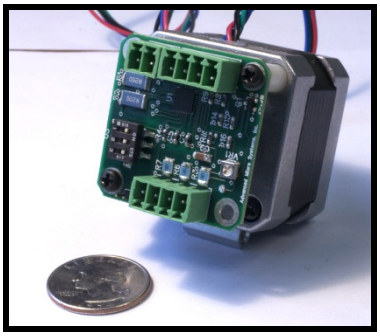
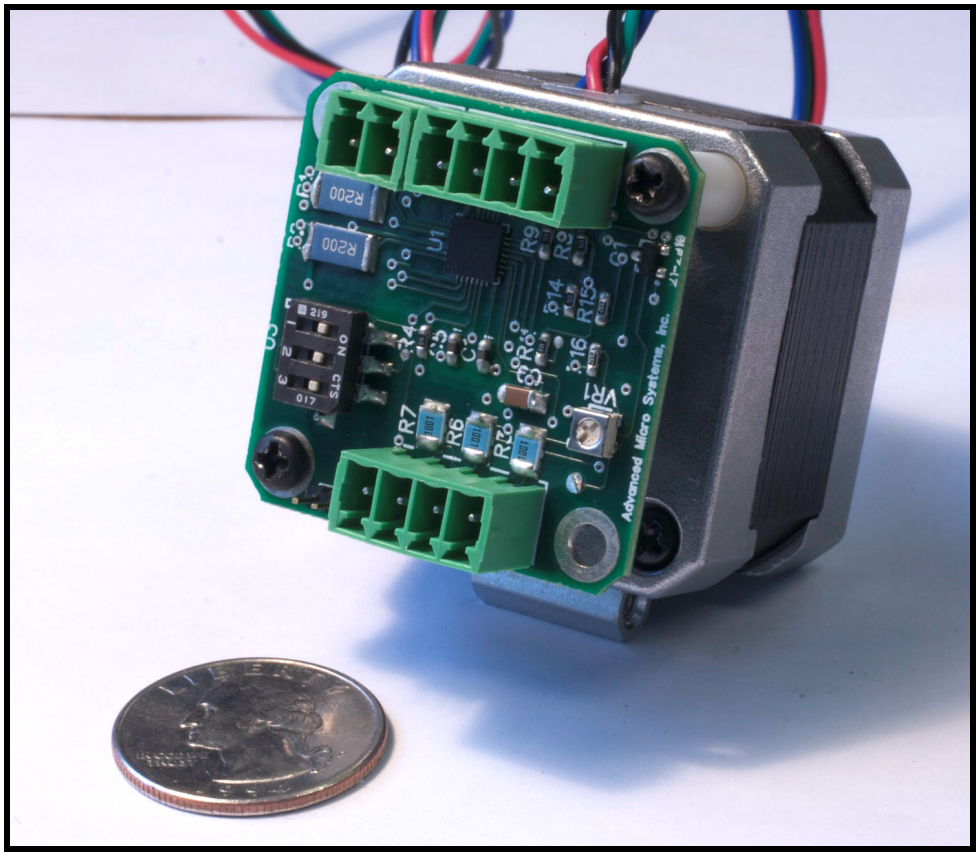


MMD-17
USERS GUIDE

Revision Date: 10/14/2011



Overview

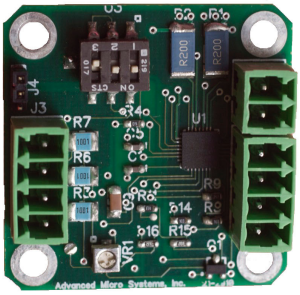
The MMD-17, one of Advanced Micro System's latest developments, represents a very compact drive that can be mounted directly onto NEMA17 motors.

