

PowerFlex® Medium Voltage AC Drives



Powerful Performance. Flexible Control.



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PowerFlex Medium Voltage AC Drives

Powerful Performance. Flexible Control.

As the global economy continues to expand, constraints to growth arise as energy demands approach power generating capabilities. Smart and efficient energy use is critical to sustainable economic expansion and a better environment.

Medium voltage motors are typically some of the largest consumers of power in many heavy industries. Applying variable frequency drives for these applications can dramatically help reduce power consumption and energy costs, along with increased process control and information sharing across your enterprise. The environment also benefits as reductions in power use directly correspond to lower CO₂ and other emissions from power plants.

Around the world, Allen-Bradley® PowerFlex® medium voltage drives from Rockwell Automation have built a reputation for providing efficient and reliable motor control for industry's most demanding applications.

Now, our PowerFlex medium voltage drive family can deliver the performance your application demands with a broader selection of drives and options.

The PowerFlex 7000 medium voltage product line is designed to meet a broad variety of heavy industry needs and configurations from 2.4 kV to 6.6 kV, with motor current up to 720 A for synchronous or induction motors. High performance, safety and robust communication features help improve asset utilization and lower safety risk for your critical applications from offshore oil platforms, natural gas or oil pipelines, mining sites, water/wastewater facilities, to marine applications and beyond.

PowerFlex 7000 medium voltage AC drives offer drive configurations and control options such as active front end (AFE) with Direct-to-Drive™ technology and high performance torque control to help meet application demands. Add to this, the Safe Torque Off control option, and the ArcShield™ arc-resistant enclosure option, and the PowerFlex 7000 drive can provide a complete solution that delivers higher performance and enhanced safety for your critical assets.





Trust Your Critical Applications to a Market Leader

Rockwell Automation®, the world's largest company dedicated to industrial automation and information, has been developing leading medium voltage motor control technology for over eighty years.

More than a decade ago (2005), we introduced the industry's first Active Front End (AFE) transformerless solution for medium voltage drives. Our continuous enhancements and trusted experience with Direct-to-Drive technology has allowed us to stay ahead of our competition and help reduce unforeseen risks to your critical applications.

In addition to our drive family, Rockwell Automation medium voltage solutions include Allen-Bradley motor controllers, soft starters and motor protection relays. We can develop and deliver complete power and control solutions, engineered to your specifications.

The PowerFlex 6000 medium voltage AC drive is designed to address applications from 2.3 kV up to 10 kV. These easy-to-use drives are well-suited for variable torque applications like simple, stand-alone centrifugal fans and pumps.

No matter where your applications are located – and whether your requirements are simple or complex, count on PowerFlex medium voltage drives for the optimal solution.

Drive Productivity with Medium Voltage PowerFlex AC Drives

We understand the challenges to increase production, while keeping the costs of sustaining operations down. That is why the PowerFlex medium voltage portfolio of drives has been designed to optimize production. From robust hardware with a low parts count, a design for quick maintenance, and communication options for seamless integration into your control system, PowerFlex medium voltage drives deliver a solution to optimize production processes, increase profits and reduce costs.

A key to productivity is the access to valuable information from your systems. Better information leads to higher asset availability, reduced energy and maintenance costs, and personnel and asset protection – all resulting in an increased return on your investment and real bottom-line savings.



PowerFlex 6000 Medium Voltage AC Drives

Cost-Effective Variable Torque Control



Automatic Power Module Bypass

In the unlikely event of a power module failure, the automatic power module bypass option allows the PowerFlex 6000 drive to bypass that power module, along with the corresponding modules in the other two phases, so that the drive will remain running at a reduced capacity, providing time to plan for a scheduled shut-down.

- Helps achieve less downtime in your critical applications
- Available up to 200 amp configurations

Particularly suitable for new and retrofit centrifugal fan and pump applications, PowerFlex 6000 drives provide cost-effective solutions for motor control applications from 200 kW to 5600 kW (190 Hp to 7500 Hp), for motors rated from 2.3 kV to 10 kV.

Air-cooled PowerFlex 6000 drives are designed to maximize energy efficiency by enabling soft-starting and variable-speed control in normal duty applications.

