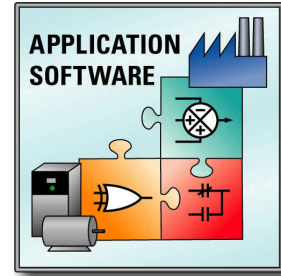




# Quick Start

## Drive Application Software Positioning Point to Point 9329-KAA11D



### Introduction

This document is designed to guide you through the basic steps needed to install, start-up and program the PowerFlex 700S AC Drive with DriveLogix for use with the Application Module (Positioning Point to Point). The information provided does not replace the user manual and is intended for qualified personnel only. For detailed information regarding the PowerFlex 700S AC Drive and the Application Module (Positioning Point to Point) refer to the following:

Title	Publication	Available
PowerFlex 700S User Manual	20D-UM001B-EN-P	<a href="http://www.theautomationbookstore.com">www.theautomationbookstore.com</a>
PowerFlex 700S Reference Manual	PFlex-RM002A-EN-E	
PowerFlex 700S Firmware Release Notes	20D-RN004A-EN-P	
PowerFlex 700S Quick Start	20D-QS001A-EN-P	
DriveLogix Controller User Manual	20D-UM002A-EN-P	
Positioning (Pt to Pt) User Manual	9329-UM005A-EN-E	not available

### Important User Information

Because of the variety of uses for the product 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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## Precautions

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### 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 should plan or implement the installation, start-up and subsequent maintenance of the system. 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.

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## 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 with Function Modules and additional programming to perform a specific machine sections application (task). Application Modules are complete programs, only requiring configuration and integration to perform the designated tasks.

## 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.

## Normalized Quantities

A physical quantity is typically 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 without the knowledge of the specific motor size and current rating. 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.

## Installing the Application

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.

## Customer Connections



**ATTENTION:** The following information is merely a guide for proper installation. Rockwell Automation Company cannot assume responsibility for the compliance or the noncompliance to any code, national, local or otherwise for the proper installation of this drive or associated equipment. A hazard of personal injury and/or equipment damage exists if codes are ignored during installation.

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### Minimum Connections;

1. The Enable input on the drive must be satisfied before the drive can be started.
2. A motor feedback device is required for positioning operation.
  - a. This can be an incremental quadrature encoder (this will required homing after each drive power cycle)
  - b. This can be a Hi-Resolution Stegmann device for absolute positioning
3. As a minimum connection requirement, the application module could be operated with only 1 position command input (Next Position). With this one input, the drive will start and move to the next programmed position in sequence as specified in the application configuration. See the Basic Operation description.

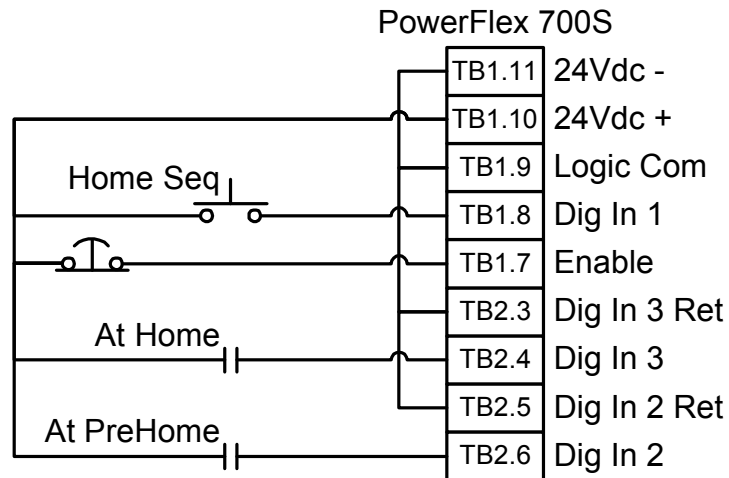
*\* If used with incremental encoder, the following connections are also required.*
4. Home sequence command, is required to command the application module to find actual position of the machine after a power cycle.
5. An (At Home Sensor) input is required to indicate the home position reached when the homing sequence is utilized. See the Basic Operation description.

### Generic Connections;

The following connections provide a configuration that allows for implementation of all control features supported in the Application Module – Positioning (Point to Point). This shows all input command for the application. The inputs may be commanded from many different forms of digital inputs and/or communication platforms. The data from the input (controlling) source must be connected to the control inputs of the application module. Following the list of control inputs is an example ladder logic program showing the connections from a Flex I/O input card. The contacts in this ladder program represent the format used to command the inputs to the application module, regardless of the source of the input commands (digital I/O or communicated data).

## Default Connections

When using the homing function, the “At Home” and “At PreHome” inputs should be connected to the native digital inputs for the fastest update of the signals.