MMD-17 Features:

- Single 8V – 35V input supply voltage range
- 0 to 1.5A phase current adjustable via potentiometer (shipping default is 0.8A)
- Full, 1/2, 1/4, 1/8, 1/16 step set by DIP switch
- Electrically isolated and optically coupled STEP, DIR & ENABLE inputs
- Control input voltage: 5-20V default or 10-30V for MMD-17-30V option
- Motor mountable
- Easy wire-up using the screw terminal connectors included with the drive
- No heat sink required
- Automatic current decay mode detection / selection

Included in the Box

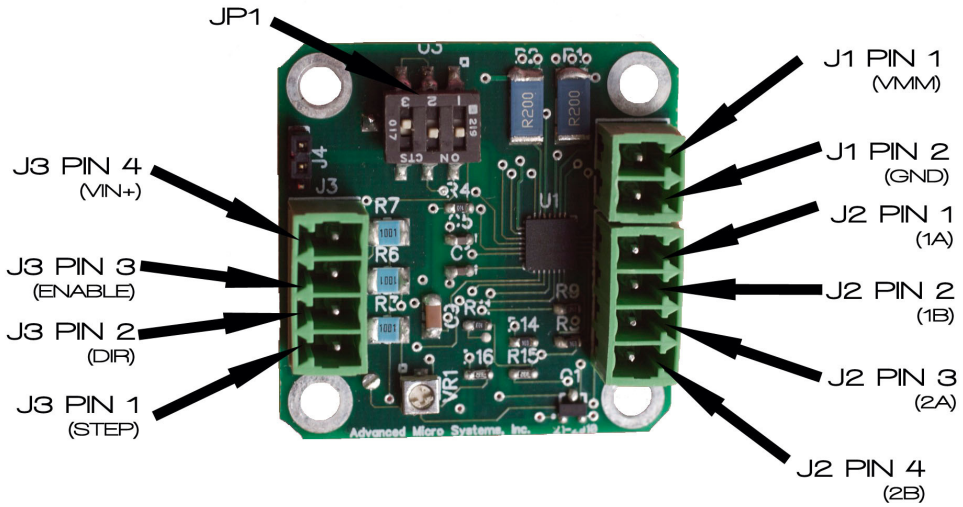
MMD-17 Drive:



Mating Connectors:

Pinout

The following picture shows the pins on the MMD-17 board:



Installation

The following installation procedure outlines the minimum steps required to make the MMD-17 operational:

1. Connect an 8VDC to 35VDC power supply to connector J1 (see diagram). Pin 1 needs to be connected to the positive voltage (VMM) and Pin 2 to Ground. The power supply must be capable of providing 1A to 2A of current depending on the supply voltage and current settings that you are planning to use. See section “Power Supply”.

2. With the power “Off” connect a motor to the four pins of J2 (see diagram). Typical motor connection diagrams are shown in the “Stepping Motors” section of this manual. Be sure to insulate all motor leads and unused leads (6 lead motor) to prevent shorts to ground or to each other.

3. Set the appropriate current value using the potentiometer (VR1). Turning the potentiometer clockwise decreases the current and counterclockwise increases the current. Be sure the current (output current) is set at a value that is consistent with the current rating of the motor. See also section “Setting the Output current”.

4. Wire in your step, direction, and driver enable signals as well as the positive reference voltage level of the signals (VIN+) to connector J3. See section “Control Input” of this manual for more details.

5. Set the resolution as desired using the DIP switches. See Section “Microstep Resolution” for more information.

6. Apply power to the MMD-17.

“Do’s, Don’ts and Important Notes”

Do not connect or disconnect the motor when power is “ON.“

The power supply voltage, including ripple and line voltage fluctuations must not exceed 35Vdc or be less than 8Vdc.

Make sure the motor to be used is compatible with the drive.

Power Supply

The MMD-17 is powered from a single unregulated DC power supply. The power supply is connected via pins 1 and 2 of the J1 Connector. The input voltage must be in the range of 8VDC to 35VDC.

Pin	Function
1	High voltage
2	Ground

Recommended Power Supply Circuit

In general, unregulated DC (or linear regulated) power supplies are best suited for stepper motor applications. Switching power supplies, which tend to be very cost efficient, are also suited for many stepper motor applications. However, their ability to provide surge currents is limited and may require additional capacitors to be added depending on your application.

