IMS™

INTELLIGENT MOTION SYSTEMS, INC.

Excellence in Motion™

IM1007

HIGH PERFORMANCE MICROSTEPPER DRIVE

OPERATING INSTRUCTIONS

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INTRODUCTION

The IM1007 is a High Performance, low cost microstepping driver that incorporates advanced surface mount and ASIC technology. The IM1007 is small, easy to interface and use, yet powerful enough to handle the most demanding applications. The IM1007 was designed around the highly intergrated IM2000 microstepping controller IC developed by IMS (which is also the heart of our miniature IM483 microstepping driver).

IMS recognizes that cost and size are important criteria in many low and medium power applications. The IM1007 was developed to meet those needs along with innovative features found only in IMS drivers.

The IM1007 allows you to change the number of microsteps per step at anytime. There is no need to reset the driver. Built into the driver are 14 different resolutions in both binary and decimal. This feature will allow the user to rapidly move long distances, yet precisely position the motor at the end of its movement without the expense of high performance controllers.

Incorporated into the IM1007 are proprietary circuits that minimize ripple current while maintaining a 20KHZ chopping rate. This prevents additional motor heating that is common with drivers requiring higher chopping rates. Now low inductance stepper motors can be used to improve high speed performance and peak system efficiency.

FEATURES

- LOW COST
- SMALL SIZE
- HIGH INPUT VOLTAGE (80V)
- HIGH OUTPUT CURRENT
  (7 AMPS RMS, 10 AMPS PEAK)
- NO MINIMUM INDUCTANCE
- SINGLE SUPPLY
- NUMBER OF MICROSTEPS PER STEP CAN BE CHANGED ON-THE-FLY WITHOUT MOTOR MOVEMENT INTERRUPTION
- 10 MHz STEP CLOCK RATE (2MHz for the –NR version)
- HIGH GAIN OPTOs PROVIDE ISOLATION ON ALL INPUTS
- AUTOMATIC CURRENT REDUCTION
- CURRENT BOOST MODE
- OVER TEMPERATURE PROTECTION AND ALL WAY SHORT CIRCUIT PROTECTION
- OVER AND UNDER VOLTAGE PROTECTION
- PLUGGABLE SCREW TYPE TERMINAL CONNECTORS, FOR EASY REMOVAL
- UP TO 51,200 STEPS/REV
- AUTOMATICALLY SWITCHES FROM SLOW TO FAST DECAY FOR UNMATCHED PERFORMANCE
- 20 KHz CHOPPING FREQUENCY GREATLY REDUCES MOTOR HEATING OVER HIGH FREQ. DRIVERS WHILE REMAINING ABOVE THE AUDIBLE RANGE
- 14 SELECTABLE MICROSTEP RESOLUTIONS – BOTH IN DECIMAL AND BINARY
- FAULT OUTPUT
- AT FULL STEP OUTPUT
- OPTIONAL ON BOARD INDEXER & ENCODER FEEDBACK

PATENTS PENDING

PIN DESCRIPTION

CONNECTOR P1

PIN # DESCRIPTION

1,2,3,4 Microstep Select Inputs (0-3): These inputs select the number of microsteps per step. They are optically isolated binary encoded inputs. For more information refer to Section 10.

5 **+5 VDC:** This input is used to supply current to the isolated inputs. A higher voltage may be used, but care should be taken to limit the current through the optocoupler. For more information refer to Section 11

6 **Step Clock Input:** A positive going edge on this isolated input advances the motor one increment. The size of the increment is dependent on the Microstep Select Inputs of Connector P1.

7 **Direction:** This isolated input is used to change the direction of the motor. Physical direction also depends on the connection of the motor windings. For timing information refer to Section 12.

8 **Reset:** When LOW, this isolated input will reset the driver (outputs will disable). When released, the driver will be at its initial state (Phase A off, Phase B full on). For more information refer to Section 12.

9 **Enable Input:** This isolated input is used to enable/disable the output section of the driver. When HIGH (open) the outputs are enabled. However, this input does not inhibit the step clock. Therefore when enabled the outputs will update by the number of clock pulses (if any) applied to the driver while it had been disabled.

10 **Current Reduction:** This isolated input is used to switch in and out the Current Reduction Resistor connected to Connector P2 Pins 3 and 4. When this input is LOW the Reduction Resistor is switched in. For more information refer to Section 13.

CONNECTOR P2

PIN # DESCRIPTION

1 **Fullstep:** This open collector output indicates when the driver is positioned at a full step. This output can be used to count the number of full steps the motor has moved, regardless of the number of microsteps in between. This output is active low. For more information refer to Section 10.

2 **Fault:** This open collector output indicates a fault has occurred (ie. short circuit, over temperature or over voltage). This output is active low. For more information refer to Section 14.

3 **Reduction Adjust:** Phase Current Adjustment Input. A resistor between this pin and pin 4 (Connector P2, Current Adjust) will proportionately reduced the current in both windings (when selected by pin 10 Connector P1 or approximately 1 second after the last positive going edge of the step clock input). The amount of current reduction will depend on the value of the resistor used. For further information refer to Section 13.

4 **Current Adjust:** Phase Current Adjustment Input. A resistor is connected between this input and the ground input (connector P2, Pin 5). to adjust the maximum phase current in the motor. A resistor MUST be connected to this input. Refer to Section 7 for further information and resistor values.

5 **Ground:** Supply Voltage Ground. (Return)

6 **+V:** Supply Voltage Input.

