PowerFlex® Drives for Crane and Hoist Applications

A Reliable Solution for a Wide Variety of Crane and Hoist Applications
PowerFlex Drives Use Patented Motor Control to Help Ensure Correct Management of the Load

Applications that involve the lifting or hoisting of a load require special considerations. Smooth, safe and reliable control is necessary to help protect both personnel and assets. To meet the specialized needs of these types of applications, Allen-Bradley® offers select PowerFlex AC and DC drives, all with patented TorqProve™ technology.

Benefits of Using PowerFlex Drives with TorqProve

**Reduced Set-up Time**
- Seamless drive and control system integration reduces configuration time
- Convenient set-up, only a few parameters to set
- Brake control is performed by drive

**No Special Drive or Software Required**
- TorqProve is a standard feature of the drive
- The same drive can be used for entirely independent functions on the same machine or in the same facility. This versatility allows you to reduce inventory costs

**System Performance**
- PowerFlex drives provide high-power capability in a compact footprint
- With the drive controlling the braking, the life of the mechanical brake can be extended
- The drive easily integrates via the same communication networks you currently use
- Seamless integration of PowerFlex drives and Logix programmable automation controllers helps increase productivity by providing easy access to system and machine level data and diagnostic information
PowerFlex Drives for Crane and Hoist Applications

PowerFlex drives are well established and designed for application flexibility and ease of use. The TorqProve feature is specifically tailored for applications requiring coordinated and sustained control of a load and brake. TorqProve helps to ensure control of the load in lifting applications of all kinds. Control capability helps confirm that the mechanical brake has control of the load when stopping the drive, and the drive has control of the load when releasing the brake during any move command. Combined with excellent low or zero speed performance with accurate torque and speed regulation, TorqProve helps eliminate concerns with brake timing.

It can also significantly help to reduce wear and tear on the mechanical brake with smooth operation and reduced machine stress.

TorqProve can be used in any application where coordination between the drive and the mechanical brake is required:

- Cranes
- Hoists
- Draglines
- Material handling lifts (vertical conveyors)
- Automatic Storage and Retrieval Systems (ASRS)
- Palletizer lifts

Premier Integration

Premier Integration is the exclusive experience of integrating Allen-Bradley motor control devices into the Allen-Bradley Logix control platform. Use just one software tool to help reduce your programming time, ease startup and commissioning and streamline diagnostics.

- Single development environment to configure and program your entire control and device system
- Consolidating controller programming and device system configuration helps reduce complication and eliminates mismatch errors
- Diagnostic, fault, alarm and event information are integral to the Studio 5000* environment

Studio 5000 software can help reduce programming time by automatically populating drive parameters in the controller memory as controller tags.

- Descriptive tag names are automatically generated
- Address mismatch errors can be eliminated
- Copy and paste function makes duplicating drives fast and easy
- Advanced graphical wizards walk you through drive configuration

When functioning as part of the Rockwell Automation® Integrated Architecture®, PowerFlex drives can do much more than just respond to interlocking commands.

- Predict mechanical problems and help improve performance with diagnostics and real-time data
- Monitor performance either locally or remotely to make informed decisions about your assets

Simplify Machine Programming and Use

To further simplify your drive and controller set up, you can use Studio 5000 motion instructions, which allow you to speed the programming of your PowerFlex 755* drives. The ability to configure and program variable frequency drives using the motion instructions in the Studio 5000 environment helps reduce complexity and save valuable engineering time.

The use of the Studio 5000 Logix Designer® motion instructions has been extended to the TorqProve feature in PowerFlex 755 drives. This allows the drive to perform as a natural extension of the controller and provides exclusive application resources that offer additional time-saving features and performance enhancements for hoist applications.

