.

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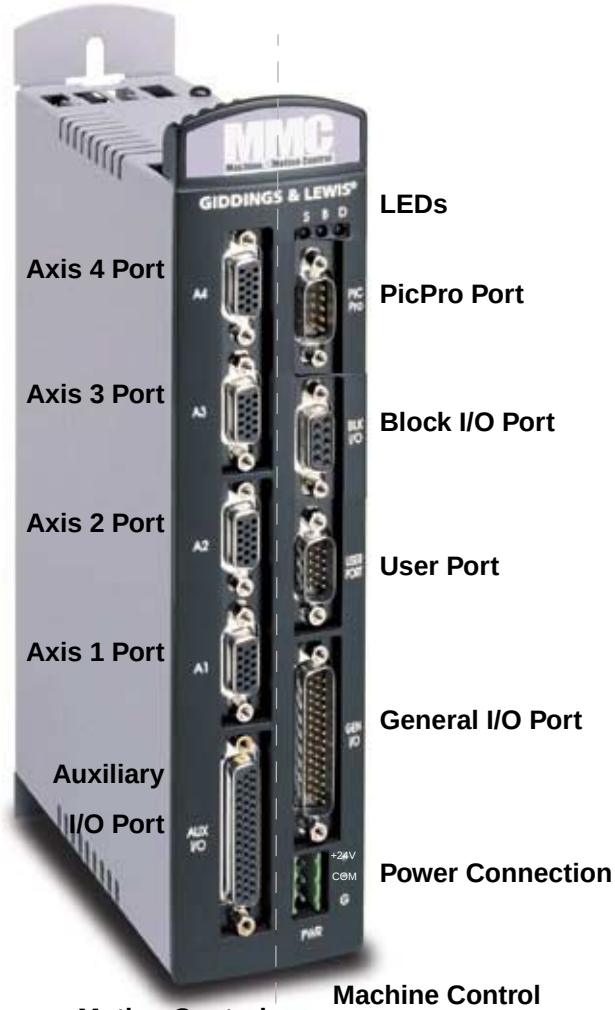
The MMC offers a complete solution to both machine and motion control in a stand-alone unit. The MMC family includes these models:

- MMC-A2 (2 1/2 axis analog servo control)
- MMC-A4 (4 1/2 axis analog servo control)
- MMC-S8 (8 axis SERCOS control) (future)

The PiCPro for Windows programming tool used with the PiC family of controls is also used to program the MMC. The built-in I/O [up to 28 inputs (24 VDC) and 16 outputs (24 VDC)] can be expanded using Giddings & Lewis serially distributed block I/O. There are also eight (four) low current DC outputs and four (two) DC inputs on the Axis connectors of the MMC-A4 (MMC-A2).

Field-installable options for the MMC include an Ethernet TCP/IP interface and a DeviceNet™ master interface. (future)

Figure 1. The MMC-A4 Servo Control Unit



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The MMC consists of the motion control module (on the left) and the machine control module (on the right). The machine control side of the MMC unit contains the CPU module. Ladder logic programming is used for machine control. The motion control side of the MMC unit can be either an analog servo module or a SERCOS module. The analog servo module provides conventional analog/digital interfacing for two or four drives.

The typical signals needed to interface to a drive are provided by the module. The drive command is in the form of an analog voltage (±10V). Feedback is accepted from quadrature type encoders with RS422 style differential outputs. Digital I/O (+24 VDC) is used for drive signals enable, reset, and fault.

The analog servo module is offered in both 2 1/2 and 4 1/2 axis configurations. An axis is considered to be an analog output with a corresponding encoder input. In each configuration shown below, note that there is an extra encoder input. This is referred to as a half axis.

Available I/O	**2 1/2 Axis**	**4 1/2 Axis**
Analog Inputs	1	1
Analog Outputs	2	4
Encoder Inputs	3	5
Axis DC Inputs	2	4
Axis DC Outputs	4	8
Axis Fast DC Inputs	3	5
AUX I/O Port DC Inputs	6	12
General I/O Port DC Inputs	16	16
General I/O Port DC Inputs	16	16

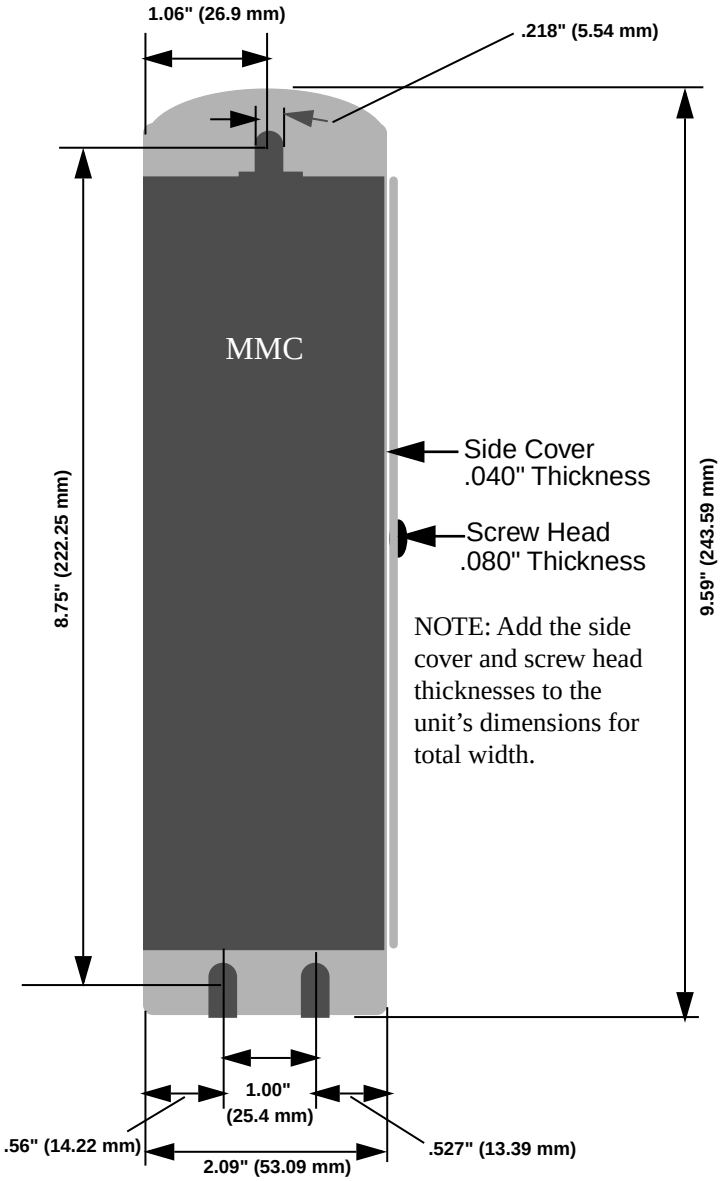
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Mount the unit to your cabinet using the mounting slots on the MMC. The MMC unit may be mounted vertically or horizontally. The recommended size of mounting hardware is:

- #10 bolts with #10 star washers (to ensure proper ground connection)

See Figure 2 below.

Figure 2. MMC Mounting Dimensions

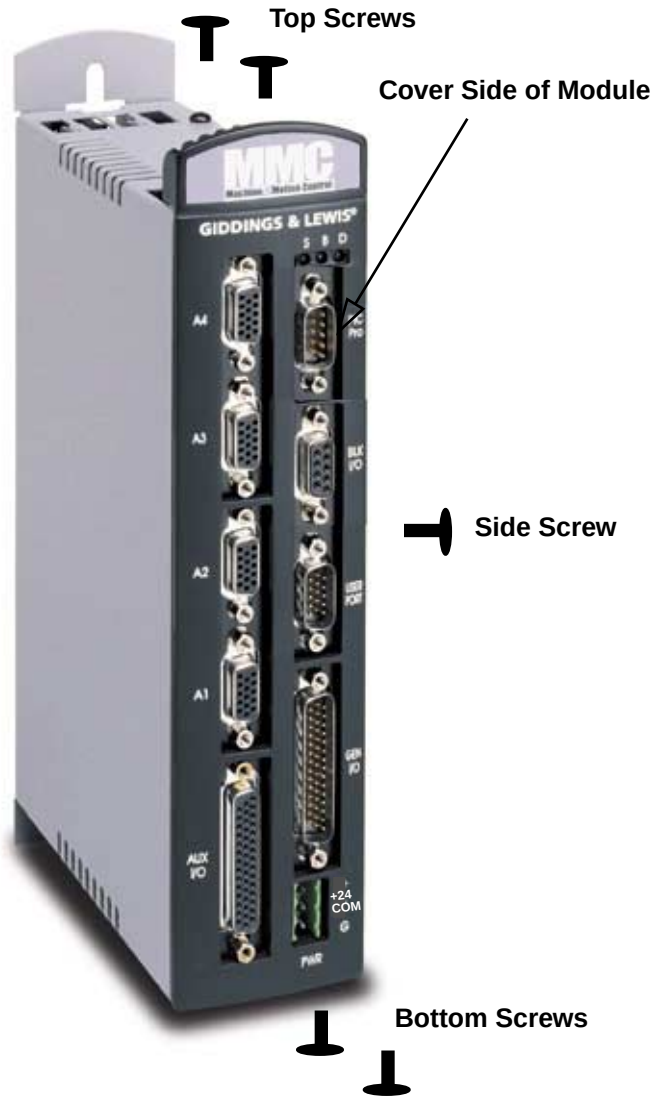


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Option modules are shipped with a 50-pin square post connector and screws needed to attach the module to the MMC. Follow the procedure below to add an option module to the MMC.

1. Place the MMC and the option module on a static free surface. Ground yourself using a properly grounded wrist strap before you begin. These are standard precautions before handling any electronic components.
2. Remove the five screws securing the MMC cover using a #1 Phillips screwdriver and set them aside. There are two screws on the top, two screws on the bottom, and one screw on the side of the module.

Figure 3. Location of Screws on MMC



3. Lift the side cover off and set aside.

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4. Locate the 50-pin square post socket at the top of the MMC board. Press one side of the 50-pin square post male connector into this socket ensuring that the pins are aligned and it is firmly seated.
5. Pick up the option module. Line up the socket on the option module with the male end of the connector extending from the MMC ensuring that the pins are aligned. Press firmly into place. Be sure to align the screw tabs on the top and bottom of the option module with the screw slots on the top and bottom of the MMC module so that the modules slide together easily.
6. Screw four screws (of the five included in your package) into the screw tabs to attach the option module to the MMC.
7. Lay the unit on the bench. Place the cover you set aside in Step 3 on the option module. Be sure to align the screw tabs on the top and bottom of the cover with the screw slots on the top and bottom of the option module.
8. Screw the five screws removed in Step 2 back into place to secure the cover.
9. To add an additional option module, repeat the steps above removing the five screws and the cover from the option module on the MMC and then proceeding with steps 4 through 8.