7,8 **B:** Phase B of the Stepping Motor is connected between Pin 7 and Pin 8. For further information refer to Section 8.

9,10 **A:** Phase A of the Stepping Motor is connected between Pin 9 and 10. For further information refer to Section 8.

ABSOLUTE MAXIMUM RATING

Table 1

INPUT VOLTAGE	+24 TO +180 VDC
OUTPUT CURRENT	10 AMPS PEAK
PLATE TEMPERATURE	70 C *
STORAGE TEMPERATURE	-40 TO +125 C
INPUT CURRENT (INPUT PINS 1,2,3,4,6,7,8,9,10)	15 mA

* ADDITIONAL COOLING MAY BE REQUIRED TO LIMIT PLATE TEMPERATURE TO 70 C.

Note: An optional thermal pad is available for the IM1007.

ELECTRICAL SPECIFICATIONS

Table 2

T_A = 25 C, V + = 80 V

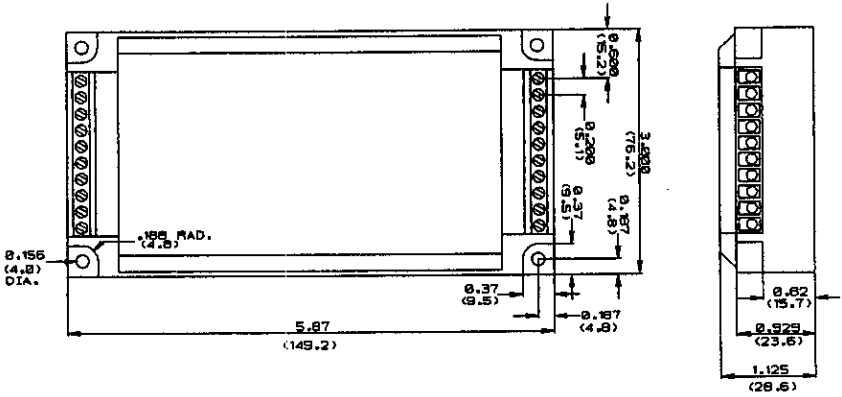
	TEST CONDITION	MIN	TYP	MAX	UNITS
INPUT VOLTAGE		24		*80	V
PHASE OUTPUT CURRENT	RMS	†2		7	A
PHASE OUTPUT CURRENT	PEAK			10	A
QUIESCENT CURRENT	OUTPUTS FLOATING		85		mA
ACTIVE POWER DISSIPATION	IOUT = 7 AMPS RMS			19	W
INPUT FORWARD CURRENT	(INPUT PINS 1,2,3,4,6,7,8,9,10)		7.0	15	mA
INPUT FORWARD VOLTAGE			1.5	1.7	V
INPUT REVERSE BREAKDOWN VOLTAGE		5			V
OUTPUT CURRENT	FAULT, FULLSTEP OUTPUTS			25	mA
COLLECTOR-EMITTER VOLTAGE	FAULT OUTPUT			140	VM
COLLECTOR-EMITTER SATURATION VOLTAGE	FAULT OUTPUT I_{OS} = 25 mA DC			0.2	V
DRAIN-SOURCE VOLTAGE	FULLSTEP OUTPUT			100	V
DRAIN-SOURCE ON-RESISTANCE	FULLSTEP OUTPUT I_{OS} = 25 mA DC		6.5		Ω

*THE MAXIMUM INPUT VOLTAGE WITH THE OUTPUTS DISABLED IS VMAX +10%

† The IM1004 is recommended for output currents below 2 amps.

NOTE: The aluminum bottom plate is electrically isolated.

MECHANICAL SPECIFICATIONS



Dimensions are inches (mm)

Fig. 1

THERMAL SPECIFICATIONS

Table 3

OPERATING TEMPERATURE	0 TO +50 C
STORAGE TEMPERATURE	-40 TO +125 C
* PLATE TEMPERATURE (MAX)	+70 C

* ADDITIONAL COOLING MAY BE REQUIRED TO LIMIT PLATE TEMPERATURE TO 70 C.

NOTE: A non-insulating thermal pad is available for the IM1007.

OVER TEMPERATURE PROTECTION

The IM1007 microstepping is a power device and is designed to protect itself from over heating. It does this by monitoring the surface temperature of the drive plate and will automatically shut down if the temperature reaches 60 C (152 F).

To prevent nuisance shut downs proper heatsinking is required to limit the temperature at the drive plate. An optional heatsink is available for those applications where the mounting surface is inadequate.

A thermal grease or thermal pad should be used between the drive plate and the mounting surface of the heat-sink. The fins of the heatsink should be mounted vertically with at least 3" of space below and above the heat-sink for efficient cooling.

In some applications fan cooling will be required to maintain the plate temperature below the 60 C shut down temperature.

It is not recommended that the driver be installed in a sealed enclosure where there is no exchange of outside ambient air. The heat buildup (even with an internal fan) would cause the driver to shut down well below its full output capability.

OUTPUT CURRENT

DETERMINING OUTPUT CURRENT

The OUTPUT CURRENT for motor used for MICROSTEPPING is determined differently from that of a HALF/FULL STEP driver. In the IM1007, a sine/cosine output function is used in rotating the motor. Therefore the output current of the specified motor is equal to the RMS current of the driver.

The CURRENT ADJUSTMENT RESISTOR used to set the output current of the IM1007 sets the PEAK output current of the sine/cosine waves. Therefore the specified motor current (which is the RMS value) should be multiplied by 1.4 in order to determine the PEAK value to which the IM1007 will be set.

