epsilon Series Digital Servo Drives

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EMERSON MOTION CONTROL

12005 Technology Drive
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Epsilon Series Overview

Features

- Digital drive design using DSP, ASIC and SMT technology
- 90 to 264 VAC 1Ø input power
- Epsilon Drives use MG and NT Series servo motors utilizing encoder feedback for position control
- 5 lb-in to 15.8 lb-in standard torque range
- CE, UL and Canadian UL approvals pending
- Six inch (152 mm) panel installation depth
- Provision for alternate logic supply
- Optically isolated I/O
- RS-232/485 serial communication interface using Modbus™ protocol
- Extensive fault sensing and diagnostics including storage and time stamping of last 10 faults
- Status and diagnostic display
- 400 µs max. response to inputs
- Sinusoidal commutation for efficiency and smooth motion
- Programmable encoder output density
- Removable connectors
- Two-year extended warranty on drives and motors

Description

The Epsilon Series is Emerson's smallest servo drive and despite its size it delivers all the performance, reliability and convenience you expect from a product designed and built by Emerson. It's also been carefully designed to fit into a 6 inch deep enclosure... with cables connected.

The small size of the Epsilon Series is attainable with the use of ASICs, surface mount devices, and our high density power section. The effort put into minimizing the Epsilon's size is matched by the quality designed into it.

The Epsilon Series consistns of two drive sizes, each having three unique configurations that focus the drive toward specific applications.

The different configurations are:

Eb Epsilon Base
Es Epsilon Speed Control
Ei Epsilon Indexing

We've taken advantage of new technologies to develop these products without losing sight of the reality that reliability is key to any design. New technologies and a rigorous set of qualification tests coupled with decades of experience in servo drives culminates with Epsilon drives and NT motors — the state-of-the-art in performance, reliability, power density, and convenience.

Epsilon Series

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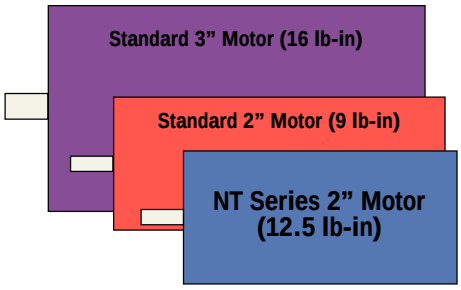
New NT Series Motors

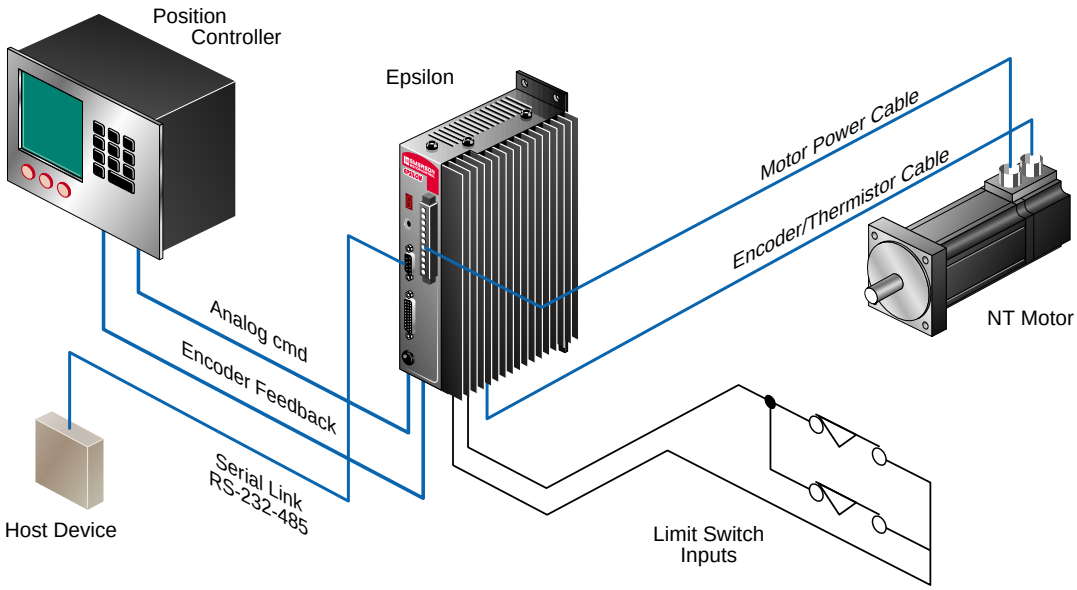
Emerson's new NT series motors, which complement the Epsilon, deliver very high power to size ratios that were previously impossible. We accomplished this with the use of the latest motor design and production technology that achieves a high motor slot fill along with high-energy Neodymium-Iron-Boron magnets. The NT motors and Epsilon drives are a natural combination where small size and high performance are needed.

The advantage of the NT motor design is apparent when you compare it to standard "high performance" motor designs. The NT motor design delivers up to 46% more torque in 20% less space.



Emerson

Typical Epsilon Eb (Base Drive) System Configuration



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Epsilon Series Overview

Control response and tuning

The control designed into the Epsilon series drive is based on the latest in State-Space algorithms, which allow the drive to control a wide range of loads. The high speed DSP processors used to execute these algorithms also make sub-millisecond I/O response a reality.

No tuning is required, in most cases, because of the wide load range capability designed into the control. The Epsilon series drive will work out of the box in applications with up to a 10:1 inertia mismatch. Inertia ratios of up to and over 50:1 are easily accommodated with just two parameter settings; Load Inertia Ratio and Response Level.

Emerson's commitment to making servos easy to apply is shown in the set up screen at right. It displays the system load adjustments in real measurable terms such as Inertia Ratio and Friction, therefore eliminating the "art" in servo applications.

Drive Communications

The Epsilon series drive communicates through an RS-232 or RS-485 serial interface port using Modbus™ protocol. This standard protocol simplifies communication and eliminates the problems encountered when developing a custom serial interface. The built-in error checking and high-speed multi-drop capability greatly simplify implementation and make your communications robust by design.

The drives will accept a standard RS-232 serial input from the host while converting it internally to an RS-485 signal for easy multi-dropping. Multi-dropping is made even easier with the use of our standard low profile multi-drop cables (DDS-xxx) and termination modules (TERM-H/ TERM-T).

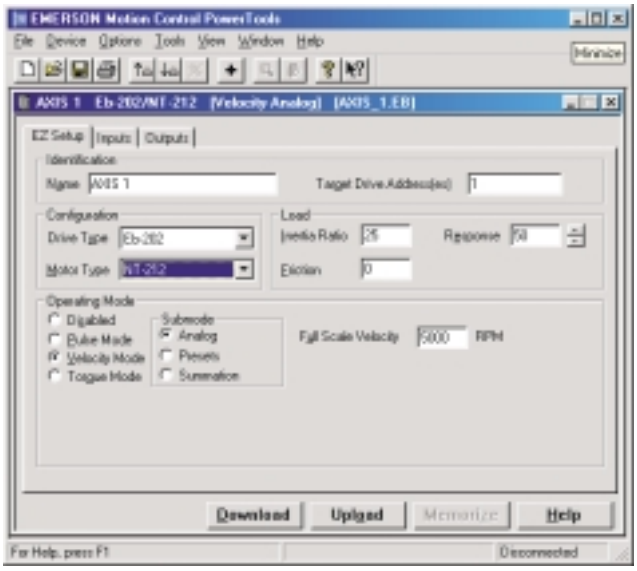
This simple interfacing makes connection to a variety of host controllers painless including:

- PLC's
- Operator Interfaces
- PC platform controllers (PC software drivers available)

operator interfacing

Operator terminals can be easily interfaced to the Epsilon series drives. The wide array of parameters available through the serial port makes the operator interface a window into the drive for easy diagnostics and adjustments. Most of the parameters need no scaling or translation to be usable so the data can be displayed as is, further simplifying your interfacing effort. An example of a Emerson OIT-3165 Operator Interface is shown below.

OIT-3165 Operator Interface



Epsilon Series Drive load definition screen

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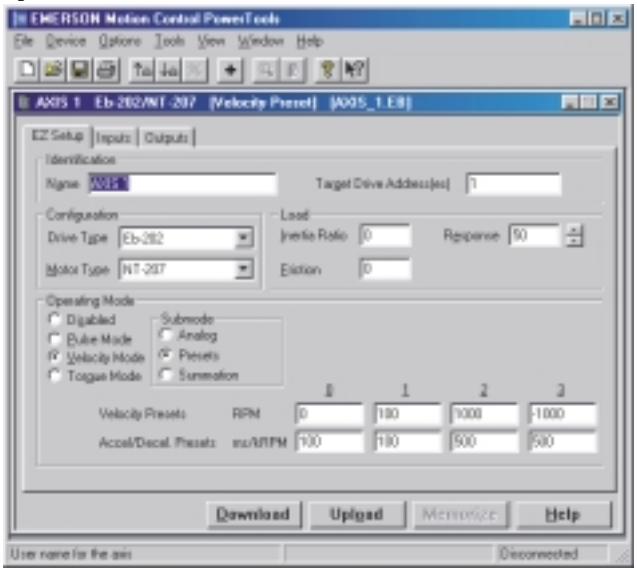
PowerTools™ Base User Interface Software

The PowerTools™ user interface software works on any PC using Windows 95/98™ or Windows NT™ 4.0. The software enables the user to upload and download configuration parameters into the Epsilon Series Drive. The screen below is a sample of the configuration screen of the Eb Base Epsilon Series drive.



PowerTools configuration screen for Epsilon Series.

PRE-defined system Setup

Commissioning an Epsilon Series Drive is simplified by giving the user a choice of pre-defined setups which will configure the drive to most applications without going through the setup screens. The setups will define everything you need to start up a typical system. This includes I/O definition, matching the drive to the motor and tuning the system to deliver good performance over a very wide load range of up to 10:1 inertia mismatch. More specific parameter adjustments are easily accessible with the PowerTools™ software package.

The seven pre-defined setups available for the Eb Drive include:

- Analog velocity command with limit switches disabled
- Analog velocity command with limit switches enabled
- Analog velocity command for AXIMA 2000/4000 with limit switches enabled
- Analog torque command with limit switches disabled
- Analog torque command with limit switches enabled
- Analog torque command for Axima 2000/4000 with limit switches enabled
- Pulse-direction command with limit switches enabled

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Epsilon Eb (Base) Drives

Features

- Digital drive design
- Five modes of operation:
- 5 optically isolated inputs
- 3 optically isolated outputs
- Programmable encoder output density
- Single cable connection to AXIMA Series Multi-Axis controller
- Compact 6" (152 mm) installed depth with cables

Description

The Epsilon Series Eb (Base) Drive is a compact drive that is ideal for use with single and multi-axis controllers and PLCs. The analog torque and velocity modes can be used with classic servo controllers using analog outputs and encoder inputs. The pulse mode is ideal for use with low cost PLC stepper controllers and for upgrading stepper applications where stepping motors and drives cannot deliver the required performance. This drive works in a variety of applications where a host control provides a command signal determining the desired motion profile. The Eb Drive is configurable for five flexible modes of operation:

- Analog Velocity mode
- Analog Torque mode
- Pulse Follower
- Digital Velocity preset
- Summation of Analog Velocity plus Digital Velocity

The drive parameters for each mode can be adjusted to tailor the drive to the particular application using Windows® based PowerTools™ software.

Travel limits and stop motion inputs are fully functional in all operating modes to provide an extra measure of safety and confidence.

Programmable Resolution Encoder

The encoder output provides a convenient and accurate method of position feedback. The resolution is programmable and can be set to provide any integer resolution in 1 pulse/rev increments up to the actual motor encoder value. This allows you to optimize the feedback resolution for the particular mechanism to eliminate accumulative error with closed loop positioning systems.

Inputs

Five current sourcing compatible input lines (Active "high") are available for interfacing. Four of the input lines are user programmable and one or more of the ten input functions can be assigned to each of them. The fifth input is a dedicated Drive Enable input, which imposes hardware control over the output Power Stage to help ensure safety.

Input functions available are:

- Stop
- Reset
- Travel Limit (+)
- Travel Limit (-)
- Torque Limit Enable
- Torque Mode Enable
- Velocity Presets
- Brake Release
- Brake Control

Outputs

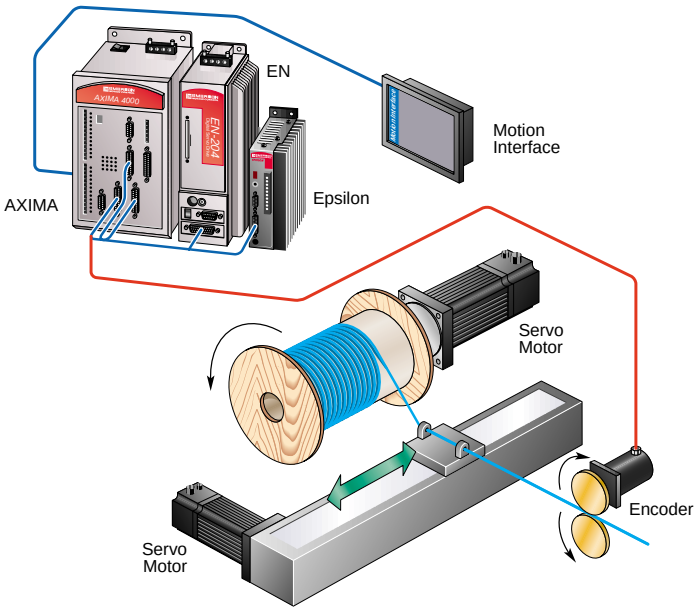
Three user programmable, current sourcing output lines (active "high") are available. Each is capable of sourcing 30 volts at up to 150 mA to easily drive relays without another interface layer. One or more of the thirteen output functions can be assigned to each output.

