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Find the *Emerson Motion Control FX-340* at our website: *Click HERE*

FX Series Positioning Servo Drive Systems

- Overview D2-D13
- Drive Specifications D14-D19
- Motor Dimensions D20-D25
- How to Order D26-D27
- Options and Accessories D28-D30
- Application Modules D31-D58
- More FX Options D59-D64

FX Series Positioning Servo Drive Systems have been providing customers with an easy to use servo solution for more than a decade. Many common applications are solved with the combination of an FX drive and PCM module. The FX and PCM module were the genesis of the current generation of "Motion Made Easy" solutions.

You will note that the information in this section came directly from the 2000 Emerson Motion Control Servo Solutions Catalog. As such, the drive pictured show the company's old logo.

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FX SERIES POSITIONING SERVO DRIVE SYSTEMS

FEATURES

- All digital design
- 96-264 1Ø auxiliary logic supply for 1-1000 lb-in, 96-264 VAC 1Ø bridge power for 0-55 lb-in, 96-264 1Ø or 3Ø bridge power for 55-120 lb-in, 380-460 VAC 3Ø power for 120-1000 lb-in
- 0-1000 lb-in continuous torque when combined with DX Series (0-120 lb-in) and BL Series (120-1000 lb-in) resolver feedback servo motors. IP65 and holding brake versions available
- FX Series Amplifiers up to 120 lb-in are UL Listed and Canadian UL Listed. CE Certified versions available
- Easily programmed with EMERSON Motion Control's fill-in-the-blank PCXWin or PCX for DOS software
- 8 input and 4 output lines (10 to 30 VDC) sinking or sourcing are standard on the base FX Drive
- Operating modes: Integral positioner; analog velocity; analog torque; pulse follower
- Application modules can be installed on the base FX Drive to add additional I/O (8 inputs, 4 outputs), memory (Storage for 256 sets of index parameters), and a wide range of specialty application functionality
- Initiate programs of motion sequences of up to 100 steps total in the base FX Drive and up to 1024 steps with the addition of an Application Module
- 93 predefined I/O functions for assignment to I/O lines on the base FX Drive or Application Module
- Non-volatile memory allows storage of up to 32 sets of index parameters
- Linear or modified sine motion profiles
- Scalable in user-defined units including inches, feet, mm, etc.
- RS-232 communications interface with baud rates up to 19.2 Kbaud for daisy chaining up to 31 FX Drives on a single communication link
- Auxiliary logic supply provision for maintaining critical drive information (i.e. position) through bridge power loss
- LED display for operating and diagnostic status
- Two year extended warranty on FX Positioning Servo Amplifiers

FX SERIES



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FX SERIES POSITIONING SERVO DRIVE SYSTEMS

DESCRIPTION

FX brushless positioning servo drives are designed to provide trouble-free solutions for a wide variety of industrial automation applications. Each FX Positioning Servo Drive System integrates the position control, I/O, feedback, servo amplifier and power supply in one housing. The drive design allows the unit to operate on a wide range of voltage sources without needing expensive isolation transformers.

Models in the FX Drive Series provide up to 1000 lb-in of continuous torque. FX Amplifiers providing 8 to 120 lb-in continuous torque are UL Listed, Canadian UL Listed and CE Certified. These amplifiers are also designed to meet IEC801 specifications for noise immunity.

FX Amplifiers are matched with EMERSON Motion Control's DX and BL Series of Brushless Servo Motors. These motors utilize advanced mechanical designs and the latest in magnetic material technology to yield exceptionally high torque to inertia ratios. These motors are virtually maintenance free and can be ordered in splashproof IP65 versions. Thermal sensors provide additional protection for the motors.

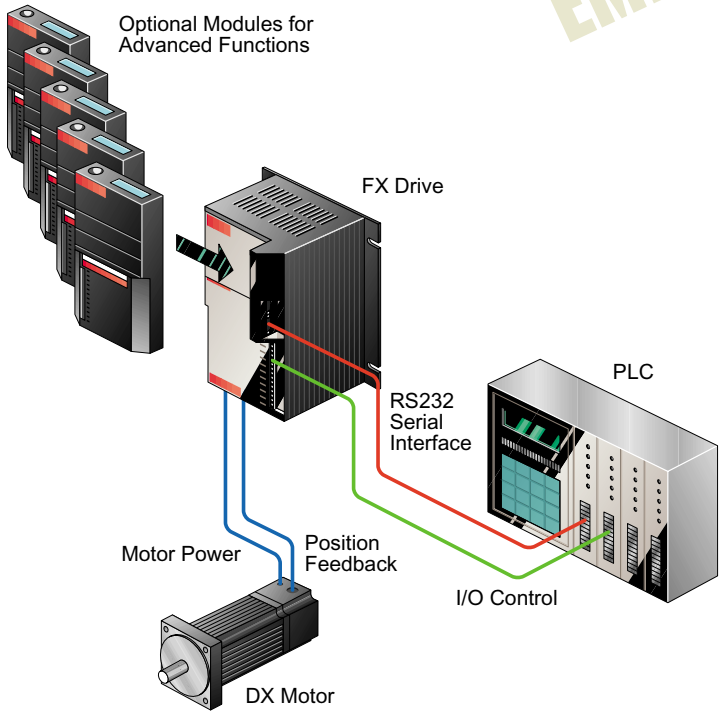
FX Drives are programmed using EMERSON Motion Control's PCX Software for DOS or PCXWin for Windows™ software which is included with the purchase of an FX Drive. This software leads the user through the application with a simple menu-driven question and answer format. No knowledge of high-level programming languages is required.

Dynamic Gain Compensation (DGC), a unique feature of the FX Servo Drive, eliminates the need for potentiometers and manual calibration. DGC provides stable operation over the full torque and velocity range with load-to-motor inertia mismatches as high as 10:1 out of the box without any adjustments.

Optically Isolated I/O lines are programmable with status indicators, choice of current sourcing or sinking for each line, choice of normally on or off state for most Input lines, and voltage ranges from 10 to 30 VDC.

EMERSON

TYPICAL FX SYSTEM CONFIGURATION



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CE MARK FX SERIES POSITIONING SERVO DRIVE SYSTEMS

CE MARK FX SYSTEMS

- Certified servo system compliance to the EMC directive, 89/336/EEC with CE Mark
- Wide system torque ranges available from 8 to 120 lb-in continuous and 200% peak for up to 1.5 seconds
- UL listed amplifiers
- UL recognized motors
- Components available to complete entire motion control system

Recently, the use of individual control products in Europe requires conformance to standards recognized by the European Union (EU) member states. These standards were designed to allow quick and fair market access throughout the EU. The Electro-Magnetic Compatibility (EMC), directive – 89/336/EEC, requirement placed on vendors is one of the toughest standards regulating electromagnetic emissions and noise immunity.

Briefly, the EMC Directive states that components, such as servos, are considered small portions of larger machines and therefore may not need individual compliance. It would then be the machine builder's responsibility to conform to the EMC Directive for machines going into Europe. This approach, taken by many servo manufacturers, places compliance burden completely on the machine builder. Product testing by the machine builder will therefore be an excessively large expense.

The fact that EMERSON Motion Control products already posses the CE Mark is a distinct advantage for machine builders. New models in our popular FX Drive series cover continuous torque ratings ranging from 8 to 120 lb-in. These models include the FX-208CE through the FX-6120CE.

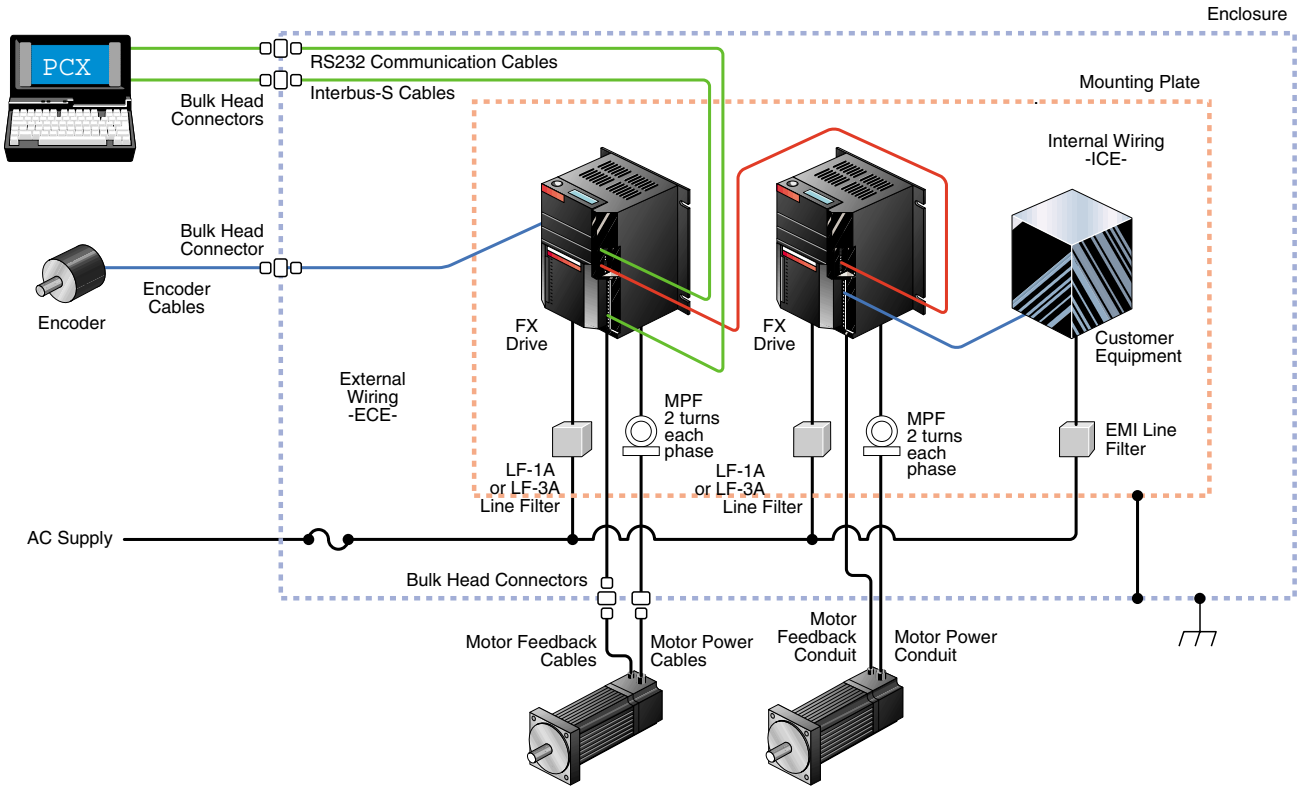


FX Drives are available in CE configurations for international installations.

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CE MARK FX SERIES POSITIONING SERVO DRIVE SYSTEMS

TYPICAL CE MARK FX SYSTEM CONFIGURATION



Note that these servo systems are designed, configured and tested to meet CE Mark specifications. In addition to the servo drives and motors, EMERSON Motion Control also offers filters and cables that satisfy compliance of the entire servo drive system.

FX Drives with the CE Mark designation have the same features and performance specifications as EMERSON Motion Control's popular FX Drives. PCX Programming software allows these drives to be set up and running in a matter of minutes. These drives are programmed with the same easy-to-use PCX Programming Software used with standard FX Drives.

CE Mark FX Drives are also compatible with EMERSON Motion Control's complete range of application modules. These modules provide FX Drives with additional hardware and programming capacity to perform specific applications. Examples of these applications include press feed control, random infeed control, phase synchronization control, and cam profiling control.

There are two methods of system wiring that meet or exceed the grounding and shielding requirements set forth by the EMC Directive of CE. Both methods are demonstrated in the diagram above.

The preferred wiring method utilizes special interconnection cables available from EMERSON Motion Control. These cable components were specifically designed to make use of a complete shield throughout multiple segments. Connector backshells, bulkhead connectors and the cable itself work together to reduce radiated emissions both inside and outside of the enclosure.

An alternate method allows for shielded motor feedback and power cable runs inside metal conduit. This method is also effective in reducing radiated noise and may be desired in some applications based on environmental conditions.

Regardless of wiring method chosen, power supply line and motor power filters are required. Both are also available from EMERSON Motion Control.

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FX SERIES APPLICATION MODULES

APPLICATION MODULES ORIENT FX DRIVES FOR SPECIFIC APPLICATIONS

For advanced positioning applications, EMERSON Motion Control offers a series of Application Modules. These modules easily attach to the front of any FX Drive and allow the drive to perform advanced positioning functions such as phase synchronization, ratio control, web control and rotary knife cutoffs.

Application Modules are programmed using the same PCX Software used for basic FX Drives. Once the positioning program has been set up, the Application Module stores the program in non-volatile memory. This allows the Application Module to be moved to a different drive of any size without having to reenter the program data.

Application Modules provide additional hardware necessary to perform the applications such as increased I/O, encoder interfaces, and analog inputs and outputs. Onboard non-volatile memory allows a module to be moved to a different FX Drive without losing parameters entered using PCX Software or ASCII serial commands.

PCM-11
Motion Program Controller

Page 34-35

- Compound Indexing
- Packaging Machinery
- Feed to Sensor
- Metal Forming
- Conveying Machinery
- Automated Assembly
- Auger Filling
- Feed to Registration
- Plastics Forming
- Feed to Length

PCM-14
Slip Compensator

Page 36-37

- Slip Compensation
- Automated Roll Feeds
- Packaging Machinery
- Material Handling
- Conveying Machinery
- Parts Handling
- Cut to Length
- Sheet Fed Printing
- Tube Rolling
- Plastic Vacuum Forming
- Rubber Stamping

PCM-15
Ratio Controller

Page 38-39

- Flying Cutoffs
- Electronic Line Shafting
- Packaging Machinery
- Conveying Machinery
- Machine Ratioing
- Traverse Wire Winding
- Metal Forming
- Plastics Forming
- Automated Testing

PCM-16
Phase Synchronization Controller

Page 40-41

- Phase Synchronization
- Packaging Machinery
- Labeling Machines
- Electronic Camming
- Converting Machinery
- Master/Slave Ratioing
- Product Marking
- Date Code Printing
- Screen Printing
- Electronic Line Shafting



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FX SERIES APPLICATION MODULES

PCM-17
Random Infeed Controller

Page 42-43

- Random Infeed Control
- Packaging Machinery
- Material Handling
- Conveying Machinery
- Parts Handling
- Food Processing
- Parts Alignment
- Automated Delivery Systems
- Collision Avoidance
- Merging

PCM-18
Web Controller

Page 44-45

- Web Velocity/Positioning Control
- Converting Machinery
- Web Processing
- Web Sychnronization
- Dancer Arm Positioning
- Automated Winding
- Textile Machinery
- Roll Forming
- Winder/Unwinder Control

PCM-19
Conveyor Controller

Page 46-47

- Merge Conveyors
- Conveyor Synchronization
- Packaging Machinery
- Product Spacing
- Automated Delivery Systems
- Parts Handling
- Plant Automation
- Package Sorting Systems

PCM-22 and PCM-22Q
Rotary Knife Controllers

Page 48-51

- Rotary Knife (cut/seal) Control
- Packaging Machinery
- Bag Machinery
- Phase Synchronization
- Converting Machinery
- Labeling Machines
- Screen Printing
- Product Marking

PCM-23
Cam Profiler

Page 52-53

- Complex Cam Profiles
- Flying Cutoffs
- Diaper Cutter

PCM-24
Press Feed Controller

Page 54-55

- Press feed
- Index and cut

IBS-11
InterBus-S Module

Page 56

- Emulates Functions of the PCM-11
- Plant Networking High Speed Data Communication
- InterBus-S Remote Network Operation

IBS-15
InterBus-S Module

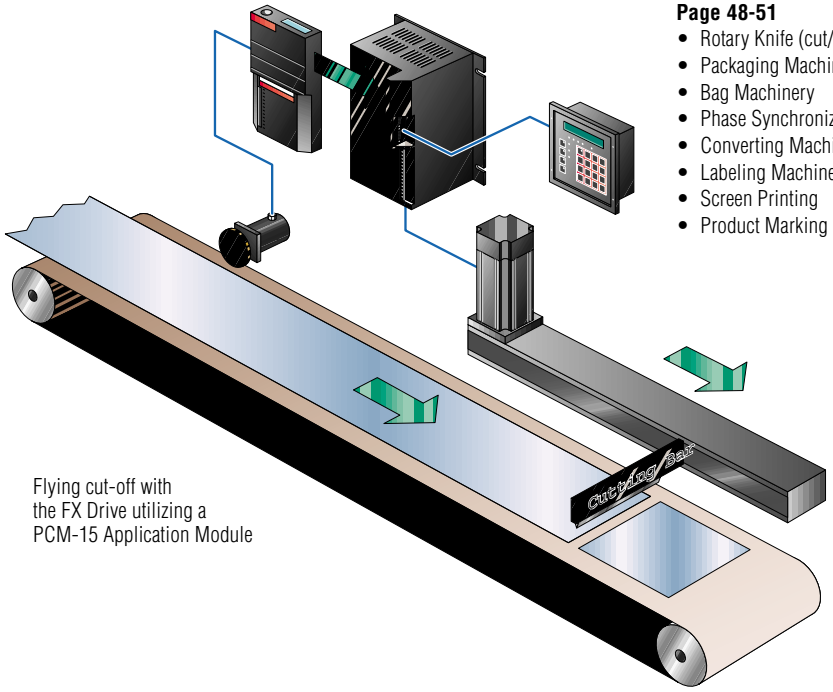
Page 57

- Emulates Functions of the PCM-15
- Plant Networking High Speed Data Communication
- InterBus-S Remote Network Operation
- Analog Output Channel for Spindle Control
- Analog Input Channel for Process Monitoring

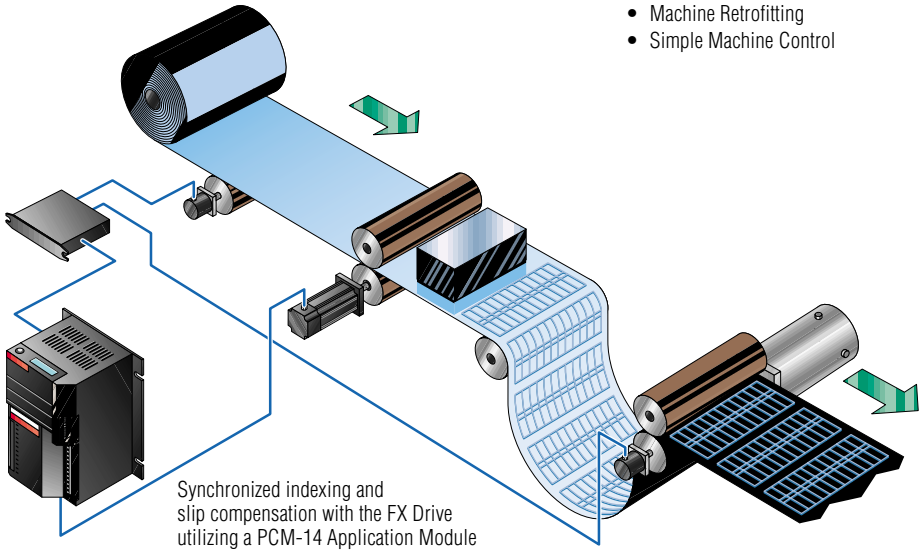
IOM-1
Input/Output Module

Page 58

- Simple Indexing
- Machine Retrofitting
- Simple Machine Control



Flying cut-off with
the FX Drive utilizing a
PCM-15 Application Module



Synchronized indexing and
slip compensation with the FX Drive
utilizing a PCM-14 Application Module

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FX SERIES OPERATING MODES

FX DRIVES SOLVE COMPLEX APPLICATIONS WITHOUT A CUSTOM ENGINEERED SOLUTION

FX Positioning Servo Drives are highly flexible. They can be used in a variety of applications where reliability, repeatability, accuracy and flexibility are key.

With the basic FX Drive, there are three main operating modes: Position Control Mode, Pulse Train Follower Mode, and Analog Mode. In each mode the FX Drive can be interfaced to a PC, PLC, or other machine control.

POSITION CONTROL MODE

The same microprocessor which performs the dynamic gain compensation and diagnostics functions also executes user defined motion control functions.

In the Position Control Mode FX Drive parameters are set up to scale the motor motion to user units. System limits and I/O are defined to interface to the application. With parameters defined, setting up motion such as jog, home and indexing becomes an easy task.

Thirty-two different indexes can be stored in a basic FX Drive. Depending on the Application Module attached to the drive, 64 or 256 indexes are available. Each index may include the following parameters:

Index Types

- Incremental
- Absolute
- Feed to Sensor
- Registration
- Rotary Clockwise
- Rotary Counter Clockwise
- Rotary Shortest Path

Distance or Position

Velocity

Acceleration Rate

Deceleration Rate

Dwell Time

In Position Window

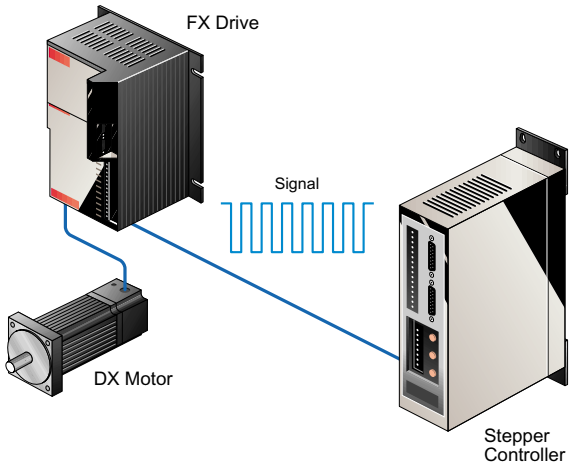
Index Count

All user defined parameters are stored in non-volatile memory so the unit is ready for operation on power up. With the addition of an Application Module, index storage capability is increased, motion programs may be created, and many other motion and control functions are added.



PULSE TRAIN FOLLOWER MODE (REPLACING STEP MOTORS)

In the Pulse Train Follower Mode, the FX Drive produces an incremental shaft rotation each time a pulse is received. The rotation increment is programmable from 50 to 25,000 steps per revolution. The shaft speed is proportional to the pulse frequency up to 210 KHz.



The FX Drive can be used as a direct replacement for existing stepper positioning systems in the Pulse Train Follower Mode. In almost all cases, indexing time can be cut to a fraction and reliability and performance can be vastly improved due to the servo system's high acceleration capability, extended torque range, and its closed-loop design.

All motion and system limits are active when in the Pulse Train Follower Mode.

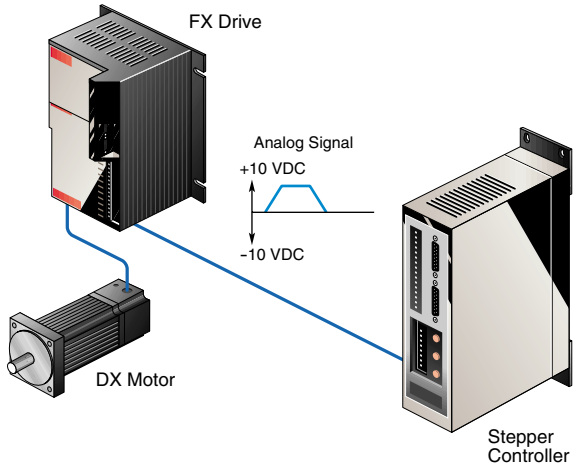
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FX SERIES OPERATING MODES

ANALOG MODE

In the Analog Mode, there are two options available: Analog Velocity and Analog Torque. When either option is selected all motion and system limits are active.

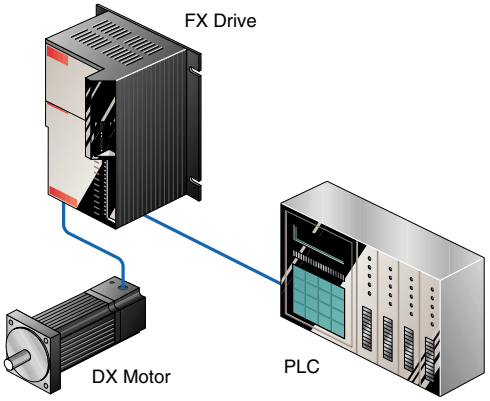


When Analog Velocity is selected the voltage applied to the FX Drive is proportional to the speed of the motor. When Analog Torque is selected the voltage applied to the FX Drive is proportional to the torque available to the motor.

INTERFACE TO PLCS AND PCS

The flexibility of the FX Drives meet the needs of system designers and machine builders who must interface to a variety of controls such as operator switch panels, PLCs, and computers in flexible manufacturing systems.

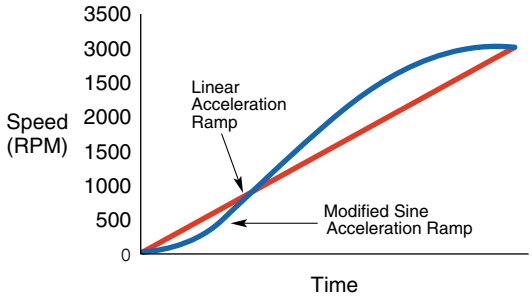
The large number of control functions that may be assigned to I/O lines allow the user to efficiently match the control inputs and status outputs to the many varying requirements of the typical panel builder. Fault indications, start and stop inputs, cycle hold inputs and more are easily designed into each system when needed.



The addition of the family of Application Modules also provides a group of programmable outputs whose on-and-off pattern is set whenever the servo motor moves past a specific position or time. This data pattern is the perfect flag for sophisticated PLCs– key elements in today's typical industrial manufacturing systems.

MODIFIED SINE ACCELERATION / DECELERATION RAMP

The Modified sine motion of FX Drives is superior to other "S" curve sine ramps or linear ramps because it is designed to minimize power required to accelerate or decelerate a load. This eliminates acceleration jerks and, unlike other motions, minimizes the peak power seen by the power transmission components. Because machine life and power consumption are a function of total power transmitted, Modified Sine Ramps result in extended machine life and reduced power consumption.



The modified sine accel./decel. shape is selected in the Drive Parameter screen in PCX Progamming Software shown on the next page.

Comparison of Selected Motion Profiles

Factor/ Ramp	Linear Trapezoidal	Modified Trapezoidal	"S" Curve Cycloidal	Modified Sine Ramp
Power	1.00	1.01	1.02	0.68
Peak Torque	1.00	1.22	1.57	1.38

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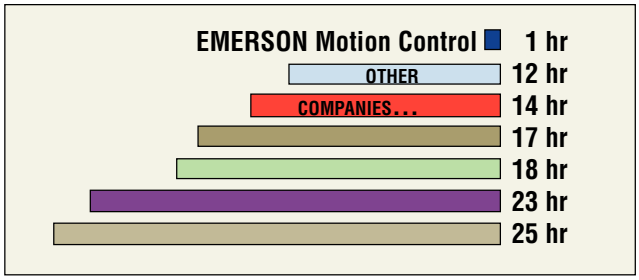
FX SERIES SOFTWARE

SIMPLE SYSTEM SET UP WHILE PROVIDING PERFORMANCE, RELIABILITY AND FLEXIBILITY WITHOUT A CUSTOM SYSTEM

The FX Series of Positioning Servo Drives is simple to set up and operate. These cost-effective systems eliminate the expense, programming knowledge and engineering time traditionally associated with implementing a closed-loop servo positioning system. While many servo drive systems require the operator to make adjustments to potentiometers associated with the servo loop gain or PID gains, the FX Drive eliminates those requirements.

In most installations of FX Drives, all that is required for system set up is for the the amplifier to be attached to the servo motor, using cabling supplied by EMERSON Motion Control, and power to be supplied to the amplifier. There are no complex wiring diagrams to contend with. FX Drives are typically installed within minutes.





INTUITIVE PCX PROGRAMMING SOFTWARE SIMPLIFIES FX DRIVE POSITIONING

The drive configuration and motion parameters are entered into the system using the intuitively simple PCX Programming Software. Unlike software supplied with other servo positioning systems, no knowledge of high level programming languages is required to operate PCX . All that is required is a thorough understanding of the application and knowledge of the mechanics of the machine using the FX Drive.

Once the requirements of the system are determined, the user enters in positioning parameters such as length of move (in feet, meters, inches, etc.), velocity, acceleration and deceleration rates, and dwell times. These parameters are stored as indexes. PCX also allows predefined I/O functions to be assigned to any of the eight optically isolated input lines and four optically isolated output lines located on the FX Drive.



