INTELLIGENT MOTION SYSTEMS, INC.

Excellence in Motion™

IB SERIES

HALF/FULL STEP STEPPING MOTOR DRIVERS
IB462 • IB463 • IB104 • IB106 • IB1010

OPERATING INSTRUCTIONS

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The information in this book has been carefully checked and is believed to be accurate; however, no responsibility is assumed for inaccuracies.

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IB Series Half/Full Step Driver Operating Instructions
Revision R032206

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IMPORTANT! READ THIS FIRST!

The Product Manual

Using This Manual

This manual is divided into two parts:

Part 1 is **General Information**, which covers details common to the entire IB Series of products such as operational theory, connection and interface instructions, and troubleshooting.

Part 2 is **Hardware Reference**. This part contains sections with information specific to each individual IB drive. Here you will find details such as mechanical, electrical and thermal specifications, current control resistor value tables and recommended power supplies and motors for each IB series drive. **Do not attempt to connect or use your drive without first consulting the section specific to the IB series drive you purchased!**

The Bookmarks

The IB Series product manual in it's electronic format (ib.pdf) can be downloaded from the IMS website at *www.imshome.com*. This version includes a Bookmark feature that allows the reader to link from a Bookmarked Topic in the Table of Contents to a corresponding page in the Product Manual.

Connecting The IB Series Driver to your System

- All logic inputs are optically isolated and MUST have a current limiting resistor at each input.
- Most regulated supplies use a voltage interrupt or "crowbar" current limit. That is, when the supply senses an over-current condition, it will turn off the output voltage for a time, and then back on again. This will continue until the over-current condition is cleared. Therefore, when using a regulated power supply for drive voltage, the supply should provide current sufficient enough to handle the high inrush motor current during power-up. If it does not, the power supply will switch into current limit and cut off regulating voltage to the drive. This can cause damage to the IB Series Motor Driver! Methods that will correct this condition are as follows:
  - Use an unregulated power supply.
  - Disconnecting any inputs or outputs from the driver while power is applied will damage the drive!

- Do not use any ux removers or cleaners that contain tricloroethane or hydrochlorofuorocarbons (HCFCs).

Tricloroethane and HCFCs will attack internal plastic components and cause permanent damage to the IB Series Driver. We recommend using a “No-Clean” solder when soldering to the input and output pins of the IB series driver. If cleaning is required an alcohol based solvent should be used.

Recommended Solders

Kester “245” No-clean core solder, Alpha Metals “Telecore Plus” solder, Multicore “X39B” No-clean solder, or equivalent.

Recommeded Solvent

Tech Spray “Envorotech 1679”, Chemtronics “Flux-off NR 2000”, or equivalent.

Recommended Solder Temperature

315°C (600°F)

Recommeded Time

10 Seconds

Notes and Warnings

WARNING! The IB series 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 IB Series drive!

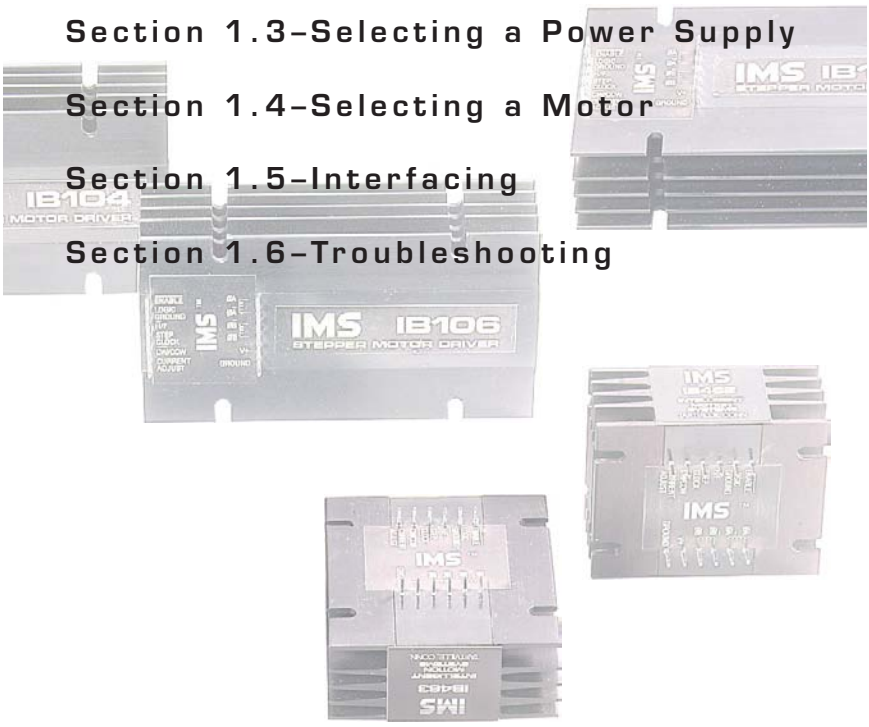
WARNING! Ensure that the power supply output voltage does not exceed the maximum input voltage of the IB Series Drive that you are using!

WARNING! A current limiting resistor is required when interfacing to the isolated inputs or damage will occur to the drive. See Part 1, Section 5 for interface details.

WARNING! Do not use any ux removers that contain trichloroethane or hydrochloro uorocarbons (HCFCs) or corrosive damage will occur to the internal drive

PART I

General Information



SECTION 1.1

Introduction to the IB Series Drivers

IB Series Half/Full Step Drivers

The IB series of miniature high performance stepper motor drives are designed for today's quality minded, price sensitive market. The 40 volt series has a +12 to +40 VDC input voltage, up to 3.5 Amps per phase drive current and a maximum step frequency of 40kHz. The 80V series has a +24 to +80 VDC input voltage, up to a powerful 9 Amps per phase of drive current and a maximum step frequency of 250kHz. All of these drives feature pin compatibility, optically isolated logic inputs, and a 20 kHz chopping rate to reduce noise. In addition, all these drives are single supply.

The 40V Line of IB Drives

IB462

The IB462 packs a powerful 160 Watts into less than 3 cu. in. This drive operates from +12 to +40VDC and effortlessly outputs 2 Amps per phase. This high voltage allows for greater speeds at higher torque without having to resort to expensive drives or larger motors.

The high efficiency of the IB462 chopper drive along with its miniature size make it ideally suited to replace the less efficient L/R drives. In addition, the low cost and off-the-shelf availability of the IB462 permits an immediate, cost effective solution to an in-house design.

IB463

The IB463 has an output capability of up to 3.5 Amps per phase and, while it operates at the same voltage range as the IB462, it can deliver 1.4 times more power. This equates to 230 Watts of power in a package that only requires 3.6 cubic inches of real estate.

The IB463 is ideal for those applications requiring more power, but where size and cost are still important factors.

The 80V Line of IB Drives

The IB104, 106 and 1010 use MOSFET technology to achieve high power from a miniature package. These drives are designed to get maximum performance from larger, higher torque motors. This type of performance is required for today's most demanding applications.

With this 80V series of the IB family, IMS has preserved pin compat-

ibility with the 40V series to provide equipment manufacturer's the ability to easily upgrade their systems if more power is needed. In addition, the small package makes them ideal for PC board mounting. They may also be frame or chassis mounted and will accept 0.200/0.196 center connectors or plug type terminal strips such as the option TS-6 terminals sold by IMS.

IB104

The IB104 operates from +24 to +80 volts at 4 Amps per phase output current. This drive is ideal for lower power applications requiring high voltage performance. The IB104 will also run cooler because it uses the same MOSFET technology as the more powerful 80V IB drives.

IB106

The IB106 was designed with higher performance motors that require more current in mind. Applications requiring increased power can take advantage of its 6 Amps/phase drive current.

IB1010

The IB1010 utilizes the same high 80V input voltage as the IB104 and IB106, but is capable of delivering a full 9 Amps per phase. This equates to an incredible 1800 Watts in the same small package. This drive is unparalleled for those applications where maximum power is required, but size and cost are still a consideration.

Features and Benefits

General Features

- Very Low Cost.
- Single Supply.
- On-Board Phase Logic.
- Isolated Inputs.
- PC Board or Chassis Mountable.
- Extremely Small Size.
- 20 kHz Chopping Rate.
- Full or Half Step.

Product Specific Features

IB462

- High Input Voltage (+12 to +40V).
- High Output Current (2 Amps/Phase).
- 40kHz Step Rate.

IB463

- High Input Voltage (+12 to +40VDC).
- High Output Current (3.5 Amps per Phase).
- 40kHz Step Rate.

IB104

- High Input Voltage (+24 to +80VDC).
- High Output Current (4 Amps per Phase).
- Over/Under Voltage Protection.
- 250 kHz Step Rate.

IB106

- High Input Voltage (+24 to +80VDC).
- High Output Current (6 Amps per Phase).
- Over/Under Voltage Protection.
- 250 kHz Step Rate.

IB1010

- High Input Voltage (+24 to +80VDC).
- High Output Current (9 Amps per Phase).
- Over/Under Voltage Protection.
- 250 kHz Step Rate.

SECTION 1.2

Theory of Operation

Section Overview

This section will cover the circuit operation for the IB series drives.

- Circuit Operation.
- Output Wave Sequences.
- Timing.

Circuit Operation

The IB series drives are bipolar chopping stepper motor drives. They receive step clock, direction and mode signals from the system controller and generate constant phase currents which are adjustable in magnitude.

The principal functions are: a translator which generates the motor phase sequences, a dual PWM chopper circuit which regulates the current in the motor windings and a power stage to drive the motor. The translator generates three different sequences selected by the half/full step input. These are normal (two phases energized), wave drive (one phase energized) and half step (alternately one phase energized/ two phases energized).

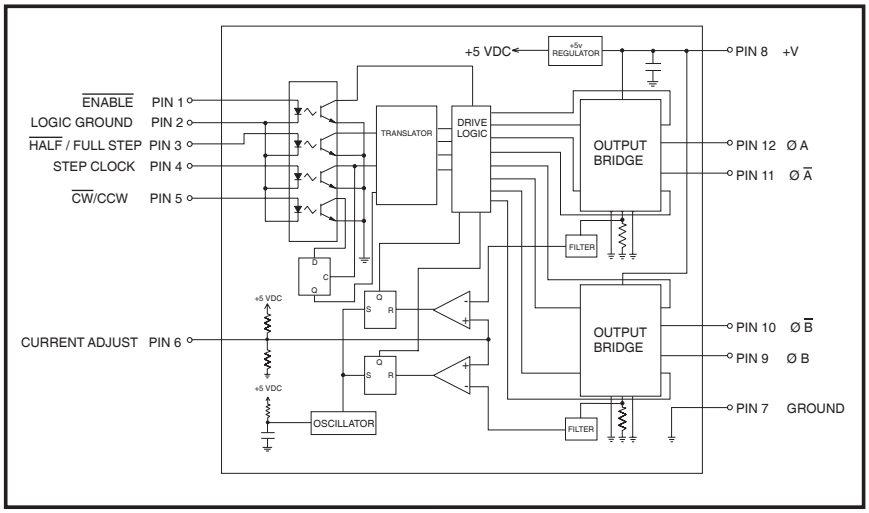


Figure 1.2.1: IB Series Block Diagram

A common on-board oscillator drives the dual chopper. It supplies pulses which set two flip-flops. When the current in a winding reaches the programmed peak value a corresponding comparator resets its flip-flop, shutting down the output stage until the next oscillator pulse comes along.

Because the windings in the motor store energy, current will continue to flow through the windings during the off period. The peak current for both windings is programmed by the current adjust input.

The output stage consists of dual full bridge drivers. The IB Series drives can be disabled by a logic HIGH signal on the enable input. Ultra fast recovery fly-back rectifiers are used to improve efficiency and help reduce noise.

Output Wave Sequences

The IB series drives generate phase sequences for normal, wave and half step modes. The state diagram and output waveforms are shown below. In all modes, the transition occurs on the falling edge of the step clock signal.

Normal Mode

In normal drive mode two phases are energized at all times. This mode is enabled by a logic HIGH on the Half/Full step input when the IB drive initializes to state 1.

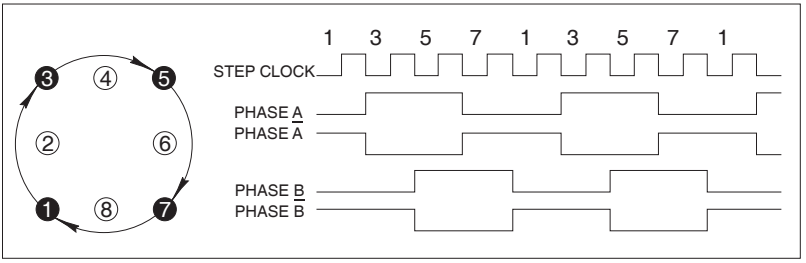


Figure 1.2.2: Normal Mode Phase Sequence

Wave Mode

In wave drive mode one phase is energized at a time. This mode is enabled by selecting full step mode when the IB drive is in an even numbered state.

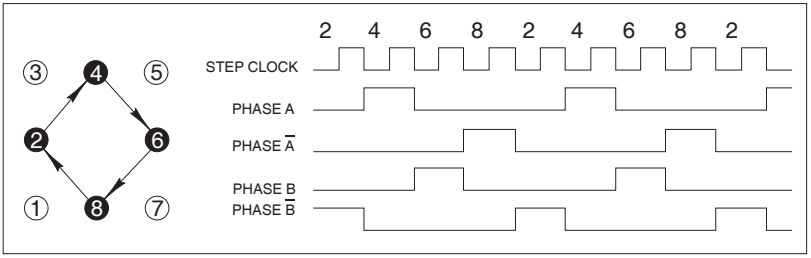


Figure 1.2.3: Wave Mode Phase Sequence

Half Step Mode

In half step mode the phasing alternates from one phase energized to two phases energized. Half step mode is selected by a logic LOW on the Half/Full step input.

