Overview

Step Motor Products

IDC has a wide range of microstepping products to meet your motion control needs. These products are:

- NextStep®, S6002 Microstepping Drives
- SmartStep, S6961, S6962 Programmable Microstepping Indexer/Drives
- 961, 962 Stand-alone Programmable Indexers
- 14 step motors ranging from low torque 17 frame single stack to high torque 42 frame step motors
- Microstepping Gearmotors

Microstepping Drives

Consider the NextStep® and S6002 high performance microstepping drives for your next application. These drives use innovative anti-resonance technology to achieve clearly superior step motor performance, and improve machine throughput. For a comparison of the NextStep® and S6002, see the table below.

NextStep®	S6002
Single Axis	Two Axis
0.1–7.9 amps	0.1–6 amps
Anti-Resonance Circuitry Internal Fan/Heatsink Auto-Adjusting Current Loop	Anti-Resonance Circuitry Conventional Heatsink Rotary Inductance Adjustment
See page G-12	See page G-16

Standalone Programmable Motion Controller and Drive Packages

IDC's SmartStep, S6961 (single axis) and S6962 (two axis) Smart Drives are standalone, packaged, microstepping indexer/drives that were designed for ease of use and to minimize implementation time. When using these products, you can literally have your system up and running in a matter of minutes! Some of the features to be found in these products are:

- Fully integrated motion controller/drive/power supply/operator interface
- High performance microstepping drives that utilize the latest in anti-resonance circuitry to optimize motor performance
- Powerful and flexible IDeal™ programming language
- Optional keypad that functions as both a programming tool and an operator interface
- See page G-19 for more information.

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Overview

Stand-alone Programmable Motion Controllers

For applications that require a stand-alone motion controller, consider the 961 one-axis and 962 two-axis indexers. Some features to be found with the 961/2 are:

- Integrated Motion Controller/Power Supply/Operator Interface/and I/O rack provides the user with an industrial motion control solution
- The 962 allows a user to control servo and stepper drives from the same controller
- Multiple drives can be run from one command signal. Useful for multi-axis applications where each axis is performing identical moves.
- 30 I/O, 8 OPTO 22 I/O slots
- Uses our easy-to-use IDeal™ programming language
- See page G-42 for more information

Microstepping Motors

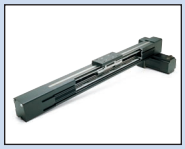
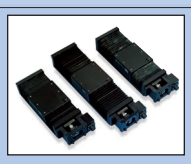
IDC has recently expanded our microstepping motor line to 14 motors. IDC's step motor family provides you with:

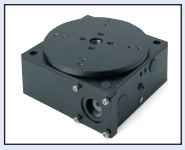
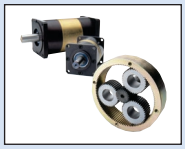
- Wide range of motor Torque/Speed curves for system optimization
- Motor sizes from 17 to 42 frame
- S series step motors with standard speed/torque ranges, or P, K series step motors with enhanced speed/torque curves
- Optional encoder
- See page G-46 for more information

Microstepping Gearmotors

To provide the exact speed and torque required for your application, an IDC microstepping gearmotor may be the most appropriate solution.

- Both inline and right angle gearmotors available
- IDC microstepping gearmotors come in gear ratios from 3:1 to 700:1
- Both Performance Planetary and Value Planetary gearmotors available providing the user with a wide range of performance
- See page I-1 for more information

Product Description			Maximum Speed in/sec [mm/sec]
Electric Cylinder Rod Type		Highest Force (Thrust) Clean, Hydraulic Replacement Compact Cross Section Extends into Work Area	52.5 [1300]
Rodless Screw Drive		High Force (Thrust) High Repeatability Long Travel Load Carrying Capability	40 [1000]
Rodless Belt Drive		Very High Speed Quiet Operation Long Travel Load Carrying Capability	120 [3000]
Linear Servo Module		Highest Speeds Highest Accelerations High Repeatability Low Maintenance, Long Life High Moment Loads	196 [5000]
Cartesian Systems Complete 2 & 3 Axis Assemblies		Fully Engineered Multi-Axis Systems Large Work Area — 60 x 108 inches Multiple & Custom Configurations Long Travel	120 [3000]
Positioning Tables		Smoothest Motion High Precision (Straightness & Flatness) Highest Moment Loads High Accuracy XY, XYZ, and XYθ Configurations	51.3 [1300]

Product Description			Maximum Speed rev/sec (rev/min)
Rotary Tables		Accuracy to 3 arc minutes Ratios to 180:1 Low Static Torque Runout to 0.001"	30 [1800] input 0.66 [40] output
Gearmotors Right Angle & Inline		High Value/Low Cost High Input Speeds Ratio to 700:1	108 [6500] input 28 [1650] output

Note 1: Electric Cylinders are designed primarily for thrust applications where loads are supported externally. See engineering section for more details.

Note 2: Thrust ratings are based on mechanical limits rather than motor limits unless indicated.

Note 3: Maximum Speed and Thrust ratings are not necessarily achievable simultaneously.

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Repeatability in [mm] [Note 5]	Max. Thrust lbs [N] [Note 2]	Max. Payload lbs [N]	Max. Travel in [mm]	Section
to 0.0005 [0.013]	5620 [25000]	[Note 1]	60 [1524]	A-1
to 0.0005 [0.013]	to 700 [3110]	300 [1335]	108 [2743]	B-1
to 0.004 [0.1]	300 [1335]	300 [1335]	108 [2734]	B-1
to 0.0003 [0.008] [Note 4]	80 Contin. [358] 281 Peak [1250]	300 [1335]	57.5 [1462]	C-1
[Note 6]	[Note 6]	to 150 [667]	60 x 108 [1524 x 2743]	D-1
to 0.00016 [0.004] bi-directional	to 234 [1041]	to 1482 [6592]	to 60 [1524]	E-1

Repeatability	Axial Load lbs (N)	Radial Load lbs (N)	Diameter	Section
0.2 arc minutes	to 214 [952]	to 108 [480]	6 to 12 inches [152 to 304.8 mm]	E-1
7 to 25 arc minutes	to 1260 [5605]	to 1260 [5605]	Frame Size 17, 23, 34, 42	I-1

Note 4: Repeatability is dependent on encoder resolution, load, friction, settling time and gain settings in the servo control.

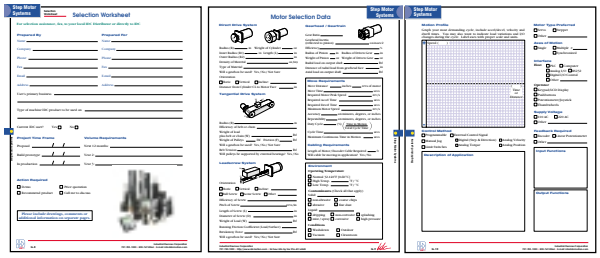
Note 5: Repeatability is uni-directional unless otherwise specified.

Note 6: Cartesian systems can be configured using a combination of IDC technologies. Repeatability and Max. Thrust are dependent on the technology selected.

MicroStepping System Selection Checklist

The following steps describe the process of selecting a microstepping system which matches your application requirements.

☐ **1) Complete the Product Selection Worksheet**
(pages G-8 through G-10)



☐ **2) Peak Speed Requirement (see Engineering Section)**
In order to calculate the peak speed of the motor, your mechanical system must be known, or you must make an assumption as to which mechanical system will meet your application's requirements. Calculate the peak speed required for your motor to complete the desired motion profile. Several motion profiles are covered in the Engineering Section. One commonly chosen motion profile is the triangular profile.

Formula: Triangular Move Profile (peak speed = average speed x 2).

Sample Calculation:

Desired Motion: Move 5 revolutions in 0.2 seconds
Peak Speed Requirement: (5 revolutions ÷ 0.2 seconds) x 2 = 50 revolutions/second

☐ **3) Peak Torque Requirement (see Engineering Section)**
Determine the peak torque requirement for your motor to complete the desired motion profile. Adjust your peak torque requirement by 30% to include the recommended safety factor for step motor systems.

Formula: Peak Torque = $T_{applied} + T_{gravity} + T_{accel} + T_{friction}$

Sample Calculation:
Peak torque = 10 + 50 + 250 + 20 = 330 oz-in

Sample Calculation:

330 oz-in x 1.3 = 429 oz-in (required for selection of step motor)

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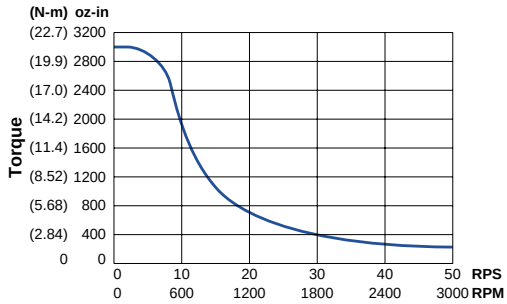
☐ **4) Select Torque-Speed Curve**

Search through the motor performance curves on pages G-47 through G-60 to find a step motor which meets your application's torque and speed requirements.

K42 Motor Torque/Speed Curve



☐ **5) Decide which IDC step motor control system is most appropriate for your application.**

IDC offers microstepping drives, programmable microstepping indexer/drive systems, and motion controllers.

- NextStep® Microstepping Drive—see page G-12.
- S6002 Two-Axis MicroStepping Drive—see page G-16.
- SmartStep MicroStepping Indexer/Drive—see page G-26.
- S6961, S6962 One- or Two-Axis MicroStepping Indexer/Drive—see page G-32.
- 961, 962 One- or Two-Axis Packaged Standalone Indexer—see page G-42.

☐ **6) Decide if a gearmotor is appropriate.**

A gearmotor may be more appropriate for your application than simply a motor-only solution. The information needed to make this determination can be found by reviewing:

- Motor Specifications, pages G-47 through G-60
- Gearhead Specifications, Section I
- Gearmotor How-to-Order, page I-1
- Motor How-to-Order, page G-46

☐ **7) Proceed to Motor and Control *How-to-Order* Pages**

You have now selected the IDC step motor and step motor control system most appropriate for your application. Proceed to the Motor *How-to-Order* page (G-46) and the *How-to-Order* page for the IDC control system you selected.

Selection Worksheet

For selection assistance, fax, to your local IDC Distributor or directly to IDC

Prepared By

Name _____

Company _____

Phone _____

Fax _____

Email _____

Address _____

Prepared For

Name _____

Company _____

Phone _____

Fax _____

E-mail _____

Address _____

User's primary business _____

_____

Type of machine IDC product to be used on _____

_____

Current IDC user? Yes ☐ No ☐

Project Time Frame

Proposal ____/____/____

Build prototype ____/____/____

In production ____/____/____

Volume Requirements

Next 12 months: _____

Year 2: _____

Year 3: _____

Action Required

☐ Demo ☐ Price quotation

☐ Recommend product ☐ Call me to discuss

Please include drawings, comments or additional information on separate pages.

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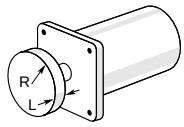
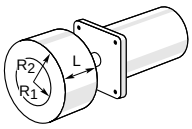
Motor Selection Data

Direct Drive System





Radius (R):_____ in Weight of Cylinder _____ oz

Inner Radius (R1) _____ in Length (L)_____ in

Outer Radius (R2) _____ in

Density of Material _____ oz/in^3

Type of Material _____

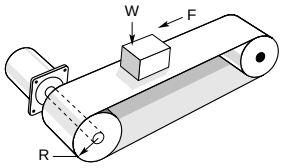
Will a gearbox be used? Yes / No / Not Sure

Orientation

☐ Horiz ☐ Vertical ☐ Incline: _____

Distance from Cylinder CL to Motor Face _____ in

Tangential Drive System



Radius (R) _____ in

Efficiency of belt or chain _____

Weight of load plus belt or chain (W) _____ lbf

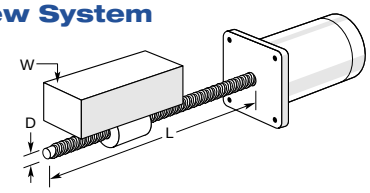
Weight of Pulleys _____ lbf Friction (F)_____ lbf

Will a gearbox be used? Yes / No / Not Sure

Belt Tension _____ lbf

Will pulleys be supported by external bearings? Yes / No

Leadscrew System



Orientation

☐ Horiz ☐ Vertical ☐ Incline: _____

☐ Ball Screw ☐ Acme Screw ☐ Other _____

Efficiency of Screw _____

Pitch of Screw _____ revs/in

Length of Screw (L) _____ in

Diameter of Screw (D) _____ in

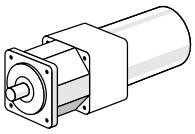
Weight of Load (W) _____ lbf

Running Friction Coefficient (Load/Surface) _____

Breakaway Force _____ lbf

Will a gearbox be used? Yes / No / Not Sure

Gearhead / Geartrain



Gear Ratio _____

Gearhead Inertia (reflected to pinion) _____ oz-in-sec^2

Efficiency _____ %

Radius of Pinion ___ in Radius of Driven Gear ___ in

Weight of Pinion ___ oz Weight of Driven Gear ___ oz

Radial load on output shaft _____ lbf

Distance of radial load from gearhead face _____ in

Axial load on output shaft _____ lbf

Move Requirements

Move Distance _____ inches _____ revs of motor

Move Time _____ secs

Required Motor Peak Speed _____ rev/s

Required Accel Time _____ secs

Required Decel Time _____ secs

Minimum Motor Speed _____ rev/s

Accuracy _____ arcminutes, degrees, or inches

Repeatability _____ arcminutes, degrees, or inches

Duty Cycle _____ (%) $\left(\frac{\text{Time in Motion}}{\text{Total Cycle Time}}\right)$

Cycle Time _____ secs

Maximum Continuous Time in Motion _____ secs

Cabling Requirements

Length of Motor / Encoder Cable Required _____ ft

Will cable be moving in application? Yes / No

Environment

Operating Temperature

☐ Normal 32-140°F [0-60°C]

☐ High Temp. _____ °F / °C

☐ Low Temp. _____ °F / °C

Contaminants (Check all that apply)

Solid: _____

☐ non-abrasive ☐ coarse chips

☐ abrasive ☐ fine dust

Liquid: _____

☐ dripping ☐ non-corrosive ☐ splashing

☐ mist / spray ☐ corrosive ☐ high pressure

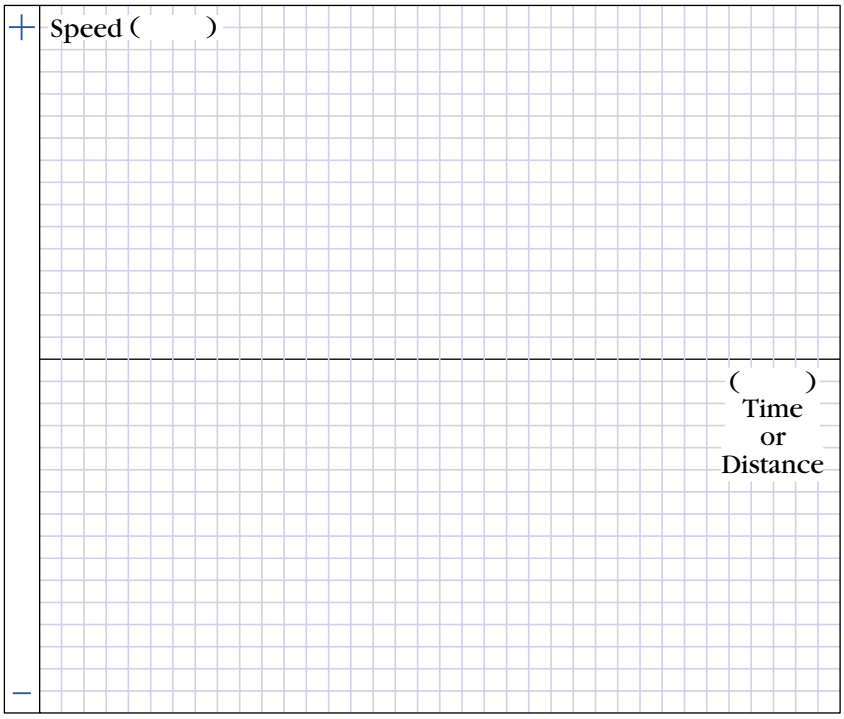
Conditions

☐ Washdown ☐ Outdoor

☐ Vacuum ☐ Cleanroom

Motion Profile

Graph your most demanding cycle, include accel/decel, velocity and dwell times. You may also want to indicate load variations and I/O changes during the cycle. Label axes with proper scale and units.



Control Method

☐ Programmable ☐ External Control Signal

☐ Manual Jog ☐ Digital (Step & Direction) ☐ Analog Velocity

☐ Limit Switches ☐ Analog Torque ☐ Analog Position

Description of Application

Motor Type Preferred

☐ Servo ☐ Stepper

☐ Other _____

Axes of Motion

☐ Single ☐ Multiple # _____

☐ Synchronized

Interface

Host

☐ PLC ☐ Computer

☐ Analog I/O ☐ RS232

☐ Digital I/O Control

☐ Other _____

Operator

☐ Keypad/LCD Display

☐ Pushbuttons

☐ Potentiometer/Joystick

☐ Thumbwheels

Supply Voltage

☐ 110 AC ☐ 220 AC

☐ Other _____

Feedback Required

☐ Encoder ☐ Linear Potentiometer

☐ Other _____

Input Functions

Output Functions

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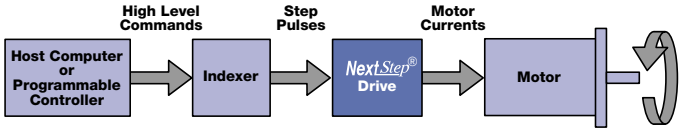
Overview

A NextStep® microstepping drive incorporates all the standard features you expect from a competitive, world class motor/drive package and much more, all at a competitive price. IDC has taken step motor performance to a new level of innovation providing performance enhancements, convenience, and quality resulting in genuine value. The NextStep®'s revolutionary design consumes significantly less panel space than other fully packaged systems, delivers an industry leading 17 Watts/in^3, is designed for long life and durability, and most important, the NextStep® increases your system's throughput to levels previously unachievable using open-loop positioning systems.

NextStep® in Functionality and Flexibility

- Operates from standard line voltages of 120 VAC & 240 VAC
- Accepts step & direction or optional CW/CCW step input
- Descriptive tri-color diagnostic LEDs
- Eight user-selectable drive resolutions of up to 50,000 steps/rev with additional resolutions optional
- Achieves peak step motor performance from the motor supplier of your choice
  - 160 VDC bus voltage (120 version) with selectable motor current setting of up to 7.9 amps
  - 320 VDC bus voltage (240 version) with selectable motor current setting of up to 3.9 amps
  - Available with high torque 17, 23, 34, & 42 frame step motors
  - Adjustable motor current waveform for optimal smoothness, and step to step accuracy
- Built in regenerative circuit safely dissipates energy from large inertial loads

Indexer, Drive, Motor Diagram



Compatible Mechanics:
EC2-S, EC3-S, EC4-S, EC5-S, NV-S, N2-S, R2A-S, R3-S, R4-S Positioning Tables

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Overview

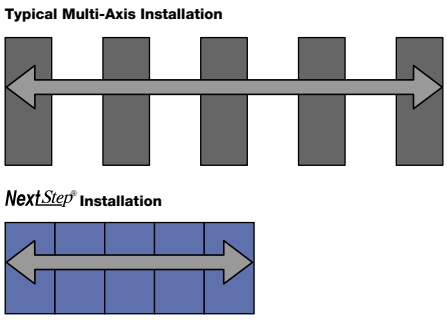

Figure 1. The latest technology in power electronics allows multiple NextStep® drives to be mounted side-by-side for the most efficient use of panel space.

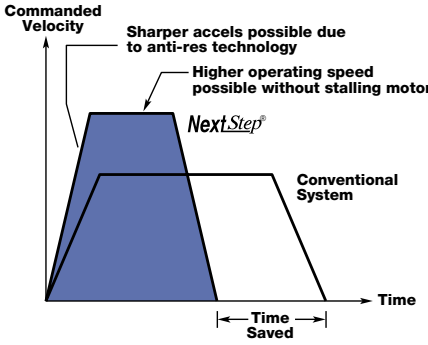

Figure 2. Higher acceleration rates and operating speeds result in better cycle times, higher through-put and better productivity.

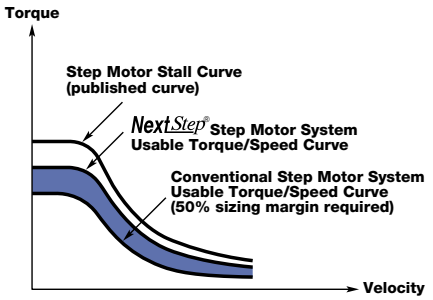

Figure 3. The NextStep® drive provides more usable torque from a given motor than any other microstepping drive on the market today, and generates a significantly better speed/torque curve than conventional step motor systems.

NextStep® in Innovation

- The microstepping industry's first Auto-Adjusting Current Loop delivers more torque at higher speeds for a better speed/torque curve (see Figure 3)
- The NextStep®'s proprietary Anti-Resonance circuitry provides optimum motor performance throughout the entire speed range resulting in:
  - The best throughput available in a stepper drive/motor package
  - Less motor vibration and more usable torque
  - Highest acceleration/deceleration rates possible from the Step Motor (see Figure 2)
  - Overall better Speed/Torque curves delivering more torque at higher speeds (see Figure 3)
  - Smoother performance throughout the entire motion profile
- Internal Cooling Tunnel keeps drive electronics cool and clean for long life (Patent in progress)
- The NextStep®'s efficient design allows it to be stacked together dramatically reducing panel space (see Figure 1)

The NextStep® in Quality

- CE, cULus certified
- Guaranteed to be reliable in unpredictable conditions: short circuit, over temperature, under voltage, and motor regenerative energy protected
- IDC's innovative internal cooling tunnel keeps drive electronics cool & clean for many years of reliable operation and performance
- The user selectable REST switch reduces motor current when your drive is powered, but not in use, reducing both the drive and motor temperature
- The NextStep® uses the latest in surface mount technology and energy efficient hybridized power circuitry
- All NextStep® drives undergo rigorous testing and burn-in processes prior to shipment
- The NextStep® is backed by IDC with a two year warranty

and the NextStep® in Value!

- Dollar for Dollar, square inch for square inch, the best throughput available in a stepper drive/motor package
- Designed for quick and easy installation & operation
- Built in power supply and compact design saves the user time and valuable panel space
- Accessible and removable screw terminal connectors for easy wiring
- Removable connectors are conveniently located on top and bottom of drive for clean panel layout
- Compact design and "stackability" minimizes required panel space (see Figure 1)
- Best Drive Power Density in the Microstepping Industry!

Specifications

	NextStep®	NextStep®-240
AC Power Input	90-120 VAC Single Phase, 50/60 Hz 500 VA max, @ 7.9 amp setting	100-240 VAC Single Phase, 50/60 Hz 500 VA max, @ 3.9 amp setting
Motor Current	0-7.9 amps, 0.1 amp increments If current setting is higher than 6 amps, drive will fold back current to 6 amps when the motor is at rest	0-3.9 amps, 0.1 amp increments No automatic current fold back feature in NextStep®-240
Bus Voltage	160 VDC nominal	320 VDC nominal
Standard Resolutions	5000, 10000, 18000, 20000, 25000, 25400, 36000, 50000	
Low Resolution Option	200, 400, 1000, 2000	

Motor Compatibility

Type	2 phase, hybrid permanent magnet, 1.8° full step
Inductance	2–60 mH for NextStep®; 8–240 mH for NextStep®-240. Motor inductance less than 10 mH set dipswitch to low. Greater than or equal to 10 mH set to high. Combines with Auto Adjusting Current Loop to optimize performance of any inductance step motor .