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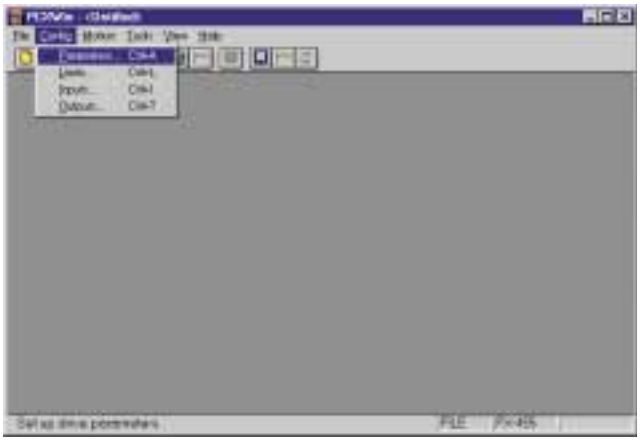
SIMPLIFIES SYSTEM SET UP WHILE MAINTAINING THE POWER, RELIABILITY AND FLEXIBILITY OF SERVO POSITIONING

PCX Software from EMERSON Motion Control is a powerful PC-based programming tool. With PCX, users of FX Positioning Servo Drives have an intuitive software interface that allows access to the vast number of positioning functions available with the FX Drives. The programming ease inherent with PCX allows users to get systems up and running typically within an hour after installation. Other systems require several hours or even days of programming and set up time. The graph to the left shows in number of hours how long it takes to set up a typical axis of positioning for an EMERSON EMC FX Drive compared to other selected servo positioning systems.

PCX operates on a simple principle–the user enters data into the program relating to how the FX Drive will position within the machine or system. PCX takes care of all other necessary operations required to perform the selected positioning requirements. For example, if an actuator needs to move 12.000 inches, the user types in 12.000. PCX will then load the data into the FX Drive to move or position the actuator. All operations performed by PCX are transparent to the user. This allows the machine builder or designer to concentrate efforts on system design. Users of PCX do not need any programming experience. Knowledge of the machine and the application are all that is required to successfully set up an FX Drive using PCX.

CONFIGURING AN FX DRIVE WITH PCX SOFTWARE

The first step in using PCX Software is to configure the FX Drive for the application. The PCX Program is a series of menus that walk the user through the set up of the FX Drive. The user configures the system by entering the Drive Parameter screen as shown below.



The drive parameters used in PCX must be configured before any positioning data is entered into the FX Drive. This screen scales all motion to user units.

One of the parameters that needs to be configured is distance user units. User units can be defined in terms of feet, inches, millimeters or any other desired unit. The default setting for velocity user units is RPM (revolutions per minute). The formula below shows how to rescale the motor's speed of 3000 rpm to the linear velocity of a five pitch lead screw.

$$\frac{3000\ \cancel{\text{Rev}}}{\cancel{\text{Minute}}} \times \frac{1\ \cancel{\text{Minute}}}{60\ \text{Seconds}} \times \frac{1\ \text{Inch}}{5\ \cancel{\text{Rev}}} = \frac{10\ \text{Inches}}{\text{Seconds}}$$

Velocity scaling takes place in the Drive Parameters screen shown above right. In this example, the actuator polarity has been set as positive, the distance user units are inches, distance units scaling is set for one motor revolution equal to 0.2000 inches of linear movement. Velocity user units are IPS (inches per second) with 3000 rpm equaling 10 IPS. The acceleration/ deceleration shape is set for modified sinewave. The analog override function is active, allowing all velocity scaling to be reshaped based on a +10 VDC analog signal coming into the FX Drive. With all drive parameters defined, motion parameters can now be set up.



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FX SERIES SOFTWARE

DEFINING MOTION WITH PCX

The following shows how to define motion parameters, initiate motion, and sequence indexes into a program for an FX Drive. Motion can be initiated directly from the PCX software ASCII serial commands, or as a response to a hardware input on the FX Drive.

JOGGING

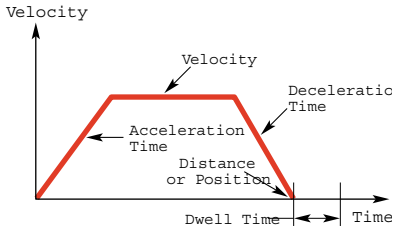
PCX allows the user to define jog speeds of the FX Drive. Jogs are typically used to clear machine cycles or test positioning during system set up. Jog parameters are defined in the Define Motion screen of PCX .

When jogging the FX Drive, motion is typically started by activating an input line on the FX Drive or via a serial command from a host controller. The screen below defines three jog velocities: serial jog velocity, jog fast velocity, and jog slow velocity. The jog serial velocity is set for 15.00 IPS with an acceleration and deceleration time of .100 seconds. In this example, the jog fast velocity is set for 60.00 IPS and the jog slow velocity is set for 8.00 IPS. The Lock command defines whether a homing move must take place before a jog is done.



INDEXING

Shown below are the elements that derive an index.

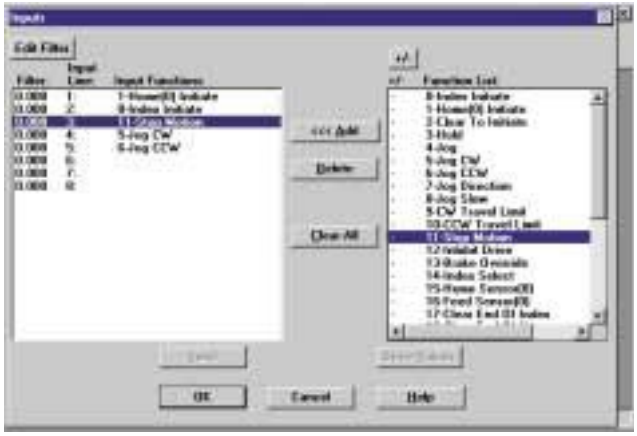


The PCX Index Set Up screen below shows where the index parameters are entered. The FX Drive allows up to 32 indexes to be defined and stored in the FX Drive's non-volatile memory. Between 64 and 256 indexes can be defined and stored when an Application Module is attached to the FX Drive.



I/O SET UP

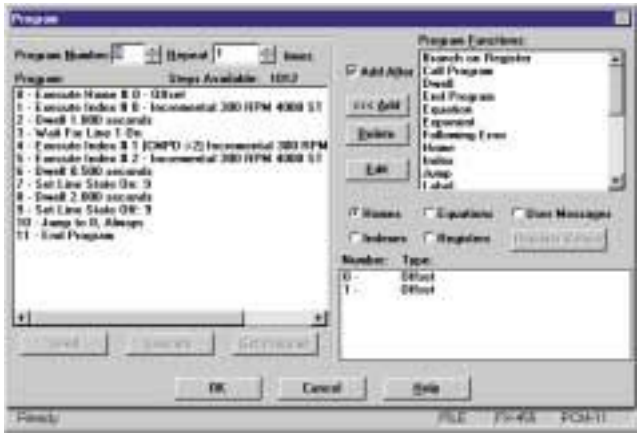
With the basic FX Drive there are 45 predefined I/O functions available. The addition of an Application Module increases the number of available I/O functions to as many as 93. Assigning I/O is a simple task. Available functions are shown on the right while a listing of available I/O lines and functions assigned to those lines appear on the left. The desired I/O line is entered in on the line corresponding to the I/O functions. Shown below is the Input Set Up screen (the Output Set Up screen is similar.)



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PROGRAMS

With the addition of an Application Module, individual indexes and other functions can be sequenced into a program. A program can include up to 256 steps. As many as 100 programs, a total of 1024 steps, and 256 indexes can be stored in the Application Module's non-volatile memory. The example Program Set Up screen below consists of five indexes and 10 steps. Other programs stored in the Application Module can also be called up for execution as a program step. At the bottom of the Program Set Up screen is a complete list of all program codes.



PREDEFINED I/O FUNCTIONS

PCX Software simplifies the method in which functions are assigned to any of the 12 I/O lines on the FX Amplifier. With the addition of an Application Module 12 more I/O lines are available. All I/O lines are optically isolated to insure optimum noise immunity.

I/O functions are assigned to the FX Drive using PCX Software. As many as 93 predefined I/O functions may be assigned to any of the 16 input and eight output lines available on the FX Drive and Application Module.

The screen on the left shows some of the input functions available. With PCX Software assigning I/O is a simple task. Available I/O functions are shown on the right of the screen, while a listing of existing assignments is displayed on the left. The user merely needs to move the cursor to the desired I/O function and type in the I/O line number to which the function will be assigned.

INPUT FUNCTIONS

Index Initiate
Home Initiate
Clear to Initiate
Hold Motion
Jog
Jog CW
Jog CCW
Jog Direction
Enable Slow Jog Speed
CW Travel Limit
CCW Travel Limit
Stop Motion
Inhibit Drive (amplifier section)
Brake Override
Index Select
Home Sensor
Feed Sensor
Clear End of Index Output
Clear End of Home Output
Clear End of Index Count Output
Clear Sensor Limit Output
Clear Fault Output
Zero Position Display
Zero Display Position
Remember Position
Return to Position
Clear End of Sequence Output
Clear All Programmable Outputs
External Output
Program Initiate
Program Select
Suspend Program
Resume Suspended Program
Clear Suspend Program Data
Clear End of Program
Clear End of Program Count
Clear All Program Outputs
Feed Sensor
External Mode Override
Home (1) Initiate
Home Sensor (1)
Index Direction
Torque Jog
Analog Override
Clear Torque Limit Output
Zero Master Cycle
Zero Foll. Cycle/Infeed
Phase/Target Angle Advance
Phase/Target Angle Retard
Cycle Drop Out
Clear In Position Timeout
Web Jog Select
Loop Position Control
Actuator Polarity
New Roll Diameter
Fast Ratio Learn
Product Measuring #1
Product Measuring #2
Product Measuring #3
Initiate Release
Global Release
Conveyor Dropout
Feed Control
Clear Conveyor Error

OUTPUT FUNCTIONS

System Ready
External Control Mode
In Motion
End of Each Index
End of Home Motion
End of Index Count
Hardware Fault
Travel Limit Hit Fault
Following Error Fault
Home Move Completed
Sensor Sensor Limit Hit
End of Each Sequence
Programmable Outputs
End of Each Program
End of Program Complete
System in Suspend
End of Home
At Sync Velocity
External Distance Fault
External Brake Output
Torque Limit Hit
In Position Window Timeout
Master Cycle Defined
Correction Limit
Master Cycle Missing
Empty Cycle
Double Infeed
Overlap Limit
High Loop Position Limit
Low Loop Position Limit
Roll Full/Empty
Center Wind Fault
Product Ready
Product Released
Feed Conveyor On-Line
Feed Conveyor Error



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FX SERIES SPECIFICATIONS

SPECIFICATIONS

FX Sytem Specifications

Model	Suggested Line Ampacities Amps	Motor Torque RMS lb-in (Nm)	Motor Torque Peak lb-in (Nm)	Motor Rotor Inertia lb-in-sec² (kg-cm²)	Cont Rated Power @ Max Speed HP (W)	Max Motor Speed RPM	Min Time To Max Speed Secs
FX-208	10	8 (0.90)	16 (1.86)	0.000183 (0.113)	0.47 (352)	5000	0.010
FX-316	10	16 (1.81)	32 (3.62)	0.00052 (0.588)	0.57 (423)	4000	0.010
FX-340	15	40 (4.51)	80 (9.04)	0.00140 (1.580)	1.42 (1058)	3000	0.010
FX-455	15	55 (6.21)	110 (12.42)	0.00260 (2.940)	1.95 (1454)	3000	0.015
FX-490	20	90 (10.20)	180 (20.30)	0.00510 (5.760)	3.33 (2486)	3000	0.015
FX-4120	20	120 (13.60)	240 (27.12)	0.00740 (8.360)	4.38 (3265)	3000	0.025
FX-6120	20	120 (13.60)	240 (27.12)	0.00960 (10.850)	4.38 (3265)	3000	0.020
FX-6210	30	210 (23.70)	390 (44.10)	0.01800 (20.340)	7.10 (5300)	3000	0.020
FX-6310	30	310 (35.00)	550 (62.20)	0.02688 (30.370)	9.60 (7200)	3000	0.020
FX-8500	30	530 (59.90)	1000 (113.00)	0.07440 (84.670)	17.10* (12800*)	3000	0.040
FX-8800	50	800 (90.40)	1600 (180.80)	0.11160 (126.100)	18.00* (13500*)	2250	0.100
FX-81000	50	1000 (113.00)	2000 (226.00)	0.14880 (168.000)	25.60* (18000*)	2250	0.100

*120°C Motor Case, 25°C Ambient

Holding Brake Specifications (Optional)

Model	Holding Torque lb-in (Nm)	Inertia lb-in-sec-2 (kg-cm²)	Added Weight lb (kg)	Coil Voltage (VDC)	Coil Current (Amps)	Engagement Time (ms) Brake Holding	Disengagement Time (ms) Brake Release
DXM/E-208	12 (1.4)	0.00010 (0.112)	1.8 (0.55)	24	0.48 ±10%	250	100
DXM/E-316	60 (6.8)	0.00015 (0.169)	2.4 (1.1)	24	0.52 ±10%	250	100
DXM-340	60 (6.8)	0.00015 (0.169)	2.4 (1.1)	24	0.52 ±10%	250	100
DXM/E-455	240 (27.1)	0.00090 (1.016)	5.8 (2.6)	24	0.88 ±10%	250	100
DXE-490	240 (27.1)	0.00090 (1.016)	5.8 (2.6)	24	0.88 ±10%	250	100
DXE-4120	240 (27.1)	0.00090 (1.016)	5.8 (2.6)	24	0.88 ±10%	250	100
DXE-6120	360 (40.7)	0.00120 (1.355)	12.1 (5.5)	24	1.2 ±10%	150	100
BLM-6210B-4	420 (47.5)	0.001125 (1.412)	12.8 (5.8)	24	1.2 ±10%	100	250
BLM-6310B-4	420 (47.5)	0.001125 (1.412)	12.8 (5.8)	24	1.2 ±10%	100	250
BLM-8500-4				N.A.			
BLM-8800-4				N.A.			
BLM-81000-4				N.A.			

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FX SERIES SPECIFICATIONS

DRIVE SPECIFICATIONS

Input Power Supply Voltage

FX-208 through FX-455: 90-264 VAC, 47 to 63 Hz, 1Ø
FX-490 through FX-6120: 90-264 VAC, 47 to 63 Hz, 1Ø* or 3Ø
FX-6210 through FX-81000: 96-264 VAC, 47 to 63 Hz, 1Ø (logic); 380-460 VAC, 47 to 63 Hz, 3Ø (bridge)
* Output power must be derated by 15% for single phase operation

Control Modes

Position Control Mode:
- Drive parameters
- System limits
- I/O set up and configuration
- Jog
- Home
- Programs
- Indexing
- Index types: Incremental; rotary clockwise; absolute; rotary counter clockwise; feed to sensor; rotary shortest path; registration
- Typical index parameters: distance/position; velocity; acceleration rate; deceleration rate; in position window; dwell time after index is completed; count-number of times index is repeated

Digital pulse follower mode:
- Signal input: TTL compatible, 1.5 micro sec. min. pulse width
- Input frequency range: 0 to 210 KHz
- Input types: CW/CCW pulses or pulse/direction

Analog mode:
- 10 bit analog to digital converter
- Analog inputs: +10 VDC operating range
- +12 VDC Absolute Maximum
- Differential Input
- Input Impedance: > 9 Kohms

Serial Interface

Two RS-423C ports (Serial A and Serial B)
- RS-232C/RS-422C signal compatible
- All serial ports are optically isolated

Baud rates: 110, 300, 1200, 2400, 4800, 9600, 19200 baud
Axis identifier: “1” through ”9,” “A” through “V”, 31 total for multi-axis drop

Programming Methods

RS-423C Serial ASCII Terminal (RS-232C and RS-422C signal compatible)
PCX Programming Software for IBM compatible PCs
T-21 Data Entry Terminal
T-60 Operator Interface Terminal (with EMERSON Motion Control ApplicationBuilder Software)

Diagnostics Indicator

Front panel eight segment LED

Noise Immunity

AC Line: tested to IEEE Std.
C62.41 - 1980, Cat. B., Impulsive wave
Designed to meet IEC801 Standard

Input/Output Lines Specifications

10 to 30 VDC, 2 ma. min. from external power supply
Outputs sink or source 200 ma. each inputs sink or source, 2 K ohms each

Input/Output Line Capacity

Basic FX Drive:12 optically isolated DC (8 input/4 output)
FX with PCM Application Module: 24 optically isolated DC (16 input/8 output)

Input/Output Functions

Maximum of 93 functions assignable to any input/output line (dependent on PCM Application Module used with FX Amplifier)

Resolution

Resolver Position: 12 bit, 4096 positions (FX Drives)
Steps per revolution: 50 - 25,000, user programmable

Performance

Resolver Accuracy:
Position
Cable Feedback
Length Accuracy
15’ ±20 arc. minutes
50’ ±30 arc. minutes
100’ ±40 arc. minutes
Velocity Accuracy: +0.01% of set speed

Motor Enclosure

TENV., splashproof per IP65 (dust tight, splashproof against 3.3 gpm water stream from 0.25"/6.35mm I.D. nozzle)

Environmental Specifications

Operating Temperature: (Derate available torque by 1%/°C for operation above 30°C for both motor and amplifier)
- Amplifier: 0° to 45° C (32° to 113° F)
- Motor: 0° to 90° C (32° to 194° F)

Relative Humidity: 0% to 95%, non condensing
Storage Temperature: -40° C to 85° C

Note: Actual system specifications will vary depending on the combination of FX Amplifier and Application Module selected. All stated specifications are +10%. Contact an EMERSON Motion Control Applications Engineer for verification of critical specifications.

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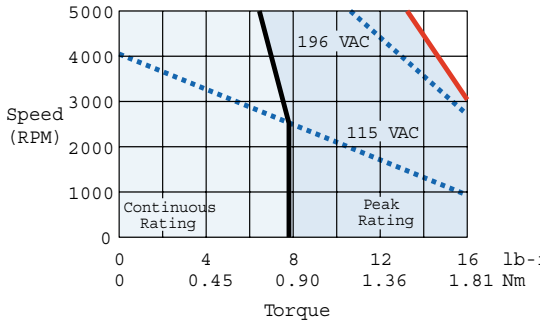
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FX SERIES PERFORMANCE CURVES

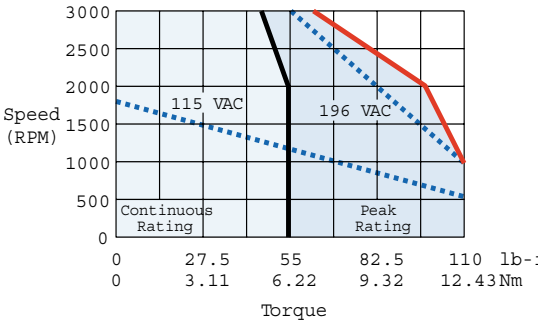
FX SPEED TORQUE CURVES

Performance curves below apply to all FX Series units. Based on 240 VAC (460 VAC on FX6210 and larger drives), 25° C motor ambient, 75° C rise on motor surface, motor mounted to an aluminum plate.

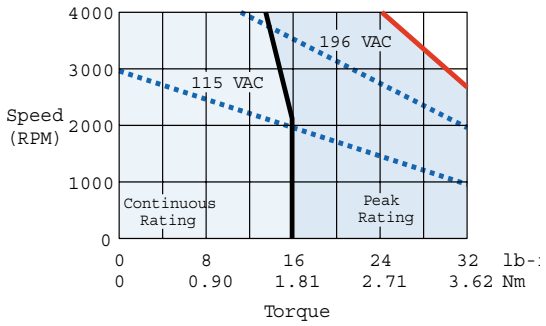
FX-208 WITH DX-208



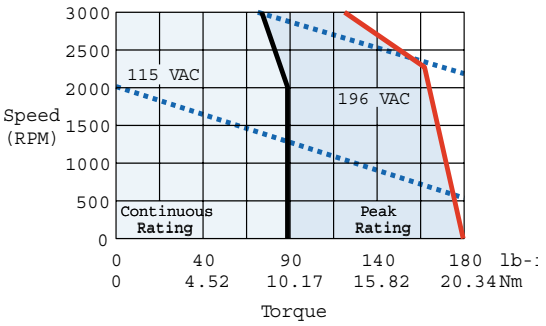
FX-455 WITH DX-455



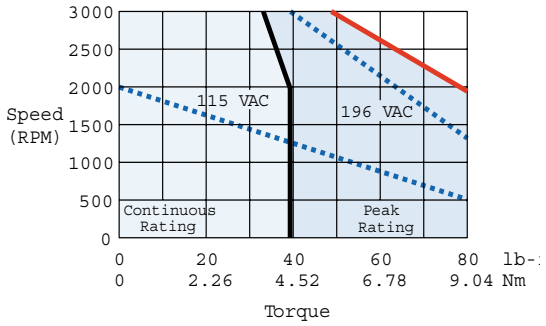
FX-316 WITH DX-316



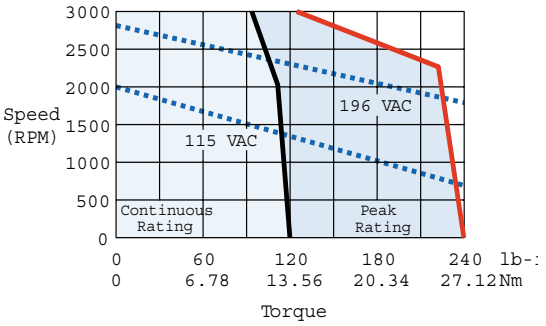
FX-490 WITH DX-490



FX-340 WITH DX-340



FX-4120 WITH DX-4120



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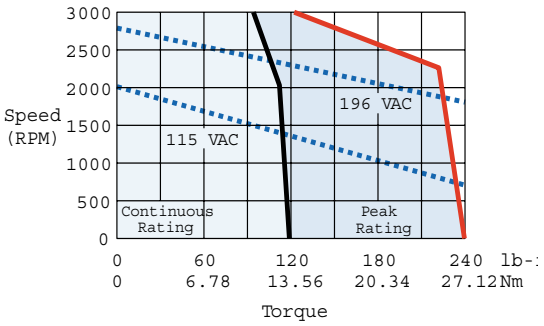
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FX SERIES PERFORMANCE CURVES

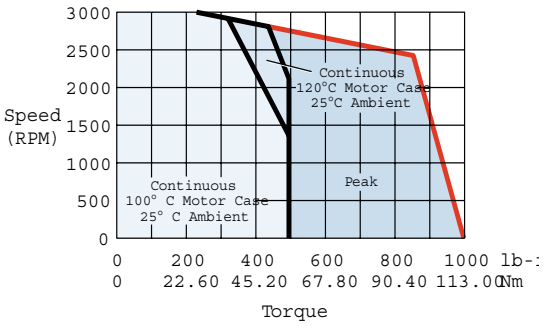
FX SPEED TORQUE CURVES

Performance curves below apply to all FX Series units. Based on 240 VAC (460 VAC on FX6210 and larger drives), 25° C motor ambient, 75° C rise on motor surface, motor mounted to an aluminum plate.

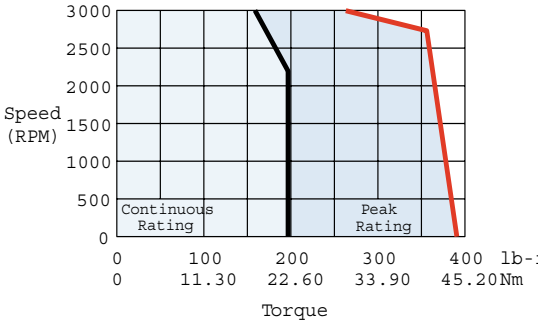
FX-6120 WITH DXM-6120



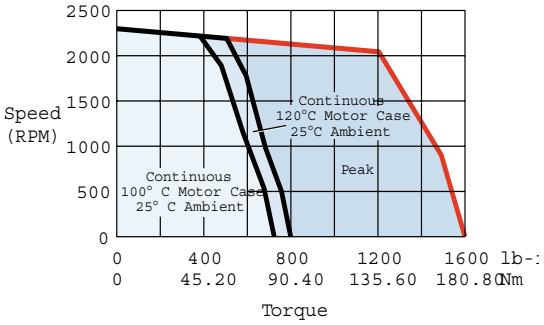
FX-8500 WITH BLM-8500-4



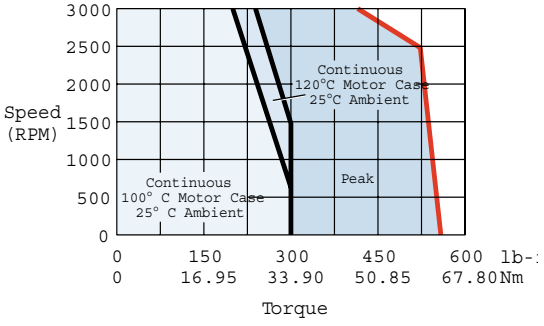
FX-6210 WITH BLM-6210



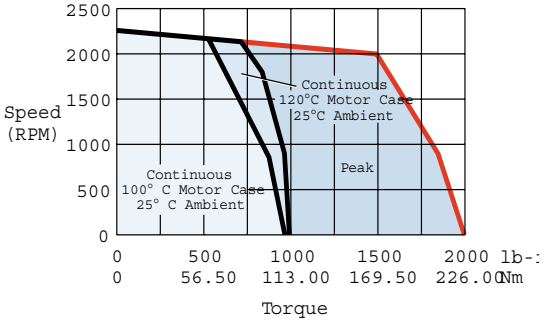
FX-8800 WITH BLM-8800-4



FX-6310 WITH BLM-6310-4



FX-81000 WITH BLM-81000-4



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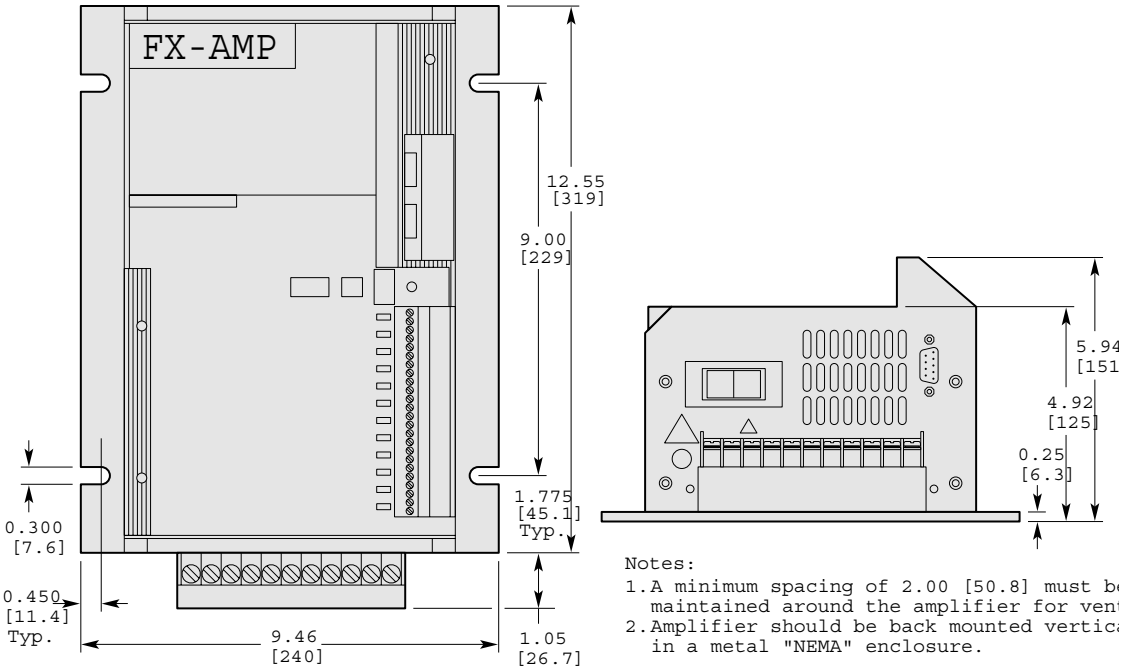
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FX SERIES DIMENSIONS

DRIVE DIMENSIONS

FX-280 / FX-316 /FX-340 / FX-455

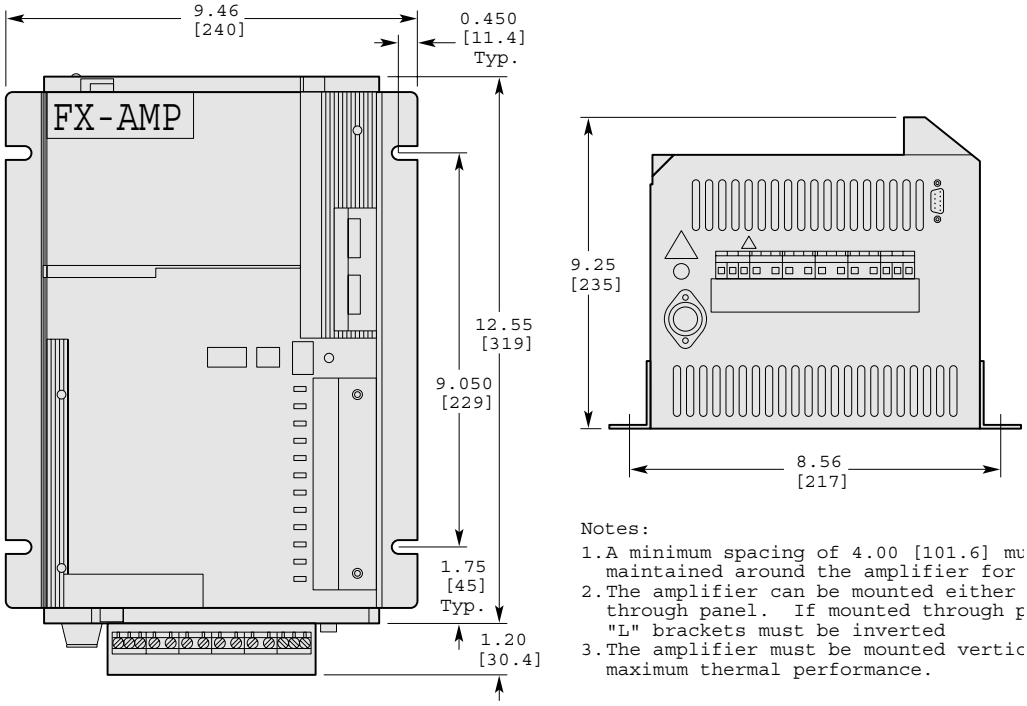
Inches [mm]



Notes:
1. A minimum spacing of 2.00 [50.8] must be maintained around the amplifier for vent
2. Amplifier should be back mounted vertica in a metal "NEMA" enclosure.

