MDrive AccuStep
Step • Torque • Speed
Integrated Motor and Driver

INTELLIGENT MOTION SYSTEMS, INC.

Schneider Electric

AccuStep Manual Change Log		
Date	Revision	Changes
07/02/2009	R070209	Added MDrive AccuStep 34 AC specifications and details. Reformatted document to current standards.
10/10/2009	R032610	Added velocity mode support.
03/26/2010	R032610	Added support for the DPM75 Drive Protection Module. Added assembly instructions for the anti-backlash nut for external linear actuators.

Important information

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

Qualification of personnel

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

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

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

Intended Use

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

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

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

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

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

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

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MDrive® AccuStep

Step • Torque • Speed

Part 1: General Usage

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1 Introduction

1.1 About this manual

This manual is applicable for the MDrive AccuStep Step • Torque • Speed.

1.2 MDrive AccuStep overview

The MDrive AccuStep is a high-torque 1.8° brushless step motor integrated with a high performance microstepping drive equipped with advanced AccuStep revolutionary technology for unsurpassed performance.

AccuStep technology offers the system designer a low cost alternative to 3-phase servo motors and brushed DC motors. Because AccuStep is a stepper-based technology, no tuning is required and the loop is closed by means of an integrated encoder.

MDrive AccuStep can be configured to operate in one of four modes:

1. Step (Step/Direction: In step mode the MDrive AccuStep will be controlled by an external step clock signal.
2. Torque (Torque Control): In torque mode, the device will maintain a constant, preset torque output of the motor. The torque may be set in software, or controlled via the analog input using a 0 to +5 V, 0 to +10 V or -10 to +10 V signal.
3. Speed (Speed Control): In speed mode the device will operate as an intelligent speed control, with velocity being controlled via the Analog input by a 0 to +5 V, 0 to +10 V or -10 to +10 V signal.
4. Velocity (Velocity Control) In velocity mode the device will operate at a constant velocity commanded by the SL (slew) parameter.

The AccuStep communicates using RS-422/485 via a 10-pin wire crimp style connector.

I/O and power interface is accomplished using a 12-pin wire crimp connector.

An encoder interface is provided via a 10-pin locking wire crimp connector.

The MDrive AccuStep Step • Torque • Speed is available in the following power ranges and motor styles:

Rotary motor

- +12 to +60 VDC: NEMA 23
- 120 or 240 VAC: NEMA 34

External or non-captive linear actuator

- +12 to +60 VDC: NEMA 23

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1.2.1 AccuStep configuration utility

The AccuStep configuration utility is an easy to install and use graphical user interface (GUI) for configuring the MDrive AccuStep from an RS-422/485 host. The utility may be download at www.imshome.com. An optional communication converter cable is available for ease of connecting and configuring this product.

AccuStep configuration utility features include:

- Easy installation via web interface or using CD included with Quick Start kits.
- Automatic communication configuration.
- Will not set out-of-range values.
- Tool-tips display valid range setting for each option.
- Required to set operational mode: step, torque, speed or velocity.

1.3 Documentation reference

The following documentation is available for the MDrive AccuStep:

- This product manual, describes the technical data, installation, configuration and programming of the product.
- Quick Reference, describes the basic wiring, connection and use of this product. The quick reference is shipped in printed form with the product.

This documentation is also available for download from the IMS web site at www.imshome.com.

1.4 Product software

The MDrive AccuStep integrated motor and driver uses the AccuStep configuration utility which may be downloaded from www.imshome.com/software_interfaces.html.

Installation and usage instructions are to be found in this document.

The AccuStep configuration utility is required to configure the operating mode and to upgrade the firmware.

Once the device mode is set parameters may be changed using the GUI or by using an ANSI terminal emuluator such as Hyperterminal or IMS terminal.

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2 Safety

2.1 Qualification of personnel

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

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

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

2.2 Intended Use

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

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

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

2.3 Hazard Categories

Safety notes and general information are indicated by hazard messages in the manual. In addition there are symbols and instructions affixed to the product that warn of possible hazards and help to operate the product safely.

Depending on the seriousness of the hazard, the messages are divided into three hazard categories.

⚠ DANGER

DANGER indicates an imminently hazardous situation, which, if not avoided, **will result** in death, serious injury, or equipment damage.

⚠ WARNING

WARNING indicates a potentially hazardous situation, which, if not avoided, **can result** in death, serious injury, or equipment damage.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation, which, if not avoided, **can result** in injury or equipment damage.

2.4 General safety instructions

⚠ DANGER

EXPOSED SIGNALS

Hazardous voltage levels may be present if using an open frame power supply to power the product.

Failure to follow these instructions will result in death or serious injury.

⚠ WARNING

LOSS OF CONTROL

- Observe the accident prevention regulations. (For USA see also NEMA ICS1.1 and NEMA ICS7.1)
- The system manufacturer must take the potential error possibilities of the signals and the critical functions into account to ensure a safe status during and after errors. Some examples are: emergency stop, final position limitation, power failure and restart.
- The assessment of error possibilities must also include unexpected delays and the failure of signals or functions.
- Suitable redundant control paths must be in place for dangerous functions.
- Check that measures taken are effective.

Failure to follow these instructions can result in death or serious injury.

⚠ CAUTION

HOT PLUGGING!

Do not connect or disconnect power, logic, or communications while the device is in a powered state.

Remove DC power by powering down at the AC side of the DC power supply.

Failure to follow these instructions can result in equipment damage.

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3 Power supply selection and connection

⚠ DANGER

EXPOSED SIGNALS

Hazardous voltage levels may be present if using an open frame power supply to power the product.

Failure to follow these instructions will result in death or serious injury.

⚠ CAUTION

MAXIMUM VOLTAGE INPUT

Do not exceed the maximum rated voltage of the +60 VDC! Motor Back EMF, power supply ripple and high line must be taken into account when selecting a power supply voltage level.

Failure to follow these instructions may result in damage to system components!

⚠ CAUTION

GENERAL POWER SUPPLY PRACTICE

Do not connect or disconnect the power supply while power is applied.

Disconnect the AC side to power down the DC supply.

For battery operated systems connect a “transient suppressor” across the switch to prevent arcs and high-voltage spikes.

Failure to follow these instructions may result in damage to system components!

⚠ CAUTION

HOT PLUGGING!

Do not connect or disconnect power, logic, or communications while the device is in a powered state.

Remove DC power by powering down at the AC side of the DC power supply.

Failure to follow these instructions may result in damage to system components!

3.1 Selecting a power 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.

3.1.1 Power supply — motor relationship

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

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

3.1.2 Power supply — driver relationship

The MDrive AccuStep 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 power supply.

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

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

3.1.3 Regulated vs unregulated

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

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

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

3.2 Recommended power cable configurations

⚠ CAUTION

EMI and RFI

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.

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

Always use Shielded/Twisted Pairs for the MDrive AccuStep DC Supply Cable and the AC Supply Cable.

Failure to follow these instructions may result in damage to system components!

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

Figure 3.1 illustrates 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 Figures 3.2 and 3.3).

Correct AWG wire size is determined by the current requirement plus cable length. Please see the detailed specfication section specific to the MDrive AccuStep you purchased.

3.2.1 DC Cabling Under 50' (13.24 m)

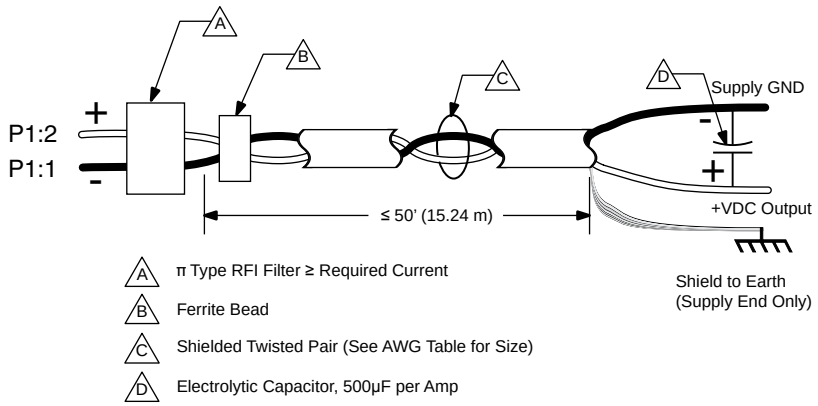


Figure 3.1 DC power supply cabling under 50' (13.24 m)

3.2.2 50’ (13.24 m) or greater, AC power to full wave bridge

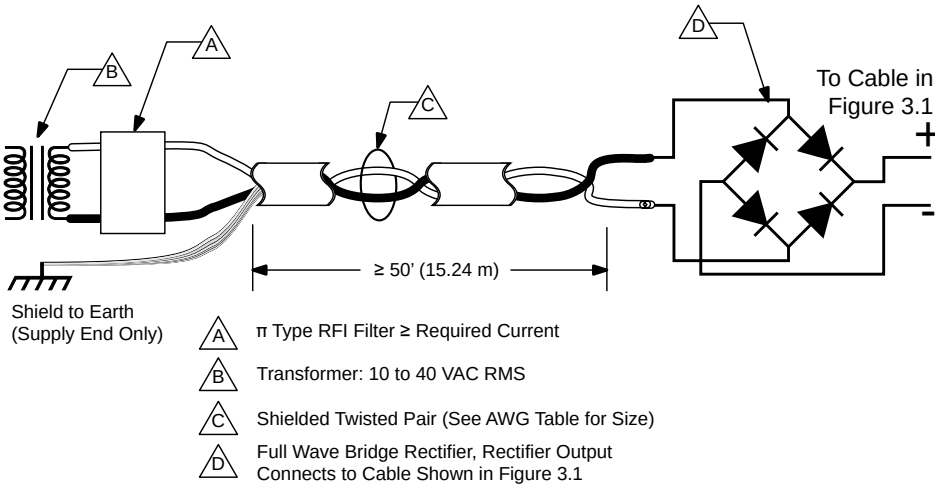


Figure 3.2 **50’ (13.24 m) or greater, AC power to full wave bridge**

3.2.3 50’ (13.24 m) or greater, AC power DC supply

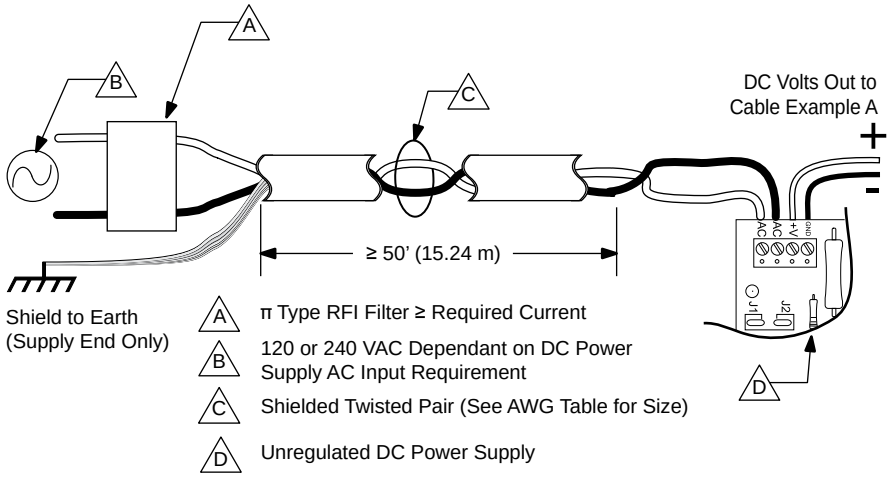


Figure 3.3 **50’ (13.24 m) or greater, AC power to DC supply**

3.4 Switching DC power (DPM75 accessory)

⚠ CAUTION

HOT PLUGGING!

Do not connect or disconnect power, logic, or communications while the device is in a powered state without additional protection.

Remove DC power by powering down at the AC side of the DC power supply.

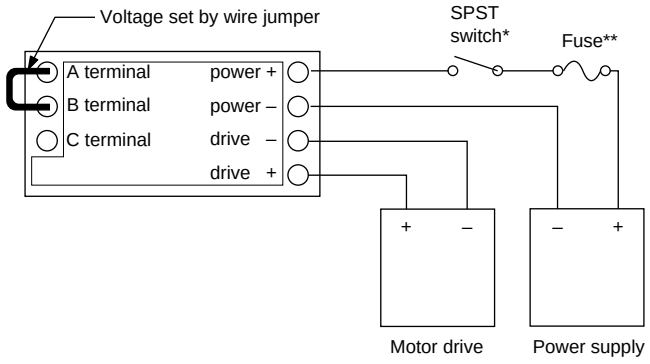
Failure to follow these instructions may result in damage to system components!

The function of the DPM75 Drive Protection Module is to limit the surge current and voltage to a safe level when DC input power is switched on and off to a motor drive. This provides the added protection necessary for reliable motor drive operation when switching the DC power, instead of the recommended AC power to the DC power supply. The device is designed to protect the motor drive when operating under all load conditions. This device does not protect the motor drive from wiring the power incorrectly.

The unit is capable of being used with 48, 60, and 75 volt rated motor drives. An external jumper selection is available so the user can match the circuit to their particular application. The DPM75 is capable of a steady state operating current of 4 amps.

The DPM75 can be used for any frame size motor drive, when properly configured. It can also be used for more than one unit provided the current and voltage do not exceed the DPM75's ratings. The maximum DPM75 ratings are 75 volts and 4 amps.

Power requirements and wiring details are available in the product detail section pertaining to the MDrive product purchased.



* Do not switch negative side of supply
**Fuse = 6.3 Amp slow blow (recommended: Bussman S505-6.3A or Littelfuse 215006.3). The fuse is optional.

Figure 3.4 DPM75 basic wiring and connection

4 Interfacing AC power

⚠ DANGER

EXPOSED SIGNALS

Hazardous voltage levels may be present if using an open frame power supply to power the product.

Failure to follow these instructions will result in death or serious injury.

⚠ CAUTION

MAXIMUM VOLTAGE INPUT

Do not exceed the maximum rated voltage of the device! Motor back EMF, power supply ripple and high line must be taken into account when selecting a power supply voltage level.

Failure to follow these instructions may result in damage to system components!

⚠ CAUTION

HOT PLUGGING!

Do not connect or disconnect power, logic, or communications while the device is in a powered state.

Remove DC power by powering down at the AC side of the DC power supply.

Failure to follow these instructions may result in damage to system components!

Detailed specifications, voltage limits, current requirements and connectivity information are located in the product detail section corresponding to the MDrive AccuStep model you purchased.

4.1 Applicability

This section is only applicable to those MDrive AccuStep models with a 120 or 240 VAC input voltage.

4.2 Interfacing AC voltage

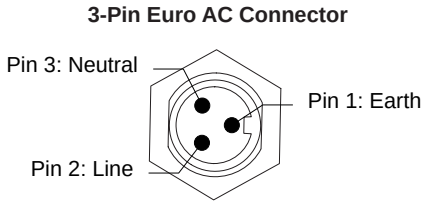


Figure 4.1 Euro AC connector (P3)

Signal	European (IEC) color code	US color code
Earth	Yellow/Green	Green
Line	Brown	Black
Neutral	Blue	White

Table 4.1 AC standard wire colors

4.3 MD-CS20x-000 cordset

The single-end three conductor cordsets are used with the MDrive AC. Measuring 13.0’ (4.0m) long, they are available in either straight or right angle termination. IEC color code, oil-resistant yellow PVC jacket, IP68 and NEMA 6P rated.

Straight Termination MD-CS200-000

Right Angle Termination MD-CS201-000

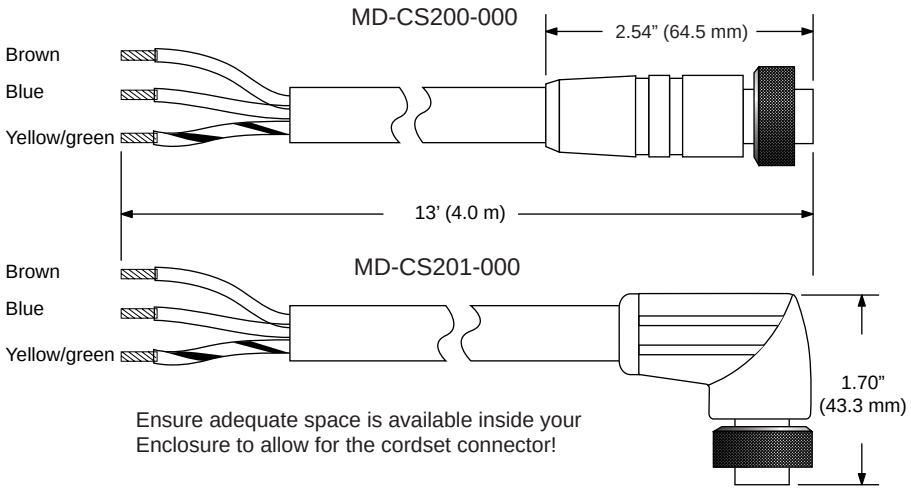


Figure 4.2 MD-CS20x-000

5 Interfacing serial communications

The MDrive communicates to the host using the RS-422/485 protocol. Communications may be configured as either half duplex (RS-485) or full duplex (RS-422) using the Echo Mode dropdown on the communications configuration screen of the AccuStep configurator GUI.\. RS-422/485 may be used in two ways: either to communicate to a single MDrive, or to address up to 62 individually named nodes in a multidrop system.

5.1 Applicability

This section applies to all MDrive models with an RS-422/485 communications interface.

5.2 USB to RS-422/485 isolated communications converter cables

To simplify the wiring and connection process we offer an electrically isolated USB to RS-422/485 communications cables for the MDrive. These convenient 12.0' (3.6m) accessory cables connect a PC's USB port to the MDrive P2 connector. An in-line RS-422/485 converter enables parameter setting to a single MDrive. Cable purchase recommended with first order.

There are two communications converter cables available depending on the connector type:

USB to 10-pin wire crimp.....Part No. MD-CC402-001

USB to 5-pin M-12 circular .....Part No. MD-CC401-001

5.2.2 Driver installation procedure

These Installation procedures are written for Microsoft Windows XP Service Pack 2. Users with earlier versions of Windows please see the alternate installation instructions at our web site (http://www.imshome.com).

The installation of the MD-CC40x-000 requires the installation of two sets of drivers:

- Drivers for the IMS USB to RS-422 Converter Hardware.
- Drivers for the Virtual Communications Port (VCP) used to communicate to your IMS Product.

Therefore the Hardware Update wizard will run twice during the installation process.

The full installation procedure will be a two-part process: Installing the Cable/VCP drivers and Determining the Virtual COM Port used.

Installing the Cable/VCP Drivers

1) Download the MD-CC40x-001 communications converter drivers from http://www.imshome.com/downloads/cable_drivers.html. Extract to a folder on your hard drive.
2) Plug the USB converter cable into the USB port of the MD-CC40x-001.
3) Plug the other end of the USB cable into an open USB port on your PC.
4) Your PC will recognize the new hardware and open the Hardware Update dialog.
5) Select “No, not this time” on the radio buttons in answer to the query “Can Windows Connect to Windows Update to search for software?” Click “Next”.
6) Select “Install from a list or specific location (Advanced)” on the radio buttons in answer to the query “What do you want the wizard to do?” Click “Next”.
   - Select “Search for the best driver in these locations.”
   - Check “Include this location in the search.”
   - Browse to the download location on your hard drive.
7) Click Next.
8) The drivers will begin to copy.
9) On the Dialog for Windows Logo Compatibility Testing, click “Continue Anyway”.
10) The Driver Installation will proceed. When the Completing the Found New Hardware Wizard dialog appears, Click “Finish”.
11) Upon finish, the Welcome to the Hardware Update Wizard will reappear to guide you through the second part of the install process. Repeat steps 1 through 9 above to complete the cable installation.
12) Your MD-CC40x-001 is now ready to use.

Determining the Virtual COM Port (VCP)

The MD-CC40x-000 uses a Virtual COM Port to communicate through the USB port to the MDrive. A VCP is a software driven serial port which emulates a hardware port in Windows.

The drivers for the MD-CC40x-000 will automatically assign a VCP to the device during installation. The VCP port number will be needed when IMS Terminal is set up in order that IMS Terminal will know where to find and communicate with your IMS Product.

To locate the Virtual COM Port.

1) Right-Click the “My Computer” Icon and select “Properties”.
2) Browse to the Hardware Tab, Click the Button labeled “Device Manager”.
3) Look in the heading “Ports (COM & LPT)” IMS USB to RS-422 Converter Cable (COMx) will be listed). The COM # will be the Virtual COM Port connected. The AccuStep configurator GUI should autodetect the port number when opened, if need be you may manually select the port in the GUI.

5.3 Interfacing single mode communications

> **⚠ CAUTION**
>
> HOT PLUGGING!
>
> Do not connect or disconnect communications while the device is in a powered state.
>
> **Failure to follow these instructions may result in damage to system components!**

5.3.1 Full duplex (RS-422)

To interface the MDrive using RS-422 protocol you will need one of the following:

- A PC equipped with RS-422 Interface.
- A PC RS-232 to RS-422/485 converter.
- MD-CC40x-001 or equivalent communications converter.

Use the following diagram to connect RS-422 communications to the MDrive (not required if using the IMS cables)

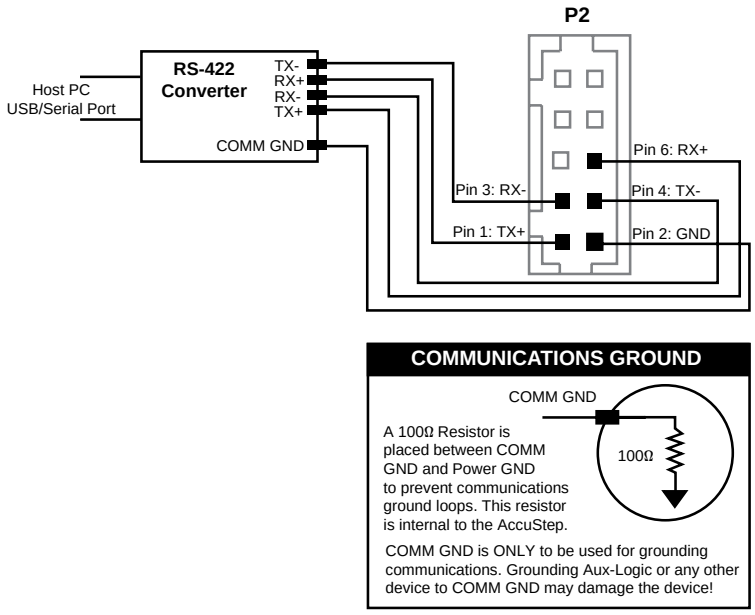


Figure 5.2 Full duplex RS-422 connection.

5.3.2 Half duplex (RS-485)

The MDrive can be operated in a two wire RS-485 communication bus. Before connecting the two wire RS-485, download your program and setup instructions using the standard four wire RS-422 Communications Cable. If a program is not being used, download and save any setup parameters. To ensure the MDrive responds only to commands specifically meant for it, set the unit in party mode

The Echo Mode parameter (EM) must be set to the value of 1 (EM=1). This will set the MDrive communication into “half duplex” mode. Connect the driver in the two wire RS-485 configuration. The following diagram illustrates how to connect the four wire RS-485 to operate as a two wire system.

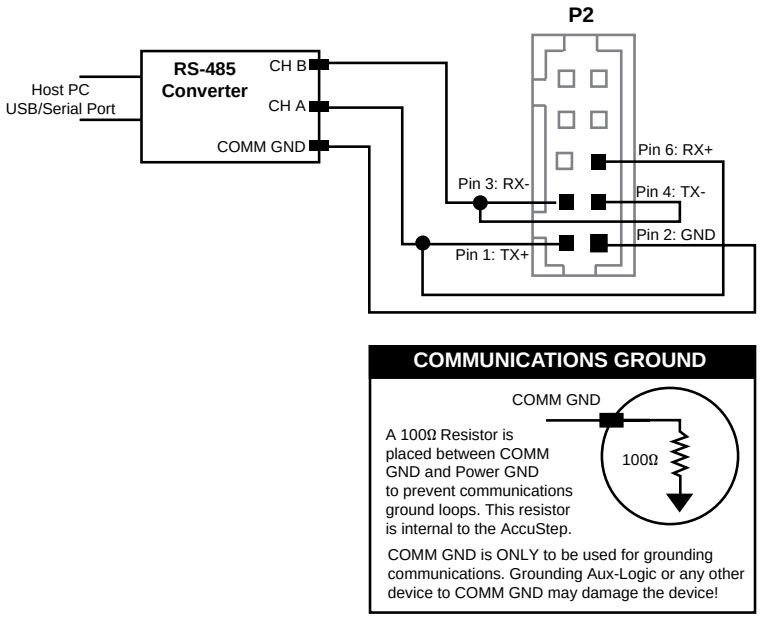


Figure 5.3 Half duplex RS-485 connection.

5.4 interfacing party mode communications

⚠ CAUTION

HOT PLUGGING!

Do not connect or disconnect communications while the device is in a powered state.

Failure to follow these instructions may result in damage to system components!

⚠ CAUTION

COMMUNICATIONS GROUND LOOPS

To avoid ground loops in the system only connect communications ground to the first MDrive in the system. Do not connect communications ground on subsequent MDrives.

Failure to follow these instructions may result in damage to system components!

⚠ CAUTION

SHIELDED CABLES

Do not use the IMS MD-CC400-001 communications converter cable for multi-drop systems. Ribbon cables are not recommended for use in multi-drop communications systems due to the lack of shielded cabling.

Failure to follow these instructions may result in damage to system components!

DEVICE NAME

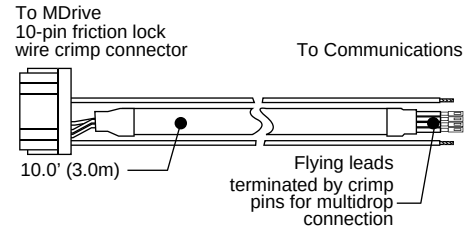
Each unit in a party mode system must have a unique identifier, or device name. Each unit MUST be connected and communicated with in single mode communications and given a name using the name field on the AccuStep configuration tool Communications screen. See subsection 5.5.

5.4.1 Mutli-drop communications using IMS MD-CC402-001

Required:

- MD-CC402-001 communications converter cable
- PD10-1434-FL3 prototype development cable(s)

Used in conjunction with the MD-CC402-001 communications converter cable to facilitate multi-drop RS-422/485 communications.



Wire Colors	Function
White/Red Stripe	Aux-Logic
White/Blue Stripe	TX+
Blue/White Stripe	TX-
White/Orange Stripe	RX+
Orange/White Stripe	RX-
Green/White Stripe	GND

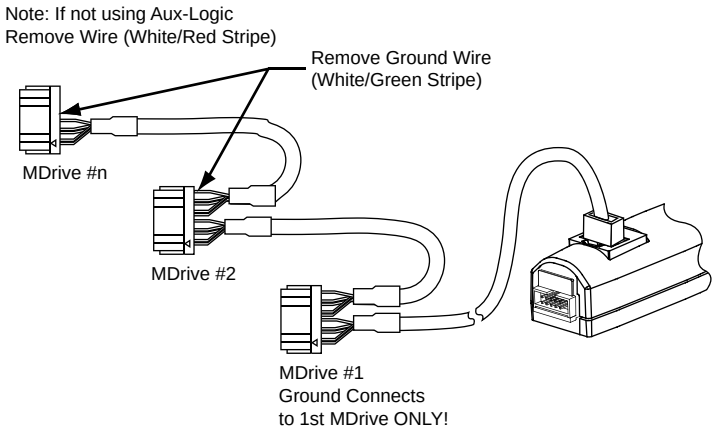


Figure 5.4 Multi-drop communications using the PD10-1434-FL3

Procedure

1) Remove ground wire (unless this is the first system MDrive, green/white stripe)
2) Remove aux-logic (if not used, red/white stripe)
3) Connect pre-crimped flying leads as shown in Figure 5.7 below

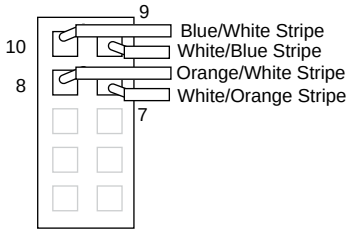


Figure 5.5 Wiring a second PD10-1434-FL3 into the 10-pin wire crimp connector.

5.4.2 Mutli-drop communications connection

Figure 5.6 illustrates the connection schematic for a multi-drop communications system, note that communications ground only connects to the first system MDrive.

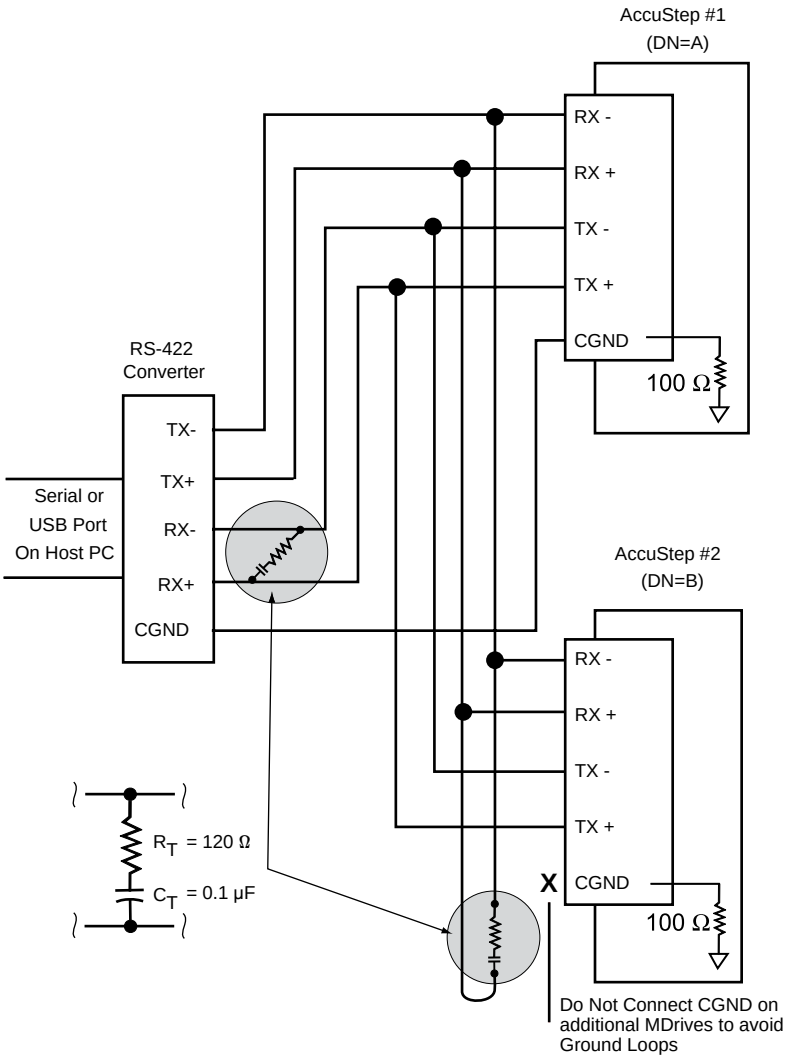


Figure 5.6 Interface for party-mode operation

Data Cable Termination Resistors

Data cable lengths greater than 15 feet (4.5 meters) are susceptible to signal reflection and/or noise. IMS recommends 120 Ω termination resistors in series with 0.1µf capacitors at both ends of the receive lines of the commu7ications cables. An example of resistor placement is shown in Figure 5.8. For systems with data cables 15 feet (4.5 meters) or less, the termination resistors are generally not required.

5.5 AccuStep configurator GUI comm settings

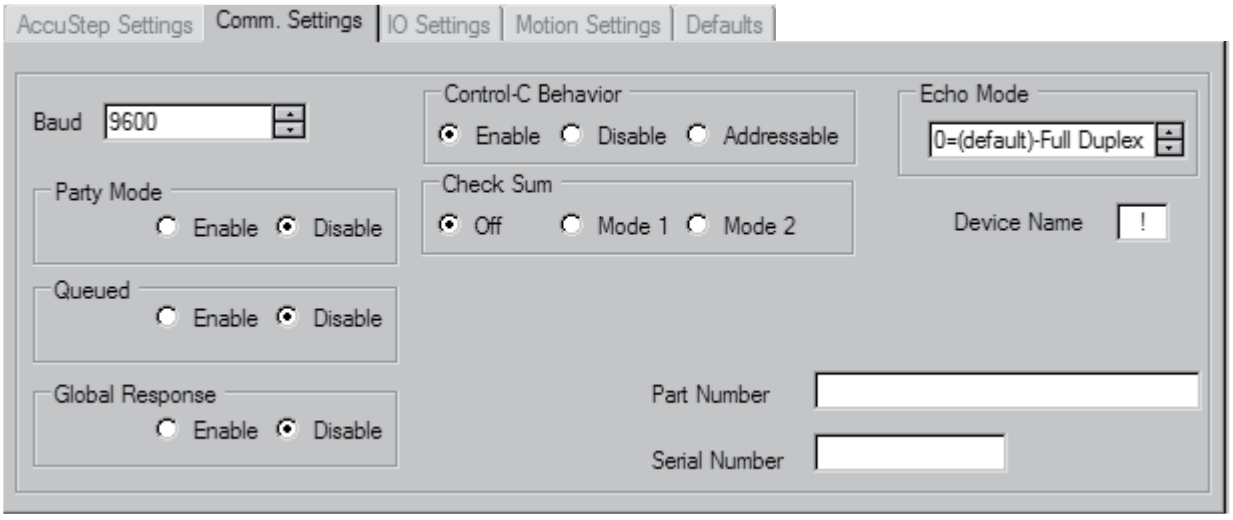


Figure 5.7 Communications parameter setup screen

Mnemonic	Function	Parameter	Range	Default	Description
BD	BAUD Rate	48=4800 kbps 96=9600 kbps 19=19200 kbps 38=38400 kbps 11=115200 kbps	48,96,19,38,11	96	Set the communications BAUD rate.
PY	Party Mode	0=disabled 1=enabled	0/1	0	Enables/disables party mode operation.
QD	Queued	0=disabled 1=enabled	0/1	0	If enabled will “Queue” devices in party mode. If a drive or drives are Queued, then, when they see the address “^”, they will respond to it. All other, non-queued drives will ignore the command.
DG	Global Response	0=disabled 1=enabled	0/1	0	The DG flag enables or disables device response to global commands made while in Party Mode.
CE	Control-C Behavior	0=disabled 1=enabled 2=Addressable	0-2	0	This setup flag will configure the device to respond or not respond to a CTRL+C software reset, or if the device will respond to an addressable reset in party mode.

CK	Check Sum	0=off 1=ack/nak cksum+error 2=ack/nak cksum only	0-2	0	CK=1 puts the device into Check Sum Mode. When enabled, all communications with the device require a Check Sum to follow the commands. The Check Sum is the 2's complement of the 7 bit sum of the ASCII value of all the characters in the command "OR"ed with 128 (hex = 0x80). The command will be acknowledged with a NAK (0x15) if the Check Sum is incorrect or an ACK (0x06) when the command is correctly processed (no error). CK=2 will enable check sum mode, however NAK only sent for bad check sum. "ACK" is not echoed if a program is running. Only a NAK is echoed if an error occurs. In immediate mode both ACK or NAK characters are echoed.
EM	Echo Mode	0=full duplex 1=half duplex 2=LIST/PRT only 3=QUEUE Immediate 4=computer friendly	0-4	0	The Echo Mode Flag will set the full/ half duplex configuration of the RS-485 channel. 0=Full Duplex (default), 1=Half Duplex, 2=Only respond to PR and L, 3=Prints after command is terminated.
DN	Device Name	—	See desc.	!	Set the device name for party mode operation. Valid names A-Z, a-z, 0-9
PN	Part Number	—	—	—	Read only device part number
SN	Serial Number	—	—	—	Read only device serial number

Table 5.1 Communications parameters

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6 Logic and I/O Interface

⚠ DANGER

EXPOSED SIGNALS

Hazardous voltage levels may be present if using an open frame power supply to power the optocouplers.

Failure to follow these instructions will result in death or serious injury.

⚠ CAUTION

HOT PLUGGING!

Do not connect or disconnect logic while the device is in a powered state.

Failure to follow these instructions can result in equipment damage.

⚠ CAUTION

EMI and RFI

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.

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

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

Failure to follow these instructions may result in damage to system components!

Revision R032610

6.1 Optically iIsolated inputs

The AccuStep has three optically isolated inputs which are located on connector P1. These inputs are isolated to minimize or eliminate electrical noise coupled onto the drive control signals. Each input may be connected to sinking or +5 to +24 VDC sourcing outputs on a controller or PLC. These inputs are:

1) Motion
2) Direction (DIR)
3) Enable (EN)

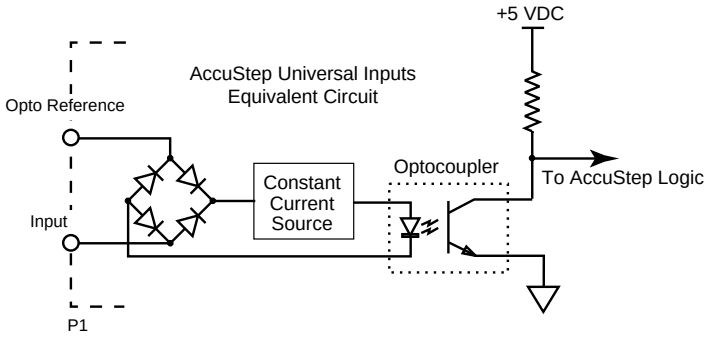

Figure 6.1 Universal optically isolated input equivalent circuit

6.1.1 Optically isolated input description

Motion The motion input function is determined by the mode the AccuStep is operatingin.

- Step Mode: (Step/Direction, CW/CCW, Quadrature) input is where the motion clock from your control circuitry will be connected. The motor will advance one microstep in the plus or minus direction (based upon the state of the direction input) on the rising edge of each clock pulse. The size of this increment or decrement will depend on the microstep setting.
- Torque Mode: The motion input will operate as a Stop/Start input for the AccuStep internal clock generator. No current through opto=stop, current through opto=start.
- Speed Mode: The motion input will operate as a Stop/ Start input for the AccuStep internal clock generator. No current through opto=stop, current through opto=start.