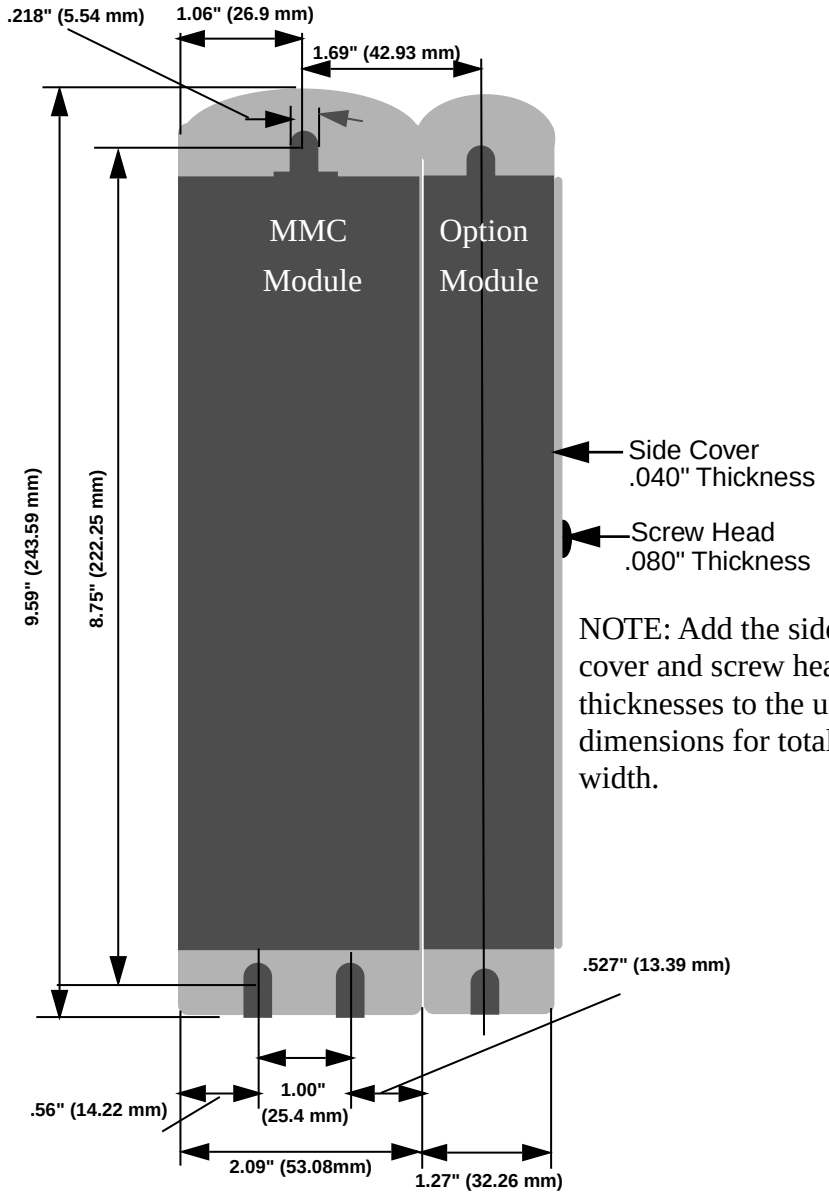
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After attaching the option module to the MMC module, mount the unit to your cabinet using the mounting slots on the MMC and the option module. The recommended size of mounting hardware is:

- #10 bolts with #10 star washers (to ensure proper ground connection)

See Figure 2 below.

Figure 4. MMC Mounting Dimensions with Option Module



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General Requirements

The MMC is suitable for operation in a pollution degree 2 environment (i.e., normally, only non-conductive pollution occurs). You are not required to install the system rack in a control cabinet. However a cabinet protects the system from dust and mechanical damage and is recommended.

Power distribution is shown in Figure 5. Install the system rack away from all sources of strong electromagnetic noise. Such noise can interfere with MMC operation.

- Protect the MMC system from all the following:

  conductive fluids and particles
  corrosive atmosphere
  explosive atmosphere

The diagrams and recommendations may be modified if necessary so the wiring conforms to current NEC standards or government regulations.

Control Cabinet Specifications

1. A control cabinet for the MMC should have a NEMA-12 rating or better. A cabinet with this rating protects its contents from dust and mechanical damage.
2. It must be large enough to provide adequate air circulation for the MMC, drives, and other components. Always allow for adequate air flow through the MMC vents.
3. It must have a rigid vertical surface to mount the MMC on.
4. The door should open fully for easy access.

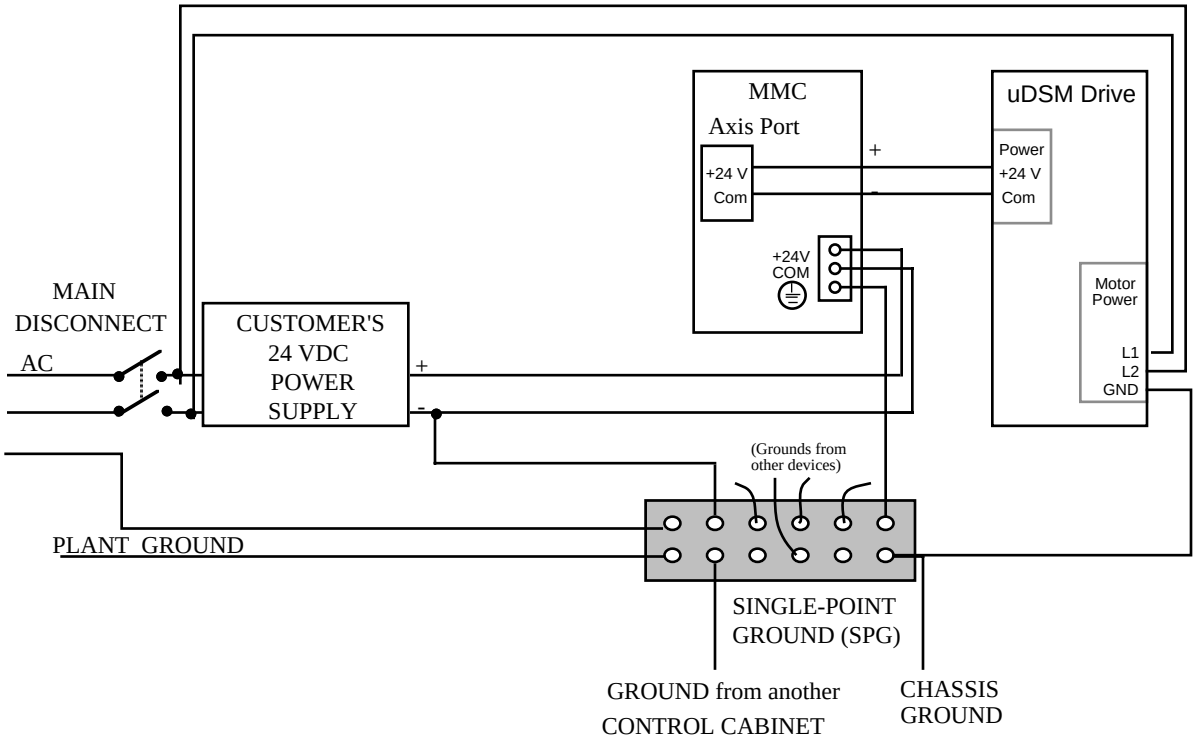
IMPORTANT
Post warnings according to National, State, or local codes for the voltage present in the control cabinet.

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Power Distribution Diagram

The MMC requires an external DC power source. The power distribution drawing that follows shows an MMC connected to a µDSM Drive. The drive's 24 VDC power is supplied via the MMC in this example. If the drive has its own external 24 VDC supply, the +24 V line would not be connected.

Figure 5. Example of 24 VDC Power Distribution to an MMC System



The DC power source is connected to the MMC system through a 3-pin connector. It plugs into the power connector of the MMC. The ground from the power source and ground from the MMC must be connected to the Single-Point Ground (SPG).

Devices connected to the hardware may have their own power sources for input data or output control signals. You can use other wiring setups, provided that each one is:

- at the correct voltage and current levels for the module and the device.
- connected to the same Single-Point Ground that the MMC uses.

It is recommended that the same main disconnect switch be used for the MMC system and for all devices in the application.

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IMPORTANT

No matter how the system is installed, before you connect the MMC to the application, make sure that power is off to the system and to the devices the MMC is wired to.

Notes on the 24V power supply and the MMC

An MMC system consists of a main module (servo analog or SERCOS based) and up to two option modules. An external 24 VDC supply is required to power the MMC's internal circuitry and external I/O. The 24 VDC is distributed internally to three different buses or sections. When you size your power supply, you must ensure that the supply is large enough to handle the total load and that the maximum current capability of each bus is not exceeded.

The table below shows the distribution of the 24 VDC power within the MMC system:

Power Bus	Supplying Current To:	Maximum Current
1	Module Circuitry	3 A
2	General I/O	5 A
3	Module I/O	1 A

In most cases, one power supply can be used for the entire control system. However, depending upon the modules, drives, and external I/O used in your application, you may split the power distribution into two or more power supplies. For example, the Axis I/O on an MMC A2 module can be powered from the MMC, from the drive, or from another external power supply.

CAUTION

A possible ignition hazard within the MMC exists if the maximum currents listed for Bus 2 or Bus 3 are exceeded or if excessive current is drawn at the 24 V line going into the MMC. If these currents might be exceeded (due to improper wiring or external device failure), circuit breakers or fuses should be used in series with the 24 VDC going to and coming from the MMC. Specifically, the circuit breakers or fuses should be sized for 10 A total on the 24V line coming into the MMC, 1 A total from the +24 VDC OUT pins of the AXIS and AUXILIARY I/O connectors, and 5 A total from the I/O 24V pins of the GENERAL I/O connector. For maximum protection, use fast blow fuses. When using molded cables supplied by Giddings & Lewis to connect the MMC to the drives, no overload protection is required.

The worksheet below can be used to size the power supply required by your application.

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24 VDC Power Supply Sizing Worksheet

Line	MMC Module	Current (mA)	# of Units	Col A Subtotal (mA)	Col B Current (mA)
1	MMC-A2 or MMC-A4	250			
2	MMC SERCOS	300			
3	MMC Ethernet	200			
4	Subtotal, Power Bus 1 (Add Column A, Lines 1 or 2 and 3, 3000 mA max)				

Line	MMC Component	Max Current (mA)	Actual Current (mA)	Number of I/O	Col A Subtotal (mA)	Col B Current (mA)
5	General Inputs	7.5	7.5			
6	General Outputs	250				
7		250				
8		250				
9		250				
10		250				
11	Subtotal, Power Bus 2 (Add Column A, Lines 5-10, 5000 mA max)					
12	Axis inputs	7.5	7.5			
13	Axis outputs	100				
14		100				
15		100				
16		100				
17	Auxiliary inputs	7.5	7.5			
18	Fast inputs	7.5	7.5			
19	Subtotal, Power Bus 3 (Add Column A, Lines 12-18, 1000 mA max)					
20	MMC Power (Add Column B, Lines 4, 11, and 19, 10,000 mA max)					
21	Other (i.e. block I/O)					
22						
23						
24	Subtotal (Add Column A, Lines 21-24					
25	Total Power (Add Column A, Lines 20 and 24)					

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Below is an example showing how to use the worksheet to calculate the maximum current required for a theoretical four axes MMC.

24 VDC Power Supply Sizing Example

Line	MMC Component	Current (mA)	# of Units	Col A Subtotal (mA)	Col B Current (mA)
1	MMC-A2 or MMC-A4	250	1	250	250
2	MMC - S8	300			
3	MMC TCP/IP Module	200			
4	Subtotal, Power Bus 1 (Add Column A, Lines 1 or 2 and 3, 3000 mA max)				250

Line	MMC Component	Max Current (mA)	Actual Current (mA)	Number of I/O	Col A Subtotal (mA)	Col B Current (mA)
5	General Inputs	7.5	7.5	16	120	
6	General Outputs	250	250[1]	16	4000	
7		250				
8		250				
9		250				
10		250				
11	Subtotal, Power Bus 2 (Add Column A, Lines 5-10, 5000 mA max)					4120
12	Axis inputs	7.5	7.5	4	30	
13	Axis outputs	100	100[1]	8	800	
14		100				
15		100				
16		100				
17	Auxiliary inputs	7.5	7.5	16	120	
18	Fast inputs	7.5	7.5	5	40	
19	Subtotal, Power Bus 3 (Add Column A, Lines 12-18, 1000 mA max)					990
20	MMC Power (Add Column B, Lines 4, 11, and 19, 10,000 mA max)				5360	
21	Other (i.e. block I/O)					
22						
23						
24	Subtotal (Add Column A, Lines 21-24				0	
25	Total Power (Add Column A, Lines 20 and 24)					5360

[1]For this example, the maximum allowed per output of 250 mA or 100 mA was used. Actual currents may be less depending on the types of devices that are being powered.

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Grounding the System

The ground of the MMC power source must be connected directly to a *Single Point Ground* (SPG) tie block. The tie block should be made of brass or copper, bolted or brazed to the control cabinet. If the tie block is bolted rather than brazed, scrape away paint or grease at the point of contact. Put star washers between the tie block and the cabinet to ensure good electrical contact.

Metal enclosures of power supplies, drives, etc., should also have good electrical contact with the SPG.

CAUTION

The Single Point Ground should be the only common point for all the ground lines. If not, ground loops may cause current flow between components of the system which can interfere with proper operation of the MMC.

