

MICROKINETICS

C o r p o r a t i o n

Wood Routers

CNC & AUTOMATION CATALOG

2009

Express

your

Creativity

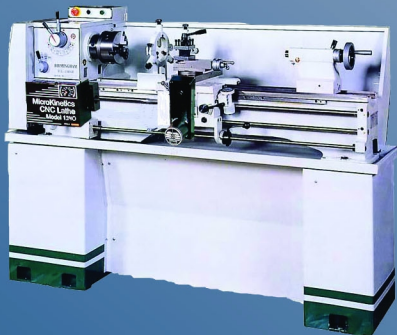
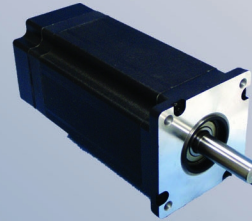
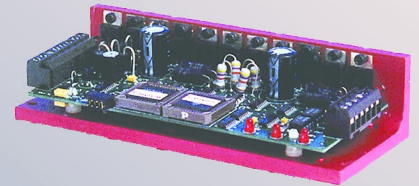
in

Motion

Motion Control

Express Mill

Software



Stepper Motors

www.microkinetics.com

LOOK AT WHAT'S NEW!

The items featured here are the latest additions to our product line. MicroKinetics always strives to provide the latest in motion control technology.

The new **MN400E** showcases all of the capabilities of our popular MN400 motion controller. The sloped front aluminum enclosure

houses a power supply and wiring interfaces, including a control panel which has jog switches, feed rate override control, and indicator lights. For integration engineers, the system allows easy evaluation of the MN400 motion controller's capabilities.

The MN400E can be used to upgrade existing OptiStep systems to support Windows XP/2000 through USB and serial interfaces. This eliminates the requirement for an ISA slot or Windows 98 of these older systems. Applicable Motion Control systems include the DT Lathe, DT Mill, Benchtop Lathe, and Benchtop Mill systems. Turn to page 24 for more details.



The new **CNC Express Mill GTS** is a package that can't be beat! See page 88 for details. This system includes all of our options for the most complete system at an unbelievably low price!

Includes:

- Precision CNC Mill
- Driverack power system
- MN400 advanced motion controller
- 8" CNC Rotary Table
- Variable speed spindle controller with a remote keypad
- Precision tapered roller bearings
- Quick change tooling which allows for one-handed tool changes with precise registration
- Flood coolant system
- Safety shield/ Splash guard



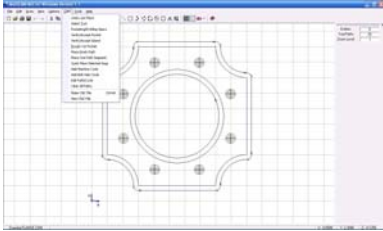
Now quick and precise tool changes for milling machines are at your fingertips with the new **R8 Quick-Change Tool System!** See page 92 to learn more.



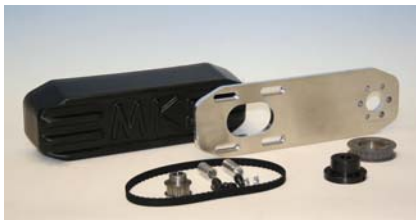
As the newest addition to our standard machine line, the **CNC Lathe 1340** is equipped with all the great features of our smaller lathes, but is designed for a larger capacity. One of our customers uses this machine to make custom baseball bats. What can you make on a CNC Lathe with 40 inches between centers? This product is detailed on page 95.



Introducing MicroKinetics own CAD/CAM software



MultiCAM Mill for Windows™ is a reincarnation of the popular DOS program with the same name. Capitalizing on the resources of the Windows operating system and the vast amounts of memory, MultiCAM Mill for Windows is more capable than ever before with advanced pocketing algorithms, gouge avoidance and path editing features tailor-made for MicroKinetics machines. Now with bolt-hole circles and magnetic snaps as well as support for canned cycles, MultiCAM Mill™ is a joy to use. Our philosophy behind this product is to offer CAM software that is so easy to use you can draw and machine basic parts in literally minutes! See page 10 for limited time introductory pricing.



The **Bridgeport Knee CNC retrofit kit** includes all of the mechanical components needed to convert the knee of your manual Bridgeport or Enco mill for CNC operation. All components are precision engineered. Use with one of our NEMA 42 motors for optimal performance. See page 110 for more details.

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Dear Colleagues,

I am grateful for all the friends and experiences that I've enjoyed since I started this company in 1985. I personally have been involved in many innovative and amazing projects with many of you. I continue to be inspired by the fresh talent applying MicroKinetics controllers and software every year! In this catalog, we hope to provide you with more tools and products to inspire your imagination. For those of you who have been working with us since the early years, we appreciate your support and for those who are just joining us, welcome! We look forward to working with you as our company goals for growth and success meet with yours.

Regards,

Maurice Khano
Founder/CEO

Front Row (L to R): Charlotte, Jo, Linda, Melissa; Back Row (L to R): Maurice, Mary Ann, Norm, Sam, Brandon, Wendy.



Some Prominent MicroKinetics Customers

- Baxter Healthcare
- Boeing Aerospace
- Corning
- Delphi Medical Systems
- Emory University
- Ethicon Endoscopy
- Johnson & Johnson
- Flextronics
- General Electric
- Goody Products
- Hamilton Beach
- Proctor Silex
- Honeywell
- Intel Corporation
- Los Alamos National Labs
- Meridian Medical
- NASA
- N.I.S.T.
- NYU
- RJ Reynolds
- Sandia National Labs
- Xerox

Top 10 Reasons to Choose MicroKinetics Products

MicroKinetics has been providing high quality motion control products for 23 years to a small number of high volume users. In 1991, MicroKinetics began marketing its products to small volume OEM's and end users. Now you can benefit from the availability of high performance products at reasonable cost. Here are some of the most important reasons to choose MicroKinetics:

1. Comprehensive Software Base

To complement your selection of a motion controller, we offer several software packages including SuperScribe, a plotter emulator for a quick and easy CAD interface to routing and engraving. In addition, we have G-code processors for control and graphical simulation of turning and routing/milling applications. Also available is MultiCAM, our powerful and easy to use CAD/CAM software. MultiCAM Mill is for milling and MultiCAM Lathe is for turning applications.

2. Excellent Technical Support

Our experienced engineers are ready to help you complete your motion control project in less time and with less effort. Simply email via our website at www.microkinetics.com for a timely, written response. Technical support is also available by phone within 1 year of purchase.

3. Complete Motion Control Packages

Our growing product line currently includes indexers, drivers, power supplies, motors and software. All products are designed to compliment each other for maximum productivity and all provide high value and reduced cost.

4. Cost-Effective Designs

We designed our products to be affordable. Because they are relatively low in cost, MicroKinetics products can be incorporated into your final design achieving a high level of reliability and functionality without significantly increasing the cost of manufacture of your end product!

5. Field Proven Products

Thousands of our controllers are providing reliable service day in and day out in applications that in-

clude 3-D modeling, PCB prototyping, articulated robotic arms, wafer probing and automated PCB testing. Year after year, our controllers continue to demonstrate their superior performance and unequalled reliability.

6. Five Year Warranty

Our exclusive 5 year warranty on most of our products backs up our commitment to quality, reliability, service and total customer satisfaction.

7. Money Back Guarantee

Our money back guarantee eliminates your risk. If you are not completely satisfied with any standard product purchase, just return it within 30 days for a full refund. Items must be returned in new condition or a refurbish fee will apply. Unfortunately, we can not offer this guarantee on custom or special order items.

8. Immediate Delivery

Most of our products are in stock ready for immediate shipment. Products normally ship via UPS ground service. Priority shipment methods are available upon request.

9. Free Software Updates

We do not charge for minor software updates/enhancements. We want all of our customers to have the most current versions of our software. We offer free downloads of our most recent updates on the web at www.microkinetics.com or you can get an update on disk for a nominal postage & handling fee. Major revision changes may carry a small upgrade fee.

10. Quantity Discounts

In addition to the low single shipment OEM prices, you can also save more by scheduling your requirements over a period of up to 1 year. This allows you to save money now, while insuring timely future deliveries without any further action on your part. We offer this additional discount because we'll be able to plan our workload well in advance.

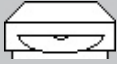
Ordering Information

How to Order



By Telephone: 770.422.7845 Toll Free: 800.674.8419

Our knowledgeable sales representatives are ready to serve you from 8:30 am to 5:30 pm EST Monday through Friday. For most efficient service, please have a list of quantities and part numbers. If paying by credit card, please have your VISA or MasterCard at hand when calling.



By FAX: 770.422.7854 (complete order form inside back cover)

Our fax lines are open 24 hours a day, 7 days a week, 365 days a year. Fax orders received after 2:00 pm EST will be processed the next business day. Please include your daytime telephone number in case we have questions about your order.



On the Internet:

On-line ordering is available on our web page at www.microkinetics.com.



By Mail:

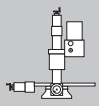
Complete the order form (inside back cover) and mail to:

MicroKinetics Corporation
Attn: Order Processing
2117-A Barrett Park Drive
Kennesaw, GA 30144



Payment:

Several convenient payment options are available. MicroKinetics accepts VISA, MasterCard, COD (certified funds only), wire transfer, prepay (by check or money order), and extends credit to educational institutions. Companies with excellent credit rating are granted open accounts upon approval of credit application. Terms of open account are NET 10 days. When opening an account, please allow sufficient time to complete the approval process. First orders from companies wishing to open an account are always prepaid, credit card or COD certified. Shipping charges are prepaid and billed. All International orders must be prepaid by VISA, MasterCard, or wire transfer.



Shipping:

All prices are F.O.B. Kennesaw, Georgia. Shipping charges are typically prepaid and added to the order unless different arrangements are requested. UPS Ground is the shipping method used unless otherwise specified. We can also ship packages via Federal Express. Some of our larger machines (CNC Express, 1236 Lathe, 1340 Lathe) must ship by motor freight carrier.

Sales Tax:

Only Georgia businesses and residents are required to pay sales tax. In-state sales may be exempt if goods are for resale and a resale certificate is provided. Sales tax is charged at the county rate, based on the county where the goods are delivered. If you are unsure of the rate for your county, contact our accounting department. International or out-of-state orders do not pay sales tax.

International Orders:

MicroKinetics accepts orders from individuals and companies outside the United States. All orders are exported from the US in accordance with the Export Administration Regulations. Diversion contrary to US law is prohibited. MicroKinetics cannot accept letters of credit, personal/company checks or certified personal/company checks. All international orders must be prepaid in US dollars by VISA, MasterCard or wire transfer. Please contact our customer service department for wiring instructions. All bank/wire transfer fees as well as shipping costs are paid by the customer.

Warranty:

The following MicroKinetics Products are warranted against any defects in manufacture for a period of five (5) years: Unodrive, MotionNet (MN) Series, ServoStep, PWR14E, PWR36, PWR7205, DM4050, DR8010, and DM8010. All other products including components, interconnecting cables, and motors are warranted for one (1) year (unless otherwise indicated). MicroKinetics will repair or replace, at its option, any items found to be defective within the warranty period, provided the item is delivered prepaid to the fac-

tory with a valid return authorization number. (please see "Return Policy" section)

This warranty does not apply to any product which has been subject to misuse (including static discharge), negligence, improper installation or which has been modified without the written consent of MicroKinetics.

Limited Liability:

MicroKinetics shall not be responsible for any incidental, consequential, or direct damages or expenses associated with the use or misuse of its products. MicroKinetics does not guarantee that any of its products are designed for any particular use or purpose. The entire risk as to the suitability and performance of all products as applied lies with the user. **DO NOT USE PRODUCTS DESCRIBED HEREIN AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS!**

Products sold by MicroKinetics are not intended for use as critical components in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

Notice:

Information in this catalog is believed to be accurate, however MicroKinetics does not guarantee the absence of typographical errors, omissions, or any other inadvertent errors. MicroKinetics reserves the right to change the design of its products at any time.

Return Policy:

MicroKinetics will gladly accept merchandise returns** and will replace the product or refund the purchase price at your option providing you observe the following:

1. Contact a Customer Service Representative to obtain a RMA number.
2. Returns must be made within 30 days of date of invoice and be accompanied by the original invoice number and a brief explanation of the reason for return.
3. Products returned after the 30 day return period are subject to a restocking fee. *No returns*

are accepted after 90 days from purchase date.

4. Return merchandise must be in original packaging and in resalable condition. Shipping containers used and arrangement of product within must protect the product against handling damage.

5. Return freight charges must be prepaid. Any shipping charges billed to you are not refundable.

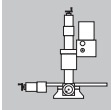
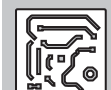
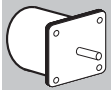
****Custom items are nonreturnable. Any item not listed by part # in this catalog is considered to be a custom item. Due to the proprietary nature of retrofit kits, they may not be returned. Non-returnable stock items are denoted in the catalog with a "*" at the end of the part number.**

Cancellations/Changes to order:

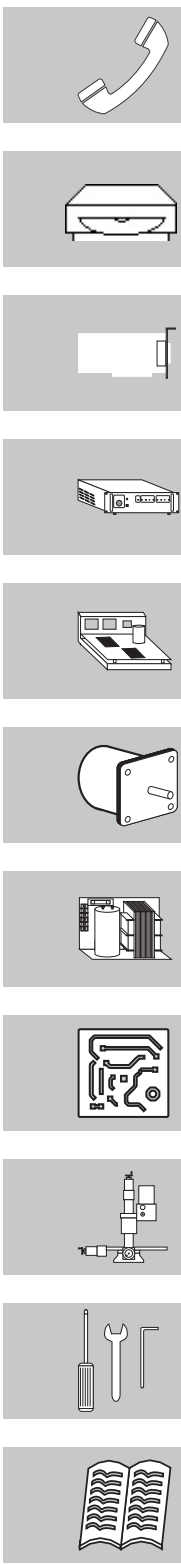
Once an order is placed, any changes or cancellations may result in a fee for any work in process.

Product Demonstrations by Appointment Only:

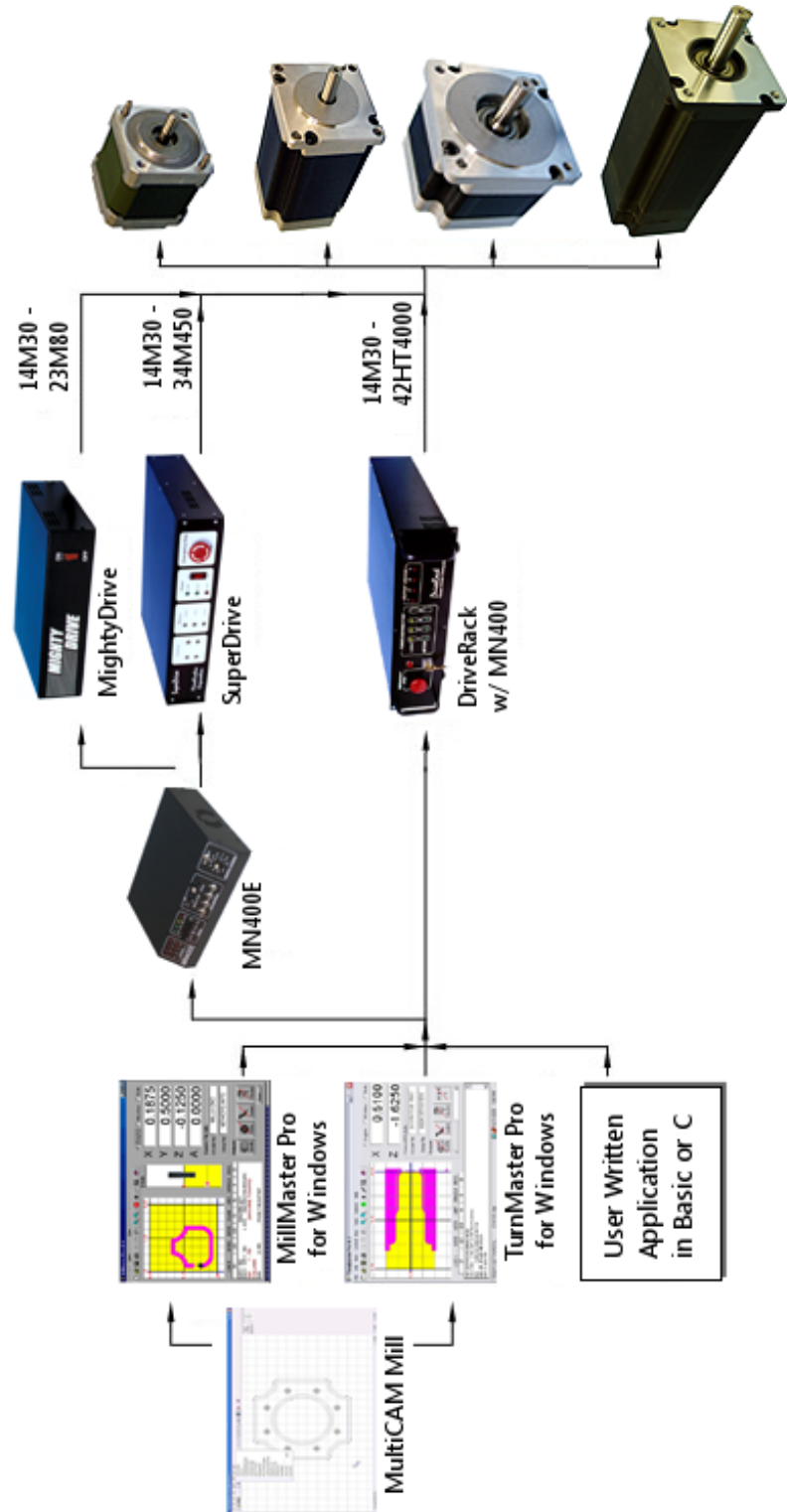
We offer product demonstrations on many of our systems, but do ask that you make arrangements in advance for this. We are not setup to accommodate "walk-ins". We like to gear our product demo to your specific needs and want to take adequate time to show all of the features that would be of interest to you. Please contact our sales dept. for details on product demonstrations.



To order by phone call 1-800-674-8419, or fax 770-422-7854

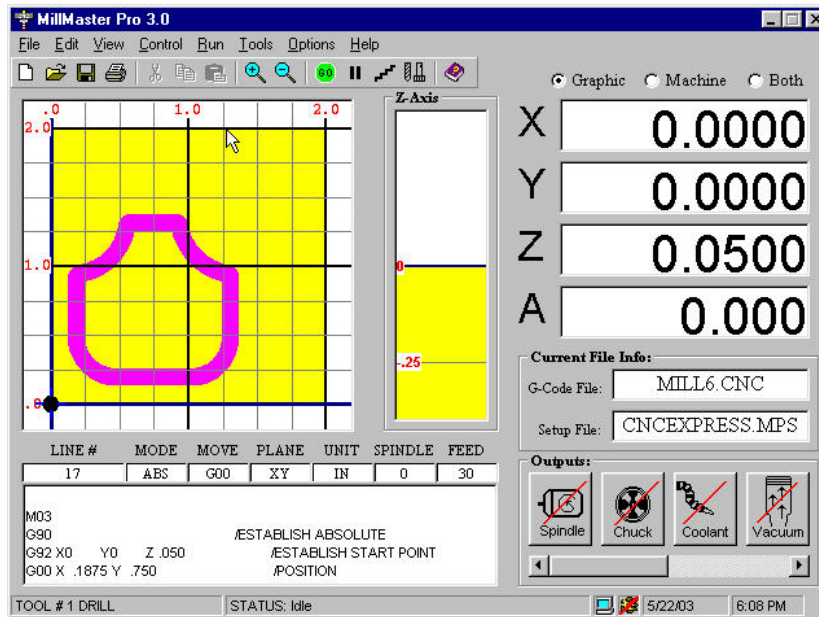


Product Function Map



This diagram graphically indicates what is needed for a complete working motion control application. Start on the left and choose a path that leads you to the motors.

Software



The software you select for your application is dependent on whether your application is a standard milling, lathe or engraving application or a special machine for which you would like to write a custom program yourself. The software that is most suitable for your project can be determined as follows:

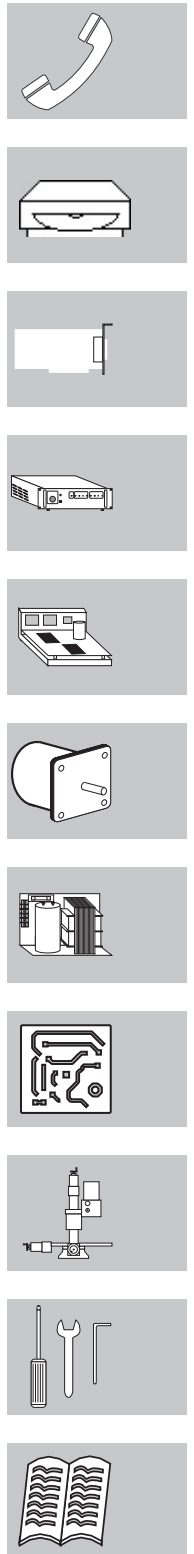
If your application is:

- 3 axis milling/machining
- 2 axis lathe/turning
- 3 axis CAD/CAM design

Select:

- MillMaster Pro
- TurnMaster Pro
- MultiCAM Mill

Demo versions of our software are available for download via our website at www.microkinetics.com. Demo versions have most of the same features as the full package, with certain limitations. If you would like to purchase the full version, you may simply call us for an unlock code to convert the demo to the full package.



Software



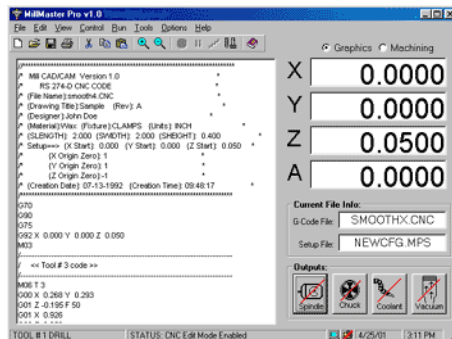
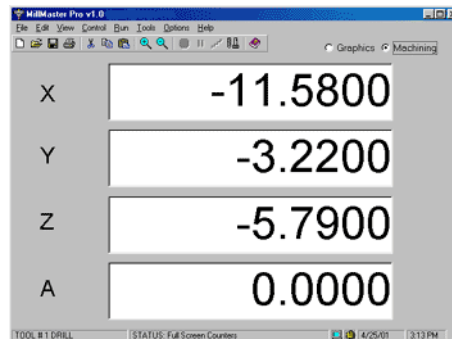
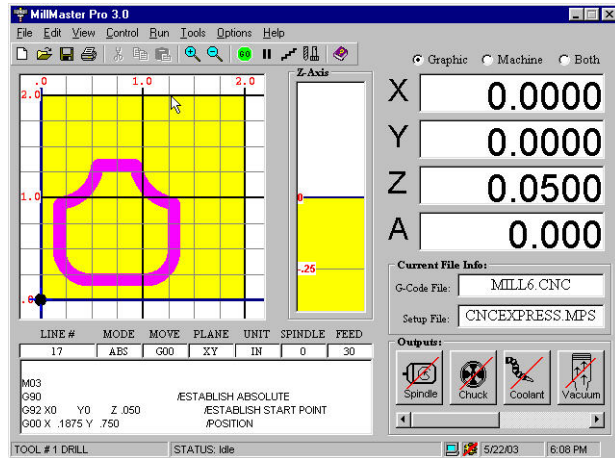
FEATURES:

- Huge capacity for large part programs under Windows
- Graphics reflect actual tool diameter allowing clearances to be verified
- RS274D standard G & M-codes
- Capacity for very long part programs as generated by CAD/CAM software
- Backlash compensation
- Includes lettering subroutine library
- Easy tool jogging from the keyboard
- External speed control for wire EDM
- Supports subroutines/macros and global variables
- Has canned cycles including drilling, boring, and deep profiling
- Graphically simulates all tool movements and cutting operations
- Includes a full screen text editor
- Automatically incorporates ramping on rapid traverse moves
- Supports metric and inch programming

MillMaster Pro for Windows simulates a 3-axis milling type CNC control on any PC running Windows. The CNC part program can be typed directly into the editor screen, or can be generated via a CAD/CAM program. The interactive mode allows you to see the operation performed graphically as you type each CNC line, aiding in part program development or training. For documentation purposes, you can print the graphics screen and the part program together or separately. True circular interpolation on any two axes and simultaneous linear interpolation on all axes are standard. This allows full 3-D surfacing designs to be run on the target 3 axis machine.

MillMaster Pro[™] For Windows

Control Software for Milling, Routing & Torch Machines



Product	Order #	Price
MillMaster Pro For Windows Software	999-5004-001	\$295

G & M Code Command Summary

Preparatory Functions (G-Codes)

G00	Rapid positioning move
G01	Linear cutting move
G02	Clockwise circular cutting move
G03	Counterclockwise circular cutting move
G04	Set dwell in seconds
G17	Select the XY plane for contouring (default)
G18	Select the XZ plane for contouring
G19	Select the YZ plane for contouring
G25	Execute subroutine
G26	Conditional branch
G27	Unconditional branch
G28	Set system or user defined variable to value
G70	Set inch programming (default)
G71	Set metric programming
G72	Set rotary table scaling
G74	Set single quadrant arc mode (default)
G75	Set multiple quadrant arc mode
G79	Canned cycle for milling a deep channel
G80	Cancel canned cycle
G81	Canned cycle for drilling a hole
G82	Canned cycle for spot facing
G83	Canned cycle for deep hole drilling
G85	Canned boring cycle
G87	Canned drilling cycle with chip break
G89	Canned boring cycle with dwell
G90	Set absolute programming mode
G91	Set incremental programming mode (default)
G92	Set current tool position counters to value

G95 Chain to next part program

Miscellaneous Functions (M-Codes)

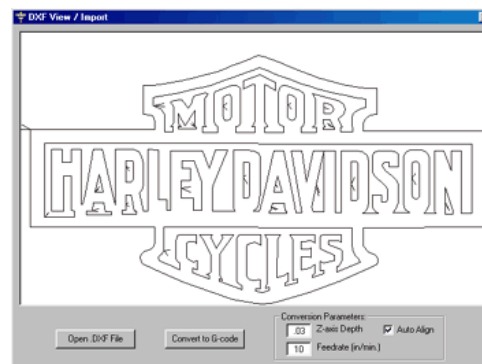
M00	Temporary stop
M02	End of program stop
M03	Spindle <ON> CW (output #1)
M04	Spindle <ON> CCW (output #5)
M05	Spindle <OFF> (output#1, output#5)
M06	Tool change
M08	Coolant <ON> (output #2)
M09	Coolant <OFF> (output #2)
M10	Vacuum <ON> (output #3)
M11	Vacuum <OFF> (output #3)
M12	Auxiliary Output <ON> (output #4)
M13	Auxiliary Output <OFF> (output #4)
M17	Return from subroutine
M25	Rapid traverse to home position
M39	Chuck <CLOSE> (output #6)
M40	Chuck <OPEN> (output #6)
M94	Issue Controller literal command
M97	Wait for true input state then continue
M99	Restart part program from beginning

Special Codes

*	Multiplies two variables
A	Rotary table angle
F	Feedrate
S	Spindle speed
T	Tool number
V	Rotary table velocity

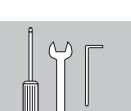
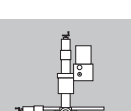
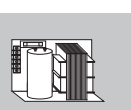
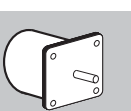
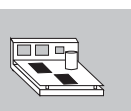
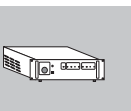
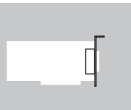
Computer Requirements:

- EGA or VGA monitor
- Microsoft mouse or compatible (optional)
- CD-ROM
- Windows NT, 2000, XP or Vista (for use with MN400 Controller)
- 166mhz processor or higher, 64 MB of RAM, 10-15 MB of hard drive space
- Serial or USB port if using MN400

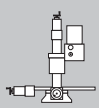


Machining Requirements:

- Any 2 or 3 axis routing or milling machine
- MN400 Motion Controller



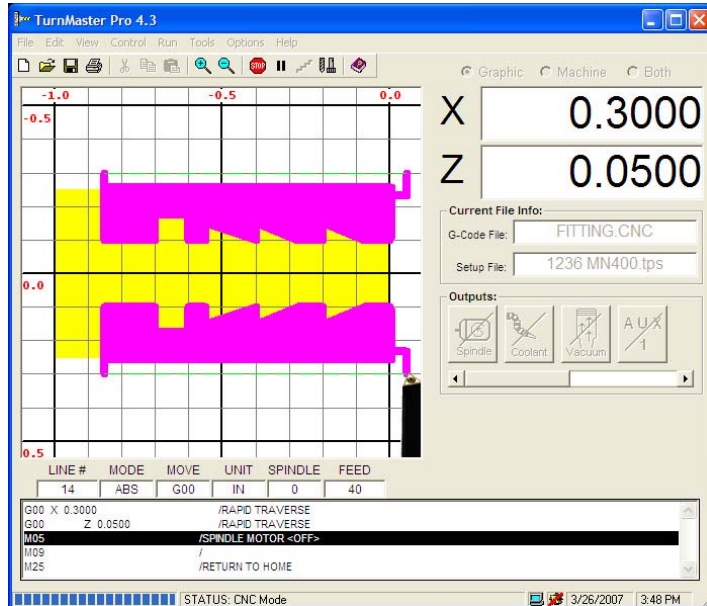
Software



TurnMaster Pro[™] for Windows G-CODE Interpreter for Turning Machines

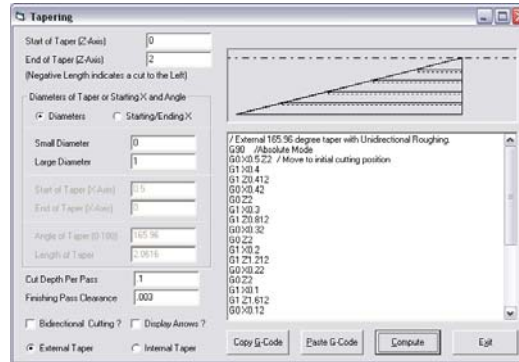
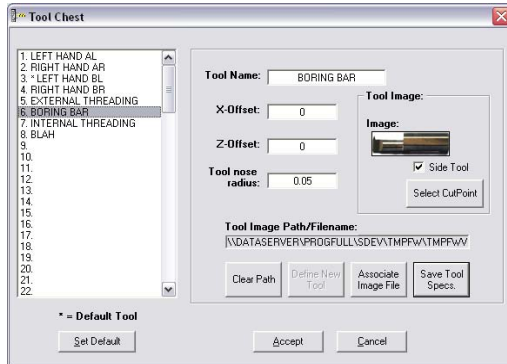
FEATURES:

- Large X & Z axis coordinate display
- Displays current G-code & setup file name in use
- RS274D standard G & M-codes
- Capacity for very long part programs as generated by CAD/CAM software
- Backlash Compensation
- Outputs and machine status display
- Easy tool jogging from the keyboard
- Full color animated graphics with true tool diameter depiction for clearances
- Supports subroutines/macros and global variables
- Graphically simulates all tool movements and cutting operations
- Includes a full screen text editor
- Automatically incorporates ramping on rapid traverse moves
- Supports metric and inch programming



TurnMaster Pro for Windows is a machine control program supporting industry standard G & M codes and canned cycles for turning down outside diameter and reducing part length. Other features include full color animated graphics which simulate all tool movements, threading encoder input support for internal and external threading operations, easy tool positioning directly from the keyboard, auto ramping on high feed moves, metric and inch programming modes, and true circular and linear interpolation. Tool turret and S-code spindle speed control are also included. TurnMaster Pro for Windows builds on 10 years of development and refinement of the original Turnmaster Pro for DOS and adds the conveniences of the Windows environment, the ability to load very large programs without chaining and using digital images of actual cutting tools.

Product	Order #	Price
TurnMaster Pro Software for Windows	999-5002-000	\$295



G & M Code Command Summary

Preparatory Functions (G-Codes)

G00 Rapid positioning move
 G01 Linear cutting move
 G02 Clockwise circular cutting move
 G03 Counterclockwise circular cutting move
 G04 Set dwell in seconds
 G25 Execute subroutine
 G26 Conditional branch
 G27 Unconditional branch
 G28 Set system or user defined variable to value
 G33 Canned threading cycle
 G70 Set inch programming (default)
 G71 Set metric programming
 G72 Set rotary table scaling
 G74 Set single quadrant arc mode (default)
 G75 Set multiple quadrant arc mode
 G80 Cancel canned cycle
 G81 Canned outside and inside diameter turning cycle
 G82 Canned cycle for reducing part length (facing)
 G90 Set absolute programming mode
 G91 Set incremental programming mode (default)
 G92 Set current tool position counters to value
 G95 Chain to next part program

Computer Requirements:

- EGA or VGA monitor
- Microsoft mouse or compatible (optional)
- CD-ROM
- Windows NT, 2000 or XP
(for use with MN400 Controller)
- 166mhz processor or higher, 64 MB of RAM, 10-15 MB of hard drive space
- Serial or USB port if using MN400

Miscellaneous Functions (M-Codes)

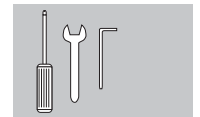
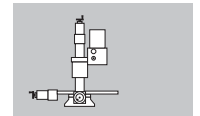
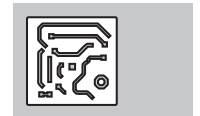
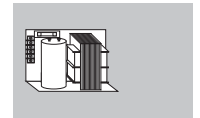
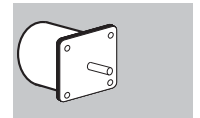
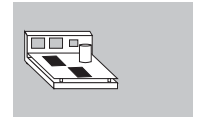
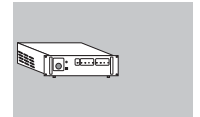
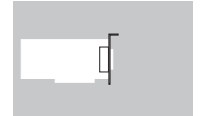
M00 Temporary stop
 M02 End of program stop
 M03 Spindle CW (output #1)
 M04 Spindle CCW (output #5)
 M05 Spindle (output#1, output#5)
 M06 Tool change
 M08 Coolant (output #2)
 M09 Coolant (output #2)
 M10 Vacuum (output #3)
 M11 Vacuum (output #3)
 M12 Auxiliary Output (output #4)
 M13 Auxiliary Output (output #4)
 M17 Return from subroutine
 M25 Rapid traverse to home position
 M39 Chuck (output #6)
 M40 Chuck (output #6)
 M66 Jog axis during execution
 M97 Wait for true input state then continue
 M99 Restart part program from beginning

Special Codes

+ Adds two variables
 - Subtracts two variables
 * Multiplies two variables
 / Divides two variables
 A Rotary table angle
 F Feedrate
 S Spindle speed
 T Tool number
 V Rotary table velocity

Machining Requirements:

- A user retrofitted lathe/turning machine ready to accept step and direction signals
- MN400



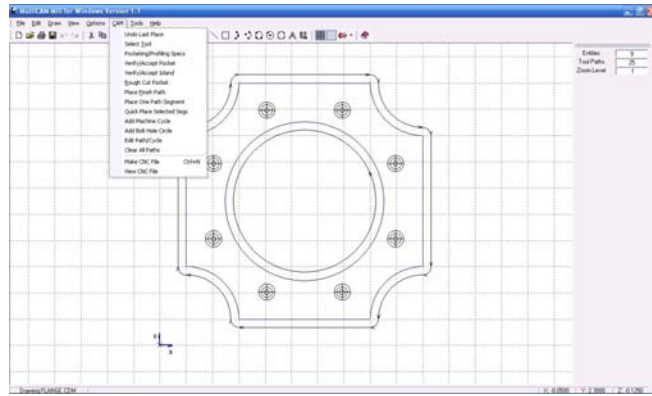
Software



MultiCAM Mill[™] for Windows Computer Aided Manufacturing Software

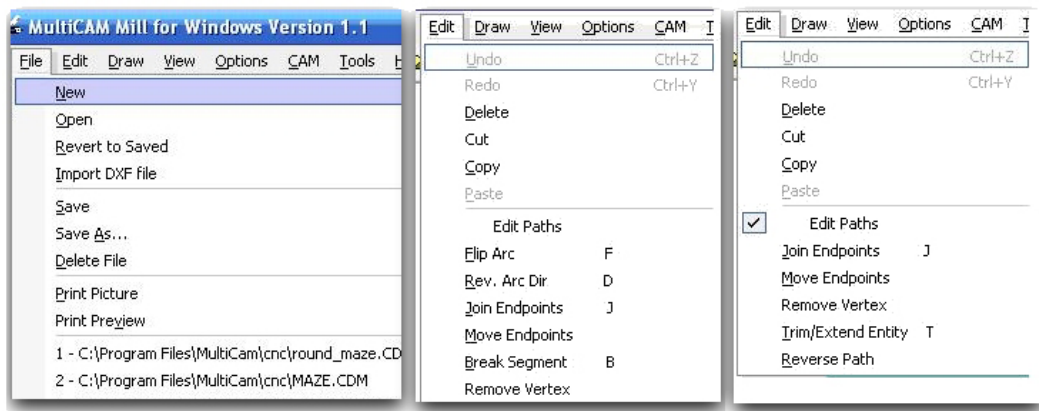
FEATURES:

- Fully automatic roughing cuts w/ graphic representation
- Cutter rolls around the corners for precision profiling
- Creates industry standard RS274D CNC code
- Fast zoom in/out functions
- Optional *automatic comments* included with CNC code
- Lead-in and Lead-out for better quality finish cuts
- Independently programmable roughing and finishing feed rates
- Digital readout of cursor position during part design
- Very easy to use - just draw the profile using Lines, Arcs, etc. or import AutoCAD[™] DXF files
- "Hot Keys" for single keystroke access to common functions
- Directly supports metric and inch designs

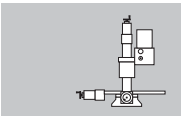
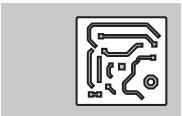
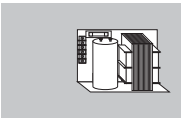
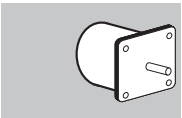
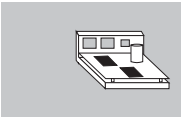
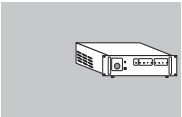


MultiCAM Mill allows entry of a part design by using arcs, lines, circles, and rectangles or by importing a DXF file created with AutoCAD or most other CAD programs. Then the user selects a cutting tool and places a tool path along any continuous geometry. Automatic pockets with island(s) avoidance and multiple sweeps can be placed to any finish depth. Finishing passes can be placed with a simple point and click of the mouse. Selecting one menu item writes the G-code file in 10 to 20 seconds! Selecting another menu item runs MillMaster Pro (sold separately) automatically, loading the corresponding part program for the fastest design/test cycles!