Direction The direction input controls the CW/CCW direction of the motor. The input may be configured as sinking or sourcing based upon the state of the Optocoupler Reference.

Enable Input

This input can be used to enable or disable the driver output circuitry. Leaving the enable switch open, (disconnected) for sinking or sourcing configuration, the driver outputs will be enabled and the step clock pulses will cause the motor to advance. When this input switch is closed (active signal) in both sinking and sourcing configurations, the driver output circuitry will be disabled. Please note that the internal sine/cosine position generator will continue to increment or decement as long as step c pulses are being received by the device. No current through opto=enable, current through opto=disable.

Note that a position or locked rotor error may be generated if the Accustep continues to receive step clock pulses if the bridge is in a disabled state.

6.1.2 Optocoupler reference input

The optocoupler reference sets the reference state, sinking or sourcing, for the universal isolated logic inputs.

If a +5 to +24 VDC power source is connected to the reference, the inputs will be sinking-type inputs.

If the reference is connected to ground, the inputs will be sourced by a +5 to +24 VDC signal.

6.2 Interfacing the isolated logic inputs

6.2.1 Open collector interface

NPN Sinking inputs

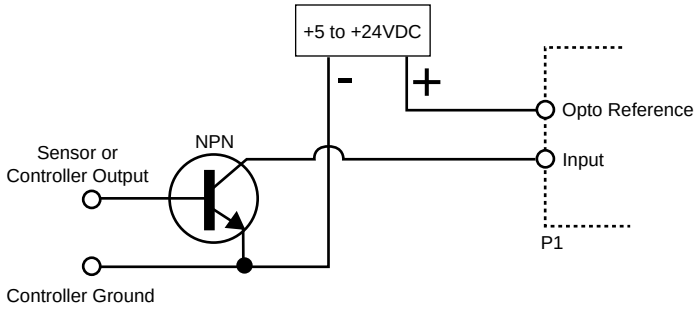

Figure 6.2 Open collector sinking input

PNP sourcing inputs

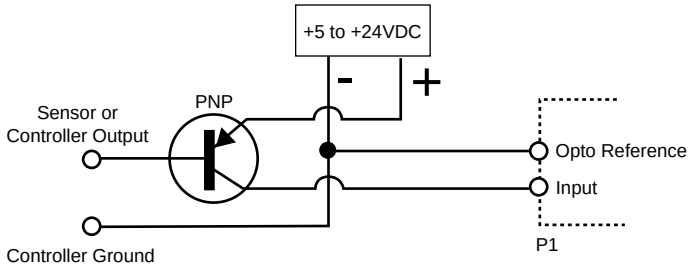

Figure 6.3 Open collector sourcing input

6.3.2 Switch interface

Sinking inputs

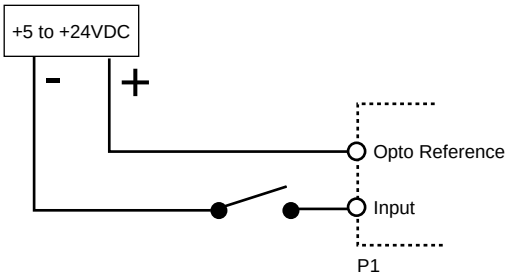

Figure 6.4 Switch interface sinking input

Sourcing inputs

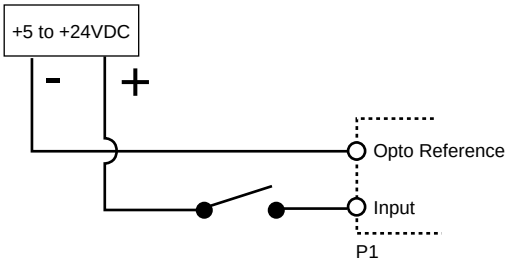

Figure 6.5 Switch interface sourcing input

6.3 Attention Output

The attention output is a multi-function fault/error/status output that may be used as an open collector or an open emitter output.

The output can be configured to activate when one or more selectable conditions exist.

6.3.1 Interfacing the attention output

Open Collector Interface

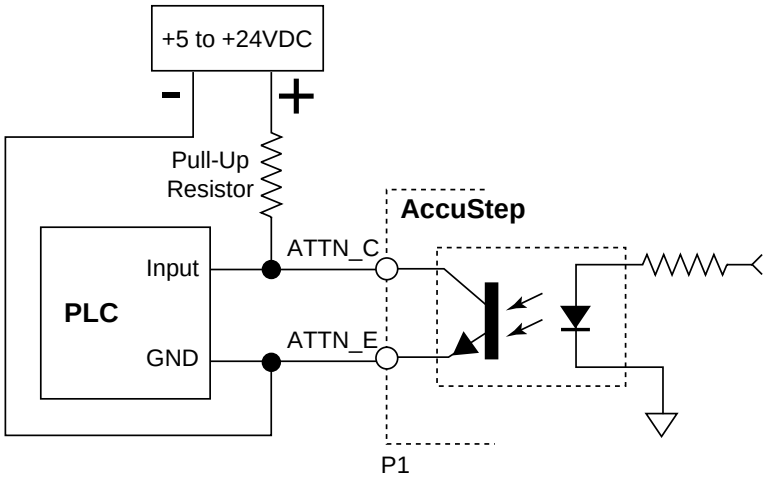

Figure 6.6: Attention output Interface to a PLC

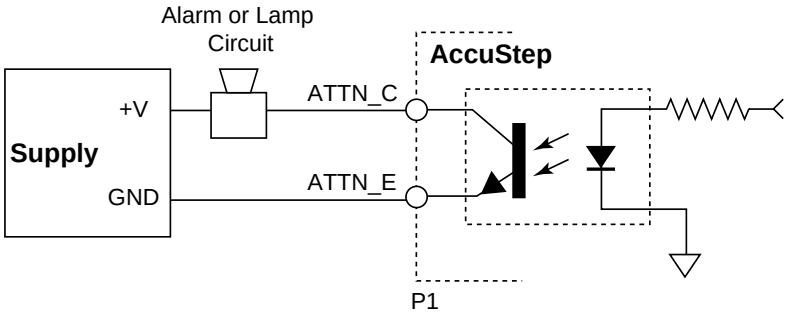

Figure 6.7: Attention output interface to an alarm or lamp circuit

Open Emitter Interface

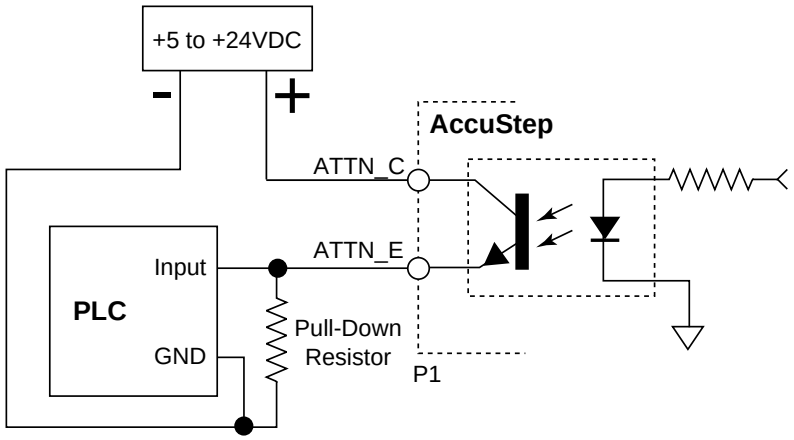

Figure 6.8: Attention output interface to a PLC

6.3.2 Attention conditions

The attention output can be configured to activate on one or more of the following conditions. Please note that if multiple conditions are used, the AccuStep status will have to be read to know which condition activated the output.

Function	Description
Error Flag	Indicates an error state. See Appendix A for error codes.
Locked Rotor	Indicates a “Locked Rotor” condition.
Lead Limit	Indicates that the maximum rotor lead limit as set in software has been reached.
Lag Limit	Indicates that the maximum rotor lag limit as set in software has been reached.
AS Active	Indicates when the AccuStep anti-stall circuitry is active.
Calibration Active	Indicates that the accustep is calibrating.
Over Temp	Indicates that the AccuStep temperature has reached the maximum rating and the bridge is disabled.
At Zero Cross	Indicates when the phase current is at zero crossing.
Cur. Red. Active	Indicates when current reduction is active.
MU Active	Indicates when the AccuStep is making up lost steps.

Table 6.1 Attention output connection pins on connector P1

6.4 Analog Input (Torque and Speed modes only)

The Analog Input is used to control the axis torque (torque mode(and velocity (speed mode). It can be connected using one of three voltage ranges.

- 0 to +5 VDC
- 0 to +10 VDC
- -10 to +10 VDC

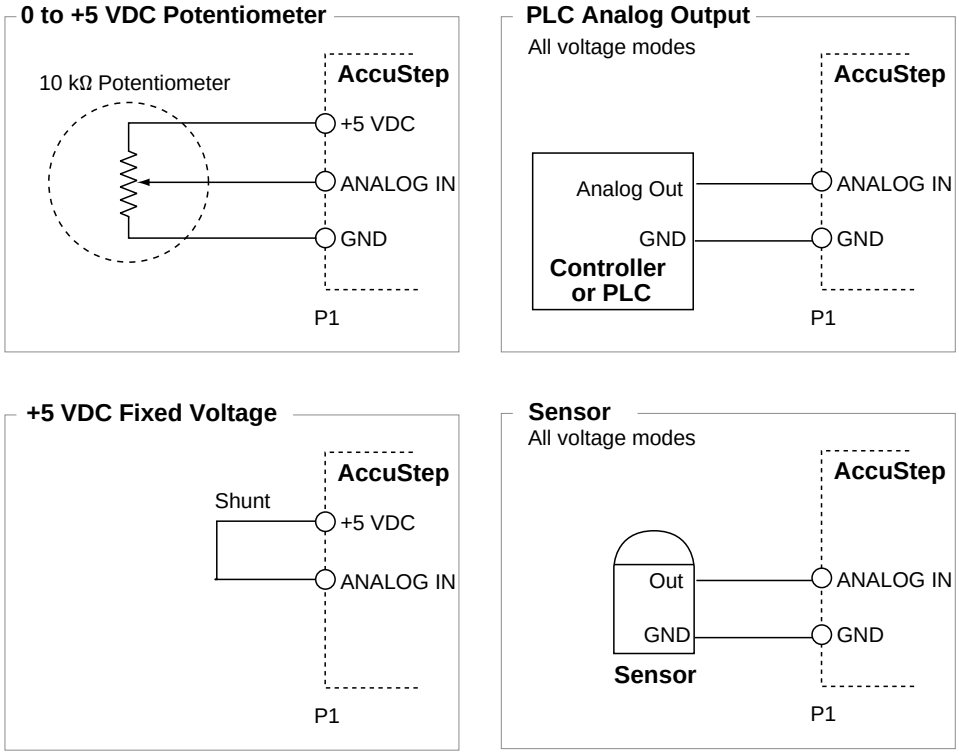

Figure 6.9: Interfacing the analog input

6.5 Auxiliary Power (P1: pin 7)

The Auxiliary power input is an optional +12 to +24 VDC input used to power the AccuStep logic circuitry in the absence of motor power.

Variable data such as position information will be retained.

If motor power is removed while the Accustep continues to receive clock pulses, the device may give a “Locked Rotor” status

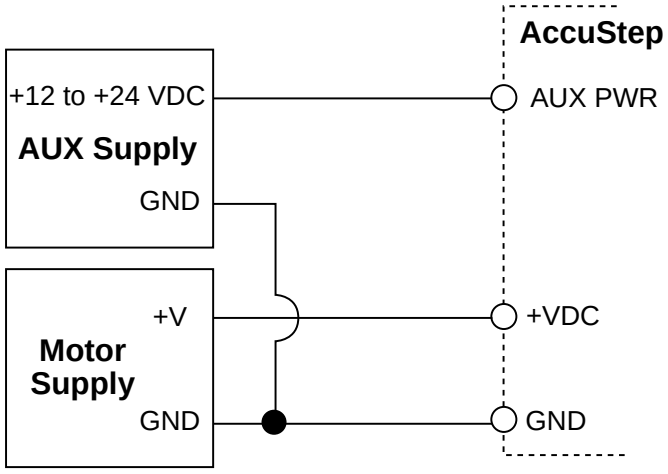

Figure 6.10: Interfacing the auxiliary supply

6.6 Step Mode Interface

Please see Section 8: Step (ASM) Mode Configuration for setup parameters and usage.

6.6.1 Minimum required interface connections

When operating in Step mode the following connections are required to operate the device:

- +V
- Power Ground
- Opto Reference
- Step Clock Input (Motion)
- Direction

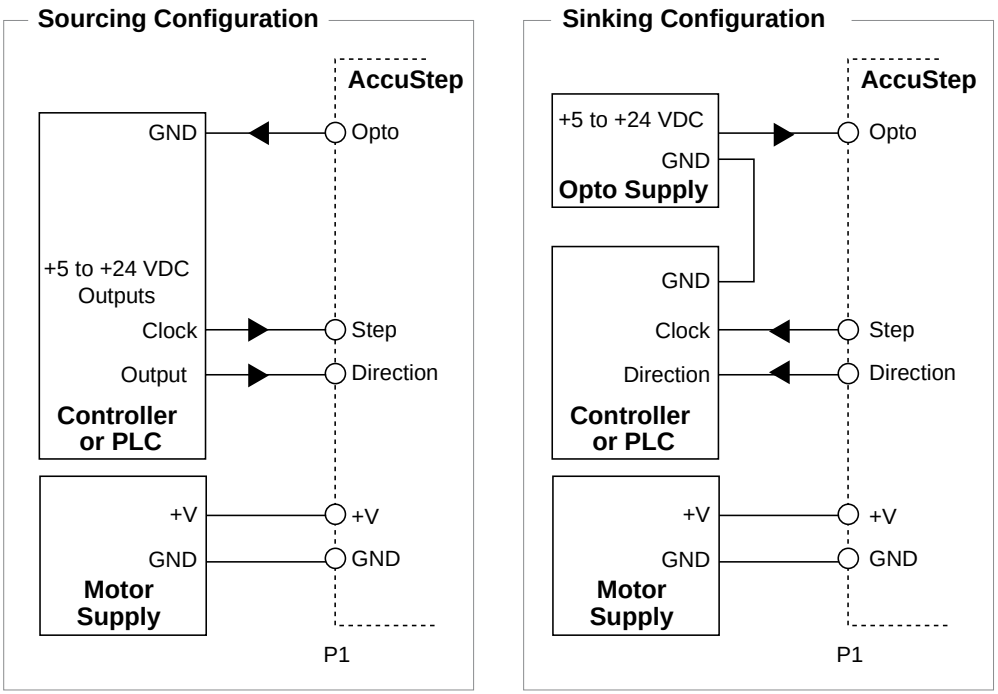

Figure 6.11: Minimum required connections - Step and Direction Mode

6.6.2 Full Interface

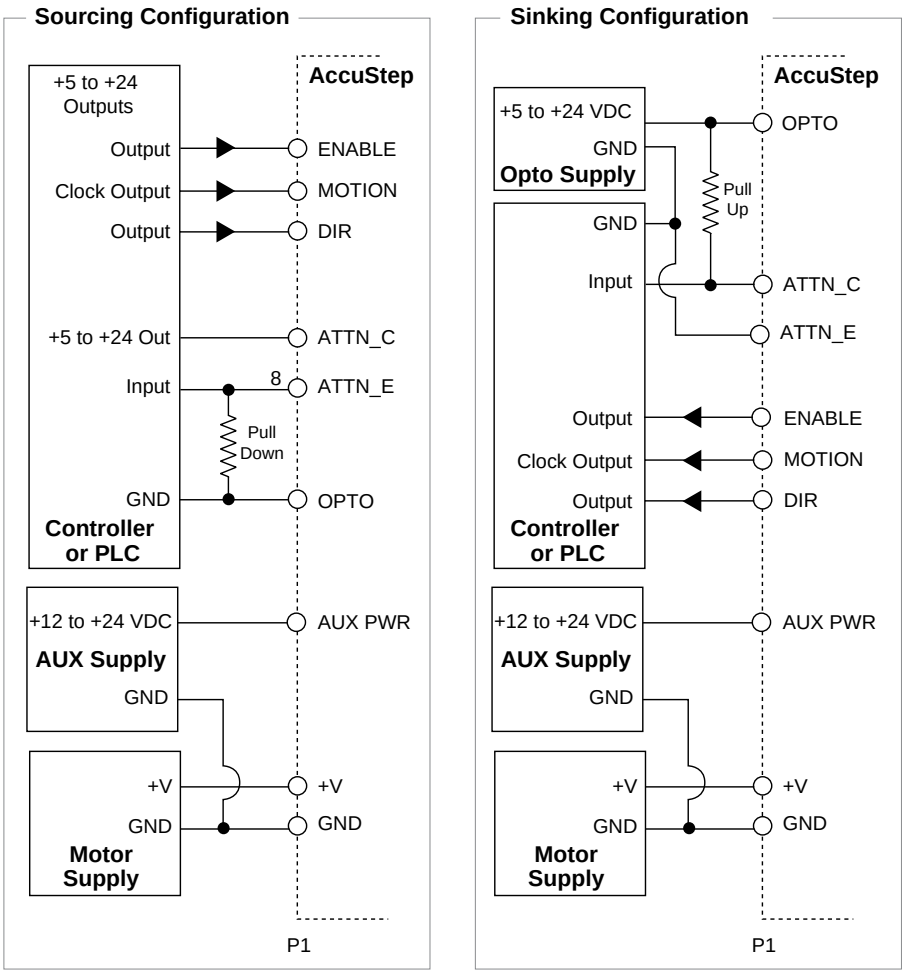

Figure 6.12: Full connections - Step and Direction Mode (ASM)

6.7 Speed Control and Torque Mode Interface

The interface method for Speed Control and Torque Control modes are the same. The only impact will be in how the AccuStep is configured in software.

6.7.1 Minimum required interface connections

When operating in torque or speed mode the following connections are required to operate the device:

- +V
- Power Ground
- Opto Reference
- Analog input
- Direction

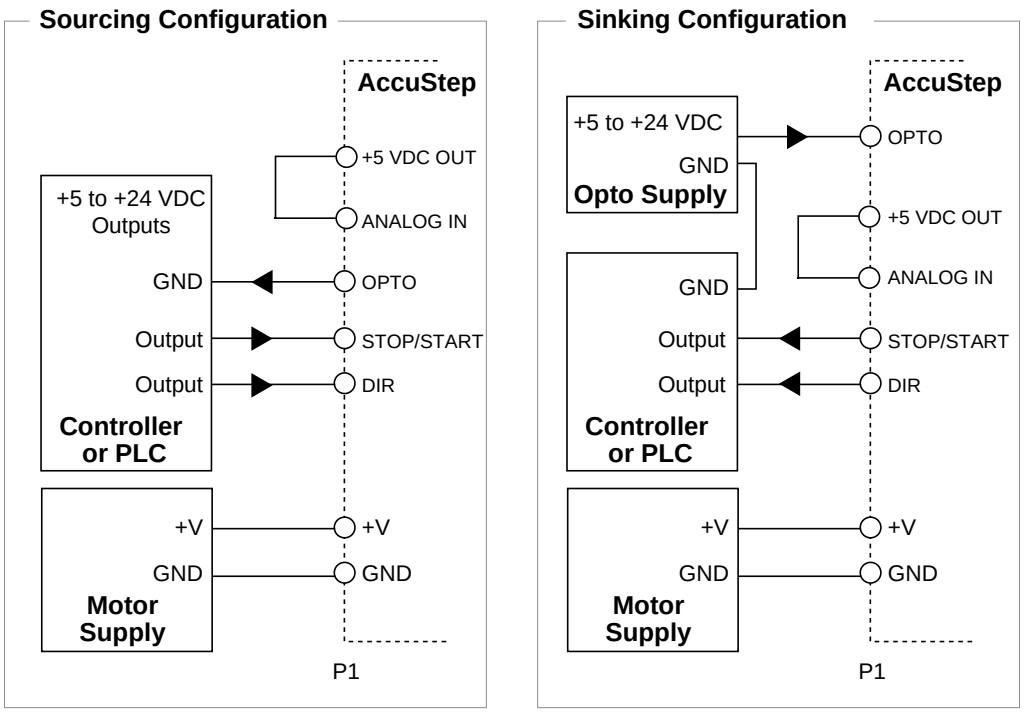

Figure 6.13: Minimum required connections - Torque and Speed Modes

6.7.2 Full interface

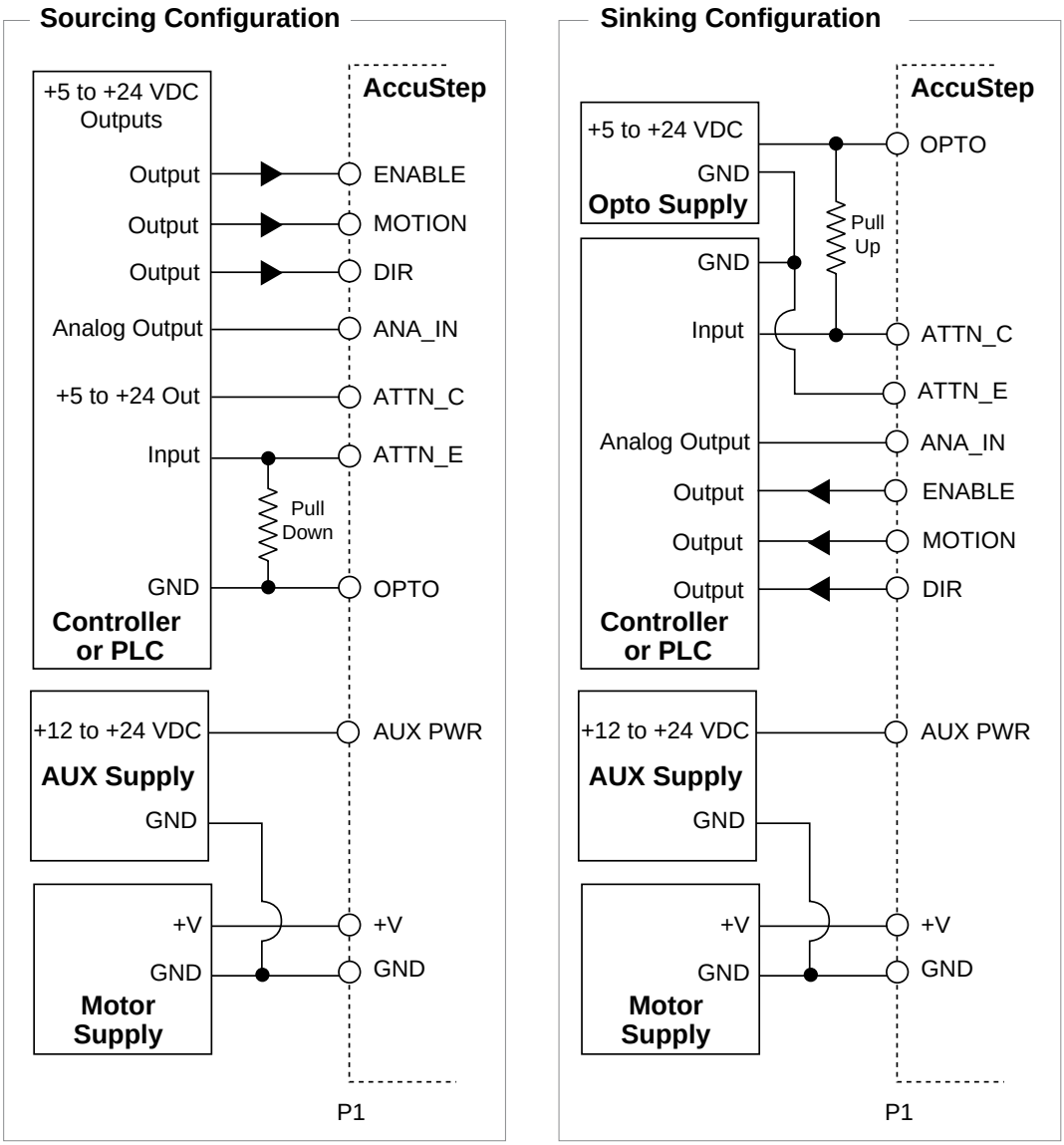

Figure 6.14:Full connections - Torque and Speed Modes

Velocity Mode Interface

In velocity mode the operation of the AccuStep will be similar to the operation in Speed Control mode, the difference being that speed commands are issued via the RS-422/485 interface.

6.7.1 Minimum required interface connections

When operating in velocity mode the following connections are required to operate the device:

- +V
- RS-422/485 communications
- Power Ground
- Opto Reference
- Direction

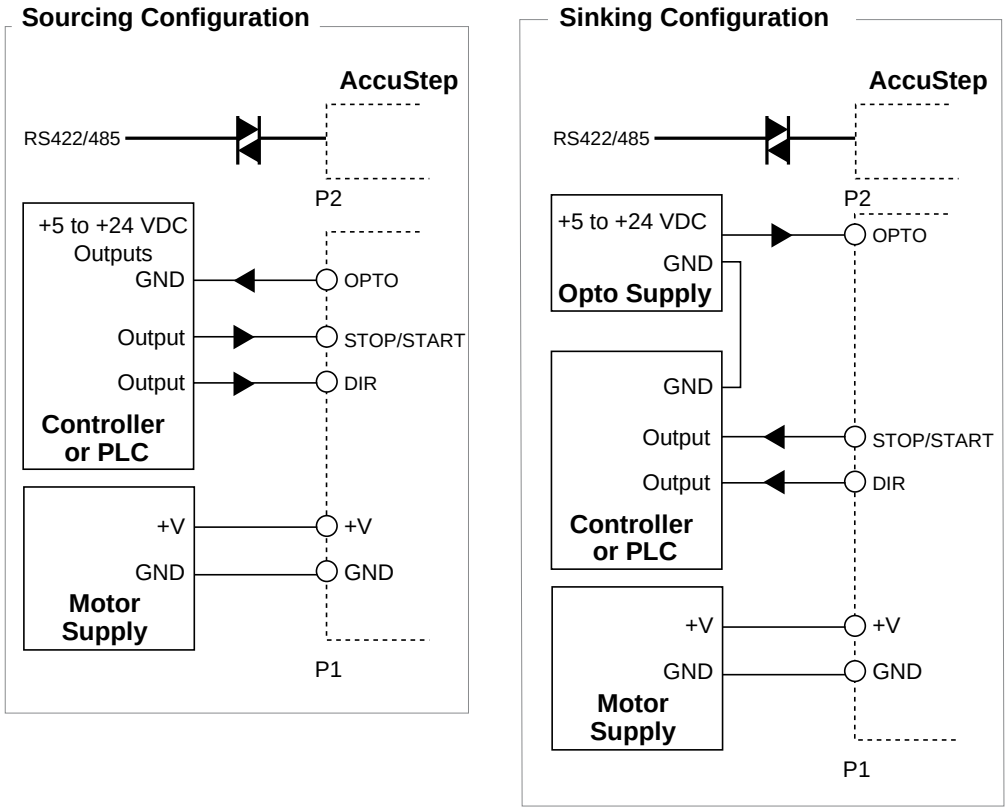

Figure 6.15: Minimum required connections - Velocity Mode

6.7.2 Full interface

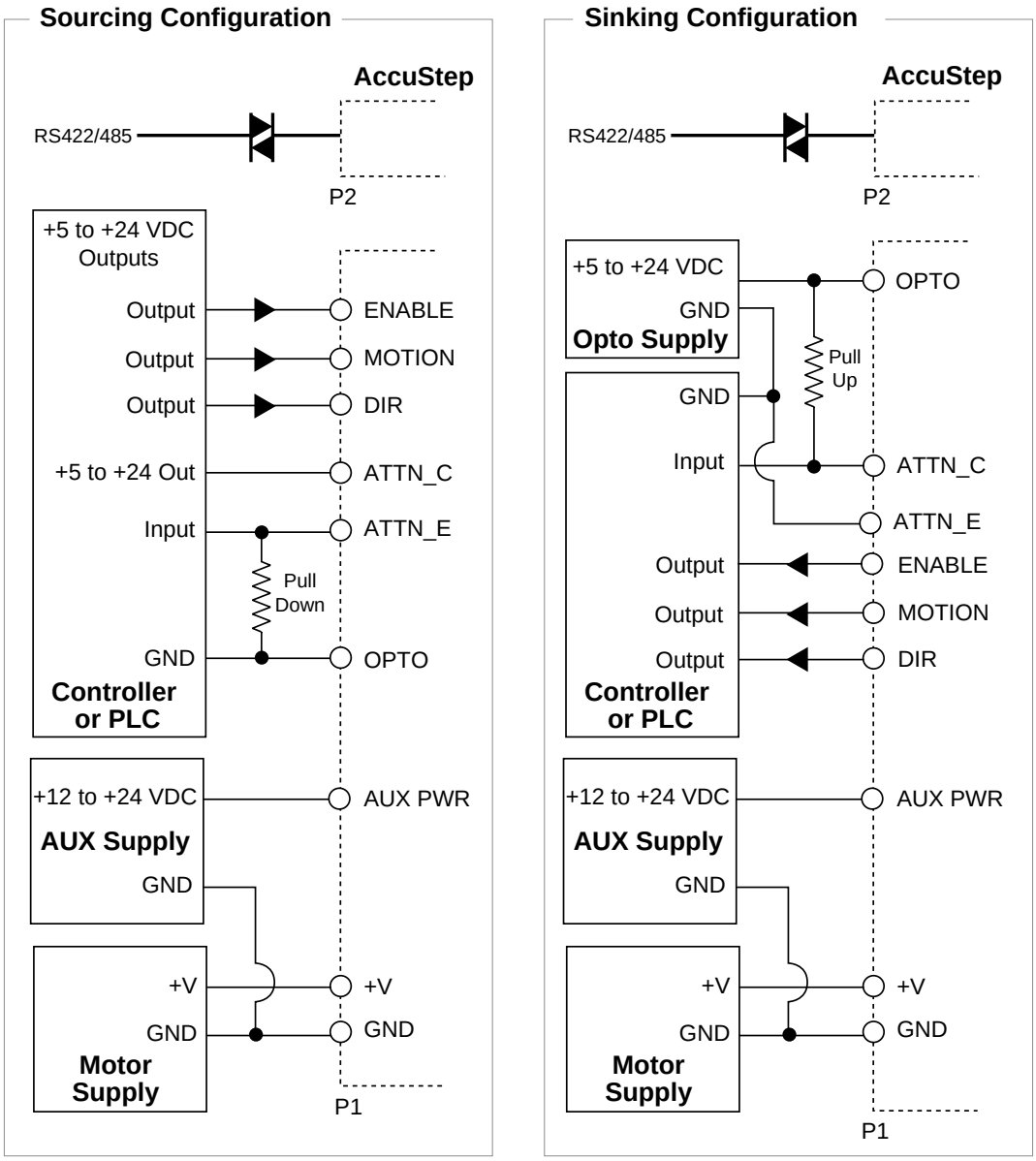

Figure 6.16: Full connections -Velocity Modes

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7 Step & Direction (ASM) mode configuration

This section will cover the setup and configuration for Step & Direction (ASM) mode only. For other application modes please see the section relevant to that mode:

- Section 9 Torque Control (ASO) Mode
- Section 10: Speed Control (AST) Mode

7.1 AccuStep configuration utility

The AccuStep configuration utility is the setup and configuration utility developed to provide the customer with a Graphical User Interface (GUI) to configure the AccuStep product.

The utility is required in order to load the application mode.

7.1.1 System requirements

- PC or notebook running Windows XP™ service pack 2 or greater.

7.1.2 Installation

1) Download the installation package from www.imshome.com/software_interfaces.html
2) Browse to the download location on your PC harddrive and extract the files from the zip file.
3) Double-click setup.exe
4) Follow the installation prompts to complete the installation.

7.1.3 Initial mode setup

Following installation, open the configuration utility by double clicking its icon or selecting it from your windows start menu.

1. In the area labeled “Select Application” select the radio button marked “ASM - Step/Dir Vel”
2. Click the “Set” button at the bottom right of the window.
3. A progress bar will show on the window bottom.
4. Once complete, you may now begin to adjust the setup parameters for the MDrive AccuStep in Step & Direction (ASM) mode.

7.1.4 Screen overview

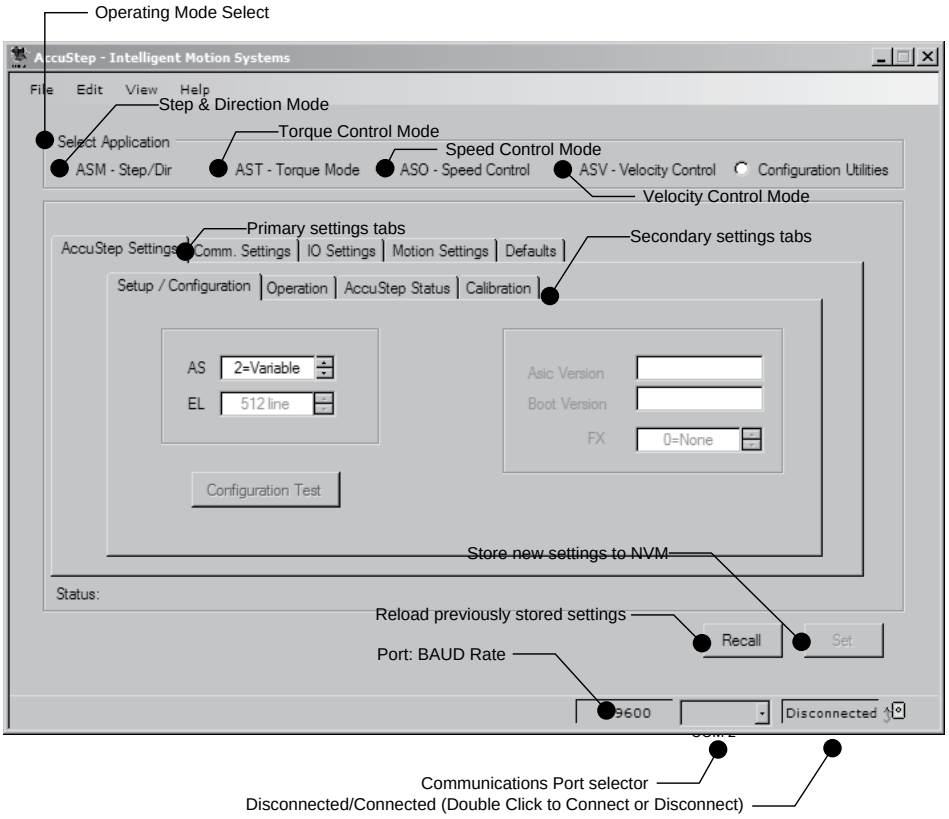

Figure 7.1 AccuStep configuration utility main screen

7.2 Step & Direction (ASM) mode parameters

7.2.1 AccuStep parameters

AccuStep setup screen

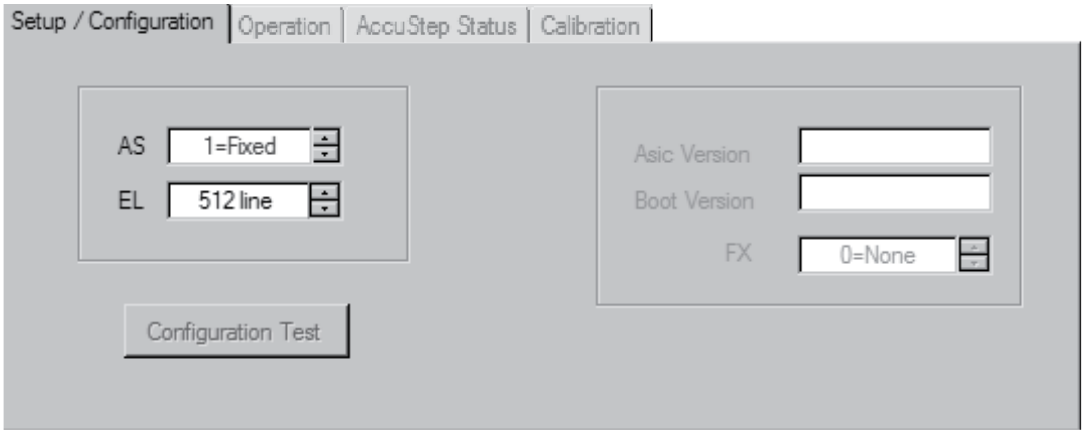

Figure 7.2 AccuStep setup and configuration

Mnemonic	Function	Parameter	Range	Default	Description
AS	AccuStep Mode	0=Off 1=Fixed 2=Variable	0-2	2	Sets the operation parameter of the accustep. When off (0) the accustep circuitry will be disabled. Fixed mode (1) the drive current will be as specified by the Hold and Run current variables. In variable mode (2) the current will vary between 2% of HC and RC.
EL	Encoder line count	—	100-1024	Sets to installed encoder line count	Sets the encoder line count to the count of the encoder installed. The configuraton test button will verify the accuracy of the setting.