FX-490 / FX-4120 / FX-6120

Inches [mm]



Notes:
1. A minimum spacing of 4.00 [101.6] mu maintained around the amplifier for
2. The amplifier can be mounted either through panel. If mounted through p "L" brackets must be inverted
3. The amplifier must be mounted vertic maximum thermal performance.

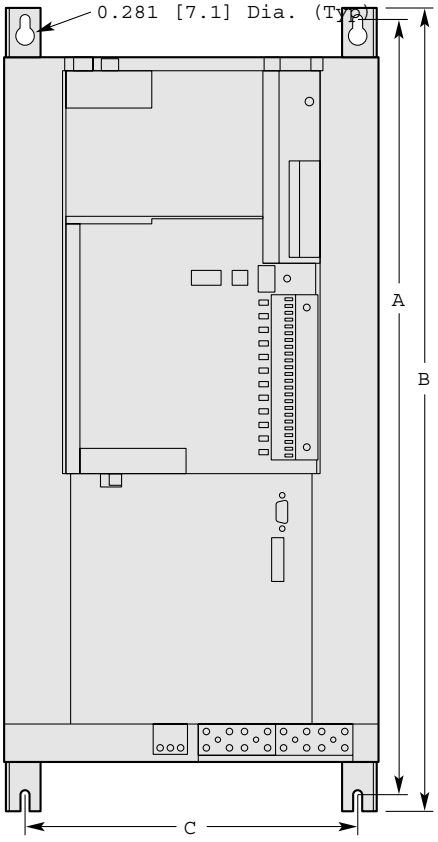
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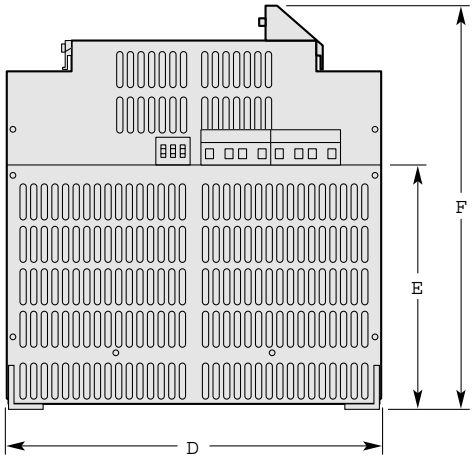
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DRIVE DIMENSIONS

FX-6210 / FX-6310 / FX- 8500 / FX-8800 / FX-810000

Inches [mm]





Model	Dim "A"	Dim "B"	Dim "C"	Dim "D"	Dim "E"	Dim "F"
FX-6210	21.25 [539.8]	22.00 [558.8]	6.00 [152.4]	7.62 [193.8]	8.50 [215.9]	13.75 [349.3]
FX-6310	21.25 [539.8]	22.00 [558.8]	6.00 [152.4]	7.62 [193.8]	8.50 [215.9]	13.75 [349.3]
FX-8500	21.25 [539.8]	22.00 [558.8]	6.00 [152.4]	7.62 [193.8]	8.50 [215.9]	13.75 [349.3]
FX-8800	22.69 [576.2]	23.50 [596.9]	9.85 [250.2]	11.13 [285.8]	8.36 [212.7]	13.75 [349.3]
FX-81000	22.69 [576.2]	23.50 [596.9]	9.85 [250.2]	11.13 [285.8]	8.36 [212.7]	13.75 [349.3]

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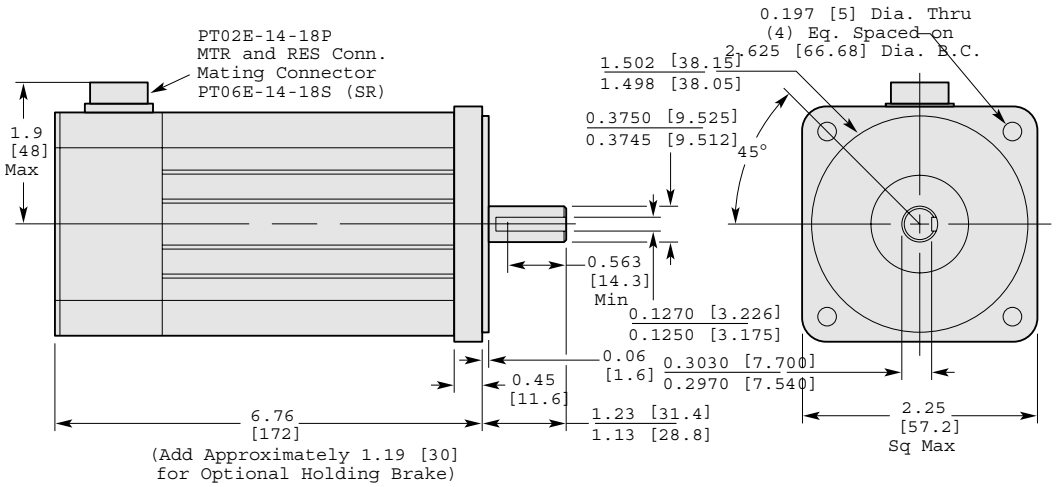
DX SERIES MOTOR DIMENSIONS

ENGLISH MOTOR **NEMA 23 FACE** **0.375 INCH SHAFT DIAMETER**

IP65 Rated

DXE-208

Inches [mm]

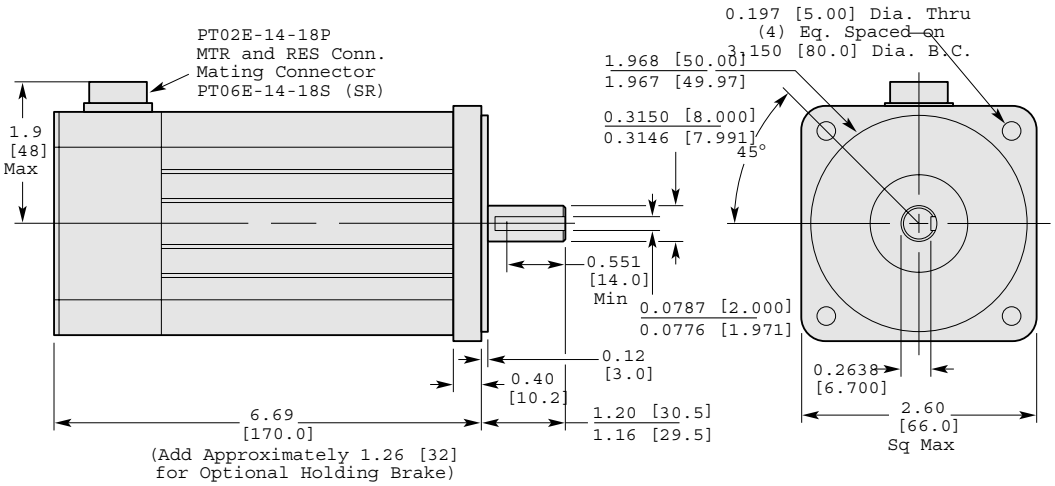


METRIC MOTOR

IP65 Rated

DXM-208

Inches [mm]



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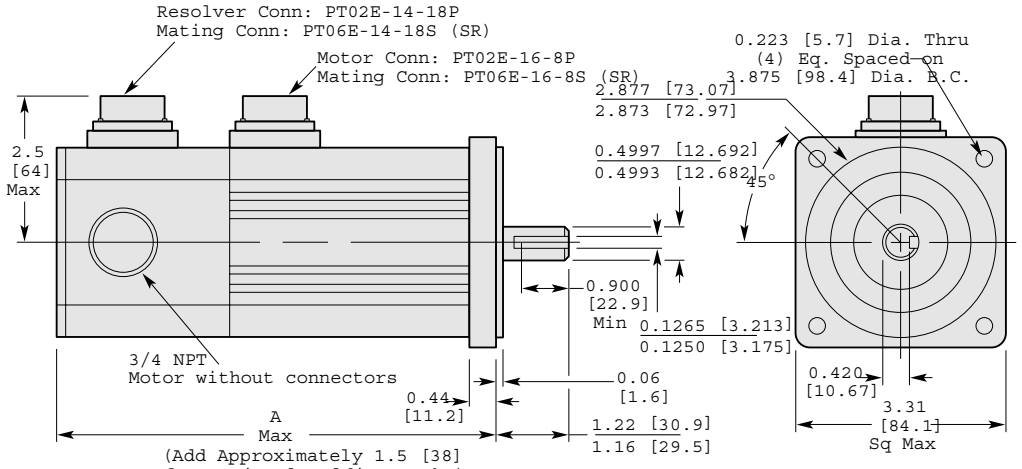
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ENGLISH MOTOR **NEMA 23 FACE** **0.5 INCH SHAFT DIAMETER**

IP65 Rated

DXE-316

Inches [mm]



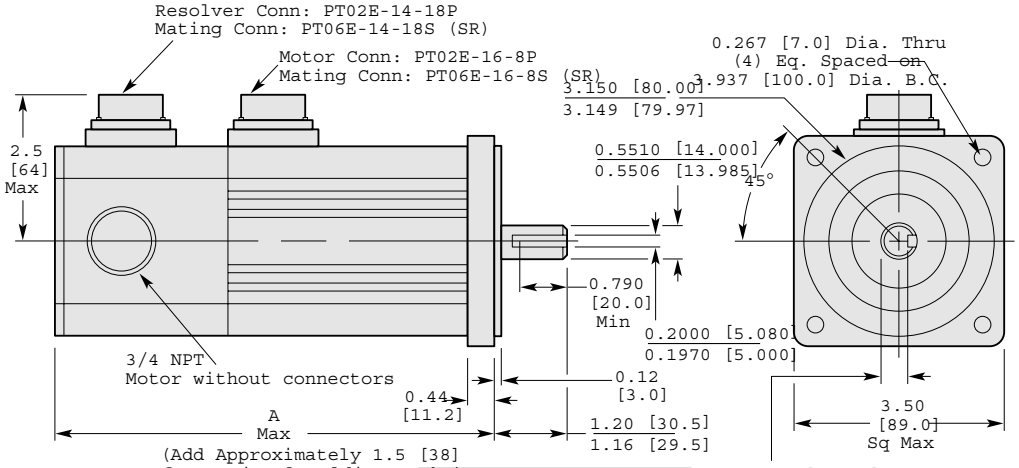
	Dim "A"
Motor with connectors	7.24 [184.0]
Motor without connectors	8.75 [223.0]

METRIC MOTOR

IP65 Rated

DXM-316 / DXM-340

Inches [mm]



	DXM-316	DXM-340
	Dim "A"	
Motor with connectors	7.24 [184.0]	10.24 [260.0]
Motor without connectors	8.75 [223.0]	11.75 [299.0]

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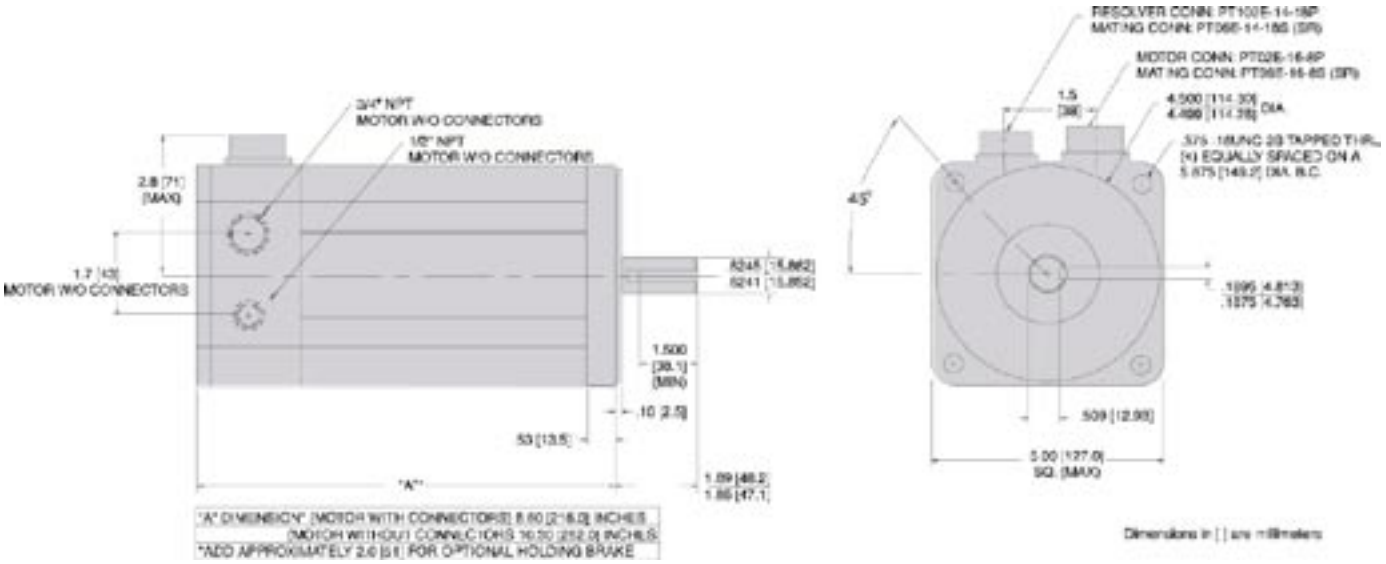
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DX SERIES MOTOR DIMENSIONS

ENGLISH MOTOR **NEMA 56C FACE** **0.625 INCH SHAFT DIAMETER**

IP65 Rated

DXE-455

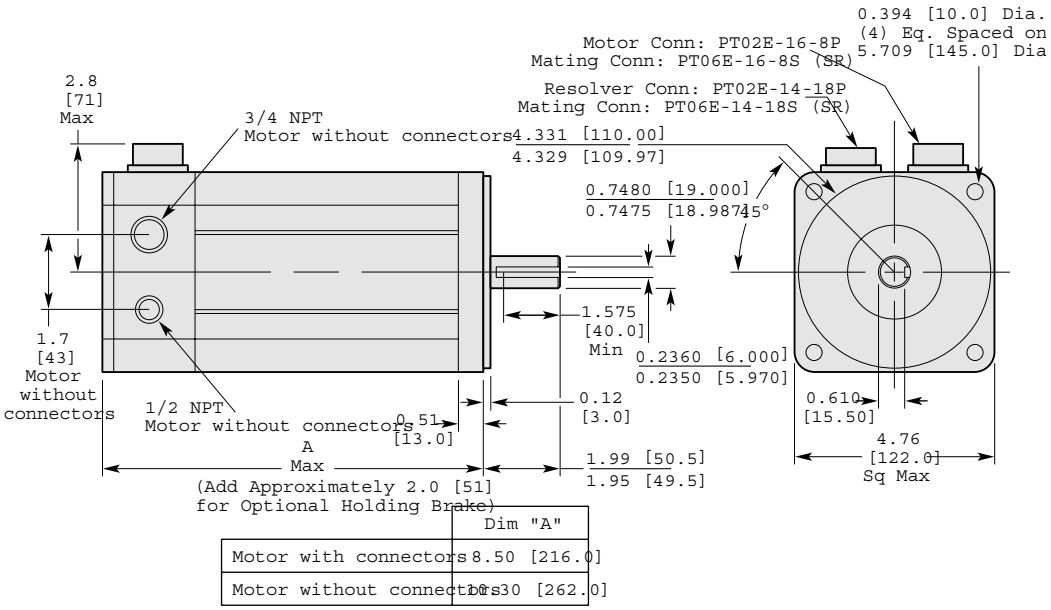


METRIC MOTOR

IP65 Rated

DXM-455

Inches [mm]



	Dim "A"
Motor with connectors	8.50 [216.0]
Motor without connectors	10.30 [262.0]

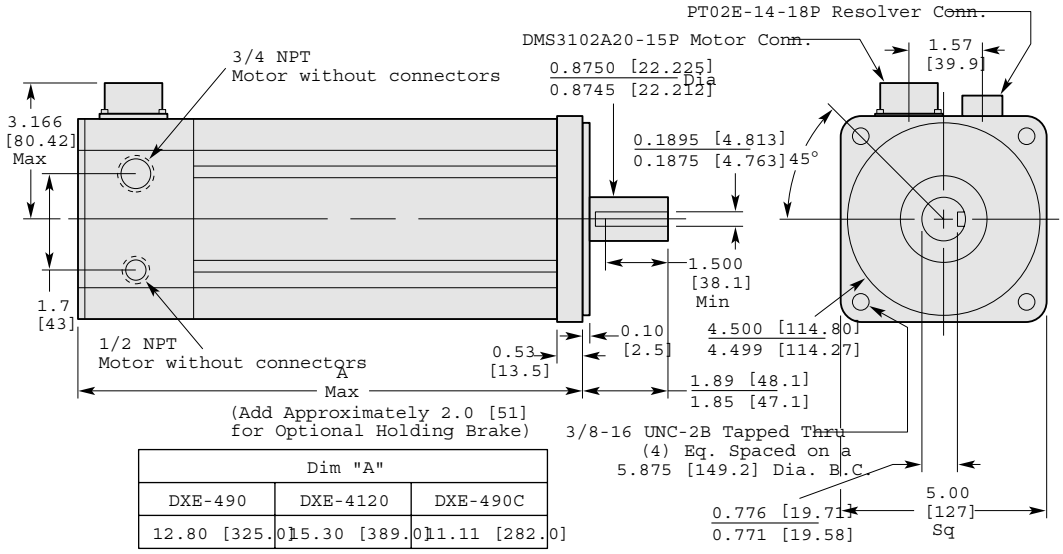
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ENGLISH MOTOR **NEMA 56C FACE** **0.875 INCH SHAFT DIAMETER**

IP65 Rated

DXE-490 / DXE-490C / DXE-4120

Inches [mm]



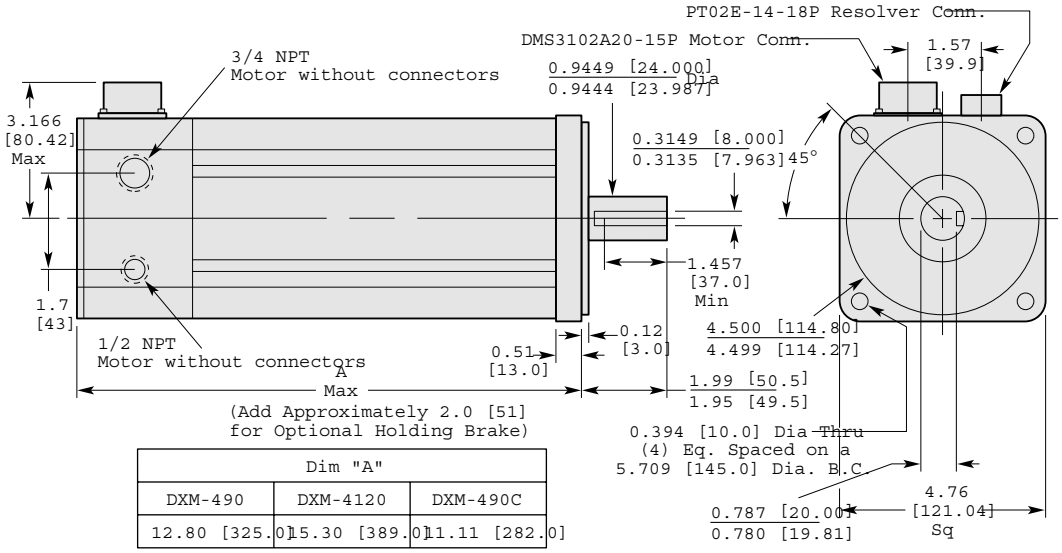
Dim "A"		
DXE-490	DXE-4120	DXE-490C
12.80 [325.0]	15.30 [389.0]	11.11 [282.0]

METRIC MOTOR

IP65 Rated

DXM-490 / DXM-490C / DXM-4120

Inches [mm]



Dim "A"		
DXM-490	DXM-4120	DXM-490C
12.80 [325.0]	15.30 [389.0]	11.11 [282.0]

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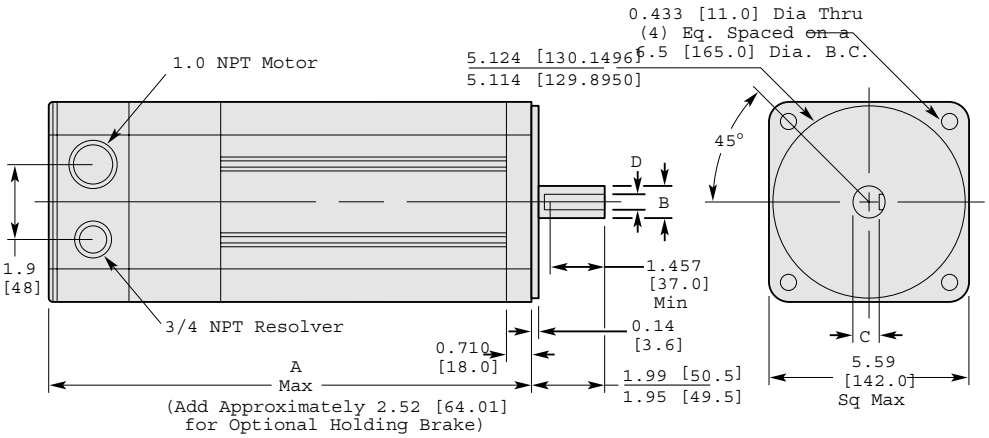
DX SERIES MOTOR DIMENSIONS

METRIC MOTOR

IP65 Rated

DXM-6120

Inches [mm]



Dim "A"	Dim "B"	Dim "C"	Dim "D"
13.35 [339]	0.9454 [24.009] 0.9448 [23.996]	0.787 [20.00] 0.780 [19.80]	0.3149 [8.000] 0.3135 [7.964]

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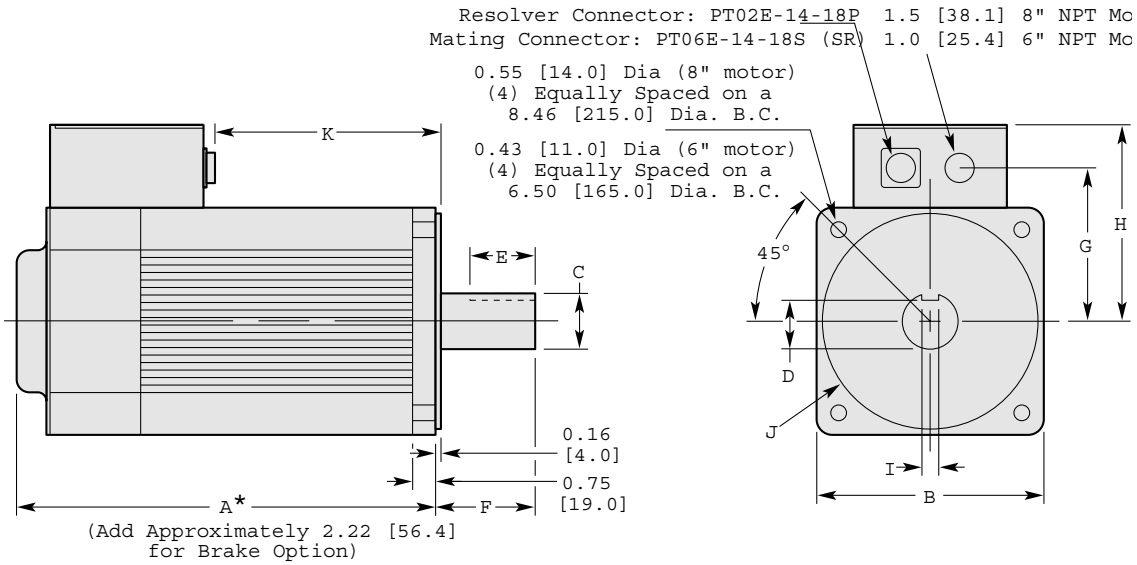
BL SERIES MOTOR DIMENSIONS

METRIC MOTOR

IP65 Rated

BLM-6210 / BLM-6310 / BLM-8500 / BLM-8800 / BLM-81000

Inches [mm]



	BLM-6210-4	BLM-6310-4	BLM-8500-4	BLM-8800-4	BLM-81000-4
Dim "A"	14.48 [367.8]	17.18 [436.4]	17.71 [449.9]	21.24 [539.4]	24.76 [628.9]
Dim "B"	5.59 [142.0]	5.59 [142.0]	7.48 [190.0]	7.48 [190.0]	7.48 [190.0]
Dim "C"	0.95 [24.0]	1.26 [32.0]	1.26 [32.0]	1.89 [48.0]	1.89 [48.0]
Dim "D"	0.79 [20.0]	1.06 [27.0]	1.06 [27.0]	1.67 [42.4]	1.67 [42.4]
Dim "E"	1.46 [37.0]	1.77 [45.0]	1.54 [39.0]	2.13 [54.0]	2.13 [54.0]
Dim "F"	1.97 [50.0]	2.28 [58.0]	2.28 [58.0]	3.23 [82.0]	3.23 [82.0]
Dim "G"	3.93 [99.8]	3.93 [99.8]	5.28 [134.0]	5.28 [134.0]	5.28 [134.0]
Dim "H"	6.02 [153.0]	6.02 [153.0]	7.35 [186.8]	7.35 [186.8]	7.35 [186.8]
Dim "I"	0.32 [8.0]	0.39 [10.0]	0.39 [10.0]	0.55 [14.0]	0.55 [14.0]
Dim "J"	5.12 [130.0]	5.12 [130.0]	7.09 [180.0]	7.09 [180.0]	7.09 [180.0]
Dim "K"	8.37 [212.6]	11.07 [281.2]	10.12 [257.0]	13.60 [346.5]	17.1 [436.0]

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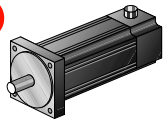
FX SERIES SELECTION

HOW TO ORDER

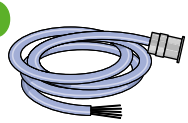
To build a complete FX system, one item from each of the following four ordering columns must be selected. Note that items 2-4 require additional input as to motor type and cable lengths. The basic systems respresented on this page can be built upon with a variety of optional configurations and accessory components that are ordered separately. Descriptions of these options and accessories are found on pages D28 thru D64.