## Standard Input Connections

Input Connections / Command word [wDLx\_DrvCmmdPositAM]

Bit	Input Signal	Description
00	Clear Fault	Clear all Faults
01	Run (2 Wire)	1 = Start, transition to 0 = Stop
02	Start (3 Wire)	1 = Start, 0 = no action
03	Stop	1 = Stop, 0 = no action (OK to Start or Run)
04	Jog Forward	Jog in Forward direction
05	Jog Reverse	Jog in Reverse direction
06	Reverse Rotation	for Turret Indexer – Not Supported
07	Reserved	
08	Home Sequence	Starts the homing sequence
09	Set Home	Sets current position as Home
10	Go Home	Position controlled move to Home position
11	At Home Input	Home Sensor input
12	At PreHome Input	PreHome Sensor input
13	Move Fwd Permissive	OK to move / (Jog) Forward
14	Move Rev Permissive	OK to Jog Reverse
15	Reserved	
16	Next Position	Position to next position in sequence
17	Return to A	for Turret Indexer – Not Supported
18	Return to B	for Turret Indexer – Not Supported
19	Position 1	Position controlled move to Position 1
20	Position 2	Position controlled move to Position 2
21	Position 3	Position controlled move to Position 3
22	Position 4	Position controlled move to Position 4
23	Position 5	Position controlled move to Position 5
24	Position 6	Position controlled move to Position 6
25	Position 7	Position controlled move to Position 7
26	Position 8	Position controlled move to Position 8
27	Position 9	Position controlled move to Position 9
28	Position 10	Position controlled move to Position 10
29	Position 11	Position controlled move to Position 11
30	Position 12	Position controlled move to Position 12
31	Reserved	

2	Digital Input 2 DLx_p824LocalIOStatus.2 <Drive:I.LocalIOStatus.2>	At PreHome Input wDLx_DrvCmdPositAM.12
3	Digital Input 3 DLx_p824LocalIOStatus.3 <Drive:I.LocalIOStatus.3>	At Home Input wDLx_DrvCmdPositAM.11
4	Digital Input 1 DLx_p824LocalIOStatus.1 <Drive:I.LocalIOStatus.1>	Home Sequence wDLx_DrvCmdPositAM.8
5	Local:0:I.0 <Local:I.Data[0].0>	Start (3Wire) wDLx_DrvCmdPositAM.2
6	Local:0:I.1 <Local:I.Data[0].1>	Stop wDLx_DrvCmdPositAM.3
7	Local:0:I.2 <Local:I.Data[0].2>	Clear Fault wDLx_DrvCmdPositAM.0
8	Local:0:I.3 <Local:I.Data[0].3>	Move Fwd Permissive wDLx_DrvCmdPositAM.13
9	Local:0:I.4 <Local:I.Data[0].4>	Move Rev Permissive wDLx_DrvCmdPositAM.14
10	Local:0:I.5 <Local:I.Data[0].5>	Jog Forward wDLx_DrvCmdPositAM.4
11	Local:0:I.6 <Local:I.Data[0].6>	Jog Reverse wDLx_DrvCmdPositAM.5
12	Local:0:I.7 <Local:I.Data[0].7>	Go Home wDLx_DrvCmdPositAM.10
13	Local:0:I.8 <Local:I.Data[0].8>	Next Position Command wDLx_DrvCmdPositAM.16
14	Local:0:I.9 <Local:I.Data[0].9>	Position 1 Command wDLx_DrvCmdPositAM.19
15	Local:0:I.10 <Local:I.Data[0].10>	Position 2 Command wDLx_DrvCmdPositAM.20
16	Local:0:I.11 <Local:I.Data[0].11>	Position 3 Command wDLx_DrvCmdPositAM.21
17	Local:0:I.12 <Local:I.Data[0].12>	Position 4 Command wDLx_DrvCmdPositAM.22

## Basic Operation

The 32 bit command word [wDLx\_DrvCmmdPositAM] is the only word that must be written to for successful implementation of the Application Module – Positioning (Point to Point). Using digital inputs or a communications network, simply write to the specified bit of the command word to activate the associated function / action. A complete definition of the command word is available in the notes routine of the unscheduled program in the application program.

**Bit 00 Clear Fault** – The Clear Fault input will clear all faults in the Logix program and the drive. The clear fault will not function if the drive is in run.

**Bit 01 Run (2 Wire), Bit 02 Start (3 Wire), Bit 03 Stop** – The start/stop control of the application module is designed to support 2 and 3 wire operation simultaneously. Setting the start command will start the drive and setting the stop command will cause the drive to ramp to a stop. Setting the run command will start the drive and setting the run command low will cause the drive to ramp stop. If the drive is started with the run command and the stop command is then set, the drive will stop and will not restart until the run command is set low and then high or if the start command is set. In any state of operation if the run command transitions from high to low or the stop command is set the drive will ramp stop.

**Operation** – When the drive is started with the Run or Start command the drive will operate in speed control and regulate zero speed until a position command is given. When one of the position commands is given, the drive will change to position control and move to the commanded target position. When the target position is reached, the drive will remain in position control and hold that target position until the stop or jog command is given. If the desired operation of the position control is to stop motor control after the target position is reached the drive should not be separately started. If the drive is in the stopped state when a position command is given, the drive will start, move to the target position, and then stop.