EXAMPLE:

IMS motor number HM200-2232-190 A8 wired in parallel has a specified PHASE CURRENT of 2.7 amps.

Therefore 2.7 X 1.4 = 3.78 amps

The Resistor Value = OUTPUT CURRENT/.003 or in this example 3.78/.003 = 1,260 ohms.

Note: Stepper motors can be configured as 4, 6, or 8 leads. Each configuration requires different currents. Shown below are different lead configurations and the procedures to determine their output current.

4 Lead Motors: Use specified motor current to determine the current adjustment resistor value.

6 Lead Motors: 1) When configuring a 6 lead motor in a half coil configuration (i.e. connected from one end of the coil to the center tap(higher speed configuration)) use the specified per phase (or unipolar) current rating to determine the current adjustment resistor value.

2) When configuring the motor so the entire coil is used (i.e. connected from end to end with the center tap floating (higher torque configuration)) multiply the per phase (or unipolar) current rating by 0.7. Use this result to determine the current adjustment resistor value.

8 Lead Motors: **SERIES CONNECTION** When configuring the motor windings in series, multiply the per phase (or unipolar) current rating by 0.7. Use this result to determine the current adjustment resistor value.

PARALLEL CONNECTION When configuring the motor windings in parallel, multiply the per phase (or unipolar) current rating by 1.4. Use this result to determine the current adjustment resistor value.

NOTE: After the current has been determined, according to the motor connections above, follow the procedure Determining Output Current above to find the PEAK current value. Then use Table 4 to choose the proper resistor value.

WARNING! Although stepping motors will run hot when configured correctly, damage may occur to the motor if a higher than specified current is used. Most specified motor currents are maximum values. Care should be taken when exceeding these ratings.

SETTING OUTPUT CURRENT

The OUTPUT CURRENT on the IM1007 is set by an external 1/8 watt (or higher) resistor between pins 4 and 5 of connector P2. This resistor determines the per phase peak output current of the driver. The IM1007 uses a 1mA current source to establish the reference voltage needed to control the output current. The relationship between the output current and the resistor value is as follows:

OUTPUT CURRENT (Amps) = .003 x Resistor Value (ohms)

Table 4 shows the resistor values with respect to output current.

WARNING!: A current adjustment resistor is always necessary to keep the drive in a safe operating region. **Do not operate driver without a current adjustment resistor.**

NOTE: When connecting the CURRENT ADJUSTMENT resistor between Pins 4 and 5 of Connector P2 the leads should be as short as possible to help minimize the noise coupled into the driver (See Figure 2).

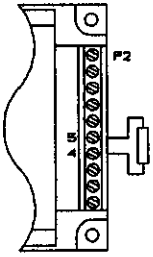


Fig. 2

RESISTOR TABLE

Table 4

OUTPUT CURRENT	RESISTOR VALUE (1%)
2.0	665
2.2	732
2.4	787
2.6	866
2.8	931
3.0	1000
3.2	1070
3.4	1130
3.6	1180
3.8	1270
4.0	1330
4.2	1400
4.4	1470
4.6	1500
4.8	1580
5.0	1650
5.2	1690
5.4	1780
5.6	1870
5.8	1910
6.0	2000
6.2	2050
6.4	2100
6.6	2150
6.8	2260
7.0	2320
7.2	2370
7.4	2430
7.6	2490
7.8	2610
8.0	2670
8.5	2800
9.0	3010
9.5	3160
10.0	3320

MOTOR SELECTION

The IM1007 is a Bipolar driver which works equally well with both Bipolar and Unipolar motors,(i.e. 8 and 4 lead motors and 6 lead center tapped motors (see section 6.2 Connecting the Motor)).

To maintain a given set motor current, the IM1007 chops the voltage using a constant 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 resistance. To avoid this situation, it is necessary to choose a motor with a low winding resistance. The lower the winding resistance (hence lower winding inductance) the higher the step rate.

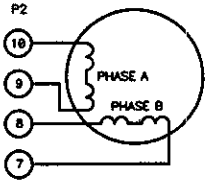
Since the IM1007 is a constant current source, it is not necessary to use a motor that is rated at the same voltage as the supply voltage. What is important is that the IM1007 is set to the motor's rated current.

The higher the voltage used the faster the current can flow through the motor coils. This in turn means a higher step rate. Care should be taken not to exceed the maximum voltage of the driver.

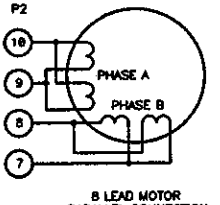
Therefore in choosing a motor for a system design, the best performance for a specified torque is a motor with the lowest possible winding resistance used in conjunction with the highest possible driver voltage.

CONNECTING THE MOTOR

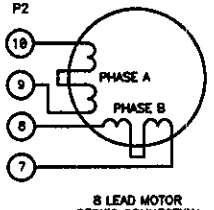
Phase A of the Stepping Motor is connected between pins 9 and 10 on connector P2. Phase B of the Stepping Motor is connected between pins 7 and 8 on connector P2. The following drawings illustrate the connection of 4,6, and 8 Lead Stepping Motors to the IM1007 Driver.