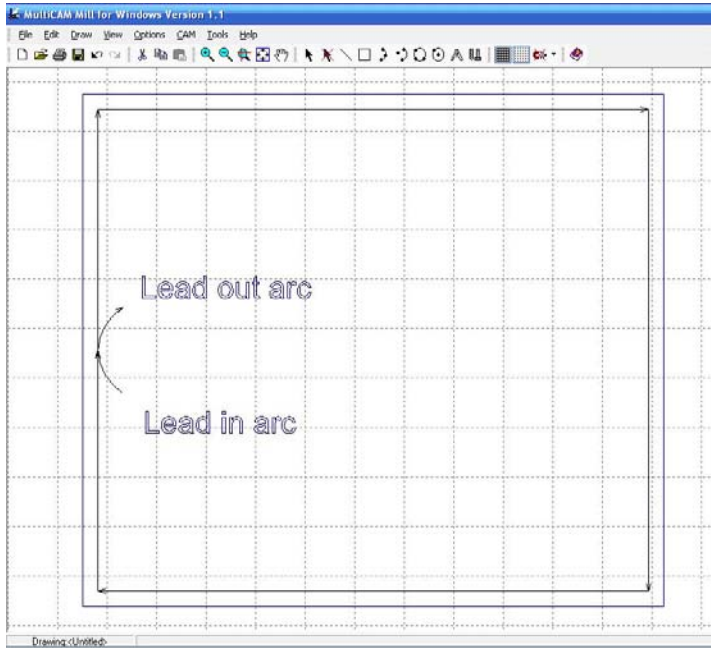
MultiCAM Menus



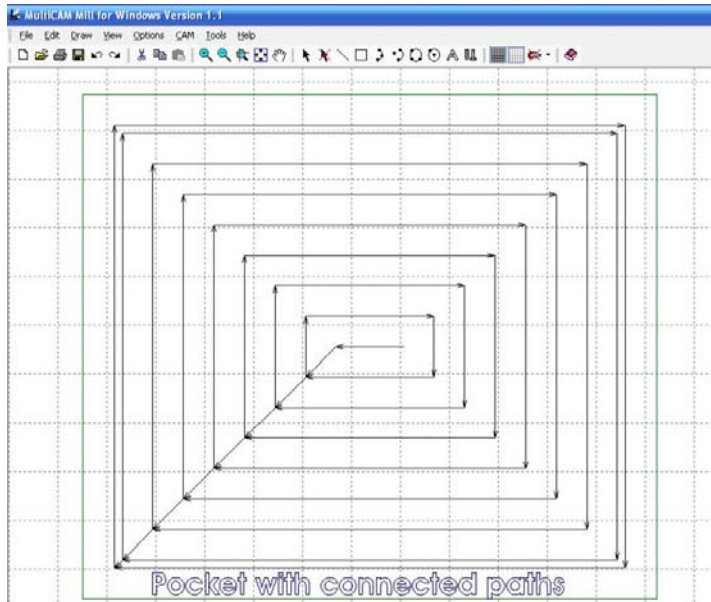
Software



MultiCAM Lead-in and Lead-out for Finish Cuts



MultiCAM Rectangular Pocketing



Product	Order #	Price
MultiCAM Mill Software	999-5004-013	\$495

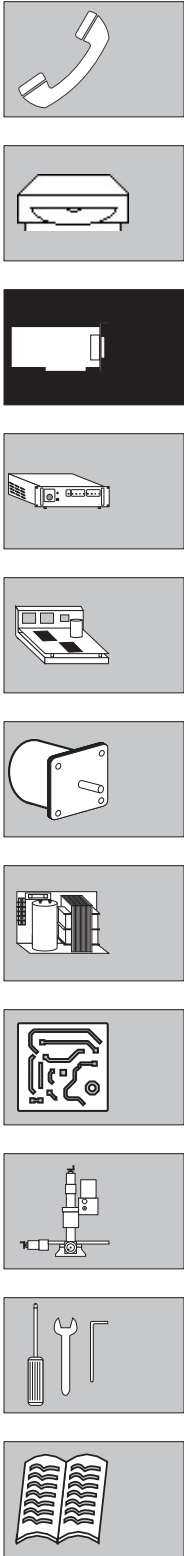
Motion Controllers



For your motion control projects, MicroKinetics manufactures a variety of motion control boards and one enclosed system. Depending on your interface requirements, you may choose a USB interface or a PC card. Here are the selections available and the features:

The Motionet MN100tm is a low cost single axis networkable controller that is PC independent. Use the MN100 where true coordinated motion between axes is not required. Useable in most operating systems.

The Motionet MN400tm is a high performance, 4 axis, coordinated motion controller suitable for microstepping applications. Useable in most operating systems.



Motion Controllers

Motionet™ MN100

Single Axis Controller for Networked Applications

FEATURES:

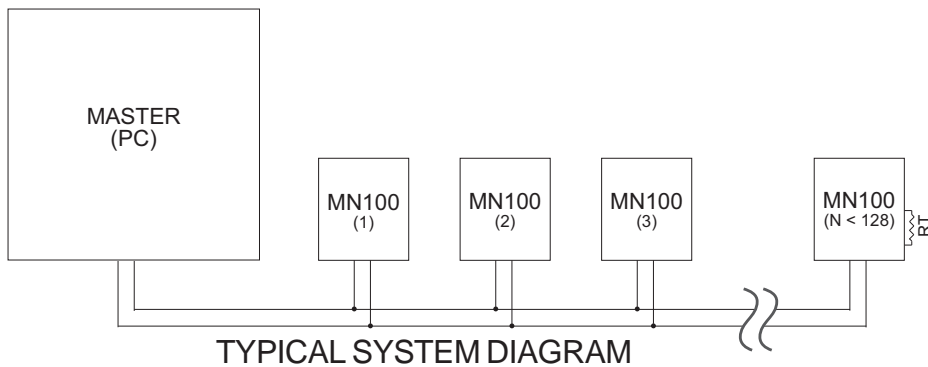
- RS-485 interface to PC
- Up to 127 devices can be networked
- Four software selectable baud rates (9600, 19200, 38400, and 57600)
- Convenient device addressing via on-board rotary switches
- Easy to use command set
- Connects directly to existing drivers



The MN100 is a single axis stepper motor controller. It communicates with a master controller or a PC via RS485 serial port. The MN100 controller can be used with our DM8010, DR8010, DM4050, and UnoDrive or with any third party driver that accepts industry standard step and direction commands.

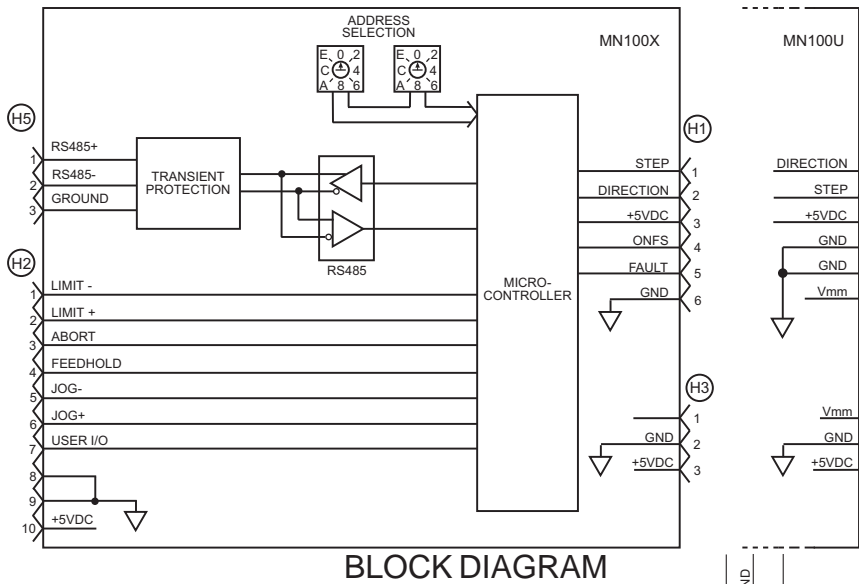
SPECIFICATIONS

Maximum Step Rate	20,000 pulses/sec
Minimum Step Rate	20 pulses/sec
Operating Voltage	5 VDC ±5%
Current Requirements	100mA max.
Outputs	1 Step and 1 Direction (TTL compatible)
Inputs	6 TTL compatible (See Table 3)
I/O Ports	1 User Defined I/O (TTL compatible)
Output Current Drive	25 mA sink or source on each output
Physical Dimensions	2.235" w x 2.325" d x 0.75" h
Working Temperature Range	32°F ~ 158° F (0° C ~ 70° C)

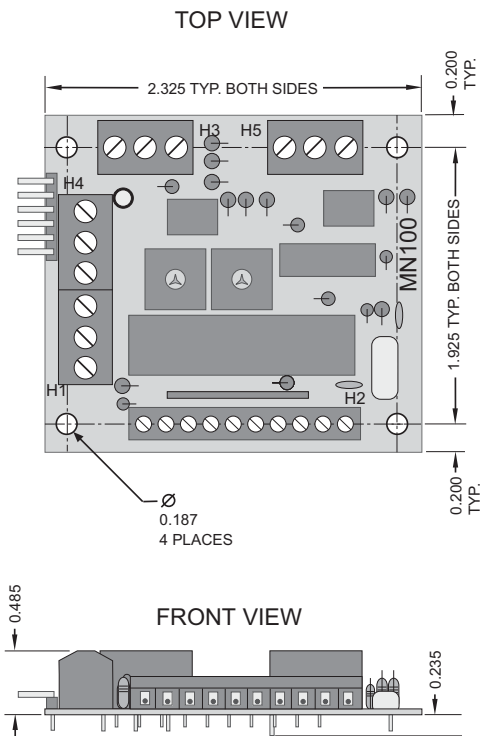


Product	Order #	Price
Motionet MN100U (use with UnoDrive)	900-4000-001	\$99
Motionet MN100X (screw terminals)	900-4000-002	\$99

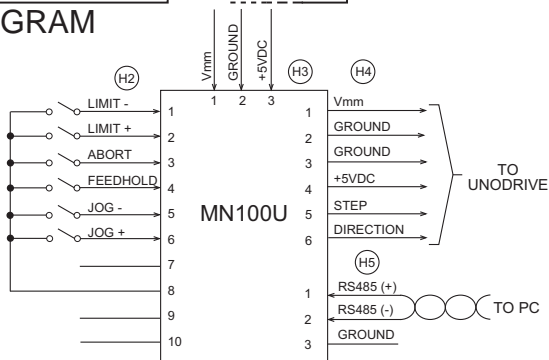
Motion Controllers



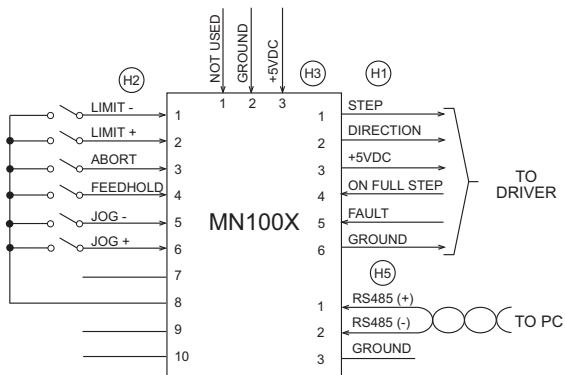
BLOCK DIAGRAM



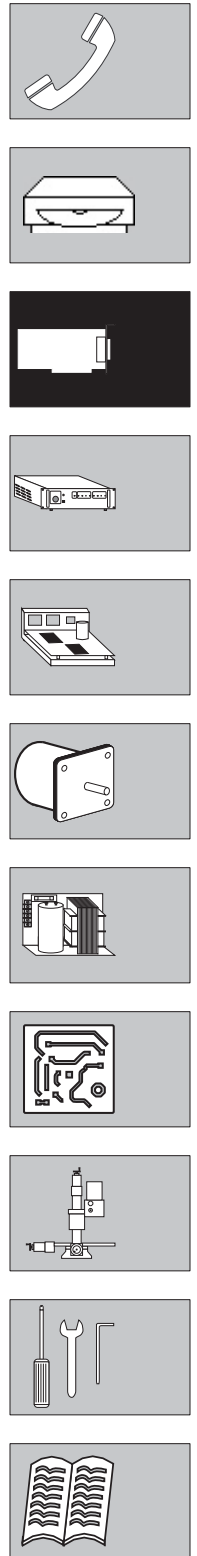
MECHANICAL OUTLINE



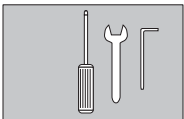
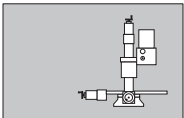
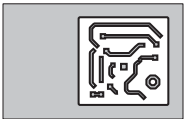
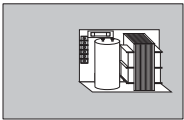
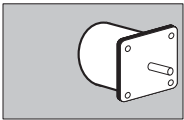
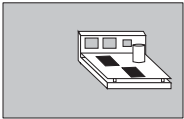
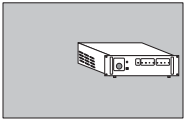
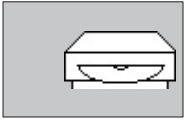
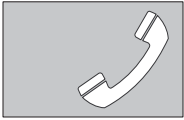
TYPICAL APPLICATION USING UNODRIVE



TYPICAL APPLICATION FOR OTHER DRIVERS



To order by phone call 1-800-674-8419, or fax 770-422-7854



Motionet[™] MN100

Single Axis Controller for Networked Applications

MN100 Command Summary

Command	Command Definition	Parameter	Function
E	Read Position	None	Returns the position counter.
F	Profile Select	0 to 5	Selects the acceleration profile (See Table 4).
G	Jog Tap Steps	1 to 255	Set the number of steps per button push.
H	Hold	0 or 1	0 - disables synchronized moves between drivers. Execute moves immediately. 1 - enables synchronized moves between drivers. Waits for release command before executing move commands. (Remote)
I	Set Mode	0 or 1	0 - absolute mode (default) 1 - incremental mode
K	Release	None	Enables move commands if HOLD is enabled. (Remote)
L	Load Count	±8,388,607	Loads the position register with the specified data.
M	Move	±8,388,607	Performs an accelerated move generating the specified number of steps. Returns exit code if an error occurred or if the move was terminated by a switch closure.
N	Read Count	None	Returns the number of uncompleted steps.
O	Loop	None	Restart the program from beginning. (Program)
Q	Abort Move	None	Aborts the move in progress. (Remote)
R	Read Memory	None	Returns the program stored in memory.
S	Port Status	0 to 2	Returns status of the input ports (port0 or port 2).
U	Run Program	None	Runs the program stored in memory. (Remote)
V	Velocity	20 to 20000	Sets the speed in steps/sec.
W	Wait	None	Halts program until input is low. (Remote)
Y	Jog Speed	20 to 20000	Sets the speed for jogging (not accelerated).
Z	Program Mode	None	Puts the device in program mode. All subsequent commands are written to memory until <Ctrl-D> is received. (Remote)
?	Firmware Revision	None	Returns the device name and firmware revision. (Remote)
*	Poll	None	Request response from all connected controllers. (Remote)
&	Retransmit	None	Request the MN slave to resend the last message. (Remote)
~	Change Baud Rate	0 to 4	Changes baud rate. Must be sent to all devices simultaneously (address 0) . 0 - 9600, 1 - 19200, 2 - 38.4K, 3 - 57.6K, 4 - 115K. (Remote)
!	Configure and Read/Write I/O Port	0 to 3	Controls reading and writing of I/O port. 0 - output at 0VDC (low) 1 - output at 5VDC (high) 2 - input to run program on switch closure (default) 3 - input with interrupt (high to low transition) (Remote)
#	Label	<text>	Marks a point in the program for branching. (Program)
^	Branch	<text>	Transfers program execution to a line following a # with matching label. (Program)

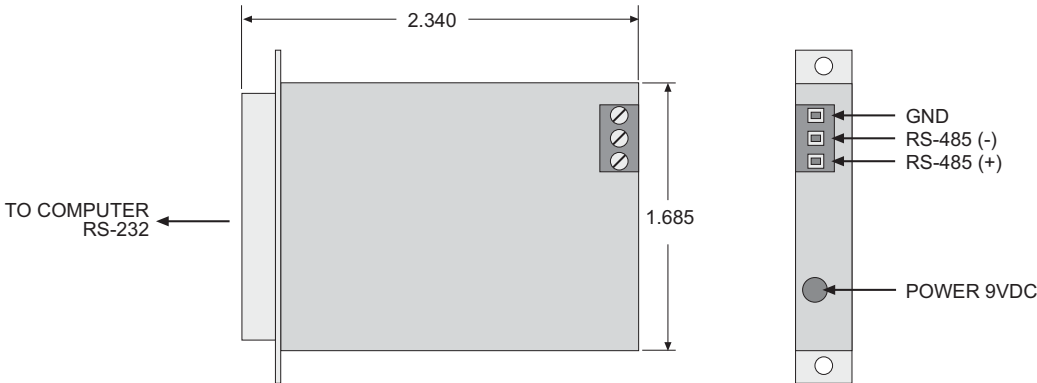
Motionet[™] MN85 RS232 to RS485 Converter

FEATURES:

- Converts Standard RS232 signals to RS485 Multidrop network
- Drives up to 127 devices
- Convenient screw terminal hookup
- Includes 9 VDC power adaptor
- Plugs directly into PC com port



The MN85 is an RS232 to RS485 converter used to connect multiple Motionet devices to a standard com port on MSDOS/Windows PC's. The device allows up to 127 devices to be connected to a single port. Only two wires are required for communications. If connecting more than one device, you can daisy chain the devices. Connect (+) terminal on MN85 to (+) on MN100 and (-) terminal on MN85 to (-) on MN100. The RS485 network requires that the two extreme ends of the cables be terminated with a 120 ohm resistor. This terminating resistor is built into the MN85. Make sure you have resistors installed only at each end of the network.



MECHANICAL OUTLINE

ELECTRICAL

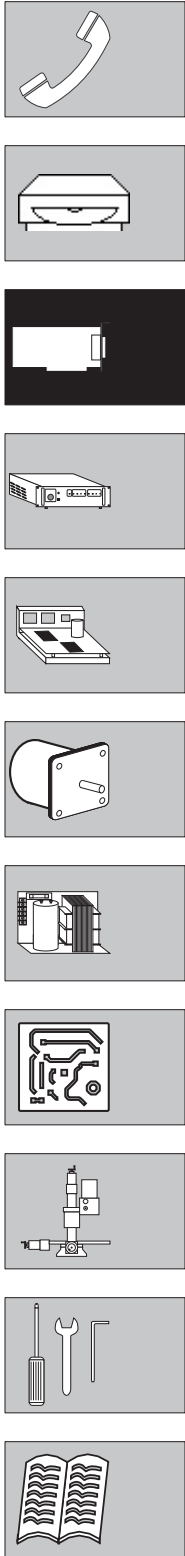
Supply Voltage	9VDC@200mA
Input	RS232
Output	RS485
Temperature	0 to 70° C operating & storage

TERMINATION

Header	3 pin screw terminal
Power Connector	3.5mm audio jack

Product	Order #	Price
Motionet MN85	900-4000-085	\$59

To order by phone call 1-800-674-8419, or fax 770-422-7854



Motionet[™] MN400 Multi-Axis Contouring Motion Controller

FEATURES:

- Controls up to 4 axes
- Serial communications via USB, RS232 or RS485
- 8 Kbyte FLASH memory for nonvolatile program & configuration storage
- Well engineered instructions with 30 powerful ASCII commands
- Analog inputs for interactive feedrate override and jog speed control
- Resolution selection for jog mode
- Complete opto-isolation of driver power for improved reliability
- Programmable acceleration/deceleration
- Remote and local jogging
- Optional 4 channel incremental encoder feedback board

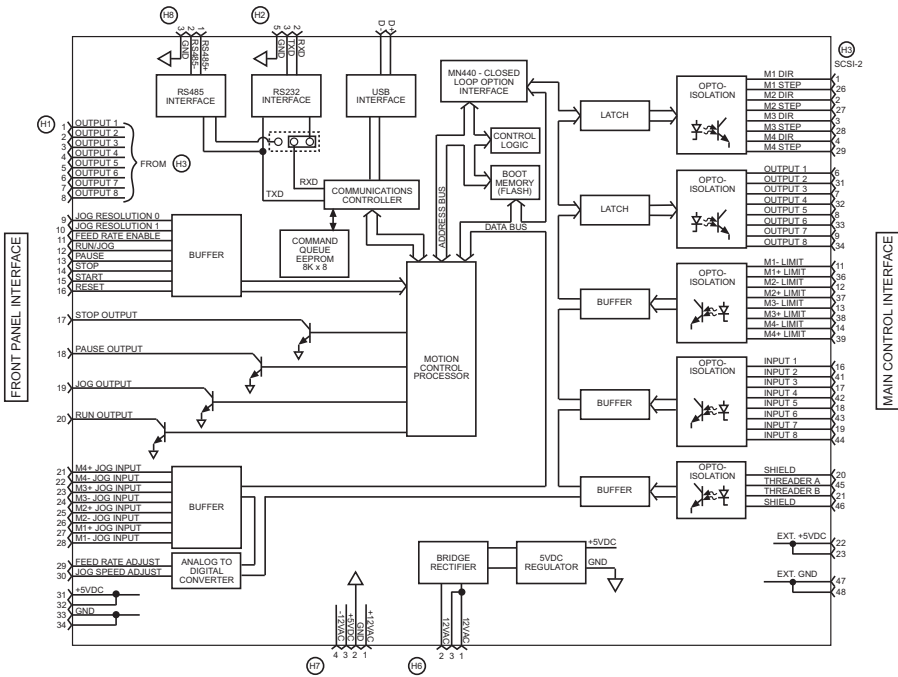


The MN400[™] is a new dual processor motion controller that communicates through RS232, RS485, or USB ports. Utilizing DSP processor technology to achieve high speeds, the MN400 implements a unique continuous contouring algorithm that effectively eliminates the accel/stop/decel between motion vectors. The sophisticated algorithm optimizes the motion speeds for smooth motion without compromising geometry. Multiple MN400's can be connected on the same two wire network for a practically unlimited number of axes. Other features include remote motion speed override, programmable accel/decel, electronic gearing, end of travel detection on all axes, eight auxiliary outputs per card and a "safety shield open" interrupt. On-board non-volatile memory allows local configuration and program storage. The command format is intuitive and is very easy to incorporate into any application. The included communication libraries support Visual C and Visual Basic and contain example programs.

ELECTRICAL SPECIFICATIONS:

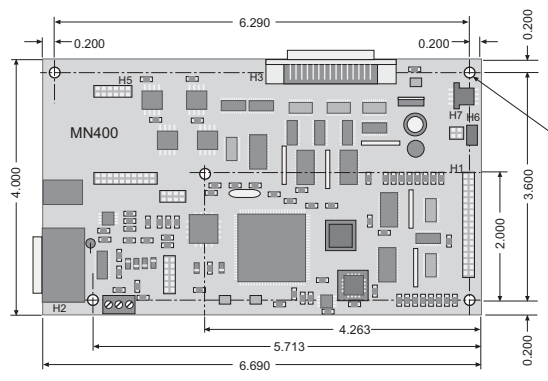
Power source	+5VDC ±5%
Current requirements	> 400mA
Step signals	4 opto-isolated open collector
Direction signals	4 opto-isolated open collector
Limit switch input signals	8 TTL compatible active low
Safety shield interrupt input signal	1 TTL compatible active low
Auxiliary input signals	8 TTL compatible active low
Auxiliary output signals	8 opto-isolated open collector
Jog inputs	8 TTL compatible active low
Threading encoder inputs	3 TTL compatible
Maximum step rate	150,000 steps per second
Working temperature range	(32° F ~ 158° F (0° C ~ 70° C)

Motion Controllers



BLOCK DIAGRAM

TOP VIEW



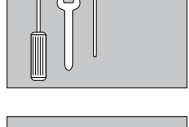
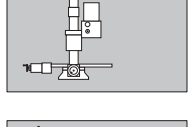
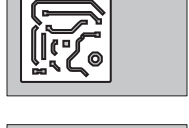
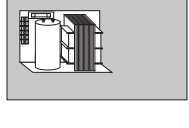
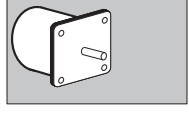
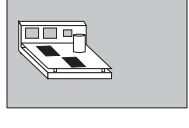
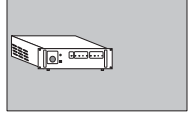
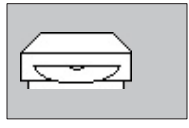
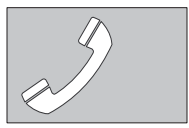
FRONT VIEW



MECHANICAL OUTLINE

MOTION CAPABILITIES:

- Linear and circular interpolation
- Point-to-point positioning
- Coordinated motion
- Jogging
- Vector positioning
- Continuous Contouring
- Electronic gearing



Product	Order #	Price
Motionet MN400	900-4000-004	\$295

To order by phone call 1-800-674-8419, or fax 770-422-7854

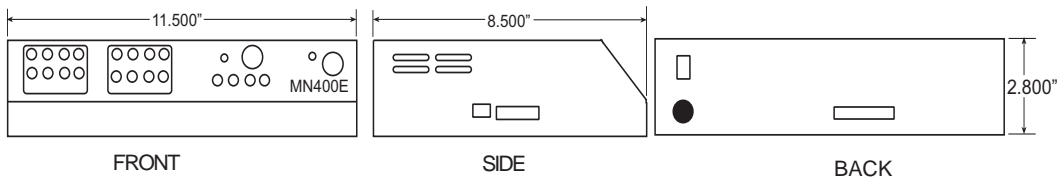
Motion Controllers

Motionettm MN400E

Enclosed Controller for Easy System Integration

FEATURES:

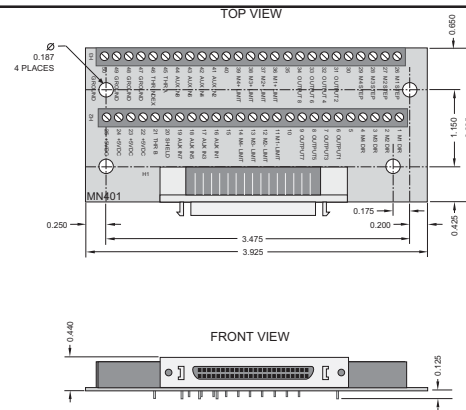
- Houses power supply and wiring
- Control panel with jog switches, feed rate override control, and indicator lights
- Same footprint as Mighty Drive, which allows units to be stacked and reduces work surface area requirements



MN401 Breakout Wiring Board

DESCRIPTION:

The MN401 provides easy access to wire to all the signals available on the MN400's 50 position connector. Silk screened legend is adjacent to each connection for identification.



MECHANICAL OUTLINE

Product	Order #	Price
Motionet MN400E	999-3600-000	\$774
Motionet MN400E- 220V	999-3600-001	\$774
Motionet MN401	900-4000-401	\$32

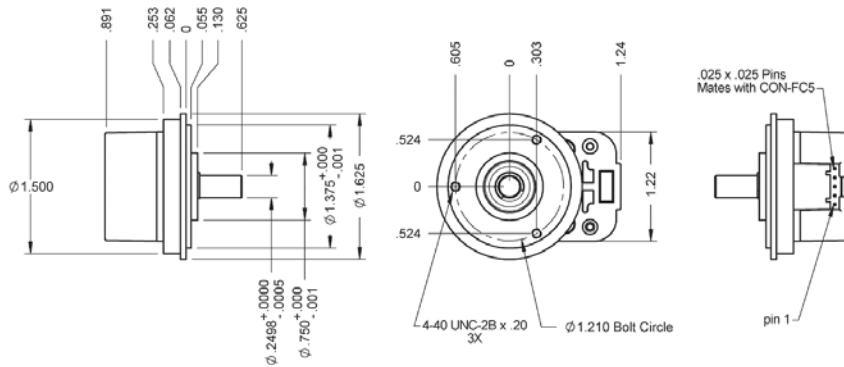
ES Series Encoders

These high resolution rotary encoders are ideal for threading applications. They mount to the spindle shaft of a lathe or other rotating shaft. Shaft diameter is .250". Standard line resolution: 2000 PPR



MECHANICAL

Dimensions	(See drawing)
Weight	2 oz.
Shaft Size	0.25 in.
Shaft Load	Axial 4 lbs Radial 8 lbs.
Torque	Starting < 0.4 oz. in. Running < 0.2 oz. in..
Inertia	1.8×10^{-4} oz. in/sec ²



ELECTRICAL

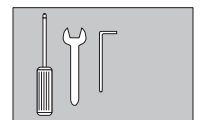
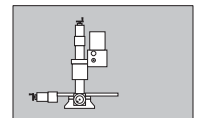
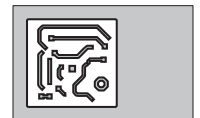
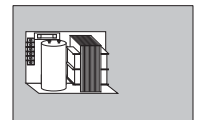
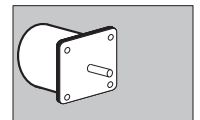
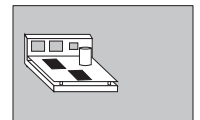
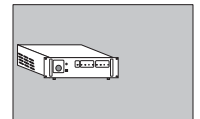
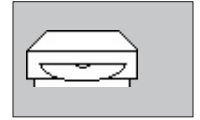
Code	Incremental
Supply Voltage	+5 +/-10% @ 135ma max.
Output	Dual channel quadrature plus index w/ complements.
Output Type	TTL Buffer/Driver (7406) open collector
Maximum Sink Current	40 mA
Frequency Response	100 kHz Data, 40 kHz Index
Temperature	0 to 80° C operating -25 to 90° C storage

TERMINATION

Header	8 pin single row PC board header
Mating Connector	Molex 22-01-3087 or equivalent

Product	Order #	Price
Threading Encoder and Cable	970-1250-200	\$180

To order by phone call 1-800-674-8419, or fax 770-422-7854

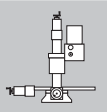
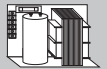
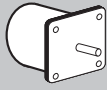
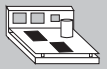
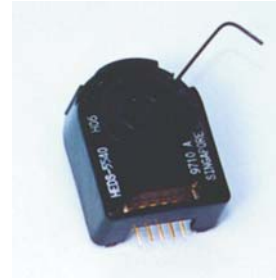


Motion Controllers



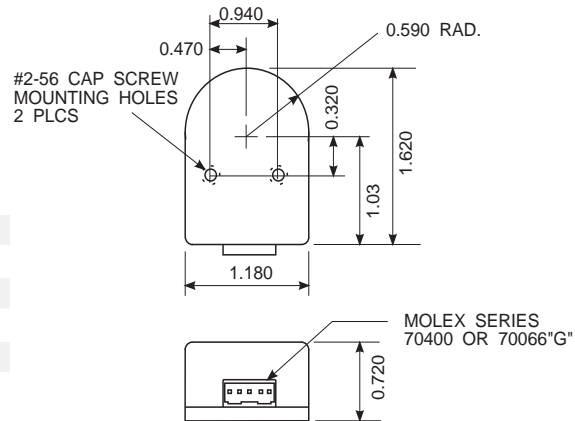
EH Series Encoders

These hollow shaft quadrature output encoders are suitable for use as a stand alone DRO or for coordinate measurement applications. Standard line resolution is 200. Standard shaft diameter is .250". Resolutions of 200 or 400 counts per revolution are available.



MECHANICAL

Dimensions	(See drawing)
Weight	<1 oz.
Bore Size	0.25 in.
Shaft Runout	0.005 TIR
Shaft Endplay	+/- 0.010 in.
Shaft Length required	0.35 - 0.65 in.



ELECTRICAL

Code	Incremental
Supply Voltage	+5 +/-10% @ 60ma max.
Output	Dual channel quadrature plus index.
Output Type	Square Wave; TTL and CMOS compatible
Maximum Sink Current	95 mA
Frequency Response	100 kHz (Data & Index)
Temperature	-40 to 100° C operating & storage

TERMINATION

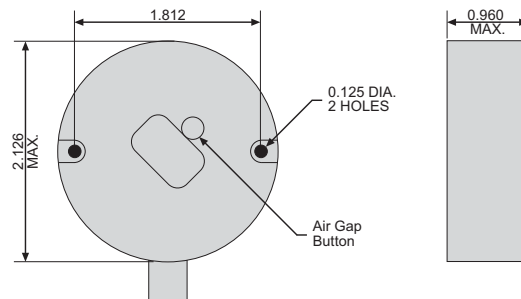
Header	5 pin single row positive locking
Mating Connector	AMP 103959-4, Molex 70066 "G" or 70400 for 22-30 AWG

EH23 and EH34 Mounting Plates allow mounting EH type encoders to the back of Size 23 and 34 motors respectively. A double shaft motor is required.

Product	Order #	Price
Encoder .25" shaft 200 line	970-0250-200	\$58
Encoder .25" shaft 400 line	970-0250-400	\$58
EH Encoder Cable 10' length	970-1250-001	\$15
EH23 Mounting Plate	980-0000-230	\$38
EH34 Mounting Plate	980-0000-340	\$38

EC Series Encoders

These hollow shaft quadrature output encoders are available in .375" or .5" diameter shafts. Encoder resolution is 200, 400 or 1000 lines/rev standard. Cable is included.



MECHANICAL

Dimensions	(See drawing)
Weight	2.1 oz.
Shaft Size	0.375 in.
Acceleration	500,000 rad/sec ²
Inertia	2.6 x 10 ⁻⁵ oz. in/sec ²

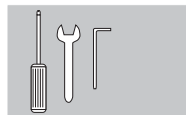
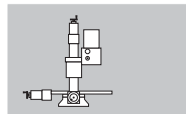
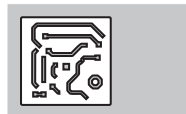
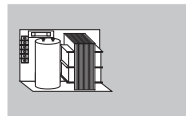
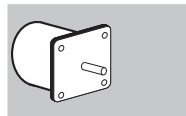
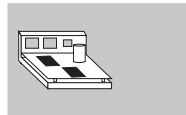
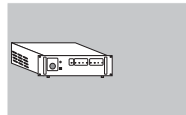
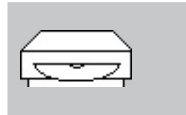
ELECTRICAL

Code	Incremental
Supply Voltage	+5 +/-10% @ 135ma max.
Output	Dual channel quadrature plus index w/ complements.
Output Type	TTL Buffer/Driver (7406) open collector
Maximum Sink Current	40 mA
Frequency Response	100 kHz Data, 40 kHz Index
Temperature	0 to 80° C operating -25 to 90° C storage

TERMINATION

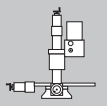
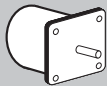
Header	10 pin dual row PC board header
Mating Connector	Molex 10-56-3103 or equivalent

Product	Order #	Price
Encoder .375" shaft 200 line	970-0200-038	\$242
Encoder .375" shaft 400 line	970-0400-038	\$242
Encoder .375" shaft 1000 line	970-1000-380	\$242
Encoder .5" shaft 200 line	970-0200-050	\$242
Encoder .5" shaft 1000 line	970-1000-500	\$242



To order by phone call 1-800-674-8419, or fax 770-422-7854

MultiDriver Subsystems



MultiDriver Subsystems



The drive systems featured in this section are designed for ease of installation & immediate functionality. These rugged, enclosed units provide a complete multi-driver system consisting of drive electronics & power supplies that are pre-wired, pretested and ready for immediate use. All systems features on/off switch, solid state relay(s), motor connections, controlled AC outlet(s), and connection/cables for direct interface with the motion controller. Select the proper size based on the torque requirements (see torque curves in motor section).

Available Models:

Mighty Drive (1.2 amp, 40 volt / 1 to 4 axes max)

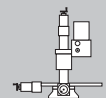
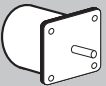
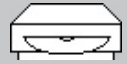
SuperDrive (1 to 5 amp, 40 volt / 3 axes max)

DriveRack (1 to 10 amp, 40 or 80 volt / to 4 axes max)

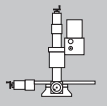
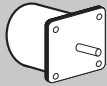
DriveRack packages, w/motors, software, & controller

Standard configuration on all systems is input voltage of 115VAC. Available with input voltage of 230VAC on request- simply specify when ordering.

To order by phone call 1-800-674-8419, or fax 770-422-7854



MultiDriver Subsystems



Mighty Drivetm



Mighty Drive (Standard)

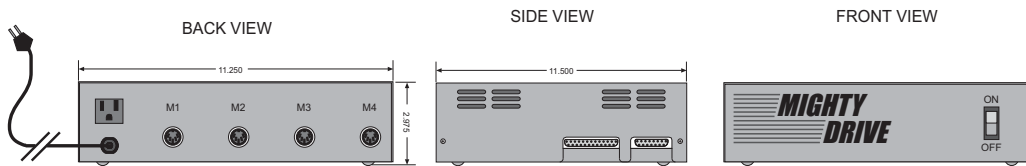
FEATURES:

- Cost effective modular design
- Uses compact UnoDrives to allow expansion from 1 to 4 axes
- Individually selectable full-step or half-step operation on each axis
- Automatic over-temperature protection
- Solid State Relay (12 AMP) for spindle motor or general purpose AC control
- Available as "-SL" model with Emergency Stop button for added safety
- Has same footprint as MN400E Controller, allowing units to be stacked to reduce work surface area requirements

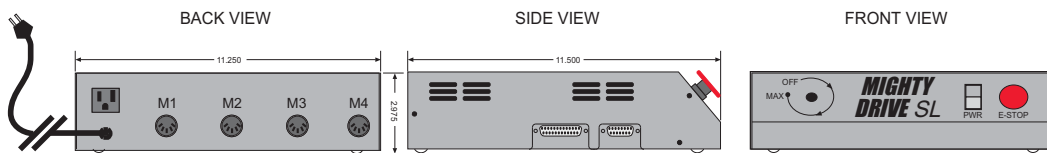


Mighty Drive-SL

The MightyDrive is a compact, modular stepper motor driver subsystem, and is available in 1, 2, 3, or 4 axis models. The current per phase is factory set at 1.2 amps but can be adjusted via a resistor. The built-in 40 volt high efficiency power supply delivers 1.2 amps per phase to up to 4 stepper motors. The Mighty Drive-SL model features an E-Stop button on the front panel that will shut down the system. This is especially useful in educational settings, or in other applications where added safety is a must.



MECHANICAL OUTLINE-STANDARD MODEL



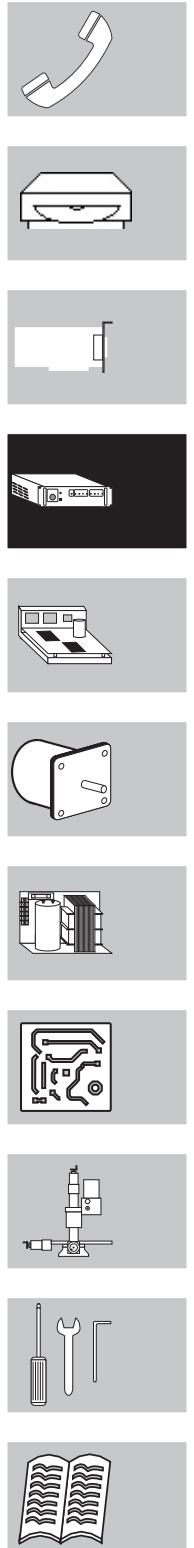
MECHANICAL OUTLINE-SL MODEL

SPECIFICATIONS:

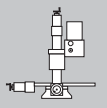
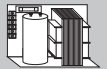
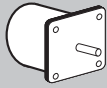
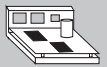
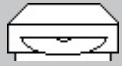
Drive circuit	Bipolar constant current
Chopping rate	20 KHz nominal
Operating voltage	40 VDC
Output Current	1.2 amps per phase continuous
Stepping Mode	Half / Full step selectable
Current cutback	Half current. after 1/2 second of idle
Step inputs	4 TTL compat. pos. edge trig.
Direction inputs	4 TTL compatible
Limit switch inputs	8 TTL compatible
Shield switch input	1 TTL compatible
Control output	1 AC 12Aamp non inductive 5 Amp inductive max.
Motor control outputs	4 lines per axis
Working temp. range	32°F ~ 158° F (0° C ~ 70° C)
Warranty	5 years parts and labor

Product	Order #	Price
1 axis Mighty Drive	999-3600-501	\$550
2 axis Mighty Drive	999-3600-502	\$650
3 axis Mighty Drive	999-3600-503	\$750
4 axis Mighty Drive	999-3600-504	\$850
1 axis Mighty Drive-SL	999-3600-601	\$650
2 axis Mighty Drive-SL	999-3600-602	\$750
3 axis Mighty Drive-SL	999-3600-603	\$850
4 axis Mighty Drive-SL	999-3600-604	\$950

To order by phone call 1-800-674-8419, or fax 770-422-7854



MultiDriver Subsystems



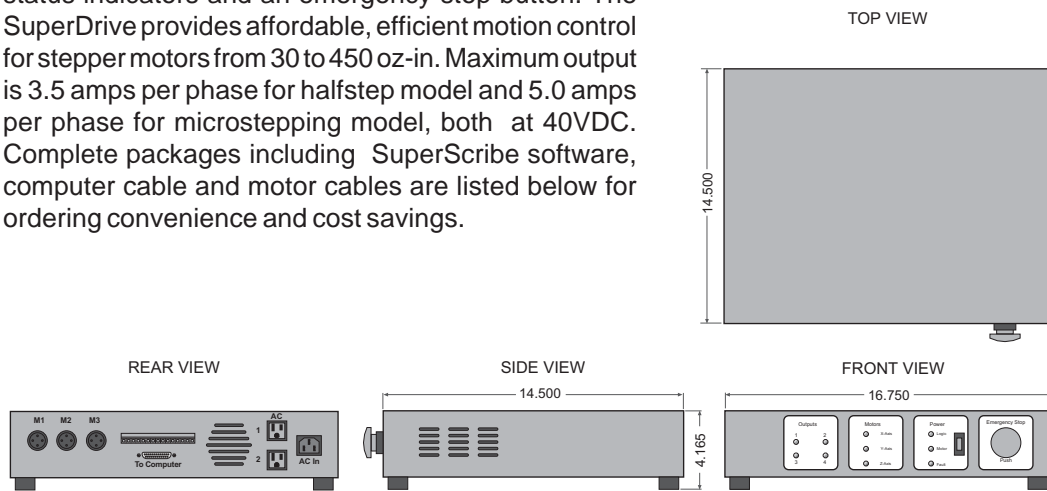
SuperDrive[™]

FEATURES:

- Completely wired and tested system
- Emergency stop and lighted power switch
- Bicolored LEDs to indicate motion and output status
- Solid state relays for AC control
- Built-in cooling fan
- Toroidal transformer for compact overall profile



SuperDrive is a complete power driver subsystem with built in power supply and drivers for up to 3 stepper motors and 2 software controlled AC outlets. This controller is equipped with output status indicators and an emergency stop button. The SuperDrive provides affordable, efficient motion control for stepper motors from 30 to 450 oz-in. Maximum output is 3.5 amps per phase for halfstep model and 5.0 amps per phase for microstepping model, both at 40VDC. Complete packages including SuperScribe software, computer cable and motor cables are listed below for ordering convenience and cost savings.