- Helps confirm control of the load in lifting or hoisting applications to help protect personnel and assets
- Simplifies coordination of multiple lifting, hoisting and crane systems using intrinsic motor synchronization
- The use of motion instructions allows code reuse which helps make machine design more efficient
- Powerful diagnostics, including time stamped events, provide precise drive information to help you quickly identify and resolve problems
- With the use of motion instructions, the Logix controller maintains every aspect of the drive’s parameters, and resets them each time it connects to the drive. This creates inherent Automatic Device Replacement to help minimize machine downtime
- Synchronization can be accomplished using just a few instructions
- Synchronization can be done over the network without the need for any additional hardware devices

* Programming with motion instructions currently only applies to the PowerFlex 755 drives.
Automated Torque Proving & Brake Proving

- When a run command is initiated, the drive will:
  - Perform a fast flux-up of the motor then command torque
  - Verify that torque is present before releasing the brake
  - Also be configurable to test brake torque prior to Torque Prove routine
- After run command is removed (and after float time), the drive will:
  - Set the brake
  - Verify that the brake has control of the load before removing torque (Brake Slip Test)
- TorqProve can be used with and without an encoder (Encoderless applications require a risk assessment)

Float Capability
- Allows operator to suspend the load at zero speed and smooth Reverse Plugging transition without setting the brake immediately
- This function is NOT available when configured in “Encoderless” mode

Micro Position
Reduces the active commanded speed by a programmed percentage. This helps with small or slow movements when positioning a load manually.

Fast Stop
When this input is present, the drive will stop the load as fast as possible (effectively a current limit stop disregarding any decel ramps) then set the brake. This action reduces wear on the mechanical brake. Includes the ability to combine Fast Stop with simultaneous Mechanical Brake hardware set.

Brake Test
This test verifies brake holding torque prior to implementing Torque Proving routine

Continuous Brake Slip Monitor
Can be configured to continuously monitor brake integrity in standby mode. Automatically starting and taking control of the load upon brake slip detection.

Brake Slip Detection
- When the load is stopped and the mechanical brake is closed, the drive will ramp down the commanded torque and monitor position to determine if the load is being held
- If position is changing (brake slipping), the drive will increase torque to regain control of the load then lower the load by a programmed number of revolutions
- This cycle will repeat until the brake holds the load or the load is safely lowered to the ground

Safety & Monitoring
These functions help provide safe and proper operation to help maintain system availability and productivity. For added safety, when PowerFlex drives are configured for lifting/crane applications, the drive is set to stop if any faults are detected.

- Speed Deviation – monitors speed feedback within range of commanded speed
- Input Phase Loss Detection – monitors source power connection integrity
- Output Phase Loss Detection – monitors motor leads connection integrity
- Encoder Loss Fault – monitors the encoder for proper operation and feedback signals

Torque Preload Selections
Selections are made via setpoint values, analog or communications.

Load Sharing
Can be engineered to accomplish load sharing. Load sharing can be configured between multiple drive systems to provide effectively shared torque control contribution.

Field Weakening Load Limit
Drives can safely operate at speeds above base speed (unloaded or based on % under-rated load).

Digital Input Selections
I/O points that are hardwired to your drive or controller to monitor the loads location and indicate when the load needs to slow down or has reached the end of travel point.
Maximize Your Productivity by Taking Advantage of PowerFlex AC and DC Drives

In addition to helping provide outstanding performance for lifting applications, the robust family of PowerFlex AC and DC drives provide ease of use, flexibility and performance for a variety of industrial applications up to 4000 Hp/3000 kW.

PowerFlex 755 Drives

With a complete power range of 1 to 2000 Hp (0.75 to 1500 kW), the PowerFlex 755 AC drive was designed for high performance and ease of use. The drive supports a wide range of network protocols to simplify integration into your architecture and features an embedded EtherNet/IP port for easy, management of drive data over EtherNet/IP networks. To help protect personnel and equipment while reducing machine downtime, the drive offers safety solutions up to and including PLe/SIL3, Cat 3 and Cat 4.

Automatic device configuration (ADC) is a productivity-enhancing benefit of Premier Integration and is available when the drive is used on an EtherNet/IP network. ADC enables a Logix controller to automatically detect a replaced PowerFlex 755 drive and download all configuration parameters, minimizing the need for manual reconfiguration.

