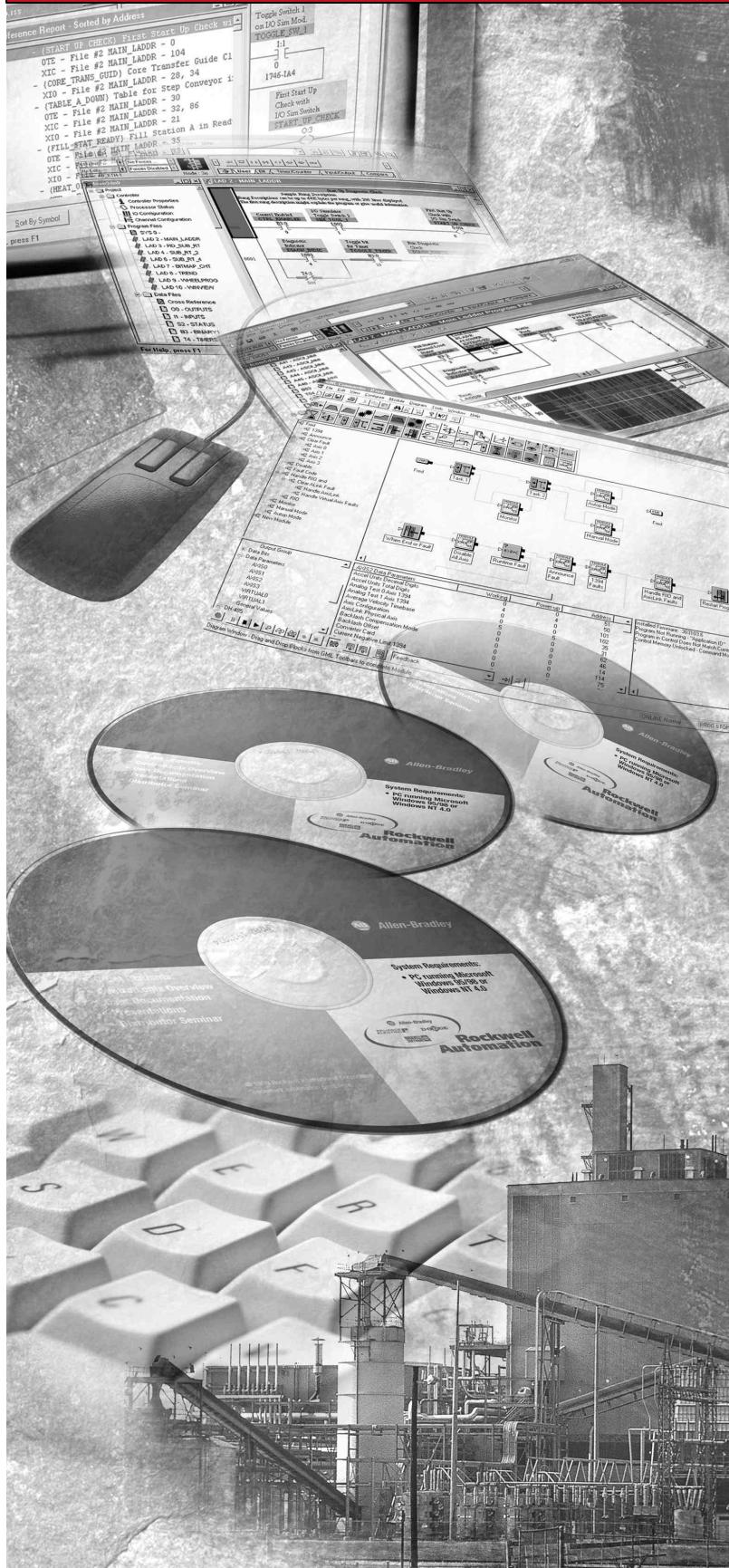


Drive Application Software

Function Module

Diameter Calculation Imperial Units

Reference Manual





Important User Information

Users of this Reference Manual must be familiar with the application this Function Module is intended to support and its usage. Function Modules intended usage are as a building blocks for a created application. The user must be familiar with the programming tools used to implement this module, the program platform to be used in the application, and the Rockwell Automation drive products to be controlled in the application.

Because of the variety of uses for the products described in this publication, those responsible for the application and use of this control equipment must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes and standards.

The illustrations, charts, sample programs and layout examples shown in this guide are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, Rockwell Automation does not assume responsibility or liability (to include intellectual property liability) for actual use based upon the examples shown in this publication.

Rockwell Automation publication SGI-1.1, *Safety Guidelines for the Application, Installation, and Maintenance of Solid-State Control* (available from your local Rockwell Automation office), describes some important differences between solid-state equipment and electromechanical devices that should be taken into consideration when applying products such as those described in this publication.

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1.0 Precautions

Class 1 LED Product



ATTENTION: Hazard of permanent eye damage exists when using optical transmission equipment. This product emits intense light and invisible radiation. Do not look into module ports or fiber optic cable connectors.

General Precautions



ATTENTION: This drive contains ESD (Electrostatic Discharge) sensitive parts and assemblies. Static control precautions are required when installing, testing, servicing or repairing this assembly. Component damage may result if ESD control procedures are not followed. If you are not familiar with static control procedures, reference Allen Bradley publication 8000-4.5.2, "Guarding Against Electrostatic Damage" or any other applicable ESD protection handbook.



ATTENTION: An incorrectly applied or installed drive can result in component damage or a reduction in product life. Wiring or application errors such as under sizing the motor, incorrect or inadequate AC supply, or excessive surrounding air temperatures may result in malfunction of the system.



ATTENTION: Only qualified personnel familiar with the PowerFlex 700S AC Drive and associated machinery the products control should plan, program, configure, or implement the installation, start-up and subsequent maintenance of the system / product. Failure to comply may result in personal injury and/or equipment damage.



ATTENTION: To avoid an electric shock hazard, verify that the voltage on the bus capacitors has discharged before performing any work on the drive. Measure the DC bus voltage at the +DC & -DC terminals of the Power Terminal Block (refer to Chapter 1 in the PowerFlex 700S User Manual for location). The voltage must be zero.



ATTENTION: Risk of injury or equipment damage exists. DPI or SCANport host products must not be directly connected together via 1202 cables. Unpredictable behavior can result if two or more devices are connected in this manner.



ATTENTION: Risk of injury or equipment damage exists. Parameters 365 [Encdr0 Loss Cnfg] - 394 [VoltFdbkLossCnfg] let you determine the action of the drive in response to operating anomalies. Precautions should be taken to ensure that the settings of these parameters do not create hazards of injury or equipment damage.



ATTENTION: Risk of injury or equipment damage exists. Parameters 383 [SL CommLoss Data] - 392 [NetLoss DPI Cnfg] let you determine the action of the drive if communications are disrupted. You can set these parameters so the drive continues to run. Precautions should be taken to ensure the settings of these parameters do not create hazards of injury or equipment damage.

2.0 Definitions

A Function Module [FM] is a base program designed to perform a specific function (operation) in an application. Function Modules are not complete applications and will require additional programming to control a machine section. The additional programming required for the application and configuration of the overall application is the responsibility of the user.

An Application Module [AM] is a complete program designed to perform a specific machine sections application (task). Application Modules are complete programs and only require configuration setup in order to perform the designated tasks.

2.1 Conventions

The conventions described below are used in programming and documentation of Function Modules and Application Modules.

1. All FM tags are program scoped.
2. All user connections to the FM are through the Jump to Sub-Routine (JSR) instruction input and return parameters.
3. Users cannot edit Function Modules.
4. Data format

<i>Data Type</i>	<i>RSLogix Type</i>	<i>Format</i>	<i>Range</i>	<i>Example</i>
B = Boolean	BOOL	x	0 to 1	0 or 1
I = Integer	INT	x	+/- 32767	8947
D = Double INT	DINT	x	+/- 2097151	74364
R = Real (Float)	REAL	x.x	+/-16777215*	3.4 / 13.0

* = Applies to single precision accuracy.

2.2 Normalized Quantities

Often a physical quantity is normalized by dividing the physical quantity by a base quantity with the same engineering units as the physical quantity. As a result, the normalized quantity does not have units, but is ‘expressed per-unit’. The normalized quantity has a value of 1.0 [per-unit] when the physical quantity has a value equal to the base quantity.