Product	Order #	Price
2 axis F/H stepping	999-3410-001	\$1,279
3 axis F/H stepping	999-3410-002	\$1,439
2 axis microstepping	999-3410-003	\$1,465
3 axis microstepping	999-3410-004	\$1,745
2 axis F/H stepping pkg	999-6150-001	\$1,835
3 axis F/H stepping pkg	999-6150-002	\$1,995
2 axis microstepping pkg	999-6150-003	\$2,021
3 axis microstepping pkg	999-6150-004	\$2,301

DriveRacktm

FEATURES/BENEFITS:

- Rugged all steel construction shields against RFI/EMI interference
- Completely wired and tested system for ease of installation
- Emergency stop and keylock for improved safety
- High (105) CFM fan increases reliability
- Externally removable and washable fan filter eases maintenance
- Solid state relays for AC control allow control of external devices

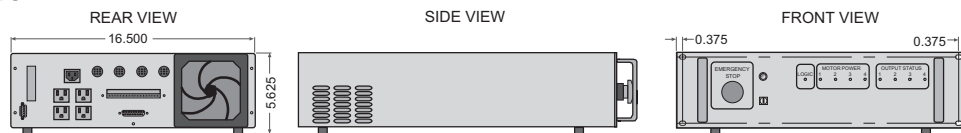


The DriveRack is a rack mountable enclosure containing all of the necessary electronics, switches, indicator lights and wiring. A DriveRack has an electronically latched ON/OFF keylock switch, emergency stop button, two solid state relays to control spindle, vacuum, coolant etc., a powerful (105 cfm) fan, and your choice of drivers and power supplies. Drivers are available in full/half stepping and microstepping models. Custom configurations are available.

Full/half stepping drivers are: DR3535 (40V), DR8010 (80V)

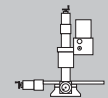
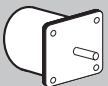
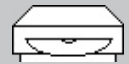
Microstepping models are: DM4050 (40V), DM8010 (80V)

See the following page for complete packages that include a Driverack, NEMA 42 motors, G-code software, all cables & manuals.

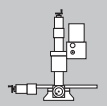
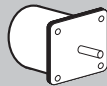


Product	Order #	Price
2 axis 40V F/H stepping	999-3400-201	\$1,308
2 axis 80V F/H stepping	999-3400-202	\$1,738
2 axis 40V microstepping	999-3400-203	\$1,408
2 axis 80V microstepping	999-3400-204	\$1,938
3 axis 40V F/H stepping	999-3400-301	\$1,637
3 axis 80V F/H stepping	999-3400-302	\$2,258
3 axis 40V microstepping	999-3400-303	\$1,787
3 axis 80V microstepping	999-3400-304	\$2,558
4 axis 40V F/H stepping	999-3400-401	\$1,806
4 axis 80V F/H stepping	999-3400-402	\$2,708
4 axis 40V microstepping	999-3400-403	\$1,966
4 axis 80V microstepping	999-3400-404	\$3,108

To order by phone call 1-800-674-8419, or fax 770-422-7854



CNC Rack-Mount Control Systems for Full-Size Machines



MicroKinetics now offers a complete pre-engineered package to automate your full size Bridgeport, Enco, or similar size machine. Just couple the motor shafts to your machine's drive screws, plug the cables, turn on the power, and install the software. You can immediately jog the motors by pressing ctrl-J, and then using the cursor keys! It's that easy!



SYSTEM INCLUDES:

- DriveRack high performance power driver
- Motionnet MN400 motion controller
- 42M1625D Stepper Motors
- G-code control & graphical software (MillMaster Pro or TurnMaster Pro)
- All cables & illustrated manuals

The DriveRack features the powerful DR8010 (or DM8010) motor drivers capable of delivering up to 10 amps per phase to drive NEMA size 42 motors. The front panel is equipped with output status indicators, a keyed power control, and an E-Stop button. When used with the MN400 motion controller (pre-installed), the DriveRack provides state-of-the-art motor control at a very reasonable price.

The Motionnet MN400 is a high performance, 4 axis, coordinated motion controller suitable for full/half or microstepping applications. dual processor motion controller that communicates through RS232, RS485, or USB ports. Utilizing DSP processor technology to achieve high speeds, the MN400 implements a unique continuous contouring algorithm that effectively eliminates the accel/stop/decel between motion vectors.

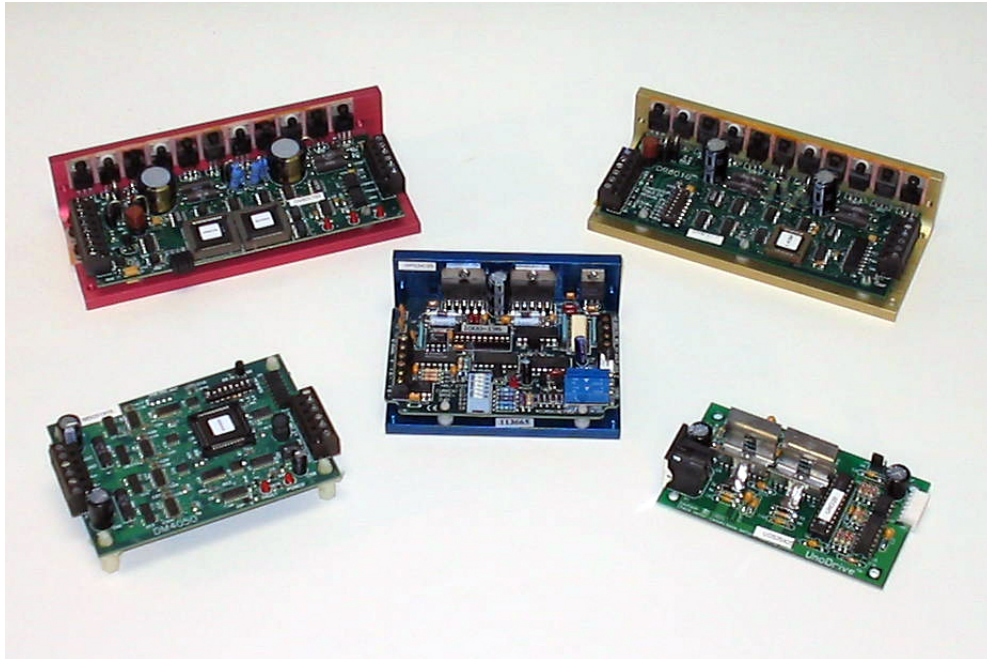
The 42M1625 stepper motors are matched and wired in parallel for awesome performance. These NEMA 42 motors deliver 1,625 oz/in of torque and are suitable for use with standard half stepping or microstepping drivers. The shaft is 0.625" diameter and 1.327" long and has a #404 keyway. Rear 0.50" shaft allows mounting of handwheels or encoders. Each motor is professionally wired with 10' cables and DriveRack mating connectors.

MillMaster Pro software is a 4-axis milling CNC control on a PC, and includes a rich set of standard G & M codes.

<i>Product</i>	<i>Order #</i>	<i>Price</i>
<i>2 axis Rack Mount System</i>	<i>999-6200-102</i>	<i>\$2,435</i>
<i>3 axis Rack Mount System</i>	<i>999-6200-103</i>	<i>\$2,991</i>
<i>4 axis Rack Mount System</i>	<i>999-6200-104</i>	<i>\$3,122</i>
<i>2 axis Rack Mount Microstep System</i>	<i>999-6200-112</i>	<i>\$2,463</i>
<i>3 axis Rack Mount Microstep System</i>	<i>999-6200-113</i>	<i>\$3,475</i>
<i>4 axis Rack Mount Microstep System</i>	<i>999-6200-114</i>	<i>\$3,595</i>

All systems include same number of motors as axes except 4 axis- these include three motors.

Motor Drivers



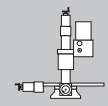
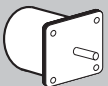
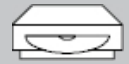
In selecting the drivers for your system, you should determine the maximum current required by the motor and whether full/half stepping is adequate or if microstepping will be needed. You may be able to increase the maximum speed possible with a given motor if you choose a driver with a higher voltage capability and use a higher voltage power supply. All drivers shown are one axis each. All MicroKinetics stepper motor drivers are designed for maximum performance/cost in their class.

Full/Half Stepping Drivers

UnoDrive	42-43
DR3535	44-45
DR8010	46-47

MicroStepping Drivers

DM4050	48-49
DM8010	50-51



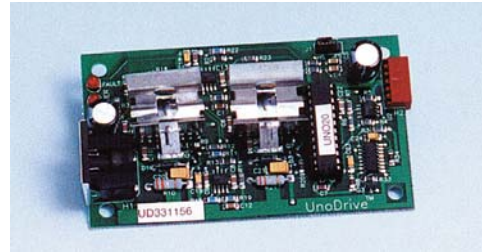
To order by phone call 1-800-674-8419, or fax 770-422-7854

Motor Drivers

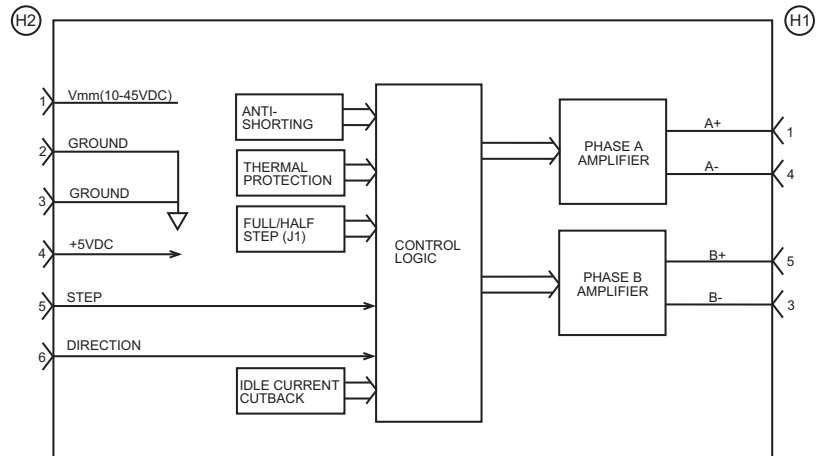
UnoDrive™ Stepper Motor Driver Full & Half Step, 40V 1.2A

FEATURES:

- Bipolar constant current output
- Automatic over-current and over-temperature protection
- Selectable full step/half step operation
- Compact design
- Power and fault indicators
- Low cost



The UnoDrive is a constant current stepper motor driver. It receives step and direction signals from the controller and can drive motors with up to 40 volts to maximize the high speed performance. The UnoDrive can be used in conjunction with our MN100 or MN400 motion controllers or with any controller capable of producing TTL compatible step and direction signals.



BLOCK DIAGRAM

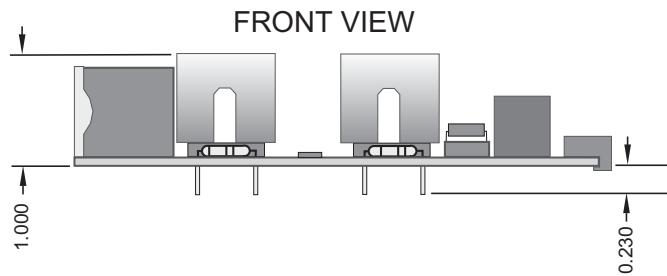
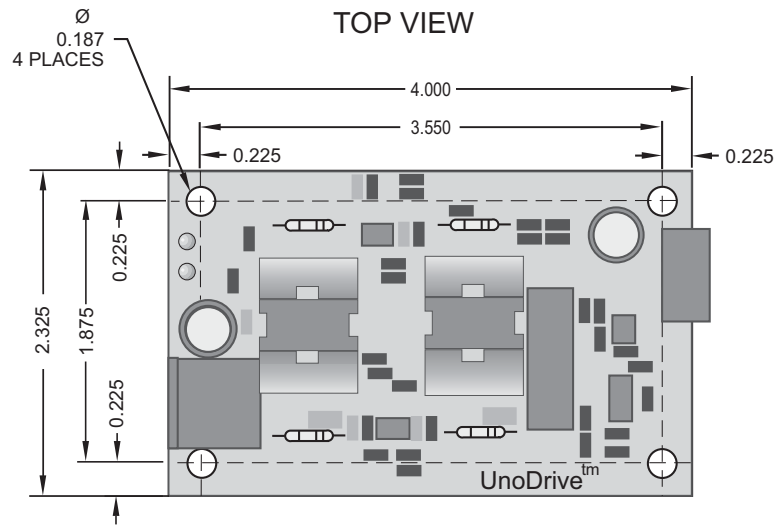


TYPICAL APPLICATION

Motor Drivers

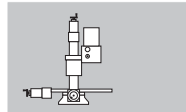
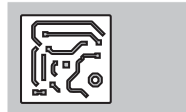
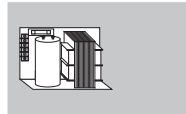
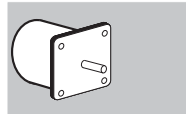
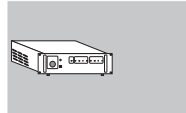
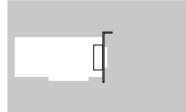
SPECIFICATIONS:

Drive circuit	Constant current bipolar chopper
Chopping rate	20 KHz nominal
Operating voltage range	12 ~ 40 VDC
Output current	Resistor selectable
Stepping modes	Half / Full step jumper selectable
Current cutback	Automatic after one second of idle
Step input signal	TTL compatible positive edge trigger
Direction input signal	TTL compatible positive edge trigger
Fault and Home output signals	Open collector type (50 mA max sink)
Motor control outputs	4 current mode chopper lines per axis
Current capability	1.2 amps maximum
Physical dimensions	4.00" w x 2.325" d x 1.23" h
Working temperature range	32° F ~ 158° F (0° C ~ 70° C)
Warranty	Five years parts and labor



MECHANICAL OUTLINE

Product	Order #	Price
UnoDrive motor driver	900-3001-001	\$49



To order by phone call 1-800-674-8419, or fax 770-422-7854

Motor Drivers

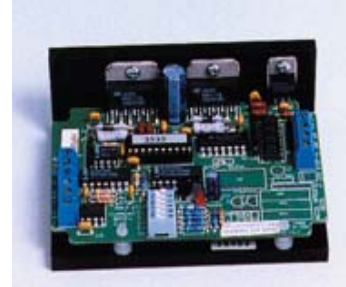


DR3535tm Stepper Motor Driver

Full & Half Step, 40V 3.5A

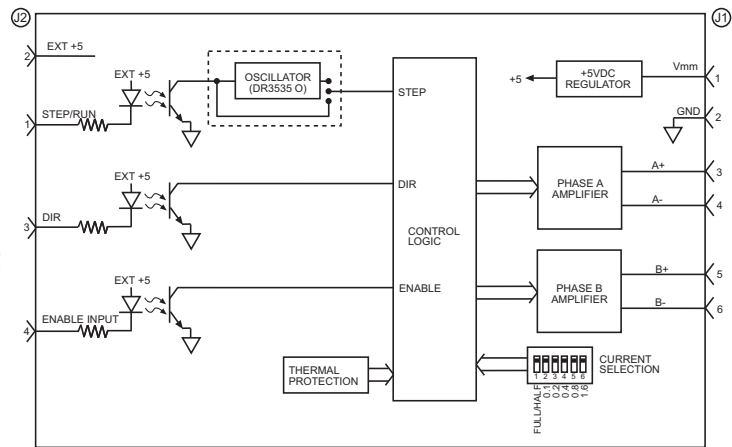
FEATURES:

- DIP switch selectable current from 32 levels
- Selectable full-step or half-step operation
- Uses bipolar chopper circuit to provide the highest performance
- Thermal protection
- Screw terminal connectors
- Optoisolated inputs
- Available with Oscillator (DR3535-O)

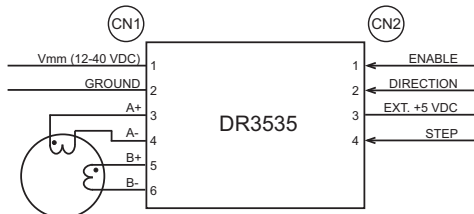


The DR3535 is a high current stepper motor driver. It receives step and direction signals from the controller and can drive motors with up to 40 volts to maximize the high speed performance. The DR3535 can be used in conjunction with our MN100, and MN400 motion controllers, or with any controller capable of producing TTL compatible step and direction signals.

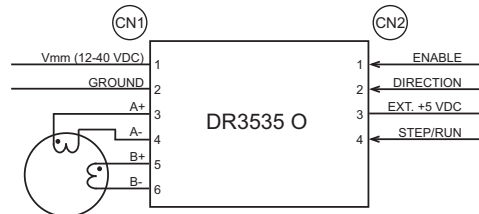
The DR3535-O version has a built in ramping pulse generator (oscillator) with adjustable speed, acceleration and deceleration. Oscillator speed range is 400-5,000 Hz. Speed can be set from on-board trimpot or external pot. A jumper allows you to select the internal oscillator. In oscillator mode, the pulse input becomes a run/stop signal: when this input is activated, the motor accelerates to a preset speed and slews. Removing the input signal causes the drive to decelerate to rest.



BLOCK DIAGRAM



DR3535
TYPICAL APPLICATION

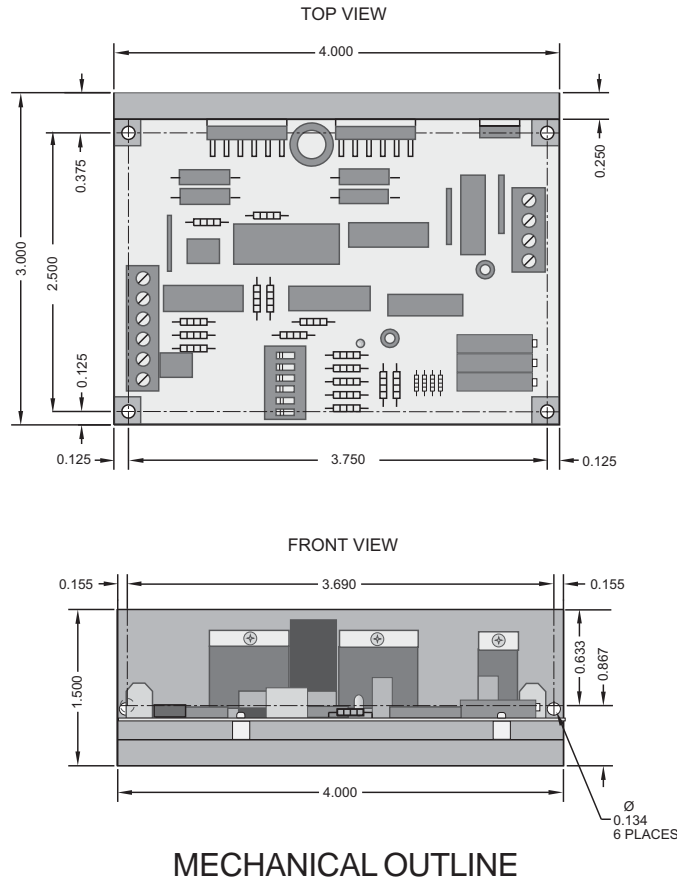


DR3535-O
TYPICAL APPLICATION

Motor Drivers

SPECIFICATIONS:

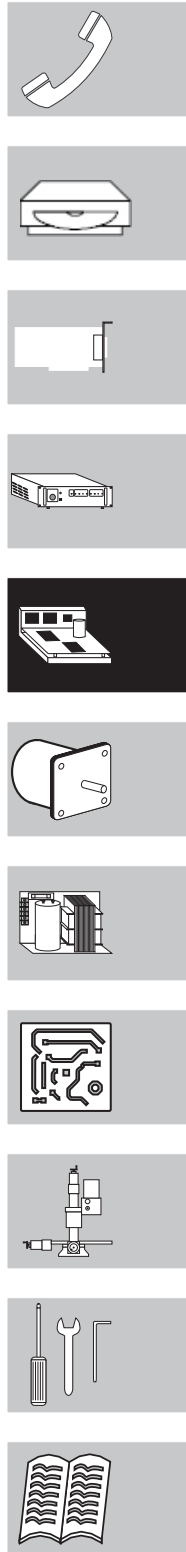
Drive circuit	Constant current bipolar chopper
Chopping rate	20 KHz nominal
Operating voltage range	12 ~ 40 VDC
Output current	0.4 -3.5 Amps in 0.1 A increments
Stepping modes	Half / Full step selectable
Current cutback	Automatic after one second of idle
Step input signal	TTL compatible positive edge trigger
Direction input signal	TTL compatible positive edge trigger
Fault and Home output signals	Open collector type (50 mA max sink)
Motor control outputs	4 current mode chopper lines per axis
Current capability	3.5 amps per phase continuous
Physical dimensions	4.00" x 3.00" x 1.50"
Working temperature range	32° F ~ 158° F (0° C ~ 70° C)
Warranty	One year parts and labor



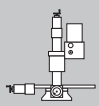
MECHANICAL OUTLINE

Product	Order #	Price
DR3535 motor driver	931-3535-000	\$149
DR3535-O motor driver	931-3535-001	\$189

To order by phone call 1-800-674-8419, or fax 770-422-7854



Motor Drivers



DR8010tm Stepper Motor Driver

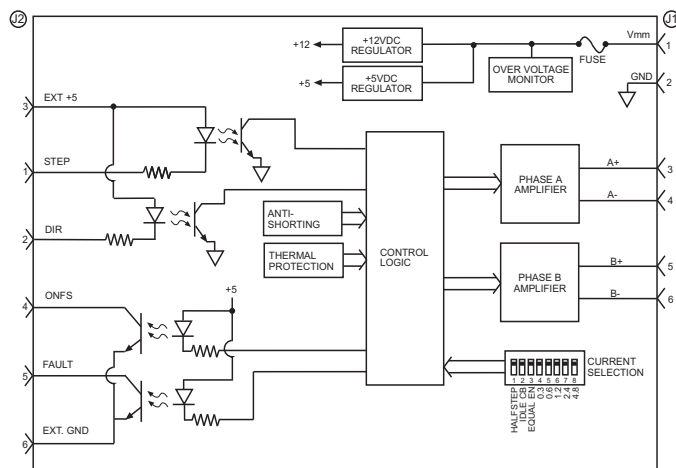
Full & Half Step, 80V 10A

FEATURES:

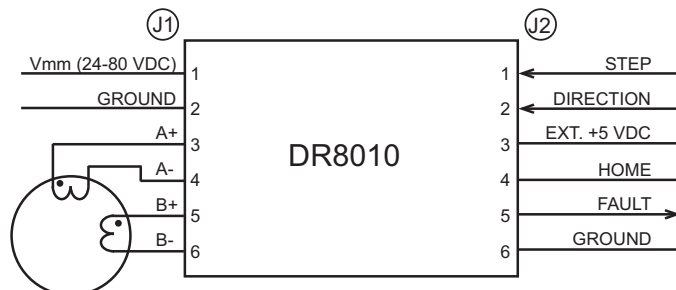
- Selectable full-step or half-step operation
- Equalized half-step mode for smooth operation
- Full over-current, over-voltage and over-temperature protection
- Easy screw terminal hookup
- Switch selectable current levels
- Bipolar chopper circuit provides the highest efficiency and motor performance
- Optical isolation for the control logic
- Current cutback (50% current after 1/2 second of idle when enabled)
- Compact design for ease of placement, utilizes surface mount MOSFETs



The DR8010 is a single axis stepper motor driver. It can drive motors with up to 80 volts for excellent high speed performance. The DR8010 driver can be used in conjunction with the Motionettm series of controllers or with any controller capable of producing TTL compatible step and direction signals. Phase current is switch selectable from 32 different levels ranging from 0.7 to 10.0 amps in 0.3 amp increments.



BLOCK DIAGRAM

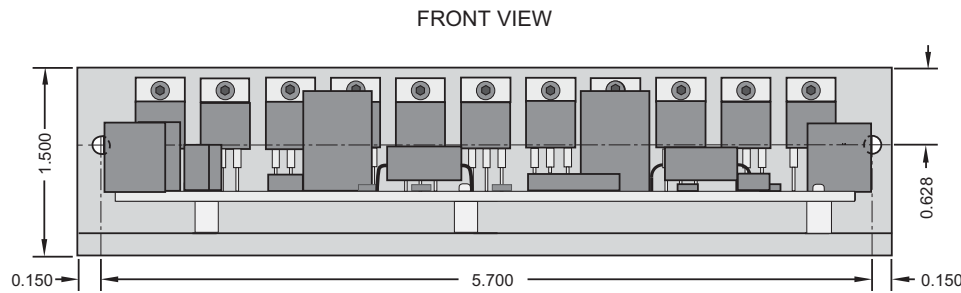
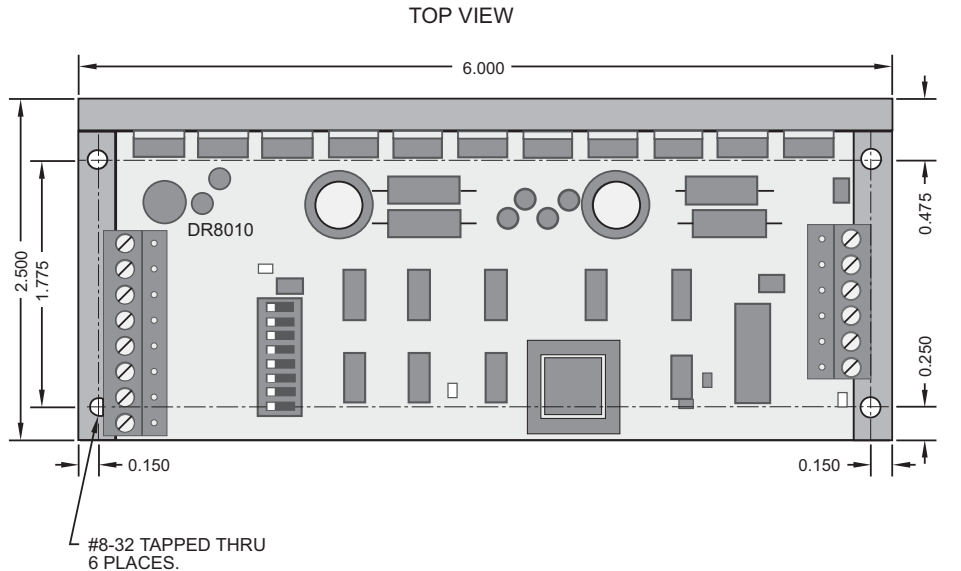
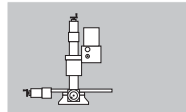
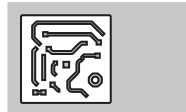
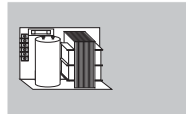
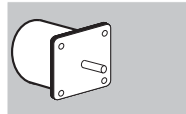
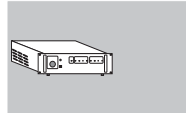
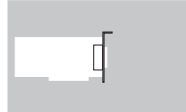


TYPICAL APPLICATION

Motor Drivers

SPECIFICATIONS:

Drive circuit	Constant current bipolar chopper
Chopping rate	21 KHz nominal
Operating voltage range	24 ~ 80 VDC
Output current	0.7 - 10.0 Amps in 0.3 A increments
Stepping modes	Half / Full step selectable
Current cutback	50 % of full current when enabled
Step input signal	TTL compatible positive edge trigger
Direction input signal	TTL compatible
Fault and Home output signals	Open collector type (50 mA max sink)
Motor control outputs	4 screw terminal motor connections
Current capability	10.0 amps per phase continuous
Physical dimensions	6.00" x 2.50" x 1.50"
Working temperature range	32° F ~ 158° F (0° C ~ 70° C)
Warranty	5 years parts & labor

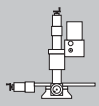


MECHANICAL OUTLINE

Product	Order #	Price
DR8010 motor driver	931-8010-000	\$197

To order by phone call 1-800-674-8419, or fax 770-422-7854

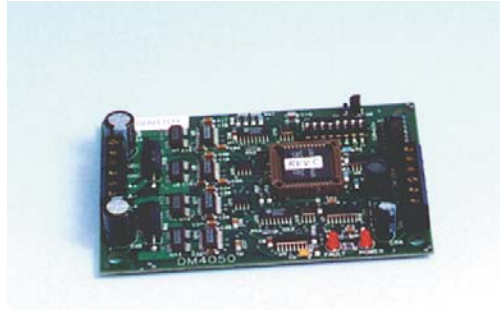
Motor Drivers



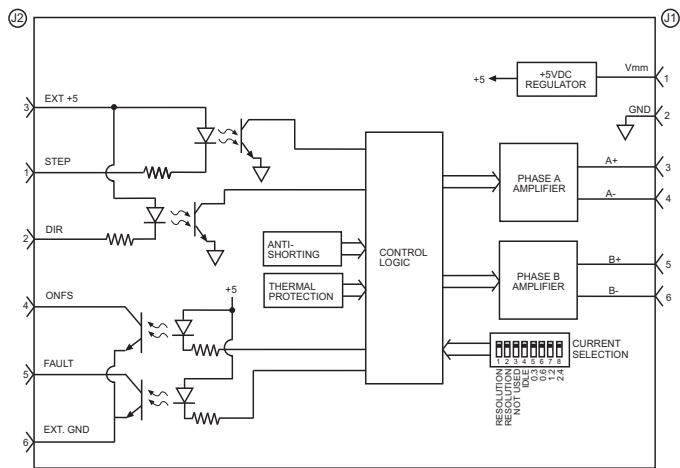
DM4050[™] Stepper Motor Driver Microstepping, 40V 5A

FEATURES:

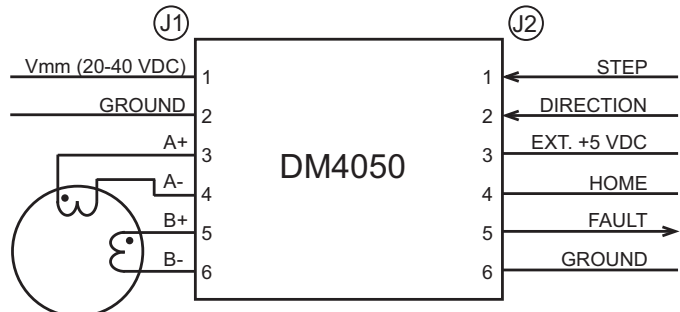
- Switch selectable full-step, half-step, quarter-step or eighth-step resolutions
- Equalized half-step mode for smooth operation
- Over-current and short-circuit protection
- Easy screw terminal hookup
- Switch selectable current levels
- Bipolar chopper circuit provides the highest performance
- Optoisolated step & direction inputs
- Optoisolated fault and home signal outputs
- Current cutback (50% current after 1/2 second of idle, when enabled)
- Compact design for ease of placement; Utilizes surface mount MOSFETs



The DM4050[™] microstepping driver is a 40 volt, 5 Amp per phase stepper motor driver providing 400 watts of power in a compact package. The DM4050[™] is suitable to drive NEMA size 23 and 34 motors typically used in engravers, wood routers and many types of automated machinery. The DM4050 driver can be used with the Motionet[™] series of controllers or with any controller capable of producing TTL compatible step and direction signals.



BLOCK DIAGRAM



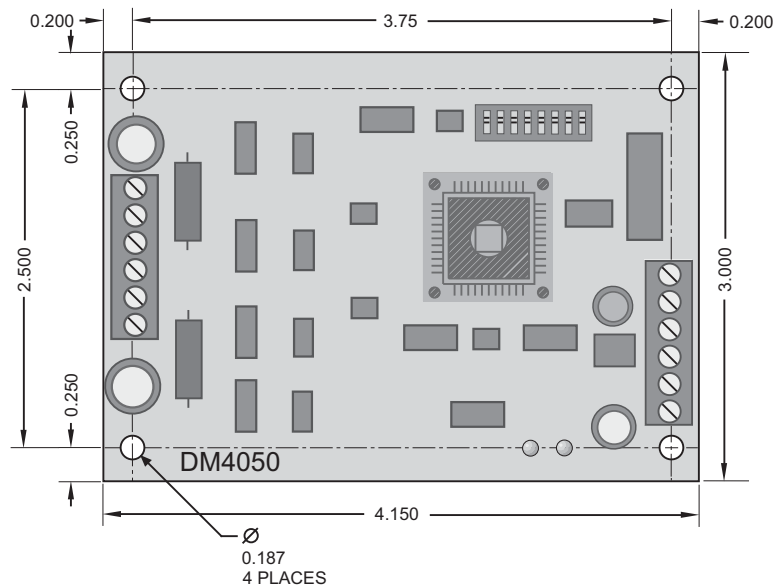
TYPICAL APPLICATION

Motor Drivers

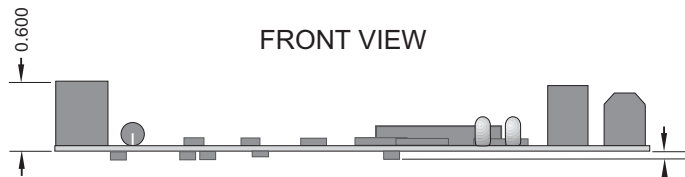
SPECIFICATIONS:

Drive circuit	Constant current bipolar chopper
Chopping rate	21 KHz nominal
Operating voltage range	20 ~ 40 VDC
Output current	0.5 - 5.0 Amps in 0.3 A increments
Stepping modes	Full/Half/Quarter/Eighth step
Current cutback	50 % of full current when enabled
Step input signal	TTL compatible positive edge trigger
Direction input signal	TTL compatible
Fault and Home output signals	Open collector (50 mA max sink)
Motor control outputs	4 current mode chopper lines
Current capability	5.0 amps per phase continuous
Physical dimensions	4.15" x 3.00" x 0.75"(add 0.60" for standoffs)
Working temperature range	32° F ~ 158° F (0° C ~ 70° C)
Warranty	5 years parts & labor

TOP VIEW



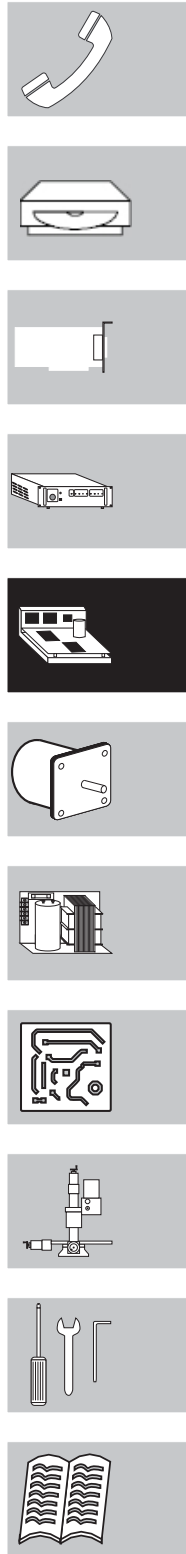
FRONT VIEW



MECHANICAL OUTLINE

Product	Order #	Price
DM4050 motor driver	932-4050-000	\$199

To order by phone call 1-800-674-8419, or fax 770-422-7854



Motor Drivers



DM8010[™] Stepper Motor Driver

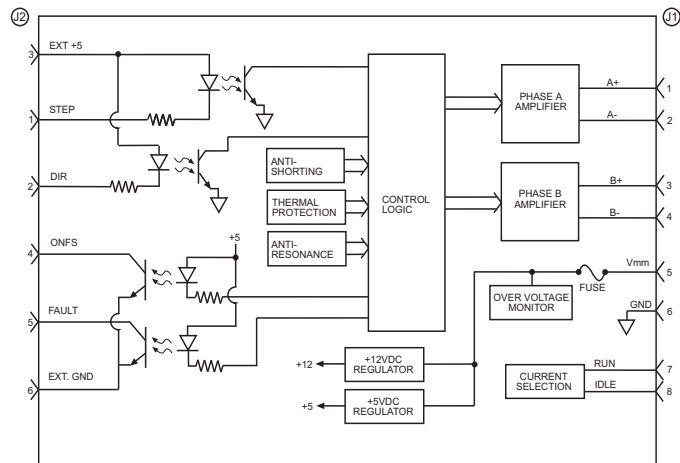
Microstepping, 80V 10A

FEATURES:

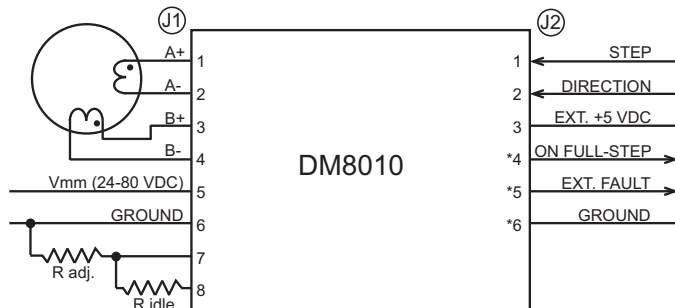
- 14 user selectable step resolutions (on-the-fly switching capable)
- Antiresonance circuitry for smooth operation
- Full over-current, over-voltage and over-temperature protection
- Opto-isolation on inputs keeps high power noise from interfering with motion controller logic
- Exact phase current is set with a resistor
- Compact design for ease of placement
- Bipolar chopper circuit provides the highest efficiency and motor performance
- Fault and On-Full-Step output signals provided for intelligent feedback to motion controller
- Advanced inverse-speed-proportional current reduction saves power and reduces heat even during motion



The DM8010 is an advanced high powered single axis microstepping motor driver. It can drive motors with up to 80 volts for excellent high speed performance. The DM8010 can be used in conjunction with the Motionet[™] series of controllers or with any controller capable of producing TTL compatible step and direction signals. Phase current is resistor settable and ranges from 2 to 10 Amps.



BLOCK DIAGRAM



*May be left unconnected if not required by the application.