The PowerFlex 755 offers TorqProve as a standard feature and no special software is required. Setup is convenient, with only a few parameters to set. No PLC programming is required since brake control is performed by the drive. And with the drive controlling the braking, the life of the mechanical brake can be extended.

PowerFlex 755T Drives

The new PowerFlex 755T drives were designed to provide harmonic mitigation, regeneration and common bus solutions that help reduce energy costs, provide flexibility and increase productivity. These are the first drives to offer TotalFORCE™ technology which uses several patented features that were developed to help optimize your system. With a power range of 250 to 3000 Hp (160 – 2300 kW), the PowerFlex 755T drives offer predictive diagnostics and maintenance, safety options, and a modular design that provides easy access to key components for simplified servicing. Similar to the PowerFlex 755 Drives, TorqProve is a standard feature of the drives.

PowerFlex 7000 Drives

The PowerFlex 7000 family of medium voltage AC drives deliver flexibility and highly efficient performance in a single solution for motor control applications from 200 to 34,000 Hp (150 kW to 25,400 kW), rated from 2.4 kV to 6.6 kV. To reduce energy costs and motor wear and tear, PowerFlex 7000 drives enable soft-starting and variable-speed control of processes with high power demands. Along with high performance in a medium voltage format, the PF7000 provides virtually perfect current and voltage waveforms to allow the use of standard or existing motors and motor cables. To help protect personnel and equipment while reducing machine downtime, the drive offers safety solutions up to and including PLe/SIL3, Cat 3.

Choose a configuration with Direct-to-Drive™ technology – and connect a drive directly to the line without the use of an isolation transformer. Direct-to-Drive technology combines an active front end (AFE) rectifier to dramatically lower line-side harmonics and a patented DC link inductor to address common mode voltage at its source.

PowerFlex 7000 medium voltage AC drives with TorqProve control helps to control torque around zero speed and provide a higher drive speed and torque response required for applications, such as hoists, drag lines, winches and teststands. This enhanced torque control feature is a firmware option available in AFE configurations.

PowerFlex DC Drives

The PowerFlex DC drive combines powerful performance between 1.5 to 1400 Hp (1.2 to 1044 kW), with flexible control to produce a highly functional, cost effective drive and control solution. PowerFlex DC drive modules are available in both regenerative and non-regenerative configurations and standard IP20 open type enclosure. The PowerFlex DC comes standard with an armature converter, regulated field converter for field weakening or economy applications, an advanced regulator with integrated DPI functionality, DC tachometer and encoder capability.

Unlike many other DC drives available today, the PowerFlex DC can be easily integrated into the complete manufacturing system. With drive profiles for Premier Integration, end users can now have a single software approach to configure their controller, drive system, and for operation and maintenance.
## PowerFlex AC Drive Specifications

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<td>160…1250 kW</td>
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<td>Common Bus Inverter: 160…2000 kW</td>
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<td>0…1250 kW</td>
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<td>160…2000 kW</td>
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<td>- Built-in EtherNet/IP port or Dual-Port EtherNet/IP option module</td>
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<td>- IP54, NEMA/UL Type 12 = 0…40 °C (32…104 °F)</td>
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* -3 dB Crossing (Closed Loop) specifications
## PowerFlex 7000 AC Drive Specifications

### PowerFlex 7000 Drive

| Ratings | Heavy Duty 150% OL | • 2400V: 200...1000 Hp  
|          |                   | • 3300V: 187...1500 kW  
|          |                   | • 4160V: 350...3350 Hp  
|          |                   | • 6600V: 400...3000 kW  
| Heavy Duty 200% OL | • 2400V: 200...750 Hp  
|                   | • 3300V: 187...1100 kW  
|                   | • 4160V: 350...2500 Hp  
|                   | • 6600V: 400...2250 kW  
| Motor Control | • Flux Vector with a Feedback Device  
|              | • Induction Motor Control  
|              | • Single Drive Multi-Motor Capability  
|              | • Multi Drive Loadshare Operation  
| Speed Control Sources | • Analog (0 – 10V DC, 4 – 20 mA, +/- 10V DC)  
|                      | • Digital Pulse Train Input/Output  
|                      | • Drive Generated Segmented Ramp or S Curve  
|                      | • Serially Communicated Digital Reference  
| Communication Interface | • Ethernet I/P  
|                          | • DeviceNet  
|                          | • Modbus  
|                          | • Interbus  
|                          | • ControlNet  
| Safety | • Safe Torque Off  
| Enclosure Types | • IP21  
|              | • IP42  
| Applications | Hoists, Draglines, Winches, Grinding Mills  

(1) Drive power rating based on single module unit. Please consult factory for PowerFlex 7000 extended power configurations.

