IM483 & IM805
High Performance
Microstepping Drivers

INTELLIGENT MOTION SYSTEMS, INC.

by Schneider Electric

IM483 and IM805 Product Manual Changelog		
Date	Revision	Changes
01/25/2008	R012508	Redesign of Manual to integrate IM483 and IM805 into a single document.

IM483 and IM805 Product Manual

Revision R021708

Important information

The drive systems described here are products for general use that conform to the state of the art in technology and are designed to prevent any dangers. However, drives and drive controllers that are not specifically designed for safety functions are not approved for applications where the functioning of the drive could endanger persons. The possibility of unexpected or un-braked movements can never be totally excluded without additional safety equipment. For this reason personnel must never be in the danger zone of the drives unless additional suitable safety equipment prevents any personal danger. This applies to operation of the machine during production and also to all service and maintenance work on drives and the machine. The machine design must ensure personal safety. Suitable measures for prevention of property damage are also required.

Qualification of personnel

Only technicians who are familiar with and understand the contents of this manual and the other relevant documentation are authorized to work on and with this drive system. The technicians must be able to detect potential dangers that may be caused by setting parameters, changing parameter values and generally by the operation of mechanical, electrical and electronic equipment.

The technicians must have sufficient technical training, knowledge and experience to recognise and avoid dangers.

The technicians must be familiar with the relevant standards, regulations and safety regulations that must be observed when working on the drive system.

Intended Use

The drive systems described here are products for general use that conform to the state of the art in technology and are designed to prevent any dangers. However, drives and drive controllers that are not specifically designed for safety functions are not approved for applications where the functioning of the drive could endanger persons. The possibility of unexpected or unbraked movements can never be totally excluded without additional safety equipment.

For this reason personnel must never be in the danger zone of the drives unless additional suitable safety equipment prevents any personal danger. This applies to operation of the machine during production and also to all service and maintenance work on drives and the machine. The machine design must ensure personal safety. Suitable measures for prevention of property damage are also required.

In all cases the applicable safety regulations and the specified operating conditions, such as environmental conditions and specified technical data, must be observed.

The drive system must not be commissioned and operated until completion of installation in accordance with the EMC regulations and the specifications in this manual. To prevent personal injury and damage to property damaged drive systems must not be installed or operated.

Changes and modifications of the drive systems are not permitted and if made all no warranty and liability will be accepted.

The drive system must be operated only with the specified wiring and approved accessories. In general, use only original accessories and spare parts.

The drive systems must not be operated in an environment subject to explosion hazard (ex area).

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Part 1: Hardware Reference

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IM483 and IM805 Basic Setup

Before You Begin

The Getting Started section is designed to help quickly connect and begin using your IM483 or IM805 High Performance Microstepping Driver. The following examples will help you get a motor turning for the first time and introduce you to the basic settings of the drive.

Tools and Equipment Required

- IM483 or IM805 High Performance Microstepping Drive
- A NEMA 14, 17 or 23 Size Stepping Motor (IM483) or a NEMA 23 or 34 Size Stepping Motor (IM805)
- Control Device for Step/Direction (A Signal Generator may be used - square wave output, 0 to 10 MHz Output Frequency)
- +5 VDC Optocoupler Supply.
- An Unregulated +12 to +48 VDC Power Supply (IM483) or an Unregulated +24 to +75 VDC Power Supply (IM805)
- A 1/8W 1%Ω Resistor to adjust the output current.
- Basic Tools: Wire Cutters / Strippers / Screwdriver
- 20 AWG (IM483) 18 AWG (IM805) Wire for Power Supply and Motor
- 22 AWG Wire for Logic Connections

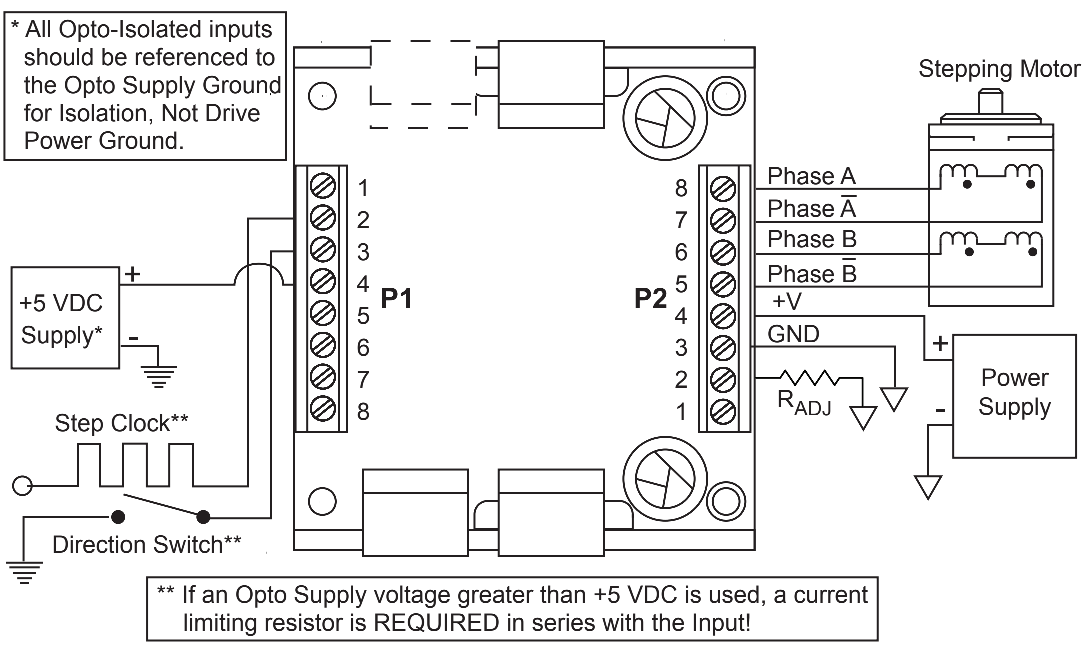


Figure GS.1: Minimum Logic and Power Connections

Connecting the Power Supply

1. Using recommended wire, connect the DC output of the power supply to P2 Pin 4.
2. Connect the power supply ground to P2 Pin 4.

Connect Optocoupler Supply and Logic Inputs

1. Using 22 AWG wire, connect the Opto Supply to P1 Pin 1, The ground of the opto supply should be connected to the ground of your control circuitry.
2. Not that you may use an opto supply voltage greater than +5 VDC, however a current limiting resistor must be placed in series with the input.
3. Connect the Step and Direction inputs to the appropriate outputs of your PLC or controller.

WARNING! The IM483 and IM805 have components which are sensitive to Electrostatic Discharge (ESD). All handling should be done at an ESD protected workstation.

WARNING! Hazardous voltage levels may be present if using an open frame power supply to power your IM series driver.

WARNING! Ensure that the power supply output voltage does not exceed the maximum input voltage of the model that you are using!

Note: A characteristic of all motors is back EMF. Back EMF is a source of current that can push the output of a power supply beyond the maximum operating voltage of the driver. As a result, damage to the stepper driver could occur over a period of time. Care should be taken so that the back EMF does not exceed the maximum input voltage rating of the IM483 or IM805.

WARNING! If using an Optocoupler Supply greater than +5 VDC a current limiting resistor is required in series with the isolated input. See the I/O Specifications Table for Maximum limits.

Note: A Current Adjustment resistor is required to operate the device!

Connecting the Motor

1. Using the recommended wire, connect the Motor Phases to P2 as shown in Figure GS.1. Ensure that the phases are connected correctly.

Setting the Output Current

1. First, decide on a peak output current. To calculate the value of the resistor use the equation: $R_{ADJUST} = 500 \times I_{PEAK}$
2. Connect the resistor between P2 Pin 2 (Current Adjust) and P2 Pin 3 (Power Ground).
3. This resistor is required. If the unit is powered up without this resistor it will immediately latch into a fault condition anf the output bridge will be disabled.

IM483 & IM805

PART 1: HARDWARE REFERENCE

CE

Notes

Introduction to the IM483 and IM805

The IM483 and IM805 are high performance, yet low cost microstepping drivers that utilize surface mount and ASIC technology. These drivers are small, easy to interface and use, yet powerful enough to handle the most demanding applications.

The IM483 features a high input voltage (+12 to +48 VDC) and has a peak output current of 4 Amps (3A RMS). The IM805 features a +24 to +75 VDC input voltage and can output 7A Peak (5A RMS).

The IM483 and IM805 have 14 built-in microstep resolutions (both binary and decimal). The resolution can be changed at any time without the need to reset the driver. This feature allows the user to rapidly move long distances, yet precisely position the motor at the end of travel without the expense of high performance controllers.

Figure 1.1.1: IM483 and IM805

With the development of proprietary and patented circuits, ripple current has been minimized to reduce motor heating common with other designs, allowing the use of low inductance motors to improve high speed performance and system efficiency.

The IM483 and IM805, because of their small size and low cost, can be used to increase accuracy and smoothness in systems using higher step angle motors. In many instances mechanical gearing can be replaced with microstepping, reducing cost and eliminating potential maintenance.

Available as options for both drives are a variety of connector styles, a heat sink and an adhesive thermal pad to eliminate the need for Heat Sink compound. If intelligent and/or closed loop control is needed the IM483 is available with on-board indexer (IM483I) and indexer/encoder (IM483IE) versions. The IM805 is not available with an Indexer/Encoder option.

The IM483 and IM805 were developed to provide designers with affordable, state-of-the-art technology for the competitive edge needed in today's market.

Configuring

Configurable features of the IM483 and IM805 are Microstep Resolution, with a range from Half Stepping to 256 Microsteps/step, is configured by means of an on-board DIP switch, or alternately may be digitally configured (IMx-34P1) on versions with a 34-Pin header at connector P1. The run and hold current is configured by means of 1/8W 1%Ω resistors.

Features and Benefits

- Low Cost.
- Small Size 2.75" x 3.00" x 1.20"
  (69.9 x 76.2 x 30.5 mm).
- Advanced Surface Mount and ASIC Technology.
- High Input Voltage (IM483: +12 to +48VDC, IM805: +24 to +75VDC).
- High Output Current (IM483: 3A RMS, 4A Peak, IM805: 5A RMS, 7A Peak).
- No Minimum Inductance.
- FAULT Output.
- Optically Isolated Inputs.
- Single Supply.
- Up to 10MHz Step Clock Rate.
- Short Circuit and Over Temperature Protection.
- Microstep Resolution to 51,200 Steps/Rev.
- Microstep Resolutions can be Changed "On-The-Fly" Without Loss of Motor Position.
- 20 kHz Chopping Rate.

- Automatically Switches Between Slow and Fast Decay for Unmatched Performance.
- 14 Selectable Resolutions Both in Decimal and Binary.
- Adjustable Automatic Current Reduction.
- At Full Step Output.
- Optional On-board Indexer and Encoder Feedback (IM483 Only).
- Screw Terminal Interface with multiple connector options.
- CE Certified.

IM483 Detailed Specifications

General Specifications

Electrical Specifications	Condition	Min	Typ	Max	Unit
Input Voltage (+V) Range*	—	+12	—	+48	VDC
Output Current	RMS	—	—	3	A
Output Current	Peak (Per Phase)	0.4	—	4	A
Quiescent Current	I/O Floating	—	70	—	mA
Active Power Dissipation	I_{OUT} = 3A RMS	—	12	—	W

** Actual Power Supply Current will depend on Voltage and Load. Voltage includes motor back EMF.*

Table 1.2.1: IM483 Electrical Specifications

WARNING! Do not exceed the maximum input voltage of +48VDC! This voltage includes motor back EMF!

Thermal Specifications	Min	Typ	Max	Unit
Storage Temperature	-40	—	+125	ºC
Ambient Temperature	0	—	+50	ºC
Plate Temperature (Additional cooling may be required)	—	—	+70	ºC

Table 1.2.2: IM483 Thermal Specifications

WARNING! Additional cooling may be required to limit the plate temperature to 70°C!

I/O Specifications	Condition	Min	Typ	Max	Unit
Input Forward Current	Isolated Inputs	—	7.0	15	mA
Input Forward Voltage	Isolated Inputs	—	1.5	1.7	VDC
Input Reverse Breakdown Voltage	Isolated Inputs	5	—	—	VDC
Output Current	Fault, Fullstep	—	—	25	mA
Collector-Emitter Voltage	Fault	—	—	140	VDC
Collector-Emitter Saturation Voltage	Fault (I_{CS}=25mA)	—	—	0.2	VDC
Drain-Source Voltage	Fullstep	—	—	100	VDC
Drain-Source On Resistance	Fullstep	—	6.5	—	Ω

Table 1.2.3: IM483 I/O Specifications

Motion Specifications	
Microstep Resolution	
Number of Resolutions	14

Available Microsteps Per Revolution						
2	4	5	8	10	16	25
32	50	64	125	128	250	256

Step Frequency (Max)	10 MHz
Step Frequency Minimum Pulse Width	250 nS

Table 1.2.4: IM483 Motion Specifications

Mechanical Specifications - Dimensions in Inches (mm)

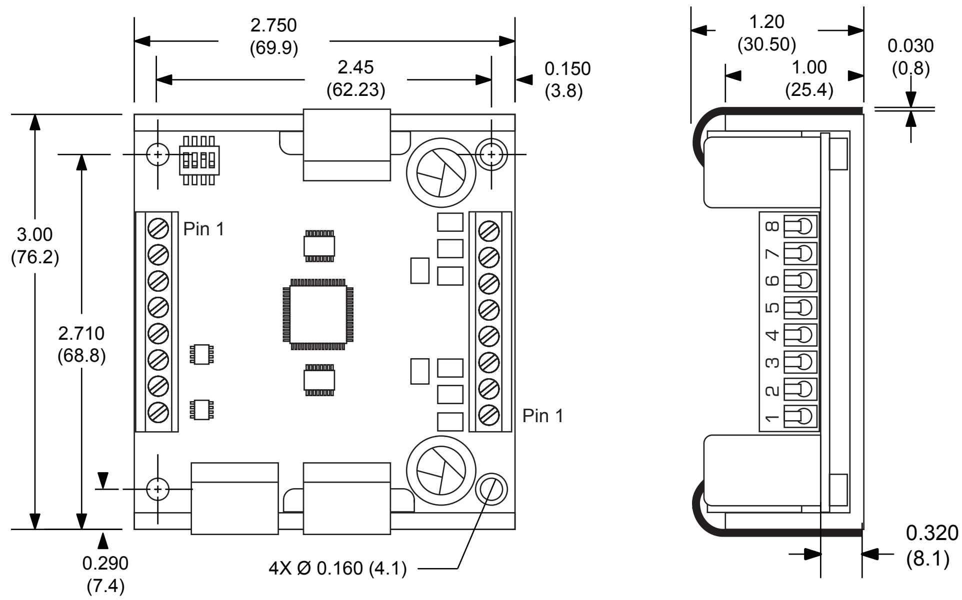
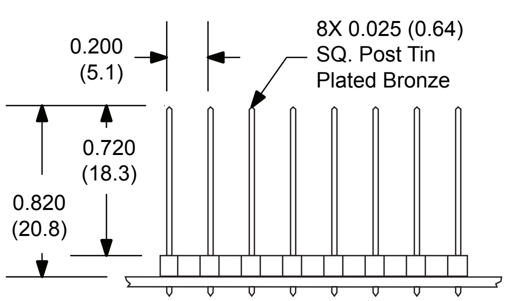


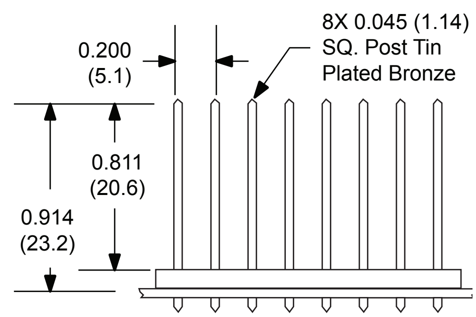
Figure 1.2.1: IM483 Mechanical Specifications

Standard Connector Options

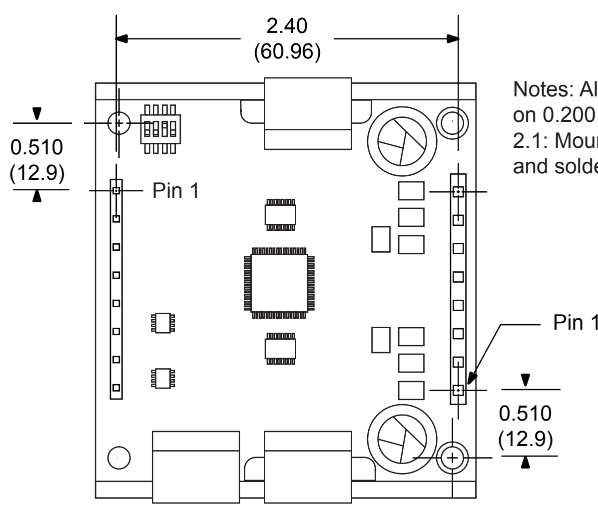
8-Pin Post Connectors on P1 and P2 (IM483-8P2)



Connector P1



Connector P2



Notes: All connector pins are on 0.200 (5.1) center. See Section 2.1: Mounting, for PCB hole pattern and soldering recommendations

Figure 1.2.2: IM483-8P2 Mechanical Specifications

8-Pin Locking Pluggable Connectors on P1 and P2 (IM483-8P2)

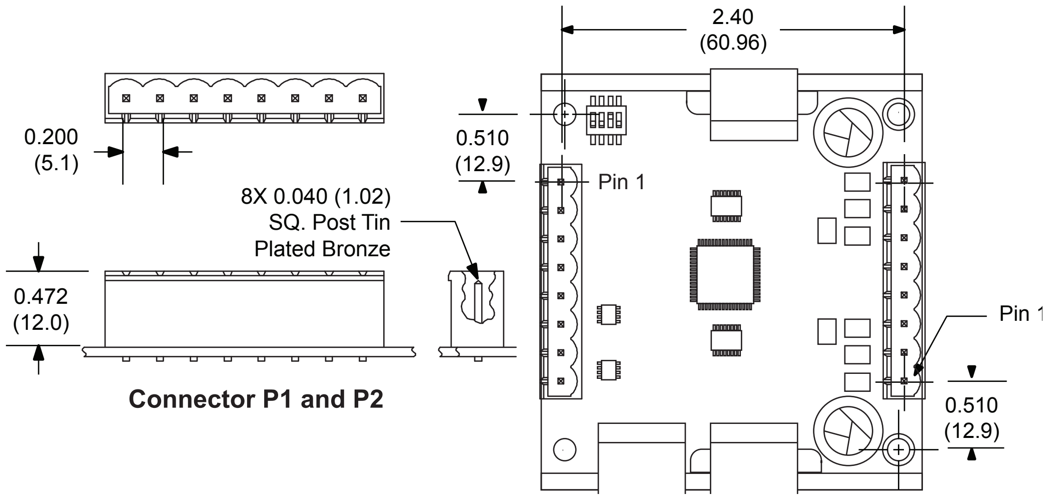


Figure 1.2.3: IM483-PLG Mechanical Specifications

34-Pin Header on P1 and 8-Position Screw Terminal on P2 (IM483-34P1)

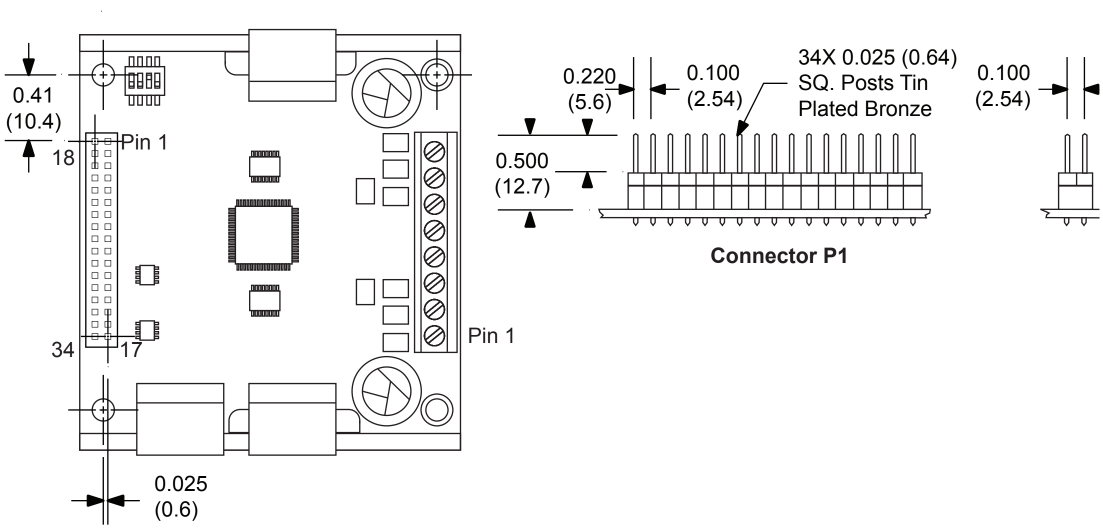


Figure 1.2.4: IM483-34P1 Mechanical Specifications

34-Pin Header on P1 and 8-Pin Post Connector on P2 (IM483-34P1-8P2)

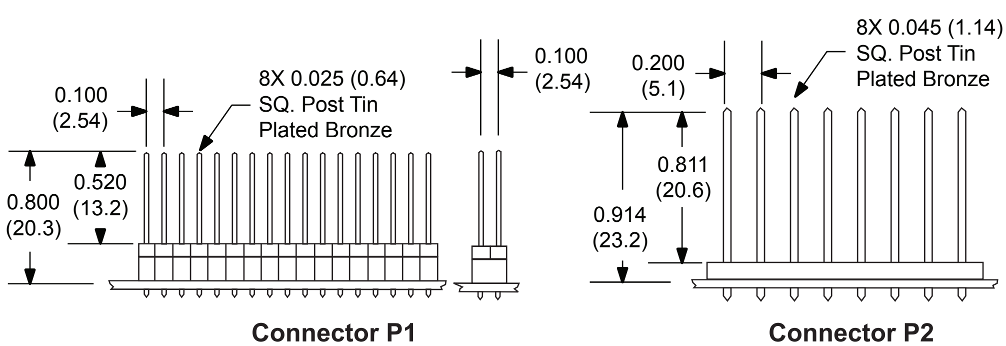


Figure 1.2.5: IM483-34P1-8P2 Mechanical Specifications

Pin Assignment and Description

P1 Connector - Logic and I/O

WARNING! Current Limiting resistors MUST be used in series with the isolated inputs if using an optocoupler supply with an output voltage greater than +5 VDC!