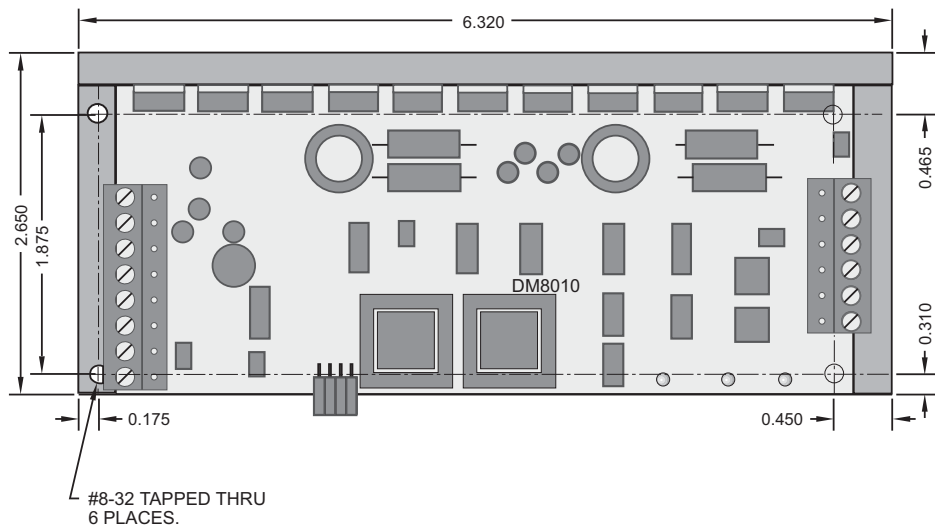
TYPICAL APPLICATION

Motor Drivers

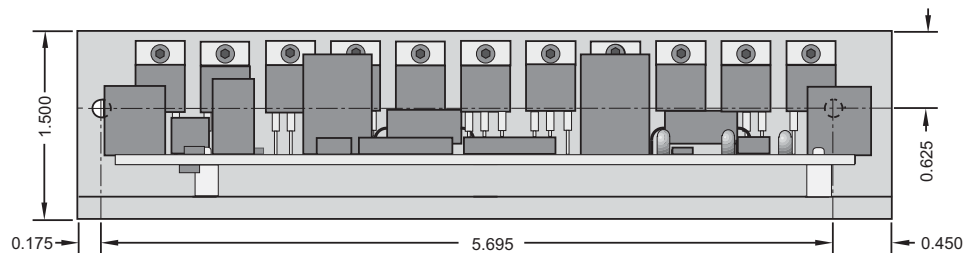
SPECIFICATIONS:

Drive circuit	Constant current bipolar chopper
Chopping rate	20 KHz nominal
Maximum step rate	300 KHz
Operating voltage range	24 ~ 80 VDC
Output current	2 - 10 Amps peak per phase (selectable)
Stepping modes	14 selectable binary & decimal resolutions
Current cutback	Resistor selectable idle current
Step input signal	TTL compatible positive edge trigger
Direction input signal	TTL compatible
Fault and On-Full-Step output signals	Open collector (50 mA max sink)
Motor control connections	4 screw terminals for 2 motor windings
Physical dimensions	6.32" x 2.650" x 1.50"
Working temperature range	32° F ~ 158° F (0° C ~ 70° C)
Warranty	Five years parts & labor

TOP VIEW



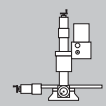
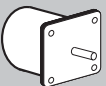
FRONT VIEW



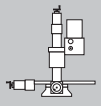
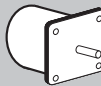
MECHANICAL OUTLINE

Product	Order #	Price
DM8010 motor driver	932-8010-000	\$248

To order by phone call 1-800-674-8419, or fax 770-422-7854



Motor Drivers

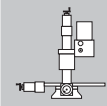
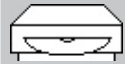


Stepper Motors



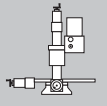
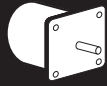
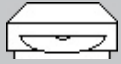
The two most important factors in selecting a stepper motor are the torque and the current requirements. Choose a motor that can develop enough torque to overcome the frictional and inertial loads at the highest stepping rate needed. The current rating is a maximum continuous duty rating. You can certainly operate a motor at somewhat less than the rated current to reduce motor heating or to utilize a smaller driver for cost reasons. You may also overdrive a stepper motor if adequate heat sink is available or if the operate-to-idle ratio (duty cycle) is relatively low and the driver provides a "current cutback at idle" capability.

Additional information is available in the 'Educational Resources' section of this catalog to help you select the motor best suited to your application.

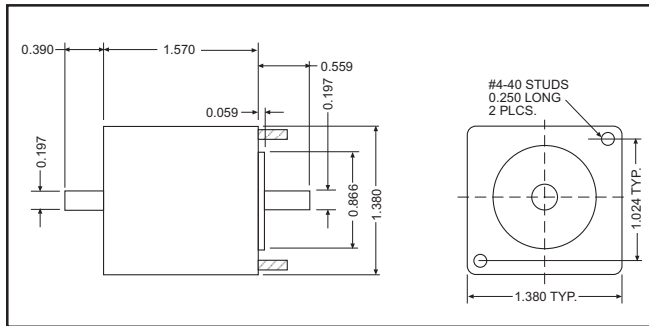


To order by phone call 1-800-674-8419, or fax 770-422-7854

Stepper Motors



14M30

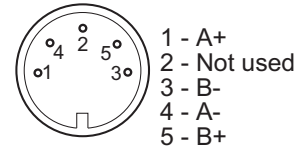


SPECIFICATIONS:

Holding Torque 30 oz-in
 Rotor Inertia109 oz-in²
 Step Angle 1.8 deg.
 Weight 0.47 lbs

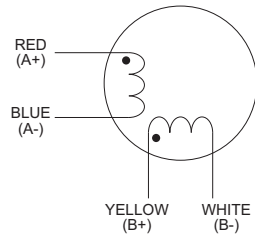
Resistance 4.3 ohms
 Rated Current 1.2 amps
 Rated Voltage 4.8 volts
 Inductance 5.5 mH

MOTOR POWER CONNECTORS:



5 pin female DIN connector-
front view

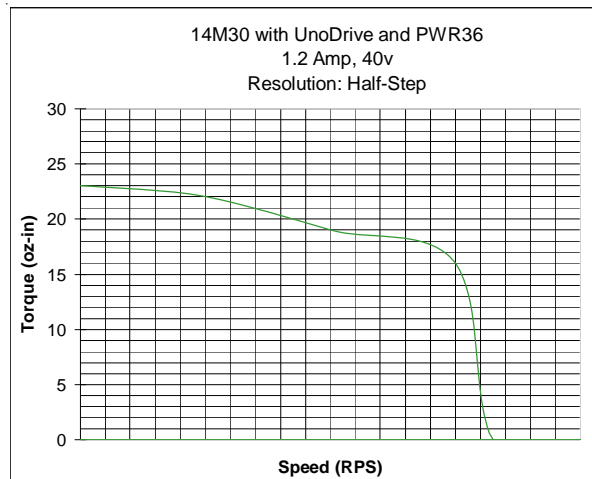
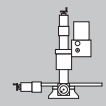
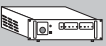
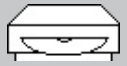
WIRING CONFIGURATIONS:



4 lead motor Wiring
Diagram

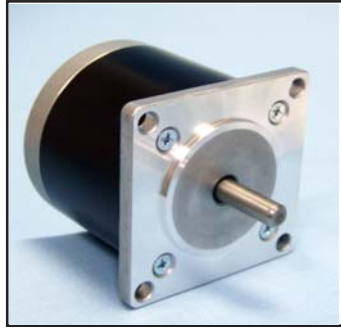
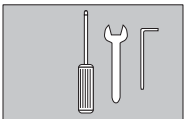
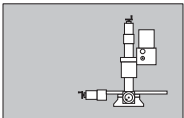
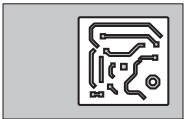
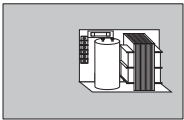
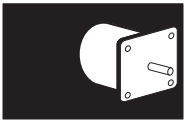
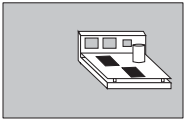
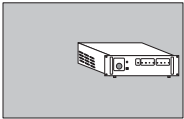
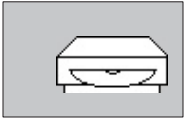
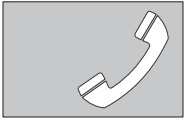
Product	Order #	Price
14M30-single shaft (flying leads)	305-1430-001	\$48
14M30-double shaft (flying leads)	305-1430-002	\$53
14M30-single shaft (DIN conn)	305-1430-201	\$53
14M30-double shaft (DIN conn)	305-1430-202	\$58

Stepper Motors

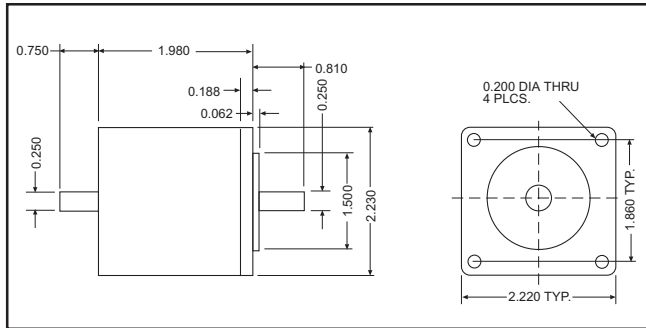


To order by phone call 1-800-674-8419, or fax 770-422-7854

Stepper Motors



23M50

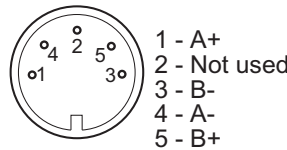


SPECIFICATIONS:

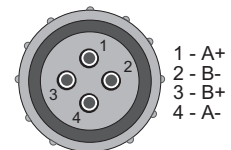
Holding Torque 53 oz-in
 Rotor Inertia 0.547 oz-in²
 Step Angle 1.8 deg.
 Weight 1.17 lbs

	Center Tap	Series
Resistance	5.1 ohms	10.2 ohms
Rated Current	1.0 amps	0.71 amps
Rated Voltage	5.1 volts	7.2 volts
Inductance	10 mH	40 mH

MOTOR POWER CONNECTORS:

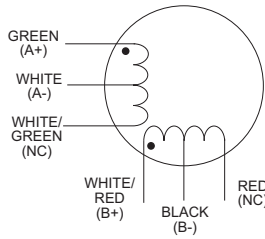


5 pin female DIN connector- front view

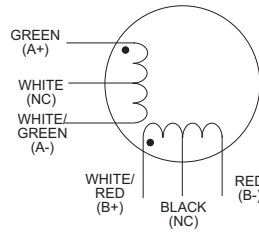


4 pin female circular connector-front view cable length-10' standard

WIRING CONFIGURATIONS:



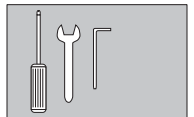
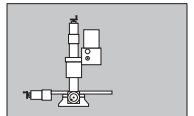
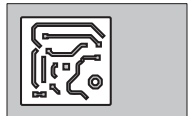
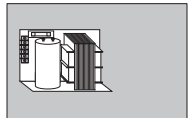
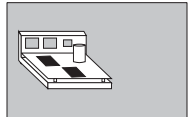
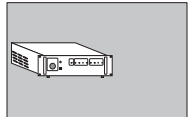
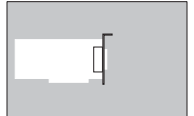
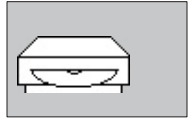
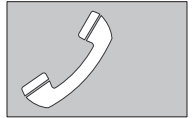
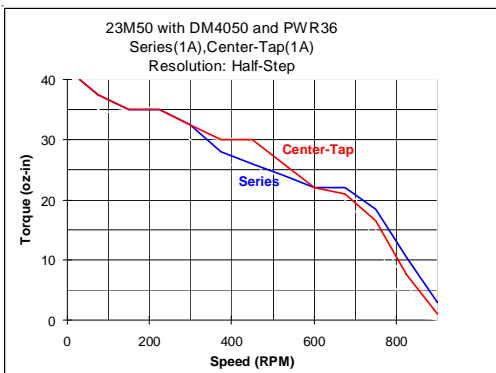
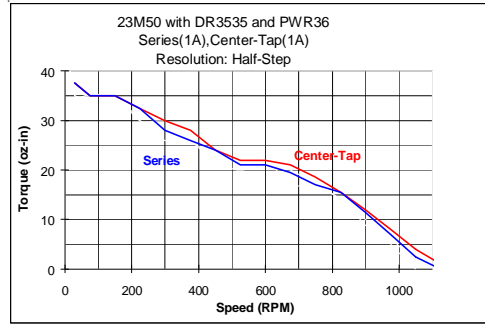
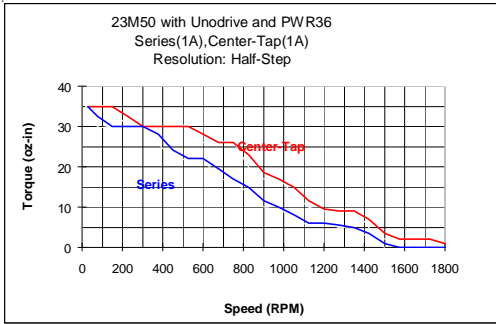
6 Lead Center Tapped (standard)



6 Lead Series

Product	Order #	Price
23M50-double shaft (flying leads)	305-2350-002	\$54
23M50-double shaft (DIN conn)	305-2350-202	\$59
23M50-double shaft (circ conn)	305-2350-102	\$79

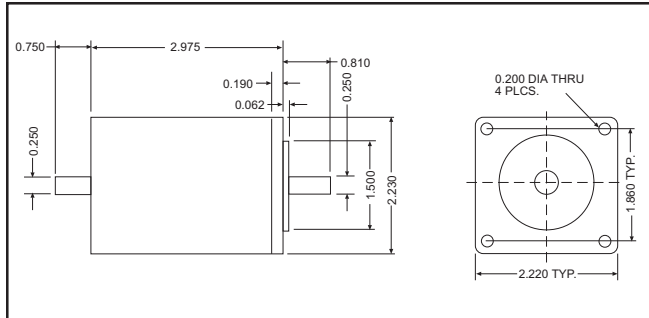
Stepper Motors



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Stepper Motors

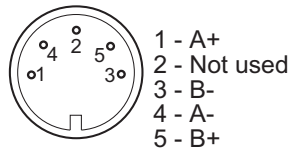
23M110



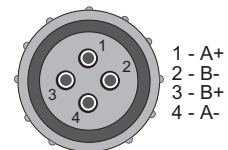
SPECIFICATIONS:

Holding Torque 112 oz-in
 Rotor Inertia 1.14 oz-in²
 Step Angle 1.8 deg.
 Weight 2.0 lbs

MOTOR POWER CONNECTORS:



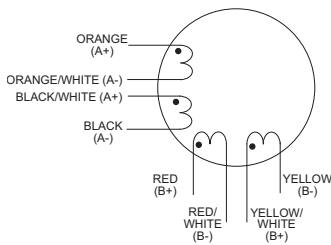
5 pin female DIN connector-
front view



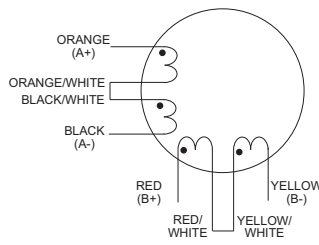
4 pin female circular
connector-front view
cable length-10'
standard

	Parallel	Series	Half Coil
Resistance	1.2 ohms	4.6 ohms	2.3 ohms
Rated Current	3.6 amps	1.26 amps	1.78 amps
Rated Voltage	2.94 volts	2.97 volts	4.2 volts
Inductance	4.7 mH	18.8 mH	4.7 mH

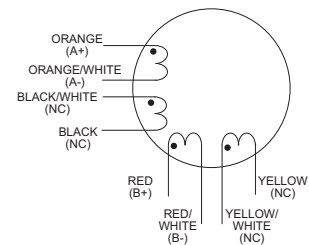
WIRING CONFIGURATIONS:



8 lead parallel (standard)



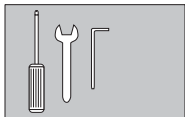
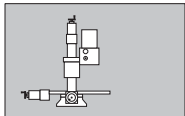
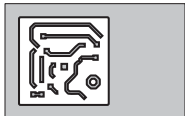
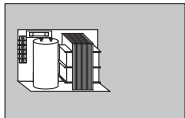
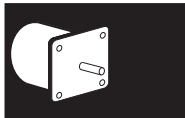
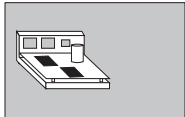
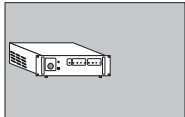
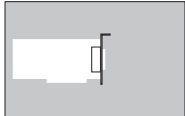
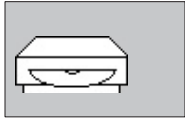
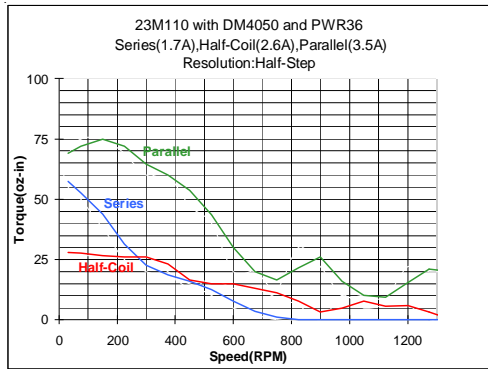
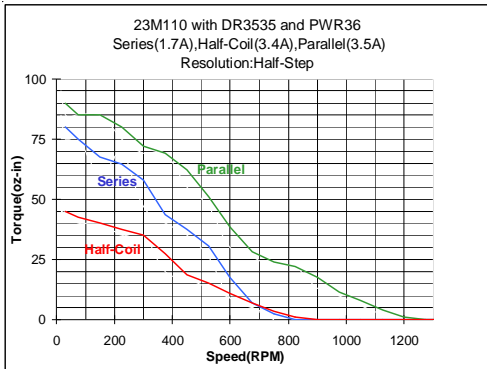
8 lead series



8 lead half coil

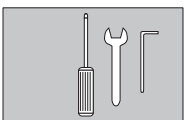
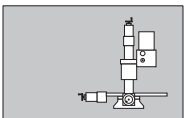
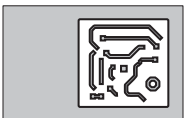
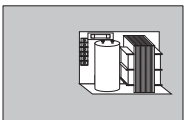
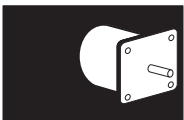
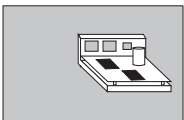
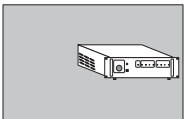
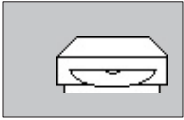
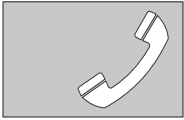
Product	Order #	Price
23M110-single shaft (flying leads)	305-2311-081	\$110
23M110-double shaft (flying leads)	305-2311-082	\$115
23M110-single shaft (DIN conn)	305-2311-281	\$115
23M110-double shaft (DIN conn)	305-2311-282	\$120
23M110-single shaft (circ conn)	305-2311-181	\$135
23M110-double shaft (circ conn)	305-2311-182	\$140

Stepper Motors

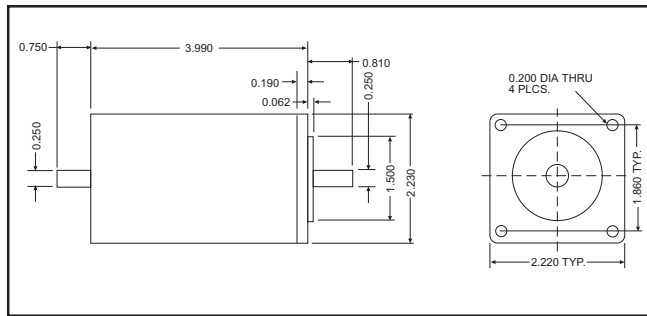


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Stepper Motors



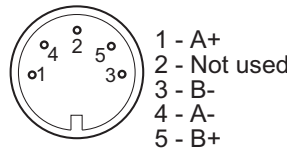
23M160



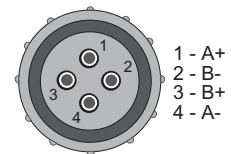
SPECIFICATIONS:

Holding Torque 160 oz-in
 Rotor Inertia 1.72 oz-in²
 Step Angle 1.8 deg.
 Weight 2.8 lbs

MOTOR POWER CONNECTORS:



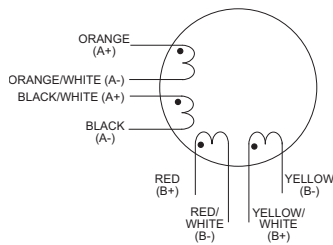
5 pin female DIN connector-
front view



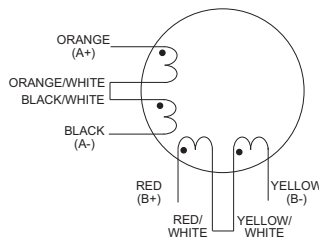
4 pin female circular
connector-front view
cable length-10'
standard

	Parallel	Series	Half Coil
Resistance	0.82 ohms	3.26 ohms	1.63 ohms
Rated Current	3.49 amps	1.75 amps	2.47 amps
Rated Voltage	2.83 volts	5.66 volts	4.0 volts
Inductance	4.2 mH	16.8 mH	4.2 mH

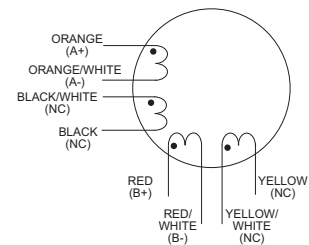
WIRING CONFIGURATIONS:



8 lead parallel (standard)



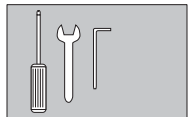
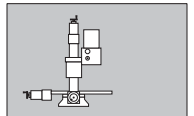
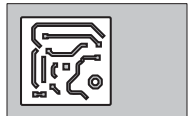
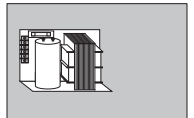
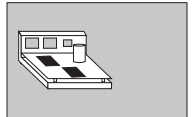
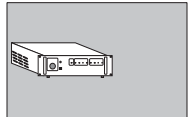
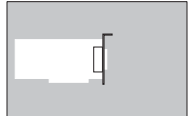
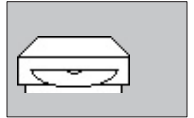
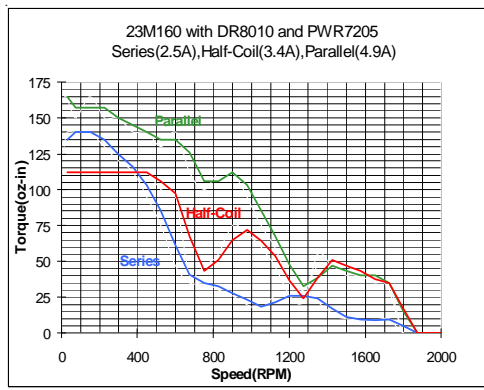
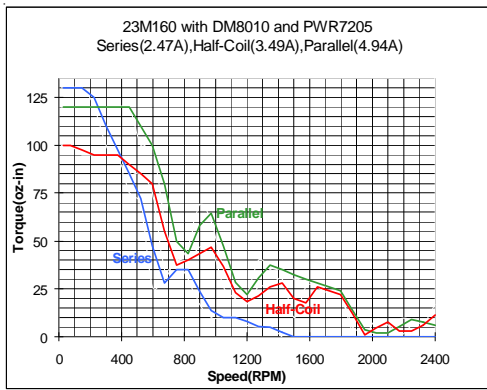
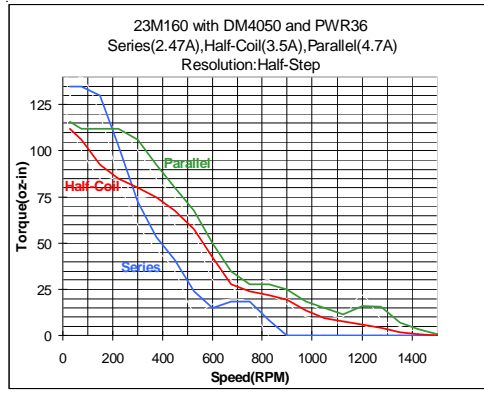
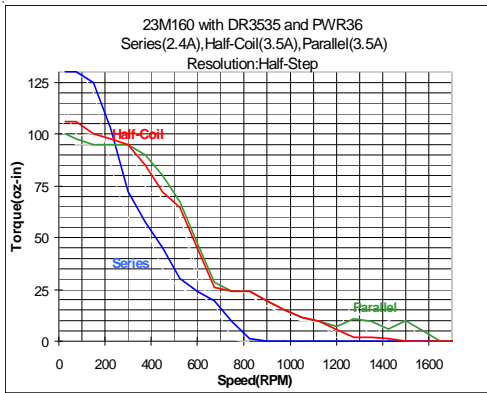
8 lead series



8 lead half coil

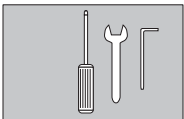
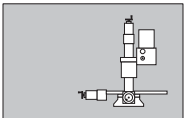
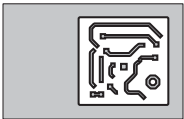
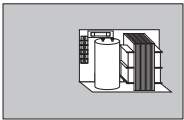
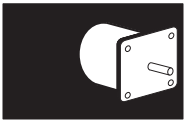
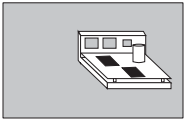
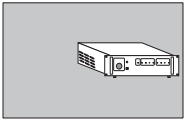
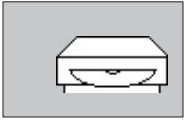
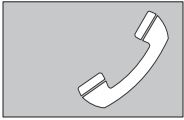
Product	Order #	Price
23M160-single shaft (flying leads)	305-2316-081	\$145
23M160-double shaft (flying leads)	305-2316-082	\$150
23M160-single shaft (DIN conn)	305-2316-281	\$150
23M160-double shaft (DIN conn)	305-2316-282	\$155
23M160-single shaft (circular conn)	305-2316-181	\$170
23M160-double shaft (circular conn)	305-2316-182	\$175

Stepper Motors

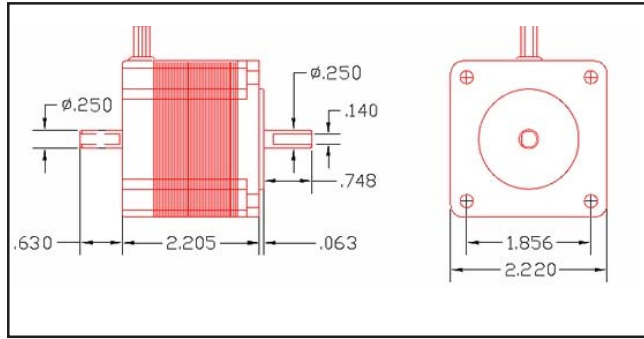


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Stepper Motors



23HT175

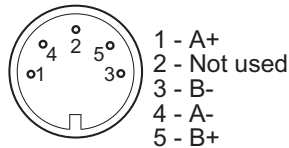


SPECIFICATIONS:

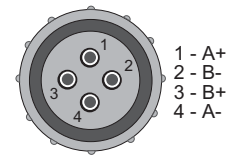
Holding Torque 176 oz-in
 Rotor Inertia 1.64 oz-in²
 Step Angle 1.8 deg.
 Weight 1.54 lbs

Resistance 3.6 ohms
 Rated Current 1.42amps
 Rated Voltage 5.1 volts
 Inductance 11.0 mH

MOTOR POWER CONNECTORS:

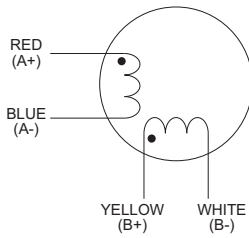


5 pin female DIN connector-
front view



4 pin female circular
connector-front view
cable length-10'
standard

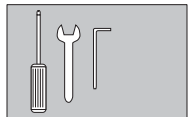
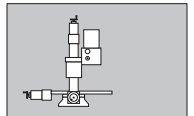
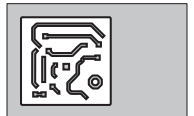
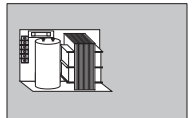
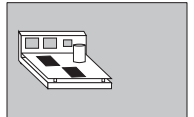
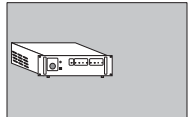
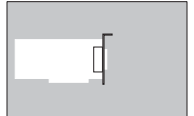
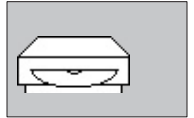
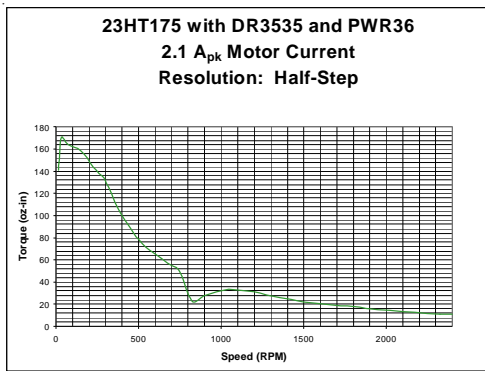
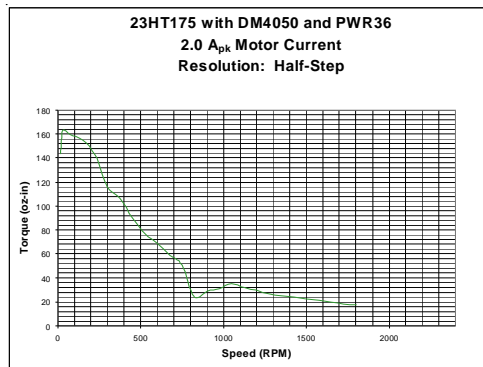
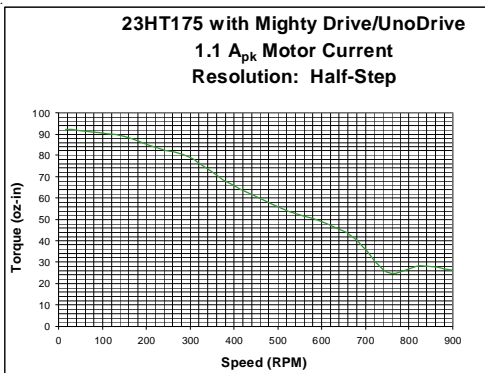
WIRING CONFIGURATIONS:



4 lead motor Wiring
Diagram

Product	Order #	Price
23HT175-double shaft (flying leads)	305-2317-080	\$44
23HT175-double shaft (circular conn)	305-2317-180	\$59
23HT175-double shaft (DIN conn)	305-2317-280	\$49

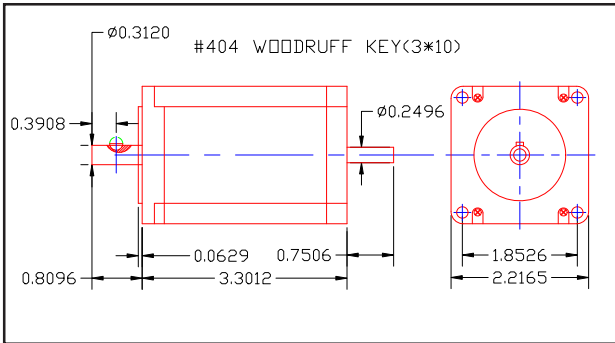
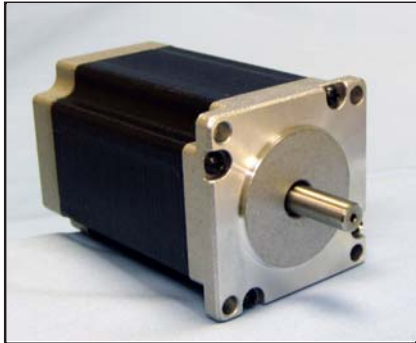
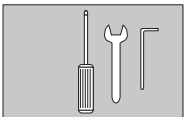
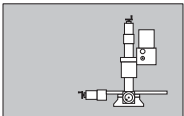
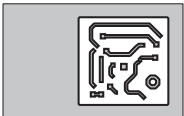
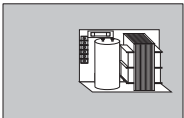
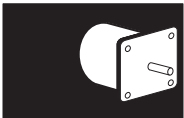
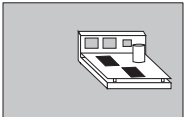
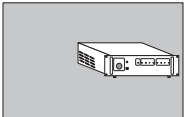
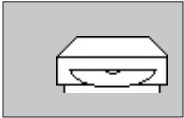
Stepper Motors



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Stepper Motors

23HT350

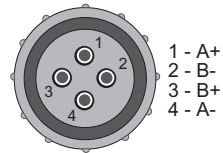


SPECIFICATIONS:

Holding Torque 350 oz-in
 Rotor Inertia 4.59 oz-in²
 Step Angle 1.8 deg.
 Weight 2.5 lbs

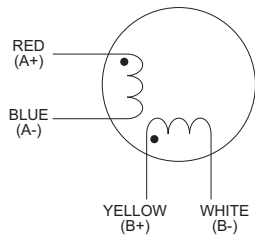
Resistance 0.28 ohms
 Rated Current 6.6 amps
 Rated Voltage 1.85 volts
 Inductance 1.54 mH

MOTOR POWER CONNECTORS:



4 pin female circular
 connector-front view
 cable length-10'
 standard

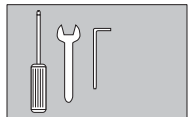
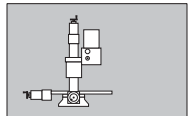
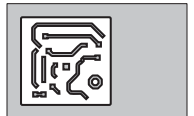
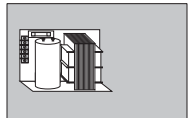
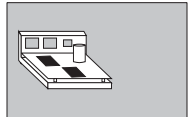
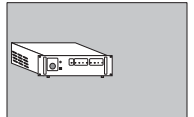
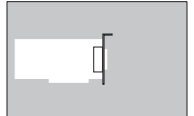
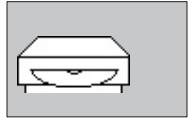
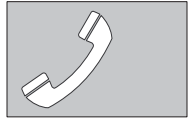
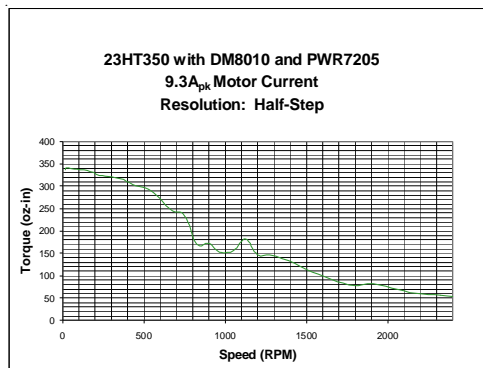
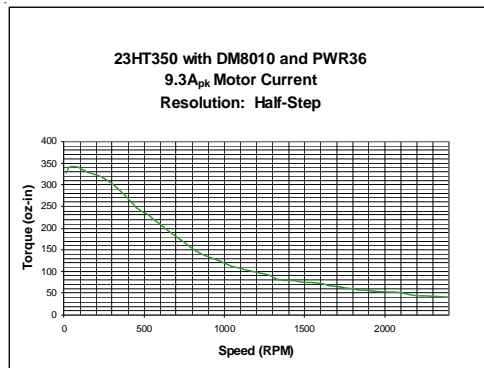
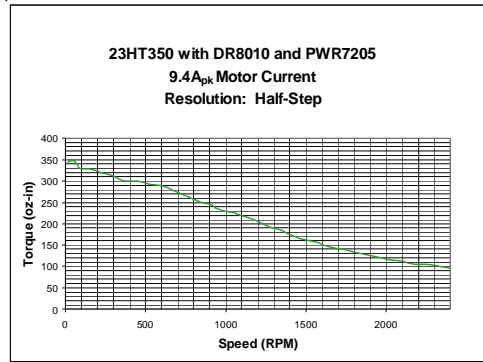
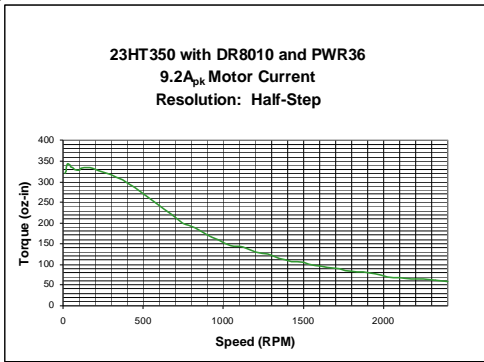
WIRING CONFIGURATIONS:



4 lead motor wiring diagram

Product	Order #	Price
23HT350-double shaft (flying leads)	305-2335-040	\$86
23HT350-double shaft (circular conn)	305-2335-140	\$111

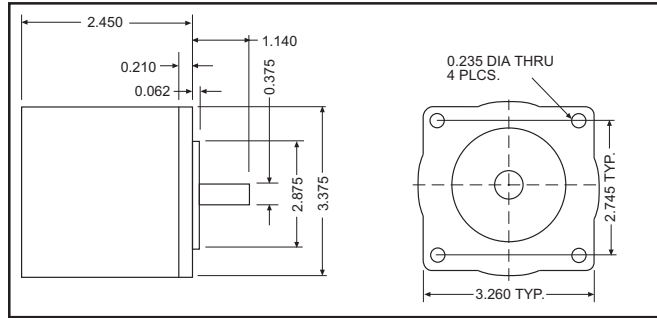
Stepper Motors



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Stepper Motors

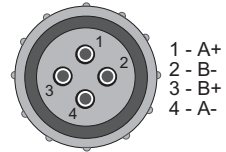
34M220



SPECIFICATIONS:

Holding Torque 220 oz-in
 Rotor Inertia 3.66 oz-in²
 Step Angle 1.8 deg.
 Weight 3.0 lbs

MOTOR POWER CONNECTORS:

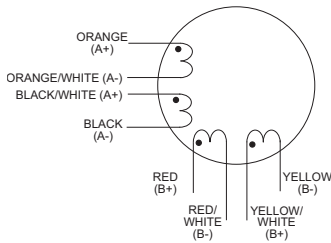


1 - A+
 2 - B-
 3 - B+
 4 - A-

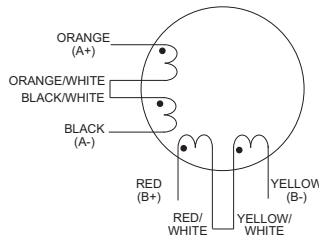
4 pin female circular
 connector-front view
 cable length-10'
 standard

	Parallel	Series	Half Coil
Resistance	0.19 ohms	0.76 ohms	0.38 ohms
Rated Current	6.6 amps	3.3 amps	4.7 amps
Rated Voltage	1.27 volts	2.5 volts	1.8 volts
Inductance	1.25 mH	5.0 mH	1.25 mH

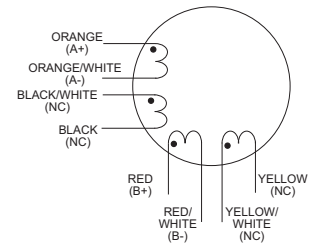
WIRING CONFIGURATIONS:



8 lead parallel (standard)



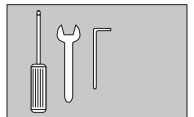
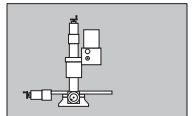
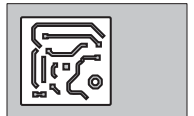
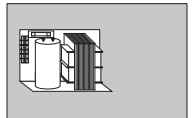
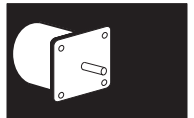
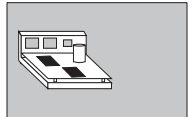
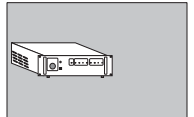
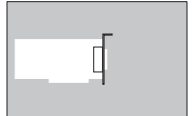
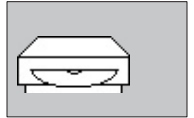
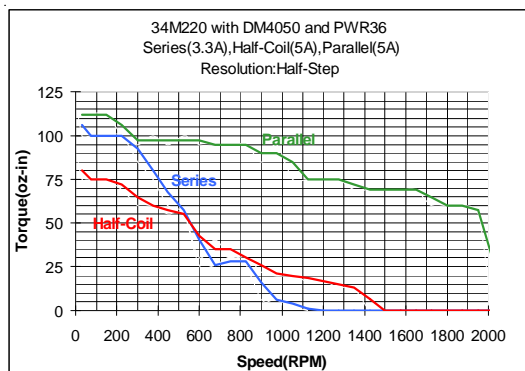
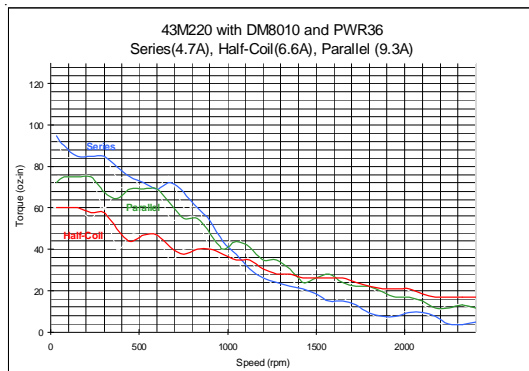
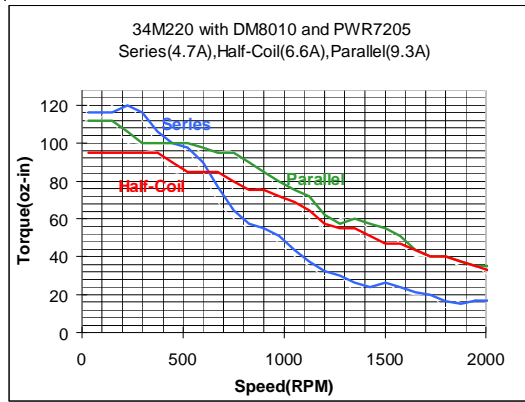
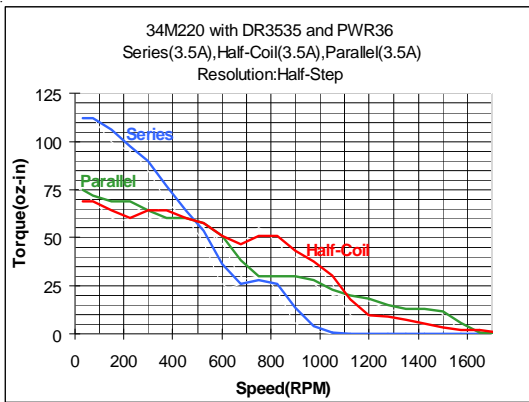
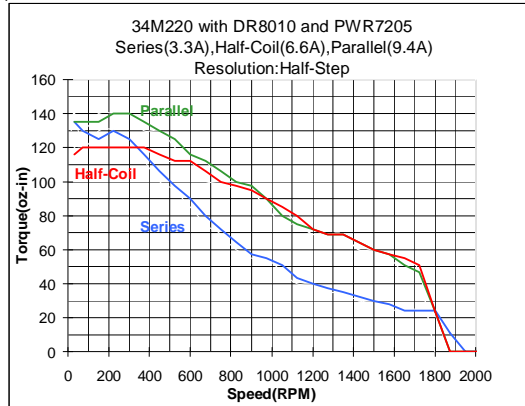
8 lead series