* Encoder card required when using PowerFlex 7000 with TorqProve Control.

## PowerFlex DC Drive Specifications

### PowerFlex DC Drive

| Ratings | • 200...240V: 1.2...224 kW / 1.5...300 Hp / 7...1050 A  
|         | • 380...380V: 1.5...671 kW / 2...900 Hp / 4.1...1494 A  
|         | • 500...600V: 37...932 kW / 50...1250 Hp / 67.5...1688 A  
|         | • 690V: 298...1044 kW / 400...1400 Hp / 452...1582 A  
| Motor Control | • Full Wave Regeneration  
|              | • 6 Pulse  
|              | • Regulated Field Supply  
|              | • Field Weakening and Economize  
| Additional Features | • Overload Protection  
|                    | • PID Control (Speed or Torque)  
|                    | • Adaptive Gain, Droop, Feedback Loss Switchover  
|                    | • TorqProve Control  
| Certifications | • C-Tick  
|                | • c-UL  
|                | • CE  
|                | • IEC (Designed to Meet)  
|                | • UL  
| Communication Interface | • EtherNet/IP  
|                          | • BACnet  
|                          | • ControlNet  
|                          | • DeviceNet  
|                          | • HVAC  
|                          | • Modbus/TCP  
|                          | • PROFIBUS DP  
|                          | • Dual port EtherNet/IP  
| Enclosure Types | • IP20/ Type 1/ Type 12 Open  
| Applications | Cranes, Hoists, Conveyors, Elevators, Palletizers, ASRS  

For more information, see www.ab.com/drives
Glossary of Terms

- **AutoTune** – establishes torque control criteria within motor equivalent circuit characteristics and rating
- **Brake Proving** – the Brake Slip Test verifies that the brake has control of the load before removing torque
- **Communications** – easily integrates with networks: Ethernet (embedded port), ControlNet, DeviceNet, Profinet, ModBus, and most other industrial protocols
- **Configuration** – easily configure PowerFlex drives with Studio 5000® and Connected Components Workbench™ software
- **Diagnostics and Alarms** – reduce downtime and troubleshooting with clear full text messages on drive status
- **Fast Stop** – implements a current limit stop of the load as fast as possible; configurable with or without the mechanical brake
- **Field Weakening Load Limit** – helps safely improve productivity by regulating allowable above base speed movement after a load level check
- **Float Capability** – improves productivity, reduces brake wear and smooths Reverse Plugging transition with “timed standby” mode without setting the brake immediately
- **Load Loss Detection** – Mechanical drive train failure detection. Detects difference between motor and load feedback
- **Load Sharing** – controls two or more mechanically coupled motors to provide effectively shared torque control contribution
- **Packaging** – compact design and enclosures for variable environmental classes provide more flexibility in installation
- **TorqProve** – a specific set of parameters for crane/hoist/lifting applications that uses torque demand and feedback for coordinated and sustained control of the load and brake
- **Torque Preload** – provides a means to adjust and adapt to load changes after brake set – or set fixed values pertinent to direction of travel
- **Torque Proving** – automated routine function develops and verifies torque before releasing the brake
- **Traverse** – same drive is configurable for traverse functions with or without TorqProve enabled

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**www.rockwellautomation.com**

**Power, Control and Information Solutions Headquarters**

*Americas*: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444

*Europe/Middle East/Africa*: Rockwell Automation NV, Pegasus Park, De Kleerlaan 12a, 1831 Diegem, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640

*Asia Pacific*: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

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