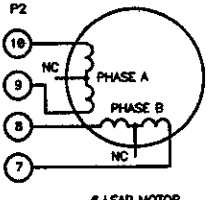
4 LEAD MOTOR



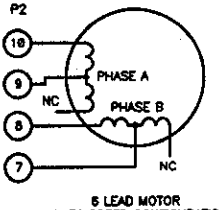
8 LEAD MOTOR
PARALLEL CONNECTION



8 LEAD MOTOR
SERIES CONNECTION



6 LEAD MOTOR
HIGHER TORQUE CONFIGURATION
NC: NO CONNECTION



6 LEAD MOTOR
HIGHER SPEED CONFIGURATION
NC: NO CONNECTION

Fig. 3

NOTE: The physical direction of the motor with respect to the direction input will depend on the connection of the motor windings. To reverse the direction of the motor with respect to the direction input, switch the wires on phase A or phase B outputs. **Warning !! Do not connect or disconnect motor wires while power is applied.**

CONNECTING POWER

Pins 5 and 6 on connector P2 are used to connect the DC Power Supply to the IM1007. Wire size used to connect the power source to the driver should be at least 16 gage. Heavier wire should be used for longer distances between the power supply and the driver. The power supply requirement are as follows:

Table 5

POWER SUPPLY SPECIFICATIONS

Recommended Type:..... Unregulated DC.
Ripple Voltage: ..... ± 10%
Output Voltage: ..... +24 to +80v DC
* Output Current:..... 3 Amps (TYPICAL)

NOTE: Switching Power Supplies and regulated linears with overcurrent protection are not recommended because of their inability to handle surge currents.

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

Warning! When using an unregulated power supply, care should be taken to ensure that the output voltage DOES NOT exceed the maximum driver input voltage because of line voltage fluctuations. It is recommended that a input line filter be used on the power supply to limit voltage spikes to the driver.

* THE OUTPUT CURRENT NEEDED IS DEPENDENT ON THE SUPPLY VOLTAGE, MOTOR SELECTION, AND LOAD.

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

MICROSTEP SELECTION

The number of microsteps per step is selected by pins 1, 2, 3, and 4 of Connector P1. Table 6 shows the standard resolution values along with the associated inputs for pins 1, 2, 3, and 4.

Table 6

RESOLUTION (Microsteps Per Step)	STEPS/REVOLUTION (1.8°/Step MOTORS)	MICROSTEP Select 1	MICROSTEP Select 2	MICROSTEP Select 3	MICROSTEP Select 4
BINARY					
2	400	*Ground	Ground	Ground	Ground
4	800	**Floating	Ground	Ground	Ground
8	1,600	Ground	Floating	Ground	Ground
16	3,200	Floating	Floating	Ground	Ground
32	6,400	Ground	Ground	Floating	Ground
64	12,800	Floating	Ground	Floating	Ground
128	25,600	Ground	Floating	Floating	Ground
256	51,200	Floating	Floating	Floating	Ground
DECIMAL					
5	1,000	Ground	Ground	Ground	Floating
10	2,000	Floating	Ground	Ground	Floating
25	5,000	Ground	Floating	Ground	Floating
50	10,000	Floating	Floating	Ground	Floating
125	25,000	Ground	Ground	Floating	Floating
250	50,000	Floating	Ground	Floating	Floating

* DO NOT connect inputs to POWER GROUND (Connector P2, Pin 5) or loss of isolation will occur. These inputs should be connected to LOGIC GROUND.

** Leaving the inputs FLOATING is equivalent to +5VDC (logic) being connected to the input.

When the number of microsteps per step are changed such that the IM1007 does not fall on a full step (ie. zero crossing of the sine/cosine waveform) the IM1007 will readjust itself at the next step clock input that would overshoot the full step position to the full step position. This feature allows the IM1007 to readjust the motor so that the poles will align no matter what resolution is chosen or when it is changed.

FULLSTEP OUTPUT SIGNAL

The IM1007 has an active LOW open drain output at Connector P2, Pin 1 labled FULLSTEP. This output is TRUE (active low) for the duration of the full step. A full step occurs when either Phase A or Phase B cross through zero (ie. full current in one winding and 0 current in the other winding). This fullstep position is a common position no mater what resolution is selected.

This output can be used to count the number of mechanical full setps the motor has traveled without having to count the number of microsteps in between. A controller that utilizes this output can greatly reduce its position tracking overhead and thus substantially increasing its throughput.

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

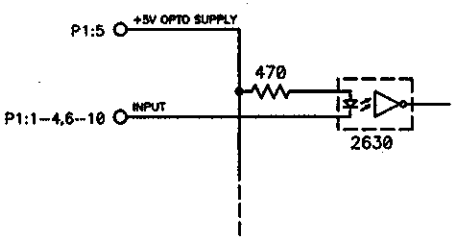
OPTICALLY ISOLATED INPUTS

The following inputs to the IM1007 are Optically Isolated.

Table 7

Connector P1

Microstep Select 1-4	Pin 1–4
Step Clock	Pin 6
Direction	Pin 7
Reset	Pin 8
Enable	Pin 9
Current Reduction	Pin 10



OPTICALLY ISOLATED INPUTS
(EACH CHANNEL)

Fig. 4

The isolated inputs may be powered be a DC voltage other than +5 VDC. In doing so, care should be taken to limit this current, an external resistor should be placed in series with the input pins (1–4, 6–10). The value of the resistor should be calculated such that the input current is approximately equal to the value listed in the Electrical Specifications in Table 2.

WARNING! If using a voltage other than +5VDC, the current through the optocoupler must NOT exceed the maximum limit.