8 lead half coil

Product	Order #	Price
34M220-single shaft (flying leads)	305-3422-081	\$124
34M220-single shaft (circular conn)	305-3422-181	\$149

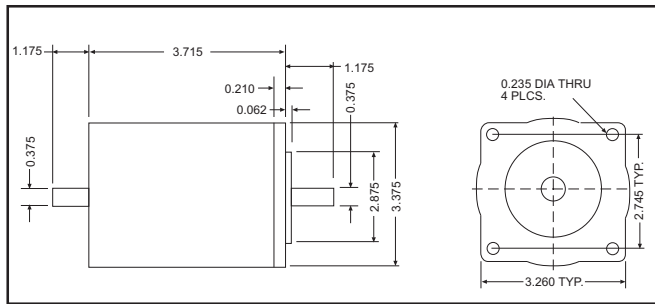
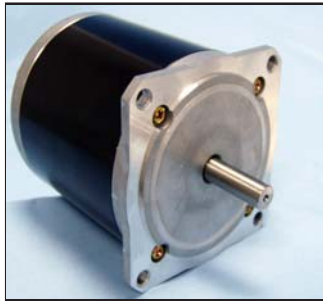
Stepper Motors



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Stepper Motors

34M315

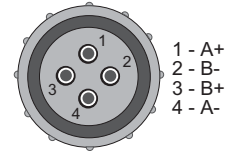


SPECIFICATIONS:

Holding Torque 315 oz-in
 Rotor Inertia 6.72 oz-in²
 Step Angle 1.8 deg.
 Weight 5.4 lbs

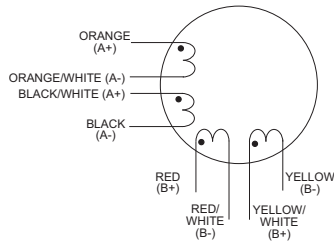
	Parallel	Series	Half Coil
Resistance	0.25 ohms	1.0 ohms	0.50 ohms
Rated Current	7.0 amps	3.5 amps	5.0 amps
Rated Voltage	1.77 volts	3.5 volts	2.5 volts
Inductance	2.9 mH	11.6 mH	2.9 mH

MOTOR POWER CONNECTORS:

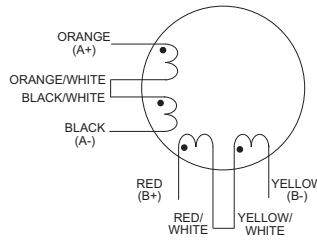


1 - A+
 2 - B-
 3 - B+
 4 - A-
 4 pin female circular
 connector-front view
 cable length-10'
 standard

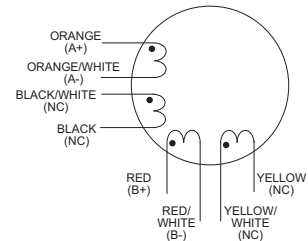
WIRING CONFIGURATIONS:



8 lead parallel (standard)



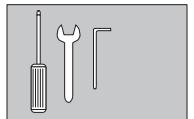
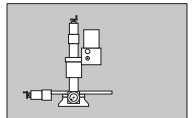
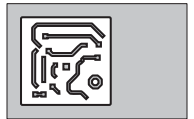
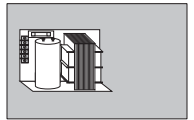
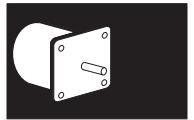
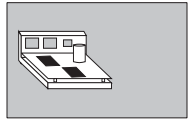
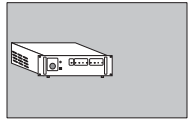
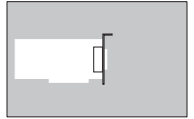
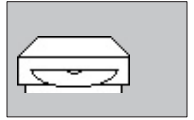
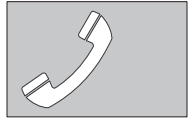
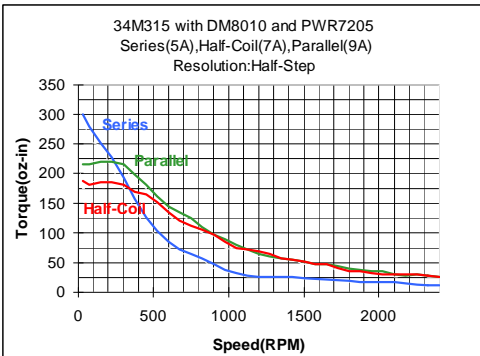
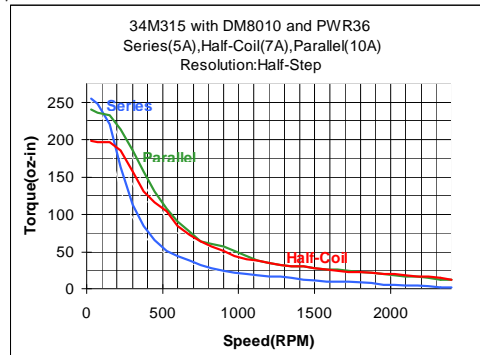
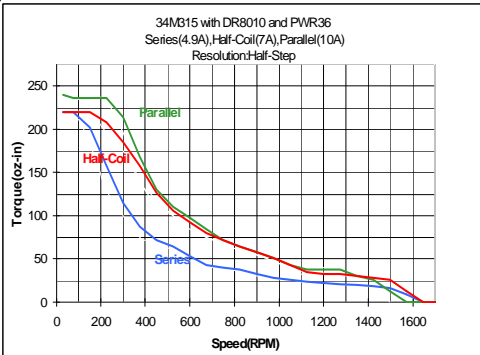
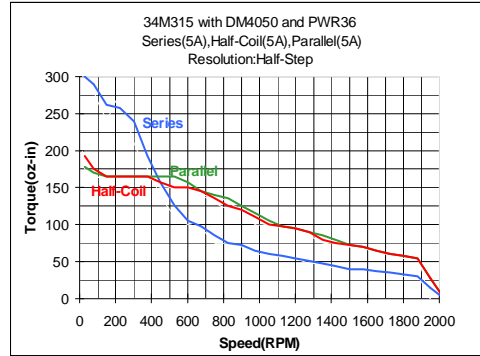
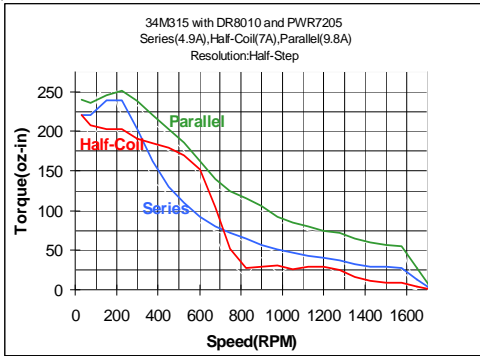
8 lead series



8 lead half coil

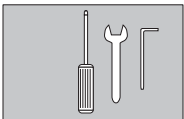
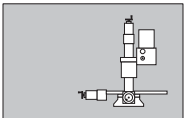
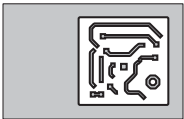
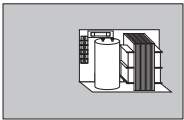
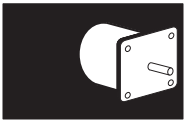
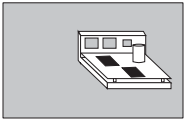
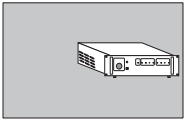
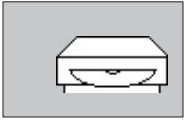
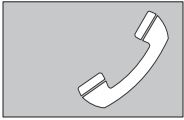
Product	Order #	Price
34M315-single shaft (flying leads)	305-3431-081	\$185
34M315-double shaft (flying leads)	305-3431-082	\$190
34M315-single shaft (circular conn)	305-3431-181	\$210
34M315-double shaft (circular conn)	305-3431-182	\$215

Stepper Motors

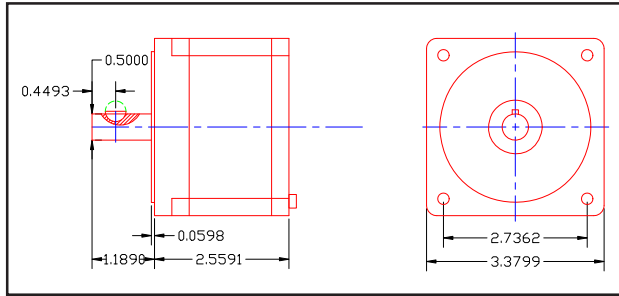
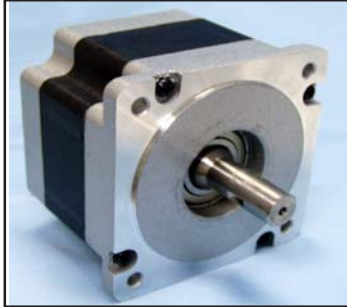


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Stepper Motors



34HT390

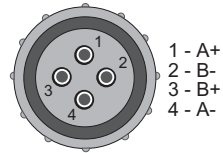


SPECIFICATIONS:

Holding Torque 390 oz-in
 Rotor Inertia 5.47 oz-in²
 Step Angle 1.8 deg.
 Weight 4.0 lbs

Resistance 0.27 ohms
 Rated Current 6.6 amps
 Rated Voltage 1.79 volts
 Inductance 1.57 mH

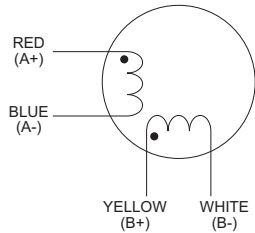
MOTOR POWER CONNECTORS:



1 - A+
 2 - B-
 3 - B+
 4 - A-

4 pin female circular
 connector-front view
 cable length-10'
 standard

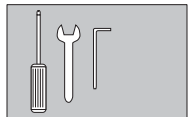
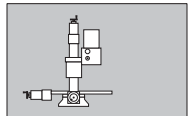
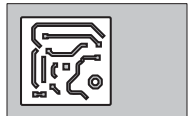
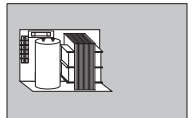
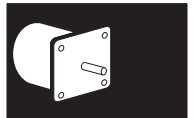
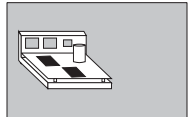
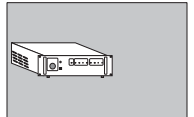
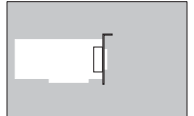
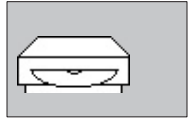
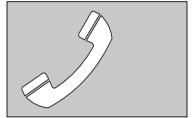
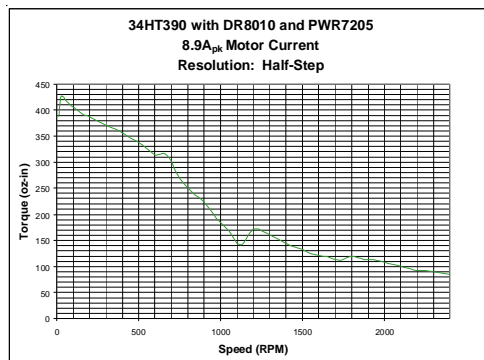
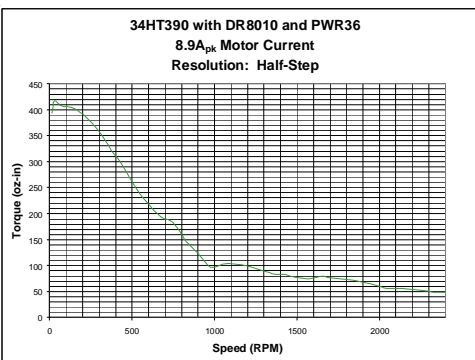
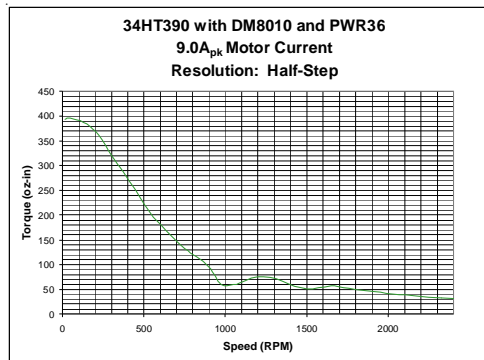
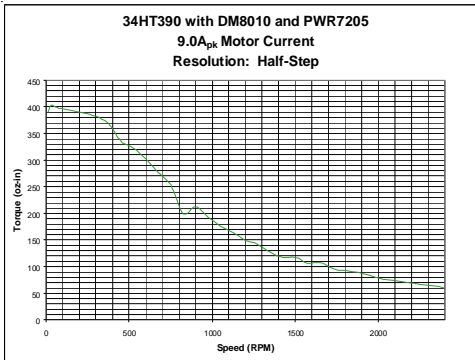
WIRING CONFIGURATIONS:



4 lead motor wiring diagram

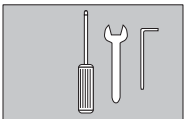
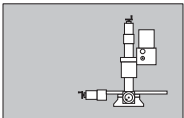
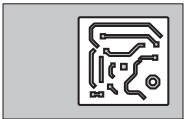
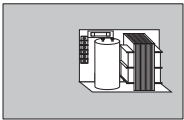
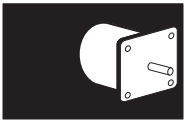
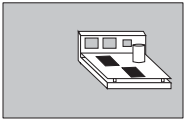
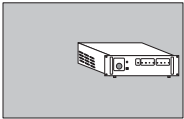
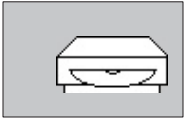
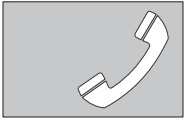
Product	Order #	Price
34HT390-single shaft (flying leads)	305-3439-081	\$118
34HT390-single shaft (circular conn)	305-3439-181	\$143

Stepper Motors

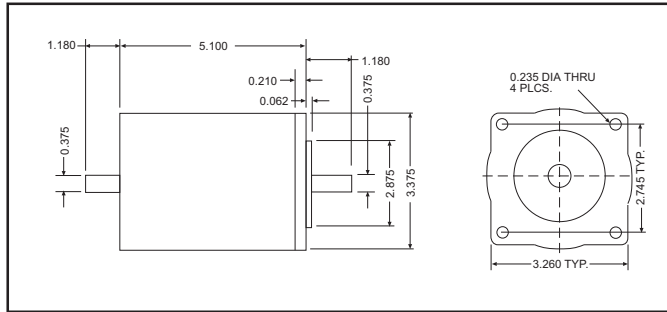


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Stepper Motors



34M450

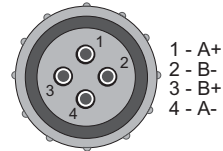


SPECIFICATIONS:

Holding Torque 450 oz-in
 Rotor Inertia 10.2 oz-in²
 Step Angle 1.8 deg.
 Weight 7.7 lbs

	Center Tap	Series
Resistance	1.22 ohms	2.44 ohms
Rated Current	3.5 amps	2.47 amps
Rated Voltage	4.3 volts	6.1 volts
Inductance	7.0 mH	28 mH

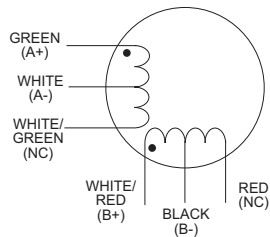
MOTOR POWER CONNECTORS:



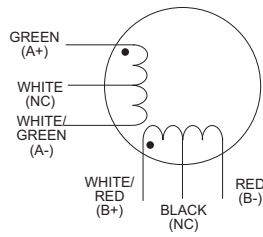
1 - A+
 2 - B-
 3 - B+
 4 - A-

4 pin female circular connector-front view
 cable length-10' standard

WIRING CONFIGURATIONS:



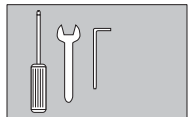
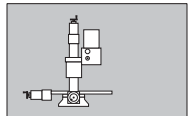
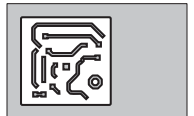
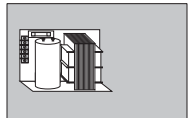
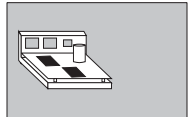
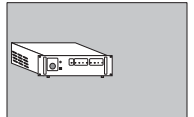
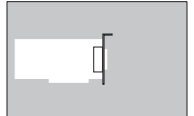
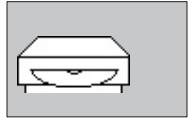
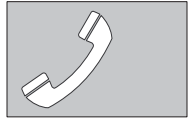
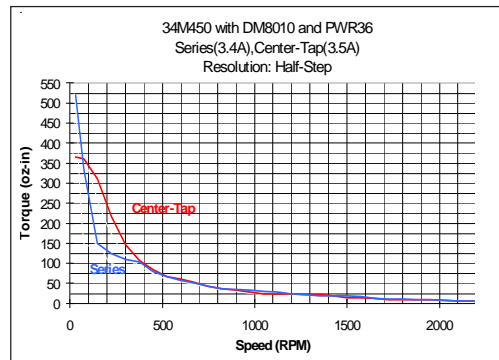
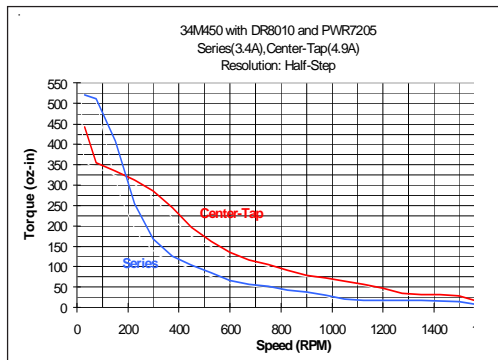
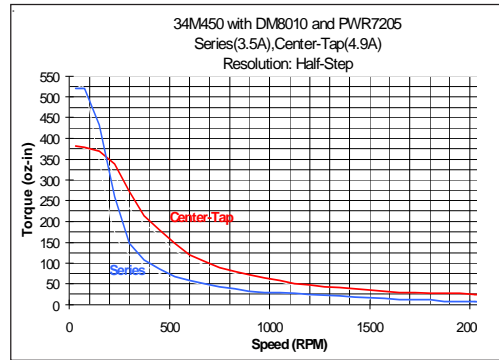
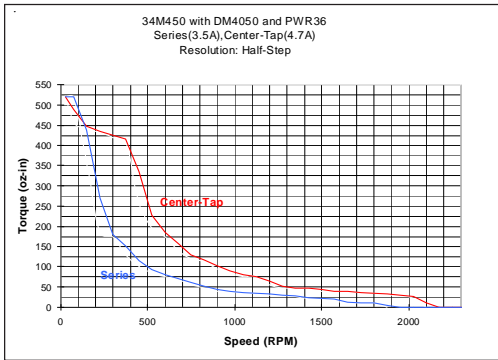
6 lead center tapped (standard)



6 lead series

Product	Order #	Price
34M450-single shaft (flying leads)	305-3445-060	\$210
34M450-double shaft (flying leads)	305-3445-061	\$215
34M450-single shaft (circular conn)	305-3445-160	\$235
34M450-double shaft (circular conn)	305-3445-161	\$240

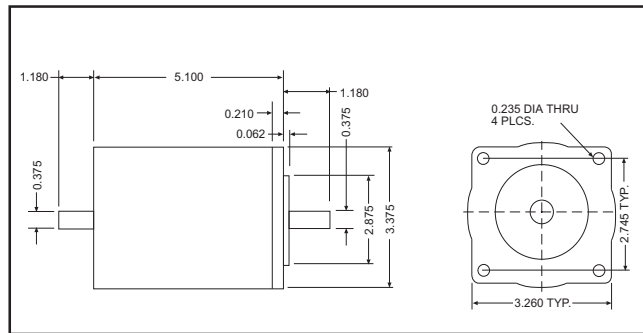
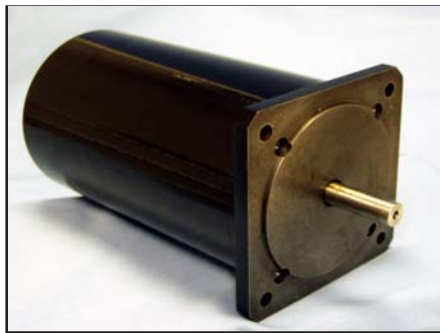
Stepper Motors



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Stepper Motors

34M470

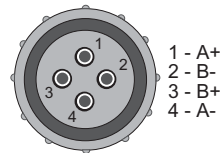


SPECIFICATIONS:

Holding Torque 470 oz-in
 Rotor Inertia 10.2 oz-in²
 Step Angle 1.8 deg.
 Weight 7.7 lbs

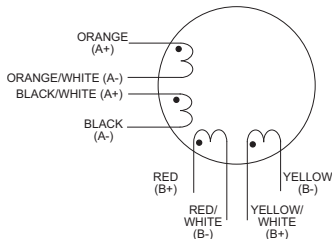
	Parallel	Series	Half Coil
Resistance	0.21 ohms	0.84 ohms	.42 ohms
Rated Current	8.4 amps	4.2 amps	5.9 amps
Rated Voltage	1.75 volts	3.5 volts	2.5 volts
Inductance	2.6 mH	10.4 mH	2.6 mH

MOTOR POWER CONNECTORS:

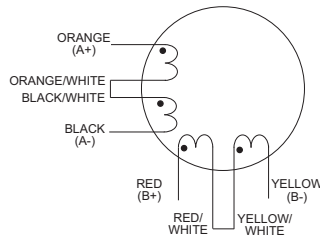


1 - A+
 2 - B-
 3 - B+
 4 - A-
 4 pin female circular
 connector-front view
 cable length-10'
 standard

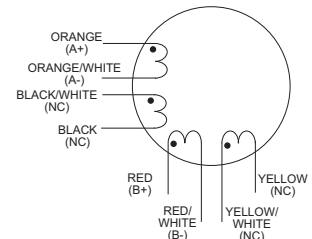
WIRING CONFIGURATIONS:



8 lead parallel (standard)



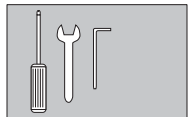
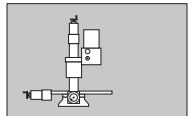
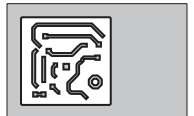
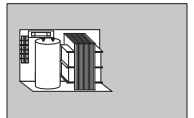
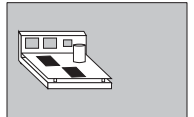
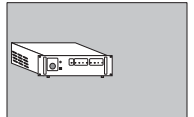
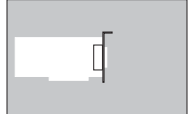
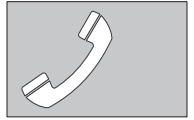
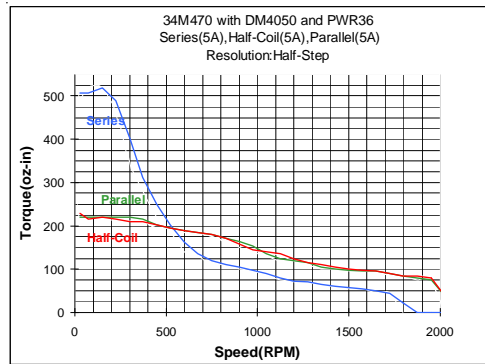
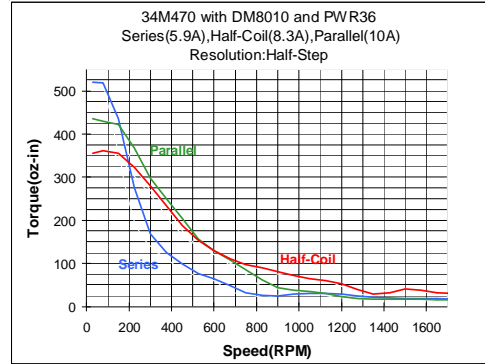
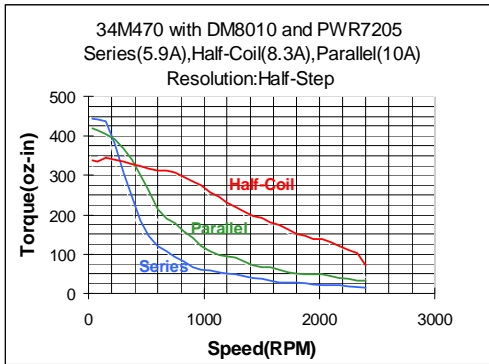
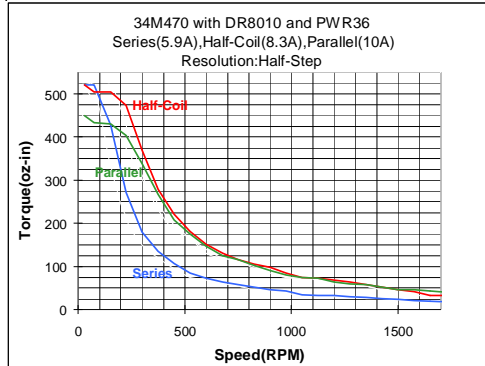
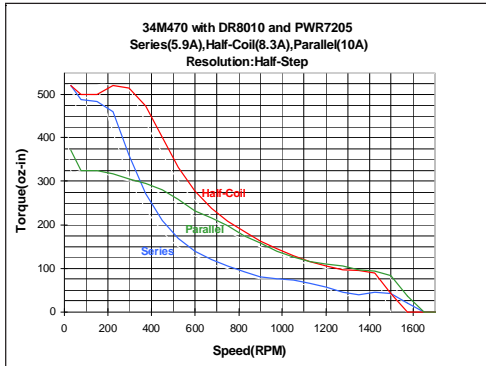
8 lead series



8 lead half coil

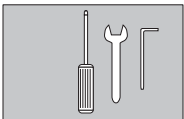
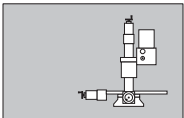
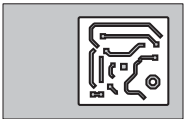
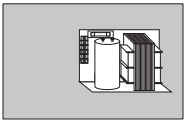
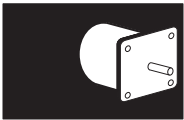
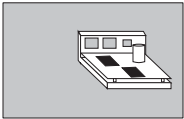
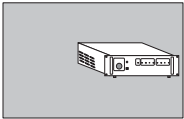
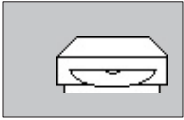
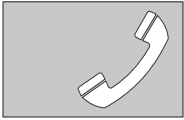
Product	Order #	Price
34M470-single shaft (flying leads)	305-3447-080	\$151
34M470-double shaft (flying leads)	305-3447-081	\$155
34M470-single shaft (circular conn)	305-3447-180	\$176
34M470-double shaft (circular conn)	305-3447-181	\$180

Stepper Motors

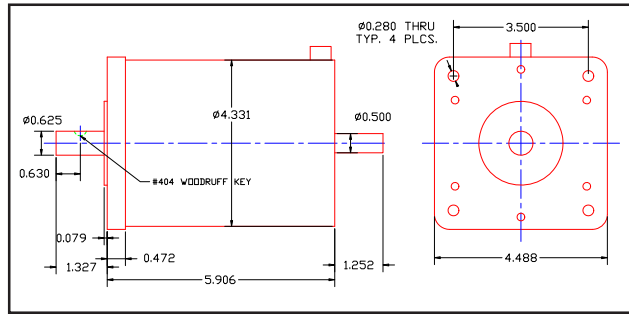


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Stepper Motors



42M1625

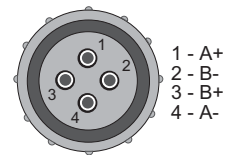


SPECIFICATIONS:

Holding Torque 1625 oz-in
 Rotor Inertia 88.6 oz-in²
 Step Angle 1.8 deg.
 Weight 14.5 lbs

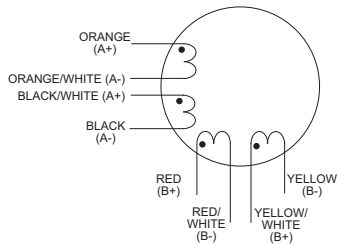
	Parallel	Series	Half Coil
Resistance	0.16 ohms	0.628 ohms	0.314 ohms
Rated Current	17.4 amps	6.15 amps	8.7 amps
Rated Voltage	1.93 volts	3.86 volts	2.73 volts
Inductance	1.3 mH	5.2 mH	1.3 mH

MOTOR POWER CONNECTORS:

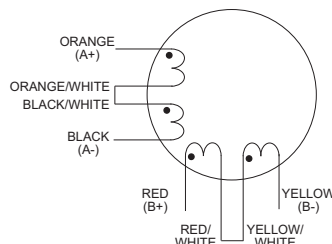


4 pin female circular connector-front view
 cable length-10' standard

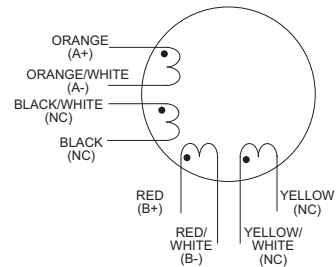
WIRING CONFIGURATIONS:



8 lead parallel (standard)



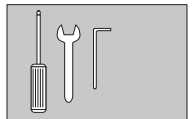
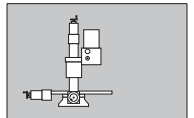
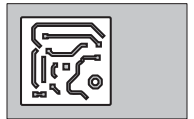
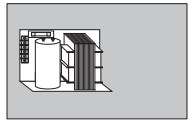
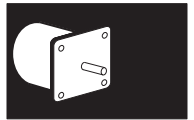
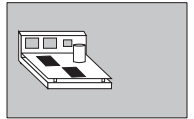
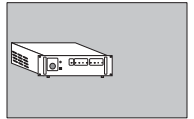
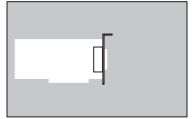
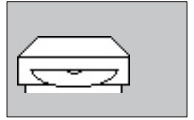
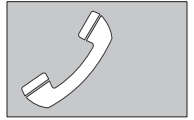
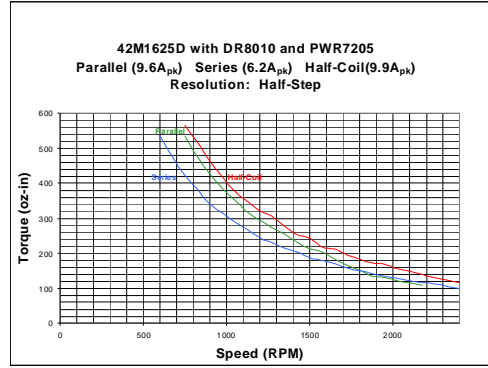
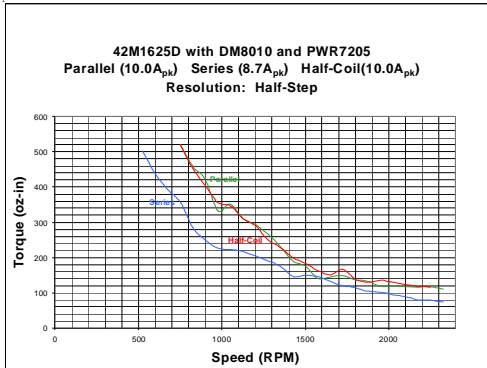
8 lead series



8 lead half coil

Product	Order #	Price
42M1625-double shaft (screw terminals)	305-4216-251	\$229
42M1625-double shaft (circular conn)	305-4216-252	\$249

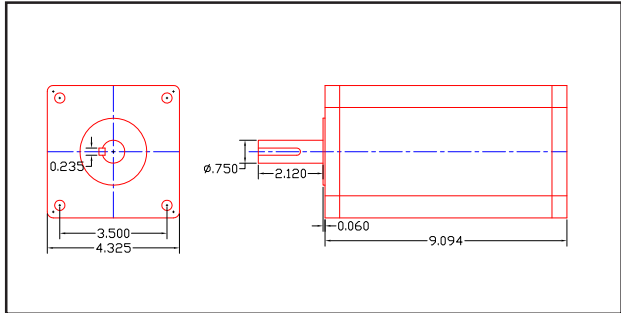
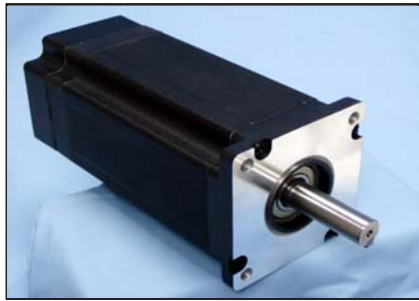
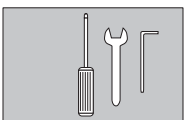
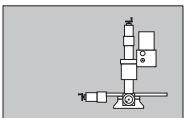
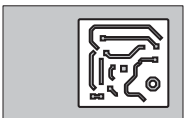
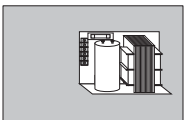
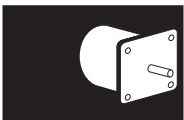
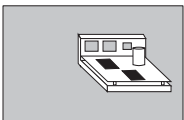
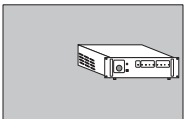
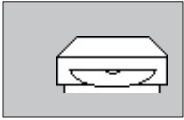
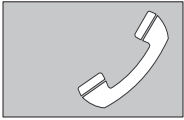
Stepper Motors



To order by phone call 1-800-674-8419, or fax 770-422-7854

Stepper Motors

42HT4000

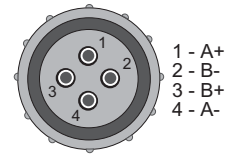


SPECIFICATIONS:

Holding Torque 4000 oz-in
 Rotor Inertia 88.6 oz-in²
 Step Angle 1.8 deg.
 Weight 25.0 lbs

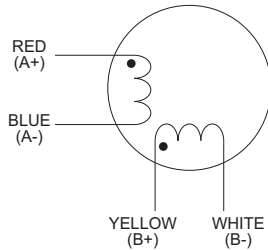
Resistance 0.67 ohms
 Rated Current 8.0 amps
 Rated Voltage 5.36 volts
 Inductance 11 mH

MOTOR POWER CONNECTORS:



1 - A+
 2 - B-
 3 - B+
 4 - A-
 4 pin female circular
 connector-front view
 cable length-10'
 standard

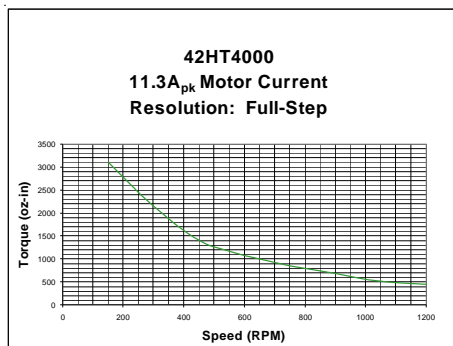
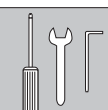
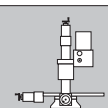
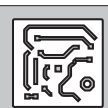
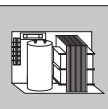
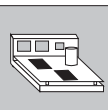
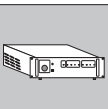
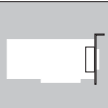
WIRING CONFIGURATIONS:



4 lead motor wiring diagram

Product	Order #	Price
42HT4000-double shaft (screw terminals)	305-4240-001	\$336
42HT4000-double shaft (circular conn)	305-4240-101	\$361

Stepper Motors

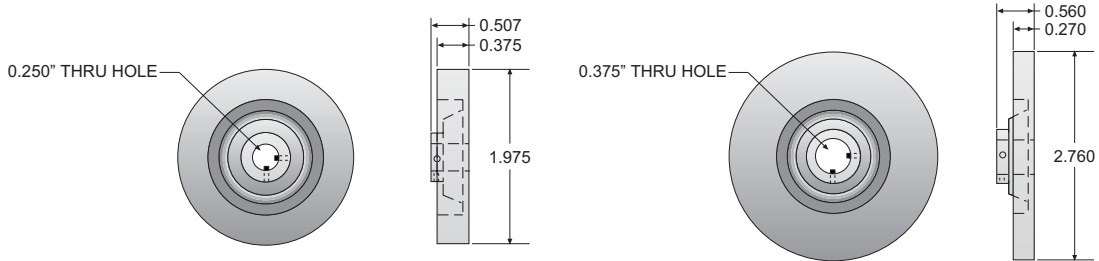


To order by phone call 1-800-674-8419, or fax 770-422-7854

Motor Accessories

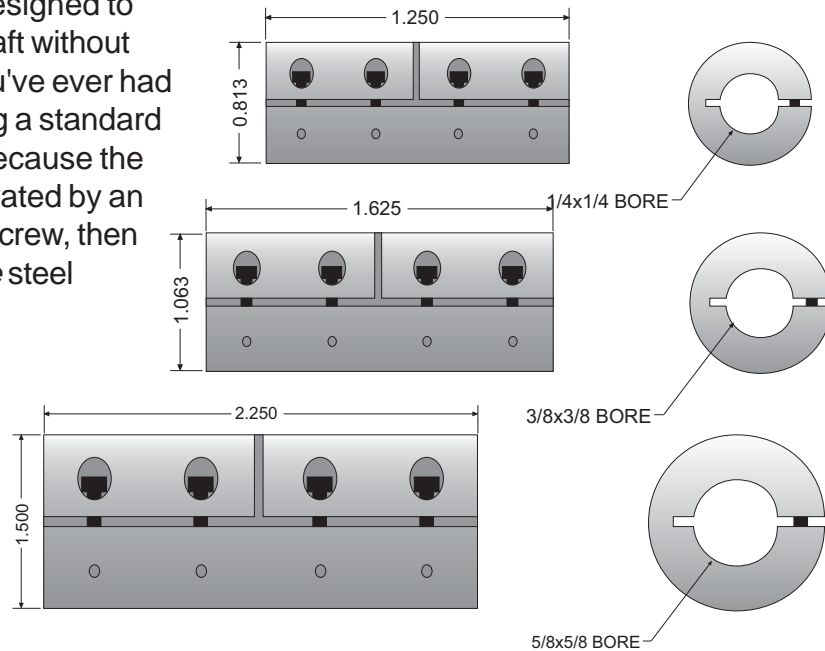
Dampers

These magnetic dampers are effective in smoothing the high-speed torque of a stepper motor, resulting in increased top speeds. Great for engraving and router applications where a double shafted size 23 or size 34 motor is used!



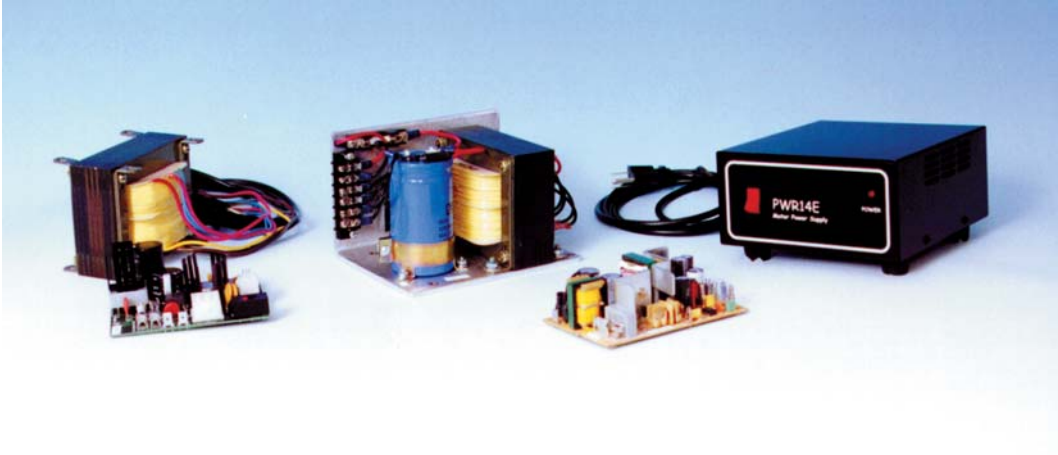
Couplings

These high torque single piece couplings are designed to clamp on the shaft without gouging it. If you've ever had trouble removing a standard solid coupling because the shaft was obliterated by an unforgiving set screw, then you'll want *these* steel couplings!



