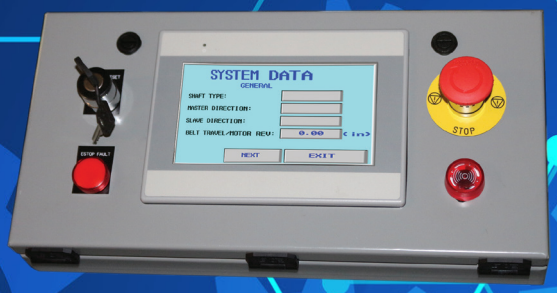
PRODUCT LINE

Dual Axis Back-Folding Control System

Industrial Indexing Systems, Inc

Air-conditioned control system cabinet with a removable HMI operator station can be mounted in a position convenient for operator access.



Introduction ~ IIS is introducing a servo controlled upgrade package for a popular back-folding conversion system used to accurately form, fold and glue the flaps on the back end of cardboard sheets used in the box making process. The system will accommodate different size flaps and box widths using simple set-up recipes when configuring the back end folding phase of the box making process.

Precision indexing motion accurately moves a set of folding fingers that bend a flap to its proper length as the cardboard sheet travels in the forward direction. Folding fingers rotate at the proper rate of speed to assure the flap is accurately formed in the smallest time possible and moved out of the way in time to repeat the process for the next cardboard sheet.

Built-in flexibility using a variety of set-up configuration screens provides the operator the ability to adapt the system for different product sizes and folding variations. In-bound and out-bound points of contact are selected based on the desired flap length. The finger size and the number of fingers used for folding are part of the recipe setup allowing the recall of optimum folding cycle rates. Either the in-board or the out-bound servomotor can be enabled or disabled at the operator station.

Performance through state-of-the-art servomotor and servo drive controls provide the speed and agility to accomplish quality production goals. Two IIS Emerald servomotors connected to two IIS ESD servo drives, a master encoder and two high speed photo edge detectors are all coordinated by the Emerald Programmable Automation Controller over the hi-speed Sercos automation bus.

Modernizing with upgraded automation components advanced software techniques provides durable system designed to endure the industrial environment. For added longevity the air conditioning unit brings added assurance in minimizing failure due to overheating the internal electronic components.

Easy setup sequences, presented by the touchscreen HMI operator interface, provide quick changeovers and adjustments for fine tuning the back-folding process. Diagnostic screens and status messages, that alert the operator, minimize loss of production.

Call us today at (585) 924-9181 to discuss our product line in greater detail

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Steps in the back-fold cycle outlined:

(See figure 3 on page 3)

1) Based on the FLAP SIZE that was entered during setup, the system calculates a contact point on the sheet. The CONTACT POINT is calculated differently for each BACK FOLDING axis. This dimension, along with the configurable PHOTOCELL OFFSET DISTANCE, will create a value that will initiate the BACK FOLD sequence.

2) A folding recipe is selected by the operator that specifies the FINGER TYPE and number of FINGERS that are attached to the shaft. The type of FINGER sets the HOME position of the axis. A longer FINGER would park closer to the PAPER LINE than a shorter FINGER for a particular HOME position. The motion profile for the fingers is optimized for the number of fingers that are attached to the shaft by digtally compensating for an increase in weight added to or subtracted from the rotating shaft.

3) The FOLDER-GLUER is running and the Feed is enabled. As the trailing edge of a BLANK passes over the first photocell, the system will initiate an encoder count cycle that will track the BLANK to its target position. When the BLANK reaches its target position the servo axis will begin to accelerate the FINGER forming the flap on the BLANK. **[Step A]**

4) The servo axis will continue to accelerate until it achieves its velocity set point. As the axis accelerates, the BACK FOLDING FINGER will strike the flap at the CONTACT POINT. The FINGERS will continue to accelerate, pushing the flap onto the body of the tray. **[Step B]**

5) As the axis approaches TOP DEAD CENTER, it will begin to decelerate to a stop. TOP DEAD CENTER is the point in the fold cycle where the servo motion stops. The flap of the tray is folded over the body of the tray and is captured by the BACK FOLDING FINGERS. The horizontal portion of the FINGER, that has captured the folded flap, is parallel to the PAPER LINE. **[Step C]** The vertical portion of the FINGER is perpendicular to the folded edge and will be a distance from the folded edge equal to END CLEARANCE.

