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PCM-19 APPLICATION MODULE OPERATORS MANUAL

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SECTION 1

INTRODUCTION

This manual provides information for setup and programming of the PCM-19 Application Module as a part of an Emerson EMC FX drive. It is important that the operator becomes familiar with section 1 of the PCX 6.X manual (P/N 400240-01). The PCX 6.X manual provides the background information needed to setup and configure an FX Drive Amplifier using PCX 6.X software.

Note: The PCM-19 module requires PCX software version 6.02 or above.

1.1 OVERVIEW OF PCM-19

The PCM-19 Application Module provides a solution for conveyor requirements for merge conveyor systems consisting of 1 to 4 feed conveyors. Given a set of parameters entered from PCX, inputs, sensors and/or a merge controller, the PCM-19 performs algorithms to ensure specified product spacing on the outgoing or "merge conveyor" without product jamming.

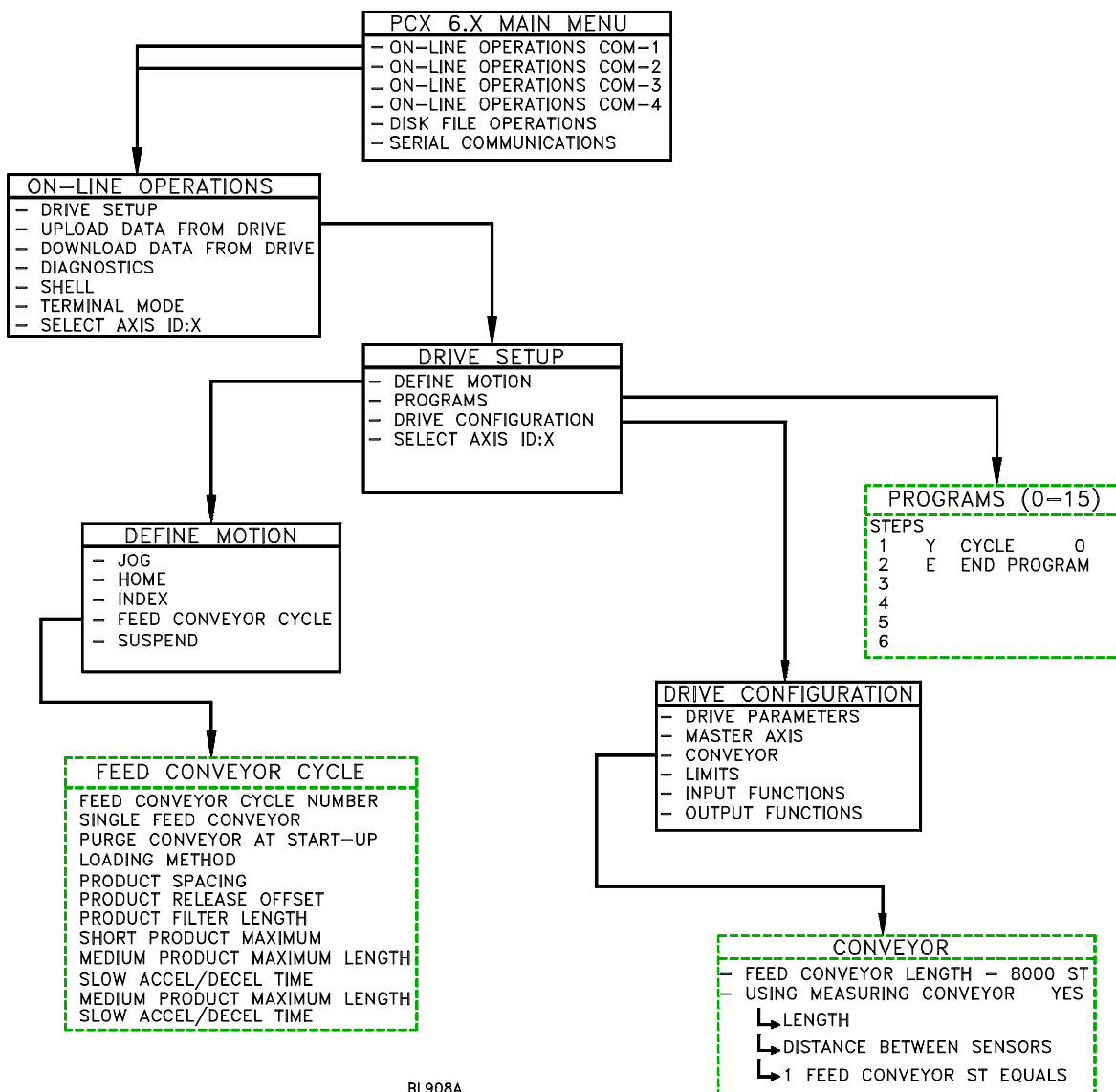
1.2 BASIC OPERATION

The PCM-19 allows an Emerson Positioning Drive to monitor the motion of a merge conveyor system and accelerate or decelerate its associated feed conveyors to release products onto a merge conveyor at the appropriate time to achieve the specified product spacing. The PCM-19 controller is designed to run stand-alone as a single feed drive or along with a merge controller in a multiple feed drive system.