Table 7.1 AccuStep setup and configuration parameters

AccuStep operation configuration screen

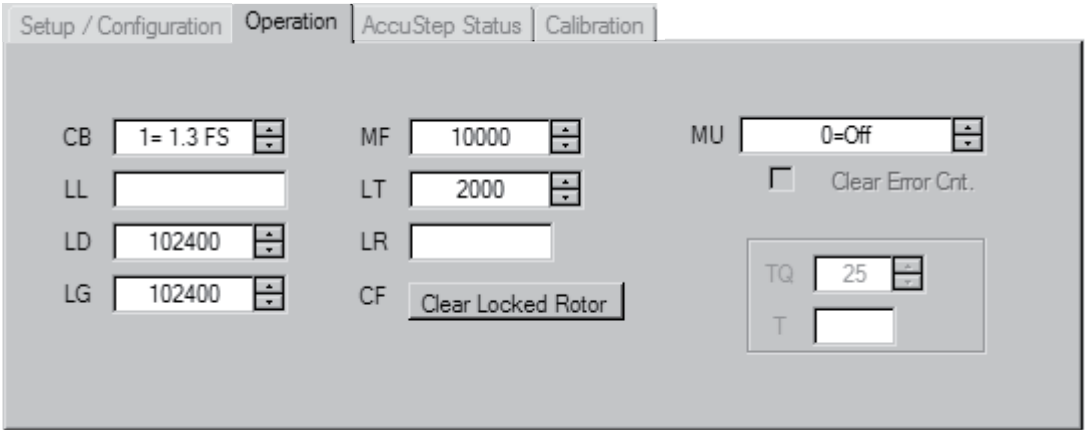

Figure 7.3 AccuStep operation

Mnemonic	Function	Parameter	Range	Default	Description
CB	Control Bounds	0-1.1, 1=1.3 2=1.5, 3=1.7	0-3	1=1.3	Sets the control bounds of the Accustep in motor full steps. Bounds of 1.1=greater torque, bounds of 1.7=greater speed
LL	Lead/Lag Count	—	0-2147483647	102400	Represent the number of counts that the rotor leads or lags the stator.
LD	Lead Limit	—	0-2147483647	102400	Sets the position lead limit in counts
LG	Lag Limit	—	0-2147483647	102400	Sets the position lag limit in counts
MF	Make-Up Freq.	—	306-5000000	10000	Sets the make-up step frequency. Limited to maximum system speed, see Clock Width (CW)
LT	Locked Rotor Timeout	—	2-65535	2000	Locked rotor timeout in milliseconds. This is the time from the locked rotor flag activates to the disabling of the output bridge
LR	Locked Rotor Flag	—	0/1	0	Read only flag will indicate a locked rotor condition.
CF	Clear Locked Rotor	—	—	—	Clears a locked rotor fault.
MU	Make-Up Mode	0=Off 1=(see desc.) 2=(see desc.)	0-2	0	Mode selection for making up step: 1=use maximum system frequency 2=use make-up frequency (MF)
	Clear Error Count	—	0/1	0	If checked, LL count will be cleared on an MU change and set.

Table 7.2 AccuStep operation parameters

AccuStep status screen (read-only)

The AccuStep status screen is a read-only dialog which will display the status of the device. The decimal value of the combined status alerts will be shown in the AccuStep Status field (ST).

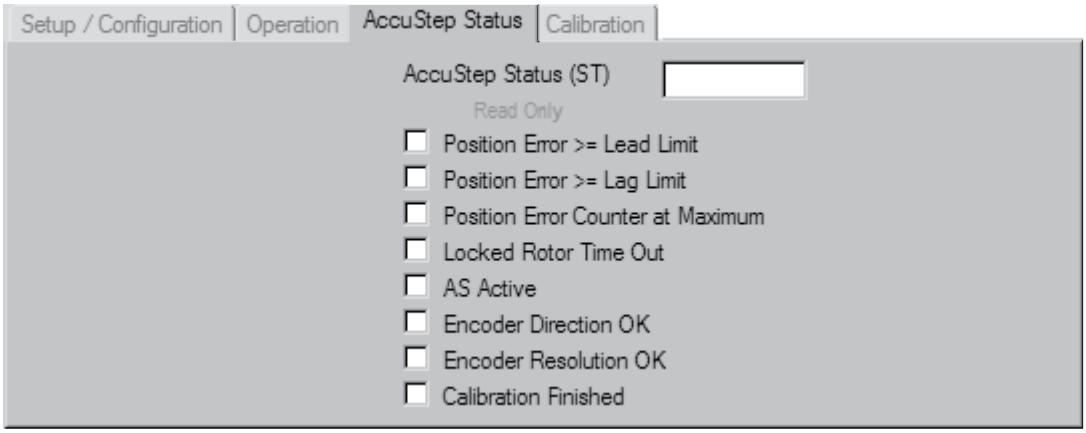

Figure 7.4 AccuStep status (read only)

Status	Description
Position Error >= Lead Limit	Will indicate that the position error is equal to or greater than the lead limit (LD) value specified in the AccuStep operation screen.
Position Error >= Lag Limit	Will indicate that the position error is equal to or greater than the lag limit (LG) value specified in the AccuStep operation screen.
Position Error Counter at Maximum	Indicates that the position error counter is at maximum.
Locked Rotor Time Out	Indicates the locked rotor time out (LR) value specified in the AccuStep operation screen has been exceeded.
AS Active	Indicates that the AccuStep circuitry is active.
Encoder Direction OK	Indicates that the encoder direction is correct.
Encoder Resolution OK	Indicates that the encoder line count (EL) is correctly set.
Calibration Finished	Indicates that the calibration process is complete

Table 7.3 AccuStep status (read only)

Accustep calibration screen

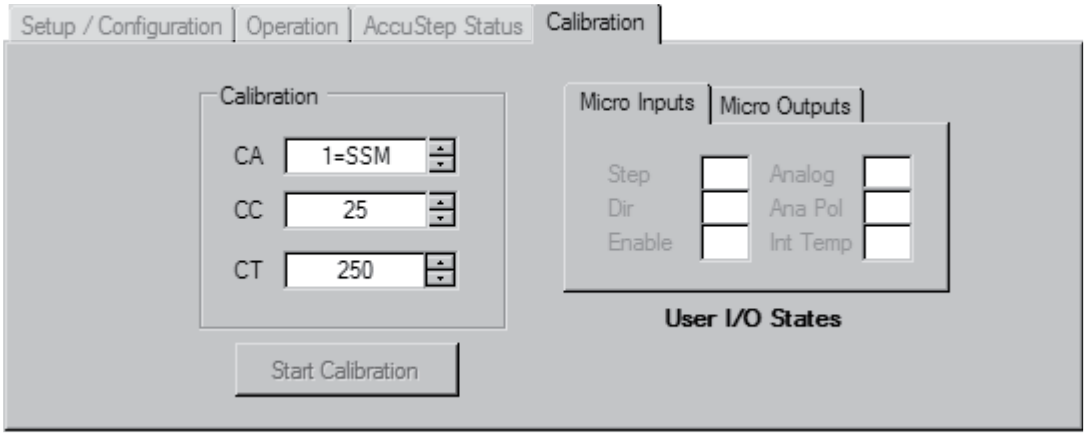

Figure 7.5 AccuStep calibration

Mnemonic	Function	Parameter	Range	Default	Description
CA	Calibration Mode	0 = Fixed Time 1 = SSM	0/1	1	Sets the calibration mode to SSM (Shaft Snap Minimization) or Fixed Time, which is set by the variable CT.
CC	Calibration Current	percent	1-100	25	Sets the calibration current in percent.
CT	Calibration Time	milliseconds	2-65535	250	Sets the calibration time. Only valid if CA=0.

Table 7.4 AccuStep calibration parameters

7.2.2 Communications parameters

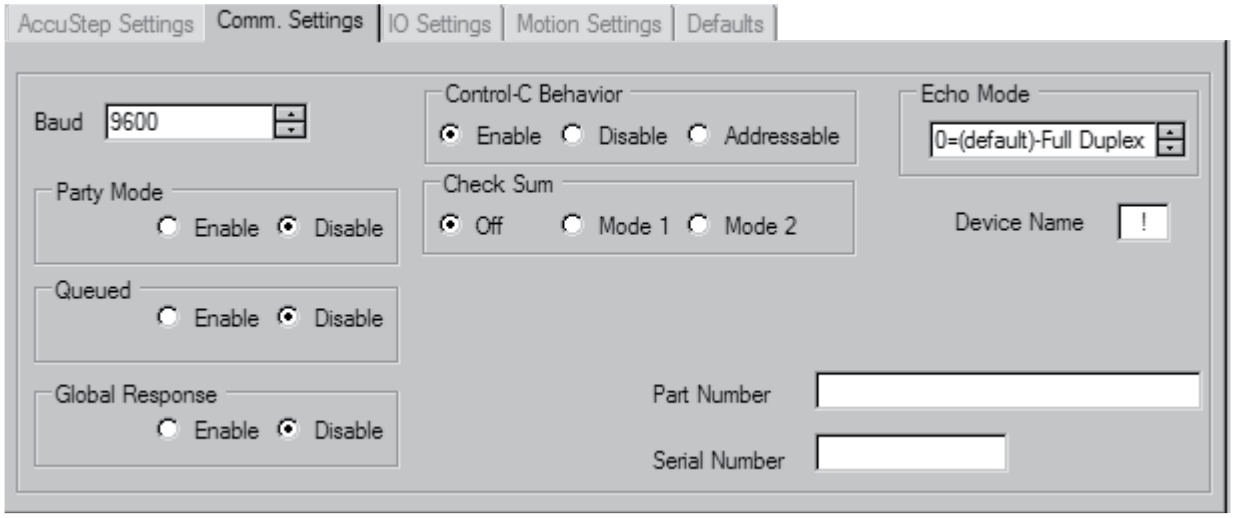

Figure 7.6 Communications parameter setup screen

Mnemonic	Function	Parameter	Range	Default	Description
BD	BAUD Rate	48=4800 kbps 96=9600 kbps 19=19200 kbps 38=38400 kbps 11=115200 kbps	48,96,19,38,11	96	Set the communications BAUD rate.
PY	Party Mode	0=disabled 1=enabled	0/1	0	Enables/disables party mode operation.
QD	Queued	0=disabled 1=enabled	0/1	0	If enabled will “Queue” devices in party mode. If a drive or drives are Queued, then, when they see the address “^”, they will respond to it. All other, non-queued drives will ignore the command.
DG	Global Response	0=disabled 1=enabled	0/1	0	The DG flag enables or disables device response to global commands made while in Party Mode.
CE	Control-C Behavior	0=disabled 1=enabled 2=Addressable	0-2	0	This setup flag will configure the device to respond or not respond to a CTRL+C software reset, or if the device will respond to an addressable reset in party mode.

CK	Check Sum	0=off 1=ack/nak cksum+error 2=ack/nak cksum only	0-2	0	CK=1 puts the device into Check Sum Mode. When enabled, all communications with the device require a Check Sum to follow the commands. The Check Sum is the 2's complement of the 7 bit sum of the ASCII value of all the characters in the command "OR"ed with 128 (hex = 0x80). The command will be acknowledged with a NAK (0x15) if the Check Sum is incorrect or an ACK (0x06) when the command is correctly processed (no error). CK=2 will enable check sum mode, however NAK only sent for bad check sum. "ACK" is not echoed if a program is running. Only a NAK is echoed if an error occurs. In immediate mode both ACK or NAK characters are echoed.
EM	Echo Mode	0=full duplex 1=half duplex 2=LIST/PRT only 3=QUEUE Immediate 4=computer friendly	0-4	0	The Echo Mode Flag will set the full/ half duplex configuration of the RS-485 channel. 0=Full Duplex (default), 1=Half Duplex, 2=Only respond to PR and L, 3=Prints after command is terminated.
DN	Device Name	—	See desc.	!	Set the device name for party mode operation. Valid names A-Z, a-z, 0-9
PN	Part Number	—	—	—	Read only device part number
SN	Serial Number	—	—	—	Read only device serial number

Table 7.5 Communications parameters

7.2.3 I/O parameters

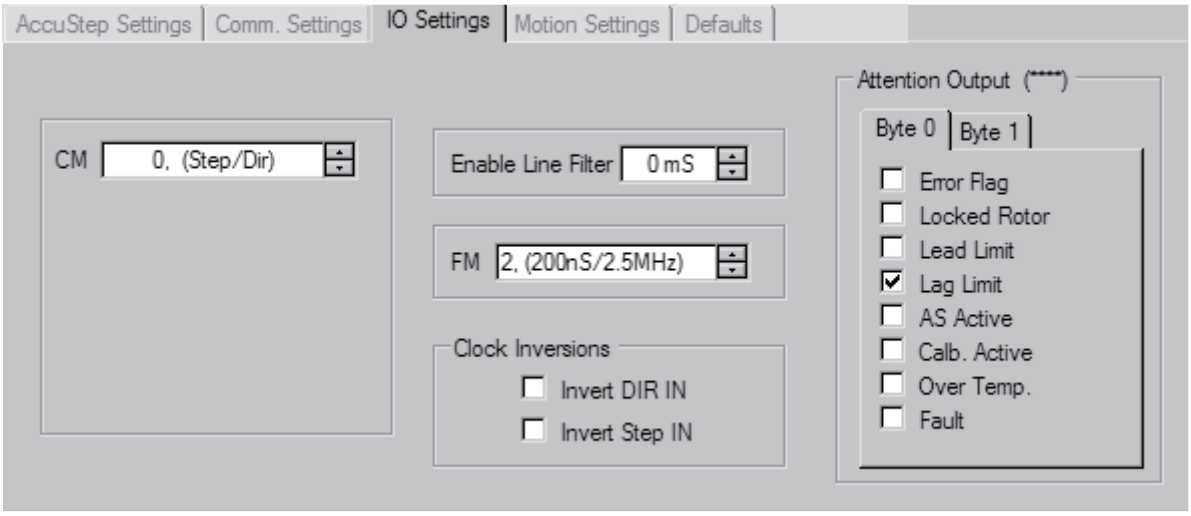

Figure 7.7 I/O parameter setup screen

Mnemonic	Function	Parameter	Range	Default	Description
CM	Clock Mode	0=Step/Direction 1=Quadrature 2=CW/CCW	—	0	Sets the clock input mode to step/ direction, quadrature or CW/CCW inputs.
FE	Enable Input Filter	—	0 to 255 ms	0	Filter enable input.
FM	Clock Filter	See desc.	0-9	2	Sets the filtering for the input clock and encoder 0=50 ns/10 MHz 1=150 ns/3.3 MHz 2=200 ns/2.5 MHz 3=300 ns/1.67 MHz 4=500 ns/1.0 MHz 5=900 ns/555 kHz 6=1.7 µs/294 kHz 7=3.3 µs/151 kHz 8=6.5 µs/76.9 kHz 9=12.9 µs/37.8 kHz
—	Clock Inversions	—	—	—	Allows the user to invert the clock inputs: Invert direction in Invert step in Invert both in

Table 7.6 I/O setup parameters

Attention output configuration

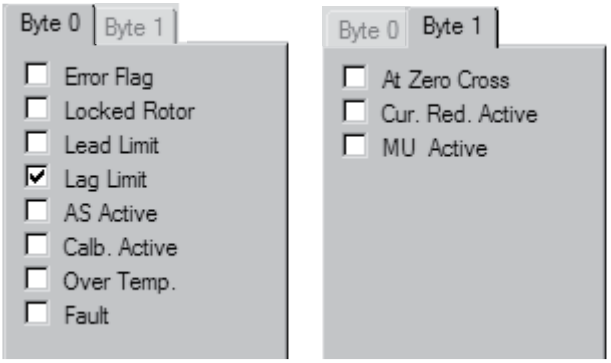

Figure 7.8 Attention output function settings

The attention output can be configured to activate on one or more of the following conditions. Please note that if multiple error conditions are used, the AccuStep status will have to be read to know which condition(s) activated the output.

Function	Description
Error Flag	
Locked Rotor	Indicates a “Locked Rotor” condition
Lead Limit	Indicates that the maximum rotor lead limit as set in software has been reached.
Lag Limit	Indicates that the maximum rotor lag limit as set in software has been reached. Selected by default.
AS Active	Indicates when the AccuStep anti-stall circuitry is active
Calibration Active	
Over Temp	Indicates that the AccuStep temperature has reached the maxim rating and the bridge is disabled.
Fault	
At Zero Cross	Indicates when the phase current is at zero crossing
Cur. Red. Active	Indicates when current reduction is active.
MU Active	Indicates when the AccuStep is making up lost steps.

Table 7.7 Attention output connection pins on connector P1

7.2.4 Motion parameters

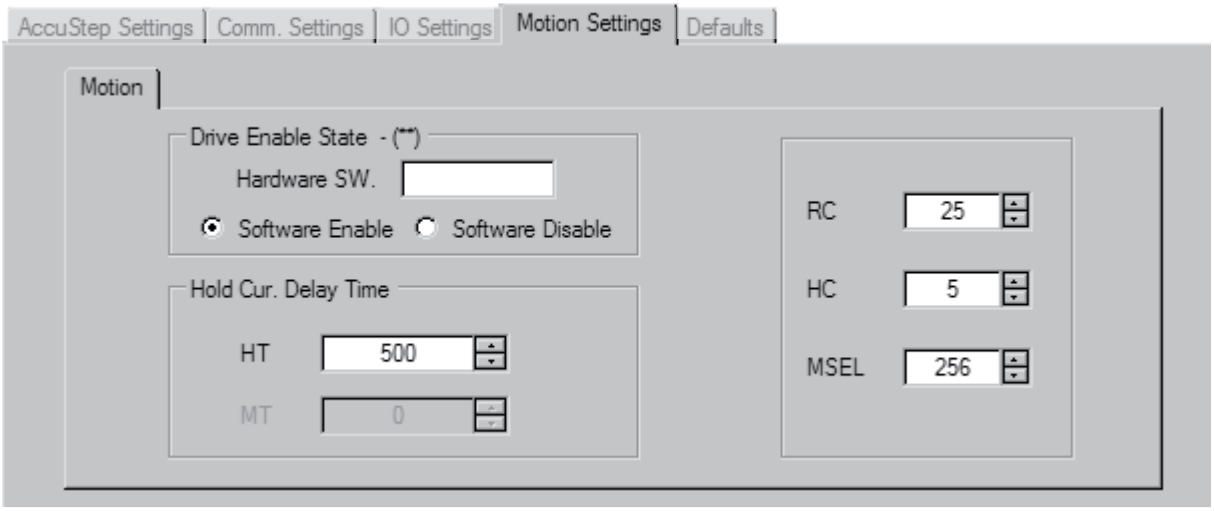

Figure 7.9 Motion settings

Mnemonic	Function	Parameter	Range	Default	Description
DE	Drive Enable State	—	0/1	1	Software enable /disable of the output bridge. If disabled, will over-ride the enable hardware input.
HC	Hold Current	percent	0-100	5	Motor holding current in percent.
HT	Hold Current Delay Time	msec	0-65000	500	Represents the time delay in milliseconds between the last motion input and the shift to the commanded holding current.
MS	Microstep Resolution Select	—	See Table 7.7	256	Sets the microstep resolution in microsteps/fullstep.
RC	Run Current	percent	1-100	25	Motor running current in percent.

Table 7.6 Motion setup parameters

Microstep resolution select settings

Binary		Decimal	
microsteps/step	steps/revolution	microsteps/step	steps/revolution
1	200	5	1000
2	400	10	2000
4	800	25	5000
8	1600	50	10000
16	3200	100	20000
32	6400	125	25000
64	12800	200	40000
128	25600	250	50000
256	52100		
Additional resolution settings			
180	36000 (0.01°/µstep)		
108	21600 (1 arc-min/µstep)		
127	25400 (0.001 mm/µstep)		

Table 7.7 Microstep resolution settings

7.2.5 Defaults

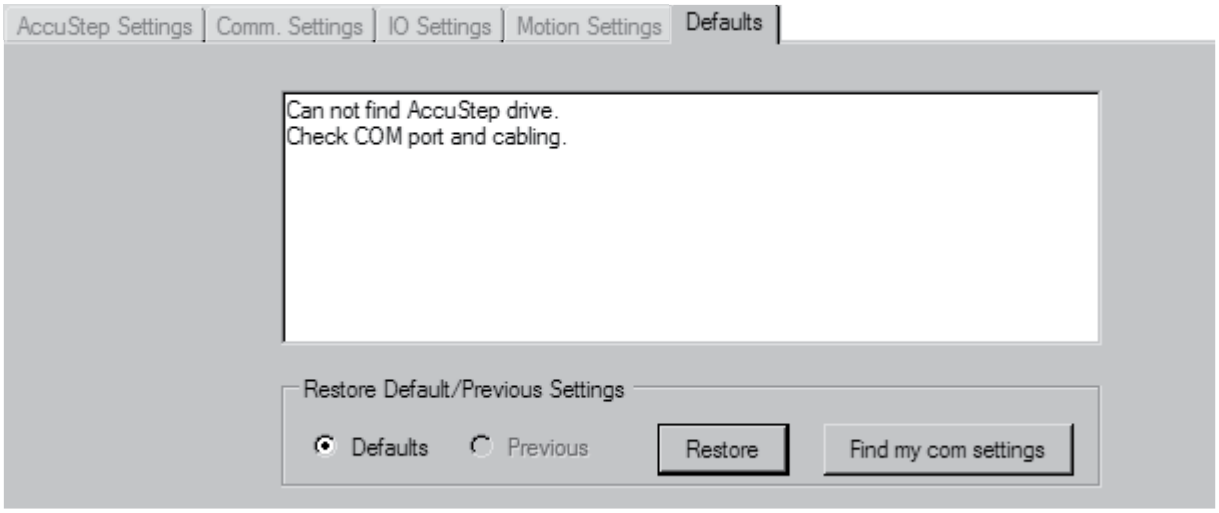

Figure 7.10 Defaults

The defaults screen allows the user to restore either the system defaults or the previously stored settings. It will also allow the user to find the current communications configuration of the device.

8 Torque Control (AST) mode configuration

This section will cover the setup and configuration for torque control (AST) mode only. For other operating modes please see the section relevant to that mode:

- Section 8 Step & Direction (ASM) Mode
- Section 10: Speed Control (ASO) Mode

8.1 AccuStep configuration utility

The AccuStep configuration utility is the setup and configuration utility developed to provide the customer with a Graphical User Interface (GUI) to configure the AccuStep product.

The utility is required in order to load the application mode.)

8.1.1 System requirements

- PC or notebook running Windows XP™ service pack 2 or greater.

8.1.2 Installation

1) Download the installation package from http://www.imshome.com/software_interfaces.html
2) Browse to the download location on your PC hard-drive and extract the files from the zip file
3) Double-click setup.exe.
4) Follow the installation prompts to complete the installation.

8.1.3 Initial mode setup

Follw1ng installation, open the configuration utility by double clicking its icon or selecting it from your windows start menu.

1. In the area labeled “Select Application” select the radio button marked “AST - Torque Mode”
2. Click the “Set” button at the bottom right of the window.
3. A progress bar will show on the window bottom.
4. Once complete, you may now begin to adjust the setup parameters for the AccuStep

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8.1.4 Screen overview

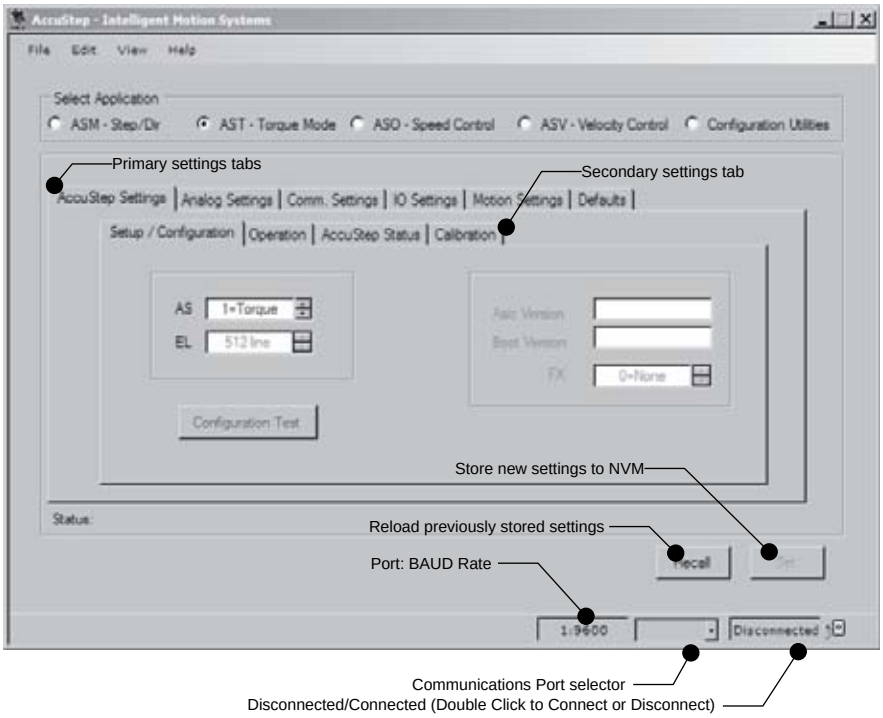

Figure 8.1 AccuStep configuration utility main screen (Torque Mode)

8.2 Torque control (AST) mode parameters

8.2.1 AccuStep parameters

AccuStep setup screen

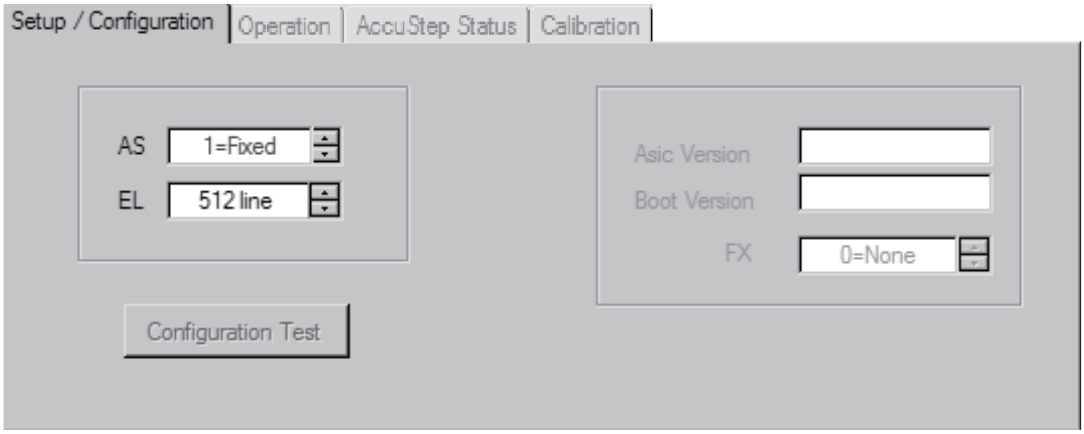

Figure 8.2 AccuStep setup and configuration

Mnemonic	Function	Parameter	Range	Default	Description
AS	AccuStep Mode	0=Off 1=Fixed 2=Variable	0-3	2	Sets the operational mode of the accustep. When off (0) the accustep circuitry will be disabled. Fixed mode (1) the drive current will be as specified by the Hold and Run current variables. In variable mode (2) the current will vary between HC and RC as needed to move the load.
EL	Encoder line count	—	100-1024	Installed encoder line count	Sets the encoder line count to the count of the encoder installed. The configuration test button will verify the accuracy of the setting.

Table 8.1 AccuStep setup and configuration parameters

AccuStep operation configuration screen

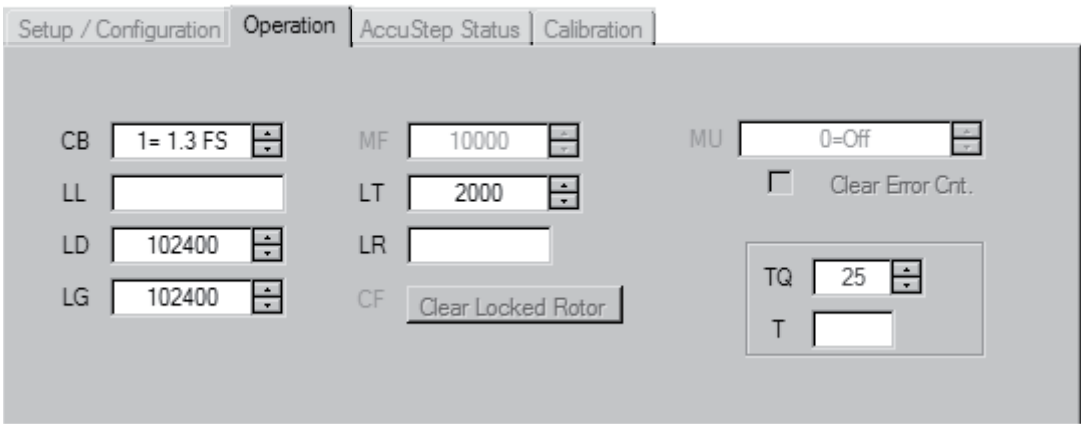

Figure 8.3 AccuStep operation

Mnemonic	Function	Parameter	Range	Default	Description
CB	Control Bounds	0-1.1, 1=1.3 2=1.5, 3=1.7	0-4	1=1.3	Sets the control bounds of the Accustep in motor full steps. Bounds of 1.1=greater torque, bounds of 1.7=greater speed
LL	Lead/Lag Count	—	0-2147483647	102400	Represent the number of counts that the rotor leads or lags the stator.
LD	Lead Limit	—	0-2147483647	102400	Sets the position lead limit in counts
LG	Lag Limit	—	0-2147483647	102400	Sets the position lag limit in counts
LT	Locked Rotor Timeout	—	2-65535	2000	Locked rotor timeout in milliseconds. This is the time from the locked rotor flag activates to the disabling of the output bridge
LR	Locked Rotor Flag	—	0/1	0	Read only flag will indicate a locked rotor condition.
CF	Clear Locked Rotor	—	—	—	Clears a locked rotor fault.
TQ	Torque	percent	0-100	25	Sets the percentage of motor torque the device will operate at.
T	Current Torque Setting	percent	—	—	Read only field displays the torque.

Table 8.2 AccuStep operation parameters

AccuStep status screen (read-only)

The AccuStep status screen is a read-only dialog which will display the status of the device. The decimal value of the combined status alerts will be shown in the AccuStep Status field (ST).

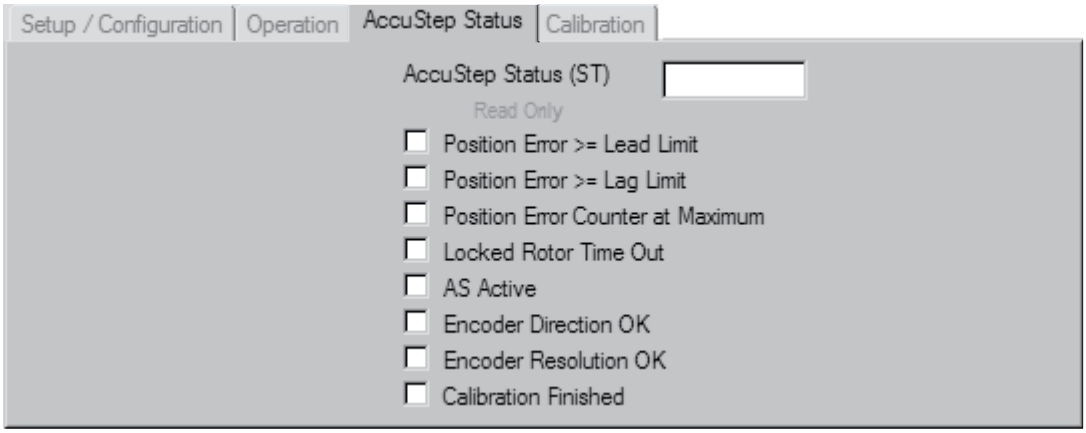

Figure 8.4 AccuStep status (read only)

Status	Description
Position Error >= Lead Limit	Will indicate that the position error is equal to or greater than the lead limit (LD) value specified in the AccuStep operation screen.
Position Error >= Lag Limit	Will indicate that the position error is equal to or greater than the lag limit (LG) value specified in the AccuStep operation screen.
Position Error Counter at Maximum	Indicates that the position error counter is at maximum.
Locked Rotor Time Out	Indicates the locked rotor time out (LR) value specified in the AccuStep operation screen has been exceeded.
AS Active	Indicates that the AccuStep circuitry is active.
Encoder Direction OK	Indicates that the encoder direction is correct.
Encoder Resolution OK	Indicates that the encoder line count (EL) is correctly set.
Calibration Finished	Indicates that the calibration process is complete

Table 8.3 AccuStep status (read only)

Accustep calibration screen

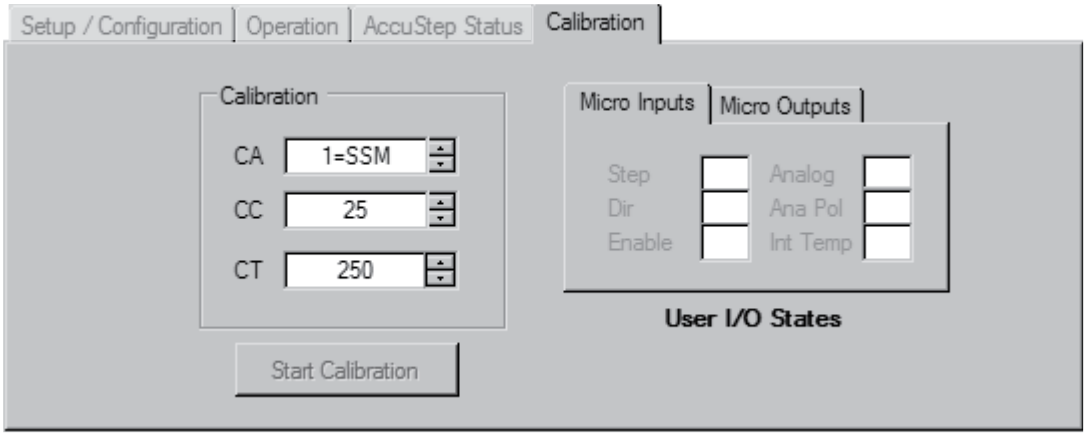

Figure 8.5 AccuStep calibration

Mnemonic	Function	Parameter	Range	Default	Description
CA	Calibration Mode	0 = Fixed Time 1 = SSM	0/1	1	Sets the calibration mode to SSM (Shaft Snap Minimization) or Fixed Time, which is set by the variable CT.
CC	Calibration Current	percent	1-100	25	Sets the calibration current in percent.
CT	Calibration Time	milliseconds	2-65535	250	Sets the calibration time. Only valid if CA=0.

Table 8.4 AccuStep calibration parameters

8.2.2 Analog input parameters

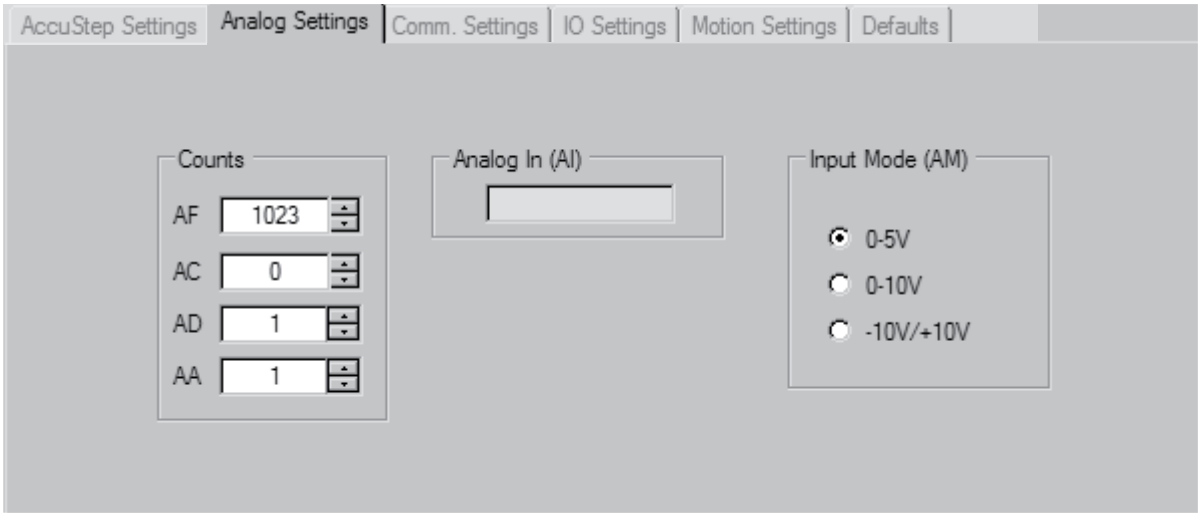

Figure 8.6 Analog input parameter setup screen

Mnemonic	Function	Parameter	Range	Default	Description
AF	Analog Full Scale	counts	1-1023	1023	Sets the full scale range of the analog input. By default it is at the maximum allowed range. The max voltage of the selected input mode will = 100% of the preset torque.
AC	Analog Center	counts	0-1022	0	Sets the center point of the analog full scale for directional control using the analog input.
AD	Analog Deadband	counts	0-255	1	Sets the ± deadband for the analog center (AC).
AA	Analog Average	counts	1-1000	1	Input filtering for the analog input.
AI	Analog Input	counts	—	—	Read analog input level
AM	Analog Input Mode	mode = 0-5V = 0-10V = -10/+10V	—	0-5V	Sets the analog input to 0 to +5V, 0 to +10V or -10 to +10V.

Table 8.5 Analog input setup parameters

8.2.3 Communications parameters

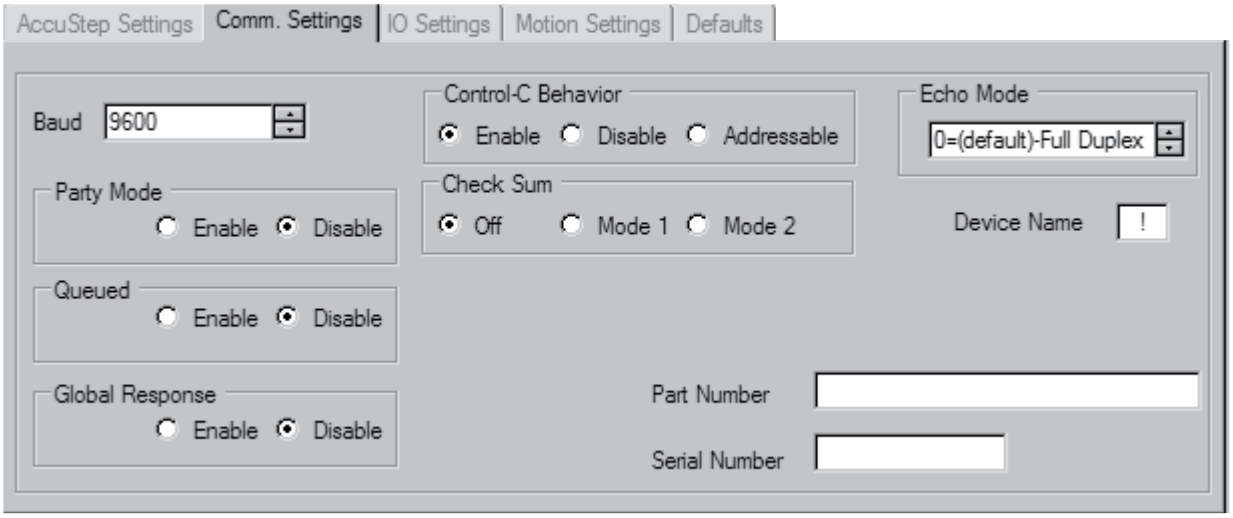

Figure 8.7 Communications parameter setup screen

Mnemonic	Function	Parameter	Range	Default	Description
BD	BAUD Rate	48=4800 kbps 96=9600 kbps 19=19200 kbps 38=38400 kbps 11=115200 kbps	48,96,19,38,11	96	Set the communications BAUD rate.
PY	Party Mode	0=disabled 1=enabled	0/1	0	Enables/disables party mode operation.
QD	Queued	0=disabled 1=enabled	0/1	0	If enabled will “Queue” devices in party mode. If a drive or drives are Queued, then, when they see the address “^”, they will respond to it. All other, non-queued drives will ignore the command.
DG	Global Response	0=disabled 1=enabled	0/1	0	The DG flag enables or disables device response to global commands made while in Party Mode.
CE	Control-C Behavior	0=disabled 1=enabled 2=Addressable	0-2	0	This setup flag will configure the device to respond or not respond to a CTRL+C software reset, or if the device will respond to an addressable reset in party mode.