Devices to be connected directly to the Single Point Ground include:

1. Plant safety ground.
2. Chassis ground from MMC power connector.
3. The metal panel or cabinet on which the MMC is mounted.
4. "Common" or "0 V" lines from power supplies that provide external power to the I/O modules and the devices to which they are connected.
5. Chassis grounds from the devices themselves, such as device drivers, machinery, and operator interface devices.
6. AC common line from the noise filter, if any.
7. The ground of the power source of the computer workstation, if any, from which you monitor the system operation. An AC outlet in the control cabinet is recommended.
8. Single point grounds from other control cabinets, if any, in the system.

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IMPORTANT

You must ensure that the "0V" or "Common" of all devices connected to the MMC are connected to Single Point Ground (SPG). Failure to do so may result in erratic operation or damage to the MMC. Examples of devices connected to the MMC include the power source that supplies 24VDC power to the MMC and devices connected to the MMC PiCPro Port or User Port. Note that some devices (for example, a Personal Computer) may have their "0V" and "Chassis" connected together internally, in which case only one connection has to be made to SPG for that device.

Also, you must ensure that the MMC "Chassis connection is connected to SPG, and that the MMC is mounted to a metal panel or enclosure that is connected to SPG.

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Controlling Heat Within the System

The hardware MMC case is designed to promote air circulation and dissipate heat. The MMC can be mounted vertically or horizontally to take advantage of this design. Normally no fans or air conditioners are needed. However, if the environment outside the control cabinet is hot or humid, you may need to use a fan, heat exchanger, dehumidifier or air conditioner to provide the correct operating environment.

Table 1-1. Operating Limits for the MMC

Temperature	5 to 55˚ C (41 to 131˚ F)
Relative humidity	5 to 95%, non-condensing

.

Make sure that components installed in the cabinet with the MMC do not raise the temperature above system limits and that any hot spots do not exceed specifications. For instance, when heat-generating components such as transformers, drives or motor controls are installed, separate them from the system by one of the following:

- Place them near the top of the control cabinet so their heat output rises away from the MMC.
- Put them in another control cabinet above or to one side of the cabinet with the MMC. This protects the MMC from both heat and electrical noise.

The MMC itself is a source of heat, though in most installations its heat dissipates without harmful effects. System heat is generated from power dissipated by:

1. field side input/output components
2. other components within the MMC

CAUTION

If the MMC is operated outside the recommended limits, it may be damaged. This will void the warranty.

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Handling an MMC

The case protects the MMC's internal circuitry against mechanical damage in shipping and handling. However, like any electronics device, the circuitry can be destroyed by:

- temperatures over 55˚ C (131˚ F)
- moisture condensing inside the module
- static discharge
- exposure to a magnetic field strong enough to induce a current in the circuitry
- freezing temperatures, vibration, and other hazards

Normally there is no need to open the case. Occasionally you must replace a battery. Modules with replaceable components have a diagram and detailed anti-static precautions in the appendixes.

Wiring the System to the Application

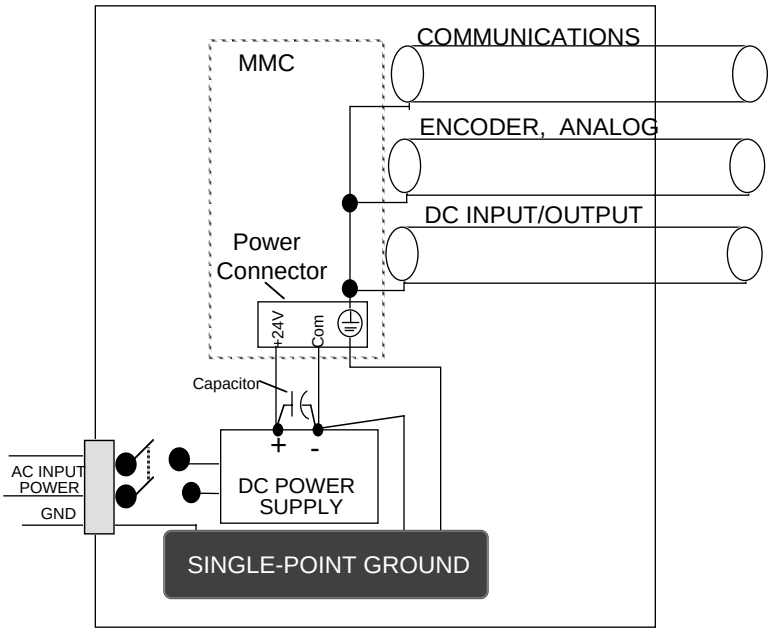
The MMC relies on electrical signals to report what is going on in the application and to send commands to it. In addition, signals are constantly being exchanged within the system. The MMC is designed for use in industrial environments, but some guidelines should be followed.

Giddings & Lewis continues to recommend separation of low level signals (encoder, analog, communications, fast DC inputs) from high voltage or high current lines. Maintain at least one inch of separation around signals.

The figure below illustrates the recommended connections when using EMC compliant products. Note that a capacitor is connected to the 24 VDC supply. To prevent excessive conducted emissions from a DC power source (typically 24 V) used for digital I/O, a 1000 picofarad capacitor should be used. Connect the capacitor from the +24 VDC to COMMON at the distribution terminals.

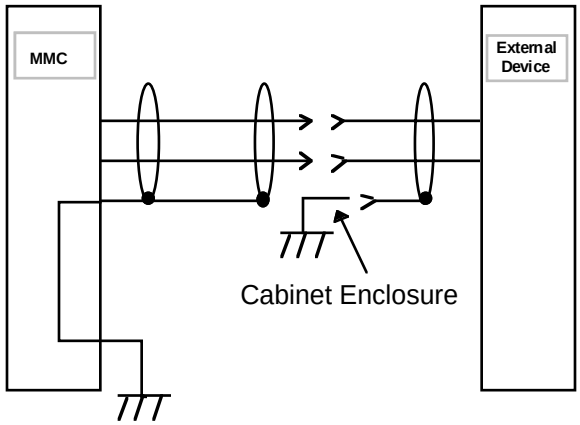
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Figure 6. Recommended EMC Compliant Connections



Inside a control cabinet, connect the shields of shielded cables at the MMC. The figure below illustrate shielded cable entering/leaving the cabinet.

Figure 7. Connecting Shielded Cable



The two different methods of terminating shields are used to accommodate two different immunity requirements. Immunity required inside an enclosure is considered lower because cables are typically less than three meters in length and/or can be separated from each other and from noise sources.

Immunity required external to an enclosure is considered higher because the user may have less control over the noise environment. Low level signal cables that can be external to an enclosure are tested at a 2 KV level for electrical fast transients (EFTs). Low level signals that can be less than three meters in length or can be separated from noise sources are tested at a 1 KV level.

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Under the stated conditions, there will be no disturbance of digital I/O, encoder, or stepper operation. For analog signals, there may be momentary disturbances but there will be self-recovery when the noise subsides.

As a general precaution, do not operate transmitters, arc welding equipment, or other high noise radiators within one meter of an enclosure that has the door open. Continue to equip inductive devices, if they are in series with a mechanical contact or switch, with arc suppression circuits. These devices include contactors, solenoids and motors. Shield all cables that carry heavy current near the system, using continuous foil wrap or conduit grounded at both ends. Such cables include power leads for high-frequency welders and for pulse-width-modulated motor drives.

WARNING

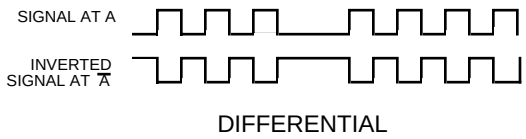
Use care when wiring I/O devices to the MMC and when plugging in cables. Wiring the wrong device to the connector or plugging a connector into the wrong location could cause intermittent or incorrect machine operation.

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Use Differential Devices for Analog and Encoder Signals

A *differential* device receives or sends one signal over two wires (typically a shielded twisted pair). The input/output voltage at the second terminal is the inverse of the first. Information is received/sent as the difference between the two voltages.

Figure 8. Differential Digital Pulse Train



The advantages of using differential signals are:

1. A differential signal is less susceptible to electromagnetic noise. Static or other interference affects both of the twisted-pair wires equally, so the difference between the normal and inverted voltage remains unchanged. A differential signal can be transmitted over a much longer distance or in a much noisier environment than a single-ended one.
2. MMC hardware circuitry can detect signal loss from an encoder if the signal is differential. The application program can be set to shut down the application if such an error is detected.

IMPORTANT
Always use differential drivers or differential inputs.

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Good procedure suggests that the system should be tested each time a new application is powered up. The DIAG LED on the MMC should be off indicating that the diagnostic tests were passed.

Turn off the main disconnect switch and plug the DC connector into the power connector. Turn on input power. The DIAG LED turns on and then turns off when the MMC passes its diagnostic tests.

Connecting the MMC to the Application

1. Turn off the main disconnect switch in the control cabinet. If some devices are not powered from the control cabinet, turn them off also.
2. Connect the connectors according to your diagrams.
3. Turn on power to the system. The PWR light goes on and stays on. The DIAG light goes on, then goes off in turn.
   The SCAN light goes on.
   The application starts to work under control of the system.
4. If an application program is not in system memory, use the download command in the PiCPro software to place it there.

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Table 1-2 summarizes how to proceed when performing certain maintenance and/or setup functions.

Table 1-2. Summary

In order to:	
Turn off the entire application.	Turn off main disconnect (which should also turn off all external power supplies to the application); unplug the DC power to the MMC.
Wire the I/O to the application.	Turn off main disconnect (which should also turn off all external power supplies to the application); unplug the DC power to the MMC.
Change the battery.	Turn off main disconnect (which should also turn off all external power supplies to the application); unplug the DC power to the MMC.
Connect/disconnect the MMC with the computer workstation through the PiCPro port.	Turn off main disconnect (which should also turn off all external power supplies to the application); unplug the DC power to the MMC.
Connect/disconnect the MMC with an operator interface through the User port.	Turn off main disconnect (which should also turn off all external power supplies to the application); unplug the DC power to the MMC.
Download an application program into the memory.	Make sure power is on (check the **P** LED).
Stop the scan.	From the workstation - use the Stop Scan commands in the PiCPro software.

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This section covers two types of diagnostics; power-on and run-time.

Power-On Diagnostics

When the system is powered up, it tests itself and reports the results of the tests in the form of LED signals.

Power LED

If the power light (P) does not go on, or goes off during operation of the system, check that power is still connected to the MMC. If it is, turn off the main disconnect switch and replace the MMC.

Scan LED

If the SCAN LED does not go on:

- Check that the power (P) light is ON.
- Check that the diagnostic (D) light is OFF.

Diagnostic LEDs

The MMC has an LED marked D which lights up briefly while its diagnostic tests are running and then goes off. If the DIAG LED remains on, the MMC has failed one of its tests. Follow these steps:

1. Turn off power to the system and to the application.
2. If the I/O wiring is connected, remove the connector .
3. Remove the defective MMC from the system
4. Replace with a new MMC. Connect the I/O wiring.
5. Turn on power to check diagnostics again.

NOTE

Diagnostics are run only when the system is powered up. It is possible that a failure might occur during operation. If so, its DIAG light remains off. If you suspect that a module might be defective, cycle power to run diagnostics again.

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Run-Time Diagnostics

While the MMC is running, other tests are performed on a regular basis with their results also reported to you through LEDs.

•If the POWER (P) LED on the MMC starts flashing, the battery must be replaced. Follow the battery replacement procedure in this document.

•While the MMC is running, the DIAG LED will flash a three digit code signal if there is an error. For example, if there is a long pause-flash-pause-flash-flash-pause-flash-flash-flash-long pause, the code is 123. The errors are described in the LED section of this document.

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NOTE: Giddings & Lewis provides many optional accessories that simplify wiring the MMC to external devices. These accessories include cables to connect the MMC to Giddings & Lewis's line of DSM and Micro DSM drives and breakout boxes that provide screw-terminal connections to the MMC. Consult the factory for further information.

PiCPro Port

The PiCPro port provides serial communication for the PiCPro programming interface.