SECTION 2 SETUP AND PROGRAMMING

2.1 SYSTEM SETUP

To properly set up the conveyor system the **Master Axis** and the **Feed Conveyor Cycle** must be defined first. This is accomplished with Emerson EMC PCX (version 6.2 or greater) software. The following menu hierarchy chart shows in dotted lines the menus that are added or changed when a PCM-19 module is attached. These menus are accessed via the **Drive Setup**, **Drive Configuration** and **Define Motion** screens.



BL908A

Figure 1 PCX 6.X Hierarchy Menu Setup With A PCM-19 Module

SYSTEM SETUP (continued)

The PCM-19 controller is designed to run synchronized with the merge conveyor motion, allowing the outgoing merge conveyor system to vary its velocity without affecting the spacing of the products. The synchronization is typically achieved with an external encoder or direct drive to drive monitoring of the master motion.

Sensors, such as photoeye sensors, are used to monitor the products as they enter and exit the feed conveyor. Using faster and more accurate sensors will increase the accuracy of product placement and maximize system output capabilities.

To maximize the performance of your system and reduce the risk of product damage, the PCM-19 has the capability of categorizing the products by size and adjusting the acceleration and deceleration of the conveyor based on operator specified parameters. If the optional "product measuring" feature is to be used, then the following basic system components are recommended for each feed conveyor employed in the system:

- Separation Conveyor - A first stage separation or "gap puller" belt which generates gaps between products to enable product measuring using sensors. This conveyor must run at a slower velocity than the Measuring Conveyor in order to ensure gaps exist between products.
- Measuring Conveyor - A second stage measuring conveyor that runs at a higher velocity than the Separation Conveyor but slower velocity than the Feed Control conveyor. Product measuring takes place on this conveyor. The product measuring feature allows the PCM-19 to sense the width and height of the products on the infeed conveyor. This feature helps to eliminate the possibility of damage to products due to tipping or slipping on the infeed conveyor because of accelerating or decelerating too rapidly.
- Feed Control Conveyor - A third stage conveyor that runs at a higher velocity than the Measuring Conveyor. This conveyor merges products on to the Merge Conveyor to achieve the desired product spacing.
- Merge Conveyor - A final stage merge or "out-feed" conveyor which is common to all feed conveyors employed in the system.

Note: If the product measuring feature is not used, the measuring conveyor can be omitted from the system. Refer to section 2.2 for information on specifying whether or not the "product measuring" capability will be used.

Figure 2 gives a "birds eye" view of a possible PCM-19 configuration.