TIMING

The Direction and Microstep Resolution Select inputs are syncronized with the positive going edge of the Step Clock input. When the Step Clock input goes high, the Direction and Microstep Select inputs are latched and futher changes to the inputs are ignored until the next rising edge of the Step Clock input.

After these signals are latched, the IM1007 looks to see if any changes have occured to the Direction and the Microstep Select inputs. If a change has occurred, the IM1007 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 occured the IM1007 will simply take the next step. (This feature works as an automatic debounce for the Direction and Microstep Select inputs.)

The minimum pulse width for the Step Clock input is 75 nS. The typical execution time for a Direction or Microstep Select change is 100nS. The typical execution time for a Step input is 100nS.

The Reset and Enable inputs are asynchronous to any input and can be changed at any time.

The Reset requires a minimum pulse width of 500 nS.

The Fullstep output typically occurs 75nS after the positive edge of the Step Clock (excluding changes to the Direction or the Microstep Select inputs).

REDUCING OUTPUT CURRENT

DETERMINING OUTPUT CURRENT

Reducing the output current in the IM1007 can be accomplished by connecting an external 1/8 watt (or higher) resistor between pins 3 and 4 of connector P2 and then by either activating pin 10 on connector P1 or approximately 1 second after the last positive going edge of the step clock input. (See Figure 5)

When pin 10 on connector P1 is pulled LOW, (Active) the output current of each phase will reduce to the value set by the current reduction resistor.

The amount of current per phase in the reduction mode is related to the value of the current adjustment resistor and the current reduction resistor. When the current reduction circuit is activated, the current reduction resistor is paralleled with the current adjustment resistor. This lowers the total resistance value, and thus lowers the per phase output current. The relationship between the output current and the resistor's values is as follows:

$$\text{Output Current (Amps)} = \frac{.003 \times {}^{*}\text{R(Current Adjust)} \times \text{R(Current Reduction)}}{\text{R(Current Adjust)} + \text{R(Current Reduction)}} \qquad \text{OR}$$

$$\text{R(Current Reduction)} = \frac{\text{Output Current} \times \text{R(Current Adjust)}}{.003 \times \text{R(Current Adjust)} - \text{Output Current}}$$

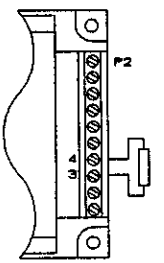


Fig. 5

*Resistor values are in ohms.

NOTE: When connecting the current reduction resistor between pins 3 and 4 of connector P2 , the leads should be as short as possible to help minimize noise coupled into the driver.

AUTOMATIC CURRENT REDUCTION

Built into the IM1007 is the ability to automatically reduce the current in the motor windings after the completion of a move.

The reduction occurs approximately one (1) second after the last positive edge of the step clock input. The IM1007 will then revert back to the original current setting at the next positive going edge of the step clock input.

To utilize this feature, a resistor must be connected between pins 3 & 4 on connector P2 (See Figure 5). The value of the resistor will determine the amount of the current reduced. To calculate the resistor value, refer to Section 13.1 on reducing output current.

FAULT PROTECTION

The IM1007 is internally protected against overtemperature, over and under voltage, and short circuits.

The over temperature set point is between 60 and 70 C. Care should be taken when choosing a heatsink so that there is good thermal flow, otherwise hot spots may occur in the IM1007 which will reduce the effectiveness of the thermal protection.

The short circuit protection consist of PHASE to PHASE, PHASE to GROUND, and +V to PHASE.

In the condition where the DC voltage to the driver drops below approximately 23 volts, the driver's output stage will be disabled. When the driver's DC voltage rises back above 24 volts, the driver will automatically re-enable the outputs (if previously enabled).

In the condition where the DC voltage to the driver exceeds approximately 90 volts, the driver will execute a fault.

If any fault is detected by the IM1007, the outputs will be disabled and can not be re-enabled without resetting or powering down the driver (does not include under voltage). At the same time the open collector FAULT output is turned on.

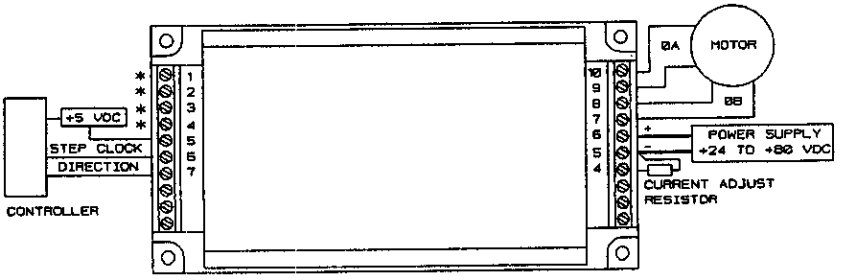
The FAULT output is non-isolated and has the ability to sustain the maximum driver voltage. It is capable of sinking up to 25mA which can be used to drive a small relay or LED.

OPTIONS

Discription	Part Number
High Performance Indexer	IM1007I
High Performance Indexer with Encoder Feedback	IM1007IE
High Performance Indexer with RS-232 option	IM1007I2
High Performance Indexer with Encoder Feedback with RS-232 option	IM1007IE2
Differiential Encoder Option for IM1007IE & IM1007IE2	-DE
Thermal Pad	TN - 1000
34 Pin Breakout Box	BB - 34
RS232 to RS422 In Line Converter	CV - 3222
GUI Controller Software (Requires †Windows V3.0 or greater)	Quickstart 1

*Windows is a registered trasemark of the Microsoft Corp.