Amplifier

Switching Frequency	20 kHz
Protection	
Short Circuit	Amp disabled if phase to phase, or phase to ground short detected
Brownout (Under Voltage)	Amp disabled if supply drops below 90 VAC (100 VAC for -240 version)
Over Temperature	Amp disabled if heatsink exceeds 65° C
Interlock	Amp disabled if interlock connection is broken on motor connector
Regen/Over Voltage	Amp disabled if regen condition causes bus voltage to exceed 220 VDC for 120 VAC input voltage, or 440 VDC for 240 VAC input voltage
Rest (Current Settings)	Switch Selectable. If selected, will reduce motor current to 1 amp after no motion has occurred for 20 minutes. Full current level will resume upon receipt of next step pulse. Reduces drive and motor temperature
Idle (Current Settings)	Switch Selectable. If selected will reduce current to 75% of drive setting if no step pulses are received for 10 ms. Full current level will resume upon receipt of next step pulse. Reduces drive and motor temperature.
Waveform	Switch Selectable. Configures the shape of the current waveform. Default is pure sinusoid. Turning switch On changes waveform to -4% 3rd harmonic. Optimizes smoothness and step-to-step accuracy.

Command Interface

Inputs	Step, direction, and shutdown are optically isolated. (6.5 ma min, 15 ma max) CW/CCW mode is optional & must be ordered from the factory.
Step	250 nsec min width, 2 Mhz max pulse rate, triggered on rising edge
Direction	Logic Low = CW rotation, High = CCW rotation. Direction of motor rotation (CW/CCW) is determined by looking down the motor towards the load. A 0.4 µs set up time is required after a direction change before next step pulse is sent to the drive.
Shutdown	Current Conducting = Amp Disabled, Current not Conducting = Amp Enabled
Fault Output	Optically isolated NPN, Collector (Fault+) and Emitter (Fault-) connections available. Fault output is normally ON (current flowing)
LED Indications	Steps Received, Direction Received, Over-Voltage, Thermal Shutdown, Under Voltage, Interlock, Regen, Short Circuit

Environment

Operating Ambient Temp.	Max. ambient temperature of 50°C (122°F) @ 6 amps current setting
Storage Temperature	-40°C to 80°C (-40°F to 176°F)
Humidity	0% to 90% non-condensing
Dimensions	5.4 x 5.4 x 2.5 inches

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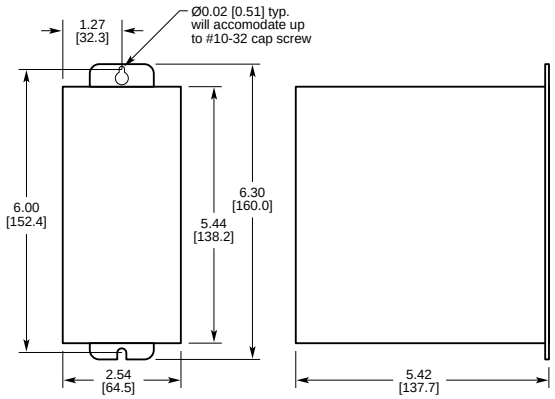
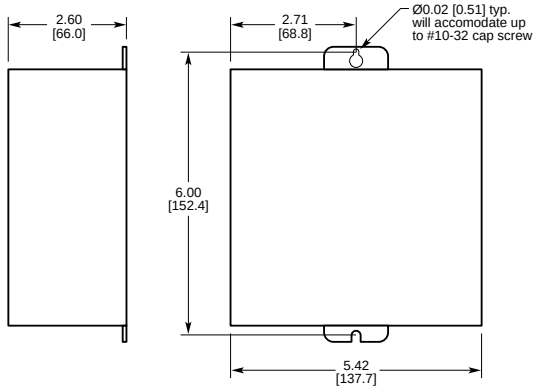
Specifications

Mounting Dimensions in [mm]

Minimum Width (Standard)



Minimum Depth (must order as an option)



How To Order

Model	Description	Options	Description
	—		
NextStep®	Single axis, 7.9 amp microstepping drive 120 VAC input voltage	LRES	Low drive resolution
NextStep®-240	Single axis, 3.9 amp microstepping drive 240 VAC input voltage	CW	CW/CCW option
		MD	Minimum depth mounting option

To confirm your selection, review the checklist on page G-6.

Overview

IDC introduces the Impulse microstepping drive as the newest addition to their family of high performance microstepping drives and controls. The Impulse microstepping drive uses the power of a Digital Signal Processor (DSP) to obtain the ultimate performance out of a stepping motor. Five new advanced motor control functions now are made possible with each providing unparalleled performance. Having 4 amps of available current, up to 34 frame size stepping motors can be powered. With our complete line of motors, electric cylinders, rodless actuators, and precision positioning tables, IDC has the IDeal system for your application.

The Impulse Microstepping Drive

Five Key Features

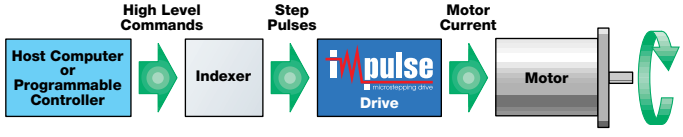
- **Open Loop Stall Detect™ (OLSD™)** Detect a motor stall without an encoder or resolver
- **Multi-Stepping™** Low resolution step input = 25,600 microsteps out
- **Dynamic Smoothing™** Rounds the edges of the move profile (pseudo-S curve)
- **Xtreme Smoothness™** Eliminates the motor's natural resonance speeds
- **Motion Node option** Move capabilities

Other Features

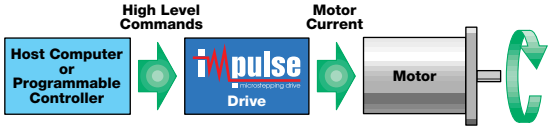
- Anti-Resonance — Best performing and largest range in the industry (7.2°)
- Programmable jog function with dual speed settings
- Current reduction modes with programmable time and reduction amount
- 4 programmable inputs — -Jog+, Jog-, Jog Speed, EOT, Move Select, Warm Boot, Stop, Kill
- Programmable output — Brake, In Motion, Stalled (in addition to fault output)
- All I/O user configurable to active high or active low operation
- Input resolution, programmable from 200-100,000 step/rev in increments of 200
- DIN rail mountable
- Internal fan powered cooling tunnel
- Ultra compact size and ability to mount tightly together
- 160 VDC Bus voltage for more torque at higher speeds
- Built in regenerative circuit
- Diagnostic LED
- Configurable with Application Developer software or FP100 keypad (shown above)

TWO VERSIONS:

Drive Only—



Motion Mode—



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Overview

Avoid the Chance of an Undetected Stall with Open Loop Stall Detect™

Open Loop Stall Detect™

- Know when the motor stalls
- Eliminate cost of encoder or resolver
- Reduces overall length of motor
- Simplifies wiring
- Reduces setup time

The Impulse eliminates the need for feedback to detect motor stalls. No encoder or resolver is required! The Impulse's DSP has the brains and processing power to know when a motor stall occurs. It achieves this in a true open loop configuration. The drive's advanced algorithms continually monitor the back EMF of the motor and use a proprietary method to accurately determine if a motor slips even one tooth count.

The motor only needs to be rotating at 0.5 rev/sec or higher in order to generate sufficient back EMF. There are no complicated or time consuming tests or setup configuration that need to be performed to determine gain settings. All of our motors have been thoroughly tested and configured, so that it simply works right out of the box. OLSD™ allows you to have the comfort of a closed loop system, but without the added cost.

Overview

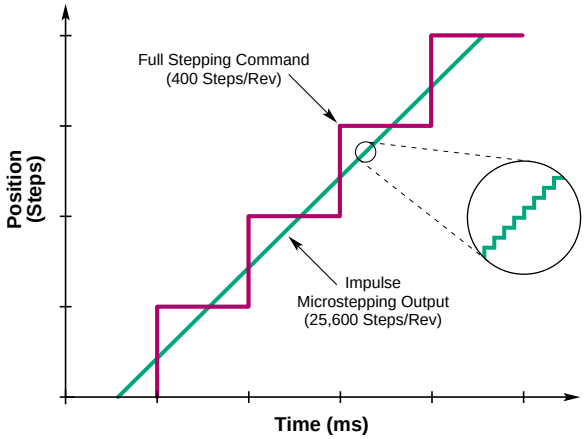
Obtain the Benefits of Microstepping with a Low Frequency Command Signal

MultiStepping™

- Eliminates the cost of high frequency motion controller
- Gives motor more usable torque
- Dramatic reduction of vibration
- Simple and cost effective upgrade from full or half stepping to microstepping (no changes to original machine programming code required)

With the development of MultiStepping™, you can now use a low frequency output signal and obtain the benefits of microstepping. The Impulse can internally interpolate a low input resolution and output high frequency microstepping to the motor. For example, if the input resolution is 200 steps/rev, MultiStepping™ allows the Impulse to take multiple steps in between these large steps so that the motor is actually rotating at 25,600 steps/rev. Any input resolution that is a multiple of 200 can be used, since all the drive's settings are configured in the DSP. By microstepping, the motor's resonance is dramatically reduced and the motor will have more usable torque to move the load. By having more usable torque the motor will be capable of higher accelerations and faster velocities, which directly corresponds to increased throughput and overall better machine operation. Also, it provides much quieter and smoother operation. You can easily upgrade existing full of half stepping systems and get the advantages of microstepping without rewriting any software code or changing the motion controller.

Multistepping™ Example (Snapshot of Move in Progress)



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Overview

Profile Rounding Provides Smooth Operation

Dynamic Smoothing™

- Smooth motion
- Extends life of mechanics
- Reduce motion controller cost
- Simplify PLC programming

Dynamic Smoothing™ makes programming a motion profile very simplistic and can extend the life of the machine's mechanics. It rounds off the edges of the commanded motion profile, like an S-curve. This softens the blows to the mechanics at the transition points, which is where significant mechanical wear takes place. Mechanical wear happens at these points because large amounts of torque are abruptly exerted to the mechanics in order to start or stop the system. By rounding the motion profile, it eliminates the jarring to the system. This is analogous to a passenger riding in an automobile. If the driver suddenly presses the gas pedal, the passenger will be jerked back into the seat and conversely if the driver quickly slams on the brake, the passenger will be jerked forward. This puts the passenger under significant stress. A good driver would gradually press on the gas to ramp the car up to speed and also carefully apply the brake when it is time to stop. The passenger in this vehicle will be able to sustain a much longer ride (Figure 1). Of course, this adds a slight delay to getting to the end position but the end of move ringing is eliminated because of the gentle stop, so the motor is actually settled in position sooner. Also, with Dynamic Smoothing™ the motor can obtain higher accelerations and shorten the overall move time. The extent of the profile rounding is completely adjustable through the use of a gain setting, so that the optimal setting for the machine can be found. Since the drive maintains an internal position counter and is only rounding the commanded profile no steps are ever lost.

Dynamic Smoothing™ can be taken one step further. Traditionally, a move profile requires an acceleration rate and deceleration rate in addition to the velocity and final position to be programmed. With the advent of Dynamic Smoothing™, one doesn't even need to program an accel or decel ramp anymore. A generic PLC output can simply be used to send a stream of pulses to the Impulse. The Impulse will create it's own accel and decel ramps to correctly move the motor to the commanded position (Figure 2). This allows simplistic programming in a PLC or any other programmable control.

Figure 1: Dynamic Smoothing™ Example of Trapezoidal Move Profile

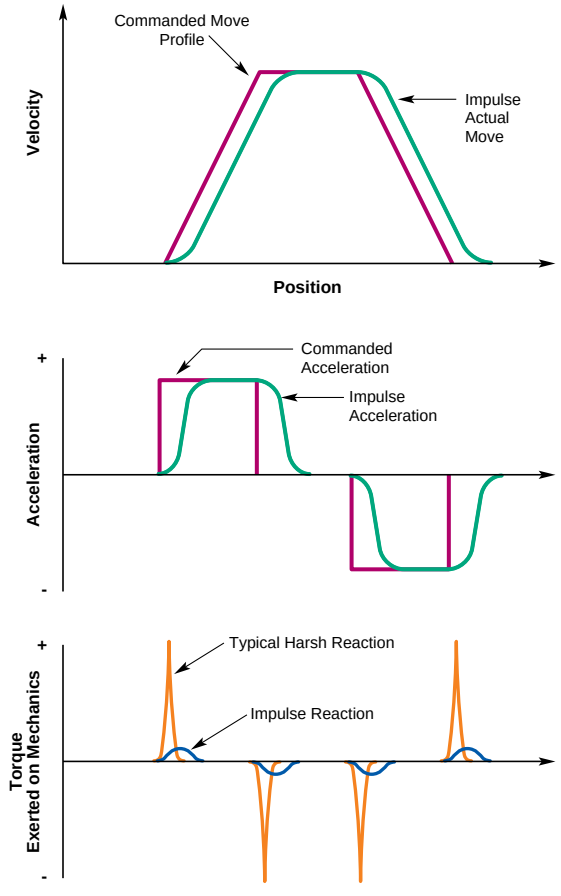
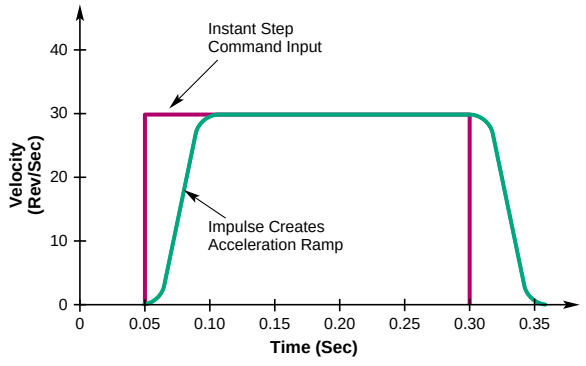


Figure 2: Dynamic Smoothing™ Example of Instantaneous Accel/Decel Move Profile



Overview

Get Servo-Like Smoothness from a Stepping Motor

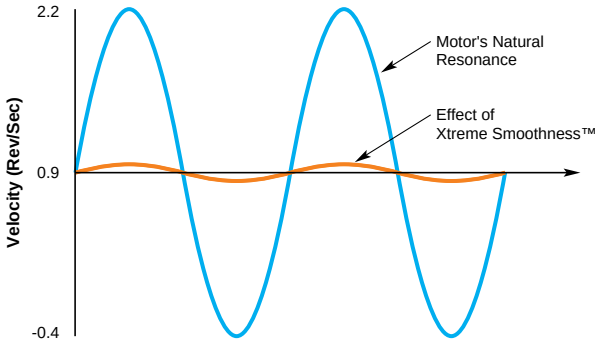
Xtreme Smoothness™

- Eliminates natural low speed motor resonance
- Allows smooth motor operation at low velocities
- Saves cost of gear reducer typically required to operate in the speed ranges of 1-4 rps

Never again will stepping motors be plagued with low speed resonance. All stepping motors have natural resonance speeds that cause the motor to vibrate and usable torque to be lost. Even with standard microstepping techniques, smoothness of motion is still compromised in the 1 to 4 rev/sec range. Torque loss and vibration at these velocities is very evident. If operation at these speeds is required, an expensive gear reducer typically will be needed. Many times this would be discovered after the machine had already been built. Even accelerating through these ranges quickly can cause motor stalls under certain circumstances. The Impulse has the ability to eliminate these resonances altogether. So you'll never be caught with resonance speed problems again. Through the use of proprietary advanced waveform alteration techniques, the Impulse will turn even the most resonant motor into servo-like smoothness.

Velocity Ripple Example

At resonance speeds, the motor's rotor can actually be moving in the negative direction at times even though the average velocity is positive. Xtreme Smoothness™ reduces this resonance frequency by up to a 50:1 factor.



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Overview

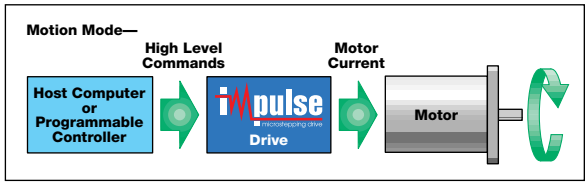
Turn the Impulse into a Motion Node

Motion Node Option

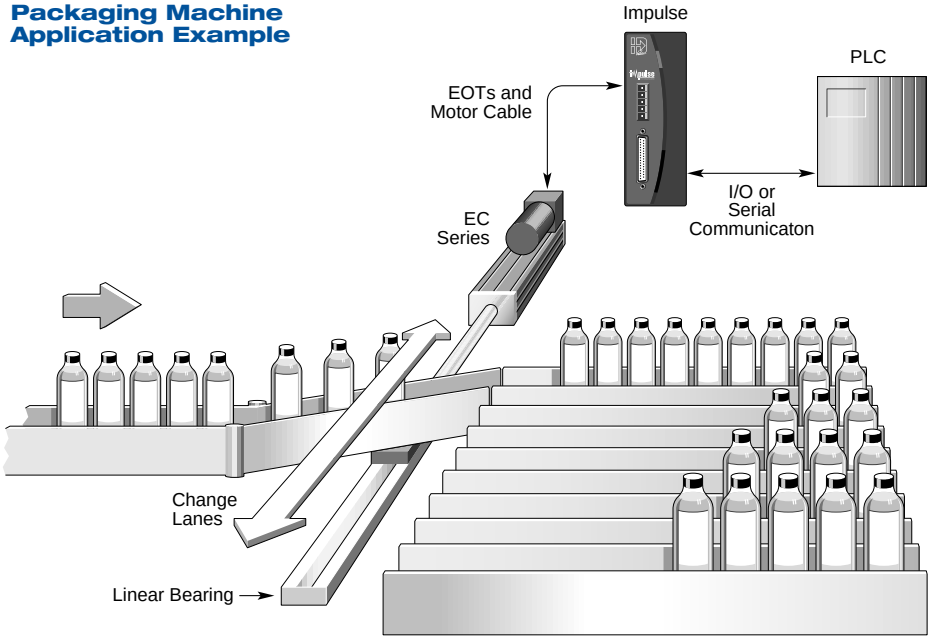
- No programming language to learn
- Simple and cost effective method of controlling motion
- Designed for use with PLC

The Motion Node option adds user definable move capabilities to the Impulse. This can eliminate the need for a programmable motion controller to solve certain applications. The moves are simply configured by defining four parameters: acceleration, deceleration, position, and velocity. There is no programming language to be learned. It's as easy as simply filling in the four move parameter boxes. The Impulse has an internal position counter, so it always knows the position of the motor. Therefore, the moves can be incremental or absolute or even a mix of each. A homing routing also can be defined.

There are two methods of triggering the moves. They can be either triggered via binary input selects or over the communication port using RS232 or RS485. When using the binary input select method, up to seven preset moves can be stored in the Impulse. The first three inputs are then configured for the move select function and the fourth input is typically used for homing and EOT switches. When using the RS232/485 communication port, the preset moves can simply be triggered with a command. The host also can download and execute new moves to the Impulse continually, so that there is no limit on the number of positions attainable.



Packaging Machine Application Example



Specifications

Power Requirements	90 to 120 VAC single phase, 50/60 Hz, 500 VA max @ 4A
Current Output Range	0.75 to 4.0 Amps
Motor Inductance Range	2 to 80 mH
Input Resolution	200 to 100,000 in increments of 200
Step & Direction Inputs	
Input Voltage	5 to 24* VDC
Input Current	5 to 15 mA
Setup Time (Direction)	250 ns
Max. Frequency (Step)	2 MHz
Shutdown Input	
Single-Ended Mode Input Voltage (VDC)	HIGH: 3.5 V min. to 5 V max.; LOW: 0 V min. to 1.5 V max.
Differential Mode (VDC between + and –)	HIGH: 2 V min. to 5 V max.; LOW -5 V min. to -2 V max.
Input Current (any terminal @ 0 V to Gnd)	-1 mA to 15 mA
Digital Inputs	
Input Voltage	HIGH: 3 V min. to 24 V max.; LOW: 0 V min. to 1.5 V max.
Digital Outputs	
Current Sink (ON state, Max.)	100 mA
Output Voltage (ON state @ 100 mA Max.)	0.4 V
Off Voltage (OFF state)	24 V
Environmental	
Operating Ambient Temperature	0 to 50°C
Storage Temperature	-40 to 80°C
Relative Humidity (Max.)	95% non condensing
Altitude Above Sea Level	10,000 ft. [3,048 m]
Thermal Characteristics	
Cooling	Internal fan
Heat Dissipation @ 4 A (typical)	32 W
Dimensions (inches [mm])	H = 5.60 [142]; W = 1.78 [45]; D = 6.37 [162]
Weight	1.75 lbs. [0.794 kg]

*External current-limiting resistor required 12 V and 24 V power supply connections. Use 560 Ω, 1/4 W resistor for 12 V connection. Use 1.3 KΩ resistor for 24 V connection.

*Please see our 800+ page catalog for specifications on our mechanical system and motor offerings. Our complete catalog is online at **www.idcmotion.com**.*

How To Order

IMPULSE	Input Power	Capability	Drive Type	Communication	Accessories
IM	– L		T4		

Input Power
L: Line Voltage 120 VAC

Capability
M: Motion Node Version
D: Drive Version

Drive Type
T4: Stepper Drive, 4A

Communication
2: RS232
4: RS485

Accessories (order separately)
FP100: Configuration Keypad
DB25BO: 25 pin D-Shell to screw terminal I/O connector
SS-IO: 25 pin D-Shell I/O cable, 2 ft.
SS-IO-6: 25 pin D-Shell I/O cable, 6 ft.

Note: Application Developer configuration software included.

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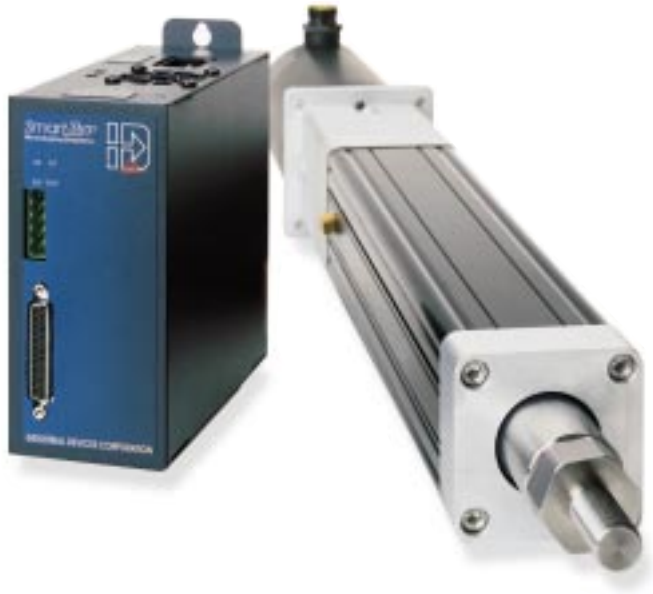
Overview

IDC's SmartStep is a complete, packaged microstepping drive/control that provides a user friendly system, as well as many compelling features and benefits. Consider a SmartStep when your application requires:

- **High Throughput.** The SmartStep has the same outstanding dynamic performance as the NextStep microstepping drive which incorporates the latest in Anti-Resonance technology to maximize the torque, and optimize the performance of step motors.
- **Ease of Integration.** The SmartStep uses IDC's IDeal™ programming language, and Application Developer software package which simplifies system set-up and integration.
- **Small Panel Space.** The SmartStep has an internal heatsink and fan which keeps the panel space required for each unit small, and allows multiple units to be stacked together in multi-axis applications.
- **Smoother performance** across the entire motion profile.
- **Up to 8 amps of motor current.** The SmartStep is compatible with both standard and enhanced 23 frame to 42 frame step motors.