Pin Assignment - P1 Logic and I/O Connections			
8-Pin	***34-Pin***	***Function***	***Description***
—	3	Resolution Select 3 (MSEL3)	Microstep Resolution Select 3 Input (Internally pulled up to +5 VDC, if open (floating) is considered to be in the OFF state.
2	4	Step Clock Input	A positive going edge on this input will advance the motor one increment, the size of that increment. The step clock input is optically isolated.
3	6	CW/CCW Direction Input	This optically isolated, sinking input controls the direction of the motor. Note that the physical direction of the motor will depend upon the connection of the motor windings.
4	8	Optocoupler Supply	This +5 VDC input is used to supply power to the isolated inputs. A higher voltage may be used, but care must be taken to limit the current through the optocoupler. This is generally accomplished using a current limiting resistor in series with the isolated input.
5	10	Enable/$\overline{\text{Disable}}$ Input	This optically isolated, sinking input is used to enable or $\overline{\text{disable}}$ the output bridge of the IM483. When HIGH (Open, Disconnected) the output bridge is enabled, sinking the input to the ground of the controller or opto supply will disable the bridge.
6	12	$\overline{\text{Reset}}$ Input	The optically isolated, sinking input is used to reset the IM483 to it's initial state (Phase A OFF, Phase B ON).
7	14	Fault Output	This open-collector output indicates that a short circuit condition has occurred. It is ACTIVE LOW.
8	16,26	On-Full-Step Output	This open-drain output indicates when the motor is positioned at full-step. It is ACTIVE LOW.
	21	Step Clock Output	Non-isolated step clock output will follow the step clock input at a 1:1 ratio.
	22	Direction Output	Non-isolated direction output will follow the state of the direction input.
	23	Resolution Select 0 (MSEL0)	Microstep Resolution Select 0 Input (Internally pulled up to +5 VDC, if open (floating) is considered to be in the OFF state.
	24	Resolution Select 2 (MSEL2)	Microstep Resolution Select 2 Input (Internally pulled up to +5 VDC, if open (floating) is considered to be in the OFF state.
	25	Resolution Select 1 (MSEL1)	Microstep Resolution Select 1 Input (Internally pulled up to +5 VDC, if open (floating) is considered to be in the OFF state.
	27	Ground	Non-isolated ground, common with power ground.

Table 1.2.5: P1 — Pin Assignment, Logic and I/O, No Connect pins on the -34P1 versions are ommited

P2 - Power, Motor and Current Control

Pin #	Function	Description
Pin Assignment - P2 Power, Motor and Current Control		
1	Current Reduction Adjust	Phase Current Reduction Adjustment input. A resistor connected between this pin will reduce the current in both motor windings approximately 0.5 seconds following the last positive edge of the step clock input. The amount of the current reduced will depend on the value of the resistor used. The equation for determining the resistor value is: $R_{RED} = 500 \times (I_{RUN} X I_{HOLD}/I_{RUN} - I_{HOLD})$. Use a 1/8W 1%Ω Resistor.
2	Current Adjustment	Phase Current Adjustment input. A resistor connected between this pin and power ground (P2:3) will adjust the the maximum peak Phase current in the motor. The equation for calculating this resistor value is: $R_{ADJUST} = 500 X I_{PEAK}$ Use a 1/8W 1%Ω Resistor. Note that use of this resistor is REQUIRED to operated the IM483. If left disconnected the unit will latch into a fault condition.
3	Power Supply Return (Ground)	Motor power ground.
4	+VDC	+12 to +48 VDC motor power.
5	Phase $\overline{B}$	Phase $\overline{B}$ of the stepping motor.
6	Phase B	Phase B of the stepping motor.
7	Phase $\overline{A}$	Phase $\overline{A}$ of the stepping motor.
8	Phase A	Phase A of the stepping motor.

Table 1.2.6: P1 Connector – Power, I/O and SPI Communications

Options and Accessories

Heat Sink Kit

The optional Heat Sink kit includes the H-4X Heat Sink, associated mounting hardware and a non-insulating thermal pad.

Heat Sink Kit H-4X
Thermal Pad (Alone) TN-48

Side Mounting Clips

Allows for side mounting the IM483 to a panel.

Side Mounting Clips U3-CLP

Mating Connectors

Mating connectors for the IM483-PLG Pluggable connector option.

Mating Connectors PLG-R1/R2

Noise Reduction Option

Option limits the step clock input frequency to 1.8 MHz.

Noise Reduction IM483-NR1

Notes

IM805 Detailed Specifications

General Specifications

Electrical Specifications	Condition	Min	Typ	Max	Unit
Input Voltage (+V) Range*	—	+24	—	+75	VDC
Output Current	RMS	—	—	5	A
Output Current	Peak (Per Phase)	1	—	7	A
Quiescent Current	I/O Floating	—	13	—	mA
Active Power Dissipation	I_{OUT} = 3A RMS	—	9	—	W

** Actual Power Supply Current will depend on Voltage and Load. Voltage includes motor back EMF.*

Table 1.3.1: IM805 Electrical Specifications

WARNING! Do not exceed the maximum input voltage of +75VDC! This voltage includes motor back EMF!

Thermal Specifications	Min	Typ	Max	Unit
Storage Temperature	-40	—	+125	ºC
Ambient Temperature	0	—	+50	ºC
Plate Temperature (Additional cooling may be required)	—	—	+70	ºC

Table 1.3.2: IM805 Thermal Specifications

WARNING! Additional cooling may be required to limit the plate temperature to 70°C!

I/O Specifications	Condition	Min	Typ	Max	Unit
Input Forward Current	Step and Direction	—	7.0	20	mA
Input Forward Voltage	Step and Direction	—	1.4	1.7	VDC
Input Forward Current	Reset and Enable	—	5.0	50	mA
Input Forward Voltage	Reset and Enable	—	1.1	1.4	VDC
Input Reverse Breakdown Voltage	Isolated Inputs	5	—	—	VDC
Output Current	Fault, Fullstep	—	—	25	mA
Drain-Source Voltage	Fault, Fullstep	—	—	100	VDC
Drain-Source On Resistance	Fault, Fullstep (I_{CS}=25mA)	—	6.5	—	Ω

Table 1.3.3: IM805 I/O Specifications

Motion Specifications	
Microstep Resolution	
Number of Resolutions	14

Available Microsteps Per Revolution						
2	4	5	8	10	16	25
32	50	64	125	128	250	256

Step Frequency (Max)	10 MHz
Step Frequency Minimum Pulse Width	250 nS

Table 1.3.4: IM805 Motion Specifications

Mechanical Specifications - Dimensions in Inches (mm)

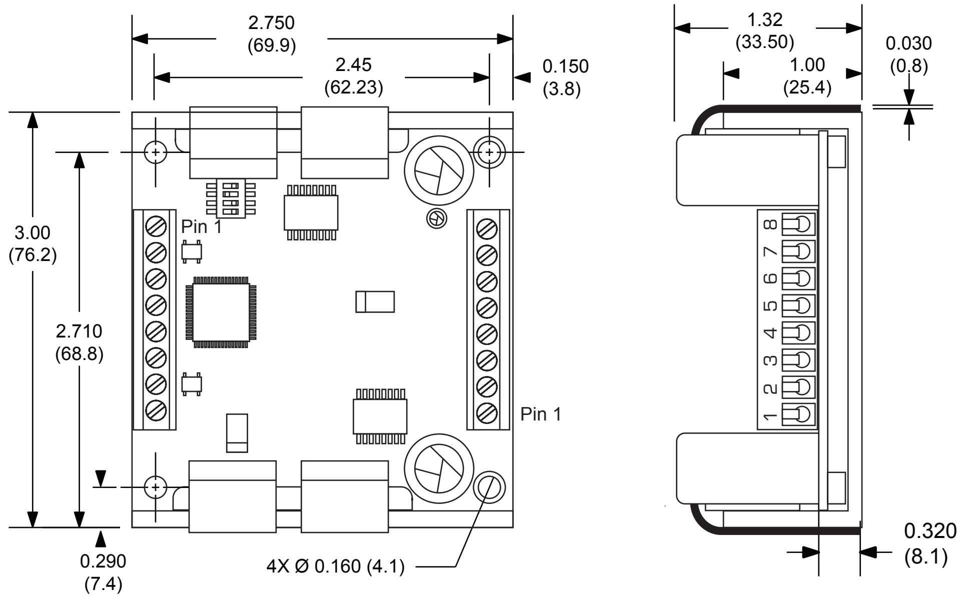


Figure 1.3.1: IM805 Mechanical Specifications

Standard Connector Options

8-Pin Post Connectors on P1 and P2 (IM805-8P2)

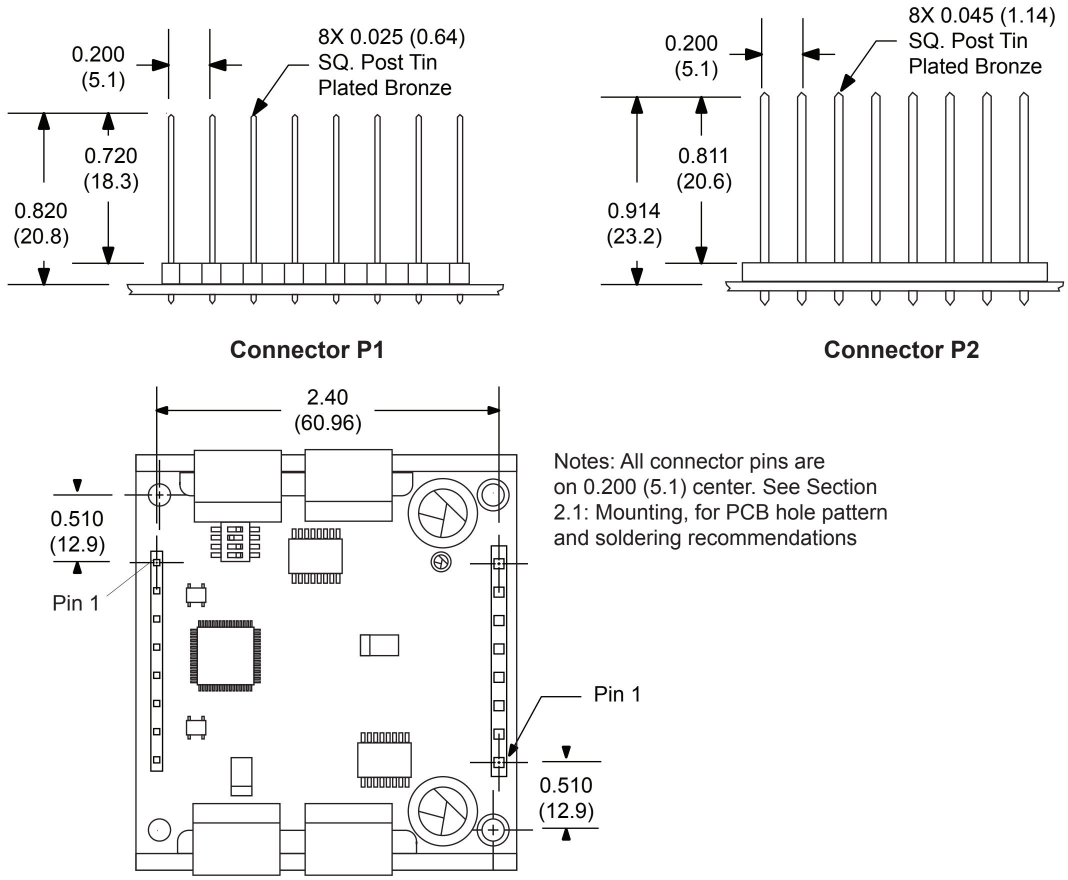


Figure 1.3.2: IM805-8P2 Mechanical Specifications

8-Pin Locking Pluggable Connectors on P1 and P2 (IM805-8P2)

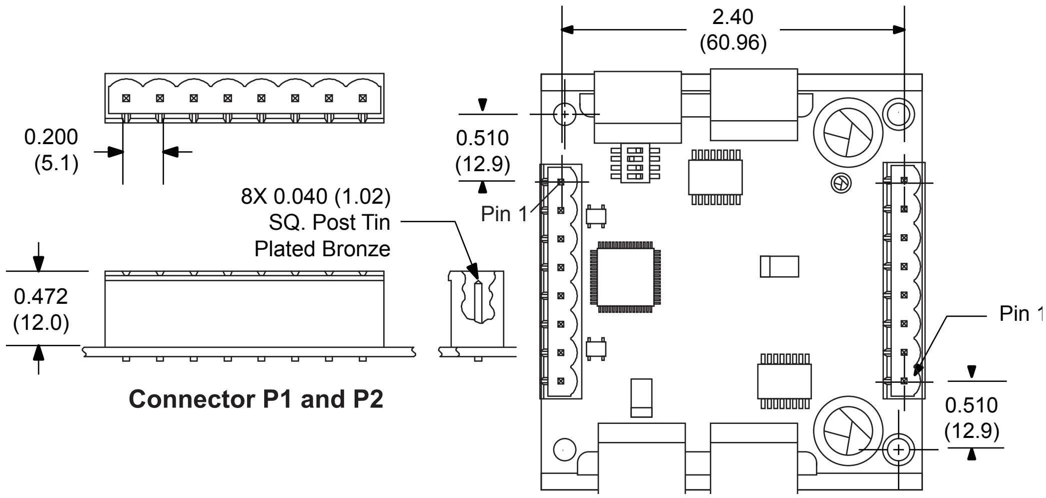


Figure 1.3.3: IM805-PLG Mechanical Specifications

34-Pin Header on P1 and 8-Position Screw Terminal on P2 (IM805-34P1)

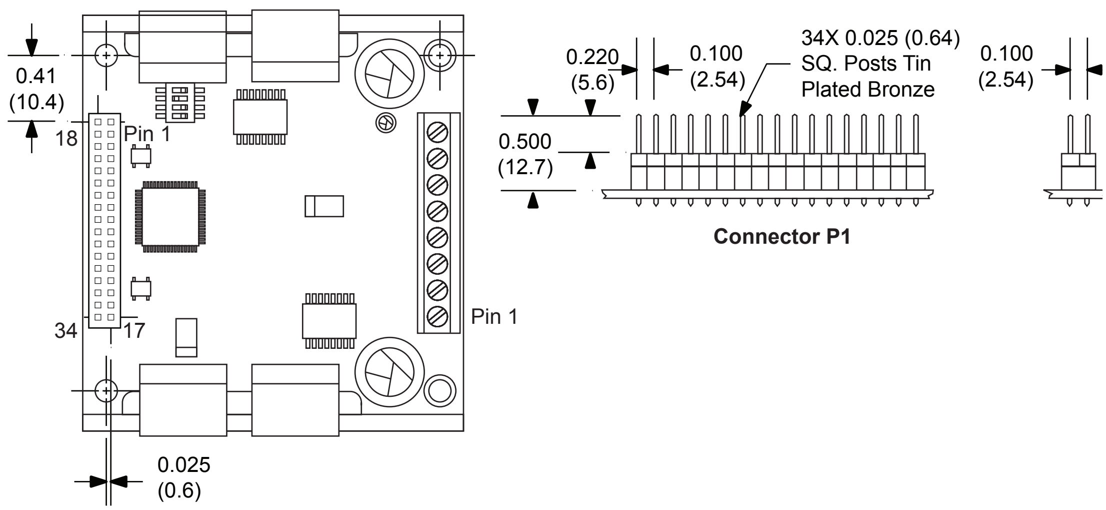


Figure 1.3.4: IM805-34P1 Mechanical Specifications

34-Pin Header on P1 and 8-Pin Post Connector on P2 (IM805-34P1-8P2)

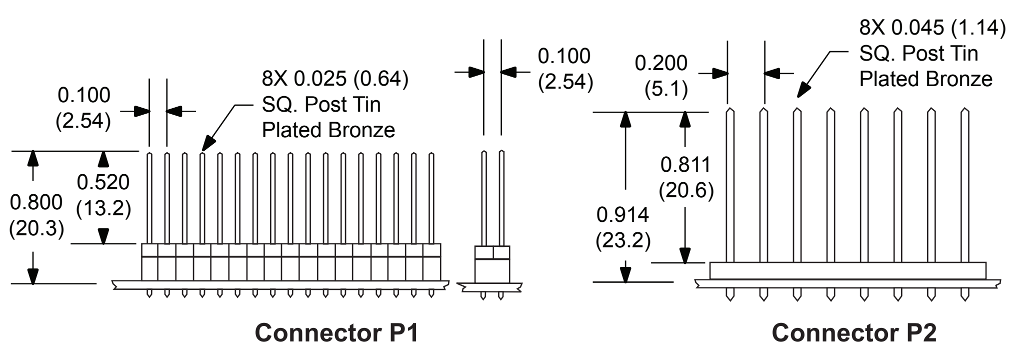


Figure 1.3.5: IM805-34P1-8P2 Mechanical Specifications

Pin Assignment and Description

P1 Connector - Logic and I/O

Pin Assignment - P1 Logic and I/O Connections

8-Pin	*34-Pin*	*Function*	*Description*
—	3	Resolution Select 3 (MSEL3)	Microstep Resolution Select 3 Input (Internally pulled up to +5 VDC, if open (floating) is considered to be in the OFF state.
2	4	Step Clock Input	A positive going edge on this input will advance the motor one increment, the size of that increment. The step clock input is optically isolated.
3	6	CW/CCW Direction Input	This optically isolated, sinking input controls the direction of the motor. Note that the physical direction of the motor will depend upon the connection of the motor windings.
4	8	Optocoupler Supply	This +5 VDC input is used to supply power to the isolated inputs. A higher voltage may be used, but care must be taken to limit the current through the optocoupler. This is generally accomplished using a current limiting resistor in series with the isolated input.
5	10	Enable/$\overline{\text{Disable}}$ Input	This optically isolated, sinking input is used to enable or $\overline{\text{disable}}$ the output bridge of the IM805. When HIGH (Open, Disconnected) the output bridge is enabled, sinking the input to the ground of the controller or opto supply will disable the bridge.
6	12	$\overline{\text{Reset}}$ Input	The optically isolated, sinking input is used to reset the IM805 to it's initial state (Phase A OFF, Phase B ON).
7	14	Fault Output	This open-drain output indicates that a short circuit condition has occurred. It is ACTIVE LOW.
8	16,26	On-Full-Step Output	This open-drain output indicates when the motor is positioned at full-step. It is ACTIVE LOW.
	21	Step Clock Output	Non-isolated step clock output will follow the step clock input at a 1:1 ratio.
	22	Direction Output	Non-isolated direction output will follow the state of the direction input.
	23	Resolution Select 0 (MSEL0)	Microstep Resolution Select 0 Input (Internally pulled up to +5 VDC, if open (floating) is considered to be in the OFF state.
	24	Resolution Select 2 (MSEL2)	Microstep Resolution Select 2 Input (Internally pulled up to +5 VDC, if open (floating) is considered to be in the OFF state.
	25	Resolution Select 1 (MSEL1)	Microstep Resolution Select 1 Input (Internally pulled up to +5 VDC, if open (floating) is considered to be in the OFF state.
	27	Ground	Non-isolated ground, common with power ground.