A single power supply can be used for single axis configurations, or multiple axes, provided component values are scaled accordingly. Alternatively, individual axes can be supported by individual power supplies.

If multiple drivers are used with one power supply, each drive should have separate power and ground wires that connect directly to the output capacitor of the power supply.

For 1.5A of output phase current, we recommend a power supply with an output power of 27-30 Watts minimum. The required current output capability of the power supply will depend on the output voltage and can be calculated by dividing the above wattage by the output supply voltage. For example, when using a power supply with 24V a current capability of 1.25A will be sufficient (30W/24V). For lower output phase currents this rule scales linearly.

"Do's, Don'ts and Important Notes"

Individual axes should be independently fused for fault isolation.

The power supply voltage, including ripple and line voltage fluctuations must not exceed the peak rating of 35Vdc or be less than 8Vdc.

Do not connect or disconnect motor wires while power is applied.

Wire size used to connect the power source to the driver should be at least 18 gauge. Heavier wire should be used for longer distances between the power supply and the driver.

The power supply output current needed is dependent on the supply voltage, motor selection and load.

Stepping Motors

The MMD-17 is a bi-polar, chopper driver that works with both bi-polar and uni-polar motors, i.e. 8, 4 and 6 lead motors. It is also possible to half a 6 lead center tapped motor with the MMD-17, however the performance may be compromised. To avoid unstable chopping conditions and to provide a higher speed-performance ratio, a motor with a low winding inductance is preferred.

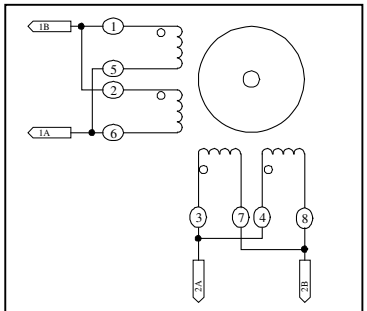
Drive Current

The ideal current for a given motor is based on the specific characteristics of the motor and the requirements of the application. As a result, establishing the correct current is often determined empirically. Insufficient current will result in inadequate torque and under utilization of the motor. Excessive current can cause high-speed torque ripple, resulting in stalling or pole slippage, over heating of the motor and general inefficiency of the system. Current setting procedures are described in the next section; "Setting The Output Current"

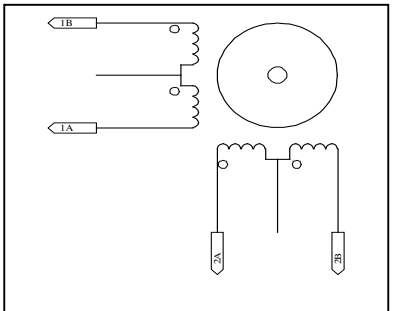
Connecting a Stepping Motor (J2 pins 1-4)

Pin #	Description	Function
1, 2	1A, 1B	Phase 1 of the Stepping Motor is connected between Pin 1 and 2 of J2.
3, 4	2A, 2B	Phase 2 of the Stepping Motor is connected between Pin 3 and 4 of J2.

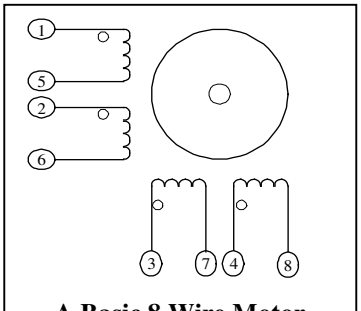
Typical 4, 6 and 8 lead motor configurations



4 Wire Parallel



6 Wire Motor



A Basic 8 Wire Motor

"Do's, Don'ts and Important Notes"