A good example of this is the physical quantity of motor current. The information that the motor is drawing 40 amps has little significance. The motor nameplate states that the rated motor current is 30 amps. The motor is drawing 133% current is significant information. In the previous illustration the quantity of motor amps was normalized to 133%. In per unit, the quantity is normalized to 1.33.

2.3 Terminology

2.3.1 Web

A web is defined as the material that is being transported through the machine. A web is sometimes referred to as “sheet” or “strip”.

2.3.2 Strip

The strip is defined as the material that is being transported through the machine. A web is sometimes referred to as “sheet” or “web”. The term “strip tension” is referencing the tension of the material in the machine.

2.3.3 Drive

The drive is the power device that is transmitting power to the motor. The motor is connected to a mechanical device that is propelling the material. This manual is specific to the PowerFlex 700S drive.

2.3.4 Motor Torque

A D.C. Motor has two currents flowing through it. The first current is the flux, also known as the field current. This is the magnetizing current that allows the motor to produce torque. The second current is the armature current. This is the actual torque producing current of the motor.

An A.C. motor has only one current physically flowing through the machine. However, this current is a combination of both magnetizing and torque producing current. Motor Torque on an AC motor is the torque producing portion of the total current flowing through the motor.

2.3.5 Section

A Web Handling Machine is broken up into sections. A section consists of one or more drives used to propel the material through the line.

An Unwind Section could consist of one drive, one motor, and one spindle

A lead Section could consist of more than one drive and one motor combination. This could consist of line pacer and then several helper drives. The helper drives “help” in transporting the strip through the machine.

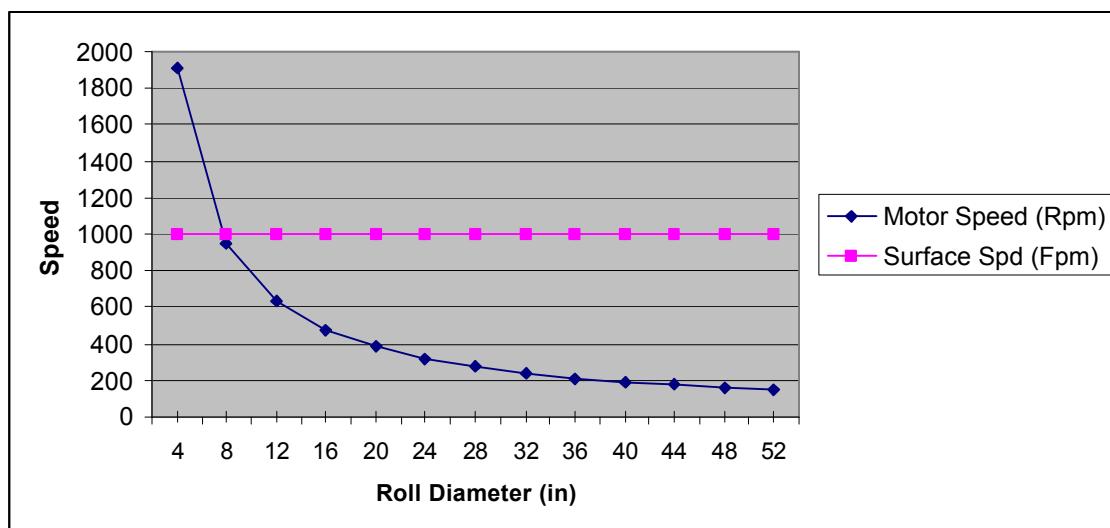
Typically when more than one drive is in a section, one drive is the leader and the other drive is the follower. The follower typically follows the leader’s torque reference.

3.0 Overview

Diameter calculation is the process by which a dynamically changing roll diameter is mathematically calculated during machine operation. In center driven winding and unwinding applications, the actual diameter of the driven section changes as product is wound about the axis or unwound from the axis. As the diameter of the driven section changes it is necessary to change the axial speed and torque in order to maintain constant surface speed and tension on the product. Diameter calculation can also be used to calculate the change in total reflected inertia. This is typically used to profile the speed loop gain and in inertia compensation.

3.1 Diameter effects on surface speed

If the rotational speed of the driven section is kept constant, the surface speed will increase as the diameter of the section increases. To maintain constant surface speed, the rotational speed must decrease proportional to the increase in roll diameter. If the roll diameter doubles, the rotational speed must be reduced by half to maintain constant surface speed.

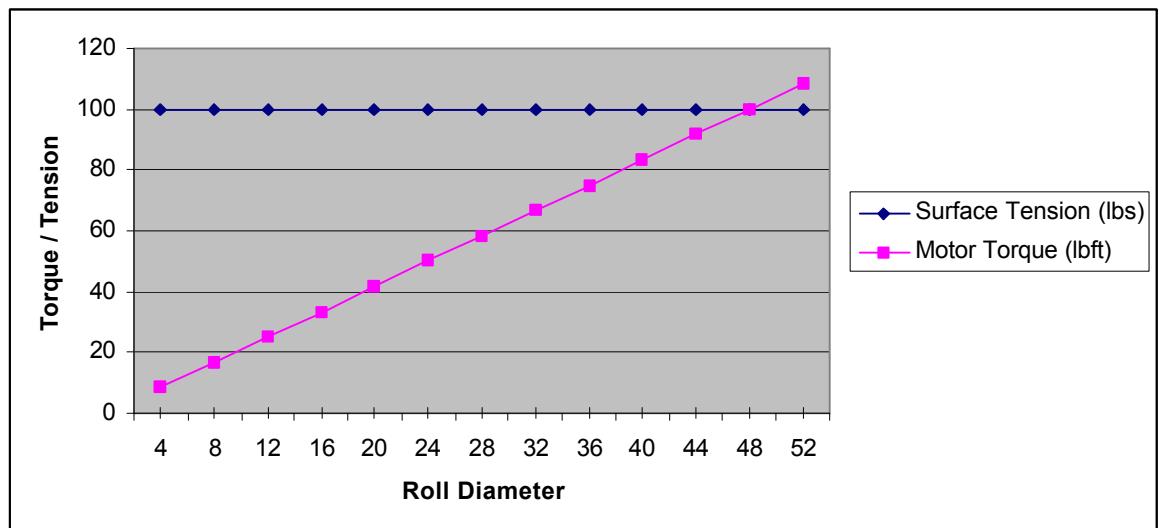


$$RollDiameter(ft) = \frac{RollDiameter(in)}{12}$$

$$MotorSpeed(Rpm) = \frac{LineSpeed(Fpm)}{RollDiameter(ft)*p} * GearRatio$$

3.2 Diameter effects on surface tension

If the torque applied to a driven section is kept constant, the tension applied to the product at the surface of the roll will decrease as the diameter of the driven section increases. To maintain constant tension on the product, the torque must be increased proportional to the change in diameter. If the roll diameter doubles the torque applied must double to maintain constant product tension at the surface of the roll.



$$RollDiameter(ft) = \frac{RollDiameter(in)}{12}$$

$$RollRadius(ft) = \frac{RollDiameter(ft)}{2}$$

$$MotorTorque(lbft) = \frac{RollRadius(ft) * Tension(lbs)}{GearRatio}$$

4.0 Functional Description

4.1 Overview

The Diameter Calculation Function Module consists of a program with three routines in RSLogix 5000™. The three routines are the Main, DiamPreset, & DiamCalc. These routines are dependent on one another and may not be separated. The user may edit the Main routine to connect signals (tags) and configure the FM. The user cannot edit the DiamPreset or DiamCalc routines.

4.1.1 Main routine

The Main routine is where the user connects user created controller tags to the input and output program tags of the FM. These links are created in the Jump to Sub-Routine (JSR) instructions. One JSR is used to call the DiamPreset routine and another JSR is used to call the DiamCalc routine.

4.1.2 DiamPreset routine

The DiamPreset routine is used to select and command a preset value to the diameter calculator. Diameter preset is used to “reset” the roll diameter to a preset value such as core diameter as used in winder applications or to the starting roll diameter as used in unwind applications. If the diameter calculator is not preset to the correct starting roll diameter, the machine control may not function correctly.