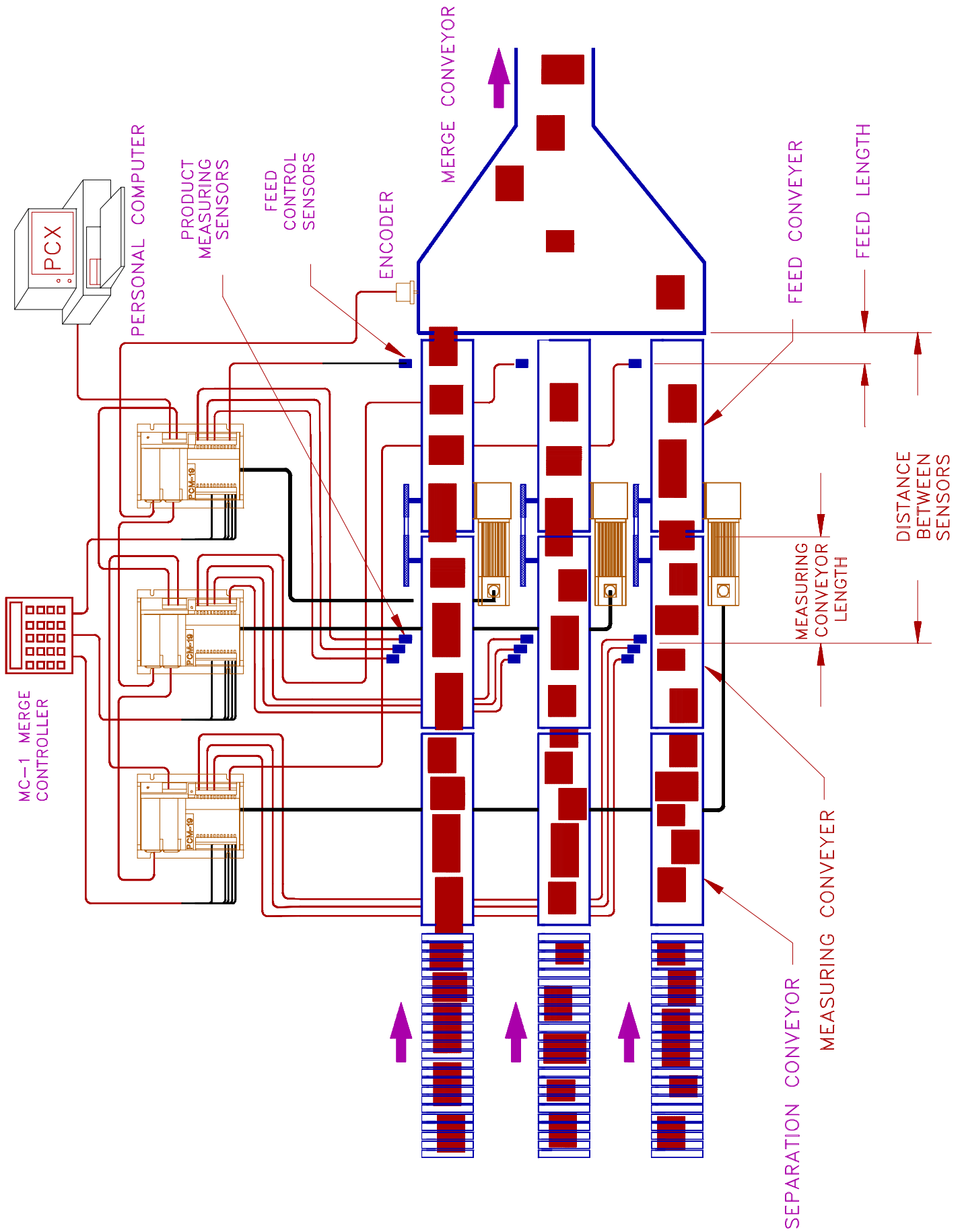
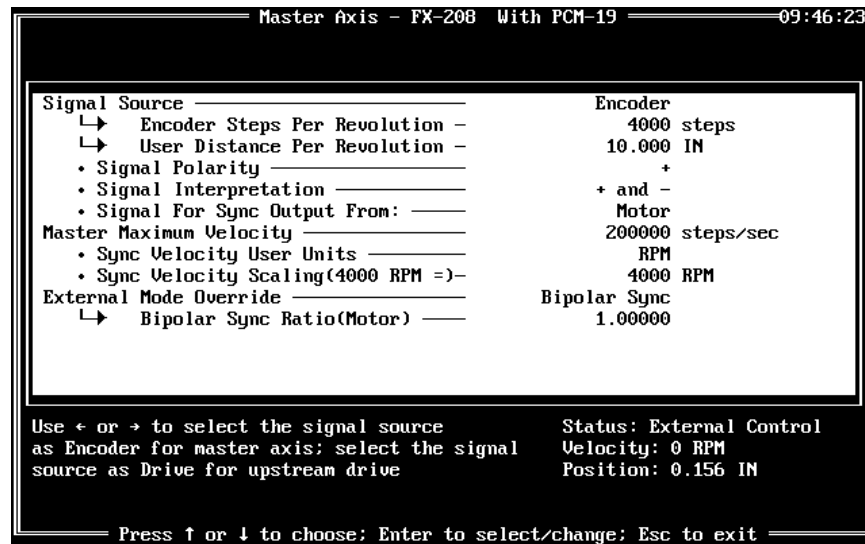


Figure 2

2.1.1 SETTING UP THE MASTER AXIS

When configuring your system with a PCM-19 Module, the first step is to define the **Master Axis**. The master axis can be another FX Series amplifier or an Emerson 520 PMC. Alternatively, it can be an SCS-X encoder which produces a specific number of steps per revolution or a customer supplied encoder of any line density yielding more than 200 steps per revolution.