Output functions available are:

- Drive OK
- At Velocity
- Travel Limits (+)
- Travel Limits (-)
- Foldback Active
- In Motion (+)
- In Motion (-)
- Power Stage Active
- Torque Limit Active
- Velocity Limiting
- Fault
- Brake
- Shunt Active

analog command with encoder feedback

Analog command is a very popular choice for closed loop controllers and the Epsilon allows for both Analog Velocity and Analog Torque command methods. The 14-bit analog input delivers very high command resolution for smooth and precise control. The Programmable Analog input filter permits you to filter out unwanted system noise from the command before it causes a problem.



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Velocity Preset Mode

This mode allows the Epsilon series drive to store four user-defined velocities with accel / decel ramps which can then be selected with input lines. The velocities are programmable with resolution of 0.1 RPM and ramps from 0 to 3278.8 milliseconds per 1000 RPM.

The preset velocities can be changed with PowerTools™ setup software or with any operator interface using the Modbus protocol.

Application Examples

- Clutch-brake replacement
- Phase control with a differential
- Automatic feed control for machining operations
- Spindle speed control

Pulse Follower Mode

In the Pulse follower mode, ratios from 20 to 163,840,000 input pulses per motor revolution are easily selectable with the PowerTools™ setup software. There are 3 command choices available

- Quadrature encoder
- Pulse – Direction
- CW/CCW pulse

Any of these signals can be one of the two command signal source types:

- Differential 5 volt (RS-422)
- Single ended TTL with customer or drive supplying the pull up resistor

Application Examples

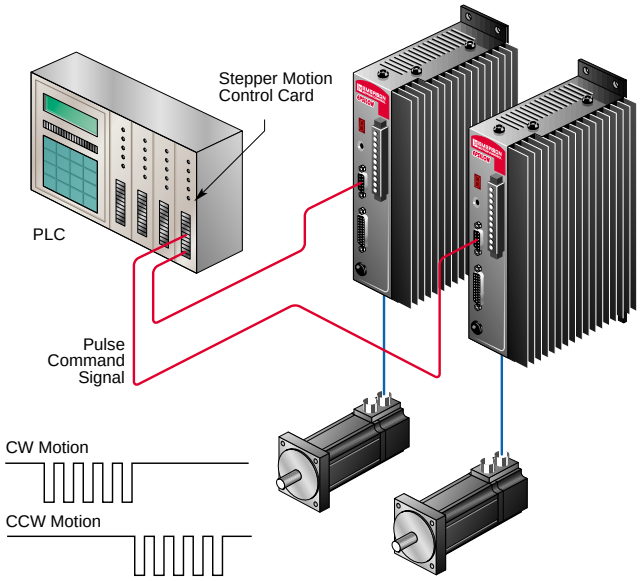
- PLC pulse command outputs
- Electronic gearing
- Stepper drive replacement
- Web line ratio control

velocity summation mode

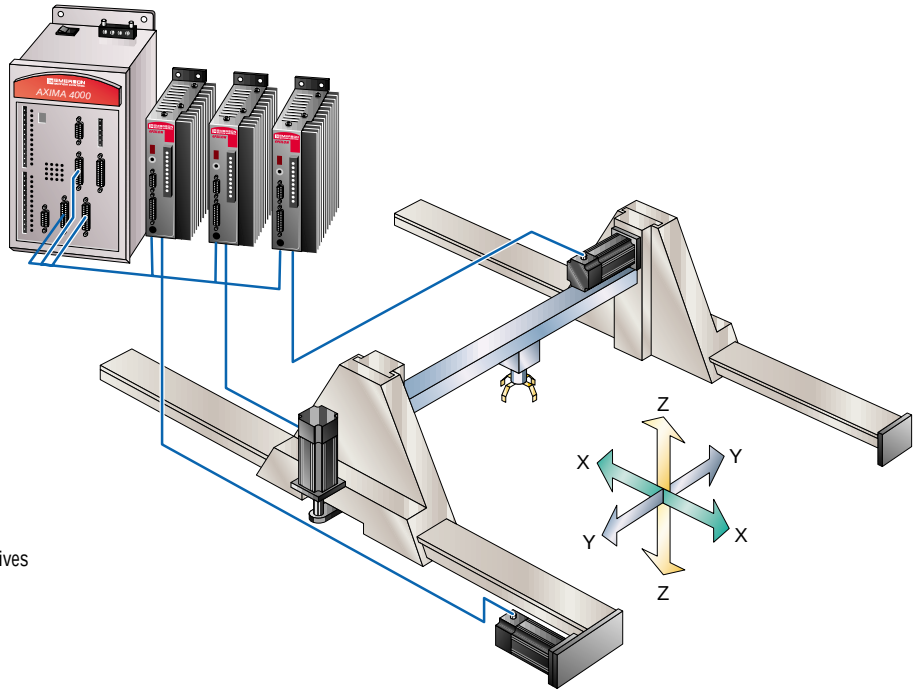
This mode combines all the features of Analog Velocity and Preset Velocity in one mode. It allows you to run at a preset velocity and trim it with an analog input or vice versa, so advanced applications can be solved simply without complex controllers.

Application Examples

- Loop/dancer arm control
- Phase advance/retard
- Speed trimming



2 axis application using pulse output from a PLC motion card to Epsilon Eb Drives



Three axis gantry pick and place system using an AXIMA 4000 Motion Controller with Epsilon Eb Drives

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Epsilon Es (speed Control) Drives

Features

- 8 Velocity presets
- 8 Torque presets
- 8 Ratio presets (late '99)
- Ratio acceleration ramps (late '99)
- Ratio plus velocity (preset or analog) summation modes
- Alternate mode selection with I/O input
- 12 general purpose inputs
- 7 general purpose outputs
- Compact 6" (152 mm) installed depth with cables

Description

The Epsilon Series Es (Speed Control) Drive offers a number of powerful features in addition to the base drive functions, while maintaining the compact Epsilon package size. These features are over and above those in the base Epsilon Eb Drive described on the preceeding pages.

Applications requiring any of the functions listed below, and others, can be easily implemented without a complex controller or a lot of programming time.

- Line shafting with "key to key" phasing and no phase loss during speed changes
- Simple phase adjustment of a follower axis with I/O or analog signals
- Acceleration ramping of the follower while the master is running

Travel limits and stop motion inputs are fully functional in all operating modes to provide an extra measure of safety and confidence.

Firmware is stored in Flash Memory so that feature updates can be accomplished in the field. The drive is configured with Emerson's powerful PowerTools™ FM Software.

Inputs

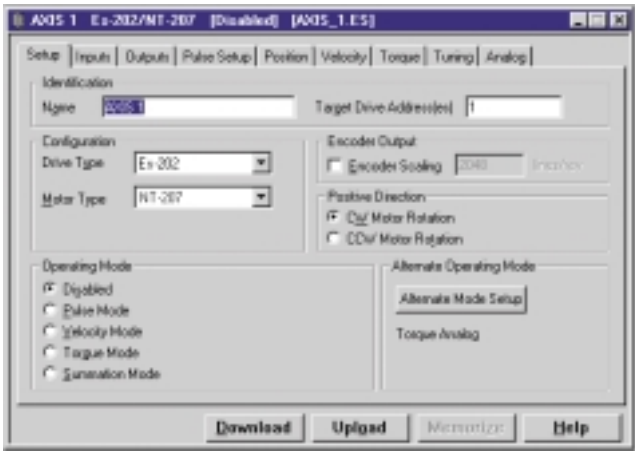
Twelve general purpose digital inputs (10-30 VDC, active-high, optically isolated) are available for interfacing. One or more of the 13 input functions can be assigned to each input. The dedicated Drive Enable input imposes hardware control over the Power Stage to help assure safety.

- Travel Limit +
- Travel Limit -
- Velocity Select 1
- Velocity Select 2
- Velocity Select 3
- Torque Limit Enable
- Torque Select 1
- Torque Select 2
- Torque Select 3
- Ratio Select 1
- Ratio Select 2
- Ratio Select 3
- Alternate Operating Mode
- Brake Control
- Brake Release
- Reset
- Stop
- Ratio Stop

Outputs

Seven general purpose digital outputs (10-30 VDC, active-high, optically isolated) are available. Each is capable of driving relays without another interface layer. One or more of the 13 output functions can be assigned to each output.

- Drive OK
- In + Motion
- In - Motion
- At Velocity
- Fault
- Travel Limit +
- Travel Limit -
- Brake
- Torque Limit Active
- Shunt Active
- Foldback Active
- Velocity Limiting Active
- Power Stage Enabled



Es setup screen using PowerTools-FM

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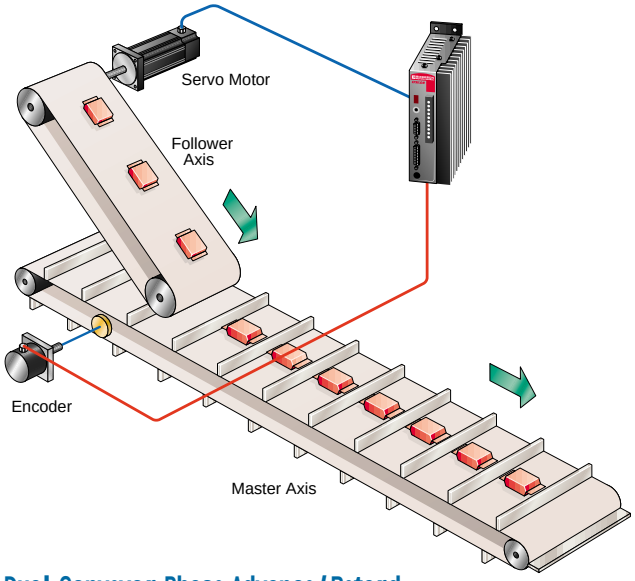
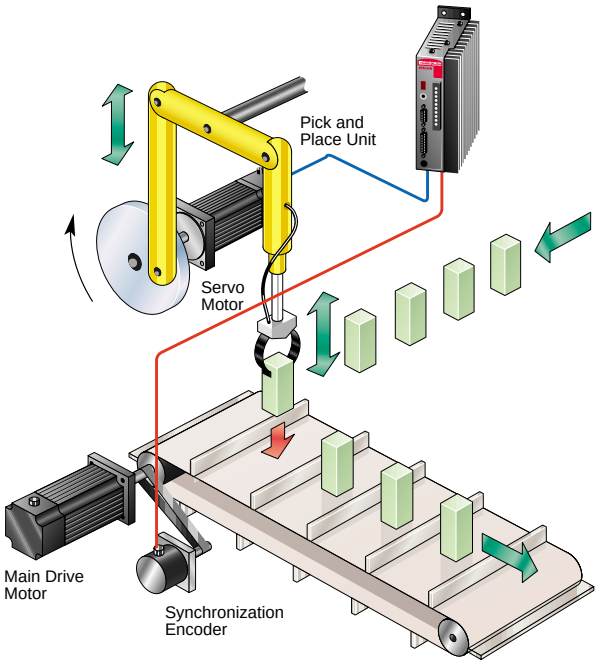


Dual Conveyor Phase Advance / Retard

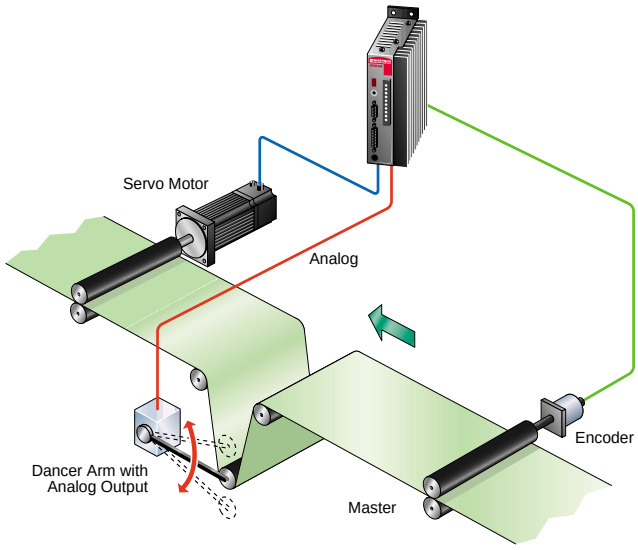
In this application, the follower always synchronizes to the master and can be phase advanced and retarded as necessary whether the master is running or not. Only a simple master to slave synchronization signal is required to lock the axes together. Two inputs on the follower control the phase advance and retard.



line shaft synchronization with phase advance / retard

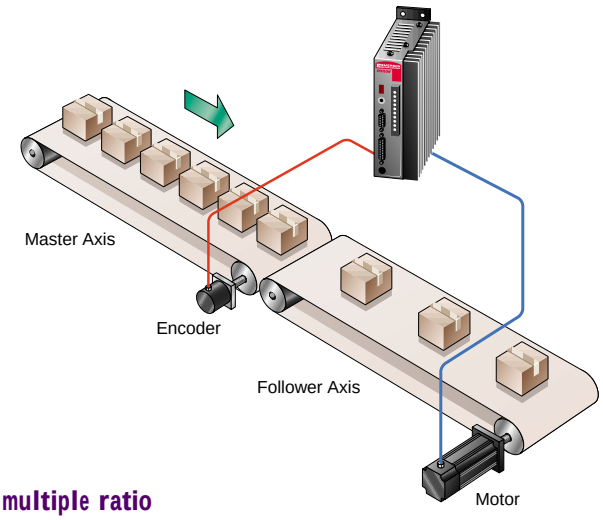
This application demonstrates the ability of the drive to change operation modes. The idea is to have the drive "Home" to a sensor stop position and wait until the master trips the "Go" flag. Once the "Go" flag is tripped, the follower accelerates to the speed of the master following a repeatable ramp.