APPLICATION NOTES



* A VALID MICROSTEP RESOLUTION MUST BE USED ON THESE INPUTS. FOR MORE INFORMATION REFER TO SECTION 10.

IM1007 MINIMUM CONNECTIONS

Fig. 6

A P P E N D I X A

Recommended Cable Configurations: DC Supply to IMS Driver

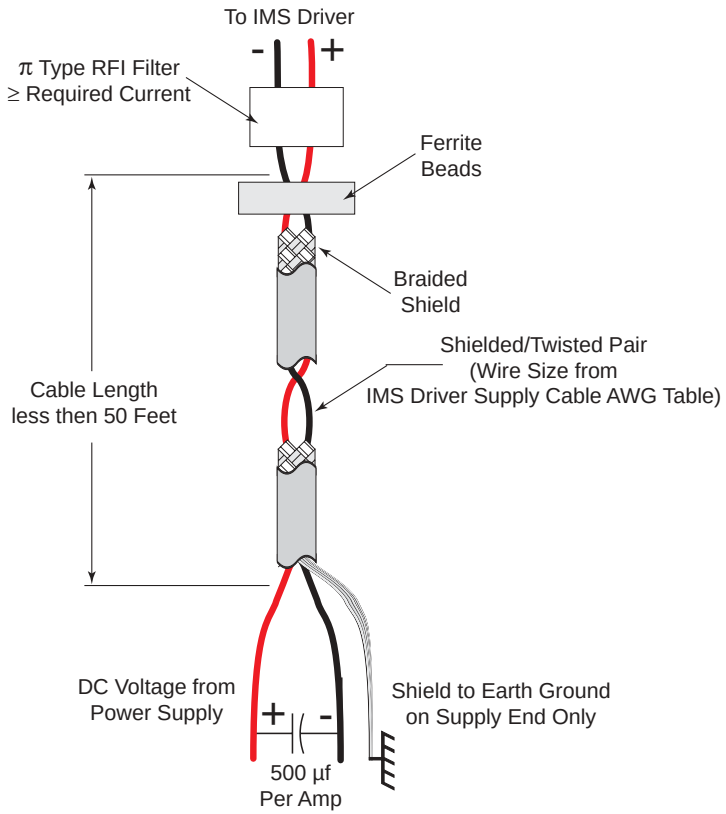
Cable length, wire gauge and power conditioning devices play a major role in the performance of your IMS Driver and Motor.

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

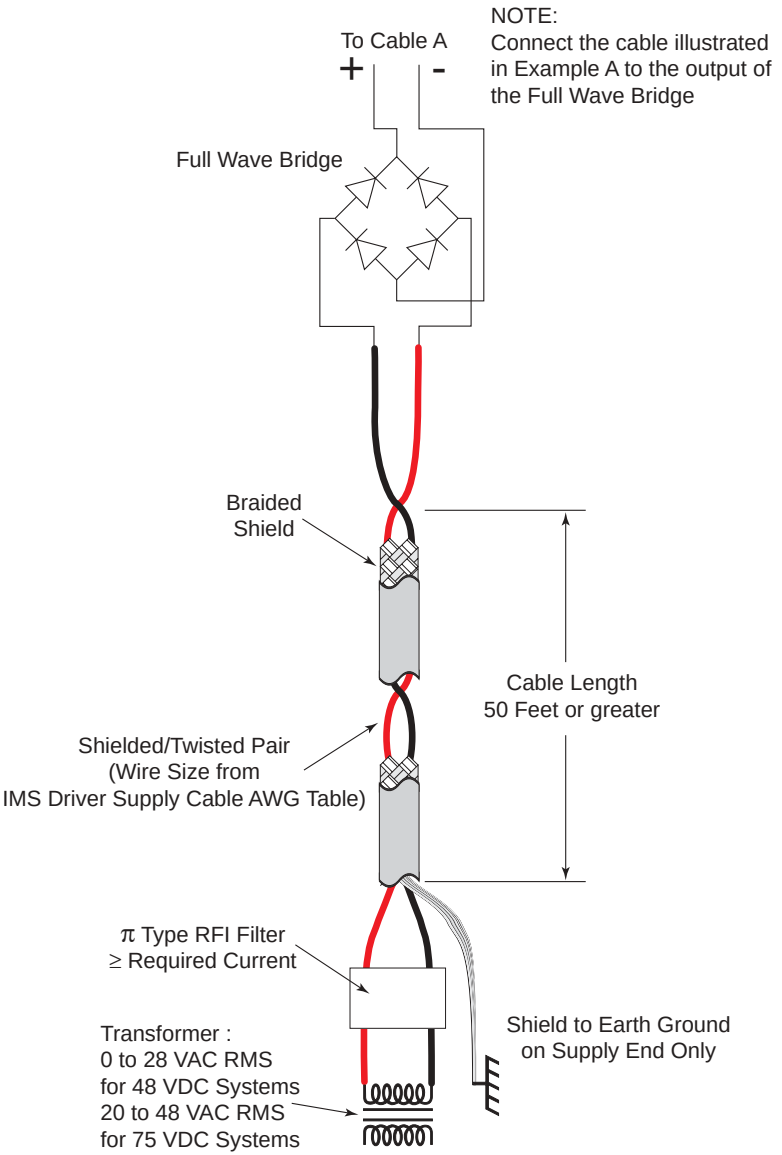
Example A demonstrates the recommended cable configuration for DC power supply cabling under 50 feet long. If cabling of 50 feet or longer is required, the additional length may be gained by adding an AC power supply cable (see Examples B & C).