The **Master Axis** setup screen is accessed from the **Drive Configuration** screen (see hierarchy diagram in Figure 1). This screen contains information needed to setup the PCM-19 as well as information on how to setup synchronization indexes.



2.1 MASTER AXIS SCREEN DEFINITIONS

Signal Source

Using the arrow keys to toggle between **Drive** and **Encoder**, you can select the source of the signals used to determine the positional information of the **Master Axis**.

Encoder Steps Per Revolution

This parameter, which only comes up if ENCODER is chosen as the signal source, specifies the number of encoder counts or steps that the feed drive will read per revolution of the encoder.

User Distance Per Revolution

This parameter specifies the distance (in user units) traveled by the merge conveyor per revolution of the signal source.

Signal Polarity

This parameter defines the direction of the master axis that corresponds to a positive master position change. Clockwise is indicated with a (+), counterclockwise is indicated with a (-). Perspective is looking at the encoder or master drive shaft.

Signal Interpretation

Use the arrow keys to toggle between choices. The Signal Interpretation feature allows you to define how the follower axis reacts to clockwise and counterclockwise motion of the master axis.

Note: The following signal polarity modes do not apply to the Bipolar Sync mode of operation.

Mode #1 (+ and -): When the master axis moves either CW or CCW, the follower axis will move in its commanded direction. If the master axis changes direction the follower axis will continue in the same commanded direction. The follower axis will not reverse direction.

Mode #2 (+): The follower will only react to synchronization pulses when the master axis runs in the CW direction. CCW master axis pulses are ignored.

Mode #3 (-): The follower will only react to synchronization pulses when the master axis runs in the CCW direction. CW master axis pulses are ignored.

Mode #4 (COMP +): The follower will only react to synchronization pulses when the master axis runs in the CW direction. The drive counts the pulses received in the CCW direction and ignores that exact number of CW pulses before follower motion in the CW direction occurs. This feature compensates for master axis motion in the opposite (CCW) direction. For example, the master stops, then inadvertently backs up due to conveyor slack, etc.

Mode #5 (COMP -): The follower axis will only react to synchronization pulses when the master axis runs in the CCW direction. The drive counts the pulses received in the CW direction and ignores that exact number of CCW pulses before follower motion in the CCW direction occurs. This feature compensates for master axis motion in the opposite (CW) direction. For example, the master stops, then inadvertently backs up due to conveyor slack, etc.

Note: For PCM-19 applications, it is recommended that comp(+) or comp(-) mode be used due to the "uni-directional" nature of merge conveyor systems.

Signal For Sync Output From:

Use the arrow keys to toggle between the choices. If you select *Motor*, the amplifier will output a sync signal based on the performance of its own motor. If you select *Upstream Drive*, the amplifier will output the signal it is receiving from its master.

Note: Encoder pulses are passed to all amplifiers in the synchronization chain. Selecting either motor or upstream drive has no effect on the quality of the encoder signal.

The following parameters in the master axis screen are used in applications using encoder synchronization and do not apply to PCM-19 conveyor cycles. For details on encoder synchronization, see the PMC-15 section of manual P/N 400240-01.

Master Maximum Velocity

Sync Velocity User Units

Sync Velocity Scaling (4000 RPM Equals)

Sync Ratio

External Mode Override (Bi-polar Sync Motor)

2.2 CONVEYOR SCREEN

The next step is to setup the parameters in the Conveyor screen. Depending on the configuration of your system you may want to use the product measuring feature. By entering "YES" for the "Using Measuring Conveyor?" parameter three additional parameters will appear on the screen (see Figure 5). If you enter "NO" (default response), the screen will be as shown in Figure 4.

```
Conveyor - FX-208 With PCM-19 09:08:46
Feed Conveyor Length _____ 30.000 IN
Using Measuring Conveyor? _____ No

Sets distance from the feed control sensor to the end of feed conveyor
Default: 8.000 IN
Status: External Control
Velocity: 0 RPM
Position: 0.000 IN
Range: 0.000 to 2147483.647 IN
Press ↑ or ↓ to choose; Enter to select/change; Esc to exit
```

Figure 4

The product measuring feature allows the PCM-19 to sense the width and height of the products on the infeed conveyor. This feature helps to eliminate the possibility of damage to products due to tipping or slipping on the infeed conveyor because of accelerating or decelerating too rapidly.

```
Conveyor - FX-208 With PCM-19 09:08:29
Feed Conveyor Length _____ 30.000 IN
Using Measuring Conveyor? _____ Yes
└─> Length _____ 30.000 IN
└─> Distance Between Sensors _____ 48.000 IN
└─> 1 Feed Conveyor IN Equals _____ 0.50 IN

Sets distance from the feed control sensor to the end of feed conveyor
Default: 8.000 IN
Status: External Control
Velocity: 0 RPM
Position: 0.000 IN
Range: 0.000 to 2147483.647 IN
Press ↑ or ↓ to choose; Enter to select/change; Esc to exit
```

Figure 5

2.2.1 CONVEYOR SCREEN DEFINITIONS

Feed Conveyor Length

Defines the length from the feed sensor to the seam between the feed and merge conveyors in user units.