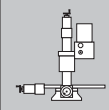
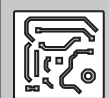
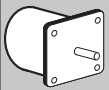
Product	Order #	Price
Damper for NEMA 23 motors	216-0000-023	\$65
Damper for NEMA 34 motors	216-0000-034	\$68
Coupling-1/4" shaft	216-0002-014	\$16.50
Coupling-3/8" shaft	216-0002-038	\$18
Coupling-5/8" shaft	216-0002-058	\$21

Power Supplies



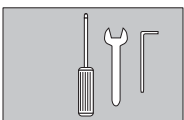
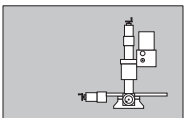
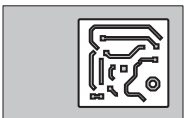
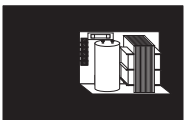
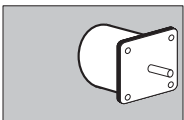
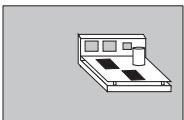
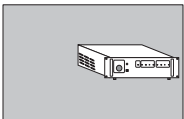
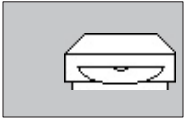
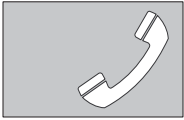
MicroKinetics power supplies are specifically designed to handle the high surge current requirements of stepper motor controls. Typically, it is better to use one small power supply per axis than a larger power supply that has the capacity for all motors. This eliminates electrical noise in one motor circuit from feeding back into other motors.

To select an appropriate power supply, check the voltage range limits of the driver and choose a power supply with a voltage that is within the voltage range of the driver and whose current output is at least 1/2 that of the motor current rating. A power supply with a voltage output that is near the maximum voltage rating of the driver will provide improved torque at high motor speeds. See the motor torque curves in the stepper motors section to see the effect this has on motor torque output.



To order by phone call 1-800-674-8419, or fax 770-422-7854

Power Supplies

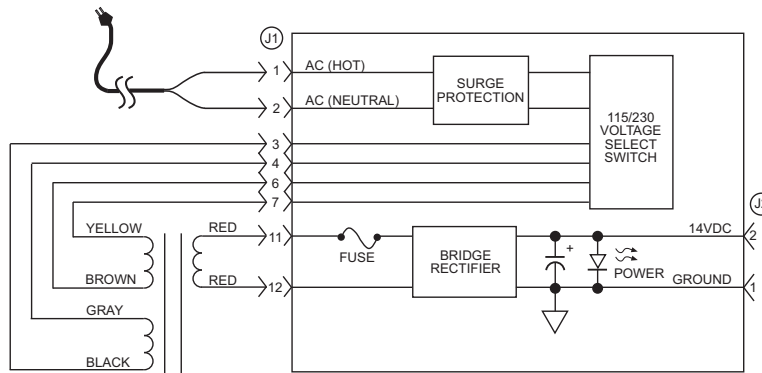


PWR14E 14VDC, 5A Power Supply

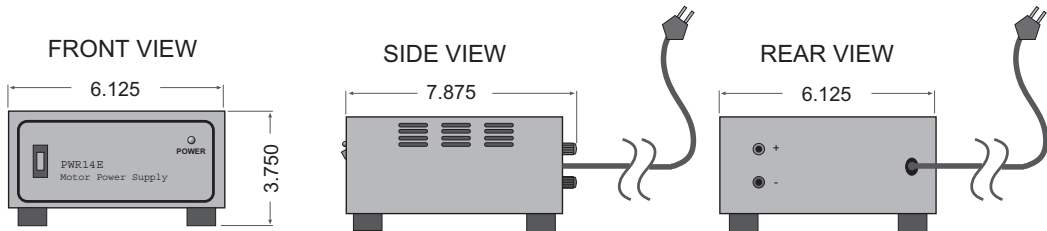
FEATURES

- AC input voltage (115/230 VAC)
- Fused output
- Transient protection

The Power14E may be used in any application that requires an unregulated 14-18 volt DC power source. Convenient banana jacks on the rear panel are color coded black and red for polarity.



BLOCK DIAGRAM



SPECIFICATIONS:

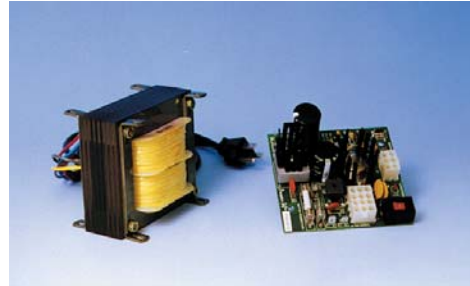
Voltage input	115/230 volts
Maximum Current Consumption	1 amp at 115 volts
Voltage outputs	14 volts unregulated at 3 Amps
Physical dimensions	6.125" w X 7.875" d X 3.75" h
Working temperature range	32°F ~ 122° F (0° C ~ 50° C)
Warranty	5 years parts and labor

Product	Order #	Price
PWR14E power supply	999-3600-014	\$79

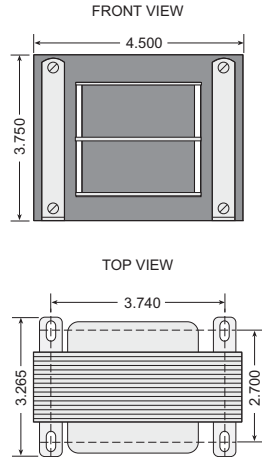
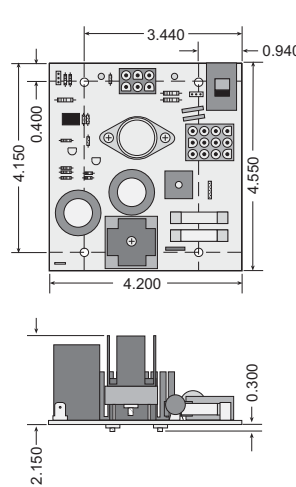
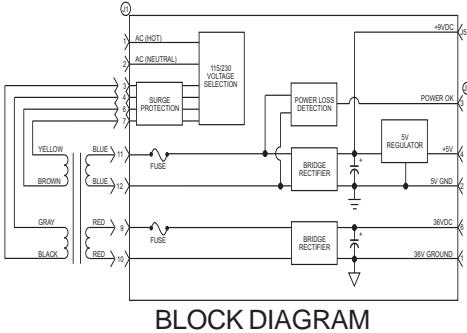
PWR36 36VDC, 10A Power Supply

FEATURES

- Single board provides both high-voltage motor power and +5V logic power
- Small footprint requires minimal mounting space
- User selectable AC input voltages
- Two LED's indicate status of output voltages
- Separately fused DC outputs for easy fault isolation
- Includes transformer, cables, and PCB mount hardware
- Power OK signal provides early warning of power interruption



The PWR36 is a complete power source for a multi-axis stepper motor driver. It is designed to provide ample power and excellent regulation. Built-in MOV transient suppression protects the electronics from damage caused by surges and spikes on the AC line.

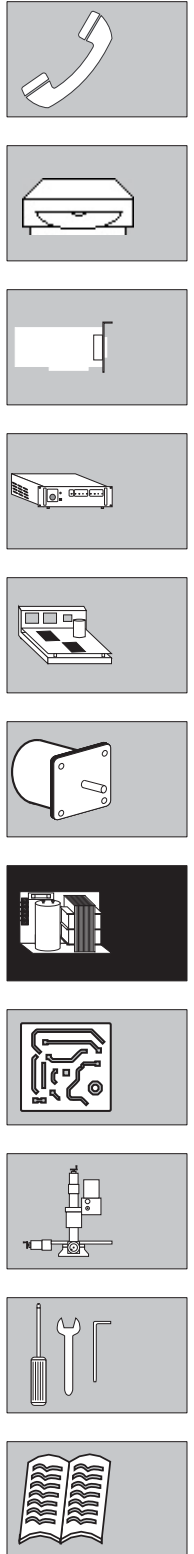


SPECIFICATIONS:

Voltage input	115 or 230 volts, selectable 2.5 amps max at 115 volts
Voltage outputs	36 volts unregulated at 10 Amps 5 volts regulated at 3 Amps
Physical dimensions	(power board) 4.2" w X 4.55" d X 2.45" h (transformer) 4.5" w X 3.265" d X 3.75" h
Working temperature range	32°F ~ 158° F (0° C ~ 70° C)
Warranty	5 years parts and labor

Product	Order #	Price
PWR36 power supply	998-0000-001	\$180

To order by phone call 1-800-674-8419, or fax 770-422-7854

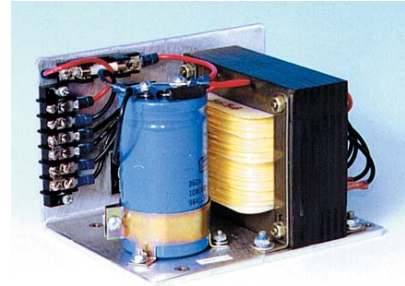


Power Supplies

PWR7205 72VDC, 5A Power Supply

FEATURES

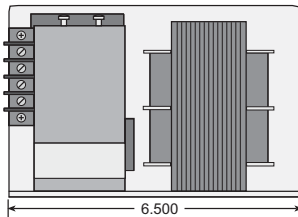
- AC input voltage jumper selectable between 115 VAC and 230 VAC
- Fused output
- Threaded mounting holes for easy installation
- Large filter capacitor for improved motor response



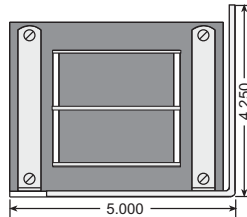
SPECIFICATIONS:

Voltage input	115 or 230 volts, selectable
Current consumption	3 amps at 115 volts/1.5 amps at 230 volts
Voltage outputs	72VDC unregulated
Current output	5 Amps
Physical dimensions	6.5" w X 5.0" d X 4.25" h
Working temperature range	32°F ~ 122° F (0° C ~ 50° C)
Warranty	5 years parts and labor

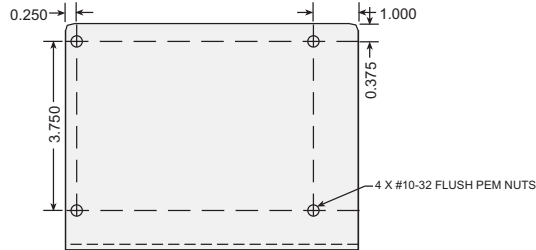
FRONT VIEW



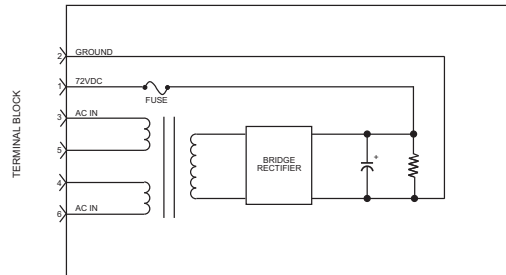
SIDE VIEW



BOTTOM VIEW



MECHANICAL OUTLINE



BLOCK DIAGRAM

WIRING CONNECTIONS

For 115 VAC input, place the jumpers across 3 & 4 ,and across 5 & 6.
For 230 VAC input, place one jumper across 4 & 5.

Product	Order #	Price
PWR7205 power supply	900-0000-008	\$192

PWR72

72VDC, 10A Power Supply

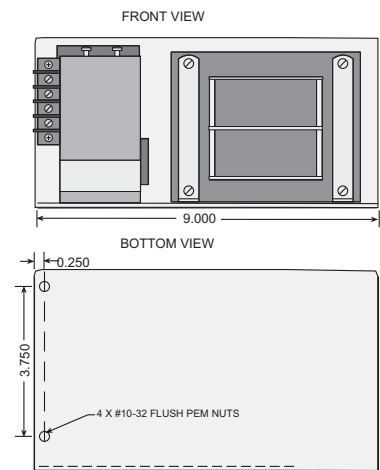
FEATURES

- AC input voltage jumper selectable between 115 VAC and 230 VAC
- Fused output
- Threaded mounting holes for easy installation
- Large filter capacitor for improved motor response

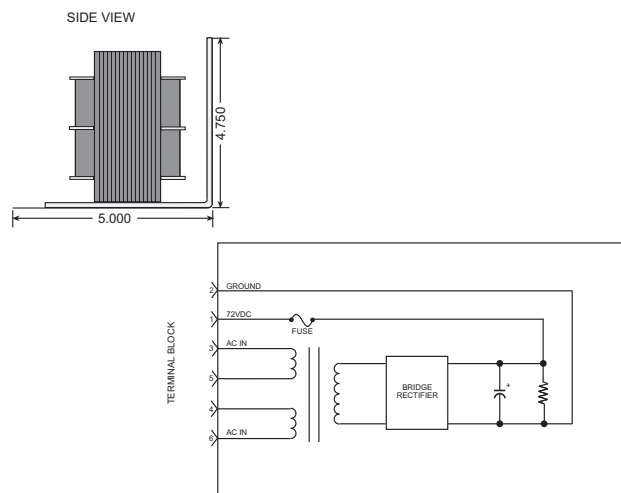


SPECIFICATIONS:

Voltage input	115 or 230 volts, selectable
Current consumption	6 amps at 115 volts/3 amps at 230 volts
Voltage outputs	72VDC unregulated
Current output	10 Amps
Physical dimensions	9.0" w X 5.0" d X 4.75" h
Working temperature range	32°F ~ 122° F (0° C ~ 50° C)
Warranty	5 years parts and labor



MECHANICAL OUTLINE



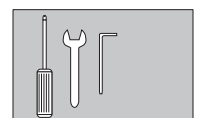
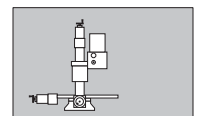
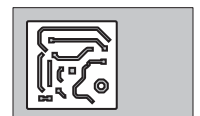
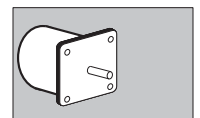
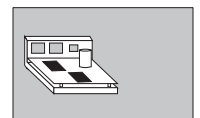
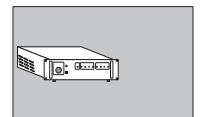
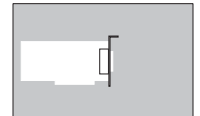
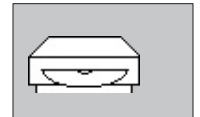
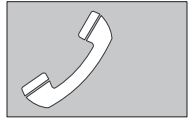
BLOCK DIAGRAM

WIRING CONNECTIONS

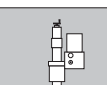
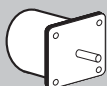
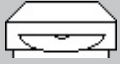
For 115 VAC input, place the jumpers across 3 & 4 ,and across 5 & 6.
For 230 VAC input, place one jumper across 4 & 5.

Product	Order #	Price
PWR72 power supply	900-0000-007	\$285

To order by phone call 1-800-674-8419, or fax 770-422-7854



Power Supplies



PWR5 5VDC, 3A Power Supply

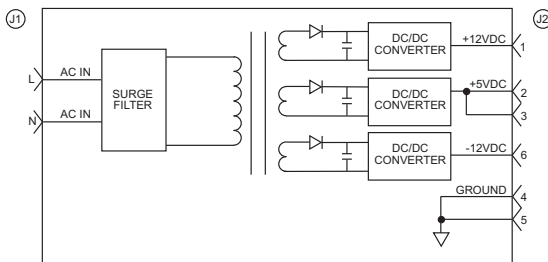
FEATURES

- Efficient switching design
- Compact
- 115/230V switchable
- Ideal for powering opto-isolation circuits on most drivers
- Can be used to provide +/-12VDC power to ServoStep

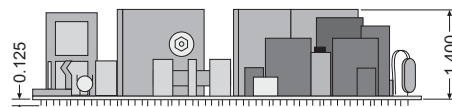
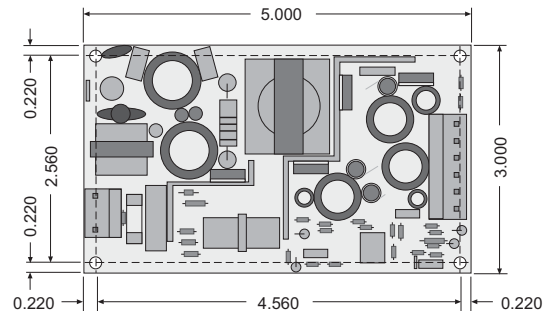


SPECIFICATIONS:

Voltage input	Jumper selectable input for 115VAC/230VAC 115 VAC @ 1A; 230VAC @ 0.5A
Voltage outputs	+5VDC @ 3A +12VDC @ 0.5A -12VDC @ 0.35A
Physical dimensions	5.0" w X 3.0" d X 1.525" h
Working temperature range	32°F ~ 158°F (0° C ~ 70° C)
Warranty	6 months parts and labor



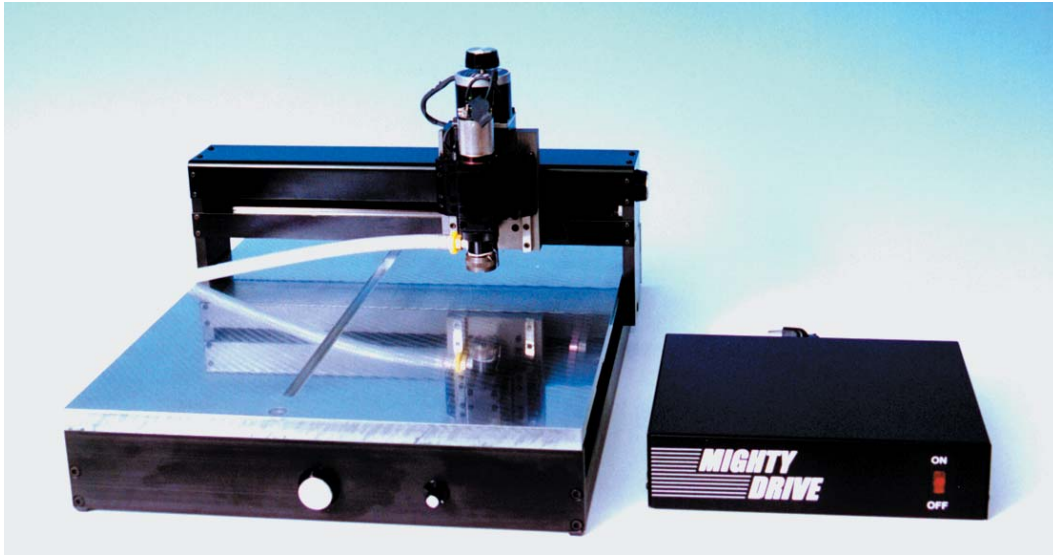
BLOCK DIAGRAM



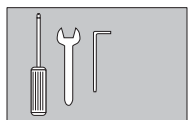
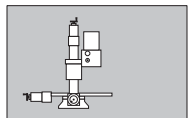
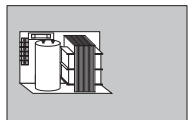
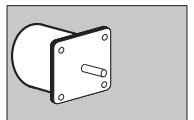
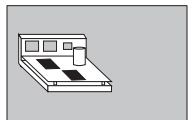
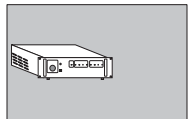
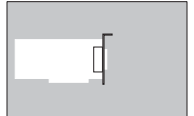
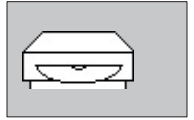
MECHANICAL OUTLINE

Product	Order #	Price
PWR5 power supply	999-0000-005	\$48

PCB Prototyping

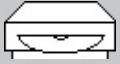


Through extensive research and development, MicroKinetics is able to manufacture and offer a very precise and easy to use circuit prototyping system. The SuperScribe Circuit Board Prototyping System eliminates set screw tool holding by using a collet system, has fully controllable Z axis and excellent alignability and stability. Additionally, we designed and integrated a dust transport vacuum system that is very effective! Now with easy to use Windows XP and Vista software, the SuperScribe circuit Prototyping System is truly the state of the art in mechanical etching technology of the future.



To order by phone call 1-800-674-8419, or fax 770-422-7854

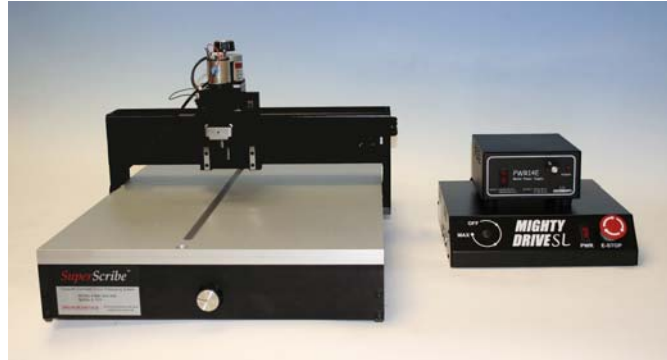
PCB Prototyping



Circuit Board Prototyping Systems

FEATURES

- Full Z axis control allows precisely controlled drilling and eliminates problem with broken bits as with solenoid systems
- Collet system eliminates tedious and inaccurate set screw tool holding
- Hand control knobs for easy, manual position adjustment
- Superb suction performance through expertly designed chip transport system
- Variable spindle speed control
- 115/230V power compatible



The SuperScribe™ model 1812 is a complete, desktop circuit board prototyping system capable of producing single and double sided boards using standard Gerber™, Excellon™, and HPGL™ data. The system's high resolution and repeatability allow quick, precise prototyping of high density and surface mount circuit boards. The SuperScribe system features a variable speed collet spindle which accepts widely available standard 1/8" diameter cutters and drills. The software controlled, stepper motor actuated Z-axis provides precision depth and feedrate control for hands-off multiple pass milling, routing, and engraving. Use of a 3/4" thick, high-precision base plate and dual, high accuracy ball bearing components makes the Model 1812 a superb performer in rigidity, precision, and accuracy.

SPECIFICATIONS

Board Work Area	Large: 18" x 12" Compact 8"x12"
Resolution	.00025"
Repeatability	.00025"
Minimum Trace Width	.004"
Minimum Engraving Width	.006"
Smallest Drill Hole Size	.013"
Largest Drill Hole Size	Unlimited
Max Material Width	12"
Max Material Length	Unlimited
Max Material Thickness	1.5"
Spindle Speed	0-25,000 RPM
Spindle Type	Bottom Loading 1/8" Collet
Tool Size	.125" Diameter 1.5" Length
Milling Speed	0.15 - 1.25" IPS
Actuation	Stepper Motors / .100 Lead Screws
Machine Dimensions	26"(L) 18"(W) 15"(H)
Construction	Machined Aluminum

MINIMUM REQUIREMENTS

- CPU: 1ghz or better
- RAM: 512 MB minimum
- HDD Space: 10MB

ACCESSORIES

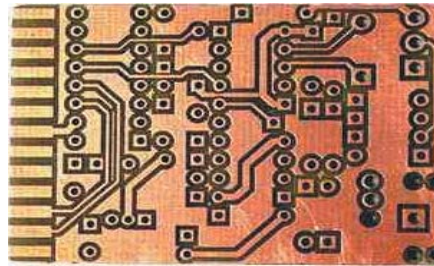
- Starter Package of Tools & Materials
- Sound Enclosure
- External Vacuum System
- Through-hole Plating System

****Accessories detailed on following pages**

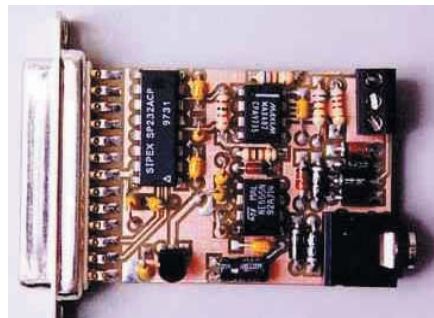
SOFTWARE

The SuperScribe circuit board prototyping system includes PCB design and prototyping software, which combines both schematic capture and circuit board layout in one powerful, easy-to-use package. It features transparent import/export filters to enable you to effortlessly read and write files from ORCAD™, TANGO™, PROTEL™, and AutoCAD™ as well as Gerber, HPGL, and DMPL™ files. Intelligent CAM functions automatically optimize and route isolation paths for milling around all pads and traces to quickly produce accurate, high quality prototype circuit boards. Also included is MillMaster Pro software which interprets machine control file. It is compatible with hundreds of programs including AutoCAD, CIRCAD, and InstaCAM™. The stepper motor actuated Z-axis features separate programmable up/down feed rates to assure maximum tool life and minimum production time. Other software features include semi-automatic tool change, interactive keyboard jogging, programmable origin/start position, and contour routing with true circular interpolation.

(accessories detailed on following page)



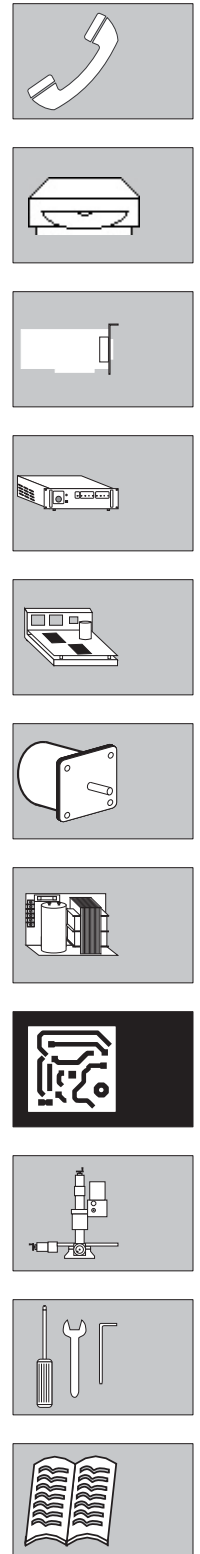
Mechanically etched double sided board (For the MN85 converter)



Same board populated with components (Actual working MN85 converter)



PCB house production unit



Product	Order #	Price
Large Prototyping System w/software	999-1812-100	\$9,995
Compact Prototyping System w/software	999-1812-102	\$7,995
Sound Enclosure	999-1812-150	\$695
External Vacuum System	999-1812-160	\$965
Standard Starter package	999-1812-500	\$385
Through Hole Plating System	999-1812-600	\$350

To order by phone call 1-800-674-8419, or fax 770-422-7854

PCB Prototyping

Accessories for the SuperScribe Circuit Board Prototyping System

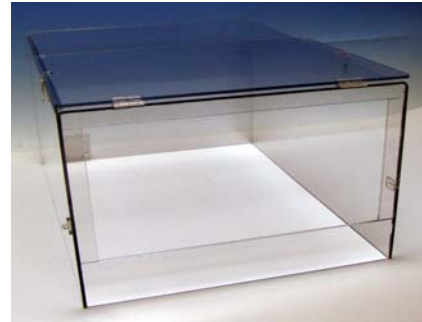
Prices and ordering info on previous page.

The sound enclosure allows for quieter, cleaner operation, making the system better suited for use in an office or laboratory environment. Designed exclusively for this system to optimize the noise containment! Overall size: 28" x 20.5" x 15.5"

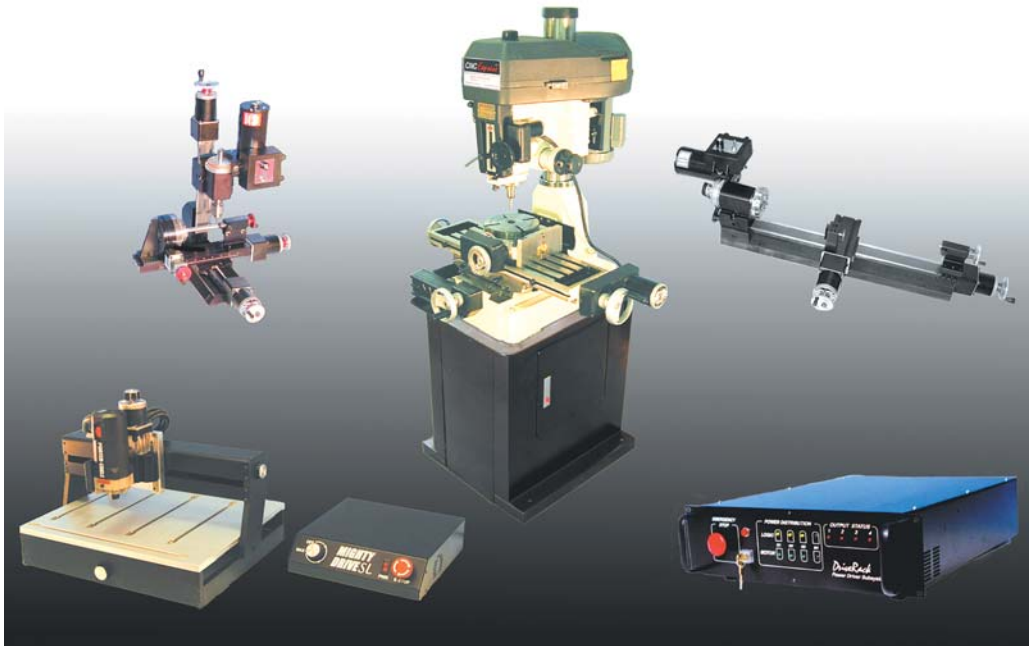
This vacuum's 4-stage filtration system features a 2 1/4-gallon capacity paper bag, extra-large cotton main filter, microfilter and HEPA (High Efficiency Particulate Air) exhaust filter. The GM 80 is capable of retaining 99.97% of all particles down to and including 0.3 microns in size. The combination of powerful suction, filtration capabilities and quiet performance makes this vacuum cleaner ideal for a laboratory setting. Sound Level: 59 dB(A)

The Starter Package is a set of engraving tools, router kits, PCB materials, and accessories that will enable you to get started on your first project immediately. In the future you can replenish your kit by ordering the specific disposable materials.

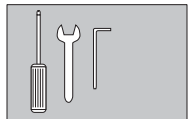
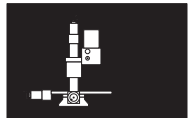
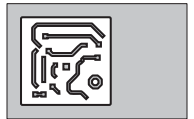
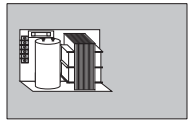
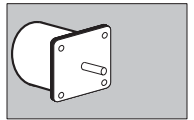
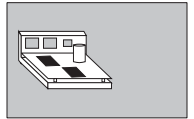
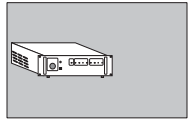
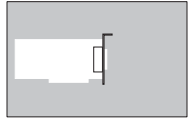
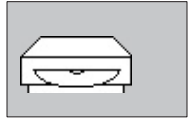
The Copperset Through Hole Plating System is the most convenient way to connect through hole pads from one side to the other in mechanically etched double sided circuit boards.



CNC Machining Centers

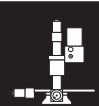
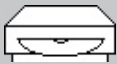


A highly productive CNC machine shop specializing in small parts can be created with modest space and budget requirements. A typical setup may include a CNC Desktop or Benchtop Mill, a CNC Desktop or Benchtop Lathe, a PC computer and assorted accessories! For larger parts and/or higher production speed, the CNC Express Milling Machine and the CNC Lathe 1236 /1340 offer more substantial machining capabilities, adding great value to your projects. The speed of CNC prototyping and the reduction in design cycle time are now within the reach of everyone from the hobbyist to the R&D department of your company!



To order by phone call 1-800-674-8419, or fax 770-422-7854

CNC Machining Centers



CNC Express Milling System

The CNC Express offers the latest advances in technology to provide the highest performing CNC conversion mill in it's class! Capitalizing on proven, solid, mid-size machines, the CNC Express has a good size working envelope (several sizes available), runs on 115 or 220 VAC single or 3 phase, has high speed machining performance, and accommodates coolant, and spindle control. The custom made anti-backlash ballscrews allow precision conventional and climb milling operations and accurate circular and contour cuts along any pair of axes without time consuming setups. Offering impressive machining power, repeatability, and convenience, the CNC Express Milling System is available as a prebuilt and factory certified system as well as a user installed conversion kit.

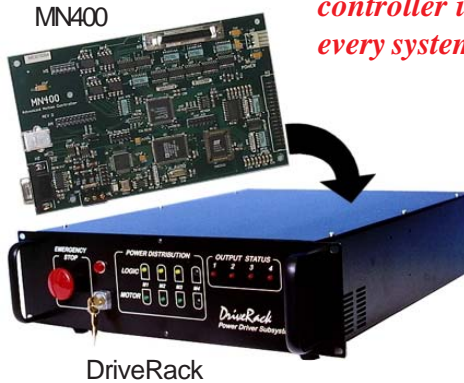
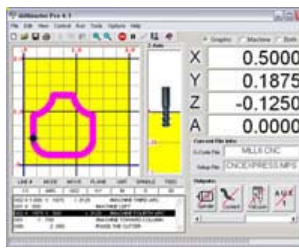


SPECIFICATIONS:

Parameter	CNC Express	CNC Express SQ	CNC Express XL
X-axis Travel	17.00" (432 mm)	20.00" (508 mm)	28.00" (711 mm)
Y-axis Travel	7.00" (178 mm)	8.00" (203 mm)	12.00" (305 mm)
Z-axis Travel	5.00" (127 mm)	5.00" (127 mm)	4.75" (121 mm)
Resolution	.00025" (.00635 mm)	.00025" (.00635 mm)	.00025" (.00635 mm)
Column Type	Round Column	Dovetail	Dovetail
Head Movement	Swivel 360 Degrees 15 7/8" (403 mm)	Tilt 90 Degrees Left / 90 Degrees Right	Tilt 90 Degrees Left / 90 Degrees Right
Spindle Taper	R-8	R-8	R-8
Spindle Speeds	12 speeds Belt Selectable 120-2500 RPM	6 Speeds Gear Selectable 95-1500 RPM	6 Speeds Gear Selectable 100-1600 RPM
Spindle Motor	2 HP 115 VAC	2 HP 115 VAC	2 HP 115 VAC
Table Size	8 1/4" x 28 1/2" (210 mm X 724 mm)	9 1/2" x 32 1/2" (241.3 mm X 825.5 mm)	9 3/8" x 39 1/2" (238 mm X 1003 mm)
Net weight	700 lbs. / 317 kg.	765 lbs. / 347 kg.	1000 lbs. / 454 kg.
Gross weight	810 lbs. / 367 kg.	875 lbs. / 398 kg.	1115 lbs. / 506 kg.

CNC EXPRESS UNIQUE ADVANTAGES:

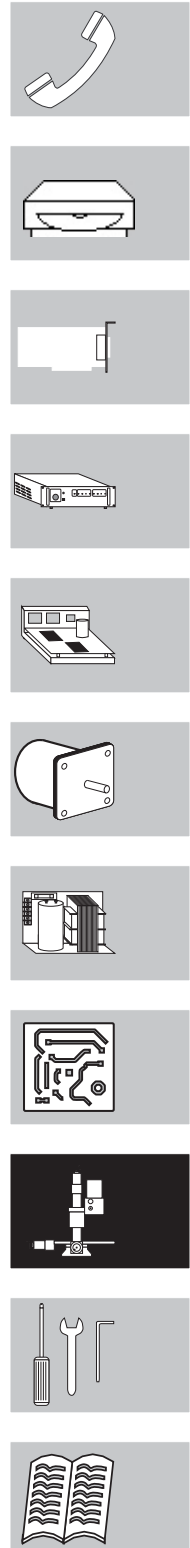
- **Limit switches in both directions on X and Y** for more convenient referencing and for end of travel without relying solely on mechanical dead stops. Mechanical dead stops provide redundancy which comes into play in the event a limit sensor is not recognized for any reason.
- **Lifetime timing belts** derated to never break or need replacement in this application but are important in achieving low vibration and smooth operation.
- High voltage drivers offer **impressive high speed performance (over 150 Inches per minute typical)**.
- We replace the thrust bearings with **high performance Timken (tapered roller) bearings**. Other inferior designs may use existing thrust bearings which limit the speed and the long term reliability of the machine.
- Custom made 470 oz-in (unipolar rating) motors deliver 41% more torque in bipolar drive method used here plus a 2 to 1 pulley ratio produces **1,329 oz-in of direct coupled equivalent torque at the shaft**. Ultimately the torque available at the cutting speed is what really counts, not the holding torque. This design maximizes overall performance with a properly engineered system of mechanics and electronics resulting in very impressive performance at both cutting and rapid positioning speeds.
- **Stand and other accessories are included with the system at no extra charge.**
- **Our own custom designed software with built in graphic test mode and geometry functions.**
- More G-codes and M-codes supported, and **Windows 98/XP/2000/Vista support.**



*Now
Windows®
Vista
Compatible
and includes
our advanced
USB motion
controller in
every system!*

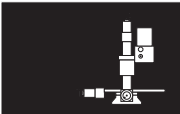
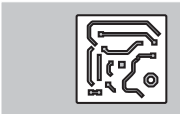
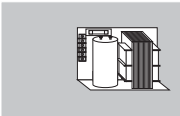
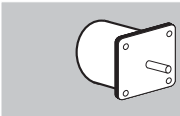
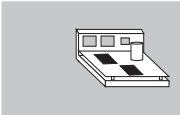
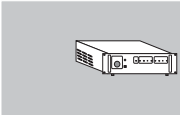
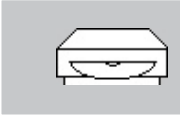


Product	Order #	Price
CNC Express Mill Package	999-6500-000	\$5,995
CNC Express Mill SQ Package	999-6510-000	\$7,495
CNC Express Mill XL Package	999-6520-000	\$8,495
GTS Option Group	999-6500-200	\$3,500
<i>(can be added to any of above 3 models)</i>		
CNC Express Conversion Kit only	999-1000-200	\$4,395



To order by phone call 1-800-674-8419, or fax 770-422-7854

CNC Machining Centers



SYSTEM INCLUDES:

- Milling base system with USA 2 HP motor
- 5TPI (.200") ballscrews at .003" per foot max linear error
- Stepper motors (2) 34M470 and (1) 23HT350 160 oz-in
- DriveRack high performance power driver
- MN400 motion controller
- MillMaster Pro for Windows G-code control & graphical software
- Limit switches, cables, and technical manuals
- Included accessories: Cabinet stand with chip pan, shelf and latched door plus the following pictured accessories:



Optional Accessories for the CNC Express Milling System

accessories continued on next page

Flood Coolant System

Designed to reduce heat around the cutting tool and help achieve a smoother finish on your machined parts, this system works with water soluble and light cutting oil. It comes complete with a tank w/baffle, pump, 6' plastic hose, flexible nozzle and valve, and a screen strainer. The pump is submersible and comes with a 6' 3-conductor cord with a three-prong plug. 220V pump available upon request.



Safety Shield / Splash Guard



Covering the front and both sides of the table, this shield provides an added safety measure and retains chips and fluid, keeping the work area clean. The front forward slant design offers improved functionality. No drilling or tapping is needed- the guard mounts easily with two thumbscrews (provided).

Variable Frequency Drive

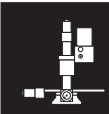
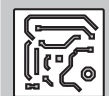
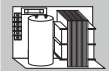
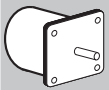
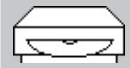
The VFD displays the spindle's speed in RPM on a bright LED panel next to the spindle's height indicator. The speed may be controlled by computer (via an S code) or manually via a dial on the VFD's control panel. The VFD is powered with single phase 208-240 or 3 phase power, eliminates the need for a phase converter, and is available for 1, 2, or 3 HP motors. For other applications, larger horsepower versions are available.



Optional Accessories for the CNC Express Milling System (continued)

8" Precision Rotary Table

This is a high precision, stepper motor driven rotary table. The rotary "A" axis is supported by MillMaster Pro and is commanded in degrees. The standard resolution using half stepping results in 200 discrete positions per degree (or 0.005 degrees/step). The stepper motor is an 8 lead 34HT390 rated at 6.6 amps per phase. Features: 90:1 Gear Ratio; 0.005° Resolution, Horizontal and Vertical Mounting, #3 Morse Taper Center Hole and 1/2" T-Slots-extra deep coolant channels. Tailstock available.