Correct AWG wire size is determined by the current requirement plus cable length. Please see the IMS Driver Supply Cable AWG Table in this Appendix.

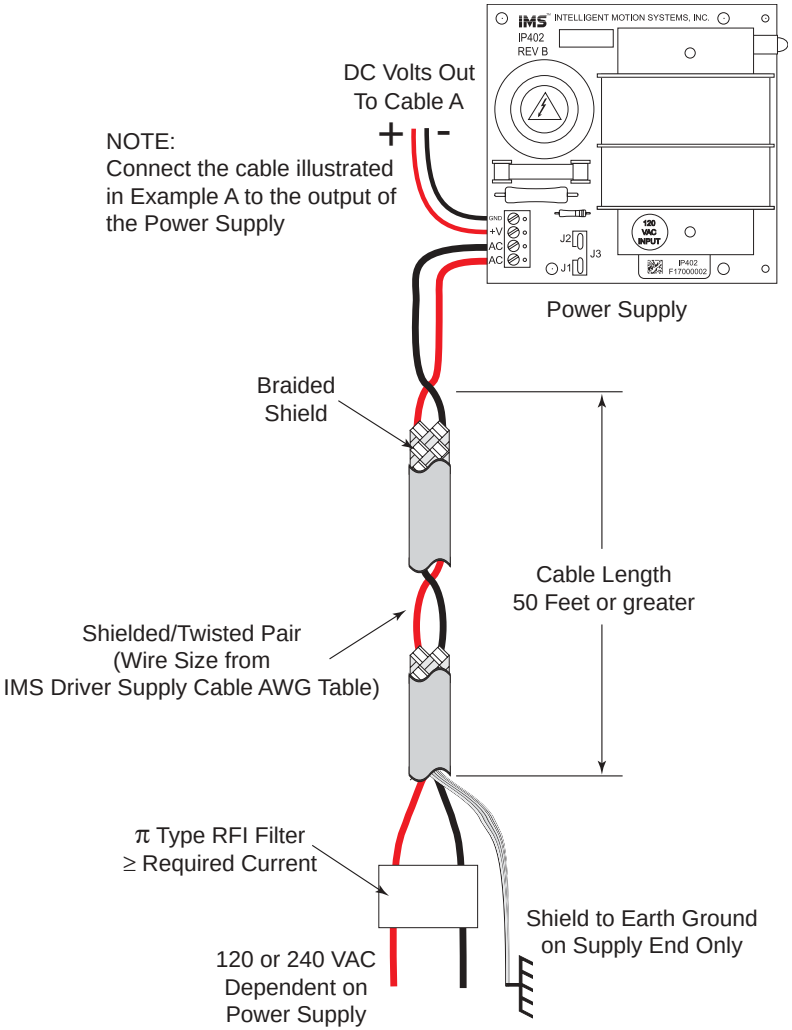
Example A – Cabling Under 50 Feet, DC Power



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



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



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.

IMS Driver Supply Cable AWG Table					
1 Ampere (Peak)					
Length (Feet)	10	25	50*	75*	100*
Minimum AWG	20	20	18	18	16
2 Amperes (Peak)					
Length (Feet)	10	25	50*	75*	100*
Minimum AWG	20	18	16	14	14
3 Amperes (Peak)					
Length (Feet)	10	25	50*	75*	100*
Minimum AWG	18	16	14	12	12
4 Amperes (Peak)					
Length (Feet)	10	25	50*	75*	100*
Minimum AWG	18	16	14	12	12
* Use the alternative methods illustrated in Examples A and B when the cable length is ≥ 50 feet. Also, use the same current rating when the alternate AC power is used.					

Driver Supply Cable Wire Size

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

Recommended Cable Configurations: IMS Driver to Motor

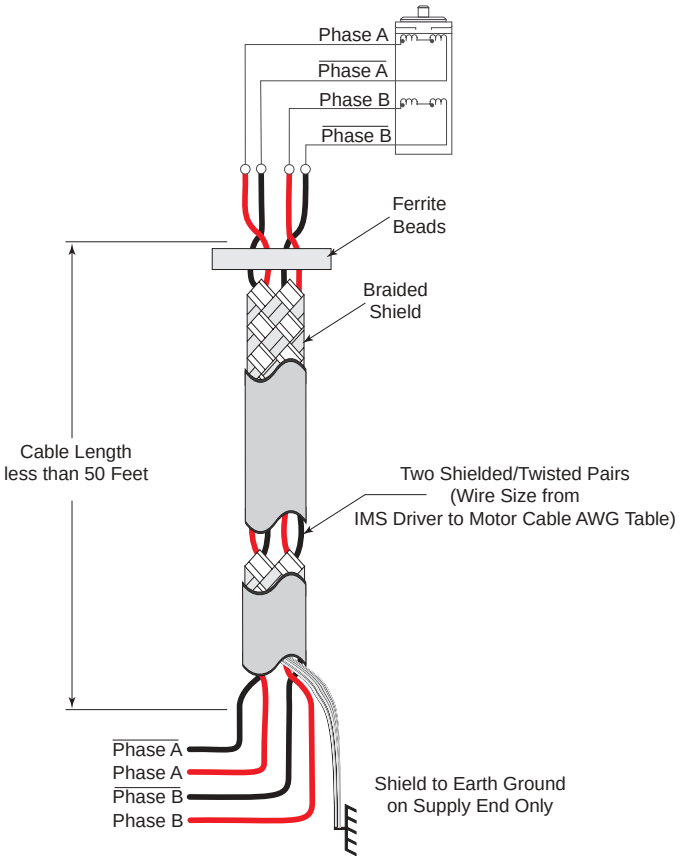
Cable length, wire gauge and power conditioning devices play a major role in the performance of your IMS Driver and Motor.