Using Measuring Conveyor?

Entering "YES" enables the product measuring feature. (See Figure 2)

*Measuring Conveyor Length

Defines the length from the measuring sensor #1 to the seam between the measuring and feed conveyors in user units.

*Distance Between Sensors

Specifies the distance between the feed sensor and the product measuring sensor #1.

*1 Feed Conveyor ST Equals

Defines the ratio of liner distance of measuring conveyor to the feed conveyor. This parameter is entered as a fraction. Example: Entering .33 defines a 1:3 gear ratio (i.e. the measuring conveyor travels 1/3 the distance of the feed conveyor at any given velocity).

Note: *These parameters are available only when "YES" is entered for "Using Measuring Conveyor?".

2.3 FEED CONVEYOR CYCLES

The next step in setting up your conveyor system is to define the parameters in the Feed Conveyor Cycles screen that pertain to your specific application. The parameters in this screen will define the accel/decel times, product spacing, and product loading method (see Figure 7). The number of parameters shown in this screen will vary depending on your response to the "Using Measuring Conveyor" question in the Conveyor setup screen. If you answer "NO" to "Using Measuring Conveyor" there will be fewer parameters that you need to setup. The following figures show the differences.

```

Feed Conveyor Cycles - FX-208 With PCM-19 09:10:27
-----
Feed Conveyor Cycle Number _____ 1
Single Feed Conveyor _____ Yes
Purge Conveyor At Start-up _____ Yes
Loading Method _____ Tail to Head
Product Spacing _____ 5.000 IN
Product Release Offset _____ 0.000 IN
Product Filter Length _____ 0.500 IN
Accel/Decel Time _____ 0.250 seconds

Selects a valid feed conveyor cycle number      Status: External Control
Default: 0                                       Velocity: 0 RPM
Range: 0 to 15                                  Position: 0.000 IN

Press ↑ or ↓ to choose; Enter to select/change; Esc to exit
  
```

Figure 6 Feed Conveyor Cycle Screen When Not Using Measuring Conveyor Option

```

Feed Conveyor Cycles - FX-208 With PCM-19 09:46:00
-----
Feed Conveyor Cycle Number _____ 1
Single Feed Conveyor _____ Yes
Purge Conveyor At Start-up _____ Yes
Loading Method _____ Tail to Head
Product Spacing _____ 5.000 IN
Product Release Offset _____ 0.000 IN
Product Filter Length _____ 0.500 IN
Short Product Maximum Length _____ 6.000 IN
Medium Product Maximum Length _____ 12.000 IN
Slow Accel/Decel Time _____ 1.000 seconds
Medium Accel/Decel Time _____ 0.500 seconds
Fast Accel/Decel Time _____ 0.250 seconds

▼ Product Size vs Accel/Decel Times ▼

Selects a valid feed conveyor cycle number      Status: External Control
Default: 0                                       Velocity: 0 RPM
Range: 0 to 15                                  Position: 0.156 IN

Press ↑ or ↓ to choose; Enter to select/change; Esc to exit
  