To achieve low input harmonics and near-unity power factor, the drives utilize a Cascaded "H" Bridge (CHB) topology. This topology combines an integrally mounted phase-shifting isolation transformer with series-connected power modules for each phase.

PowerFlex 6000 AC drives allow for flexibility in a variety of applications and are available in many configurations based on motor voltage and available to meet either IEC or UL/CSA requirements.

The PowerFlex 6000 drive portfolio includes:

18-Pulse Rectifier (2.3 - 3.3 kV)

IEC: For motors from 160...1815 kW (214...2433 Hp) at 3/3.3 kV (up to 420 Amps)

UL/CSA: For motors from 137...702 kW (183...941 Hp) at 2.3/2.4 kV (up to 200 Amps)

24-Pulse Rectifier (4.16 kV)

IEC: For motors from 225...2350 kW (300...3150 Hp) at 4/4.16 kV (up to 420 Amps)

UL/CSA: For motors from 225...1220 kW (300...1635 Hp) at 4/4.16 kV (up to 200 Amps)

36-Pulse Rectifier (6.0 - 6.6 kV)

IEC: For motors from 200...3685 kW (268...4986 Hp) at 6/6.6 kV (up to 420 Amps)

UL/CSA: For motors from 300...1940 kW (400...2600 Hp) at 6/6.3/6.6 kV (up to 200 Amps)

54-Pulse Rectifier (10 kV)

IEC: For motors from 200...5600 kW (268...7500 Hp) at 10 kV (up to 420 Amps)



User-Friendly Control for Variable Torque Applications

The PowerFlex 6000 drive provides a cost-effective, simple solution for new and retrofit variable torque applications.

- Controls speed, stopping and starting of normal duty induction motors, to **improve asset utilization** in your critical applications
- **Improves efficiency** by operating at near unity power factor throughout the speed range
- Integrally mounted multi-pulse isolation transformer helps ensure low line-side harmonics and high input power factor, **improving asset utilization and lowering enterprise risk**
- Automatic power module bypass helps achieve **less downtime** in your critical applications (optional), available up to 200 amp configurations
- All power modules are identical and designed for easy removal **minimizing mean time to repair (MTTR)**
- Include an intuitive, **easy-to-use**, color touchscreen operator interface to monitor and control your application
- Standard supplied on-line UPS helps **improve your asset utilization**
- Self-powered cooling fans **reduce customer supplied power requirements**
- Key and electromechanical interlocks help protect personnel from exposure to medium voltage for **added safety**



PowerFlex 6000 drive



PowerFlex 7000 Medium Voltage AC Drives

Efficient & Integrated High-Power Performance



Control Options

Safe Torque Off

Help save time and costs through decreased downtime, while helping to protect personnel and property from preventable accidents by increasing the functional safety of your system with Safe Torque Off. This feature is TÜV Certified and helps achieve requirements for SIL 3/PLe/IEC 61508/ISO 13849-1. This option is available for AFE PowerFlex 7000 drives.

High Performance Torque Control

PowerFlex 7000 medium voltage AC drives now offer the option of zero speed holding torque control capabilities and TorqProve control. Ideal for applications such as hoists, drag lines, winches and test stands, the PowerFlex 7000 drive can now deliver 100% torque at zero speed. This control capability continuously helps to control torque around zero speed and provides a higher drive speed and torque response required for these applications. This option is available for AFE PowerFlex 7000 drives.

The Allen-Bradley PowerFlex 7000 family of medium voltage AC drives deliver flexibility and high-power performance in a single solution for motor control applications from 150 kW to 25,400 kW (200 Hp to 34,000 Hp), rated from 2.4 kV to 6.6 kV.

To help reduce energy costs and motor wear and tear, PowerFlex 7000 drives enable soft-starting and variable-speed control of processes with high power demands. Our portfolio provides virtually perfect current and voltage waveforms to allow the use of standard or existing motors and motor cables.

Thanks to advanced power semiconductor technology and a simple, straightforward design, the drive's component count is the lowest of any medium voltage drive available. The result? Increased reliability, less downtime and fewer spare parts. To achieve even more efficiency, choose a configuration with Direct-to-Drive™ technology – and connect a motor directly to the drive without an isolation transformer.