6) The servo axis waits at TOP DEAD CENTER until the captured folded flap moves outside of the radius of motion of the BACK FOLDING FINGERS. This is the dwell time of the BACK FOLD cycle. It is computed by subtracting the END CLEARANCE dimension, that is part of the recipe setup, from the length of the FINGER. The dwell distance varies based on finger length.

Figure 2 Picture showing one finger set on one axis of a typical machine. Fingers are adjustable along the axis. The servomotor that drives this axis is not shown.

7) The master encoder counts down the dwell distance and then the servo axis accelerates until the BACK FOLDING FINGERS reach their PARK position. This acceleration-deceleration profile allows the BACK FOLDING FINGERS to get below the PAPER LINE as quickly as possible in order to not interfere with the next BLANK in-line and to be in a position to initiate the next fold sequence if required. To prevent damage to the next BLANK to be folded the move from TOP DEAD CENTER to the PARK position must be performed so that the backlash or wind-up component of the servo axis does not force the FINGERS to cross the PAPER LINE. **[Step D]** Each axis has two PARK positions each 180 degrees apart from the other. Each FINGER TYPE has a unique PARK position due to variations in FINGER length.

8) If another BLANK passes the photocell gets to the target position before the fingers can stop at the PARK position, its motion will continue to properly fold this BLANK. The system has the capability of responding to the next BLANK to be folded while it is completing the fold profile on the previous BLANK.

9) The operation of the second BACK FOLDING axis is the same as the above described sequence. The second BACK FOLDING axis is physically mounted approximately eight feet downstream of the first axis. Each axis of the two axis BACK FOLDING SYSTEM operates in real-time independent of one the other.

Steps in the back-fold cycle illustrated:

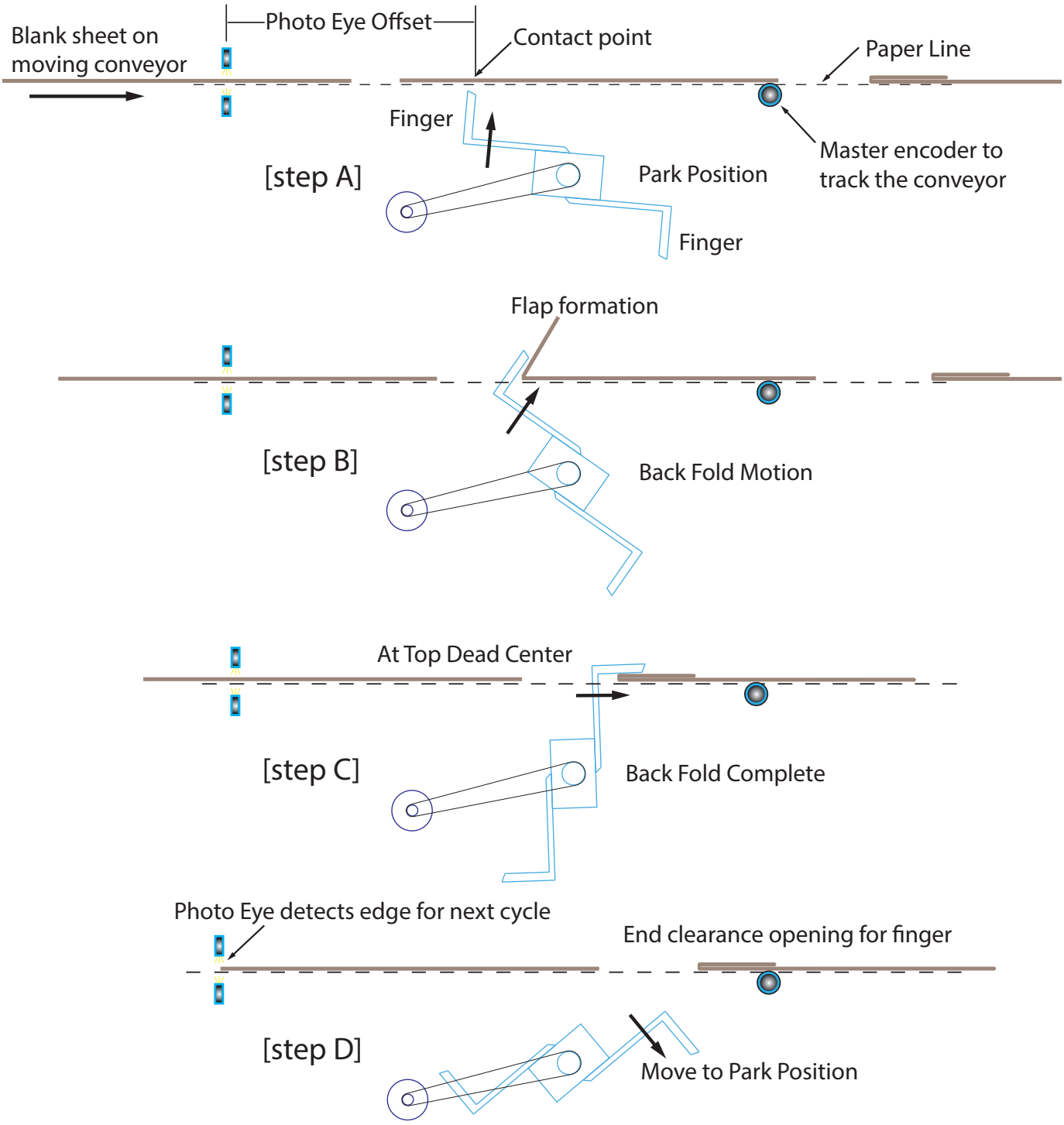


Figure 3 Flap folding process shown for steps A through D.