Do not connect or disconnect motor wires while power is supplied

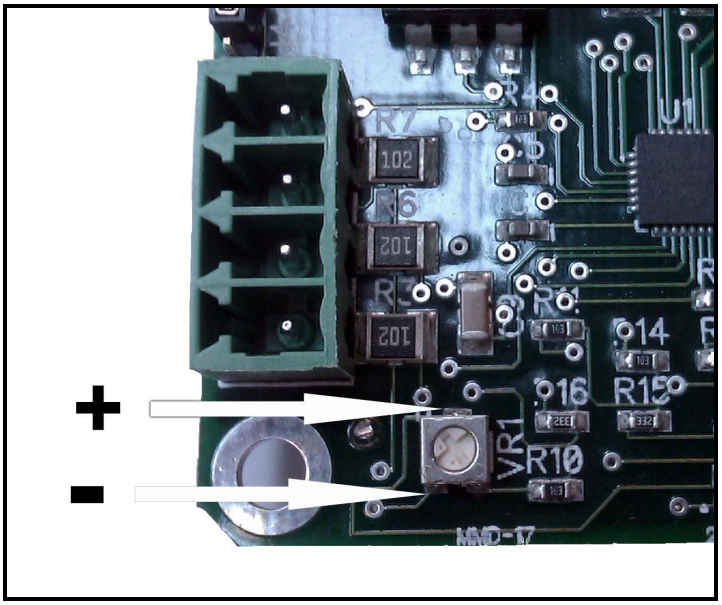
When using a 6 lead motor be sure to insulate/isolate unused wires.

The physical direction of the motor with respect to the direction input will depend on the connection of the motor windings. To reverse the direction of the motor with respect to the direction input, switch the wires on phase 1 or phase 2 of the outputs.

Setting the Output Current

The Potentiometer VR1 is used to set the MMD-17's maximum phase current. Turning the potentiometer clockwise reduces the current and counterclockwise increases the current. Be sure the output phase current is set at a value that is consistent with the current rating of the motor, meaning that your current setting may never be beyond the rated current of the motor. Minimum current is 0A, maximum current is 1.5A on V1.1 of the MMD17 (on the previous revision it was 1.8A).

Please see the section Set-up for Current Calibration on how to measure the actual phase current. Setting the current based on actual current measurements represents the most accurate method for current calibration. If desired, AMS will be happy to preset the products to the desired value prior to shipment at no charge. Unless requested otherwise, the current is set to 0.8A by the factory prior to shipment.



Alternatively, the current can also be adjusted based on a voltage measurement across 2 nodes of the potentiometer VR1 as shown above. The output current can be approximated based on the following formula:

output current [in A] = Voltage on potentiometer [in V] / 1.82

If neither the current measurement set-up or a voltmeter are available it is possible to perform an approximate current setting based on the angular setting of the potentiometer. The total angular range of the pot is 270˚ from end to end. The current increases linearly throughout the range of the potentiometer. Therefore, every 45˚ rotation will change the current by 0.25A. Due to imperfections and inaccuracies of the potentiometer this method will not yield as accurate settings as the alternative 2 methods described above.

The range of 0A to 1.5A may be used without the need for a heat sink. Comment regarding the MMD-17 version prior to V1.1: It is not recommended to operate the MMD-17 at a current setting beyond 1.5A to avoid overheating of the device. When the device overheats it will shut down temporarily and resume operation after the temperature goes below the threshold. Any steps issued to the unit during the shutdown period will be lost.

The Rule of Thumb is to set the output current just above the setting where reliable motion is achieved without excessive motor heating.

"Do's, Don'ts and Important Notes"

Apply minimal force when adjusting the potentiometer or you risk damaging it.

Using low power values may cause a slight change in the motor resting position.

Microstep Resolution (JP1)

The number of microsteps per full step is selected by the 3 DIP switches according to the below table. Note that the 'ON' position is labeled on the DIP switch unit.