Pin	Description	In/Out
1	NC	
2	Receive Data	In
3	Transmit Data	Out
4	Data Terminal Ready	Out
5	Signal Ground	In/Out
6	NC	
7	Request to Send	Out
8	NC	
9	NC	

The pinout for a typical PiCPro Port cable is shown below.

PiCPro Cable Pinout

9-pin female (to PC)		9-pin female (to PiCPro Port)
3	to RD	2
2	to TD	3
5	to GND	5

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Block I/O Port

The block I/O port provides:

- Up to 77 expansion block I/O units
- 4-wire communication interface
- Up to 200 feet between block I/O units

Pin	Description	In/Out
1	NC	
2	NC	
3	Block I/O Transmit Data +	Out
4	Block I/O Transmit Data -	Out
5	Block I/O Receive Data +	In
6	Block I/O Receive Data -	In
7	Shield	
8	NC	
9	NC	

User Port

The User Port is used to communicate with a touch-screen, a hand-held controller, or other serial interface device. The user port provides:

- RS232/RS485 communication
- Baud rates to 19.2 K
- Multidrop capability

Pin	Description	In/Out	Pin	Description	In/.Out
1	NC		9	RS232 Receive Data	In
2	NC		10	RS232 Transmit Data	Out
3	+5V	Out	11	NC	
4	RS232 Data Terminal Ready	Out	12	RS485 Receive Data +	In
5	RS232 Request to Send	Out	13	RS485 Receive Data -	In
6	NC		14	RS485 Transmit Data +	Out
7	RS232 Clear to Send	In	15	RS485 Transmit Data -	Out
8	Signal Ground	In/Out			

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General I/O Port

The general I/O port includes:

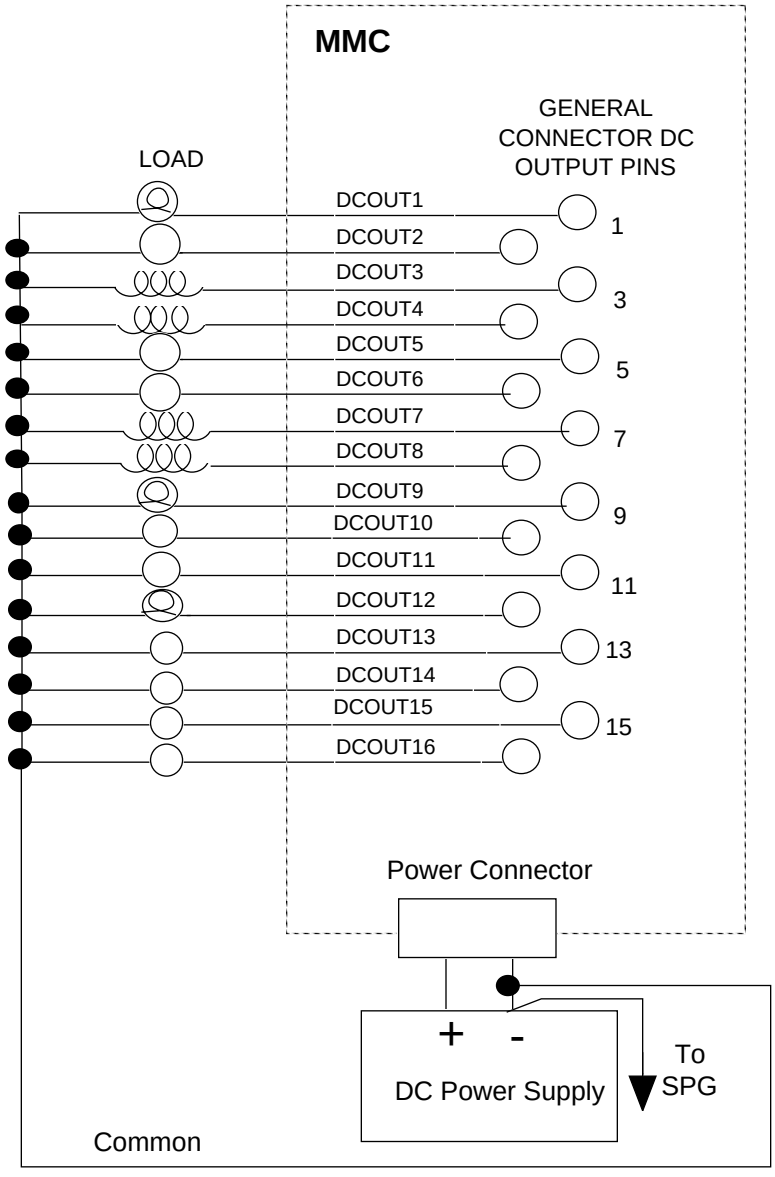
- 16 24 VDC inputs
  Sink or source in groups of eight
  Inputs 1 and 9 can trigger an interrupt on the rising or falling edge
- +24 VDC and 24 V Common
- 16 24 VDC outputs
  Source only
  250 mA output capacity
  short circuit protected

Pin	Description	In/Out	Pin	Description	In/Out	Pin	Description	In/Out
1	DCOUT1	Out	16	DCOUT16	Out	31	NC	
2	DCOUT2	Out	17	NC		32	NC	
3	DCOUT3	Out	18	NC		33	NC	
4	DCOUT4	Out	19	NC		34	IO24V	Out
5	DCOUT5	Out	20	IO24V	Out	35	DCSS2	In
6	DCOUT6	Out	21	DCSS1	In	36	IO24C	Out
7	DCOUT7	Out	22	IO24C	Out	37	DCIN9	In
8	DCOUT8	Out	23	DCIN1	In	38	DCIN10	In
9	DCOUT9	Out	24	DCIN2	In	39	DCIN11	In
10	DCOUT10	Out	25	DCIN3	In	40	DCIN12	In
11	DCOUT11	Out	26	DCIN4	In	41	DCIN13	In
12	DCOUT12	Out	27	DCIN5	In	42	DCIN14	In
13	DCOUT13	Out	28	DCIN6	In	43	DCIN15	In
14	DCOUT14	Out	29	DCIN7	In	44	DCIN16	In
15	DCOUT15	Out	30	DCIN8	In			

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There are 16 DC outputs on the general connector. These outputs get their power internally from the MMC. See Figure 9 below.

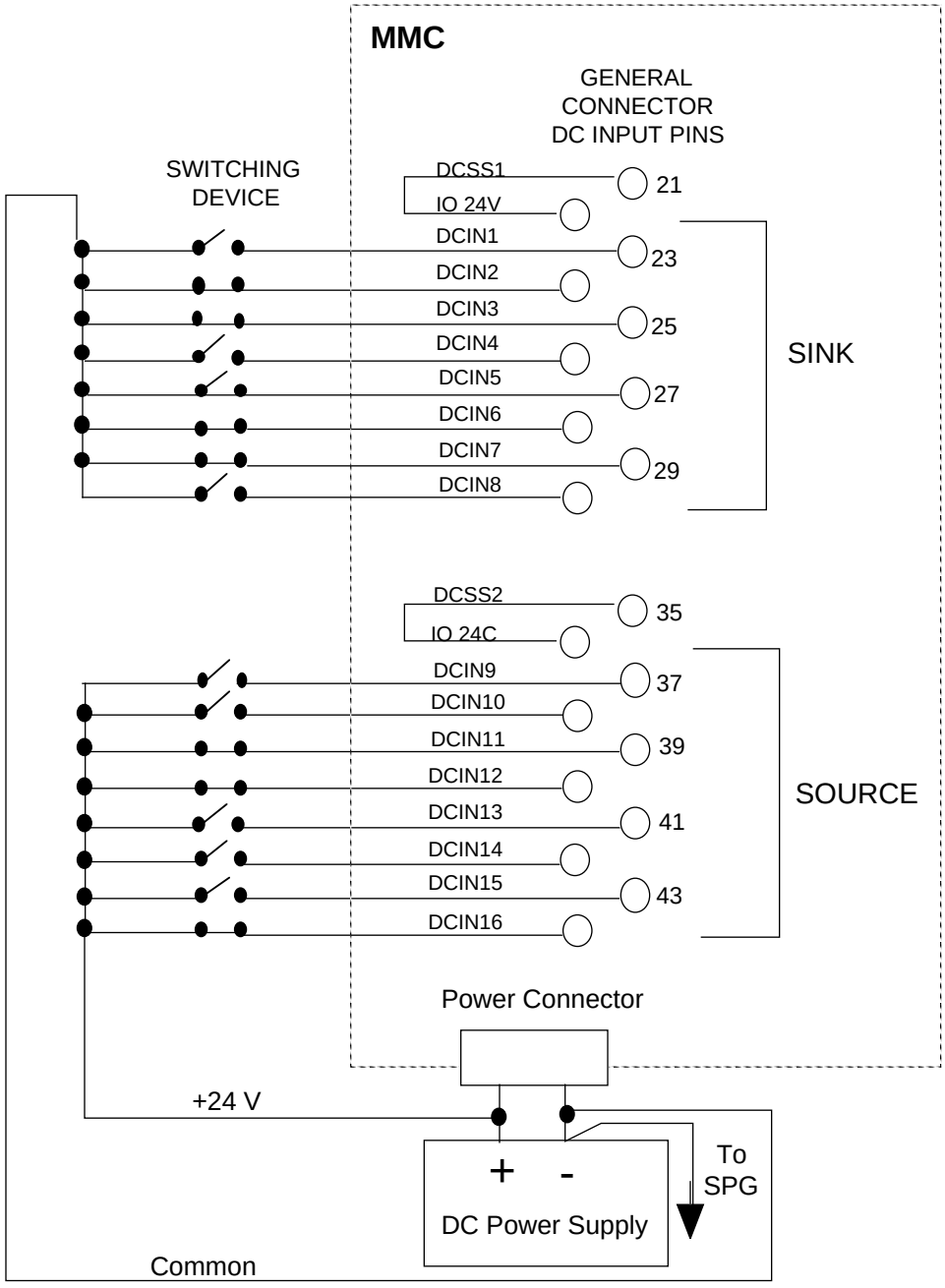
Figure 9. General Outputs Connected to Loads



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There are 16 general inputs on the general connector. The inputs are configured as two groups of eight. Each group can be configured as sourcing or sinking. Connect the DCSS pin to +24 V for a sourcing configuration. Connect the DCSS pin to COM for a sinking configuration. You can use the internal +24 V supply. See Figure 10 below.

Figure 10. Sink/Source General Input Configuration

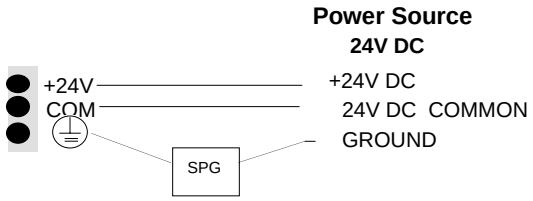


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Power Connection

You must provide a +24 VDC power supply as the power source for the MMC. The power supply screw terminal connection (3 pin) is at the bottom of the CPU section of the MMC. This +24 V appears as an output at several points on the MMC connectors. See Figure 11 below.

Figure 11. Pin Out for the 3-pin Power Supply Screw Terminal Connection



The 24 VDC applied at the MMC input power connector is also available:

- To power the DC outputs
- To power the sink/source inputs
- To power the axes interface
- To power the optional Ethernet or DeviceNet modules

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There are five connectors on the MMC analog module.

Axis Connectors

Each axis has its own 15 pin high density D connector. Each axis connector provides the following signal connections:

- One 16-bit resolution analog output (±10 VDC)
- One quadrature, incremental encoder input
- Two DC outputs (24 VDC sink or source)
- One DC input (24 VDC sink or source)
- +24 VDC output

These signals are typically connected to the drive as shown below.

MMC Axis Signal	Connection
Analog output	Drive command
Encoder input	Drive encoder output
DC output 1	Drive enable input
DC output 2	Drive reset input
DC input 1	Drive fault output
DCOSS	+24V or COMMON (on MMC)

The axis connector pinout is listed below.