PowerFlex 7000 drives incorporate information and communication capabilities and an intuitive, easy-to-use, color touchscreen operator interface to monitor and control your processes – and optimize performance and maintenance.

The PowerFlex 7000 portfolio includes:

PowerFlex 7000 Air-Cooled Drives

For motors from 150 kW to 6000 kW (200 Hp to 8000 Hp) at 2.4 kV to 6.6 kV. This drive offers different frame sizes and heat sink or heat pipe configurations to accommodate various power ranges.

PowerFlex 7000 Liquid-Cooled Drives

For motors from 2240 kW to 6340 kW (3000 Hp to 8500 Hp*) at 4.16 kV to 6.6 kV, this option uses a closed-loop liquid-cooling system with liquid-to-air or liquid-to-liquid heat exchanger options and provides redundant pumps as standard, for optimal reliability.

PowerFlex 7000 Marine Drives

With power ratings from 600 kW to 24 MW (800 Hp to 32,000 Hp), these liquid-cooled marine drives use Direct-to-Drive technology to conserve space and weight and is built to withstand the rigors at sea.

PowerFlex 7000 Extended Power Configurations

Available up to 25,400 kW (up to 34,000 Hp), these high power air-cooled and liquid-cooled drive modules are effective solutions for hot back-up and redundancy, Load Commutated Inverter (LCI) retrofits and power upgrades.

Control Options:

Safe Torque Off
High Performance Torque Control with TorqProve
Synchronous Transfer

Enclosure Options:

ArcShield™ arc resistant enclosures
IP42

* Ratings for single drive channel configuration



PowerFlex 7000 air-cooled drive (720A configuration with high efficiency heat pipe technology)

Capabilities Across a Broad Range of Applications

The PowerFlex 7000 drive is a flexible, easy-to-use solution designed to meet diverse application requirements across a wide spectrum of heavy industrial settings.

- Controls **speed, torque and direction** of induction or synchronous AC motors, **normal duty or heavy duty**
- **Broad power range:** 150 kW to 25,400 kW (200 Hp to 34,000 Hp)
- Achieves **near unity power factor** throughout the typical operating speed range for variable torque loads
- Virtually perfect sinusoidal current and voltage waveforms **allow use of standard motors**
- Accommodates **motor cable lengths up to 15 km** without a filter
- **EtherNet/IP™** communication interface. Optional interfaces for a variety of network protocols
- Drive control: Sensorless vector control or **full vector control** with tachometer feedback (optional)
- **Flexible input configurations:** Direct-to-Drive (transformerless), Active Front End (AFE) rectifier or 18-pulse rectifier
- Patented PowerCage™ allows **SGCT replacement in less than ten minutes**
- Achieve requirements for Safety Integrity Level 3 (SIL 3) and Performance Level e (PL e) with TÜV **certified Safe Torque Off**
- **Premier Integration** into the Logix control platform with Studio 5000 Logix Designer™ software **reduces development and integration time**
- **Help reduce downtime** with built-in diagnostic and detection features that monitor the health of drive components
- Synchronous bypass and transfer to control **multiple motor systems**
- Local and remotely mounted **HMI options.**
- Remote **Virtual Support Engineer™** service available
- **ArcShield arc resistant drive systems** help provide protection from arc flash incidents