**Next Position** and all **Position xx** inputs are position commands.

**Bit 08 Home Sequence** – This will start the selected homing sequence. Select the desired mode of homing sequence with [zDLx\_HomingMode]. If the homing mode is selected for “Direct 1 Sensor” the **At Home Input (Bit 11)** must be connected to a home position sensor on the machine. If the homing mode is selected for “Direct 2 Sensors” the **At PreHome Input (Bit 12)** and the **At Home Input (Bit 11)** must be connected to position sensors.

1. **Direct 1 Sensor** – When the homing sequence is activated the drive will start in speed mode, run in the reverse direction, and at the **zDLx\_HomeSpd1\_Pct** speed. When the **At Home Input (Bit 11)** is set high the drive will current limit stop.
2. **Direct 2 Sensors** – When the homing sequence is activated the drive will start in speed mode, run in the reverse direction, and at the **zDLx\_HomeSpd1\_Pct** speed. When the **At PreHome Input (Bit 12)** is set high the drive will ramp to the **zDLx\_HomeSpd2\_Pct** speed. When the **At Home Input (Bit 11)** is set high the drive will current limit stop.

**Bit 09 Set Home** – Sets the current position of the machine as HOME. Typically used during commissioning of Linear ABS mode to set the home position of an absolute feedback device.

**Bit 16 Next Position** – Commands the drive to start, activates the position mode, and commands the next target in the positioning sequence. When the drive reaches the requested target position, the drive will stop. If the drive was already running, the drive will not stop controlling the motor when the target position is reached. The drive will not stop regulation until the stop command is given.

**Bits 19-30 Position xx** – Each position command will start the drive, activate the position mode, and command the selected target for the position reference. When the drive reaches the requested target position, the drive will stop. If the drive was already running, the drive will not stop controlling the motor when the target position is reached. The drive will not stop regulation until the stop command is given.

## Parameter (Tag) Adjustments

All tags in the RSLogix5000 Application Module program that require tuning or adjustment during commissioning or maintenance are prefixed with a (z). These tags are referred to as (z tags). Please review and adjust the setting of all (z tags) as required before activating control of the drive.

The following (z tags) are of particular importance for operation of the application module;

**zDLx\_ControlMode** – Select the positioning mode of operation. Only “Linear Posit” and “Linear ABS” are supported in rev 110101 and 110102. Linear ABS requires the use of a “Multi-Turn Stegmann” feedback device.

**zDLx\_EuperMachineRev\_EU** – Sets the scaling of the position targets to the desired engineering unit. This scaling value is used to calculate the actual position counts per the position target setpoints. All motor controlled machinery begins with rotational motion.

If the machine is operated as rotational motion, a common form of engineering units is degrees. There are 360degrees in 1 rotation of the machine, therefore set this tag for 360. (1 rotation = 360°) a command of 720° will equal 2 machine rotations.

If converted to linear motion, measure the linear distance traveled for 1 final mechanical rotation (not motor rotation, unless no gearing). This may be entered in any units desired by the customer. The units specified here are the units used throughout the application. All position commands will be entered in these units.

**zDLx\_GearRatio** – required for calculation of actual position counts to position target in EU. Number of motor rotations per 1 final mechanical rotation of the machine.

**zDLx\_HomeHexigonBckup\_Cnt** – not supported in rev 110101 and 110102

**zDLx\_HomingMode** – Select the operation desired for the Homing sequence.

1 = Direct 1 Sensor

2 = Direct 2 Sensors

3 = Hexigonal – not supported in rev 110101 and 110102

**zDLx\_PositionQty** – Sets the quantity of target positions used with the “Next Position” command.

**zDLx\_PositionTrgtRef\_EU** – Each target position to be used must have an appropriate target position value set.

**zDLx\_PositionTrgtSpeed\_Pct** – Each target position to be used must have an appropriate speed value set. This will determine the speed at which the move to position for each target is completed.

## Drive Startup / Tuning

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 10 to 100 radians.
4. Adjust the position regulators Kp gain (param 768) to 1/5 of the speed regulators bandwidth. Example: If  $p90 = 50$  then set  $p768 = 50/5 = 10$
5. Set param 153 bit 8 Low. This will set the start/stop control to 2 wire for operation via DriveLogix.



**ATTENTION:** Parameter 153 bit 8 must be set low for operation from the DriveLogix controller. If the control selection of 2 wire (**NOT** 3 Wire Control) is not made the drive will fail to stop when the run command is removed. 2 wire control is the intended and designed configuration for the PowerFlex 700S drive when operated from a controller such as DriveLogix

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6. The drive is ready for control from DriveLogix and the rest of the commissioning and tuning may be completed.

## Reading additional signals from PowerFlex 700S

Reading of additional signals from the PowerFlex 700S can be accomplished through the Peer Communications setup in the drive. **Do not change any defined links, as this will break the application module.** In the Positioning (Pt to Pt) application there are available 5 undefined REAL data connections. In DriveExecutive access the “Peer Communication Setup” under “Drive” / “Peer Communication...”. Select the tab “To Controller” and edit the undefined links as needed. These are Real data links only. Parameters with data types other than real cannot be connected at these points. The data will be sent to DriveLogix and available at tags ( Drive:I.UserDefinedRealData[2] – [6] ). If additional data is required, messaging must be employed. Contact Local Drives Solutions or SupportPlus for assistance.