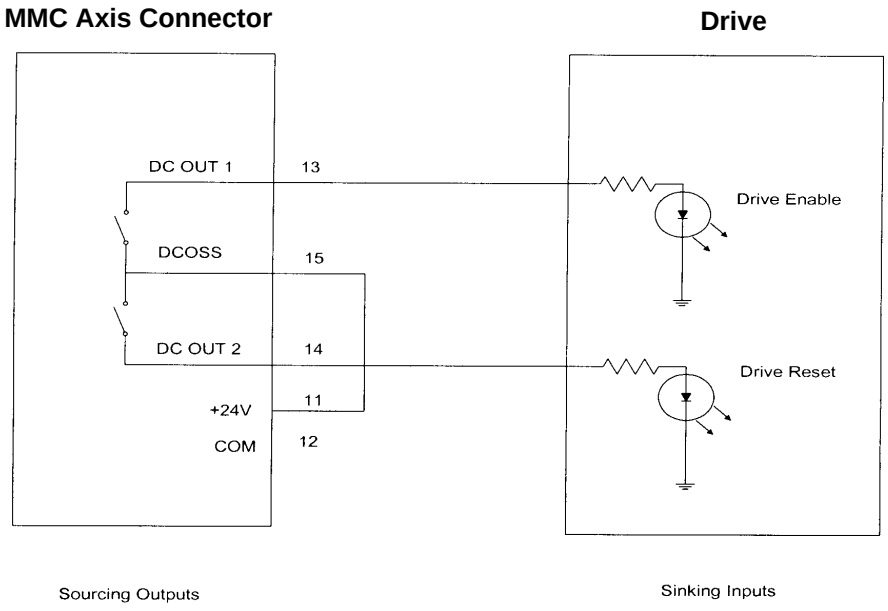
Pin	Description	Pin	Description
1	A	9	DA-
2	A/	10	I/
3	B	11	+24 VDC out
4	B/	12	COM
5	I	13	DCOUT1
6	DCIN+	14	DCOUT2
7	DCIN-	15	DCOSS
8	DA+		

The metal shell of the 15-pin connector is tied to the chassis ground terminal on the MMC power connector. Cables provided by Giddings & Lewis will have the shield connected to the metal shell of the cable connector. If you use other cables, be sure to connect the shield to the metal shell of the connector.

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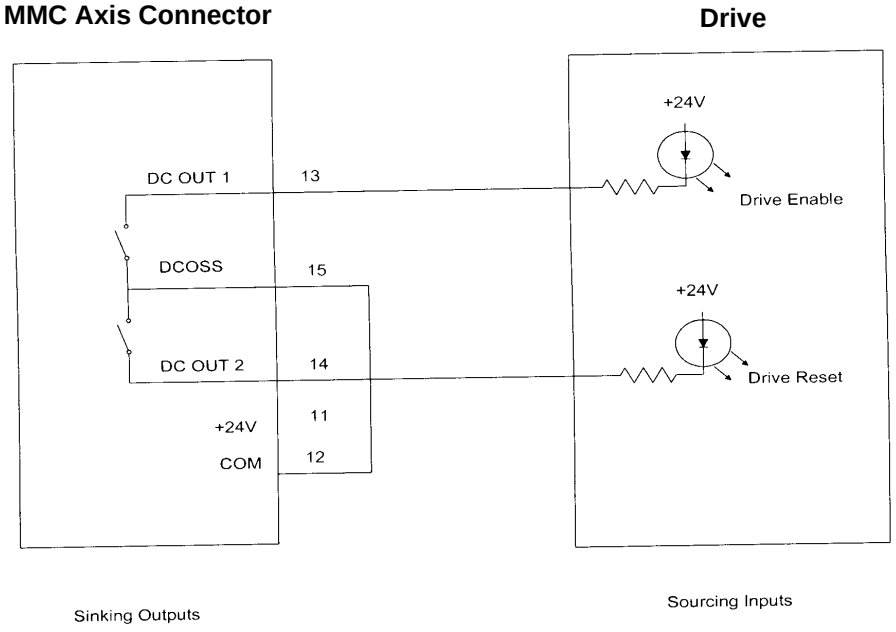
The DC outputs can be configured for either sink or source operation. When the DCOSS pin is tied to the +24V, the outputs will be in a source configuration. See Figure 12 below.

Figure 12. Source Configuration



When the DCOSS pin is tied to COMMON, the outputs will be in a sink configuration. See Figure 13 below.

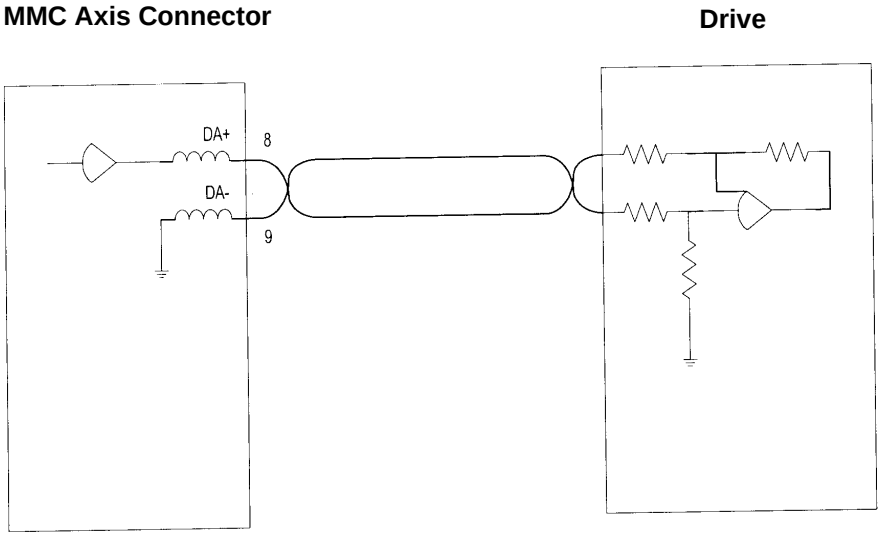
Figure 13. Sink Configuration



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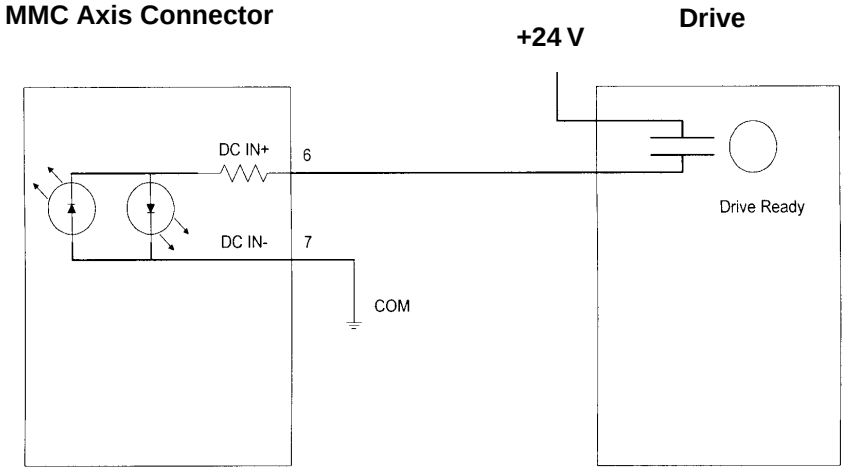
The analog output is connected to the drive command input. Twisted pair wire should be used to make the connection between the analog output and the drive. See Figure 14 below.

Figure 14. Axis Analog Output Connected to Drive Command Input



Drives will typically have an output signal indicating that the drive is operational. This "drive ready" signal can be connected to the Axis DC Input. One of the input pins should be connected to either +24 V or COM. The remaining input pin should be tied to the input signal that will be switching. See Figure 15 below.

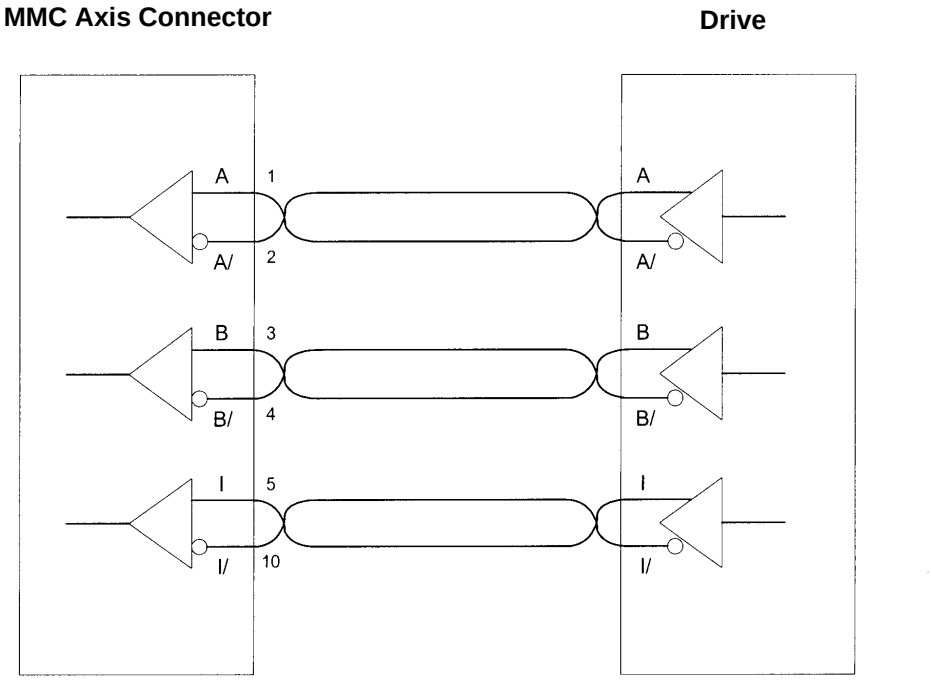
Figure 15. Axis DC Input Connected to Drive Ready



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The encoder output signals from the drive should be connected to the encoder input on each axis. The MMC analog section accepts RS422 level differential inputs. The encoder signals should be quadrature type. All encoder wiring between the MMC and the drive should be shielded twisted pair. NOTE: The encoder input on the auxiliary connector is identical to the encoder inputs on the axis connectors. See Figure 16 below.

Figure 16. MMC Encoder Inputs Connected to Drive Encoder Outputs



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Auxiliary I/O Connector

The auxiliary I/O 44-pin connector provides the following inputs:

- One quadrature, incremental encoder channel (1 Mhz frequency, RS422 interface)
- Five fast DC inputs (one per encoder input) for high speed position latching)
- One 12-bit resolution analog input channel
- 12 optically isolated DC inputs
- +24 VDC output
- +5 VDC output
- Seven Shields

The auxiliary I/O connector pinout for the MMC-A4 (4 axes) is listed below.