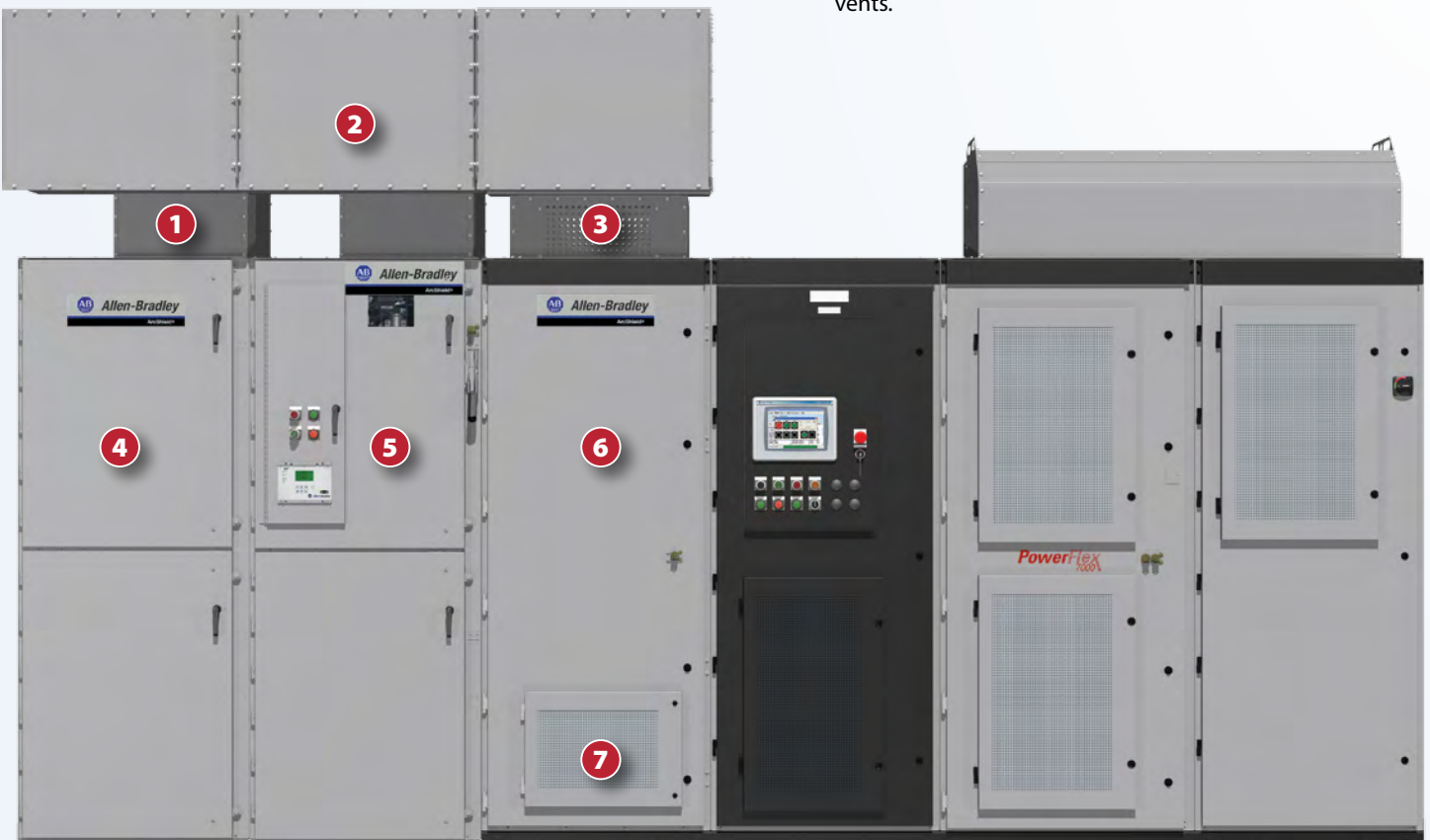
PowerFlex 7000 Drive System with ArcShield

Meeting Safety Standards with an Effective Design

The PowerFlex 7000 drive system with ArcShield is a fully integrated Allen-Bradley® CENTERLINE® starter and PowerFlex 7000 drive combination. Standalone, fully integrated systems and systems that are designed to work with existing Allen-Bradley medium voltage starter lineups are available – providing either a 40 kA or 50 kA arc fault rating.

Designed to redirect the energy that is created from an arc flash event, out the top of the enclosure and away from personnel, Type 2B accessibility helps protect personnel while in front, at the side, or behind the enclosure in the event of an arcing fault. Additionally, Type 2B protection is maintained when the low voltage control door is open for maintenance purposes.