Switch 1	Switch 2	Shunt 3	Resolution	Steps/Revolution (1.8˚ motor)
Off	Off	Off	Full	200
On	Off	Off	1/2	400
Off	On	Off	1/4	800
On	On	Off	1/8	1,600
On	On	On	1/16	3,200

**Factory default resolution is preset to ½ stepping.

Control Input

The control inputs are wired to J3. To create motor motion at least the STEP and VIN+ inputs need to be wired. Note that since the inputs are electrically isolated from the internal circuitry of the MMD-17, the high level voltage of the input signals needs to be provided as reference for the optocoupler circuitry. The low level does not need to be provided in addition.

Pin #	Name	Description
1	STEP	Stepping is triggered on every rising transition of the STEP input. Minimum duration of the high and low level is 1µs.
2	DIR	Direction signal. If unconnected a high level is assumed.
3	ENABLE	If left unconnected or supplied with a high level, the drive is enabled. A low level on this input will disable the drive.
4	VIN+	High level of input signals STEP / DIR / ENABLE. This is required as reference for the optocoupler circuitry.

For the allowable voltage range on the control inputs please see the section Electrical Specifications.

Electrical Specifications

Parameter	Min	Max	Unit
Supply Voltage	8	35	V (DC)
Output Current/Phase (PEAK)	0	1.5	A

Input Signals:

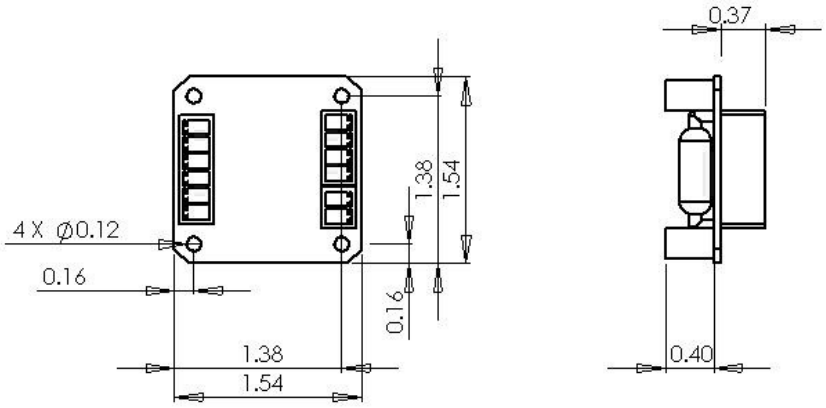
Signals	Min	Max	Unit
Frequency (limited by optocoupler)	0	500	kHz
High Input Voltage (for standard MMD-17 device)	5	20	V (DC)
High Input Voltage for MMD-17-30V device	10	30	V (DC)
High Input Current		0	mA
Low Input Current For 20V input high level For 5V input high level		 20 5	 mA mA
Low time / high time for STEP input	1		µs

A step sequence is triggered with the rising edge of the Step Input.

Thermal/Mechanical Specifications

Operating Temperature……0 to +50° C
Storage Temperature…… -40 to +125° C
Size……...1.55” x 1.55” x 1.1” including mating connector
Weight……..20g including mating connectors

Dimensions & Mounting



**Drawing shown with minimum 0.40” spacers (plastic) required for mounting drive on motor or panel
**See below for motor mounting instructions
**Mounting holes match NEMA 17 dimensions only

Motor Mounting

When mounting the MMD-17 onto a motor you will be required to replace the four machine screws that hold the motor together with longer screws. See the table below for suggested screws and lengths for usage with the AMS motors, if you are using a different brand motor refer to that manufacturers information.

AMS Motor	Machine Screw Required	Length (mm)
BM17-30-S	M3-0.5	40
BM17-50-S	M3-0.5	45
BM17-61-S	M3-0.5	55

**When selecting the type of machine screw, it is critical that the bottom side of the head of the screw is flat and not tapered.
***When removing the screws from any stepper motor use extreme caution and do not completely disassemble the motor. In doing so you can potentially damage the motor and void the warranty.

Decay Modes / Off-Time Settings

The Decay mode / Off-time can be set via a jumper provided with the MMD-17.