Pin	Description	Pin	Description	Pin	Description
1	A	16	FASTIN1+	31	DCSSA
2	A/	17	FASTIN1-	32	DCIN1
3	B	18	SHIELD	33	DCIN2
4	B/	19	FASTIN2+	34	DCIN3
5	I	20	FASTIN2-	35	DCIN4
6	I/	21	SHIELD	36	DCIN5
7	SHIELD	22	FASTIN3+	37	DCIN6
8	+24 VDC out	23	FASTIN3-	38	DCSSB
9	+24 VDC out	24	SHIELD	39	DCIN7
10	COM	25	FASTIN4+	40	DCIN8
11	COM	26	FASTIN4-	41	DCIN9
12	+5 VDC out	27	SHIELD	42	DCIN10
13	ANLGIN+	28	FASTIN5+	43	DCIN11
14	ANLGIN-	29	FASTIN5-	44	DCIN12
15	SHIELD	30	SHIELD		

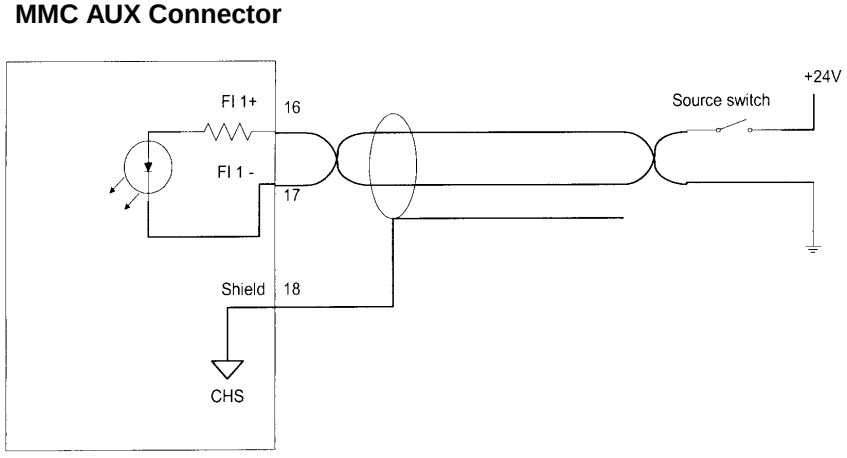
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The auxiliary I/O connector pinout for the MMC-A2 (2 axes) is listed below

Pin	Description	Pin	Description	Pin	Description
1	A	16	FASTIN1+	31	DCSSA
2	A/	17	FASTIN1-	32	DCIN1
3	B	18	SHIELD	33	DCIN2
4	B/	19	FASTIN2+	34	DCIN3
5	I	20	FASTIN2-	35	DCIN4
6	I/	21	SHIELD	36	DCIN5
7	SHIELD	22	NC	37	DCIN6
8	+24 VDC out	23	NC	38	NC
9	+24 VDC out	24	SHIELD	39	NC
10	COM	25	NC	40	NC
11	COM	26	NC	41	NC
12	+5 VDC out	27	SHIELD	42	NC
13	ANLGIN+	28	FASTIN5+	43	NC
14	ANLGIN-	29	FASTIN5-	44	NC
15	SHIELD	30	SHIELD		

Each encoder channel has a fast DC input associated with it. The fast input can be used to latch the encoder position. Shielded twisted pair wiring should be used for all fast input connections. The fast inputs can be connected in either a source or sink configuration. The source configuration is illustrated here. See Figure 17 below.

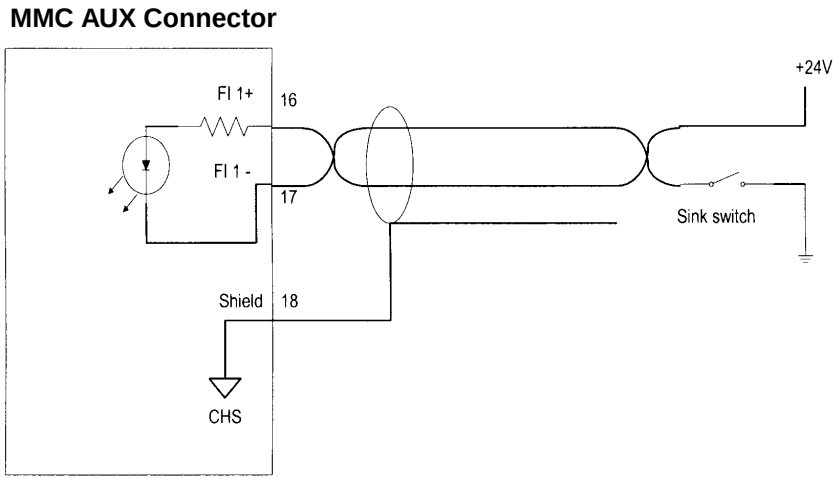
Figure 17. Fast Inputs Connected Using Shielded Twisted Pair (Source)



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The fast input sink configuration is illustrated. See Figure 18 below.

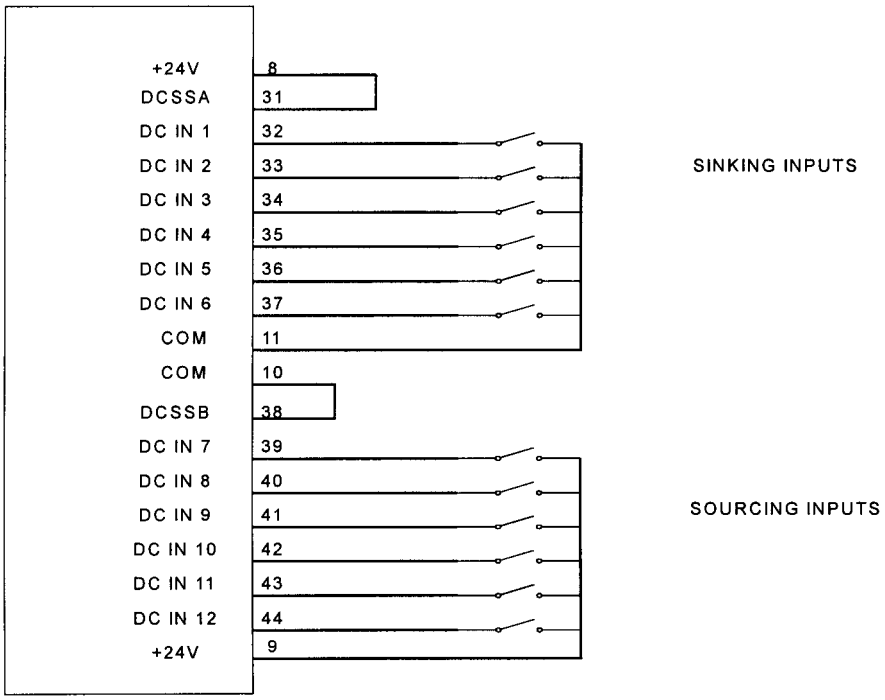
Figure 18. Fast Inputs Connected Using Shielded Twisted Pair (Sink)



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There are 12 general purpose inputs on the auxiliary connector. The inputs are configured as two groups of six. Each group can be configured as sourcing or sinking. Connect the DCSS pin to +24 V for a sourcing configuration. Connect the DCSS pin to COM for a sinking configuration. You can use the internal +24 V supply. See Figure 19 below. The 12 inputs are available on the four axis MMC. The two axis MMC has six inputs. See the pinouts on pages 39 and 40 for those connections.

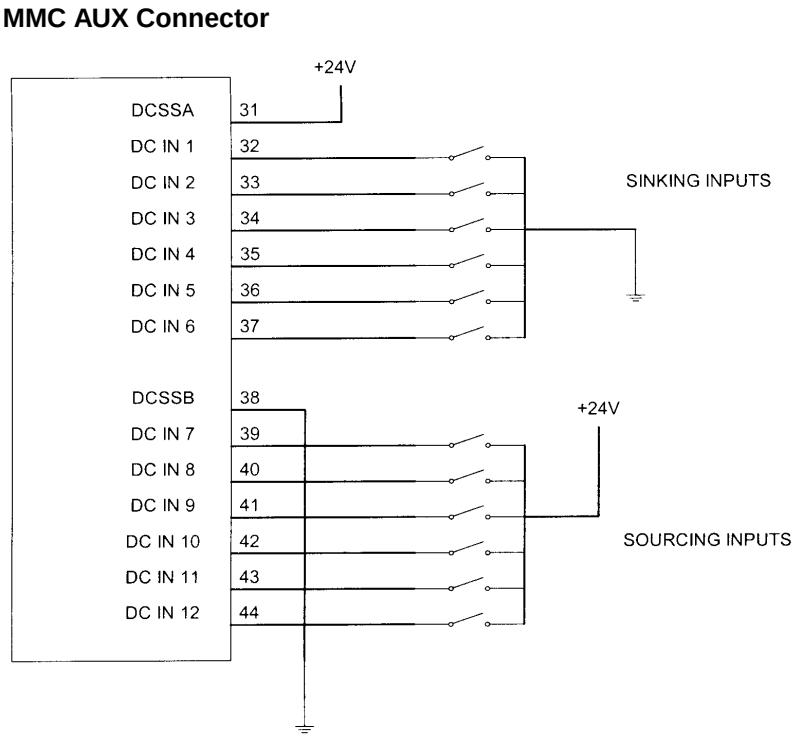
Figure 19. Sink/Source Connections using Internal +24 V Supply (4-Axis MMC)



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Or you can use an external +24 V supply. See Figure 20 below.

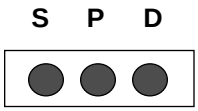
Figure 20. Sink/Source Connections using an External DC Supply (4-Axis MMC)



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There are three LEDs on the top of the CPU section of the MMC.

Figure 21. LEDs



Below is a list of the LEDs and what they mean.

Scan (S) Green	
ON	The processor is executing the application program.
OFF	Scan is lost and there is an orderly shut down procedure followed.
Power/Battery (P) Green	
ON	Power is on to the system and the battery is OK. It indicates that the on-board +5 VDC supply is within tolerance.
OFF	Power is off.
Flashing	Power is on to the system (+5 V supply is OK) but the battery is bad. Replace lithium battery. See replacement procedure that follows.
Diagnostic (D) Yellow	
ON	On briefly during startup diagnostics. If it remains ON, module has failed startup diagnostics.
OFF	Normal operation
Flashing	Flashes error codes (listed below) under certain conditions.

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Diagnostic Error Codes

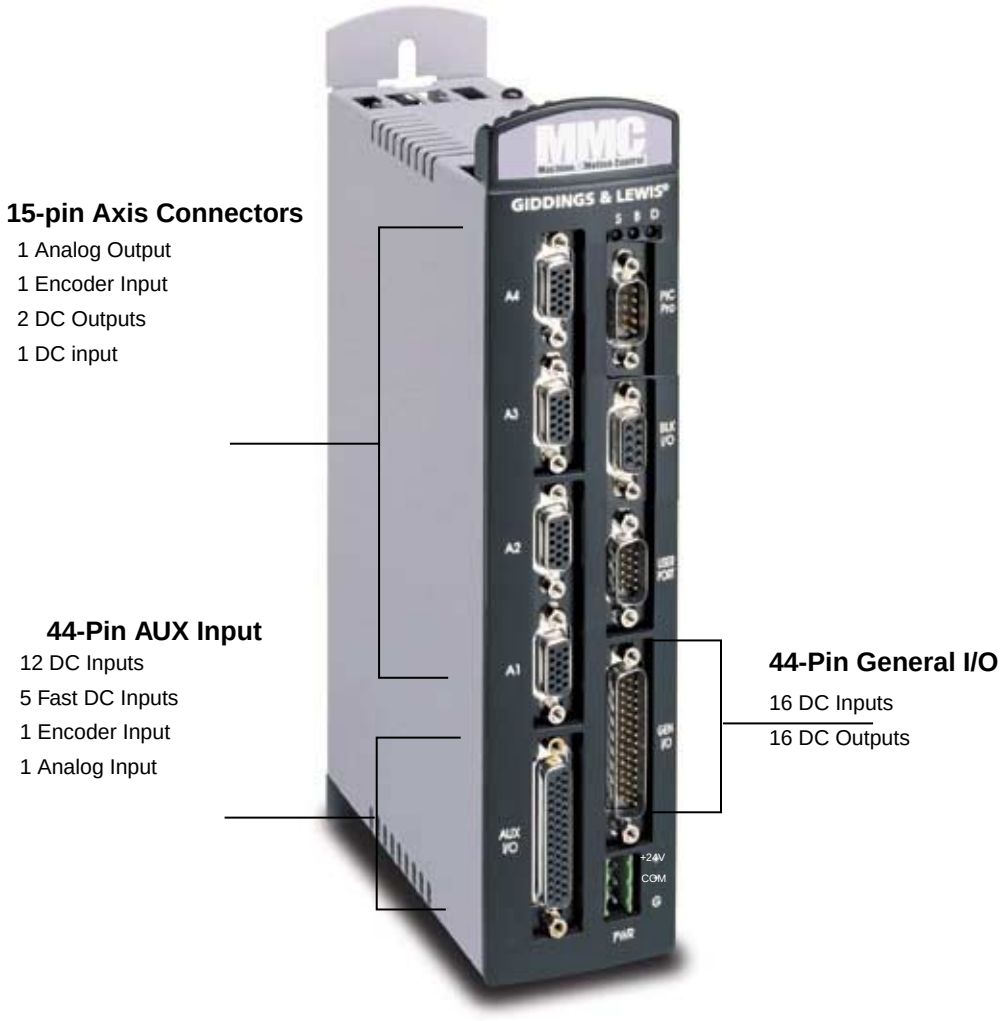
While the MMC is running, the DIAG LED on the CPU module will flash a three digit code signal if there is an error. For example, if there is a long pause-flash-pause-flash-flash-pause-flash-flash-flash-long pause, the code is 123. The errors are described below.