- 1** Pressure relief vents direct arc gases and material away from the front, rear and sides of the enclosure during an arc flash.
- 2** Gases and materials are vented up and out of the top of the enclosure through the plenum exhaust system.
- 3** Patented self-closing vent plates prevent arc flash gases from escaping through the fan exhaust vents.
- 4** Cabinet doors are reinforced with welded channels designed to maintain structural integrity during an arc flash.
- 5** Robust cabinet construction, including reinforced side sheets, doors, roof, and back plates are designed to increase rigidity to contain the arc fault energy.
- 6** High strength hinges, latches and bolts securely attach door to cabinet for added protection.
- 7** Patented self-closing vent plates prevent arc flash gases from escaping out through front air intake vents.



Fully integrated 50 kA rated PowerFlex 7000 Drive System with ArcShield Technology

Optimize Your Solution

Comprehensive Testing & Training

When you select a PowerFlex medium voltage drive, you are assured of a solution that is thoroughly tested – before it arrives at your facility.

Rockwell Automation performs load testing of medium voltage drives on medium voltage induction motors installed in our test facility, this test allows for simulation of two load profiles:

- Constant torque – conveyor, hoist, grinding mills and reciprocating compressor applications, etc.
- Variable torque – pump, fan and centrifugal compressor applications, etc.

We can also conduct combined testing of your motor and the drive – and test large transformers with the drive system.

In addition, our testing facilities offer extensive hands-on training sessions focused on programming and safely operating and servicing your PowerFlex drive.

To meet the needs of our global customers, production, training, and testing facilities are located in:

- Cambridge, Canada
- Harbin, China
- Jundiai, Brazil
- Katowice, Poland

Global Support – Locally

At Rockwell Automation, we build our PowerFlex medium voltage drives at manufacturing locations around the world – in Asia, Europe, Latin America and North America. Building our drives locally shortens your delivery time and reduces shipping costs – and is one more way we help lower your total cost of ownership.

Protect Your Investment

By leveraging our global infrastructure of support centers and subject matter experts, we're here to help you protect your automation investment. Real-time access to our global network of technical support engineers and online resources or services performed at your site to supplement maintenance and engineering activities are available to help keep your facilities up and running.

Maximize Your Uptime with Virtual Support Engineer

Keeping your system healthy is paramount. That's why we offer Virtual Support Engineer.

Through this service, Rockwell Automation technical support engineers proactively monitor your drive's critical performance parameters – remotely.

If your system experiences a fault, warning, or performs out of its defined tolerance, you are immediately notified via email or text message. In addition, system data and analytics are available on the web, including from mobile devices.

This scalable, cost-effective solution provides you the support you need – and features simple and secure one-way connectivity through a standard internet connection.

Real-time Remote Monitoring & Alarming

- Guaranteed response time by Rockwell Automation Remote Support Engineers
- Immediate notification by a Rockwell Automation engineer of issues via email or text message

Data Collection & Analytics

- Data and analytics available on the web, including from mobile smart devices (iPhone, iPad and Android devices)
- View alarm data and analytics, status, uptime and warning/fault queues through a single portal
- Look at multiple systems or locations in one portal

Simple & Secure Connectivity

- Secure socket layer (SSL) through a standard internet connection
- No inbound packet transfer for a secure connection

Scalable, Cost-Effective Solution

- Remotely configurable interface
- Select only the support you need

PowerFlex Medium Voltage AC Drives

POWERFLEX AC DRIVES

Description

Power Rating Range @ 2.3/2.4 kV

Power Rating Range @ 3 kV

Power Rating Range @ 3.3 kV

Power Rating Range @ 4/4.16 kV

Power Rating Range @ 6 kV

Power Rating Range @ 6.3 kV

Power Rating Range @ 6.6 kV

Power Rating Range @ 10 kV

Motor Type

Input Voltage Rating

Input Voltage Tolerance

Input Voltage Sag

Input Frequency

Input Power Factor

Input Impedance Device

VFD Efficiency

VFD Noise Level

Output Voltage

Overload Capacity

Rectifier Configurations

Rectifier Switch

Inverter Configuration

Inverter Switch

Output Current THD
(1st...49th)