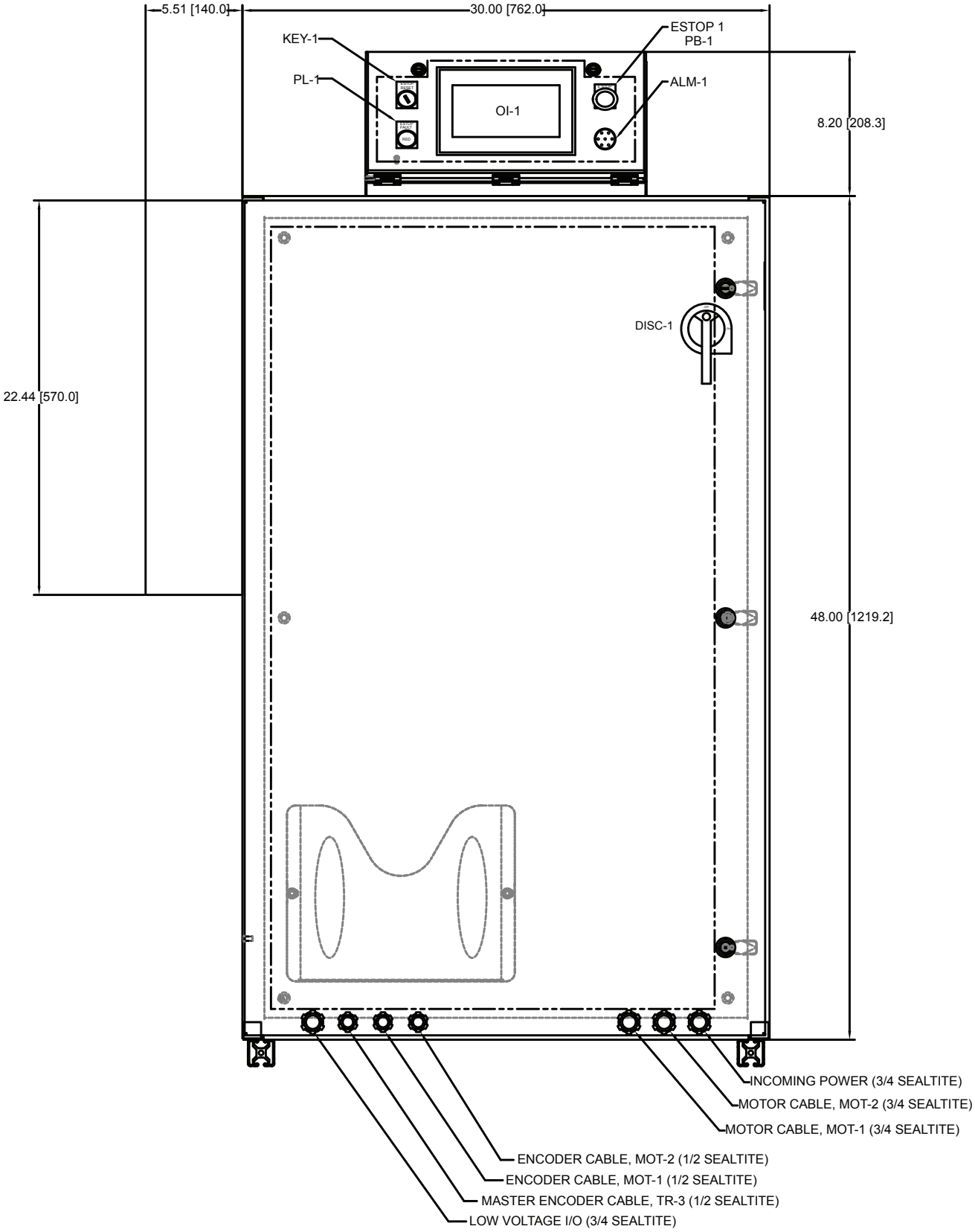


Figure 4 Cabinet dimensions and backside cable access ports. Cabinet depth is 16 inches