4.1.3 DiamCalc routine

The DiamCalc routine is where the diameter is actually calculated. The diameter is calculated by measuring the distance of web wound onto the roll for a given number of roll revolutions. Setting the number of roll revolutions to a whole number, helps avoid variations in diameter calculation with eccentric rolls.

4.2 Main routine

The Main routine consists of two rungs of ladder logic programming. A rung description briefly describes the Input and Return (output) parameters of the JSR instructions for each routine called. Temporary tags have been entered for each input parameter and each return parameter. The tag names entered in the JSR's are not declared. The user must replace these tag names with existing project tags or create new tags. The routine will show an error until all input and return parameters are satisfied. The input parameters may also be entered as actual values. If an input parameter is set to a value and not a tag, the value cannot be edited in run mode. Values entered directly in the JSR should be constants that do not change during machine operation. Specific formatting is required for values entered directly in the JSR.

NOTE: For Application Module users, the tags in the JSR's are predefined and configured for operation. No additional integration is necessary.

Data Type	Format	Example
B = Boolean	x	0 or 1
I = Integer	x	123
R = Real (Float)	x.x	3.4 / 13.0

If any signal scaling is required to interface the FM into the user application, the user may use the main routine for this programming. Note; any scaling for inputs to the routines should be done before the JSR and any scaling applied to the return values from the routines should be done after the JSR.

Below are descriptions of each parameter required for use of the Diameter Calculation FM.

4.3 DiamPreset routine

The diameter preset routine is designed for applications where the diameter calculator will be preset to one of several preset diameters or where a preset increase/decrease function is required. If only a single diameter preset is required, this routine and the JSR instruction can be deleted. If the DiamPreset routine is deleted, the (DiamCalc – In15 & In16) inputs [yDiamPresetCmmd] & [yDiamPresetVal_in] must be controlled by the user's custom programming. If the diameter is not properly preset, the machine section may not be able to regulate product tension in the process.

Input Parameters

	Name	Type	Range	Description
1	Preset1Cmmd	BOOL	0 to 1	Preset diameter to Preset1Val_in
2	Preset2Cmmd	BOOL	0 to 1	Preset diameter to Preset2Val_in
3	Preset3Cmmd	BOOL	0 to 1	Preset diameter to Preset3Val_in
4	Preset1Val_in	REAL	0 to 500	Value of Preset 1
5	Preset2Val_in	REAL	0 to 500	Value of Preset 2
6	Preset3Val_in	REAL	0 to 500	Value of Preset 3
7	PresetIncCmmd	BOOL	0 to 1	Manual Diameter Increase
8	PresetDecCmmd	BOOL	0 to 1	Manual Diameter Decrease
9	PresetIncDecRate_inSec	REAL	0 to 10	Manual Diameter Increase/Decrease Rate adjustment

Return Parameters

	Name	Type	Range	Description
1	DiamPresetCmmd	BOOL	0 to 1	Diameter Preset Command to DiamCalc routine
2	DiamPresetVal_in	REAL	0 to 500	Diameter Preset Value to DiamCalc routine

4.3.1 Preset1Cmmd

This input is the command to the routine to select the Preset1Val_in as the output DiamPresetVal_in. When this input is high and EnablePresets is high the DiamPresetCmmd will be set high and the DiamPresetVal_in will be set equal to Preset1Val_in.

Usage – Use this input to activate the value of Preset1Val_in as the preset input to the DiamCalc routine.

4.3.2 Preset2Cmmd

This input is the command to the routine to select the Preset2Val_in as the output DiamPresetVal_in. When this input is high and EnablePresets is high the DiamPresetCmmd will be set high and the DiamPresetVal_in will be set equal to Preset2Val_in.

Usage – Use this input to activate the Preset2Val_in as the preset value of the DiamCalc routine.

4.3.3 Preset3Cmmd

This input is the command to the routine to select the Preset3Val_in as the output DiamPresetVal_in. When this input is high and EnablePresets is high the DiamPresetCmmd will be set high and the DiamPresetVal_in will be set equal to Preset3Val_in.

Usage – Use this input to activate the Preset3Val_in as the preset value of the DiamCalc routine.

4.3.4 Preset1Val_in

The value of Preset1 entered in inches of roll diameter. This value will be sent to the diameter calculator when Preset1Cmmd is set high.

Usage – Set this vale for the smallest roll diameter used when presetting the diameter calculator in Winder applications. For Unwind applications, set to the largest diameter used when presetting the diameter calculator.

4.3.5 Preset2Val_in

The value of Preset2 entered in inches of roll diameter. This value will be sent to the diameter calculator when Preset2Cmmd is set high.

Usage – Set this value to the diameter in inches to be used for Preset2Cmmd.

4.3.6 Preset3Val_in

The value of Preset3 entered in inches of roll diameter. This value will be sent to the diameter calculator when Preset3Cmmd is set high.

Usage – Set this value to the diameter in inches to be used for Preset3Cmmd.

4.3.7 PresetIncCmmd

The diameter preset increase input is used to increase the calculated diameter. The function of this input is inhibited when the EnablePresets input is low. The rate of change for this increase in diameter is set by the DiamIncDecRate_inSec input.

Usage – This input should be connected to a dynamic command that can be set high when the operator wishes to increase the diameter calculator, using an increase pushbutton.

4.3.8 PresetDecCmmd

The diameter preset decrease input is used to decrease the calculated diameter.

The function of this input is inhibited when the EnablePresets input is low. The rate of change for this decrease in diameter is set by the DiamIncDecRate_inSec input.

Usage – This input should be connected to a dynamic command that can be set high when the operator wishes to decrease the diameter calculator, using a decrease pushbutton.

4.3.9 PresetIncDecRate_inSec

The diameter increase/decrease rate input is set in inches of diameter change per second. This parameter sets the rate of change for the DiamInc and DiamDec inputs. To aid in manual adjustment of the calculated diameter, the rate of change will be increased by 3x when the DiamInc or DiamDec inputs are high for more than 3 seconds. If the inputs are set low and then high again, the 3 second delay will repeat. This configuration allows for precise adjustment of the diameter preset value and quick changes if the amount of change to be made is significant.

Usage – Adjust this input for a value that allows the operator to accurately adjust the diameter preset as desired. Recommend initial setting of 0.5 to 1 in/Sec.

4.3.10 DiamPresetCmmd

This return parameter is used to activate the preset function of the DiamCalc routine. This output will be set high when the EnablePresets is high and one of the preset inputs are high. This output will command the DiamCalc routine to read the value in DiamPresetVal_in as the actual diameter.

Usage – The tag entered in the DiamPreset JSR instruction for this return parameter should be entered as an input parameter to the DiamCalc JSR instruction.

4.3.11 DiamPresetVal_in

This return parameter is used as the value to preset the diameter calculation when the DiamPresetCmmd is high.

Usage - The tag entered in the DiamPreset JSR instruction for this return parameter should be entered as an input parameter to the DiamCalc JSR instruction.

4.4 DiamCalc routine

The diameter calculation routine is the heart of this function module. The routine includes programming for the diameter calculator, programming to scale an external measurement of diameter, and scaled outputs for referencing to the drive and to other function modules. The module has been configured for operation in Imperial units. All data must be entered in the units specified by the tags. If the line speed is not directly available in FPM, the user must scale the line speed reference to FPM. The programming for this may be entered in the main routine and should be executed before the JSR instruction for the DiamCalc routine. Example equations for converting the line speed reference to FPM are below.

Note: The change in diameter or actual roll diameter should not be used in the calculation of Line Speed. The Line Speed input parameter (DiamCalc routine – In4) must be an independent source of line speed, not the spindle rotational speed converted to line speed (using the calculated diameter).

$$\text{LineSpeed(Fpm)} = \frac{\text{LineSpeedMtr(Rpm)} * \text{MinCoreDiam(in)} * p}{\text{GearRatio}} / 12$$

$$\text{LineSpeed(Fpm)} = 0.083333 * \text{LineSpeed(in/min)}$$

$$\text{LineSpeed(Fpm)} = 3 * \text{LineSpeed(Ypm)}$$

$$\text{LineSpeed(Fpm)} = 0.05 * \text{LineSpeed(Yph)}$$

$$\text{LineSpeed(Fpm)} = 3.2804 * \text{LineSpeed(Mpm)}$$

Typically, line speed reference is used for the diameter calculator line speed input. If the line speed reference is not available, a line speed feedback signal from an adjacent fixed diameter drive or a surface tachometer can also be used.