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

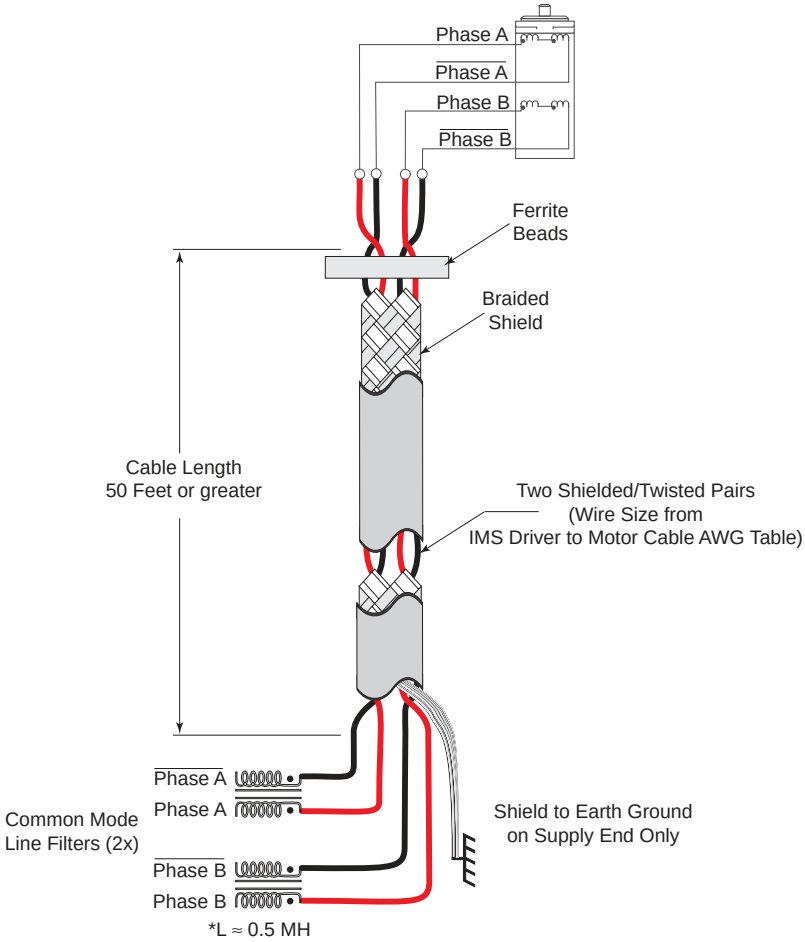
Example A demonstrates the recommended cable configuration for the IMS Driver to Motor cabling under 50 Feet long. If cabling of 50 feet or longer is required, the additional length can be gained with the cable configuration in Example B.

Correct AWG wire size is determined by the current requirement plus cable length. Please see the IMS Driver to Motor Cable AWG Table in this Appendix.

Example A - Cabling Under 50 Feet, IMS Driver to Motor



Example B - Cabling 50 Feet or Greater, IMS Driver to Motor



* 0.5 MH is a typical starting point for the Common Mode Line Filters. By increasing or decreasing the value of L you can set the drain current to a minimum to meet your requirements.

IMS Driver to Motor Cable AWG Table												
1 Ampere (Peak)						5 Amperes (Peak)						
Length (Feet)	10	25	50*	75*	100*	Length (Feet)	10	25	50*	75*	100*
Minimum AWG	20	20	18	18	16	Minimum AWG	16	16	14	12	12
2 Amperes (Peak)						6 Amperes (Peak)						
Length (Feet)	10	25	50*	75*	100*	Length (Feet)	10	25	50*	75*	100*
Minimum AWG	20	18	16	14	14	Minimum AWG	14	14	14	12	12
3 Amperes (Peak)						7 Amperes (Peak)						
Length (Feet)	10	25	50*	75*	100*	Length (Feet)	10	25	50*	75*	100*
Minimum AWG	18	16	14	12	12	Minimum AWG	12	12	12	12	12
4 Amperes (Peak)						* Use the alternate method illustrated in Example B when cable length is ≥ 50 feet.						
Length (Feet)	10	25	50*	75*	100*							
Minimum AWG	18	16	14	12	12							

Driver to Motor Supply Cable Wire Size

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.

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.

IMS Driver Manual Addendum

Recommended Wiring

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 AC ground. 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.

Motor cabling in excess of 1 foot requires twisted pair shielded cable to reduce the transmission of EMI. The shield must be connected to AC ground at the driver. 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 driver 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 Motor and Power Supply Cables:

Motor Cables

Dual Twisted Pair Shielded (Separate Shields)

≤ 4 Amps RMS per phase motor current	Belden Part #9368 or equivalent	18 Gauge
≥ 4 Amps RMS per phase motor current	Belden Part #1492A or equivalent	16 Gauge

Power Supply Cables

Twisted Pair (Jacketed)

≤ 4 Amps DC current	Belden Part #9740 or equivalent	18 Gauge
≥ 4 Amps DC current	Belden Part #8471 or equivalent	16 Gauge

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