6 PC R8 Milling Collet Set



- Made of high grade steel and Precision ground to close tolerance
- Hardened
- Internally threaded: 7/16"-20
- Included sizes: 1/8" - 3/4" by 8ths

6 PC HSS End Mills Set



- High Speed Steel
- 3/8" shank
- Includes six 2-flute end mills: 1/8", 3/16", 1/4", 5/16", 3/8", 1/2"
- Comes with wooden stand for better organization

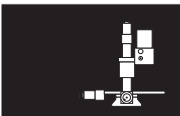
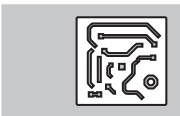
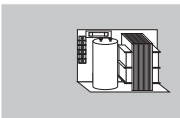
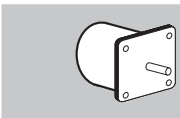
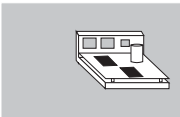
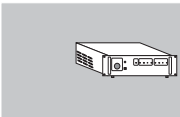
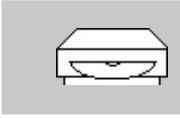
20 PC Titanium End Mills Set



- Titanium Coated for longer life
- High Speed Steel
- Center Cutting, Single End
- Complete with wooden storage case
- 10 pieces 2-flute: 3/16" - 3/4" by 16ths
- 10 pieces 4-flute: 3/16" - 3/4" by 16ths

Product	Order#	Price
CNC Express Safety Shield	999-6500-020	\$195
CNC Express Flood Coolant	999-6500-010	\$279
Variable Frequency Drive	999-6400-040	\$650
6" Precision Rotary Table	900-0095-006	\$945
8" Precision Rotary Table	900-0095-008	\$995
6 PC R8 Milling Collet Set	999-6500-070	\$44
6 PC HSS End Mills Set	999-6500-050	\$22
20 PC Titanium End Mills Set	999-6500-060	\$110

To order by phone call 1-800-674-8419, or fax 770-422-7854



Optional Accessories for the CNC Express Milling System (continued)

R8 Quick Change Tool System

The R8 collet allows you to swap out different end mills and drills with a quick one handed operation and reduces clearance needed between the tool and workpiece when changing tools. It is as simple to install as an R8 end mill holder. An M06 tool change command in your program will allow you switch tools in just a few seconds and continue machining with automatic tool length compensation. Tool holders are available in many bore sizes to accommodate your existing tools (3/8" tool holders are the most popular). A J6 chuck holder is available to match your CNC Express drill chuck.



Order #				Price	
R8 Quick Change Tool Body				900-0096-000	\$498
Endmill Tool Holder					
Bore Size:	D	L			
1/8"	1/2"	1 3/8"	900-0096-001	\$154	
3/16"	11/16"	1 3/8"	900-0096-002	\$154	
1/4"	11/16"	1 3/8"	900-0096-003	\$154	
3/8"	1 3/16"	1 3/8"	900-0096-004	\$154	
1/2"	1 3/8"	1 3/8"	900-0096-005	\$154	
5/8"	1 9/16"	1 5/8"	900-0096-006	\$154	
3/4"	1 13/16"	2 3/16"	900-0096-007	\$164	
Jacobs Taper		L			
J6		13/32"	900-0096-010	\$143	
J2		13/32"	900-0096-011	\$143	
J33		13/32"	900-0096-012	\$143	
Tapping System Tension/Compression			999-6500-080	\$1,495	
Quickchange Tooling System			999-6500-090	\$1,310	
<i>with 6 Tool Holders*</i>					

CNC Lathe 1236

The CNC Lathe 1236 is a well engineered, professionally built, PC based CNC retrofit lathe. Now available with Windows-based control software, this metal turning system is truly one of the finest examples of applying the latest PC technology to reduce cost and increase performance. Utilizing a proven mid-size cast iron bed machine, the 1236 offers stability, has a good machining envelope, runs on 220 to 240 VAC, has high-speed machining performance, and accommodates program control of coolant, feedrate override, and many more functions through the PC based open architecture. Careful selection and conditioning of base machines as well as application of the latest technology in motion control electronics and software allow for new levels of quality and performance to be achieved.



SPECIFICATIONS:

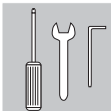
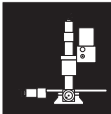
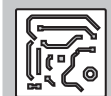
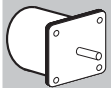
Table Work Surface Area	12" x 36"
Swing Over Bed	12"
Swing Over Gap	17"
Length of Gap	9"
Swing Over Cross-Slide	7 1/2"
Swing Over Compound	3"
Distance Between Centers	36"
Carriage Travel	30"
Cross-Slide Travel	5 1/2"
Compound Travel	2 5/8"
Tailstock Spindle Travel	3 5/8"
Tailstock Taper	3 MT
Spindle Nose Mounting	D1-4
Spindle Bore Diameter	1 1/2"
Spindle Taper	5 MT
Spindle Taper with Sleeve	3 MT
Spindle Speeds	9 Speeds (70-1400 RPM)
Motor & Electrics	2 HP, 220V, single phase
Machine Dimensions (without stand)	22"H x 26"W x 60"L
Floor Space Required-Max	30"W x 70" L

SYSTEM INCLUDES:

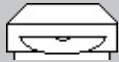
- 12" x 36" Geared Head Gap Bed Bench Lathe
- Easy change 9 Speeds (70 to 1400 RPM)
- Powerful 2 HP motor, 1 phase, 220 Volt D1-4 spindle
- Hardened and ground bed with reinforced cross ribs
- Headstock with tapered roller bearings
- Electromagnetic starter switch
- 1 1/2" spindle bore diameter
- Splash lubrication in headstock
- Stepper motors (1) 470 oz-in (1) 1625 oz-in
- DriveRack high performance power driver
- Motionet MN400 motion controller
- TurnMaster Pro G-code control & graphical software
- Limit switches, cables, and technical manuals
- Included accessories: Chip pan, 6" 3-jaw chuck, 7" 4-jaw chuck, 10" faceplate steady rest, follow rest, 3 MT dead center, 1 1/16" capacity 4-way toolpost and 52 piece toolbox

Product	Order #	Price
CNC Lathe 1236-No Threading	999-1236-000	\$7,495
CNC Lathe 1236-With Threading	999-1236-001	\$7,995

To order by phone call 1-800-674-8419, or fax 770-422-7854



CNC Machining Centers



The new CNC Lathe 1340 is perfectly suited for applications where the larger capacity of 13 inch swing by 40 inch between centers are valuable features. It is a robust, heavy duty machine with a 2 horsepower spindle motor. The 1340 lathe utilizes the latest technology in electronics and Windows based software to make this an easy to install and operate machine. Available factory training and a generous warranty make this machine a superb value.

SPECIFICATIONS:

Table Work Surface Area	13" x 40"
Swing Over Bed	13"
Swing Over Gap	18 3/4"
Length of Gap	7 7/8"
Swing Over Cross-Slide	8"
Distance Between Centers	40"
Carriage Travel	35 1/4"
Cross-Slide Travel	6 7/8"
Tailstock Spindle Travel	3 3/4"
Tailstock Taper	3 MT
Spindle Nose Mounting	D1-4
Spindle Bore Diameter	1 3/8"
Spindle Taper	5 MT
Spindle Taper with Sleeve	3 MT
Spindle Speeds	8 Speeds (70-2000 RPM)
Motor & Electrics	2 HP, 220V, single phase
Machine Dimensions w/o Stand	73 1/4" x 30" x 33"
Floor Space Required-Max	30"W x 74" L

CNC Lathe 1340



SYSTEM INCLUDES:

- 13" x 40" Geared Head Gap Bed Bench Lathe
- Easy change 8 Speeds (70 to 2000 RPM)
- Powerful 2 HP motor, 1 phase, 220 Volt D1-4 spindle
- Hardened and ground bed with reinforced cross ribs
- Headstock with tapered roller bearings
- Electromagnetic starter switch
- 1 1/2" spindle bore diameter
- Splash lubrication in headstock
- Stepper motors (1) 470 oz-in (1) 1625 oz-in
- DriveRack high performance power driver
- Motionet MN400 motion controller
- TurnMaster Pro G-code control & graphical software
- Limit switches, cables, and technical manuals
- Included accessories: Chip pan, 6" 3-jaw chuck, 7" 4-jaw chuck, 10" faceplate steady rest, follow rest, 3 MT dead center, 1 1/16" capacity 4-way toolpost and 52 piece toolbox

Product	Order #	Price
CNC Lathe 1340-No Threading	999-1340-000	\$8,995
CNC Lathe 1340-With Threading	999-1340-001	\$9,495

CNC Lathe 1236/1340 Accessories

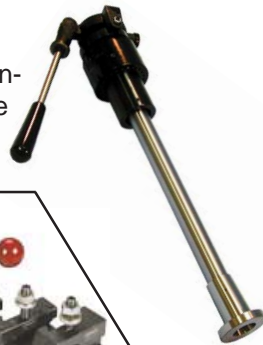


Variable Frequency Drive

The VFD displays the spindle's speed in RPM on a bright LED panel. The speed may be controlled by computer (via an S code) or manually via a dial on the VFD's control panel. The VFD is powered with single phase 208-240 or 3 phase power, eliminates the need for a phase converter, and is available for 1, 2, or 3 HP motors. For other applications, larger horsepower versions are available.

Collet Closer

Allows the use of collets instead of the chuck for close tolerances and quick holding of stock material.



Quick Change Tool Holder 6- Piece set

Series: AXA
Lathe Swing: Up to 12"
Contains one tool post and one of each style holder: Style 1, Style 2, Style 4, Style 7 and Style 10



Safety Guard

This Lexan guard provides added safety for the operator. Measures 6" x 6" x 12" and accommodates chucks up to 8".



Tooling Accessory Package

Includes tool post set (as shown to the left), 5 piece 3/8" turning tool set, carbide inserts and cutoff blades.

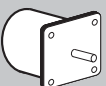
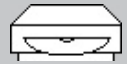
Flood Coolant

Designed to reduce heat around the cutting tool and help achieve a smoother finish on your machined parts, this system works with water soluble and light cutting oil. It comes complete with a tank w/baffle, pump, 6' plastic hose, flexible nozzle and valve, and a screen strainer. The pump is submersible and comes with a 6' 3-conductor cord with a three-prong plug. 220V pump available upon request.



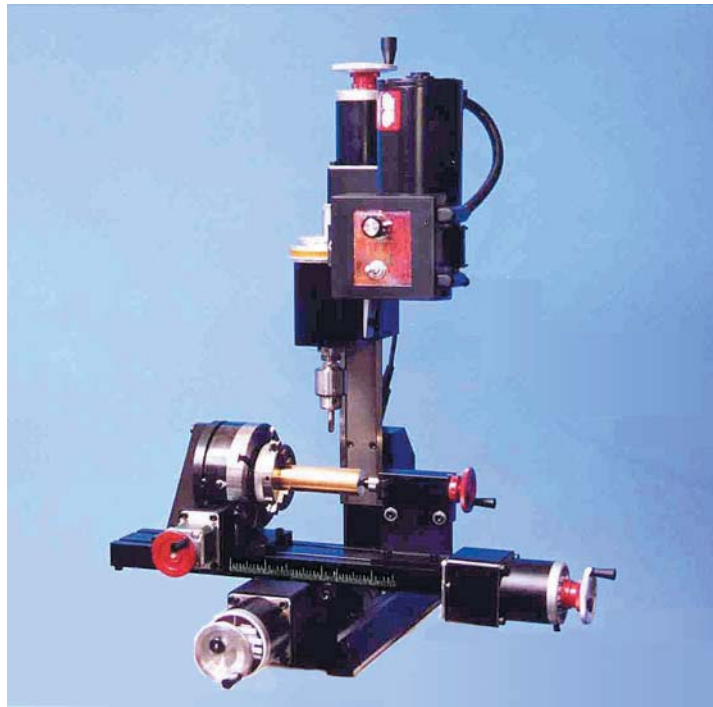
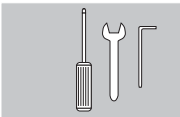
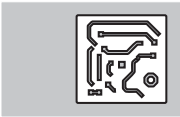
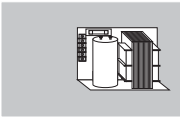
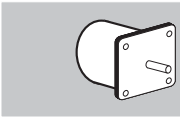
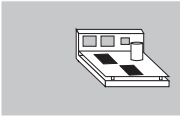
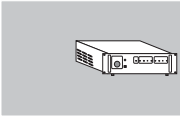
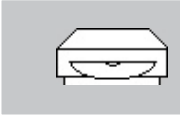
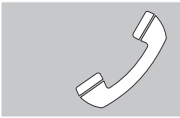
Product	Order #	Price
1236/1340 Lathe VFD option	999-1236-050	\$1,595
1236/1340 Lathe Collet Closer	999-1236-010	\$830
1236/1340 Lathe QC Tool post set	999-1236-020	\$150
1236/1340 Lathe Tooling Accessory Pkg	999-1236-200	\$395
Flood Coolant System	999-6500-010	\$279
Lathe Safety Guard	999-6500-030	\$225

To order by phone call 1-800-674-8419, or fax 770-422-7854



CNC Machining Centers

4 Axis CNC Machining Center



This 4-axis CNC system comes complete with everything you need for 4 axis operation - all you provide is a 386 or better PC and you're ready to make jewelry, rings and custom gears under CNC control without special attachments. The most commonly used accessories are included with the package for the convenience and added savings. A full assortment of additional low cost tools and accessories is available.

SYSTEM INCLUDES:

- Deluxe mill w/ resettable handwheels
- CNC rotary table with 3 jaw chuck
- Stepper motors (3) 175 oz-in
- Mighty Drive high performance power driver
- Motionet MN400E USB motion controller
- MillMaster Pro G-code control & graphical software
- Limit switches, cables, and technical manuals
- Included accessories: mill headstock riser, drill chuck & drawbar, milling vise, 4-Jaw hold down set, hold down set, 3/8" end mill holder w/spindle bar, rotary table right angle attachment, mill mount adjustable tailstock.

<i>Product</i>	<i>Order #</i>	<i>Price</i>
<i>4 axis CNC Machining Center w/MN400E</i>	<i>999-6400-204</i>	<i>\$3,975</i>
<i>4 axis CNC Desktop Center w/MN400E</i>	<i>999-6300-104</i>	<i>\$4,975</i>

Benchtop & Desktop CNC Mills

The CNC Benchtop Mill and Desktop Mill are fully assembled milling machines and may be used with the MN400 Controller and the MillMaster Pro G-code interpreter software. Precision ground bedways and powerful 175 oz-in motors on all three axes provide unmatched quality and performance. Both models available with standard or extended Y-axis. Made in USA.



Benchtop Mill

Accessories included with all CNC Mills: Milling vise, 3/8" end mill holder w/spindle bar, 4 jaw hold down set, standard hold down set, and a 1/4" drill chuck & drawbar. (Extended mill also includes headstock spacer).

Packages include:

- CNC Mill
- MN400E Motion Controller
- Limit Switch Kit
- MillMaster Pro software
- Mighty Drive PWR unit
- all necessary cables



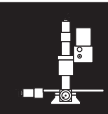
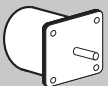
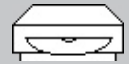
Desktop Mill

SPECIFICATIONS:

X-axis Travel	9.00"
Y-axis Travel	3.00" or 5.00"
Z-axis Travel	6.50"
Resolution	.0001"
Backlash	.003" max.
Hole thru Spindle	0.405"
Spindle Nose Thread	3/4"-16 TPI
Spindle Taper	#1 Morse
Spindle Speed Range	75-2800 RPM
Spindle Motor	1/2 HP
Table Size	2.75" X 13"

Product	Order #	Price
MILL-MN-BT (Standard Version)	999-6110-008	\$3,274
MILL-MN-BTX (Extended Version)	999-6110-108	\$3,442
Desktop Mill MN Pkg (Standard Version)	999-6300-006	\$3,583
Desktop Mill MN Pkg (Extended Version)	999-6300-106	\$3,765

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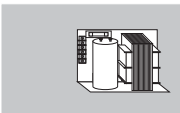
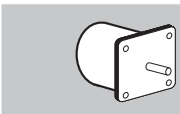
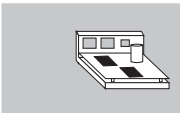
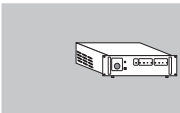
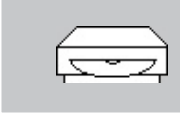
CNC Machining Centers



ACCESSORIES:

4" CNC Rotary Table

This high precision, stepper motor driven rotary table can be used with a mill and MillMaster Pro software, allowing a machinist to produce complex parts with precision. The rotary "A" axis is supported by MillMaster Pro and is commanded in degrees. The standard resolution using half stepping results in 80 discrete positions per degree (or 0.0125 deg per step). The stepper motor is a 23HT175 which is rated at 1.4 amps per phase. Fastens to mill bed using standard hold down set (included). There are two accessories available for working between centers. One is the Rotary Table Right Angle Attachment, part# 870-3701-000, and the other is the Adjustable Right Angle Tailstock part# 870-3702-000. These are described on page 105.



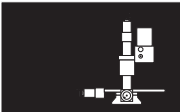
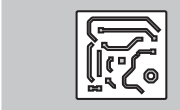
Mill Limit Switch Kit

This kit is designed to be used with the Sherline mill. The kit comes with 3 switches, mounting brackets for the X & Z axes, all installation hardware and is fully wired with a DB15 connector that plugs directly into the Mighty Drive power unit. Installation instructions are provided. Some drilling and tapping may be required on machines purchased elsewhere.

2-way Data Switch Box

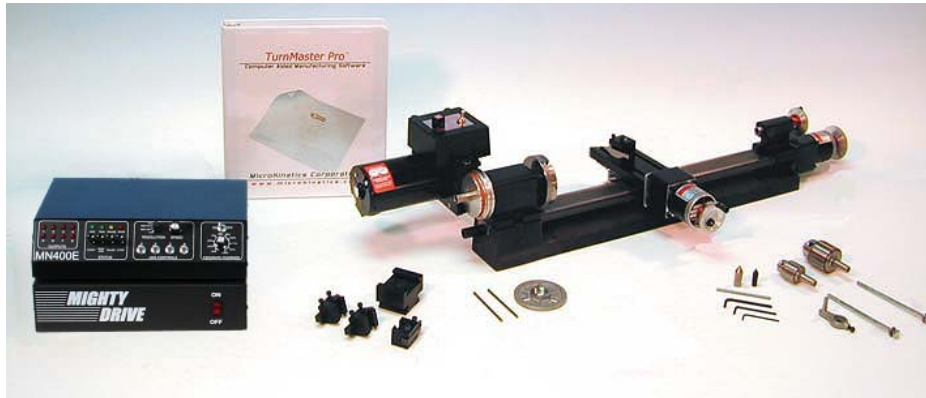
By using this switch box, you can run your lathe & mill** (or any 2 other CNC Systems) from the same computer. Save money by only providing one computer, as well as saving the time & hassle of swapping out your computer connections each time you change machines.

***Systems can not be run simultaneously.*



Product	Order #	Price
4" CNC Rotary Table	900-0095-005	\$395
Mill Limit Switch Kit	900-0090-013	\$120
2-way Data Switch Box	900-0000-000	\$50

High Capacity CNC Lathe



This advanced lathe package includes every option we offer. The 24" bed lathe with a 4.75" swing over bed allows larger parts to be made. The easy precise positioning of the quick change tooling and the versatility of electronic threading make this system the ultimate in flexibility, repeatability and convenience. Tool changes are accomplished with simple M6 Tx commands and the electronic threading is performed using the standard G33 command, specifying the length, pitch and number of passes. Also you can specify the X distance if you're making a tapered thread. This is the most versatile system we offer and is the only one that offers this level of performance in its price range. Includes MN400E USB motion controller.

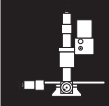
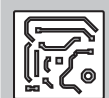
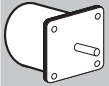
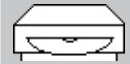


SPECIFICATIONS:

Swing Over Bed	4.75"
Swing Over carriage	3.00"
Distance Between Centers	17.00"
Cross Slide Travel	4.25"
Tail Stock Spindle Travel	1.50"
Resolution	.0001"
Backlash	.003" max
Hole thru Spindle	0.405"
Spindle Nose Thread	3/4"-16 TPI
Tail Stock Spindle Taper	#0 and #1 Morse
Spindle Speed Range	75-2800 RPM
Spindle Nose Taper	#1 Morse
Spindle Motor	1/2 HP DC

SYSTEM INCLUDES:

- Model 4400 deluxe lathe w/ resettable handwheels
- CNC Controlled Electronic Threading
- Stepper motors (2) 175 oz-in
- Mighty Drive high performance power driver
- Motion controller- Motionnet MN400E
- TurnMaster Pro G-code control & graphical software
- Limit switches, cables, and manuals
- Included accessories: spacer block kit, tailstock riser block, drill chuck & drawbar, 4-jaw hold down set, rocker tool post, #0 and #1 Morse centers, face plate, dog & screw, adjustable tailstock.

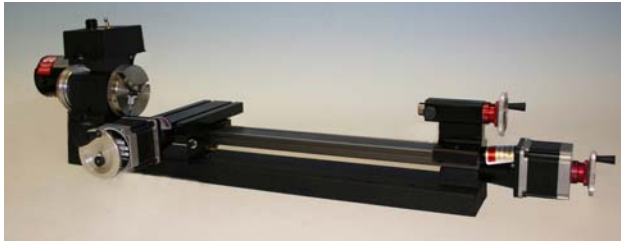


To order by phone call 1-800-674-8419, or fax 770-422-7854

CNC Machining Centers

Benchtop & Desktop CNC Lathes

This CNC Benchtop Lathe and the CNC Desktop Lathe are fully assembled turning machines. Precision ground bedways and 175 oz-in motors provide unmatched quality and performance. Machines are available with standard or extended Y-axis and are made in the USA.



- Packages include:
- CNC Lathe
 - MN400E Motion Controller
 - Limit Switch Kit
 - TurnMaster Pro software
 - Mighty Drive PWR unit
 - all necessary cables

Benchtop Lathe

SPECIFICATIONS:

Swing Over Bed	3.50"
Swing Over carriage	1.75"
Distance Between Centers	8.00" or 17.00"
Cross Slide Travel	2.25"
Tail Stock Spindle Travel	1.50"
Resolution	.0001"
Backlash	.003" max
Hole thru Spindle	0.405"
Spindle Nose Thread	3/4"-16 TPI
Tail Stock Spindle Taper	#0 Morse
Spindle Speed Range	75-2800 RPM
Spindle Nose Taper	#1 Morse
Spindle Motor	1/2 HP DC



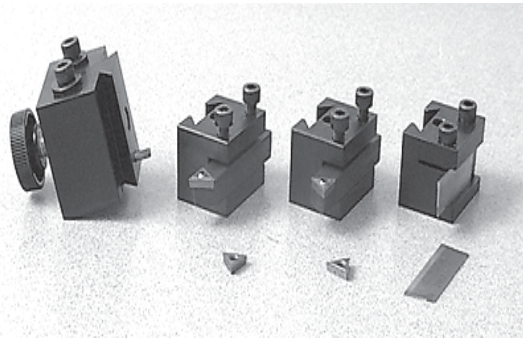
Desktop Lathe

Accessories included with all Desktop/Benchtop CNC Lathes: 3/8" tailstock chuck & key, face plate, dog & screw, #0 and #1 Morse centers, 5/32" & 3/32" hex keys, tool post & a 2.5" OD 3 jaw chuck (Extended lathe substitutes upgraded 3.125" OD chuck and rocker tool post).

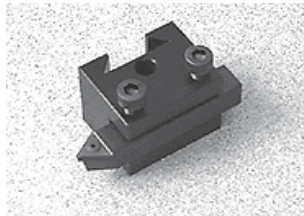
Product	Order #	Price
LATHE-MN-BT (Standard Version)	999-6110-007	\$2,832
LATHE-MN-BTX (Extended Version)	999-6110-107	\$2,997
Desktop Lathe Pkg - MN400E	999-6300-202	\$3,295
High Capacity CNC Lathe PKG-MN400E	999-6400-202	\$3,550
Desktop High Cap Lathe Pkg - MN400E	999-6400-205	\$3,920

Quickchange Tool Set

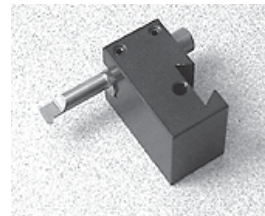
The Quickchange Tool Set allows precise and highly repeatable tool changes. This package includes the tool post, tool holder and right-hand cutting tool, a second tool holder and left-hand cutting tool, and the parting tool holder and blade. One extra insert/blade is included with each. A standard Allen wrench is used initially to set the height and a simple thumb action is all that's needed to pop tools in and out. Finally a quick change tool system that's really easy to use!



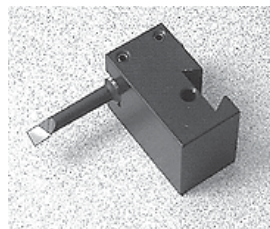
These additional tool holders are sold separately, so you can choose the tools you will need in your work. Includes both Tool holder and cutting tool.



External Threading Tool



Internal Threading Tool



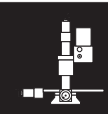
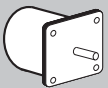
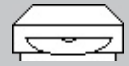
Boring Tool



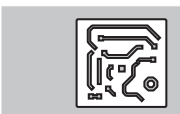
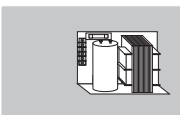
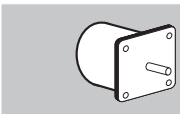
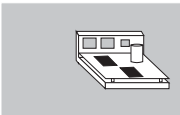
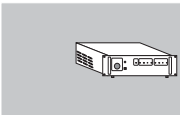
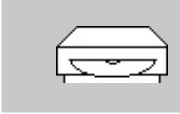
Riser Tool

Product	Order #	Price
Quickchange Tool Set	900-0095-100	\$375
Quickchange External Threading Tool	900-0095-200	\$115
Quickchange Internal Threading Tool	900-0095-300	\$115
Quickchange Boring Tool	900-0095-400	\$115
Quickchange Riser Tool	900-0095-500	\$48
Electronic Threading Kit	980-0000-350	\$359
Lathe Limit Switch Kit	900-0090-012	\$80

To order by phone call 1-800-674-8419, or fax 770-422-7854



CNC Machining Centers



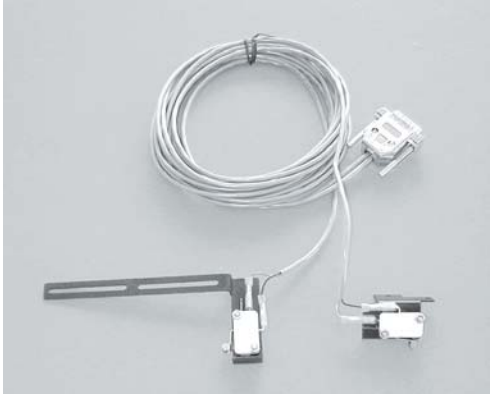
Electronic Threading Kit

This kit installs easily on the Desktop or Benchtop Lathe spindle shaft. Includes the timing belt, pulleys, hardware, and a 2000 line optical encoder (model ES-2000 - detailed on p.29). It allows straight or tapered, single or multistart threading on the inside or outside surface without the use of gears! Any standard or nonstandard thread pitches can be easily done with one G33 command using TurnMaster Pro software (sold separately). If you know the taper in degrees, simply enter on your calculator and press Tangent. The following example does 20 TPI outside threads, in 5 passes, .05" deep, with a .08749" taper (5 deg).

```
G33 Z-1 X-.05 K.05 Q5 A.08749
```



Kit installed on a BenchTop Lathe



Lathe Limit Switch Kit

This kit is designed to be used with the Benchtop Lathe. The kit comes with 2 switches, mounting brackets for both, all installation hardware and is fully wired with a DB15 connector that plugs directly into the Mighty Drive power unit. The bracket for the Z axis is adjustable. Installation instructions are provided. Some drilling and tapping may be required on machines purchased elsewhere.

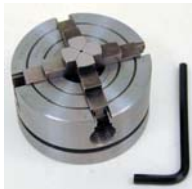
Benchtop CNC Tools & Accessories



3 jaw self centering chuck-

This compact chuck is a good all-around workhorse for most lathe work. The chuck has a 3/4-16 thread to fit Sherline's spindle.

870-1041-000 \$100



2.5-inch 4-Jaw Chuck-

Can be used to clamp either externally or internally.

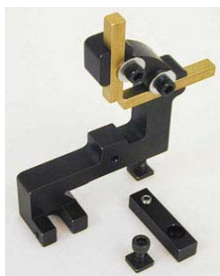
870-1044-000 \$110



Steady Rest-

Provides three adjustable brass blades mounted in a holder to the bed of the lathe. These blades can be set to the diameter of the part to provide necessary support while it turns.

870-1074-000 \$40



Follower Rest-

The brass supports actually move along with or "follow" the cutter. It is used to support a piece of round stock while it is still being machined to keep the part from deflecting away from the tool.

870-1090-000 \$70



WW Collet Set-

Collets provide a quick, easy method of mounting cylindrical parts or bar stock in a lathe with a great deal of centering accuracy.

870-1160-000 \$90



Collet Adapter & Drawbar-

Collets provide a quick, easy method of mounting cylindrical parts or bar stock in a lathe with a great deal of centering accuracy.

870-1161-000 \$50



Vertical Milling Table-

This can be mounted on the lathe crossslide to allow milling with a lathe.

870-1185-000 \$120



Chuck to T-Slot Adapter-

Mounts the chuck to the lathe or mill table for use as a vise to hold parts while machining.

870-1187-000 \$7.50



Live Center-

The center is ball bearing mounted so that it can rotate with the part, reducing wear and heat.

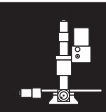
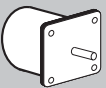
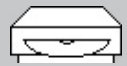
870-1191-000 \$40



Adjustable Live Center-

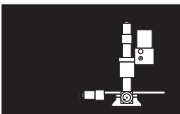
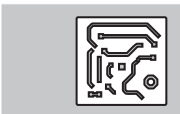
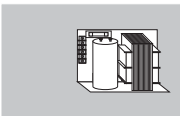
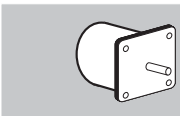
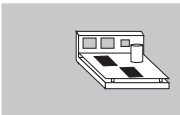
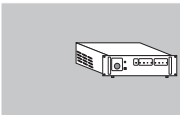
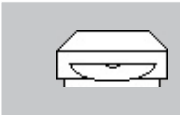
Allows you to precisely position the center to eliminate vibrating or wobbling of the part.

870-1201-000 \$65



To order by phone call 1-800-674-8419, or fax 770-422-7854

CNC Machining Centers



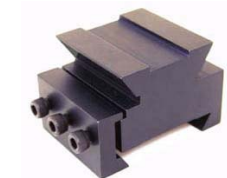
Adjustable Tailstock Chuck Holder-
As with the 1201, highly accurate centering can be achieved for your chuck.
870-1202-000 \$45



Adjustable Tailstock Custom Tool Holder-By making your own custom split collet with a 5/8" outside diameter, this part can hold virtually any tool you wish to adapt to it. A set screw tightens on the collet, holding the tool in place.
870-1203-000 \$45



Lathe headstock riser block kit (with riser tool post)- Provides additional clearance, allowing larger parts to be turned on your lathe.
870-1291-000 \$70



Tailstock Riser Block-Complements #1291, allowing larger parts to be turned between centers.
870-1292-000 \$50



Mill Headstock Spacer-Purpose is to get the spindle farther out from the column, allowing you to work farther in from the edge.
870-1297-000 \$45



Cutoff Tool and Holder- Sometimes referred to as a "parting tool". The cutoff tool and holder consists of a very slender high-speed tool steel cutting blade mounted in a special holder.
870-3002-000 \$50



Knurling Tool Holder-Add a professional look to your parts. Consists of a right and left side which evenly tighten down on your part, creating a diamond knurl.
870-3004-000 \$75



Carbide Tool Set-Recommended for cutting hard or abrasive materials. Not as easy to sharpen as high speed steel.
870-3006-000 \$20



High Speed Steel Tool Set- Cutting tool for use on most materials including wood, plastic, aluminum, brass and steel.
870-3007-000 \$25



Two Position Tool Post 5/16-3/8"- Mounts two lathe tools at once.
870-3008-000 \$25

Benchtop CNC Tools & Accessories (continued)



Hold-down Set- Provide a simple and inexpensive way to adjust for height using a carriage bolt as an adjustable spacer.
870-3012-000 \$25



Step Block Hold-down Set- Practical way to solve one of the more difficult problems that come up in the machine trades; that is, clamping a part to the table.
870-3013-000 \$40



Center Drill Set- Used with the lathe to center drill stock for mounting in the lathe. Also used extensively with the milling machine to accurately start holes.
870-3021-000 \$16



Spur Driver- Used in the Headstock to drive wood when turning between centers. It is a simple and direct method which takes less time to set up than using a 3 Jaw Chuck.
870-3035-000 \$25



Fly Cutter- A Flycutter is a great way to machine flat surfaces. It can be easily sharpened and is probably the most economical way to remove material on a mill.
870-3052-000 \$35



Boring Head- Holds boring tools. The main advantage of boring over drilling is that the hole will always come out in perfect alignment with the spindle whereas a drill may "wander".
870-3054-000 \$70



4 Jaw Chuck Hold Down Set- Consists of two clamps complete with screws and "T" nuts and can be used to clamp the 4 Jaw Chuck to the Milling Table or Lathe Crossslide.
870-3058-000 \$6



Milling Collets- These milling collets are designed to be used with the Morse #1 internal taper that is standard on both the Sherline lathe and vertical mill. Set consists of a 1/8", 3/16" and 1/4" mill collets, a drawbolt and a thrust washer. They will hold the tool very tightly and precisely.
870-3060-000 \$45

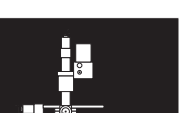
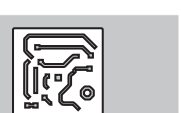
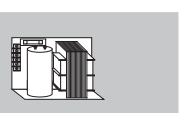
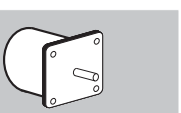
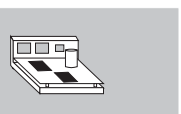
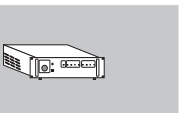
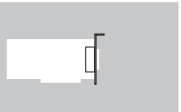
Same as above except metric. Sizes are 3mm, 4mm, and 6mm.
870-3090-000 \$45



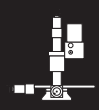
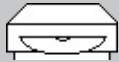
Boring Tool- Boring tools are high speed steel tools designed for use with the boring head #3054.
870-3061-000 \$15



Slitting Saw Holder- Typically used for mounting a slitting saw to the mill spindle.
870-3065-000 \$40



CNC Machining Centers



Drill Chuck & Draw Bar-
For using the mill as a drilling machine. Drawbar prevents the arbor from working loose during use.
870-3072-000 \$50



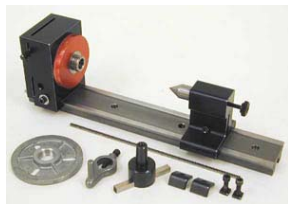
3/8" End Mill Holder-
Will increase the versatility of your milling machine by enabling you to hold some of the most popular cutters.
870-3079-000 \$30



End Mill Set- A set of three High Speed Steel end mills. Sizes are 1/8", 3/16", and 1/4".
870-3080-000 \$30



Edge Finder- A very useful tool for precisely locating edge of part.
870-1000-000 \$17.50



Indexing Attachment-
A unique design that provides a very economical means of accurately rotating a part so that special features (i.e. flats on a nut, teeth on a gear, or splines on a shaft) may be machined.
870-3200-000 \$200



Milling Vise-
Convenient way to hold small parts for milling
870-3551-000 \$75



Rotary Table Right Angle Attachment-
This has been designed to easily mount the Rotary Table on a vertical plane and still maintain rigidity.
870-3701-000 \$75



Adjustable Right Angle Tailstock for 4" Rotary Table-
Mounts on mill table and is adjustable to allow for perfect alignment between the rotary table and the tailstock while holding long parts between centers.
870-3702-000 \$75



Rotary Table Chuck Adaptor-
Allows you to attach the Sherline 3-Jaw chuck to the rotary table so that you can hold round pieces.
870-3709-000 \$5.40



Valenite Insert Holder Tool Post-
This tool holder is designed to hold the larger GE Valenite cutting tools.
870-7600-000 \$20

CNC Wood Router

FEATURES

- Full Z axis control allows precisely controlled routing depth
- Collet system eliminates tedious and inaccurate set screw tool holding
- Hand control knobs for easy, manual position adjustment
- Variable spindle speed control
- 115/230V power compatible



The CNC Wood Router system features a variable speed, heavy duty 5.6 amp motor with a bottom loading 1/4" collet designed specifically for wood routing. The software controlled, stepper motor actuated Z-axis provides precision depth and feedrate control for hands-off multiple pass milling, routing, and engraving. Use of a 1/2" thick, high-precision base plate and dual, high accuracy ball bearing components make this router a superb performer in rigidity, precision, and accuracy.

SYSTEM INCLUDES:

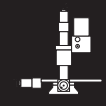
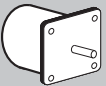
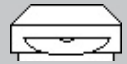
- CNC Wood router
- Mighty Drive-SL high performance power driver
- MillMaster Pro for Windows G-code software
- All cables and technical manuals
- 4 Jaw hold down set

SPECIFICATIONS:

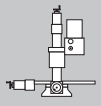
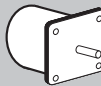
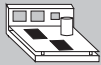
Work Area	Large : 18" x 12" Compact: 8" x 12"
Resolution	.0025"
Repeatability	.0025"
Max Material Width	12"
Max Material Length	Unlimited
Max Material Thickness	2.625"
Spindle Speed	0-30,000 RPM
Spindle Type	Bottom Loading 1/4" Collet
Tool Size	All 1/4" shaft router bits
Routing Speed	0.15 - 1.25" IPS
Actuation	Stepper motors/.100 lead screws
Machine Dimensions	15.5" (L) 19.25" (W) 14.5" (H)
Construction	Machined Aluminum

Product	Order #	Price
CNC Compact Wood Router Package	999-1812-300	\$6,995
CNC Full Size 1812 Wood Router Pkg	999-1812-302	\$8,995

To order by phone call 1-800-674-8419, or fax 770-422-7854

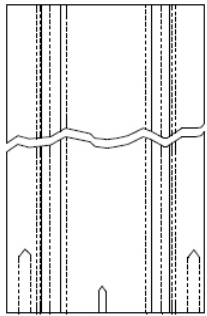
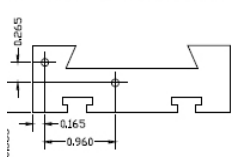


Conversion Products



CNC Conversions

X-Axis Modification



EXISTING HOLE

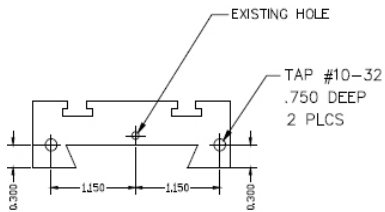


THIS HOLE "MUST" HAVE THE SAME CENTER LINE AS THE EXISTING HOLE SHOWN ABOVE.

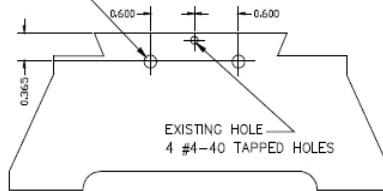


4 #4-40 TAPPED HOLES
0.80 DIA. BOLT CIRCLE
90 DEG. APART

Z-Axis Modification



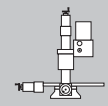
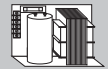
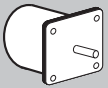
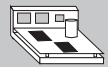
#10-32 TAPPED HOLES
.750 DEEP
2 PLCS



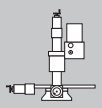
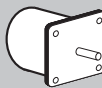
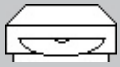
Y-Axis Modification

- NOTES:
1. ALL DIMENSIONS ARE IN INCHES.
2. ALL TOLERANCES +/- 0.005" UNLESS OTHERWISE SPECIFIED.