The externally measured diameter may be used for the calculated diameter output. It is recommended to utilize the Diameter Calculation FM when measuring the actual diameter with an external device. Using the FM will provide rate of change limits to prevent step changes in the diameter or errors in the external measurement device from instantaneously changing the output diameter value used in the speed reference to the machine section. If the measured diameter output, scaled in inches, is programmed as one of the three preset inputs, the measured diameter can be used as a preset.

Input Parameters

	Name	Type	Range	Description
1	CalcEnbl	BOOL	0 to 1	Enable the Diameter Calculation
2	CalcEnblThresh_FPM	REAL	0 to 50	Diameter Calc low speed thresh hold
3	CalcUpdate_Rev	REAL	1 to 200	Number of revolutions per length count
4	SpeedLine_FPM	REAL	+/- 5000	Line Speed
5	SpeedMotor_RPM	REAL	+/- 7200	Actual motor speed
6	GearRatio	REAL	1 to 100	Motor RPM / Roll RPM
7	DiamMinEC_in	REAL	0 to FR	Minimum diameter Empty Core
8	DiamFR_in	REAL	MinEC to 500	Full Roll diameter
9	DiamMeasEnbl	BOOL	0 to 1	Use DiamMeas value for actual Diam
10	DiamMeasInput	REAL	NA	Measured diameter input (Raw data)
11	DiamMeasMin_DC	REAL	NA	Raw data minimum
12	DiamMeasMax_DC	REAL	NA	Raw data maximum
13	DiamMeasMin_in	REAL	0 to 500	Actual diameter at DiamMeasMin_DC
14	DiamMeasMax_in	REAL	0 to 500	Actual diameter at DiamMeasMax_DC
15	yDiamPresetCmmnd	BOOL	0 to 1	Preset command from DiamPreset
16	yDiamPresetVal_in	REAL	0 to 500	Preset value form DiamPreset
17	DiamRate_inRev	REAL	0.00 to 1	Max allowed diameter rate of change
18	DiamIncEnbl	BOOL	0 to 1	Allow diameter calc to increment
19	DiamDecEnbl	BOOL	0 to 1	Allow diameter calc to decrement

Return Parameters

	Name	Type	Range	Description
1	DiamCalc_in	REAL	0 to 500	Actual calculated diameter
2	RadiusCalc_ft	REAL	0 to 21	Actual calculated radius
3	BuildUpRatio	REAL	1 to 20	Ratio of actual diameter to min core
4	BuildUpRatioRec	REAL	0.05 to 1	(1 / BuildUpRatio)
5	DiamMeas_in	REAL	0 to 500	Scaled value of measured diameter
6	Constant_RPMperFPM	REAL	NA	Scaling constant FPM to minimum empty core RPM

4.4.1 CalcEnbl

The CalcEnbl input enables the diameter calculator. When the input is low, the DiamCalc_in output will maintain its last value, unless the Measured Diameter Enable input parameter (DiamCalc – In9) is true. If a preset is commanded, the DiamCalc_in output will be updated to the preset value. When the input is high, the DiamCalc_in output will be calculated based on line speed and the number of roll rotations. If the line speed input is below CalcEnblThresh_FPM, the DiamCalc_in output will be held at last value, regardless of the CalcEnbl state.

Usage – This input should be set high when the section is in run and the line speed input represents roll surface speed (e.g. web tension control is on (Dancer / Tension / Torque). The diameter calculator is typically disabled if some form of tension control is not active.

4.4.2 CalcEnblThresh_FPM

This input adjusts the minimum line speed in FPM that the diameter calculation will be active. The diameter calculation will be disabled if the line speed is below the CalcEnblThresh_FPM. The diameter calculation should be disabled at low line speed to prevent errors in the calculation.

Usage – Typically a setting of 1% to 5% of line speed will work well.

4.4.3 CalcUpdate_Rev

This input adjusts the number of roll revolutions per diameter calculation. The calculator will measure the length of web accumulated at the set number of revolutions. A greater number of revolutions will naturally average the roll diameter. A lower number of revolutions will generate faster updates to the diameter calculator.
Usage – Typically set for 1 to 8 revolutions of the roll. Thicker webs (> 62mils) should be set lower, and thinner webs (< 62mils) should be set higher. Using a whole number of revolutions will help reduce diameter calculation variations due to roll eccentricity.

4.4.4 SpeedLine_FPM

This is the line speed, translation speed, or surface speed of the roll in FPM.

Usage – Connect to the tag that represents line speed scaled in FPM. If the signal is not available in FPM, see section 4.4 for calculating FPM.

4.4.5 SpeedMotor_Rpm

Actual speed of the driven sections motor (RPM).

Usage – Connect to the tag that is the actual motor speed (RPM) of the drive section.

4.4.6 GearRatio

The gear ratio of the machine section.

$$GearRatio = \frac{MotorRevolutions}{RollRevolutions}$$

Usage – Connect to the gear ratio tag or set the value of gear ratio in the JSR instruction.

4.4.7 DiamMinEC_in

The minimum Empty Core diameter in inches. This value is used to limit the calculated diameter and calculate BuildUpRatio and the FPM to RPM conversion constant. Enter the smallest diameter of roll cores to be used in the machine. If this is a coreless machine, enter the starting diameter for the Winder.

Usage – Set for the minimum core value.

4.4.8 DiamFR_in

The Full Roll diameter in inches. This value is used to limit the calculated diameter. If the FR diameter is a changing value and can be set, connect the tag for the value to this input. If the FR diameter is constant or can not predicted, set the input for the maximum used in the machine.

Usage - Connect to the Full Roll tag or set the constant value in the JSR.

4.4.9 DiamMeasEnbl

This input activates the measured diameter as the actual diameter output DiamCalc_in. This is set high when the actual diameter is to be measured and the controller should not calculate the diameter based on roll revolutions and length wound. Setting this input low does not inhibit usage of measured diameter for a preset. When set high, the measured diameter rate of change will be limited by DiamRate_inRev input, the measured diameter will be limited by DiamMinEC_in/DiamFR_in and the DiamCalc_in output will be held at last state when the diameter calculator is disabled.

Usage – Set high when using measured diameter for actual diameter. Set low when using measured diameter only for preset and calculated diameter for actual (running) diameter.

4.4.10 DiamMeasInput

This is the input from the external diameter measurement device.

Usage – Connect to the tag for the external measurement device. This should be the “raw” data from the device.

4.4.11 DiamMeasMin_DC

This is the minimum value of the measurement device raw data.

Usage – Set for the minimum value the measurement device will output.

4.4.12 DiamMeasMax_DC

This is the maximum value of the measurement device raw data.

Usage – Set for the maximum value the measurement device will output.

4.4.13 DiamMeasMin_in

This input scales the measured diameter (DiamMeasMin_DC) to inches.

Usage – Enter the actual diameter of the measured roll for the DiamMeasMin_DC value.

4.4.14 DiamMeasMax_in

This input scales the measured diameter (DiamMeasMax_DC) to inches.

Usage – Enter the actual diameter of the measured roll for the DiamMeasMax_DC value.

4.4.15 DiamPresetCmmd

This is the command bit from the DiamPreset routine. When the input is high, the diameter calculator will be set to the DiamPresetVal_in. Do not set this bit when the machine section is running.

Usage – Connect the yDiamPresetCmmd tag (default) to this input.

4.4.16 DiamPresetVal_in

This is the preset value from the DiamPreset routine. When the DiamPresetCmmd is high, the DiamPresetVal_in is loaded into the diameter calculator.

Usage – Connect the yDiamPresetVal_in tag (default) to this input.

4.4.17 DiamRate_inRev

This input controls the max rate of change for the diameter calculator. The value is entered in inches per revolution of the spindle (roll). The maximum rate of change required for the process should be entered in the tag. The change in diameter per revolution is the product thickness * 2. This input is used only for limitation of the diameter calculator. The formula below calculates the minimum value that should be used for DiamRate_inRev. Actual values should be at least increased by 5% to avoid unwanted limitation of the diameter calculator.