Table 1.3.5: P1 — Pin Assignment, Logic and I/O, No Connect pins on the -34P1 versions are ommited

WARNING! Current Limiting resistors MUST be used in series with the isolated inputs if using an optocoupler supply with an output voltage greater than +5 VDC!

P2 - Power, Motor and Current Control

Pin Assignment - P2 Power, Motor and Current Control		
Pin #	**Function**	**Description**
1	Current Reduction Adjust	Phase Current Reduction Adjustment input. A resistor connected between this pin will reduce the current in both motor windings approximately 0.5 seconds following the last positive edge of the step clock input. The amount of the current reduced will depend on the value of the resistor used. The equation for determining the resistor value is: $R_{RED} = 500 \times (I_{RUN} \text{ X } I_{HOLD}/I_{RUN} - I_{HOLD})$. Use a 1/8W 1%Ω Resistor.
2	Current Adjustment	Phase Current Adjustment input. A resistor connected between this pin and power ground (P2:3) will adjust the the maximum peak Phase current in the motor. The equation for calculating this resistor value is: $R_{ADJUST} = 500 \text{ X } I_{PEAK}$ Use a 1/8W 1%Ω Resistor. Note that use of this resistor is REQUIRED to operated the IM805. If left disconnected the unit will latch into a fault condition.
3	Power Supply Return (Ground)	Motor power ground.
4	+VDC	+24 to +75 VDC motor power.
5	Phase $\overline{B}$	Phase $\overline{B}$ of the stepping motor.
6	Phase B	Phase B of the stepping motor.
7	Phase $\overline{A}$	Phase $\overline{A}$ of the stepping motor.
8	Phase A	Phase A of the stepping motor.

Table 1.3.6: P1 Connector – Power, I/O and SPI Communications

Options and Accessories

Heat Sink Kit

The optional Heat Sink kit includes the H-4X Heat Sink, associated mounting hardware and a non-insulating thermal pad.

Heat Sink Kit H-4X
Thermal Pad (Alone) TN-48

Side Mounting Clips

Allows for side mounting the IM805 to a panel.

Side Mounting Clips U3-CLP

Mating Connectors

Mating connectors for the IM805-PLG Pluggable connector option.

Mating Connectors PLG-R1/R2

Noise Reduction Option

Option limits the step clock input frequency to 1.8 MHz.

Noise Reduction.. IM805-NR1

Notes

SECTION 1.4

Theory of Operation

Section Overview

This section will cover the circuit operation for the IM483 microstepping driver.

- Circuit Operation.
- Microstep Select Inputs.
- Stepping.
- Dual PWM Circuit.
- Fullstep Output.
- Timing.

Circuit Operation

Microstepping drives have a much higher degree of suitability for applications that require smooth operation and accurate positioning at low speeds than do half/fullstep drivers and reduction gearing. The IM483, which can to be set to microstep resolutions as high as 51,200 microsteps/rev (256 microsteps/step) using a 1.8° stepping motor, is ideal for such applications.

In order to subdivide motor steps into microsteps while maintaining positional accuracy, precise current control is required. The IM483 accomplishes this by the use of a unique Dual PWM circuit built into the patented IM2000 Microstep Controller ASIC, which resides at the heart of the IM483. This PWM circuit uses alternating recirculating/non-recirculating modes to accurately regulate the current in the windings of a two phase stepping motor.

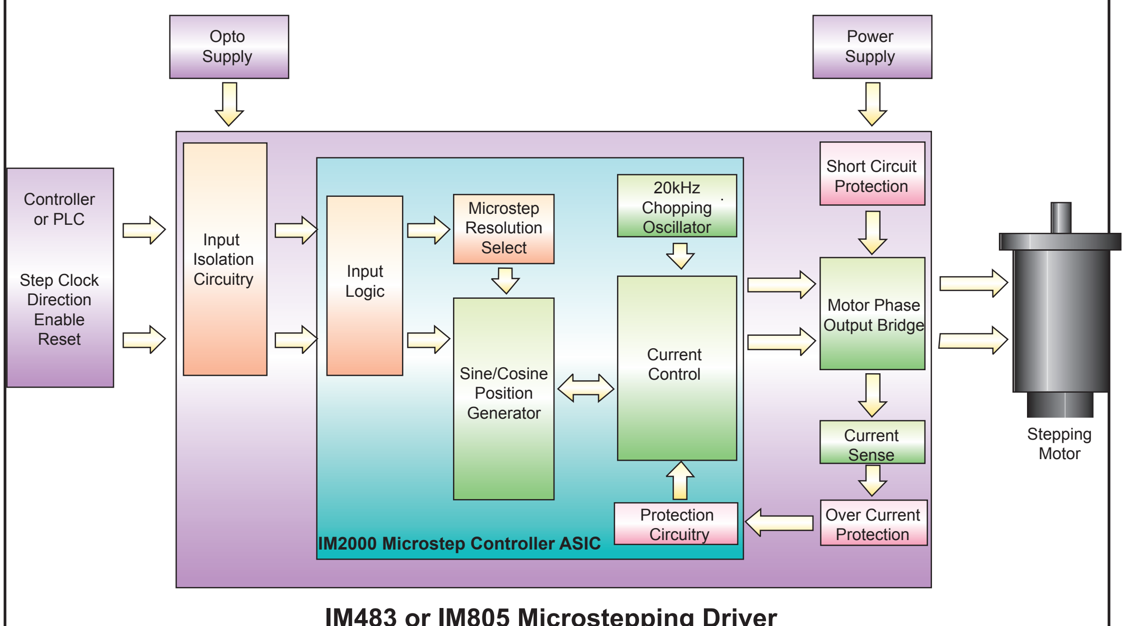


Figure 1.4.1: Block Diagram

Microstep Select (MSEL) Inputs

Another unique feature of the IM2000 is the ability to change resolutions at any time. A resolution change can occur whether the motor is being clocked or is at rest. The change will not take place until the rising edge of the next step clock input. At this time, the new resolution is latched and implemented before the step clock pulse takes effect.

If a resolution is chosen such that the sine/cosine output of the IM2000 would not land on an electrical fullstep of the motor, then the IM2000 will automatically align itself to the full step position on the step clock pulse that would have caused the motor to rotate past the full step. The step clock pulses, from that point forward, will be equal to the selected resolution. This feature allows the user to switch resolutions at any time without having to keep track of sine/cosine location. Because of this, the On-Full-Step output of the IMx can easily be used to monitor position.

Configuration settings for the Microstep Resolution are located in Section 7 of this document, Interfacing and Controlling the IMx.

Stepping

The IM2000 contains a built-in sine/cosine generator used for the generation of Phase A and Phase B position reference. This digitally encoded 9 bit sine and 9 bit cosine signal is directly fed into a digital to analog converter.

The step clock (SCLK) and direction (DIR) inputs are buffered using Schmidt triggered buffers for increased noise immunity and are used to increment or decrement the sine/cosine position generator. The position generator is updated on the rising edge of the step clock input. It will increment or decrement by the amount specified by the microstep resolution select (MSEL) inputs.

The direction (DIR) input determines the direction of the position generator and hence the direction of the motor. The DIR input is synchronized to the SCLK input. On the rising edge of the SCLK input the state of the DIR input is latched in. The position generator will then look to see if there has been a change in direction and implement that change before executing the next step. By utilizing this method to implement the direction change, the noise immunity is greatly increased and no physical change in the motor occurs if the direction line is toggled prior to the step clock input.

The enable/disable input does not affect the step clock input. The sine/cosine generator will continue to update if a signal is applied to the step clock input.

The IM2000 outputs both sine and cosine data simultaneously when applying a step clock input. Dual internal look-up tables are used to output a unique position for every step clock input to enhance system performance.

Dual PWM Circuit

The IM2000 contains a unique dual PWM circuit that efficiently and accurately regulates the current in the windings of a two phase stepping motor. The internal PWM accomplishes this by using an alternating recirculating/non-recirculating mode to control the current.

Recirculating

In a recirculating PWM, the current in the windings is contained within the output bridge while the PWM is in its OFF state. (After the set current is reached.) This method of controlling the current is efficient when using low inductance motors, but lacks response because of its inability to remove current from the windings on the downward cycle of the sine/cosine wave (See Figure 1.4.2).

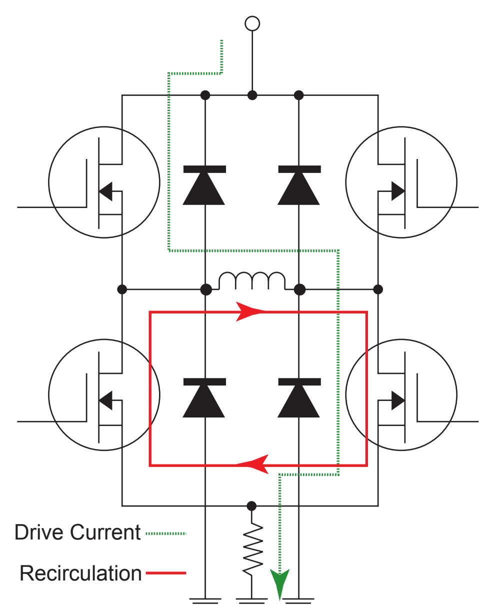


Figure 1.4.2: Recirculating PWM

Non-Recirculating

In a non-recirculating PWM, the current flows up through the bridge and back to the supply in the OFF phase of the cycle. This method of controlling current allows for much better response but reduces efficiency and increases current ripple, especially in lower inductance motors (See Figure 1.4.3).

The IM2000's PWM utilizes the best features of both by combining recirculating and non-recirculating current control. On the rising edge of the sine/cosine waveform, the PWM will always be in a recirculating mode. This mode allows the driver to run at peak efficiency while maintaining minimum current ripple even with low inductance motors. On the downward cycle of the sine/cosine waveform, the PWM operates in a two part cycle. In the first part of its cycle, the PWM is in a non-recirculating mode to pull current from the motor windings. In the second part of the cycle the PWM reverts back to recirculating mode to increase efficiency and reduce current ripple.

The IM2000 will automatically change the non-recirculating pulse widths to compensate for changes in supply voltage and accommodate a wide variety of motor inductances. This method also allows for the use of very low inductance motors with your IMx driver, while utilizing a 20kHz chopping rate which reduces motor heating but maintains high efficiency and low current ripple.

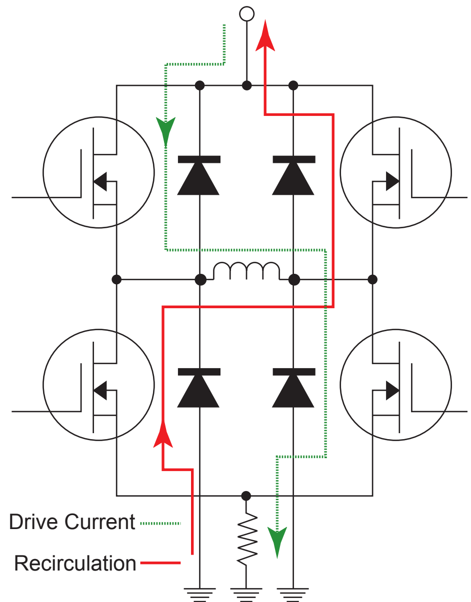


Figure 1.4.3: Non-Recirculating PWM

Fullstep Output Signal

The fullstep output signal from the IMx is an active high output at connector P1:8. This output will be TRUE for the duration of the full step. A full step occurs when either Phase A or Phase B crosses through zero (i.e. full current in one motor winding and zero current in the other winding). This fullstep position is a common position regardless of the microstep resolution selected.

The fullstep output can be used to count the number of mechanical fullsteps that the motor has traveled without the need to count the number of microsteps in between. A controller that utilizes this output can greatly reduce its position tracking overhead, thus substantially increasing its throughput.

Interface guidelines and a sample application for the fullstep output are located in Section 7 of this document, Interfacing and Controlling the IMx.

Timing

The direction and microstep resolution select inputs are synchronized with the positive going edge of the step clock input. When the step clock input goes HIGH, the direction and microstep resolution select inputs are latched. Further changes to these inputs are ignored until the next rising edge of the step clock input.

After these signals are latched, the IMx looks to see if any changes have occurred to the direction and microstep resolution select inputs. If a change has occurred, the IMx will execute the change before taking the next step. Only AFTER the change has been executed will the step be taken. If no change has occurred, the IMx will simply take the next step. This feature works as an automatic debounce for the direction and microstep resolution select inputs.

The reset and enable inputs are asynchronous to any input and can be changed at any time.

Notes

IM483 & IM805

PART 2: INTERFACING AND CONFIGURING

CE

Notes

Mounting and Connection Recommendations

Mounting Recommendations

This section has recommended mounting instructions for the standard IM Series.

Thermal Considerations

The maximum plate temperature for all IM Series models is 70°C. Ensure that the unit is mounted to adequate heat sink plating to ensure that the temperature does not exceed 70°C.

An optional Heat Sink Kit is available, for details see Appendix B: Accessories.

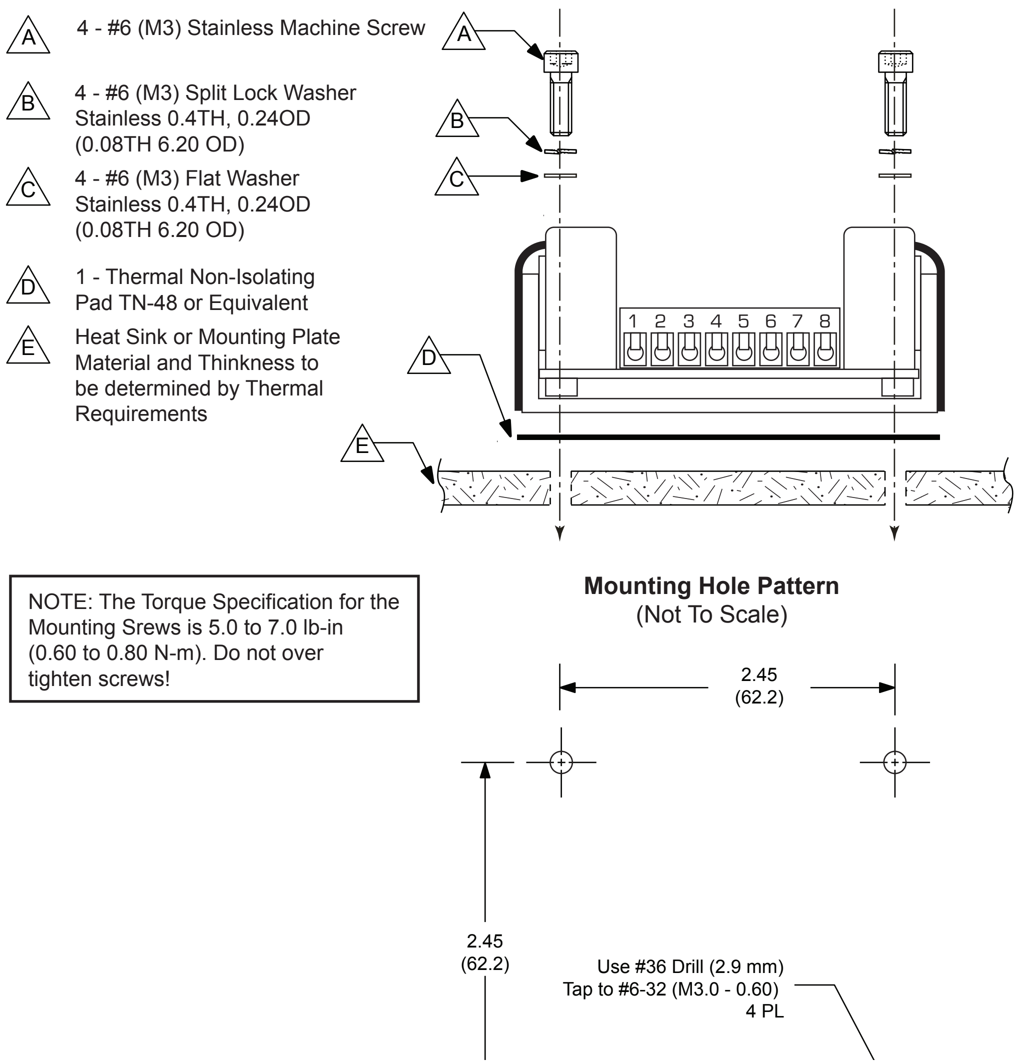


Figure 2.1.1: Mounting the IM Series Driver

WARNING! DO NOT connect or disconnect power leads when power is applied! Disconnect the AC power side to power down the DC power supply.

Connector Options PCB Mounting

Recommended Soldering Practices

Max. Soldering Temp...371°C (700°F)
Max. Soldering Time...10 sec.

Recommended Solder

IMS Recommends the use of a SAC305 ($Sn_{96.5}Ag_{3.0}Cu_{0.5}$) lead free solder for RoHS compliant circuit board manufacture.

IMx-8P2

The IMx-8P2 is ideal for solder-mounting into a user's PC board design. Figure 2.1.2 illustrates the PCB hole pattern as well as the recommended hole and pad diameter for the IMx-8P2.

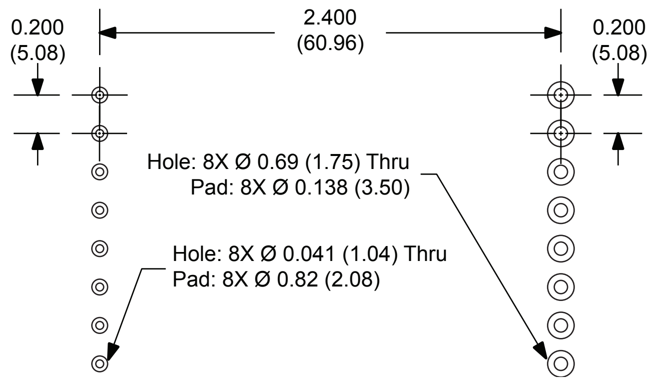


Figure 2.1.2: IMx-8P2 PCB Hole Pattern

IMx-34P1-8P2

The IMx-34P1-8P2 is ideal for solder-mounting into a user's PC board design. Figure 2.1.3 illustrates the PCB hole pattern as well as the recommended hole and pad diameter for the IMx-34P1-8P2.

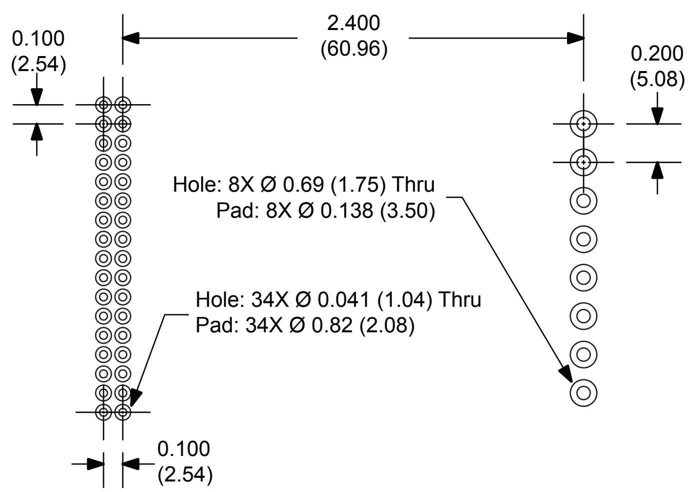


Figure 2.1.3: IMx-34P1-8P2 PCB Hole Pattern

Layout and Interface Guidelines

Logic level cables must not run parallel to power cables. Power cables will introduce noise into the logic level cables and make your system unreliable.