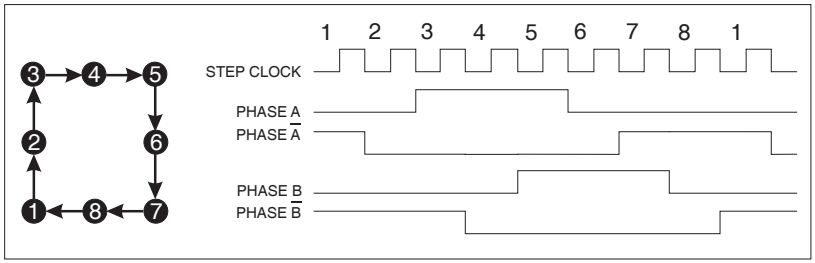


Figure 1.2.4: Half Step Mode

Timing

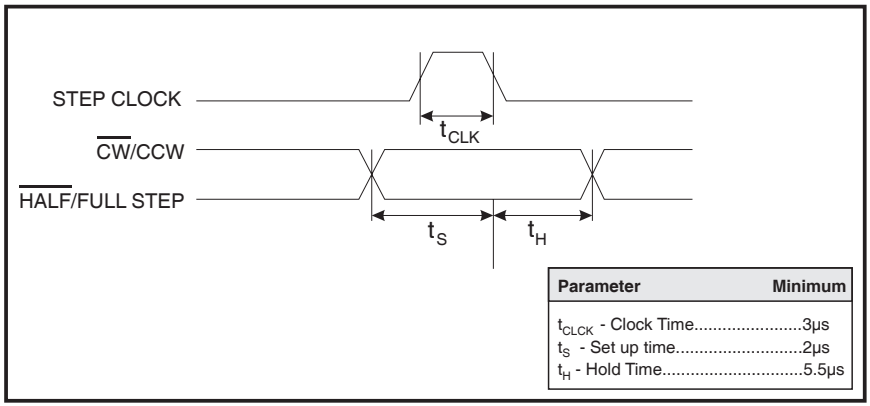


Figure 1.2.5: Timing

SECTION 1.3

Selecting a Power Supply

Section Overview

This section contains general information pertaining to power supply selection for use with the IB drive. See the section in Part II of this document titled for the specific model IB drive you purchased for power supply specifications and recommendations. Precise wiring and connection details are to be found in Section 1.5, *Interfacing to the IB Series Driver*. The following is covered by this section:

- Selecting a Power Supply.
- Recommended Wiring.
- AC Line Filtering.

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 be basically 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 and, as a result, could damage the stepper driver over a period of time.

The Power Supply - Driver Relationship

The IB series driver is 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 supply.

Stepping motor drivers are designed with the intention that a user's power supply output will ramp up to greater or equal to the minimum operating voltage. The initial current surge is quite substantial and could damage the driver if the supply is undersized. The output of the power supply could fall below the operating range of the driver upon a current surge if it is undersized. 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. All have their 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 can cause problems if the voltage drops below the working range of the drive. Also of concern are the fluctuations in line voltage. This can 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. They are also not bothered 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 may cause damage to the driver and/or power 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 IB driver.

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

WARNING! Do not connect or disconnect motor or power leads with power applied!

Recommended Wiring

Rules of Wiring and Shielding

Noise is always present in a system that involves high power and small signal circuitry. Regardless of the power configuration used for your system, there are some wiring and shielding rules that should be followed to keep the signal-to-noise ratio as small as possible.

Rules of Wiring

- Power supply and motor wiring should be shielded twisted pairs run separately from signal carrying wires.
- A minimum of 1 twist per inch is recommended.
- Motor wiring should be shielded twisted pairs using 20-gauge wire or, for distance greater than 5 feet, 18 gauge or better.
- Power ground return should be as short as possible to established ground.
- Power supply wiring should be shielded twisted pairs. Use 18 gauge wire if load is less than 4 amps, or 16 gauge for more than 4 amps.
- Do not “daisy-chain” power wiring to system components.

Rules of Shielding

- The shield must be tied to zero-signal reference potential. In order for shielding to be effective it is necessary for the signal to be earthed or grounded.
- Do not assume that earth ground is true earth ground. Depending on the distance to the main power cabinet it may be necessary to sink a ground rod at a critical location.
- The shield must be connected so that shield currents drain to signal-earth connections.
- The number of separate shields required in a system is equal to the number of independent signals being processed plus one for each power entrance.
- The shield should be tied to a single point to prevent ground loops.
- A second shield can be used over the primary shield, however, the second shield is tied to ground at both ends.

Recommended Power Supply Cables

Power supply cables must not run parallel to logic level wiring as noise will be coupled onto the logic signals from the power supply cables. If more than one driver is to be connected to the same power supply, run separate power and ground leads to each driver from the power supply. The following Belden cables (or equivalent) are recommended for use with the IB series drive.

Twisted Pair Jacketed

<4 Amps DC ..... Belden part# 9740 or equivalent 18 AWG
>4 Amps DC ..... Belden part# 8471 or equivalent 16 AWG

AC Line Filtering

The output voltage of an unregulated power supply will vary with the AC input applied. It is recommended that an AC line filter be used to prevent damage to the IB series drive due to a lightning strike or power surge.

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 drive may occur! Ensure that the power supply output voltage does not exceed the maximum rated voltage for your IB driver!

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

SECTION 1.4

Motor Selection and Connection

Section Overview

This section covers the motor configurations for the IB series drive, as well as general information concerning motor selection and connection. For specific motor recommendations see the section in Part II of this document pertaining to the model IB drive which you purchased.

- Selecting a Motor.
- Motor Wiring.
- Connecting the Motor.

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 effect everything from the power supply voltage to the type and wiring configuration of your stepper motor, as well as the current and half/full step settings of your IB series drive.

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. Though 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 IB series drivers are 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). A VR motor is a low torque and load capacity motor typically used in instrumentation. The IB series drivers 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 range 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 IB series drivers are bipolar drivers which work 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 IB drive 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.

Winding Inductance

Since the IB drive 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 drive is set to the motor's rated current. Precise current control settings are explained in the sections of Part II of this document that pertain to the model IB drive which you purchased.

As was discussed in the previous section, *Selecting a Power Supply ,* 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.

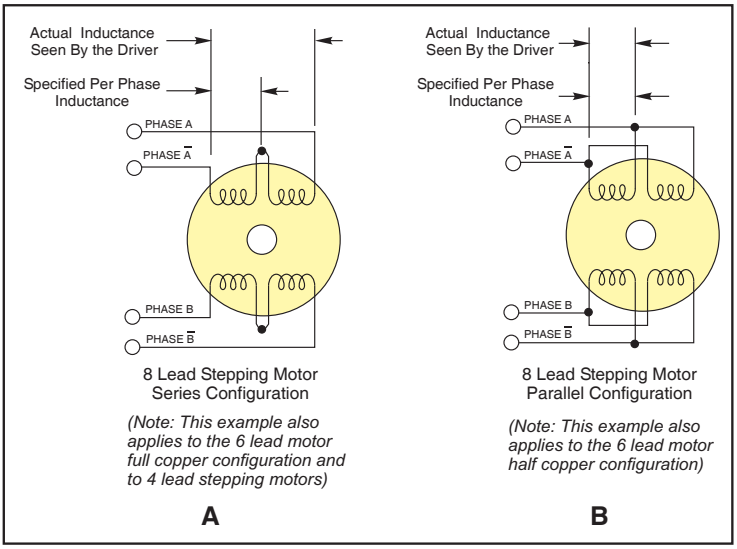


Figure 1.4.1 A & B: Per Phase Winding Inductance

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

Figure 1.4.1A 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 1.4.1B shows an 8 lead motor wired in parallel. Using this configuration the per phase inductance seen by the driver will be as specified.

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

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

Using the following equation we will show an example of sizing a motor for an IB drive used with an unregulated power supply with a minimum voltage (+V) of 18 VDC:

Motor Wiring

As with the power supply wiring, motor wiring should be run separately from logic wiring to minimize noise coupled onto the logic signals. Motor cabling exceeding 1 foot in length should be shielded twisted pairs to reduce the transmission of EMI (ElectroMagnetic Interference) which can lead to rough motor operation and poor system performance overall. For more information on wiring and shielding, please refer to *Rules of Wiring and Shielding* in Section 1.3 of this manual.

NOTE: The physical direction of the motor with respect to the direction input will depend upon the connection of the motor windings. To switch the direction of the motor with respect to the direction input, switch the wires on either phase A or phase B outputs.

WARNING! Do not connect or disconnect motor or power leads with power applied!

Recommended motor cables:

Dual twisted pair shielded (separate shields)

< 4A RMS per phase current .....Belden Part# 9368 or equivalent 18 AWG.
> 4A RMS per phase current .....Belden Part# 1492A or equivalent 16 AWG.

When using a bipolar motor, the motor must be within 100 feet of the drive.

Connecting the Motor

The motor leads are connected to the following connector pins:

Phase	Connector Pin
Phase A	12
Phase $\overline{A}$	11
Phase B	10
Phase $\overline{B}$	9

Table 1.4.1: Motor Connections

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 low speeds is needed. Because this configuration has the most inductance, the performance will start to degrade at higher speeds.

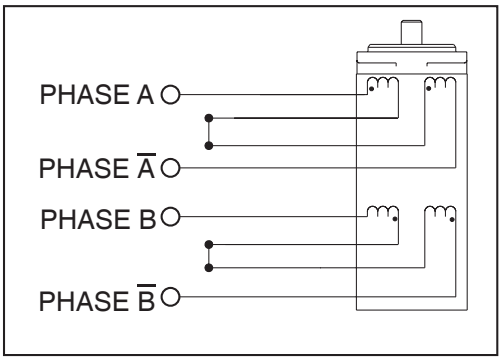


Figure 1.4.2: 8 Lead Motor Series Connection

Parallel Connection

An 8 lead motor in a parallel configuration offers a more stable, but lower torque at lower speeds. Because of the lower inductance there will be higher torque at higher speeds.

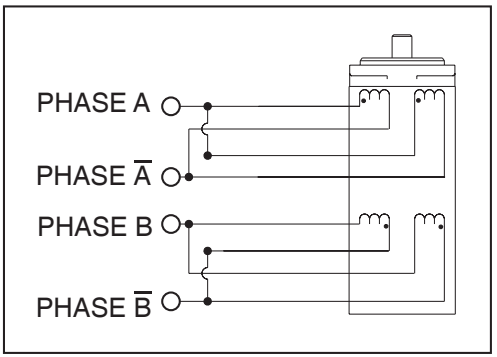


Figure 1.4.3: 8 Lead Motor Parallel Connections

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*.

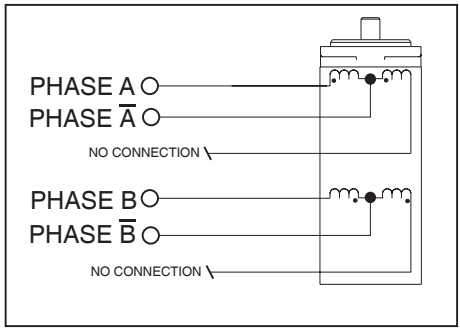


Figure 1.4.4: 6 Lead Motor Half Coil (Higher Speed) Connections

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*.

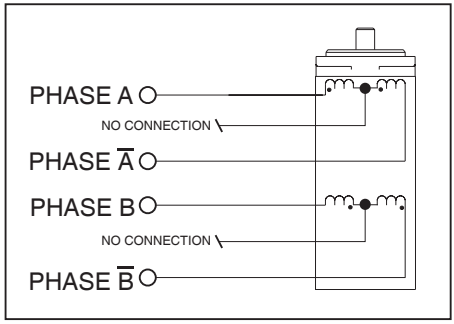


Figure 1.4.5: 6 Lead Motor Full Coil (Higher Torque) Connections

4 Lead Motors

4 lead motors are the least flexible but easiest to wire. Speed and torque will depend on winding inductance.

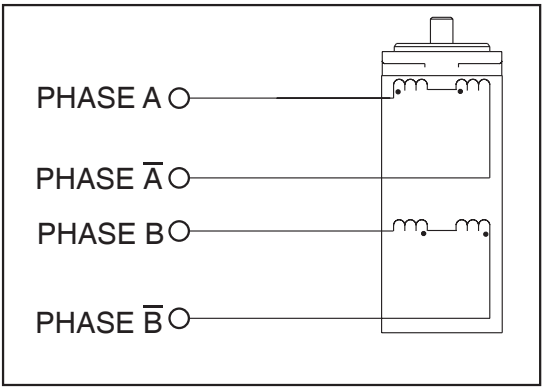


Figure 1.4.6: 4 Lead Motor Connections

SECTION 1.5

Interfacing to the IB Series Drive

Section Overview

The IB series drive may be incorporated directly in the user's printed circuit board. It may also be chassis mounted and interfaced to using either soldered wire connection or the optional plug on terminal strips (IMS PN TS-6). In order to operate, the IB drive must have the following connections

- Motor Power (+V).
- Motor.
- Logic Interface (Step Clock, Direction).

The section also contains pin assignment and description, and sample logic and current adjust interface circuit examples.

Layout and Interface Guidelines

Logic level signals should not run parallel to motor phase signals. The motor phase signals will couple noise onto the logic level signals. This will cause rough motor motion and unreliable system operation. Motor phase signals should be run as pairs and should be separated from other signals by ground traces where possible

When leaving the board, motor cables should not run parallel with other wires. Phases should be wired using twisted pairs. If motor cabling in excess of one foot is required, motor cabling should be shielded twisted pairs to reduce the transmission of EMI. The shield must be tied to AC ground at driver end only. The motor end must be left floating.

If more than one driver is connected to the power supply, separate power and ground connections from each driver to the power supply should be used.

The power supply cables need to be a twisted pair if power is connected from a source external to the board. If multiple drivers are used with an external power source, and it is not possible to run separate power and ground connections to each driver, a low impedance electrolytic capacitor equivalent to two times the total capacitance of all driver capacitors and of equal voltage must be placed at the power input of the board.