Usage – Set the input for the maximum rate of change for the application.

$$DiamRate_inRev = \frac{MaxWebThickness_mils^2}{1000}$$

4.4.18 DiamIncEnbl

This input sets the function of the diameter calculator. If the input is low, the diameter calculator cannot increase. If the input is set high, the diameter calculator can increase. The setting of this input has no effect on the diameter preset functions.

Usage – Set this bit high for winder applications. This bit is typically set low for unwind applications.

4.4.19 DiamDecEnbl

This input sets the function of the diameter calculator. If the input is low, the diameter calculator cannot decrease. If the input is set high, the diameter calculator can decrease. The setting of this input has no effect on the diameter preset functions.

Usage – Set this bit high for unwind applications. This bit is typically set low for Winder applications.

4.4.20 DiamCalc_in

This output is the actual calculated diameter in inches. If DiamMeasEnbl is high, this is the limited measured diameter value.

Usage – This output is typically used for scaling and calculation in the winder application and for display of the running diameter.

4.4.21 RadiusCalc_ft

This output is the calculated roll radius in feet.

$$RadiusCalc_ft = \frac{DiamCalc_in}{24} = \frac{DiamCalc_in / 12in}{2}$$

Usage – Typically used for calculating required motor torque or converting from FPM to RPM

$$Torque_lbft = Tension_lb * Radius_ft$$

4.4.22 BuildUpRatio

This output is a ratio of the actual diameter to the minimum empty core diameter.

$$\text{BuildUpRatio} = \frac{\text{DiamCalc_in}}{\text{DiamMinEC_in}}$$

Usage – Typically used to scale the spindle rotational speed reference.

$$\text{SpindleSpeed_RPM} = \frac{\text{CoreLineSpeedRef_RPM}}{\text{BuildUpRatio}}$$

4.4.23 BuildUpRatioRec

This output is the reciprocal ratio of the actual diameter to the minimum empty core diameter.

$$\text{BuildUpRatioRec} = \frac{1}{\frac{\text{DiamCalc_in}}{\text{DiamMinEC_in}}} = \frac{\text{DiamMinEC_in}}{\text{DiamCalc_in}}$$

Usage – Typically used to scale the spindle rotational speed reference.

$$\text{SpindleSpeed_RPM} = \text{CoreLineSpeedRef_RPM} * \text{BuildUpRatioRec}$$

4.4.24 DiamMeas_in

This output is the scaled measured diameter from an external source.

Usage – (default) This output is connected to the DiamPreset routine, for use as a preset to the diameter calculator.

4.4.25 Constant_RPMperFPM

This output is created for use as a pre-calculated scaling constant. The constant is used in conversions from FPM linear speed ref to RPM motor speed. The change in roll diameter is not included in the constant and must be applied separately.

$$\text{MotorSpeed_RPM} = \frac{\text{LineSpeed_FPM} * \text{Constant_RPMperFPM}}{\text{BuildUpRatio}}$$

$$\text{Constant_RPMperFPM} = \frac{\text{GearRatio}}{\text{DiamMinEC_in} * \frac{\text{p}}{12}}$$

Usage – Use to convert speed in FPM to motor speed in RPM.

4.4.26 Constant_RPMperFPM

This output is created to convert line speed values in FPM to the corresponding motor speed at minimum empty core diameter in RPM.

5.0 Setup / Configuration

5.1 Overview

All setup and configuration is done in the Main routine. The Diameter Calculation Function Module is connected to the balance of the application software by placing application tag names in the Jump to Sub-Routine (JSR) instructions. One JSR is used to call the DiamPreset routine and a second JSR is used to call the DiamCalc routine.

When JSR instruction input parameters are configured with tags, which are intended to be tuned by the user at commissioning, it is recommended that the (z prefix) naming convention be used for tags of this type.

5.2 DiamPreset JSR Instruction

Note: If only a single diameter preset is required, the DiamPreset routine and JSR instruction can be deleted. If the DiamPreset routine is deleted, the (DiamCalc – In15 & In16) inputs [yDiamPresetCmmd] & [yDiamPresetVal_in] must be controlled by the user's custom programming. If the diameter is not properly preset, the machine section may not be able to regulate product tension in the process.

5.2.1 Input Parameters

5.2.1.1 Preset1Cmmd – In 1, Preset2Cmmd – In 2, Preset3Cmmd – In 3
Enter application tags for the Preset Command input parameters (DiamPreset - In1, In2, and In3). Enter '0' for unused Preset Command input parameters.

5.2.1.2 DiamPreset1Val_in – In 4, DiamPreset2Val_in – In 5,
DiamPreset3Val_in – In 6

Enter application tags for the Preset Value input parameters (DiamPreset - In4, In5, and In6). If the application tag values are not in units of inches, add a rung to the Main routine that will scale the tag values to inches. Enter '0.0' for unused Preset Value input parameters.

Measured diameter can be used as a preset by configuring the tag used for the DiamCalc JSR instruction Measured Diameter return parameter (DiamCalc – Ret5) for one of the preset values.

5.2.1.3 PresetIncCmmd – In 7, PresetDecCmmd – In 8

Enter application tags for the Preset Increase/Decrease input parameters (DiamPreset - In7, In8). Enter '0' if Diameter Increase/Decrease function is not used.

5.2.1.4 PresetIncDecRate_inSec – In 9

Enter an application tag for the Preset Increase/Decrease Rate input parameter (DiamPreset - In9). If the application tag value is not in units of inches per second, add a rung to the Main routine that will scale the tag value to inches per second. If the preset increase/decrease function is not used, enter '0.0' for the Preset Increase/Decrease Rate input parameter.

5.2.2 Return Parameters

5.2.2.1 DiamPresetCmmd – Ret 1

Enter an application tag, for the Diameter Preset Command return parameter (DiamPreset - Ret1. This tag should be used in the DiamCalc JSR instruction input parameter (DiamCalc – In15).

5.2.2.2 DiamPresetVal_in – Ret 2

Enter an application tag, for Diameter Preset Value return parameter (DiamPreset – Ret2). This tag should be used in the DiamCalc JSR instruction input parameter (DiamCalc – In16).

5.2.3 Default Tags used in Drive Application Software

```

Subroutine Inputs
In1 -Bx =Preset1Cmmrd - Preset 1 Command
In2 -Bx =Preset1Cmmrd - Preset 2 Command
In3 -Bx =Preset1Cmmrd - Preset 3 Command
In4 -Rx.x =Preset1Val_in - Preset 1 Value [Inches]
In5 -Rx.x =Preset1Val_in - Preset 2 Value [Inches]
In6 -Rx.x =Preset1Val_in - Preset 3 Value [Inches]
In7 -Bx =PresetIncCmmrd - Preset Increase Command
In8 -Bx =PresetDecCmmrd - Preset Decrease Command.
In9 -Rx.x =PresetIncDecRate_inSec - Preset Increase/Decrease Rate [Inches/Second]
Subroutine Outputs
Ret1-Rx.x =DiamPresetCmmrd - Diameter Preset Command
Ret2-Rx.x =DiamPresetVal_in - Diameter Preset Value [Inches]

```

Diameter Preset	
JSR	
<i>Jump To Subroutine</i>	
Routine Name	DiamPreset
Input Par	wDLx_DrvCmmrdProcLn.16
Input Par	wDLx_DrvCmmrdProcLn.17
Input Par	wDLx_DrvCmmrdProcLn.18
Input Par	zDLx_DiamPreset1Val_in
Input Par	zDLx_DiamPreset2Val_in
Input Par	zDLx_DiamPreset3Val_in
Input Par	wDLx_DrvCmmrdProcLn.19
Input Par	wDLx_DrvCmmrdProcLn.20
Input Par	zDLx_DiamPresetIncDecRate_inSec
Return Par	DiamPresetCmmrd
Return Par	DiamPresetVal_in

5.3 DiamCalc JSR Instruction

5.3.1 Input Parameters

5.3.1.1 CalcEnbl – In 1

Enter an application tag for the Diameter Calculator Enable input parameter (DiamCalc – In1). (See section 4 for guidelines on programming this tag.) If the Measured Diameter Input is always used, enter '0' for the Diameter Calculator Enable input parameter.