```

Figure 7 Feed Conveyor Cycle Screen When Using Measuring Conveyor Option

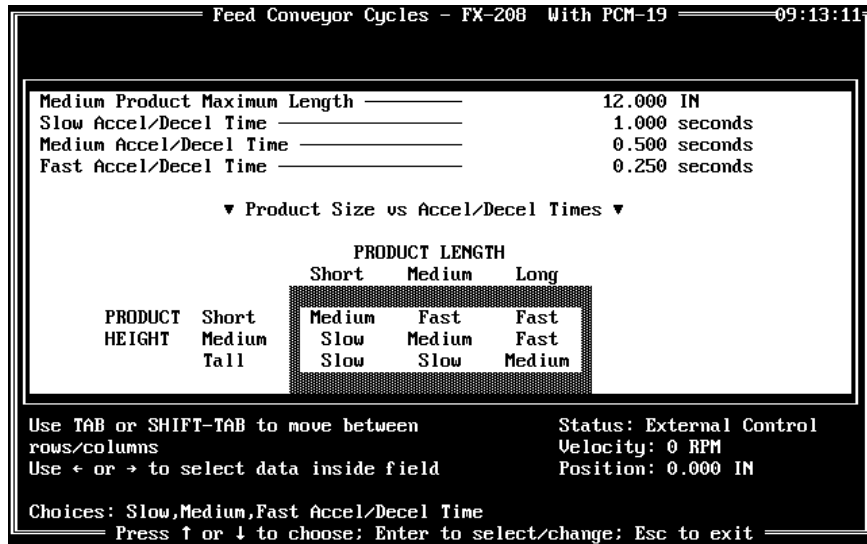


Figure 8 Feed Conveyor Cycles Screen When Using Measuring Conveyor Option

2.3.1 FEED CONVEYOR CYCLES SCREEN DEFINITIONS

Feed Conveyor Cycle Number

Specifies the cycle number (0-15) to display/edit.

Single Feed Conveyor

YES indicates a single feed conveyor which can run stand-alone without the need for a merge controller.

Purge Conveyor At Start-up

When first invoked, the conveyor cycle will accel using the slow ramp speed velocity for the distance required to release any products currently past the feed sensor onto the merge conveyor. Once purged, the conveyor will set product released output and position the next product ready for release.

Loading Method

Specifies either tail to head or head to head product spacing (see Figure 9).

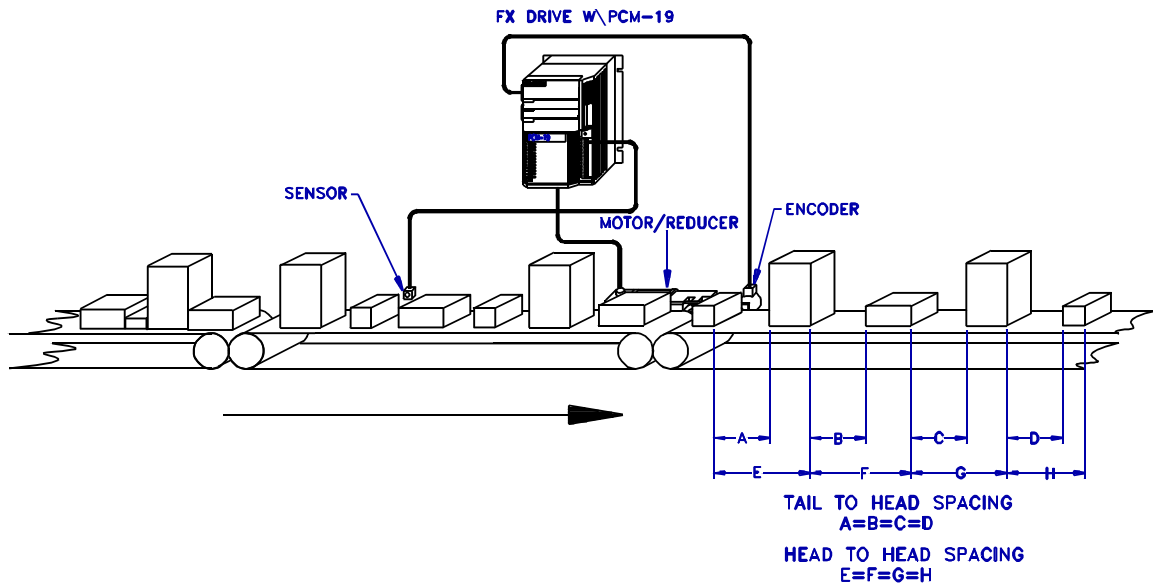


Figure 9 Product Loading Example

Product Spacing

Specifies the product spacing distance in user units.

Product Release Offset

During normal operation the placement of a product is based upon the receipt of the **global released output** (40) from the preceding product. The product offset will bias the setting of the Product Released output (#38), thus adjusting the spacing of the next product to be released by another conveyor. For example; Because of the angle of the merge rail in Figure 10, the products on feed conveyor #1 must travel 12 inches further on the merge conveyor than products on feed conveyor #4. Therefore, the offset value would be set at 12 for conveyor number 1.