Additional SmartStep Features

- CE rated
- Flash memory allows the SmartStep to be completely reconfigured from a file obtained via the Internet for easy upgrades of both hardware and firmware
- 60K memory, up to 400 programs standard
- RS-232 communications standard, RS-485 optional
- Operates from 120 VAC standard, or 240 VAC optional
- All system configuration and drive settings are software configurable, which means there are no switches to set
- High Speed Registration input
- Faster microprocessor and data bus improves the SmartStep's computational horsepower compared to the S6961
- Go Immediate Mode. This mode of operation allows the controller to multitask between motion control and I/O operations
- User scaling of position, velocity, and acceleration
- Descriptive variables, math and conditional branching
- Accepts encoder feedback for Stall Detection, Closed Loop operation, and Position Maintenance
- 1-99 Axis of immediate control via host RS-232C communication



- Compatible with IDC's Application Developer Software
- Sixteen configurable I/O (8 inputs, 8 outputs,) 1 dedicated home and 2 dedicated end of travel inputs
- Optically isolated I/O, 12/24 VDC compatible
- Compatible with IDC's S series step motors, and P/K series enhanced step motors. See page G44 for more information on IDC step motors
- A handful of accessories simplify integration. See page G18 for information.

For 23 frame step motor applications IDC has developed the SmartStep23. Some of the features included in the SmartStep23 are:

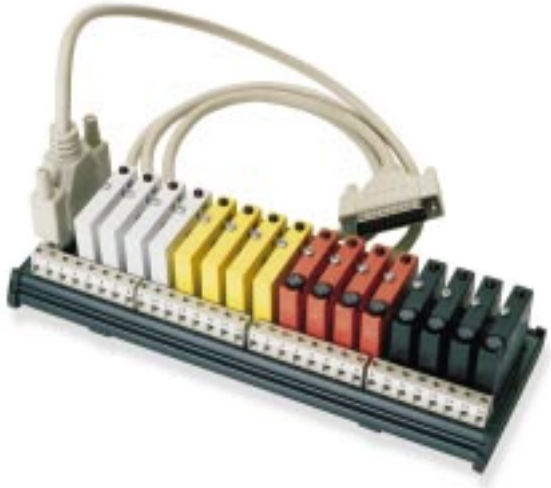
- The SmartStep23 provides up to 3 amps of current which makes it ideal for 23 frame step motor applications
- Same outstanding dynamic performance as the NextStep microstepping drive
- Operates from 120 VAC
- All the same features and benefits found in the SmartStep

Compatible Actuators:
EC2S, EC3S, EC5S
R2S, R3S, R4S
Positioning Tables

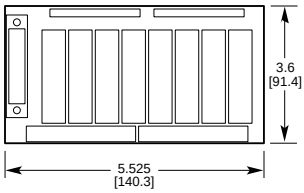
Overview

Optional Keypad

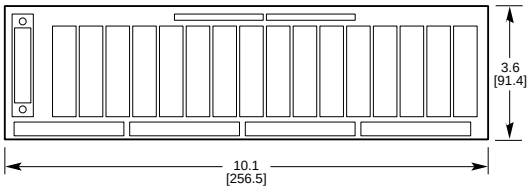
- Both a programming tool and an operator interface
- Menu–Driven set up, On line help function, diagnostic screens, and trace mode provide straightforward set up, troubleshooting, and program debugging
- Easy to read back–lit 40 character display
- Connects to control or mounts remotely
- Scratch proof, large keys
- Displays current position and I/O status
- Keypad is protected to Nema 4 (IP65) when panel mounted
- See page G-37 for more information on the keypad.



OPTO44 Dimensions

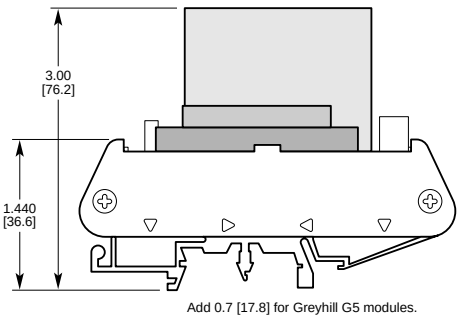


OPTO88 Dimensions



Note: OPTO44 and OPTO88 racks parallel all 16 I/O points to a second set of screw terminals so unconditioned I/O may still be used.

OPTO44/88 Rack Dimensions



Add 0.7 [17.8] for Greyhill G5 modules.

- SS-PNP-BO converts connections to screw terminals and conditions outputs to PNP signals
- The DB25BO converts connections to screw terminals
- SS-I/O cable is available as an accessory for wiring the SmartStep to a PLC or industrial PC

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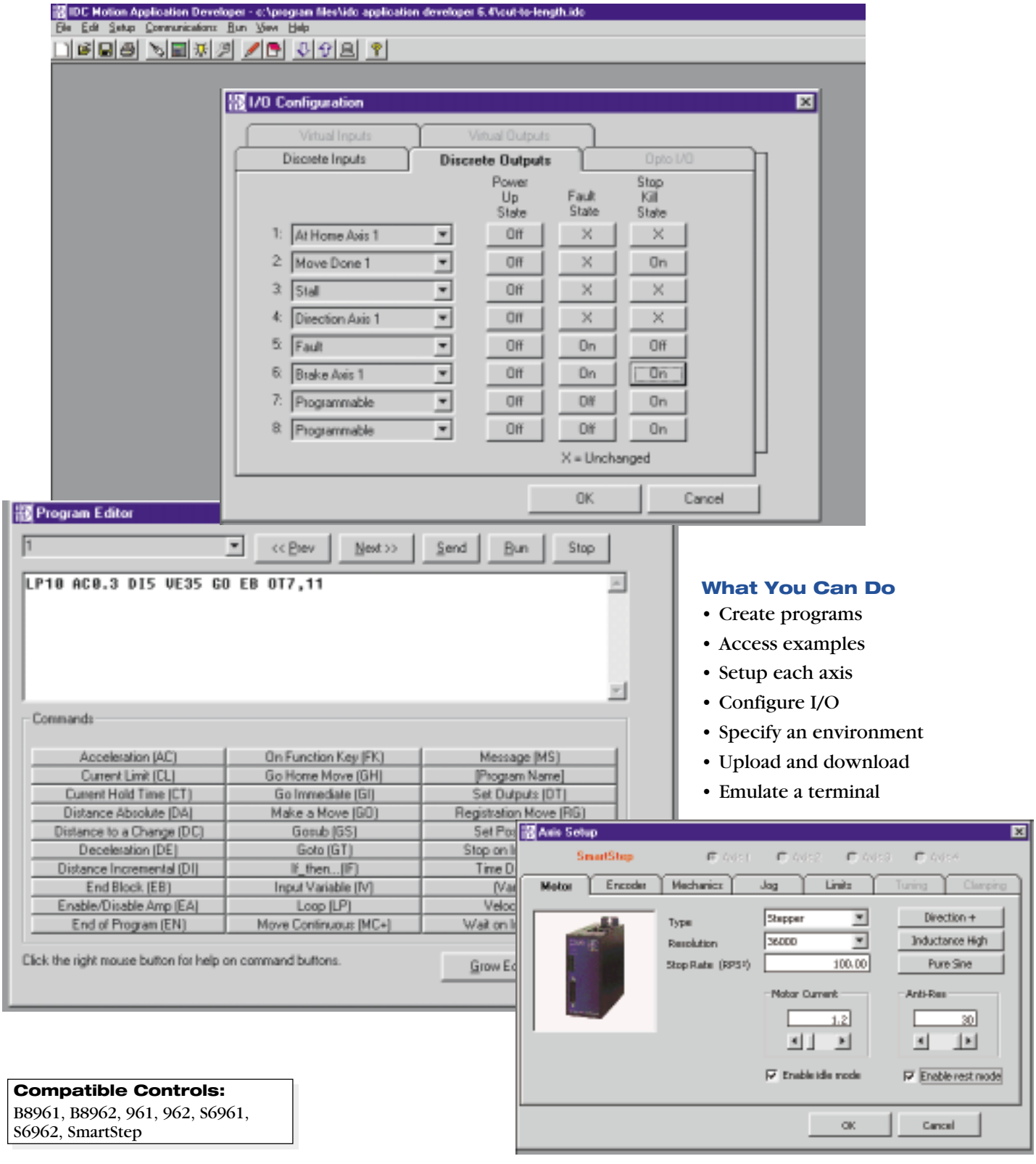
Operation

For those who prefer RS-232C communications, IDC provides Application Developer, a Windows-based application development tool. It helps you quickly setup your system, and create programs using your PC. Using Application Developer allows you to download a finished application, or retrieve an existing program from any IDC Smart product.



What You Can Do

- Create programs
- Access examples
- Setup each axis
- Configure I/O
- Specify an environment
- Upload and download
- Emulate a terminal

Compatible Controls:
B8961, B8962, 961, 962, S6961, S6962, SmartStep

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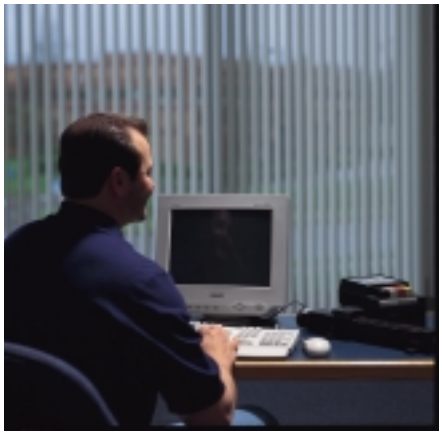
Operation

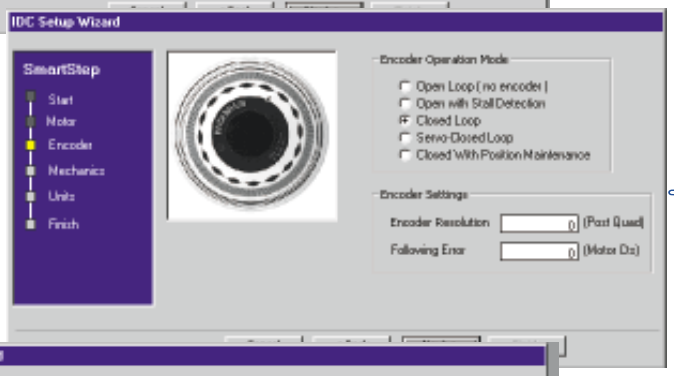
IDC Setup Wizard Makes Application Configuration Easy!

Select a Product

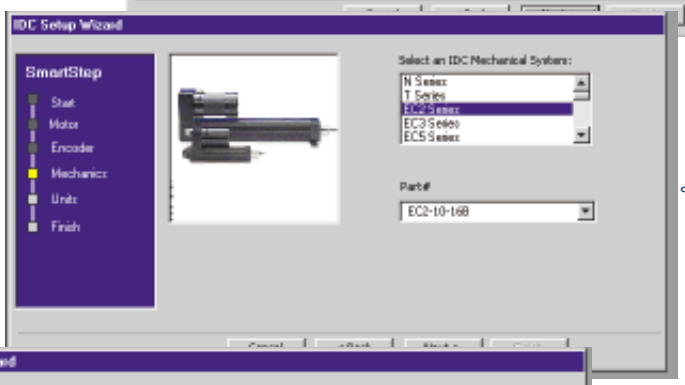
What you can do:



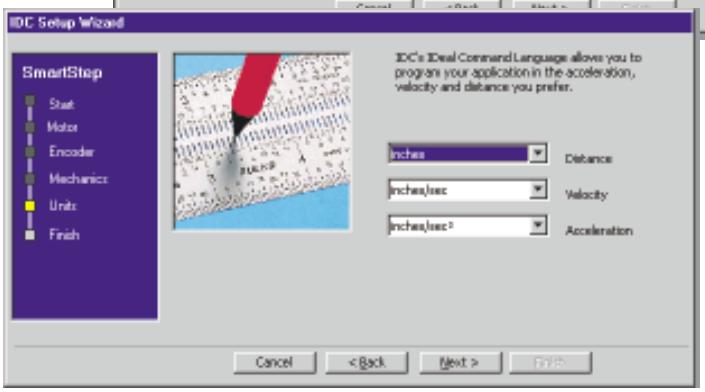
Pick a Motor



Configure your Encoder



Select your Mechanics



Select your Units

IDeal™ Command Language

Our Smart controls are sophisticated and fully featured—quickly and easily programmed with the intuitive IDeal™ programming language. Below is a partial list of the IDeal command language:

Motion Commands

AC	Acceleration
DA	Distance Absolute
DC	Distance to Change
DE	Deceleration
DI	Distance Incremental
GH	Go Home
GI	Go Immediate
GO	Start Move
GP	Go Point (Linear Interpolation)
MC	Move Continuous
RG	Registration
VE	Velocity

Program Flow Commands

BR	Break
EB	End Block
EN	End Routine
FK	Function Key
GS	Go to Subroutine
GT	Go to Program
IF	If Conditional
LP	Loop
LU	Loop Until
LW	Loop While
ST#	Stop on Command
TD	Time Delay
WT	Wait

I/O & Display Commands

IV	Input Variable
OT	Outputs On/Off
MS	Message to Keypad
“ ”	Message out Serial Port

Miscellaneous Commands

{}	Comments
EA	Enable Amplifier
SP	Set Position
SQ	Square Root
ST	Stop Move on Input

Serial Immediate Commands

CB	Clear Buffer
K	Kill
S	Stop
IS	Input Status
OS	Output Status
PAC	Tell Commanded Position
PAE	Tell Encoder Position
RS	Reset
SA	Axis Status
SD	Drive Status
SS	System Status
SW	Firmware Version
UN	Unit Number

Serial Supervisory Commands

AA	Auto Address
DP	Delete Program
DR	Download Programs to RAM
EC	Enable Terminal Echo
EP	End Program
EX	End Load All
LA	Load All
LS	List Programs
OC	Original Configuration
PR	Define Program
PW	Password
RN	Run Program
UA	Upload All
UL	Upload Programs

Setup Commands

AM	Acceleration Maximum
AU	Accel/Decel Units
DF	Display Format
DU	Distance Units
EM	Encoder Mode
GR	Gear Ratio
HE	Home Edge
HF	Home Final Direction
HM	Homing Method
HO	Home Offset
HS	Home Switch Type
ID	Input Definition
MD	Motor Direction
VU	Velocity Units

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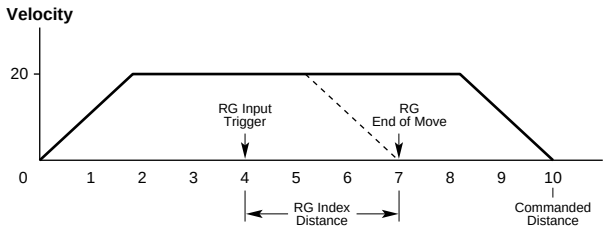
Programming Example: Registration

A customer wishes to index a distance of 3 inches from the position where the registration input is triggered. The registration input is activated while the motor is running at a constant velocity of 20 in/sec. The absolute maximum distance the system should travel is 10 inches.

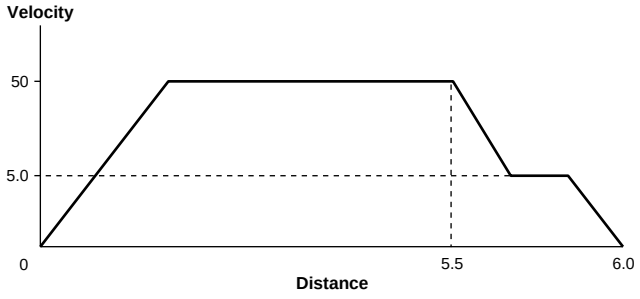
```
DA10    {Set Maximum distance to 10 inches}
VE20    {Set Velocity to 20 in/sec}
AC.2    {Set Acceleration/Deceleration time to 0.2 sec}
RG3     {Set Registration distance to 3 in.}
GO      {Start Move}
```



Programming Example: Fast In-Slow Feed Move

A customer wishes to index a distance between 0 and 5.5 inches as fast as possible to maximize machine throughput, but would like to slow down before coming to a stop to maximize repeatability.

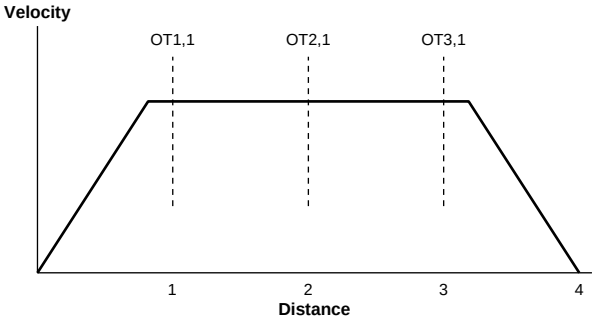
```
AC.05   {Set Acceleration time to 0.05 sec}
DE.09   {Set Deceleration time to 0.09 sec}
VE50    {Set starting Velocity to 50 in/sec}
DA6     {Set move Distance to 6 in}
DC5.5   {Set the Distance to change velocity to 5.5 in}
VE5     {Change Velocity to 5 in/sec}
GO      {Start Move}
```



Programming Example: Turning On an Output On-the-Fly

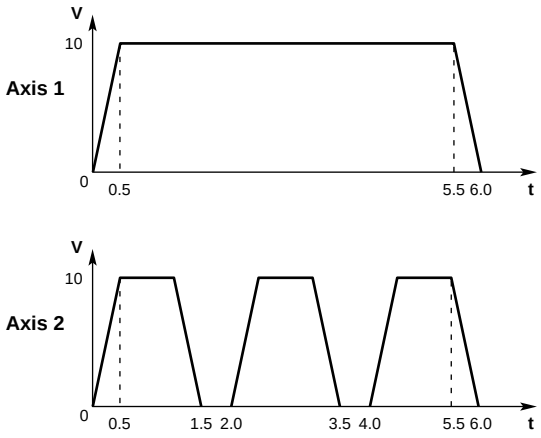
A customer would like to turn on outputs while moving at distances of 1 inch, 2 inches, and 3 inches.

```
AC0.5   {Set Acceleration to 0.5 sec}
VE10    {Set Velocity to 10 in/sec}
DA4     {Set move Distance to 4 in}
DC1     {Set point to turn on …}
OT1     {Output 1}
DC2     {Set point to turn on …}
OT2,1   {Output 2}
DC3     {Set point to turn on …}
OT3,1   {Output 3}
GO      {Start Move}
```



Programming Example, Go Immediate Mode
IDC Solution: S6962

A customer requires a very long move on axis 1, while simultaneously making 3 short moves on axis 2 with time delays of 0.5 seconds between the moves. The time delay of 0.5 seconds between axis 2 moves is important to the overall machine process. Solving this application successfully requires executing operations while both axes are moving such as: asserting outputs, checking status of inputs, doing math, and sending ASCII text out of the RS-232 port.




```
(VAR1)=10                  {Intialize Variable}
LP                         {Beginning of Loop Block}
      DI55,10              {Define Two Axis Move}
      VE10,10
      AC.5,.5
      GI                   {Start Go Immediate Move Both Axes}
      MS1,""               {Clear Screen}
      MS1,(AI9)            {Write Analog Input 9 to the Screen While Moving}
      WT,#2                {Wait for Axis 2 to Stop Moving}
      TD.5                 {Time Delay of 0.5 seconds}
      DI,10                {Define Axis 2 Move of 10 units}
      GI                   {Start Axis 2 Go Immediate Move}
      IF8,1                {If Input 8 is on}
            OT10,1         {Turn on Output 10}
            TD.1           {Time Delay of 0.1 seconds}
            OT10,0         {Turn off Output 10}
      EB                   {End of If Block}
      WT,#2                {Wait for Axis 2 to Stop Moving}
      TD.5                 {Time Delay of 0.5 seconds}
      DI,10
      GI                   {Start Axis 2 Go Immediate Move}
      (DIST)=(VAR1)*1000   {Do Variable Math while Moving}
      (TERM)=(DIST)        {Send Value of DIST Variable out of Serial Port}
      WT#1,#2              {Wait for Axis 1 and 2 to Stop Moving}
      OT1,1                {Turn On Output 1}
      DA0,0
      GO                   {Move Both Axes Back to Starting Position}
EB                         {End of Loop Block, Restart Loop}
EN                         {End Program}
```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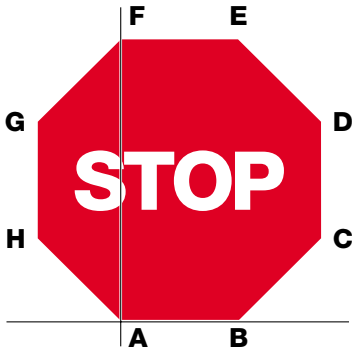
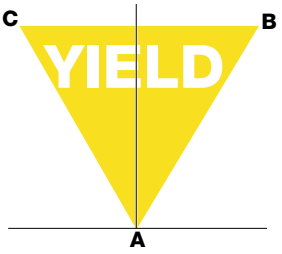
Programming Example

A customer wants to cut out signs. First a STOP sign, always the same size and shape.



[STOP]	Name the program STOP
AC.5,.5	Set acceleration times to 0.5 seconds
VE10,10	Set velocities to 10 inches/sec
SP0,0	Set current position as the origin
DA2 GO	Move X axis 2 inches to “B”
DA3.414,1.414 GP	Move both axes together, to “C”
DA,3.414 GO	Move Y axis to “D”
DA2,4.828 GP	Move both axis together to “E”
DA0 GO	Move X axis back to zero, “F”
DA-1.414,3.414 GP	Move both axis to “G”
DA,1.414 GO	Move Y axis to “H”
DA0,0 GP	Move both axis back to zero A
OT1	Turn on programmable output #1
TD.1	Time delay 0.1 second
OT0	Turn off programmable output #1

Next, the customer wants to make a (triangular) YIELD sign.



[YIELD]

SP0,0	Set current position to zero
DA2,3 GP	Move both axes to “B”
DA-2 GO	Move X axis to “C”
DA0,0 GP	Move both axes back to zero “A”

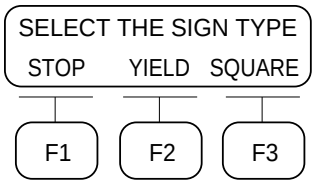
The customer now wants to make rectangular signs of varying length and width. An operator will be prompted to enter these parameters.

[SQUARE]

MS," "	Clear display
MS1,"ENTER THE SIGN"	Write a message prompting the operator
MS21"HEIGHT:"	for the sign’s height
IV28,(HEIGHT)	Position the cursor, assign input to variable HEIGHT
MS21,"WIDTH:"	Prompt operator for sign width
IV27,(WIDTH)	Position the cursor, assign input to variable WIDTH
SP0,0	Set the current position to the origin 0,0
DA,(HEIGHT) GO	Move Y axis, distance specified by variable HEIGHT
DA(WIDTH) GO	Move X axis, distance specified by variable WIDTH
DA,0 GO	Move Y axis back to 0
DA0 GO	Move X axis back to 0. Rectangle complete.

To simplify the operator’s job, the customer makes the product selection process menu-driven; counting the number of signs and selecting the type.