Code	Error	Description
123	Scan too long	A ladder scan loss has occurred because the CPU takes more than 200 ms to scan the application program. Whenever the scan light is out, the discrete outputs go to the OFF state and the analog outputs are zeroed.
124	Excessive overhead	The system overhead update time is excessive.
125	Insufficient memory	There is insufficient memory on the CPU to run the current program.
126	No hardware bit memory	There is no bit memory installed on the CPU and the program requires it.
127	No software bit memory	There is no bit memory capability via software and the program requires it.
222	Driver error	No driver support on the CPU for the I/O module. Update your system EPROMs.
22_	Master rack error	The I/O modules in the master rack do not match what was declared in the hardware master declaration table. The number of flashes in the third digit (_) identifies the slot number that is in error.
232	Communications error	A failure has occurred in remote I/O communications.
3_ _	Expansion rack error	The I/O modules in the block I/O modules do not match what was declared in the expansion hardware declaration table. **For block I/O modules:** The number of flashes in the second and third digits indicates the block I/O module (01 through 77). The second digit will flash a 1 - 7, 10 for 0. The third digit will flash a 1 - 9, 10 for 0. For example, if the second digit flashes **3** times and the third digit flashes **10** times, the module is **30**.

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This section covers the theories of operation for the MMC.

Figure 22. Locations of Input, Output, Encoder Pins on the MMC-A4 Unit



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The MMC converts input power into DC power at voltages of + 5V, + 15 V, and - 15 V and supplies them to the logic side of the system.The same supply that powers the MMC can be used for the fieldside of the system. Optionally, an external power supply (or supplies) can be used for the field side of the system. Such supplies are not routed through the MMC, but they should all have the same power cut-off switch as the MMC.

CAUTION

Always shut off power at the main disconnect switch before you begin to work on the MMC.

The MMC does the following:

- Performs diagnostic tests.
- Checks the battery.
- Performs routine maintenance tasks.
- Executes the application program.
- Communicates with the I/O.
- Maintains communication with the workstation through the PiCPro port.
- Maintains communication with the user interface device through the user port. (Details for this communication depend partly on the type of interface device. Refer to the manual that comes with the device.)
- Provides block I/O capability.

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Application in Flash

The MMC has a flash chip on board that allows you to load an application program into it. This is standard on the MMC. Having the application in the standard flash chip ensures that you will not lose the application if the battery fails. On power up, the application is transferred from the flash chip to RAM as it is when directly downloaded from PiCPro.

To place the application in flash:

1. Compile the application into a hex file in PiCPro.
2. Use the Download Hex command in PiCPro to download the application into flash.

Even though you have placed an application in flash, you can still download and run a different application from PiCPro. However, when you cycle power on the MMC, the application in flash will always be placed into RAM.

General I/O Output Theory of Operation

Each of the 16 outputs on the general I/O connector is a solid state switch rated at .250 A. It turns on or off according to the logic state sent to it by the CPU. If the CPU sends it a logic 1, the switch closes and the device is powered. If the CPU sends a logic 0, the switch opens and power to the device is cut off. The CPU updates the logic state for each switch every time it scans the program.

The logic side of the switch is optically isolated from the field side. If you need to know whether voltage is actually present at the field side, use a voltmeter.

There are two groups of eight outputs: group A = output 1 through output 8, group B = output 9 through output 16. Each group is capable of detecting a short circuit condition. When a short circuit condition is sensed, all outputs in the group are turned off and remain off for approximately 100 ms regardless of ladder activity. After 100 ms, the ladder again controls the outputs. In addition, each output is protected with internal clamping diodes. Without clamping, high voltage transients (kickback) from inductive loads might damage the module.

Protecting from an Inductive Load

Resistive and inductive loads can be connected to the MMC General outputs and controlled by the system with no precautions other than making sure they have a connection to the common of the DC power supply.

Inductive loads have an electrical "kickback" when current is stopped. This can damage or destroy the output switching device. Each output has a diode through which reverse current can be safely routed.

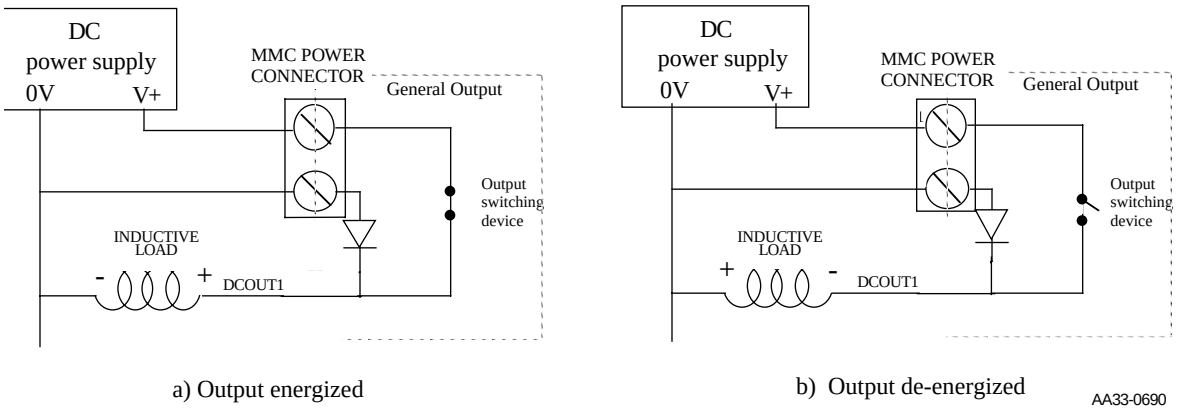
The internal diode works with an inductive load. When an output is energized, represented by a closed switch, current passes through the load into the common

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line. When the output is de-energized, represented by an open switch, current stops and the inductive field collapses. The state of the outputs is controlled by the CPU. This creates a reverse voltage across the load called "kickback" which tries to continue the current. The voltage is in series with the DC power supply. The combined voltage appears across the output switching device in the module.

If this were the only path available, voltage across the device would peak at several hundred volts. The internal diode provides another path for current. This limits the peak reverse voltage across the load to less than 1 V. Every switch has this protection so you can connect an inductive load to any point.

Figure 23. Diagram of Internal Protection for Inductive Loads



a) Output energized

b) Output de-energized

AA33-0690

Analog Output Theory of Operation (Axis Connectors)

The CPU sends the analog output section a 16-bit digital word for each analog output channel used. Each digital word is converted to a corresponding voltage within the range of ±10 V. The voltage is buffered and brought out to a pair of I/O connections as a differential type voltage output. This output is less subject to interference from electrical noise than a single-ended output would be.

You can adjust each analog output channel in software for offset adjustments, gain scaling, and unipolar outputs.

For safety reasons, all outputs are automatically reset to 0 V when a scan loss condition occurs.

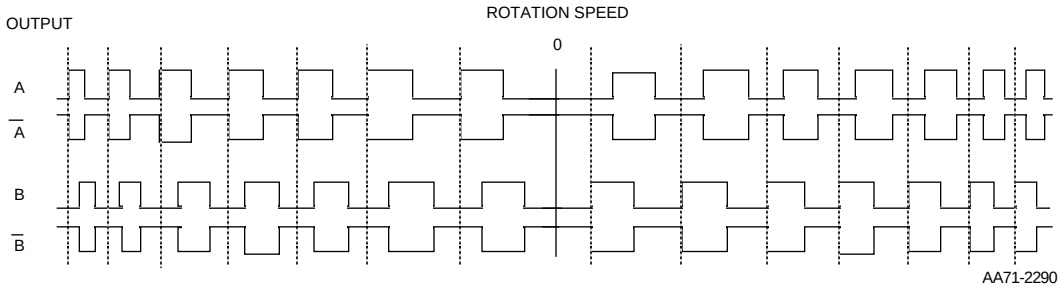
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The encoder section uses differential type inputs to interface with up to five independent incremental encoders. These inputs accept RS422 level quadrature signals.

A *quadrature encoder* sends square wave type signals. When the shaft rotates at a constant velocity, the A and B outputs are square waves and are at the same frequency. However they are out of phase with each other by 90°. When the encoder shaft rotates in one direction, each A pulse leads the corresponding B pulse by 90°. When it rotates the other direction each A pulse lags its B pulse by 90°.

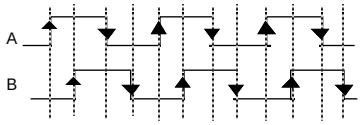
The signals illustrated in Figure 21 indicate that the encoder shaft rotates in one direction at first. Its speed of rotation decreases to 0 and then it starts rotating the other direction. The signals are shown as differential. $\overline{A}$ is the inverse of the signal A and $\overline{B}$ is the inverse of signal B.

Figure 24. Signals Transmitted by a Quadrature Encoder with Differential Outputs



The maximum input frequency is 250,000 lines per second, which results in 1,000,000 Feedback Units (FUs) per second.

Figure 25. Counting Quadrature Pulses



The module counts positive and negative transitions at both channel A and channel B. One quadrature cycle in this case gives 4 Feedback Units.

There is a 24-bit up/down counter for each channel. It is incremented or decremented on each A, B edge. There is also a 24-bit latch associated with each encoder channel.

The module can be programmed so that the counter value is "latched" or stored under one of these conditions:

- an index pulse from the encoder
- a positive or negative transition of the fast input
- the next index pulse after the required transition of the fast input

Each of the five 24-bit latches has a *fast 24 VDC input* associated with it. Each input is optically isolated. This input is intended to receive a signal from a device

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other than an encoder. It is typically used for referencing or synchronization purposes.

Fast input characteristics include:

- the detection of a signal occurs faster than it does for the DC inputs in other modules, due to less filtering. Because of this there is also less noise immunity.
- the response to a fast input signal is independent of ladder scan time. The module can be programmed to latch a position count as soon as this input is detected.

Analog Input Theory of Operation (AUX Connector)

There is one differential analog input channel on this module. The input range is ±10 VDC. The analog input voltage is sampled every 100 µsec by a 12-bit A/D converter. The most recent conversion result is stored in an on-board register. This register can be read at any time by the CPU.

The analog input signal passes through a common mode and differential mode filter prior to being applied to the A/D converter. These filters improve the noise immunity of the module.

DC Output Theory of Operation (Axis Connector)

Each axis output is an optically isolated solid state switch. It turns on or off according to the logic state sent to it by the CPU. When the switch turns on, current flows through the switch. When the switch turns off, current flow stops.

These outputs are intended to interface with the drive enable and drive reset inputs. When an output is turned on current can flow through the switch in either direction. This allows the outputs to be connected in a sink or source configuration.

For safety reasons, all outputs turn off (no current flow) when a scan loss condition occurs.