When the follower matches the master speed, it always comes into the same phase even if the master speed varies from time to time. Input functions for phase advance and retard can be used for phase adjustment while in motion.



Dancer arm loop control

In this application, the follower is synchronized to the master and pays out material according to the master speed. If the material loop is too high or too low, the analog command will adjust the speed of the pay out to correct the loop depth.



multiple ratio

The follower is synchronized to the master and its ratio can be changed on the fly to drop product on the conveyor at different spacings.

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Epsilon Ei (indexing) Drives

Features

- 16 indexes
- Jogging
- Homing
- Fixed units include: distance (revs); velocity (RPM); accel/decel (ms/kRPM)
- Firmware is stored in flash memory and is field upgradeable through the drive's serial port
- 12 general purpose inputs
- 7 general purpose outputs
- Compact 6" (152 mm) installed depth with cables

Description

The Epsilon Series Ei (Indexing) Drive offers indexing, homing and jogging, and additional I/O in a package that is the same compact size as the base Eb Epsilon Drive. Operating information is setup via a PC. These setup parameters are easily entered and stored with the use of our feature filled Windows®-based PowerTools-FM™ software. The setup can be downloaded, stored on disk or printed out for documentation. The ease-of-use saves time and money during installation and makes long term support a breeze.

Inputs

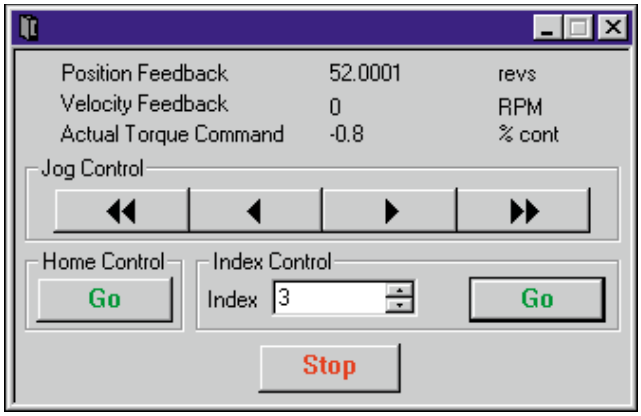
Twelve general purpose digital inputs (10-30 VDC, active-high, optically isolated) are available for interfacing. One or more of the 13 input functions can be assigned to each input. The dedicated Drive Enable input imposes hardware control over the Power Stage to help assure safety.

- Index Initiate
- Index Select 0
- Index Select 1
- Index Select 2
- Index Select 3
- Home Initiate
- Home Sensor
- Stop
- Zero Position
- Jog +
- Jog -
- Jog Fast
- Travel Limit +
- Travel Limit -
- Brake Control
- Brake Release
- Reset

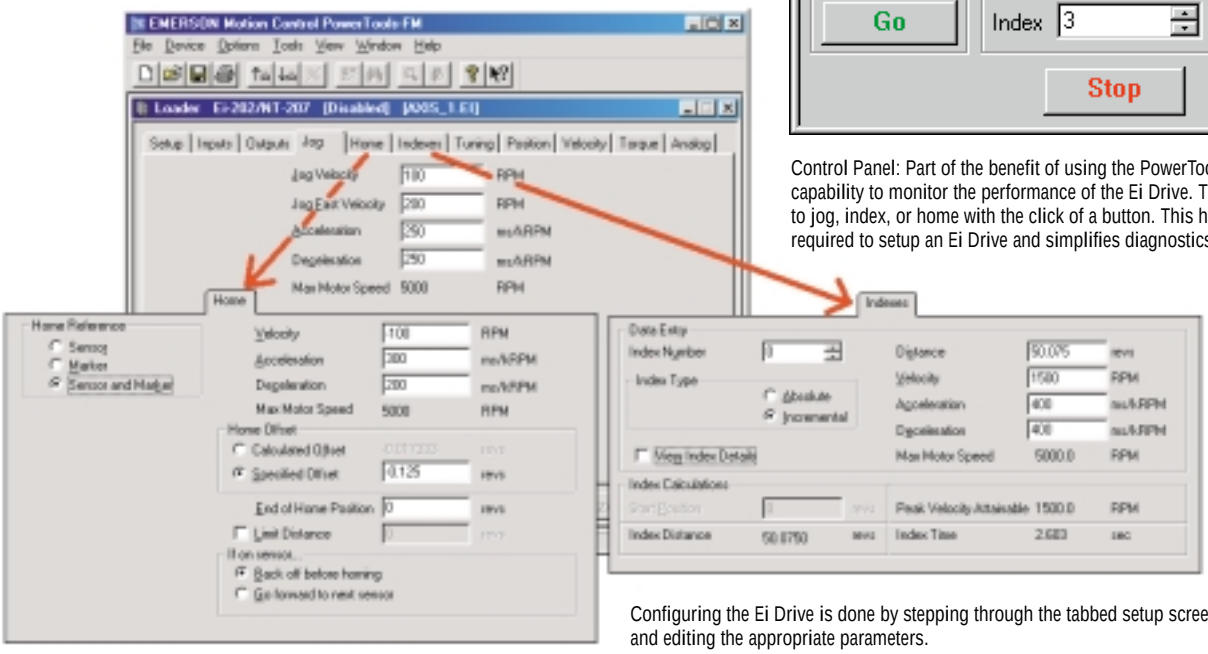
Outputs

Seven general purpose digital outputs (10-30 VDC, active-high, optically isolated) are available. Each is capable of driving relays without another interface layer. One or more of the 13 output functions can be assigned to each output.

- Absolute Position Valid
- End of Index
- End of Home
- At Velocity
- In + Motion
- In - Motion
- Drive OK
- Fault
- Brake
- Travel Limit +
- Travel Limit -
- Foldback Active
- Shunt Active
- Torque Limit Active



Control Panel: Part of the benefit of using the PowerTools – FM software is the capability to monitor the performance of the Ei Drive. This screen allows the user to jog, index, or home with the click of a button. This helps reduce the time required to setup an Ei Drive and simplifies diagnostics.



Configuring the Ei Drive is done by stepping through the tabbed setup screens and editing the appropriate parameters.

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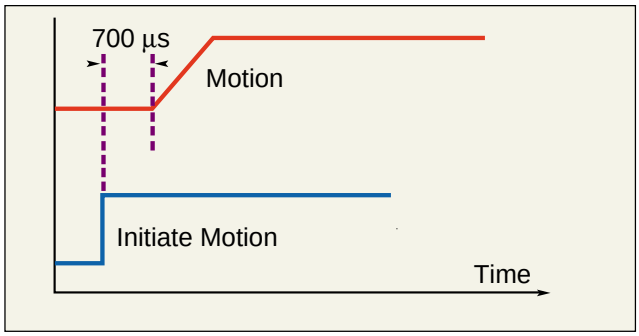
Epsilon Ei (indexing) Drives

Operating Performance

- Index initiate: 700 µsec max
- Positioning resolution: 8192 counts/rev



Jogging

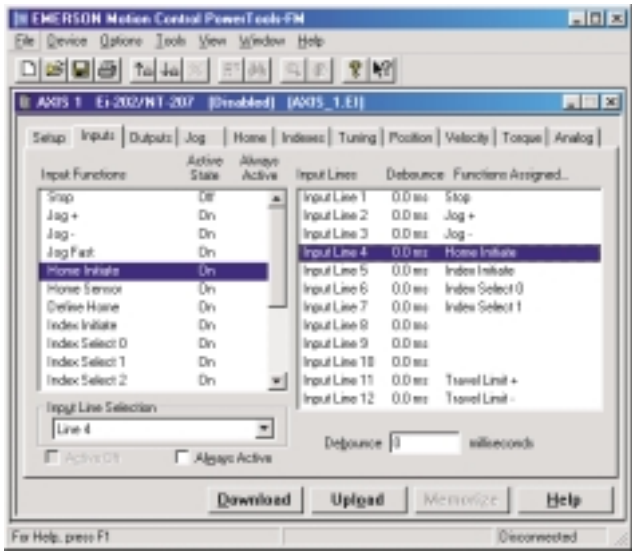
- Inputs: Jog +, Jog -, Jog Fast
- Parameters for Jog Velocity, Jog Fast Velocity, Accel and Decel

Indexing

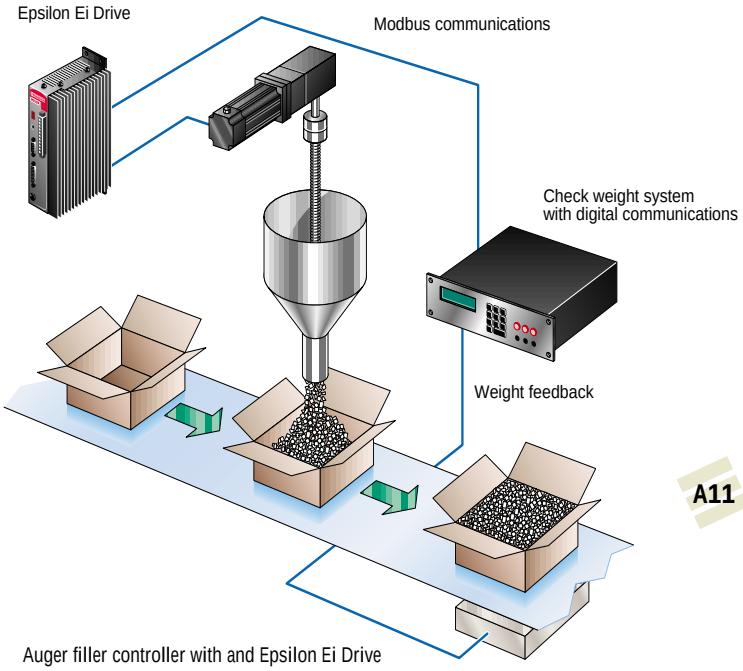
- 16 indexes
- Incremental and absolute
- Parameters for Distance, Velocity, Accel and Decel

Homing

- Sensor, Marker, Sensor & Marker
- If on home sensor, then back off before homing
- Home Offset distance relative to sensor/marker
- Parameters for Velocity, Accel, Decel, Home Offset, End-of-Home Position and Limit Distance



Input/Output Screens: To configure the 12 input and 7 output lines of the Ei Drive system, the user selects the function on the left and drags it onto the I/O line on the right. Configuring Input and Output functions can't get any easier or more flexible than that!



Auger filler controller with and Epsilon Ei Drive

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Epsilon Series Specifications

Specifications

Specifications below apply to all Epsilon Series Eb, Es and Ei units.