Output Waveforms to Motor

PowerFlex® 6000



Air-Cooled

PowerFlex® 7000



Air-Cooled



Liquid-Cooled

(UL/CSA) 137...702 kW (183...941 Hp)	150...1500 kW (200...2000 Hp)	—
(IEC) 160...1650 kW (214...2211 Hp)	—	—
(IEC) 176...1815 kW (235...2432 Hp)	187...3600 kW (250...4750 Hp)	—
(IEC) 220...2350 kW (294...3150 Hp) (UL/CSA) 225...1220 kW (300...1635 Hp)	261...4400 kW (350...5750 Hp)	2240...3900 kW (3000...5000 Hp)
(IEC) 200...3350 kW (268...4490 Hp) (UL/CSA) 300...1753 kW (402...2350 Hp)	—	—
(UL/CSA) 286...1852 kW (384...2482 Hp)	—	—
(IEC) 220...3685 kW (294...4939 Hp) (UL/CSA) 300...1940 kW (400...2600 Hp)	400...6000 kW (500 ... 8000 Hp)	3000... 5595 kW (4000... 7500 Hp)
(IEC) 200...5600 kW (268...7506 Hp)	—	—
Induction motor	Induction or synchronous motor	
(IEC): 3 kV, 3.3 kV, 4.16 kV, 6 kV, 6.6 kV, 10 kV (UL/CSA): 2.4 kV, 4.16 kV, 6.6 kV, 6.9 kV	2.4 kV, 3.3 kV, 4.16 kV, 6.6 kV	4.16 kV, 6.6 kV
±10% of nominal	±10% of nominal	
-20% of nominal, duration 60 seconds	-30% of nominal, continuous with derating	
50/60 Hz, ±5%	50/60 Hz, ± 5%	
>.95	>.95 (AFE Rectifier)	
Multiphase isolation transformer	Line reactor (Direct-to-Drive AFE), isolation transformer (AFE), or multiphase isolation transformer (18 Pulse)	
> 96%*	> 97.5% (Direct-to-Drive AFE), > 98% (18 Pulse)	
< 80 dB (A)	< 85 dB (A)	
0...2300/2400 V, 0...3000 V, 0...3300 V, 0...4000/4160 V, 0...6000 V, 0...6300 V, 0...6600 V, 0...10,000 V	0...2300 V, 0...3300 V, 0...4000 V, 0...6600 V	0...4000 V, 0...6600 V
120% overload for 1 min every 10 min	110% overload for 1 min every 10 min (normal duty/variable torque load) 150% overload for 1 min every 10 min (heavy duty/constant torque load)	
18-Pulse, 24-Pulse, 36-Pulse, 54-Pulse	Direct-to-Drive™ (transformerless AFE rectifier) AFE with separate isolation transformer AFE with integrated transformer 18-Pulse with separate isolation transformer	Direct-to-Drive™ (transformerless AFE rectifier) AFE with separate isolation transformer 18-Pulse with separate isolation transformer
Diodes	SGCTs (AFE Rectifier), SCRs (18 Pulse)	
Pulse Width Modulated (PWM) power modules	Pulse Width Modulated (PWM) power modules	
IGBTs	SGCTs	
< 5%	< 5%	
Near sinusoidal current and voltage	Near sinusoidal current and voltage	

POWERFLEX AC DRIVES

Medium Voltage Isolation

Control Method

Speed Regulation

Output Frequency Range

Acceleration/Deceleration
time

Flying Start Capability

Regen Motor Braking

Operator Interface

Languages

Control Power

External Input Ratings

External Output Ratings

Analog Inputs

Analog Outputs

Communications Protocols
(Optional)

Motor Cable Length

Safety

Enclosure

Arc Resistance Enclosure

Ambient Temperature
(Operating)

Ambient Temperature
(Storage)

