PowerFlex® Drives for Crane and Hoist Applications
A Reliable Solution for a Wide Variety of Crane and Hoist Applications
Applications that involve the lifting or hoisting of a load require special considerations. Smooth, safe and reliable control is necessary to protect both personnel and assets. To meet the specialized needs of these types of applications, Allen-Bradley® offers the PowerFlex 755 AC drive, PowerFlex 7000 medium voltage AC drive, and the PowerFlex DC drive, 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 in 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 in a compact footprint
- With the drive doing the braking, the life of the 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

The PowerFlex drives are well established and designed for application flexibility and ease of use. The drive’s TorqProve feature is specifically tailored for applications requiring coordinated and sustained control of a load and brake. TorqProve helps to assure 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 reduce wear and tear on the mechanical brake with smooth operation and reduced machine stress.

- **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 Proving** – automated routine function develops and verifies torque before releasing the brake
- **Brake Proving** – the Brake Slip Test verifies that the brake has control of the load before removing torque
- **Load Sharing** – controls two or more mechanically coupled motors to provide effectively shared torque control contribution
- **FW Load Limit** – helps safely improve productivity by regulating allowable above base speed movement after a load level check
- **AutoTune** – establishes torque control criteria within motor equivalent circuit characteristics and rating
- **Diagnostics and alarms** – reduce downtime and troubleshooting with clear full text messages on drive status
- **Float Capability** – improves productivity, reduces brake wear and smooths Reverse Plugging transition with “timed standby” mode without setting the brake immediately
- **Torque Preload** – provides a means to adjust and adapt to load changes after brake set – or set fixed values pertinent to direction of travel
- **Traverse** – same drive is configurable for traverse functions with or without TorqProve enabled
- **Fast Stop** – implements a current limit stop of the load as fast as possible; configurable with or without the mechanical brake
- **Load Loss Detection** – Mechanical drive train failure detection. Detects difference between motor and load feedback
- **Digital Input Selections** – hardwire to your drive or controller, these I/O points monitor the loads location and indicate when the load needs to slow down or has reached the end of travel point
- **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
- **Packaging** – compact design and enclosures for variable environmental classes provide more flexibility in installation
- **Communications** – easily integrates with networks: Ethernet (embedded port), ControlNet, DeviceNet, Profibus, ModBus, and most other industrial protocols
- **Configuration** – easily configure PowerFlex drives with Studio 5000® and Connected Components Workbench™ software
- **Human Interface Module (HIM)** – Makes configuring your PowerFlex 755 painless
- **Human Machine Interface (HMI)** – The PowerFlex 7000 features the user-friendly PanelView™ Plus 6 1000 configured interface

TorqProve can be used in any application where coordination between the drive and the mechanical brake is required:
- Cranes
- Hoists
- Draglines
- Winders
- Material handling lifts (vertical conveyors)
- Automatic Storage and Retrieval Systems (ASRS)
- Palletizers and many other cyclical processes
- SAG & ball mills
- Underground mines and longwall mining
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
- After run command is removed, the drive will hold zero speed with the brake held open for a programmed amount of time then the brake will be set
- Allows operator to suspend the load at zero speed and smooth Reverse Plugging transition without setting the brake immediately
- Float can also be initiated and maintained by a digital input (Micro-position/Float)
- This function is NOT available when configured in “Encoderless” mode

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

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.

Brake Slip Detection
- When the load is stopped and the mechanical brake is closed, the drive will ramp down the commanded torque and monitor encoder pulses to determine if the load is being held
- If encoder pulses are present (brake slipping), the drive will increase torque to regain control of the load then lower the load by a programmed number of revolutions
- Can also be configured to hold the suspended load or lower at a programmable safe speed
- This cycle will repeat until the brake holds the load or the load is safely lowered to the ground
- Brake Slip Detection Alarm is initiated. Brake problem must be addressed. Reset alarm via cycling power

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.

Speed Deviation Fault
The drive will continuously monitor commanded speed versus actual speed. If these speeds are not within a programmed tolerance, then the drive will fault and the brake will be set.