Combined Amplifier/Motor Specifications

Amplifier Model	Motor Model	Constant Torque lb-in (Nm)	Peak Torque lb-in (Nm)	Power HP (kW)	Inertia* lb-in-sec² (kg-cm²)	Maximum Speed RPM	Motor Weight* lb (kg)
Eb-202	NT-207	7.3 (0.82)	15.2 (1.72)	0.45 (0.34)	0.000094 (0.106)	5000	3.0 (1.36)
	NT-212	9.2 (1.04)	18.0 (2.03)	0.71 (0.53)	0.000164 (0.185)	5000	4.0 (1.81)
	MG-205	5.0 (0.56)	13.5 (1.53)	0.31 (0.23)	0.000084 (0.095)	5000	3.0 (1.36)
	MG-208	6.7 (0.76)	13.2 (1.49)	0.53 (0.40)	0.000114 (0.163)	5000	4.0 (1.81)
Eb-203	NT-212	12.5 (1.41)	27.0 (3.05)	0.80 (0.60)	0.000164 (0.185)	5000	4.0 (1.81)
	MG-205	5.0 (0.56)	15.0 (1.69)	0.31 (0.23)	0.000084 (0.095)	5000	3.0 (1.36)
	MG-208	9.1 (1.03)	20.0 (2.26)	0.58 (0.43)	0.000144 (0.163)	5000	4.0 (1.81)
	MG-316	15.8 (1.79)	31.8 (3.59)	1.00 (0.75)	0.000498 (0.562)	4000	8.3 (3.80)

*Without brake

Epsilon Series Amplifier Overview

	Units	Eb-202	Eb-203
Continuous Output Power	Watts RMS	650	1100
Continuous Output Current	Amps RMS	1.8	3.0
Maximum Output Current (2 sec)	Amps RMS	3.6	6.0
Input Line Voltage & Frequency		90 to 264 VAC; 47 to 63 Hz	
Number of AC Line Phases		1	1
Recommended Input Power Wire Gauge	AWG (mm²)	16 (1.5)	16 (1.5)
Input Line Current	Amps RMS	4	6
In-Rush Line Current	Amps/Time (@ 60 Hz)	140 / 2 ms	140 / 2 ms
Input Fusing (Low Peak Slow Blow Fuse)	Amps	6	8
Recommended Output (Motor) Wire Gauge	AWG (mm²)	18 (1.5)	18 (1.5)
Efficiency	Watts loss	7% of output power + 11 watts	

Holding Brake Specifications (Optional)

Model	Holding Torque lb-in (Nm)	Inertia lb-in-sec² (kg-cm²)	Added Weight lb (kg)	Coil Voltage VDC	Coil Current Amps	Mechanical Engagement Time (ms) Brake Holding	Mechanical Disengagement Time (ms) Brake Release
MGE - 2XXB	10 (1.1)	0.000025 (0.0282)	1.8 (0.55)	24 ±10%	0.48 ±10%	25	40
MGM/E - 3XXB	50 (5.6)	0.00015 (0.1693)	2.4 (1.1)	24 ±10%	0.52 ±10%	100	250

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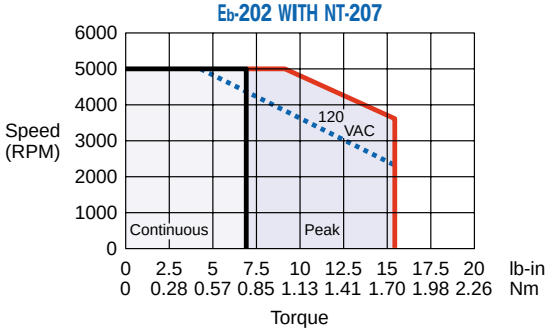
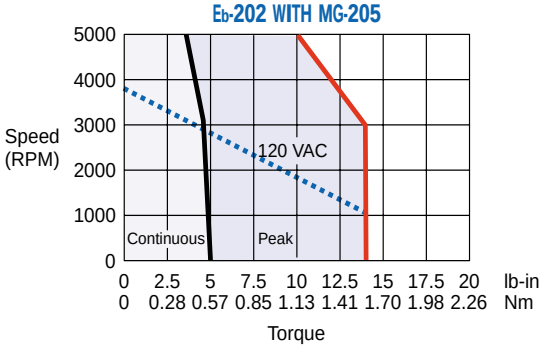
EB 202 Speed Torque Curves

Performance curves below apply to all Epsilon Series Eb, Es and Ei units. Based on 240 VAC, 25° C motor ambient, 75° C rise on motor surface, motor mounted to an aluminum plate.

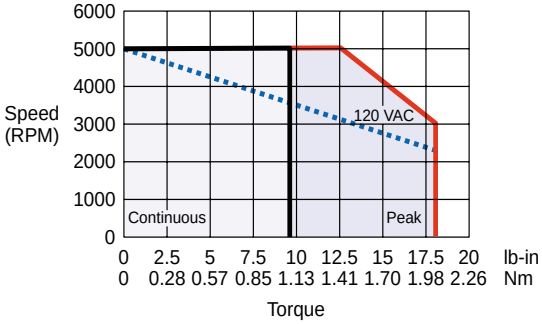
Eb-202 WITH NT-207



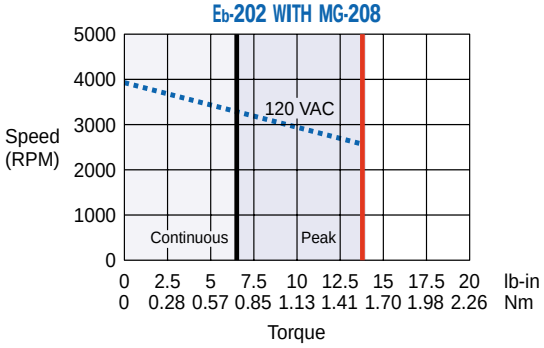
Eb-202 WITH MG-205



Eb-202 WITH NT-212



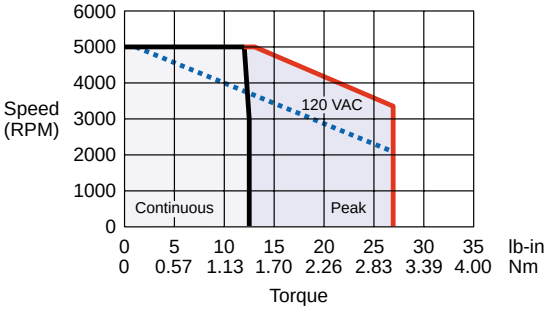
Eb-202 WITH MG-208



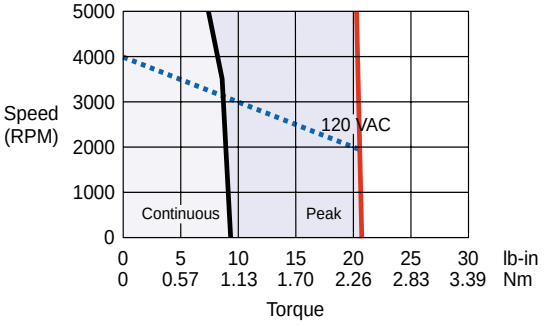
EB 203 Speed Torque Curves

Performance curves below apply to all Epsilon Series Eb, Es and Ei units.

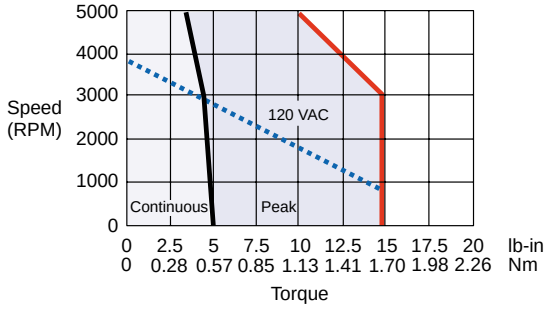
Eb-203 WITH NT-212



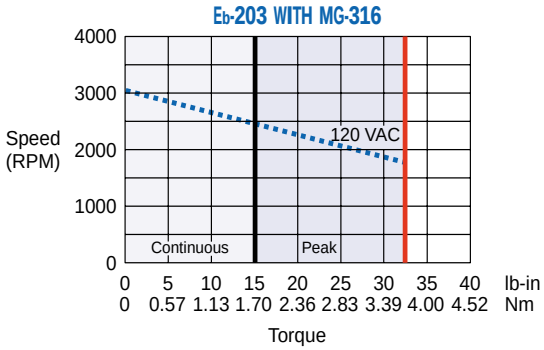
Eb-203 WITH MG-208



Eb-203 WITH MG-205



Eb-203 WITH MG-316



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Epsilon Series Specifications

Epsilon Amplifier general Specifications

AC Power

90-264 VAC 1Ø 47-63 Hz (240 VAC for rated performance)

Alternate Power Supply

For logic backup: 24 VDC, 2 amps

Power Supply Output

5 VDC 250mA maximum for master encoder usage

Efficiency

Drive: 93%

Regeneration Capacity

Internal: full speed, full torque decel with NT-212 motor and 5:1 inertial load. No internal shunt resistor.

External: Bus connection provided for external regeneration unit (EMC model RSR-2 with a 20Ω resistor) 15 ARMS capacity.

Serial Interface

RS-232 / RS-485 ModBus

Control Inputs

*Analog command: ±10 VDC 14 bit

Digital inputs: Eb = 5 inputs; Es, Ei = 13 inputs
10-30 VDC, 2.8 K ohm impedance; current sourcing signal compatible (active high); optically isolated

Control Outputs

Digital outputs: Eb = 3 outputs; Es, Ei = 7 outputs
10-30 VDC 150 mA max, current sourcing, (active high) optically isolated

Analog diagnostic outputs:
(2) ±10 VDC 10-bit, real-time, single ended, 20 mA, software selectable output signals

***Pulse Mode**

Input type: Software selectable differential (RS422) or single ended (TTL Schmitt Trigger)

Maximum Input Frequency:
Differential: 2 MHz per channel; 50% duty cycle (8 MHz count in quadrature)
Single ended: 1 MHz per channel; 50% duty cycle (4 MHz count in quadrature)

Ratio Capabilities: 20 to 163,840,000 PPR

Encoder Output Signal

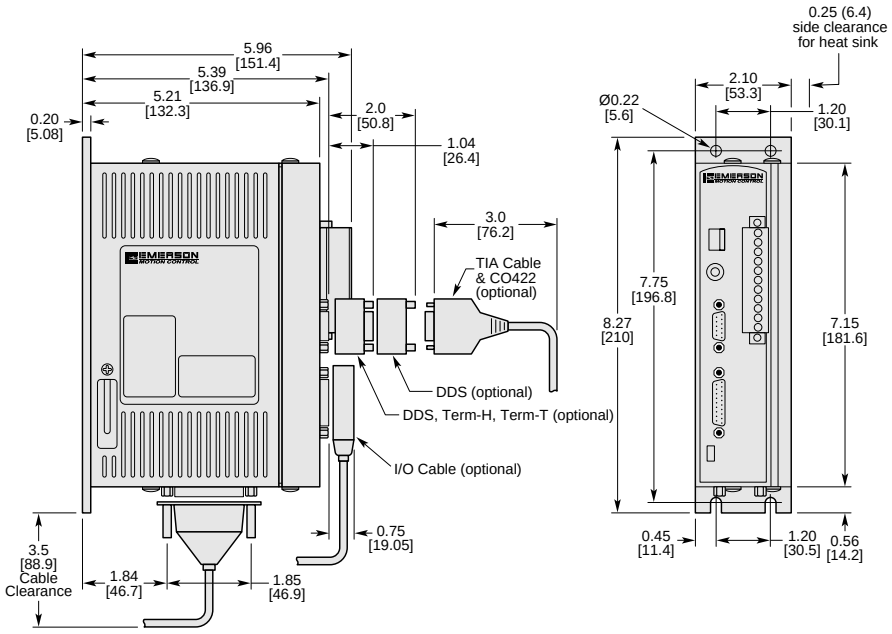
Differential line driver, RS-422 & TTL compatible

Scalable in one line increment resolution up to 2048 lines/rev of the motor (NT and MG motors)

* These functions are excluded from Ei models.

Epsilon Amplifier Dimensions

Inches [mm]



Fault Detection Capability

Low DC bus
High DC bus
Power Stage fault
Logic power
Encoder state
Encoder line break
Drive overtemperature
Motor overtemperature
Overspeed
Travel limit (+)
Travel limit (-)
Pulse mode position error
Watchdog timer
Power-up self test failure
Non-volatile memory invalid

Ingress Protection Rating

Amplifier: IP20
MG motors: IP65
NT motors: IP65/IP54
Molded motor and feedback cables: IP65

Cooling Method

Epsilon 202 and 203 (Eb, Es, Ei): Convection

Environmental

Ambient temp. range for rated output:
32° F to 104° F (0° C to 40° C)

Maximum operating temperature:
104° F to 122° F (40° C to 50° C) with power derating of 35% at 50° C

Rated altitude: 3,280 feet (1000 m)

Derating altitude: Above 3,280 ft (1000 m) reduce output by 1% per 328 ft (100 m)

Vibration: 10 - 2000 Hz at 2g

Humidity requirement: 10 - 95% Non-condensing

Storage temperature: -13° F to 167° F (-25° C to 75° C)

Standards & Agency Approvals

UL listing
Canadian UL listing
CE Mark: Low voltage directive; EMC directive

Amplifier Weight

Epsilon 202 and 203 (Eb, Es, Ei):
Bare: 3.3 lb (1.5 kg)
Shipping weight: 4.3 lb (1.95 kg)

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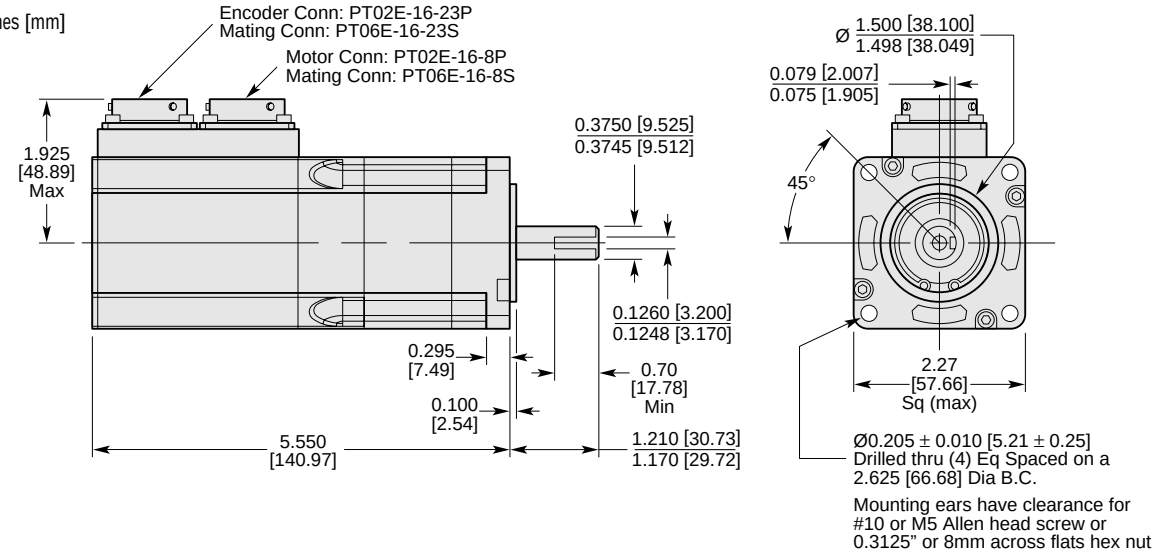
English Motors **NEMA 23 Face** **0.375 inch shaft Diameter**