CK	Check Sum	0=off 1=ack/nak cksum+error 2=ack/nak cksum only	0-2	0	CK=1 puts the device into Check Sum Mode. When enabled, all communications with the device require a Check Sum to follow the commands. The Check Sum is the 2's complement of the 7 bit sum of the ASCII value of all the characters in the command "OR"ed with 128 (hex = 0x80). The command will be acknowledged with a NAK (0x15) if the Check Sum is incorrect or an ACK (0x06) when the command is correctly processed (no error). CK=2 will enable check sum mode, however NAK only sent for bad check sum. "ACK" is not echoed if a program is running. Only a NAK is echoed if an error occurs. In immediate mode both ACK or NAK characters are echoed.
EM	Echo Mode	0=full duplex 1=half duplex 2=LIST/PRT only 3=QUEUE Immediate 4=computer friendly	0-4	0	The Echo Mode Flag will set the full/ half duplex configuration of the RS-485 channel. 0=Full Duplex (default), 1=Half Duplex, 2=Only respond to PR and L, 3=Prints after command is terminated.
DN	Device Name	—	See desc.	!	Set the device name for party mode operation. Valid names A-Z, a-z, 0-9
PN	Part Number	—	—	—	Read only device part number
SN	Serial Number	—	—	—	Read only device serial number

Table 8.6 Communications parameters

8.2.4 I/O parameters

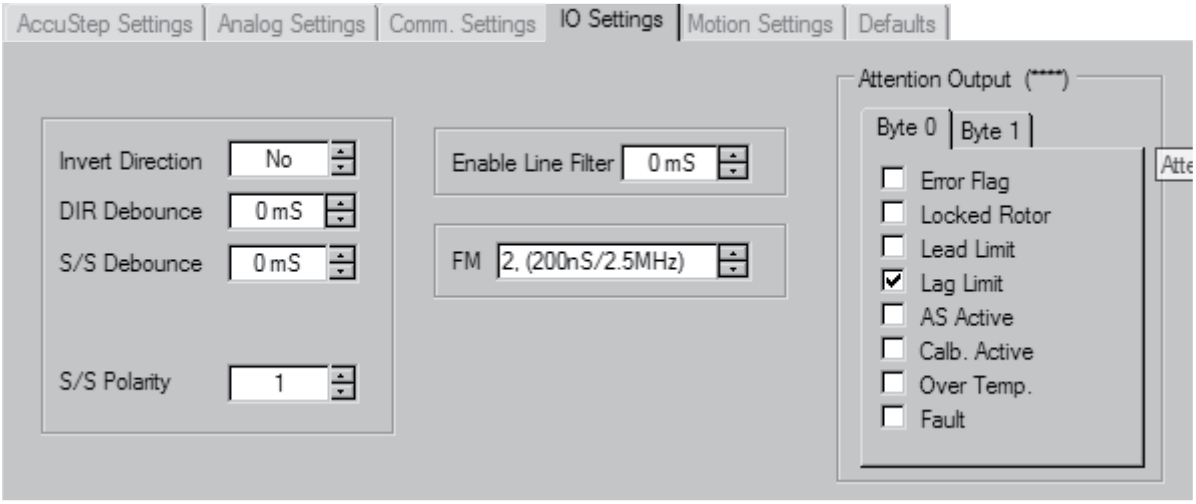

Figure 8.8 I/O parameter setup screen

Mnemonic	Function	Parameter	Range	Default	Description
ID	Invert Direction	1/0	1.0	0	Allows the user to invert the direction input.
DD	Direction Input Filter	msec	0-255	0	Direction input debounce time in milliseconds.
FE	Enable Input Filter	—	0-255	0	Enable input debounce time in milliseconds.
FM	Clock Filter	See desc.	0-9	2	Sets the filtering for the input clock and encoder 0=50 ns/10 MHz 1=150 ns/3.3 MHz 2=200 ns/2.5 MHz 3=300 ns/1.67 MHz 4=500 ns/1.0 MHz 5=900 ns/555 kHz 6=1.7 µs/294 kHz 7=3.3 µs/151 kHz 8=6.5 µs/76.9 kHz 9=12.9 µs/38.8 kHz
SD	Stop/Start Input Filter	msec	0-255	0	Stop/Start (motion) input debounce time in milliseconds
SP	Stop/Start Switch Polarity		1/0	1	1 = Active when high (disconnected) 0 = Active when low

Table 8.7 I/O setup parameters

Attention output configuration

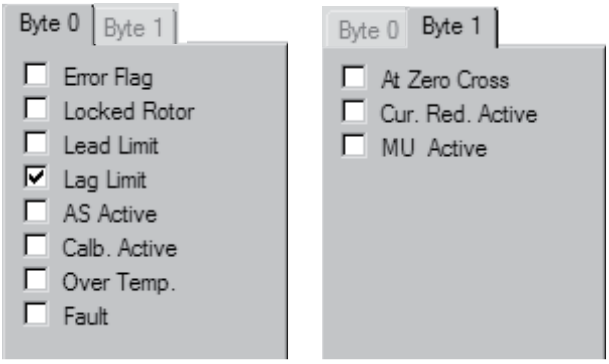

Figure 8.9 Attention output function settings

The attention output can be configured to activate on one or more of the following conditions. Please note that if multiple error conditions are used, the AccuStep status will have to be read to know which condition(s) activated the output.

Function	Description
Error Flag	
Locked Rotor	Indicates a “Locked Rotor” condition
Lead Limit	Indicates that the maximum rotor lead limit as set in software has been reached.
Lag Limit	Indicates that the maximum rotor lag limit as set in software has been reached. Selected by default.
AS Active	Indicates when the AccuStep anti-stall circuitry is active
Calibration Active	
Over Temp	Indicates that the AccuStep temperature has reached the maxim rating and the bridge is disabled.
Fault	
At Zero Cross	Indicates when the phase current is at zero crossing
Cur. Red. Active	Indicates when current reduction is active.
MU Active	Indicates when the AccuStep is making up lost steps.

Table 8.8 Attention output connection pins on connector P1

8.2.4 Motion parameters

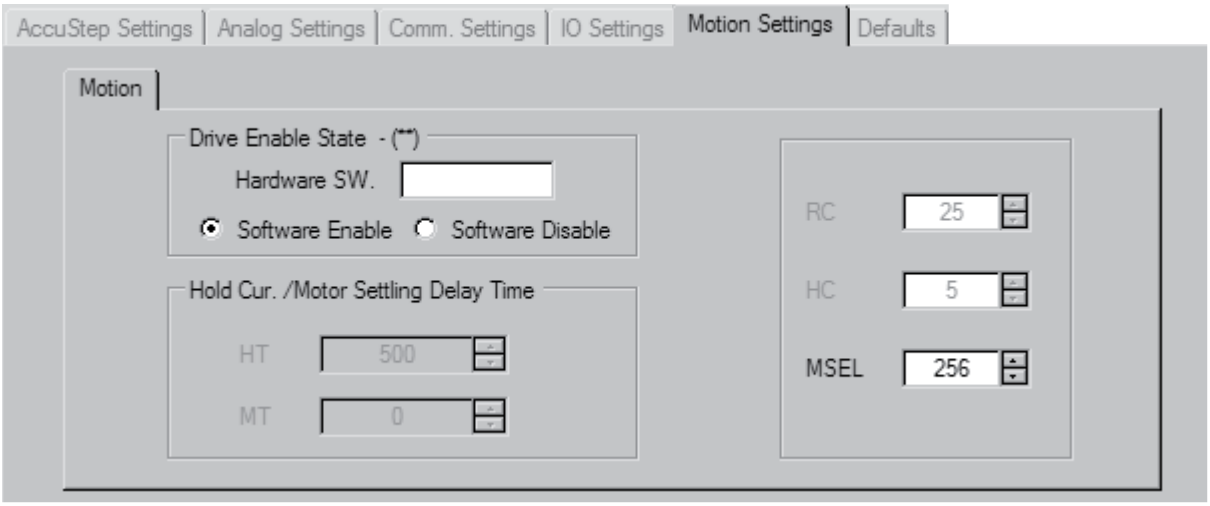

Figure 8.10 Motion settings

Mnemonic	Function	Parameter	Range	Default	Description
DE	Drive Enable State	—	0/1	1	Software enable /disable of the output bridge. If disabled, will over-ride the enable hardware input.
MS	Microstep Resolution Select	—	See Table 8.10	256	Sets the microstep resolution in microsteps/fullstep.

Table 8.9 Motion setup parameters

Microstep resolution select settings

Binary		Decimal	
microsteps/step	steps/revolution	microsteps/step	steps/revolution
1	200	5	1000
2	400	10	2000
4	800	25	5000
8	1600	50	10000
16	3200	100	20000
32	6400	125	25000
64	12800	200	40000
128	25600	250	50000
256	52100		
Additional resolution settings			
180	36000 (0.01°/µstep)		
108	21600 (1 arc-min/µstep)		
127	25400 (0.001 mm/µstep)		

Table 8.10 Microstep resolution settings

8.2.5 Defaults

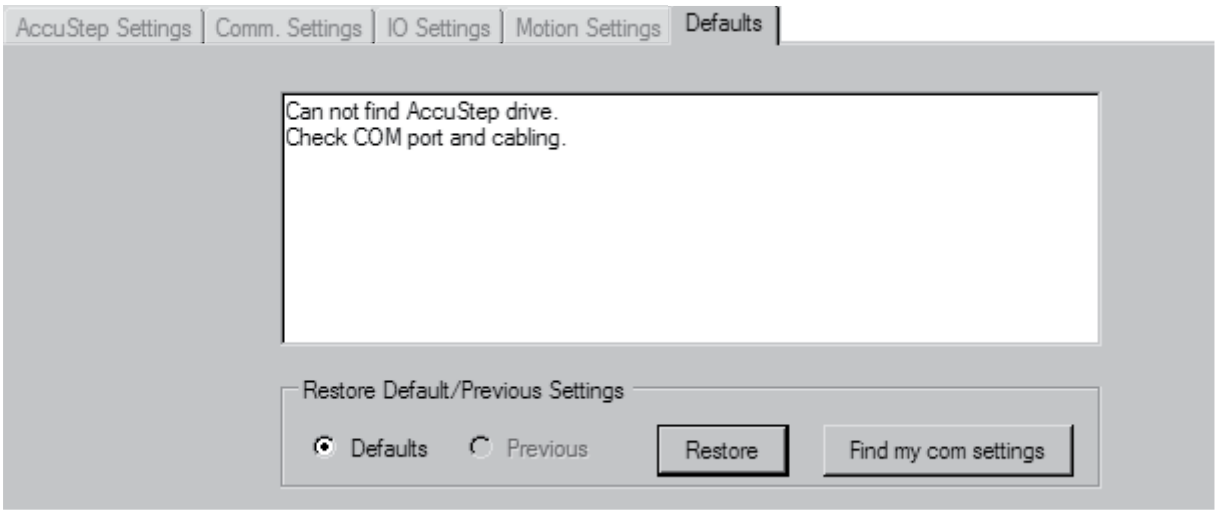

Figure 8.11 Defaults

The defaults screen allows the user to restore either the system defaults or the previously stored settings. It will also allow the user to find the current communications configuration of the device.

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9 Speed Control (ASO) mode configuration

This section will cover the setup and configuration for Speed Control (ASO) mode only. For other operating modes please see the section relevant to that mode:

- Section 8 Step and Direction (ASM) Mode
- Section 9: Torque Control (AST) Mode

9.1 AccuStep configuration utility

The AccuStep configuration utility is the setup and configuration utility developed to provide the customer with a Graphical User Interface (GUI) to configure the AccuStep product.

The utility is required in order to load the application (mode).

9.1.1 System requirements

- PC or notebook running Windows XP™ service pack 2 or greater.

9.1.2 Installation

1) Download the installation package from http://www.imshome.com/software_interfaces.html
2) Browse to the download location on your PC hard-drive and extract the files from the zip file
3) Double-click setup.exe.
4) Follow the installation prompts to complete the installation.

9.1.3 Initial mode setup

Follw1ng installation, open the configuration utility by double clicking its icon or selecting it from your windows start menu.

1. In the area labeled “Select Application” select the radio button marked “ASO - Speed Control Mode”
2. Click the “Set” button at the bottom right of the window.
3. A progress bar will show on the window bottom.
4. Once complete, you may now begin to adjust the setup parameters for the AccuStep

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9.1.4 Screen overview

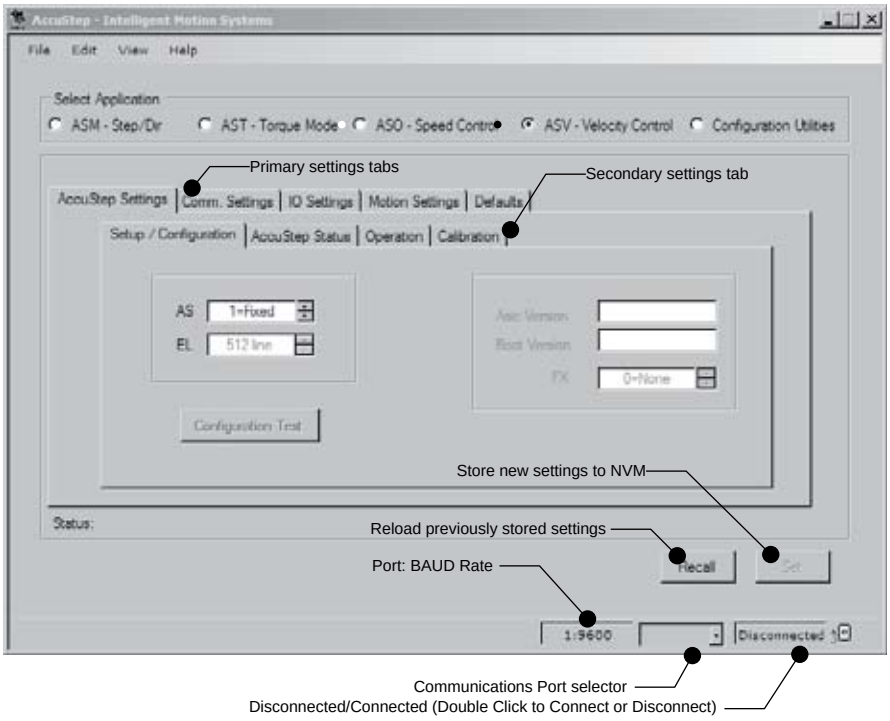

Figure 9.1 AccuStep configuration utility main screen (ASO Mode)

9.2 Speed Control (ASO) mode parameters

9.2.1 AccuStep parameters

AccuStep setup screen

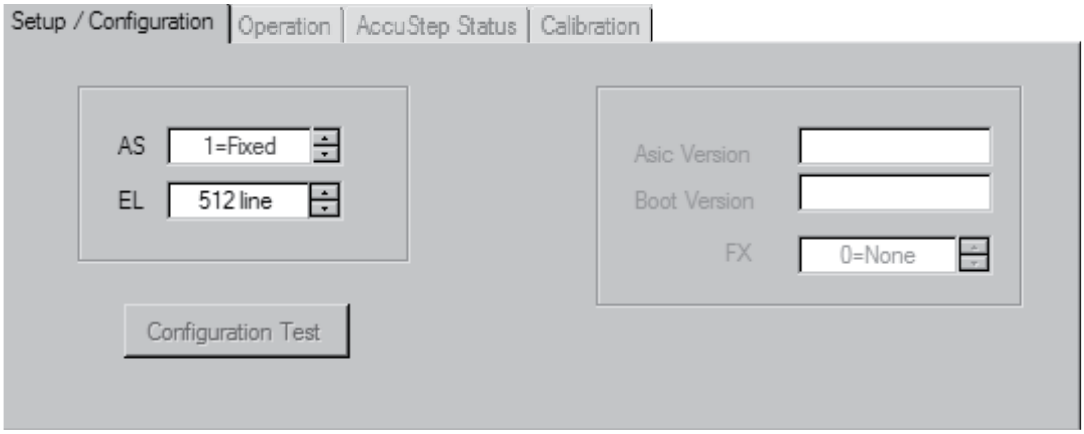

Figure 9.2 AccuStep setup and configuration

Mnemonic	Function	Parameter	Range	Default	Description
AS	AccuStep Mode	0=Off 1=Fixed 2=Variable	0-3	2	Sets the operational mode of the accustep. When off (0) the accustep circuitry will be disabled. Fixed mode (1) the drive current will be as specified by the Hold and Run current variables. In variable mode (2) the current will vary between HC and RC as needed to move the load.
EL	Encoder line count	—	100-1024	Sets to the installed encoder line count	Sets the encoder line count to the count of the encoder installed. The configuration test button will verify the accuracy of the setting.

Table 9.1 AccuStep setup and configuration parameters

AccuStep operation configuration screen

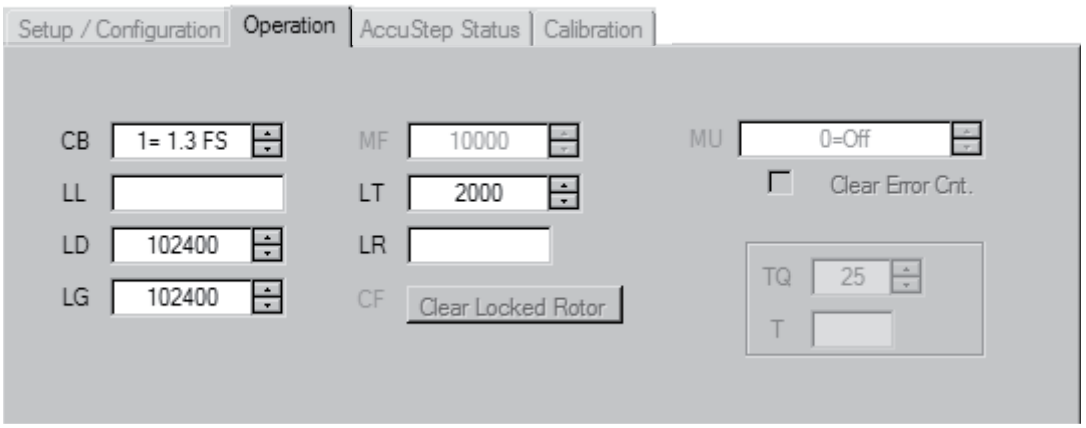

Figure 9.3 AccuStep operation

Mnemonic	Function	Parameter	Range	Default	Description
CB	Control Bounds	0-1.1, 1=1.3 2=1.5, 3=1.7	0-4	1=1.3	Sets the control bounds of the Accustep in motor full steps. Bounds of 1.1=greater torque, bounds of 1.7=greater speed
LL	Lead/Lag Count	—	0-2147483647	102400	Represent the number of counts that the rotor leads or lags the stator.
LD	Lead Limit	—	0-2147483647	102400	Sets the position lead limit in counts
LG	Lag Limit	—	0-2147483647	102400	Sets the position lag limit in counts
LT	Locked Rotor Timeout	—	2-65535	2000	Locked rotor timeout in milliseconds. This is the time from the locked rotor flag activates to the disabling of the output bridge
LR	Locked Rotor Flag	—	0/1	0	Read only flag will indicate a locked rotor condition.
CF	Clear Locked Rotor	—	—	—	Clears a locked rotor fault.

Table 9.2 AccuStep operation parameters

AccuStep status screen (read-only)

The AccuStep status screen is a read-only dialog which will display the status of the device. The decimal value of the combined status alerts will be shown in the AccuStep Status field (ST).

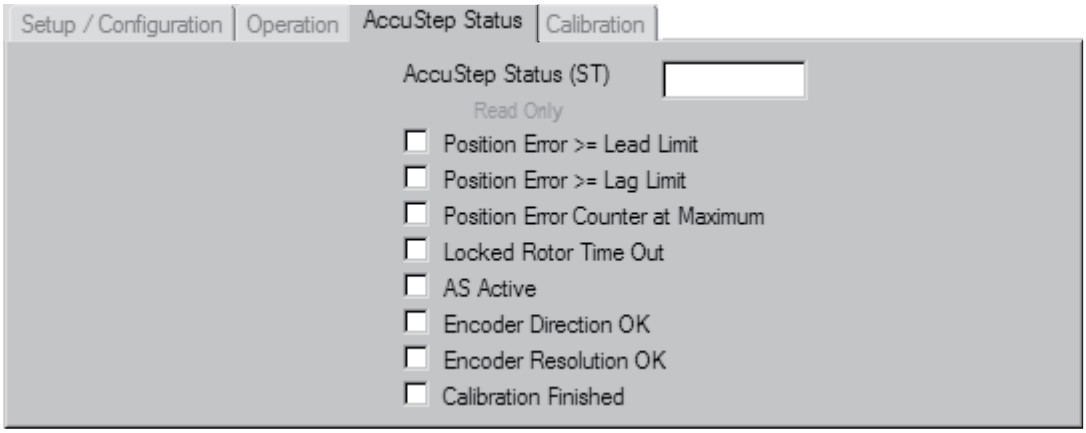

Figure 9.4 AccuStep status (read only)

Status	Description
Position Error >= Lead Limit	Will indicate that the position error is equal to or greater than the lead limit (LD) value specified in the AccuStep operation screen.
Position Error >= Lag Limit	Will indicate that the position error is equal to or greater than the lag limit (LG) value specified in the AccuStep operation screen.
Position Error Counter at Maximum	Indicates that the position error counter is at maximum.
Locked Rotor Time Out	Indicates the locked rotor time out (LR) value specified in the AccuStep operation screen has been exceeded.
AS Active	Indicates that the AccuStep circuitry is active.
Encoder Direction OK	Indicates that the encoder direction is correct.
Encoder Resolution OK	Indicates that the encoder line count (EL) is correctly set.
Calibration Finished	Indicates that the calibration process is complete

Table 9.3 AccuStep status (read only)

Accustep calibration screen

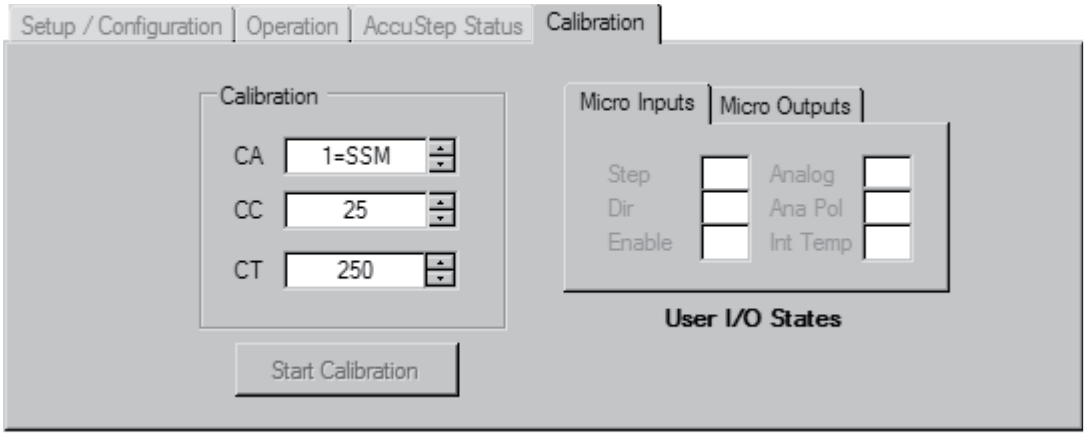

Figure 9.5 AccuStep calibration

Mnemonic	Function	Parameter	Range	Default	Description
CA	Calibration Mode	0 = Fixed Time 1 = SSM	0/1	1	Sets the calibration mode to SSM (Shaft Snap Minimization) or Fixed Time, which is set by the variable CT.
CC	Calibration Current	percent	1-100	25	Sets the calibration current in percent.
CT	Calibration Time	milliseconds	2-65535	250	Sets the calibration time. Only valid if CA=0.

Table 9.4 AccuStep calibration parameters

9.2.2 Analog input parameters

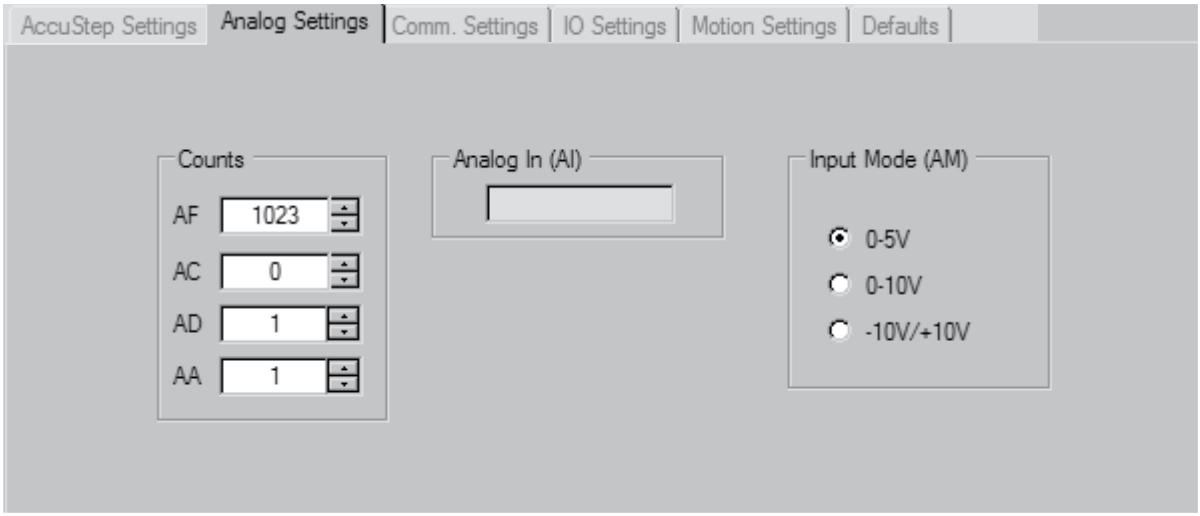

Figure 9.6 Analog input parameter setup screen

Mnemonic	Function	Parameter	Range	Default	Description
AF	Analog Full Scale	counts	1-1023	1023	Sets the full scale range of the analog input. By default it is at the maximum allowed range. The max voltage of the selected input mode will = 100% of the preset torque.
AC	Analog Center	counts	0-1022	0	Sets the center point of the analog full scale for directional control using the analog input.
AD	Analog Deadband	counts	0-255	1	Sets the ± deadband for the analog center (AC).
AA	Analog Average	counts	1-1000	1	Input filtering for the analog input.
AI	Analog Input	counts	—	—	Read analog input value
AM	Analog Input Mode	mode = 0-5V = 0-10V = -10/+10V	—	0-5V	Sets the analog input to 0 to +5V, 0 to +10V or -10 to +10V.

Table 9.5 Analog input setup parameters

9.2.3 Communications parameters

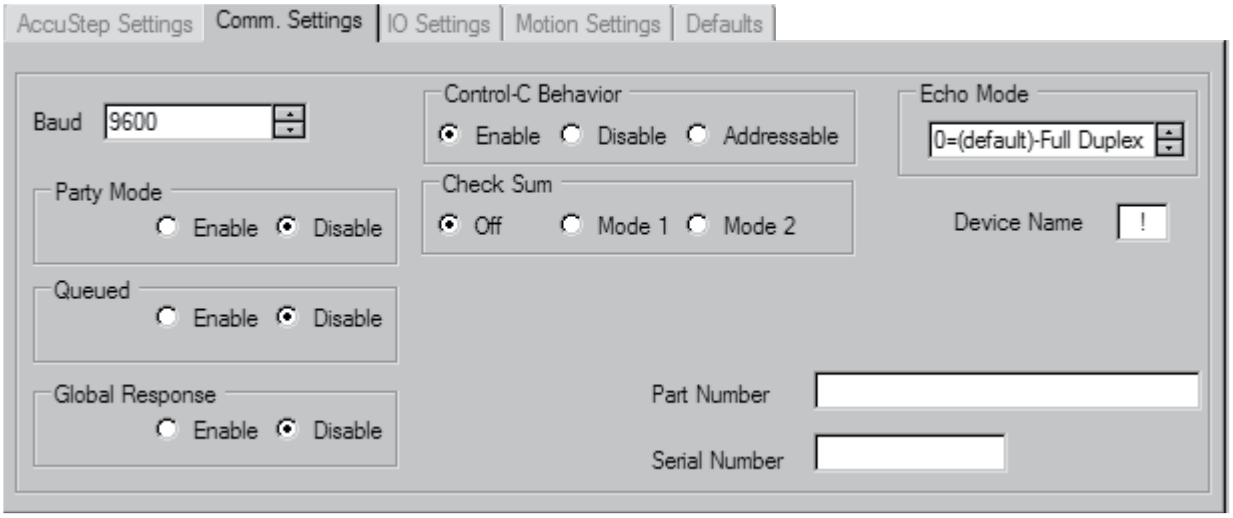

Figure 9.7 Communications parameter setup screen

Mnemonic	Function	Parameter	Range	Default	Description
BD	BAUD Rate	48=4800 kbps 96=9600 kbps 19=19200 kbps 38=38400 kbps 11=115200 kbps	48,96,19,38,11	96	Set the communications BAUD rate.
PY	Party Mode	0=disabled 1=enabled	0/1	0	Enables/disables party mode operation.
QD	Queued	0=disabled 1=enabled	0/1	0	If enabled will “Queue” devices in party mode. If a drive or drives are Queued, then, when they see the address “^”, they will respond to it. All other, non-queued drives will ignore the command.
DG	Global Response	0=disabled 1=enabled	0/1	0	The DG flag enables or disables device response to global commands made while in Party Mode.
CE	Control-C Behavior	0=disabled 1=enabled 2=Addressable	0-2	0	This setup flag will configure the device to respond or not respond to a CTRL+C software reset, or if the device will respond to an addressable reset in party mode.

CK	Check Sum	0=off 1=ack/nak cksum+error 2=ack/nak cksum only	0-2	0	CK=1 puts the device into Check Sum Mode. When enabled, all communications with the device require a Check Sum to follow the commands. The Check Sum is the 2's complement of the 7 bit sum of the ASCII value of all the characters in the command "OR"ed with 128 (hex = 0x80). The command will be acknowledged with a NAK (0x15) if the Check Sum is incorrect or an ACK (0x06) when the command is correctly processed (no error). CK=2 will enable check sum mode, however NAK only sent for bad check sum. "ACK" is not echoed if a program is running. Only a NAK is echoed if an error occurs. In immediate mode both ACK or NAK characters are echoed.
EM	Echo Mode	0=full duplex 1=half duplex 2=LIST/PRT only 3=QUEUE Immediate 4=computer friendly	0-4	0	The Echo Mode Flag will set the full/ half duplex configuration of the RS-485 channel. 0=Full Duplex (default), 1=Half Duplex, 2=Only respond to PR and L, 3=Prints after command is terminated.
DN	Device Name	—	See desc.	!	Set the device name for party mode operation. Valid names A-Z, a-z, 0-9
PN	Part Number	—	—	—	Read only device part number
SN	Serial Number	—	—	—	Read only device serial number

Table 9.6 Communications parameters

9.2.4 I/O parameters

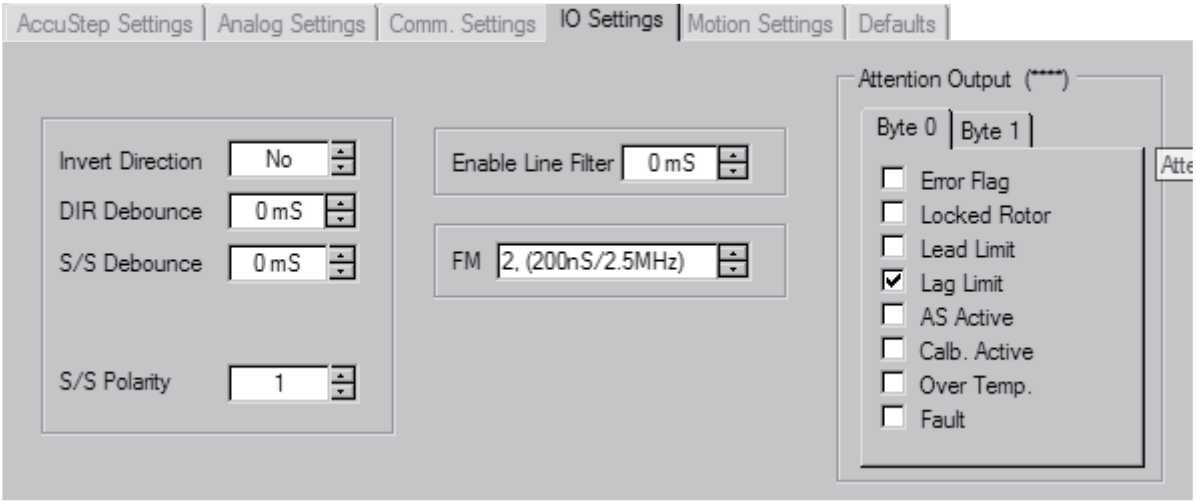

Figure 9.8 I/O parameter setup screen

Mnemonic	Function	Parameter	Range	Default	Description
ID	Invert Direction	1/0	1.0	0	Allows the user to invert the direction input.
DD	Direction Input Filter	msec	0-255	0	Direction input debounce time in milliseconds.
FE	Enable Input Filter	—	0-255	0	Enable input debounce time in milliseconds.
FM	Clock Filter	See desc.	0-9	2	Sets the filtering for the input clock and encoder 0=50 ns/10 MHz 1=150 ns/3.3 MHz 2=200 ns/2.5 MHz 3=300 ns/1.67 MHz 4=500 ns/1.0 MHz 5=900 ns/555 kHz 6=1.7 µs/294 kHz 7=3.3 µs/151 kHz 8=6.5 µs/76.9 kHz 9=12.9 µs/38.8 kHz
SD	Stop/Start Input Filter	msec	0-255	0	Stop/Start (motion) input debounce time in milliseconds
SP	Stop/Start Switch Polarity		1/0	1	1 = Active when high (disconnected) 0 = Active when low

Table 9.7 I/O setup parameters

Attention output configuration

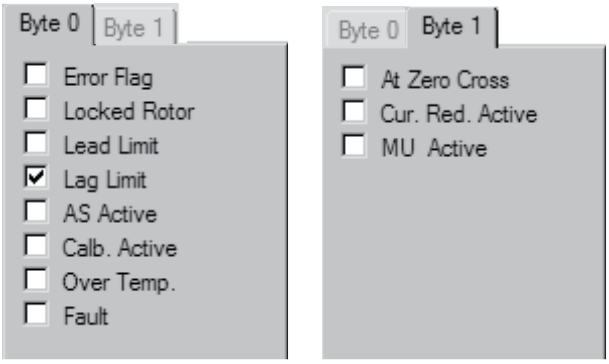

Figure 9.9 Attention output function settings

The attention output can be configured to activate on one or more of the following conditions. Please note that if multiple error conditions are used, the AccuStep status will have to be read to know which condition(s) activated the output.

Function	Description
Error Flag	
Locked Rotor	Indicates a “Locked Rotor” condition
Lead Limit	Indicates that the maximum rotor lead limit as set in software has been reached.
Lag Limit	Indicates that the maximum rotor lag limit as set in software has been reached. Selected by default.
AS Active	Indicates when the AccuStep anti-stall circuitry is active
Calibration Active	
Over Temp	Indicates that the AccuStep temperature has reached the maxim rating and the bridge is disabled.
Fault	
At Zero Cross	Indicates when the phase current is at zero crossing
Cur. Red. Active	Indicates when current reduction is active.
MU Active	Indicates when the AccuStep is making up lost steps.