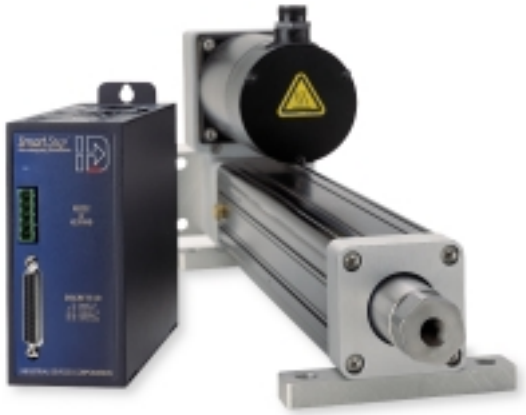
[MAIN]	The name of the program
(# PER BOX)=2	Set value for numbers of BOXES
MS,””	Clear display
MS1,“ENTER THE NUMBER OF”	Displays this message at line 1
MS21,”BOXES:”	Displays this message at the first character of line 2
IV27,(# OF BOXES)	Places cursor at position 27 and reads in number entered into the input variable (# OF BOXES)
(# OF SIGNS)=(# OF BOXES) *(# PER BOX)	Create a new variable and calculate its value
LP(NUM OF SIGNS)	Loop through the program (NUM OF SIGNS) times
MS1,“SELECT THE SIGN TYPE”	Write this message to the sceen
MS21,“STOP YIELD SQUARE”	Write these choices above the function keys
FK1,2,3	Wait for function key to be pressed and create variable (FKEY) to hold the selection
IF(FKEY)=1 GS[STOP] EB	If function key 1 is pressed, go-sub to program [STOP] and then return
IF(FKEY)=2 GS[YIELD] EB	If function key 2 is pressed, go-sub to program [YIELD] and then return
IF(FKEY)=3 GS[SQUARE] EB	If function key 3 is pressed, go-sub to program [SQUARE] and then return
EB	End the loop
EN	End the program



Overview

IDC's SmartStep is a complete, packaged microstepping drive/control that provides a user friendly system, as well as many compelling features and benefits. Consider a SmartStep when your application requires:

- **High Throughput.** The SmartStep has the same outstanding dynamic performance as the NextStep® microstepping drive which incorporates the latest in Anti-Resonance technology to maximize the torque, and optimize the performance of step motors.
- **Ease of Integration.** The SmartStep uses IDC's IDeal™ programming language, and Application Developer software package which simplifies system set-up and integration.
- **Small Panel Space.** The SmartStep has an internal heatsink and fan which keeps the panel space required for each unit small, and allows multiple units to be stacked together in multi-axis applications.
- **Smoother performance** across the entire motion profile.
- **Up to 8 amps of motor current.** The SmartStep is compatible with both standard and enhanced 17 frame to 42 frame step motors.

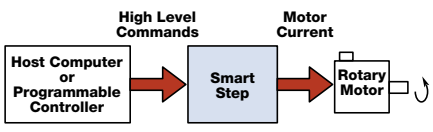


Additional SmartStep Features

- CE rated
- Flash memory allows the SmartStep to be completely reconfigured from a file obtained via the Internet for easy upgrades of both hardware and firmware
- 60K memory, up to 400 programs standard
- RS-232 communications standard, RS-485 optional
- Operates from 120 VAC standard, or 240 VAC optional
- All system configuration and drive settings are software configurable, which means there are no switches to set
- High Speed Registration input
- Faster microprocessor and data bus improves the SmartStep's computational horsepower compared to the S6961
- Go Immediate Mode. This mode of operation allows the controller to multitask between motion control and I/O operations
- User scaling of position, velocity, and acceleration
- Descriptive variables, math and conditional branching
- Accepts encoder feedback for Stall Detection, Closed Loop operation, and Position Maintenance
- 1-99 Axis of immediate control via host RS-232C communication
- Compatible with IDC's Application Developer Software
- Sixteen configurable I/O (8 inputs, 8 outputs,) 1 dedicated home and 2 dedicated end of travel inputs
- Optically isolated I/O, 12/24 VDC compatible
- Compatible with IDC's S series step motors, and P/K series enhanced step motors. See page G-52 for more information on IDC step motors
- A handful of accessories simplify integration. See page G-30 for information.

For 17 or 23 frame step motor applications IDC has developed the SmartStep23. Some of the features included in the SmartStep23 are:

- The SmartStep23 provides up to 3 amps of current which makes it ideal for 17 or 23 frame step motor applications
- Same outstanding dynamic performance as the NextStep microstepping drive
- Operates from 120 VAC
- All the same features and benefits found in the SmartStep



Compatible Mechanics:
EC2-S, EC3-S, EC4-S, EC5-S
NV-S, N2-S, R2A-S, R3-S, R4-S
Positioning Tables

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Specifications

	SmartStep	SmartStep23	SmartStep-240
AC Power Input	90-120 VAC Single Phase, 50/60 Hz, 500 VA max, @ 7.9 amp setting	90-120 VAC Single Phase, 50/60 Hz, 250 VA max, @ 3.0 amp current setting	100-240 VAC Single Phase, 50/60 Hz, 500 VA max, @ 3.9 amp setting
Motor Current	0-7.9 amps, 0.1 amp increments If current setting is higher than 6 amps, drive will fold back current to 6 amps when the motor is at rest	0-3 amps, 0.1 amp increments	0-3.9 amps, 0.1 amp increments
Bus Voltage	160 VDC nominal	160 VDC nominal	320 VDC nominal
System Resolution	36,000 steps/motor rev		

Motor Compatibility

Type	2 phase, hybrid permanent magnet; 0.9°, 1.8° or 7.2° full step
Inductance	2-60 mH for SmartStep and SmartStep23; 8-240 mH for SmartStep-240.

Amplifier

Switching Frequency	20 kHz
Protection	
Short Circuit	Amp disabled if phase to phase, or phase to ground short detected
Brownout (Under Voltage)	Amp disabled if supply drops below 90 VAC (100 VAC for -240 version)
Over Temperature	Amp disabled if heatsink exceeds 70° C
Interlock	Amp disabled if interlock connection is broken on motor connector
Regen/Over Voltage	Amp disabled if regen condition causes bus voltage to exceed 220 VDC for 120 VAC input voltage, or 440 VDC for 240 VAC input voltage

Current Settings

Rest	Software selectable. If selected, will reduce motor current to 1 amp after no motion has occurred for 20 minutes. Full current level will resume upon receipt of next motion command. Reduces drive and motor temperature
Idle	Software selectable. If selected will reduce current to 75% of drive setting if no motion is commanded for 10 ms. Full current level will resume when motion is commanded. Reduces drive and motor temperature.
Waveform	Software selectable. Configures the shape of the current waveform. Default is pure sinusoid. Selecting On changes waveform to -4% 3rd harmonic. Optimizes smoothness and step-to-step accuracy.

Additional SmartStep Specifications

Inputs 8 Programmable, Limits, Home	12 VDC or 24 VDC compatible, optically isolated, as little as 3.0 mA sinking current required
Incremental Encoder	Optically isolated, differential line driven 5 VDC signal, 2 mHz max frequency (post quadrature); 5 VDC, 200 mA available on SmartStep to power encoder
Outputs 8 Programmable	Open collector, 12 VDC or 24 VDC compatible, optically isolated, 100 mA max sink current per output. 350 mA total sink current
LED Indications	Green—functioning normally; Red—Fault; Amber—FLASH fault

Environment

Operating Ambient Temp.	Max. ambient temperature of 50°C (122°F) @ 6 amps current setting
Storage Temperature	-40°C to 80°C (-40°F to 176°F)
Humidity	0% to 90% non-condensing

Dimensions

5.9" (L) x 2.5" (W) x 6.3" (H)

Accessories

SmartStep I/O Accessories

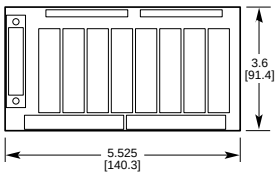
Optional Keypad

- Both a programming tool and an operator interface
- Menu-driven set up, online help function, diagnostic screens and trace mode provide straightforward set up, troubleshooting and program debugging
- Easy to read, backlit 40-character display
- Connects to control or mounts remotely
- Scratch-proof, large keys
- Displays current position and I/O status
- Keypad is protected to NEMA 4 (IP65) standards when panel is mounted with gasket
- See page G-38 for more information on keypad.

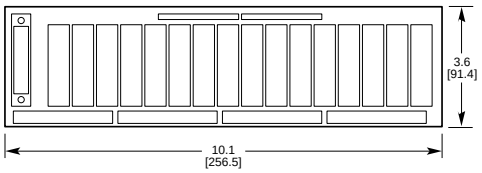
OPTO44 Board

OPTO rack that accepts up to 8 OPTO modules (up to 4 OPTO inputs and 4 OPTO outputs). OPTO I/O is useful when your application needs to switch on and off large voltages or currents (i.e., turning on a solenoid, switching on and off a 230 VAC brake, etc.). OPTO44 racks parallel all 16 I/O points to a second set of screw terminals so unconditioned I/O may still be used.

OPTO44 Dimensions



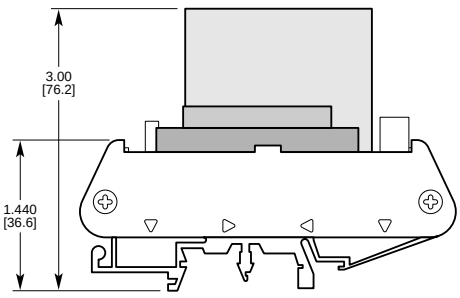
OPTO88 Dimensions



OPTO88 Board

OPTO rack that accepts up to 16 OPTO modules (up to 8 OPTO inputs and 8 OPTO outputs). OPTO I/O is useful when your application needs to switch on and off large voltages or currents (i.e., turning on a solenoid, switching on and off a 230 VAC brake, etc.). OPTO44 racks parallel all 16 I/O points to a second set of screw terminals so unconditioned I/O may still be used.

OPTO44/88 Rack Dimensions



Add 0.7 [17.8] for Greyhill G5 modules.

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Accessories

DB25BO Breakout Board

This accessory converts the DB25 I/O connector on the SmartStep to screw terminals.

SS-IO and SS-IO-6 Cables

I/O cables that connect SmartStep to other devices or PLC.

SS-IO cable is 2 ft
SS-IO-6 cables is 6 ft

SS-RS232 Cable

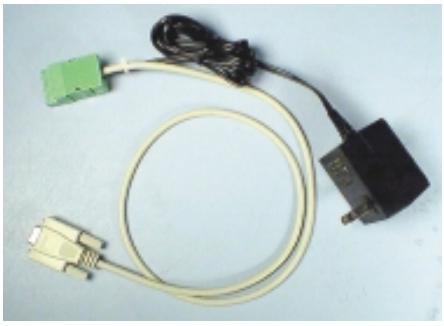
Cable for connecting SmartStep to PC (9-pin comm. port).

SS-PNP-BO Breakout Board

Screw terminal breakout board that converts the SmartStep's sinking outputs to sourcing outputs.

PCS-5004 Cable

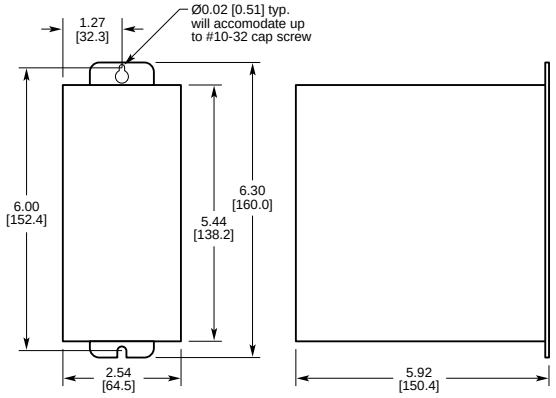
PC-keypad cable for copying programs between keypad and PC (5 VDC power supply not included).



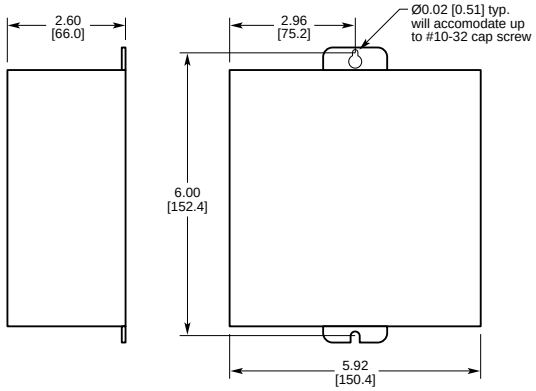
Specifications

Mounting Dimensions in [mm]

Minimum Width (Standard)



Minimum Depth (must order as an option)



How To Order

Model	Description
SmartStep	Single axis, 7.9 amp programmable microstepping drive/ control, operates from 120 VAC
SmartStep–240	Single axis, 3.9 amp programmable microstepping drive/ control, operates from 240 VAC
SmartStep23	Single axis, 3 amp programmable microstepping drive/ control, operates from 120 VAC

Option	Description
RS485	RS–485 option
FP	Front Panel option
MD	Minimum Depth Option
DB25	Includes DB25BO Breakout Board

To confirm your selection, review the checklist on page G-6.

SmartStep Accessories

Model	Description
OPTO44	OPTO breakout board (4I/4O). First 4 slots must be inputs; last 4 slots must be outputs.
OPTO88	OPTO (8I/8O). First 8 slots must be inputs; last 8 slots must be outputs.
DB25BO	25 pin D-Shell to screw terminal I/O connector for SmartStep
SS–IO	25 pin D–Shell I/O cable
SS–RS232	RS–232 cable for PC to SmartStep
SS-PNP-BO	25 pin D-Shell to screw terminal adapter that converts outputs to PNP logic
PCS-5004	PC to keypad RS-232 cable

OPTO44 Position*

1	2	3	4	5	6	7	8

OPTO88 Position*

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Inputs

Code	I/O Module Description
A	DC/AC In, 10-32 VDC, 12-32 VAC
B	DC In, TTL
C	DC In, 35-60 VDC
D	AC In, 90-140 VAC
E	AC In, 180-240 VAC
I	Input test switch
J	Analog In, 0–10 volts
K	Analog In, 4–20 mA
X	Empty

Outputs

Code	Output Module Description
F	DC Out, 5-60 VDC, 3 Amps
G	AC Out, 12-140 VAC, 3 Amps
H	AC Out, 24-280 VAC, 3 Amps
X	Empty

* If no OPTO modules are desired, leave blank.

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Overview

The S6002 is a two-axis micro-stepping drive which incorporates the latest breakthroughs in microstepping technology to provide the user with superior step motor/drive performance. This drive accepts either differential step and direction or clockwise/counterclockwise control signals, and can interface with controls from IDC or other suppliers. All S6000 Series products contain microstepping drives capable of resolutions up to 25,400 steps per revolution.

Our drives have been carefully engineered for exceptional reliability, dynamic performance and repeatability. An extremely efficient isolated switchmode power amplifier means greater power density and less electrical noise than other drives.

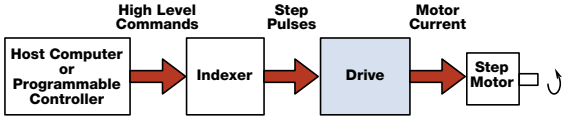
Anti-Resonance Circuitry

Many step motor users are familiar with mid-range instability, or resonance, which under some conditions can cause a step motor to stall between 13 and 18 rps. Microstepping technology alone does not address mid-range instability. However, our S6000 drives use anti-resonance circuitry to virtually eliminate it.

Protection and Diagnostics

LEDs indicate when power is on, step inputs are received, and when a fault condition exists. Internal circuitry protects against damage caused by a mis-wired or damaged motor (short circuit protection), as well as allowing considerable regenerative energy to be dissipated.

Features	Benefits
• Anti-Resonance circuitry.	Significantly reduces chance of stalling.
• 120 VAC power input.	Convenient power, no external transformer required.
• Step and Direction or CW/CCW inputs.	Works with popular stepper controls.
• Short circuit protected (phase to phase and phase to ground).	Prevents failure due to mis-wired, or damaged motors.
• Brownout and overtemperature protected.	Less concern for unpredictable extremes.
• Isolated switchmode power amp.	Highly efficient, lower electrical noise than other drives.
• Optically isolated I/O.	Excellent noise immunity.
• LED status indicators.	Simple troubleshooting.
• Built-in and external re-gen power dump.	Protects system, allows extreme inertial loads when you need it.
• 2.5" x 9" footprint, 5.84" deep.	Compact. Same size for single or two-axis drive.



Compatible Mechanics:
EC2-S, EC3-S, EC4-S, EC5-S
NV-S, N2-S, R2A-S, R3-S, R4-S
Positioning Tables

Specifications

Power Input

105-132 VAC Single Phase, 50/60 Hz
1000 VA max @ 6 Amp setting

Motor Output

Current	0.1 to 6.0 Amp, in 0.1 Amp increments (rotary switch selectable)
Voltage	160 VDC Bus Voltage
Resolution	Switch selectable: 200; 400; 1000; 5000; 10,000; 18,000; 25,000; 25,400

Motor Compatibility

Type	2 phase, hybrid permanent magnet, 0.9°, 1.8°, or 7.2° full step
Inductance	2 mH to 60 mH per phase (rotary switch selectable)

Amplifier

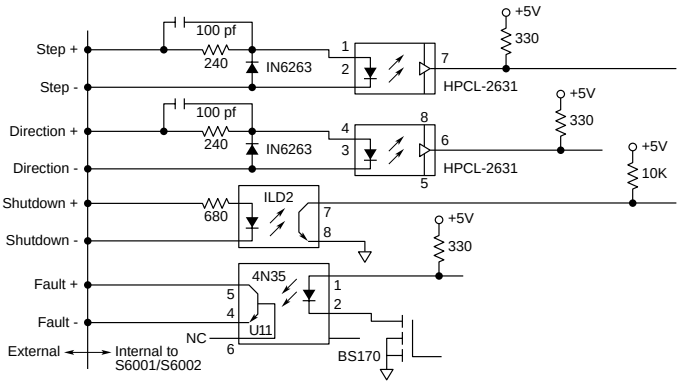
Protection	
Short Circuit	Amp disabled if phase-to-phase or phase-to-ground short detected.
Brownout	Amp disabled if supply drops below 90 VAC
Over-temperature	Amp disabled if heat sink temperature exceeds 65°C
Standby	Switch selectable. Reduces motor current to 75% of preset value if no step pulses are received for 1 second. Rated current levels resume upon receipt of next step pulse. Reduces motor heating.
Waveform	Switch selectable. Configures the shape of the current waveform. Optimize smoothnesss and step-to-step accuracy.

Command Interface

Inputs	Step, Direction and Shutdown are Optically Isolated 6.5 mA min, 15 mA max. Step and direction can be configured as CW/CCW step inputs through switch selection.
Step	400 nsec min. width, 1.25 MHz max pulse rate, triggered on rising edge
Direction	Logic High = CW rotation, Low = CCW rotation, 0.4 µs set-up time required after direction change before next step pulse
Shutdown	Logic High = amp disabled, Low = normal operation
Fault Output	Optically isolated NPN, Collector (Fault+) and Emitter (Fault–) connections available. Output Off = drive not faulted; Output On = drive faulted

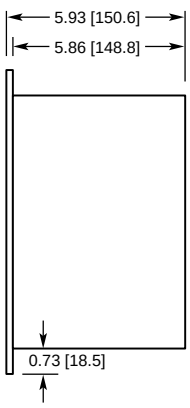
Environmental

Operating Temperature	Thermal shutdown occurs if heat-sink temperature exceeds 65°C (149°F). Heat-sink temperature is a function of motor current, motor regen, and ambient temperature. Severe applications may require -FK1 fan kit option. Most applications will not require the -FK1 if the *total* motor current is less than 6 amps (sum the current setting for the two drives). See page G-44 for more information.
Storage Temperature	-40°C to 80°C (-40°F to 176°F)
Humidity	0% to 90% non-condensing

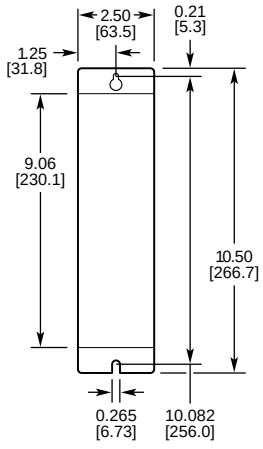


S6002 Mounting Dimensions

Side View in [mm]

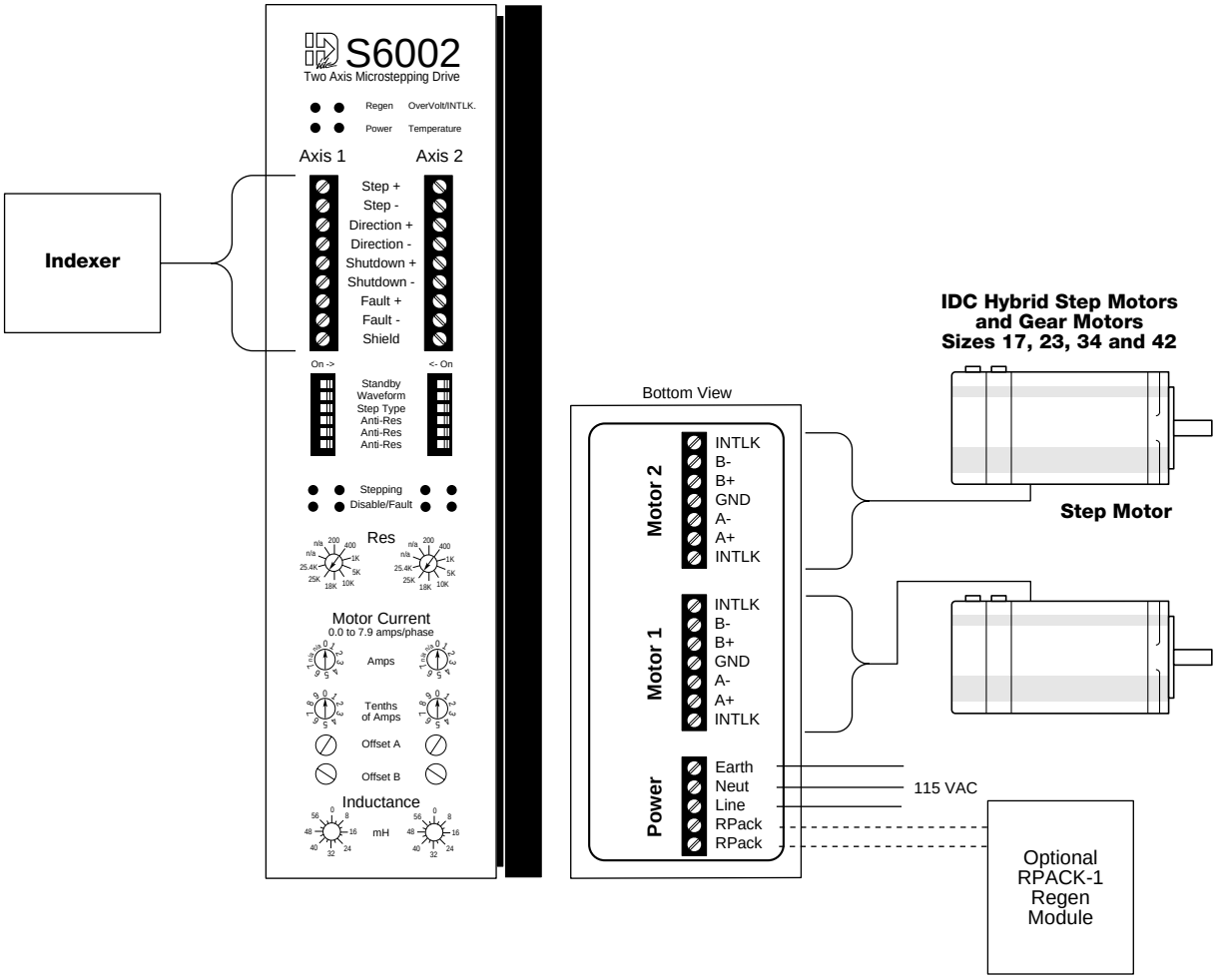


Front View in [mm]



Operation

System Configuration



How To Order

Model	Description	Options	Description
S6002	2-axis, 6 amp/axis microstepping drive	-FK1 Fan Kit	When exceeding 6 Amps total current setting (sum of axis 1 and axis 2 current setting). See page G-37.