IP54 without shaft seal

IP65 with shaft seal

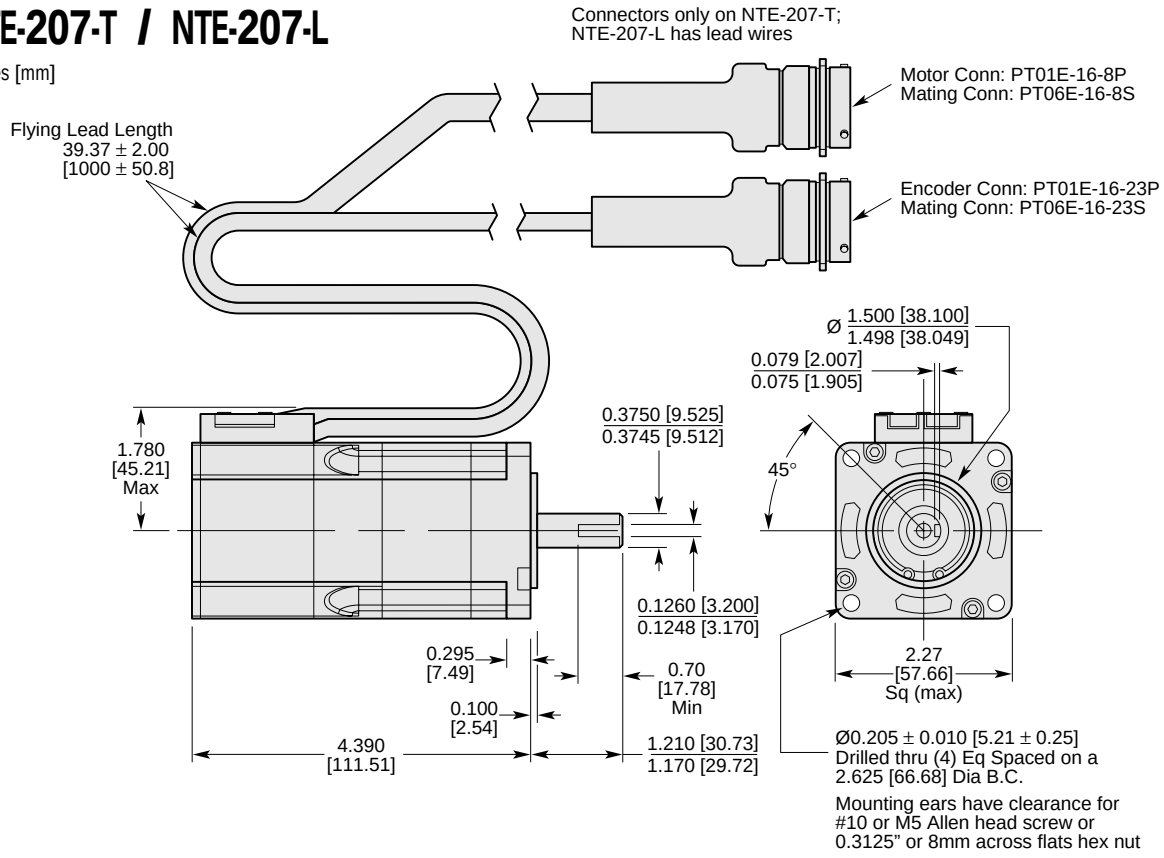
NTE-207-C

Inches [mm]



NTE-207-T / NTE-207-L

Inches [mm]



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NT Series Motor Dimensions

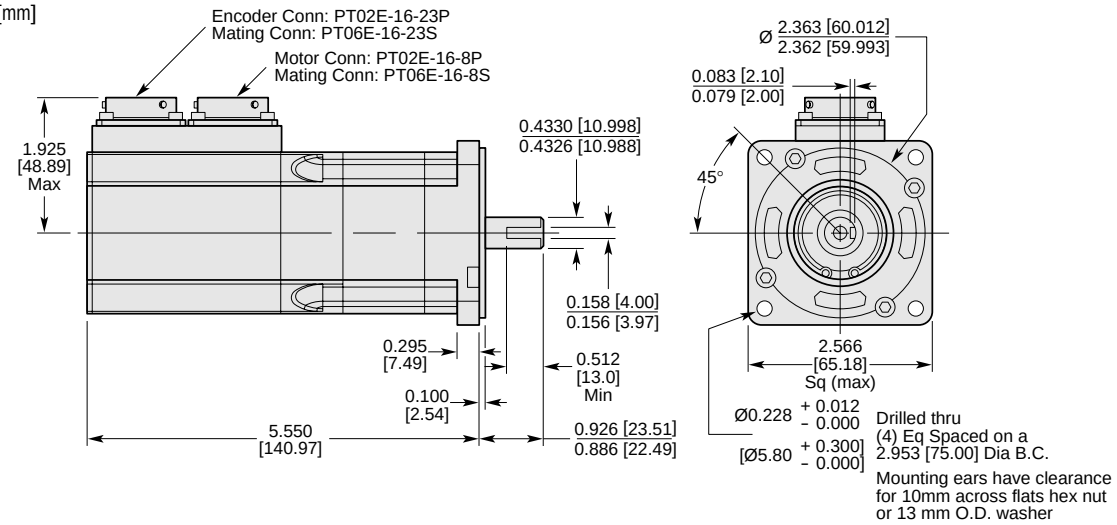
METRIC Motors

IP54 without shaft seal

IP65 with shaft seal

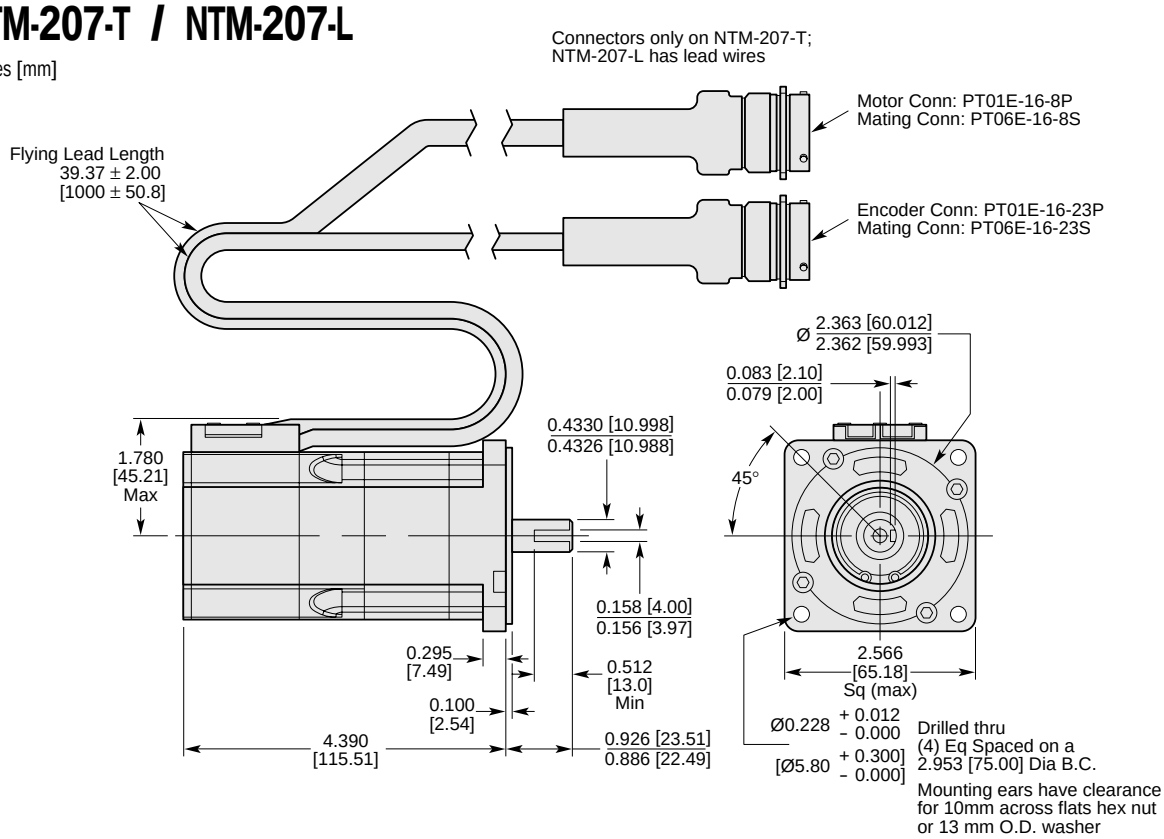
NTM-207-C

Inches [mm]



NTM-207-T / NTM-207-L

Inches [mm]



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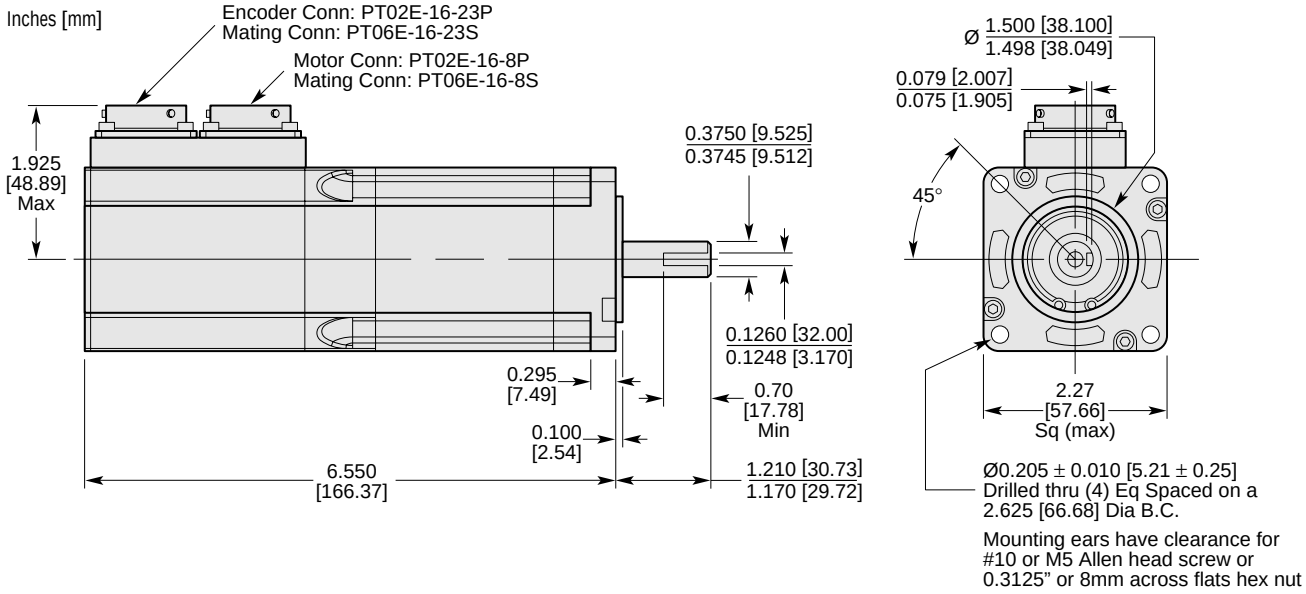
English Motors **NEMA 23 Face** **0.375 inch shaft Diameter**