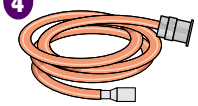
1 FX Servo Drive



2 DX or BL Servo Motor*



3 Motor Power Cable



4 Feedback Cable

FX Servo Drive	DX or BL Servo Motor*	Motor Power Cable	Feedback Cable
FX-208 (230 VAC)	DXE-208C DXM-208C	ECS-xxx (Combo Motor Power, Brake and Feedback Cable)	
	DXE-208CB DXM-208CB	ECS-xxx (Combo Motor Power, Brake and Feedback Cable)	
FX-316 (230 VAC)	DXE-316C DXE-316CB DXM-316C DXM-316CB	ECM-xxx	ECF-xxx
	DXE-316W DXE-316WB DXM-316W DXM-316WB	HPS-xxx or 16 AWG, 4 cond (customer supplied)	RC-xxx
FX-340 (230 VAC)	DXM-340C DXM-340CB	ECM-xxx	ECF-xxx
	DXM-340W DXM-340WB	HPS-xxx or 14 awg, 4 cond (customer supplied)	RC-xxx
FX-455 (230 VAC)	DXE-455C DXE-455CB DXM-455C DXM-455CB	ECM-xxx	ECF-xxx
	DXE-455W DXE-455WB DXM-455W DXM-455WB	HPS-xxx or 14 awg, 4 cond (customer supplied)	RC-xxx
FX-490 (230 VAC)	DXE-490C DXE-490CB DXM-490C DXM-490CB	ECL-xxx	ECF-xxx
	DXE-490W DXE-490WB DXM-490W DXM-490WB	HPM-xxx or 12 awg, 4 cond (customer supplied)	RC-xxx
FX-4120 (230 VAC)	DXE-4120C DXE-4120CB DXM-4120C DXM-4120CB	ECL-xxx	ECF-xxx
	DXE-4120W DXE-4120WB DXM-4120W DXM-4120WB	HPM-xxx or 12 awg, 4 cond (customer supplied)	RC-xxx
FX-6120 (230 VAC)	DXM-6120 DXM-6120B	HPM-xxx or 12 awg, 4 cond (customer supplied)	RC-xxx
FX-6210 (460 VAC)	BLM-6210-4 BLM-6210B-4	HPM-xxx or 12 awg, 4 cond (customer supplied)	HCF-xxx
FX-6310 (460 VAC)	BLM-6310-4 BLM-6310B-4	HPI-xxx or 8 awg, 4 cond (customer supplied)	HCF-xxx
FX-8500 (460 VAC)	BLM-8500-4	HPI-xxx or 8 awg, 4 cond (customer supplied)	HCF-xxx
FX-8800 (460 VAC)	BLM-8800-4	HPL-xxx or 6 awg, 4 cond (customer supplied)	HCF-xxx
FX-81000 (460 VAC)	BLM-81000-4		

2 MOTOR MODEL NUMBER GUIDE

BLE-316WB

Motor Series
DX = 230V
BL = 460 V

Mounting Flange
E = English
M = Metric

Frame Size (In)

Cont. Torque (lb-in)

Type
C = Connectorized
W = IP 65 w/o Connector

Brake Option
B = with Brake
Blank = w/o Brake

CABLE ORDERING OPTIONS

Motor power and feedback cables are available in standard lengths of 15 ft (015); 25 ft (025); and 50 ft (050). Non-standard lengths can be special ordered from the factory. *See page D30 for more information.*

3 MOTOR POWER CABLES

ECS-xxx For motors with connectors (ECS is a combination Motor Power, Brake, Feedback Cable – order only one per system)

ECM-xxx For motors with connectors and brake wires

ECL-xxx For motors with connectors and brake wires

HPS-xxx 16 AWG shielded cable w/brake wires

HPM-xxx 12 AWG shielded cable w/brake wires

HPI-xxx 8 AWG shielded cable w/ brake wires

HPL-xxx 6 AWG shielded cable w/ brake wires

4 FEEDBACK CABLES

ECS-xxx (see Motor Power Cable above)

RC-xxx Resolver feedback cable used with motor without connectors

ECF-xxx Resolver feedback cable used with connectorized 230 VAC motors

HCF-xxx Resolver feedback cable used with connectorized 460 VAC motors

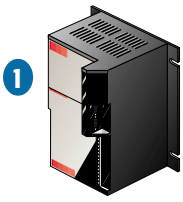
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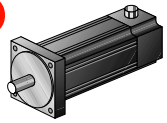
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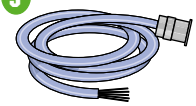
FX CE MARK SERIES SELECTION

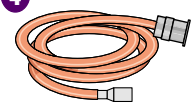
HOW TO ORDER

To build a complete FX CE Mark system, one item from each of the following four 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 are found on pages D28 thru D64.









1 FX Servo Drive	2 DX or BL Servo Motor	3 Motor Power Cable	4 Feedback Cable	Filters*
FX-208CE (230 VAC)	DXE-208C-090 DXM-208C-090 DXE-208CB-090 DXM-208CB-090	ECM-ICE-xxx ECM-ECE-xxx BHF-xxx	ECF-ICE-xxx ECF-ECE-xxx BHF	960186-02 and MPF
FX-316CE (230 VAC)	DXE-316C DXE-316CB DXM-316C DXM-316CB	ECM-ICE-xxx ECM-ECE-xxx	ECF-ICE-xxx ECF-ECE-xxx BHF	960186-02 and MPF
	DXE-316W DXE-316WB DXM-316W DXM-316WB	HPS-xxx or 16 AWG, 4 cond (customer supplied)	RC-xxx	
FX-340CE (230 VAC)	DXM-340C DXM-340CB	ECM-ICE-xxx ECM-ECE-xxx	ECF-ICE-xxx ECF-ECE-xxx, BHF	960186-02 and MPF
	DXM-340W DXM-340WB14 awg, 4 cond (customer supplied)	HPS-xxx or	RC-xxx	
FX-455CE (230 VAC)	DXE-455C DXE-455CB DXM-455C DXM-455CB	ECM-ICE-xxx ECM-ECE-xxx	ECF-ICE-xxx ECF-ECE-xxx BHF	960186-02 and MPF
	DXE-455W DXE-455WB DXM-455W DXM-455WB	HPS-xxx or 14 awg, 4 cond (customer supplied)	RC-xxx	
FX-490CE (230 VAC)	DXE-490C DXE-490CB DXM-490C DXM-490CB	ECL-ICE-xxx ECL-ECE-xxx	ECF-ICE-xxx ECF-ECE-xxx BHF	960187-02 and MPF
	DXE-490W DXE-490WB DXM-490W DXM-490WB	HPM-xxx or 12 awg, 4 cond (customer supplied)	RC-xxx	
FX-4120CE (230 VAC)	DXE-4120C DXE-4120CB DXM-4120C DXM-4120CB	ECL-ICE-xxx ECL-ECE-xxx	ECF-ICE-xxx ECF-ECE-xxx BHF-xxx	960187-02 and MPF
	DXE-4120W DXE-4120WB DXM-4120W DXM-4120WB	HPM-xxx or 12 awg, 4 cond (customer supplied)	RC-xxx	
FX-6120CE (230 VAC)	DXM-6120 DXM-6120B	HPM-xxx or 12 awg, 4 cond (customer supplied)	RC-xxx	960187-02 and MPF

* See page D29 for descriptions

2 MOTOR MODEL NUMBER GUIDE

BLE-316WB

Motor Series
DX = 230V
BL = 460 V

Mounting Flange
E = English
M = Metric

Frame Size (In)

Cont. Torque (lb-in)

Type
C = Connectorized
W = IP 65 w/o Connector

Brake Option
B = with Brake
Blank = w/o Brake

CABLE ORDERING OPTIONS

Motor power cables aren't available in standard lengths and must be special ordered from the factory. See page D30 for more information.

3 MOTOR POWER CABLES

HPS-xxx 16 AWG shielded cable w/brake wires

ECM-ICE-xxx Cable from drive to bulkhead connector

ECM-ECE-xxx Cable from bulkhead connector to motor power connector

ECL-ICE-xxx Cable from drive to bulkhead connector

ECL-ECE-xxx Cable from bulkhead connector to motor power connector

HPM-xxx 12 AWG shielded cable w/brake wires

4 FEEDBACK CABLES

ECF-ICE-xxx Cable from drive to bulkhead connector

ECF-ECE-xxx Cable from bulkhead connector to motor power connector

BHF Bulkhead connector

RC-xxx Resolver feedback cable used with motor without connectors

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FX SERIES OPTIONS AND ACCESSORIES

OPERATOR INTERFACE TERMINALS

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

T-21 Operator Interface Panel

T-21 2 line by 40 character, back lit LCD display; up to 98 user-defined messages

T-60 Operator Interface Panel

T-60 8 line by 40 character, back lit LCD display; 32k of RAM (standard); programmable to perform specific tasks. ACSII communication.

T-61 Operator Interface Panel

T-61 Same as T-60 but additional base, I/O 24 points, and more room for internal options

SCS SINEWAVE AND LINE DRIVER SYNCHRONIZATION ENCODERS

SCS Encoders provide speed and position information to the FX System. (See Options and Accessories Section, pages F38-F39 for complete specifications on SCS Encoders.)

Encoders for Syncronization Feedback - Sinewave

SCS-2 1000 line (4000 counts/rev)

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

SCS-3 2500 line (10000 counts/rev)

SCS-4 3000 line (12000 counts/rev)

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

Encoders for Syncronization Feedback - Line Driver

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

CE MARK ENCODER CABLES

Specify length in feet. (For example, 10 feet = 010). Non-standard lengths can be special ordered from the factory.

MSC-ICE-xxx Encoder feedback cable

MSC-ECE-xxx Encoder feedback cable with BHF bulkhead connector

Encoder Cable to PCM Modules

MSC-xxx



Cable from PCM application module to sync encoder; connector on both ends. Available in standard lengths of 15 ft (015); 25 ft (025) and 50 ft (050). Non-standard lengths can be special ordered from the factory.

SSC-xxx



Cable from PCM Application Module to PCM Application Module; connector on both ends. Available in standard lengths of 3 ft (003); 6 ft (006) and 10 ft (010). Non-standard lengths can be special ordered from the factory.

Dual Encoder Module

DEM-1 Dual encoder input module (See page D60 for complete specifications)

DSC-xxx



Cable from DEM-1 to a PCM Application Module; connector on both ends. Available in standard lengths of 6 ft (006) and 10 ft (010) only.

SERIAL INTERFACE CABLES

TIA-xxx



RS232 serial interface cable; DB9-F (AT type) straight molded connector on computer end; DB9P 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-F (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.

DDS-xxx



Drive to drive serial interface cable. Standard lengths of 3, 6 and 9 feet available. Order Number DD-003 for 3 ft; DD-006 for 6 ft; or DD-009 for 9 ft.

CE MARK SERIAL INTERFACE CABLES

Specify length in feet. (For example, 10 feet = 010). Non-standard lengths can be special ordered from the factory.

TIA-ICE-xxx Communication cable from PC to bulkhead or to FX Drive

TIA-ECE-xxx Communication cable from bulkhead to FX Drive; with BHF bulkhead connector

IBC-ICE-xxx Interbus-S communication cable from host to bulkhead or FX Drive

IBC-ECE-xxx Interbus-S communication cable from bulkhead to FX Drive; with BHF bulkhead connector



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FX SERIES OPTIONS AND ACCESSORIES

EXTERNAL SHUNT RESISTORS

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

Model	Dimensions W x H x D in (mm)	Value Ω	Capacity KWatts	FX Model Compatibility
ES-20-500	14 x 7 x 5 (356 x 178 x 127)	20	0.5	FX-6210 thru 81000
ES-20-1K	14 x 13 x 5 (356 x 330 x 127)	20	1	FX-6210 thru 81000
ES-20-2K	14 x 13 x 5 (356 x 330 x 127)	20	2	FX-6210 thru 81000
ES-14-3K	21 x 13 x 5 (533 x 330 x 127)	14	3	FX-6210 thru 81000



MPF MOTOR POWER FILTER

MPF Flange mounted ferrite ring for noise suppression. Required for CE installations. See Options and Accessories Section F, Page F42 for further specifications.



AC LINE FILTERS

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

Line Filter Model	Rating	FX Model Compatibility
LF-1A	1Ø 240 VAC 16A	FX-208 thru FX-455
LF-3A	3Ø 480 VAC 16A	FX-490 thru FX-6120

FX SERIES APPLICATION MODULES

For advanced positioning applications, EMERSON Motion Control offers a series of Application Modules that are quickly and easily attached to the front of any FX Drive. These modules allow FX Drives to perfom advanced positioning functions such as phase synchronization, ratio control, web control and rotary knife cutoffs. See page D31 for Application Modules Overview and Selection, or use the index chart at right to go directly to the appropriate module.



MISCELLANEOUS ACCESSORIES

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

I/O Jumper Strip



JMP-12 I/O jumper strip (quantity 10)

DC Bus Sharing Kit

For FX-8800 and FX-81000 only

BS-BASE KIT Main Kit

BS-EXT KIT Extension Kit

DX and BL Motor Fan Kits

FK6S-120 6 inch motor fan kit for DX-6120, BL-6210 and BL-6310

FK8K-120 8 inch motor fan kit for BL-8500, BL-8800 and BL-81000

525 Programming Motion Controller

525 Complete stand-alone programmable motion controller, controls any servo amplifier with analog velocity command

(See page D62 for complete specifications.)

Master Frequency Generator



MFG-1 Master frequency generator output. Emulates a synchronization encoder by generating quadrature encoder output signals. Allows system speed to be adjusted digitally.

(See page D61 for complete specifications.)



Module	Description	Page
PCM-11	Motion Program Controller	34-35
PCM-14	Slip Compensator	36-37
PCM-15	Ratio Controller	38-39
PCM-16	Phase Synchronization Controller	40-41
PCM-17	Random Infeed Controller	42-43
PCM-18	Web Controller	44-45
PCM-19	Conveyor Controller	46-47
PCM-22	Rotary Knife Controllers	48-49
PCM-22Q	Rotary Knife Controllers	50-51
PCM-23	Cam Profiler	52-53
PCM-24	Press Feed Controller	54-55
IBS-11	InterBus-S Module	56
IBS-15	InterBus-S Module	57
IOM-1	Input/Output Module	58

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FX SERIES CABLE OPTIONS

STANDARD FX CABLES

Motor power cables are available in standard lengths of 15 ft (015); 25 ft (025); and 50 ft (050). Non-standard lengths can be special ordered from the factory.

Motor Power cables

ECS-xxx and **ECSB-xxx**
(Combo Motor Power, Brake and Feedback Cable)



ECS-xxx For motors with connectors

ECM-xxx and **ECL-xxx**



ECM-xxx For motors with connectors and brake wires

ECL-xxx For motors with connectors and brake wires

HPS/HPM/HPI/HPL



HPS-xxx 16 AWG shielded cable w/ brake wires

HPM-xxx 12 AWG shielded cable w/ brake wires

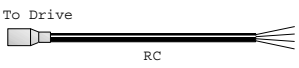
HPI-xxx 8 AWG shielded cable w/ brake wires

HPL-xxx 6 AWG shielded cable w/ brake wires

Feedback Cables

ECS-xxx (see Motor Power Cables above)

RC-xxx



Resolver feedback cable used with motor without connectors

ECF-xxx



Resolver feedback cable used with connectorized 230 VAC motors

HCF-xxx



Resolver feedback cable used with connectorized 460 VAC motors

STANDARD CE MARK CABLES

Motor power cables are available in standard lengths of 15 ft (015); 25 ft (025); and 50 ft (050). Non-standard lengths can be special ordered from the factory.

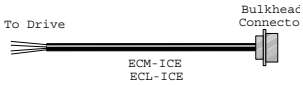
Motor Power Cables

HPS-xxx



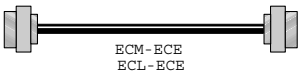
16 AWG shielded cable w/brake wires

ECM-ICE-xxx and **ECL-ICE-xxx**



Cable from drive to bulkhead connector

ECM-ECE-xxx and **ECL-ECE-xxx**



Cable from bulkhead connector to motor power connector

HPM-xxx



12 AWG shielded cable w/brake wires

Feedback Cables

ECF-ICE-xxx



Cable from drive to bulkhead connector; use with BHF

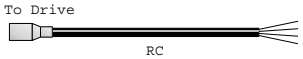
ECF-ECE-xxx



Cable from bulkhead connector to motor power connector

BHF  Bulkhead connector

RC-xxx



Resolver feedback cable used with motor without connectors

BULKHEAD CABLES

Specify length in feet. (For example, 10 feet = 010).

FX-208

Motor Power and Feedback Cables

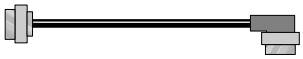
RMECS-xxx



Cable from drive to motor; right angle at motor

BHF  Bulkhead connector

RMECSB-xxx



Cable from bulkhead to motor; right angle at motor

FX-316 thru FX-455

Motor Power Cables
(Feedback cables listed below right)

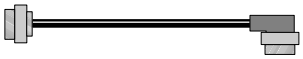
RMECM-xxx



Cable from drive to motor; right angle at motor

BHM  Bulkhead connector

RMECMB-xxx



Cable from bulkhead to motor; right angle at motor

ECMC-xxx



Cable from bulkhead to motor

FX-490 and FX-4120

Motor Power Cables
(Feedback cables listed below)

RMECL-xxx



Cable from drive to motor; right angle at motor

ECLB-xxx



Cable from drive to bulkhead connector

RMECLA-xxx



Cable from bulkhead to motor; right angle at motor

ECLC-xxx



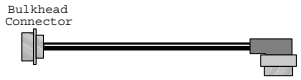
Cable from bulkhead to motor

ECLBA-xxx



Cable from bulkhead connector to motor

RMECLB-xxx

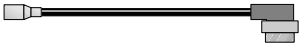


Cable from bulkhead to motor; right angle at motor

FX-316 thru FX-4120

Feedback Cables

RMECF-xxx



Cable from drive to motor; right angle at motor

BHF  Bulkhead connector

RMECFB-xxx



Cable from bulkhead to motor; right angle at motor

ECFC-xxx



Connectorized at both ends

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APPLICATION MODULES OVERVIEW AND SELECTION

OVERVIEW



APPLICATION MODULE FEATURE COMPARISON CHART

Product	Description	Indexes	Number of Programs	Total Program Steps	Hardware I/O	Cycles/ Setup/ Cam Profiles	Enhanced Programm. Features Available	Sync. Indexes	Cycle PGOs	PLS Points	Master Axis PLS Points	InterBus-S Comm.	Analog Inputs	Analog Outputs
FX Drive Only		32	10	100	8 Inputs 4 Outputs								1 Input 10 Bit	
FX with: **PCM-11**	Motion Program Controller	256	100	1024	16 Inputs 8 Outputs (total on drive and PCM Module)	N/A	YES	N/A	NONE	16	N/A	NO	1 Input (10 Bit)	NO
FX with: **PCM-14**	Slip Compensation Controller							YES						
FX with: **PCM-15**	Ratio Controller													
FX with: **PCM-16**	Phase Synchronization Controller	64		512		16 Cycles	NO		8 / Cycle	NONE				
FX with: **PCM-17**	Random Infeed Controller					16 Infeeds			NONE					
FX with: **PCM-18**	Web Controller	256		1024		N/A							2 Inputs (10 & 12 Bit)	
FX with: **PCM-19**	Conveyor Controller	64		512		16 Setups							1 Input (10 Bit)	
FX with: **PCM-22**	Rotary Knife Controller (Repeatable master lengths)					16 Cycles								
FX with: **PCM-22Q**	Rotary Knife (Random master lengths)					16 Cycles								
FX with: **PCM-23**	Cam Profile Controller	256		1024		4 Cam Profiles	YES			16	16 / Cycle			
FX with: **PCM-24**	Press Feed Controller					N/A					N/A		2 Inputs (10 & 12 Bit)	1 Output (12 Bit)
FX with: **IBS-11**	Motion Program Controller (with InterBus-S communications)							N/A				InterBus-s	1 Input (10 Bit)	
FX with: **IBS15**	Ratio Controller (with InterBus-S communications)												2 Inputs (10 & 12 Bit)	1 Output (12 Bit)

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ADVANCED PROGRAMMING FOR APPLICATION MODULES

FEATURES

- Performs equations and math operations within the PCX Software program
- Allows user to label individual axes with an ID description
- Provides global external input time limit
- Expands available I/O lines to 16 inputs and 8 outputs
- Programmable limit switch operation
- User registers are available for storage of data
- User messages can be transmitted to the drive via the serial port
- Advanced jump and wait capabilities
- Conditional branching of program steps to accomodate complex positioning tasks
- Alpha-numeric labels as program step addresses
- Enables variations of programmable indexes and jog parameters during execution of a program
- Send commands directly to the FX Drive from within a program
- Synchronizes jogs to master axis (PCM-14 and 15 only)

DESCRIPTION

Advanced Programming provides many enhanced features when setting up motion programs using PCX Software with an FX Drive and a PCM-11, PCM-14, PCM-15, PCM-23, PCM-24, IBS-11 and IBS-15 Application Module. These additional programming features and the easy-to-use PCX software format make the FX Drive and PCM Module combination an extremely powerful motion control tool for complex positioning tasks.

AXIS ID DESCRIPTION

This function allows the user to enter a unique, 32 character, alpha-numeric description for each axis in their system which is displayed at the top of each PCX screen. The descriptions allow quick identification of an axis selected when communication with the FX Drive is required.

PROGRAMMABLE LIMIT SWITCHES

With the PLS feature output patterns can be updated at up to 16 specific motor positions. The user sets the starting and ending position as well as the desired output pattern. When the position of the motor is in that range the FX Drive will output the user defined outputs.

INPUT AND OUTPUT LINE EXPANSION

There are an additional 16 internal input and 16 internal output lines available. These internal I/O lines give the user access to a total of 32 input (16 hardware and 16 internal) and 24 output (eight hardware and 16 internal) lines per FX Drive. They can be linked to each other to provide “flag setting” capabilities within a program. Hardwired inputs can also be linked to output lines.

USER REGISTERS FOR DATA STORAGE

User Registers act as “workspaces” for the storage of data in non-volatile memory. Examples of stored data include:

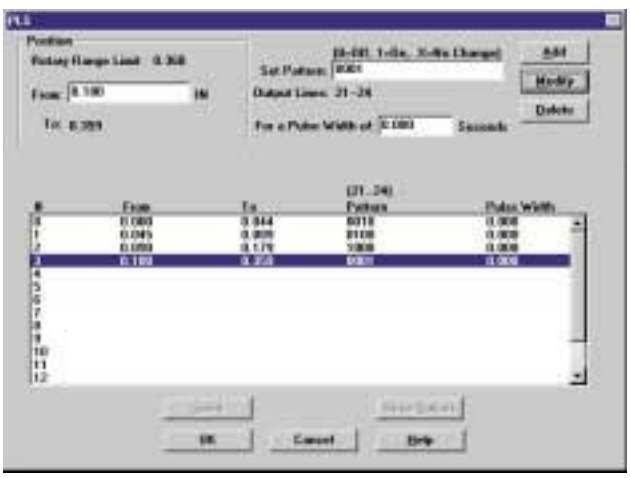
- FX Drive variables that are used in math equations.
- Values to be used in conditional branches in programs.
- Flags or counters that act as progress monitors in programs.

From the User Registers Setup Screen, shown below, variable names are defined with up to 16 characters. A total of 64 individual registers with data can be stored in non-volatile memory.

Drive Parameters



Programmable Limit Switches



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ADVANCED PROGRAMMING FOR APPLICATION MODULES

EQUATIONS AND MATH OPERATIONS

Equations and math operations may modify the content of user registers. The values stored in the register may later be used to change motion parameters during a program, such as index distance, velocity, dwell time, or the number of times an action takes place.

The following math operators are available:

+	Addition
-	Subtraction
*****	Multiplication
/	Division
=	Equals
^	Exponent of a value or register (e.g., Length ^3)
SQRT	(Square root of a value)
(	Left paren
)	Right paren

USER MESSAGES FOR TRANSMISSION TO THE SERIAL PORT

Sixteen unique user messages of up to 32 characters may be defined and used within a program. Each of these messages may be sent to the FX Drive Serial Port along with corresponding numeric data such as following error, current velocity, current position, etc. This allows the user to watch program progress or trigger information on a users' display or terminal.

SYNCHRONIZED JOG (PCM-14, 15 ONLY)

Synchronized Jog allows the user to place the FX Drive in a Jog mode and have the velocity vary according to sync encoder. The ratio at which Sync Jog follows the encoder is based on the user defined ratio.

GLOBAL EXTERNAL INPUT TIME LIMIT

An optional time limit has been added to enhance the Wait for Input function. This new function will prevent program execution from waiting indefinitely at a Wait for Input program statement when a required sensor input is not received.

ADVANCED PROGRAM COMMANDS

Listed below are enhanced program commands available. These commands greatly increase the flexibility of a program. With these commands a user can now perform much more complex motion and control functions. These commands, as with all FX Drive program commands, are user prompted on what is required making the FX Drive easy to set up.

Additional Command Set

- Divide a Register
- Add a Register
- Subtract a Register
- Multiply a Register
- Raise a Register to an Exponent
- Load a Value into a Register
- Branch on Specific Register Data
- Change Drive Parameters
- Program Index
- Advanced Jump Commands
- Advanced Wait Commands
- Program Label
- Call a Math Equation
- Programmable Outputs
- Program Jog
- Stop Motion
- Wait for Encoder Count
- Write Jog Parameter
- Write Index Parameter
- Send Data Out the Serial Port
- Wait for Specific User Defined Data

PROGRAM INDEX, PROGRAM JOG (I,PJ)

An important feature of Advanced Programming is the ability to initiate motion from the program and execute subsequent non-motion program steps. The program can monitor control parameters such as position, velocity, encoder position, and other drive parameters while the motor is in motion.

User Registers Set Up



Global External Input Time Limit Set Up



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PCM-11 MOTION PROGRAM CONTROLLER

FEATURES

- Programmed with easy-to-use PCX Software
- Access to Advanced Programming Features (see pages D32-D33)
- Stores up to 256 indexes, 100 motion programs, and 1024 steps in non-volatile memory
- Indexes and other functions may be sequenced using the PCX programming software
- Allows FX Positioning Servo Drive to perform compound indexes for precise velocity changes at specified limits
- Programs moves as incremental, absolute, feed to sensor, registration, rotary clockwise or rotary counterclockwise
- Conditional jump and wait commands modify flow of program
- Expands I/O capacity with 8 optically isolated input lines and 4 optically isolated output lines
- 65 user assignable I/O functions
- Stores parameters in non-volatile memory to allow unit to be moved to another FX Drive of the same size without losing data

DESCRIPTION

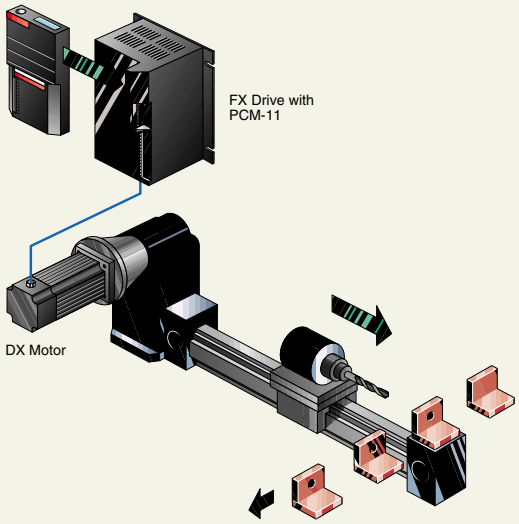
The PCM-11 Motion Program Controller is an Application Module that attaches to any FX Positioning Servo Drive. The PCM-11 increases the capability of the basic FX Drive from a simple indexing drive to a flexible and powerful motion programmer.