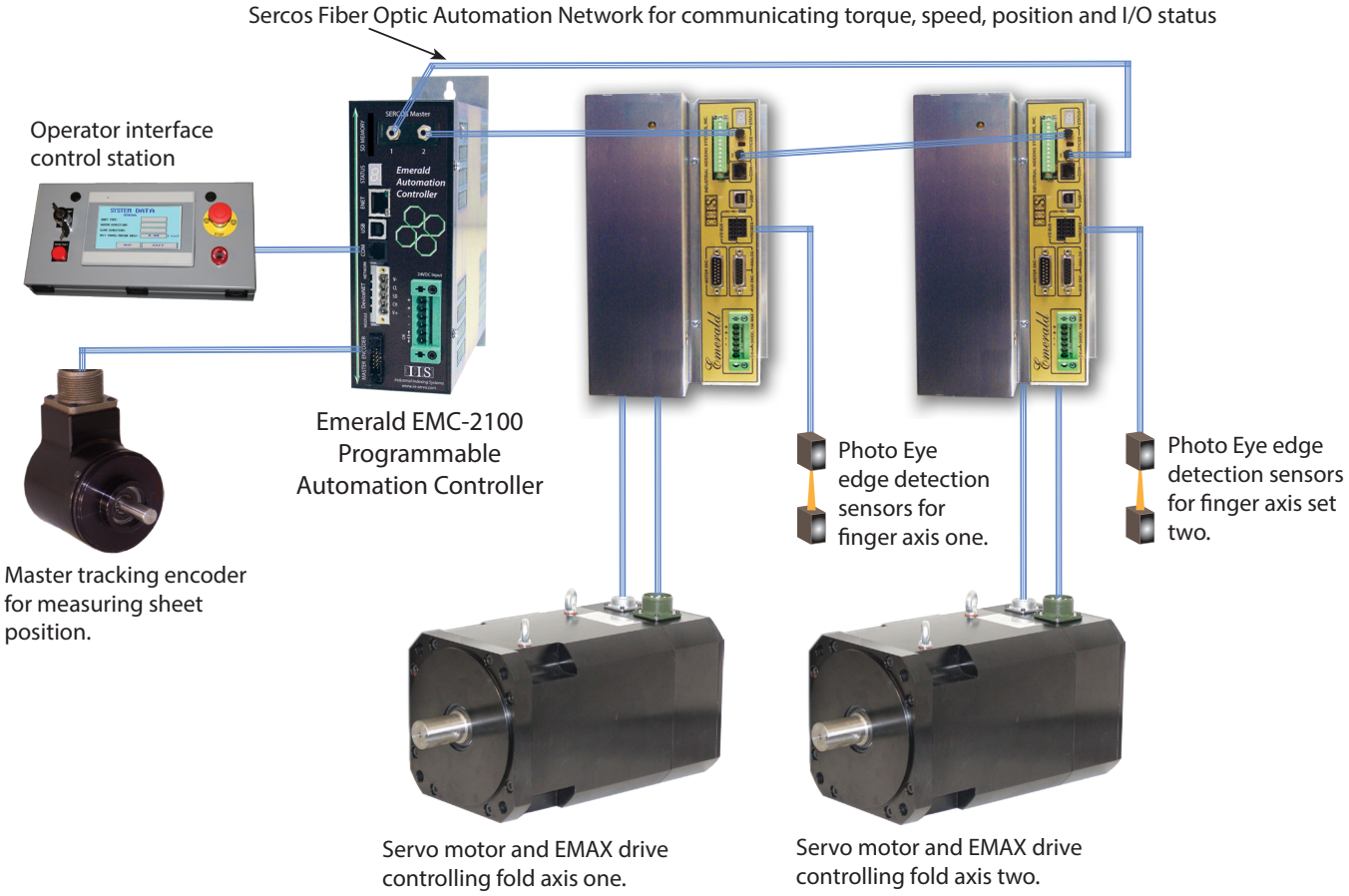


Figure 5 Back fold system component interconnection overview

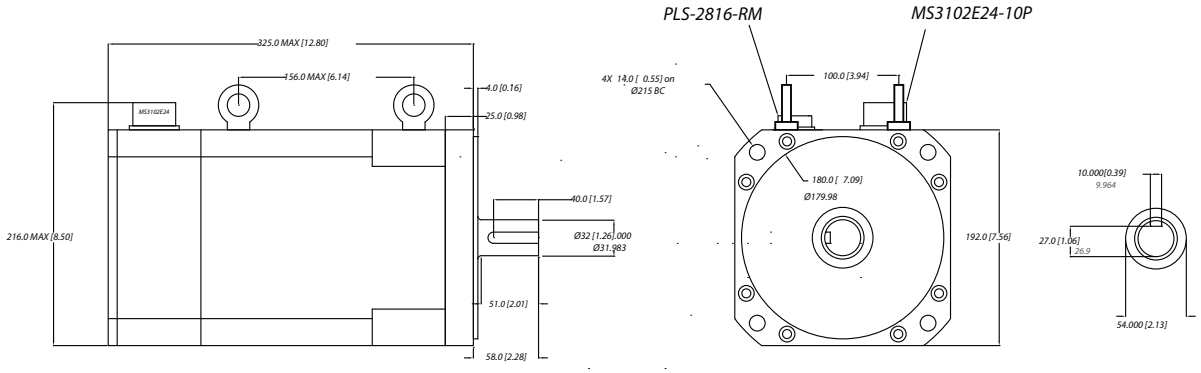


Figure 6 Servomotor dimensions and mounting details

Overview of the Emerald Servomotor and Drive Selection

Type	Frame Size	Shaft Dia.	Pilot Dia.	Power	Speed Rated	Torque Rated	Speed Max	Torque Max	Inertia	Matching Drive	Servo Motor
	mm	mm	mm	watts	rpm	Nm	rpm	Nm	kg-m2 x10^{-4}	ESD-#	ESM#
C	60	14	50	400	3000	1.27	4000	3.8	0.40	5/AEP	60A
	85	14	30	400	2000	1.9	4000	5.7	2.44	5/AEP	85A-C
	85	16	30	600	2000	2.48	4000	9.0	3.34	5/AEP	85B-C
	85	16	50	750	2000	3.53	4000	10.6	4.20	5/AEP	85C-C
	85	16	50	1000	2000	4.8	4000	11.5	5.10	10/AEP	85D-C
A	125	19	70	750	2000	3.6	4000	10.8	6.66	5/AEP	125A(I)
	125	22	70	1000	2000	4.8	4000	14.4	10.10	5/AEP	125B(I)
	125	24	80	1500	2000	7.2	4000	21.6	14.40	10/AEP	125C(I)
	125	24	80	2200	2000	10.5	4000	31.5	20.35	20/AEP	125D(I)
	125	28	80	3000	2000	14.3	4000	42.9	27.25	20/AEP	125E(I)
	125	28	110	4000	2000	19	4000	48.7	35.90	20/AEP	125F(I)
	125	22	110	1000	1500	4.8	4000	14.4	10.10	5/AEP	125B(II)
	125	24	110	1500	1500	7.2	4000	21.4	14.40	5/AEP	125C(II)
	125	24	110	2200	1500	10.5	4000	31.5	20.35	10/AEP	125D(II)
	125	28	110	2300	1500	14.3	4000	42.9	27.25	10/AEP	125E(II)
	125	28	110	2600	1300	19	4000	48.7	35.90	10/AEP	125F(II)
	130	22	110	1800	3400	5.09	4000	11.2	6.00	10/AEP	130-1800/34E
	130	22	110	3700	3400	10.5	4000	28.6	11.60	20/AEP	130-3700/34E
	130	26	110	5700	3400	15.9	4000	47.7	17.20	40/AEP	130-5700/34E
	130	26	110	5700	2000	15.9	4000	45	17.20	20/AEP	130-5700H/34E