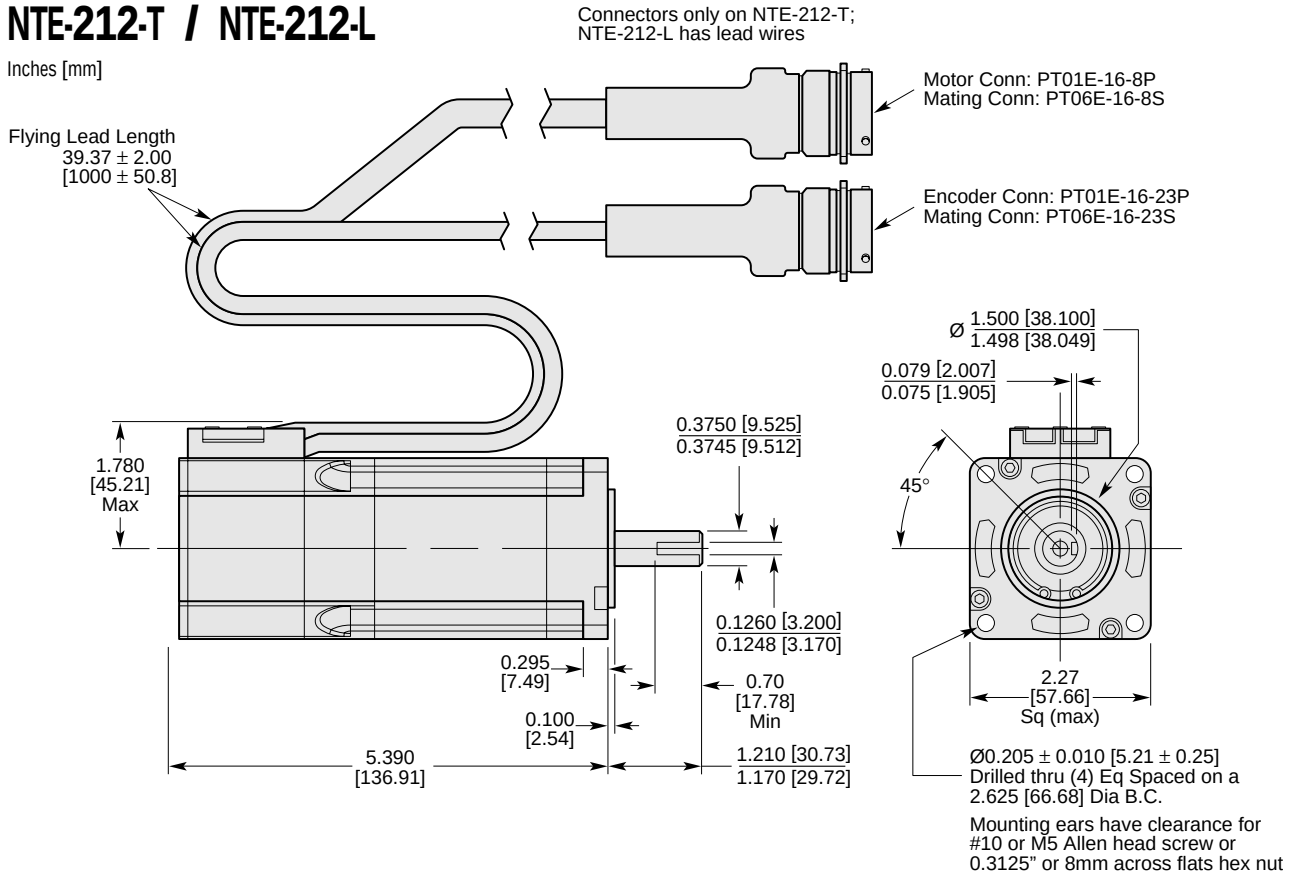
IP54 without shaft seal

IP65 with shaft seal

NTE-212-C



NTE-212-T / NTE-212-L



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NT Series Motor Dimensions

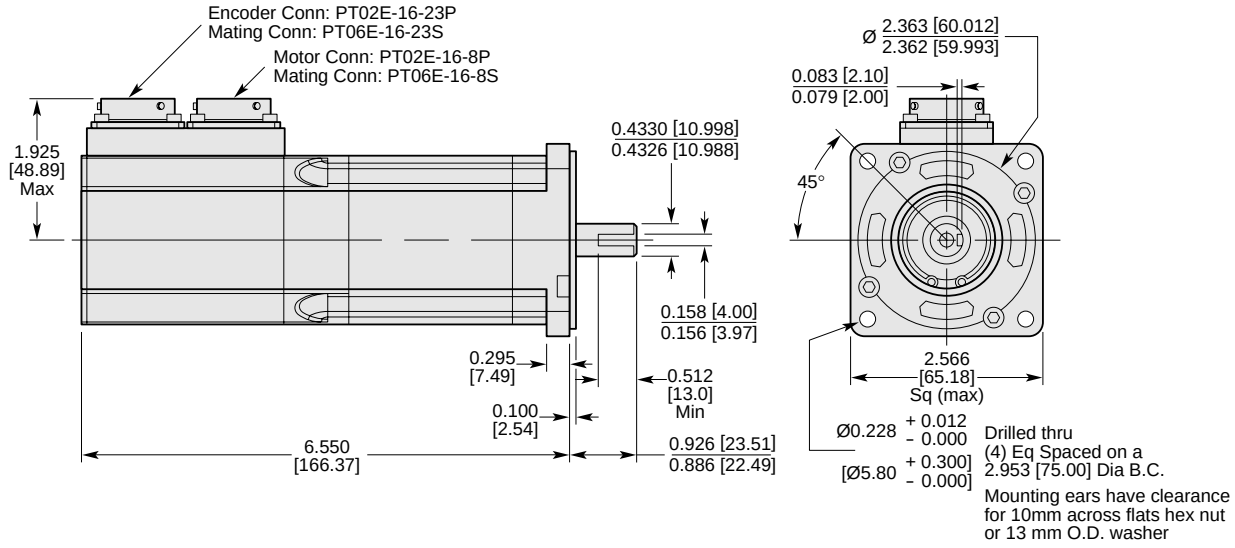
METRIC Motors

IP54 without shaft seal

IP65 with shaft seal

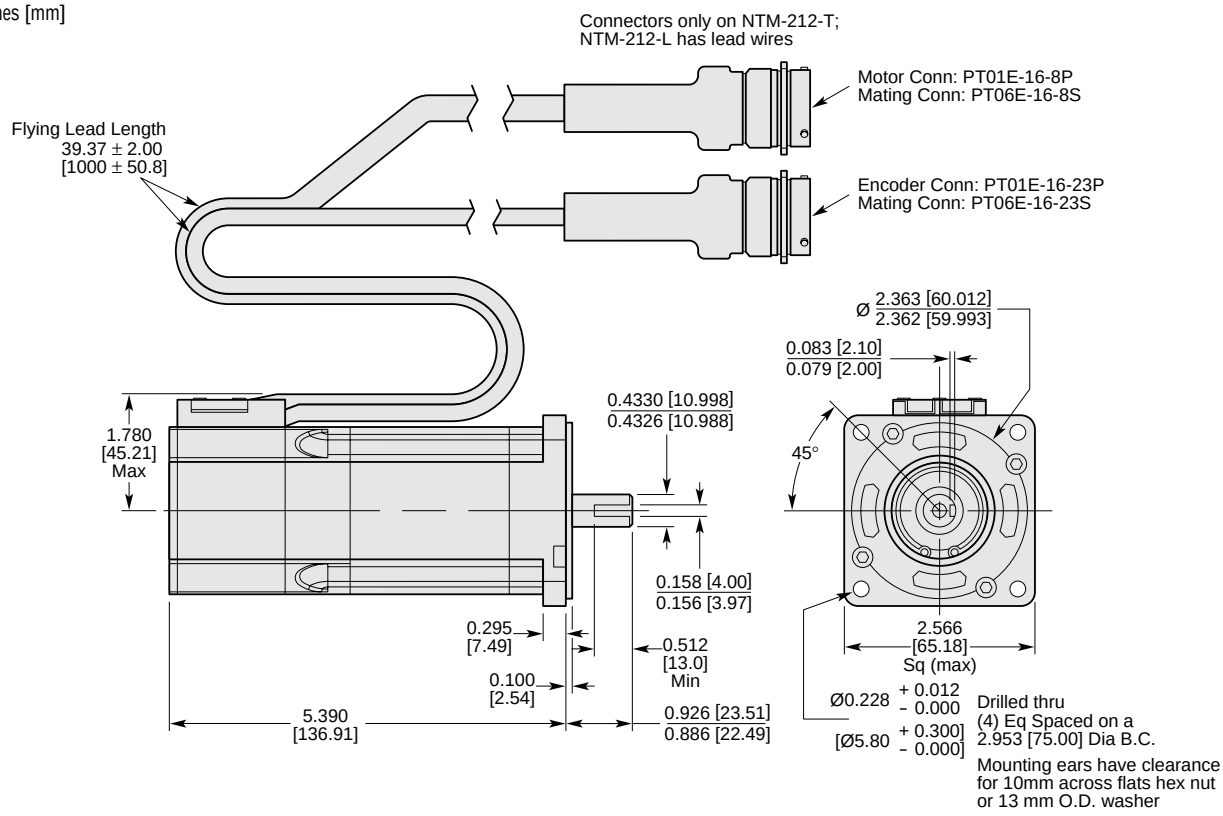
NTM-212-C

Inches [mm]



NTM-212-T / NTM-212-L

Inches [mm]



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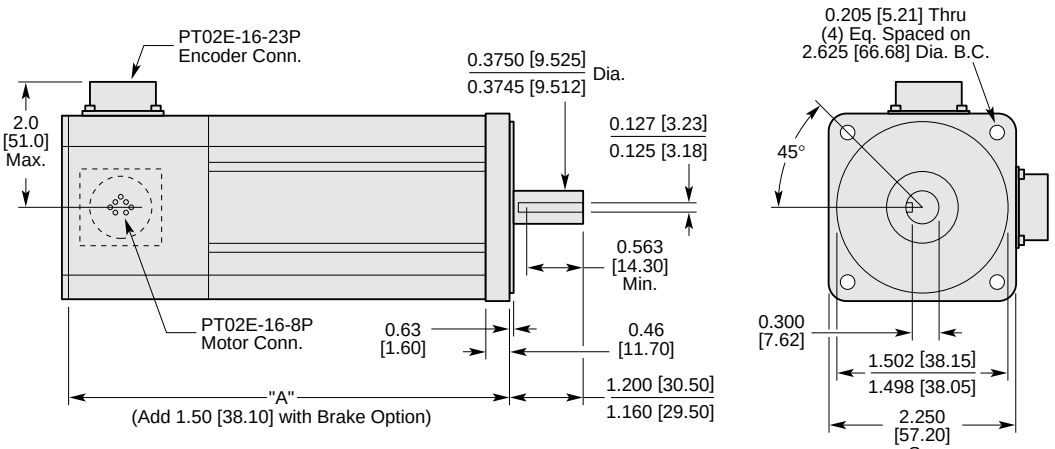
English Motor **NEMA 23 FACE** **0.375 INCH SHAFT Diameter**

IP65 with shaft seal

MGE-205 / MGE-208

Inches [mm]



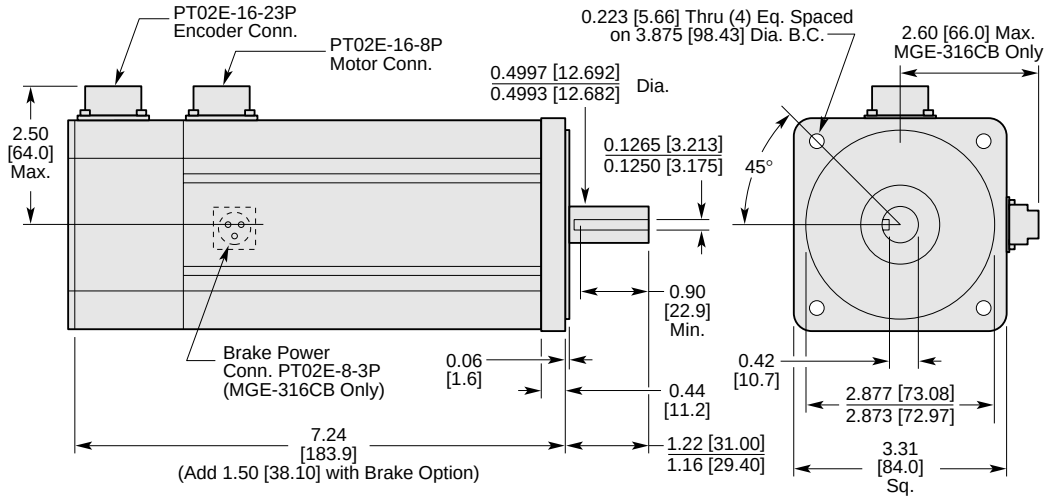
	MODEL	
	MGE-205	MGE-208
Dim "A"	5.60 [143.0]	6.75 [171.4]

English Motor **NEMA 34 FACE** **0.5 INCH SHAFT Diameter**

IP65 with shaft seal

MGE-316

Inches [mm]



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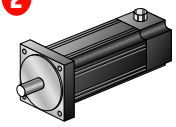
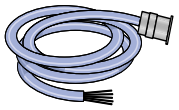
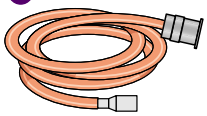
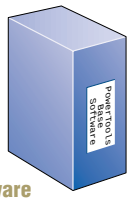
EPSILON DIGITAL SERVO DRIVE SELECTION

HOW TO ORDER

To build a complete Epsilon system, one item from each of the following five ordering columns must be selected. Note that items 2-5 require additional input as to motor type and cable lengths.The basic systems respresented on this page can be built upon with a variety of optional configurations and accessory components that are ordered separately. Descriptions of these options and accessories begin on page A21.