Several programming features are added to an FX Drive with the addition of a PCM-11. Some of those features include an increased number of indexes from 32 to 256, the ability to define up to 100 programs with as many as 30 steps per program with a total of 1024 steps, and the ability to compound indexes.

In addition to the increased programming capacity offered by the PCM-11, available I/O is doubled to 16 input lines and 8 output lines. All I/O on the FX Drive and the PCM-11 is optically isolated. The PCM-11 stores all parameters in non-volatile memory. This allows the module to be moved to another FX Drive of the same size to operate the same programs without downloading the program.

The PCM-11 is programmed using EMERSON Motion Control's PCX Software. This software greatly simplifies system set up by calculating all necessary moves based on parameters supplied by the user such as length of move and dwell time.

TYPICAL PCM-11 MOTION PROGRAM CONTROLLER APPLICATION



In this PCM-11 application, the FX Drive with a PCM-11 positions the drill head toward the product at a high speed, then slows as the drill gets closer to the product. A very slow index is executed as the drill makes contact and drills through the product. After the drilling is complete, the FX Drive executes a fast index moving the drill back to the home position. At the home position, the PCM-11 waits for an input alerting the FX Drive that product is once again in position and that the program can once again be executed. Outputs are used to control drill and motor coolant. An input is used to look for a broken drill.

OPERATION

The PCM-11 Motion Program Controller allows 256 indexes to be set up and executed to meet the needs of the application. The PCX Programming software is menu-driven allowing parameters relating to application to be loaded into a the FX Drive. A program consists of a series of steps. Each step can be defined as an index or another function. Other functions include: compound indexing, dwell times, home, wait for input, set output, jump on input, set motor torque, set following error, and call program. Up to 256 steps can be entered into a single program. Individual programs can also be linked by being called in steps. The PCM-11 can store up to 100 separate programs and 1024 individual steps in onboard, non-volatile memory.

Each program generated using PCX performs a series of events. When executed in conjunction with machine cycles, particular functions can be performed. For example, as a conveyor moves products past a sensor, the sensor activates an input on the PCM-11 instructing the FX Drive to initiate a program. This program may position the product towards a packaging machine. If a different sensor identifies a flaw in the product, that sensor could activate an input on the PCM-11 instructing the FX Drive to position the product towards a rejection bin.

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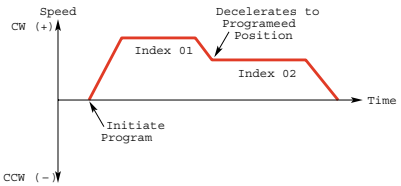
PCM-11 MOTION PROGRAM CONTROLLER

Selecting and initiating programs in the PCM-11 can be performed in one of two ways: hardware selection of the appropriate input line, or via serial selection using serial commands sent to the FX Drive's serial port from a PLC or from PCX.

Outputs can also be generated by the PCM-11 to communicate to other machine controls such as PLCs. The program screen in PCX allows the user to define when in the program the output will be generated. Output states can be changed while the FX Drive is executing a program.

COMPOUND INDEXES

In addition to standard indexes, the PCM-11 can compound indexes. Compounding indexes allows precise velocity changes to be made without the FX Drive having to stop the motion of the motor to perform another index. This function can help decrease machine cycle times.



This drawing illustrates a simple move using compound indexing. Index 01 accelerates to speed, maintains that speed, then decelerates to the speed specified in index 02 at the distance specified in index 01. Index 02 distance is then completed.

PROGRAMMING

The PCM-11 is programmed using EMERSON Motion Control's PCX Software. This software runs on any IBM or compatible PC with at least 545K of free RAM. PCX allows users to customize the PCM-11 to meet the requirements of a specific applications. No knowledge of high level programming languages is required to operate PCX.

SPECIFICATIONS

Programming:

- Programs using PCX Software, Version 6.2 or above
- ASCII Serial Commands

Data Capacity:

- 100 programs with 1024 program steps, 256 indexes

Interfaces:

- 12 optically isolated I/O lines (8 input, 4 output)

Data Entry Options:

- PCX Software for use on PCs
- T-21 Data Entry Panel
- T-60 Operator Interface
- ASCII Serial Commands

Available Predefined I/O Functions:

- 35 Input Functions
- 20 Output Functions

ORDERING INFORMATION:

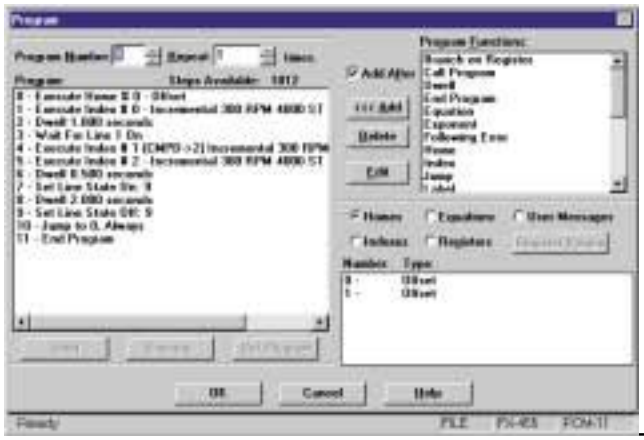
- PCM-11 Motion Program Controller
- T-21 Data Entry Panel
- T-60 Operator Interface



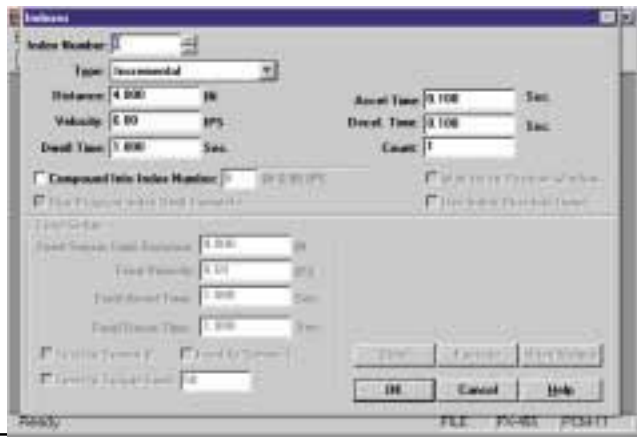
The PCX programming software allows the user to set up as many as 256 indexes. These indexes can be called up for execution into any of 100 programs. Both the indexes and the programs are stored in the PCM-11's non-volatile memory.

After drive configuration parameters have been defined, the normal sequence would be to set up indexes to be used within a program. In the Index Set up Screen below, an index is defined as an incremental move, meaning that the move is relative to the current position of the motor. The distance of the move has been defined as 6.0 inches at a velocity of 300 inches per minute. Both the acceleration time and the deceleration time are set at 0.100 seconds.

PCX: Program Set Up Screen



PCX: Index Set Up Screen



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PCM-14 SLIP COMPENSATOR

FEATURES

- Programmed with easy-to-use PCX Software
- Access to Advanced Programming Features (see pages D32-D33)
- Allows an FX Drive to automatically compensate for product slip to maintain precise position
- Monitors an external encoder to provide precise position feedback of product
- Programmable to run in re-index slip compensation mode, continuous slip compensation mode, or both modes combined
- Allows FX Drive to be synchronized to a master axis
- Stores up to 100 separate programs and 256 indexes in non-volatile memory
- 68 assignable I/O functions
- Expands I/O capacity of basic FX Drive with 8 optically isolated input and 4 optically isolated output lines
- Stores parameters in non-volatile memory to allow unit to be moved to another FX Drive of the same size without losing data

DESCRIPTION

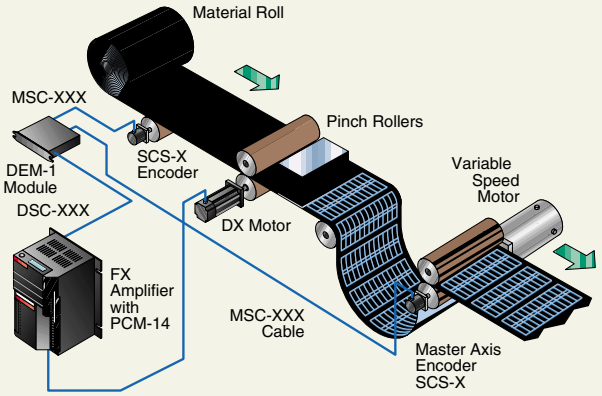
The PCM-14 Slip Compensator is an application module that attaches to any EMERSON Motion Control FX Positioning Servo Drive. The PCM-14 allows an FX Drive to compensate for slippage so that consistent and precise positioning can be maintained. Slippage may be caused by friction or mechanical deficiencies in a system.

Slip compensation is accomplished by using the PCM-14 to monitor the output of a compatible encoder or linear scale which measures the actual movement of the material or product being indexed by an FX Drive. The PCM-14 compares the encoder feedback with the actual position of the DX Motor. The PCM-14 then calculates any correction needed to move the product to the desired final position. To simplify and expand the flexibility of machines and processes, the PCM-14 can synchronize its motion to a master axis. Master axis reference signals can come from either an upstream FX Drive or from a synchronization encoder.

OPERATION

When attached to a standard FX Drive, the PCM-14 will operate as a simple motion program controller–executing user defined indexes based on externally generated inputs. The PCM-14 is able to compensate for slippage when the product or material needs to be in precise position for applications such as cutting, perforating, vacuum forming, marking, or high precision metal removal.

TYPICAL PCM-14 SLIP COMPENSATOR APPLICATION



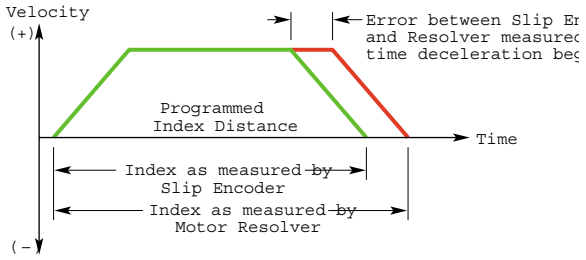
In this application, the PCM-14 monitors signals from two encoders. A DEM-1 Dual Encoder Module allows two encoder signals to be connected to the PCM-14 Module. Signals from the slip encoder allows the FX Drive to make corrections to the position of the material. Precise positioning is required so that the material is accurately set in place to be stamped by a die cutter. Reference signals from the master axis encoder allows the PCM-14 to synchronize the FX Drive to the master axis driven by a variable speed motor. The screens on the facing page show an example of how an index of 8.000 inches is set up and how a program using this index is configured for the application above.

An FX-Drive with a PCM-14 can be programmed to operate in one of two modes: Continuous Slip Compensation Mode or Re-index Compensation Mode. The PCM-14 can also be set up to run in both modes simultaneously.

CONTINUOUS SLIP COMPENSATION MODE

When performing Continuous Mode slip compensation, the FX Drive monitors feedback from the encoder while executing indexes. The FX Drive compares the programmed motion for the index being executed with the motion measured by the slip encoder. The error between the two is accumulated as the index runs.

At the dynamically calculated point of deceleration the accumulated error is added algebraically to the index length to compensate for all of the slip which has occurred up to that point. In the Continuous Mode, the system does not attempt to compensate for any additional slip that may occur during deceleration.



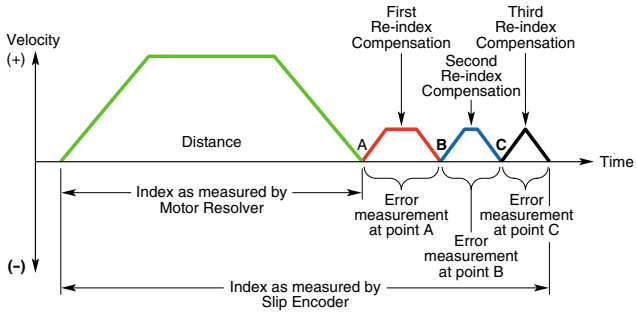
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PCM-14 SLIP COMPENSATOR

RE-INDEX MODE SLIP COMPENSATION MODE

When using the Re-index Mode slip compensation feature, the user defines a compensation index. This index will cause a move forward or a move backward at the completion of the programmed index to compensate for error between the motor resolver and the remote encoder feedback measured at the end of the move.



The compensation index operates at a user defined acceleration/ deceleration rate and velocity. The length and direction of compensation index will be calculated by the FX Drive and will equal the error measured at the completion of the programmed index. If additional slippage occurs during the move in the Re-index Mode, the FX Drive can be programmed to re-execute the compensation index. The compensation index can be repeated until the error is within a programmed Final Position Error Limit setting or until a preset number of re-indexes is executed.

PROGRAMMING

The PCM-14 is programmed using EMERSON Motion Control's PCX software. This software operates on any IBM or compatible PC with at least 545K of free RAM. Using PCX requires no knowledge of high level programming languages. Thorough knowledge of the application is needed. This knowledge is used to set up the FX Drive with the PCM-14 to meet the physical system requirements.

PCM-14 SPECIFICATIONS

Programming:

- Programs using PCX Software, Version 6.2 or above
- ASCII Serial Commands

Data Capacity:

- 100 programs with 1024 program steps, 63 indexes

Available Predefined I/O Functions:

- 44 Input Functions
- 24 Output Functions

Interfaces:

- 12 optically isolated I/O lines (8 input, 4 output)
- Synchronization/Position Input
  SCS-X Encoder Signals
  Upstream FX Drive Position
- Synchronization/Position Output
  SCS-X Encoder Signals
  Upstream FX Drive Position
  DX Motor Position

Data Entry Options:

- T-21 Data Entry Panel
- T-60 Operator Interface
- ASCII Serial Commands



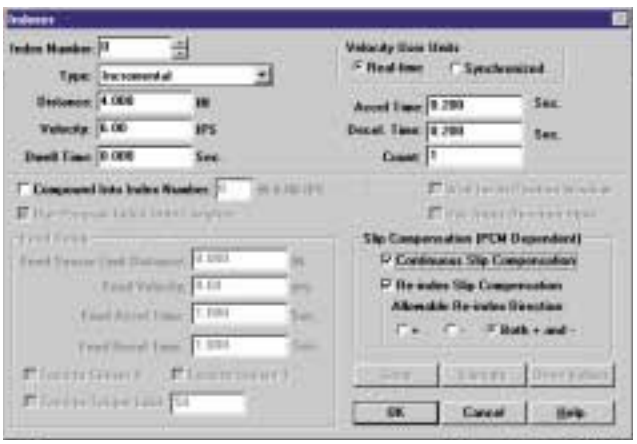
ORDERING INFORMATION:

- PCM-14 Slip Compensator
- DEM-1 Dual Encoder Module
- DSC-xxx* DEM-1 to Application Module cable
- SCS-X Synchronization Encoder
- MSC-xxx* Encoder to Application Module cable
- SSC-xxx* App. Module to App. Module Sync. cable

*xxx refers to cable length in feet.

When setting up a PCM-14 system the first parameter to be defined should be the slip encoder's relationship to actual distance moved. The next step is to configure an index for slip compensation. Shown below is a sample index. This index is set up for both continuous and re-index capability. The screens shown below demonstrate the simplicity in setting up an FX Drive.

PCX: Index Set Up Screen



PCX: Program Set Up Screen



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PCM-15 RATIO CONTROLLER

FEATURES

- Programmed with easy-to-use PCX Software
- Access to Advanced Programming Features (see pages D32-D33)
- Provides programmable time base ratio control between an FX Drive and another axis of motion
- Allows ratio control, electronic line shafting and flying cutoff capability
- Allows execution of both synchronized and non-synchronized motion in the same motion program
- Programmable counters for solving flying cutoff applications
- 68 user assignable I/O functions
- Expands I/O capacity with 8 optically isolated input and 4 optically isolated outputs lines
- Stores parameters in non-volatile memory to allow PCM-15 to be moved to another FX Drive of the same size without losing data

DESCRIPTION

The PCM-15 Ratio Controller is an application module that attaches to any EMERSON Motion Control FX Positioning Servo Drive. The PCM-15 provides precise programmable ratio control relative to other machine motion. The PCM-15 has the capability to follow a master encoder or another FX Drive with a PCM Application Module providing synchronization signal output.

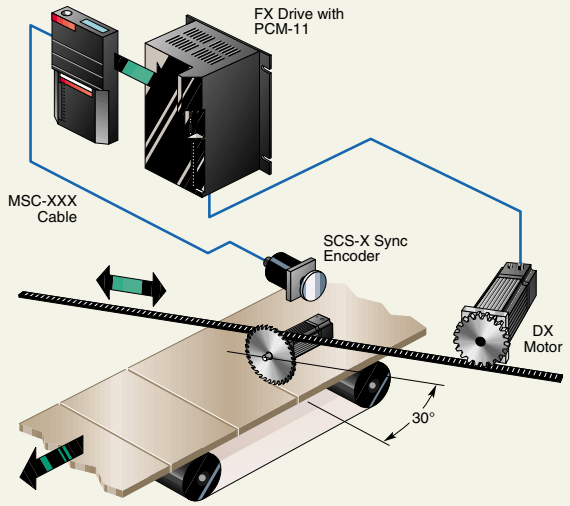
There are two modes of operation with the PCM-15. The Time Based Ratio Mode allows the PCM-15 to vary the ratio based on the velocity of the master axis. The Electronic Line Shaft Mode allows the PCM-15 to track a master reference signal pulse per pulse.

The PCM-15 also adds I/O line capacity to the FX Drive for a total of 16 input lines and 8 output lines. These lines can be used to interface to other machine controls such as PLCs and industrial computers. All I/O lines are optically isolated.

OPERATION

The master signal may be taken from a Synchronization Encoder coupled to the master shaft, or from another FX Series Drive with a PCM-15 acting as the system master. More than one PCM-15 may be linked to a single master encoder or PCM-15 with easy to install preassembled connectorized cables. Changes in ratio, velocity, distance, etc., may be entered using a T-21 Data Entry Panel, T-60 Operator Interface, ASCII serial commands or PCX. These parameters can be entered either during machine operation or while the follower motor is at rest.

TYPICAL PCM-15 RATIO CONTROLLER APPLICATION



In this typical flying cutoff application using an FX Drive equipped with a PCM-15, a programmable pulse count generated by an encoder with a measuring wheel riding on a moving web represents a desired product length to be cut. When the correct product length has passed beneath the encoder wheel, the PCM-15 will accelerate the cutoff mechanism to web speed and maintain synchronization while the cut is made (even if web speed varies or stops). After the programmed distance during cutoff has been traveled, the PCM-15 will decelerate the cutoff mechanism to a stop. The PCM-15 will then complete the cycle by causing the cutoff head to return to the start position. The above screen is a sample program that performs this cut cycle.

TIME BASED RATIO MODE

The Time Based Ratio Mode of the PCM-15 controls motion of an FX Drive at a specified proportion of the speed of a master shaft. In this mode, the PCM-15 will accelerate the controlled drive to the speed demanded by the synchronization ratio. The PCM-15 will then maintain that speed (ratio) for the constant velocity portion of the index distance entered in the index. When the motor has traversed that distance, the PCM-15 will smoothly decelerate the motor to a stop and wait for further commands.

The PCM-15 may execute a completely independent index (motion), and then make a move ratioed to an external shaft or signal. Both types of moves may be used interchangeably wherever required in the process. There is no limitation on mixing ratioed and independent indexes in a program.

ELECTRONIC LINE SHAFT MODE

The Position-to-Position Mode of the PCM-15 is the electronic equivalent of line shaft synchronization. In this mode, the PCM-15 matches instantaneous position pulses from the master shaft or signal to position pulses from the follower motor on a continuous basis. CCW and CW rotation of the master shaft results in identical movement of the controlled motor. This ratio can vary from 0.125 to 1 to 20.000

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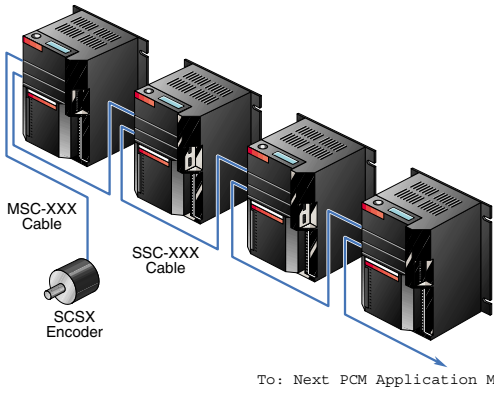
PCM-15 RATIO CONTROLLER

to 1. For example, in a 5 to 1 ratio, the master axis will rotate its axis 5 times for every 1 rotation of the FX Drive.

Once in the Electronic Line Shaft Mode, the follower motor will precisely track all movements of the master shaft from complete stop to full speed to full stop, as well as master shaft reversals.

MULTI AXIS SYNCHRONIZATION

As many as 10 axes can be synchronized to a common master axis. The master axis reference signals can come from either an external encoder or from an FX Drive. This is the reason the PCM-15 has two interface connectors. One connector reads in encoder signals the and upstream FX Drive signals while the other connector sends the selected signals out to a following PCM-15.



PROGRAMMING

A PCM-15 Ratio Control Module is programmed using EMERSON Motion Control's PCX programming software running on an IBM compatible PC with 545K of free RAM. As many as 100 programs can be used to tailor the PCM-15 to specific applications. The PCM-15 stores these programs in non-volatile memory for later selection and execution.

PCM-15 SPECIFICATIONS

Programming

- Programs using PCX Software, Version 6.1 or above
- ASCII Serial Commands

Data Capacity:

- 100 programs with 1024 program steps, 256 indexes

Available Predefined I/O Functions:

- 46 Input Functions
- 22 Output Functions

Interfaces:

- 12 optically isolated I/O lines (8 input, 4 output)
- Synchronization/Position Input
  SCS-X Encoder Signals
  Upstream FX Drive Position
- Synchronization/Position Output
  SCS-X Encoder Signals
  Upstream FX Drive Position
  DX Motor Position

Data Entry Options:

- PCX Software for use on PCs
- T-21 Data Entry Panel
- T-60 Operator Interface
- ASCII Serial Commands



ORDERING INFORMATION:

- PCM-15 Ratio Controller
- SCS-X Synchronization Encoder
- MSC-xxx* Encoder to Application Module cable
- SSC-xxx* App. Module to App. Module Sync. cable

*xxx refers to cable length in feet.

Shown below is an Index Set Up screen. This index, number 1, is configured to run at a 1:1 ratio and travel 60 inches in a constant velocity at that ratio.

The user may combine several indexes (both synchronized and independent) in a sequence or program. Once in the program mode, many commands are available, such as Wait for External Input, Dwell for fixed time interval, Wait for external count to be completed (flying cutoff application), and Set Programmable Outputs.

PCX: Index Set Up Screen



PCX: Program Set Up Screen



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PCM-16 PHASE SYNCRONIZATION CONTROLLER

FEATURES

- Programmed with easy-to-use PCX Software
- Allows an independent follower axis to match cycles of a master axis in a phase synchronization relationship
- Cycle profile allows user to create non-linear functions such as cam type profiles
- Spreads corrections over defined number of cycles
- Stores up to 16 cycle profiles with 12 segments per cycle in non-volatile memory to be called up for execution
- 78 user assignable I/O functions
- Expands I/O capacity with 8 optically isolated inputs and 4 optically isolated outputs
- Stores parameters in non-volatile memory to allow the unit to be moved to another FX Drive of the same size without losing data

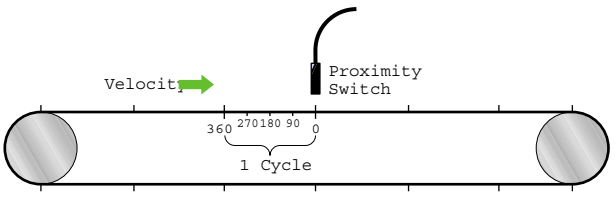
DESCRIPTION

The PCM-16 Phase Synchronization Controller is an application module that attaches to any EMERSON Motion Control FX Positioning Servo Drive. The PCM-16 allows an FX Drive to position based on the motion of an independent axis. The independent axis is defined as the master axis. Motion of the master axis is assumed to produce some measurable repetitive cycle such as lugs passing a proximity switch. The FX Drive on which the PCM-16 is mounted is defined as the follower axis.

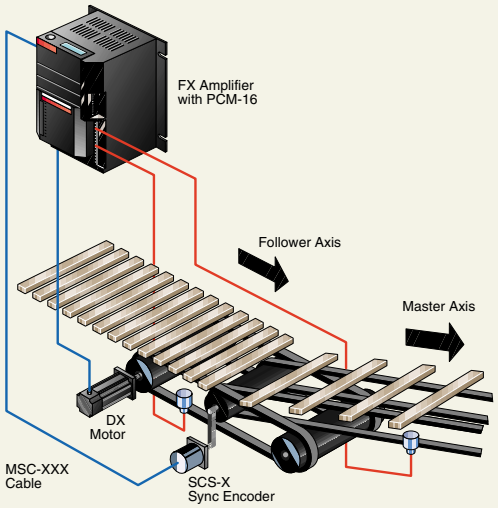
Phase Synchronization causes the follower axis to produce one cycle of motion for every cycle produced by the master axis and to be in phase with it at predetermined positions within the cycle.

OPERATION

For the purpose of set up and programming, machine cycles are measured in degrees. A cycle is defined as 360° of motion. By monitoring machine mounted sensors which define the start points (zero degree position) of each axis' cycle, proper cycle-to-cycle alignment is assured. If required, the follower drive will slightly speed up or slow down at the beginning of each cycle in order to maintain proper phase synchronization between the two axes.



TYPICAL PCM-16 PHASE SYNCHRONIZATION CONTROLLER



In this application the FX Drive with a PCM-16 controls a follower axis. An encoder attached to the master axis feeds signals back to the PCM-16 allowing the follower axis to synchronize and be in phase with the master axis. This permits the follower axis to deliver product to the master axis at defined intervals which correspond to spacing of the lugs. The above follower axis set up screen shows most of the parameters required to define the follower axis cycle.

PHASE ANGLE

A Phase Angle setting entered by the user defines how far (in degrees of the master cycle) the zero point of the follower axis lags behind the zero point of the master axis. Phase Angle can also be defined as an offset in degrees of the master axis relative to the follower cycle.

Adjustments to the Phase Angle setting can be made during execution of a cycle (while in motion) by using the Phase Angle Advance/ Retard inputs. These inputs would be assigned to two of the drive's 16 optically isolated input terminals. Typically, the user of a FX Drive with PCM-16 toggles the advance and/or retard inputs until the proper phase angle setting is achieved. Once set, the FX Drive will maintain that precise setting.

CYCLE PROFILE

The Cycle Profile feature of the PCM-16 allows the user to create variable speed ratios. When executed, these variable ratios repeat during each cycle, thus imprinting a programmed "shape" to the motion produced. A follower cycle can be divided into 64 segments creating a CAM type profile.

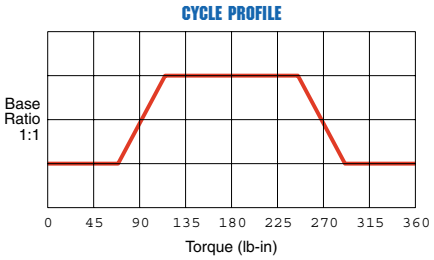
Cycle Profile is especially useful in applications that require the creation of a relationship between the follower cycle and the master cycle where the ratio varies as a function of position within the cycle. Examples of applications that would require such a feature includes rotary knife cutoffs,

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PCM-16 PHASE SYNCHRONIZATION CONTROLLER

labelers, printers, merging system, etc. Shown below is an example of a cycle profile that can be set up using PCX.



MASTER CYCLE PROGRAMMABLE OUTPUTS

The PCM-16 has the ability to turn on and off up to eight predefined output lines based on the position of the master axis. These output lines can be programmed to turn on for a specified amount of time or for a specified distance of the master axis. There can be eight defined positions for each of the 16 master cycles. There's an example of the Master Cycle Program Output Screen below.

PROGRAMMING

The PCM-16 is programmed using EMERSON Motion Control's PCX Software. This software operates on any IBM or compatible PC with at least 545K of free RAM and DOS Version 3.0 or higher. PCX software allows users to customize the PCM-16 to meet a specific application. Using this software is fast and simple. The PCX programming software allows the user to program a variety of motion profiles required to solve the application. Up to 16 cycle profiles can be stored in the PCM-16's non-volatile memory and called up for execution.