Table 9.8 Attention output connection pins on connector P1

9.2.4 Motion parameters

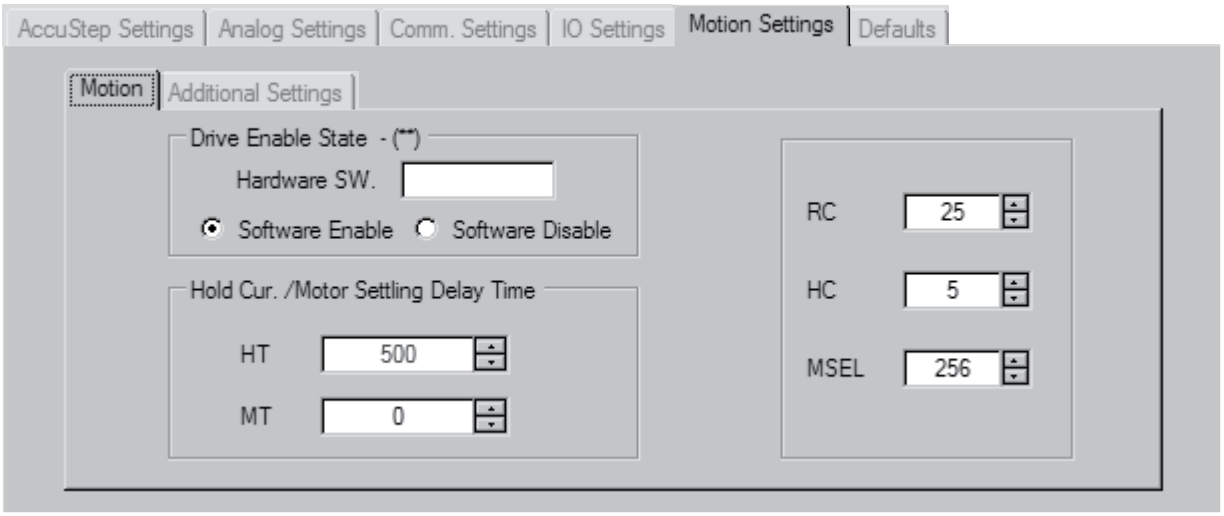

Figure 9.10 Motion settings

Mnemonic	Function	Parameter	Range	Default	Description
DE	Drive Enable State	—	0/1	1	Software enable /disable of the output bridge. If disabled, will over-ride the enable hardware input.
HC	Hold Current	percent	0-100	5	Motor holding current in percent.
HT	Hold Current Delay Time	msec	0-65000	500	Represents the time delay in milliseconds between the last motion input and the shift to the commanded holding current.
MS	Microstep Resolution Select	—	See Table 8.7	256	Sets the microstep resolution in microsteps/fullstep.
MT	Motor Settling Delay Time	msec	0-65000	0	Represents the time in milliseconds that the motor current is allowed to settle before transitioning to holding current. This value is additive with holding current delay time (HC) Total time=HC+MT
RC	Run Current	percent	1-100	25	Motor running current in percent.

Table 9.9 Motion setup parameters

Microstep resolution select settings

Binary	
microsteps/step	steps/revolution
1	200
2	400
4	800
8	1600
16	3200
32	6400
64	12800
128	25600
256	52100
Additional resolution settings	
180	36000 (0.01°/µstep)
108	21600 (1 arc-min/µstep)
127	25400 (0.001 mm/µstep)

Decimal	
microsteps/step	steps/revolution
5	1000
10	2000
25	5000
50	10000
100	20000
125	25000
200	40000
250	50000

Table 9.10 Microstep resolution settings

Additional (acceleration and velocity)

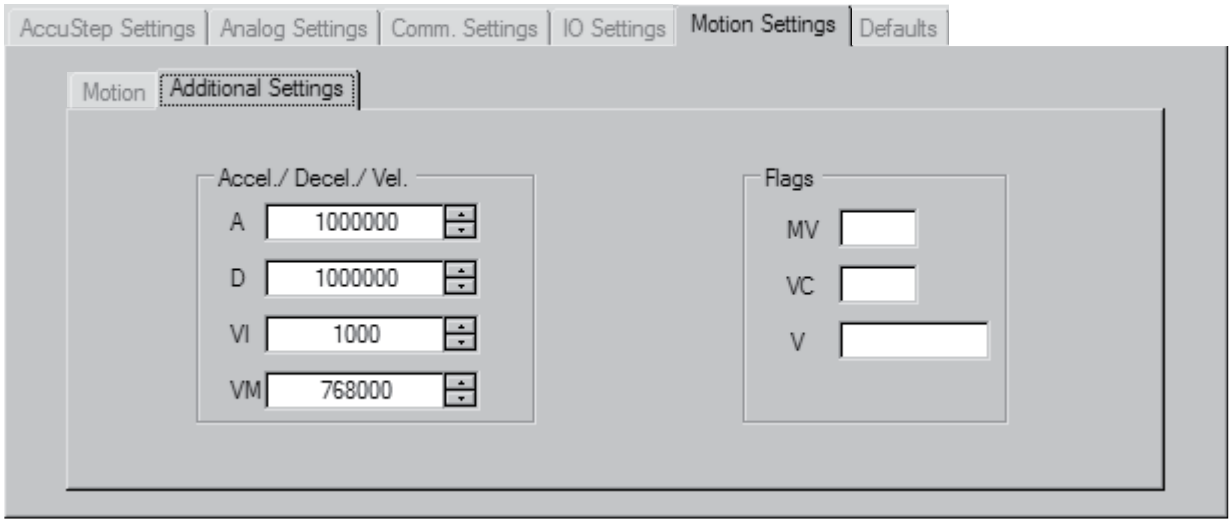

Figure 9.11Additional motion settings (acceleration and velocity)

Mnemonic	Function	Parameter	Range	Default	Description
A	Acceleration	steps/sec^2	1000000000	1000000	Motor acceleration in steps-per-second squared.
D	Deceleration	steps/sec^2	1000000000	1000000	Motor deceleration in steps-per-second squared.
VI	Initial Velocity	steps/sec	1-5000000	1000	Start velocity of the motor. Motor will accelerate from VI to VM based on the voltage measured on the analog input.
VM	Maximum Velocity	steps/sec	1-5000000	768000	Maximum velocity the motor will attain at the maximum voltage measured at the analog input.
MV	Moving Flag	0/1	0/1	—	Read only moving flag, will be active when the motor is in motion.
VC	Velocity Changing	0/1	0/1	—	Read only velocity changing flag indicates that the motor is accelerating or decelerating.
V	Current Velocity	steps/sec	-5000000 to + 5000000	—	Read only field will display the current motor velocity in motor steps-per-second

Table 9.11 Motion setup parameters

9.2.5 Defaults

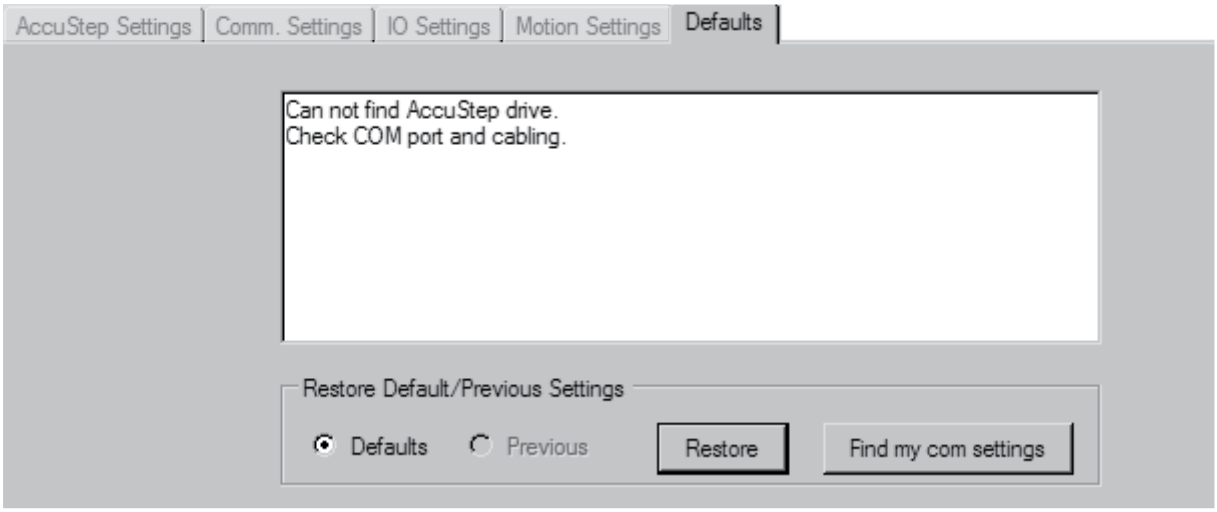

Figure 9.12 Defaults

The defaults screen allows the user to restore either the system defaults or the previously stored settings. It will also allow the user to find the current communications configuration of the device.**9.2.5 Defaults**

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10 Velocity Control (ASV) mode configuration

This section will cover the setup and configuration for Velocity Control (ASV) mode only. For other operating modes please see the section relevant to that mode:

10.1 AccuStep configuration utility

The AccuStep configuration utility is the setup and configuration utility developed to provide the customer with a Graphical User Interface (GUI) to configure the AccuStep product.

The utility is required in order to load the application (mode).

10.1.1 System requirements

- PC or notebook running Windows XP™ service pack 2 or greater.

10.1.2 Installation

1) Download the installation package from http://www.imshome.com/software_interfaces.html
2) Browse to the download location on your PC hard-drive and extract the files from the zip file
3) Double-click setup.exe.
4) Follow the installation prompts to complete the installation.

10.1.3 Initial mode setup

Follw1ng installation, open the configuration utility by double clicking its icon or selecting it from your windows start menu.

1. In the area labeled “Select Application” select the radio button marked “ASV - Velocity Control Mode”
2. Click the “Set” button at the bottom right of the window.
3. A progress bar will show on the window bottom.
4. Once complete, you may now begin to adjust the setup parameters for the AccuStep

10.1.4 Screen overview

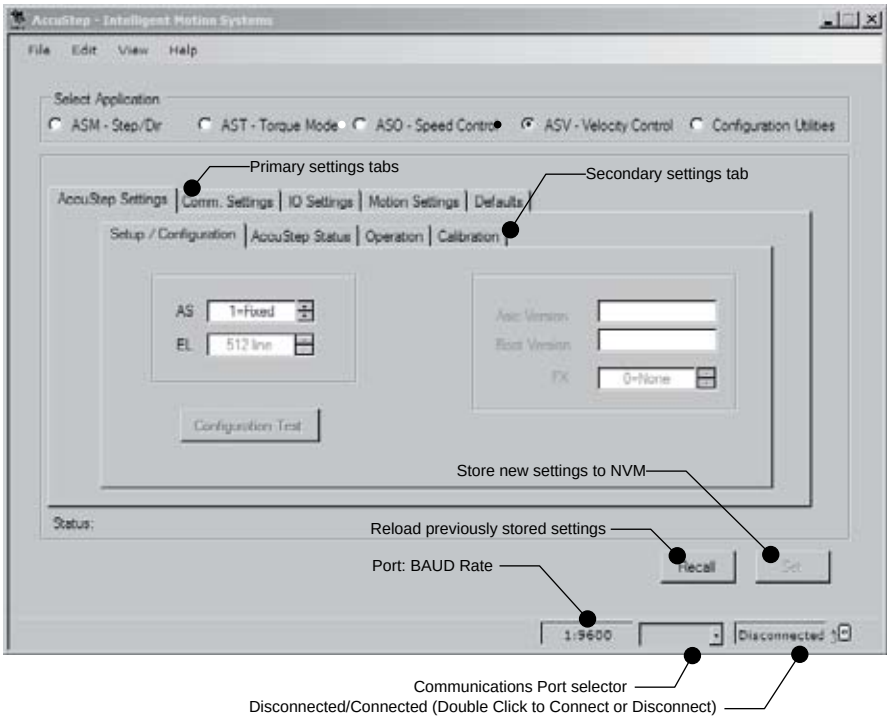

Figure 10.1 AccuStep configuration utility main screen (ASO Mode)

10.2 Velocity Control (ASV) mode parameters

10.2.1 AccuStep parameters

AccuStep setup screen

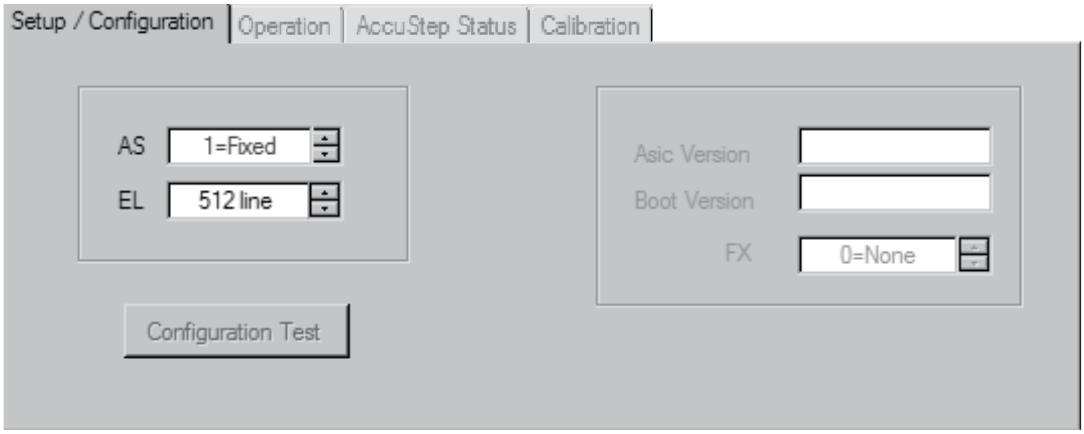

Figure 10.2AccuStep setup and configuration

Mnemonic	Function	Parameter	Range	Default	Description
AS	AccuStep Mode	0=Off 1=Fixed 2=Variable	0-3	2	Sets the operational mode of the accustep. When off (0) the accustep circuitry will be disabled. Fixed mode (1) the drive current will be as specified by the Hold and Run current variables. In variable mode (2) the current will vary between HC and RC as needed to move the load.
EL	Encoder line count	—	100-1024	Sets to the installed encoder line count	Sets the encoder line count to the count of the encoder installed. The configuration test button will verify the accuracy of the setting.

Table 10.1 AccuStep setup and configuration parameters

AccuStep operation configuration screen

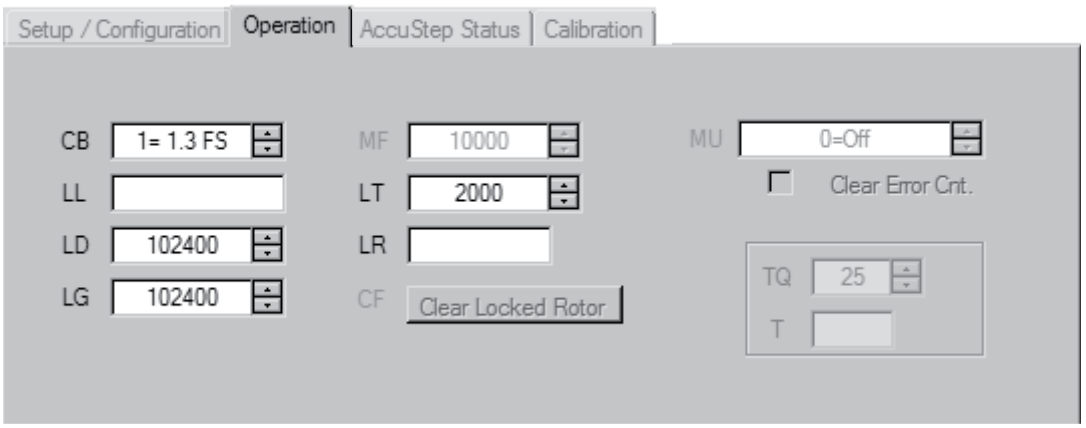

Figure 10.3 AccuStep operation

Mnemonic	Function	Parameter	Range	Default	Description
CB	Control Bounds	0-1.1, 1=1.3 2=1.5, 3=1.7	0-4	1=1.3	Sets the control bounds of the Accustep in motor full steps. Bounds of 1.1=greater torque, bounds of 1.7=greater speed
LL	Lead/Lag Count	—	0-2147483647	102400	Represent the number of counts that the rotor leads or lags the stator.
LD	Lead Limit	—	0-2147483647	102400	Sets the position lead limit in counts
LG	Lag Limit	—	0-2147483647	102400	Sets the position lag limit in counts
LT	Locked Rotor Timeout	—	2-65535	2000	Locked rotor timeout in milliseconds. This is the time from the locked rotor flag activates to the disabling of the output bridge
LR	Locked Rotor Flag	—	0/1	0	Read only flag will indicate a locked rotor condition.
CF	Clear Locked Rotor	—	—	—	Clears a locked rotor fault.

Table 10.2 AccuStep operation parameters

AccuStep status screen (read-only)

The AccuStep status screen is a read-only dialog which will display the status of the device. The decimal value of the combined status alerts will be shown in the AccuStep Status field (ST).

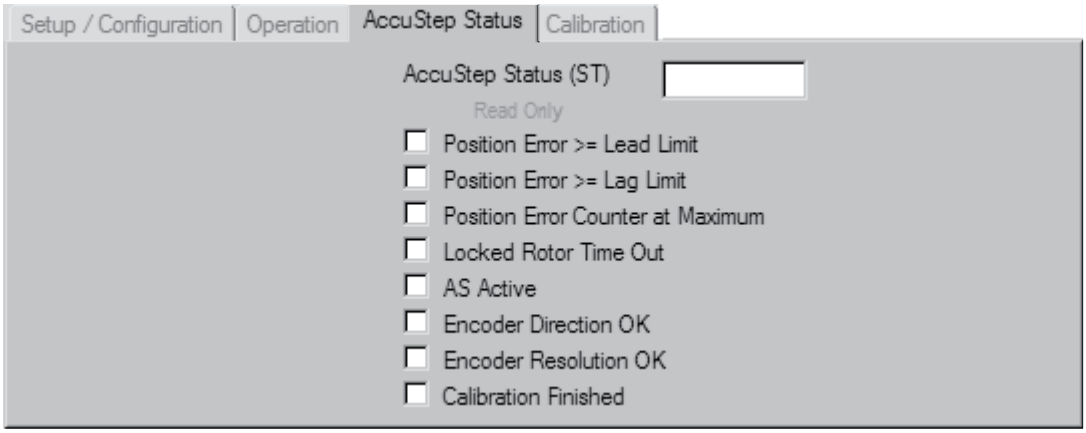

Figure 10.4AccuStep status (read only)

Status	Description
Position Error >= Lead Limit	Will indicate that the position error is equal to or greater than the lead limit (LD) value specified in the AccuStep operation screen.
Position Error >= Lag Limit	Will indicate that the position error is equal to or greater than the lag limit (LG) value specified in the AccuStep operation screen.
Position Error Counter at Maximum	Indicates that the position error counter is at maximum.
Locked Rotor Time Out	Indicates the locked rotor time out (LR) value specified in the AccuStep operation screen has been exceeded.
AS Active	Indicates that the AccuStep circuitry is active.
Encoder Direction OK	Indicates that the encoder direction is correct.
Encoder Resolution OK	Indicates that the encoder line count (EL) is correctly set.
Calibration Finished	Indicates that the calibration process is complete

Table 10.3 AccuStep status (read only)

Accustep calibration screen

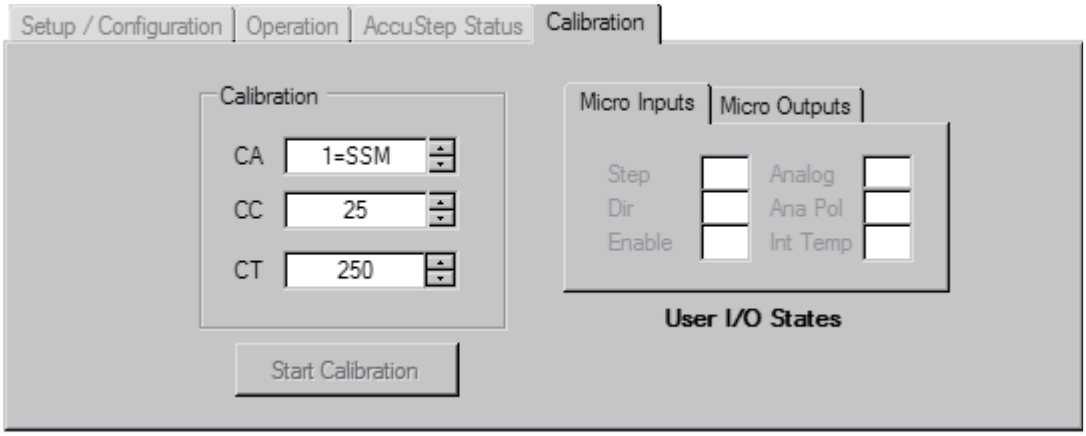

Figure 10.5AccuStep calibration

Mnemonic	Function	Parameter	Range	Default	Description
CA	Calibration Mode	0 = Fixed Time 1 = SSM	0/1	1	Sets the calibration mode to SSM (Shaft Snap Minimization) or Fixed Time, which is set by the variable CT.
CC	Calibration Current	percent	1-100	25	Sets the calibration current in percent.
CT	Calibration Time	milliseconds	2-65535	250	Sets the calibration time. Only valid if CA=0.

Table 10.4 AccuStep calibration parameters

10.2.2 Communications parameters

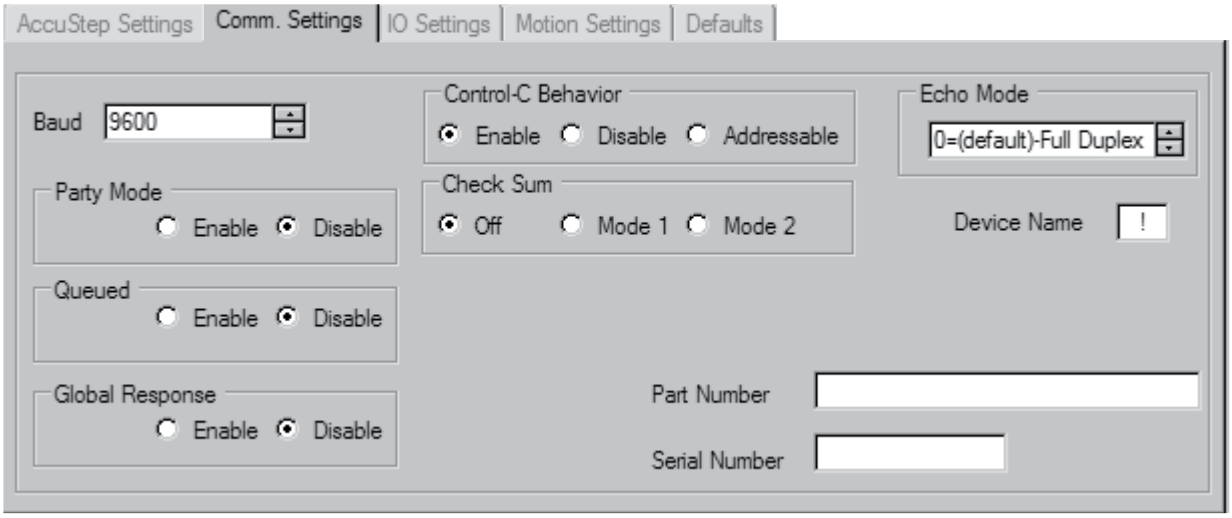

Figure 10.6 Communications parameter setup screen

Mnemonic	Function	Parameter	Range	Default	Description
BD	BAUD Rate	48=4800 kbps 96=9600 kbps 19=19200 kbps 38=38400 kbps 11=115200 kbps	48,96,19,38,11	96	Set the communications BAUD rate.
PY	Party Mode	0=disabled 1=enabled	0/1	0	Enables/disables party mode operation.
QD	Queued	0=disabled 1=enabled	0/1	0	If enabled will “Queue” devices in party mode. If a drive or drives are Queued, then, when they see the address “^”, they will respond to it. All other, non-queued drives will ignore the command.
DG	Global Response	0=disabled 1=enabled	0/1	0	The DG flag enables or disables device response to global commands made while in Party Mode.
CE	Control-C Behavior	0=disabled 1=enabled 2=Addressable	0-2	0	This setup flag will configure the device to respond or not respond to a CTRL+C software reset, or if the device will respond to an addressable reset in party mode.

CK	Check Sum	0=off 1=ack/nak cksum+error 2=ack/nak cksum only	0-2	0	CK=1 puts the device into Check Sum Mode. When enabled, all communications with the device require a Check Sum to follow the commands. The Check Sum is the 2's complement of the 7 bit sum of the ASCII value of all the characters in the command "OR"ed with 128 (hex = 0x80). The command will be acknowledged with a NAK (0x15) if the Check Sum is incorrect or an ACK (0x06) when the command is correctly processed (no error). CK=2 will enable check sum mode, however NAK only sent for bad check sum. "ACK" is not echoed if a program is running. Only a NAK is echoed if an error occurs. In immediate mode both ACK or NAK characters are echoed.
EM	Echo Mode	0=full duplex 1=half duplex 2=LIST/PRT only 3=QUEUE Immediate 4=computer friendly	0-4	0	The Echo Mode Flag will set the full/half duplex configuration of the RS-485 channel. 0=Full Duplex (default), 1=Half Duplex, 2=Only respond to PR and L, 3=Prints after command is terminated.
DN	Device Name	—	See desc.	!	Set the device name for party mode operation. Valid names A-Z, a-z, 0-9
PN	Part Number	—	—	—	Read only device part number
SN	Serial Number	—	—	—	Read only device serial number

Table 10.5 Communications parameters

10.2.3 I/O parameters

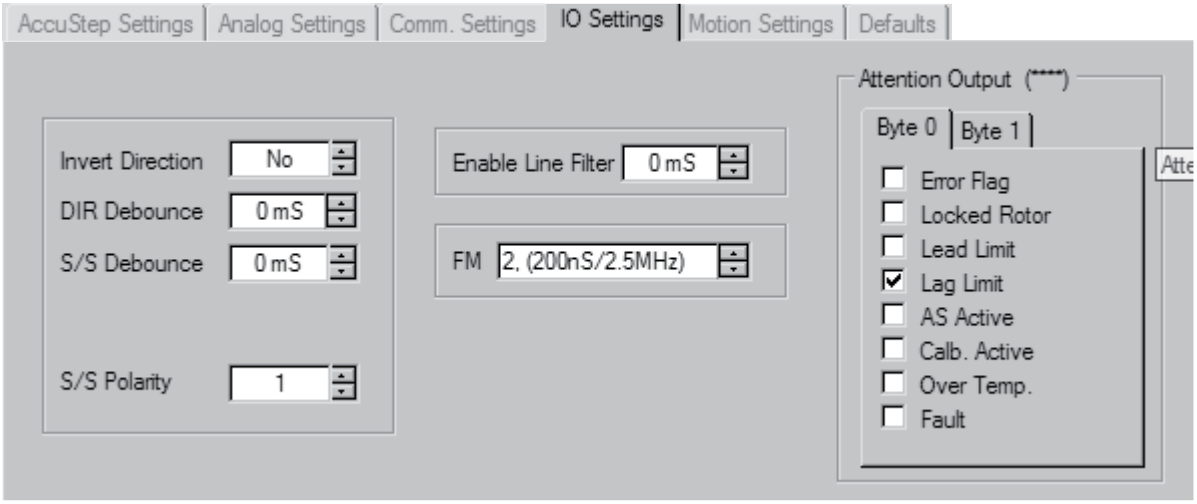

Figure 10.7I/O parameter setup screen

Mnemonic	Function	Parameter	Range	Default	Description
ID	Invert Direction	1/0	1.0	0	Allows the user to invert the direction input.
DD	Direction Input Filter	msec	0-255	0	Direction input debounce time in milliseconds.
FE	Enable Input Filter	—	0-255	0	Enable input debounce time in milliseconds.
FM	Clock Filter	See desc.	0-9	2	Sets the filtering for the input clock and encoder 0=50 ns/10 MHz 1=150 ns/3.3 MHz 2=200 ns/2.5 MHz 3=300 ns/1.67 MHz 4=500 ns/1.0 MHz 5=900 ns/555 kHz 6=1.7 µs/294 kHz 7=3.3 µs/151 kHz 8=6.5 µs/76.9 kHz 9=12.9 µs/38.8 kHz
SD	Stop/Start Input Filter	msec	0-255	0	Stop/Start (motion) input debounce time in milliseconds
SP	Stop/Start Switch Polarity		1/0	1	1 = Active when high (disconnected) 0 = Active when low

Table 10.6 I/O setup parameters

Attention output configuration

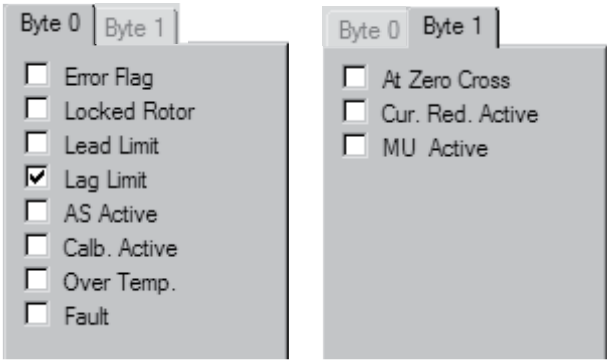

Figure 10.8Attention output function settings

The attention output can be configured to activate on one or more of the following conditions. Please note that if multiple error conditions are used, the AccuStep status will have to be read to know which condition(s) activated the output.

Function	Description
Error Flag	
Locked Rotor	Indicates a “Locked Rotor” condition
Lead Limit	Indicates that the maximum rotor lead limit as set in software has been reached.
Lag Limit	Indicates that the maximum rotor lag limit as set in software has been reached. Selected by default.
AS Active	Indicates when the AccuStep anti-stall circuitry is active
Calibration Active	
Over Temp	Indicates that the AccuStep temperature has reached the maxim rating and the bridge is disabled.
Fault	
At Zero Cross	Indicates when the phase current is at zero crossing
Cur. Red. Active	Indicates when current reduction is active.
MU Active	Indicates when the AccuStep is making up lost steps.

Table 10.7 Attention output connection pins on connector P1

10.2.4 Motion parameters

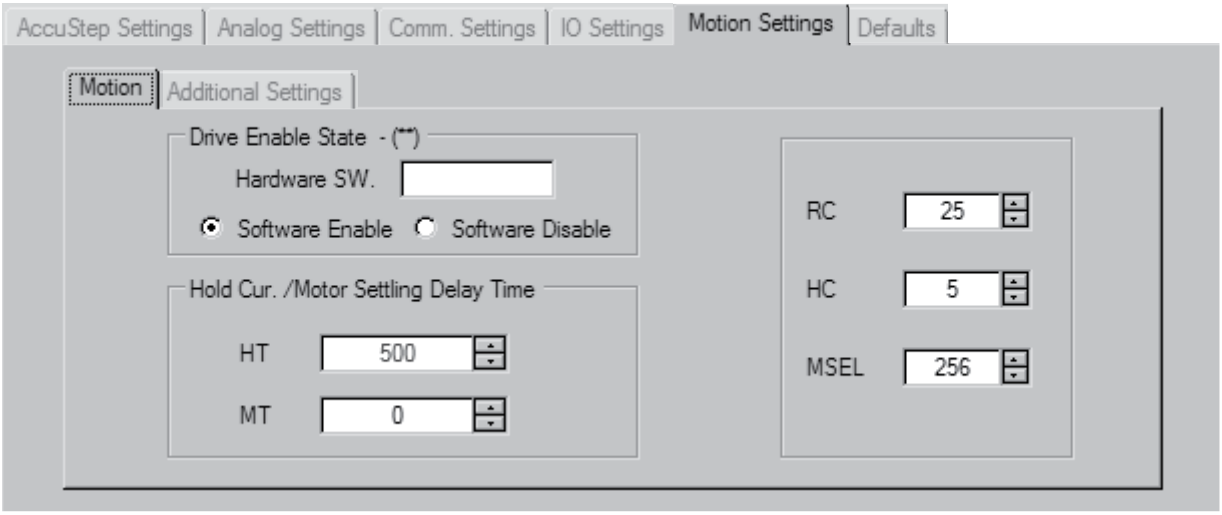

Figure 10.9 Motion settings

Mnemonic	Function	Parameter	Range	Default	Description
DE	Drive Enable State	—	0/1	1	Software enable /disable of the output bridge. If disabled, will over-ride the enable hardware input.
HC	Hold Current	percent	0-100	5	Motor holding current in percent.
HT	Hold Current Delay Time	msec	0-65000	500	Represents the time delay in milliseconds between the last motion input and the shift to the commanded holding current.
MS	Microstep Resolution Select	—	See Table 8.7	256	Sets the microstep resolution in microsteps/fullstep.
MT	Motor Settling Delay Time	msec	0-65000	0	Represents the time in milliseconds that the motor current is allowed to settle before transitioning to holding current. This value is additive with holding current delay time (HC) Total time=HC+MT
RC	Run Current	percent	1-100	25	Motor running current in percent.

Table 10.8 Motion setup parameters

Microstep resolution select settings

Binary	
microsteps/step	steps/revolution
1	200
2	400
4	800
8	1600
16	3200
32	6400
64	12800
128	25600
256	52100
Additional resolution settings	
180	36000 (0.01°/µstep)
108	21600 (1 arc-min/µstep)
127	25400 (0.001 mm/µstep)

Decimal	
microsteps/step	steps/revolution
5	1000
10	2000
25	5000
50	10000
100	20000
125	25000
200	40000
250	50000

Table 10.9 Microstep resolution settings

Additional (acceleration and velocity)

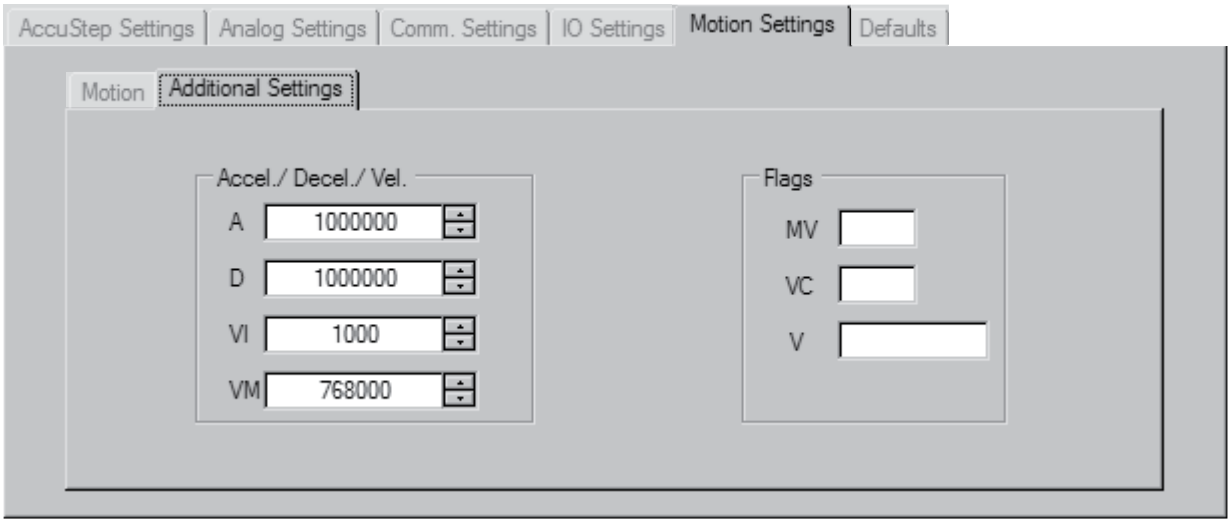

Figure 10.10 Additional motion settings (acceleration and velocity)

Mnemonic	Function	Parameter	Range	Default	Description
A	Acceleration	steps/sec^2	1000000000	1000000	Motor acceleration in steps-per-second squared.
D	Deceleration	steps/sec^2	1000000000	1000000	Motor deceleration in steps-per-second squared.
VI	Initial Velocity	steps/sec	1-5000000	1000	Start velocity of the motor. Motor will accelerate from VI to VM based on the voltage measured on the analog input.
VM	Maximum Velocity	steps/sec	1-5000000	768000	Maximum velocity the motor will attain at the maximum voltage measured at the analog input.
MV	Moving Flag	0/1	0/1	—	Read only moving flag, will be active when the motor is in motion.
VC	Velocity Changing	0/1	0/1	—	Read only velocity changing flag indicates that the motor is accelerating or decelerating.
V	Current Velocity	steps/sec	-5000000 to + 5000000	—	Read only field will display the current motor velocity in motor steps-per-second

Table 10.10 Motion setup parameters

10.2.5 Defaults

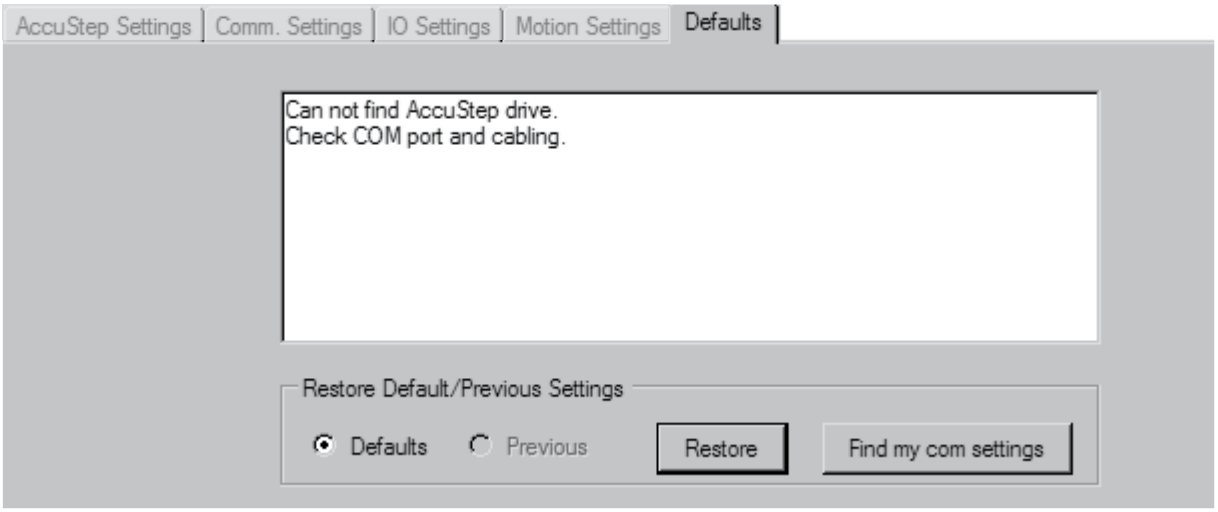

Figure 10.11 Defaults

The defaults screen allows the user to restore either the system defaults or the previously stored settings. It will also allow the user to find the current communications configuration of the device.