Accessories

RPACK-1	External regenerative power dissipation module. Only for exceptionally large inertial and/or vertical loads with ballscrew actuators. See page G-39.

To confirm your selection, review the checklist on page G-6.

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Overview

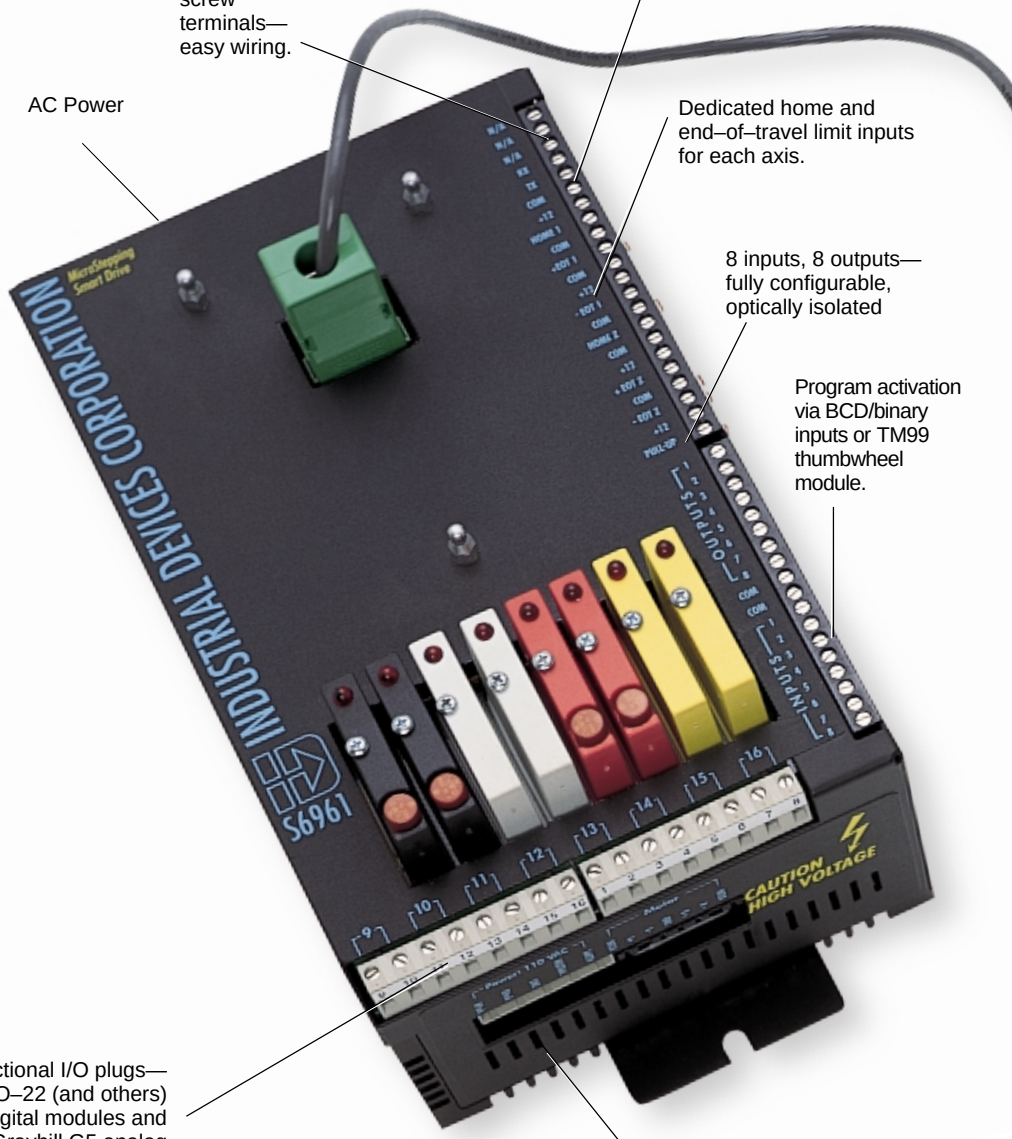
Programmable Smart Drives

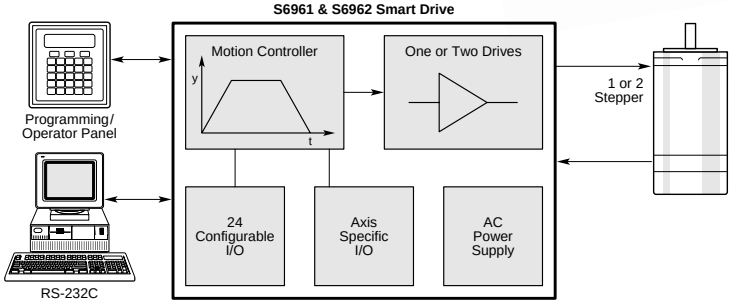
IDC's Programmable Smart Drive Positioning Controls offer tremendous application flexibility. They provide exceptional value and performance relative to similar competitive integrated control solutions.

A single compact package combines a one- or two-axis motion controller, drive(s), OPTO modules, an AC input power supply plus an optional, detachable front panel. Our Smart Drive Systems feature the same outstanding dynamic performance as our stepper and brushless drives.

Our powerful and intuitive IDeal™ programming language will dramatically reduce the time it takes to get your machine running. 6K user memory is available for up to 199 motion programs (30K, 400 programs optional). Our IDCMotion™ Application Development Software is included to program from your PC.

These controls are designed, built, tested and supported by IDC—a complete motion control solution from one reliable source.





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Overview

Models	S6961 & S6962
Motor Type	Hybrid, Permanent Magnet Step Motors
Number of Axes	1 & 2
Compatible Mechanics	NV-S, N2-S, EC2-S, EC3-S, EC4-S, EC5-S R2A-S, R3-S, R4-S, Tables
Shaft Power Continuous/Peak	600 Watts
AC Power	120 VAC
Control Method	Microstepping
Other Features	Anti–Resonance Technology provides excellent motor performance Open or Closed Loop Registration, Linear Interpolation, Go Immediate Mode, Optional Analog I/O

Overview

IDC's S6961 (1-axis) and S6962 (2-axes) Microstepping Smart Drives are user friendly systems that offer you many compelling features and benefits. Consider these systems when your motion control application requires:

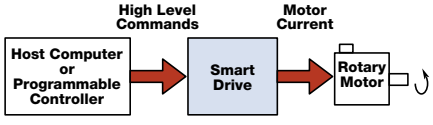
- A well integrated motion controller, microstepping drive, operator interface, power supply, 30 I/O, and built-in OPTO 22 I/O rack
- A simple Machine Controller
- Configurable I/O
- Go Immediate Mode. This mode of operation allows the controller to multitask between motion control and I/O operations. Immediate Mode also allows each axis to move completely independently of the other axis
- Interrupts
- Linear interpolation and registration
- Accepts encoder feedback for stall detect, closed loop operation and position maintenance
- Coordinated motion between two axes
- 1-99 axes of immediate control via host RS-232C communication
- Optional analog I/O for:
  - Reading an analog input proportional to temperature, distance, or pressure
  - Setting an analog output to control position of another axis of motion (for use with a D2500, H3501/4501, or B8501 analog position controls)

Optional Keypad

- Both a programming tool and an operator interface
- Menu-driven setup, on-line Help Function, Diagnostic Screens, Trace Mode provides straight forward set up, troubleshooting and program debugging
- Easy to read backlit 40 character display
- Attaches to control or mounts remotely
- Scratch-proof, large keys
- Displays current position and I/O status
- Keypad is protected to Nema 4 (IP65) when panel mounted

Drive Performance

- The S6961 and S6962 feature the same outstanding dynamic performance and reliability as our S6002 micristepping drive, described on page G-21



Motion Control

- 6K memory for up to 199 user programs (30K, 400 programs optional)
- User scaling of position, velocity, and acceleration
- Descriptive variables, math and conditional branching
- High-speed interrupt driven inputs-registration
- S6962-linear interpolated vector moves
- Windows Application Developer software included. See page G-35

OPTO Compatible I/O

- Accepts OPTO-22 (G4) digital modules and Grayhill (G5) analog and temperature modules
- 100% solid state, opto-isolation to 4000 volts
- 8 positions, all bidirectional
- Specify (intermix) OPTO I/O modules: for AC, DC, analog, and temperature signals

Compatible Mechanics:
EC2-S, EC3-S, EC4-S, EC5-S
NV-S, N2-S, R2A-S, R3-S, R4-S
Positioning Tables

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Specifications

Input Power

105-132 VAC single phase, 50/60 Hz
S6961: 500 VA Max @ 6 amp setting
S6962: 500 VA max @ 6 amp setting

Motor Output

Current	0.1 to 6 amp in 0.1 amp increments
Voltage	160 VDC motor bus voltage

Motor Compatibility

Type	2 phase, hybrid permanent magnet, 1.8° full step
Inductance	2 mH to 60 mH per phase

Motion

Position Range	±2,147,483,647 steps; absolute position and incremental
Velocity Range	0 to 50 rev/sec (0-3000 rpm)
OPTO Compatible I/O	8 positions support OPTO-22 (G4) digital, Grayhill (G5) analog and temperature modules

Inputs

8 programmable, End-of-Travel Limits, Home	24 VDC max, optically isolated internally pulled up to 12 VDC. Disconnect jumper to 12 VDC supply, & connect pull up to +24 VDC to make I/O 24 VDC
Incremental Encoder	Optically isolated, differential 5 VDC, 2 mHz max (post-quadrature); 5 VDC, 200 mA available total to power encoder

Outputs

8 Programmable	Open collector, 24 VDC max, optically isolated, internally pulled up to 12 VDC, sink current of 100 mA max. Disconnect jumper to 12 VDC supply, and connect pull up to +24 VDC to make I/O 24 VDC
Amplifier	Same amplifier specs as the S6002; see page G-21 for more information.

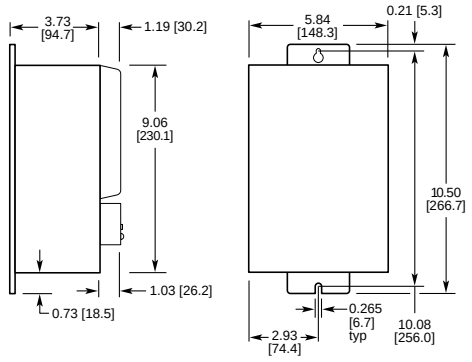
Environmental

Operating Temperature	Thermal shutdown occurs if heatsink temperature exceeds 65°C
Humidity	0% to 90% non-condensing

Mounting Dimensions

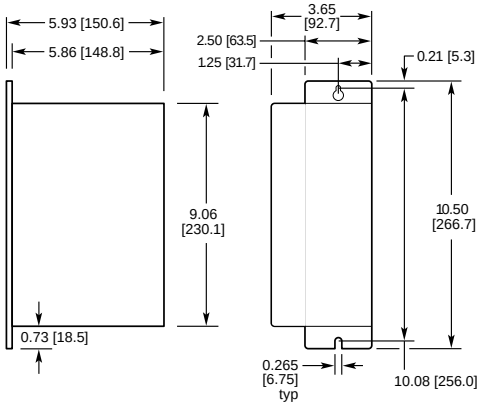
(S6961 and S6962)

Minimum Depth Mounting in [mm]

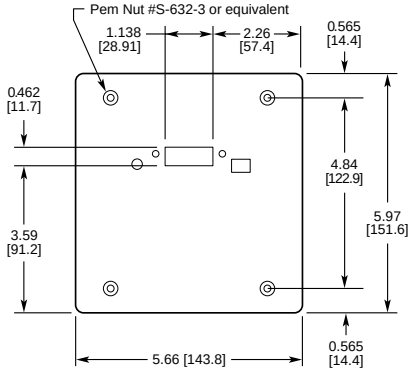


Minimum Width Mounting in [mm]

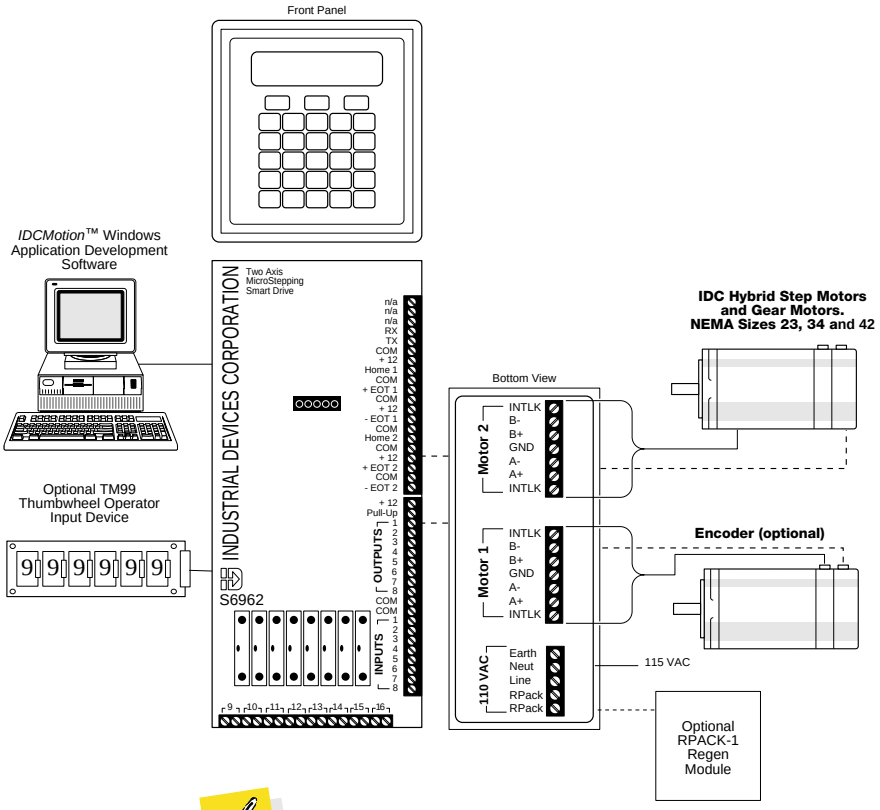
(Front panel and opto modules removed)



Remote Mounting Front Panel (Rear View) in [mm]



Operation



How To Order

Model	Description
S6961	1-axis unit, with front panel
S6962	2-axis unit, with front panel
S6961NP	1-axis unit, no front panel
S6962NP	2-axis unit, no front panel

Code	I/O Module Description
	1 2 3 4 5 6 7 8
	Position
A	DC/AC In, 10-32 VDC, 12-32 VAC
B	DC In, TTL
C	DC In, 35-60 VDC
D	AC In, 90-140 VAC
E	AC In, 180-240 VAC
F	DC Out, 5-60 VDC, 3 Amps
G	AC Out, 12-140 VAC, 3 Amps
H	AC Out, 24-280 VAC, 3 Amps
I	Input test switch
J	Analog In, 0-10 VDC
K	Analog In, 4-20 mA
L	Analog Out, 0-10 VDC
M	Analog Out, 4-20 mA
N	J Thermocouple In, 0-700°C
O	K Thermocouple In, -100-924°C
P	RTD In, 100 Ohm
X	Empty

Option	Description
-FK1	Fan Kit When exceeding 6 amps total current setting (sum of axis 1 and axis 2 current setting). See page G-37.
-30K	30K user program memory

Accessories

TM99	Thumbwheel input module. See page G-46.
RPACK-1, 115 VAC Operation	External regenerative power dissipation module. See page G-43.

To confirm your selection, review the checklist on page G-6.

Specifications

IDC controls are designed for convection cooling. The shape and size of our heatsinks are the result of thermal analysis and experimentation.

All of our controls have built-in temperature protection. Thermal sensors inside the S6000 controls will activate at a conservative heatsink temperature of 55°C. Thus, IDC controls will not be damaged when overtemperature conditions occur.

A number of factors affect the internal temperature of a control and whether or not it needs additional cooling:

- Ambient temperature
- Air flow
- Duty cycle
- Power delivered (the RMS current output)
- Number of axes per control
- Regenerative energy returned from the load
- Whether or not standby current is enabled

Adequate ventilation in the enclosure does a lot to cool our controls. Most often, a single fan in your enclosure or panel will circulate enough air.

When is a Fan Kit Needed?

Here are a few general guidelines to indicate when a fan kit may be necessary for your high performance application.

S6000 Series Controls:

- With very high regenerative loads.
- When the total motor current exceeds 6A (sum current of both axes with S6002 and S6962).

  For example, the fan is needed when driving an S42 motor, or when driving two S32 or larger motors.

Ordering information

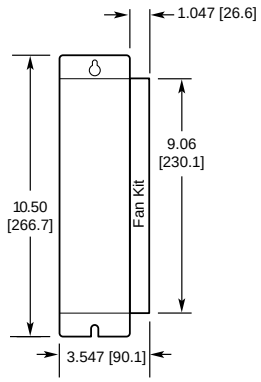
- The Fan Kit is available as an option on the controls listed above by adding an -FK1 suffix to the control model number.

  FK1 – for use with all S Series applications.

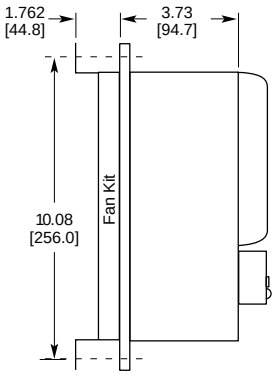
  If you are in doubt as to whether a fan kit will be needed for your application, simply leave sufficient panel space for the control with fan kit and test the control without a fan. If your control needs forced air cooling, the fan kit can be purchased separately and easily retrofitted in the field.

Dimensions in [mm]

Front View (S6002)



Side View (S6961, S6962)



How To Order

Model	Description
FANKIT-1	120 VAC Fan Kit The Fan Kit is available as an option on the controls listed above by adding an -FK1 suffix to the control model number. If you are in doubt as to whether a fan kit will be needed for your application, simply leave sufficient panel space for the control with fan kit and test the control without a fan. If your control requires forced air cooling, the fan kit can be purchased separately and easily retrofitted in the field.

Specifications

All of IDC's programmable Smart Drives and stand-alone motion controllers, which use the IDeal™ programming language, can be programmed and operated from the FP220 removable front panel (keypad). The FP220 makes a great operator-machine interface, as it provides the user with many features and benefits. Some of the features of the FP220 are:

- Remote mountable
- Menu-driven set up and Help
- NEMA 4 (IP65) standard
- Scratch-proof, large keys
- Easy to read, backlit 2 line, 40 character display
- Displays current position and I/O status
- Great for machine diagnostics and troubleshooting
- For mounting dimensions, see page G-35.

Keypad Menus and Functions

RUN	EDIT	HELP	COPY	DEL
PROGRAM: Run programs by *name* or number.	PROGRAM: Edit programs. Most commands are listed on the keypad.	At Main Menu: Provides help on the function of each key.	PROGRAM: Copies programs within a control.	PROGRAM: Deletes a program.
JOG: Jog at low or high speeds using submenu and arrow keys	SETUP: Define system environment and operating limits.	At Menu: Provides help on how to move about menus.		
TRACE: De-bug tool. Runs a program one command at a time.	LIST: Directory of stored programs, memory usage and available space.	At Submenus: Explains setup choices and how to select an option.		
	TEACH: Teach positions	In Editor: Command descriptions, with syntax.		

SETUP:

- Motor: Select motor model
- Mechanics: Scale acceleration, velocity, distance, coordinate system and gear ratio.
- I/O: Set up I/O and OPTO module functions.
- Jog: Set Jog acceleration, velocities, and allow Jog access from run menu.
- Home: Set type of home switch and offset position.
- Prog: Select program to run on power up and how to scan program select inputs.
- Enc: Select open/closed loop mode, encoder resolution and following error
- RS-232C: Set RS-232C parameters.
- Misc: Set useful tools like display mode, stop-rate and faults and shutdown polarity.

How To Order

Model	Description
FP220	Removeable front panel; comes with 6-ft* communications cable

* Longer cables are available.

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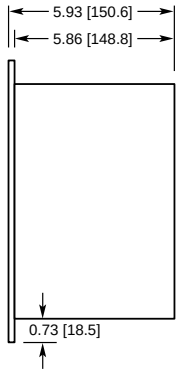
Specifications

When a large inertial load is decelerated or a vertical load is lowered, the mechanical energy that is not dissipated as heat in the actuator or drive is “regenerated” by the motor and transferred back into the drive’s power supply. This causes the drive's power supply voltage to increase. Without circuit protection, this voltage increase can damage a drive. Without a means of dissapating this energy, such applications cannot be solved.

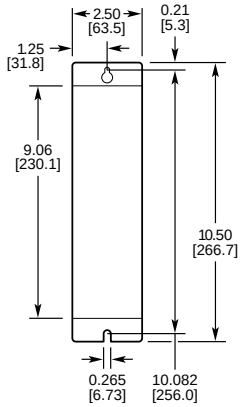
All IDC servo drives are fully protected against excessive regenerative energy. First, they are overvoltage and short circuit protected. Second, they are capable of dissipating regenerative energy both internally, and in extreme cases, externally using our model RPACK-1. Our drive’s LEDs will even indicate when excessive regenerative energy is present in your application.

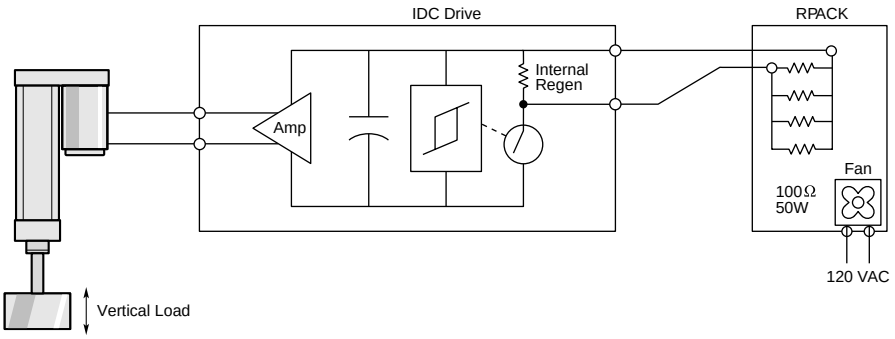
An RPACK allows you to make more aggressive moves in high inertia, low friction applications. Each RPACK provides connections for hook-up to either servo or stepper drives for a total dissipation of 240W continuous and 1000W peak (for 3 seconds).

Side View



Front View





Regen Capacity (watts or joules)	1-Axis S6000 Series	2-Axis S6000 Series
Internal without fan		
Continuous	20	20
Peak (3 sec)	300	600
Internal with fan		
Continuous	60	60
Peak (3 sec)	300	600
RPack (additional)		
Continuous	240	240
Peak (3 sec)	1,000	1,000
When to use an RPack-1	• Almost never needs an external RPACK-1	
	• Only recommended if your drive faults due to excessive regenerative energy	

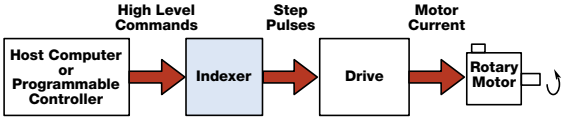
How To Order

Model	Description
RPACK-1	Regen Pack, 120 VAC Fan

Overview

IDC's 961 (single axis) and 962 (two axis) indexers output step and direction or CW/CCW control signals to one or more drives. The 961 and 962 use IDC's IDeal™ command language, insuring a user-friendly programming environment. These indexers can be used with any stepper drive or any digital servo drive that accepts an industry standard step and direction control signal (either differential or single ended). Consider the 961/2 for your motion control application when you require:

- A mix of servo and stepper drives. The 962 is an ideal solution when your application requires coordinated motion between two axis: one of which requires a high power brushless servo, and the other requires a low power stepper.
- Multiple drives to be run from one command signal. This is very useful when an application calls for multiple drive/motor systems to always do identical moves.
- The motion controller to be separate from the drive for E-Stop reasons. Using a 961/2 with a separate drive allows power to be cut from the drive without cutting power to the motion controller.
- A non-IDC drive/motor system, but would like to implement a user friendly motion controller.