Logic level cables must be shielded to reduce the chance of EMI induced noise. The shield needs to be grounded at the signal source to earth. The other end of the shield must not be tied to anything, but allowed to float. This allows the shield to act as a drain.

Power supply leads to the IM Series drive need to be twisted. If more than one driver is to be connected to the same power supply, run separate power and ground leads from the supply to each driver.

Recommended Wiring

The following wiring/cabling is recommended for use with the MForce MicroDrive:

Logic Wiring..22 AWG
Wire Strip Length .... 0.25" (6.0 mm)
Power, Ground and Motor ....20 AWG

Securing Power Leads and Logic Leads

Some applications may require that the IMx move with the axis motion. If this is a requirement of your application, the motor leads must be properly anchored. This will prevent flexing and tugging which can cause damage at critical connection points.

Notes

Selecting and Interfacing a Power Supply

Section Overview

This section covers the power supply requirements of the IM Series drivers. The following is covered by this section:

- Selecting a Power Supply.
- Recommended IMS Supplies.
- Recommended Power Cable Configurations.

Selecting a Power Supply

Selecting a Motor Supply (+V)

Proper selection of a power supply to be used in a motion system is as important as selecting the drive itself. When choosing a power supply for a stepping motor driver, there are several performance issues that must be addressed. An undersized power supply can lead to poor performance and possibly even damage to your drive.

The Power Supply - Motor Relationship

Motor windings can basically be viewed as inductors. Winding resistance and inductance result in an L/R time constant that resists the change in current. To effectively manipulate the rate of charge, the voltage applied is increased. When traveling at high speeds, there is less time between steps to reach current. The point where the rate of commutation does not allow the driver to reach full current is referred to as voltage mode. Ideally you want to be in current mode, which is when the drive is achieving the desired current between steps. Simply stated, a higher voltage will decrease the time it takes to charge the coil and, therefore, will allow for higher torque at higher speeds.

Another characteristic of all motors is back EMF. Back EMF is a source of current that can push the output of a power supply beyond the maximum operating voltage of the driver. As a result, damage to the stepper driver could occur over a period of time.

The Power Supply - Driver Relationship

The IM series are very current efficient as far as the power supply is concerned. Once the motor has charged one or both windings of the motor, all the power supply has to do is replace losses in the system. The charged winding acts as an energy storage in that the current will recirculate within the bridge and in and out of each phase reservoir. This results in a less than expected current draw on the power supply.

Stepping motor drivers are designed with the intent that a user's power supply output will ramp up to greater than or equal to the minimum operating voltage of the drive. The initial current surge is substantial and could damage the driver if the supply is undersized. The output of an undersized power supply could fall below the operating range of the driver upon a current surge. This could cause the power supply to start oscillating in and out of the voltage range of the driver and result in damage to either the supply, the driver, or both.

There are two types of supplies commonly used, regulated and unregulated, both of which can be switching or linear. Each have advantages and disadvantages.

Regulated vs. Unregulated

An unregulated linear supply is less expensive and more resilient to current surges, however, the voltage decreases with increasing current draw. This may cause problems if the voltage drops below the working range of the drive.

Fluctuations in line voltage are also a point of concern. These fluctuations may cause the unregulated linear supply to be above or below the anticipated or acceptable voltage.

A regulated supply maintains a stable output voltage, which is good for high speed performance. These supplies are also not affected by line fluctuations, however, they are more expensive. Depending on the current regulation, a regulated supply may crowbar or current clamp and lead to an oscillation that, as previously stated, can cause damage to the driver and/or supply. Back EMF can cause problems for regulated supplies as well. The current regeneration may be too large for the regulated supply to absorb. This could lead to an over voltage condition which could damage the output circuitry of the IMx.

Non IMS switching power supplies and regulated linear supplies with overcurrent protection are not recommended because of their inability to handle the surge currents inherit in stepping motor systems.

Power Supply Requirements		
Recommended Supply Type		Unregulated DC
Ripple Voltage		±10%
Output Voltage	IM483	+12 to +48 VDC
	IM805	+24 to +75 VDC
Output Current	IM483	3A Peak
	IM805	4A Peak

** Actual Power Supply Current will depend on Voltage, Motor Selection and Load. Voltage includes motor back EMF.*

Table 1.3.1: Motor Power Supply Requirements

WARNING! Verify that the power supply wiring is correct prior to power application. If +V and GND are connected in reverse order, catastrophic damage to the IMx may occur! Ensure that the power supply output voltage does not exceed the maximum input voltage!

WARNING! Hazardous voltage levels may be present if using an open frame power supply to power the IMx!

Recommended IMS Power Supplies

IMS has designed a series of low cost miniature unregulated switchers and unregulated linears which can handle extreme varying load conditions. This makes them ideal for stepper motor drives and DC servo motors as well. Each of these is available in either 120 or 240 VAC configuration. See the IMS Catalog or web site (http://www.imshome.com) for information on these supplies. Listed below are the power supplies recommended for use with the IM Series Drives.

IM483

IP404 Unregulated Linear Supply

Input — Range
- 120 VAC Version .... 102-132 VAC
- 240 VAC Version .... 204-264 VAC

Output
- No Load Output Voltage* .... 43 VDC @ 0 Amps
- Continuous Output Rating* .... 32 VDC @ 2 Amps
- Peak Output Rating* .... 26 VDC @ 4 Amps

Option
- IP404-240........ 240 VAC Input

ISP200-4 Unregulated Switching Supply

Input — Range
- 120 VAC Version ....102-132 VAC
- 240 VAC Version ....204-264 VAC

Output
- No Load Output Voltage* ....41 VDC @ 0 Amps
- Continuous Output Rating* ....38 VDC @ 1.5 Amps
- Peak Output Rating* ....35 VDC @ 3 Amps

Option
- ISP200H-4 ....240 VAC Input

** All measurements were taken at 25°C, 120 VAC, 60 Hz.*

IP804/IP804-240† Unregulated Linear Supply

Input	Range
120 VAC Version	102-132 VAC
240 VAC Version	204-264 VAC
Output	
No Load Output Voltage*	76 VDC @ 0 Amps
Continuous Output Rating*	65 VDC @ 2 Amps
Peak Output Rating*	58 VDC @ 4 Amps

ISP200-7/ISP200H-7† Unregulated Switching Supply

Input	Range
120 VAC Version	102-132 VAC
240 VAC Version	204-264 VAC
Output	
No Load Output Voltage*	70 VDC @ 0 Amps
Continuous Output Rating*	62 VDC @ 1 Amps
Peak Output Rating*	59 VDC @ 2 Amps

** Measurements taken at 25°C, 120 VAC, 60 Hz.*
† Optional 240 VAC Version

Recommended Power and Cable Configurations

Cable length, wire gauge and power conditioning devices play a major role in the performance of your IMx drive.

Example A demonstrates the recommended cable configuration for DC power supply cabling under 50 feet long. If cabling of 50 feet or longer is required, the additional length may be gained by adding an AC power supply cable (see Examples B & C).

Correct AWG wire size is determined by the current requirement plus cable length. Please see the Supply Cable

NOTE: These recommendations will provide optimal protection against EMI and RFI. The actual cable type, wire gauge, shield type and filtering devices used are dependent on the customer's application and system.

NOTE: The length of the DC power supply cable to an IMx should not exceed 50 feet.

NOTE: These recommendations will provide optimal protection against EMI and RFI. The actual cable type, wire gauge, shield type and filtering devices used are dependent on the customer's application and system.

NOTE: Always use Shielded/Twisted Pairs for the IMx DC Supply Cable and the AC Supply Cable.

Example A – Cabling Under 50 Feet, DC Power

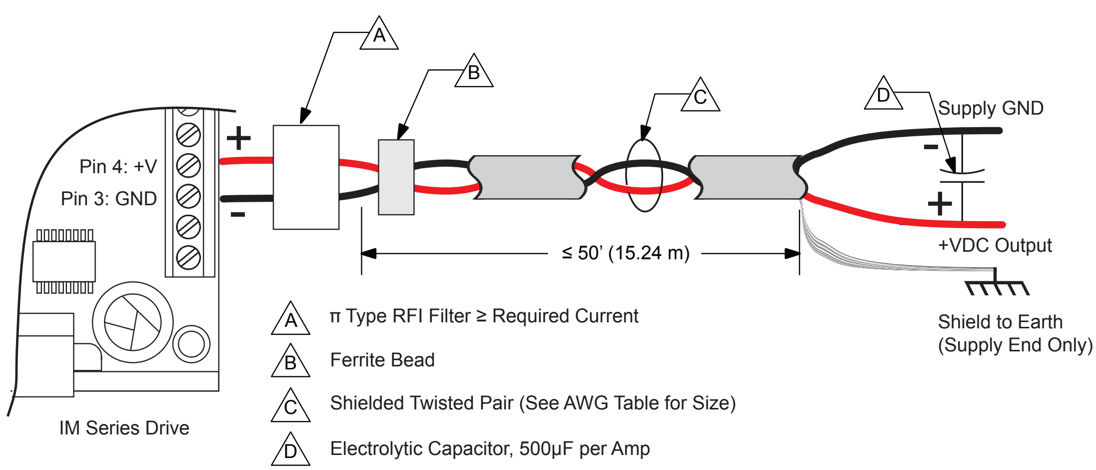


Figure 2.2.1: DC Cabling - Under 50 Feet

Example B – Cabling 50 Feet or Greater, AC Power to Full Wave Bridge

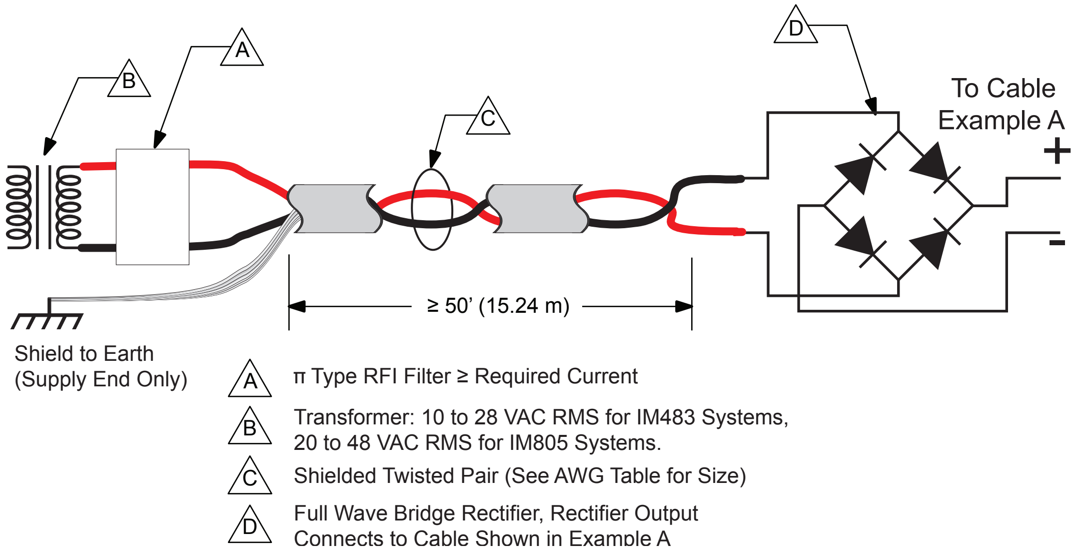


Figure 2.2.2: DC Cabling - 50 Feet or Greater - AC To Full Wave Bridge Rectifier

Example C – Cabling 50 Feet or Greater, AC Power to Power Supply

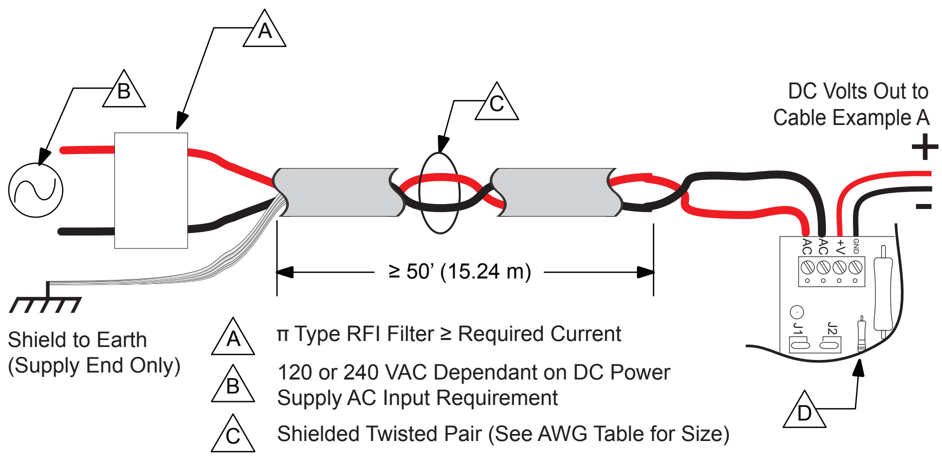


Figure 2.2.3: AC Cabling - 50 Feet or Greater - AC To Power Supply

Recommended Power Supply Cabling

Power Supply Cable AWG Table					
1 Amp Peak					
Length: Feet (Meters)	10 (3.0)	25 (7.6)	50 (15.2)*	75 (22.9)*	100 (30.5)*
Minimum AWG	20	20	18	18	18
2 Amps Peak					
Length: Feet (Meters)	10 (3.0)	25 (7.6)	50 (15.2)*	75 (22.9)*	100 (30.5)*
Minimum AWG	20	18	16	14	14
3 Amps Peak					
Length: Feet (Meters)	10 (3.0)	25 (7.6)	50 (15.2)*	75 (22.9)*	100 (30.5)*
Minimum AWG	18	16	14	12	12
4 Amps Peak					
Length: Feet (Meters)	10 (3.0)	25 (7.6)	50 (15.2)*	75 (22.9)*	100 (30.5)*
Minimum AWG	18	16	14	12	12

**Use the alternative methods illustrated in examples B and C when cable length is ≥ 50 feet. Also, use the same current rating when the alternate AC power is used.*

Table 2.2.2: Recommended Wire Gauges

Notes

Selecting and Interfacing a Motor

Section Overview

This section covers the motor configurations for the IM Series drive.

- Selecting a Motor.
- Recommended IMS Motors.
- Recommended Cable Configurations.
- Wiring Configuration for Various Motor Types.

Selecting a Motor

When selecting a stepper motor for your application, there are several factors that need to be taken into consideration:

- How will the motor be coupled to the load?
- How much torque is required to move the load?
- How fast does the load need to move or accelerate?
- What degree of accuracy is required when positioning the load?

While determining the answers to these and other questions is beyond the scope of this document, they are details that you must know in order to select a motor that is appropriate for your application. These details will affect everything from the power supply voltage to the type and wiring configuration of your stepper motor. The current and microstepping settings of your IM Series drive will also be affected.

Types and Construction of Stepping Motors

The stepping motor, while classed as a DC motor, is actually an AC motor that is operated by trains of pulses. Although it is called a “stepping motor”, it is in reality a polyphase synchronous motor. This means it has multiple phases wound in the stator and the rotor is dragged along in synchronism with the rotating magnetic field. The IMx is designed to work with the following types of stepping motors:

1) Permanent Magnet (PM)

2) Hybrid Stepping Motors

Hybrid stepping motors combine the features of the PM stepping motors with the features of another type of stepping motor called a variable reluctance motor (VR). VR motors are low torque and load capacity motors which are typically used in instrumentation. The IMx cannot be used with VR motors as they have no permanent magnet.

On hybrid motors, the phases are wound on toothed segments of the stator assembly. The rotor consists of a permanent magnet with a toothed outer surface which allows precision motion accurate to within ± 3 percent. Hybrid stepping motors are available with step angles varying from 0.45° to 15° with 1.8° being the most commonly used. Torque capacity in hybrid steppers ranges from 5 - 8000 ounce-inches. Because of their smaller step angles, hybrid motors have a higher degree of suitability in applications where precise load positioning and smooth motion is required.

Sizing a Motor for Your System

The IM Series are bipolar drivers which works equally well with both bipolar and unipolar motors (i.e. 8 and 4 lead motors, and 6 lead center tapped motors).

To maintain a given set motor current, the IMx chops the voltage using a constant 20kHz chopping frequency and a varying duty cycle. Duty cycles that exceed 50% can cause unstable chopping. This characteristic is directly related to the motor’s winding inductance. In order to avoid this situation, it is necessary to choose a motor with a low winding inductance. The lower the winding inductance, the higher the step rate possible.

NOTE: In calculating the maximum phase inductance, the minimum supply output voltage should be used when using an unregulated supply.

Winding Inductance

Since the IMx is a constant current source, it is not necessary to use a motor that is rated at the same voltage as the supply voltage. What is important is that the IM Series drive is current control is configured to the motor's rated current.

As was discussed in the previous section, Power Supply Requirements, the higher the voltage used the faster the current can flow through the motor windings. This in turn means a higher step rate, or motor speed. Care should be taken not to exceed the maximum voltage of the driver. Therefore, in choosing a motor for a system design, the best performance for a specified torque is a motor with the lowest possible winding inductance used in conjunction with highest possible driver voltage.

The winding inductance will determine the motor type and wiring configuration best suited for your system. While the equation used to size a motor for your system is quite simple, several factors fall into play at this point.

The winding inductance of a motor is rated in milliHenrys (mH) per Phase. The amount of inductance will depend on the wiring configuration of the motor.

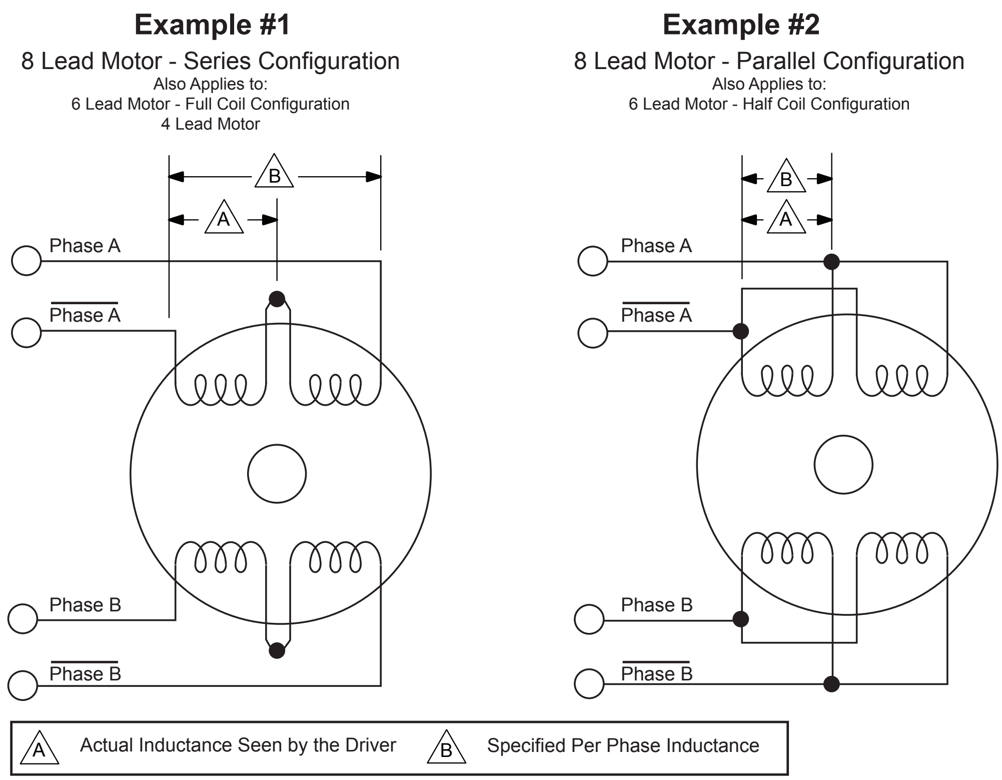


Figure 2.3.1: Winding Inductance

The per phase winding inductance specified may be different than the per phase inductance seen by your IMx driver depending on the wiring configuration used. Your calculations must allow for the actual inductance that the driver will see based upon the wiring configuration.