THE PCM-16 IN A MULTI-AXIS SYSTEM

When using one of EMERSON Motion Control's standard synchronization modules, up to 10 axes can be connected together in a cascaded fashion to form a multi-axis system. Configuration of a multi-axis system is simplified using EMERSON Motion Control's standard SSC-X cables to link the drives.

While programming, the user has the option of establishing the system encoder as the source for the master axis signal or the adjacent upstream amplifier in the system. This simple method allows the user to configure arrangements of master/follower relationships throughout the system to meet specific application requirements.

PCM-16 SPECIFICATIONS

Programming:

- Programs using PCX Software, Version 6.3 or above
- ASCII Serial Commands

Data Capacity:

- 100 programs, 512 program steps, 16 cycles, 64 indexes

Available Predefined I/O Functions:

- 51 Input Functions
- 27 Output Functions

Interfaces:

- 12 optically isolated I/O lines (8 input, 4 output)
  Synchronization/Position Input
  SCS-X Encoder Signals
  Upstream FX Drive Position
- Synchronization/Position Output
  SCS-X Encoder Signals
  Upstream FX Drive Position
  DX Motor Position

Data Entry Options:

- PCX Software for use on PCs
- T-21 Data Entry Panel
- T-60 Operator Interface
- ASCII Serial Commands



ORDERING INFORMATION:

- PCM-16 Phase Synchronization Controller
- SCS-X Synchronization Encoder
- MSC-xxx* Encoder to Application Module cable
- SSC-xxx* App. Module to App. Module Sync. cable

*xxx refers to cable length in feet.

PCX: Cycle Profile



PCX: Follower Axis Set Up Screen



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PCM-17 RANDOM INFEED CONTROLLER

FEATURES

- Programmed with easy-to-use PCX software
- Allows FX Drive to synchronize randomly placed products with a downstream process
- Automatically advances or delays randomly placed product to arrive at predetermined point in a downstream process
- Uses signals from a synchronization encoder to match cycle of a master axis
- Multiple FX Drives can be cascaded to accommodate high speed random infeed applications
- Stores up to 16 random infeed profiles in non-volatile memory to be called up for execution
- 77 user assignable I/O functions
- Expands I/O capacity with 8 optically isolated inputs and 4 optically isolated outputs
- Stores parameters in non-volatile memory to allow the unit to be moved to another FX Drive of the same size without losing data

DESCRIPTION

The PCM-17 attached to an FX Drive allows the drive to receive a product at random from an upstream process. The PCM-17 then calculates a correction profile and delivers the product to a downstream process synchronized and in position. The downstream process must exhibit some repetitive cycle, such as a flighted or lug conveyor.

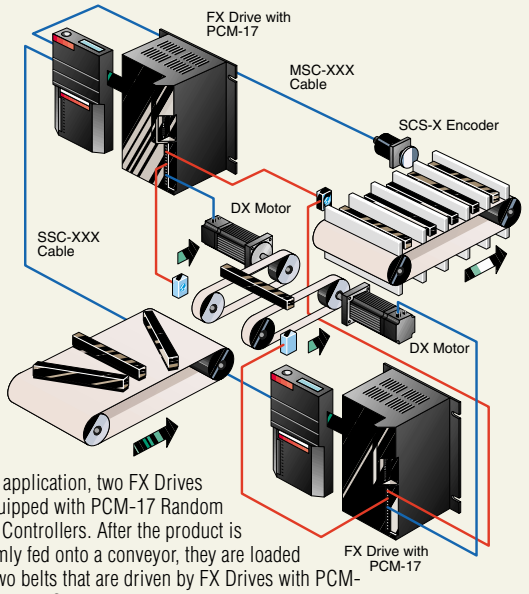
Objects or products entering a system may be nominally synchronized with the conveyor's cycles or may enter the system at completely random times.

OPERATION

In operation, the system varies the speed of an Infeed conveyor in response to the timing of a product's entry onto the lug conveyor. The FX Drive with a PCM-17 attempts to time the exit of the product from the infeed conveyor with the cycles of the mechanism being loaded. The intent is that the product will be loaded onto the conveyor at approximately the same position within each cycle despite variations in the speed of the system and the time of the product's entry into the system.

The axis being loaded is referred to as the Master Axis. The FX-Drive with the PCM-17 tracks the Master Axis' cycles by monitoring a signal once each cycle (e.g., sensing each flight as it passes). The signal which is generated by the Master Cycle Sensor defines the Master Cycle Zero Degree Point.

TYPICAL PCM-17 RANDOM INFEED APPLICATION

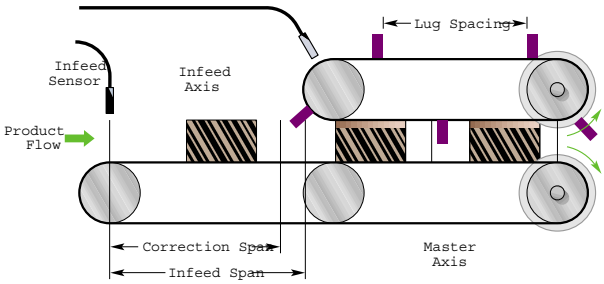


In this application, two FX Drives are equipped with PCM-17 Random Infeed Controllers. After the product is randomly fed onto a conveyor, they are loaded onto two belts that are driven by FX Drives with PCM-17 Modules. Sensors are used to sense the entry of both ends of the product onto the belts. Based on calculations made by the FX Drive, each of the two belts is either slowed down or sped up so that the product is straightened out before it is placed within lugs on a conveyor. Above is an example of an infeed conveyor cycle. The first question configures the length of the infeed conveying cycle. The rest of the questions relate to how the system will react to products entering the system.

During normal operation the follower axis runs at a velocity ratioed to the master axis' velocity. The constant speed ratio between the follower and the master axis is defined as the Base Ratio.

Base ratio = Infeed Span/Master Cycle Length

The Infeed Span is the distance on the infeed conveyor measured from the infeed sensor to the point where effective position control of the product terminates as it exits the system. The Correction Span is the portion of the infeed span programmed to perform the correction profile, allowing the target angle to be achieved.

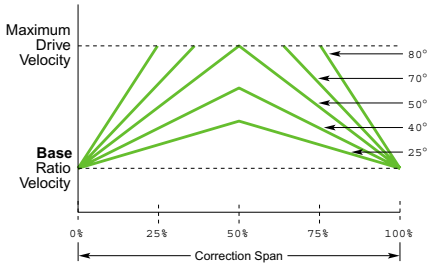


The Infeed Sensor that signals the introduction of a new product onto the infeed conveyor observes the angle of the Master Axis at the exact moment the product is introduced. This angle is defined as the Infeed Angle. The drive then calculates a Correction Profile, which the Infeed drive immediately executes to adjust the product's position relative

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to the target position within the master's cycle. This position is called the Target Angle.

The measured Infeed Angle is compared to the programmed Target Angle for the particular infeed being executed. The FX Drive calculates a change in velocity or Correction Profile based on the amount of error (Error Angle) which will cause the product to move through the infeed conveyor and be at the proper Target Angle as it leaves the infeed conveyor. This profile is added (subtracted) to the current velocity of the base ratio. The correction profile is completed at the time the product reaches the end of the correction span.

The timing of a product's entry will determine the required amount of the velocity change from the base ratio. If products are introduced at the rate of one product per cycle of the master and the timing of its introduction is ideal, little or no velocity adjustment will be required. The greater the difference in the timing of the product's introduction differs from ideal, the greater the velocity change required to achieve proper target angle insertion.

The user can alter the Target Angle at any time while the system is running in order to fine tune or alter the programmed loading position.

PRODUCT SEPARATION

For proper system operation, the frequency of product entry must be less than or equal to the frequency of the cycles on the master axis. This task can be accomplished by employing two feed conveyors operating at a fixed ratio relative to each other. The two conveyors separate adjacent products by having the downstream conveyor run faster than the conveyor feeding it. The upstream conveyor, which is slaved to the master at a fixed ratio, then feeds product into the infeed conveyor at approximately the same frequency as the cycles in the master. The input supply of products cannot exceed the output capacity of the machine.

MASTER CYCLE PROGRAMMABLE OUTPUTS

The PCM-17 has the ability to turn on and off up to eight predefined output lines based on the position of the master axis. These output lines can be programmed to turn on for a specified amount of time or for a specified distance of the master axis.

PCM-17 SPECIFICATIONS

Programming:

- Programs using PCX Software, Version 6.3 or above
- ASCII Serial Commands

Data Capacity:

- 100 programs, 512 program steps, 16 cycles, 64 indexes

Available Predefined I/O Functions:

- 50 Input Functions
- 27 Output Functions

Interfaces:

- 12 optically isolated I/O lines (8 input, 4 output)
- Synchronization/Position Input
  SCS-X Encoder Signals
  Upstream FX Drive Position
- Synchronization/Position Output
  SCS-X Encoder Signals
  Upstream FX Drive Position
  DX Motor Position

Data Entry Options:

- PCX Software for use on PCs
- T-21 Data Entry Panel
- T-60 Operator Interface
- ASCII Serial Commands



ORDERING INFORMATION:

- PCM-17 Random Infeed Controller
- SCS-X Synchronization Encoder
- MSC-xxx* Encoder to Application Module cable
- SSC-xxx* App. Module to App. Module Sync. cable

*xxx refers to length of cable in feet.

PROGRAMMING

The PCM-17 is programmed using EMERSON Motion Control's PCX Software. All that is required is an IBM or IBM compatible PC with at least 545K of free RAM and DOS version 3.0 or higher.

During programming, the user has the option of establishing the system's master encoder as the source for the master axis signal or the adjacent upstream drive for each drive in the system.

PCX: Infeed Set Up Screen



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PCM-18 WEB CONTROLLER

FEATURES

- Programmed with easy-to-use PCX Software
- Allows constant speed of web when the roll is center wound by an FX Positioning Servo Drive
- Enables the speed of the web to be modified to maintain loop position control of a dancer arm
- Indexing based on encoder signal feedback
- Synchronization function allows either the speed of the web or the speed of the motor to be synchronized to a master axis
- Stores up to 100 different programs with 1024 program steps and 256 indexes
- Expands I/O capacity of FX Drive with 8 optically isolated inputs and 4 optically isolated outputs
- 75 predefined I/O functions
- Stores parameters in non-volatile memory to allow the unit to be moved to another FX Drive of the same size without losing data

DESCRIPTION

The PCM-18 Web Controller is an application module that attaches to any EMERSON Motion Control FX Positioning Servo Drive. When a roll is center wound by an FX Drive with a PCM-18 Web Controller, constant speed of the web can be maintained. Constant velocity is maintained by the FX Drive using feedback from a synchronization encoder on the web. The velocity of the motor driving the take-up roll is updated at a selected rate according to a changing ratio between web velocity (web encoder) and motor velocity (motor resolver).

The PCM-18 also allows an FX Drive to modify the speed of the web to maintain loop control of a dancer arm. This function is typically used to maintain a specific amount of material in the loop.

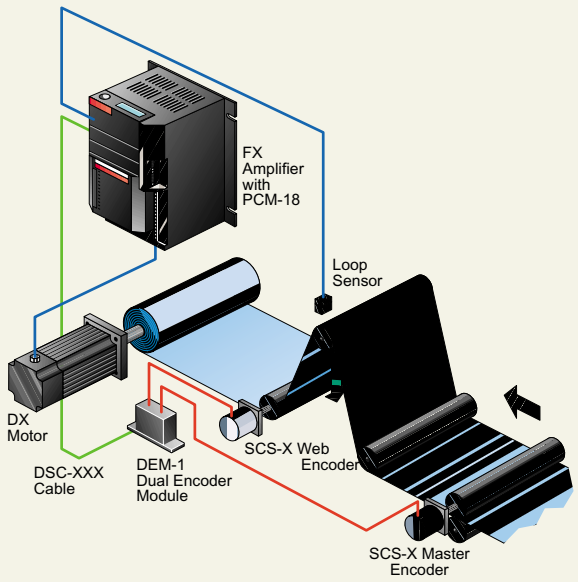
OPERATION

When using an FX Positioning Servo Drive with a PCM-18 Web Controller, there are three modes of operation: Center Wind Operation, Dancer Arm Operation, and Time Base Ratio Operation. These modes of operation can be used individually in an application or they can be combined in the same application.

CENTER WIND MODE

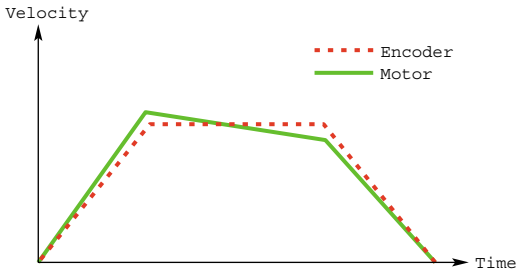
Under normal center wind operations where the motor speed is constant, the speed of the web increases as the take up roll increases in diameter. By applying an FX Positioning Servo Drive equipped with a PCM-18 Web Controller, the speed of the web can be accurately controlled. The FX Drive monitors signals put out by a synchronization encoder placed on the web. The speed of the FX Drive is varied based on the speed of the web as measured by the encoder.

TYPICAL PCM-18 WEB CONTROLLER APPLICATION



This diagram depicts a typical application using an FX Drive with a PCM-18 Web Controller. In this application, both the Center Wind Mode and the Dancer Arm Mode of operation are used. An FX Drive attached to the take-up roll uses an SCS-2 Synchronization Encoder to provide that positional feedback that allows the FX Drive to control the speed of the web. Analog signals from a sensor are used to maintain the position of the dancer arm.

In most closed loop servo applications, the length of an index is based on feedback from the motor. (This feedback typically comes from a resolver attached to the motor shaft.) When using a PCM-18, the length of the index is determined by the web encoder. Corrections to the speed of the motor are made to maintain the velocity acceleration and deceleration of the web. The index distance is based on the encoder riding on the web.



DANCER ARM MODE

The PCM-18 allows an FX Drive to position a dancer arm and maintain loop position control. The dancer arm is connected to an analog sensor. This sensor indicates the position of a dancer arm as an analog voltage. The analog

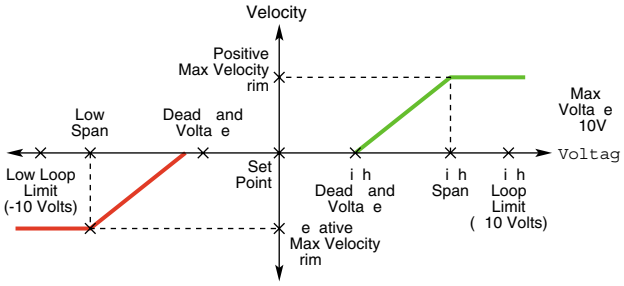
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voltage, from the sensor, is used to determine when to modify the velocity of the web to maintain proper dancer position.

Loop position control can be achieved when a DX Motor is attached to a drive roller, or when attached directly to the center of the roll as shown on the facing page.

When using the Dancer Arm Operation mode, parameters relating to the operation must be set up. These parameters will determine the position of the dancer arm during operation. Parameters that need to be defined in PCX include the input voltage span, the deadband voltages, the loop limit voltages, and the maximum velocity trim. The graph below depicts the effect of these parameters.



SYNCHRONIZATION

The PCM-18 allows the speed of the motor or the speed of the web to be synchronized to a master axis. Signals from this master axis can be from another FX Drive upstream of the web, or from a synchronization encoder.

The Time Based Ratio Mode of the PCM-18 controls motion of an FX Drive at a specified ratio of the speed of a master shaft. In this mode, the PCM-18 will accelerate the motor or the web to the speed demanded by the synchronization ratio. The PCM-18 will then maintain that speed (ratio) for the distance entered in the index. When the motor or the web encoder has traversed that distance, the FX Drive with the PCM-18 will smoothly decelerate to a stop and wait for further commands.

PCX Center Wind Ratio Screen



PCM-18 SPECIFICATIONS

Programming:

- Programs using PCX Software, Version 6.1 or above
- ASCII Serial Commands

Data Capacity:

- 100 programs with 1024 program steps, 16 cycles. 256 indexes

Interfaces:

- 12 optically isolated I/O lines (8 input, 4 output)
- Synchronization/Position Input
  SCS-X Encoder Signals
  Upstream FX Drive Position
- Synchronization/Position Output
  SCS-X Encoder Signals
  Upstream FX Drive Position
  DX Motor Position
- 12 Bit +10 VDC Analog Input

Data Entry Options:

- PCX Software for use on PCs
- T-21 Data Entry Panel
- T-60 Operator Interface
- ASCII Serial Commands

Available Predefined I/O Functions:

- 50 Input Functions
- 25 Output Functions



ORDERING INFORMATION:

- PCM-18 Web Controller
- DEM-1 Dual Encoder Module
- DSC-xxx* DEM-1 to PCM Module cable
- SCS-X Synchronization Encoder
- MSC-xxx* Encoder to Application Module cable
- SSC-xxx* App. Module to App. Module Sync. cable

*xxx refers to cable length in feet.

The PCM-18 may execute a completely independent index (motion), and then make a move ratioed to an external shaft or signal. Both types of moves may be used wherever required in the process, since there is no limitation on mixing ratioed and independent indexes in a program.

PROGRAMMING

The PCM-18 Web Controller is programmed using EMERSON Motion Control's PCX Software. System requirements for operating PCX include an IBM or compatible PC with at least 545K of free RAM and DOS Version 3.0 or higher. Using PCX requires no knowledge of high level programming languages. What is required is a thorough understanding of the application. Knowledge of the application is used to set up the FX Drive and PCM-18.

An example of PCX Software used with the PCM-18 is shown on the left. When using the Center Wind Mode, PCX supplies a screen that allows parameters to be defined. These parameters are related to defining new core and limits that can be detected and used by the system to optimize its performance.

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PCM-19 CONVEYOR CONTROLLER

FEATURES

- Programmed with easy-to-use PCX Software
- Allows a conveyor controlled by an FX Drive to maximize product density on a merge conveyor by spacing products head-to-head or tail-to-head
- Up to four conveyors lines can be coordinated to merge into one merge conveyor while maintaining specified spacing (requires MC-1 Merge Controller)
- Stores up to 16 conveyor configurations in non-volatile memory to be called up for execution
- Expands I/O capacity of FX Drive with 8 optically isolated inputs and 4 optically isolated outputs
- 80 predefined I/O functions
- Stores parameters in non-volatile memory to allow the unit to be moved to another FX Drive of the same size without losing data

DESCRIPTION

The PCM-19 Conveyor Controller is an application module that attaches to any EMERSON Motion Control FX Positioning Servo Drive. The PCM-19 allows an FX Drive to position products onto an independent conveyor at predetermined intervals. These intervals can be based on head-to-head or tail-to-head product spacing. Using PCX Software, specific data relating to the infeed conveyor is loaded into the PCM-19's non-volatile memory.

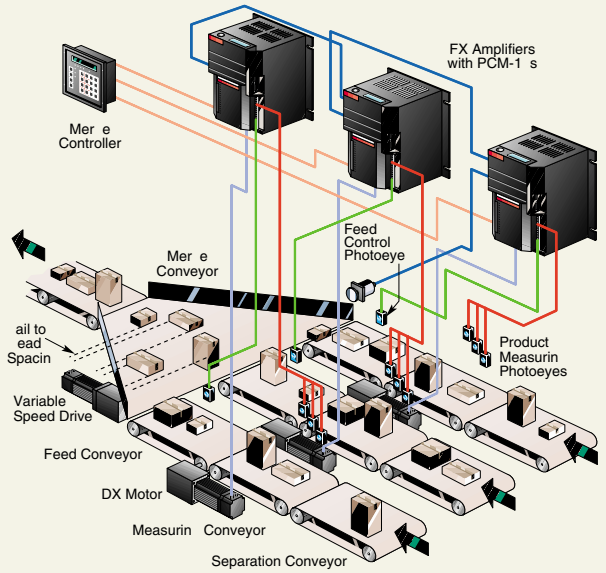
Length limits can be entered for three product sizes. Any products passing the product measuring photo eyes are measured for length and height. The products are then classified as short, medium or tall. The FX Drive will decelerate and accelerate the conveyor at the user defined rates so as not to cause the product to tip or slip, while still obtaining the defined distance between products.

OPERATION

To achieve proper spacing of products onto a merge conveyor, the PCM-19 varies the motion of an infeed conveyor. Signals from a synchronization encoder tracking the merge conveyor are used by the FX Drive to monitor position and speed. Calculations are performed within the FX Drive using data entered into the PCX program. An appropriate deceleration then acceleration ramp is executed based on the calculation to achieve the desired spacing. The defined acceleration and deceleration rates are used to eliminate product slipping or tipping.

Because of its ability to synchronize, the FX Drive can change its velocity based on the varying velocity of the outgoing merge conveyor system without affecting the spacing of the products. Synchronization is typically achieved though the use of an external encoder on the merge conveyor providing reference signals to the FX Drives. The PCM-19 can store up to 16 conveyor configurations.

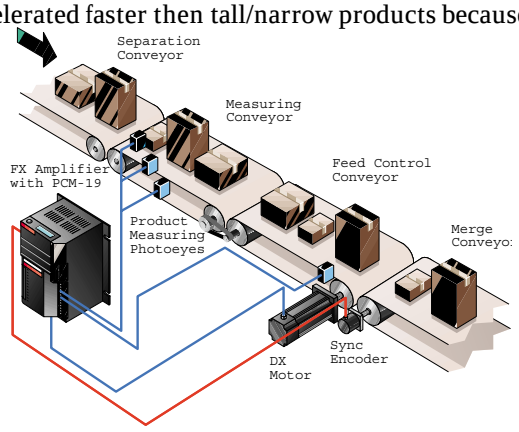
TYPICAL PCM-19 CONVEYOR CONTROLLER APPLICATION WITH MC-1



When using an MC-1 Merge Controller with FX Drives and PCM-19s, up to four conveyor lines can be merged onto a single merge conveyor. In this application, products come off of an assembly line and first enter the system on the separation conveyor where an adequate distance is placed between the products as they enter the measuring conveyor. On the measuring conveyor products are scanned by photo eyes to determine the maximum acceleration rate allowed. (Short and long products can be accelerated faster than tall and thin products.) The feed conveyor loads the products onto the merge conveyor at user defined intervals. The MC-1 controls the release of products to ensure that products from all three lines are released at equal intervals and that the merge conveyor does not become clogged.

PRODUCT MEASURING

The PCM-19 is equipped with a "Product Measuring" feature that allows the length and height of products on the infeed conveyor to be measured. This helps eliminate the possibility of products tipping or slipping on the infeed conveyor because of accelerating or decelerating too rapidly. Short/long products can be accelerated and decelerated faster then tall/narrow products because they



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PCM-19 CONVEYOR CONTROLLER

are more stable. When there are only short/long products on the infeed conveyor, the PCM-19 will use fast user defined acceleration or deceleration times. If there is a tall/narrow product anywhere on the infeed conveyor the PCM-19 will use slower defined acceleration and deceleration times.

When using the product measuring capability, the following conveyor system components are required:

Separation Conveyor–First stage separation conveyor ensures that there are gaps between products to allow for accurate measuring using photo eyes.

Measuring Conveyor–Measuring of products using photo eyes takes place on this belt. This conveyor runs faster than the separation conveyor but slower than the feed control conveyor. The different speed insures that products are accurately measured and categorized at a slower speed to minimize products from slipping or tipping

Feed Control Conveyor–Releases products onto the merge conveyor at predefined distances.

Merge Conveyor–Typical outfeed conveyor common in many applications. An SCS Synchronization Encoder attached to this conveyor provides positional data to the PCM-19 to allow the FX Drive to be synchronized. Some merge conveyor applications do not require product height measuring sensors. For example, when all the products are the same size or when acceleration and deceleration rates are constant.

PROGRAMMING

The PCM-19 Conveyor Controller is programmed using EMERSON Motion Control's PCX Software. System requirements for operating PCX include an IBM or compatible PC with at least 545K of free RAM and DOS Version 3.0 or higher. Using PCX requires no knowledge of high level programming languages. A thorough understanding of the application is required. This understanding of the application is used to set up the FX Drive with the PCM-19.

PCX: Feed Conveyor Cycles Screen



PCM-19 SPECIFICATIONS

Programming:

- Programs using PCX Software, Version 6.1 or above
- ASCII Serial Commands

Data Capacity:

- 100 programs with 512 program steps, 16 feed conveyor cycles, 64 indexes

Available Predefined I/O:

- 54 Input Functions
- 26 Output Functions

Interfaces:

- 12 optically isolated I/O lines (8 input, 4 output)
- Synchronization/Position Input
  SCS-X Encoder Signals
  Upstream FX Drive Position
- Synchronization/Position Output
  SCS-X Encoder Signals
  Upstream FX Drive Position
  DX Motor Position

Data Entry Options:

- PCX Software for use on PCs
- MC-1 Merge Controller
- T-60 Operator Interface
- ASCII Serial Commands



ORDERING INFORMATION:

- PCM-19 Conveyor Controller
- MC-1 Merge Controller
- SCS-X Synchronization Encoder
- MSC-xxx* Encoder to Application Module cable
- SSC-xxx* App. Module to App. Module Sync. cable

*xxx refers to cable length in feet.

MC-1 MERGE CONTROLLER

The MC-1 Merge Controller is an industrial hardened control terminal designed for use with the PCM-19 Conveyor Controller. The MC-1 functions as a "traffic cop" in a multiple infeed conveyor system by coordinating the release of products onto a merge conveyor. At the same time the MC-1 is coordinating the release of products, it is maintaining the highest possible density of products on the merge conveyor. Up to 4 axes can be coordinated with an MC-1. Twelve optically isolated inputs lines and 12 optically isolated outputs lines are available to allow the MC-1 to communicate with FX Drives or PLCs.

Individual conveyor lines or the entire conveying system can be taken off line and started again by the MC-1 using simple keypad commands. The MC-1 can perform self-diagnostic routines and can be programmed to accommodate a wide range of custom applications involving multiple merge conveyors.

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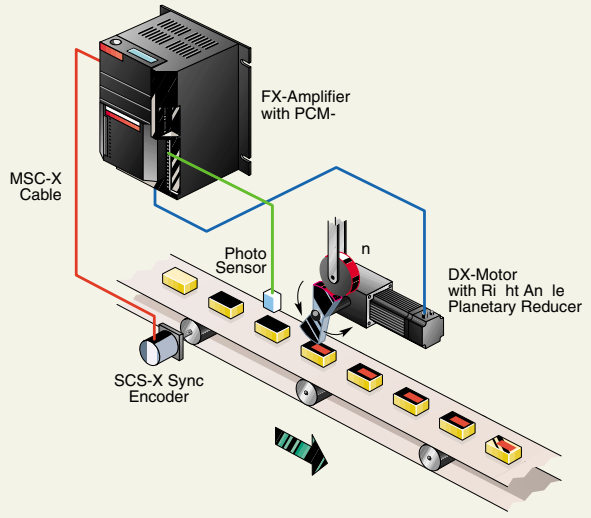
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PCM-22 ROTARY KNIFE CONTROLLER (REPEATABLE MASTER LENGTHS)

FEATURES

- Programmed with easy-to-use PCX Software
- Allows an FX Drive to accurately position and match speed based on data received from a master axis
- Calculates cycle profile based on user defined parameters while maintaining position and velocity
- Parameters can be changed on-the-fly
- All parameters are defined in user units
- Two internal counters for each cycle: product cycle counter and product batch counter
- Stores up to 16 cycle profiles in memory to be called up for execution
- Interactive cycled diagnostic capabilities
- 104 user assignable I/O functions
- Expands I/O line capacity of FX Drive with 8 optically isolated input lines and 4 optically isolated outputs
- Stores parameters in non-volatile memory to allow the unit to be moved to another FX Drive of the same size without losing data

TYPICAL PCM-22 ROTARY KNIFE CONTROLLER APPLICATION



This diagram shows a typical marking application using the PCM-22 with an FX Drive. The PCM-22 monitors signals from a sync encoder measuring the position of the conveyor. A photo sensor records the registration of the product. As product passes, the FX Drive positions a printing pad into place to match speed of the product printing the product in the correct place. A right angle reducer allows the DX Motor to be placed inline with the conveyor to save space and minimize the system cost. Shown above is the program that executes the cycle profile.