Pin Assignment and Description

IB Series Drive Pin Assignment and Description		
Pin #	FUNCTION	Details
1	$\overline{\text{Enable}}$	When Logic LOW, the phase outputs are enabled.
2	Logic Ground	Logic Signal Common. This pin is the return path for the logic inputs. In order to maintain isolation this pin should not be connected to pin 7 (Power Ground).
3	$\overline{\text{Half}}$/Full Step Input	Half/Full Step select input. When in a Logic LOW state the drive will be in half step mode. When HIGH the drive will be operating in full step mode. Wave Mode, or One-Phase-On full step mode, is obtained by selecting full step when the IB drive is at an even numbered state. Normal Mode, or Two-Phase-On full step mode, is set by selecting full step when the drive is at an odd numbered state. When power is applied to the IB drive it automatically initializes to state 1. If full step operation is selected the IB will automatically go into Normal Mode. See Section 2: Theory of Operation for more details.
4	Step Clock Input	Step Clock input. An active HIGH pulse on this input advances the motor one increment. The step occurs on the falling edge of this signal. (See Figure 1.2.5)
5	$\overline{\text{CW}}$/CCW Input	Clockwise/counterclockwise direction control input. Physical direction of motor rotation depends on the connection of the motor windings. This input is internally synchronized.
6	Current Adjust	Phase Current Adjustment input. A resistor is connected between this input and Power Ground (Pin 7) to adjust the phase current of the motor. If the resistor is omitted, the current in each phase of the motor will be at the maximum current of the driver. See the section in Part II of this document pertaining to the model IB drive you purchased for resistor tables and equations.
7	Power Ground	Power supply return (GND).
8	+V	Power supply input.
9	ØB	Motor phase B output.
10	$\overline{\text{ØB}}$	Motor phase B output.
11	ØA	Motor phase A output.
12	$\overline{\text{ØA}}$	Motor phase A output

Table 1.5.1: Pin Assignment and Description

NOTE: See the section in Part II of this document pertaining to the model IB drive you purchased for electrical specifications of the input/output signals.

Basic Connections

The diagram below illustrates the basic connections required to operate the IB series driver. The connection of each part is discussed at length in this section. In order to run the IB drive the following is required: a power supply, a stepping motor, and a control interface supplying step clock and direction.

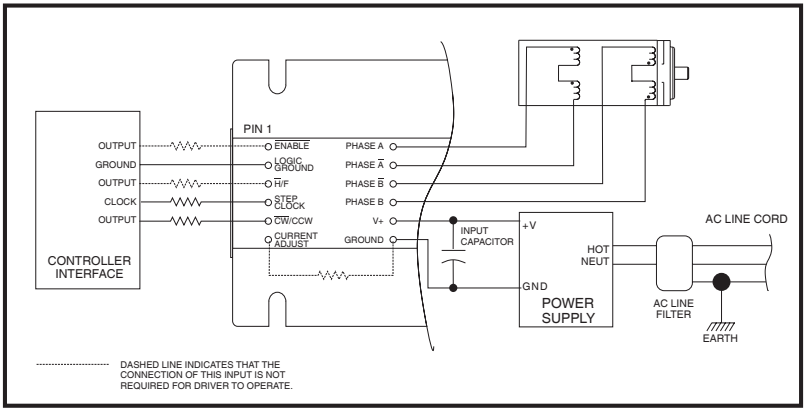


Figure 1.5.1: Basic Connections

WARNING! A current limiting resistor or recommended interface is required in series with the logic inputs! Use of these inputs without this resistor or recommended interface will result in damage to the drive!

Interfacing Motor Power (+V)

Pins 7 (+V), and 8 (Ground) are used to connect motor DC power to the IB drive. A low impedance aluminum electrolytic capacitor is required. The continuous operating voltage of the capacitor should exceed the maximum supply voltage (+V) as well as any additional voltage caused by the motor's back EMF.

The value of the capacitor should be approximately 150µF for every Amp of peak per phase output current and should be placed as close

EXAMPLE: 5.2A (Peak Output Current)@ 70VDC X 150µF = 780µF 100V

to pins 7 and 8 as possible. See figure 1.5.1 for connection drawing.

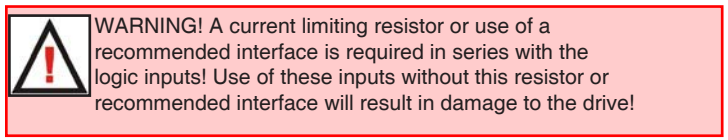
See the section titled for the model IB drive you purchased in Part II

of this document for power supply specifications and recommendations.

Interfacing the Logic Inputs

The IB series drives have 4 isolated logic inputs: Enable, Step Clock, Direction, and Half/Full Step. These inputs are optically isolated and have a maximum forward input current of 15mA. Precise specifications on these inputs can be found in Part II of this manual, in the section pertaining to the model IB drive you purchased. These inputs require a current limiting resistor or use of one of the interfaces diagrammed in this section. Failure to utilize a resistor or recommended interface will damage the input circuitry of the drive and render it inoperable.

The following diagrams illustrate the recommended circuits for interfacing the logic inputs.



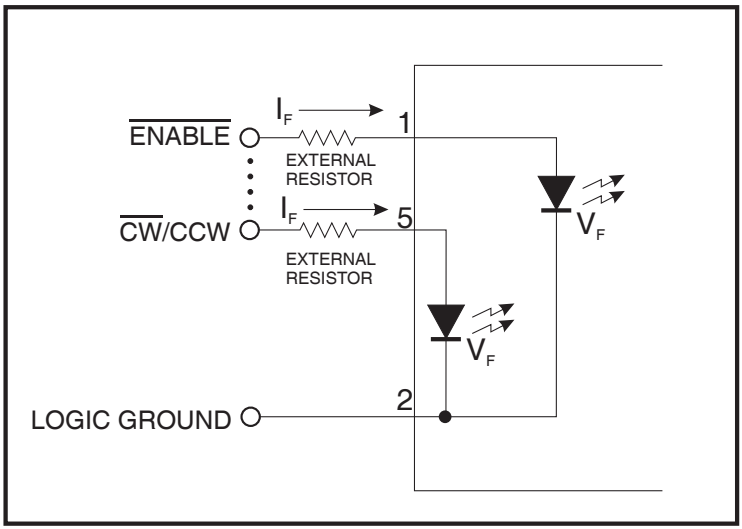


Figure 1.5.2: Opto-coupler Input Circuit

TTL Interface

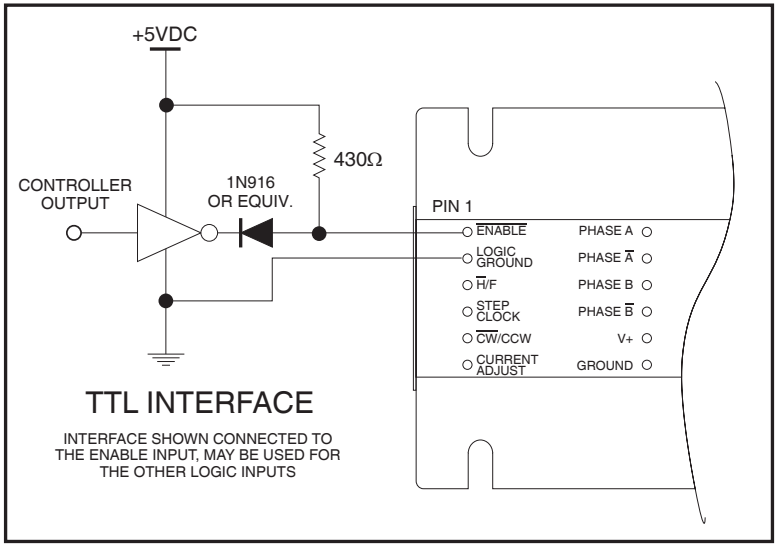


Figure 1.5.3: TTL Interface

Open Collector Interface

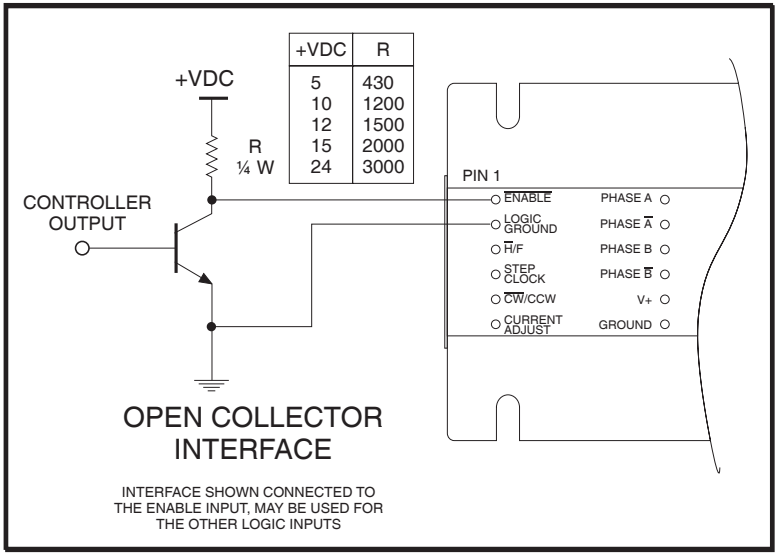


Figure 1.5.4: Open Collector Interface

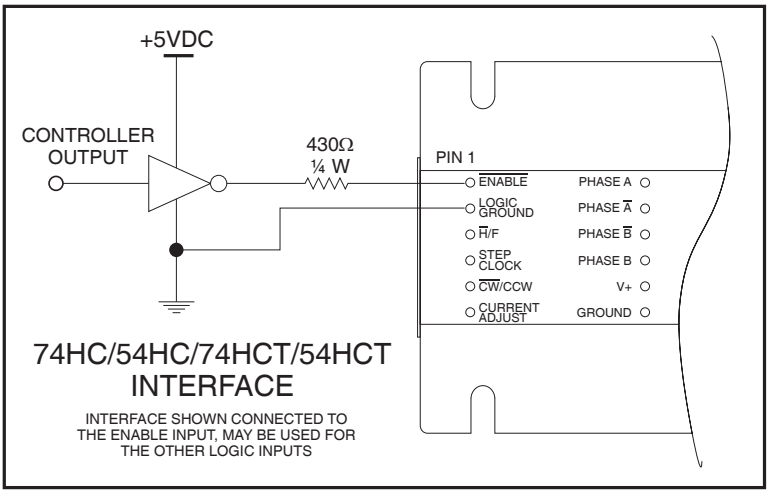
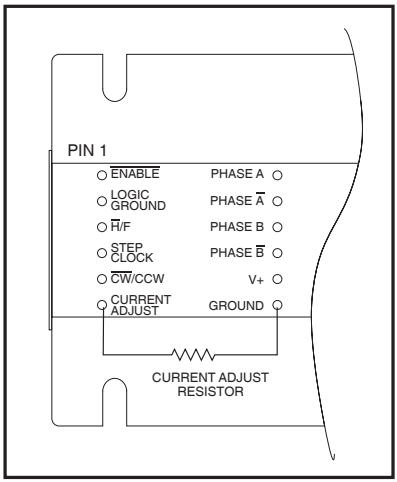


Figure 1.5.5: 74HC/54HC/74HCT/54HCT Interface

Controlling the Output Current

The IB series drivers are internally configured to run at full current. In order to lower the output current a resistor must be placed between pin 6 (Current Adjust) and pin 7 (Power Ground). This resistor value will be different for each model of the IB series. The section pertaining to each particular model contains a table that lists output current settings and adjust resistor values.

It is possible to switch the current adjust resistor value using the



NOTE: If a resistor is not placed between Pins 6 and 7, the drive will be at full current.

NOTE: See the section in Part II of this document pertaining to the model IB drive purchased for resistor value tables.

Figure 1.5.6: Current Adjust Resistor Placement

circuit examples provided in this section. These circuits may be used to switch from one output current setting to another, or to reduce the current in the motor windings when the motor is in a locked position. Use of this will reduce motor and drive heating considerably.

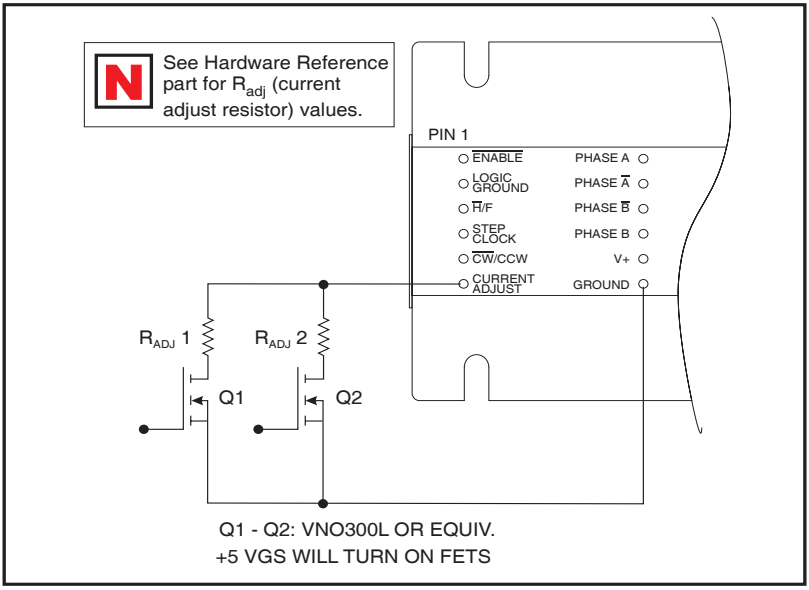


Figure 1.5.7: Switching Phase Currents

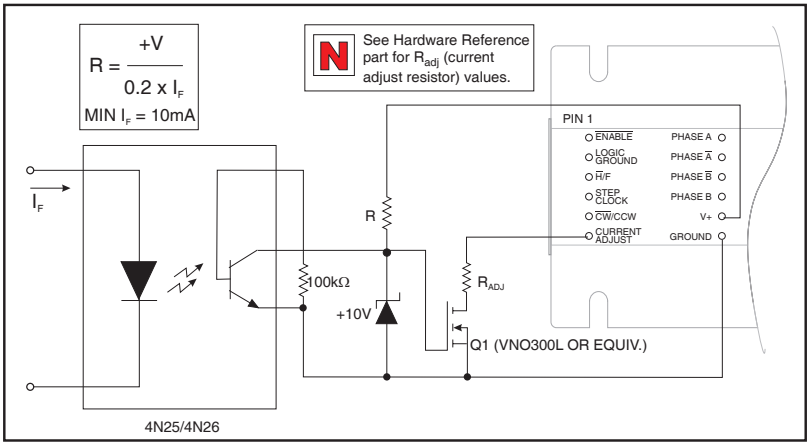


Figure 1.5.8: Isolated Switching of Phase Currents

SECTION 1.6

Troubleshooting

Section Overview

This section will cover the following:

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

Basic Troubleshooting

In the event that your IB series drive 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. These details will greatly assist one of our application engineers in determining the problem should you need assistance.