Figure 2.3.1, Example #1 shows a stepper motor in a series configuration. In this configuration, the per phase inductance will be 4 times that specified. For example: a stepping motor has a specified per phase inductance of 1.47mH. In this configuration the driver will see 5.88 mH per phase.

Figure 2.3.1, Example #2 shows an 8 lead motor wired in parallel. Using this configuration the per phase inductance seen by the driver will be as specified.

Using the following equation we will show an example of sizing a motor for a IMx used with an unregulated power supply with a minimum voltage (+V) of 26 VDC:

Maximum Motor Inductance (mH per Phase) =
.2 X Minimum Supply Voltage

.2 X 26 = 5.2 mH

The recommended per phase winding inductance we can use is 5.2 mH.

Recommended IMS Motors

IMS stocks the following 4 lead, 1.8° enhanced torque hybrid stepping motors that are recommended for the IM Series Drivers.

These motors use a unique relationship between the rotor and stator to generate more torque per frame size while ensuring more precise positioning and increased accuracy.

The special design allows the motors to provide higher torque than standard stepping motors while maintaining a steadier torque and reducing torque drop-off.

Each frame size is available in 3 stack sizes, single or double shaft (with the exception of the size 23, 2.4A), with or without encoders. Holding torque ranges from 32 oz.-in. (M-1713-1.5) to 1303 oz.-in (M-3447-6.3) (64 N-cm to 920 N-cm).

These CE rated motors are ideal for applications where higher torque is required. For more detailed information on these motors, please see the IMS Full Line catalog or the IMS web site at http://www.imshome.com.

IM483

Single Shaft	Double Shaft
M-1713-1.5S	M-1713-1.5D
M-1715-1.5S	M-1715-1.5D
M-1719-1.5S	M-1719-1.5D

23 Frame Enhanced (2.4A - Not Available with Double Shaft)

Single Shaft	Double Shaft
M-2218-2.4S	N/A
M-2222-2.4S	N/A
M-2231-2.4S	N/A

23 Frame Enhanced (3.0A)

Single Shaft	Double Shaft
M-2218-3.0S	M-2218-3.0D
M-2222-3.0S	M-2222-3.0D
M-2231-3.0S	M-2231-3.0D

IMS also offers 17 and 23 Frame hybrid linear actuators for use with the IM483. Please see the IMS Full Line catalog or the IMS web site at http://www.imshome.com.

IM805

23 Frame Enhanced (2.4A - Not Available with Double Shaft)

Single Shaft	Double Shaft
M-2218-2.4S	N/A
M-2222-2.4S	N/A
M-2231-2.4S	N/A

23 Frame Enhanced (3.0A)

Single Shaft	Double Shaft
M-2218-3.0S	M-2218-3.0D
M-2222-3.0S	M-2222-3.0D
M-2231-3.0S	M-2231-3.0D

23 Frame Enhanced (6.0A)

Single Shaft	Double Shaft
M-2218-6.0S	M-2218-6.0D
M-2222-6.0S	M-2222-6.0D
M-2231-6.0S	M-2231-6.0D

34 Frame Enhanced (6.3A)

Single Shaft	Double Shaft
M-3424-6.3S	M-3424-6.3-D
M-3431-6.3S	M-3431-6.3D
M-3447-6.3S	M-3447-6.3D

IMS also offers 23 and 34 Frame hybrid linear actuators for use with the IM805. Please see the IMS Full Line catalog or the IMS web site at http://www.imshome.com.

Recommended Motor Cable Configurations

NOTE: These recommendations will provide optimal protection against EMI and RFI. The actual cable type, wire gauge, shield type and filtering devices used are dependent on the customer's application and system.

NOTE: Always use Shielded/Twisted Pairs for the IMS Driver DC Supply Cable, the AC Supply Cable and the IMS Driver to Motor Cable.

Cable length, wire gauge and power conditioning devices play a major role in the performance of your IMS Driver and Motor.

NOTE: The length of the DC power supply cable between the IMS Driver and the Motor should not exceed 50 feet.

Example A demonstrates the recommended cable configuration for the IMS Driver to Motor cabling under 50 Feet long. If cabling of 50 feet or longer is required, the additional length can be gained with the cable configuration in Example B.

Correct AWG wire size is determined by the current requirement plus cable length. Please see the IMS Driver to Motor Cable AWG Table at the end of this subsection.

Example A - Cabling Under 50 Feet

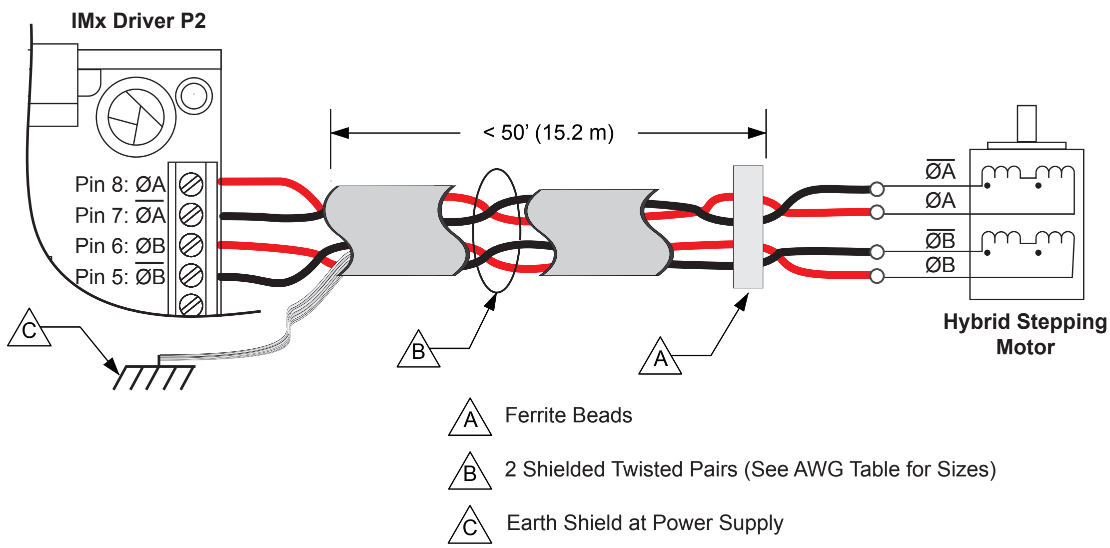
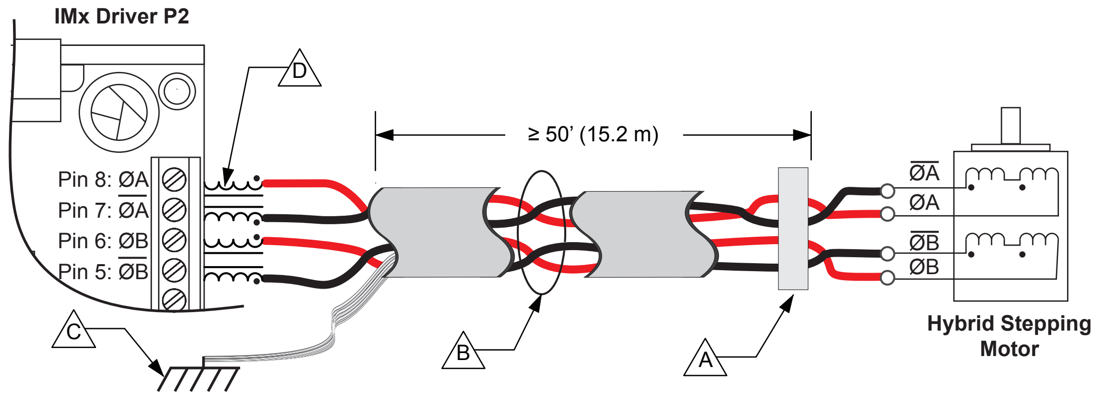


Figure 2.3.2: Motor Cabling Under 50 Feet (15.2 meters) from Drive

Example B - Cabling 50 Feet or Greater



A — Ferrite Beads

B — 2 Shielded Twisted Pairs (See AWG Table for Sizes)

C — Earth Shield at Power Supply

D — Common Mode Line Filters (2x), L ≈ 0.5 mh inductance. 0.5 mh is the typical starting point. By increasing or decreasing the inductance, the drain current can be set to a minimum to meet your requirements.

Figure 2.3.3: Motor Cabling 50 Feet or Greater (15.2 meters) from Drive

Recommended Power Supply Cabling

Power Supply Cable AWG Table					
1 Amp Peak					
Length: Feet (Meters)	10 (3.0)	25 (7.6)	50 (15.2)*	75 (22.9)*	100 (30.5)*
Minimum AWG	20	20	18	18	18
2 Amps Peak					
Length: Feet (Meters)	10 (3.0)	25 (7.6)	50 (15.2)*	75 (22.9)*	100 (30.5)*
Minimum AWG	20	18	16	14	14
3 Amps Peak					
Length: Feet (Meters)	10 (3.0)	25 (7.6)	50 (15.2)*	75 (22.9)*	100 (30.5)*
Minimum AWG	18	16	14	12	12
4 Amps Peak					
Length: Feet (Meters)	10 (3.0)	25 (7.6)	50 (15.2)*	75 (22.9)*	100 (30.5)*
Minimum AWG	18	16	14	12	12
5 Amps Peak					
Length: Feet (Meters)	10 (3.0)	25 (7.6)	50 (15.2)*	75 (22.9)*	100 (30.5)*
Minimum AWG	16	16	14	12	12
6 Amps Peak					
Length: Feet (Meters)	10 (3.0)	25 (7.6)	50 (15.2)*	75 (22.9)*	100 (30.5)*
Minimum AWG	14	16	14	12	12
7 Amps Peak					
Length: Feet (Meters)	10 (3.0)	25 (7.6)	50 (15.2)*	75 (22.9)*	100 (30.5)*
Minimum AWG	12	12	12	12	12

**Use the alternative methods illustrated in examples B when cable length is ≥ 50 feet.*

Table 2.3.1: Recommended Wire Gauges

WARNING! Although stepping motors will run hot when configured correctly, damage may occur to a motor if a higher than specified current is used. In most cases, the specified motor currents are maximum values and should not be exceeded!

Wiring Configuration for Various Motor Types

8 Lead Motors

8 lead motors offer a high degree of flexibility to the system designer in that they may be connected in series or parallel, thus satisfying a wide range of applications.

Series Connection

A series motor configuration would typically be used in applications where a higher torque at lower speeds is required. Because this configuration has the most inductance, the performance will start to degrade at higher speeds. Use the per phase (or unipolar) current rating as the peak output current, or multiply the bipolar current rating by 1.4 to determine the peak output current.

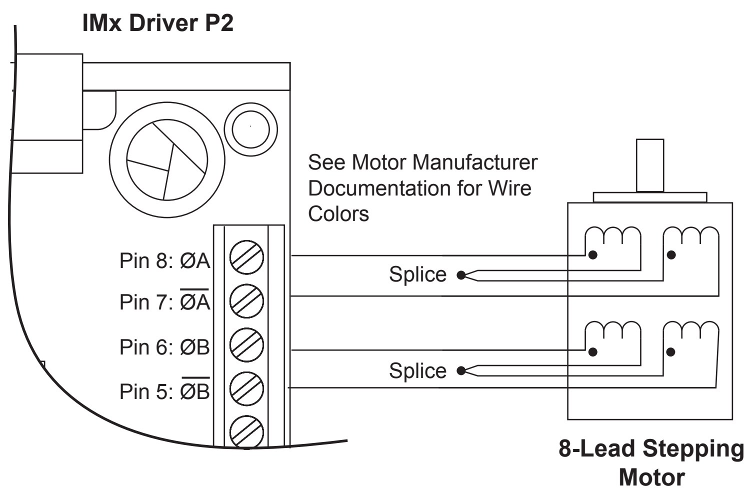


Figure 2.3.4: 8 Lead Motor, Series Configuration

Parallel Connection

An 8 lead motor in a parallel configuration offers a more stable, but lower torque at lower speeds. But because of the lower inductance, there will be higher torque at higher speeds. Multiply the per phase (or unipolar) current rating by 1.96, or the bipolar current rating by 1.4, to determine the peak output current.

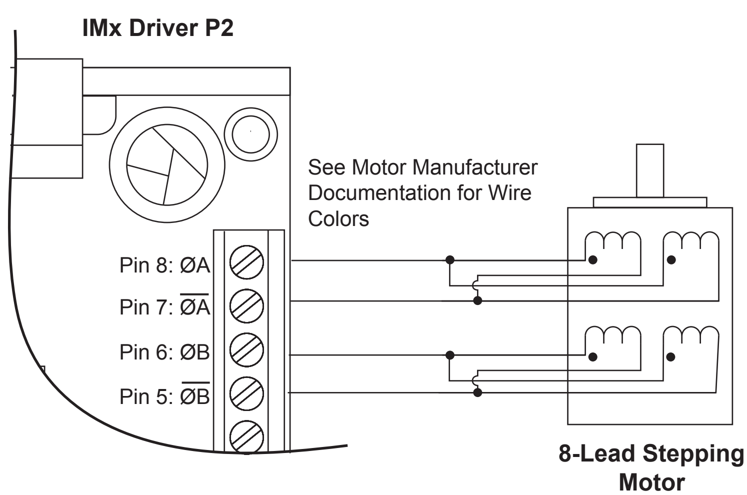


Figure 2.3.5: 8 Lead Motor, Parallel Configuration

6 Lead Motors

Like 8 lead stepping motors, 6 lead motors have two configurations available for high speed or high torque operation. The higher speed configuration, or half coil, is so described because it uses one half of the motor's inductor windings. The higher torque configuration, or full coil, uses the full windings of the phases.

Half Coil Configuration

As previously stated, the half coil configuration uses 50% of the motor phase windings. This gives lower inductance, hence, lower torque output. Like the parallel connection of 8 lead motor, the torque output will be more stable at higher speeds. This configuration is also referred to as half copper. In setting the driver output current multiply the specified per phase (or unipolar) current rating by 1.4 to determine the peak output current.

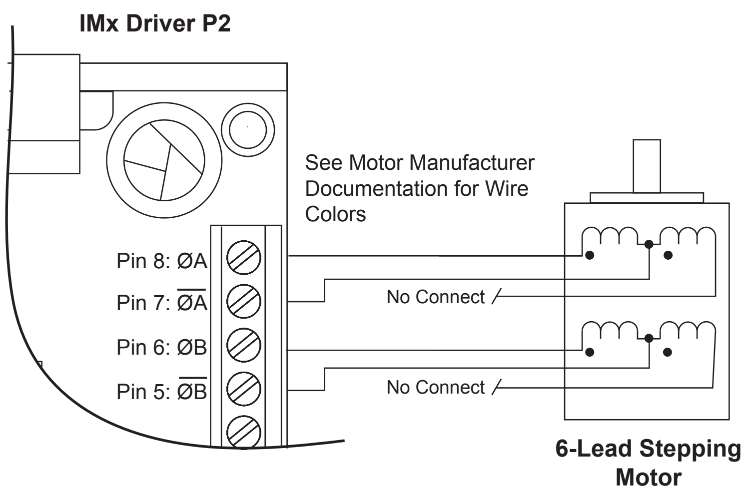


Figure 2.3.6: 6 Lead Motor, Half Coil Configuration

Full Coil Configuration

The full coil configuration on a six lead motor should be used in applications where higher torque at lower speeds is desired. This configuration is also referred to as full copper. Use the per phase (or unipolar) current rating as the peak output current.

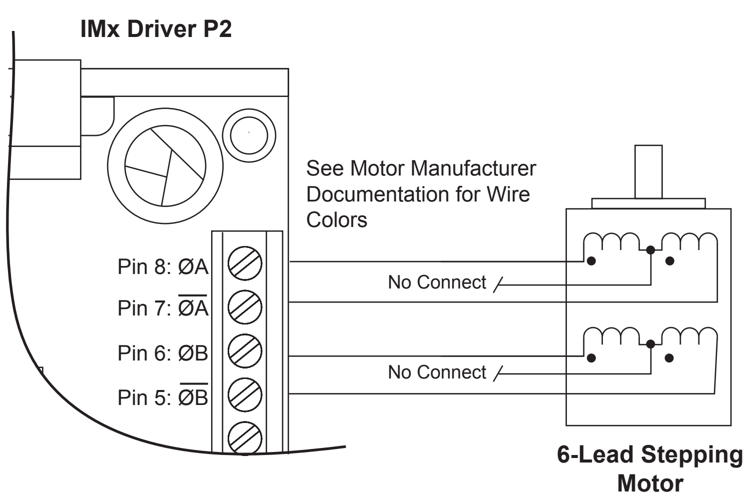


Figure 2.3.7: 6 Lead Motor, Full Coil Configuration

4 Lead Motors

4 lead motors are the least flexible but easiest to wire. Speed and torque will depend on winding inductance. In setting the driver output current, multiply the specified phase current by 1.4 to determine the peak output current.

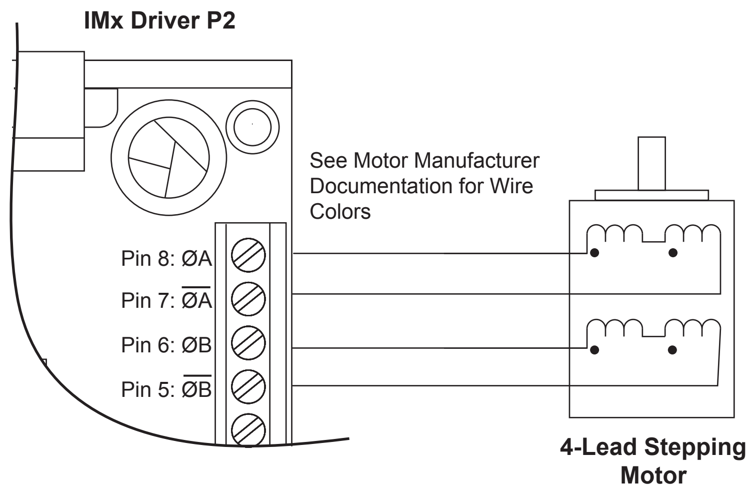


Figure 2.3.8: 4 Lead Motor

Configuration and I/O Interface

Section Overview

This section covers the interface connections, configuration and control signals of the IMx. Covered are:

- Controlling the Output Current
- Controlling the Microstep Resolution.
- Logic Interface Connection and Use.
- Using the Fault Output.
- Using the On-Fullstep Output.
- Minimum Required Connections.

Controlling the Output Current

For any given motor, the output current used for microstepping is determined differently from that of a half/full step driver.

In the IM Series driver, a sine/cosine output function is used in rotating the motor. Therefore, when microstepping, the specified phase current of the motor is considered an RMS value.

The output current is set by means of a current adjustment resistor placed between P2:2 (Current Adjust) and P2:3 (Power Ground). See the next subsection titled "Setting the Output Current" for connection instructions and resistor values.

The IMx also has an automatic current reduction feature, which allows the user to reduce the current in the motor windings to the level required to maintain holding torque, thus allowing for cooler motor operation and greater system power efficiency. This feature is controlled by means of a resistor connected between P2:1 (Reduction Adjust) and P2:2 (Current Adjust). The subsection; "Reducing the Output Current" contains reduction adjustment resistor calculations and connection instructions.

Determining the Output Current

Stepper motors can be configured as 4, 6 or 8 leads. Each configuration requires different currents. Shown below are the different lead configurations and the procedures to determine the peak per phase output current setting that would be used with different motor/lead configurations.

WARNING! Although stepping motors will run hot when configured correctly, damage may occur to a motor if a higher than specified current is used. In most cases, the specified motor currents are maximum values and should not be exceeded!

4 Lead Motor

Multiply the specified phase current by 1.4 to determine the peak output current.