11 Error Codes

0	no error

IO 1 - 19

DATA 20 - 39

20	Tried to SET Unknown Variable/Flag
21	Tried to SET to an incorrect value
22	VI set greater than or equal to VM
23	VM set less than or equal to VI
24	Illegal Data Entered.
25	Variable of Flag is Read Only
35	Trying to Print Illegal variable or flag
37	Command, Variable or Flag Not Available in Drive
38	Missing parameter separator

FLASH 40 - 59

40	FLASH Check Sum Fault
41	Boot Data Blank

COMM 60 - 69

60	Tried to Enter Unknown Command
61	Trying to set illegal baud rate

SYSTEM 70 - 79

70	Internal Temperature Warning
71	Internal OVER TEMP Fault, Disabling Drive
72	Tried to SAVE while Moving
73	Drive Over Current

MOTION 80 - 99

80	Stall Detected
81	Accu-Step Locked Rotor
82	Config Test Done - Encoder Res Mismatch
83	Config Test Done - Encoder Dir Wrong
84	Config Test Done - Encoder Res + Dir Wrong
85	Config NOT Done - Drive not enabled

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MDrive® AccuStep
Step • Torque • Speed

Part 2: Detailed specifications and connectivity information

1. MDrive AccuStep 23
2. MDrive AccuStep 34 ac

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MDrive® AccuStep 23
Step•Torque•Speed
Integrated Motor and Driver

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1 Introduction

1.1 About this manual

This manual is applicable for the MDrive AccuStep Step•Torque•Speed.

1.2 MDrive AccuStep overview

The MDrive AccuStep is a high-torque NEMA 23 1.8° brusless step motor integrated with a high performance microstepping drive equipped with advanced AccuStep revolutionary technology for unsurpassed performance.

AccuStep technology offers the system designer a low cost alternative to 3-phase servo motors and brushed DC motors. Because AccuStep is a stepper-based technology, no tuning is required and the loop is closed by means of an integrated encoder.

The MDrive AccuStep features an input voltage range of +12 to +60 VDC and is available in four motor lengths: single, double, triple and quad.

MDrive AccuStep can be configured to operate in three modes:

1. Step (Step/Direction: In step mode the MDrive AccuStep will be controlled by an external step clock signal.
2. Torque (Torque Control): In torque mode, the device will maintain a constant, preset torque output of the motor. The torque may be set in software, or controlled via the analog input using a 0 to +5 V, 0 to +10 V or -10 to +10 V signal.
3. Speed (Speed Control): In speed mode the device will operate as an intelligent speed control, with velocity being controlled via the Analog input by a 0 to +5 V, 0 to +10 V or -10 to +10 V signal.

The AccuStep communicates using RS-422/485 via a 10-pin wire crimp style connector.

I/O and power interface is accomplished using a 12-pin wire crimp connector.

An encoder interface is provided via a 10-pin locking wire crimp connector.

1.2.1 AccuStep configuration utility

The AccuStep configuration utility is an easy to install and use graphical user interface (GUI) for configuring the MDrive AccuStep from an RS-422/485 host. The utility may be download at www.imshome.com. An optional communication converter cable is available for ease of connecting and configuring this product.

AccuStep configuration utility features include:

- Easy installation via web interface or using CD included with Quick Start kits.

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- Automatic communication configuration.
- Will not set out-of-range values.
- Tool-tips display valid range setting for each option.
- Required to set operational mode: step, torque or speed.

1.2.1 Features and benefits

- Integrated microstepping drive/NEMA 23 high torque brushless step motor
- Advanced 2nd generation current control for exceptional performance and smoothness
- Single supply +12 to +60 VDC
- Configurable
  - Prevents loss of synchronization
  - Selectable option for automatic position correction
  - Optionally powers down the bridge on a locked rotor condition
- Low cost alternative to brush, brushless and servo motors.
- Extremely compact
- 20 microstep resolutions up to 51,200 steps per rev. Includes degrees, arc-minutes and metric.
- Optically isolated logic inputs will accept +5 to +24 VDC signals, sourcing or sinking
- Three operating modes
  - Step: Step/Direction
  - Torque: Torque Control
  - Speed: Speed Control
- Configurable:
  - Motor run/hold current
  - Hold current delay time
  - Analog input voltage range: 0 to +5/0 to +10/-10 to +10 VDC
  - Microstep resolution
  - Input Clock Type: Step/Direction, CW/CCW, Quadrature
  - Programmable digital filtering for clock and direction inputs
- Multi-function isolated attention output
- Options:
  - Control knob
  - Planetary gearbox
- Single supply
- Interface
  - I/O and Power: 12-pin locking wire crimp connector
  - Communications: 10-pin friction lock wire crimp connector
  - Encoder: 10-pin locking wire crimp connector
- Graphical user interface (GUI) for quick and easy parameter setup

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1.3 Product identification

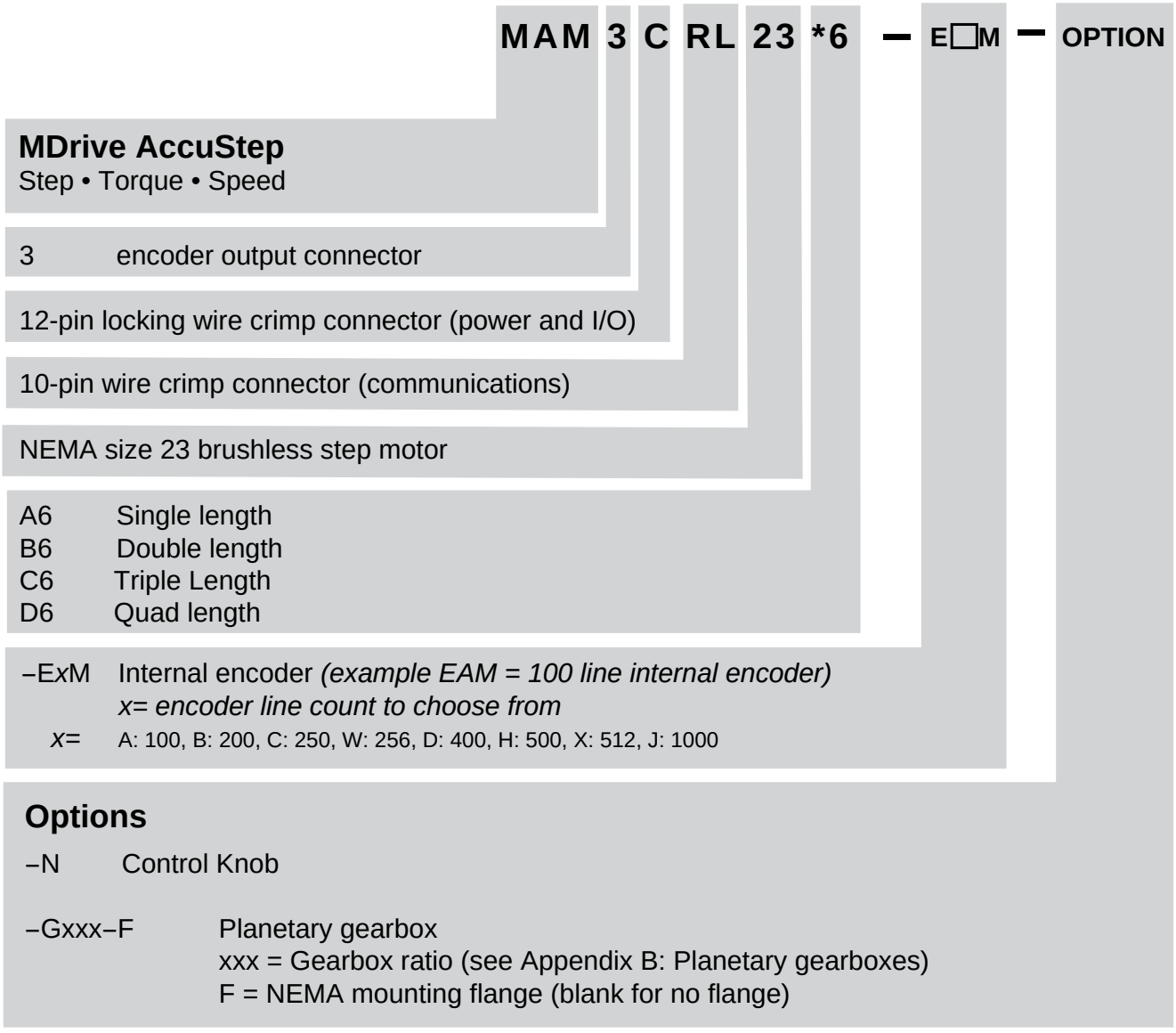

Figure 1.1 Standard product options

1.4 Documentation reference

The following documentation is available for the MDrive AccuStep:

- This product manual, describes the technical data, installation, configuration and programming of the product.
- Quick Reference, describes the basic wiring, connection and use of this product. The quick reference is shipped in printed form with the product.

This documentation is also available for download from the IMS web site at www.imshome.com.

1.5 Product software

The MDrive AccuStep integrated motor and driver uses the AccuStep configuration utility which may be downloaded from www.imshome.com/software_interfaces.html.

Installation and usage instructions are to be found in this document.

The AccuStep configuration utility is required to configure the operating mode and to upgrade the firmware.

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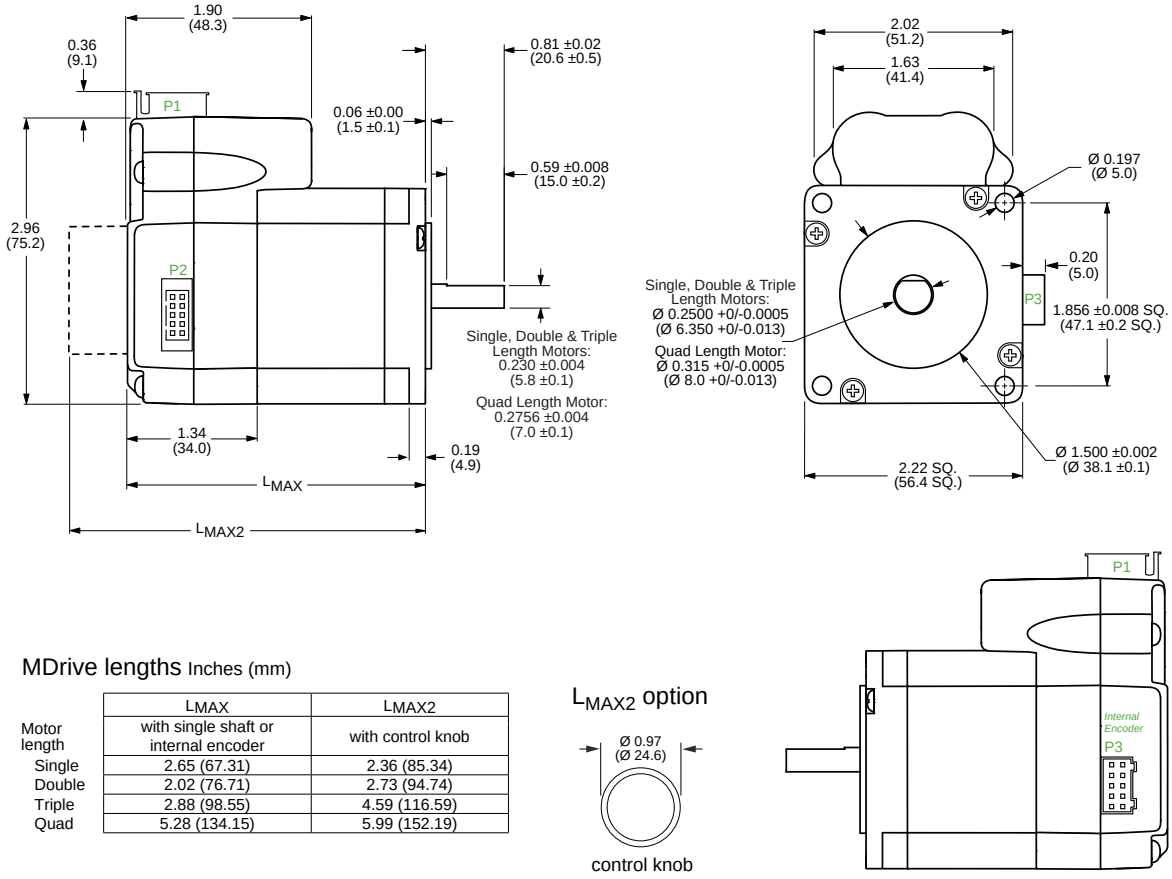
2 Specifications

2.1 Mechanical specifications



MDrive lengths Inches (mm)

Motor length	L_{MAX} with single shaft or internal encoder	L_{MAX2} with control knob
Single	2.65 (67.31)	2.36 (85.34)
Double	2.02 (76.71)	2.73 (94.74)
Triple	2.88 (98.55)	4.59 (116.59)
Quad	5.28 (134.15)	5.99 (152.19)

L_{MAX2} option

control knob

Figure 2.1 Mechanical specifications - dimensions in inches (mm)

2.2 General specifications

2.2.1 Electrical specifications

	Condition	Min	Typ	Max	Unit
Input voltage range	—	+12	—	+60	VDC
Max power supply current	—	—	—	2.5*	Amps

**per unit, actual current depends on voltage and load.*

Table 2.1 Electrical specifications

2.2.2 Logic specifications

	Condition	Min	Typ	Max	Unit
Isolated Inputs					
Isolated input voltage range (sourcing or sinking)	Isolated inputs	+5	—	+24	VDC
Current (+5 VDC Opto Reference)	+5 VDC max	—	—	8.7	mA
Current (+24 VDC Opto Reference)	+24 VDC max	—	—	14.6	mA
Attention Output					
Collector-Emitter Output Voltage				60	VDC
Emitter-Collector Output Voltage				7	VDC
Output Current		5.5		42	mA
Encoder Output					
Current	I_{OH}			-20	mA
Current	I_{OL}			20	mA
Voltage	V_{OH}@20 mA	2.4	2.4		VDC
Voltage	V_{OL}@20 mA		0.2	0.4	VDC

Table 2.2 I/O specifications

2.2.3 Communications specifications

Protocol	RS-422/485

Table 2.3 Communications specifications

2.2.4 Thermal specifications

		Min	Typ	Max	Unit
Heat sink temperature	non-condensing humidity	-40	—	+85	ºC
Motor temperature	non-condensing humidity	-40	—	+100	ºC

Table 2.4 Thermal specifications

2.2.5 Motion specifications

Number of microstep resolutions	20

Available microsteps per revolution

200	400	800	1000	1600	2000	3200	5000	6400	10000
12800	20000	25000	25600	40000	50000	51200	36000[1]	21600[2]	25400[3]

1=0.01 deg/µstep 2=1 arc minute/µstep *3=0.001 mm/µstep
** 1" per revolution lead screw*

Digital filter range	50 ns to 12.9 µs (10 MHz to 38.8 kHz)
Clock types	step/direction, up/down, quadrature
Step frequency (max)	5 MHz
Step frequency minimum pulse width	100 ns

Table 2.5 Motion specifications

2.3 Motor Specifications

Single Length

Holding torque oz-in (N-cm)	90 (64)
Detent torque oz-in (N-cm)	2.9 (2.7)
Rotor inertia oz-in-sec^2 (kg-cm^2)	0.0025 (0.18)
Weight motor and driver oz (g)	21.6 (612.3)

Double Length

Holding torque oz-in (N-cm)	144 (102)
Detent torque oz-in (N-cm)	5.6 (2.92)
Rotor inertia oz-in-sec^2 (kg-cm^2)	0.0037 (0.26)
Weight motor and driver oz (g)	26.4 (748.4)

Triple Length

Holding torque oz-in (N-cm)	239 (169)
Detent torque oz-in (N-cm)	9.7 (6.86)
Rotor inertia oz-in-sec^2 (kg-cm^2)	0.0065 (0.46)
Weight motor and driver oz (g)	39.2 (1111.3)

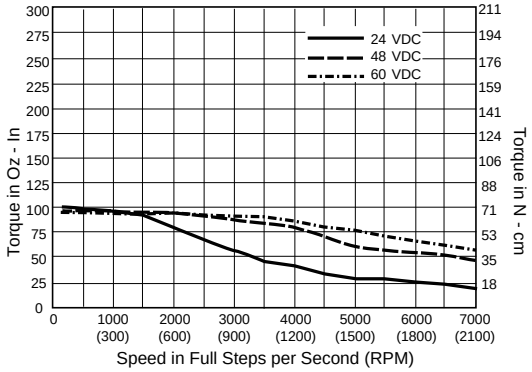
Quad Length

Holding torque oz-in (N-cm)	239 (169)
Detent torque oz-in (N-cm)	9.7 (6.86)
Rotor inertia oz-in-sec^2 (kg-cm^2)	0.0065 (0.46)
Weight motor and driver oz (g)	39.2 (1111.3)

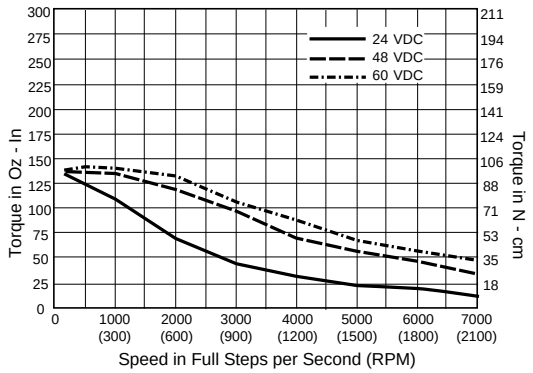
Table 2.6 Motor specifications

2.2.1 Torque-Speed Performance

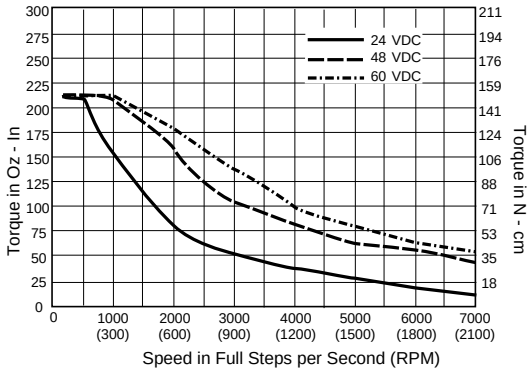
Single length motor speed-torque curves



Double length motor speed-torque curves



Triple length motor speed-torque curves



Quad length motor speed-torque curves

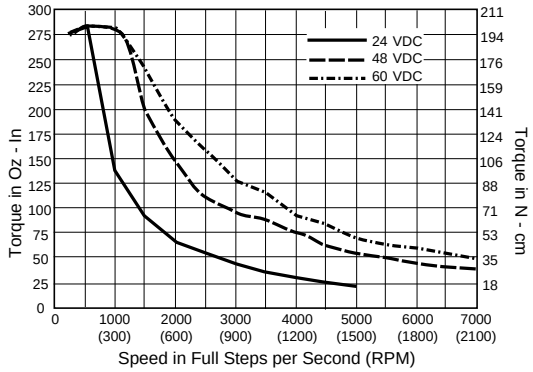


Figure 2.2 Torque-Speed performance curve

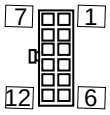
2.4 Connector pin assignment and description

2.4.1 Connector P1 Power and Logic

⚠ CAUTION

CONNECTOR PRODUCT ALERT!

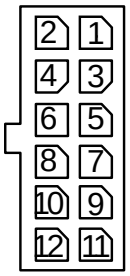
The manufacturer of the Tyco 12-pin connector has begun marking the connector shell, PN 1-794617-2. with pin numbers as shown in the diagram on the right.



Disregard these markinings

Disregard these pin number markings. Use the pin numbering scheme as shown below.

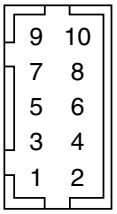
Failure to follow these instructions can result in equipment damage.



Pin #	Function	Description
1	PWR GND	Power supply return (ground).
2	+V	+12 to +75 VDC motor power.
3	OPTO	The opto reference will determine the sink-source state of the I/O. If grounded, the inputs will be sourcing, if +5 to + 24 VDC the inputs will be sinking.
4	MOTION	Motion input: If in ASM mode this will operate as a Step Clock input. If in ASO or AST mode this will operate as a stop/start input for the internal clock generator.
5	ENABLE	Enable/Disable the bridge.
6	DIR	Direction input..
7	AUX-PWR	The AUX power input will keep the micro powered in the absence of motor power.
8	ATTN OUT_E	Open emitter Attention output - error/fault output, function configured in software.
9	ATTN OUT_C	Open collector Attention output - error/fault output, function configured in software.
10	ANALOG	Analog input used in Torque and Speed modes of operation. Input may be configured to accept the following voltage ranges: 0 to +5V, 0 to +10V or -10 to +10V. If using a 10kΩ pot, the centertap is connected here.
11	GND	Analog input ground (10kΩ pot —).
12	+5V	+5 VDC output (10kΩ pot +).

Table 2.7 P1 Power and logic

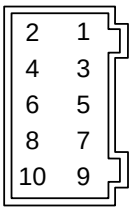
2.4.2 Connector P2 RS-422/485 communications



Pin #	Function	Description
1	TX+	Transmit + output
2	COM GND	Communications Ground (Resistor isolated)
3	RX –	Receive – input
4	TX–	Transmit – output
5	COM GND	Communications Ground (Resistor isolated)
6	RX+	Receive + input
7	RX+	Receive + input
8	RX –	Receive – input
9	TX+	Transmit + output
10	TX–	Transmit – output

Table 2.8 P2 RS-422/485 communications

2.4.3 Connector P3 encoder output



Pin #	Function	Description
1	GND	Encoder ground
2	CH A+	Encoder channel A+ output
3	CH A–	Encoder channel A– output
4	CH B+	Encoder channel B+ output
5	CH B–	Encoder channel B– output
6	IDX +	Encoder + index mark
7	IDX–	Encoder – index mark
8	N/C	Not connected
9	N/C	Not connected
10	N/C	Not connected

Table 2.9 P3 optional encoder output

2.5 Setup parameters

Active setup parameters will vary for each mode of operation. Please see the section appropriate to the mode of operation being utilized for available parameters and commands.

2.6 Encoder Line Counts Available

Internal Encoder

Internal differential magnetic encoders with index mark are available with the MDrive AccuStep.

Line counts: 100, 200, 250, 256, 400, 500, 512,, 1000

Differential Locking Cable (6.0'/1.8m) ED-CABLE-JST10

2.7 Options

Drive Protection Module

The function of the DPM75 Drive Protection Module is to limit the surge current and voltage to a safe level when DC input power is switched on and off to the MDrive.

Control Knob

The MDrive AccuStep is available with a factory-mounted rear control knob for manual shaft positioning.

Planetary Gearbox

Efficient, low maintenance planetary gearboxes are offered assembled with the MDrive AccuStep

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2.8 Connectivity

QuickStart kit

For rapid design verifi cation, all-inclusive QuickStart Kits have communication converter, prototype development cable(s), instructions and CD for MDrive AccuStep initial functional setup and system testing.

Communication Converters

Electrically isolated, in-line converters pre-wired with mating connectors to conveniently set/program communication parameters for a single MDrive product via a PC's USB port. Length 12.0' (3.6m).

Mates to connector:

P2 10 pin wire crimp MD-CC302-001

Prototype Development Cables

Speed test/development with pre-wired mating connectors that have flying leads other end. Length 10.0' (3.0m).

Mates to connector:

P1 12-pin locking wire crimp..... PD12-1434-FL3

P4 10-pin wire crimp (encoder) ED-CABLE-JST10

Mating Connector Kits

Use to build your own cables. Kit contains 5 mating shells with pins. Cable not supplied. Manufacturer's crimp tool recommended.

Mates to connector:

P2 10-pin wire crimp..... CK-02

P1 12-pin wire crimp..... CK-03

P4 10-pin wire crimp..... CK-13

3 Mounting and connection recommendations

3.1 Mounting

The maximum temperature for the device is 85°C measured at the heat sink, 100°C measured at the motor. Ensure that the unit is mounted to adequate heat sink plating to ensure that the temperature does not exceed 85°C.

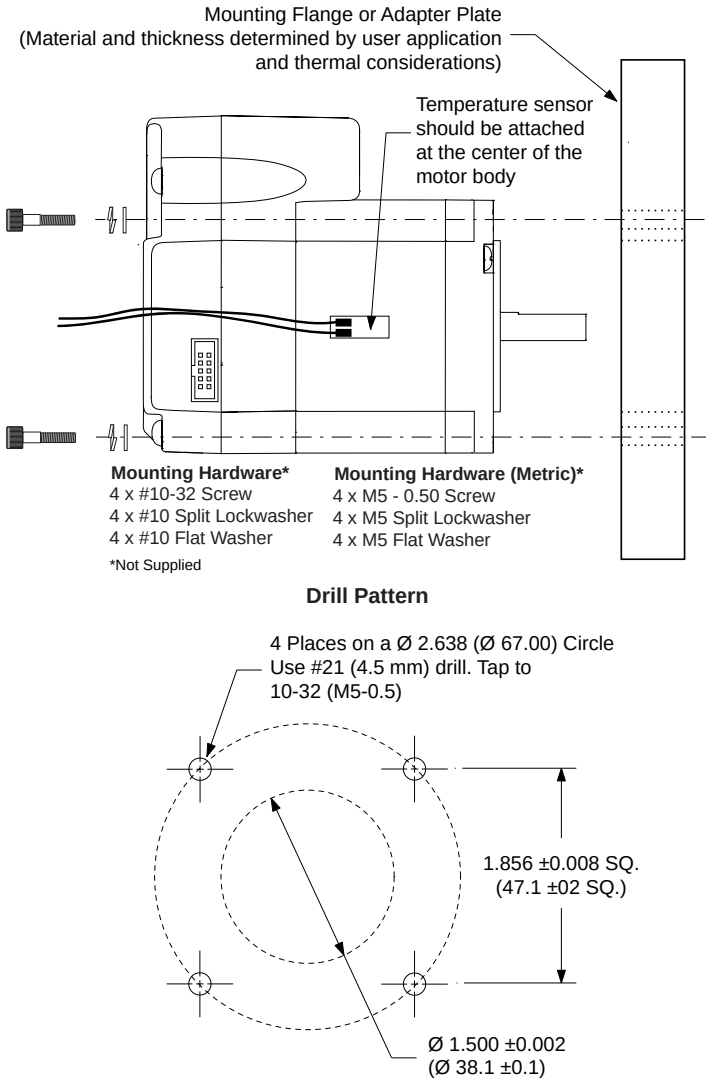


Figure 3.1 Mounting the MDrive AccuStep

Note that the torque specification for the mounting screws is 5.0 to 7.0 lb-in (0.60 to 0.80 N-m). Do not over-tighten screws.

4.2 Layout and interface guidelines

⚠ DANGER

EXPOSED SIGNALS

Hazardous voltage levels may be present if using an open frame power supply to power the product.

Failure to follow these instructions will result in death or serious injury.

⚠ CAUTION

HOT PLUGGING!

Do not connect or disconnect power, logic, or communications while the device is in a powered state.

Remove DC power by powering down at the AC side of the DC power supply.

Failure to follow these instructions can result in equipment damage.

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

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

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

4.2.1 Recommended Wiring

The following wiring/cabling is recommende:d

Logic Wiring..... 22 AWG

Wire Strip Length..... 0.25” (6.0 mm)

Power, Ground ..... 20 AWG

4.2.2 Securing power and logic leads

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

4 Connection and interface

⚠ DANGER

EXPOSED SIGNALS

Hazardous voltage levels may be present if using an open frame power supply to power the product.

Failure to follow these instructions will result in death or serious injury.

⚠ CAUTION

SWITCHING DC POWER/HOT PLUGGING

Do not connect or disconnect power, logic, or communications while the device is in a powered state.

Remove DC power by powering down at the AC side of the DC power supply.

Failure to follow these instructions can result in equipment damage.

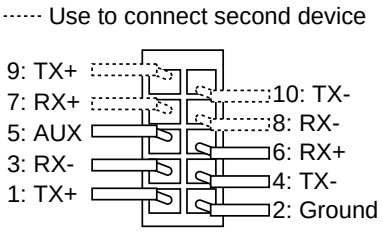
4.1 Interfacing communications

RS-422/435 communications is interfaced using the following connector:

1. 10-pin wire crimp connector at P2

For general RS-422/485 communications methods and practices please see Part 1, Section 5 of this document.

4.1.1 P2 — 10-pin friction lock wire crimp



Pin #	Function	Description
1	TX +	Transmit plus
2	Comm GND	Communications ground only.
3	RX -	Receive minus
4	TX -	Transmit minus
5	Comm GND	Communications ground only.
6	RX +	Receive plus
7	RX +	Receive plus
8	RX -	Receive minus
9	TX +	Transmit plus
10	TX -	Transmit minus

Table 4.1 P2 communications, 10-pin locking wire crimp

Connectivity accessories

Mating connector kit CK-02
(contains 5 connector shells, ribbon cable not included)

Communications converter cable (10'/3.0 m) MD-CC402-001

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4.2 Interfacing DC power

See part 1 of this document, section 3, for recommended power cable configurations.

⚠ CAUTION

OVER VOLTAGE

The DC voltage range for the MDrive AccuStep 23 is +12 to +60 VDC

. Ensure that motor back EMF is factored into your power supply size calculations.

Allow 3.0 A maximum power supply output current per MDrive-23Plus in the system. Actual power supply current will depend on voltage and load.

Failure to follow these instructions can result in equipment damage.

4.2.1 Recommended power supply characteristics

	+12 to +60 VDC
Type	Unregulated linear
Ripple	± 5%
	3.5 A (per MDrive 23)

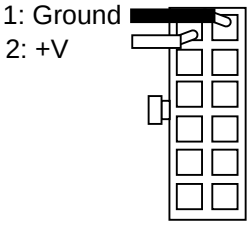
Table 4.2 Recommended power supply characteristics

4.2.2 Recommended wire gauge

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

Table 4.3 Recommended power supply wire gauge

4.2.3 P1 — 12-pin locking wire crimp interface



Pin #	*Signal*	*IMS cable wire colors*
		PD12-1434-FL3
1	Power ground	Black
2	Motor power supply	Red

Table 4.4 Power and ground connections, 12-pin locking wire crimp

Connectivity accessories

Mating connector kit CK-03
(contains 5 connector shells and the appropriate quantity of pins to make 5 cables)

Prototype development cable (10'/3.0 m)..... PD12-1434-FL3

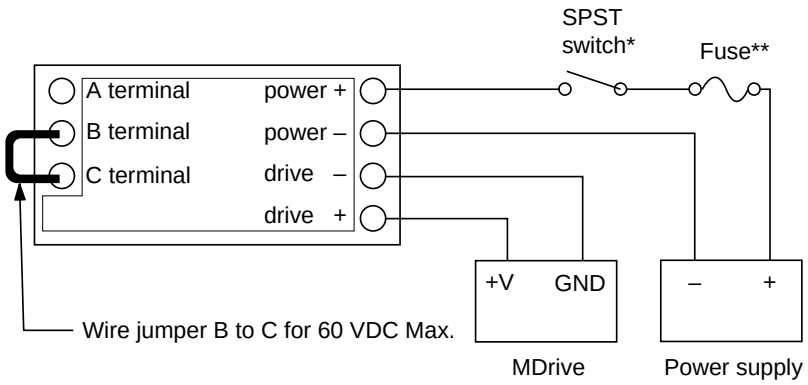
Manufacturer (Tyco) part numbers

Connector shell.....1-794617-2

Pins.....794610-1

4.2.4 Power Interface using Drive Protection Module DPM75

The DPM75 Drive Protection Module will limit surge currents for one (1) MDrive AccuStep 23 at up to 60 VDC to allow switching DC Power.



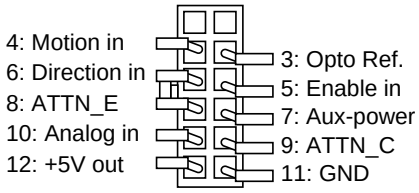
* Do not switch negative side of supply
**Fuse = 6.3 Amp slow blow (recommended: Bussman S505-6.3A or Littelfuse 215006.3). The fuse is optional.

Figure 4.1 DPM75 Drive Protection Module

4.3 Interfacing Logic and I/O

See part 1 of this document, section 6, for logic interface configurations and methods.

4.3.1 P1 — 12-pin locking wire crimp



Pin #	*Signal*	
		PD12-1434-FL3
3	Opto reference	White/blue
4	Motion input	Blue/white
5	Enable input	White/orange
6	Direction input	Orange/white
7	Aux-Power	White/brown
8	Attention output - emitter	White/green
9	Attention output - collector	Green/white
10	Analog input	White/gray
11	Analog input ground	Gray/white
12	+5 VDC output	Brown/white

Table 4.5 Universal input connections, 12-pin locking wire crimp

Connectivity accessories

Mating connector kit CK-03
(contains 5 connector shells and the appropriate quantity of pins to make 5 cables)

Prototype development cable (10'/3.0 m)..... PD12-1434-FL3

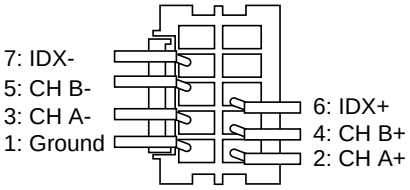
Manufacturer (Tyco) part numbers

Connector shell.....1-794617-2

Pins.....794610-1

4.4 Encoder interface

4.4.1 P4 — 10-pin wire crimp



Pin #	*Signal*	*IMS cable wire color*
		ED-CABLE-JST10
1	GND	White/Brown
2	CH A+	White/green
3	CH A-	Green/white
4	CH B+	White/orange
5	CH B-	Orange/white
6	IDX+	White/blue
7	IDX-	Blue/white
8	No Connect	Brown/white

Table 4.6 P4 - Encoder interface

4.5 Connectivity accessory details

4.5.1 USB to 10-pin wire crimp connector P2 P/N: MD-CC402-001

Electrically isolated in-line USB to RS-422/485 converter pre-wired with mating connector to conveniently program and set configuration parameters

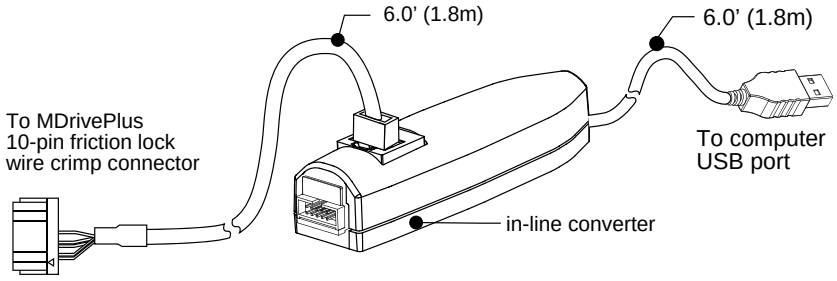
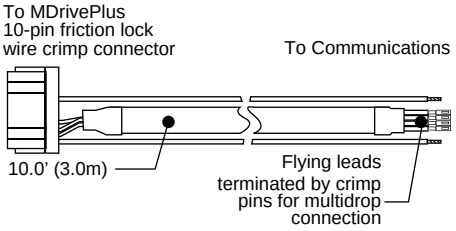


Figure 4.2 MD-CC402-001 communications converter cable

4.6 Prototype development cables

4.6.1 Flying leads to10-pin wire crimp connector P2 -P/N: PD10-1434-FL3

Used in conjunction with the MD-CC402-001 communications converter cable to facilitate multi-drop RS-422/485 communications.



Wire Colors	Function
White/Red Stripe	Aux-Logic
White/Blue Stripe	TX+
Blue/White Stripe	TX-
White/Orange Stripe	RX+
Orange/White Stripe	RX-
Green/White Stripe	GND

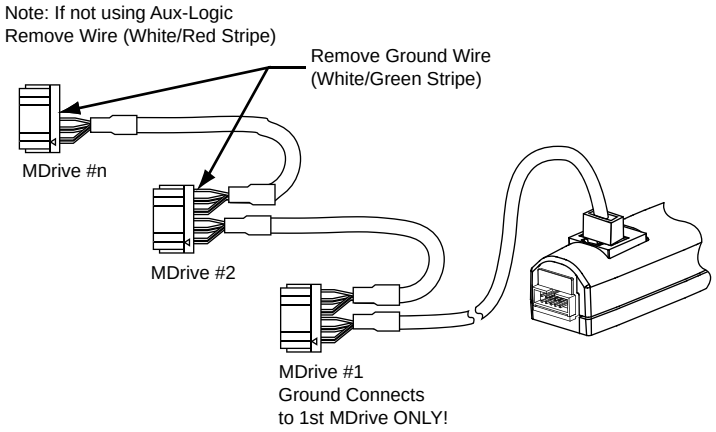


Figure 4.3 Multi-drop communications using the PD10-1434-FL3

Procedure

1) Remove ground wire (unless this is the first system MDrive, green/white stripe)
2) Remove aux-logic (if not used, red/white stripe)
3) Connect pre-crimped flying leads as shown in Figure 5.7 below

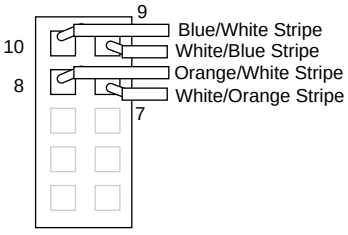
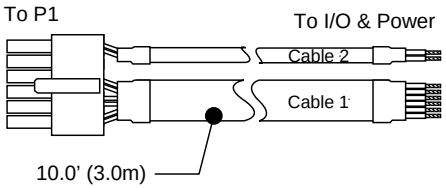


Figure 4.4 Wiring a second PD10-1434-FL3 into the 10-pin wire crimp connector.

4.6.2 P1 — 12-pin locking wire crimp PD12-1434-FL3

The PD12-1434-FL3 prototype development cable is used to rapidly interface the MDrive to the users power, communications and logic interface. This 10’ (3.0 m) cable consists of a 12-pin locking wire crimp connector to plug directly into the MDrive P1 connector with flying leads on the opposite end to interface to power, communications and logic.