1	2	3	4	5
				
Epsilon Servo Drive	**NT or MG Servo Motor**	**Motor Power Cable**	**Feedback Cable**	**Software**
Eb-202 **Es-202** **Ei-202**	**NT-207** **NT-212** **MG-205** **MG-208***	**CMDS-xxx**	**CFCS-xxx** **CFCO-xxx** **CFOS-xxx**	**PTools-FM (all models)** **PTools-BASE (Eb Drives only)** **PTools-BASE-DSK (Eb Drives only)**
Eb-203 **Es-203** **Ei-203**	**NT-212** **MG-205** **MG-208*** **MG-316***	**CMDS-xxx**	**CFCS-xxx** **CFCO-xxx** **CFOS-xxx**	**PTools-FM (all models)** **PTools-BASE (Eb Drives only)** **PTools-BASE-DSK (Eb Drives only)**

* Available with integral brake. Requires CBMS brake power cable or equivalent.

2 MOTOR MODEL NUMBER GUIDE

NTE - 212-CONS-0000

Motor Series
MG or NT

Mounting Flange Type
E = English M = Metric

Frame Size
(approximate in inches)

Continuous Torque
(approximate lb-in)

Connector Type
C = MS connectors on motor
T = MS connectors on 1 meter leads
L = 1 meter leads; no connectors

Brake Option
B = with Brake 0= No Brake

Feedback Type
N = Encoder Feedback

Seal Configuration
S = Standard (MG motors include shaft seals; NT motors do not)
L = Lip seal installed (NT motors only)

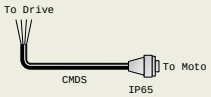
Special Options

CABLE ORDERING OPTIONS

Motor power, feedback and brake cables are fully shielded with IP65 molded connectors and are available in standard and custom lengths. Several standard lengths including 5, 15, 25, 50 and 100 feet are available from stock. (Non-standard lengths require additional lead time.) When ordering, replace xxx with specified length in feet (i.e. 005 = 5 ft). For applications involving continuous flexing, flexible cables are available. Cable components such as connector kits and raw cable are also available. See pages A24-A26 for details or consult factory for special requirements.

3 MOTOR POWER CABLES

CMDS-xxx 16 AWG for 2-3" motors; connector on motor end, ferrules on drive end

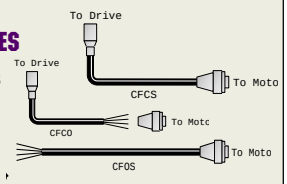


4 MOTOR FEEDBACK CABLES

CFCS-xxx Connectors on both ends

CFCO-xxx Connector on drive end

CFOS-xxx Connector on motor end



MOTOR BRAKE CABLE

CBMS-xxx Required for all motors with brake option; connector on motor end only

5 POWERTOOLS SOFTWARE OPTIONS FOR EPSILON DRIVES

PTools-BASE-DSK **PowerTools BASE (Disk Only)** Used to configure Epsilon Eb Series Drives. 3.5" diskette, serialized and registerable; no manuals included. (Available free of charge if ordered with system.)

PTools-BASE **PowerTools BASE** Used to configure Epsilon Eb Series Drives. 3.5" diskette, serialized and registerable; reference manuals for amplifier included in a bookshelf box.

PTools-FM **PowerTools-FM** Used to configure Epsilon Eb, Es and Ei Series Drives. 3.5" diskette, serialized and registerable; reference manuals for amplifier included in a bookshelf box.

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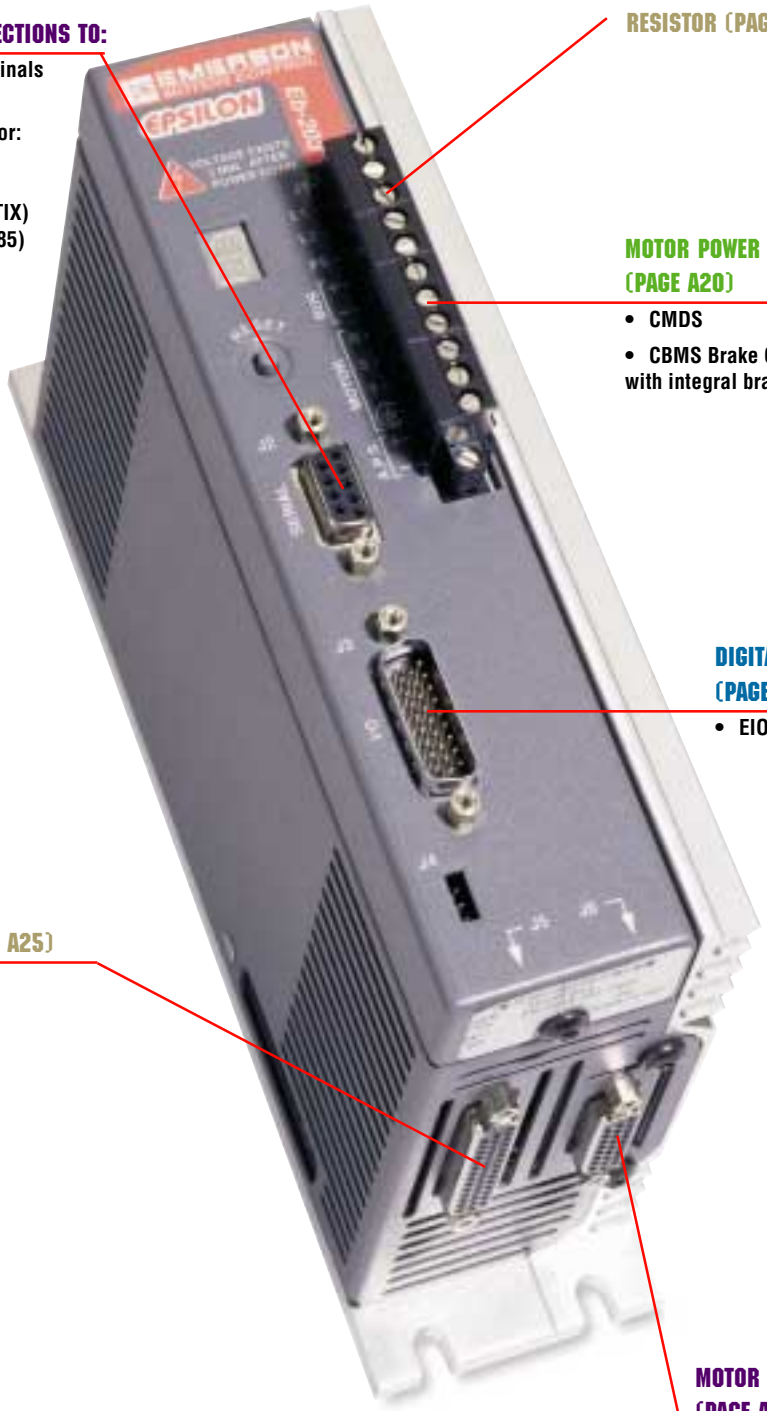
EPSILON SERIES OPTIONS AND ACCESSORIES

SERIAL INTERFACE CONNECTIONS TO:

- Operator Interface Terminals (Page A22)
- Serial Interace Cables for: (Page A25)
  - Drive-to-Drive (DDS)
  - Drive-to-PC (TIA OR TIX)
  - Drive-to-RS485 (CO485)

EXTERNAL SHUNT CONTROLLER AND RESISTOR (PAGE A23)



MOTOR POWER CABLE – REQUIRED (PAGE A20)

- CMDS
- CBMS Brake Cable (required for use with integral brake on certain motors)

DIGITAL I/O INTERFACE CABLE (PAGE A25)

- EIO

COMMAND CABLES (PAGE A25)

- AX4-CEN
- CDRO
- CMDO
- CMDX

MOTOR FEEDBACK CABLES – REQUIRED (PAGE A20)

- CFCS
- CFCO
- CFOS

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EPSILON SERIES OPTIONS AND ACCESSORIES

AXIMA SERIES MULTI-AXIS CONTROLLER

The Epsilon Series Drive is ideally suited to interface with Emerson's AXIMA Multi-Axis Controller Series. Interfacing to an AXIMA is as easy as connecting the single Emerson supplied interface cable from the AXIMA command connector to the Epsilon Series Drive command connector. Requires either an AX4-CEN or CDRO cable. (See Section E for AXIMA details.)

AX4-CEN-xxx Command cable required to connect Epsilon drive with AXIMA 2000/4000. Standard lengths of 2, 4 and 10 feet are offered, with custom lengths available on special order. See command cables on page A25 for details.

CDRO-xxx Recommended command cable for use with Axima Classic. See command cables on page A25 for details.

OPERATOR INTERFACE TERMINALS

A variety of operator interface panels can communicate with Epsilon Drives. Refer to the Options and Accessories Section F, pages F2-F9 at the back of this catalog for complete specifications.

OIT-3165 Operator Interface Panel

OIT-3165 2 line by 20 character, back lit LCD display; 24 user programmable keys with a slide-in key legend; Modbus communications; CE rated.

Motion Interface Touch Screen Panels

MI-710 7.4" gray scale; 4 shades and 4 blink

MI-730 8" dual scan color; 8 colors and 8 blink

MI-740 8" dual scan color; 256 colors with dynamic graphics

POWERTOOLS SOFTWARE OPTIONS FOR EPSILON DRIVES

PowerTools Software for Epsilon Series Drives are available in a variety of packages depending on the drive configuration

PTools-BASE-DSK **PowerTools BASE (Disk Only)** Used to configure Epsilon Eb Series Drives. 3.5" diskette, serialized and registerable; no manuals included. (Available free of charge if ordered with system.)

PTools-BASE **PowerTools BASE** Used to configure Epsilon Eb Series Drives. 3.5" diskette, serialized and registerable; reference manuals for amplifier included in a bookshelf box.

PTools-FM **PowerTools-FM** Used to configure Epsilon Eb, Es and Ei Series Drives. 3.5" diskette, serialized and registerable; reference manuals for amplifier included in a bookshelf box.

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24-hour tech support:
612/995-8033

EPSILON SERIES OPTIONS AND ACCESSORIES

MISCELLANEOUS ACCESSORIES

Epsilon Drives are available with a variety of accessory items to accommodate specific application requirements.

Modbus Communication Modules for PLCs

3100-MCM ModBus communication module for A-B PLC5 (1771 Series) Supplied by ProSoft

3150-MCM ModBus communication module for A-B SLC5 (1746 Series)

Diagnostic Cable

DGNE Diagnostic analog output connection cable provides a convenient method of connecting test equipment such as an oscilloscope to the diagnostic analog outputs on the Epsilon Drive.

External Shunt Control and Resistors

RSR-2 2kW regeneration shunt regulator. One RSR-2 with an appropriately sized shunt resistor can increase the regeneration capacity of a drive up to 2kW. Multiple RSR-2s can be "stacked" for additional capacity.

Resistors include open vented enclosure and overtemperature switch. See Options and Accessories Section F, Page F40-F41 for further specifications.

ES-20-500 20 , 0.5kW (14"w x 7"h x 5"d)

ES-20-1K 20 , 1kW (14"w x 13"h x 5"d)

ES-20-2K 20 , 2kW (21"w x 13"h x 5"d)

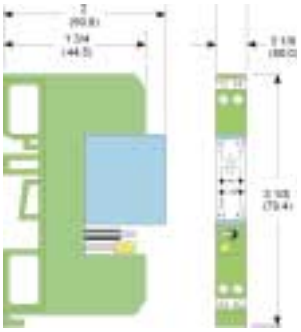
AC Line Filters

Required for CE installations. See Options and Accessories Section F, Page F42 for further specifications.

960307-01 For all Epsilon models, 240 VAC 1Ø, 10 A

Brake Relay Module

BRM-1 Interfaces the drive I/O outputs to the motor brake. This is a mechanical relay with a flyback diode and screw terminals with provisions for DIN rail mounting. 24 V coil with internal flyback diode, 1 N.O. contact, 6 amp rating.



Encoders for Master Synchronization Feedback - Line Driver

(See Options and Accessories Section, pages F38-F39 for complete specifications on SCSLD encoders.)

SCSLD-2 1000 line (4000 counts/ rev)

SCSLD-2R 1000 line (4000 counts/ rev) w/right angle connection

SCSLD-3 2500 line (10000 counts/ rev)

SCSLD-3R 2500 line (10000 counts/ rev) w/right angle connection

SCSLD-4 3000 line (12000 counts/ rev)

SCSLD-4R 3000 line (12000 counts/ rev) w/right angle connection

Encoder Cable to Epsilon Drive

ENCO-xxx Available in standard lengths of 15 ft (015); 25 ft (025); and 50 ft (050). Use with ECI-44. Non-standard lengths can be special ordered from the factory. See Options and Accessories Section F, pages F38-39.