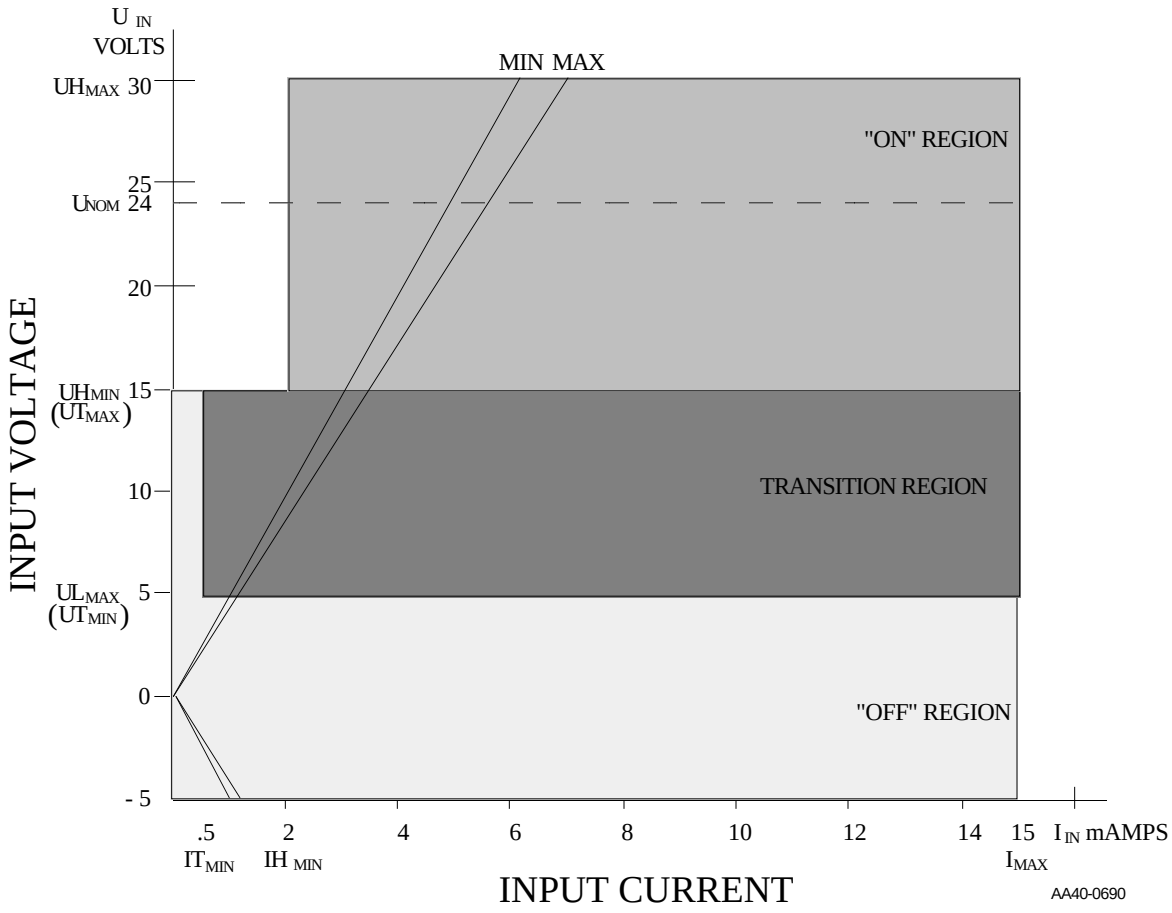
DC Input Theory of Operation (Axis, AUX, and General Connectors)

Each input is guaranteed "on" at 14 to 30 VDC and guaranteed "off" at 0 to 5 VDC; polarity doesn't matter. Its on/off state is converted to a corresponding logic 1 or 0. This logic state is transmitted through the system bus to the CPU module, where the processor uses it as data in the ladder program. The logic side of the input is optically isolated from the field side.

The shaded blocks in the figure that follows show the limits specified by the IEC. The lines show the maximum and minimum V/I of the inputs in this module. The voltage/current curve in this graph shows that the input module is well within the IEC Type 1 limits.

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Figure 26. Input Characteristics Compared to IEC Standards



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IMPORTANT

Switching devices can sometimes have a leakage current that exceeds the IT_{min} (current allowed when off) of an input module. In order to use such a device, an impedance (typically, a resistor) needs to be used in parallel with the input.

For example, some of the newer proximity switches use two wires instead of three. The third wire was used for a power or ground line. Without the third wire, the switch is easier to install. However, it requires more leakage current in the off state to power its internal circuitry.

As a conservative estimate, use the following formula to calculate an external resistance value. It keeps the input voltage at or below 2.4V when the switching device is in the "off" state.

$$\frac{2.4V}{\text{Switch Leakage} - 0.75mA} \geq R$$

If the switch leakage specification is ≤ 1.7 mA, then:

$$\frac{2.4V}{1.7 - 0.75mA} \geq 2.5K\Omega$$

Use a resistor less than or equal to 2.5 K Ω. Be sure that the wattage is adequate for the resistor when the switching device is in the "on" state remembering that:

$$P = \frac{V^2}{R}$$

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Follow the procedure below to replace the MMC battery when the "P" LED is flashing.

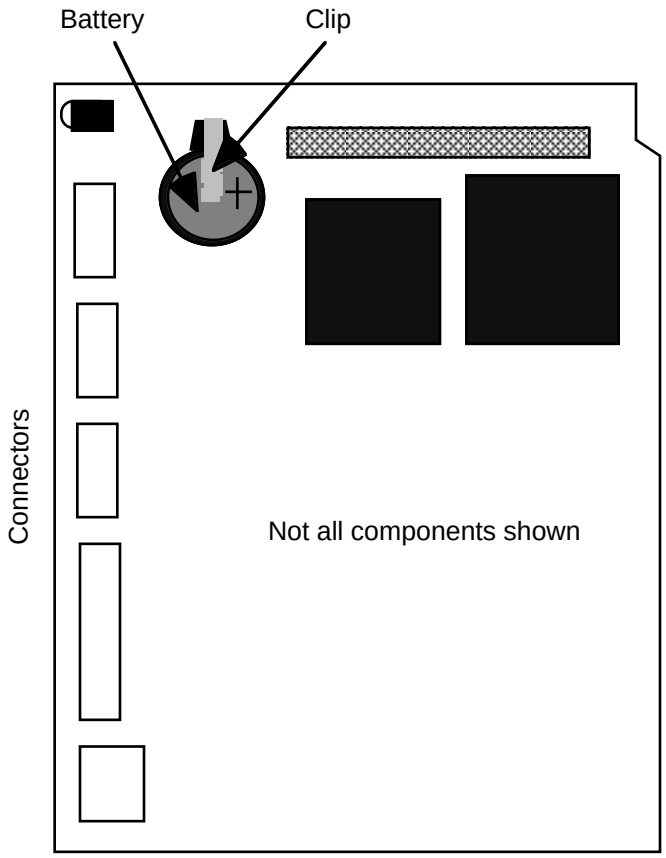
1. After DC power has been applied to the MMC for at least five minutes, turn off power. This ensures that the contents of memory will not be lost while the battery is removed. Disconnect the input power connector from the MMC.
2. Remove the MMC (including any optional modules) from the cabinet.
3. Use a static-free work surface if possible. Ground yourself using a properly grounded wrist strap before you open the case. These are standard precautions before handling any electronics component.
4. Lay the MMC system on the work surface. If there are no optional modules attached, remove the cover by removing the five screws , two on top, two on the bottom, and one on the right side of the MMC.
   If there are one or more optional modules attached, remove the four screws that attach the first optional module and remove the MMC from the optional modules.

WARNING
DO NOT touch any of the capacitors. Do not touch the pins on any of the ICs; even with precautions against static you may destroy the circuitry.

5. Use Figure 27 to locate the battery. Note how it is oriented.

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Figure 27. Battery Location in MMC



6. Use a screwdriver to gently pry up the battery clip. Slide the battery out. Replace it with a 3V coin cell, BR2032 battery, + side up.
7. Screw the cover or optional modules back on. Return the MMC to the cabinet. Connect the power cable. Turn on power and check the LEDs.

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Specification Table

Characteristic	MMC specifications										
	Part Number	Speed	App Mem	RAM Mem	User Mem	8 ms	4 ms	2 ms	1 ms	.5 ms	.25 ms
Models available						Number of servo axes available at six update rates*					
MMC-A2	503-26606-21	32 MHz	256K	128K	64K	4	4	4	4	2	1
MMC-A4	503-26606-41	32 MHz	256K	128K	64K	4	4	4	4	2	1
MMC-S8	503-26606-00	32 MHz	256K	128K	64K	NA	NA	NA	NA	NA	NA

*Consult Giddings & Lewis for assistance if you want to exceed the number of axes in this chart.

CPU	32 bit RISC processor with numeric coprocessor
Battery	3V Coin Cell, BR2032 lithium battery
CAUTION for Lithium Batteries Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the manufacturer. Dispose of used batterries according to the manufacturer's instructions.	
Flash Disk	2 Megabytes
Memory	1 Megabyte max.
PiCPro Port (to workstation)	RS232 serial port, secured protocol Software selectable baud rate to 57.6K
User Port (to serial interface device)	RS232/RS485 serial port Supports RTS/CTS hardware handshaking Software selectable baud rate to 19.2K
Input voltage	20 VDC to 30 VDC
Input power	250 mA plus I/O power
Time-of-day clock Clock tolerance	Access via PiCPro 10.2 and above or your application program At 25°C (77°F),±1 second per day Over temperature, voltage and aging variation, +2/-12 seconds per day
Operating temperature range	5°C to 55°C (41°F to 131°F)
Storage temperature range	-40°C to 85°C (-40°F to 185°F)

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Humidity	5 to 95%, non-condensing
CE Marked	Conforms to Directives 73/23/EEC, 89/336/EEC, 92/31/EEC, 93/68/EEC by conforming to the following standards: EN 50081-2:1993 EMC Generic Industrial Emissions EN 50082-2:1995 EMC Generic Industrial Immunity EN 61131-2:1994/A11:1996 Low voltage directive requirements for programmable controllers Operates with emissions below EN55011/ CISPR 11 Class A limits Immune to: • Electrostatic discharge (4K V contact mode, 8K V air discharge) per EN61000-4-2 • RF electromagnetic fields per EN61000-4-3, ENV 50141, and ENV50204 • Electrical fast transients per EN61000-4-4 • Magnetic fields per EN61000-4-8 Refer to the EMC Guidelines for more information.
UL and C/UL Listed	In process
Physical size	2.25" wide x 9.6" high x 5.3" deep 57.15 mm x 243.84 mm x 134.62 mm
Analog Output	
Output channels	2 or 4
Resolution	16 bits
Output voltage range	±10 VDC
Maximum output current (1K Ω load)	±10 mA
Power on output voltage	0 V ±100 mV
Scan loss output voltage	0V ±100 mV
Accuracy	±0.375% of FSR Drift ± 50ppm/˚C
Update rate	68 µsec
Analog Input	
Input channel	1
Resolution	12 bits

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Input voltage range	±10 V
Accuracy	±0.2% of FSR
Sample rate	100 µsec
Common mode filter	3 dB @ 10 K Hz
Differential mode filter	3 dB @ 475 Hz
Encoder Input	
Input channels	3 or 5
Input receiver type	2632 differential RS422 type receiver
Encoder signals	Differential quadrature
Input threshold	±750 mV
Input termination	120 Ω
Maximum input voltage	5 V
Maximum A or B input frequency	250 K Hz (1 M feedback unit count rate)
Fast input voltage	Nominal 24 VDC, maximum 30 VDC
Guaranteed on voltage	15 VDC
Guaranteed off voltage	5 VDC
Turn on/off time	1 ms
General, Auxiliary and Axis DC Inputs	
Configuration	The general inputs are divided into two groups of eight . Each group can be configured for sourcing or sinking. The auxiliary inputs are divided into two groups of six inputs. Each group can be configured for sourcing or sinking. The axis inputs have one input per axis. Each input can be configured for sourcing or sinking. Operates with IEC Type 1 inputs (per IEC 1131=2).
Input voltage	Nominal 24 VDC, maximum 30 VDC
Guaranteed on voltage	15 VDC
Guaranteed off voltage	5 VDC
Turn on/off time	1 ms

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General DC Outputs	
Number of outputs	16 outputs
Input voltage	Nominal 24 VDC, 30 VDC maximum
Configuration	Two groups of eight solid-state switches.
Protection of logic circuits	Optical isolation between the logic and field side, transient suppression on the 24V external supply
Maximum current	.25 A per output
Voltage range	24 VDC nominal, 5 to 30 VDC
Switch characteristics	Solid-state switches
Time delay on for resistive loads	50 µsec max
Time delay off for resistive loads	50 µsec max
Leakage current in off state	0.5 mA max
Switch voltage, maximum ON	1 VDC max
Short circuit protection for each group	15 A (max) pulses for about 130 µsec every 100 msec until short is removed
Scan loss response	Outputs turn off
Axis DC Outputs	
Number of outputs	2 outputs per axis
Configuration	Each set of axis outputs can be configured as sourcing or sinking.
Maximum current	100 mA per output
Voltage range	24 VDC nominal, 5 to 30 VDC range
Scan loss response	Outputs turn off
Auxiliary DC Output	
+5 VDC	150 mA maximum current available. Connections to this point should be over short distances and away from electric noise signals.

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