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

Problem Symptoms and Possible Causes

Symptom

Motor does not move.

Possible Problem

No power.

Step clock is not grounded to opto supply ground.

Unit is in a reset condition.

Unit is disabled.

Symptom

Motor moves in the wrong direction.

Possible Problem

Motor phases may be connected in reverse.

Symptom

Erratic motor motion.

Possible Problem

Motor/power wiring unshielded or not twisted pair.

Logic wiring next to motor/power wiring.

Ground loop in system.

Open winding of motor.

Phase blown on drive.

Symptom

Motor stalls during acceleration.

Possible Problem

Incorrect current adjust setting or resistor value.

Motor is undersized for application.

Acceleration on controller is set to high.

Power supply voltage too low.

Symptom

Excessive motor and driver heating.

Possible Problem

Inadequate heat sinking / cooling.

Current set too high.

Symptom

Inadequate holding torque.

Possible Problem

Incorrect current adjust setting or resistor value.

Contacting Application Support

In the event that you are unable to isolate the problem with your IB series driver, the first action you should take is to contact the distributor from whom you originally purchased your product or IMS Application 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 website located at *www.imshome.com*. This site is updated monthly with tech tips, applications and new product updates.

Returning Your Product to IMS

If Application Support determines that your IB series drive 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.

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PART II

Hardware Reference

SECTION 2.1

IB462

Section Overview

This section includes the hardware specifications of the IB462.

- Mechanical Specifications.
- Electrical Specifications.
- Thermal Specifications.
- Current Adjust Resistor Values.
- Recommended IMS Power Supplies.
- Recommended IMS Motors.
- Options and Accessories.

Mechanical Specifications

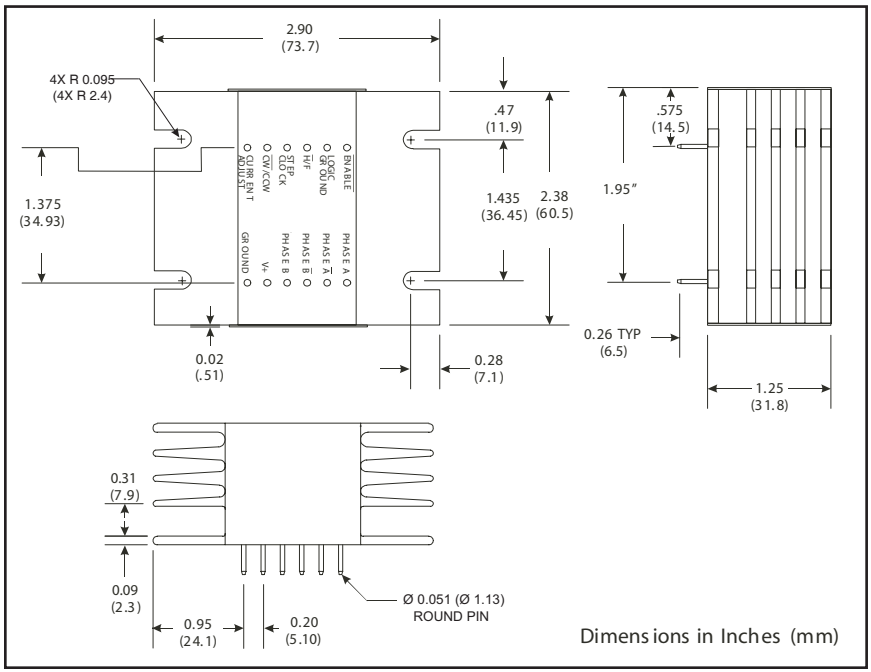


Figure 2.1.1: IB462 Dimensions

Electrical Specifications

IB462 Electrical Specifications					
Specification	**Test Condition**	**Min.**	**Typ.**	**Max.**	**Unit**
Overall Test Condition T_A = 25˚C, +V = 40VDC					
+V (Input Voltage)		12		40*	V
I_I Input Current				2	A
I_Q Quiescent Current	Outputs Floating		75		mA
V_{CE} sat (h) Source Saturation Voltage	I_I = 2A		1.8	2.6	V
V_{CE} sat (i) Source Saturation Voltage	I_I = 2A		1.7	2.4	V
B_{VR} Input Reverse Breakdown Voltage		5			V
V_F Input Forward Voltage	I_F = 10mA		1.5	1.75	V
I_F Input Forward Current		5	7.5	15	mA
T_{CLK} Step Clock Pulse Width		3			µS
T_S Set-up Time	CW/CCW & H/F	2			µS
T_H Hold Time	CW/CCW & H/F	5.5			µS
F_C Commutation Frequency				40	kHz
* The maximum input voltage with the phase outputs disabled is V_{MAX} + 10%					

Table 2.1.1: IB462 Electrical Specifications

Thermal Specifications

IB462 Thermal Specificatons	
Specification	**Unit**
Ambient Temperature	0 to +50˚ C
Storage Temperature	-40 to +125˚C
Maximum Case Temperature	70˚C

Table 2.1.2: IB462 Thermal Specifications

NOTE: Additional cooling may be required to limit case temperature to 70°C. An optional heat sink, IMS PN H-4X, is available. See Appendix B: Cooling Solutions, for details.
WARNING! The Driver must be mounted to a thermally conductive surface such as a metal enclosure wall or a Heat Sink. The Driver must not be operated when resting on an insulated surface such as wood or acrylic.

Current Adjust Resistor Values

The table below lists the phase currents and their associated adjust resistor value.

Current Adjust Resistor and Reference Values for the IB462		
Output Current (Amps Peak)	Reference (Volts)	Resistor Value (Ohms 1%)
0.1	0.05	21.0
0.2	0.10	44.2
0.3	0.15	69.8
0.4	0.20	100
0.5	0.25	133
0.6	0.30	169
0.7	0.35	215
0.8	0.40	267
0.9	0.45	324
1.0	0.50	402
1.1	0.55	487
1.2	0.60	604
1.3	0.65	750
1.4	0.70	931
1.5	0.75	1210
1.6	0.80	1620
1.7	0.85	2260
1.8	0.90	3570
1.9	0.95	7680
2.0	1.00	OPEN CIRCUIT

Table 2.1.3: IB462 Current Adjust Resistor Values

NOTE: If a resistor is not placed between Pins 6 and 7, the drive will be at full current.

Recommended IMS Power Supplies

IP402/IP402-240†
Unregulated Linear Supply

	Range
Input 120 VAC Version	102-132 VAC
240 VAC Version	204-264 VAC
No Load Output Voltage*	39 VDC @ 0 Amps
Continuous Output Rating*	30 VDC @ 1 Amps
Peak Output Rating*	25 VDC @ 2 Amps

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

Recommended IMS Motors

IMS stocks the following 1.8° enhanced hybrid stepping motors that are recommended for the IB462. The 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 hybrid design allows the motors to provide higher torque than standard stepping motors while maintaining a steadier torque and reducing torque drop-off. For more detailed information on these motors, please see the IMS catalog or web site at *www.imshome.com*.

Size 17 Hybrid Stepping Motors are available in three stack sizes, single or double shaft, with or without encoders. They handle currents up to 1.5 Amps, and holding torque ranges from 32 oz-in to 75 oz-in (23 N-cm to 53 N-cm).

17 Frame Motors

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

Size 23 Hybrid Stepping Motors are available in three stack sizes, single or double shaft (not available for 2.4 Amp version), with or

without encoders. They handle currents up to 3 Amps, and holding torque ranges from 90 oz-in to 239 oz-in (64 N-cm to 169 N-cm).

23 Frame Motors

Single Shaft	**Double Shaft**
M-2218-2.4S	N/A
M-2222-2.4S	N/A
M-2231-2.4S	N/A
M-2218-3.0S	M-2218-3.0D
M-2222-3.0S	M-2222-3.0D
M-2231-3.0S	M-2231-3.0D

Options and Accessories

See appendices for descriptions and technical data on these accessories.

Thermal Isolating Pad TI-462

Thermal Non-Isolating Pad TN-462

Heat Sink..... H-4X

Interface Board OPT140

Plug-on Screw Terminal Set..... TS-6

SECTION 2.2

IB463

Section Overview

This section includes the hardware specifications of the IB463.

- Mechanical Specifications.
- Electrical Specifications.
- Thermal Specifications.
- Current Adjust Resistor Values.
- Recommended IMS Power Supplies.
- Recommended IMS Motors.
- Options and Accessories.

Mechanical Specifications

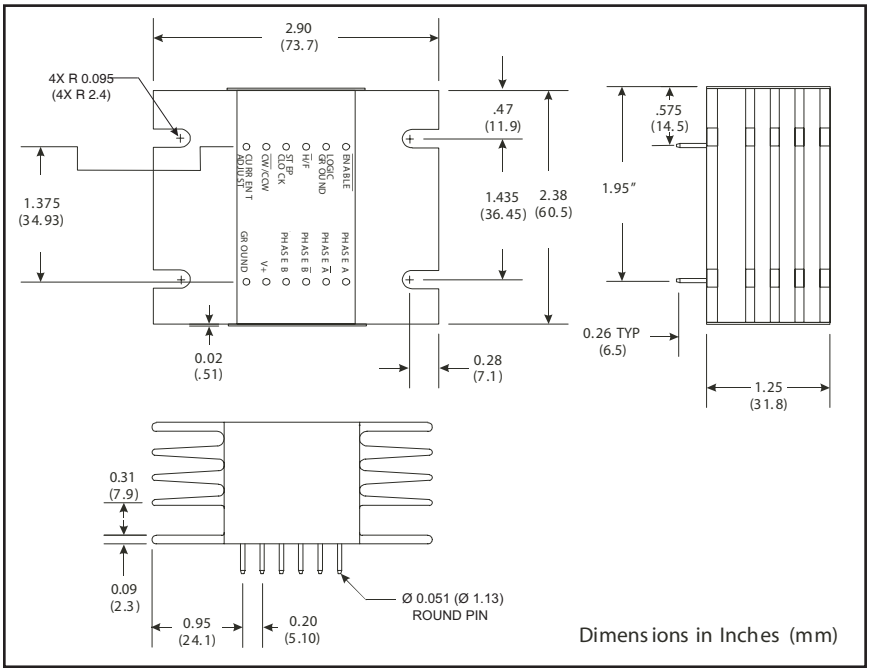


Figure 2.2.1: IB463 Dimensions

Electrical Specifications

IB463 Electrical Specifications					
Specification	**Test Condition**	**Min.**	**Typ.**	**Max.**	**Unit**
Overall Test Condition T_A = 25°C, +V = 40VDC					
+V (Input Voltage)		12		40*	V
I_I Input Current				3.5	
I_Q Quiescent Current	Outputs Floating		90		mA
V_{CE} sat (h) Source Saturation Voltage	I_I = 2A		1.7	2.4	V
V_{CE} sat (i) Source Saturation Voltage	I_I = 2A		1.6	2.3	V
B_{VR} Input Reverse Breakdown Voltage		5			V
V_F Input Forward Voltage	I_F = 1.6mA		1.5	1.75	V
I_F Input Forward Current		5	7.5	15	mA
T_{CLK} Step Clock Pulse Width		3			µS
T_S Set-up Time	CW/CCW & H/F	2			µS
T_H Hold Time	CW/CCW & H/F	5.5			µS
F_C Commutation Frequency				40	kHz
* The maximum input voltage with the phase outputs disabled is V_{MAX} + 10%					

Table 2.2.1: IB463 Electrical Specifications

Thermal Specifications

IB463 Thermal Specificatons	
Specification	**Unit**
Ambient Temperature	0 to +50° C
Storage Temperature	-40 to +125°C
Maximum Case Temperature	70°C

Table 2.2.2: IB463 Thermal Specifications

NOTE: Additional cooling may be required to limit case temperature to 70°C. An optional heat sink, IMS PN H-4X, is available. See Appendix B: Cooling Solutions, for details.
WARNING! The Driver must be mounted to a thermally conductive surface such as a metal enclosure wall or a Heat Sink. The Driver must not be operated when resting on an insulated surface such as wood or acrylic.

Current Adjust Resistor Values

Current Adjust Resistor and Reference Values for the IB463		
Output Current (Amps Peak)	Reference (Volts)	Resistor Value (Ohms 1%)
0.1	0.02	8.25
0.2	0.04	16.9
0.3	0.06	26.1
0.4	0.08	36.5
0.5	0.10	46.4
0.6	0.12	57.6
0.7	0.14	69.8
0.8	0.16	82.5
0.9	0.18	97.6
1.0	0.20	110
1.1	0.22	127
1.2	0.24	147
1.3	0.26	165
1.4	0.28	187
1.5	0.30	210
1.6	0.32	237
1.7	0.34	261
1.8	0.36	294
1.9	0.38	332
2.0	0.40	374
2.1	0.42	422
2.2	0.44	475
2.3	0.46	536
2.4	0.48	640
2.5	0.50	698
2.6	0.52	806
2.7	0.54	931
2.8	0.56	1100
2.9	0.58	1330
3.0	0.60	1650
3.1	0.62	2150
3.2	0.64	2940
3.3	0.66	4640
3.4	0.68	9530
3.5	0.70	OPEN CIRCUIT

Table 2.2.3: IB463 Current Adjust Resistor Values

Recommended IMS Power Supplies

IP404/IP404-240†
Unregulated Linear Supply

	Range
Input 120 VAC Version	102-132 VAC
240 VAC Version	204-264 VAC
No Load Output Voltage*	43 VDC @ 0 Amps
Continuous Output Rating*	32 VDC @ 2 Amps
Peak Output Rating*	26 VDC @ 4 Amps

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

Recommended IMS Motors

IMS stocks the following 1.8° enhanced hybrid stepping motors that are recommended for the IB463. The 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 hybrid design allows the motors to provide higher torque than standard stepping motors while maintaining a steadier torque and reducing torque drop-off. For more detailed information on these motors, please see the IMS catalog or web site at *www.imshome.com*.