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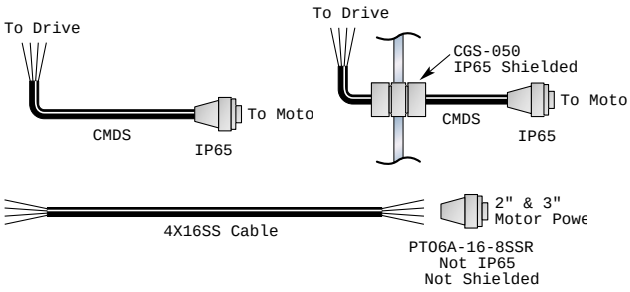
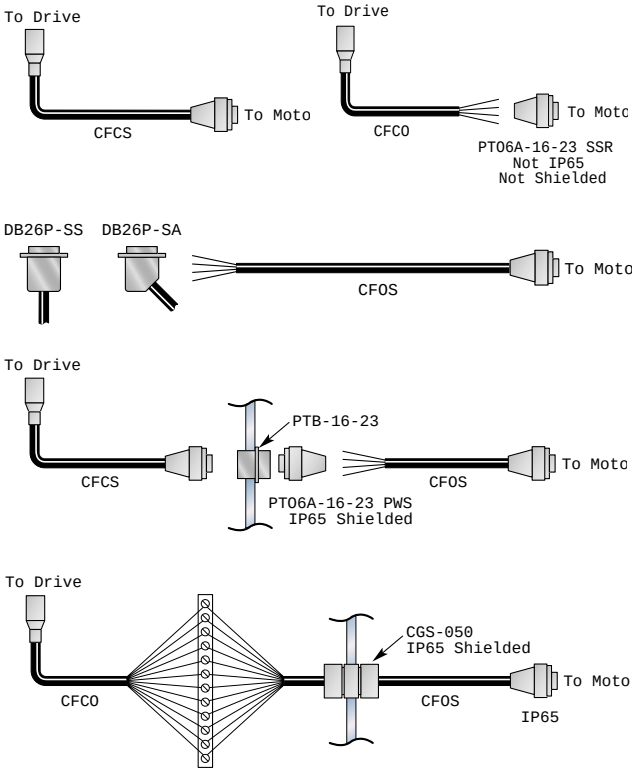
STANDARD DUTY CABLES AND CONNECTIONS

A variety of cable and connection options are available to configure your Epsilon Drive and motor to your specific installation requirements.

MOTOR POWER CABLES AND CONNECTORS



MOTOR FEEDBACK CABLES AND CONNECTORS



BULK CABLE

Twenty feet minimum order on all bulk cable.

4X16SS Motor power cable for NT and MG 2" and 3" motors; 4 wire, 16 AWG w/ shield; 0.380" (9.7 mm) diameter

MGFS-xxx Motor feedback cable for NT and MG motors; 8 pair w/shield; 0.390" (9.9 mm) diameter; 26 GA, low capacitance signal wires 18 GA encoder power

13PX26SS-xxx Command cable 13 pair,; 26 AWG w/shield; 0.380" (9.7 mm) diameter for use on CDRO cable

18PX26SS-xxx Command cable 18 pair,; 26 AWG w/shield; 0.410" (10.4 mm) diameter for use on CMDX and CMDO cable

CABLE CONNECTOR KITS

DB44P-SA For Epsilon command cable; DB 44 pin male; 45° cable outlet; metallized plastic backshell. 0.490" (11.5 mm) max cable diameter

DB26P-SS For Epsilon feedback cable; DB 26 pin male; straight cable outlet; metallized plastic backshell. 0.330" (8.4 mm) max cable diameter

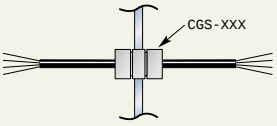
DB26P-SA For Epsilon feedback cable; DB 26 pin male; 45° cable outlet; metallized plastic backshell. 0.330" (8.4 mm) max cable diameter

DB9P-SS For Epsilon serial cable; DB 9 pin male; straight cable outlet; metallized plastic backshell. 0.330" (8.4 mm) max cable diameter

DB9P-SA For Epsilon serial cable; DB 9 pin male; 45° cable outlet; metallized plastic backshell. 0.330" (8.4 mm) max cable diameter

CGS THROUGH-WALL CABLE GROMMET SIZING

CGS-xxx IP65 shielded grommet provides through-wall connection for a variety of power and feedback cables.



CGS-038 0.25 -0.375 ID for use with ENCO-xxx master encoder cable.

CGS-050 0.375-0.50 ID for use with:

4x16SS	CMDS	MGFS
4x12SS	CMMS	CDRO
4x16SF	CMDF	CFCO
13PX26SS	CMDO	CFOS
18PX26SS	CMDX	

CGS-063 0.50-0.625 ID for use with:

MGFF	CFCF	CFOF

CGS-075 0.625-0.75 ID for use with: 4x12SF CMMF

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STANDARD DUTY CABLES AND CONNECTIONS

SERIAL INTERFACE CABLES

TIA-xxx

RS232 serial interface cable; DB9-S (AT type) straight molded connector on computer end; DB9-P straight molded connector on drive end. Black PVC outer jacket. Standard length of 10, 25 and 50 feet available. Order Number TIA-010 for 10 ft; TIA-025 for 25 ft; or TIA-050 for 50 ft.

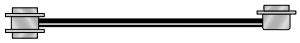
TIX-xxx

RS232 serial interface cable; DB9-P straight, assembled connector on drive end and DB25-S (XT type) straight, assemble on other. Gray PVC outer jacket. Standard length of 10, 25 and 50 feet available. Order Number TIX-010 for 10 ft; TIX-025 for 25 ft; or TIX-050 for 50 ft.

CO485-xxx

RS485 serial interface cable; DB9-P straight, molded connector on drive end and flying leads on computer end. Black PVC outer jacket. Standard length of 10, 25 and 50 feet available. Order Number CO485-010 for 10 ft; CO485-025 for 25 ft; or CO485-050 for 50 ft.

DDS-xxx



Standard multi-drop drive to drive serial interface cable. Standard lengths of 1, 5, 10 and 20 feet available, with custom lengths available on special order. Use with TERM-H and TERM-T termination plugs at both ends if total multi-drop serial cable length is greater than 50 feet. Order Number DDS-001 for 1 ft; DDS-05 for 5 ft; DDS-10 for 10 ft; or DDS-020 for 20 ft.

TERM-H Terminator block for head of serial string

TERM-T Terminator block for tail of serial string

COMMAND CABLES

AX4-CEN-xxx

Command cable required to connect Epsilon drive with AXIMA 2000/4000. Standard lengths of 2, 4 and 10 feet are offered, with custom lengths available on special order. Order Number AX4-CEN-002 for 2 ft; AX4-CEN-004 for 4 ft. or AX4-CEN-010 for 10 ft.

CDRO-xxx

Command cable to position controller; 13 pair; 45° angle connector at drive (DB44); pigtails on other end for screw terminals. Standard lengths of 5, 10 and 15 feet are offered, with custom lengths available on special order. Recommended cable for use with AXIMA Classic and other position controllers.Order Number CDRO-005 for 5 ft; CDRO-010 for 10 ft; or CDRO-015 for 15 ft.

CMDO-xxx

Command cable; 18 pair; DB44M straight connector on drive end; pigtails on other end for screw terminals. Standard lengths of 3, 5 and 15 feet are offered, with custom lengths available on special order. Order Number CMDO-003 for 3 ft; CMDO-005 for 5 ft; or CMDO-015 for 15 ft.

CMDX-xxx

Command cable; 18 pair; DB44M straight connectors on both ends. Used in conjuction with ECI-44 screw terminal interface (see ECI-44 description, above right). Standard lengths of 3, 5 and 15 feet are offered, with custom lengths available on special order. Order Number CMDX-003 for 3 ft; CMDX-005 for 5 ft; or CMDX-015 for 15 ft.

DIGITAL I/O INTERFACE CABLE

EIO-xxx

I/O interface cable provides access to all digital I/O points while maintaining 6" drive installation depth.; 18 pair; DB44M straight connector on drive end; pigtails on other end for screw terminals. Standard lengths of 3, 5 and 15 feet are offered, with custom lengths available on special order. Order Number EIO-003 for 3 ft; EIO-005 for 5 ft; or EIO-015 for 15 ft.

TERMINAL STRIP

ECI-44

External connection interface terminal strip; provides a convenient field wiring screw terminal strip for all connections available on the Epsilon command connector. Requires a CMDX-xxx cable (see description, below left) to connect to the drive. Includes labeled terminals and provisions for DIN rail mounting.

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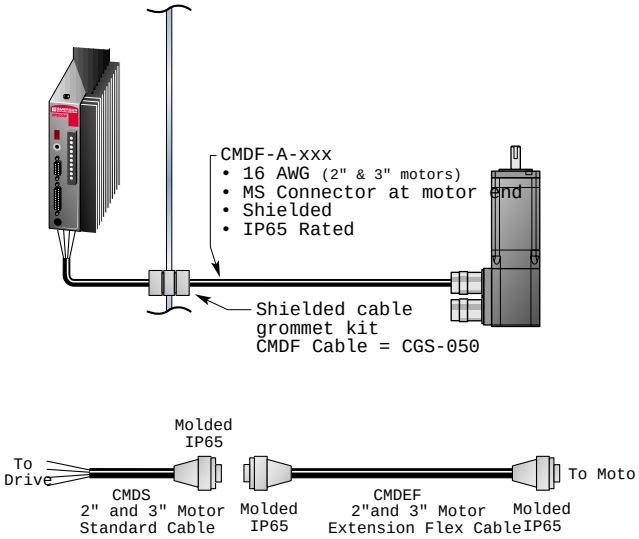
FLEXIBLE DUTY CABLES AND CONNECTIONS

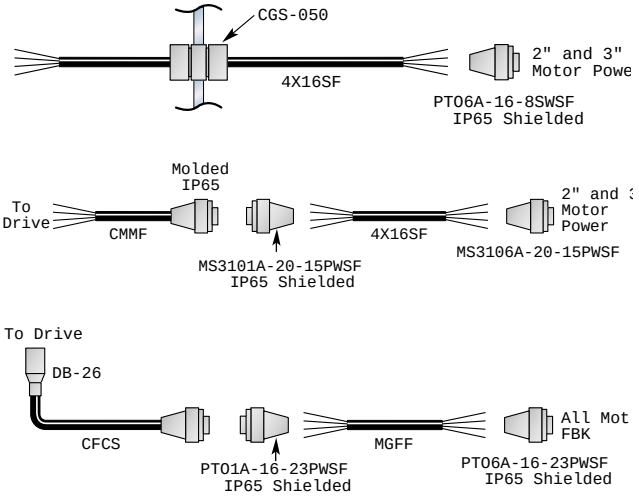
For Epsilon Drive applications involving continuous flexing, a variety of flexible cable configurations are available.

FLEX MOTOR POWER CABLES

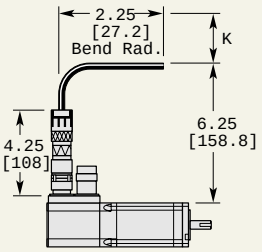
CMDF-A-xxx For 2" and 3" motors; circular connector at motor end only 0.430" (11 mm) diameter



FLEX MOTOR CABLE AND CONNECTOR KITS



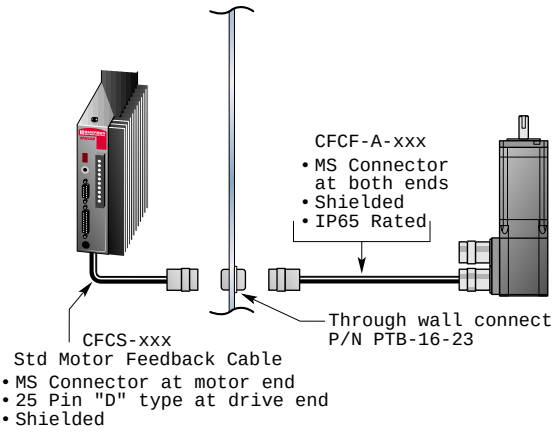
MOTOR FLEX CABLE CONNECTOR CLEARANCES

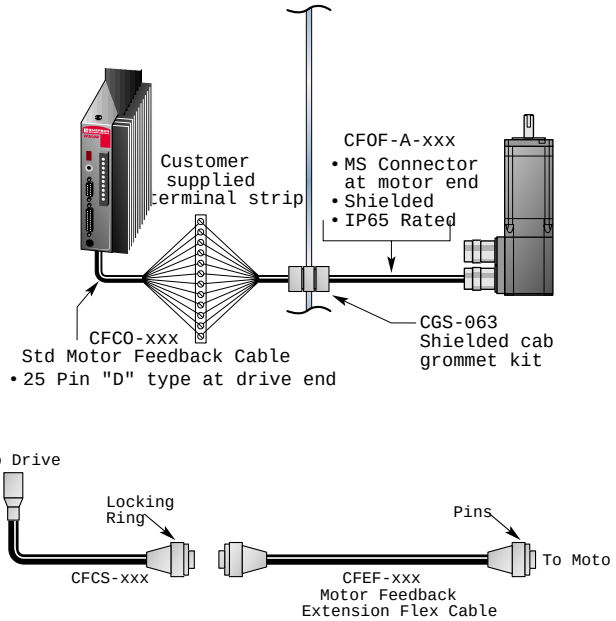


Unplugging Clearance

Motor Size	K	
	Power	FBK
2" and 3"	0.4 [10.2]	0.4 [10.2]

FLEX MOTOR FEEDBACK CABLES





FLEXIBLE DUTY BULK CABLE

Twenty feet minimum order.

4X16SF-xxx Flexible duty motor power cable for NT and MG 2" and 3" motors; 4 wire, 16 AWG w/shield; 0.430" (11 mm) diameter

MGFF-xxx Flexible duty motor feedback cable for MG motors; 8 pair w/shield; 0.590" (15 mm) diameter

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