5.3.1.2 CalcEnblThresh_FPM – In 2, CalcUpdate_Rev – In 3

Enter an application tag for the Diameter Calculator Enable Threshold and the Diameter Calculator Update Interval input parameters (DiamCalc – In2, In3). If the Measured Diameter Input is always used, enter '0.0' for both the Diameter Calculator Threshold and the Diameter Calculator Update Interval. The Diameter Calculator Threshold and the Diameter Calculator Update Interval are typically configured with tags that can be tuned on-line.

5.3.1.3 LineSpeed_FPM – In 4

Enter an application tag for the Line Speed input parameter (DiamCalc – In4). If the application tag values are not in units of FPM and RPM, add a rung to the Main routine that will scale the tag values to FPM and RPM. (See section 4 for guidelines on programming these tags.)

5.3.1.4 SpeedMotor_RPM – In 5, GearRatio – In 6

Enter application tags for the Motor Speed and Gear Ratio input parameters (DiamCalc – In5, In6). The Gear Ratio is typically configured with a tag that can be tuned on-line. Since diameter rate is a function of Motor Speed and Gear Ratio, Motor Speed and Gear Ratio should always be configured.

5.3.1.5 DiamMinEC_in – In 7, DiamFR_in – In 8

Enter application tags for the Minimum Empty Core Diameter and Full Roll Diameter input parameters (DiamCalc – In7, In8). The Minimum Empty Core Diameter and Full Roll Diameter are typically configured with tags that can be tuned on-line. The Minimum Empty Core Diameter and Full Roll Diameter limit the magnitude of the Diameter Calculator return parameters. Build-Up Ratio is a function of Minimum Empty Core Diameter.

5.3.1.6 DiamMeasEnbl – In 9, DiamMeasInput – In 10, DiamMeasMin_DC – In 11, DiamMeasMax_DC – In 12, DiamMeasMin_in – In 13, DiamMeasMax_in – In 14

Enter application tags for Measured Diameter Enable, Measured Diameter Input [Data Counts], Minimum Measured Diameter [Data Counts], Maximum Measured Diameter [Data Counts], Minimum Measured Diameter [Inches], Maximum Measured Diameter [Inches] input parameters (DiamCalc – In9, In10, In11, In12, In13, In14). If a Measured Diameter signal is not used, enter ‘0’ for Measured Diameter Enable, ‘0.0’ for Measured Diameter Input, ‘1.0’ for both Minimum Measured Diameters, and ‘2.0’ for both Maximum Measured Diameters. When a Measured Diameter signal is used, Minimum and Maximum Diameter tags are typically configured with tags that can be tuned on-line.

5.3.1.7 DiamPresetCmmrd In 15, DiamPreset Val_in – In 16

Enter application tags for Diameter Preset Command and Diameter Preset Value input parameters (DiamCalc – In15, In16). If the DiamPreset routine is used, enter the tags used as return parameters in the DiamPreset JSR instruction. If the DiamPreset routine is not used, enter the appropriate application tags. Measured diameter can be used as a preset by configuring the tag used for the Measured Diameter input parameter (DiamCalc – Ret5).

5.3.1.8 DiamRate_inRev – In 17, DiamIncEnbl – In 18, DiamDecEnbl – In 19

Enter application tags for Diameter Rate Limit, Diameter Calculator Increase Enable and Diameter Calculator Decrease Enable input parameters. These parameters are typically configured with tags that can be tuned on-line.

5.3.2 Return Parameters

5.3.2.1 DiamCalc_in – Ret 1, RadiusCalc_ft – Ret 2

Enter application tags, for the Calculated Diameter and Calculated Radius return parameters.

5.3.2.2 BuildUpRatio – Ret 3, BuildUpRatioRec – Ret 4

Enter application tags, for the Normalized Diameter and Reciprocal of Normalized Diameter return parameters (DiamCalc – Ret3, Ret4).

5.3.2.3 DiamMeas_in – Ret 5

Enter an application tag, for the Measured Diameter return parameter (DiamCalc – Ret5). If the Measured Diameter is used to preset the Diameter Calculator and the Diameter Preset routine is used, enter this tag name for the one of the Preset Value input parameters. If the Measured Diameter is used to preset the Diameter Calculator and the Diameter Preset routine is not used, enter this tag name for the Diameter Preset Value input parameter (DiamCalc – In16).

5.3.2.4 Constant_RPMperFPM – Ret 6

Enter an application tag, for the Calibration Constant return parameter.

5.3.3 Default Tags used in Drive Application Software

Subroutine Inputs:

```

In1 -Rx =CalcEnbl - Diameter Calculator Enable
In2 -Rx.x =CalcEnblThresh_FPM - Diameter Calculator Enable Threshold [FPM]
In3 -Rx.x =CalcUpdate_Rev - Diameter Calculator Update Interval [Roll Revolutions]
In4 -Rx.x =SpeedLine_FPM - Line Speed or Translational Speed [FPM]
In5 -Rx.x =SpeedMotor_RPM - Motor Speed [RPM]
In6 -Rx.x =GearRatio - Gear Ratio [Motor Revolutions / Roll Revolutions]
In7 -Rx.x =DiamMinEC_in - Minimum Empty Core Diameter [Inches]
In8 -Rx.x =DiamFR_in - Full Roll Diameter [Inches]
In9 -Rx =DiamMeasEnbl - Measured Diameter Enable
In10-Rx.x =DiamMeasInput - Measured Diameter Input
In11-Rx.x =DiamMeasMin_DC - Minimum Measured Diameter [Data Counts]
In12-Rx.x =DiamMeasMax_DC - Maximum Measured Diameter [Data Counts]
In13-Rx.x =DiamMeasMin_in - Minimum Measured Diameter [Inches]
In14-Rx.x =DiamMeasMax_in - Maximum Measured Diameter [Inches]
In15-Bx =yDiamPresetCmmnd - Diameter Preset Command from DiamPreset routine
In16-Rx.x =yDiamPresetVal_in - Diameter Preset Value from DiamPreset routine
In17-Rx.x =DiamRate_inRev - Diameter Rate Limit [Inches / Roll Revolution]
In18-Bx =DiamIncEnbl - Diameter Calculator Increase Enable
In19-Bx =DiamDecEnbl - Diameter Calculator Decrease Enable

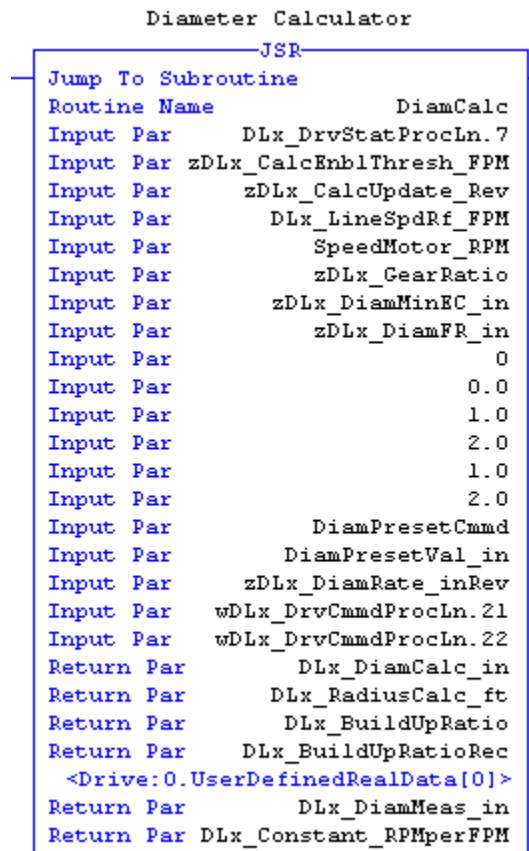
```

Subroutine Outputs:

```

Ret1-Rx.x =DiamCalc_in - Calculated Diameter [Inches]
Ret2-Rx.x =RadiusCalc_ft - Calculated Radius [Feet]
Ret3-Rx.x =BuildUpRatio - Normalized Diameter [1.0=Min Diam]
Ret4-Rx.x =BuildUpRatioRec - Reciprocal of Normalized Diameter
Ret5-Rx.x =DiamMeas_in - Measured Diameter [Inches]
Ret6-Rx.x =Constant_RPMperFPM - Calibration Constant [RPM Per FPM]

```



6.0 Tuning / Startup

6.1 Installing the Application Module

Perform the following operations in the order listed to ensure proper signal connections between the DriveLogix controller and the PowerFlex 700S firmware.