Size 17 Hybrid Stepping Motors are available in three stack sizes, single or double shaft, with or without encoders. They handle currents up to 1.5 Amps, and holding torque ranges from 32 oz-in to 75 oz-in (23 N-cm to 53 N-cm).

17 Frame Motors

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

Size 23 Hybrid Stepping Motors are available in three stack sizes, single or double shaft (not available for 2.4 Amp version), with or without encoders. They handle currents up to 3Amps, and holding torque ranges from 90 oz-in to 239 oz-in (64 N-cm to 169 N-cm).

23 Frame Motors

Single Shaft	Double Shaft
M-2218-2.4S	N/A
M-2222-2.4S	N/A
M-2231-2.4S	N/A
M-2218-3.0S	M-2218-3.0D
M-2222-3.0S	M-2222-3.0D
M-2231-3.0S	M-2231-3.0D

Options and Accessories

See appendices for descriptions and technical data on these accessories.

Thermal Isolating Pad TI-462

Thermal Non-Isolating Pad TN-462

Heat Sink..... H-4X

Interface Board OPT140

Plug-on Screw Terminal Set..... TS-6

SECTION 2.3

IB104

Section Overview

This section includes the hardware specifications of the IB104.

- Mechanical Specifications.
- Electrical Specifications.
- Thermal Specifications.
- Current Adjust Resistor Values.
- Recommended IMS Power Supplies.
- Recommended IMS Motors.
- Options and Accessories.

Mechanical Specifications

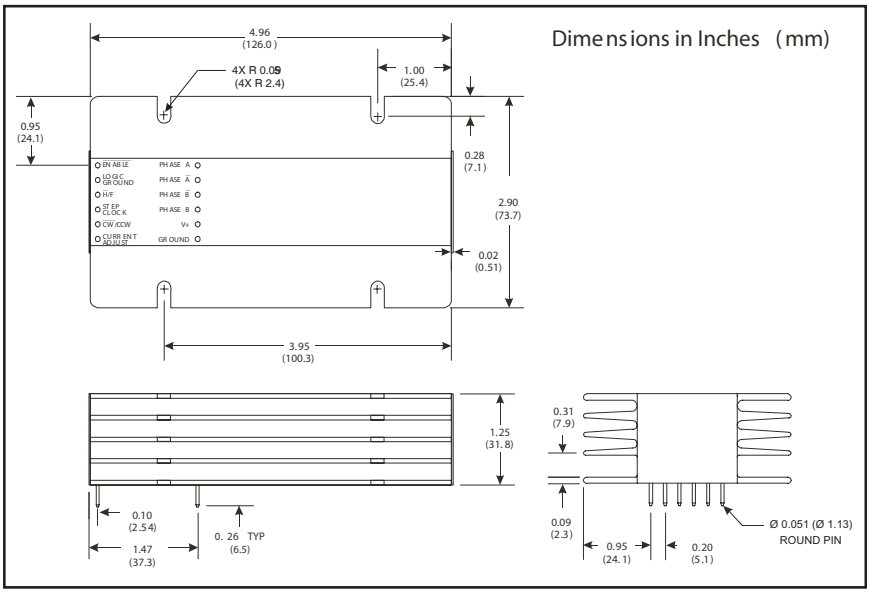


Figure 2.3.1: IB104 Dimensions

Electrical Specifications

IB104 Electrical Specifications					
Specification	**Test Condition**	**Min.**	**Typ.**	**Max.**	**Unit**
Overall Test Condition T_A = 25˚C, +V = 40VDC					
+V (Input Voltage)		24		80*	V
I_I Input Current				4.0	A
I_Q Quiescent Current	Outputs Floating			144	mA
R_{DS} High	I_D = 8.4A			0.20	Ohms
R_{DS} Low	I_D = 5.7A			0.20	Ohms
B_{VR} Input Reverse Breakdown Voltage		5			V
V_F Input Forward Voltage	I_F = 1.6mA		1.5	1.75	V
I_F Input Forward Current		5	7.5	15	mA
T_{CLK} Step Clock Pulse Width		3			µS
T_S Set-up Time	CW/CCW & H/F	2			µS
T_H Hold Time	CW/CCW & H/F	5.5			µS
F_C Commutation Frequency				40	kHz
* The maximum input voltage with the phase outputs disabled is V_{MAX} + 10%					

Table 2.3.1: IB104 Electrical Specifications

Thermal Specifications

IB104 Thermal Specificatons	
Specification	**Unit**
Ambient Temperature	0 to +50˚ C
Storage Temperature	-40 to +125˚C
Maximum Case Temperature	70˚C

Table 2.3.2: IB104 Thermal Specifications

NOTE: Additional cooling may be required to limit case temperature to 70°C. An optional heat sink, IMS PN H-100, is available. See Appendix B: Cooling Solutions, for details.
WARNING! The Driver must be mounted to a thermally conductive surface such as a metal enclosure wall or a Heat Sink. The Driver must not be operated when resting on an insulated surface such as wood or acrylic.

Current Adjust Resistor Values

Current Adjust Resistor and Reference Values for the IB104		
Output Current (Amps Peak)	Reference (Volts)	Resistor Value (Ohms 1%)
1.0	0.20	107
1.1	0.22	121
1.2	0.24	137
1.3	0.26	154
1.4	0.28	174
1.5	0.30	191
1.6	0.32	215
1.7	0.34	237
1.8	0.36	261
1.9	0.38	287
2.0	0.40	324
2.1	0.42	357
2.2	0.44	392
2.3	0.46	432
2.4	0.48	487
2.5	0.50	536
2.6	0.52	590
2.7	0.54	665
2.8	0.56	750
2.9	0.58	845
3.0	0.60	953
3.1	0.62	1100
3.2	0.64	1270
3.3	0.66	1500
3.4	0.68	1780
3.5	0.70	2210
3.6	0.72	2870
3.7	0.74	3920
3.8	0.76	5900
3.9	0.78	12400
4.0	0.80	OPEN CIRCUIT

Table 2.3.3: IB104 Current Adjust Resistor Values

NOTE: If a resistor is not placed between Pins 6 and 7, the drive will be at full current.

Recommended IMS Power Supplies

IP804/IP804-240†
Unregulated Linear Supply

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

ISP300-7/ISP300H-7†
Unregulated Switching Supply

	Range
Input 120 VAC Version	102-132 VAC
240 VAC Version	204-264 VAC
No Load Output Voltage*	68 VDC @ 0 Amps
Continuous Output Rating*	63 VDC @ 2 Amps
Peak Output Rating*	59 VDC @ 4 Amps

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

Recommended IMS Motors

IMS stocks the following 1.8° enhanced hybrid stepping motors that are recommended for the IB104. The 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 hybrid design allows the motors to provide higher torque than standard stepping motors while maintaining a steadier torque and reducing torque drop-off. For more detailed information on these motors, please see the IMS catalog or web site at *www.imshome.com*.

Size 23 Hybrid Stepping Motors are available in three stack sizes, single or double shaft, with or without encoders. They handle currents up to 3 Amps, and holding torque ranges from 90 oz-in to 239 oz-in (64 N-cm to 169 N-cm).

23 Frame Motors

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

Size 34 Hybrid Stepping Motors are available in three stack sizes, single or double shaft, with or without encoders. They handle currents up to 6.3 Amps, and holding torque ranges from 419 oz-in to 1303 oz-in (296 N-cm to 920 N-cm).

34 Frame Motors

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

Options and Accessories

See appendices for descriptions and technical data on these accessories.

Thermal Isolating Pad	TI-100
Thermal Non-Isolating Pad	TN-100
Heat Sink	H-100
Interface Board	OPT-140
Plug-on Screw Terminal Set	TS-6

SECTION 2.4

IB106

Section Overview

This section includes the hardware specifications of the IB106.

- Mechanical Specifications.
- Electrical Specifications.
- Thermal Specifications.
- Current Adjust Resistor Values.
- Recommended IMS Power Supplies.
- Recommended IMS Motors.
- Options and Accessories.

Mechanical Specifications

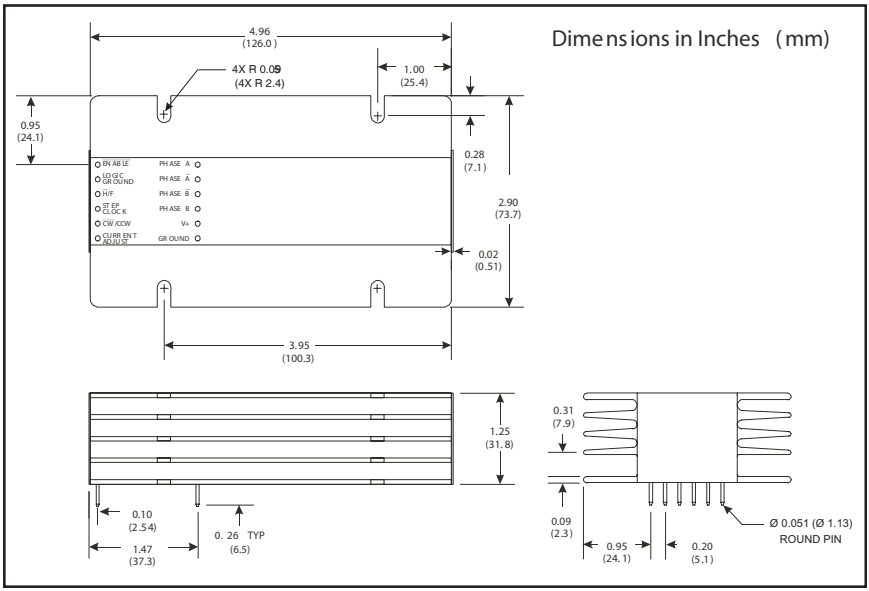


Figure 2.4.1: IB106 Dimensions

Electrical Specifications

IB106 Electrical Specifications					
Specification	Test Condition	Min.	Typ.	Max.	Unit
Overall Test Condition T_A = 25˚C, +V = 40VDC					
+V (Input Voltage)		24		80*	V
I_I Input Current				6.0	A
I_Q Quiescent Current	Outputs Floating			144	mA
R_{DS} High	I_D = 11A			0.117	Ohms
R_{DS} Low	I_D = 15A		0.05	0.77	Ohms
B_{VR} Input Reverse Breakdown Voltage		5			V
V_F Input Forward Voltage	I_F = 1.6mA		1.5	1.75	V
I_F Input Forward Current		5	7.5	15	mA
T_{CLK} Step Clock Pulse Width		3			µS
T_S Set-up Time	CW/CCW & H/F	2			µS
T_H Hold Time	CW/CCW & H/F	5.5			µS
F_C Commutation Frequency				40	kHz
* The maximum input voltage with the phase outputs disabled is V_{MAX} + 10%					

Table 2.4.1: IB106 Electrical Specifications

Thermal Specifications

IB106 Thermal Specificatons	
Specification	Unit
Ambient Temperature	0 to +50˚ C
Storage Temperature	-40 to +125˚C
Maximum Case Temperature	70˚C

Table 2.4.2: IB106 Thermal Specifications

NOTE: Additional cooling may be required to limit case temperature to 70°C. An optional heat sink, IMS PN H-100, is available. See Appendix B: Cooling Solutions, for details.
WARNING! The Driver must be mounted to a thermally conductive surface such as a metal enclosure wall or a Heat Sink. The Driver must not be operated when resting on an insulated surface such as wood or acrylic.

Current Adjust Resistor Values

Current Adjust Resistor and Reference Values for the IB106		
Output Current (Amps Peak)	Reference (Volts)	Resistor Value (Ohms 1%)
2.0	0.20	121
2.1	0.21	130
2.2	0.22	140
2.3	0.23	150
2.4	0.24	162
2.5	0.25	174
2.6	0.26	187
2.7	0.27	200
2.8	0.28	215
2.9	0.29	226
3.0	0.30	243
3.1	0.31	261
3.2	0.32	280
3.3	0.33	301
3.4	0.34	316
3.5	0.35	340
3.6	0.36	365
3.7	0.37	392
3.8	0.38	422
3.9	0.39	453
4.0	0.40	487
4.1	0.41	523
4.2	0.42	562
4.3	0.43	619
4.4	0.44	665
4.5	0.45	732
4.6	0.46	806
4.7	0.47	887
4.8	0.48	976
4.9	0.49	1100
5.0	0.50	1210
5.1	0.51	1370
5.2	0.52	1580
5.3	0.53	1870
5.4	0.54	2210
5.5	0.55	2670
5.6	0.56	3400
5.7	0.57	4640
5.8	0.58	7150
5.9	0.59	14300
6.0	0.60	OPEN CIRCUIT

Table 2.4.3: IB106 Current Adjust Resistor Values

Recommended IMS Power Supplies

IP804/IP804-240†
Unregulated Linear Supply

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

IP806/IP806-240†
Unregulated Linear Supply

	Range
Input 120 VAC Version	102-132 VAC
240 VAC Version	204-264 VAC
No Load Output Voltage*	76 VDC @ 0 Amps
Continuous Output Rating*	68 VDC @ 3 Amps
Peak Output Rating*	64 VDC @ 6 Amps

ISP300-7/ISP300H-7†
Unregulated Switching Supply

	Range
Input 120 VAC Version	102-132 VAC
240 VAC Version	204-264 VAC
No Load Output Voltage*	68 VDC @ 0 Amps
Continuous Output Rating*	63 VDC @ 2 Amps
Peak Output Rating*	59 VDC @ 4 Amps

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

Recommended IMS Motors

IMS stocks the following 1.8° enhanced hybrid stepping motors that are recommended for the IB106. The 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 hybrid design allows the motors to provide higher torque than standard stepping motors while maintaining a steadier torque and reducing torque drop-off. For more detailed information on these motors, please see the IMS catalog or web site at *www.imshome.com*.

Size 23 Hybrid Stepping Motors are available in three stack sizes, single or double shaft, with or without encoders. They handle currents up to 6 Amps, and holding torque ranges from 90 oz-in to 257 oz-in (64 N-cm to 181 N-cm).

23 Frame Motors

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
M-2218-6.0S	M-2218-6.0D
M-2222-6.0S	M-2222-6.0D
M-2231-6.0S	M-2231-6.0D

Size 34 Hybrid Stepping Motors are available in three stack sizes, single or double shaft, with or without encoders. They handle currents up to 6.3 Amps, and holding torque ranges from 419 oz-in to 1303 oz-in (296 N-cm to 920 N-cm).