DESCRIPTION

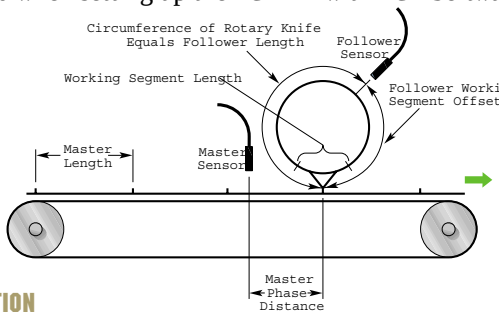
The PCM-22 Rotary Knife Controller is an application module that attaches to any EMERSON Motion Control FX Positioning Servo Drive. The PCM-22 allows an FX Drive to automatically calculate and create a motion profile using user defined parameters. This type of motion profile is typically used in cutting, sealing and perforating applications.

The PCM-22 positions and maintains a phase relationship of its motor as a function of the motion of an independent axis. Motion of the independent, or master axis, is assumed to produce some repetitive cycle. Reference signals from the master axis are generated from either a synchronization encoder driven by the master axis or from an upstream FX Drive, which can supply positioning data directly to a downstream FX Drive.

The FX Drive with the PCM-22 acting as the follower axis will produce one or more cycles of motion for every cycle produced by the master axis. The positioning of the follower axis is based on a distance relationship with the master axis. This permits the follower axis to be synchronized and in phase with the master axis at a selected portion of the cycle. This portion is defined as the working segment.

The follower axis may be registered to the master axis. When either the master or follower axis uses a registration sensor, the PCM-22 can “learn” new parameters based on the sensor information about that axis. It will, within user defined limits, automatically compensate for length changes, phase changes and detected mechanical inaccuracies. For example, if the distance between registration sensor inputs on the follower axis indicates that the length is 8.25” and not 8.30” as entered via PCX, the PCM-22 will automatically make adjustments to compensate for the difference in length.

Shown below is an illustration of a typical application with the working segment length depicted at the bottom of the rotary knife. This drawing illustrates some of the parameters defined when setting up the PCM-22 with PCX Software.



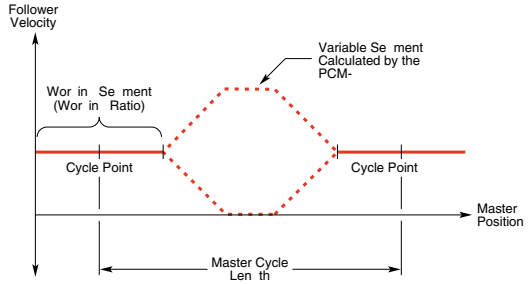
OPERATION

Using a PCM-22 requires applying knowledge relating to the mechanics of the positioning system. The PCM-22 takes application data that has been entered into the FX Drive using PCX Software to calculate the motion necessary to meet the application positioning requirements. The system then calculates and creates a motion profile.

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PCM-22 ROTARY KNIFE CONTROLLER (REPEATABLE MASTER LENGTHS)



Mechanical data required for the application includes the circumference of the cutting blade, position of the cut, cutting ratio, and the distance at the cutting ratio. These parameters are entered into the PCM-22 using PCX. Parameters are defined in PCX as: Follower Length, Master Length, Working Offset, Working Ratio and Working Segment Width, and Master Phase Distance.

Using the supplied mechanical data and the user defined criteria, the FX Drive calculates how to create the motion profile to achieve the correct position relationship to the master axis.

Many parameters relating to the PCM-22 application can be changed "on-the-fly." This allows constant machine motion since the FX Drive doesn't have to stop to receive downloaded parameters and recalculate the motion profile. Using the new parameters, the PCM-22 will recalculate the next profile as soon as it leaves the working segment.

PROGRAMMING

The PCM-22 is programmed using EMERSON Motion Control's PCX Software. This software runs on any IBM or compatible PC with at least 545K of free RAM and DOS Version 3.3 or higher. PCX allows users to customize the PCM-22 to meet the requirements of an application. No knowledge of programming languages is required to operate PCX.

The PCX programming software allows the user to define up to 16 cycles. These cycles are stored in the PCM-22's non-volatile memory and are called up for execution. Shown (right) is the master cycle screen in PCX used in PCM-22 applications. The Program Set Up screen is shown to its right. With PCX, there is a logical progression to follow in which to set up and start any application.

In this example, the length of the product to be cut is 11.000 inches. Because product registration is being maintained, other parameters relating to the master cycle registration sensor appear in the screen. The next series of questions pertain to how the FX Drive will react to changes in the sensing of the master axis. These questions can be thought of as gains and limits.

PCM-22 SPECIFICATIONS

Programming:

- Programs using PCX Software, Version 7.0 or above
- ASCII Serial Commands

Data Capacity:

- 100 programs with 512 program steps, 16 cycles, 64 indexes

Available Predefined I/O Functions:

- 67 Input Functions
- 37 Output Functions

Interfaces:

- 12 optically isolated I/O lines (8 input, 4 output)
- Synchronization/Position Input
  SCS-X Encoder Signals
  Upstream FX Drive Position
- Synchronization/Position Output
  SCS-X Encoder Signals
  Upstream FX Drive Position
  DX Motor Position

Data Entry Options:

- PCX Software for use on PCs
- T-21 Data Entry Panel
- T-60 Operator Interface
- ASCII Serial Commands



ORDERING INFORMATION:

- PCM-22 Rotary Knife Controller
- SCS-X Synchronization Encoder
- MSC-xxx* Encoder to Application Module cable
- SSC-xxx* App. Module to App. Module Sync. cable

*xxx refers to cable length in feet.

PCX: Master Cycle Screen



PCX: Program Set Up Screen



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PCM-22Q QUEING ROTARY KNIFE CONTROLLER (RANDOM MASTER LENGTHS)

FEATURES

- Programs with easy-to-use PCX Software.
- Allows an FX drive to accurately position and match speed based on data received from a Master axis.
- Calculates cycle profiles based on user defined parameters and sensor information automatically.
- Provides 32 Master Cycle and 32 Follower Cycle motion profile definitions.
- All parameters are in user defined units.
- Parameters can be changed “on-the-fly”.
- Interactive cycle diagnostic capabilities.
- 101 user assignable I/O functions.
- Stores the drive setup parameters in the PCM-22Q module which allows it to be transferred to another FX amplifier of the same size without losing any setup parameters.
- Expands I/O line capacity of FX drive with an additional eight optically isolated input lines and four optically isolated outputs.

DESCRIPTION

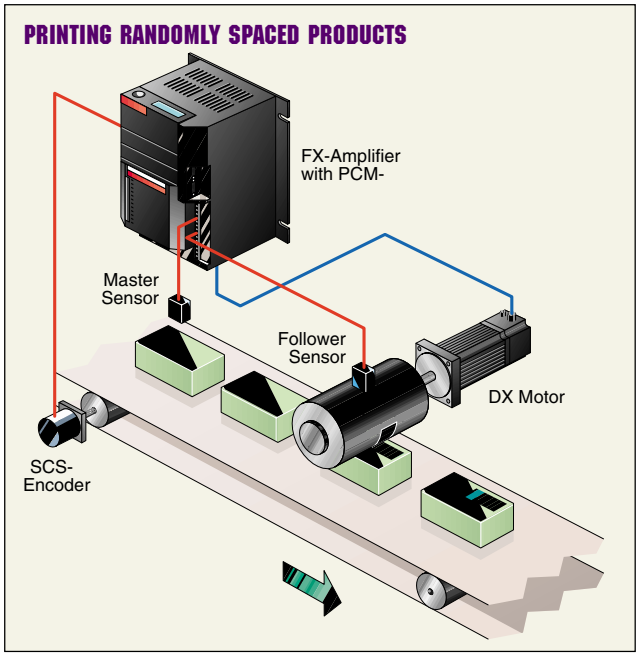
The PCM-22Q Queuing Knife Controller is an application module that attaches to any EMERSON Motion Control FX Positioning Servo Drive. The PCM-22Q allows an FX drive to automatically calculate and create motion profiles using sensor information and/or user defined parameters.

The PCM-22Q maintains a phased relationship between the motor axis (referred to as the Follower axis) and the motion of an independent axis (referred to as the Master axis).

This type of motion profile is commonly used in cutting, sealing, printing and perforating applications.

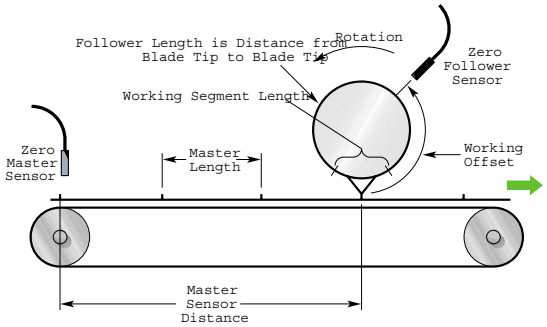
The PCM-22Q uses application data based on the mechanical dimensions of the system entered via PCX Software. This information along with sensor and synchronization information from an encoder driven by the master axis or an upstream FX drive, are used by the PCM-22Q to calculate the motion profile necessary to meet the specific positioning requirements of the application on an individual product basis.

Many parameters relating to the PCM-22Q application can be changed using hardware inputs, PCX Software or serial commands. Using these new parameters, the PCM-22Q will calculate the new motion profile “on-the-fly” to maintain continuous machine operation.



OPERATION

Using mechanical data about the application, the PCM-22Q uses the length of the controlled axis (die, print head, knife, etc.), product length, distance in contact with the material at the desired ratio, position of the contact point to create an individual profile for that product. These parameters are defined in PCX as: Follower Length, Master Length(s), Working Segment Length, Working Ratio, Working Offset & Master Sensor Distance.



If a product registration sensor is used, the PCM-22Q can store the positions of up to 32 individual products within the Master Sensor Distance to be acted upon individually.

If an axis uses a registration sensor, the PCM-22Q can “learn” new parameters based on sensor information about that axis. It will, within user defined limits, automatically compensate for length changes and detected mechanical inaccuracies. For example, if the distance between registration sensor inputs on the Follower axis indicate that the length is 8.25” and not 8.30” as entered via PCX, the PCM-22Q will automatically make adjustments to compensate for the difference in length.

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PCM-22Q QUEING ROTARY KNIFE CONTROLLER (RANDOM MASTER LENGTHS)

If no product registration sensor is used, a list of up to eight user defined product lengths to be acted upon in sequence. An output function can be activated when the end of the sequence is reached.

These capabilities allow the PCM-22Q to produce one cycle of motion for every individual cycle of motion produced by the Master axis. The PCM-22Q will position the Follower axis to a corresponding position and velocity relative to the Master axis at all times while it is executing a cycle.

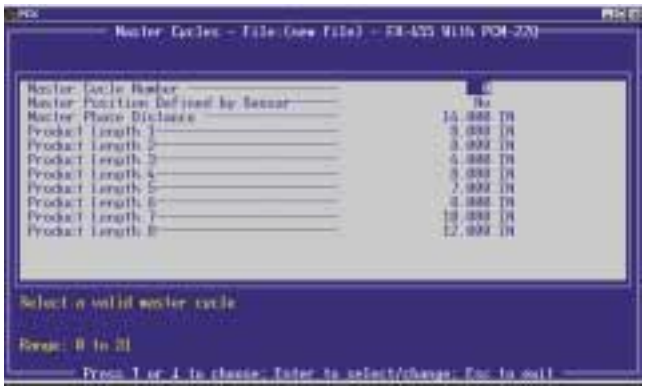
PROGRAMMING

The PCM-22Q is programmed using EMERSON Motion Control's PCX Software. This software runs on any IBM or compatible PC with at least 545K of free RAM and DOS version 3.3 or higher. PCX allows users to customize the PCM-22Q to meet the requirements of applications. No knowledge of programming language is required to operate PCX.

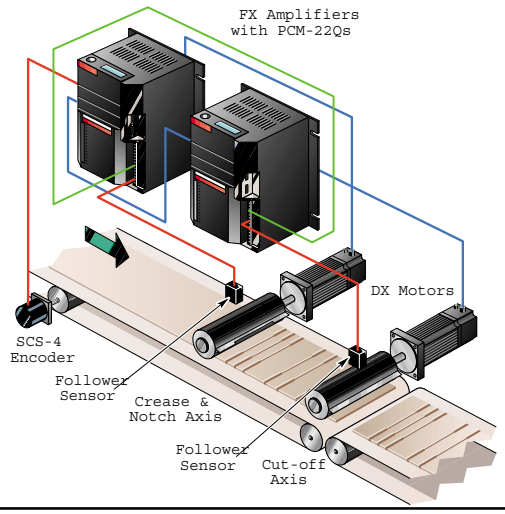
The PCX Software allows the user to define up to 32 Master Cycle and 32 Follower Cycle motion profile definitions that may be mixed and matched. These cycle definitions along with all other user parameters are stored in non-volatile memory and are called up for execution.

Shown below is a non-sensor application Master Cycles Screen used in PCM-22Q applications. With PCX there is a logical progression to follow in which to setup and start any application.

PCX: Master Cycle Screen



In the example at right, the goal was to put different length creases and notches on unmarked material to form the sides and flaps of a box and then cut off each box. The Solution involved two FX Positioning Drives with PCM-22Q Queuing Knife Controllers, an encoder, registration sensors for the crease-notchers and the rotary cut-off knife (Follower axes).The creaser-notcher PCM-22Q axis (operating in `Master Not Defined By Sensor` mode) outputs creases on unmarked material in sequence at different length intervals. When the set of creases is completed, the crease-notcher PCM-22Q activates the `Job Queue Complete` output function. This output function was wired to the rotary cut-off knife axis (operating in `Master Defined by Sensor` mode) PCM-22Q's `Zero Master Cycle` sensor input function. This will be used to position where to cut the box off.The result was a flexible system capable of putting in up to 8 different length creases in sequence on a part and then cut the part off to length without any registration marks on the material.



PCM-22Q SPECIFICATIONS

Programming:

- Programs using PCX Software Version 7.0 or above
- ASCII Serial Commands

Data Capacity:

- 100 programs with 512 program steps, 32 cycles, 64 indexes

Available Predefined I/O Functions:

- PCX Software Version 7.0 or above
- 65 Input Functions
- 38 Output Functions

Interfaces:

- 12 optically isolated I/O lines (6 input, 4 output)
- Synchronization/Position Input
  SCS-X Encoder Signals
  Upstream FX Drive Position
- Synchronization/Position Output
  SCS-X Encoder Signals
  Upstream FX Drive Position
  DX Motor Position

Data Entry Options:

- PCX Software, Version 7.0 or above
- ASCII Serial Commands
- T-21 Data Entry Panel
- T-60 Operator Interface



ORDERING INFORMATION:

- PCM-22Q Queuing Knife Controller
- SCS-X Synchronization Encoder
- MSC-xxx* Encoder to Application Module
- SSC-xxx* App. Module to App. Module Sync Cable

*xxx refers to cable length in feet.

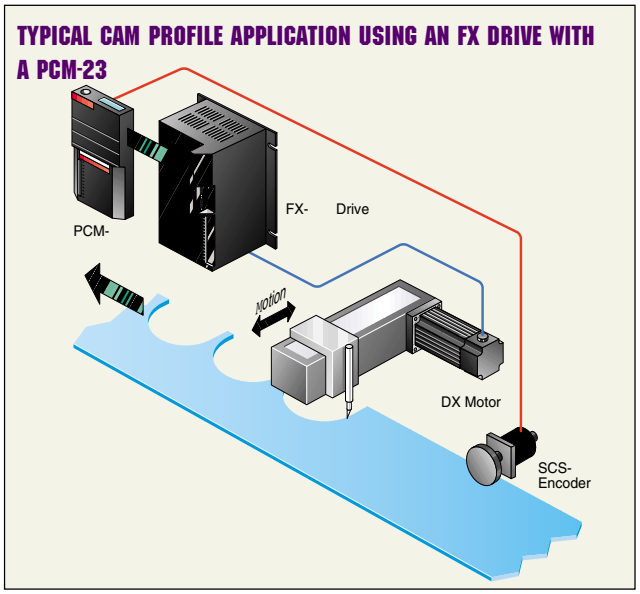
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PCM-23 CAM PROFILE CONTROLLER

FEATURES

- Programmed with easy-to-use PCX Software
- Allows FX Drive to perform CAM type profiles
- Follower axis can rotate forward to reverse based on position of master axis
- User definable CAM start sequence for flexible startups
- Position to position mapping of up to 256 points enables precise profiles
- CAM stop profile returns follower axis to user defined position based on what is required for the application
- 93 user assignable I/O functions
- Expands I/O capacity of FX Drive with 8 optically isolated input lines and 4 optically isolated output lines
- Stores parameters in non-volatile memory to allow the unit to be moved to another FX Drive of the same size without losing data



DESCRIPTION

The PCM-23 CAM Profiler is an application module that attaches to any EMERSON Motion Control FX Positioning Servo Drive. The PCM-23 allows an FX Drive to position at various points in a cycle to produce a CAM type profile (as shown lower right). The CAM Profile can be shaped based on the position of a master axis.

The PCM-23 was designed to be used in applications that require a constant positioning profile to be maintained by one axis of motion while being synchronized to a second axis. These applications typically involve the cutting of thick material, such as foam rubber, while the material is being moved along a conveyor maintaining a perpendicular cut. Another example is indexing forward and backward cutting a pattern out of a piece of moving web material, creating a user defined pattern. The drawing on the back illustrates this application.

The follower axis controlled by an FX Drive with a PCM-23 can rotate the motor shaft forward or backward based on the position of the master axis. This feature is key in allowing the FX Drive to perform CAM Profiles. Reference signals generated by the master axis are used by the PCM-23 to synchronize the follower axis, controlled by an FX Drive, and produce a user defined CAM Profile. These reference signals can be generated from a second FX Drive or from a compatible synchronization encoder.

Position to position mapping points supplied by the operator are used by the PCM-23 to define the shape of a CAM Profile. As many as 256 points for the follower axis and 256 points for the master axis can be used to define a CAM Profile. The FX Drive automatically linear interpolates between the points. For applications that require only a coarse CAM Profile as few as three points need to be defined. The higher the number of position points used, the finer the shape of the CAM Profile.

OPERATION

When using an FX Drive to perform a CAM Profile using a PCM-23, the first step is to define the shape of the profile itself. With the shaped define a series of position to position mapping points need to be defined. Applications requiring the execution of a very precise CAM Profile will require that a large number of mapping points be defined versus an application requiring a coarse CAM Profile.

The shape of the CAM Profile is defined by the user during setup using PCX Software. PCX also allows the user to set up other motion parameters such as velocity, dwell time, and count.

The user has the option of assigning any of up to 93 predefined I/O functions to the 16 input lines and 8 output lines available on the FX Drive and PCM-23. All I/O lines are optically isolated for maximum noise immunity.

When one revolution of a master encoder is equal to one cycle of the master axis, the encoder's marker pulse can be used to reference the master axis (0 position). This can eliminate the need for a sensor to track the master axis' position.

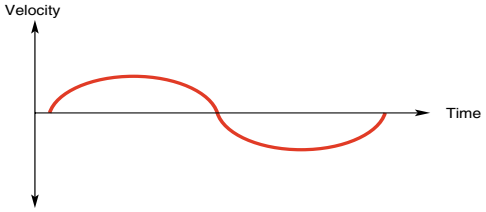
Programmable Limit Switches (PLS) allow the PCM-23 to start and stop machine processes based on the position of

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PCM-23 CAM PROFILE CONTROLLER

the master axis. This could be used to, for example, start and stop the application of glue during the execution of a CAM Profile. Up to 8 PLS are available with the PCM-23. The first four PLS used are defined as high speed PLS. These high speed PLS have an update time of 0.33 milliseconds.

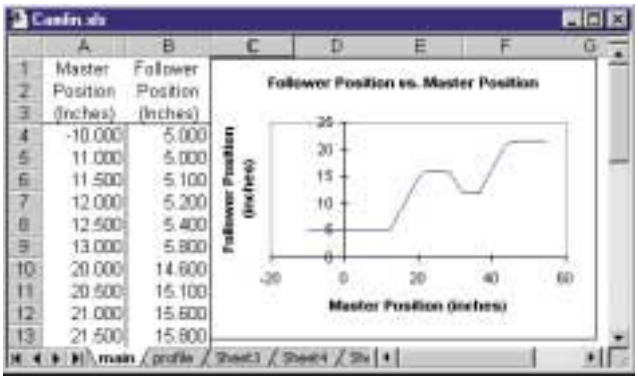


PROGRAMMING

The PCM-23 is programming using EMERSON Motion Control's PCX Software. This software runs on any IBM or compatible PC with at least 545K of free RAM and DOS version 3.0 or higher. PCX allows users to customize the PCM-23 and an FX Drive to meet the exact requirements of the application. No knowledge of high level programming languages is required to use PCX.

The PCX programming software allows the user to define up to 4 CAM Profiles, with each profile consisting of as many as 256 position to position mapping points. To simplify entering these points, users can define these points first in a table generated by a spreadsheet program as seen below. The table can then be exported to an ASCII text file and imported directly into PCX.

MicroSoft™: Excel File with Graph



The PCX screen above right shows the available motion options available to the user when using a PCM-23. The screen to the lower right shows user defined mapping points for both the master and the follower axis used in a CAM Stop Mode.

PCM-23 SPECIFICATIONS

Programming:

- Programs using PCX Software Version 6.6 or above
- ASCII Serial Commands

Data Capacity:

- 4 cam profiles with 256 points

Available Predefined I/O Functions:

- 64 Input Functions
- 29 Output Functions

Interfaces:

- 12 optically isolated I/O lines (8 input, 4 output)
- Synchronization/Position Input
  SCS-X Encoder Signals
  Upstream FX Drive Position
- Synchronization/Position Output
  SCS-X Encoder Signals
  Upstream FX Drive Position
  DX Motor Position

Data Entry Options:

- PCX Software for use on PCs
- T-21 Data Entry Terminal
- T-60 Operator Interface
- ASCII Serial Commands



ORDERING INFORMATION:

- PCM-23 CAM Profiler
- SCS-X Synchronization Encoder
- MSC-xxx* Encoder to Application Module
- SSC-xxx*App. Module to App. Module Sync Cable
  *xxx refers to cable length in feet

PCX: Define Motion



PCX: Cam Profile Configuration



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PCM-24 PRESS FEED CONTROLLER

FEATURES

- Programmed with easy-to-use PCX Software
- Access to Advanced Programming Features (see pages D32-D33)
- Performs press feed control without requiring the user to have servo control experience
- Synchronizes roll feed to press cycle
- Provides slip compensation for accurate positioning
- Progressive stamping applications are simplified with set-up mode which allows jogging up to one feed length
- Fault indicators alert user to unfavorable conditions
- Internal logic allows FX Drive to control: opening and closing of feed rolls, opening and closing or anti-backup rolls, speed of upstream straightener, leveler, or unwind
- User adjustable timers for control of feed rolls and anti-backup rolls
- Stores up to 100 jobs which can be either individual parts or sequences of parts
- Expands I/O capacity of FX Drive with 8 optically isolated input lines and 4 optically isolated output lines

DESCRIPTION

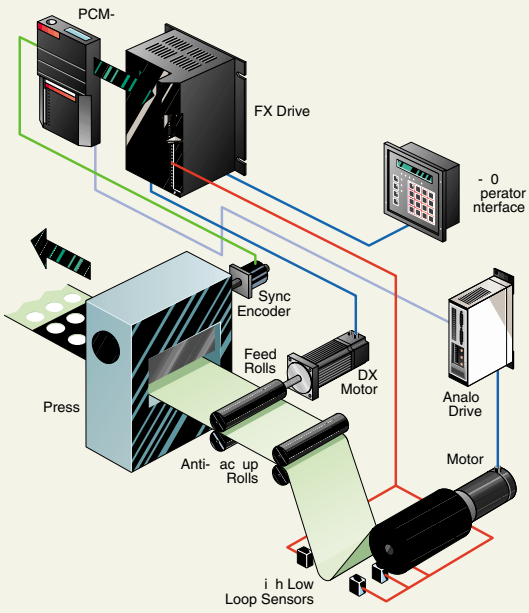
The PCM-24 Press Feed Controller is an application module that attaches to any EMERSON Motion Control FX Positioning Servo Drive. With the PCM-24, the FX Drive is able to provide sophisticated control of a press feed with minimal operator required servo control knowledge or programming experience.

A master synchronization encoder is used to track the position of the press ram. The PCM-24 synchronizes the feed to the press cycle. The synchronous relationship between the follower axis, the press feed, and the master axis, the press, ensures precise and repeatable manufacturing.

OPERATION

The PCM-24 has two modes of operation; Manual and Automatic. From within the Manual Mode, the operator can select a secondary mode, Setup. Setup Mode allows the strip to be jogged one feed length. This is especially helpful for setting up progressive stamping applications. All motion is initiated by the operator in the Manual Mode. While the Automatic Mode motion occurs after the PCM-24 has received the appropriate inputs from the system. With no mode select inputs active, the system is in the Manual Mode. The systems goes into Automatic Mode when that input becomes active. The system stays in Automatic Mode until the Automatic Mode Input is cleared. When the input is cleared, the cycle in progress is completed then the system returns to the Manual Mode.

TYPICAL PRESS FEED APPLICATION USING AN FX DRIVE WITH A PCM-24



The Automatic Mode Input is one of 44 predefined input functions and 24 output functions available to the user when setting up the PCM-24 Application Module with EMERSON EMC's PCX Software.

In the Automatic Mode of operation there are three configuration options from which the user can choose during setup. Those options are as follows:

Intermittent Feed vs. Continuous Feed. Intermittent Feed is selected when the press and the press feed alternate at their own rates with one signaling the other to go using outputs. Continuous Feed applications are those in which the press runs continuously and the feed must be completed within a portion of the cycle. When Continuous Feed is selected, the PCM-24 keeps the Enable Press Output set throughout the run. The press provides a Feed Initiate Input to the FX Drive when the feed should begin.

Press Before Feed vs. Feed Before Press: When Press Before Feed is selected, the PCM-24 will expect a Feed Initiate from the press before performing the first feed. In Feed Before Press, the first feed will be initiated when the Cycle Start Input is set and subsequent feeds will wait for the Feed Initiate Input.

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PCM-24 PRESS FEED CONTROLLER

Full Feed Angle vs. Begin Feed Angle: When Full Feed Angle is selected, the PCM-24 requires the Feed Initiate Input to be maintained for the duration of the feed. If Begin Feed Angle is selected, the Feed initiate input only needs to be set at the beginning of the feed.

With the PCM-24 the FX Drive also has the ability to automatically compensate for product slip in the feed rolls by comparing the output of the compatible encoder which measures the actual movement of the strip. The PCM-24 compares the motion of the strip with the commanded motion, calculates the compensation necessary and modifies the motion profile to accurately position the strip.

The PCM-24 also can control the speed of an upstream straightener, leveler or unwind. The user defines the range of the analog output (up to ±10 VDC) and the strip speed it relates to. The PCM-24 updates the analog output on every press cycle based on feed length, cyclic rate, and the status of loop sensors.

PROGRAMMING

The PCM-24 is programmed using EMERSON Motion Control's PCX Software. This software runs on any IBM or compatible PC with at least 545K of free RAM and DOS version 3.0 or higher. PCX allows users to customize the PCM-24 and an FX Drive to meet the exact requirements of the application. No knowledge of high level programming languages is required to use PCX.

The PCX Software allows the user to define up to 100 jobs. A job can be either an individual part or a series of parts, which is referred to as a job queue. Each part can consist of a single feed or several feeds in sequence. Each part also has assigned to it a part counter and a batch counter. Batch Complete and Batch Count Complete outputs provide a means of enunciating the completion of production quantities. Job identifiers are eight character alpha-numeric "part numbers" which can be assigned to each job to simplify setup. The PCM-24's unique system of identifiers, counters and queues allow an operator to define a whole days work quickly and accurately.

The screen directly below illustrates how a feed for a PCM-24 is setup in PCX. In this example, a continuous feed cycle type is selected along with the Feed Before Press and Begin Feed Angle options. The screen to the left shows how a program is setup in PCX.