$I_{Peak} = I_{Phase}$ X 1.4

Example: A 4 Lead Motor has a specified phase current of 2.0 Amps

2.0 X 1.4 = 2.8

I_{Peak} = 2.8 Amps

6 Lead Motor - Half Coil Configuration

When configuring a 6 lead motor in a half coil configuration (i.e. connected from one end of the coil to the center tap (high speed configuration)) multiply the specified per phase (or unipolar) current rating by 1.4 to determine the peak output current.

$I_{Peak} = I_{Phase}$ X 1.4

Example: A 6 Lead Motor in half coil configuration has a specified phase current of 3.0 Amps

3.0 X 1.4 = 4.28

I_{Peak} = 4.2 Amps

WARNING! Although stepping motors will run hot when configured correctly, damage may occur to a motor if a higher than specified current is used. In most cases, the specified motor currents are maximum values and should not be exceeded!

6 Lead Motor - Full Coil Configuration

When configuring the motor so the full coil is used (i.e. connected from end-to-end with the center tap floating (higher torque configuration)) use the per phase (or unipolar) current rating as the peak output current.

$I_{Peak} = I_{Phase}$

Example: A 6 Lead Motor in full coil configuration has a specified phase current of 3.0 Amps

3.0 X 1.4 = 4.28

I_{Peak} = 4.2 Amps

8 Lead Motors - Series Connection

When configuring the motor windings in series, use the per phase (or unipolar) current rating as the peak output current, or multiply the bipolar current rating by 1.4 to determine the peak output current.

Unipolar: $I_{Peak} = I_{Phase}$

Bipolar: $I_{Peak} = I_{Phase} \times 1.4$

Example: An 8 lead motor in series configuration with a specified unipolar current of 3.0A

3.0 = 3.0

I_{Peak} = 3.0 Amps

An 8 lead motor in series configuration with a specified bipolar current of 2.8A

2.8 X 1.4 = 3.92

I_{Peak} = 3.92 Amps

8 Lead Motors - Parallel Connection

When configuring the motor windings in parallel, multiply the per phase (or unipolar) current rating by 2.0 or the bipolar current rating by 1.4 to determine the peak output current

Unipolar: $I_{Peak} = I_{Phase} \times 2.0$

Bipolar: $I_{Peak} = I_{Phase} \times 1.4$

Example: An 8 lead motor in parallel configuration with a specified unipolar current of 2.0A

2.0 X 2.0 = 4.0

I_{Peak} = 4.0 Amps

An 8 lead motor in parallel configuration with a specified bipolar current of 2.8A

2.8 X 1.4 = 3.92

I_{Peak} = 3.92 Amps

Setting the Output Current

The IM Series Drivers uses an internal 1 milliamp current source to establish the reference voltage needed to control the output current. This voltage is programmed by means of an external 1/8 watt or higher, 1 percent ohms resistor connected between P2:2 (Current Adjust) and P2:3 (Power Ground).

The relationship between the output current and the current adjust resistor value is expressed as follows:

$R_{Adjust} = I_{Peak} \times 500$

The same equation applies to both the IM483 and the IM805. Because the drives have different current ranges the resistor value to peak output current will be detailed in separate tables.

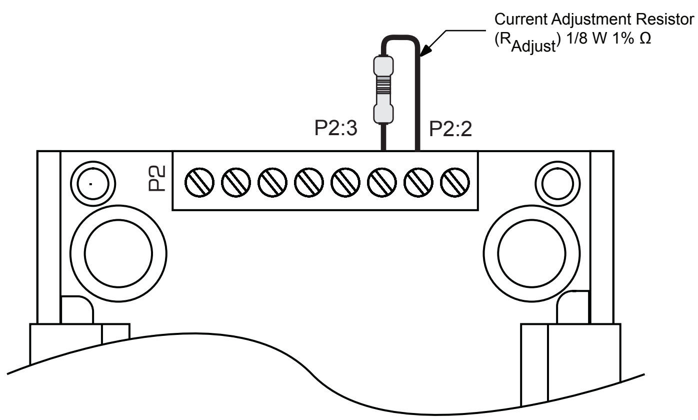


Figure 2.4.1: Current Adjustment Resistor

NOTE: Resistor lead length should be a short as possible to prevent electrical noise from being coupled onto the current adjust/reduction circuitry.

Current Adjustment Resistors

Output Current (Amps Peak)	IM483 Value (1% Ω)	IM805 Value (1% Ω)
0.4	200	—
0.6	301	—
0.8	392	—
1.0	499	—
1.2	590	—
1.4	698	698
1.6	787	787
1.8	887	887
2.0	1000	1000
2.2	1100	1100
2.4	1210	1210
2.6	1300	1300
2.8	1400	1400
3.0	1500	1500
3.2	1580	1580
3.4	1690	1690
3.6	1780	1780
3.8	1910	1910
4.0	2000	2000
4.2	—	2100
4.4	—	2210
4.6	—	2320
4.8	—	2370
5.0	—	2490
5.2	—	2610
5.4	—	2670
5.6	—	2800
5.8	—	2870
6.0	—	3010
6.2	—	3090
6.4	—	3240
6.6	—	3320
6.8	—	3400
7.0	—	3480

Table 2.4.1: Recommended Current Adjustment Resistor Values

NOTE: Resistor lead length should be a short as possible to prevent electrical noise from being coupled onto the current adjust/reduction circuitry.

Reducing/Disabling the Output Current

The IM Series has the capability of automatically reducing the current in the motor windings following a move. Use of this feature will reduce motor and driver heating, thus allowing for cooler operation and improved system power efficiency.

The output current may be reduced to the level needed to maintain motor holding torque by means of a 1/8 watt or higher, 1 percent resistor. This resistor is connected between P2:1 (Reduction Adjust) and P2:2 (Current Adjust). The value of the reduced output current will also be dependant on the current adjust resistor value as expressed in the equation below. Figure 7.3 illustrates the connection. If no resistor is placed, the current in the motor windings will be at the amount set by the current adjust resistor when the motor is stopped and the driver enabled.

To reduce the current in the motor windings to zero between moves, the drive may be disabled by pulling the enable/disable input (P1:5) to ground by means of a sinking output on your controller or PLC, or by placing a shunt between pins 1 and 2 of connector P2. Note that if the controller continues to send step clock pulses to the driver, the internal counter on the IM2000 controller ASIC will continue to increment unless the driver is reset. This will only affect your system if the On-Full-Step output is used for position monitoring.

The amount of current reduced will depend upon the value of the reduction adjust resistor (R_{Red}) and the value of the current adjust resistor (R_{Adj}). The current will be reduced approximately 1.0 seconds after the rising edge of the last step clock pulse. The value of R_{Red} is calculated as follows:

$$R_{Red} = 500 \text{ X } \frac{I_{Run} \text{ X } I_{Hold}}{(I_{Run} - I_{Hold})}$$

I_{Run} is the desired peak running current.

I_{Hold} is the desired peak holding current.

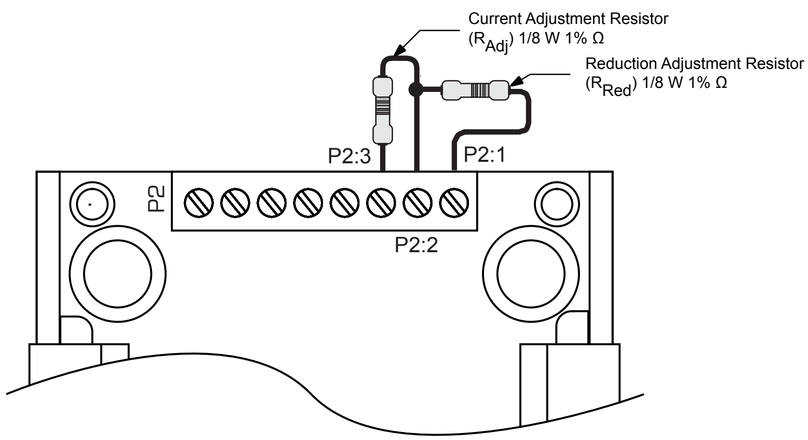


Figure 2.4.2: Current Reduction Resistor

Controlling the Microstep Resolution

The number of microsteps per step is selected by the DIP switch (SW1). Table 2.4.2 lists the standard resolution values along with the associated switch settings for a 1.8° stepping motor.

If a motor with a different step angle is used, then the steps per revolution resolution will have to be calculated manually by multiplying the microsteps/step setting by the number of full steps per motor revolution.

For example, a 0.45° step angle motor (800 Fullsteps/Rev) set to 16 microsteps/step will have a resolution of 12,800 steps/rev.

These settings may be switched on-the-fly. There is no need to reset or disable the drive in order to change the output resolution. The resolution change will occur upon the rising edge of the step clock pulse following the change.

If remote control of the output resolution is required, these signals are brought out on connector P1 on the IM Series variants with a 34-pin header on connector P1. This option is discussed in detail in the Application Example Appendix.

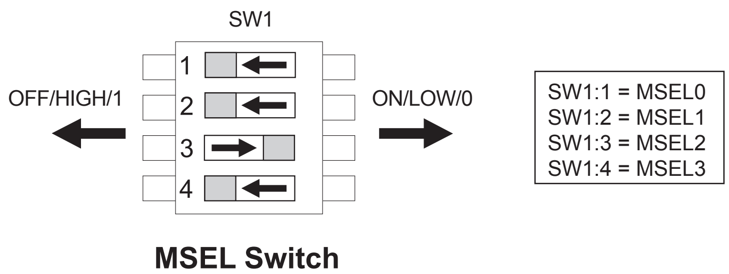


Figure 2.4.3: Microstep Resolution Select Switch

Microstep Resolution Select					
Resolution Microsteps/Step	**Steps/Rev**	**MSEL 0 SW1:1**	**MSEL 1 SW1:2**	**MSEL 2 SW1:3**	**MSEL 3 SW1:4**
Binary Resolutions					
2	400	ON	ON	ON	ON
4	800	OFF	ON	ON	ON
8	1600	ON	OFF	ON	ON
16	3200	OFF	OFF	ON	ON
32	6400	ON	ON	OFF	ON
64	12800	OFF	ON	OFF	ON
128	25600	ON	OFF	OFF	ON
256	51200	OFF	OFF	OFF	ON
Decimal Resolutions					
5	1000	ON	ON	ON	OFF
10	2000	OFF	ON	ON	OFF
25	5000	ON	OFF	ON	OFF
50	10000	OFF	OFF	ON	OFF
125	25000	ON	ON	OFF	OFF
250	50000	OFF	ON	OFF	OFF
Invalid Resolution Settings					
xxxxxx	xxxxxx	ON	OFF	OFF	OFF
xxxxxx	xxxxxx	OFF	OFF	OFF	OFF

Table 2.4.2: Microstep Resolution Select Switch Settings

WARNING! The isolated logic inputs on the IMx are internally limited to allow for an optocoupler supply voltage of +5 VDC. If using a higher voltage supply, a current limiting resistor must be placed in series with the input or damage will occur to the IMx input circuitry, rendering the drive inoperable.

Optically Isolated Inputs

The IM Series has 4 optically isolated logic inputs which are located on connector P1. These inputs are isolated to minimize or eliminate electrical noise coupled onto the drive control signals. Each input is internally pulled-up to the level of the optocoupler supply and may be connected to sinking outputs on a step motor controller or a PLC. These inputs are:

1] Step Clock (P1:2)

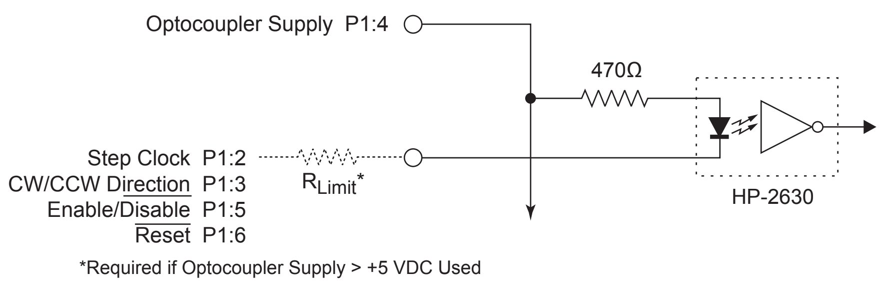
2] Direction (P1:3)

3] Enable (P1:5)

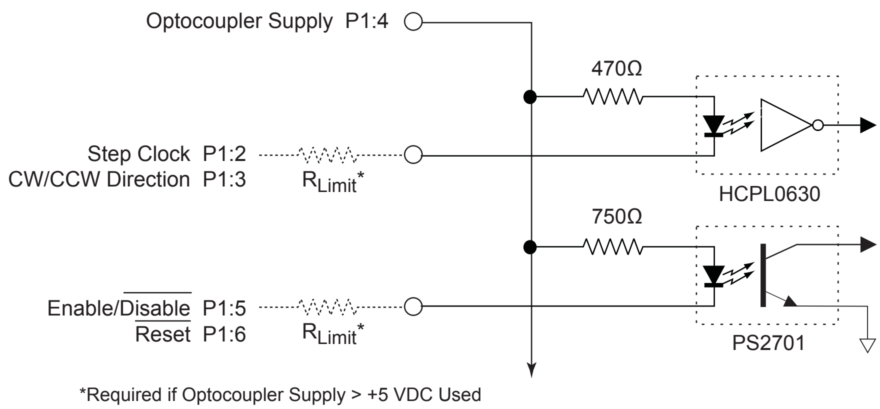
4] Reset (P1:6)

Of these inputs only step clock and direction are required to operate the IM Series drive.

The schematics shown in Figure 2.4.4 illustrate the inputs.



IM483 Optical Isolation Circuitry



IM805 Optical Isolation Circuitry

Figure 2.4.4: Optically Isolated Input Circuits for the IM Series Drivers

Powering the Optocouplers

In order to maintain isolation, the optocouplers must be powered by an external power supply connected to P1:4, with the opto supply ground connected to the ground of the input control circuitry. The logic inputs are internally limited to allow for a +5VDC power supply.

A power supply in excess of +5 volts may be used, however a current limiting resistor MUST be placed in series with the input to limit the input forward current to the recommended 7 milliamperes. At no time can the input forward current exceed 15 milliamperes or damage may occur to the drive.

Current Limiting Resistors		
Opto Supply (+VDC)	**R_{Limit} Value (5% Ω)**	**R_{Limit} Value (1% Ω)**
5	—	—
10	680	681
12	1000	1000
15	1300	1300
24	2700	2670

Table 2.4.3: Current Limiting Resistor Values by Opto Supply Voltage Level

Isolated Logic Input Characteristics

Step Clock (P1:2)

The step clock input is where the motion clock from your control circuitry will be connected. A positive going edge on this input will increment or decrement the sine/cosine position generator in the IM2000 ASIC. The size of this increment or decrement will depend on the microstep resolution setting. The motor will advance one microstep in the plus or minus direction (based upon the state of the direction input) on the rising edge of each clock pulse.

The positive going edge of this input will also update and latch the states of the direction and microstep select inputs. If no change has occurred to these inputs then the drive will make the next step.

CW/CCW Direction (P1:3)

The direction input controls the CW/CCW direction of the motor. The direction of motion will depend upon the wiring of the motor phases. This input is synchronized to the positive going edge of the step clock input.

Enable/$\overline{\text{Disable}}$ (P1:5)

This input can be used to enable or disable the driver output circuitry. When in a logic HIGH (default, unconnected) state the driver outputs will be enabled and step clock pulses will cause the motor to advance. When this input is pulled LOW, by means of a switch or sinking output, the driver output circuitry will be disabled. Please note that the internal sine/cosine position generator will continue to increment or decrement as long as step clock pulses are being received by the IMx.

This input is asynchronous to any other input and may be changed at any time.

$\overline{\text{Reset}}$ (P1:6)

The reset input will disable the outputs and reset the driver to its initial state (Phase A OFF, Phase B full ON) when pulled LOW by a switch or sinking output.

Use of this input may also be used to clear a “Fault” condition, provided the cause of the fault has been eliminated.

The reset input is asynchronous to any other input and may also be changed at any time.

Input Timing

The direction input and the microstep resolution inputs are internally synchronized to the positive going edge of the step clock input. When the step clock pulse goes HIGH, the state of the direction input and microstep resolution settings are latched. Any changes made to the direction and/or microstep resolution will occur on the rising edge of the step clock pulse following this change. Table 2.4.4 lists the timing specifications.

Input Timing Specifications

Specification	Input	Time (nS)
Minimum Pulse Width	Reset	500
Minimum Pulse Width	Step Clock	75
Typical Execution Time	Step Clock/Direction	100

Table 2.4.4: Isolated Input Timing Characteristics

Interface Methods

The isolated logic inputs may be interfaced to the user's control system in a variety of ways. In all cases the inputs are normally in a logic HIGH state when left floating. For purposes of this manual we will show three interface methods:

1] Switch Interface.

2] Open Collector Interface.

3] TTL Interface.

Switch Interface

A switch connected between the input and the opto supply ground will sink the input. If this method is used a SPST (Single-Pole, Single-Throw) switch works well for enable and direction. A normally-open momentary switch works well for reset. Figure 2.4.5 illustrates a SPST switch connected to the direction input.

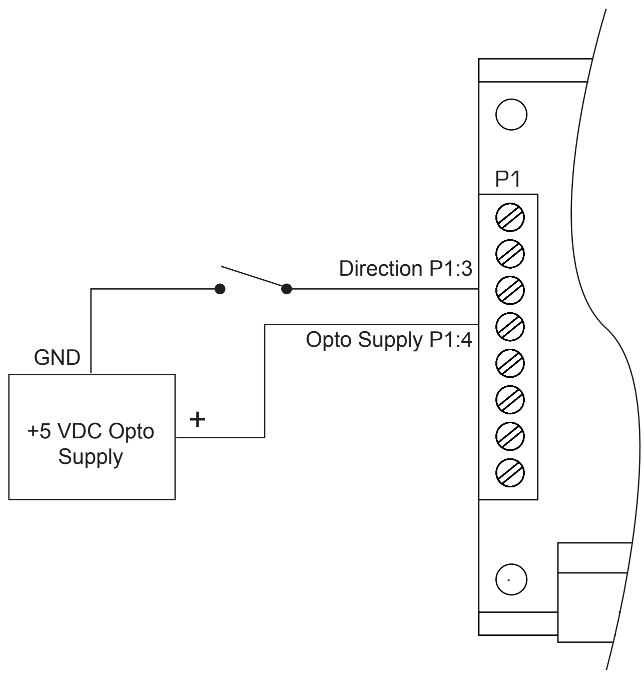
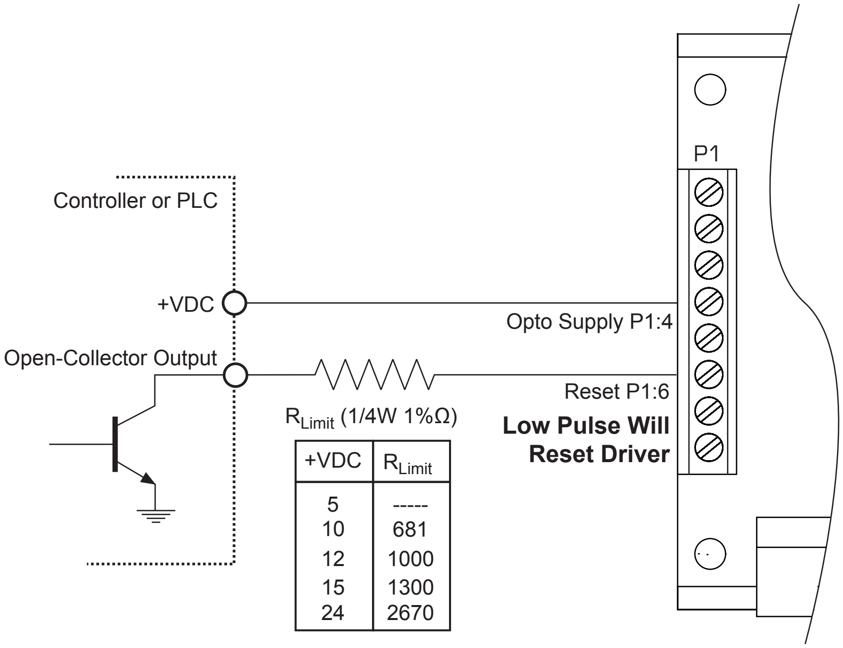


Figure 2.4.5: SPST Switch Interface to the Direction Input

Open Collector Interface

Figure 2.4.6 shows an open collector interface connected to the reset input. This interface method may be used with any of the logic inputs. Remember that a current limiting resistor is required if an opto supply voltage greater than +5 VDC is used.