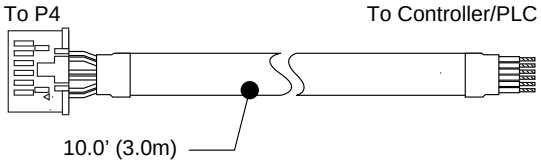


Wire Colors	Function
Gray/White	Analog ground
White/Gray	Analog input
White/Brown	Aux power
Brown/White	+5V output
White/Green	Attn out (e)
Green/White	Attn out (c)
White/Orange	Enable
Orange/White	Direction
White/Blue	Opto Ref
Blue/White	Motion
Black	Power Gnd
Red	+V
Uninsulated	Drain Wire

Figure 4.5 Prototype development cable PD12-1434-FL3

4.6.3 P4 — 10-pin wire crimp ED-CABLE-JST10

The ED-CABLE-JST10 prototype development cable is used to rapidly interface the MDrive optional encoder interface to the users controller. This 10’ (3.0 m) cable consists of a 10-pin locking wire crimp connector to plug directly into the MDrive optional P4 connector with flying leads on the opposite end to interface a control device.



Pair	Wire Colors	Function
1	White/Blue	IDX+
	Blue/White	IDX-
2	White/Orange	CH B+
	Orange/White	CH B-
3	White/Green	CH A+
	Green/White	CH A-
4	White/Brown	Ground
	Brown/White	N/C

Figure 4.6 Encoder interface cable ED-CABLE-JST10

4.7 Mating connector kits

Use to build your own cables. Kit contains 5 mating shells with pins. Cable not supplied. Manufacturer’s crimp tool recommended.

Mates to connector:

P2 10-pin IDC CK-01

P1 12-pin wire crimp CK-03

P4 10-pin wire crimp (encoder) CK-13

MDrive® AccuStep 34ac

Step • Torque • Speed

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Table of Contents

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List of Figures

List of Tables

1 Introduction

1.1 About this manual

This manual is applicable for the MDrive AccuStep 34 ac Step•Torque•Speed.

1.2 MDrive AccuStep overview

The MDrive AccuStep is a high-torque NEMA 34 1.8° brusless step motor integrated with a high performance microstepping drive equipped with advanced AccuStep revolutionary technology for unsurpassed performance.

AccuStep technology offers the system designer a low cost alternative to 3-phase servo motors and brushed DC motors. Because AccuStep is a stepper-based technology, no tuning is required and the loop is closed by means of an integrated encoder.

The MDrive AccuStep 34 ac is available with an input voltage of 120 or 240 VAC and is available in three motor lengths: single, double and triple.

MDrive AccuStep can be configured to operate in three modes:

1. Step (Step/Direction: In step mode the MDrive AccuStep will be controlled by an external step clock signal.
2. Torque (Torque Control): In torque mode, the device will maintain a constant, preset torque output of the motor. The torque may be set in software, or controlled via the analog input using a 0 to +5 V, 0 to +10 V or -10 to +10 V signal.
3. Speed (Speed Control): In speed mode the device will operate as an intelligent speed control, with velocity being controlled via the Analog input by a 0 to +5 V, 0 to +10 V or -10 to +10 V signal.

The AccuStep communicates using RS-422/485 via a 5-pin M12 circular connector.

I/O and logic and encoder interface is accomplished using a 19-pin M23 circular connector.

AC power is interfaced through a 3-pin EURO AC connector at P3

1.2.1 AccuStep configuration utility

The AccuStep configuration utility is an easy to install and use graphical user interface (GUI) for configuring the MDrive AccuStep from an RS-422/485 host. The utility may be download at www.imshome.com. An optional communication converter cable is available for ease of connecting and configuring this product.

AccuStep configuration utility features include:

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- Easy installation via web interface or using CD included with Quick Start kits.
- Automatic communication configuration.
- Will not set out-of-range values.
- Tool-tips display valid range setting for each option.
- Required to set operational mode: step, torque or speed.

1.2.1 Features and benefits

- Integrated microstepping drive/NEMA 23 high torque brushless step motor
- Advanced 2nd generation current control for exceptional performance and smoothness
- 120 or 240 VAC input voltage.
- Configurable
  - Prevents loss of synchronization
  - Selectable option for automatic position correction
  - Optionally powers down the bridge on a locked rotor condition
- Low cost alternative to brush, brushless and servo motors.
- Extremely compact
- 20 microstep resolutions up to 51,200 steps per rev. Includes degrees, arc-minutes and metric.
- Optically isolated logic inputs will accept +5 to +24 VDC signals, sourcing or sinking
- Three operating modes
  - Step: Step/Direction
  - Torque: Torque Control
  - Speed: Speed Control
- Configurable:
  - Motor run/hold current
  - Hold current delay time
  - Analog input voltage range: 0 to +5/0 to +10/-10 to +10 VDC
  - Microstep resolution
  - Input Clock Type: Step/Direction, CW/CCW, Quadrature
  - Programmable digital filtering for clock and direction inputs
- Multi-function isolated attention output
- Options:
  - Control knob
  - Planetary gearbox
- Graphical user interface (GUI) for quick and easy parameter setup

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1.3 Product identification

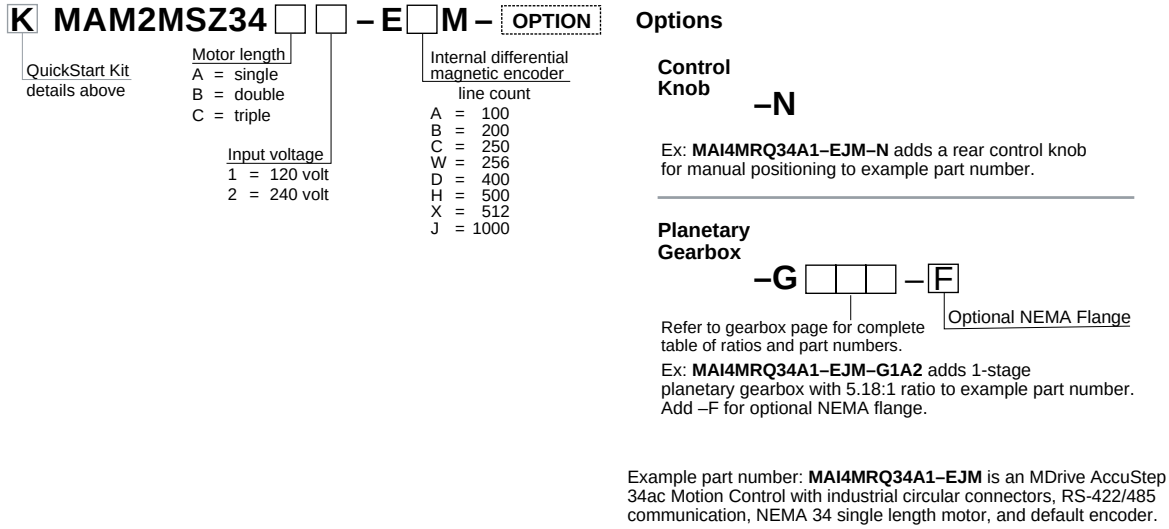

Figure 1.1 Standard product options

1.4 Documentation reference

The following documentation is available for the MDrive AccuStep:

- This product manual, describes the technical data, installation, configuration and programming of the product.
- Quick Reference, describes the basic wiring, connection and use of this product. The quick reference is shipped in printed form with the product.

This documentation is also available for download from the IMS web site at www.imshome.com.

1.5 Product software

The MDrive AccuStep integrated motor and driver uses the AccuStep configuration utility which may be downloaded from www.imshome.com/software_interfaces.html.

Installation and usage instructions are to be found in this document.

The AccuStep configuration utility is required to configure the operating mode and to upgrade the firmware.

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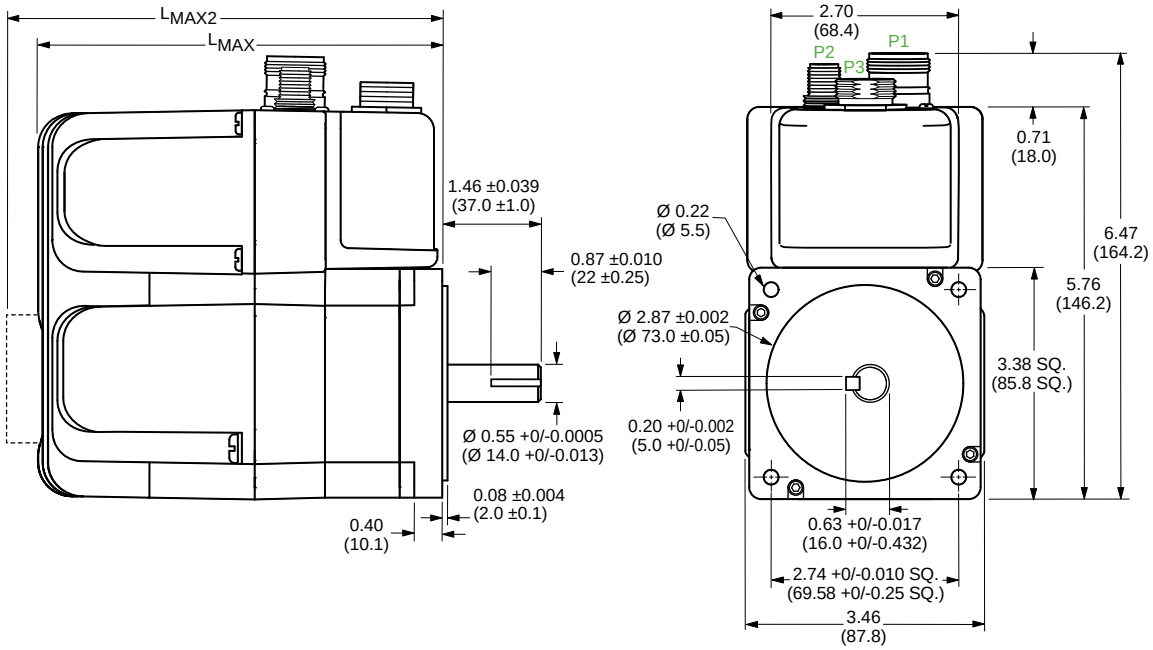
2 Specifications

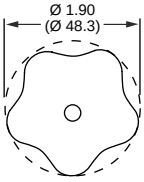
2.1 Mechanical specifications



MDrive AccuStep lengths Inches (mm)

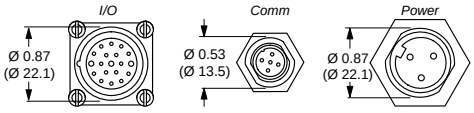
Motor length	L_{MAX} with single shaft or internal encoder	L_{MAX2} with control knob
Single	6.1 (155.0)	7.1 (180.4)
Double	6.9 (174.3)	7.9 (199.7)
Triple	8.4 (214.3)	9.4 (239.7)

L_{MAX2} option



control knob

connectors



P1: 19-pin M23 P2: 5-pin M12 P3: 3-pin Euro AC

Figure 2.1 Mechanical specifications - dimensions in inches (mm)

2.2 General specifications

2.2.1 Electrical specifications

		Condition	Min	Typ	Max	Unit
Input voltage range	120 VAC	—	95	—	132	VAC
	240 VAC	—	95		264	VAC
Aux-Logic Input Voltage*		—	+12	—	+24	VDC
Max Aux-Logic Supply Current (Per MDrive)**		—	—	—	194	mA

** Maintains power to control and feedback circuits [only] when input voltage is removed*

Table 2.1 Electrical specifications

2.2.2 Logic specifications

	Condition	Min	Typ	Max	Unit
Isolated Inputs					
Isolated input voltage range (sourcing or sinking)	Isolated inputs	+5	—	+24	VDC
Current (+5 VDC Opto Reference)	+5 VDC max	—	—	8.7	mA
Current (+24 VDC Opto Reference)	+24 VDC max	—	—	14.6	mA
Attention Output					
Collector-Emitter Output Voltage				60	VDC
Emitter-Collector Output Voltage				7	VDC
Output Current		5.5		42	mA
Encoder Output					
Current	I_{OH}			-20	mA
Current	I_{OL}			20	mA
Voltage	V_{OH}@20 mA	2.4	2.4		VDC
Voltage	V_{OL}@20 mA		0.2	0.4	VDC

Table 2.2 I/O specifications

2.2.3 Communications specifications

Protocol	RS-422/485

Table 2.3 Communications specifications

2.2.4 Thermal specifications

		Min	Typ	Max	Unit
Heat sink temperature	non-condensing humidity	-40	—	+85	ºC
Motor temperature	non-condensing humidity	-40	—	+100	ºC

Table 2.4 Thermal specifications

2.2.5 Motion specifications

Number of microstep resolutions	20

Available microsteps per revolution

200	400	800	1000	1600	2000	3200	5000	6400	10000
12800	20000	25000	25600	40000	50000	51200	36000[1]	21600[2]	25400[3]

1=0.01 deg/µstep 2=1 arc minute/µstep *3=0.001 mm/µstep
** 1" per revolution lead screw*

Digital filter range	50 ns to 12.9 µs (10 MHz to 38.8 kHz)
Clock types	step/direction, up/down, quadrature
Step frequency (max)	5 MHz
Step frequency minimum pulse width	100 ns

Table 2.5 Motion specifications

2.2.6 Motor Specifications

Specification	**Single length**	**Double length**	**Triple length**
Holding torque oz-in (N-cm)	330 oz-in (233)	500 (353)	700 (529)
Detent torque oz-in (N-cm)	10.9 (7.7)	14.16 (10.0)	19.83 (14.0)
Rotor inertia oz-in-sec^2 (kg-cm^2)	0.0142 (1.0)	0.0227 (1.6)	0.0482 (3.4)
Weight motor and driver lb (kg)	6.4 (2.9)	7.7 (3.5)	11.0 (5.0)

Table 2.6 Motor specifications

2..2.7 Speed-force performance curves

120 VAC motor performance

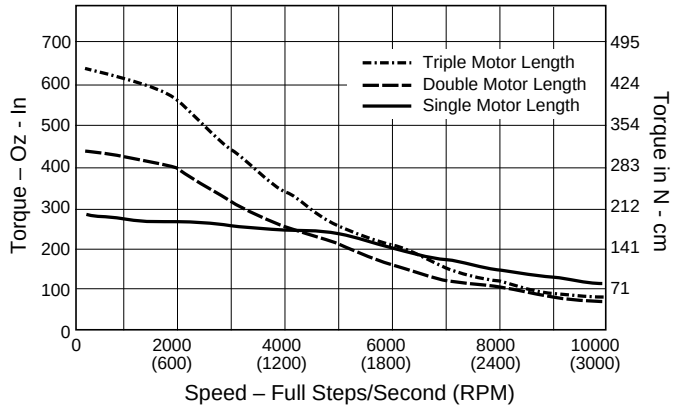


Figure 2.2 Motor performance curve — 120 VAC

240 VAC motor performance

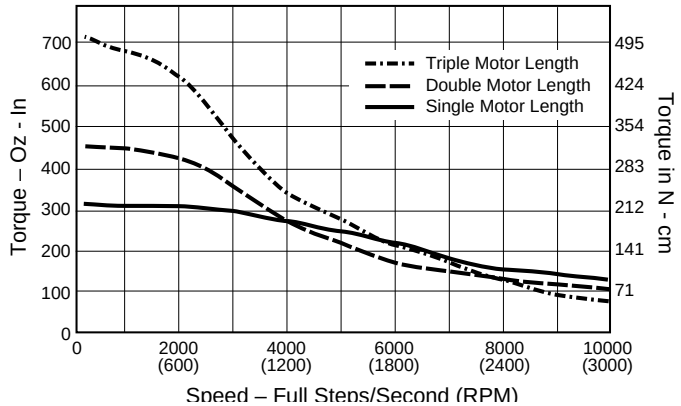
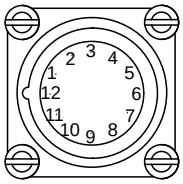


Figure 2.3 Motor performance curve — 240 VAC

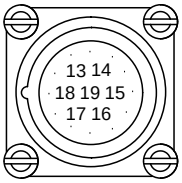
2.4 Connector pin assignment and description

2.4.1 Connector P1 I/O and encoder — 19-pim M23 circular

Outside: Pins 1 -12



Inside: Pins 13 -19

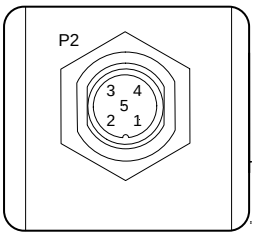


Connectivity Options
Cordset
Straight MD-CS100-000
Right-angle: MD-CS101-000

Pin #	Function	Description
1	OPTO	The opto reference will determine the sink-source state of the I/O. If grounded, the inputs will be sourcing, if +5 to + 24 VDC the inputs will be sinking.
2	ENABLE	Enable/Disable the bridge.
3	IDX +	Encoder + index mark
4	CH B+	Encoder channel B+ output
5	CH B–	Encoder channel B– output
6	N/C	Not connected
7	CH A+	Encoder channel A+ output
8	ATTN OUT_C	Open collector Attention output - error/fault output, function configured in software.
9	AUX-PWR	The AUX power input will keep the micro powered in the absence of motor power.
10	+5V	+5 VDC output (10kΩ pot +).
11	GND	Analog input ground (10kΩ pot —).
12	N/C	Not connected
13	DIR	Direction input..
14	IDX–	Encoder – index mark
15	CH A–	Encoder channel A– output
16	ANALOG	Analog input used in Torque and Speed modes of operation. Input may be configured to accept the following voltage ranges: 0 to +5V, 0 to +10V or -10 to +10V. If using a 10kΩ pot, the centertap is connected here.
17	ATTN OUT_E	Open emitter Attention output - error/fault output, function configured in software.
18	MOTION	Motion input: If in ASM mode this will operate as a Step Clock input. If in ASO or AST mode this will operate as a stop/start input for the internal clock generator.
19	AUX-GND	Aux-ground

Table 2.7 P1 Powerand logic

2.4.2 Connector P2 RS-422/485 communications

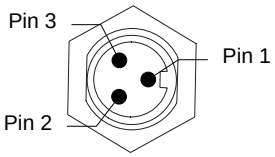


Pin #	Function	Description
1	TX -	Transmit minus
2	TX +	Transmit plus
3	RX +	Receive plus
4	RX -	Receive minus
5	Comm Gnd	Communications ground

Table 2.8 P2 communications, 5-pin M12F circular connector

Connectivity Options
USB to RS-422/485 Converter:
MD-CC401-001

2.4.3 Connector P3 — AC power



Pin #	Function	Description
1	Earth	Chassis (earth) ground
2	Line	AC line
3	Neutral	AC neutral

Table 2.9 P3 DC power, 2-pin locking wire crimp

Connectivity Options
Cordset
Straight MD-CS200-000
Right-angle: MD-CS201-000

2.5 Setup parameters

Active setup parameters will vary for each mode of operation. Please see the section appropriate to the mode of operation being utilized for available parameters and commands.

2.6 Encoder Line Counts Available

Internal Encoder

Internal differential magnetic encoders with index mark are available with the MDrive AccuStep.

Line counts: 100, 200, 250, 256, 400, 500, 512,, 1000

Differential Locking Cable (6.0'/1.8m) ED-CABLE-JST10

2.7 Options

Control Knob

The MDrive AccuStep is available with a factory-mounted rear control knob for manual shaft positioning.

Planetary Gearbox

Efficient, low maintenance plan

2.8 Connectivity

QuickStart Kit

For rapid design verification, all-inclusive QuickStart Kits have communication converter, prototype development cable, encoder cable, instructions and CD for MDrive AccuStep initial functional setup and system testing.

Communication Converters

Electrically isolated, in-line converters pre-wired with mating connectors to conveniently set/program communication parameters for a single MDrive product via a PC's USB port. Length 12.0' (3.6m).

Mates to connector:

P2 5-pinM12 circular..... MD-CC401-001

Prototype Development Cables

Speed test/development with pre-wired mating connectors that have flying leads other end. Length 10.0' (3.0m).

Mates to connector:

P1 19-pin M23 (straight)..... MD-CS100-000

P1 19-pin M23 (right-angle)..... MD-CS101-000

P3 Euro AC (straight) MD-CS200-000

P3 Euro AC (right-angle) MD-CS201-000

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3 Connection and interface

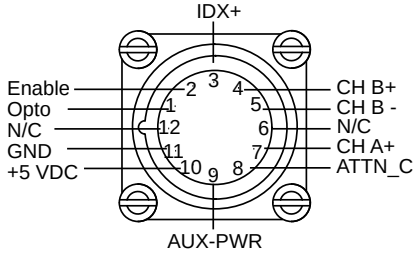
> **⚠ CAUTION**
>
> HOT PLUGGING
>
> Do not connect or disconnect power, logic, or communications while the device is in a powered state.
>
> **Failure to follow these instructions can result in equipment damage.**

3.1 Interfacing I/O

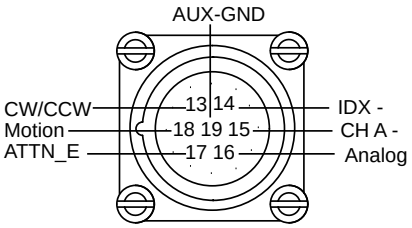
See part 1 of this document, section 6, for I/O interface configurations and methods.

3.1.1 P1 — 19-pin M23 circular connector

Outside: Pins 1 -12



Inside: Pins 13 -19



Pin Numbers	*Signal*	*Prototype development cable wire colors (twisted pairs)*
1	OPTO	Violet
2	ENABLE	Red
3	IDX +	Grey
4	CH B+	Red/Blue
5	CH B–	Green
6	N/C	Blue
7	CH A+	Gray/Pink
8	ATTN OUT_C	White/Green
9	AUX-PWR	White/Yellow
10	+5V	White/Gray
11	GND	Black
12	N/C	Green/Yellow*
13	DIR	Yellow/Brown
14	IDX–	Brown/Green
15	CH A–	White
16	ANALOG	Yellow
17	ATTN OUT_E	Pink
18	MOTION	Gray/Brown
19	AUX-GND	Brown

Table 3.1 I/O connections, 19-pin M23 circular

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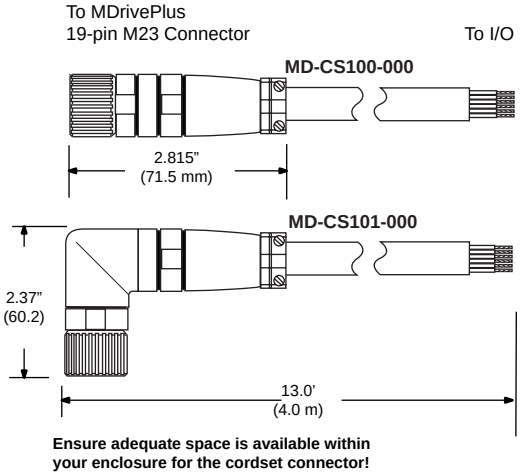
3.1.2 Connectivity option — 19 conductor cordset

19-pin M23 single-ended cordsets are offered to speed prototyping. Measuring 13.0’ (4.0m) long, they are available in either straight or right angle termination. PVC jacketed cables come with a foil shield and unconnected drain wire.

Straight Termination..... MD-CS100-000

Right Angle..... MD-CS101-000

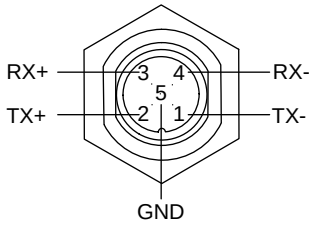


Wire Colors	Function
Violet	OPTO
Red	ENABLE
Gray	IDX +
Red/Blue	CH B+
Green	CH B–
Blue	N/C
Gray/Pink	CH A+
White/Green	ATTN OUT_C
White/Yellow	AUX-PWR
White/Gray	+5V
Black	GND
Green/Yellow	N/C
Yellow/Brown	DIR
Brown/Green	IDX–
White	CH A–
Yellow	ANALOG
Pink	ATTN OUT_E
Gray/Brown	MOTION
Brown	AUX-GND

Figure 3.1 MD-CS10x-000 cordset

3.2 Interfacing RS-422/485 communications

3.2.1 P2 — 5-pin M12 circular connector (male)



Pin #	Function	Description
1	TX -	Transmit minus
2	TX +	Transmit plus
3	RX +	Receive plus
4	RX -	Receive minus
5	Comm GND	Communications ground only. Do not ground aux-logic to this pin.

Table 3.2 P2 communications, 5-pin M12F circular connector

3.2.2 Communications converter — MD-CC401-000

Electrically isolated in-line USB to RS-422/485 converter pre-wired with mating connector to conveniently program and set configuration parameters.

No mating connector kit is available for this connector style. Compatible mating connectors may be purchased from the following suppliers:

- Phoenix
- Turck
- RDE Connectors

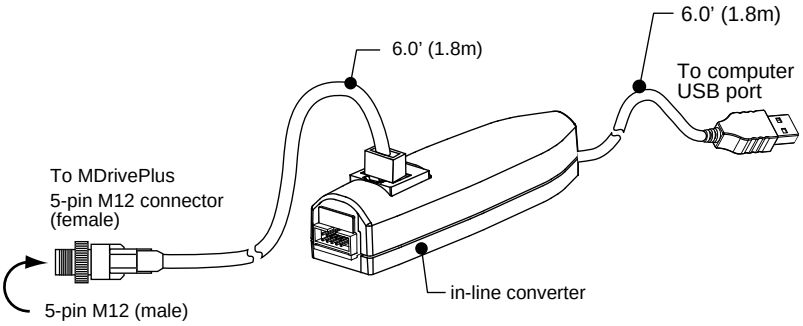
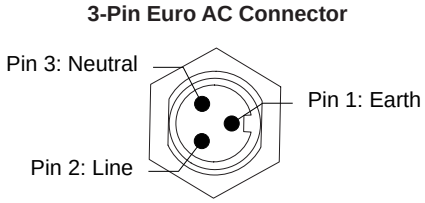


Figure 3.2 MD-CC401-001 communications converter

3.3 Interfacing AC power

3.3.1 P3 — 3-pin Euro AC



Pin number	Signal	European (IEC) color code
1	Earth	Yellow/Green
2	Line	Brown
3	Neutral	Blue

Table 3.3 AC standard wire colors

3.3.2 MD-CS20x-000 cordset

The single-end three conductor cordsets are used with the MDrive AC. Measuring 13.0’ (4.0m) long, they are available in either straight or right angle termination. IEC color code, oil-resistant yellow PVC jacket, IP68 and NEMA 6P rated.

Straight Termination MD-CS200-000

Right Angle Termination MD-CS201-000

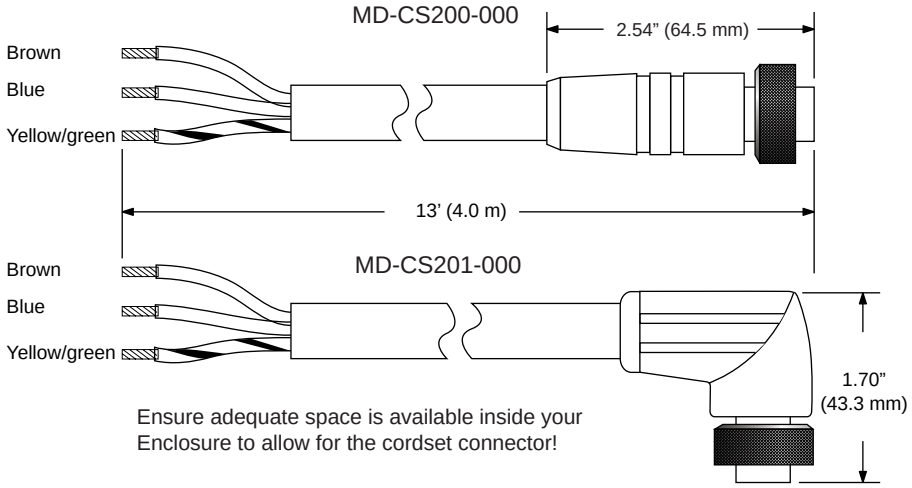


Figure 3.3 MD-CS20x-000

MDrive® AccuStep Linear Actuator Step • Torque • Speed

Part 3: Detailed specifications and connectivity information

1. MDrive AccuStep 23

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MDrive® AccuStep 23 Linear Actuator Step•Torque•Speed

Integrated Motor and Driver

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1 Introduction

1.1 About this manual

This manual is applicable for the MDrive AccuStep Step•Torque•Speed.

1.2 MDrive AccuStep overview

The MDrive AccuStep is a high-torque NEMA 23 1.8° brusless step motor integrated with a high performance microstepping drive equipped with advanced AccuStep revolutionary technology for unsurpassed performance.

AccuStep technology offers the system designer a low cost alternative to 3-phase servo motors and brushed DC motors. Because AccuStep is a stepper-based technology, no tuning is required and the loop is closed by means of an integrated encoder.

The MDrive AccuStep features an input voltage range of +12 to +60 VDC and is available in four motor lengths: single, double, triple and quad.

MDrive AccuStep can be configured to operate in three modes:

1. Step (Step/Direction: In step mode the MDrive AccuStep will be controlled by an external step clock signal.
2. Torque (Torque Control): In torque mode, the device will maintain a constant, preset torque output of the motor. The torque may be set in software, or controlled via the analog input using a 0 to +5 V, 0 to +10 V or -10 to +10 V signal.
3. Speed (Speed Control): In speed mode the device will operate as an intelligent speed control, with velocity being controlled via the Analog input by a 0 to +5 V, 0 to +10 V or -10 to +10 V signal.

The AccuStep communicates using RS-422/485 via a 10-pin wire crimp style connector.

I/O and power interface is accomplished using a 12-pin wire crimp connector.

An encoder interface is provided via a 10-pin locking wire crimp connector.

1.2.1 AccuStep configuration utility

The AccuStep configuration utility is an easy to install and use graphical user interface (GUI) for configuring the MDrive AccuStep from an RS-422/485 host. The utility may be download at www.imshome.com. An optional communication converter cable is available for ease of connecting and configuring this product.

AccuStep configuration utility features include:

- Easy installation via web interface or using CD included with Quick Start kits.

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- Automatic communication configuration.
- Will not set out-of-range values.
- Tool-tips display valid range setting for each option.
- Required to set operational mode: step, torque or speed.

1.2.1 Features and benefits

- Integrated microstepping drive/NEMA 23 high torque brushless step motor
- Advanced 2nd generation current control for exceptional performance and smoothness
- Single supply +12 to +60 VDC
- Configurable
  - Prevents loss of synchronization
  - Selectable option for automatic position correction
  - Optionally powers down the bridge on a locked rotor condition
- Low cost alternative to brush, brushless and servo motors.
- Extremely compact
- 20 microstep resolutions up to 51,200 steps per rev. Includes degrees, arc-minutes and metric.
- Optically isolated logic inputs will accept +5 to +24 VDC signals, sourcing or sinking
- Three operating modes
  - Step: Step/Direction
  - Torque: Torque Control
  - Speed: Speed Control
- Configurable:
  - Motor run/hold current
  - Hold current delay time
  - Analog input voltage range: 0 to +5/0 to +10/-10 to +10 VDC
  - Microstep resolution
  - Input Clock Type: Step/Direction, CW/CCW, Quadrature
  - Programmable digital filtering for clock and direction inputs
- Multi-function isolated attention output
- Options:
  - Control knob
  - Planetary gearbox
- Single supply
- Interface
  - I/O and Power: 12-pin locking wire crimp connector
  - Communications: 10-pin friction lock wire crimp connector
  - Encoder: 10-pin locking wire crimp connector
- Graphical user interface (GUI) for quick and easy parameter setup

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1.3 Documentation reference

The following documentation is available for the MDrive AccuStep:

- This product manual, describes the technical data, installation, configuration and programming of the product.
- Quick Reference, describes the basic wiring, connection and use of this product. The quick reference is shipped in printed form with the product.

This documentation is also available for download from the IMS web site at www.imshome.com.

1.4 Product software

The MDrive AccuStep integrated motor and driver uses the AccuStep configuration utility which may be downloaded from www.imshome.com/software_interfaces.html.

Installation and usage instructions are to be found in this document.

The AccuStep configuration utility is required to configure the operating mode and to upgrade the firmware.

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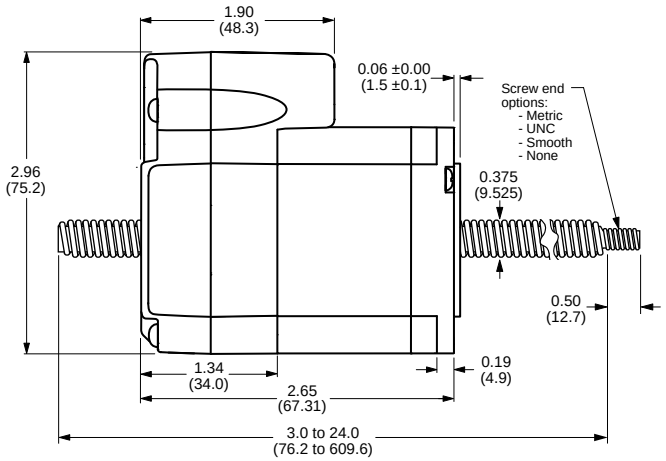
2 Specifications

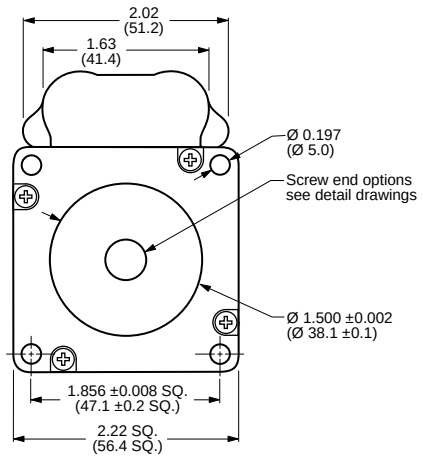
2.1 Mechanical specifications

2.1.1 Non-Captive Shaft

Side view



Front view



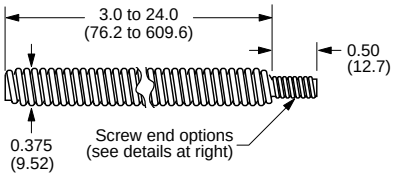
Load limit
Nominal load limit: 200 lbs (91 kg)

Screw specifications

Screw material
MDrive Linear Actuator precision rolled lead screws are designed specifically for motion control applications to deliver maximum life and quiet operation. Corrosion resistant and non-magnetic, screws are manufactured from premium grade stainless steel.

Screw coating
An optional teflon screw coating is available for smooth operation and extended life.

Standard screw
Dimensions in inches (mm)



Lead options

inches (mm)	Travel/revolution		Travel/full step	
Screw G	0.3750	(9.525)	0.001875	(0.0476)
Screw A	0.200	(5.08)	0.001	(0.0254)
Screw B	0.1670	(4.233)	0.000835	(0.0212)
Screw D	0.0833	(2.116)	0.0004165	(0.0106)

Screw end options

Threaded end	Metric end: M6 x 1.0mm thread to within 0.03" (0.76mm) of shoulder	UNC end: 1/4-20 UNC-2A thread to within 0.05" (1.3mm) of shoulder
Smooth end	Ø 0.2362" ±0.001 (Ø 6mm ±0.003)	
None	—	

Cantilevered loads

Unsupported loads and side loading are not recommended for non-captive shaft MDrive® linear actuator products.

Calculating screw length

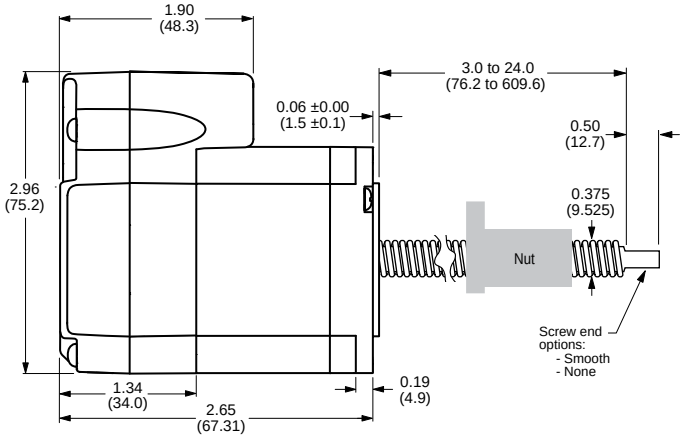
Screw length = [mounting surface plate thickness] + [1.8" (45.7mm)] + [desired stroke length]

Figure 2.1 External shaft mechanical specifications - dimensions in inches (mm)

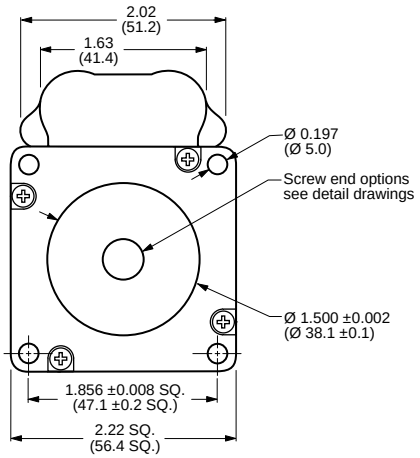
2.1.2 External Shaft

2.1.2 External Shaft

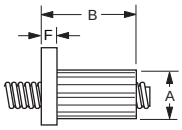
Side view



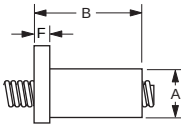
Front view



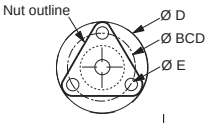
Nut detail / load limit



General purpose nut
Flange shape: round
Load limit: 60 lbs (27 kg)
Purpose: for applications not requiring anti-backlash and wear compensation.



Anti-backlash nut
Flange shape: triangle
Load limit: 25 lbs (11 kg)
Purpose: backlash free operation for high accuracy and low drag torque.



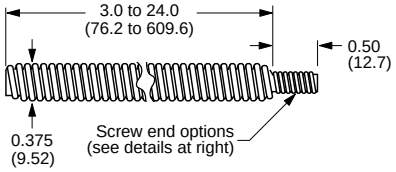
inches (mm)	A	B	D	E	F	BCD	*load limit*	*drag torque*
General purpose	0.71 (18.0)	1.50 (38.1)	1.5 (38.1)	0.20 (5.08)	0.20 (5.08)	1.125 (28.6)	60lbs/ 27kg	free wheeling
Anti-backlash	0.82 (20.8)	1.875 (47.63) max	1.5 (38.1)	0.20 (5.08)	0.20 (5.08)	1.125 (28.6)	25lbs/ 11kg	1–3

Screw specifications

Screw material
MDrive Linear Actuator precision rolled lead screws are corrosion resistant and non-magnetic, manufactured from premium grade stainless steel.