Now it is practical to take your existing manual machine and install a MicroKinetics CNC conversion in less time and with better results than ever before possible! Installing a MicroKinetics CNC conversion kit is a simple, low cost alternative to getting a whole new machine! Depending on your budget and time constraints, this option may be the best solution for you. Speak with one of our sales engineers to help you decide whether a prebuilt system or a CNC conversion kit is the better solution for you.



Conversion Products



Sherline Lathe & Mill CNC Conversion Kits



Lathe Conversion Package



Mill Conversion Package

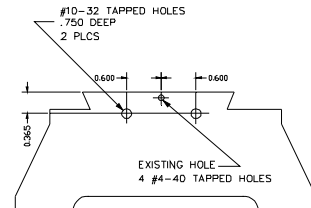
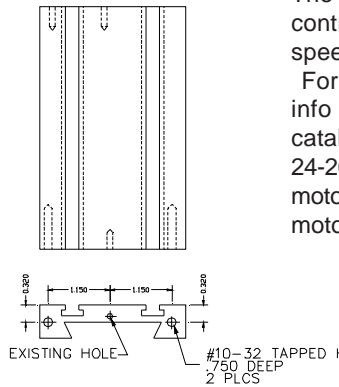
The CNC conversion products include the mechanical components and motors needed to turn your manual Sherline lathe or mill into a working CNC machine! Now you can easily machine complex contours that would otherwise be impossible. This easy-to-install kit saves you valuable time and effort. All mechanical components are precision engineered and specifically designed for the Sherline machines and include step-by-step, illustrated assembly instructions. The kits include pre-wired stepper motors, motor mounting plates with covers, shaft couplings, and all necessary bolts. In addition to the above mechanical components, these packages also include either MillMaster Pro or TurnMaster Pro G-code interpreter software and the proper electronics.



Electronics

The package incorporates the Mighty Drive driver/power supply with all the features of our most powerful motion controller, the MN400E. The MN400E is housed in an external enclosure with jogging controls, operates from a serial or USB port and supports higher speeds and continuous contouring.

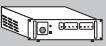
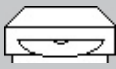
For detailed specifications on the software, see the specific product info on MillMaster Pro (p.10-11) or TurnMaster Pro (p.12-13) in this catalog. For a detailed review of the controller, see the MN400/400E (p. 24-26) and Mighty Drive (p.36-37). For motor specifications, see the 23HT175 motor (p.64-65).



Product	Order #	Price
Lathe Conversion MN Pkg	999-6100-007*	\$1,367
Advanced Mill Conversion MN Pkg	999-6100-008*	\$1,650

Bridgeport Series 1 CNC Conversion Bridgeport X-Y Conversion Kit

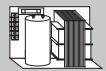
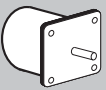
The Bridgeport XY CNC conversion kit includes the mechanical components needed to convert the X & Y axes of your manual Bridgeport or Enco mill for CNC operation. All components are precision engineered. Kit includes (2) size NEMA 42 motor mounting plates, (2) motor pulleys, (2) lead screw pulleys, (2) motor covers, (2) drive belts, and all required bolts, dowels, and spacers. For use with NEMA 42 frame motors (order separately).



Bridgeport Quill Conversion Kit

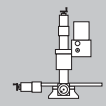


The Bridgeport Quill CNC conversion kit includes the mechanical components needed to convert the Z axis of your manual Bridgeport or Enco mill for CNC operation. All components are precision engineered. Kit includes (1) Quill feed drive frame with size NEMA 42 motor mount, (1) ball screw and ball nut assembly, (1) motor pulley, (1) ball screw pulley, (1) motor cover, and all required bolts, dowels, and spacers. For use with NEMA 34 motors (order separately).



Bridgeport Knee Conversion Kit

The Bridgeport Knee CNC retrofit kit includes the mechanical components needed to convert the knee of your manual Bridgeport or Enco mill for CNC operation. All components are precision engineered. Kit includes a size NEMA 42 motor mounting plate, motor pulleys, lead screw pulley, motor cover, drive belt, and all required bolts, dowels, and spacers. For use with NEMA 42 frame motors (order separately).

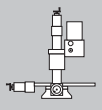
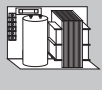
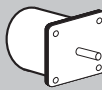
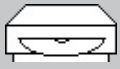


Product	Order #	Price
Bridgeport X-Y Conversion Kit	999-1000-100*	\$795
Bridgeport Quill Conversion Kit	999-1000-101*	\$1,495
Bridgeport Knee Conversion Kit	999-1000-102*	\$395



To order by phone call 1-800-674-8419, or fax 770-422-7854

Conversion Products



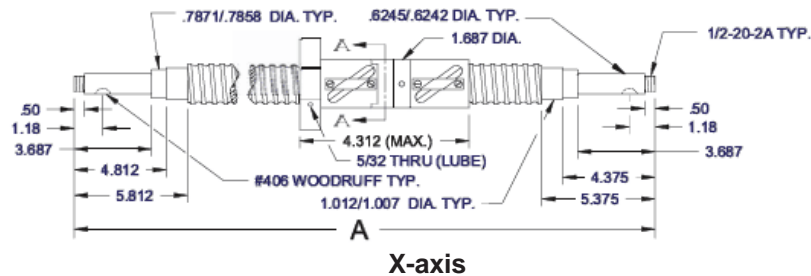
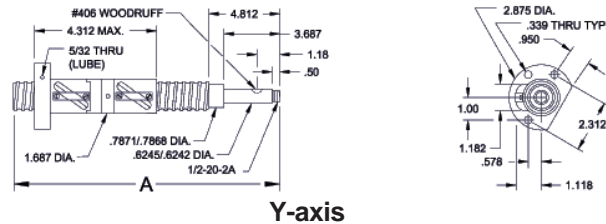
High Performance Ballscrew Kit

Upgrade your Bridgeport/Enco or other mill with this precision-rolled ballscrew kit. The screw and nut assemblies are made of hardened steel for durability and long life. This ballscrew kit will provide a load life expectancy of 50 million inches of travel at an operating load of 400 pounds. The many advantages in this design over other products on the market include:

- Accuracy of +/- .003" per foot
- Preloaded Ball Nuts- Each ball nut is preloaded to eliminate lost motion. This system stiffness provides faster response from a control command. This added stiffness also allows heavier cuts and climb milling thus increasing productivity. The preload is adjustable. This feature permits readjustment for wear and reduces the need for repair or future replacement.
- Brush-Type Wipers: Brush-type wipers, at the ends of each preloaded ball nut assembly, prevent entry of dirt and metal chips
- Easy-Access Lubrication: Lubrication of ball nuts made easy through 5/32" holes in the flanges. These holes provide for attachment of existing lube tubing.



Available lengths:
X axis: 36", 42", 48"
Y axis: 9", 12"



Product	Order #	Price
Bridgeport Ballscrew Kit 9" x 36"	999-1000-202	\$975
Bridgeport Ballscrew Kit 9" x 42"	999-1000-203	\$975
Bridgeport Ballscrew Kit 9" x 48"	999-1000-204	\$975
Bridgeport Ballscrew Kit 12" x 36"	999-1000-205	\$975
Bridgeport Ballscrew Kit 12" x 42"	999-1000-206	\$975
Bridgeport Ballscrew Kit 12" x 48"	999-1000-207	\$975

Enco & Rong Fu Milling Machine CNC Conversion Kit



(Software and electronics are described elsewhere in this catalog. Instruction manuals, and fastening hardware are included but not shown in photo for clarity)



Offering impressive machining power, repeatability, and convenience, the CNC Express Conversion Kit is available as a complete retrofit kit ready to install on your own manual Enco or similar mill/drill. Save literally thousands of dollars over an installed kit. With this kit installed, you'll be able to machine complex shapes that would otherwise be impossible and you'll be able to repeat the process with perfect duplicate parts. The custom made precision ballscrews on both the X and Y axes allow precision conventional and climb milling operations and accurate circular and contour cuts without the tedious setup of a rotary table. All mechanical components are precision engineered and specifically designed for a perfect fit and include step-by-step, illustrated assembly instructions. The kit includes pre-wired stepper motors, motor mounting plates with covers, ballscrews, pulleys, belts, limit switches, and all mounting bolts. In addition to the above components, this package also includes MillMaster Pro G-code interpreter and graphical simulation software, the Motionet MN400 motion controller, and the power drive electronics. All cabling and manuals are included - all you supply is the manual mill/drill and a low cost computer.

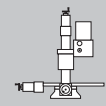
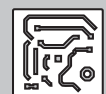
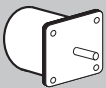
Additional accessories are available for this system. For details, please see pages 89-90.

KIT INCLUDES:

- ◆ 5TPI (.200") ballscrews at .003" per foot max linear error
- ◆ Stepper motors (2) 470 oz-in (1) 350 oz-in
- ◆ DriveRack high performance power driver
- ◆ Motionet MN400 motion controller
- ◆ MillMaster Pro G-code control & graphical software
- ◆ Limit switches, cables, technical manuals, and a CNC Express serial # name plate

Product	Order #	Price
CNC Express Mill/Drill CNC Kit	999-1000-200*	\$4,395

To order by phone call 1-800-674-8419, or fax 770-422-7854



Conversion Products

1236 & 1340 Lathe CNC Conversion Kit



The CNC Lathe 1236 and 1340 Conversion Kits are available as complete retrofit kits ready to install on your own manual Enco, Birmingham, Nova or similar 12 X 36 or 13X40 lathe. These kits offer ample machining power, repeatability, and convenience. With this kit installed, you'll be able to use single point cutting tools to take the place of form tooling. You'll be able to call up a part program and machine perfect duplicate parts. The custom made precision ballscrews on both the X and Z axes allow precision taper and curved cuts without the tedious setup of a compound slide. And with the electronic threading option you'll be able to make infinitely variable internal, external, and tapered threads. All mechanical components are precision engineered and include step-by-step, illustrated assembly instructions.

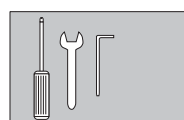
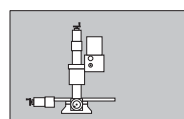
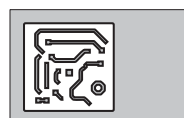
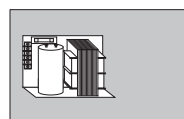
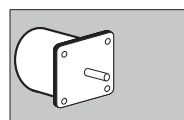
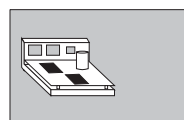
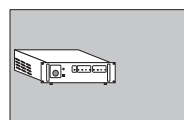
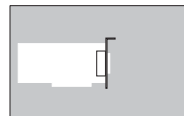
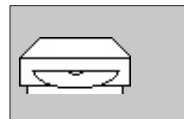
The kit includes prewired stepper motors, motor mounting plates with covers, ballscrews, pulleys, belts, limit switches, and all mounting bolts. In addition to the above components, this package also includes TurnMaster Pro for Windows G-code interpreter and graphical simulation software, the Motionet MN400 motion controller, and the power drive electronics. All cabling and manuals are included... all you supply is the manual lathe and a low cost computer.

KIT INCLUDES:

- 5TPI (.200") ballscrews at .003" per foot max linear error
- Stepper motors (1) 470 oz-in (1) 1625 oz-in
- DriveRack high performance power driver
- Motionet MN400 motion controller
- TurnMaster Pro for Windows G-code control & graphical software
- Limit switches, cables, technical manuals, and a CNC 1236 or 1340 serial #name plate

Product	Order #	Price
CNC Lathe 1236 Kit w/Threading	999-1000-301*	\$4,295
CNC Lathe 1236 Kit	999-1000-300*	\$3,995
CNC Lathe 1340 Kit w/Threading	999-1000-401*	\$5,295
CNC Lathe 1340 Kit	999-1000-400*	\$4,995

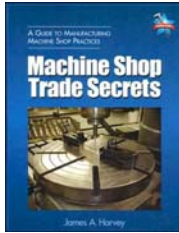
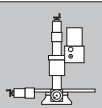
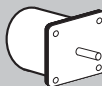
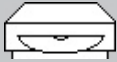
Educational Resources



A motion control product's success is, by far, most dependent on the quality of the technical information you are able to gather early in the design process. It takes considerable time and effort to bring together enough knowledge in all the required disciplines. As a motion control engineer, you need to have a mastery of physics, electronics, software, and mechanics. In this catalog, we've put together a compatible collection of software, electronics, power supplies, drivers, and motors to simplify product specification and selection. In this section, we aim to make it a little easier to locate, define, and understand some of the needed formulas, conversion tables, technical terms, and related literature. We hope that this section proves a handy reference for you.

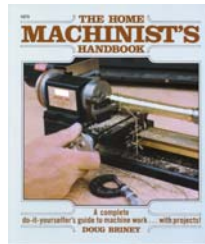
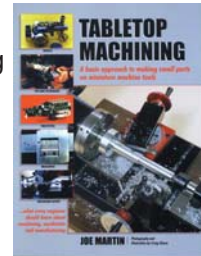
To order by phone call 1-800-674-8419, or fax 770-422-7854

Educational Resources



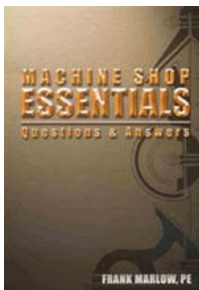
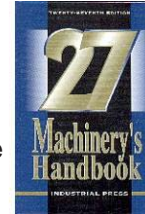
Machine Shop Trade Secrets, by James A Harvey. Written by an experienced machinist and plastic injection mold maker, this fact-filled manual will have you thinking and producing like an experienced machinist. Practical "how-to" info and topics include: Select, make, and grind cutters. Surface grind blocks, pins and shapes. Cut threads, knurl parts & eliminate warp. Choosing feeds, speeds & depths of cut. Remove broken taps, drill bits & other hardware. Applying CNC techniques to maximize output and more.

Table Top Machining, by Joe Martin. A basic approach to making small parts on miniature machine tools. The book covers manual machining principles for lathe & milling operations. This book gives you not just the "hows", but also the "whys" of machining practices. Included are descriptions as well as detailed photos and drawings. A large selection of project photos illustrate the amazing work that has been produced by craftsmen using these small but capable tools. The detail & complexity that can be achieved using these machines will astound you!



The Home Machinist's Handbook, by Doug Briney. A complete guide for all home machinists & hobbyists. This book covers it all, from how to set up a shop to instructions for actual projects you can make in your shop. It will guide you through the selection of hand & bench tools, basic lathe & milling operations, & selection of materials. Then you can practice what you've learned with the numerous projects provided with illustrations & photographs. A "must have" for all hobbyists!

Machinery's Handbook, Toolbox Version, 27th Edition, published by Industrial Press, Inc. "The Bible of the Mechanical Industries," Machinery's Handbook is the most popular engineering reference book of all time and is considered *the standard reference* for the mechanical industries throughout the world.



Machine Shop Essentials: Questions & Answers, by Frank M. Marlow. A comprehensive and detailed presentation of manual machine tools, methods, machine shop know-how and practical shop tips. Machine Shop Essentials is for machinists, engineers, model makers, R & D lab technicians, instrument makers, prototype builders, product designers and gunsmiths who need to make prototypes, models or spare parts, or need to modify existing equipment. This book can also be used to gain a basic understanding of machine tools before moving on to computer-controlled machine tools.

Product	Order #	Price
<i>Machine Shop Trade Secrets</i>	999-5800-006	\$38.50
<i>Table Top Machining</i>	999-5800-000	\$40.00
<i>The Home Machinist's Handbook</i>	999-5800-002	\$25.00
<i>Machinery's Handbook 27th edition</i>	999-5800-004	\$69.90
<i>Machine Shop Essentials Q & A</i>	999-5800-005	\$44.95

MicroKinetics CNC Machine Training



MicroKinetics offers a 2 day workshop designed to introduce you to CNC machining using MicroKinetics equipment. This course provides participants with "hands-on" experience through instruction, demonstrations, and discussion. An experienced member of our training staff will guide attendees through the process of designing and making one or more metal parts.

Since class size is limited, we can tailor the workshop to your specific needs and questions.

Program Highlights

- ◆ What are G & M codes? And how do I use them?
- ◆ Step-by step, how to design and make a part.
- ◆ How to select and change your cutting tool
- ◆ How to save part programs for repeated use
- ◆ Setting the feedrates right
- ◆ Locating the starting point
- ◆ Home referencing using the limit switch feature
- ◆ Tool changes and offsets
- ◆ How to use subroutines, macros and their use
- ◆ How to use parametric programming
- ◆ Importing DXF files for CAD/CAM use
- ◆ How to place motion profiles on drawings

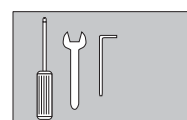
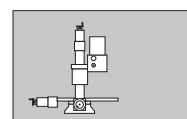
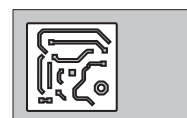
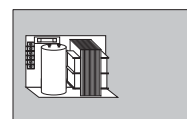
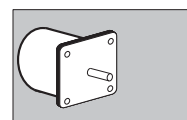
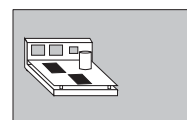
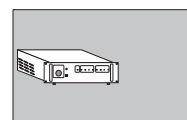
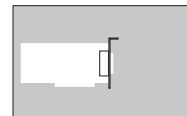
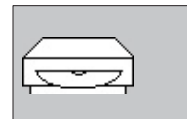


If you would like to learn more about CNC or you are an accomplished CNC machinist and would like to learn MicroKinetics systems, this class is the one for you.

Call to let us know that you would like to enroll in a CNC training workshop. We will schedule a date that is convenient for you & the instructor. Then we will arrange a telephone conference with a member of our training staff so that we can learn about your current situation and goals, and can begin planning your CNC Training Workshop.

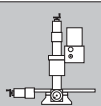
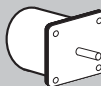
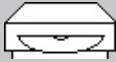
The 2 day training fee is \$1295. Printed training materials & refreshments are included. Multiple attendees may enroll at a discount.

The fee is fully refundable up to five business days before the seminar. After that, there will be a service fee of \$200. Substitutions may be made, but "no-shows" are liable for the entire fee.



To order by phone call 1-800-674-8419, or fax 770-422-7854

Educational Resources



On-Site Services



Do you have several people that would benefit to participate in obtaining CNC training but find it impractical to have them all make a field trip to our factory in Georgia? Do you have specific training needs that may be focused on safety or a specialized set of parts? Would you benefit from having a skilled MicroKinetics engineer helping you install and setup your system? If so, you'll be glad to know that MicroKinetics now offers these services. Get more out of your machine in less time with training and machine setup services right where you are!

Benefits to on site training:

- ◆ Trainer can address your specific needs- you decide what will be covered
- ◆ You are learning on the exact equipment you will be using
- ◆ More cost effective for larger groups
- ◆ No travel/down time or dealing with security checks, airport security, and car rentals for your personnel. The trainer comes to you.
- ◆ Safety issues can be addressed in the location and in your environment

Call to let us know that you would like to have a representative come on site for training/setup. We will discuss your specific needs, skill level, and goals and can schedule a date that is convenient for you and the instructor.

Design Notes

Motor & Driver Selection

To select a stepper motor and driver,

1. Calculate the total torque needed at the output shaft of the motor.
2. Use the motor performance curve to select a motor with at least 50% more torque than that calculated at the required maximum speed.
3. Select a driver that is capable of supplying the needed current to the motor of choice and providing the resolution needed.

Torque Requirements

The total torque required in an application is the sum of individual torques as follows:

$$T_T = T_A + T_F + T_V + T_G \quad (\text{oz-in})$$

Notation equivalents:

T_A = torque needed to accelerate the masses.

T_F = torque needed to overcome friction.

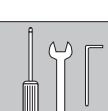
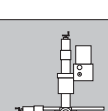
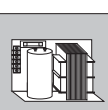
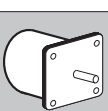
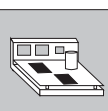
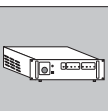
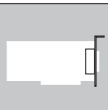
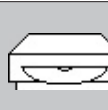
T_V = torque needed to overcome viscous resistance. This is proportional to velocity.

T_G = torque needed to overcome gravity if load is not counterbalanced.

The acceleration and gravitational torques are calculated using the following equations:

$$T_A = J_T \times \alpha \quad (\text{oz-in})$$

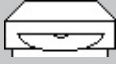
$$J_T = J_{\text{motor}} + J_{\text{encoder}} + J_{\text{load}} \quad (\text{oz-in-sec}^2)$$



Educational Resources



W = weight of the load (lbs)
 P = pitch of rotary to linear translation (rev/in)
 e = efficiency constant (<1)
 α = rotary acceleration (rad/sec²)
 J = inertia (oz-in²)



Load Inertia

Another important mechanical parameter to calculate is the total load inertia as reflected through the transmission system. Four common transmission systems are Direct Drive, Leadscrew Drive, Gear Box, and Tangential Drive.



Direct Drive

The load connects directly to the shaft and can be calculated by modeling a load of one or more cylinders.



The inertia can be calculated using the following formula:

$$J = \frac{W}{48} [r^2 + R^2] \quad (\text{oz} \cdot \text{in} \cdot \text{sec}^2)$$

if weight of the cylinder W is known, or

$$J = \frac{\rho \pi L}{768} [R^4 - r^4] \quad (\text{oz} \cdot \text{in} \cdot \text{sec}^2)$$

if the density ρ and length of cylinder L are known.

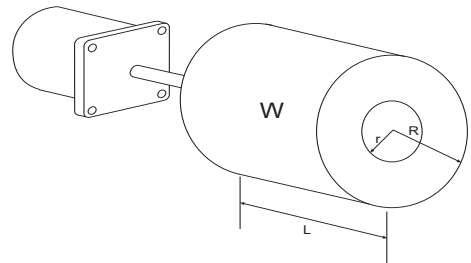


W = Weight of cylinder (lbs.)
 r = Inner radius (zero if solid) (in.)
 R = Outer radius (in.)
 L = Length of cylinder (in.)
 ρ = Density of material (oz/in³)



Leadscrew Drive

The inertia of a leadscrew or ballscrew drive is the inertia of the reflected load plus that of the leadscrew itself.



Common Densities (oz/in³)

Aluminum	1.56
Brass	4.88
Copper	5.14
Steel	4.54

$$T_G = \frac{2.55 \times W}{P \times e} \quad (\text{oz-in})$$

The load inertia is calculated as follows:

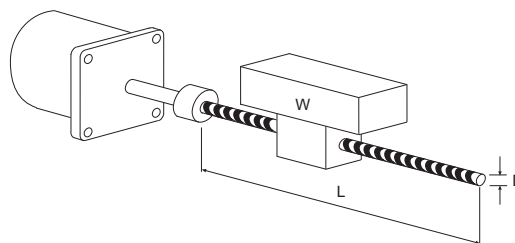
$$J_{LS} = \frac{.001}{P^2} \quad (\text{oz-in-sec}^2)$$

W = weight of load

P = screw pitch

The inertia of the lead screw is:

$$J_s = \frac{\rho \pi L D^4}{12,352} \quad (\text{oz-in-sec}^2)$$



L = length of leadscrew

D = diameter of leadscrew

ρ = material Density of leadscrew

The total inertia therefore is:

$$J = \frac{J_{LS}}{e} + J_s \quad (\text{oz-in-sec}^2)$$

Efficiency, e, is typically 0.4 for a leadscrew and 0.8 to 0.9 for a ball screw.

Gear Box

A gear-based transmission is most commonly used when the load has a large inertia. Gears are used to reduce the reflected load inertia.

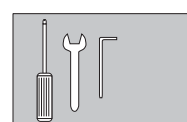
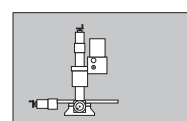
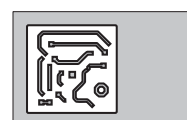
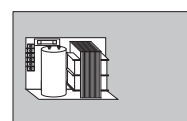
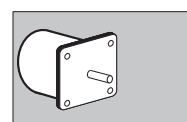
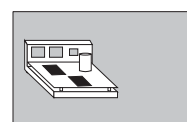
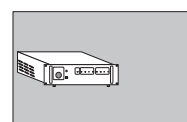
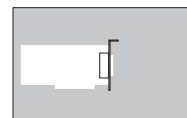
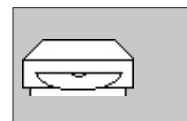
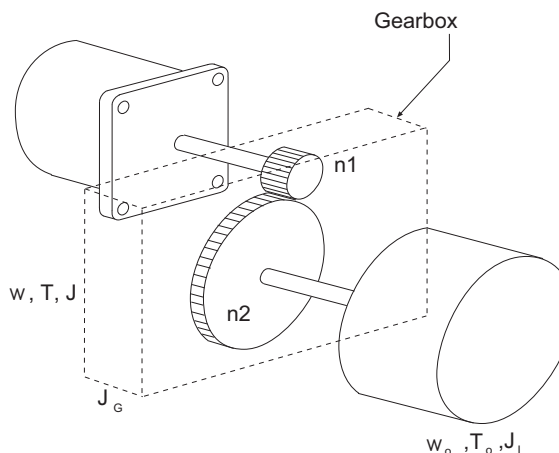
The equations for the gear box are:

$$N = \frac{n_2}{n_1}$$

$$T = \frac{T_o}{Ne}$$

$$\omega = N\omega_o$$

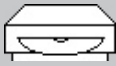
$$J = \frac{J_L}{N^2} + J_G$$



Educational Resources



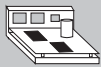
N = gear Ratio
 n_1 = teeth in gear 1
 n_2 = teeth in gear 2
 w = rotational velocity at motor shaft
 w_o = rotational velocity at output
 T = torque at motor shaft
 T_o = torque at output of shaft
 e = efficiency of gear system
 J_L = inertia of load
 J_G = gear train inertia



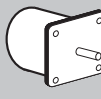
Tangential Drive

Rack and pinion, belt & pulley, and pinch rollers are typical tangential drive systems.

The following formulas can be used to calculate the total inertia of any of these systems.

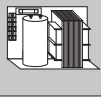


$$J = \frac{J_L}{e} + J_p \quad (\text{oz} \cdot \text{in} \cdot \text{sec}^2)$$



Where J_L is the reflected load inertia and is given by:

$$J_L = 0.0415 \times (W_B + W_L) \times r^2 \quad (\text{oz} \cdot \text{in} \cdot \text{sec}^2)$$

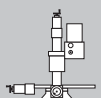
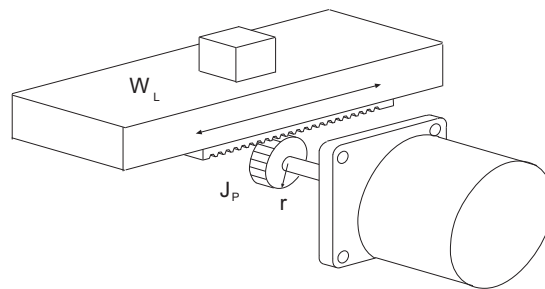


J_p = inertia of pulleys, pinion, or pinch rollers

W_B = weight of belt if any

W_L = weight of load

e = efficiency (0.98 for belt & pulley, 0.93 for rack and pinion, pinch rollers vary)



J_p is calculated the same way as in the direct section.



The open loop nature of stepper motor control requires a safety margin to be added to the total torque calculated. We recommend that the torque output of the motor and drive be 40 to 60% more than the minimum needed at the highest rotational speed.

In addition to providing theoretical answers, modeling the load and mechanical drive can be an important step in selecting the proper motor and driver for your application.



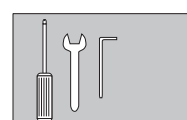
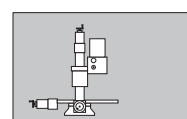
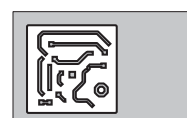
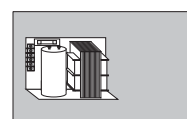
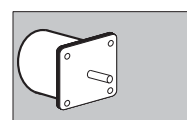
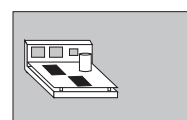
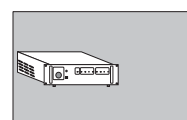
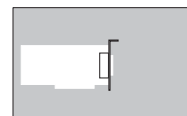
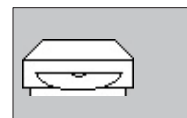
Conversion Tables

Wiring Effect on Motor Electrical Ratings

Stepper motor manufacturers may rate their motors 3 different ways. 1) unipolar (or bipolar center tap to end), 2) bipolar series and, 3) bipolar parallel. Most ratings for 6 lead motors are unipolar. Ratings for 4 lead motors are bipolar, while ratings for 8 lead motors can be any of the three. MicroKinetics motors are all rated for the unipolar method for consistency. You should use the chart below to adjust for the driver type and wiring you choose for your application. Because all MicroKinetics drivers are constant current, the main consideration is the current. Driving a 6 lead motor “end to end” will require only 70% of the rated current (when compared to the standard method of driving the motor “center tap to end”).

Desired Drive Scheme

		Desired Drive Scheme			
		Rating	Unipolar multiplier	Bipolar series multiplier	Bipolar parallel multiplier
Rated Drive Scheme	Unipolar or Bipolar Center tap to End	volts	1	1.4	0.7
		amps	1	0.7	1.4
		ohms	1	2	0.5
		mH	1	4	1
		holding torque	1	1.4	1.4
Bipolar Series	volts	0.7	1	5	
	amps	1.4	1	2	
	ohms	0.5	1	0.25	
	mH	0.25	1	0.25	
	holding torque	0.7	1	1	
Bipolar Parallel	volts	1.4	2	1	
	amps	0.7	0.5	1	
	ohms	2	4	1	
	mH	1	4	1	
	holding torque	0.7	1	1	





Torque

Multiply Number of

g-cm	N-cm	kg-cm	N-m	oz-in	lb-in	lb-ft	
980.7	10^5	9.807×10^5	10^7	7.062×10^4	1.130×10^6	1.356×10^7	dy-cm
1	1.020×10^2	10^3	1.020×10^4	72.01	1.152×10^3	1.383×10^4	g-cm
0.9807	1	9.807	100	0.7062	11.3	135.6	N-cm
10^{-3}	0.102	1	10.20	7.201×10^{-2}	1.152	13.83	kg-cm
9.807×10^{-5}	10^{-2}	9.807×10^{-2}	1	7.062×10^{-3}	0.113	1.356	N-m
1.389×10^{-2}	1.416	13.89	141.6	1	16	192	oz-in
8.681×10^{-4}	8.850×10^{-2}	0.8679	8.85	6.250×10^{-2}	1	12	lb-in
7.234×10^{-5}	7.375×10^{-3}	7.234×10^{-2}	0.7375	5.208×10^{-3}	8.333×10^{-2}	1	lb-ft

To
Obtain

To convert a torque value from oz-in to N-cm multiply by 0.7062

Inertia

Multiply Number of

g-cm ²	kg-cm ²	kg-m ²	oz-in-s ²	oz-in ²	
1	10^3	10^7	7.062×10^4	182.9	g-cm ²
10^{-3}	1	100	70.62	0.1829	kg-cm ²
10^{-7}	10^{-4}	1	7.062×10^{-3}	1.829×10^{-5}	kg-m ²
1.416×10^{-5}	1.416×10^{-2}	141.6	1	2.590×10^{-3}	oz-in-s ²
5.467×10^{-3}	5.467	5.467×10^{-4}	386.09	1	oz-in ²

To Obtain

To convert a rotor inertia value from gcm² to oz-in² multiply by 5.467×10^{-3} .

Force

Multiply Number of

kgf	N	lbf.	
1	0.102	0.4535	kgf
9.807	1	4.448	N
2.205	0.2248	1	lbf

To
Obtain

To convert kgf to lbf multiply by 2.205.

Glossary

Absolute move

A positioning move referencing a fixed origin position. Contrast with incremental move.

Acceleration

The change in motor speed as a function of time. Acceleration (also referred to as ramping) is used in stepper motor control to achieve higher speeds than otherwise possible.

Accuracy

A measure of the difference between expected position and actual position of a mechanical system. As it relates to linear travel, accuracy is usually specified as linear inches per inch.

Back EMF

The voltage generated when the shaft of a permanent magnet motor is rotated. This voltage is proportional to rotational speed.

Backlash

Free play in an axis assembly along the path of travel. The rotational shaft movement that results in no linear movement of the linear way.

Bipolar chopper driver

A type of stepper motor driver that uses a switch-mode technique to control motor current and polarity. Bipolar indicates the driver can apply current to the motor windings in either direction. This provides better efficiency than unipolar drivers.

Brushless DC motor

A DC motor with a permanent magnet rotor and coils in the stator. The stator coil currents are sequenced by an external brushless DC motor controller. The main advantages to this type of motor are the elimination of EMI caused by the arcing brushes and improved motor life.

Closed loop positioning

A mechanical system in which the output is measured and compared to the input. The output is then adjusted so that the system reaches the desired condition.

Detent torque

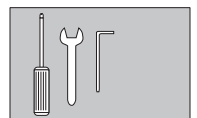
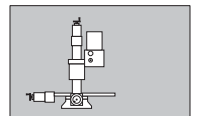
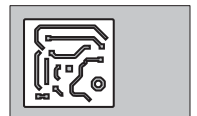
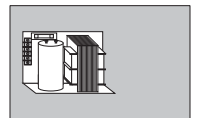
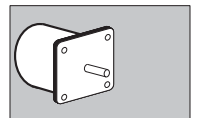
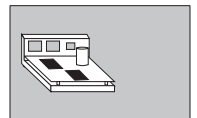
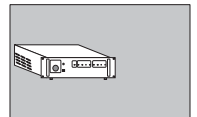
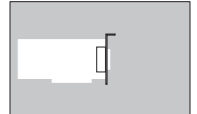
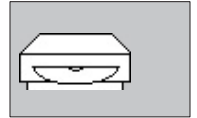
Also referred to as the residual torque; it is the torque present in a non energized stepper motor caused by its magnetic rotor. Due to the detent torque, stepper motors tend to hold their position even when not energized.

Driver

Electronic device which accepts step and direction signals and provides the high power currents and voltages to drive a stepper motor.

Efficiency

The ratio of power output to power input.

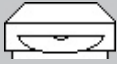


Educational Resources



Encoder

An electromechanical device for translating the incremental angular motion of a rotating shaft into a corresponding series of digital signals. For example, a 400-line encoder generates 400 pulses for every shaft revolution. Encoders may consist of a metal wheel with notched stripes, which pass through a photodetector to produce the electronic signals.



Feedback

Used in completing a closed-loop system. A signal is transmitted from the output of a system back to the input where it is used to adjust for any errors between desired and actual output position. (see encoder and closed loop)



Flatness

The deviation from the ideal straight line travel in a vertical plane. Also referred to as the vertical run-out.



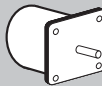
Friction

A resistance to mechanical motion caused by two surfaces rubbing against each other. The three types of friction are: 1) static; 2) dynamic (constant with varying speed); and 3) viscous (increases with increased speed).



Half stepping

A method of driving stepper motors that improves the performance, smoothness, and resolution of the system.



Holding torque

Specifies the maximum external torque that can be applied to a stopped, energized motor without causing the rotor to rotate continuously.



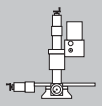
Home switch

A limit sensor that is used to establish an initial reference point. One is used per axis.



Hybrid stepper motor

A motor designed to move in discrete increments or steps. The motor is brushless and has a permanent magnet rotor and a wound stator. Motion is generated by sequencing the current to the windings.



Incremental move

A positioning move where the current location is assumed to be zero.



Idle current reduction

A feature of the driver that reduces the current to the motor when inactive for a set period of time. This feature reduces motor heating and saves energy.

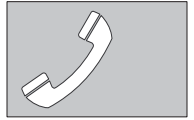


Indexer

An electronic device or software which converts motion commands from a host computer, PLC, or control panel switches into a set of step and direction signals for use by the stepper motor driver. Indexers can be broadly divided into two classes. A preset indexer typically accepts distance, speed and ramp time inputs only. The more sophisticated programmable indexer is capable of complex and coordinated motion control.

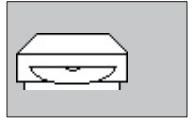
Inertia

A measure of an object's resistance to a change in velocity. The force needed to accelerate or decelerate an object is directly proportional to its mass. The torque required to rotationally accelerate or decelerate a cylindrical object is directly proportional to its mass and radius.



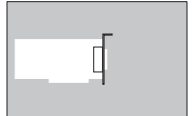
Inertial match

A load and motor have an inertial match when the reflected system inertia at the shaft is equal to the rotor inertia of the motor. This provides a maximum transfer of power and thus efficiency.



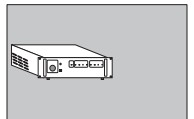
Leadscrew pitch

The number of turns a leadscrew must make to cause a linear travel of 1 inch. Common lead screw pitches are 5, 10 and 20 turns per inch.



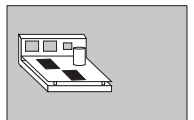
Limit switch

A mechanical, Hall effect, or optical sensor used to detect end of travel on each axis. This can also be used for home referencing.



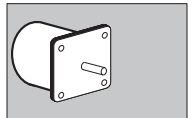
Microstepping

Some stepper motor drivers employ microstepping circuitry to increase a stepper motor's resolution and rotational smoothness by applying intermediate amounts of winding currents.



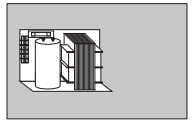
Open loop positioning

A motion control system that does not use external sensors (i.e. encoders) to provide position or speed feedback signals. Most commonly used in stepper motor systems.



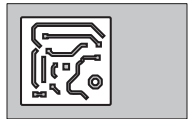
Pull-out torque

The maximum torque that can be applied to a stepper motor running at constant speed without causing a loss of synchronism.



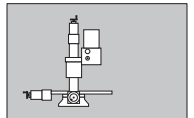
Pulse rate

The speed of the ON-OFF signals applied to a stepper motor driver. The pulse rate, multiplied by the logical steps per revolution of the motor/driver combination, is the rotational speed in revolutions per second (RPS).



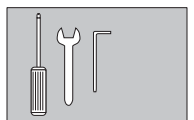
PWM

Pulse width modulation (PWM) is an efficient electronic control technique used in stepper motor drivers to set average winding current. PWM is commonly used in high-power amplifiers and power supplies.



Ramping

Acceleration or deceleration of a stepping motor, performed to increase the speed beyond the start-stop point of the motor. The optimal ramp speed is dependent on the load, screw pitch, motor and drive voltage.



Repeatability

A measure of the ability to repeatedly perform an identical move (or sequence of moves).

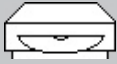


Educational Resources



Resolution

The number of steps required for a motor's shaft to rotate one full revolution. 200 steps/rev is the resolution of a commonly used 1.8° per step motor.



Resonance

Loss of synchronism caused by mechanical limitations. Usually occurs if the natural frequency of the rotor coincides with input frequency of the pulses. Possible to overcome by use of magnetic dampener.



RS-232C

A popular serial data communications protocol. This standard specifies signal levels, data formats, maximum transmission distance, etc. commonly used in micro computers and stand-alone motion, CNC, and robotic controllers.



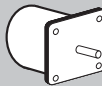
Slew speed

The constant speed portion of a move after acceleration is completed and before deceleration begins.



Start/stop speed

The highest step rate that can be immediately applied to a stepper motor without losing synchronism.



Step angle

The angular increment of the motor shaft caused by a single step pulse.



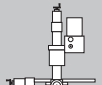
Synchronism

A motor is in synchronism if its rotational behavior corresponds directly to the input step pulse rate. Loss of synchronism occurs if the motor fails to rotate at the commanded speed. This is frequently the result of excessive load or very high commanded speed.



Torque

A measurement of rotational force which is usually expressed in oz-in or lb-ft.



Torque-to-inertia ratio

The motor's holding torque divided by its rotor inertia. A high torque-to-inertia ratio indicates a high speed capable motor.



Unipolar driver

A stepper motor driver in which the current to the motor coils always flows in the same direction. Unipolar drivers are common because of their ease of design and low cost. However, they produce less torque because they do not fully utilize the windings of the motor.



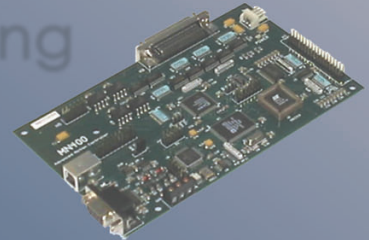
USB

USB (Universal Serial Bus) is a serial connection method that features ease of use, expandability, and speed for the end user. It supports hot swapping, auto configuration, and provides power to external devices. This connection method is quickly replacing the old serial and parallel ports used on PC's.

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