+VDC	R_{Limit}
5	-----
10	681
12	1000
15	1300
24	2670

Figure 2.4.6: Open Collector Interface

TTL Interface

Figure 2.4.7 shows a TTL device connected to the enable input. This interface method may be used with any of the logic inputs.

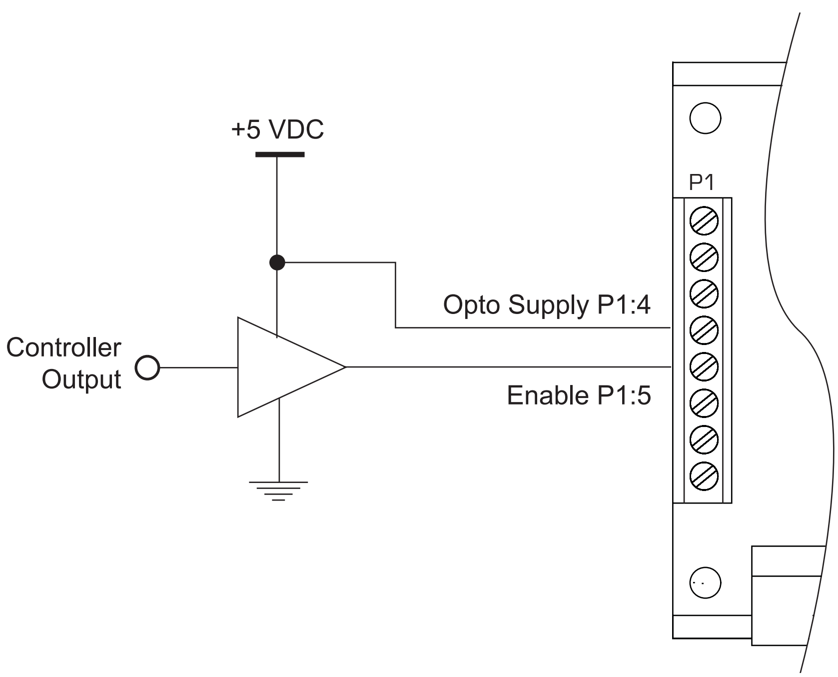


Figure 2.4.7: TTL Interface

NOTE! Once the fault output is active, it can only be cleared by toggling the reset input LOW, or by powering off the driver.

NOTE! The IMx driver outputs will disable in the event of an over-temperature condition, however, in this case the fault output WILL NOT latch. The driver will begin operating again when the temperature drops below the shut-off threshold.

Connecting and Using the Fault Output

The IMx has an open collector fault output located on P1:7. This output is non-isolated and has the ability of sustaining maximum driver voltage. It can sink a maximum of 25mA, which is sufficient to drive an LED or a small relay.

This output is active when in a LOW state. The following conditions will cause this output to become active:

1] Phase-to-phase short circuit.

2] Phase-to-ground short circuit.

3] Phase over-current condition.

When the fault output becomes active, it disables the driver outputs and latches in this condition. It can only be cleared by toggling the reset input LOW, or by powering OFF then powering ON the drive.

Figure 2.4.8 illustrates the fault output connected to an LED.

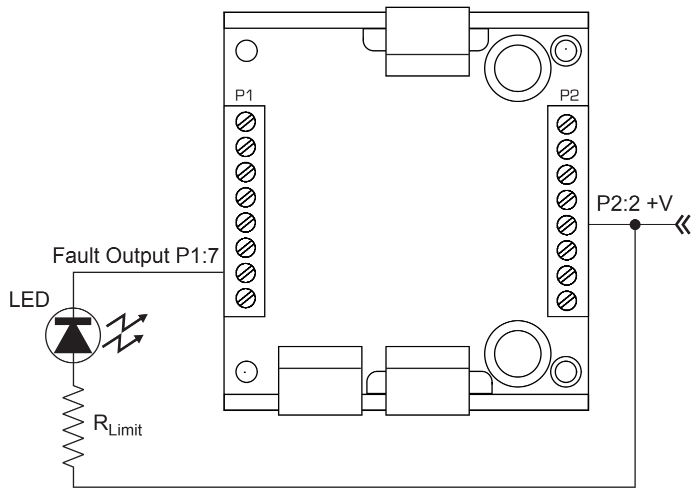


Figure 2.4.8: Fault Output Connected to an LED

Full Step Output

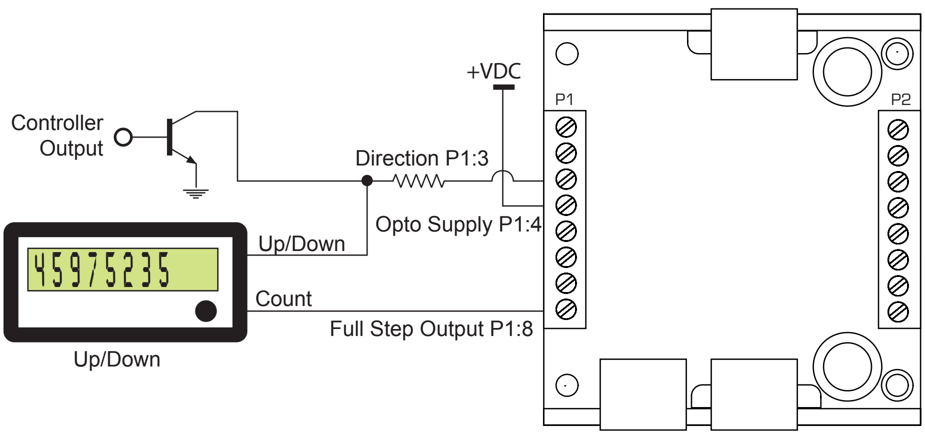
The full step output is a high speed MOSFET (open drain) output located at P1:8. This output will toggle LOW each time the driver makes a full step, and remain so for the duration of the full step. A full step occurs each time the Phase A or Phase B sine wave crosses through zero. At zero crossing there will be full current in one motor winding, zero current in the other. This full step position is a common position regardless of the microstep resolution selected.

This high speed output is non-isolated and can sustain maximum driver voltage. It is capable of sinking up to 25mA.

This output can be used to count the number of full steps directed by the driver. By so utilizing this output, the user can both measure the repeatability of the stepper system and track motor position. Please note that using this output is not closed-loop control, merely a method of monitoring position and repeatability. It represents full steps commanded by the driver, not actual full steps moved by the motor.

The application example shown in Figure 2.4.9 illustrates a method where an up/down counter may be connected to the full step output. The counter will count the number of full steps up or down based upon the state of the direction input. The count input of the counter will increment or decrement with each full step taken.

As noted in the drawing, this is only a representation of a possible application of the full step output. Additional interface circuitry may be required between the IMx and the counter. Check the documentation provided by the manufacturer of your counter for interface requirements.



N NOTE: This drawing represents a possible application of the On-Full-Step-Output. Additional Interface circuitry may be required between the IMx Driver and the counter.

Figure 2.4.9: Full Step Output Interfaced to an Up/Down Counter

NOTE! When controlling the driver output resolution externally, the DIP switches (SW1) should be in the "OFF" position.

The Resolution Select (MSEL) Inputs (-34P1 Versions Only)

One of the key features of the 34 pin header is the availability of the resolution select inputs on P1. This allows the user to take external control of the driver output resolution, enabling the user to switch the output resolution "on-the-fly".

An example would be to switch to a lower resolution (higher velocity, lower positional accuracy) during a long move. When the move nears completion, switch back to a higher resolution (lower speed, greater positional accuracy) to accurately position the axis. This on-the-fly "gear shifting" facilitates high speed slewing combined with high resolution positioning at either end of the move.

The microstep resolution is synchronized with the step clock input. If the resolution change does not fall on a full step, the IMx will readjust itself at the next pulse that would overshoot the fullstep position. This feature allows the IMx to readjust the motor position regardless of the output resolution selected during a resolution change.

These inputs are non-isolated and are active when in a logic LOW state (if left open or floating the input is considered to be OFF). They are pulled-up to +5 VDC via 1.5 kΩ resistors. These inputs may to be interfaced via an external switch or sinking output on a control device. Figure A.3 shows the resolution select inputs connected using a TTL interface method. Note that the DIP switch (SW1) is still in place and may be used to control the resolution. If controlling the resolution externally, the four switches need to be in the "OFF" position.

The driver output resolution has two modes of operation: decimal and binary. The modes are switched by changing the logic state of MSEL 3. If MSEL 3 is in a logic HIGH (open/floating) state the output resolution will be in decimal mode. Binary mode is entered by sinking MSEL 3 to a 0 state.

Typically, in cases where resolution is being switched on-the-fly, only one mode will be used. The desired mode may be selected by positioning the DIP switch (SW1:4) for MSEL 3 to the appropriate state for the selected mode, then the resolution may be controlled by changing the states of MSEL 0 - 2 as needed, thus using only 3 outputs on the control device.

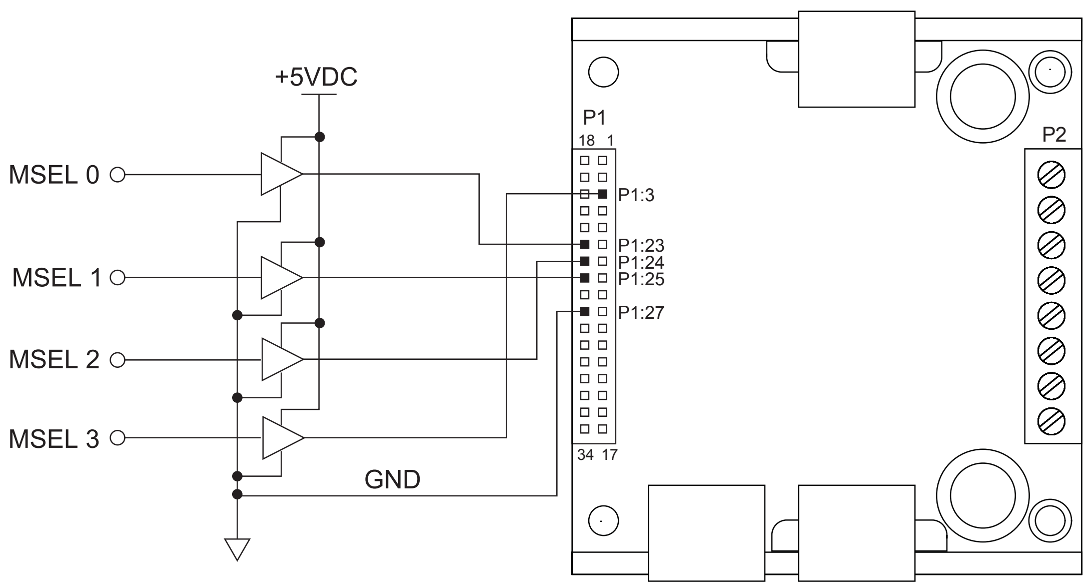


Figure 2.4.10: TTL Interface to Microstep Resolution Select Inputs on an IMx-34P1 Version

Microstep Resolution Select					
Resolution Microsteps/Step	**Steps/Rev**	**MSEL 0**	**MSEL 1**	**MSEL 2**	**MSEL 3**
Binary Resolutions					
2	400	0	0	0	0
4	800	1	0	0	0
8	1600	0	1	0	0
16	3200	1	1	0	0
32	6400	0	0	1	0
64	12800	1	0	1	0
128	25600	0	1	1	0
256	51200	1	1	1	0
Decimal Resolutions					
5	1000	0	0	0	1
10	2000	1	0	0	1
25	5000	0	1	0	1
50	10000	1	1	0	1
125	25000	0	0	1	1
250	50000	1	0	1	1
Invalid Resolution Settings					
xxxxxx	xxxxxx	0	1	1	1
xxxxxx	xxxxxx	1	1	1	1

Table 2.4.3: Microstep Resolution Truth Table

Step Clock and Direction Outputs (-34P1 Versions Only)

Another key feature offered by the IMx-34P1 is the non-isolated step clock and direction outputs. These outputs will follow the step and direction inputs. This allows for multiple drives to be cascaded, with the primary drive receiving the step/direction signals from the control device, and the drives connected to the step/direction outputs to follow the primary. Figure 2.4.11 illustrates a possible connection/application of these outputs.

These outputs used in this configuration would allow the user to electronically gear or ratio the drives using the MSEL inputs. For instance, if the resolution of the primary drive was set to 128 and the secondary drive set to 256, when a move is commanded, the secondary drive will move 1/2 the distance and velocity of the primary drive.

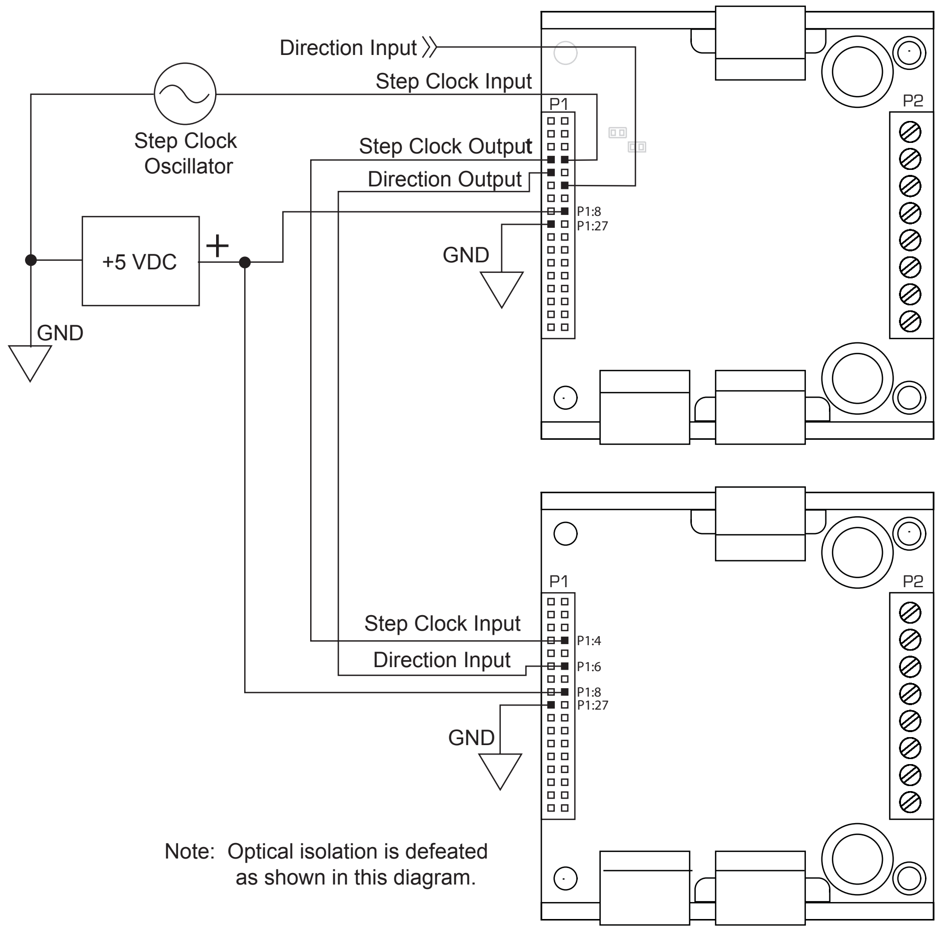


Figure 2.4.11: Tow IMx-34P1 Type Drives in a Following Configuration

Minimum Connections

The following figure illustrates the minimum connection requirements for the IMx drivers..

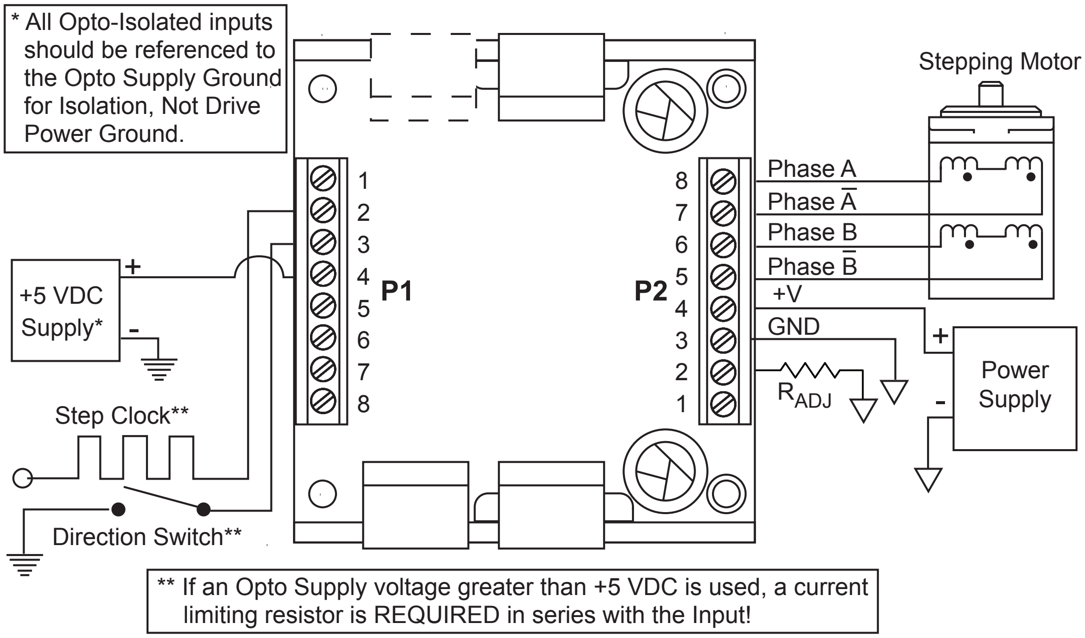


Figure 2.4.12: Minimum Required Logic and Power Connections

Notes

IM483 & IM805

APPENDICES

Notes

Troubleshooting

Section Overview

This section will cover the following:

- Basic Troubleshooting.
- Common Problems/Solutions.
- Contacting Technical Support.
- Product Return Procedure.
- 24-Month Limited Warranty.

Basic Troubleshooting

In the event that your IMx doesn't operate properly, the first step is to identify whether the problem is electrical or mechanical in nature. The next step is to isolate the system component that is causing the problem. As part of this process you may have to disconnect the individual components that make up your system and verify that they operate independently. It is important to document each step in the troubleshooting process. You may need this documentation to refer back to at a later date, and these details will greatly assist our Technical Support staff in determining the problem should you need assistance.

Many of the problems that affect motion control systems can be traced to electrical noise, controller software errors, or mistakes in wiring.

Problem Symptoms and Possible Causes

- **Symptom**

  Motor does not move.

- **Possible Problem**

  No power.
  Unit is in a reset condition.
  Invalid microstep resolution select setting.
  Current adjust resistor is wrong value or not in place.
  Fault condition exists.
  Unit is disabled.

- **Symptom**

  Motor moves in the wrong direction.

- **Possible Problem**

  Motor phases may be connected in reverse.

- **Symptom**

  Unit in fault.

- **Possible Problem**

  Current adjust resistor is incorrect value or not in place.
  Motor phase winding shorted.
  Power input or output driver electrically overstressed.

- **Symptom**

  Erratic motor motion.

- **Possible Problem**

  Motor or power wiring unshielded or not twisted pair.
  Logic wiring next to motor/power wiring.
  Ground loop in system.
  Open winding of motor.
  Phase bad on drive.
  Invalid microstep resolution select setting.

- **Symptom**

  Motor stalls during acceleration.

- **Possible Problem**

  Incorrect current adjust setting or resistor value.
  Motor is undersized for application.
  Acceleration on controller is set too high.
  Power supply voltage too low.

- **Symptom**

  Excessive motor and driver heating.

- **Possible Problem**

  Inadequate heat sinking / cooling.
  Current reduction not being utilized.
  Current set too high.

- **Symptom**

  Inadequate holding torque.

- **Possible Problem**

  Incorrect current adjust setting or resistor value.
  Increase holding current with the current reduction adjust resistor.