	142	24	130	5100	2400	20.2	4000	62.6	23.7	20/AEP	142-5100/24E
	142	24	130	9100	2800	31	4000	109.2	32.4	40/AEP	142-9100/28E
B	145	32	130	4000	2000	19	4000	48.7	66.48	20/AEP	145B(I)
	145	32	130	5600	2000	26.7	4000	80.1	91.15	40/AEP	145C(I)
A	180	32	114.3	7500	2000	35.8	3000	88	57	40/AEP	180-7500/20E
D	180	34.925	216.28	18300	2000	92	4500	278	160	50/CEP	180-18.3KW/20EF
	190	38	114.3	6000	1500	39	4000	97.5	102.7	25/CEP	190B(II)
	190	38	114.3	7500	1500	48	4000	144	139.8	25/CEP	190C(II)
	190	42	114.3	11000	1500	71.5	4000	188	177.4	50/CEP	190D(II)
	190	42	114.3	15000	1000	95	2000	200	214.5	60/AEP	190E(II)
	190	34.925	114.3	10300	2000	51.6	3000	144	84.7	40/AEP	190-10.3KW/20E
	190	32	180	13000	3000	41.8	3000	110	84.7	60/AEP	190-13KW/30E
	190	34.925	114.3	15400	2000	62.1	3000	172.8	84.7	60/AEP	190-15.4KW/20E
A	190	32	180	11900	3600	31.6	4000	135.6	48.8	50/CEP	190-11.8KW/36E
D	190	48	180	21400	2400	85.5	3000	298.3	122.2	50/CEP	190-21.5KW/24E
	210	41.275	216.28	9300	1200	86.7	4500	569	347	50/CEP	210-9.3KW/12E

Metric to English conversion key: 8.85 x [y]Nm = in-lbs 0.03937 x [y]mm = inches

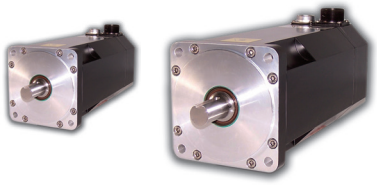
Type A Low inertia, high torque motors for quick response and frequent repetitive motion.

Type B Medium inertia motors for applications that require stable velocity and rigid shaft control.

Type C Compact motors with small weight and quick response.

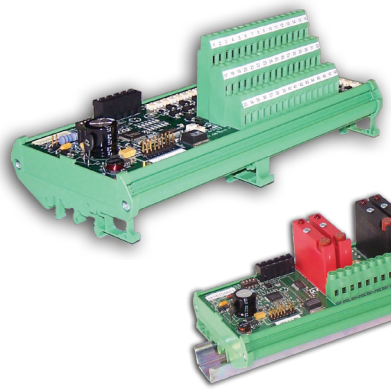
Type D Heavy-duty motors with maximum torques of 298 Nm up to 2400 rpm.