Input Phase Loss Detection
- Monitors for source power single phasing
- Monitors for line side phase imbalance

Output Phase Loss Detection
- All motor leads are monitored to verify proper connection
- This fault is automatically enabled whenever TorqProve is enabled
- Monitors for motor side phase imbalance

Encoder Loss Fault
- Continuously monitor the encoder to verify proper operation
- Any loss of encoder will cause a fault which will stop the drive and set the brake

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

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

 Traverse Capabilities
- Traverse function motor control is configurable with the same drive
- Load share capable for multiple drives and motors

Digital Input Selections
- End of Travel Limit switches (normally closed)
  - Stops drive when switch is open
  - Will not allow drive any further travel in this direction
  - Will allow travel in opposite direction
- Decel Limit switches (normally closed)
  - Slows drive to a lesser speed when switch is open
  - Only allows slower speed in set direction until end limit is reached
  - Allows normal (faster) speed in opposite direction
- Positive Hardware Over-travel and Negative Hardware Over-travel limit switches (normally closed)
  - Faults and disables drive when switch is open
  - Will not allow drive any further travel in this direction
  - Condition must be cleared, fault reset and commanded to travel in the opposite direction
- These digital function inputs can also be used in applications not requiring TorqProve to be enabled
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 and 3000 kW.

PowerFlex 755

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 handling the braking, the life of the brake can be extended.

PowerFlex DC

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.

The PowerFlex DC is available in global voltages and meets CE standards. All sizes are available to the Global Market.

Premier Integration

PowerFlex drives offer seamless integration into the Logix environment for simplified and enhanced configuration, programming, diagnostics and maintenance. Using Studio 5000® Software, you’ll be able to reduce engineering time – and related costs – while improving the control and collection of data.
### PowerFlex 755 AC Drive Specifications

#### Ratings
- 400V: 0.75…1400 kW
- 480V: 1…2000 Hp
- 600V: 0.5…1500 Hp
- 690V: 5.5…1500 kW

#### Class of Service
- CMAA Class A – F Service
- AISE TR6 Class 1 – 4
- ASME HST – 4M H1 – H5

#### Speed Range
- V/Hz & Sensorless Vector Modes: 40:1 Speed Range, 40:1 Operating Range
- Flux Vector Mode (w/o Feedback), 100:1 Speed Range, 120 Operating Range
- Flux Vector Mode (with Feedback), 100:1 Speed Range, 1000:1 Operating Range

#### Motor Control
- Standard V/Hz with Full Custom Capability
- Sensorless Vector with Full Tuning
- Flux Vector with and without a Feedback Device
- Induction and Surface Permanent Magnet Motor Control

#### Speed Control Sources
- Up to 7 Distinct Stepped Speeds
- 2-Step Infinitely Variable
- 3-Step Infinitely Variable
- Analog (0 – 10V DC, 4 – 20 mA, +/- 10V DC)
- Digital Pulse Train Input/Output

#### I/O Interface
- (6) Digital Inputs 24V DC – Per Option Card
  - Opto Isolated Low State: Less Than 5V DC
  - High State: Greater Than 20V DC
  - 11.2 mA DC Max.
- OR (6) Digital Inputs 115V AC, 50/60 Hz - Per Option Card
  - Opto Isolated Low State: Less Than 30V AC

#### Communication Interface
- • Built-in EtherNet/IP port or Dual-Port EtherNet/IP option module
  • ControlNet
  • DeviceNet
  • Remote I/O
  • BACnet/IP
  • RS485 DFI
- • PROFIBUS DP
  • Modbus/TCP
  • HVAC (Modbus RTU, FLN P1, Metasys N2)
  • Profinet IO
  • LonWorks
  • CANopen

#### Safety
- Safe Torque Off
- Safe Speed Monitoring

#### Enclosure Types
- IP20/NEMA UL Type 1
- Flange Mount
- IP54
- ATEX

#### Applications
- Hoist, Traverse Functions, Combination with Speed/Position Profile Control, Combination with Axis Position Control (Consult Factory)
  - Bascule and vertical lift waterway bridges (qualified to ASHTO specs for wind loading of bridges)
  - Case palletizers for food and beverage packaging
  - Case pallet vertical reciprocating conveyors
  - Ski resort lifts and gondolas
  - Crane bridge, trolley and hoist
  - Paper roll overhead crane and Lowerators
  - Car chassis vertical drop/lift
  - Wood yards
  - Airline jet assembly elevators and work platforms
  - Multiple Crane bridge, trolley and hoist synchronized Master-Slave configurations

**Allen-Bradley drive technology has been successfully used for crane applications since 1940.**

**Over the years, we have provided solutions in a variety of different areas, including:**
## PowerFlex 7000 AC Drive Specifications