PCM-24 SPECIFICATIONS

Programming:

- Programs using PCX Software Version 6.6 or higher
- ASCII Serial Commands

Data Capacity:

- 100 programs with 1024 program steps, 256 indexes

Available Predefined I/O Functions:

- 44 Input Functions
- 24 Output Functions

Interfaces:

- 12 optically isolated I/O lines (6 input, 4 output)
- Synchronization/Position Input
  SCS-X Encoder Signals
  Upstream FX Drive Position
- Synchronization/Position Output
  SCS-X Encoder Signals
  Upstream FX Drive Position
  DX Motor Position

Data Entry Options:

- T-21 Data Entry Terminal
- T-60 Operator Interface
- ASCII Serial Commands



ORDERING INFORMATION:

- PCM-24 Press Feed Controller
- DEM-1 Dual Encoder Module
- DSC-xxx* DEM-1 to Application Module Cable
- SCS-X Synchronization Encoder
- MSC-xxx* Encoder to Application Module
- SSC-xxx*App. Module to App. Module Sync Cable

*xxx refers to cable length in feet

PCX: Program Setup Screen



PCX: Press Feed Configuration



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IBS-11 MOTION PROGRAM CONTROLLER WITH INTERBUS-S COMMUNICATIONS

FEATURES

- Programmed with easy-to-use PCX Software
- Access to Advanced Programming Features (see pages D32-D33)
- Provides a high speed network interface to host machine controllers, sensors and actuators in real-time
- Eliminates interconnects and reduces machine wiring
- PCP byte emulates serial commands
- Simplifies system troubleshooting and maintenance
- Maintains data integrity through CRC (Cyclical Redundancy Checking)
- Configurable with 2 to 6 16 bit input/output words
- Optional 12 bit +10 VDC analog output and 12 bit +10 VDC analog input (for use in spindle control)
- Stores parameters in non-volatile memory to allow the unit to be moved to another FX Drive of the same size without losing data

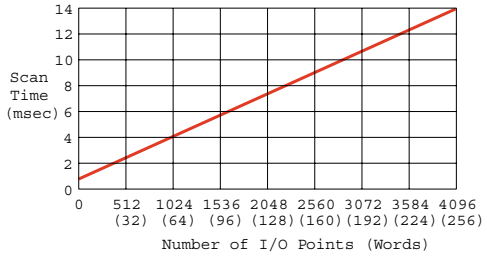
DESCRIPTION

The IBS-11 provides the same positioning functions as a PCM-11 Programmable Motion Controller with the additional high speed InterBus-S interface.

The IBS-11 InterBus-S Application Module attaches to any FX Series Positioning Servo Drive to provide a high speed network interface. This interface corresponds to the standards of the InterBus-S Serial Distributed Network for Sensors/Actuators. IBS Application Modules can be used to provide real-time remote bus connection from the host controller, sensors and various machine actuators. The drawing on the right illustrates a typical system using FX Drives configured with IBS Modules.

OPERATION

IBS Application Modules are programmed using the same easy to use PCX Software used to program PCM Application Modules and FX Drives. I/O mapping is handled through an 8K dual port RAM. The number of data words are selectable via a dip switch located on the back of the module. The number of data words can vary from 2 to 6 words. The graph below charts the performance change in speed when the number of data words is increased.



INTERBUS-S MODULE SPECIFICATIONS

Programming:

- Programs using PCX Software, (version to be determined)
- ASCII Serial Commands
- InterBus-S PCP Protocol

Data Capacity:

- 100 programs with 1024 program steps, 256 indexes

Available Predefined I/O Functions:

- 35 Input and 20 Output Functions

Interfaces:

- 2 Remote InterBus-S Interfaces
- 12 optically isolated I/O lines (8 input, 4 output)

Data Entry Options:

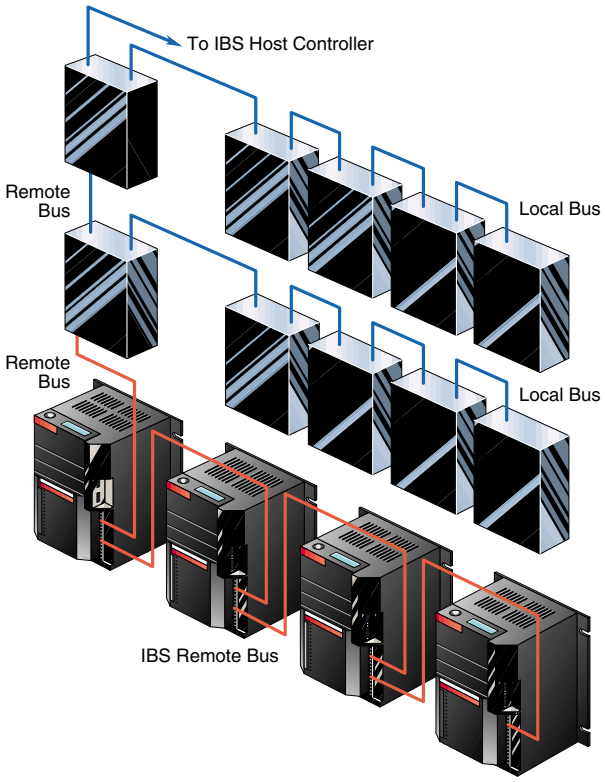
- PCX Software for use on PCs
- T-21 Data Entry Panel
- T-60 Operator Interface
- ASCII Serial Commands



ORDERING INFORMATION:

- IBS-11 Programmable Motion Control Module
- IBC-xxx* InterBus to InterBus Cable
- SSC-xxx* App. Module to App. Module Sync. cable

*xxx refers to cable length in feet.



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IBS-15 RATIO CONTROLLER WITH INTERBUS-S COMMUNICATIONS

FEATURES

- Programmed with easy-to-use PCX Software
- Access to Advanced Programming Features (see pages D32-D33)
- Provides a high speed network interface to host machine controllers, sensors and actuators in real-time
- Eliminates interconnects and reduces machine wiring
- PCP byte emulates serial commands
- Simplifies system troubleshooting and maintenance
- Maintains data integrity through CRC (Cyclical Redundancy Checking)
- Configurable with 2 to 6 16 bit input/output words
- Optional 12 bit +10 VDC analog output and 12 bit +10 VDC analog input (for use in spindle control)
- Stores parameters in non-volatile memory to allow the unit to be moved to another FX Drive of the same size without losing data

DESCRIPTION

The IBS-15 provides the same positioning functions as a PCM-15 Ratio Controller with the additional high speed interface. An IBS-15 Application Module also provides 12 bit analog output and 12 bit analog input. This allows control of an external spindle drive without requiring an additional analog module to be connected to the InterBus-S Network.

The InterBus-S Application Module attaches to any FX Series Positioning Servo Drive to provide a high speed network interface. This interface corresponds to the standards of the InterBus-S Serial Distributed Network for Sensors/Actuators. IBS Application Modules can be used to provide real-time remote bus connection from the host controller, sensors and various machine actuators. The drawing on the left illustrates a typical system using FX Drives configured with IBS Modules.

INTERBUS-S MODULE SPECIFICATIONS

Programming:

- Programs using PCX Software, (version to be determined)
- ASCII Serial Commands

InterBus-S PCP Protocol

Data Capacity:

- 100 programs with 1024 program steps, 256 indexes

Available Predefined I/O Functions:

- 46 Input and 22 Output Functions

Interfaces:

- 2 Remote InterBus-S Interfaces
- 12 optically isolated I/O lines (8 input, 4 output)
- Synchronization/Position Input
  SCS-X Encoder Signals
  Upstream FX Drive Position
- Synchronization/Position Output
  SCS-X Encoder Signals
  Upstream FX Drive Position
  DX Motor Position
- 2 remote bus connectors with IBS-15 Encoder Interface
  12 bit +10 VDC analog input
  12 bit+10 VDC analog output

Data Entry Options:

- PCX Software for use on PCs
- T-21 Data Entry Panel
- T-60 Operator Interface
- ASCII Serial Commands



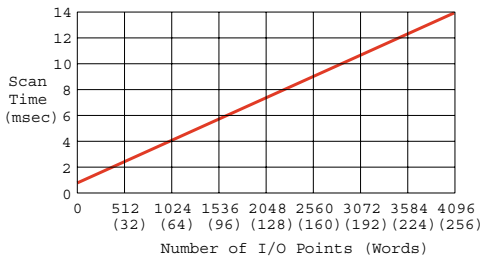
ORDERING INFORMATION:

- IBS-15 Ratio Control Module
- IBC-xxx* InterBus to InterBus Cable
- SCS-X Synchronization Encoder
- MSC-xxx* Encoder to Application Module cable
- SSC-xxx* App. Module to App. Module Sync. cable

*xxx refers to cable length in feet.

OPERATION

IBS Application Modules are programmed using the same easy to use PCX Software used to program PCM Application Modules and FX Drives. I/O mapping is handled through an 8K dual port RAM. The number of data words are selectable via a dip switch located on the back of the module. The number of data words can vary from 2 to 6 words. The graph below charts the performance change in speed when the number of data words is increased.



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IOM-1 OPTICALLY ISOLATED I/O MODULE

FEATURES

- Programmed with easy-to-use PCX Software
- Expands I/O capacity with 8 optically isolated input lines and 4 optically isolated output lines
- Parallel programming port for PLC interface
- Adds additional user assignable I/O functions
- Stores parameters in non-volatile memory in FX Servo Positioning Drive

DESCRIPTION

The IOM-1 Module is an application module that attaches to any FX Series Positioning Servo Drive. The IOM-1 provides an additional 12 I/O lines, 8 input and 4 output, for use by the FX Drive. Like the FX Drive, all I/O lines are optically isolated for maximum noise immunity.

IOM-1 SPECIFICATIONS

Programming:

- Programs using PCX Software, Version 6.1 or above
- ASCII Serial Commands

Data Capacity:

- 32 indexes

Interfaces:

- 12 optically isolated I/O lines (8 input, 4 output)
- Parallel Interface Port

Available Predefined I/O Functions:

- 32 Input Functions
- 15 Output Functions

Data Entry Options:

- PCX Software for use on PCs
- T-21 Data Entry Panel
- T-60 Operator Interface
- ASCII Serial Commands
- TW Series Thumbwheel Data Entry Module



ORDERING INFORMATION:

- IOM-1 Input/Output Module

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SCS-X SYNCHRONIZATION ENCODER

DESCRIPTION

The SCS-X Synchronization Encoder is a rotary encoder designed to provide synchronized output signals. FX Positioning Servo Drives equipped with one of the Application Modules capable of synchronized functions are able to interpret those signals. This data is then used to produce positioning cycles, synchronization to an independent axis, or machine cycles being monitored to perform a task.



Application Modules with synchronization/position input capability include the following:

- PCM-14 Slip Compensator
- PCM-15 Ratio Controller
- PCM-16 Phase Synchronization Controller
- PCM-18 Web Controller
- PCM-19 Conveyor Controller
- PCM-22 Rotary Knife Controller
- IBS-15 InterBus-S Ratio Controller

Three models of SCS-X Synchronization Encoders provide resolution of 1000, 2500 or 3000 lines per channel per revolution of the encoder shaft. This translated into 4000, 10,000 and 12,000 pulse counts per revolution respectively. EMERSON Motion Control also provides connectorized cables that attach directly from the encoder to an Application Module using a 25 pin "D" type connector.

See Options and Accessories Section F, pages F38-F39 for complete specifications on SCS-X Encoders.

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DEM-1 DUAL ENCODER MODULE

DESCRIPTION

The DEM Dual Encoder Module is a simple device that allows up to two encoder signals and signals from an upstream FX Drive to be combined into the same synchronization connector on an Application Module. The DEM accepts these different signals and outputs them to an Application Module through a DSC cable. This cable carries the different signals to the Application Module. The Application Module then uses these signals to calculate any necessary positioning changes required for the application.

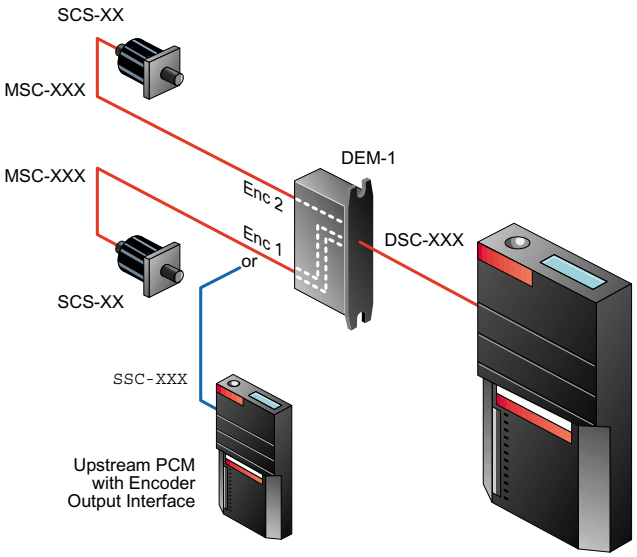
The DEM is commonly used in applications that require feedback from two different sources. PCM Modules that are designed to operate with the DEM-1 include the PCM-14 Slip Compensator and the PCM-18 Web Controller.

ORDERING INFORMATION:

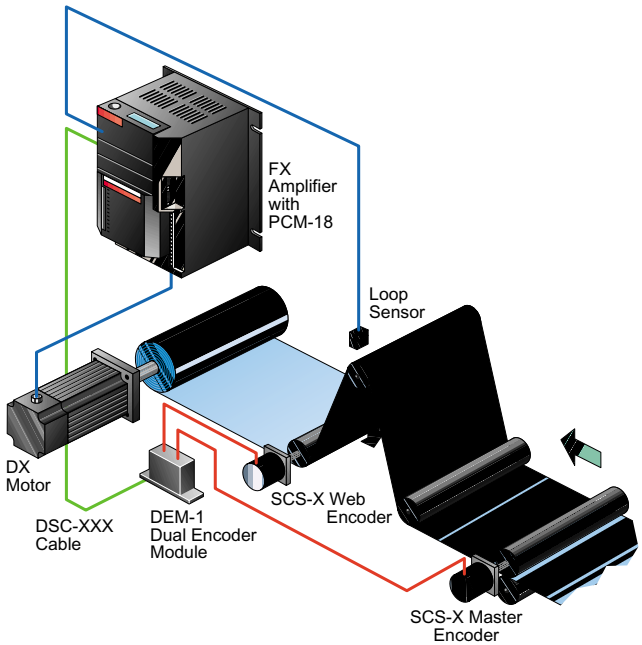
- DEM-1 Dual Encoder Module
- DSC-xxx* DEM to Application Module cable
- MSC-xxx* Encoder to DEM-1 cable
- SSC-xxx* Application Module to DEM-1 cable

*xxx refers to cable length in feet.

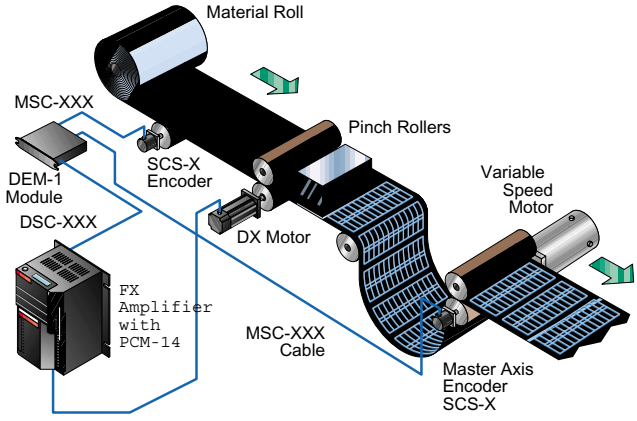
DEM SYSTEM CONFIGURATION



DEM-1 IN PCM-18 WEB CONTROLLER APPLICATION



DEM-1 IN PCM-14 SLIP COMPENSATOR APPLICATION



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MFG-1 MASTER FREQUENCY GENERATOR

FEATURES

- Emulates a synchronization encoder by generating quadrature encoder output signals
- Allows system speed to be adjusted digitally
- Enables all axes to be synchronized to the same master signal
- Inhibits signal output and changes output direction
- Operates off of 90 to 260 VAC, 47/63 Hz
- Protected with rugged industrial housing



DESCRIPTION

The MFG-1 Master Signal Generator offers a convenient method to synchronize machine cycles to a single master encoder signal. The MFG-1 can output simulated quadrature encoder signals to any Application Module capable of synchronization. This includes the PCM-14 Slip Compensator, PCM-15 Ratio Controller, PCM-16 Phase Synchronization Controller, PCM-17 Random Infeed Controller, PCM-18 Web Controller, PCM-19 Conveyor Controller, PCM-22 Rotary Knife Controller and the IBS-15 InterBus-S Ratio Controller.

Using potentiometers rated from 1K to 10K, quadrature encoder output signals can be varied to match actual or perceived machine cycles. This allows the positioning provided by the FX Drives to be evaluated before the machine is actually put on line.

The MFG-1 also provides a method to synchronize all machine cycles to a single master encoder signal. The ability to synchronize machine cycles can result in more efficient machine performance and higher system throughput. Synchronization of machine cycles also provides for digital tracking, which eliminates any drifting of the machine cycle

MFG-1 SPECIFICATIONS

Signal Code:

- 2 channel, 5 V differential line driver RS-422, complementary

Control Inputs:

- Speed: 1K to 10K potentiometer
- Inhibit if closed
- Interchange of channels

Frequency Range:

- 0 to 62.5 KHz per channel

Power Requirements:

- 90 to 260 VAC
- 0.5 amps
- 47/63 Hz

ORDERING INFORMATION:

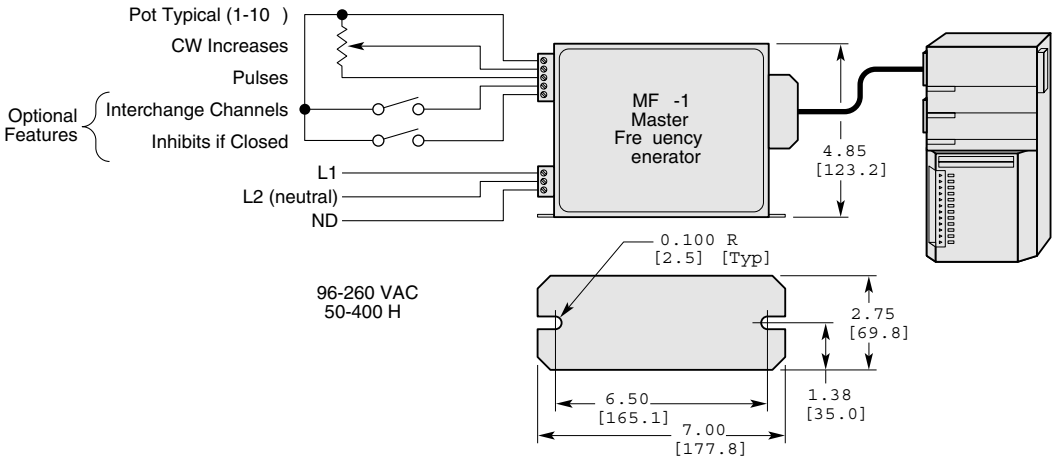
- MFG-1 Master Signal Generator

* SSC-XXX, MFG-1 to Application Module Sync. cable

* SSCO-XXX, MFG-1 to open wires cable

* XXX refers to length of cable in feet

MFG-1 SYSTEM CONFIGURATION



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525 PROGRAMMABLE MOTION CONTROLLER

FEATURES

- Complete stand-alone programmable motion controller, controls any servo amplifier with analog velocity command
- Configure motion profiles with English or metric engineering units to set velocity, position, acceleration and deceleration parameters
- Controls acceleration time and deceleration time with either linear or mod-sine ramps of up to 65.000 secs.
- Stores up to 32 indexes in basic unit, up to 256 with the addition of an Application Module
- Up to 10 motion programs with a total of 100 steps
- Accepts an amplified sine wave or TTL encoder, maximum input frequency of 51.2 KHz per channel
- Resolution selectable by user from 50 to 25,000 steps per revolution
- Front mounted full-time 8 segment LED diagnostic display shows operating status, fault conditions
- 8 optically isolated input lines and 4 optically isolated output lines provided for assignable input/output functions
- Accepts full line of EMERSON Motion Control Application Modules and operator interfaces



DESCRIPTION

The 525 Programmable Motion Controller is a complete closed-loop position control for any servo amplifier or drive with a high enough bandwidth to support the positioning requirement for the application. The amplifier or drive must accept an analog voltage velocity command.

The 525 PMC uses the same 16 bit microprocessor, system architecture, and easy-to-use interface and English language programming as the EMERSON Motion Control FX Positioning Servo Drives. The unique set up and operating convenience found in the FX Drives is now available through the 525 PMC for motors and amplifiers of almost any size and type.

OPERATION

The 525 PMC provides complete closed-loop control for positioning systems through the use of analog command signals to a selected servo amplifier and motor combination. Position feedback is derived from an encoder connected to the motor shaft. Since the control algorithms and command structure are the same as those used in the FX Series Positioning Servo Drives, multi-axis systems that have a variety of motor sizes and types, can be installed without having to work with different programming languages.

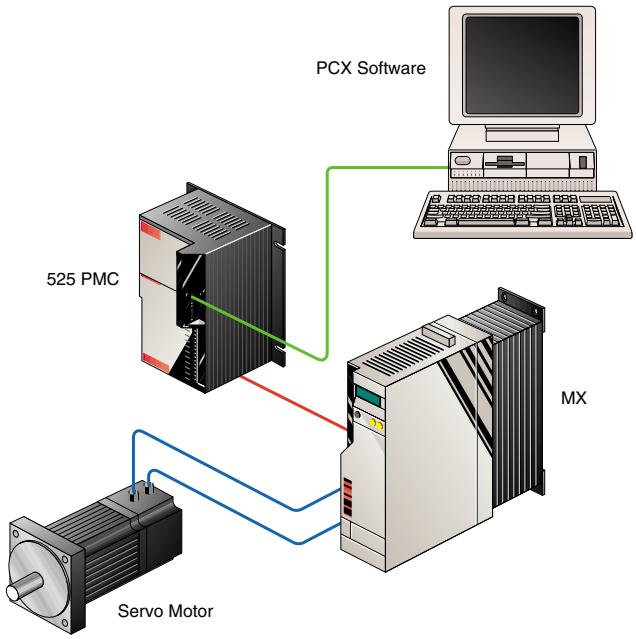
The basic unit of movement in a 525 PMC is an index. An index is defined by its acceleration rate, velocity, deceleration rate, and commanded distance or position. Dwell time after completion and a repeat count are also stored with each index.

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525 PROGRAMMABLE MOTION CONTROLLER

525 SYSTEM CONFIGURATION



After the operator has entered the data for all of the required moves, simple switch closures initiate motion. The system may also use the input/output logic of a Programmable Logic Controller (PLC) to initiate motion and monitor progress of the move that the PLC commanded. The I/O in the 525 PMC can also be used to update the PLC.

When the desired index or program is commanded, the 525 PMC transmits an analog velocity signal to the servo amplifier. Monitoring of the motor's position feedback encoder is continuous, so the 525 PMC is able to modify the velocity commands during the move to force the instantaneous position reported by the encoder to match the position expected by the micro processor.

In addition to simple motion indexing and programs, the 525 PMC can use the entire range of PMC Application Modules to perform complex applications such as Random Infeed, Phase Synchronization, Slip Compensation, Rotary Knife Cutoffs, Ratio Control, Web Control and Conveyor Control.

PROGRAMMING & SET UP

The major portion of set up tasks for the 525 PMC is handled by easy-to-use PCX Software. Complete English language question and answer format screens quickly step the user through the entries for parameters, such as the units to be used for distance commands and limits, the maximum speed in rpm (or other units) that the operator will be allowed in normal operation, and more.

The user will also find position-loop gain adjustments simpler that those found on other systems. One screen allows entry of changes in position loop gain from the computer keyboard while monitoring following error on screen in real time. Once the correct value has been chosen, a few simple commands will save all parameters and data to a disk file for backup or later reference.

In addition, a front-panel toggle switch may be set to allow a range of position-loop gain adjustment with the 525 PMC on the machine without the need for a computer. The exact range or authority of the loop gain switch is defined by the person setting up the 525 PMC.

The selection of assignable I/O is simple. The operator chooses the desired function (Stop, Hold, Index Initiate, Program Initiate, Jog CW, and others) from the menu of available functions and assigns the function to the line of his choice. Each input and output line is optically isolated from the outside world and from each other. This arrangement allows a mix of different power sources and configurations (current sourcing or sinking) throughout the input/output structure. I/O assignments are also stored on disk when 525 parameter data is downloaded to a file.

Status and fault conditions are displayed continuously on the 525 PMC front panel- mounted LED display. Each code corresponds to a specific status or fault so the operators are able to quickly locate, identify and repair the problem. Some of the codes displayed include: jogging, home move, external control, encoder fault (bad encoder or loose cable), excess RMS amplifier current, motor over temperature (for motors equipped with thermostats), and more. Fault and status monitoring is also available using the serial port and an online computer.

When the amplifier is so equipped, the 525 PMC will also display fault and status conditions of the amplifier, such as amplifier over temperature, excess amplifier current, motor over temperature, and general amplifier faults.

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525 PROGRAMMABLE MOTION CONTROLLER

525 PMC SPECIFICATIONS

Programming:

- Programs using PCX Software, version 6.1 or above
- ASCII Serial Commands

Input Power:

- 90 to 264 VAC (no switching required)
- 47/63 Hz

I/O Line Capacity:

- Eight optically isolated input lines
- Four optically isolated output lines
- I/O line capacity doubles with addition of Application Module

Available Predefined I/O:

- 29 input functions
- 15 output functions

Accuracy:

- Encoder and mounting dependent (+20 arc. minute typical)

Encoder Interface:

- Sine or square wave (+5 volt TTL)
- Two channels and marker pulse (A, A not, B, B not, M, M not)
- Complementary (double ended) input from encoder required
- Maximum Frequency input 51.2 KHz per channel

Diagnostics:

- Front panel LED display with status indicator
- Serial ASCII communication for following error, encoder monitor and position loop monitor

Weight:

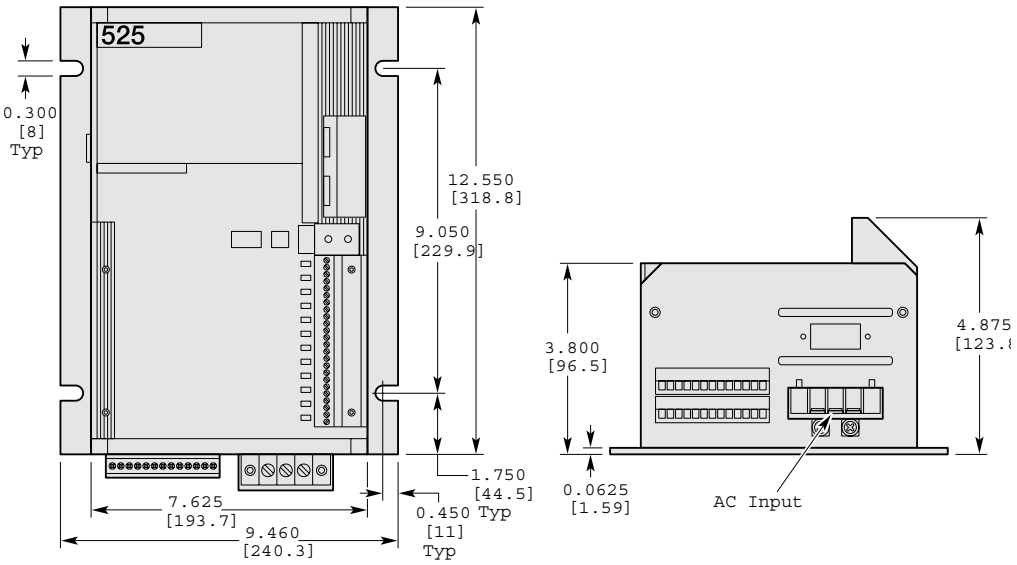
- 15 lbs. (6.8 kilograms)

ORDERING INFORMATION:

- 525 Programmable Motion Controller
- SDC-15-1 Feedback Encoder, 1024 line resolution, standard housing with pigtail leads
- SDC-25-1 Feedback Encoder, 1024 line resolution, external housing with connector

DIMENSIONS

in [mm]



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