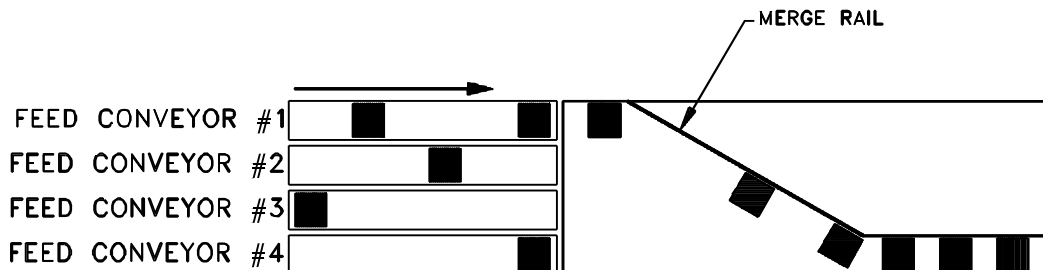


Figure 10 Product Release Offset Example

Product Release Offset (continued)

To avoid jam-ups and to insure proper spacing each feed conveyor would need to release a product at different offset intervals (see Table I).

Table I Product Release Offset Intervals

Conveyor Number	Delay Caused By Merge Rail	Product release offset
#1	12 inches	12 inches
#2	8 inches	8 inches
#3	4 inches	4 inches

Product Filter Length

Sets the minimum length for a product to be considered valid. Products measuring less than this length are ignored. This feature is useful to filter out unwanted spikes from the sensors that may occur at the leading or trailing edges of a product.

Short Product Maximum Length

Specifies the upper limit for a product to be measured as SHORT length.

Medium Product Maximum Length

Specifies the upper limit for a product to be measured as MEDIUM length.

Slow Accel/Decel Time

Specifies the slow accel/decel time. This parameter is entered as the time in seconds that it will take the motor to go from 0 to max velocity.

Medium Accel/Decel Time

Specifies the medium accel/decel time. This parameter is entered as the time in seconds that it will take the motor to go from 0 to max velocity.

Fast Accel/Decel Time

Specifies the fast accel/decel time. This parameter is entered as the time in seconds that it will take the motor to go from 0 to max velocity.

Product Size vs Accel/Decel Times

This table relates product size to the associated accel/decel rate to be used.

In typical conveyor applications, it is quite common to have a wide variety of product types on a single conveyor. Some of these products may be able to handle abrupt motion while others, tall top heavy products for instance, may require more subtle changes in motion to avoid damage. These parameters allow you to program the acceleration and deceleration of the feed conveyor based on the category that the products fall into.

Note: The feed conveyor will always use the slowest required accel/decel ramp on any product that is on, or immediately within range of the feed conveyor (which is the fastest moving conveyor).

EXAMPLE: Product type X is of long length, short height and is programmed to use a FAST accel/decel rate. Product type Y is of short length, medium height and is programmed to use a SLOW accel/decel ramp. At a particular time in conveyor operation 3 products of type Y are on the conveyor followed by 5 products of type X. The PCM-19 would use the SLOW accel/decel until all three type Y products are released, and then use the FAST accel/decel ramp for the 5 remaining products (provided that no other products requiring a SLOW or MEDIUM ramp come on to the feed conveyor).

2.4 PROGRAMS USING CONVEYOR CYCLES

The last step is to load the Conveyor Cycle information into a program (see Program screen in Figure 11). The amplifier can retain up to 16 (0-15) cycles. A Conveyor Cycle can only be initiated when it is a step in the program.

When the program reaches the Initiate Feed Conveyor "Y" step, the designated cycle will begin. Cycles do not have counts and run until stopped. Program count has no effect except that the count must be 1 or greater to enable the program to execute. No steps after the Cycle step will be executed.

```
Programs - File: - FX-316 With PCM-19
Program Number: 0 Program Count: 1
Step Code Function Description Data
1 Y Initiate Feed Conveyor 0
2 E End Program
3
4
5
6
7
8
9
10
11
12
13
14
C-Compound D-Dwell E-End F-Fol Err H-Home
I-Index J-Jump O-Outputs P-Program Q-Torque
R-Wait Cnt S-Start T-Time U-Wait Inp Y-Convyr
Ins-Insert Del-Delete
Press ↑ or ↓ to choose: Enter to select/change: Esc to exit
```

Figure 11 Sample Program Screen

2.5 INPUTS/OUTPUTS

The following Input and Output functions are added to PCX's Input and Output screens any time a PCM-19 application module is employed with an FX Drive. For a complete list of I/O functions refer to manual P/N 400240-01.

***Note:** I/O functions designated with an asterisk (*) are used only in multiple feed systems using an MC-1 merge controller.