### Ratings\(^{(1)}\)
<table>
<thead>
<tr>
<th>Heavy Duty 150% OL</th>
<th>Heavy Duty 200% OL</th>
</tr>
</thead>
<tbody>
<tr>
<td>2400V: 200…1000 Hp</td>
<td>2400V: 200…750 Hp</td>
</tr>
<tr>
<td>3300V: 187…1500 kW</td>
<td>3300V: 187…1100 kW</td>
</tr>
<tr>
<td>4160V: 350…3350 Hp</td>
<td>4160V: 350…2500 Hp</td>
</tr>
<tr>
<td>6600V: 400…3000 kW</td>
<td>6600V: 400…2250 kW</td>
</tr>
</tbody>
</table>

### Class of Service
- Topology: PWM AFE Regenerative Braking
- Power Device: SGCT (Symmetrical Gate Commutative Thyristor)
- Switching Frequency: 420…440 Hz
- Rectifier Design: Direct-to-Drive (Transformerless AFE Rectifier)

### Speed Range
- Flux Vector Mode (with Feedback), 100:1 Speed Range, 1000:1 Operating Range

### O/P Frequency
- 0…85 Hz

### 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

### External I/O
- 16 Digital Inputs, 16 Digital Outputs

### External Input Ratings
- 50…60 Hz AC or DC
- 120…240V – 1 mA

### External Output Ratings
- 50…60 Hz AC or DC
- 30…260V – 1 A

### Analog Inputs
- Three Isolated, 4…20 mA or 0…10V (250 Ω)

### Analog Resolution
- Analog Input 12 Bit (4…20 mA)
- Internal Parameter 32 Bit Resolution
- Serial Communication 16 Bit Resolution (0.1 Hz) (Digital Speed Reference)

### Analog Outputs
- One Isolated, Eight Non-isolated, 4…20 mA or 0…10V (600 Ω)

### Communication Interface
- Ethernet I/P
- Dual-Port Ethernet I/P
- DeviceNet
- Modbus
- Interbus
- ControlNet
- Profibus RS485 DF1
- Lon Works
- Can Open
- USB

### Scan Time
- Internal DPI – 2 ms Min., 4 ms Max.

### Operator Interface
- 10” Color Touchscreen, Local or Remote Mounted Built-in PDF Viewer Configure Graphics

### Languages
- English, French, Spanish, Portuguese, German, Chinese, Italian, Polish and Russian

### Remote Monitoring Program
- Virtual Support Engineer

### Enclosure Types
- IP21
- IP42

### Applications
- Hoist, Draglines, Winches, Grinding Mills, Combination with Speed/Position Profile Control, Combination with Axis Position Control (Consult Factory)

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(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

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…1050 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

Enclosures
- IP20, NEMA/UL Type Open

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

Standard I/O and Feedback

<table>
<thead>
<tr>
<th>PowerFlex DC I/O and Feedback</th>
<th>(8) Digital Inputs</th>
<th>Max. +30V, 6.4 mA</th>
<th>(2) Relay Inputs</th>
<th>N.O. Contacts Max. 250V AC, 1 A</th>
</tr>
</thead>
<tbody>
<tr>
<td>(4) Digital Outputs</td>
<td>Max. +30V, 50 mA</td>
<td>Digital Encoder</td>
<td>Incremental, Dual Channel, Differential or Single Ended + 2.5…5.2V OR 5.4…15.2V</td>
<td></td>
</tr>
<tr>
<td>(3) Analog inputs</td>
<td>Isolated, differential +/− 10V or 4-20 mA 11 bit + sign</td>
<td>DC Analog Tach</td>
<td>Max. Voltage: 22.7/45.4/90/181.6/302.9V Max. Current: 8 mA</td>
<td></td>
</tr>
<tr>
<td>(2) Analog Outputs</td>
<td>+/− 10V, 5 mA 11 bit + sign</td>
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</tbody>
</table>

Optional I/O and Feedback

<table>
<thead>
<tr>
<th>Communication Interface</th>
<th>• EtherNet/IP</th>
<th>• HVAC</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>• BACnet</td>
<td>• Modbus/TCP</td>
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<td></td>
<td>• ControlNet</td>
<td>• PROFIBUS DP</td>
</tr>
<tr>
<td></td>
<td>• DeviceNet</td>
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</tbody>
</table>

Enclosure Types
- IP20

Applications
- Cranes, Hoists, Conveyors, Elevators, Palletizers, ASRS

For more information, see www.ab.com/drives

Rockwell Automation, Inc. (NYSE:ROK), the world’s largest company dedicated to industrial automation, makes its customers more productive and the world more sustainable. Throughout the world, our flagship Allen-Bradley® and Rockwell Software® product brands are recognized for innovation and excellence.

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