34 Frame Motors

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

Options and Accessories

See appendices for descriptions and technical data on these accessories.

Thermal Isolating Pad	TI-100
Thermal Non-Isolating Pad	TN-100
Heat Sink	H-100
Interface Board	OPT-140
Plug-on Screw Terminal Set	TS-6

SECTION 2.5

IB1010

Section Overview

This section includes the hardware specifications of the IB1010.

- Mechanical Specifications.
- Electrical Specifications.
- Thermal Specifications.
- Current Adjust Resistor Values.
- Recommended IMS Power Supplies.
- Recommended IMS Motors.
- Options and Accessories.

Mechanical Specifications

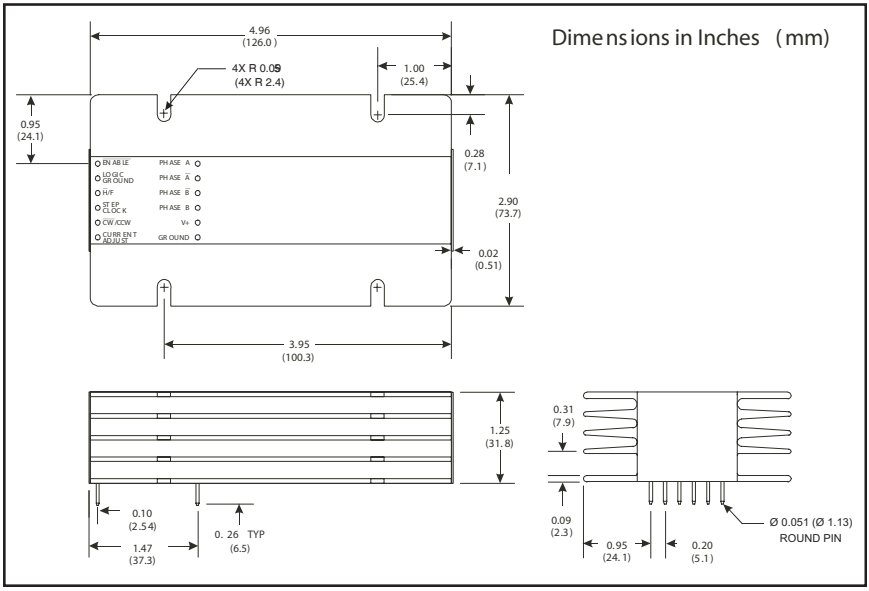


Figure 2.5.1: IB1010 Dimensions

Electrical Specifications

IB104 Electrical Specifications					
Specification	Test Condition	Min.	Typ.	Max.	Unit
Overall Test Condition TA = 25°C, +V = 40VDC					
+V Motor Voltage		24		80*	V
I_i Input Current				4	A
I_Q Quiescent Current	Outputs Floating			144	mA
R_{DS} High	ID = 8.4A			0.2	Ohms
R_{DS} Low	ID = 5.7A			0.2	Ohms
B_{VR} Input Reverse Breakdown Voltage		5			V
V_F Input Forward Voltage	IF = 1.6mA		1.5	1.75	V
I_F Input Forward Current		5	7.5	15	mA
T_{CLK} Step Clock Pulse Width		3			uS
T_S Set-up Time	CW/CCW & H/F	2			uS
T_H Hold Time	CW/CCW & H/F	5.5			uS
F_C Commutation Frequency				40	kHz
* The maximum input voltage with the phase outputs disabled is V_{MAX} +10%					

Table 2.5.1: IB1010 Electrical Specifications

Thermal Specifications

IB1010 Thermal Specifications	
Specification	**Unit**
Ambient Temperature	0 to +50°C
Storage Temperature	-40 to +125°C
Maximum Case Temperature	70°C

Table 2.5.2: IB1010 Thermal Specifications

NOTE: Additional cooling may be required to limit case temperature to 70°C. An optional heat sink, IMS PN H-100, is available. See Appendix B: Cooling Solutions, for details.
WARNING! The Driver must be mounted to a thermally conductive surface such as a metal enclosure wall or a Heat Sink. The Driver must not be operated when resting on an insulated surface such as wood or acrylic.

Current Adjust Resistor Values

Current Adjust Resistor and Reference Values for the IB1010		
Output Current (Amps Peak)	**Reference (Volts)**	**Resistor Value (Ohms 1%)**
2.0	0.20	102
2.2	0.22	115
2.4	0.24	130
2.6	0.26	147
2.8	0.28	162
3.0	0.30	178
3.2	0.32	196
3.4	0.34	221
3.6	0.36	237
3.8	0.38	261
4.0	0.40	287
4.2	0.42	316
4.4	0.44	324
4.6	0.46	374
4.8	0.48	412
5.0	0.50	453
5.2	0.52	487
5.4	0.54	536
5.6	0.56	590
5.8	0.58	649
6.0	0.60	715
6.2	0.62	787
6.4	0.64	887
6.6	0.66	976
6.8	0.68	1100
7.0	0.70	1270
7.2	0.72	1470
7.4	0.74	1650
7.6	0.76	1960
7.8	0.78	2320
8.0	0.80	2870
8.2	0.82	3650
8.4	0.84	4990
8.6	0.86	7680
8.8	0.88	15800
9.0	0.90	OPEN CIRCUIT

Table 2.5.3: IB1010 Current Adjust Resistor Values

Recommended IMS Power Supplies

IP806/IP806-240†
Unregulated Linear Supply

	Range
Input 120 VAC Version	102-132 VAC
240 VAC Version	204-264 VAC
No Load Output Voltage*	76 VDC @ 0 Amps
Continuous Output Rating*	68 VDC @ 3 Amps
Peak Output Rating*	64 VDC @ 6 Amps

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

Recommended IMS Motors

IMS stocks the following 1.8° enhanced hybrid stepping motors that are recommended for the IB1010. The 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 hybrid design allows the motors to provide higher torque than standard stepping motors while maintaining a steadier torque and reducing torque drop-off. For more detailed information on these motors, please see the IMS catalog or web site at *www.imshome.com*.

Size 23 Hybrid 6.0 Amp Stepping Motors are available in three stack sizes, single or double shaft, with or without encoders. They handle currents up to 6 Amps, and holding torque ranges from 100 oz-in to 257 oz-in (71 N-cm to 181 N-cm).

23 Frame Motors

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

Size 34 Hybrid Stepping Motors are available in three stack sizes, single or double shaft, with or without encoders. They handle currents up to 6.3 Amps, and holding torque ranges from 419 oz-in to 1303 oz-in (296 N-cm to 920 N-cm).

34 Frame Motors

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

Size 42 Hybrid Stepping Motors are available in three stack sizes, single or double shaft. They handle currents up to 10 Amps, and holding torque ranges from 810 oz-in to 2100 oz-in (572 N-cm to 1483 N-cm).

42 Frame Motors

Single Shaft	Double Shaft
M2-4247-S	M4247-D
M2-4270-S	M4270-D
M2-4288-S	M4247-D

Options and Accessories

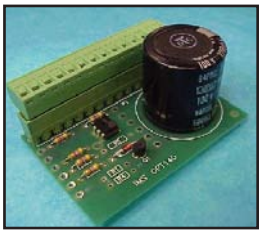
See appendices for descriptions and technical data on these accessories.

Thermal Isolating Pad	TI-100
Thermal Non-Isolating Pad	TN-100
Heat Sink	H-100
Interface Board	OPT-140

APPENDIX A

OPT140

Optional Interface Board



The OPT140 adds such features to the IB series drive as:

- A Removable Screw Terminal Interface.
- Isolated Current Reduction.
- 470Ω Pull-up Resistors on Logic Inputs.
- Input Capacitor.

Determining the Resistor Values

Setting the Output Current

To set the output current on the IB series drive using the OPT140 board you will need to place R4 (See Figure A.1 below for resistor location). The value resistor needed will match the resistor table for the model IB drive you purchased.

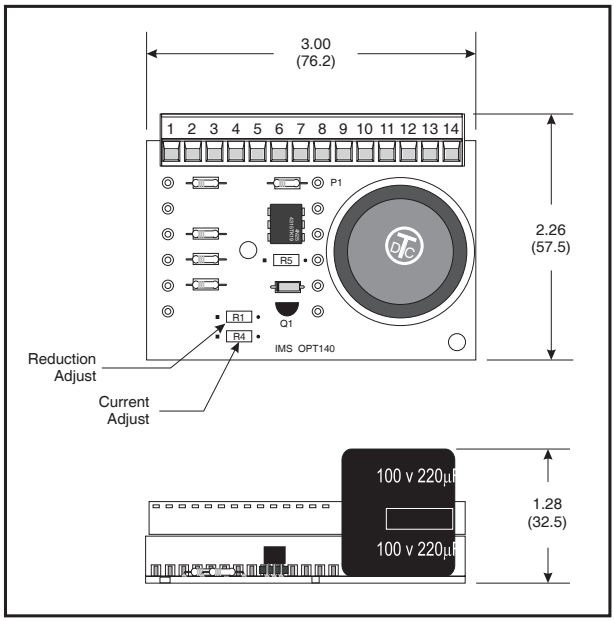


Figure A.1: OPT-140 Dimensions

Reducing the Output Current

In order to use the current reduction feature on the OPT140 there are two resistors that must be placed on the OPT140 board, R5 and R1. R5 should be a ½ watt resistor for the IB104, 106 and 1010. For the IB462 and IB463 a ¼ watt resistor should be used. The value of the resistor is calculated using the following equation:

$$R5 = 2000 \times (+V - 10)$$

The value of R1, the reduction adjust resistor (R_{RED}) is determined by using the current adjustment resistor tables in the section of the Hardware Reference part of this document pertaining to the model IB drive you purchased. It is calculated as follows:

$$R_{RED} = \frac{R_{RUN} * R_{HOLD}}{R_{RUN} - R_{HOLD}}$$

R_{RED} = Reduction adjust resistor (R1).

R_{HOLD} = Resistor value for desired holding current from current adjust table.

R_{RUN} = Resistor value for desired run current from current adjust table (also value for R4).

The current reduction input on Pin 8 is pulled-up to +5VDC via a 1kΩ resistor. When toggled LOW the current reduction adjust resistor R1 will be switched in parallel with the current adjust resistor R4, thus the output current of the driver will be set to the value specified by the total resistance (R_{HOLD}) of R1 and R4 (see figure A.2: OPT140 Schematic Representation). The value of R_{HOLD} will be the resistor value representative of the desired holding current from the current adjust resistor table in the section appropriate for the model IB drive

NOTE: If a resistor is not placed in the R4 position, the run current of the driver will be at its full scale. In this case the value of R1 would then equal the value of the current adjust resistor specified for the desired holding current from the current adjust table being used.

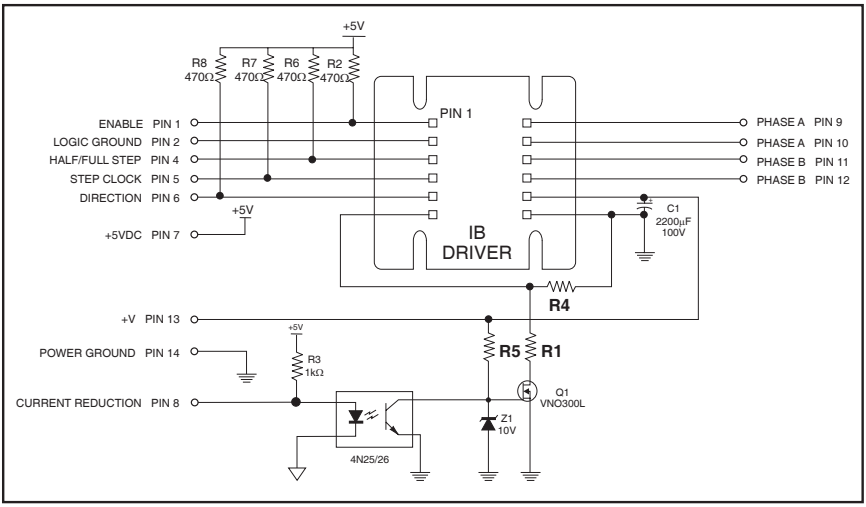


Figure A.2: OPT140 Schematic Representation

Mounting the OPT140

The OPT-140 is mounted to the IB drive as shown in Figure A.3. The power, ground and phase output pins (Pins 7-9) of the drive will be next to the input capacitor.

The pins are then soldered using a recommended solder. Use a recommended solvent for flux removal if required.

Recommended Solders:

Kester "245" No-clean core solder, Alpha Metals "Telecore Plus" solder, Multicore "X39B" No-clean solder, or equivalent.

Recommeded Solvent:

Tech Spray "Envorotech 1679", Chemtronics "Flux-off NR 2000", or equivalent.

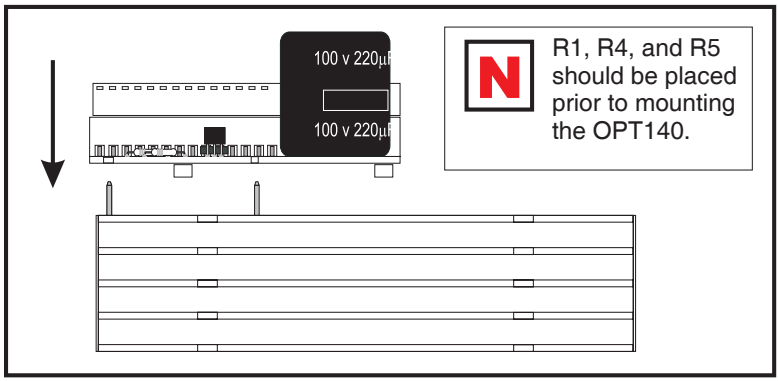


Figure A.3: OPT140 Placement

OPT140 Pin Configuration

OPT-140 Pin Assignment and Description		
PIN #	**FUNCTION**	**DETAILS**
1	$\overline{\text{Enable}}$	When in a Logic LOW (active) state, the phase outputs are enabled.
2	Logic Ground	Logic Signal Common. This pin is the return path for the logic inputs. In order to maintain isolation this pin should not be connected to pin 7 (Power Ground).
3	No Connect	–
4	$\overline{\text{Half}}$/Full Step Input	Half/Full Step select input. See *Part 1, Section 2: Theory of Operation* for more details.
5	Step Clock Input	Step Clock input. An active HIGH pulse on this input advances the motor one increment. The step occurs on the falling edge of this signal.
6	$\overline{\text{CW}}$/CCW Input	Clockwise/counterclockwise direction control input. Physical direction of motor rotation depends on the connection of the motor windings. This input is internally synchronized in the driver.
7	+5VDC	+5VDC input.
8	Current Reduction	Logic LOW on this input will reduce the current in the motor windings to the value specified by R1 and R4. See *Reducing the Output Current*, for resistor calculation.
9	ØA	Motor phase A output.
10	Ø$\overline{\text{A}}$	Motor phase $\overline{\text{A}}$ output.
11	ØB	Motor phase B output.
12	Ø$\overline{\text{B}}$	Motor phase $\overline{\text{B}}$ output.
13	+V	See specification for IB series drive being interfaced.
14	GND	Power ground.