1. Download the RSLogix 5000 [.acd] file to the DriveLogix controller
2. Download the DriveExecutive [.dno] file to the PowerFlex 700S

Note, order of these events are critical as the DriveLogix controller must send the Peer Communication format to the PowerFlex 700S firmware before the PowerFlex 700S will accept all the configuration settings provided in the DriveExecutive file. Manually setting the Peer Communication format in the drive will not be effective until configured in DriveLogix. If this sequence of operation is not followed, the DriveLogix controller may not communicate with the PowerFlex 700S.

6.2 Drive Tuning & Configuration

For basic commissioning of the application, the drive must first be tuned to regulate the motor. The following steps will guide you through the basic requirements of drive tuning when using an application module.

1. Set param 153 bit 8 high. This will set the start/stop control to 3 wire for operation via the HIM. When the start up is complete this **must** be set to low for 2 wire operation from DriveLogix.
2. From the HIM, select the “Start-Up” function and follow the directions. In this section you will perform the following steps.
 - a. Motor Control
 - i. FOC – for Induction Motor
 - ii. PMag – for Permanent Magnet Motor
 - b. Motor Data – Enter all motor data for the attached motor, check # poles
 - c. Feedback Config – Select feedback type
 - d. Pwr Circuit Diag
 - e. Direction Test – (NOTE, the motor will run) recommend always changing wires and not software, this is for maintenance purposes, if the program is restored it will default to the standard direction setting.
 - f. Motor Tests – (NOTE, the motor will run)
 - g. Inertia Measure – (NOTE, the motor will run)
 - h. Speed Limits
 - i. Select “+/- Speed Ref”
 - ii. Fwd Speed Limit
 - iii. Rev Speed Limit
 - iv. Abs Overspd Lim – Max over speed past the Fwd and Rev Speed Limit. This is where the drive will fault
 - i. **Do not** complete the remainder of the Start-Up procedure in the drive
 - j. Scroll down to “Done/Exit”
3. Tune the speed regulator. Depending on the inertia of the machine and other factors, the speed regulator bandwidth (param 90) should be set for 15 to 50 radians.
4. Set param 153 bit 8 Low. This will set the start/stop control to 2 wire for operation via DriveLogix

6.3 Offline Tuning / Startup

Verify that the number and order of JSR input parameters and JSR return parameters agree with the JSR rung comment and section 4 of this user manual.

Verify that the data type of all JSR instruction input and return parameters agree with the data type described in the JSR instruction rung comment and section 4 of this user manual. If immediate values are used for input parameters, the immediate value data type can be controlled by using or excluding a decimal point. For example, if the JSR instruction input parameter is designated as type REAL, and the desired value is zero, use “0.0” in the JSR instruction input parameter. An Input entered a “0” is used as an INTEGER value.

Check the value of all JSR instruction input parameter tags. If the tag is calculated by other Logix instructions, verify that the tag will be calculated in the correct engineering units. If the tag is not calculated by other Logix instruction, preset the tag per section 4 of this user manual.

6.4 Online Tuning / Startup

6.4.1 Measured Diameter Enable True

With the Logix controller in run, verify that the Measured Diameter return parameter (DiamCalc – Ret5) agrees with the actual diameter.

If the Measured Diameter return parameter (DiamCalc – Ret5) is not accurate:

1. Check that the value of the following input parameters:

- Measured Diameter Input (DiamCalc - In10)
- Minimum Measured Diameter (DiamCalc - In11)
- Maximum Measured Diameter (DiamCalc - In12)
- Minimum Measured Diameter (DiamCalc - In13)
- Maximum Measured Diameter (DiamCalc - In14)

Preset the Diameter Calculator to the actual diameter drive (The diameter can only be preset with the Diameter Calculator Enable input parameter (DiamCalc – In1) false.) and run the drive (The diameter rate limit is zero when the motor speed is zero.) Verify that Calculated Diameter return parameter (DiamCalc - Ret1) tracks the actual diameter.

If the Calculated Diameter return parameter (DiamCalc - Ret1) does not change with actual diameter:

1. Verify that the value of the Diameter Increase Enable, Diameter Decrease Enable and the Diameter Rate Limit (DiamCalc – In17, In18, and In19) will allow the diameter to ramp to the measured value.
2. Verify that the Motor Speed and Gear Ratio input parameters (DiamCalc – In5, In6) are entered correctly.

6.4.2 Measured Diameter Enable False (typical configuration)

Preset the Diameter Calculator to the actual diameter (the diameter can only be preset with the Diameter Calculator Enable input parameter (DiamCalc – In1) false).

After diameter preset is complete, set the Diameter Calculator Enable input true.

Run the drive at a line speed greater than the Diameter Calculator Enable Threshold (DiamCalc – In2). Verify that the Calculated Diameter return parameter (DiamCalc - Ret1) tracks the actual diameter.

If the Calculated Diameter return parameter (DiamCalc - Ret1) does not change with actual diameter:

1. Verify that the Diameter Calculator Enable input parameter (DiamCalc – In1) is true.
2. Verify that the value of the Diameter Increase Enable, Diameter Decrease Enable and the Diameter Rate Limit (DiamCalc – In17, In18, and In19) will allow the diameter to ramp to the measured value.
3. Verify that the Motor Speed and Gear Ratio input parameters (DiamCalc – In5, In6) are entered correctly.

If the Calculated Diameter return parameter (DiamCalc - Ret1) is not accurate:

1. Hand tach the roll surface and verify that the correct value of Line Speed (DiamCalc - In4). Finally, monitor motor speed and verify the correct value of Motor Speed (DiamCalc – In5).

Note: The diameter calculator is only as accurate as the Line Speed and Motor Speed input parameters (DiamCalc – In4, In5). For example, if a line speed reference signal is used for the Line Speed input parameter, lead section speed errors, lead section calibration errors, dancer loop velocity, and/or material stretch will contribute to differences between the actual surface speed of the roll and the Line Speed input parameter value.

If the Calculated Diameter return parameter (DiamCalc - Ret1) is accurate but is fluctuating:

1. Increase the Diameter Calculator Update Interval (DiamCalc – In3) and use a whole number of revolutions. Using a whole number of revolutions for the Diameter Calculator Update Interval will help reduce fluctuations due to roll eccentricity.