Screw coating
An optional teflon screw coating is available for smooth operation and extended life.

Standard screw
Dimensions in inches (mm)



Lead options

inches (mm)	Travel/revolution		Travel/full step	
Screw G	0.3750	(9.525)	0.001875	(0.0476)
Screw A	0.200	(5.08)	0.001	(0.0254)
Screw B	0.1670	(4.233)	0.000835	(0.0212)
Screw D	0.0833	(2.116)	0.0004165	(0.0106)

Screw end options

Threaded end	Metric end: M6 x 1.0mm thread to within 0.03" (0.76mm) of shoulder	UNC end: 1/4-20 UNC-2A thread to within 0.05" (1.3mm) of shoulder
Smooth end	Ø 0.2362" ±0.001 (Ø 6mm ±0.003)	
None	—	

Cantilevered loads
Loads for external shaft MDrive® linear actuator products MUST BE supported. Side loading is not recommended.

Calculating stroke length
Available stroke length = [screw length] – [nut length] – [mounting surface plate thickness]

Figure 2.2 Sealed mechanical specifications

2.2 General specifications

2.2.1 Electrical specifications

	Condition	Min	Typ	Max	Unit
Input voltage range	—	+12	—	+60	VDC
Max power supply current	—	—	—	2.5*	Amps

**per unit, actual current depends on voltage and load.*

Table 2.1 Electrical specifications

2.2.2 Logic specifications

	Condition	Min	Typ	Max	Unit
Isolated Inputs					
Isolated input voltage range (sourcing or sinking)	Isolated inputs	+5	—	+24	VDC
Current (+5 VDC Opto Reference)	+5 VDC max	—	—	8.7	mA
Current (+24 VDC Opto Reference)	+24 VDC max	—	—	14.6	mA
Attention Output					
Collector-Emitter Output Voltage				60	VDC
Emitter-Collector Output Voltage				7	VDC
Output Current		5.5		42	mA
Encoder Output					
Current	I_{OH}			-20	mA
Current	I_{OL}			20	mA
Voltage	V_{OH}@20 mA	2.4	2.4		VDC
Voltage	V_{OL}@20 mA		0.2	0.4	VDC

Table 2.2 I/O specifications

2.2.3 Communications specifications

Protocol	RS-422/485

Table 2.3 Communications specifications

2.2.4 Thermal specifications

		Min	Typ	Max	Unit
Heat sink temperature	non-condensing humidity	-40	—	+85	ºC
Motor temperature	non-condensing humidity	-40	—	+100	ºC

Table 2.4 Thermal specifications

2.2.5 Motion specifications

Number of microstep resolutions	20

Available microsteps per revolution

200	400	800	1000	1600	2000	3200	5000	6400	10000
12800	20000	25000	25600	40000	50000	51200	36000[1]	21600[2]	25400[3]

1=0.01 deg/µstep 2=1 arc minute/µstep *3=0.001 mm/µstep
** 1" per revolution lead screw*

Digital filter range	50 ns to 12.9 µs (10 MHz to 38.8 kHz)
Clock types	step/direction, up/down, quadrature
Step frequency (max)	5 MHz
Step frequency minimum pulse width	100 ns

Table 2.5 Motion specifications

2.3 Actuator motor specifications

Holding torque		90 oz-in (64 N-cm)
Rotor inertia		0.0025 oz-in-sec^2 (0.18 kg-cm^2)
Maximum thrust (Non-captive)	General purpose	200 lbs (91 kg)
	With anti-backlash nut	—
Maximum thrust (External)	General purpose	60 lbs (27 kg)
	With anti-backlash nut	25 lbs (11 kg)
Maximum repeatability (Non-captive)	General purpose	0.005" (0.127 mm)
	With anti-backlash nut	—
Maximum repeatability (External)	General purpose	0.005" (0.127mm)
	With anti-backlash nut	0.0005" (0.0127 mm)
Maximum screw misalignment		± 1°
Wieght without screw		22.0 oz (625.0 g)

Table 2.8 Linear actuator motor specifications

2.2.9 Speed-force performance curves

The curves shown here are representative of the motor performance with the AccuStep circuitry turned of (AS=0). Motor performance with AccuStep enabled will depend on the configuration of the AccuStep parameters.

+24 VDC

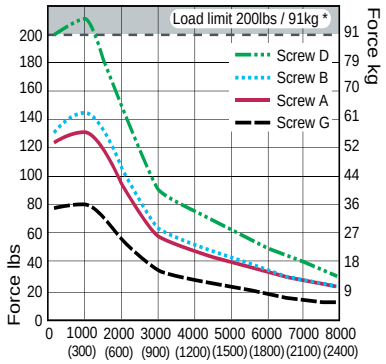


Figure 2.3 Motor performance curve — +24 VDC

+48 VDC

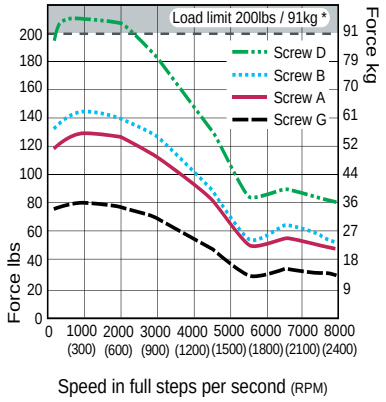


Figure 2.4 Motor performance curve — +48 VDC

+60 VDC

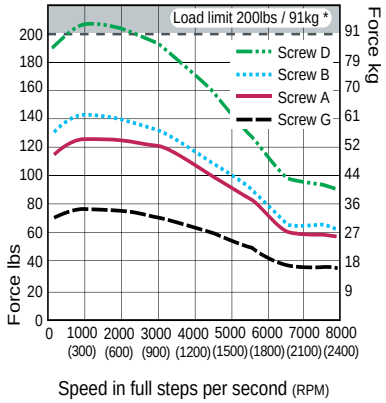
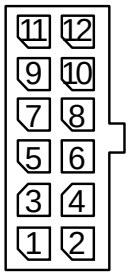


Figure 2.5 Motor performance curve — +60 VDCr

2.4 Connector pin assignment and description

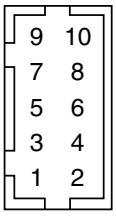
2.4.1 Connector P1 Power and Logic



Pin #	Function	Description
1	PWR GND	Power supply return (ground).
2	+V	+12 to +75 VDC motor power.
3	OPTO	The opto reference will determine the sink-source state of the I/O. If grounded, the inputs will be sourcing, if +5 to + 24 VDC the inputs will be sinking.
4	MOTION	Motion input: If in ASM mode this will operate as a Step Clock input. If in ASO or AST mode this will operate as a stop/start input for the internal clock generator.
5	ENABLE	Enable/Disable the bridge.
6	DIR	Direction input..
7	AUX-PWR	The AUX power input will keep the micro powered in the absence of motor power.
8	ATTN OUT_E	Open emitter Attention output - error/fault output, function configured in software.
9	ATTN OUT_C	Open collector Attention output - error/fault output, function configured in software.
10	ANALOG	Analog input used in Torque and Speed modes of operation. Input may be configured to accept the following voltage ranges: 0 to +5V, 0 to +10V or -10 to +10V. If using a 10kΩ pot, the centertap is connected here.
11	GND	Analog input ground (10kΩ pot —).
12	+5V	+5 VDC output (10kΩ pot +).

Table 2.7 P1 Powerand logic

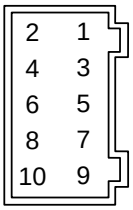
2.4.2 Connector P2 RS-422/485 communications



Pin #	Function	Description
1	TX+	Transmit + output
2	COM GND	Communications Ground (Resistor isolated)
3	RX –	Receive – input
4	TX–	Transmit – output
5	COM GND	Communications Ground (Resistor isolated)
6	RX+	Receive + input
7	RX+	Receive + input
8	RX –	Receive – input
9	TX+	Transmit + output
10	TX–	Transmit – output

Table 2.8 P2 RS-422/485 communications

2.4.3 Connector P3 encoder output



Pin #	Function	Description
1	GND	Encoder ground
2	CH A+	Encoder channel A+ output
3	CH A–	Encoder channel A– output
4	CH B+	Encoder channel B+ output
5	CH B–	Encoder channel B– output
6	IDX +	Encoder + index mark
7	IDX–	Encoder – index mark
8	N/C	Not connected
9	N/C	Not connected
10	N/C	Not connected

Table 2.9 P3 optional encoder output

2.5 Setup parameters

Active setup parameters will vary for each mode of operation. Please see the section appropriate to the mode of operation being utilized for available parameters and commands.

2.6 Encoder Line Counts Available

Internal Encoder

Internal differential magnetic encoders with index mark are available with the MDrive AccuStep.

Line counts: 100, 200, 250, 256, 400, 500, 512,, 1000

Differential Locking Cable (6.0'/1.8m) ED-CABLE-JST10

2.7 Options

Drive Protection Module

The function of the DPM75 Drive Protection Module is to limit the surge current and voltage to a safe level when DC input power is switched on and off to the MDrive.

Control Knob

The MDrive AccuStep is available with a factory-mounted rear control knob for manual shaft positioning.

Planetary Gearbox

Efficient, low maintenance planetary gearboxes are offered assembled with the MDrive AccuStep

2.8 Connectivity

QuickStart kit

For rapid design verifi cation, all-inclusive QuickStart Kits have communication converter, prototype development cable(s), instructions and CD for MDrive AccuStep initial functional setup and system testing.

Communication Converters

Electrically isolated, in-line converters pre-wired with mating connectors to conveniently set/program communication parameters for a single MDrive product via a PC's USB port. Length 12.0' (3.6m).

Mates to connector:

P2 10 pin wire crimp MD-CC302-001

Prototype Development Cables

Speed test/development with pre-wired mating connectors that have flying leads other end. Length 10.0' (3.0m).

Mates to connector:

P1 12-pin locking wire crimp..... PD12-1434-FL3

P4 10-pin wire crimp (encoder) ED-CABLE-JST10

Mating Connector Kits

Use to build your own cables. Kit contains 5 mating shells with pins. Cable not supplied. Manufacturer's crimp tool recommended.

Mates to connector:

P2 10-pin wire crimp..... CK-02

P1 12-pin wire crimp..... CK-03

P4 10-pin wire crimp..... CK-13

3 Mounting and connection recommendations

⚠ CAUTION

LEAD RESTRAINT

Some linear actuator mounting configurations require that the MDrive move along the screw. Ensure that all cabling is properly restrained to provide strain relief on connection points..

Failure to follow these instructions can result in equipment damage.

⚠ CAUTION

SCREW MISALIGNMENT

Ensure that support for the screw is in place as to not exceed the maximum misalignment of ±1°.

Failure to follow these instructions can result in equipment damage.

⚠ CAUTION

CANTILEVER LOADS

Loads for external shaft MDrive linear actuator products MUST BE supported. Side loading is not recommended.

Failure to follow these instructions can result in equipment damage.

3.1 Mounting

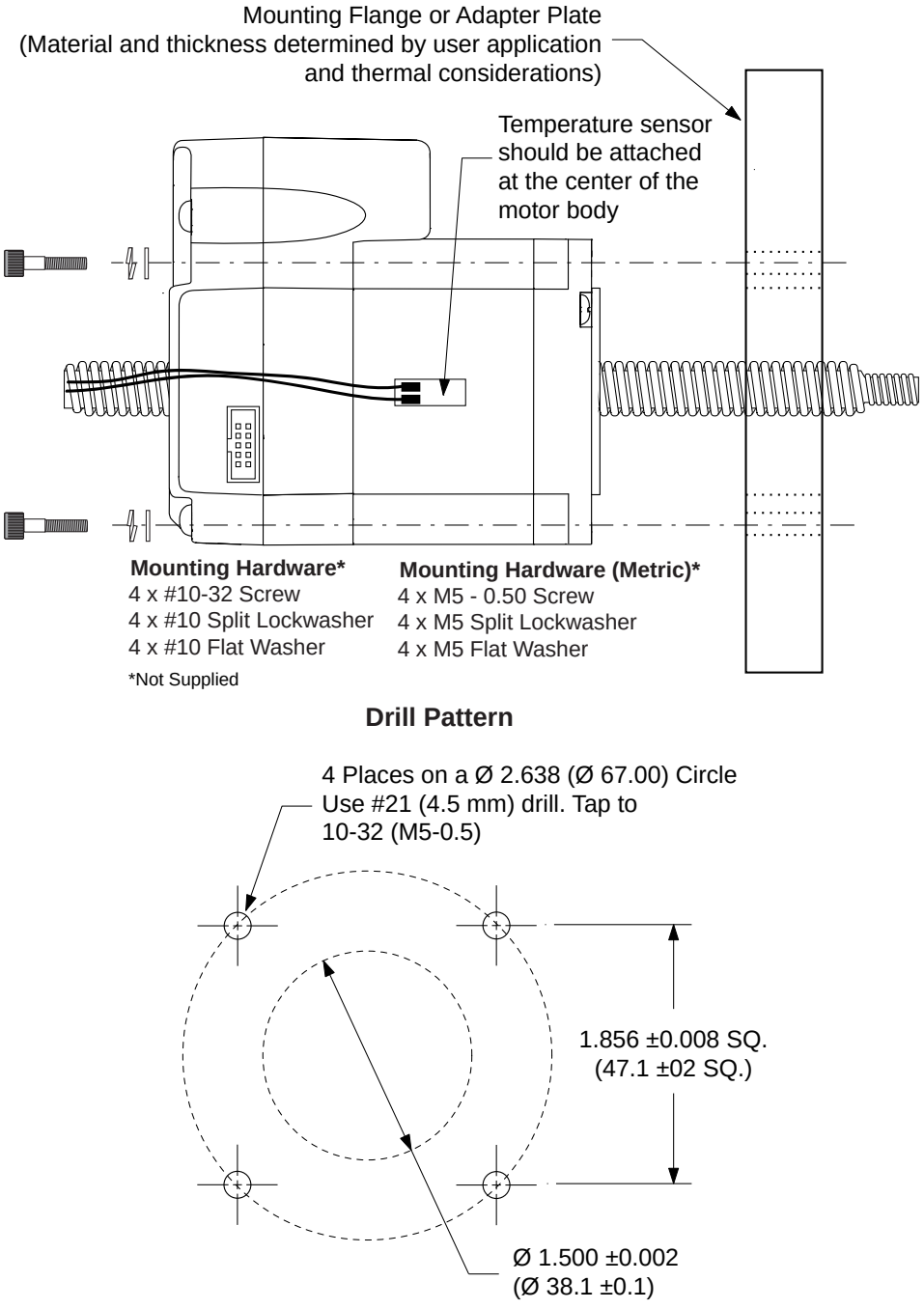


Figure 3.1 Mdrive linear actuator mounting and drill pattern

3.2 Layout and interface guidelines

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

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

Power supply leads to the MDrive23 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.

3.2.1 Rules of wiring

- Power Supply and Motor wiring should be shielded twisted pairs, and run separately from signal-carrying wires.
- A minimum of one twist per inch is recommended.
- Motor wiring should be shielded twisted pairs using 20 gauge, or for distances of more 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 of 18 gauge for less than 4 amps DC and 16 gauge for more than 4 amps DC.

3.2.2 Rules of shielding

- The shield must be tied to zero-signal reference potential. It is necessary that the signal be earthed or grounded, for the shield to become earthed or grounded. Earthing or grounding the shield is not effective if the signal is not earthed or grounded.
- •Do not assume that Earth ground is a true Earth ground. Depending on the distance from the main power cabinet, it may be necessary to sink a ground rod at the 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.

3.3 Recommended wiring

The following wiring/cabling is recommended for use with the MDrive23:

Logic Wiring.....22 AWG

Wire Strip Length.....0.25” (6.0 mm)

Power and Ground .....20 AWG

3.3.1 Recommended mating connectors and pins

Communications

10-pin wire crimp (P2).....Hirose DF11-10DS-2C

Crimp contact for 10-pin wire crimp (22 AWG) DF11-22SC

Crimp contact for 10-pin wire crimp (24 - 28 AWG)..... DF11-2428SC

Crimp Contact for 10-pin wire crimp (30 AWG)..... DF11-30SC

Logic and Power

The following mating connectors are recommended for the MDrive

12-pin Locking Wire Crimp Connector Shell.....Tyco 1-794617-2

Crimp Pins.....Tyco 794610-1

3.4 Securing power leads and logic leads

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

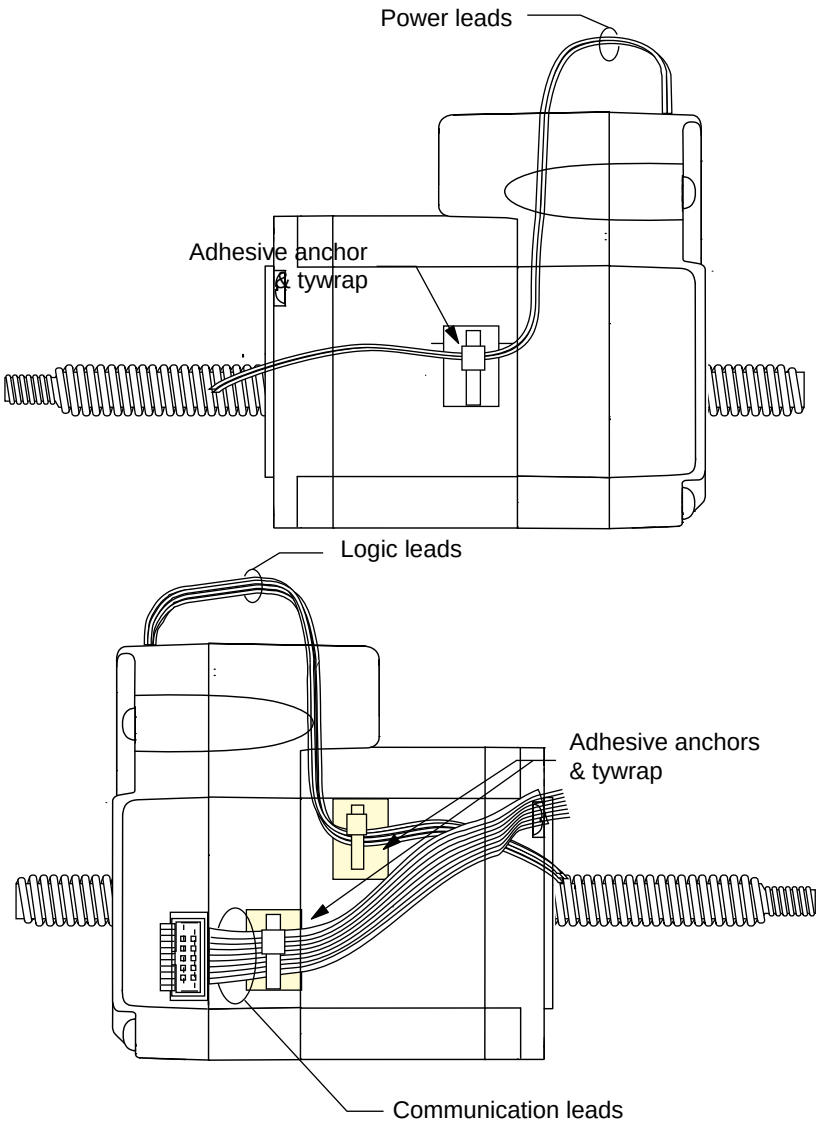


Figure 3.2 Securing leads

3.5 Anti-Backlash nut assembly and installation

3.5.1 Notes and warnings

- Do not use a wrench on the stainless steel cam of the nut.
- Do not oil the mechanism of the nut.
- Do not install the note into an interference fit bore (mechanism will not work).

3.5.2 Installation

To install threaded model nuts, simply hand tighten until shoulder is flush with mounting surface. A small amount of Loctite thread compound such as #277 can be used to prevent loosening. Alternatively, a pin can be installed to mechanically lock the threads.

Flanged models can be mounted to either the front or rear face of the flange.

Before use, it is recommended that the stainless steel preload mechanism be turned so that the caming surfaces move down the ramps. Once play is felt, allow the mechanism to slowly unwind again to establish the proper preload. (It is possible in assembly to inadvertently twist the cam creating excessive drag torque. This procedure will correct this.)

Using lubricant on the lead screw threads is recommended. This extends the life of the nut and reduces heat generation, noise and vibration. TriGEL-300S or TriGEL-1200SC is recommended.

3.5.3 Removal from screw

If it is necessary to remove the nut from your screw, you may lock the mechanism so that it can be immediately reinstalled without re-setting the preload. This can be done by wrapping tape around the junction between the stainless steel cam and the plastic nut halves. This will prevent the cam from turning when the nut is removed from screw. Remember to remove tape after installation.

For immediate transfer from one screw to another, hold the nut together between your thumb and forefinger so that it cannot expand axially. Remove the nut and install it on the second screw. It may be helpful to prevent the cam from turning with your remaining fingers as you transfer. If the nut becomes disassembled or looses its preload for any reason, follow the steps listed in the assembly procedure below.

.5.4 Assembly procedure

1) Insert spring tang into cam slot.

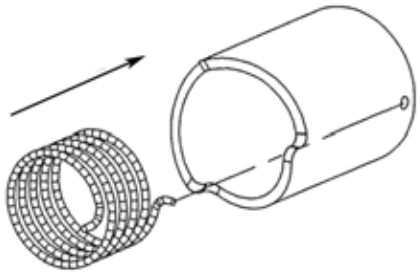


Figure 3.3 Insert spring tang

2) Ensure that the spring is engaged.

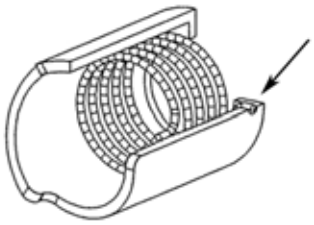


Figure 3.4 Spring engaged

3) Insert opposite tang into front nut slot or hole (dependant on size). Use the slot or hole that will allow the the cam to be positioned closest to the bottom of the ramp.

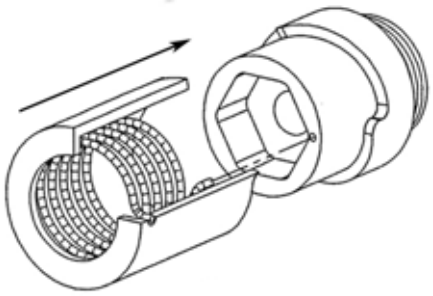


Figure 3.5 Insert opposite tang

1) With washer installed, insert the back nut into the front nut.

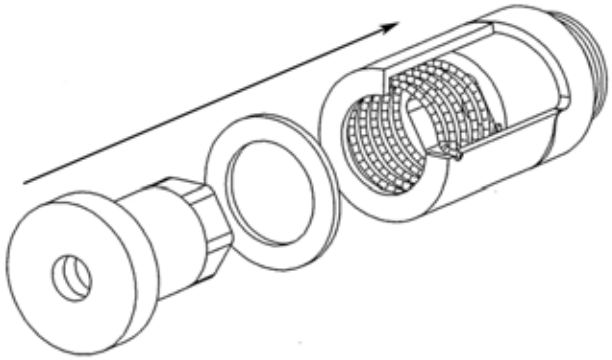


Figure 3.6 Inserting the back nut

2) With the cam held at the bottom of the ramp, thread the entire nut onto the screw starting with the front nut. After the entire nut is threaded onto the screw, release the cam to observe the gap distance (X on the drawing). The gap distance (X) should be about one-third of the full ramp distance, but no more than half.

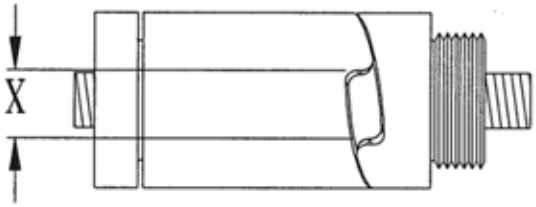


Figure 3.7 Measuring the gap distance

3) If the gap distance is incorrect, unthread the nut just enough to allow the back nut to disengage from the screw. Pull the back nut off and rotate to the next index position and reinsert back into the front nut. With the cam held at the bottom of the ramp, thread the entire nut back onto the screw. Release the cam and verify the correct gap distance. If still not correct repeat this step.

4) Once the back nut has been properly clocked to yield the correct gap distance, unthread the nut again just enough to disengage the back nut from the screw, but do not remove from the nut. Pull the cam away from the ramp and rotate in the clockwise direction for two ramp settings, then hold the cam at the bottom of the second ramp. Be careful not to allow the back nut to rotate with respect to the front nut while completing this task. With the cam held at the bottom of the second ramp, push the back nut into the front nut and thread the entire nut onto the screw.

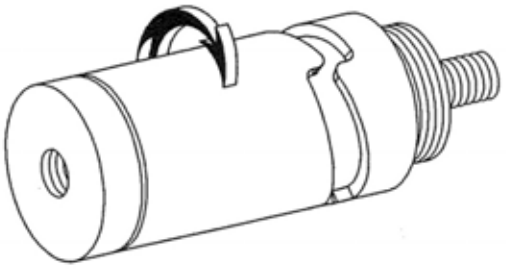


Figure 3.8 Pre-loading the nut

5) The anti-backlash nut is now pre-loaded and fully assembled.

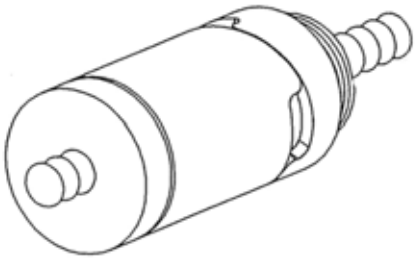


Figure 3.9 Nut pre-loaded and fully assembled

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4 Connection and interface

⚠ DANGER

EXPOSED SIGNALS

Hazardous voltage levels may be present if using an open frame power supply to power the product.

Failure to follow these instructions will result in death or serious injury.

⚠ CAUTION

SWITCHING DC POWER/HOT PLUGGING

Do not connect or disconnect power, logic, or communications while the device is in a powered state.

Remove DC power by powering down at the AC side of the DC power supply.

Failure to follow these instructions can result in equipment damage.

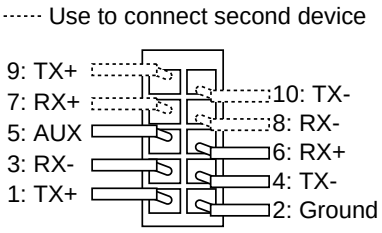
4.1 Interfacing communications

RS-422/435 communications is interfaced using the following connector:

1. 10-pin wire crimp connector at P2

For general RS-422/485 communications methods and practices please see Part 1, Section 5 of this document.

4.1.1 P2 — 10-pin friction lock wire crimp



Pin #	Function	Description
1	TX +	Transmit plus
2	Comm GND	Communications ground only.
3	RX -	Receive minus
4	TX -	Transmit minus
5	Comm GND	Communications ground only.
6	RX +	Receive plus
7	RX +	Receive plus
8	RX -	Receive minus
9	TX +	Transmit plus
10	TX -	Transmit minus

Table 4.1 P2 communications, 10-pin locking wire crimp

Connectivity accessories

Mating connector kit CK-02
(contains 5 connector shells, ribbon cable not included)

Communications converter cable (10'/3.0 m) MD-CC402-001

Revision R032610

4.2 Interfacing DC power

See part 1 of this document, section 3, for recommended power cable configurations.

⚠ CAUTION
OVER VOLTAGE The DC voltage range for the MDrive AccuStep 23 is +12 to +60 VDC . Ensure that motor back EMF is factored into your power supply size calculations. Allow 3.0 A maximum power supply output current per MDrive-23Plus in the system. Actual power supply current will depend on voltage and load. **Failure to follow these instructions can result in equipment damage.**

4.2.1 Recommended power supply characteristics

	+12 to +60 VDC
Type	Unregulated linear
Ripple	± 5%
	3.5 A (per MDrive 23)

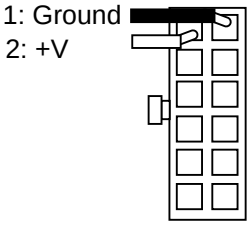
Table 4.2 Recommended power supply characteristics

4.2.2 Recommended wire gauge

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

Table 4.3 Recommended power supply wire gauge

4.2.3 P1 — 12-pin locking wire crimp interface



Pin #	*Signal*	*IMS cable wire colors*
		PD12-1434-FL3
1	Power ground	Black
2	Motor power supply	Red

Table 4.4 Power and ground connections, 12-pin locking wire crimp

Connectivity accessories

Mating connector kit CK-03
(contains 5 connector shells and the appropriate quantity of pins to make 5 cables)

Prototype development cable (10'/3.0 m)..... PD12-1434-FL3

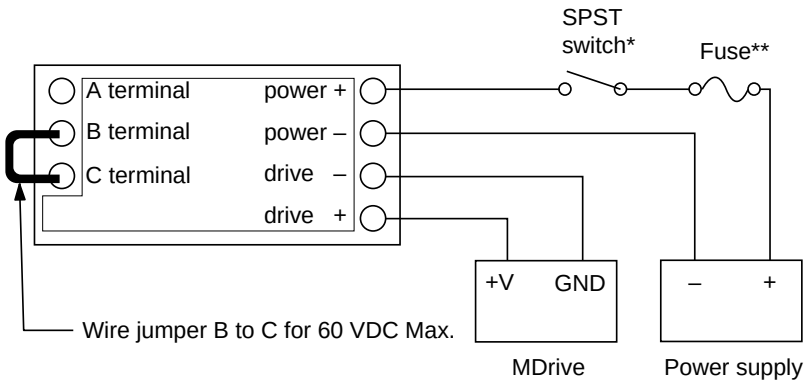
Manufacturer (Tyco) part numbers

Connector shell.....1-794617-2

Pins.....794610-1

4.2.4 Power Interface using Drive Protection Module DPM75

The DPM75 Drive Protection Module will limit surge currents for one (1) MDrive AccuStep 23 at up to 60 VDC to allow switching DC Power.



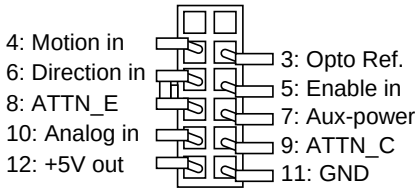
* Do not switch negative side of supply
**Fuse = 6.3 Amp slow blow (recommended: Bussman S505-6.3A or Littelfuse 215006.3). The fuse is optional.

Figure 4.1 DPM75 Drive Protection Module

4.3 Interfacing Logic and I/O

See part 1 of this document, section 6, for logic interface configurations and methods.

4.3.1 P1 — 12-pin locking wire crimp



Pin #	***Signal***	
		PD12-1434-FL3
3	Opto reference	White/blue
4	Motion input	Blue/white
5	Enable input	White/orange
6	Direction input	Orange/white
7	Aux-Power	White/brown
8	Attention output - emitter	White/green
9	Attention output - collector	Green/white
10	Analog input	White/gray
11	Analog input ground	Gray/white
12	+5 VDC output	Brown/white

Table 4.5 Universal input connections, 12-pin locking wire crimp

Connectivity accessories

Mating connector kit CK-03
(contains 5 connector shells and the appropriate quantity of pins to make 5 cables)

Prototype development cable (10'/3.0 m)..... PD12-1434-FL3

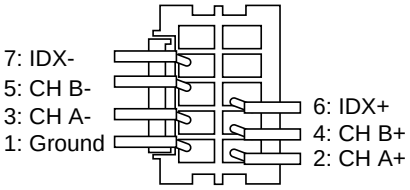
Manufacturer (Tyco) part numbers

Connector shell.....1-794617-2

Pins.....794610-1

4.4 Encoder interface

4.4.1 P4 — 10-pin wire crimp



Pin #	*Signal*	*IMS cable wire color*
		ED-CABLE-JST10
1	GND	White/Brown
2	CH A+	White/green
3	CH A-	Green/white
4	CH B+	White/orange
5	CH B-	Orange/white
6	IDX+	White/blue
7	IDX-	Blue/white
8	No Connect	Brown/white

Table 4.6 P4 - Encoder interface

4.5 Connectivity accessory details

4.5.1 USB to 10-pin wire crimp connector P2 P/N: MD-CC402-001

Electrically isolated in-line USB to RS-422/485 converter pre-wired with mating connector to conveniently program and set configuration parameters

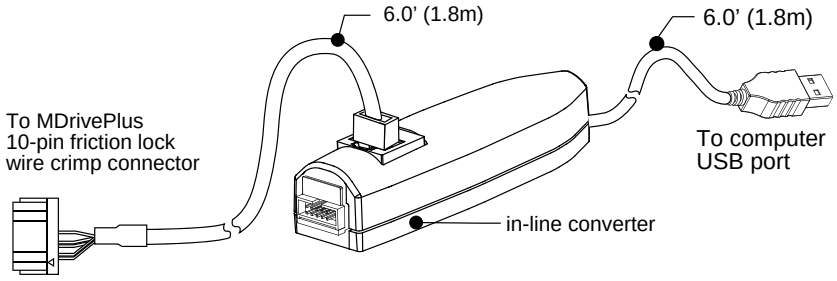
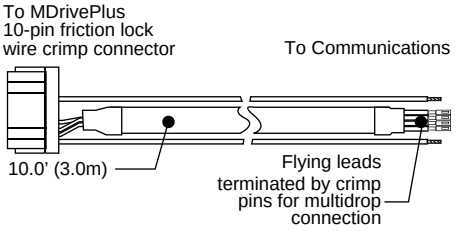


Figure 4.2 MD-CC402-001 communications converter cable

4.6 Prototype development cables

4.6.1 Flying leads to10-pin wire crimp connector P2 -P/N: PD10-1434-FL3

Used in conjunction with the MD-CC402-001 communications converter cable to facilitate multi-drop RS-422/485 communications.



Wire Colors	Function
White/Red Stripe	Aux-Logic
White/Blue Stripe	TX+
Blue/White Stripe	TX-
White/Orange Stripe	RX+
Orange/White Stripe	RX-
Green/White Stripe	GND

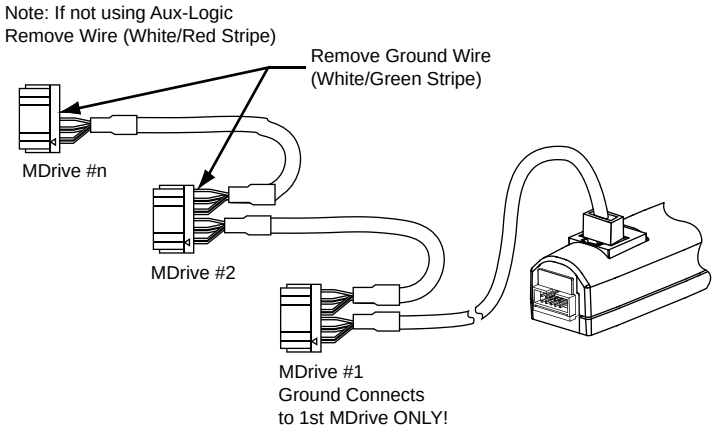


Figure 4.3 Multi-drop communications using the PD10-1434-FL3

Procedure

1) Remove ground wire (unless this is the first system MDrive, green/white stripe)
2) Remove aux-logic (if not used, red/white stripe)
3) Connect pre-crimped flying leads as shown in Figure 5.7 below

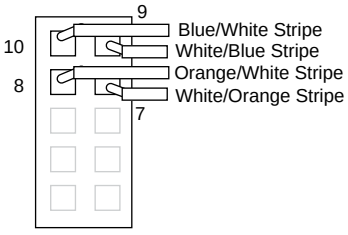
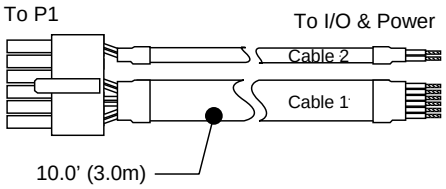


Figure 4.4 Wiring a second PD10-1434-FL3 into the 10-pin wire crimp connector.

4.6.2 P1 — 12-pin locking wire crimp PD12-1434-FL3

The PD12-1434-FL3 prototype development cable is used to rapidly interface the MDrive to the users power, communications and logic interface. This 10’ (3.0 m) cable consists of a 12-pin locking wire crimp connector to plug directly into the MDrive P1 connector with flying leads on the opposite end to interface to power, communications and logic.

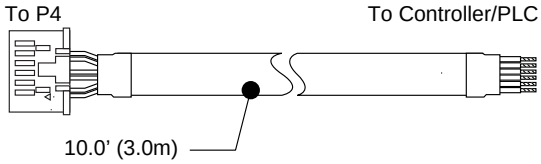


Wire Colors	Function
Gray/White	Analog ground
White/Gray	Analog input
White/Brown	Aux power
Brown/White	+5V output
White/Green	Attn out (e)
Green/White	Attn out (c)
White/Orange	Enable
Orange/White	Direction
White/Blue	Opto Ref
Blue/White	Motion
Black	Power Gnd
Red	+V
Uninsulated	Drain Wire

Figure 4.5 Prototype development cable PD12-1434-FL3

4.6.3 P4 — 10-pin wire crimp ED-CABLE-JST10

The ED-CABLE-JST10 prototype development cable is used to rapidly interface the MDrive optional encoder interface to the users controller. This 10’ (3.0 m) cable consists of a 10-pin locking wire crimp connector to plug directly into the MDrive optional P4 connector with flying leads on the opposite end to interface a control device.



Pair	Wire Colors	Function
1	White/Blue	IDX+
	Blue/White	IDX-
2	White/Orange	CH B+
	Orange/White	CH B-
3	White/Green	CH A+
	Green/White	CH A-
4	White/Brown	Ground
	Brown/White	N/C

Figure 4.6 Encoder interface cable ED-CABLE-JST10

4.7 Mating connector kits

Use to build your own cables. Kit contains 5 mating shells with pins. Cable not supplied. Manufacturer’s crimp tool recommended.

Mates to connector:

P2 10-pin IDC CK-01

P1 12-pin wire crimp CK-03

P4 10-pin wire crimp (encoder) CK-13

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