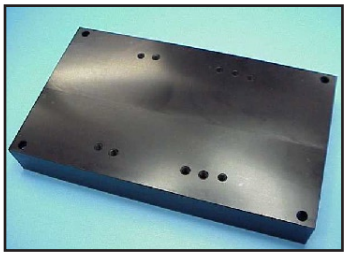
Table A.1: OPT140 Pin Configuration

WARNING! Do not connect +5VDC directly to pins 1, 4, 5, 6. An open collector driver should be used to control these inputs. See Section 1.5: Interfacing to the IB Series Drive, for interface configurations!

APPENDIX B

Cooling Solutions

H-4X Heat Sink



The H-4X heat sink is designed for use with the IB462 and IB463. The H-4X comes with the following items:

(1) H-4X heat sink.
(4) 8 X 32 mounting screws/washers.
(1) TN-462 or TN-463 non-isolating thermal pad.

Mechanical Specifications

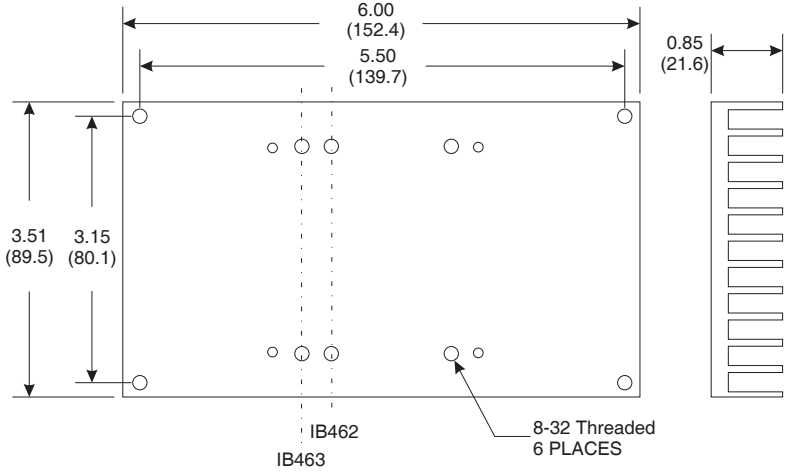


Figure B.1: H-4X Heat Sink, Dimensions in Inches (mm)

H-100 Heat Sink

The H-100 heat sink is designed for use with the IB104, IB106 and IB1010. The H-100 comes with the following items:

(1) H-100 heat sink.
(4) 8 X 32 mounting screws/washers.
(1) TN-100 non-isolating thermal pad.

Mechanical Specifications

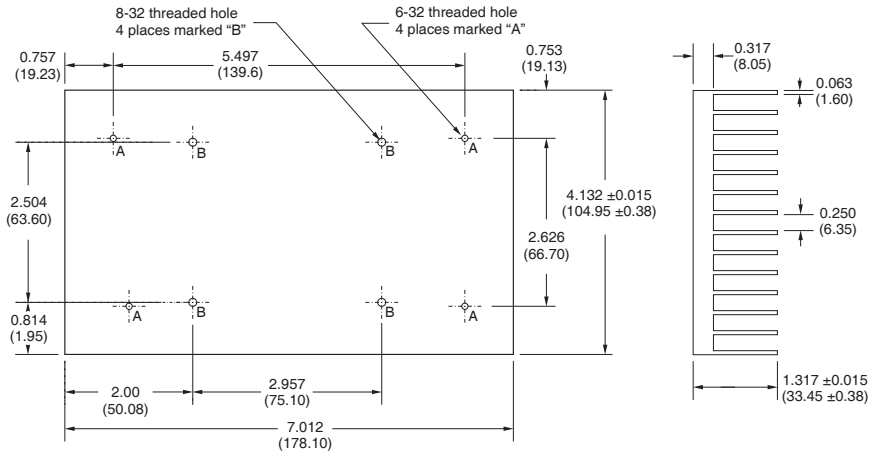


Figure B.2: H-100 Heat Sink, Dimensions in Inches (mm)

Thermal Pads

IMS has available a series of non-isolating and isolating thermal pads designed for use with the IB series of half/full step drivers.

Thermal Non-Isolating (TN)

The TN 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 pad is adhesive and may be applied directly to the IB driver. The TN pad eliminates the problems associated with using thermal grease. The following pads are available for the IB series drives:

TN-462.....IB462
TN-463.....IB463
TN-100.....IB104, IB106 & IB1010

These pads are also included in the heat sink kit.

Thermal Isolating (TI)

The TI thermal isolating pad uses a 0.006" (0.15mm) special film which has high thermal conductivity (0.9 W/m-K) and high dielectric strength (5000 Cps). The TI thermal insulating pad can withstand high voltages and does not require thermal grease to transfer heat. The following pads are available for the IB series drivers:

TI-462 ..... IB462
TI-463 ..... IB463
TI-100 ..... IB104, IB106 & IB1010

APPENDIX C

Miscellaneous Accessories

TS-6 Screw Terminal Set

The TS-6 screw terminal set is available as an option for the IB series drivers. These six position terminal blocks plug directly onto the IB drive connector pins.

There are two of the six position terminals per set.

When using the TS-6 screw terminals the following practices should be observed:

Wire Size ..... 14 to 22 AWG
Wire Strip Length ..... 0.238" (6.0 mm)
Tightening Torque .....
7 lb-in (0.79 N-m) .....

APPENDIX D

Recommended Cable Configurations: DC Supply to IMS Driver

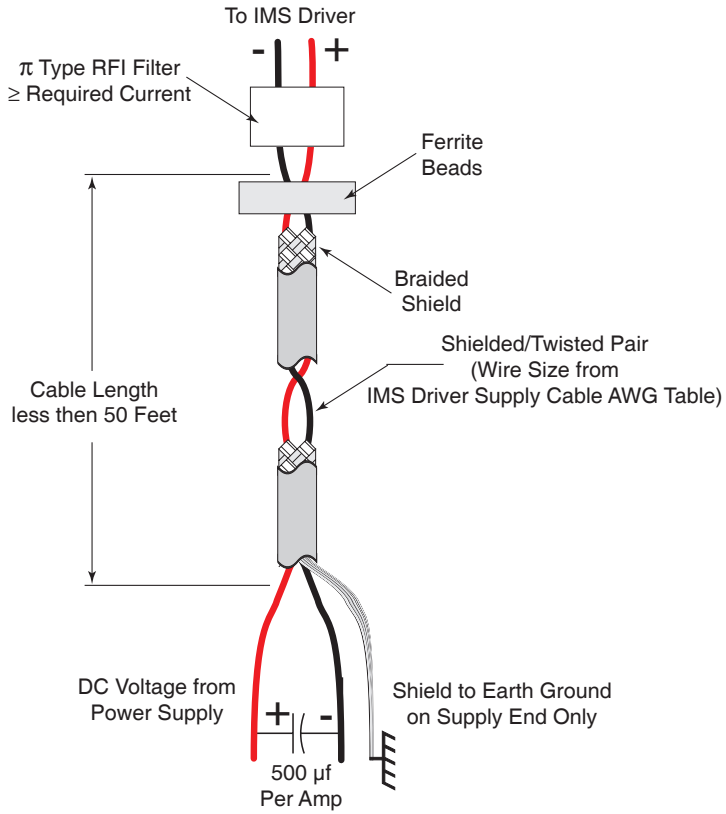
Cable length, wire gauge and power conditioning devices play a major role in the performance of your IMS Driver and Motor.

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

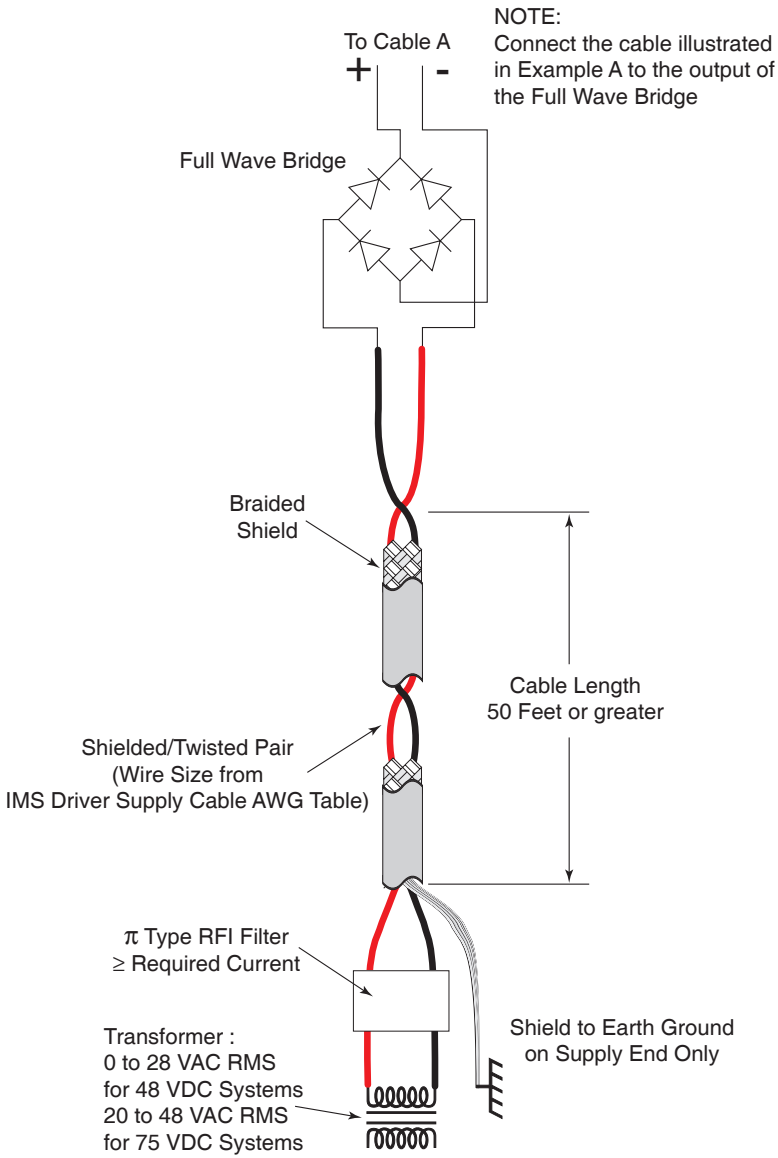
Example A demonstrates the recommended cable configuration for DC power supply cabling under 50 feet long. If cabling of 50 feet or longer is required, the additional length may be gained by adding an AC power supply cable (see Examples B & C).

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.

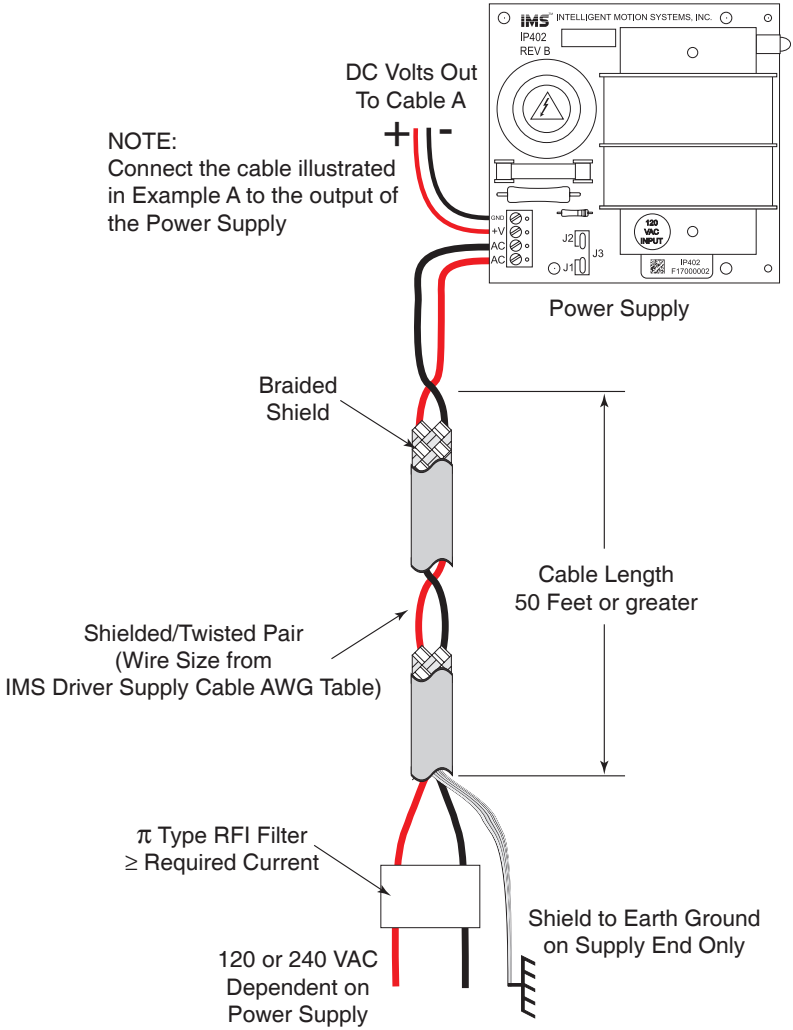
Example A – Cabling Under 50 Feet, DC Power



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 innustrated in Examples B and C 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

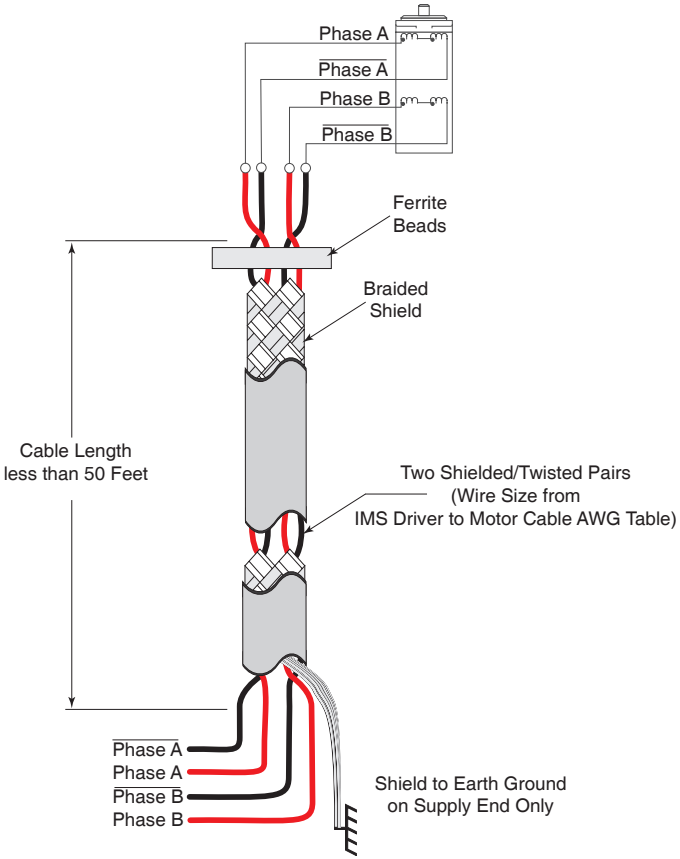
Cable length, wire gauge and power conditioning devices play a major role in the performance of your IMS Driver and Motor.