***NOTE:** Additional motors sizes and styles are available but are not listed in the table above. Please call or e-mail us if you have other requirements like wash-down, explosion-proof, and stainless servo motors. Servo rated gear-boxes are available for any servomotor we offer. Free motor sizing software is available.*



Industrial Indexing Systems, Inc.
626 Fishers Run Victor, NY 14564
Phone: (585) 924-9181

Website: www.iis-servo.com
Email: info@iis-servo.com
Fax: (585) 924-2169



ESD-IO16-DC

ESD-IO16

Digital Input and Output Expansion Racks

To expand the number of I/O points on the Emax Series drives, two types of I/O rack assemblies are available. Each drive can connect to two I/O racks for 32 positions per drive.

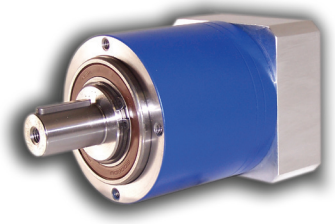
*The **ESD-IO16-DC** rack is a 16 position, 10 to 32 volt DC interface that is software configurable. Each I/O position can be wired as an output or an input.*

*The **ESD-IO16** rack is a hardware configurable, 16 position unit that accepts standard modules for AC/DC, high and low voltage, input or output interfacing.*

Master Encoders

Encoders, cables and breakout assemblies are available for the Master Encoder interface port on the Emerald Automation Controller and the Emax Series drives. Various encoder lines counts are in stock.

THA-2-4096



Servo-rated Gearboxes

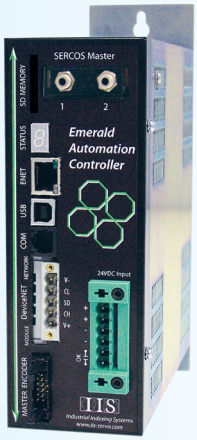
Our pre-sales support team will help specify servo-rated gearboxes for light duty or heavy duty applications that will match the servo motor for the best system performance possible...guaranteed.

Servo Motors

Our motors are for complex environments such as food production, medical applications, oil refining, explosive liquid, dust and vapor atmospheres, and submersible assemblies. Agency standards: UL, cUL, ATEX, IECEx and FDA (rated and certified).

SERCOS II Networking Accessories

For applications involving multiple servo motors the EMC-2100 Emerald Automation Controller is available to connect and control up to 32 Emax Series drives to form a SERCOS II automation network. The EMC-2100 real-time operating system coordinates servomotors, digital inputs outputs, analog sensors, and rotary sensors, at the same time providing communications to operator interface devices and corporate data centers over standard TCP/IP Ethernet and/or Modbus TCP. Program and data storage is provided with a front panel SD card slot and controller health status is displayed with a seven segment display.



Adjustable Speed Drives (VFDs) with an interface adapter (DNET-104) for the DeviceNet network; VFD Drive range: 220Volt/440Volt, 3 Phase, up to 20 HP.

DNET-104

The ESD-ACE and the ESD-ACR modules are used to provide position loop control for legacy analog interface drives on the SERCOS II network.

Mainly used to replace position loop functionality of the legacy MSC-250 and MSC-850 controllers, the DIN-rail mountable ESD-ACR modules can be used in new designs where a resolver is used as a master source device or where an interface to an adjustable speed drive is required on the network. For encoder feedback position loops, use the ESD-ACE module.

The ESD-ACE and the ESD-ACR modules also include features such as the hi-speed position trap input with a holding register for registration applications, and one general purpose 12 bit analog output.

INDUSTRIAL INDEXING SYSTEMS, INC

626 Fishers Run, Victor, NY. 14564 ~ (585) 924-9181
info@iis-servo.com ~ www.iis-servo.com

The IIS Team

Discover how our advanced motion control components and superior support can redefine your operations. Let's embark on a journey to operational excellence. Ready to elevate the efficiency, consistency, and repeatability in your operations? Call us today at (585)924-9181 to discuss your application.

Headquarters in Victor NY

Our location houses all critical departments: Applications Engineering, R&D, Production, Warehouse, Panel Shop, Quality Control, Sales, Marketing, and Customer Support. Having everything under one roof speeds communications and provides better service to our customers.

Check out our IIS InMotion Blog for the Servo Motion Control Professional ~ https://www.iis-servo.com/blog/

*If you're interested in becoming a **Sales Representative** for Industrial Indexing Systems, where you'll play a crucial role in boosting brand recognition and nurturing client connections, contact our offices: (585) 924-9181 ~ Email: sales@iis-servo.com*