Contacting Technical Support

In the event that you are unable to isolate the problem with your IM483, the first action you should take is to contact the distributor from whom you originally purchased your product or IMS Technical Support at 860-295-6102 or by fax at 860-295-6107. Be prepared to answer the following questions:

- What is the application?
- In detail, how is the system configured?
- What is the system environment? (Temperature, Humidity, Exposure to chemical vapors, etc.)
- What external equipment is the system interfaced to?

The IMS Web Site

Another product support resource is the IMS web site located at http://www.imshome.com. This site is updated monthly with tech tips, applications and new product updates.

Returning Your Product to IMS

If Technical Support determines that your IM483 needs to be returned to the factory for repair or replacement, you will need to take the following steps:

- Obtain an RMA (Returned Material Authorization) number and shipping instructions from Customer Service.
- Fill out the “Reported Problem” field in detail on the RMA form that Customer Service will fax you.
- Enclose the product being returned, and the RMA form in the box. Package product in its original container if possible. If original packaging is unavailable ensure that the product is enclosed in approved antistatic packing material. Write the RMA number on the box.

The normal repair lead time is 10 business days. Should you need your product returned in a shorter time period, you may request that a “HOT” status be placed upon it while obtaining an RMA number. Should the factory determine that the product repair is not covered under warranty, you will be notified of any charges.

Notes

Accessories

Section Overview

This section will cover the following:

- H-4x Heat Sink Kit
- TN-48 Thermal Non-Isolating Pad
- U3-CLP Side Mounting Clips.
- BB-34 Breakout Board.

H-4X Heat Sink Kit

The H-4X heat sink is designed for use with the IM483. When ordering, please specify which drive is being used as this heat sink is also used with the IB46X drivers. The H-4X comes with the following items:

(1) H-4X heat sink.

(4) 6 X 32 mounting screws/washers.

(1) TN-48 non-isolating thermal pad.

Mechanical Specifications and Mounting

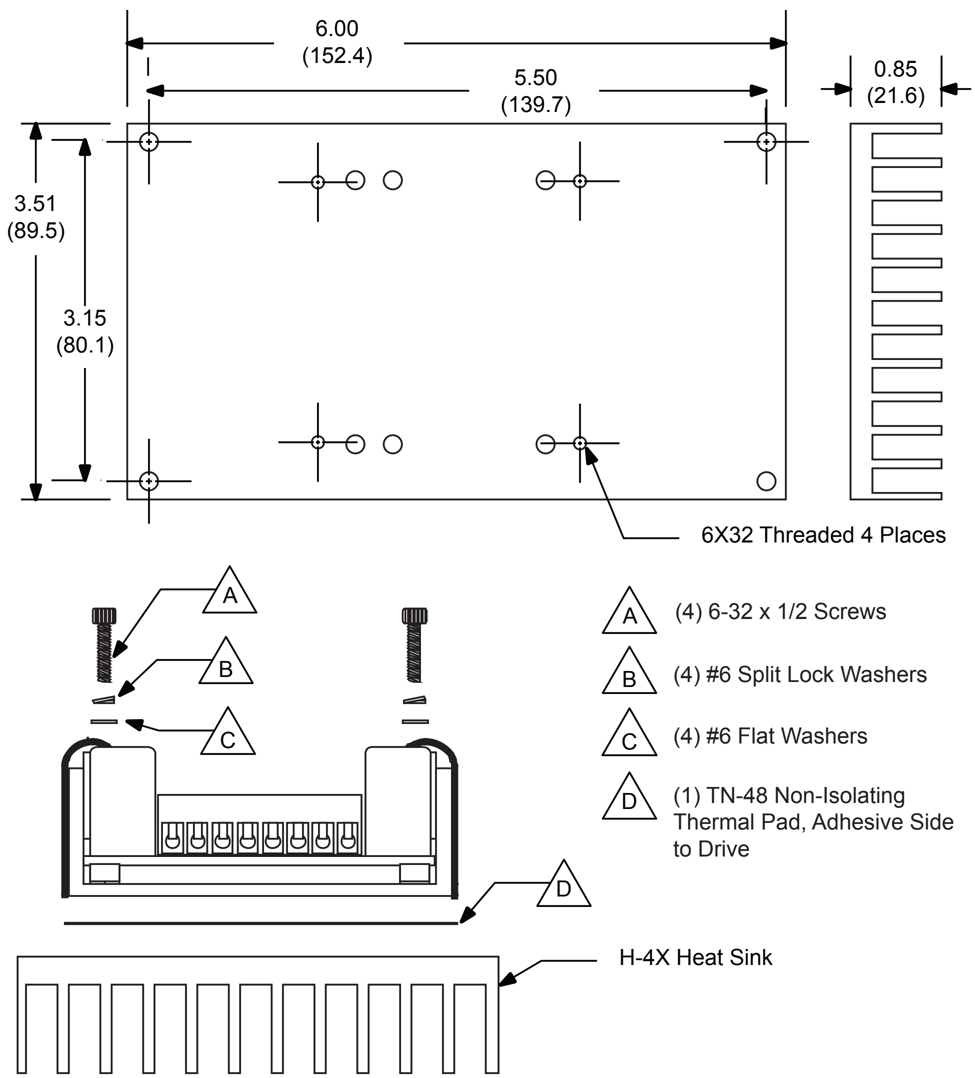


Figure B.1: H-4x Heat Sink Kit Dimensions and Mounting Instructions

Thermal Non-Isolating Pad (TN-48)

The TN-48 thermal non-isolating pad is a composite of .0015” (.038 mm) aluminum foil coated on both sides with a .0025” (.063 mm) thick thermally and electrically conductive rubber. These pads have a thermal conductivity of 0.65 W/m-K and a maximum temperature rating of 180°C.

One side of the TN-48 pad is adhesive and may be applied directly to the IMx driver. The TN-48 pad eliminates the problems associated with using thermal grease.

This pad are also included in the heat sink kit.

U3-CLP: Side-Mounting Clip

The U3-CLP mounting clips were specially designed for the IM80X, IM483 series of Microstepping drivers and driver indexers and the ISP200 and ISP300 series power supplies to decrease overall panel space and allow for more flexible mounting patterns.

The 2 clips attach easily to the unit for optional side mounting and reduce the amount of panel space required to mount the drive by 42%. The low-profile clips attach to the side of the unit and do not interfere with various connection configurations.

Included in the Kit

(1) IMS0063 Top Clip

(1) IMS0064 Bottom Clip

Recommended Hardware (Not Included)

2 - 10 X 32 Pan Head Machine Screw (Length determined by mounting plate thickness)

2 - # 10 Lock Washers

4 - # 10 Flat Washers

2 - 10 X 32 Nuts

Installation

Using the photographs in Figure B.2, place the clips on the unit to be mounted as shown. The clips must be oriented in a fashion that places the smaller retaining tab between the bottom of the printed circuit board and the aluminum channel case

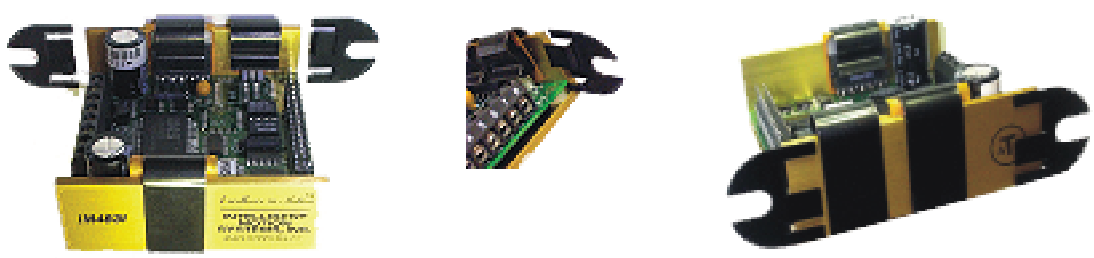


Figure B.2: U3-CLP Side Mounting Clip Installation

Mechanical Specifications and Mounting

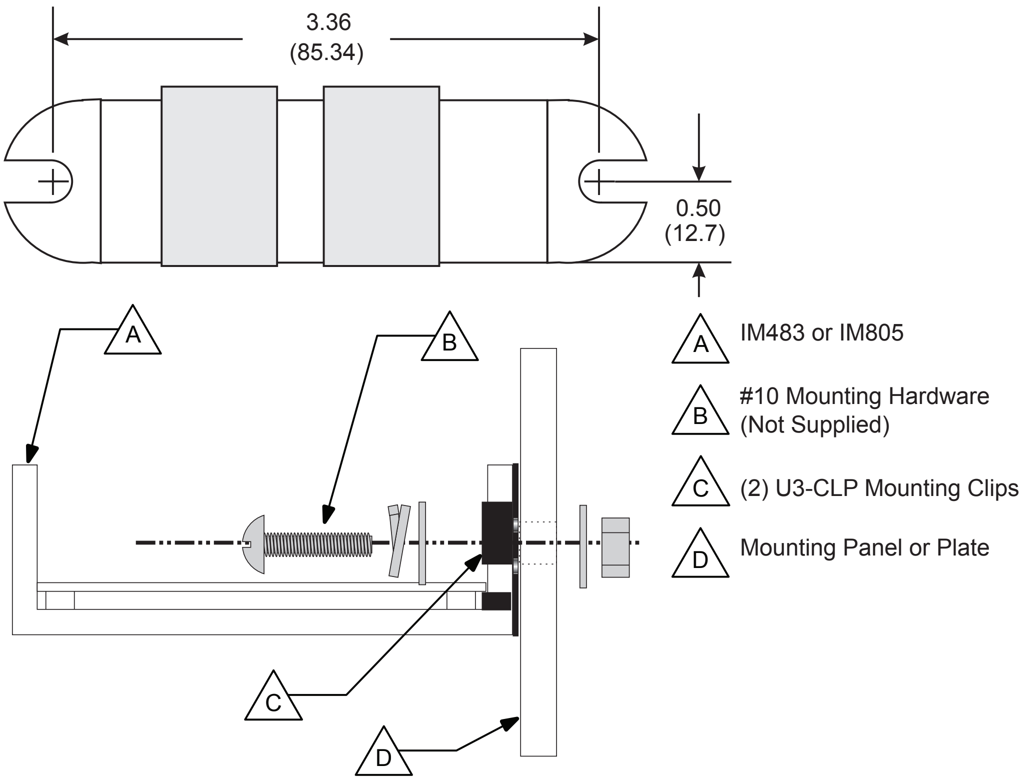


Figure B.3: U3-CLP Side Mounting Clip Dimensions and Mounting

BB-34-4P Breakout Board

The BB-34-4P breakout board is designed to provide a screw terminal interface for the IM483-34P1, IM483I, IM483IE and IM804/805-34P1 microstepping driver.

This interface is easily inserted into the P1 pin receptacle.

Wiring Recommendations

IMS recommends that the following wiring practices be used to interface to the IM483-34P1 using the BB-34-4P:

- Wire Size: 16 - 22 AWG
- Strip Length: 0.200” (5mm)
- Screw Torque: 3.0 lb-in (0.33 N-m)

Installation

To install the BB-34-4P first remove the 34 pin header from the receptacle by gently rocking it back and forth and lifting the pin header straight upwards. Do not remove at a side-to-side angle.

Insert the breakout board into the P1 pin receptacle as shown in Figure D.6. Mount to drive and heat sink plate using the recommended mounting hardware.

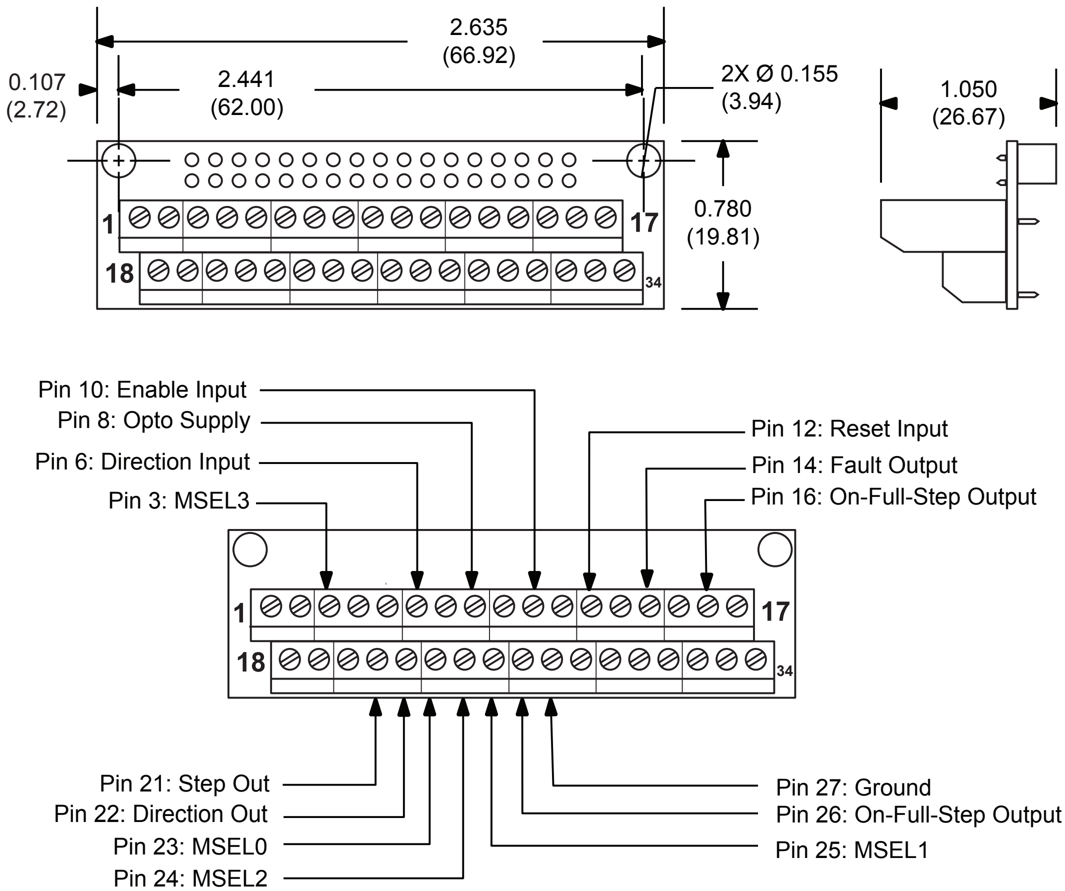


Figure B.4: BB-34-4P Dimensions and Pin Configuration

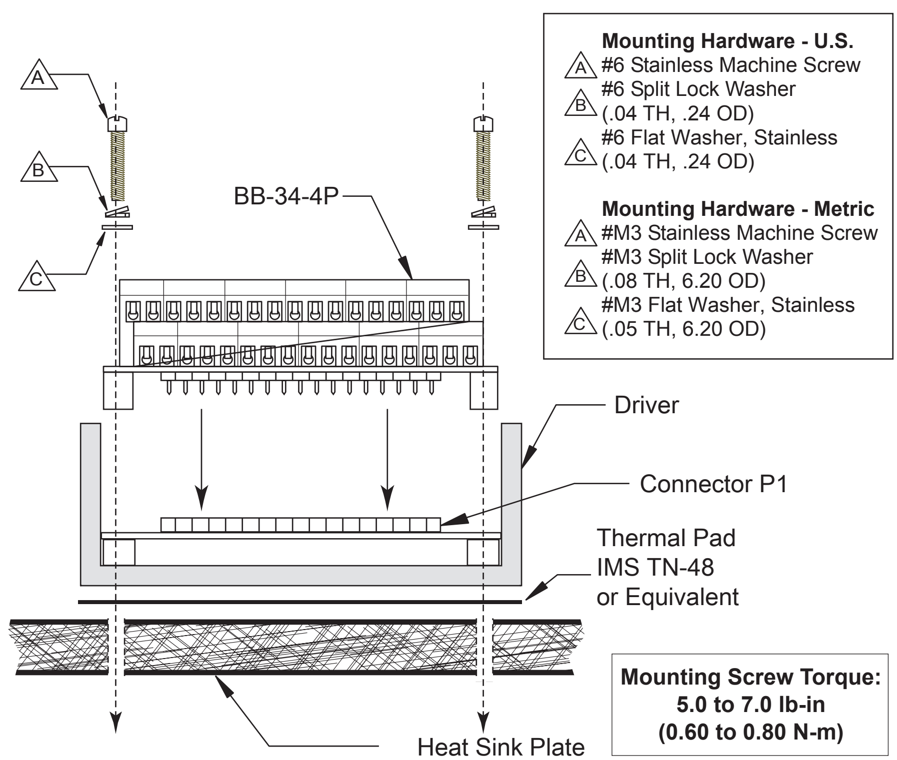


Figure B.5: BB-34-4P Mounting (The Mounting Hardware is Not Included)

WARRANTY

TWENTY-FOUR (24) MONTH LIMITED WARRANTY

Intelligent Motion Systems, Inc. ("IMS"), warrants only to the purchaser of the Product from IMS (the "Customer") that the product purchased from IMS (the "Product") will be free from defects in materials and workmanship under the normal use and service for which the Product was designed for a period of 24 months from the date of purchase of the Product by the Customer. Customer's exclusive remedy under this Limited Warranty shall be the repair or replacement, at Company's sole option, of the Product, or any part of the Product, determined by IMS to be defective. In order to exercise its warranty rights, Customer must notify Company in accordance with the instructions described under the heading "Obtaining Warranty Service."

This Limited Warranty does not extend to any Product damaged by reason of alteration, accident, abuse, neglect or misuse or improper or inadequate handling; improper or inadequate wiring utilized or installed in connection with the Product; installation, operation or use of the Product not made in strict accordance with the specifications and written instructions provided by IMS; use of the Product for any purpose other than those for which it was designed; ordinary wear and tear; disasters or Acts of God; unauthorized attachments, alterations or modifications to the Product; the misuse or failure of any item or equipment connected to the Product not supplied by IMS; improper maintenance or repair of the Product; or any other reason or event not caused by IMS.

IMS HEREBY DISCLAIMS ALL OTHER WARRANTIES, WHETHER WRITTEN OR ORAL, EXPRESS OR IMPLIED BY LAW OR OTHERWISE, INCLUDING WITHOUT LIMITATION, **ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE**. CUSTOMER'S SOLE REMEDY FOR ANY DEFECTIVE PRODUCT WILL BE AS STATED ABOVE, AND IN NO EVENT WILL THE IMS BE LIABLE FOR INCIDENTAL, CONSEQUENTIAL, SPECIAL OR INDIRECT DAMAGES IN CONNECTION WITH THE PRODUCT.

This Limited Warranty shall be void if the Customer fails to comply with all of the terms set forth in this Limited Warranty. This Limited Warranty is the sole warranty offered by IMS with respect to the Product. IMS does not assume any other liability in connection with the sale of the Product. No representative of IMS is authorized to extend this Limited Warranty or to change it in any manner whatsoever. No warranty applies to any party other than the original Customer.

IMS and its directors, officers, employees, subsidiaries and affiliates shall not be liable for any damages arising from any loss of equipment, loss or distortion of data, loss of time, loss or destruction of software or other property, loss of production or profits, overhead costs, claims of third parties, labor or materials, penalties or liquidated damages or punitive damages, whatsoever, whether based upon breach of warranty, breach of contract, negligence, strict liability or any other legal theory, or other losses or expenses incurred by the Customer or any third party.

OBTAINING WARRANTY SERVICE

Warranty service may obtained by a distributor, if the Product was purchased from IMS by a distributor, or by the Customer directly from IMS, if the Product was purchased directly from IMS. Prior to returning the Product for service, a Returned Material Authorization (RMA) number must be obtained. Complete the form at http://www.imshome.com/rma.html after which an RMA Authorization Form with RMA number will then be faxed to you. Any questions, contact IMS Customer Service (860) 295-6102.

Include a copy of the RMA Authorization Form, contact name and address, and any additional notes regarding the Product failure with shipment. Return Product in its original packaging, or packaged so it is protected against electrostatic discharge or physical damage in transit. The RMA number MUST appear on the box or packing slip. Send Product to: Intelligent Motion Systems, Inc., 370 N. Main Street, Marlborough, CT 06447.

Customer shall prepay shipping changes for Products returned to IMS for warranty service and IMS shall pay for return of Products to Customer by ground transportation. However, Customer shall pay all shipping charges, duties and taxes for Products returned to IMS from outside the United States.

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