Relative Humidity

Altitude

Design Standards

PowerFlex 6000



Air-Cooled

PowerFlex 7000



Air-Cooled



Liquid-Cooled

Fiber optic	Fiber optic	
Volts per hertz	Digital sensorless direct vector Full vector control with encoder feedback (Optional)	
0.1%	0.1% without encoder feedback 0.01-0.02% with Encoder Feedback	
0.5...75 Hz	0.2...75 Hz (Standard) 0.2...85 Hz (Optional)	
0...3276 seconds	0...4800 seconds	
Yes	Yes	
No	Yes	
7" WinCE Color Touchscreen	10" WinCE color touchscreen	
English, French, Spanish, Portuguese, German, Chinese, Italian, Russian, and Polish	English, French, Spanish, Portuguese, German, Chinese, Italian, Russian, and Polish	
120 V 60 Hz, 240 V 60 Hz, 110 V 50 Hz, or 220/230 V 50 Hz (3 KVA)	220/240 V or 110/120 V, Single phase - 50/60 Hz (20 A)	
24V DC	50...60 Hz AC or DC 120...240 V - 1 mA	
240V AC/2A	50...60 Hz AC or DC 30-260 V - 1 A	
(4) non- isolated, 4-20 mA or 0-10V DC	(3) isolated, 4-20 mA or 0-10V	
(2) isolated: 4-20 mA (2) isolated: 0-5V DC	(1) isolated: 4-20 mA, (8) non-isolated: 0-10V (600 Ω)	
EtherNet/IP, RS232/422/485, Modbus, Modbus Plus, Profibus DP	EtherNet/IP, RI/O, DeviceNet, Lon Works, Can Open, Profibus DP, RS485 HVAC, Modbus, RS485 DF1, Interbus, RS232 DF1, ControlNet, USB	
Up to 300 m (984 ft) (Contact factory for longer cable requirements)	15 km (9.3 mi)	
Keyed Mechanical Interlock	Keyed Mechanical Interlock Safe Torque option	
IP31 (standard)	Type 1/IP21 (standard), Type 1/ IP42 (optional)	
No	Yes , ArcShield option available (not available with liquid cooled drives)	
0...40° C (32...104° F) (standard) 0...50° C (32...122° F) (optional)	0...40° C (32...104° F) (standard) 0...50° C (32...122° F) (optional)	
-25° ...55° C (-13...133° F)	-40° ...70° C (-40...158° F)	
Max 95% non-condensing	Max 95% non-condensing	
0...1000 m (0...3280 ft) (standard) 1001...3000 m (3284...9843 ft) (optional)*	0...1000 m (0...3280 ft) (standard) 1001...5000 m (3284...16404 ft) (optional)*	
UL, CSA, IEC, CE	NEMA, ANSI, IEEE, UL, CSA, IEC, CE, EEMAC	

* above 1000m contact factory

Rockwell Automation Services & Support





Global Support. Local Address. Peace of Mind.

Providing the resources you need, when and where you need them, Rockwell Automation has an integrated, global network of ISO-certified repair centers, exchange hubs, field service professionals, IACET-recognized training centers, certified technical phone support centers and online tools.





www.rockwellautomation.com/go/services



Meet Your Everyday Technical Needs

Remote Support & Monitoring	Training Services	OnSite Services	Repair Services
<ul style="list-style-type: none"> Real-time product, system and application-level support Unlimited online resources and tools Live chat and support forums Secure equipment monitoring, alarming and diagnostics 	<ul style="list-style-type: none"> Instructor-led and computer or web-based courses Virtual classroom Training assessments Workstations and job aids 	<ul style="list-style-type: none"> Embedded engineering Preventive maintenance Migrations and conversions Start-up and commissioning 	<ul style="list-style-type: none"> Product remanufacturing Repair services on a full range of industrial automation brands and products Annual repair agreements 

Maximize Your Automation Investment

MRO Demand Management	Lifecycle Extension & Migrations	Network & Security Services	Safety Services
<ul style="list-style-type: none"> Comprehensive asset management planning Reliability services Warranty tracking Quick access to global spare parts inventory 	<ul style="list-style-type: none"> Installed Base Evaluation™ Pinpoint obsolescence risk Tools and lifecycle support service agreements to mitigate production risk 	<ul style="list-style-type: none"> Control system lifecycle services Manage network convergence Security technology, policies and procedures services 	<ul style="list-style-type: none"> Safety assessments and remediation Safety design, integration and validation services 

Visit the Rockwell Automation Support Center at www.rockwellautomation.com/knowledgebase

for technical information and assistance, plus:

- View technical/application notes
- Obtain software patches
- Subscribe for product/service email notifications
- Submit a Question, Live Chat, Support Forums and more

Visit Get Support Now at www.rockwellautomation.com/go/support to select your country and find your local support information.



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