Drive Compatibility

The 961 and 962 easily interface to a wide variety of step motor, and digital servo, drives which accept industry standard step and direction control signals. The 961/2 accept incremental encoder feedback, providing closed loop, and stall detect features. The frequency range of the 961/2's step output signal allows you to control drives ranging from the simplest full-step step motor drive to high speed digital brushless servo drives.

OPTO-Compatible I/O

- Accepts OPTO22 (G4) digital modules and Grayhill (G5) analog and temperature modules.
- 100% solid state, opto-isolation to 4000 volts
- 8 positions, all bidirectional
- Specify (intermix) factory installed AC, DC, and analog I/O modules

Optional Keypad

- Both a programming and operator interface
- Menu-driven setup, help functions, diagnostic screens, and trace mode to facilitate easy setup, programming and troubleshooting
- Easy to read, backlit 40 character display
- Commands listed on keys for easy reference
- Attaches to the control or mounts remotely
- Keypad is NEMA 4 (IP65) when panel mounted

Motion Control

- 6K of memory for up to 199 user programs (30K, 400 programs optional)
- Up to 2 axis of incremental encoder feedback
- User scaling of position, velocity, and acceleration
- Variable math and conditional branching
- IDCMotion™ Windows Application Development software included
- 50K resolution

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Specifications

Input Power

	120 VAC single phase, 50/60 Hz
	2.0 Amps max.
Serial Interface	RS-232C, 3 wire implementation (Tx, Rx and Gnd), 9600 Baud, 8 data bits, 1 stop bit, no parity.

Environmental

Ambient Temperature	0–50°C.
Humdity	0% to 90% non-condensing.

Drive Signals

Step, Direction & Shutdown Outputs	Optically isolated. Low signal <0.8 VDC, high signal >3.5 VDC, ±60 mA. Active high. Step pulse width is 0.8 to 10msec (depending on drive resolution setting).
Drive Fault Input	Optically isolated, TTL level, internal 1.0k pull-up to +5 VDC.
Position Range	±0-2,147,483,647 steps. Absolute and incremental
Velocity Range	1 to 1,250,000 steps/sec
Acceleration Range	1 to 20,000,000 steps/sec^2
OPTO-compatible I/O	8 Positions support OPTO-22 (G4) digital, and Grayhill (G5) analog and temperature modules (see ordering information).

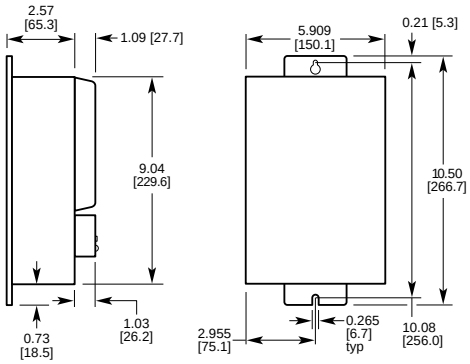
Inputs

8 Programmable, Limits, Home	24 VDC max, Optically isolated, can be pulled up to internal isolated 12VDC supply. 12 mA current required.
Incremental Encoder	Optically isolated, differential 5VDC, 2 MHz max (post-quadrature). 5VDC, 200mA power available total.

Outputs

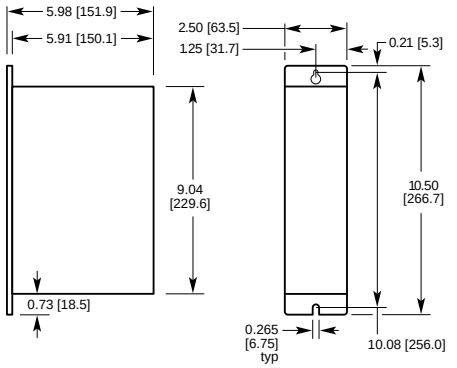
8 Programmable	Open collector, sink current per output 100 mA max, 350 mA max total sink current (sum of all outputs)
Programming	IDeal™ programming language. Program from the front panel, or via your PC using our Windows-compatible IDCMotion™ Application Developer software (included).

Minimum Depth Mounting Dimensions in [mm]

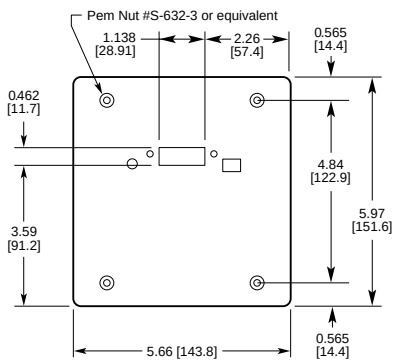


Minimum Width Mounting Dimensions in [mm]

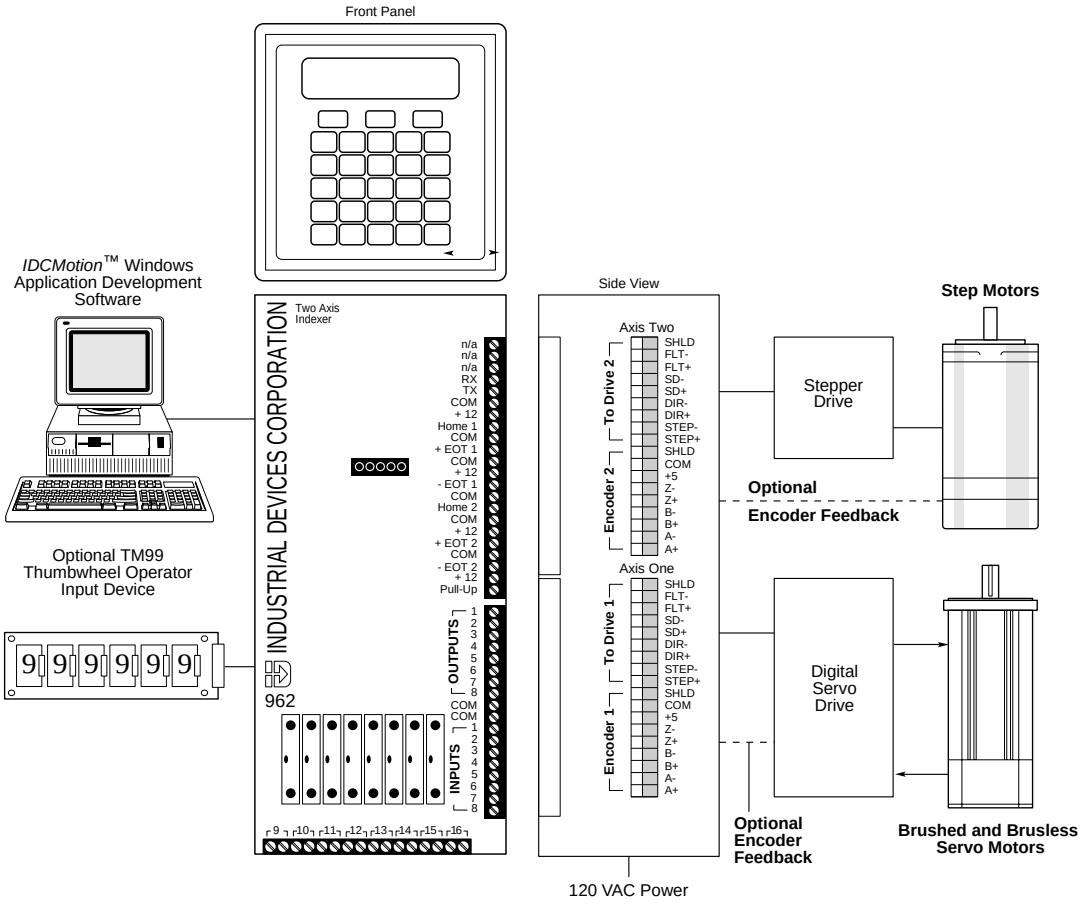
Front panel and opto modules removed.



Remote Mounting Front Panel (rear view) in [mm]



Operation



How To Order

Model	Description
961	1-axis unit, with front panel
962	2-axis unit, with front panel
961NP	1-axis unit, no front panel
962NP	2-axis unit, no front panel

To confirm your selection, review the checklist on page G-6.

Code	I/O Module Description
	1 2 3 4 5 6 7 8
	Position
A	DC/AC In, 10-32 VDC, 12-32 VAC
B	DC In, TTL
C	DC In, 35-60 VDC
D	AC In, 90-140 VAC
E	AC In, 180-240 VAC
F	DC Out, 5-60 VDC, 3 Amps
G	AC Out, 12-140 VAC, 3 Amps
H	AC Out, 24-280 VAC, 3 Amps
I	Input test switch
J	Analog In, 0-10 VDC
K	Analog In, 4-20 mA
L	Analog Out, 0-10 VDC
M	Analog Out, 4-20 mA
N	J Thermocouple In, 0-700°C
O	K Thermocouple In, -100-924°C
P	RTD In, 100 Ohm
X	Empty

Option	Description
-30K	30K user program memory

Accessories

TM99 — Thumbwheel input module. See page G-46.

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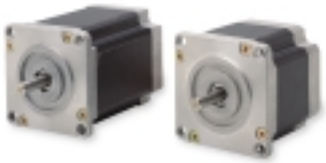
Overview



Features

- Sizes 17, 23, 34 and 42
- Optimized for use with IDC's microstepping controls
- Bipolar current ratings for use with IDC's microstepping controls
- High torque-to-inertia, yielding high acceleration
- 120°C rated Class B winding
- 12-ft motor cables standard
- Encoder optional (sizes 23, 34, 42); see page G-61
- Quick disconnect motor cabling option (sizes 34 and 42)

Model	Holding Torque oz-in [N-m]	Recommended Current/Phase Series [Parallel]	See page
S12	30 [0.25]	1.0 [2.0]	G-47
S21	65 [0.46]	1.2 [2.4]	G-48
S22	100 [0.71]	1.5 [3.0]	G-49
S23	125 [0.88]	1.75 [3.5]	G-50
S32	300 [2.1]	2.8 [5.6]	G-53
S33	400 [2.8]	3.5 [7.0]	G-54
P21	100 [0.7]	0.7 [13]	G-51
P22	200 [1.4]	1.0 [2.0]	G-52
P31	450 [3.2]	1.5 [3.0]	G-55
P32	920 [6.5]	1.6 [3.3]	G-56
P33	1260 [8.9]	2.0 [4.0]	G-57
P41	1250 [8.8]	2.8 [5.7]	G-58
P42	2300 [16.2]	3.3 [6.6]	G-59
K42	3000 [21.2]	3.2 [6.4]	G-60

How To Order

Motor Models	Options
S12	None
S21, S22, S23 P21, P22	EMK EM
S32X, S33X	EMK EM C25
P31X, P32X, P33X P41X, P42X K42X	EMK EM EQK EQ EQK25 EQ25 C25

Description

EMK – 1000 line encoder option with 12-ft, jacketed cable
EM – 500 line encoder option with 12-ft, jacketed cable
EQK – 1000 line encoder with 12-ft quick disconnect cable
EQ – 500 line encoder with 12-ft quick disconnect cable
EQK25 – 1000 line encoder with 25-ft quick disconnect cable
EQ25 – 500 line encoder with 25-ft quick disconnect cable
C25 – 25-ft quick disconnect motor lead cable

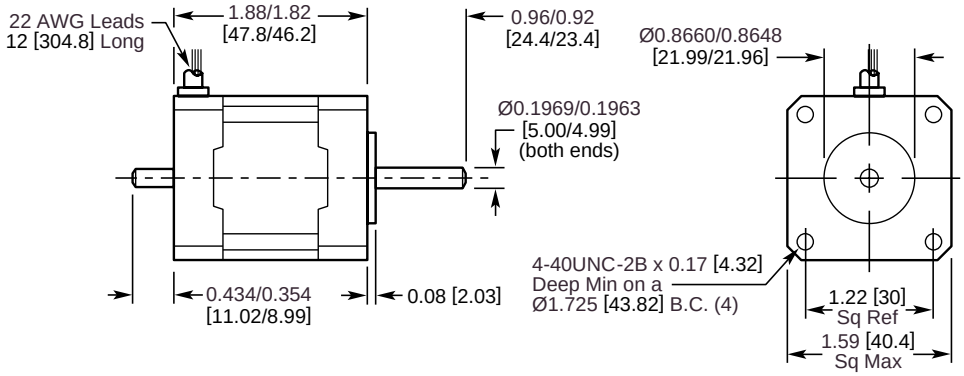
A 30% torque safety margin is recommended when applying step motors.

Replace the Xs in the above part numbers with N, T or V:
N = 8 leads, 12 inches long
T = Series wired motor and 12-foot quick-disconnect cable included
V = Parallel wired motor and 12-foot quick-disconnect cable included

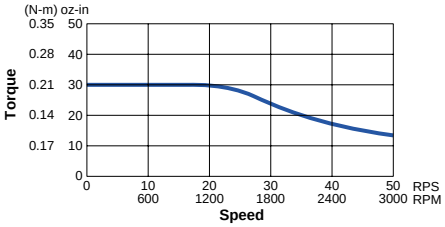
To confirm your selection, review the checklist on page G-6.

S12 Step Motor in [mm]

CE certified



Motor Performance



120 Series (100% duty cycle)

Motor and Encoder Data	S12 Series
Continuous Stall Torque oz-in [N-m]	30 [0.25]
Recommended Current/Phase Amps	1.0
Inductance mH	8.8
Max. Motor Winding Temp. °F [°C]	212 [100]
Rotor Inertia oz-in-s^2 [kg-m^2]	5.1x10^{-4} [3.6x10^{-6}]
Axial Shaft Load lbs [N]	10 [44]
Radial Shaft Load @ 0.50" [13 mm]	5 [22]
Motor Weight lbs [kg]	0.66 [0.3]
Step Angle (full step) degrees	1.8
How to order	G-46

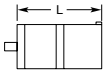
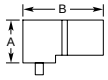
A 30% torque safety margin is recommended when applying step motors.

Warning: Do not run S12 motor with a NextStep 240 drive or SmartStep 240. Motors will exceed their rated temperatures and be damaged.

Applying Gearmotors

- See page I-1 for IDC gearmotor information and for how to determine gearmotor performance

Performance Planetary Gearmotors

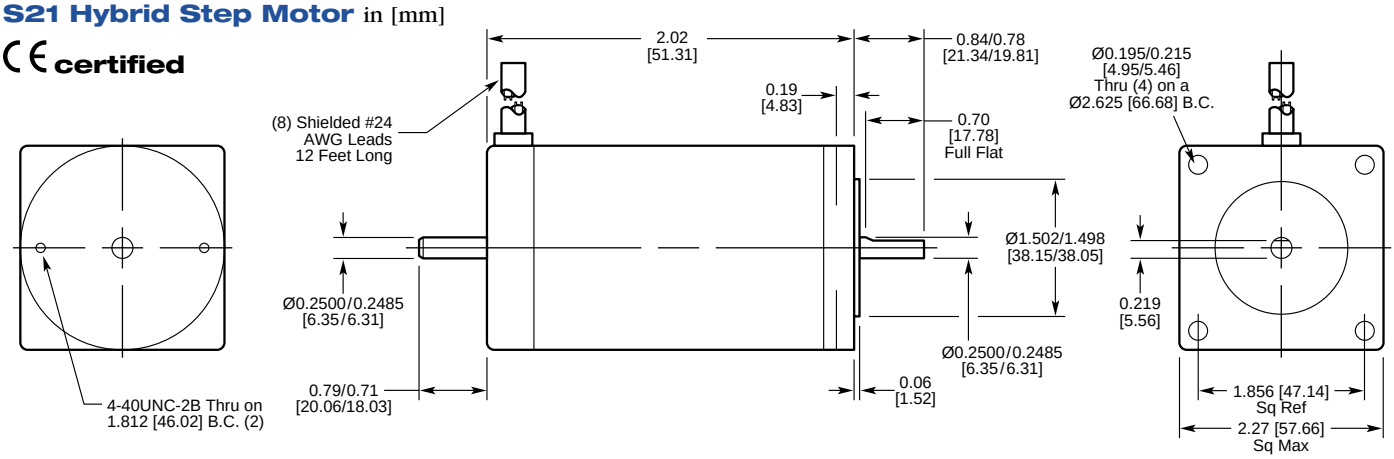
In-line  Right-angle 

Gear Ratio in [mm]	L	A x B
3 to 10	4.51 [114.6]	2.79 x 6.85 [70.9 x 174.0]
16 to 100	5.04 [128.0]	2.79 x 7.39 [70.9 x 187.7]
160 to 700	5.65 [143.5]	Above 100:1, not available

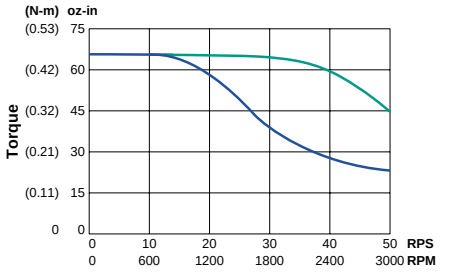
Performance

S21 Hybrid Step Motor in [mm]

CE certified



Motor Performance



120 Series (100% duty cycle)

120 Parallel*/240 Series*

* 50% duty cycle max above 5 rps (300 rpm)

Motor and Encoder Data	S21 Series	S21 Parallel
Continuous Stall Torque oz-in [N-m]	65 [0.46]	
Recommended Current/Phase Amps	1.2	2.4
Inductance mH	18	4.5
Max. Motor Winding Temp. °F [°C]	248 [120]	
Rotor Inertia oz-in-s^2 [kg-m^2]	1.66x10^{-3} [1.17x10^{-5}]	
Axial Shaft Load lbs [N]	10 [44]	
Radial Shaft Load @ 0.75" [19 mm]	15 [66]	
Motor Weight lbs [kg]	1.6 [0.73]	
Step Angle (full step) degrees	1.8	
How to order	G-46	

A 30% torque safety margin is recommended when applying step motors.

Warning: Do not run S21, S22 or S23 motors wired in parallel with a NextStep 240 drive or SmartStep 240. Motors will exceed their rated temperatures and be damaged. All motors should be wired in series when run with the NextStep 240 or SmartStep 240.

Applying Gearmotors

- See page I-1 for IDC gearmotor information and for how to determine gearmotor performance

Performance Planetary Gearmotors

In-line	Right-angle
Gear Ratio in [mm]	L	A x B
3 to 10	4.8 [121.4]	3.61 x 8.51 [91.4 x 216.2]
16 to 100	5.6 [142.5]	3.61 x 9.34 [91.4 x 237.2]
160 to 700	6.4 [162.6]	Above 100:1, not available

Value Planetary Gearmotors

In-line	Right-angle
Gear Ratio in [mm]	L	A x B
3 to 10	5.1 [129.5]	3.61 x 8.80 [91.4 x 223.5]
16 to 100	6.0 [153.4]	3.61 x 9.10 [91.4 x 246.4]

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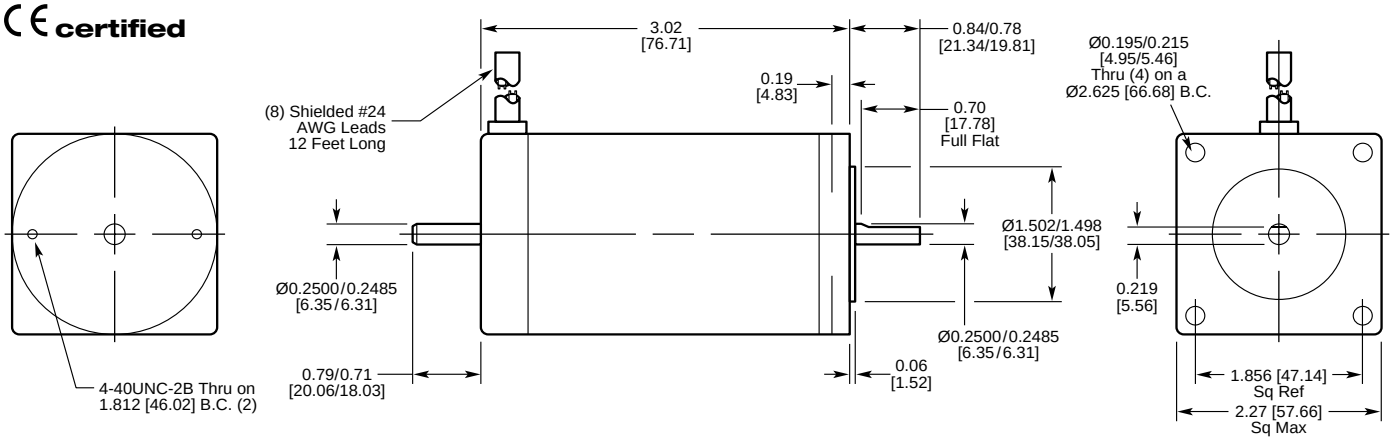
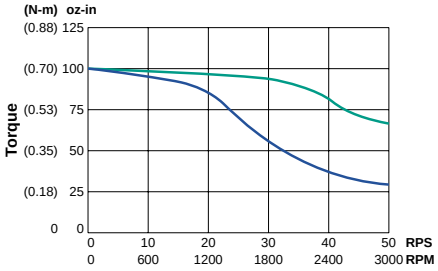
S22 Hybrid Step Motor in [mm]

CE certified



Motor Performance



120 Series (100% duty cycle)

120 Parallel*/240 Series*

* 50% duty cycle max above 5 rps (300 rpm)

Motor and Encoder Data	S22 Series	S22 Parallel
Continuous Stall Torque oz-in [N-m]	100 [0.71]	
Recommended Current/Phase Amps	1.5	3.0
Inductance mH	18	4.5
Max. Motor Winding Temp. °F [°C]	248 [120]	
Rotor Inertia oz-in-s² [kg-m²]	$3.31x10^{-3}$ [$2.34x10^{-5}$]	
Axial Shaft Load lbs [N]	10 [44]	
Radial Shaft Load @ 0.75" [19 mm]	15 [66]	
Motor Weight lbs [kg]	2.4 [1.1]	
Step Angle (full step) degrees	1.8	
How to order	G-46	

A 30% torque safety margin is recommended when applying step motors.

Warning: Do not run S21, S22 or S23 motors wired in parallel with a NextStep 240 drive or SmartStep 240. Motors will exceed their rated temperatures and be damaged. All motors should be wired in series when run with the NextStep 240 or SmartStep 240.