2.5.1 INPUT FUNCTIONS

<u>Function #</u>	<u>Description</u>
56	*Initiate Release This input comes from the merge controller to command the feed drive to start the release of a ready product.
57	Conveyor Dropout This input causes the feed drive to go off-line (remove the ON-LINE output). The feed drive will complete any current release and continue until a product is positioned ready for release. When the dropout input is removed, the feed drive will come back ON-LINE and into normal operation.
58	Clear Conveyor Error Clears the FEED CONVEYOR ERROR output #39.
59	Product Measuring #1 To be used for the product measuring sensor #1 which is the lower of the three measuring sensors and is used for product length measuring (see Figure 12).
60	Product Measuring #2 To be used for the product measuring #2 sensor which is the middle of the three measuring sensors and is used for product height measuring (see Figure 12).
61	Product Measuring #3

To be used for the product measuring sensor #3 which is the upper of the three measuring sensors and is used for product height measuring (see Figure 12).

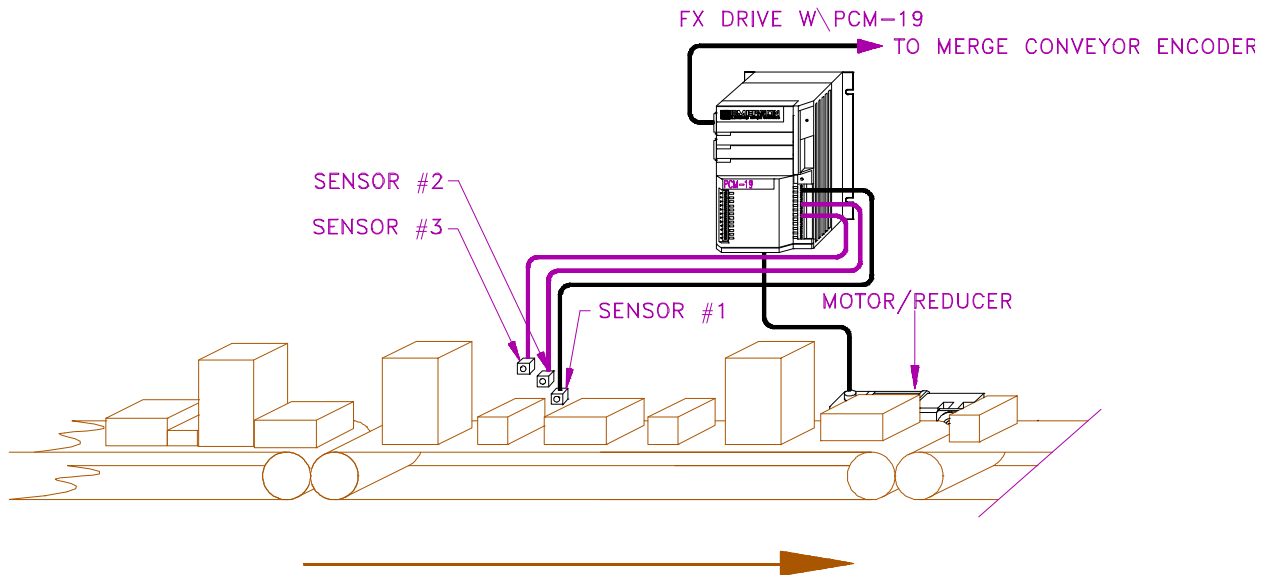


Figure 12 Product Measuring Sensors

62 Feed Control

This input function monitors the presence or absence of products on the feed conveyor. Input ON indicates the presences of a product and input OFF indicates the absences of the product.

63 *Global Release

The **global release input** receives signals from all the associated feed drives **global release outputs** which enables all feed drives to record the time of all releases. This input is critical to product spacing.

2.5.2 OUTPUT FUNCTIONS

Function # Description

36 *Feed Conveyor On-Line

This output indicates whether or not a feed drive is ON-LINE with the system. This output will not be on unless the feed conveyor program is running and is cleared when a CONVEYOR DROPOUT input is active.

37

***Product Ready**

Indicates that the feed drive has a product ready for release.

38

***Product Released**

Indicates that the feed drive has just released a product.

39

Feed Conveyor Error

Indicates that the feed drive has encountered an error. This usually means that during the process of releasing a product, another product came up too quickly to be properly placed in the ready position thus most likely missing the specified spacing requirement. This error does not affect operation other than to inform the operator that an error was encountered.

40

***Global Released Out**

This output, which follows output #38, is to be connected to all other feed drives GLOBAL RELEASE IN input so that all feed drives are informed of all releases.