By default when shipped, the jumper is mounted such that it connects pins 2 and 3. In this case the off-time is set to 30µs and the decay mode is set to automatic mixed decay. Only exception is the full step mode in which decay mode is set to slow decay. This setting is convenient for many load situations because it minimizes ripple when the current rises and prevents missed steps when the current is falling.

In some situations, especially where microstepping at very low steps is being performed it may be advantages to use the mixed decay mode all of the time for both increasing and decreasing currents, except in full step mode where it is set to slow decay mode. This setting helps to prevent missed steps. The jumper needs to be inserted between pins 1 and 2 to activate this setting. The off-time is 30µs in this mode.

A third setting can be enabled by removing the jumper entirely. In this case, the off-time is set to 12µs.

Design Tips

EMI (electromagnetic interference or electrical noise) can be a major source of problems when integrating power drivers with microprocessor based devices. EMI is typically generated through ground loops and AC power line disturbances. External devices such as, relays, coils, solenoids, arc welders, motors, drivers, and other computer-based equipment are also sources of EMI.

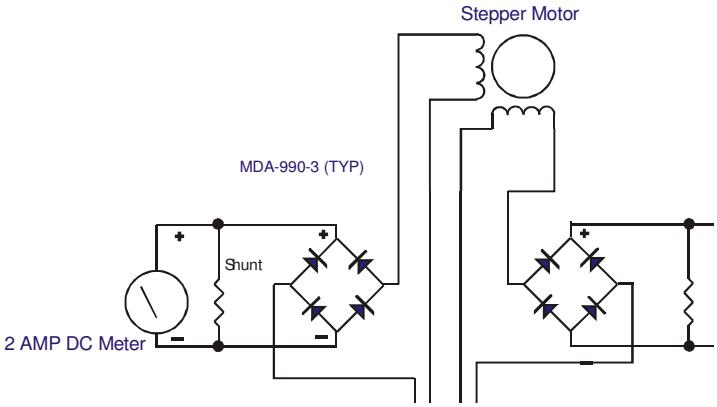
The following design tips will help to prevent EMI from interfering with the system operation:

- Shield the driver and wiring by mounting it in its own metal enclosure as far away from noise sources as possible.
- Ground motor shields only at the driver end.
- Make sure that all power wiring (motor, AC, etc.) is away from the signal wiring (I/O, communications lines, etc.).
- Mechanical grounds should all be tied to Earth at a single point. Chassis and motor grounds should be tied to the frame and the frame to Earth.
- Ground all signal wiring to one point.
- Use solid-state relays or opto isolators whenever possible to isolate remote signals. Suppress all mechanical relays with capacitors or MOV's.
- Use shielded, twisted pair cables for the motor, I/O and communications wiring.

Set-up for Current Calibration

The following is the basic setup and diagram for 2 phase current measurement:

A. The Amp meter can be digital or (preferably) analog.
B. The bridge rectifier must be rated above the maximum expected voltage and current.
C. A small capacitor (filter) may be needed across the meter.
D. A single meter circuit can be used, but two meters will indicate proper operation.
E. Additional meter protection circuitry may be desired (not shown).



********** WARNING **********

LIVE CONNECTING/DISCONNECTING MOTORS WILL CAUSE DAMAGE THAT IS NOT COVERED BY WARRANTY.

General Procedure for all Methods

Assume a 1A bipolar motor (4 wire, parallel connection). Before proceeding, make sure the power is off and let any residual power supply capacitors discharge whenever motor circuits are connected or disconnected.

1. Set the MMD-17 to half step mode
2. Adjust the output current to zero using the potentiometer VR1 by turning it carefully in the clockwise direction.
3. Connect an amp meter(s) and motor as shown above.
4. Apply power.
5. Increase the current setting until some amperage reading is obtained. Do not exceed the current rating of the motor
6. Issue multiple individual steps ("+1" or "-1" command if you are using an AMS controller), you will then see the current on the amp meter increase/decrease with every step. For the final step below, make sure that you step to a point where the current is at its peak value
7. Now set the current using VR1 to the desired value

Contact AMS

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