Applying Gearmotors

- See page I-1 for IDC gearmotor information and for how to determine gearmotor performance

Performance Planetary Gearmotors

	In-line	Right-angle
Gear Ratio in [mm]	L	A x B
3 to 10	5.8 [146.8]	3.61 x 9.51 [91.4 x 241.6]
16 to 100	6.6 [168.0]	3.61 x 10.34 [91.4 x 262.6]
160 to 700	7.4 [188.0]	Above 100:1, not available

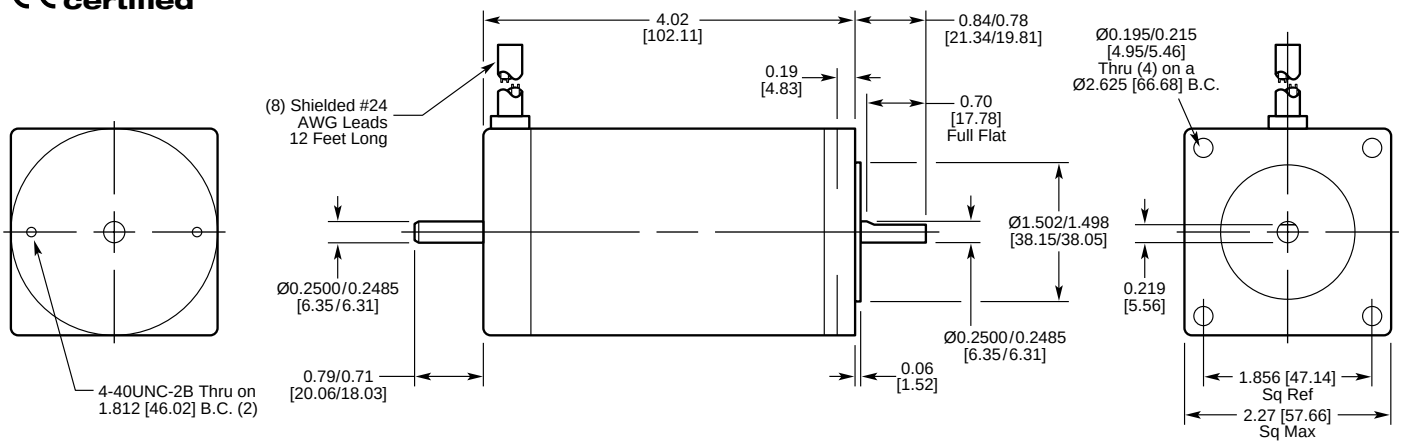
Value Planetary Gearmotors

	In-line	Right-angle
Gear Ratio in [mm]	L	A x B
3 to 10	6.1 [155.0]	3.61 x 9.80 [91.4 x 248.9]
16 to 100	7.0 [178.0]	3.61 x 10.70 [91.4 x 271.8]

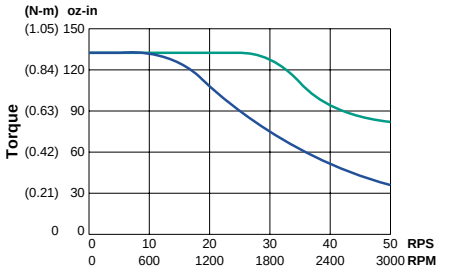
Performance

S23 Hybrid Step Motor in [mm]

CE certified



Motor Performance



120 Series (100% duty cycle)

120 Parallel*/240 Series*

* 50% duty cycle max above 5 rps (300 rpm)

A 30% torque safety margin is recommended when applying step motors.

Warning: Do not run S21, S22 or S23 motors wired in parallel with a NextStep 240 drive or SmartStep 240. Motors will exceed their rated temperatures and be damaged. All motors should be wired in series when run with the NextStep 240 or SmartStep 240.

Applying Gearmotors

- See page I-1 for IDC gearmotor information and for how to determine gearmotor performance

Motor and Encoder Data	S23 Series	S23 Parallel
Continuous Stall Torque oz-in [N-m]	125 [0.88]	
Recommended Current/Phase Amps	1.7	3.5
Inductance mH	18	4.5
Max. Motor Winding Temp. °F [°C]	248 [120]	
Rotor Inertia oz-in-s^2 [kg-m^2]	4.97x10^{-3} [3.51x10^{-5}]	
Axial Shaft Load lbs [N]	10 [44]	
Radial Shaft Load @ 0.75" [19 mm]	15 [66]	
Motor Weight lbs [kg]	3.2 [1.5]	
Step Angle (full step) degrees	1.8	
How to order	G-46	

Performance Planetary Gearmotors

	In-line	Right-angle
Gear Ratio in [mm]	L	A x B
3 to10	6.8 [172.2]	3.61 x 10.51 [91.7 x 266.9]
16 to 100	7.6 [193.3]	3.61 x 11.34 [91.7 x 288.0]
160 to 700	8.4 [213.4]	Above 100:1, not available

Value Planetary Gearmotors

	In-line	Right-angle
Gear Ratio in [mm]	L	A x B
3 to 10	7.1 [180.0]	3.61 x 10.80 [91.7 x 274.3]
16 to 100	8.0 [203.0]	3.61 x 11.70 [91.7 x 297.2]

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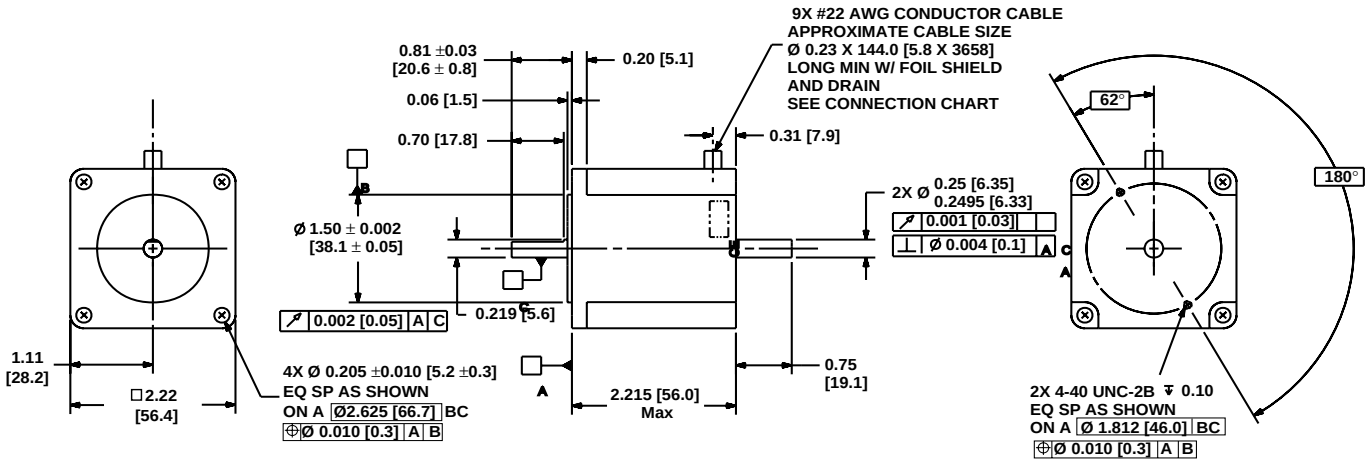
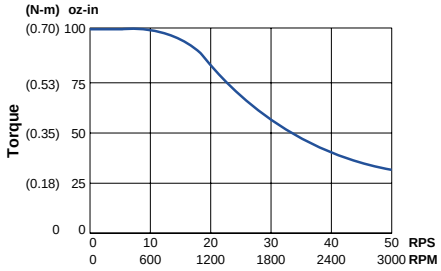
P21 Motor in [mm]

CE certified



Motor Performance



120 Parallel/240 Series (100% duty cycle)

Motor and Encoder Data	P21 Series	P21 Parallel
Continuous Stall Torque oz-in [N-m]	100 [0.70]	
Recommended Current/Phase Amps	0.7	1.3
Inductance mH	79	20
Max. Motor Winding Temp. °F [°C]	2.48 [120]	
Rotor Inertia oz-in-s² [kg-m²]	0.0035 [2.48 x10⁻⁵]	
Weight lb [kg]	1.9 [0.86]	
Axial Shaft Load lbs [N]	10 [44]	
Radial Shaft Load @ 0.75" [19 mm]	15 [66]	
How to order	G-46	

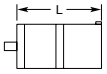
A 30% torque safety margin is recommended when applying step motors.

Please note: In order to get the performance curve shown above, motors should be wired in parallel when the drive is operated from 120 VAC; and motors should be wired in series when the drive is run off 240 VAC.

Applying Gearmotors

- See page I-1 for IDC gearmotor information and for how to determine gearmotor performance

Performance Planetary Gearmotors



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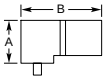
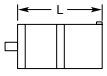


Right-angle

Gear Ratio in [mm]	L	A x B
3 to10	4.95 [125.6]	3.61 x 8.70 [91.7 x 220.9]
16 to 100	5.78 [146.7]	3.61 x 9.53 [91.7 x 241.9]
160 to 700	6.57 [166.8]	Above 100:1, not available

Value Planetary Gearmotors



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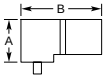


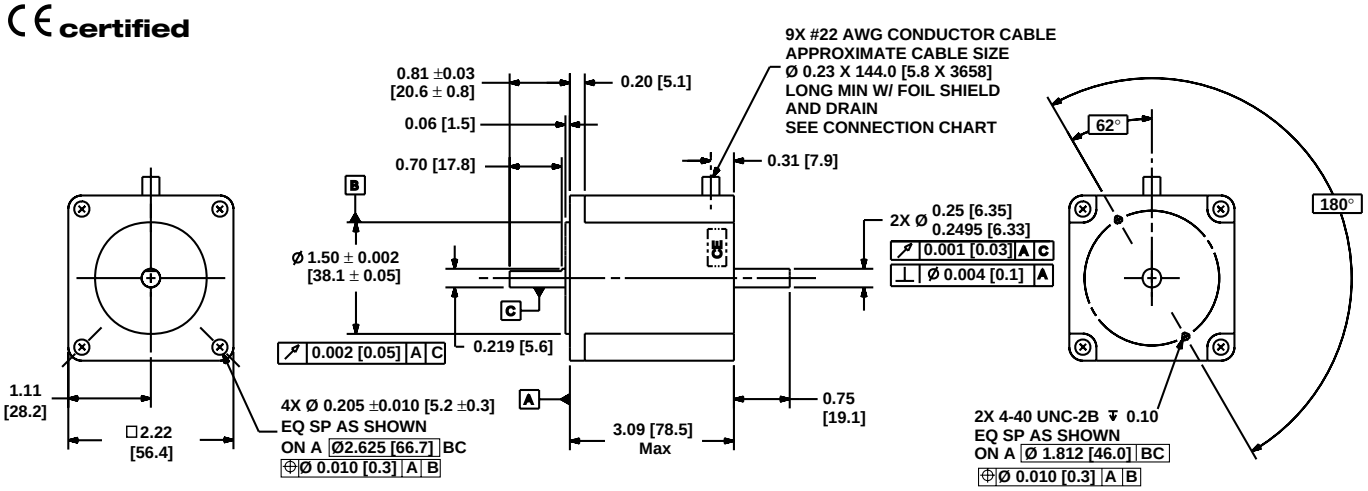
Right-angle

Gear Ratio in [mm]	L	A x B
3 to 10	5.3 [134.5]	3.61 x 8.99 [91.7 x 228.3]
16 to 100	6.21 [157.6]	3.61 x 9.89 [91.7 x 251.1]

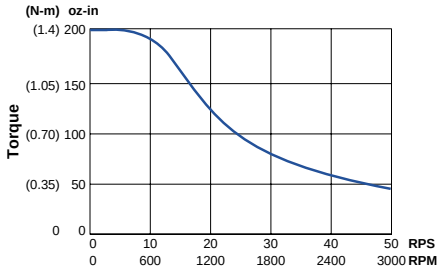
Performance

P22 Motor in [mm]

CE certified



Motor Performance



120 Parallel/240 Series (100% duty cycle)

Motor and Encoder Data	P22 Series	P22 Parallel
Continuous Stall Torque oz-in [N-m]	200 [1.4]	
Recommended Current/Phase Amps	1.0	2.0
Inductance mH	64	16
Max. Motor Winding Temp. °F [°C]	248 [120]	
Rotor Inertia oz-in-s² [kg-m²]	0.0061 [4.32 x10⁻⁵]	
Weight lb [kg]	2.7 [1.23]	
Axial Shaft Load lbs [N]	10 [44]	
Radial Shaft Load @ 0.75" [19 mm]	15 [66]	
How to order	G-46	

A 30% torque safety margin is recommended when applying step motors.

Please note: In order to get the performance curve shown above, motors should be wired in parallel when the drive is operated from 120 VAC; and motors should be wired in series when the drive is run off 240 VAC.

Applying Gearmotors

- See page I-1 for IDC gearmotor information and for how to determine gearmotor performance

Performance Planetary Gearmotors

Gear Ratio in [mm]	L	A x B
3 to10	6.8 [172.2]	3.61 x 9.58 [91.4 x 243.3]
16 to 100	7.6 [193.3]	3.61 x 10.41 [91.4 x 264.4]
160 to 700	8.4 [213.4]	Above 100:1, not available

Value Planetary Gearmotors

Gear Ratio in [mm]	L	A x B
3 to 10	7.1 [180.0]	3.61 x 9.87 [91.4 x 250.7]
16 to 100	8.0 [203.0]	3.61 x 10.77 [91.4 x 273.6]

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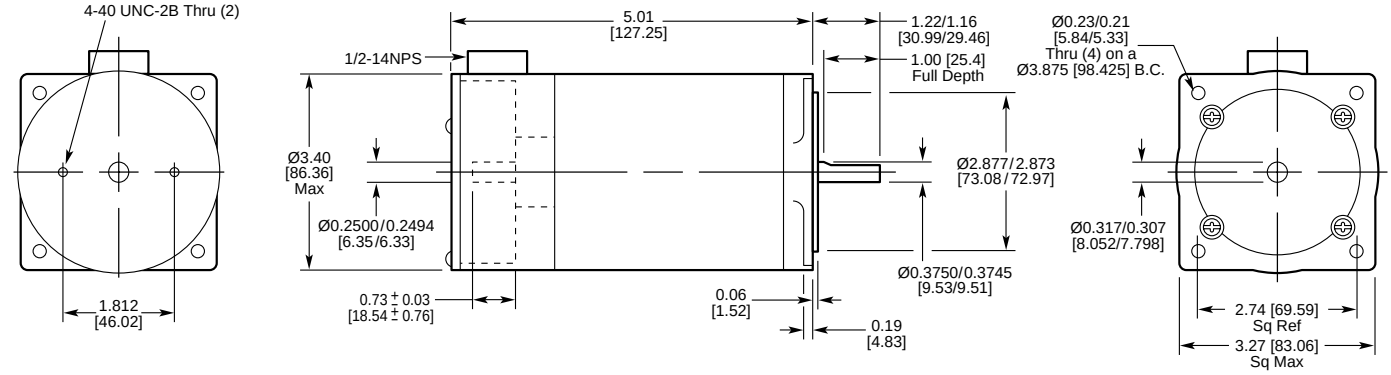
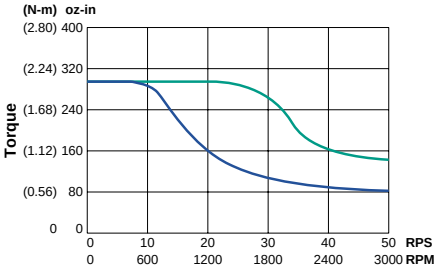
S32X Hybrid Motor in [mm]

CE certified

x = N	12 inch, 8 conductor flying leads
T	12 foot, 5 conductor quick disconnect cable wired in series
V	12 foot, 5 conductor quick disconnect cable wired in parallel



Motor Performance



120 Series (100% duty cycle)

120 Parallel*/240 Series*

* 50% duty cycle max above 5 rps (300 rpm)

Motor and Encoder Data	S32 Series	S32 Parallel
Continuous Stall Torque oz-in [N-m]	300 [2.1]	
Recommended Current/Phase Amps	2.8	5.6
Inductance mH	10	2.5
Max. Motor Winding Temp. °F [°C]	248 [120]	
Rotor Inertia oz-in-s² [kg-m²]	0.017[1.21x10⁻⁴]	
Axial Shaft Load lbs [N]	10 [44]	
Radial Shaft Load @ 0.75" [19 mm]	20 [89]	
Motor Weight lbs [kg]	5.1 [2.3]	
Step Angle (full step) degrees	1.8	
How to order	G-46	

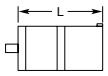
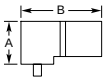
A 30% torque safety margin is recommended when applying step motors.

Warning: Do not run S32 or S33 motors wired in parallel with a NextStep 240 drive or SmartStep 240. Motors will exceed their rated temperatures and be damaged. All motors should be wired in series when run with the NextStep 240 or SmartStep 240.

Applying Gearmotors

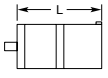
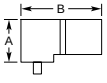
- See page I-1 for IDC gearmotor information and for how to determine gearmotor performance

Performance Planetary Gearmotors

In-line  Right-angle 

Gear Ratio in [mm]	L	A x B
3 to 10	9.2 [234.0]	5.20 x 14.17 [132.1 x 359.9]
16 to 100	10.3 [262.0]	5.20 x 15.3 [132.1 x 388.6]
160 to 700	11.6 [293.0]	Above 100:1, not available

Value Planetary Gearmotors

In-line  Right-angle 

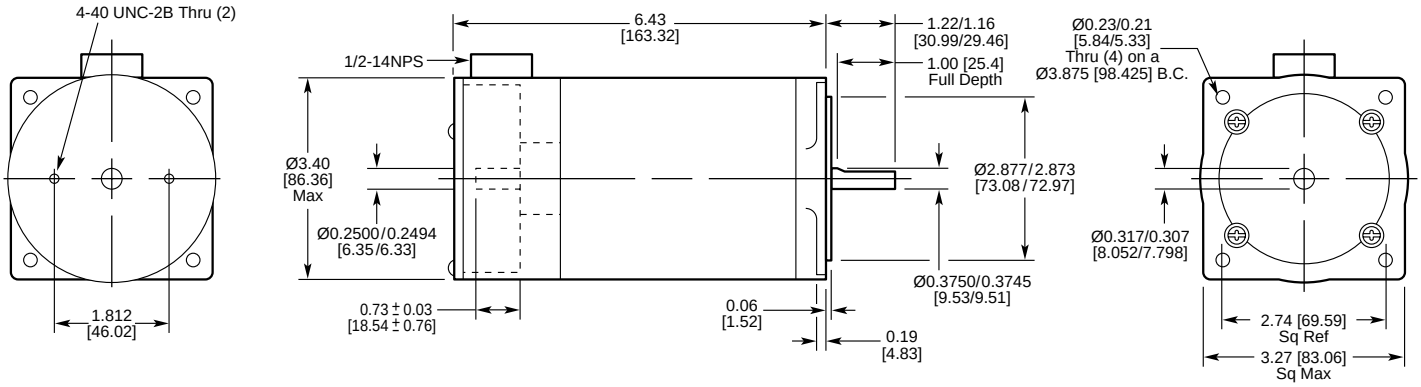
Gear Ratio in [mm]	L	A x B
3 to 10	9.6 [243]	5.20 x 14.54 [132.1 x 369.3]
16 to 100	10.8 [275]	5.20 x 15.81 [132.1 x 401.6]

Performance

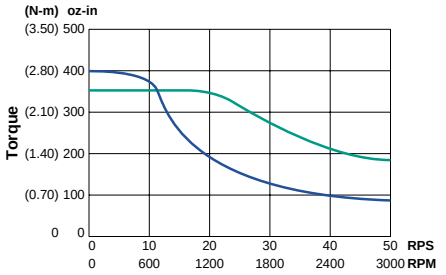
S33X Step Motor in [mm]

CE certified

x = N	12 inch, 8 conductor flying leads
T	12 foot, 5 conductor quick disconnect cable wired in series
V	12 foot, 5 conductor quick disconnect cable wired in parallel



Motor Performance



120 Series (100% duty cycle)

120 Parallel*/240 Series*

* 50% duty cycle max above 5 rps (300 rpm)

Motor and Encoder Data	S33 Series	S33 Parallel
Continuous Stall Torque oz-in [N-m]	400 [2.8]	350 [2.5]
Recommended Current/Phase Amps	3.5	7.0
Inductance mH	10	2.5
Max. Motor Winding Temp. °F [°C]	212 [100]	
Rotor Inertia oz-in-s^2 [kg-m^2]	0.0265 [1.88x10^{-4}]	
Axial Shaft Load lbs [N]	10 [44]	
Radial Shaft Load @ 0.75" [19 mm]	20 [89]	
Motor Weight lbs [kg]	8.3 [3.8]	
Step Angle (full step) degrees	1.8	
How to order	G-46	

A 30% torque safety margin is recommended when applying step motors.

Warning: Do not run S32 or S33 motors wired in parallel with a NextStep 240 drive or SmartStep 240. Motors will exceed their rated temperatures and be damaged. All motors should be wired in series when run with the NextStep 240 or SmartStep 240.

Applying Gearmotors

- See page I-1 for IDC gearmotor information and for how to determine gearmotor performance

Performance Planetary Gearmotors

In-line	Right-angle
Gear Ratio in [mm]	L	A x B
3 to 10	10.6 [270.0]	5.20 x 15.59 [132.1 x 396.0]
16 to 100	11.7 [297.0]	5.20 x 16.72 [132.1 x 424.7]
160 to 700	13.0 [331.0]	Above 100:1, not available

Value Planetary Gearmotors

In-line	Right-angle
Gear Ratio in [mm]	L	A x B
3 to 10	11.0 [279]	5.20 x 15.96 [132.1 x 405.4]
16 to 100	12.2 [310]	5.20 x 17.23 [132.1 x 437.6]

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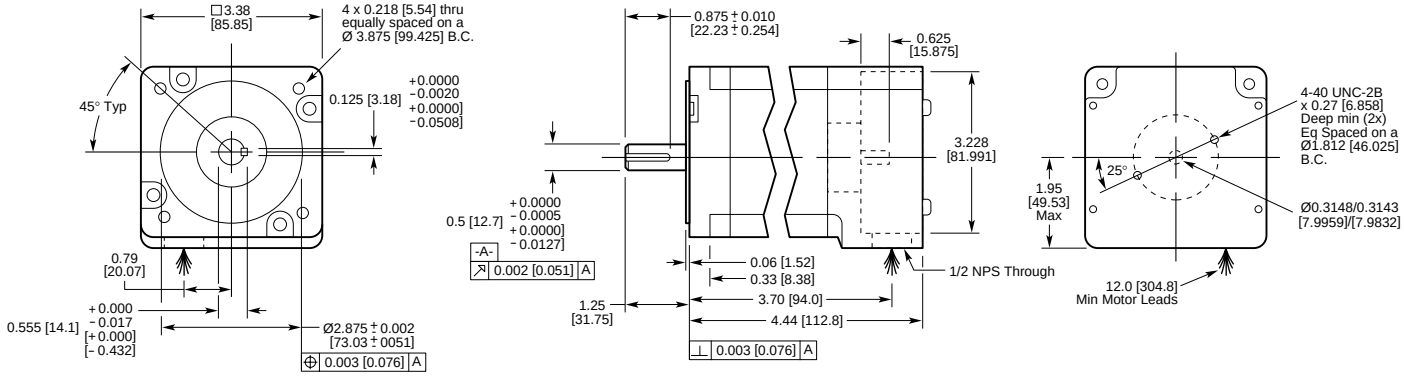
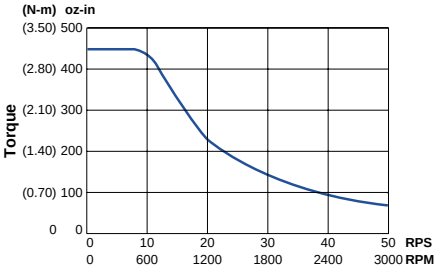
P31X Motor in [mm]

CE, cULus certified

x = N 12 inch, 8 conductor flying leads
T 12 foot, 5 conductor quick disconnect cable wired in series
V 12 foot, 5 conductor quick disconnect cable wired in parallel



Motor Performance



120 Parallel/240 Series (100% duty cycle)

A 30% torque safety margin is recommended when applying step motors.

Please note: In order to get the performance curve shown above, motors should be wired in parallel when the drive is operated from 120 VAC; and motors should be wired in series when the drive is run off 240 VAC.