Appendix A - Process Line Command & Status Words

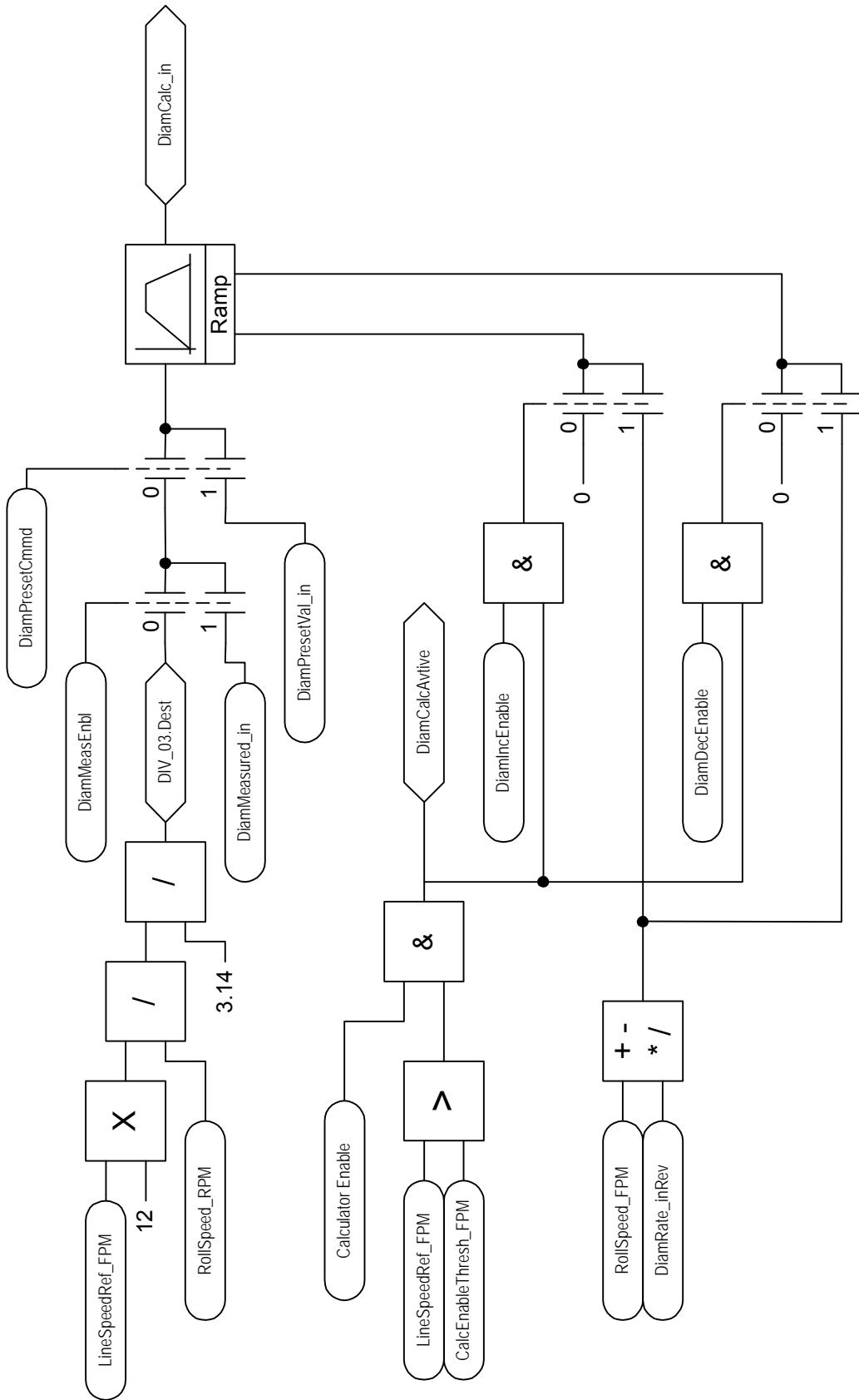
The following table is a functional list of the Process Line command word [wDLx_DrvCmmdProcLn]

<i>Bit</i>	<i>Input Signal</i>	<i>Description</i>
00	Clear Fault	Clear all Faults
01	Run (2 Wire)	1 = Start, transition to 0 = Stop
02	Reserved	
03	Coast Stop	not supported in rev 110101
04	Jog Forward	Jog in Forward direction
05	Jog Reverse	Jog in Reverse direction
06	Reverse Rotation (Under Wind)	Under wind selection
07	Tension Control Enable	Activates selected mode of Tension Control
08	Stall Tension	User determines how and when to activate Stall Tension
09	Tension Control	Selects Tension Control Mode - Tension
10	Torque Control	Selects Tension Control Mode - Torque
11	Dancer Control	Selects Tension Control Mode - Dancer
12	Torque Trim	Selects Trim type – Torque is trimmed
13	Speed Trim	Selects Trim type – Speed is trimmed
14	Draw Trim Off	Zeros the Draw trim signal
15	Torque Follower Control	Special Control mode for torque follower
16	Diam Preset 1	Commands preset 1 for Diam Calc
17	Diam Preset 2	Commands preset 2 for Diam Calc
18	Diam Preset 3	Commands preset 3 for Diam Calc
19	Diam Preset Increase	Manual increase for Diameter Calc
20	Diam Preset Decrease	Manual decrease for Diameter Calc
21	Diam Calc Increase Enable	Releases Diameter Clac for Increase
22	Diam Calc Decrease Enable	Releases Diameter Calc for Decrease
23	Reserved	
24	Reserved	
25	Reserved	
26	Reserved	
27	Reserved	
28	Reserved	
29	Torque Mem Enable	Memorizes running torque
30	Torque Mem Boost Enable	Boosts the memorized torque by user set percentage.
31	Torque Mem Knife Cut	Boosts the memorized torque by user set percentage.

The following table is a functional list of the Process Line status word [DLx_DrvStatProcLn]

<i>Bit</i>	<i>Output Signal</i>	<i>Description</i>
00	Fault	Drive Fault or a System Fault
01	Running	Drive is Running / not stopping
02	Reserved	
03	Motor Ctrl On	Motor is being control (Motor POWER)
04	Reserved	
05	Jogging	section Jogging
06	Rotational Reverse	Under Wind
07	Tension Control On	Selected mode of Tension control is enabled
08	Zero Speed	Below Zero Line speed set point
09	Diameter Calculation Active	<i>Future</i>
10	Reserved	
11	Reserved	
12	Reserved	
13	Reserved	
14	Reserved	
15	Reserved	
16	Enable Loss Fault	Drive Enable lost
17	Fail to Run fault	Drive failed to start
18	Communication fault	NA – not support
19	Message fault	NA – not support
20	Motor Overload Fault	Overload alarm from drive
21	Motor Overtemperature Flt	Over temperature alarm from drive
22	Motor Blower Loss Fault	Motor blower has stopped or tripped off
23	Reserved	
24	Reserved	
25	Reserved	
26	Reserved	
27	Reserved	
28	Reserved	
29	Reserved	
30	Operate Permissive	Use in line control logic to command a coordinated line ramp stop.
31	On Permissive	Loss of permissive resets start command. The drive will coast stop or ramp stop depending on configuration

Appendix B - Block Diagram



Appendix C - Parameter (Tag) Table

Input Tags for Diameter Calculation Function Module

Name	Type	Source Tag	from Routine	Default	User Value
DiamPreset – Routine					
Preset1Cmmd	B x	wDLx_DrvCmmdProcLn.16	NA	0	
Preset2Cmmd	B x	wDLx_DrvCmmdProcLn.17	NA	0	
Preset3Cmmd	B x	wDLx_DrvCmmdProcLn.18	NA	0	
Preset1Val_in	R x.x	zDLx_DiamPreset1Val_in	NA	4.0	
Preset2Val_in	R x.x	zDLx_DiamPreset2Val_in	NA	6.0	
Preset3Val_in	R x.x	zDLx_DiamPreset2Val_in	NA	9.0	
PresetIncCmmd	B x	wDLx_DrvCmmdProcLn.19	NA	0	
PresetDecCmmd	B x	wDLx_DrvCmmdProcLn.19	NA	0	
PresetIncDecRate_inSec	R x.x	zDLx_DiamPresetIncDecRate_inSec	NA	0.0	
DiamCalc – Routine					
CalcEnbl	B x	DLx_DrvStatProcLn.7	NA	0	
CalcEnblThresh_FPM	R x.x	zDLx_CalcEnblThresh_FPM	NA	5.0	
CalcUpdate_Rev	R x.x	zDLx_CalcUpdate_Rev	NA	2.0	
SpeedLine_FPM	R x.x	DLx_LineSpdRf_FPM	RunJogSpdRf	NA	
SpeedMotor_RPM	R x.x	SpeedMotor_RPM	Main – scaled to (RPM)	NA	
GearRatio	R x.x	zDLx_GearRatio	NA	5.0	
DiamMinEC_in	R x.x	zDLx_DiamMinEC_in	NA	4.0	
DiamFR_in	R x.x	zDLx_DiamFR_in	NA	30.0	
DiamMeasEnbl	B x	None	NA	0	
DiamMeasInput	R x.x	None	NA	0.0	
DiamMeasMin_DC	R x.x	None	NA	1.0	
DiamMeasMax_DC	R x.x	None	NA	2.0	
DiamMeasMin_in	R x.x	None	NA	1.0	
DiamMeasMax_in	R x.x	None	NA	2.0	
yDiamPresetCmmd	B x	DiamPresetCmmd	DiamPreset	NA	
yDiamPresetVal_in	R x.x	DiamPresetVal_in	DiamPreset	NA	
DiamRate_inRev	R x.x	zDLx_DiamRate_inRev	NA	0.25	
DiamIncEnbl	B x	wDLx_DrvCmmdProcLn.21	NA	0	
DiamDecEnbl	B x	wDLx_DrvCmmdProcLn.22	NA	0	



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