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

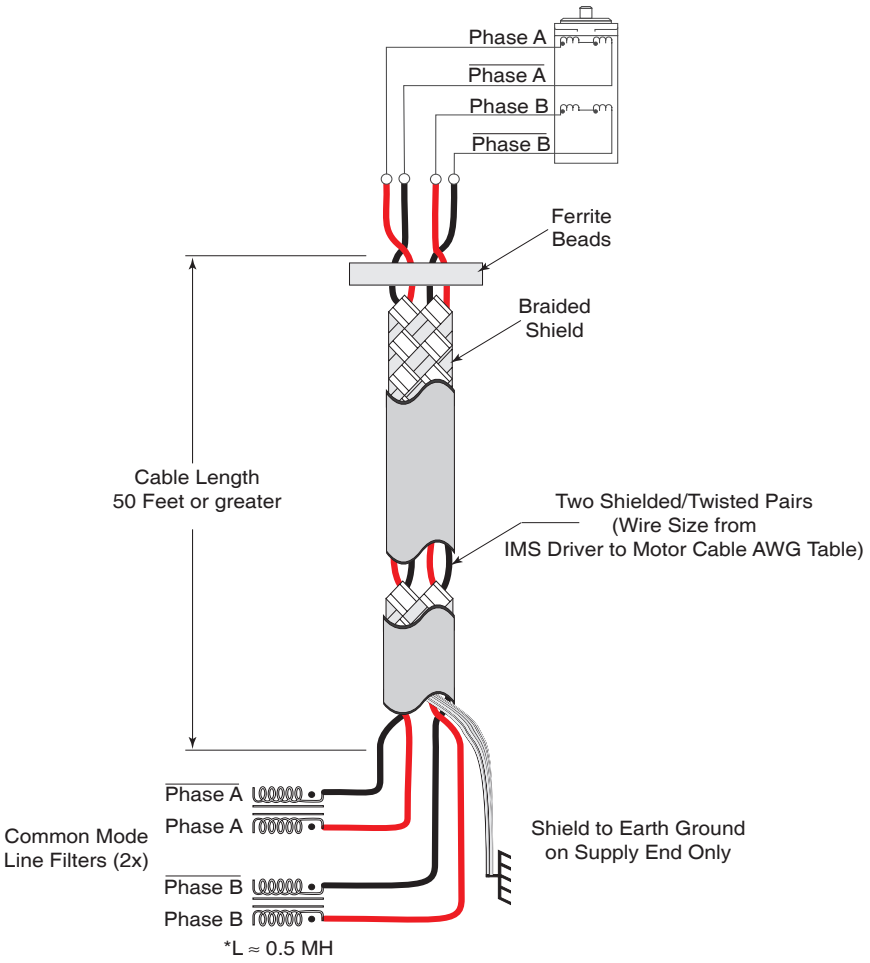
Example A demonstrates the recommended cable configuration for the IMS Driver to Motor cabling under 50 Feet long. If cabling of 50 feet or longer is required, the additional length can be gained with the cable configuration in Example B.

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 Amperess (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 Amperess (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.

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ADDENDUM

The IB Series "S" Version

General Description

The IB Series "S" Version drivers differ from the standard IB product line in that input circuitry requires a sinking interface rather than sourcing. Table 1 illustrates the differences between the "S" version and the standard IB product line.

	"S" Version	Standard IB
Input Interface Type	Sinking	Sourcing
Input Current Limiting Resistors Required	No*	Yes
External Opto-coupler Supply Required	+5VDC	-
Compatible with OPT-140	No	Yes

Table 1: Differences Between the "S" Version and Standard IB Drives

Electrical Specifications

IB104 Electrical Specifications					
Specification	Test Condition	Min.	Typ.	Max.	Unit
Overall Test Condition TA = 25°C, +V = 40VDC					
+V Motor Voltage		24		80*	V
I_I Input Current				2/3.5	A
I_Q Quiescent Current	Outputs Floating		75/90		mA
V_{CE} sat (h) Source Saturation Voltage	I_I = 2A		1.8/1.7	2.6/2.4	V
V_{CE} sat (i) Source Saturation Voltage	I_I = 2A		1.7/1.6	2.4/2.3	V
B_{VR} Input Reverse Breakdown Voltage		5			V
V_F Input Forward Voltage	IF = 1.6mA		1.5	1.75	V
I_F Input Forward Current		5	7.5	15	mA
T_{CLK} Step Clock Pulse Width		3			uS
T_S Set-up Time	CW/CCW & H/F	2			uS
T_H Hold Time	CW/CCW & H/F	5.5			uS
F_C Commutation Frequency				40	kHz
* The maximum input voltage with the phase outputs disabled is V_{MAX} +10%					

Table 2: IB Series "S" Version Electrical Specifications

Pin Assignment and Descriptions

IB Series Drive Pin Assignment and Description		
Pin #	FUNCTION	Details
1	Enable/$\overline{\text{Disable}}$	When Logic LOW, the phase outputs are disabled.
2	Logic Ground	Logic Signal Common. This pin is the return path for the logic inputs. In order to maintain isolation this pin should not be connected to pin 7 (Power Ground).
3	Half/$\overline{\text{Full}}$ Step Input	Half/Full Step select input. When in a Logic LOW state the drive will be in full step mode. When HIGH the drive will be operating in half step mode. Wave Mode, or One-Phase-On full step mode, is obtained by selecting full step when the IB drive is at an even numbered state. Normal Mode, or Two-Phase-On full step mode, is set by selecting full step when the drive is at an odd numbered state. When power is applied to the IB drive it automatically initializes to state 1. If full step operation is selected the IB will automatically go into Normal Mode. See Section 2: Theory of Operation for more details.
4	Step Clock Input	Step Clock input. An active HIGH pulse on this input advances the motor one increment. The step occurs on the falling edge of this signal. (See Figure 1.2.5)
5	CW/$\overline{\text{CCW}}$ Input	Clockwise/counterclockwise direction control input. Physical direction of motor rotation depends on the connection of the motor windings. This input is internally synchronized.
6	Current Adjust	Phase Current Adjustment input. A resistor is connected between this input and Power Ground (Pin 7) to adjust the phase current of the motor. If the resistor is omitted, the current in each phase of the motor will be at the maximum current of the driver. See the section in Part II of this document pertaining to the model IB drive you purchased for resistor tables and equations.
7	Power Ground	Power supply return (GND).
8	+V	Power supply input.
9	ØB	Motor phase B output.
10	$\overline{\text{ØB}}$	Motor $\overline{\text{phase B}}$ output.
11	ØA	Motor phase A output.
12	$\overline{\text{ØA}}$	Motor $\overline{\text{phase A}}$ output

Table 3: IB Series "S" Version Pin Assignment and Descriptions

Interfacing and Using the IB Series "S" Version Isolated Logic Inputs

The IB Series "S" Version has 4 optically isolated logic inputs. 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 controller such as the IMS LYNX or a PLC. These inputs are:

1] Enable (Pin 1)
2] Half/Full Step (Pin 3)
3] Step Clock (Pin 4)
4] CW/CCW Direction (Pin 5)

Of these inputs only step clock and direction are required to operate the IB Series "S" Version.

The schematic shown in Figure 1 illustrates the inputs.

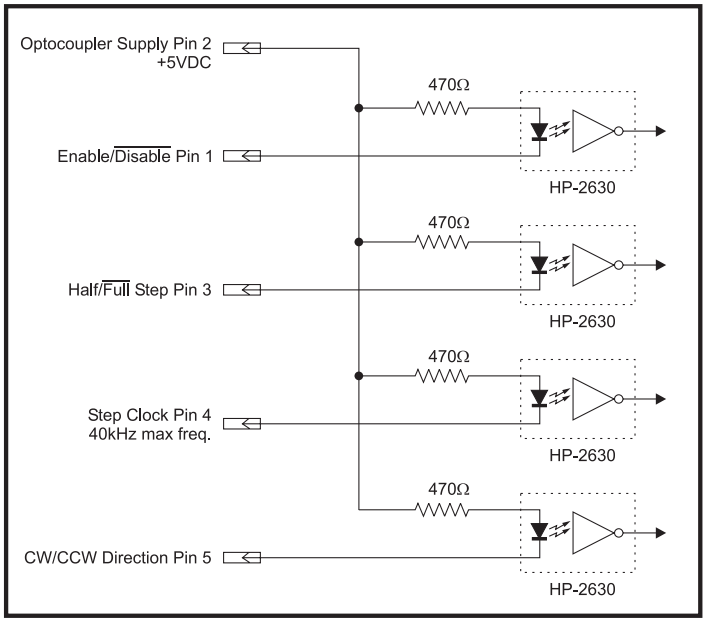

Figure 1: Isolated Logic Inputs

Powering the Optocouplers

In order to maintain isolation, the optocouplers must be powered by an external power supply connected to Pin 2, 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 milliamps. At no time can the input forward current exceed 15 milliamps or damage may occur to the drive.

Isolated Input Current Limiting Resistors		
Opto Supply (+VDC)	**Resistor Value (Ohms 5%)**	**Resistor Value (Ohms 1%)**
5	-	-
10	680	681
12	1000	1000
15	1300	1300
24	2700	2670

Table 4: Recommended Input Current Limiting Resistor Values

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 illustrates a SPST switch connected to the enable input.

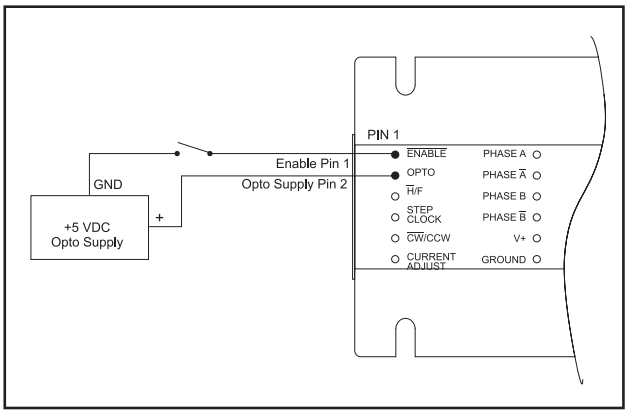

Figure 2: IB Series "S" Version Switch Interface

Open Collector Interface

Figure 3 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.

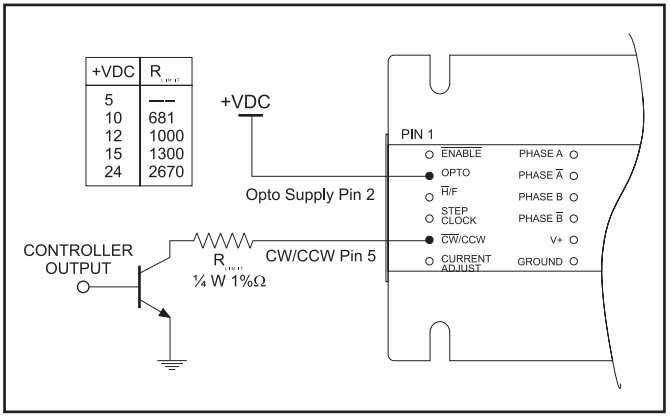

Figure 3: IB Series "S" Version Open Collector Interface

TTL Interface

Figure 4 shows a TTL device connected to the enable input. This interface method may be used with any of the logic inputs.

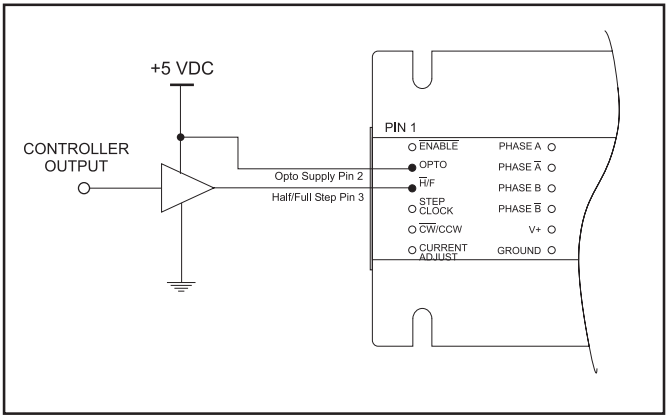

Figure 4: IB Series "S" Version TTL Interface

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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.”

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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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