Applying Gearmotors

- See page I-1 for IDC gearmotor information and for how to determine gearmotor performance

Motor and Encoder Data	P31 Series	P31 Parallel
Continuous Stall Torque oz-in [N-m]	450 [3.2]	
Recommended Current/Phase Amps	1.5	3.0
Inductance mH	56	14
Max. Motor Winding Temp. °F [°C]	212 [100]	
Rotor Inertia oz-in-s² [kg-m²]	0.0202 [1.4x10⁻⁴]	
Axial Shaft Load lbs [N]	305 [1355]	
Radial Shaft Load @ 0.5" [12.7 mm]	65 [285]	
Motor Weight lbs [kg]	5.0 [2.27]	
Step Angle (full step) degrees	1.8	
How to order	G-46	

Performance Planetary Gearmotors

	In-line	Right-angle
Gear Ratio in [mm]	L	A x B
3 to 10	8.6 [219.0]	5.20 x 13.60 [132.1 x 345.4]
16 to 100	9.8 [248]	5.20 x 14.73 [132.1 x 374.1]
160 to 700	11.0 [279]	Above 100:1, not available

Value Planetary Gearmotors

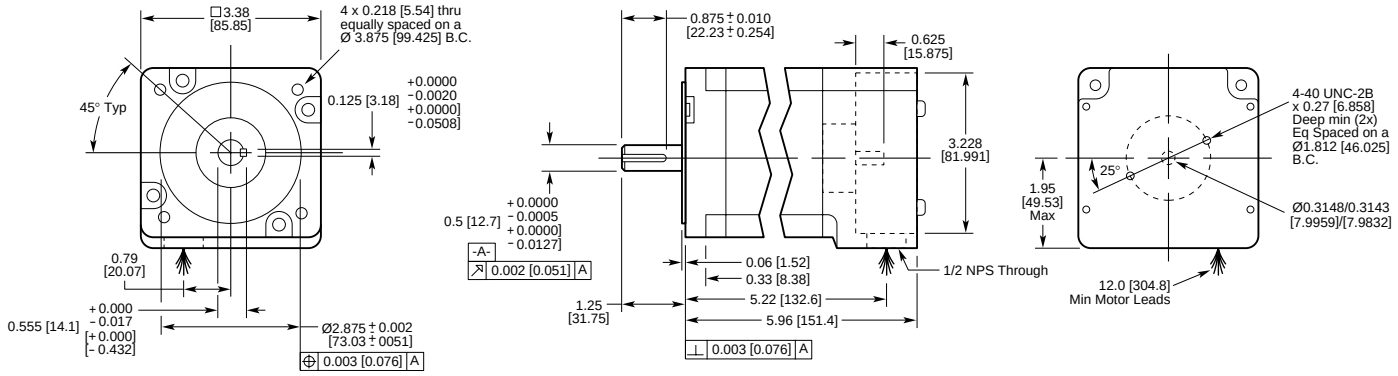
	In-line	Right-angle
Gear Ratio in [mm]	L	A x B
3 to 10	9.0 [229.0]	5.20 x 13.97 [132.1 x 354.8]
16 to 100	10.3 [261]	5.20 x 15.24 [132.1 x 387.1]

Performance

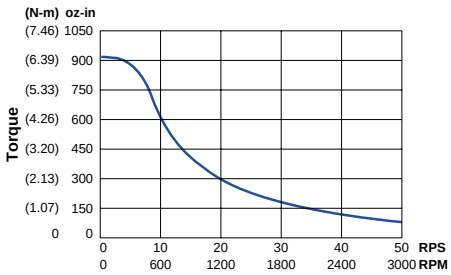
P32X Motor in [mm]

CE, cULus certified

x = N 12 inch, 8 conductor flying leads
T 12 foot, 5 conductor quick disconnect cable wired in series
V 12 foot, 5 conductor quick disconnect cable wired in parallel



Motor Performance



120 Parallel/240 Series (100% duty cycle)

Motor and Encoder Data	P32 Series	P32 Parallel
Continuous Stall Torque oz-in [N-m]	920 [6.5]	
Recommended Current/Phase Amps	1.6	3.3
Inductance mH	120	30
Max. Motor Winding Temp. °F [°C]	212 [100]	
Rotor Inertia oz-in-s^2 [kg-m^2]	0.038 [2.7x10^{-4}]	
Axial Shaft Load lbs [N]	305 [1350]	
Radial Shaft Load @ 0.5" [12.7 mm]	65 [289]	
Motor Weight lbs [kg]	8.4 [3.81]	
Step Angle (full step) degrees	1.8	
How to order	G-46	

A 30% torque safety margin is recommended when applying step motors.

Please note: In order to get the performance curve shown above, motors should be wired in parallel when the drive is operated from 120 VAC; and motors should be wired in series when the drive is run off 240 VAC.

Applying Gearmotors

- See page I-1 for IDC gearmotor information and for how to determine gearmotor performance

Performance Planetary Gearmotors

	In-line	Right-angle
Gear Ratio in [mm]	L	A x B
3 to 10	10.1 [257]	5.20 x 15.12 [132.1 x 384.1]
16 to 100	11.2 [285]	5.20 x 16.25 [132.1 x 412.8]
160 to 700	12.5 [318]	Above 100:1, not available

Value Planetary Gearmotors

	In-line	Right-angle
Gear Ratio in [mm]	L	A x B
3 to 10	10.5 [267]	5.20 x 15.49 [132.1 x 393.4]
16 to 100	11.7 [298]	5.20 x 16.76 [132.1 x 425.7]

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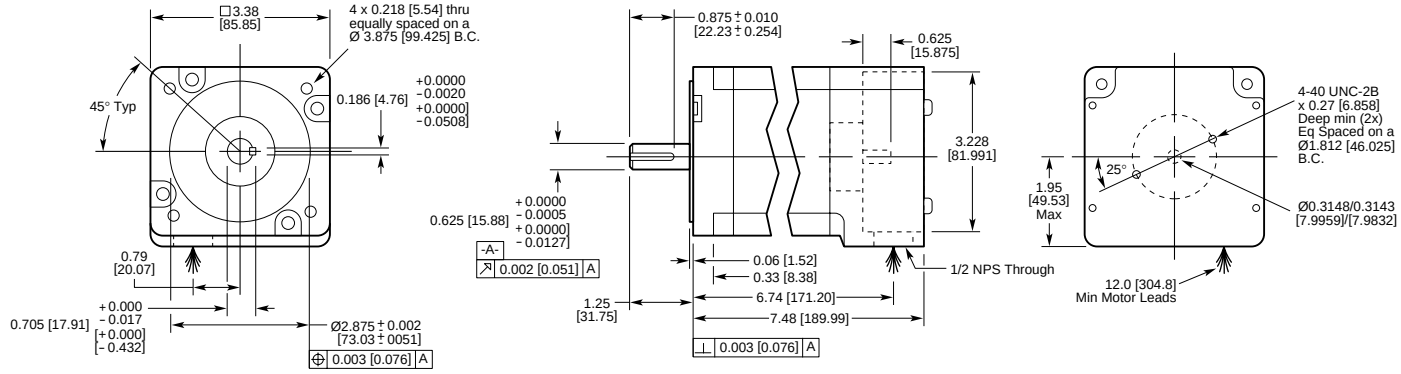
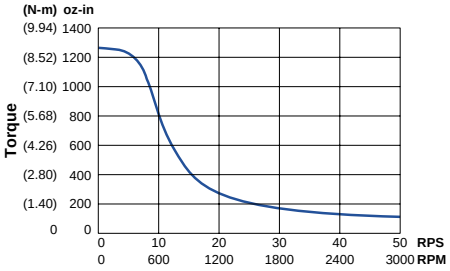
P33X Motor in [mm]

CE, cULus certified

x = N 12 inch, 8 conductor flying leads
T 12 foot, 5 conductor quick disconnect cable wired in series
V 12 foot, 5 conductor quick disconnect cable wired in parallel



Motor Performance



120 Parallel/240 Series (100% duty cycle)

Motor and Encoder Data	P33 Series	P33 Parallel
Continuous Stall Torque oz-in [N-m]	1260 [8.9]	
Recommended Current/Phase Amps	2.0	4.0
Inductance mH	100	25
Max. Motor Winding Temp. °F [°C]	212 [100]	
Rotor Inertia oz-in-s² [kg-m²]	0.057 [4.0x10⁻⁴]	
Axial Shaft Load lbs [N]	305 [1350]	
Radial Shaft Load @ 0.5" [12.7 mm]	110 [489]	
Motor Weight lbs [kg]	11.9 [5.4]	
Step Angle (full step) degrees	1.8	
How to order	G-46	

A 30% torque safety margin is recommended when applying step motors.

Please note: In order to get the performance curve shown above, motors should be wired in parallel when the drive is operated from 120 VAC; and motors should be wired in series when the drive is run off 240 VAC.

Applying Gearmotors

- See page I-1 for IDC gearmotor information and for how to determine gearmotor performance

Performance Planetary Gearmotors

	In-line	Right-angle
Gear Ratio in [mm]	L	A x B
3 to 10	11.7 [297.2]	5.20 x 16.64 [132.1 x 422.7]
16 to 100	12.8 [325]	5.20 x 17.77 [132.1 x 451.4]
160 to 700	14 [356]	Above 100:1, not available

Value Planetary Gearmotors

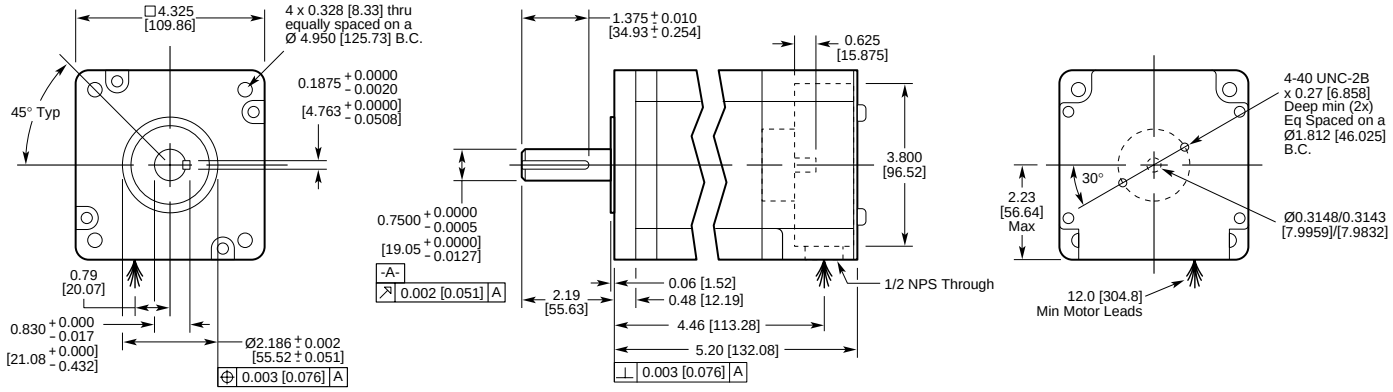
	In-line	Right-angle
Gear Ratio in [mm]	L	A x B
3 to 10	12.0 [305]	5.20 x 17.01 [132.1 x 432.1]
16 to 100	13.2 [335]	5.20 x 18.28 [132.1 x 464.3]

Performance

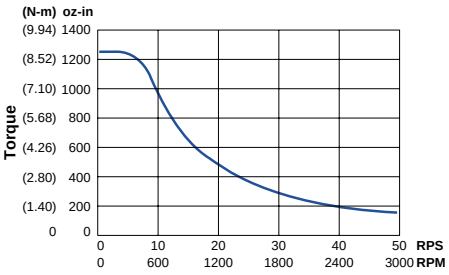
P41X Motor in [mm]

CE, cULus certified

x = N 12 inch, 8 conductor flying leads
T 12 foot, 5 conductor quick disconnect cable wired in series
V 12 foot, 5 conductor quick disconnect cable wired in parallel



Motor Performance



120 Parallel/240 Series (100% duty cycle)

A 30% torque safety margin is recommended when applying step motors.

Please note: In order to get the performance curve shown above, motors should be wired in parallel when the drive is operated from 120 VAC; and motors should be wired in series when the drive is run off 240 VAC.

Applying Gearmotors

- See page I-1 for IDC gearmotor information and for how to determine gearmotor performance

Motor and Encoder Data	P41 Series	P41 Parallel
Continuous Stall Torque oz-in [N-m]	1250 [8.8]	
Recommended Current/Phase Amps	2.8	5.7
Inductance mH	60	15
Max. Motor Winding Temp. °F [°C]	212 [100]	
Rotor Inertia oz-in-s² [kg-m²]	0.0783 [5.5x10⁻⁴]	
Axial Shaft Load lbs [N]	404 [1790]	
Radial Shaft Load @ 0.5" [12.7 mm]	125 [550]	
Motor Weight lbs [kg]	11 [5]	
Step Angle (full step) degrees	1.8	
How to order	G-46	

Performance Planetary Gearmotors

In-line		Right-angle
Gear Ratio in [mm]	L	A x B
3 to 10	9.9 [252]	5.95 x 16.59 [151.3 x 421.4]
16 to 100	11.5 [293]	5.95 x 18.22 [151.3 x 462.8]
160 to 700	13.1 [334]	Above 100:1, not available

Value Planetary Gearmotors

In-line		Right-angle
Gear Ratio in [mm]	L	A x B
3 to 10	10.4 [264]	5.95 x 17.05 [151.3 x 433.17]
16 to 100	12.0 [305]	5.95 x 18.65 [151.3 x 473.7]

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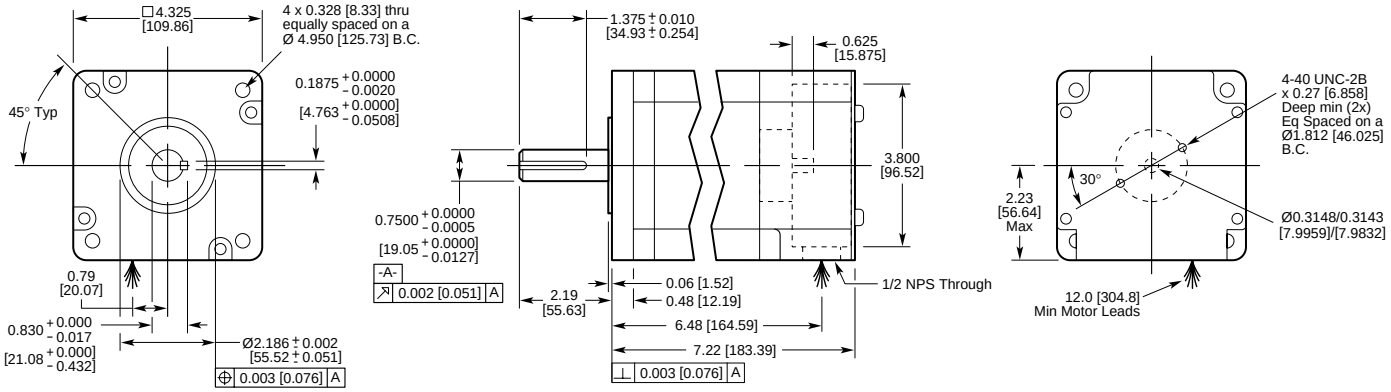
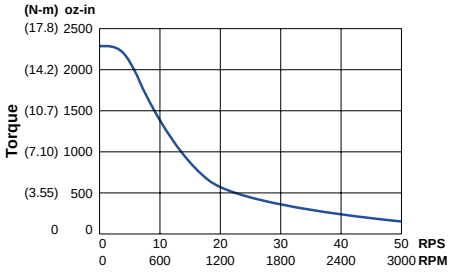
P42X Motor in [mm]

CE, cULus certified

x = N 12 inch, 8 conductor flying leads
T 12 foot, 5 conductor quick disconnect cable wired in series
V 12 foot, 5 conductor quick disconnect cable wired in parallel



Motor Performance



120 Parallel/240 Series (100% duty cycle)

Motor and Encoder Data	P42 Series	P42 Parallel
Continuous Stall Torque oz-in [N-m]	2300 [16.2]	
Recommended Current/Phase Amps	3.3	6.6
Inductance mH	84	21
Max. Motor Winding Temp. °F [°C]	212 [100]	
Rotor Inertia oz-in-s² [kg-m²]	0.155 [1.09x10⁻³]	
Axial Shaft Load lbs [N]	404 [1790]	
Radial Shaft Load @ 0.5" [12.7 mm]	110 [489]	
Motor Weight lbs [kg]	18.4 [8.35]	
Step Angle (full step) degrees	1.8	
How to order	G-46	

A 30% torque safety margin is recommended when applying step motors.

Please note: In order to get the performance curve shown above, motors should be wired in parallel when the drive is operated from 120 VAC; and motors should be wired in series when the drive is run off 240 VAC.

Applying Gearmotors

- See page I-1 for IDC gearmotor information and for how to determine gearmotor performance

Performance Planetary Gearmotors

	In-line	Right-angle
Gear Ratio in [mm]	L	A x B
3 to 10	12 [304]	5.95 x 18.61 [151.3 x 472.7]
16 to 100	13.6 [344]	5.95 x 20.24 [151.3 x 514.1]
160 to 700	15.2 [385]	Above 100:1, not available

Value Planetary Gearmotors

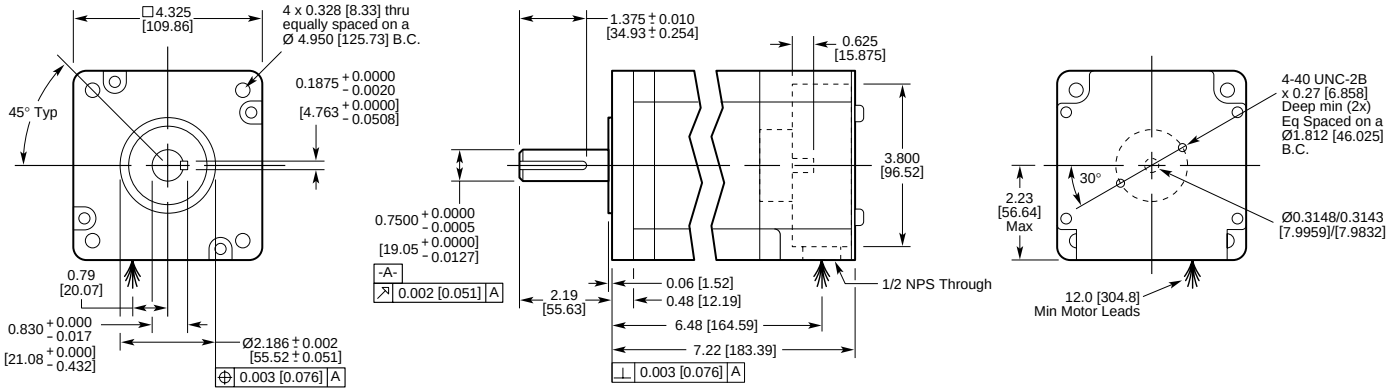
	In-line	Right-angle
Gear Ratio in [mm]	L	A x B
3 to 10	12.4 [315]	5.95 x 19.07 [151.3 x 484.4]
16 to 100	14.0 [356]	5.95 x 20.67[151.3 x 525.0]

Performance

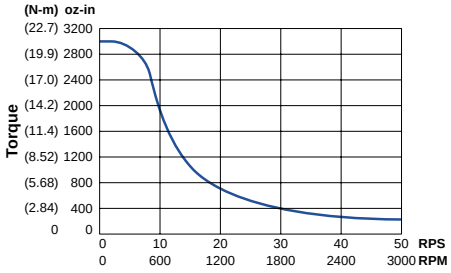
K42X Motor in [mm]

CE, cULus certified

x = N 12 inch, 8 conductor flying leads
T 12 foot, 5 conductor quick disconnect cable wired in series
V 12 foot, 5 conductor quick disconnect cable wired in parallel



Motor Performance



120 Parallel/240 Series (100% duty cycle)

A 30% torque safety margin is recommended when applying step motors.

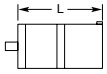
Please note: In order to get the performance curve shown above, motors should be wired in parallel when the drive is operated from 120 VAC; and motors should be wired in series when the drive is run off 240 VAC.

Applying Gearmotors

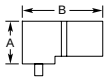
- See page I-1 for IDC gearmotor information and for how to determine gearmotor performance

Motor and Encoder Data	K42 Series	K42 Parallel
Continuous Stall Torque oz-in [N-m]	3000 [21.2]	
Recommended Current/Phase Amps	3.2	6.4
Inductance mH	60	15
Max. Motor Winding Temp. °F [°C]	212 [100]	
Rotor Inertia oz-in-s² [kg-m²]	0.156 [1.09x10⁻³]	
Axial Shaft Load lbs [N]	404 [1790]	
Radial Shaft Load @ 0.5" [12.7 mm]	110 [489]	
Motor Weight lbs [kg]	18.4 [8.35]	
Step Angle (full step) degrees	1.8	
How to order	G-46	

Performance Planetary Gearmotors



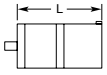
In-line



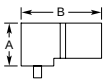
Right-angle

Gear Ratio in [mm]	L	A x B
3 to 10	12 [304]	5.95 x 18.61 [151.3 x 472.7]
16 to 100	13.6 [344]	5.95 x 20.24 [151.3 x 514.1]
160 to 700	15.2 [385]	Above 100:1, not available

Value Planetary Gearmotors



In-line



Right-angle

Gear Ratio in [mm]	L	A x B
3 to 10	12.4 [315]	5.95 x 19.07 [151.3 x 484.4]
16 to 100	14.0 [356]	5.95 x 20.67 [151.3 x 525.0]

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Specifications

The -EMK option provides an incremental 1000 line rotary encoder coupled to the rear shaft of our S, P and K Series step motors.

The -EM option provides an incremental 500 line rotary encoder coupled to the rear shaft of our S, P and K Series step motors.

An encoder is typically used with the SmartStep, S6961 and S6962 programmable step motor controls to provide stall detection and position maintenance. Encoders are also commonly used with displays to provide position information, or to provide position feedback to your own controller when using our NextStep® or S6002 drive.

-EM and -EMK are compatible with:

S, P and K Series step motors and gearmotors, sizes 23, 34 and 42

Electrical

Output Format	Incremental, dual square wave quadrature, with index.
-EMK Pulses Per Revolution	1000 line (4000 post-quadrature), one index line
-EM Pulses Per Revolution	500 line (2000 post-quadrature), one index line
Supply Voltage	5VDC ± 5 %
Current Requirements	140 mA
Frequency	100 kHz pre-quadrature, max.

Mechanical

Outline Dimensions	Adds 1.0 inch to the length of 23 frame motors. No dimension change on 34 and 42 frame motors.
Speed	6000 rpm max
Weight	6 oz
Cable	12-foot cable standard

Environmental

Operating Temperature	-10° to 70°C (S Series, P2X Series), -10° to 100°C (P3X, P4X & K Series)
Storage Temperature	-20° to 70°C (S Series, P2X Series), -30° to 110°C (P3X, P4X & K Series)
Housing	Drip-proof
Vibration	10 to 200 Hz @ 5Gs (S & P2X Series), 5-2000 Hz @ 10 Gs (P3X, P4X & K Series)
Shock	100G for 6 ms (S & P2X Series, 50 G for 11 ms (P3X, P4X & K Series)

Notes:

- S32, S33, P31, P32, P33, P41, P42, and K42 motors: the encoder is housed inside the rear plate of the motor.
- The encoder adds 1.0 inch to the length of the S21, S22, S23, P21 and P22 motors.
- The encoder cable can be extended by the customer to a maximum of 100 feet if a high quality shielded, twisted pair cable is used.