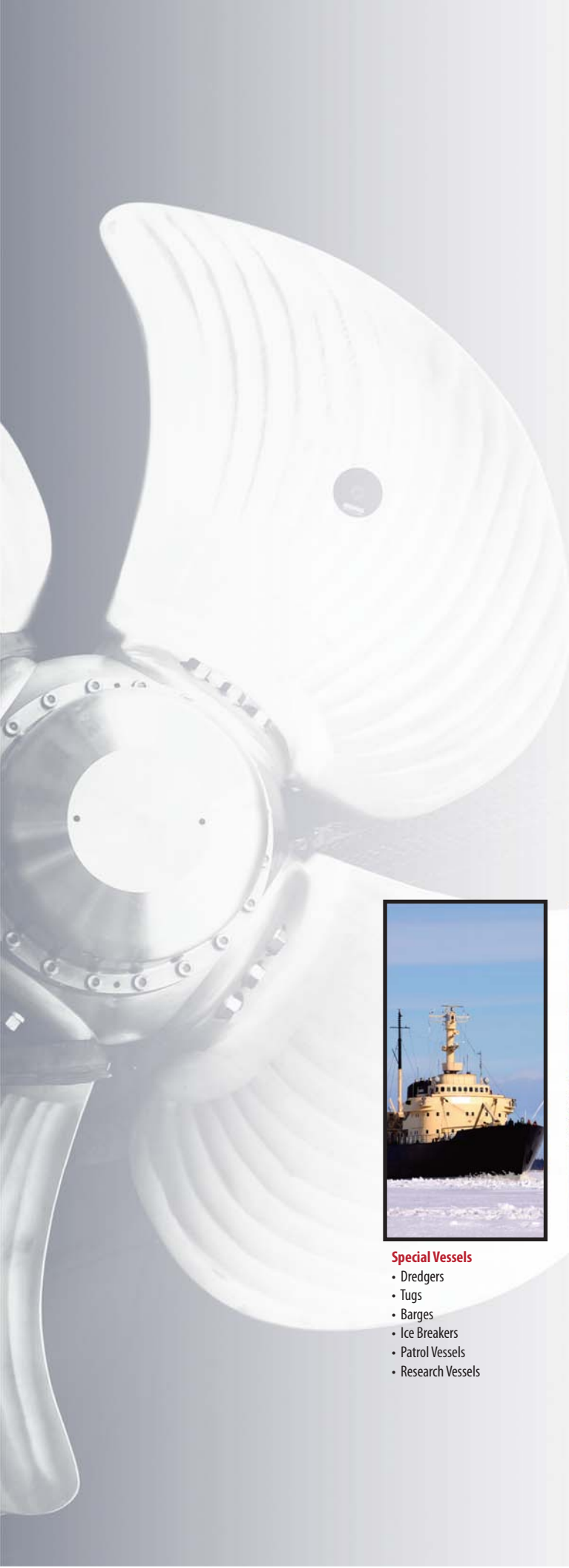


Medium Voltage Solutions for Marine Applications

Driving Efficiency Aboard Your Vessel



LISTEN.
THINK.
SOLVE.™



Propelling Efficiency and Performance to New Heights

Rising energy costs. Increasing environmental regulation. Accelerating demand for larger, multi-use ships. When it comes to designing high-performance, cost-effective diesel electric vessels, today's ship builders are faced with daunting challenges.

And for each new challenge you face, you must find a solution that can withstand the rigors of a marine environment while conserving space and weight – and optimizing maintenance at sea.

Rockwell Automation medium voltage solutions for marine applications are built to help you achieve the environmentally friendly, high operating efficiency of diesel electric propulsion in a simplified, space-saving design.

What's more, our complete solution extends to provide enhanced shipboard control and protection to keep all your motor systems up and running at optimal levels.

No matter what type of vessel, you can count on our medium voltage solutions to propel the efficiency and performance of your ship to new heights.



Special Vessels

- Dredgers
- Tugs
- Barges
- Ice Breakers
- Patrol Vessels
- Research Vessels



Cruise and Ferry

- Cruise Ships
- Ferries
- Yachts



Merchant

- Bulk Carriers
- Container Ships
- LNG Tankers
- Shuttle Tankers
- Chemical Carriers



Offshore

- Platform Support Vessels
- Offshore Supply Vessels
- Drilling Ships
- Anchor Handlers
- Platforms
- Mobile Crane Vessels

Optimal Operation Starts Here

From the main propulsion and thrusters to pumping and auxiliary systems, Rockwell Automation applies medium voltage technology to streamline ship system design and installation – while providing the control your application demands.

Our medium voltage solutions for marine applications are based on proven technology long-recognized for reliable performance in harsh industrial environments. Now, you can deliver the same control, protection and efficiency to your marine applications with these solutions:

PowerFlex® 7000 Medium Voltage Drives: Available in a broad range of power ratings, these drives feature a compact, transformerless design and control speed, torque, direction, starting and stopping of standard induction or synchronous AC motors. Marine applications include main propulsion, thrusting and auxiliary systems.

SMC™ Flex Medium Voltage Soft Starters: This solid-state reduced voltage controller applies a full range of starting and stopping methods and includes motor protection, communication and diagnostic capabilities. Marine applications include firefighting pumps, cargo pumps, and hydrolic winches.

Medium Voltage Motor Controllers:

Our motor controllers offer a range of control formats and can incorporate IntelliCENTER® technology, an integrated hardware, software and communication solution featuring plug-and-play functionality and real-time diagnostic information to speed installation and maintenance. Marine applications include drive input/output control and isolation and auxiliary hardware applications, such as pumps.

Medium Voltage Switchboards:

Custom designed for your offshore requirements, medium voltage switchboards are a key component of our marine power management system.



Medium Voltage PowerFlex 7000 Drive, SMC Flex Soft Starter and Full Voltage Controller

Our complete solution is a green solution.

The Rockwell Automation medium voltage solution for marine applications extends motor control and power management across the entire ship to improve vessel efficiency and reduce environmental impact. From soft starting to active power factor control and condition monitoring, our solution is designed to optimize generator loading and diesel engine operation – and decrease greenhouse emissions.



PowerFlex 7000 Medium Voltage Marine Drive

Simply Better at Sea

Your main propulsion and thruster systems are among the most costly – and energy-intensive – applications aboard your vessels. With power ratings from 600 kW to 24 MW, the liquid-cooled PowerFlex 7000 marine drive provides the soft-starting and variable speed control you need to significantly improve your energy efficiency.

At the same time, these drives implement advanced intelligent motor control technology to enable real-time condition monitoring and control of your processes.

More efficiency, enhanced control – in one marine-certified, cost-effective solution.

Smaller. Lighter. Simpler Power Structure

The PowerFlex 7000 marine drive simplifies your ship's power structure with Direct-to-Drive™ technology. This technology combines an Active Front End (AFE) rectifier, SGCT power semiconductors and common mode voltage protection so you can connect directly to shipboard generation systems – without a bulky isolation transformer. You can also connect any new or existing motor directly to the drive without additional motor filtering.

The result? Lower capital investment, faster installation, fewer parts – and a much lighter, smaller footprint.

Marine-Optimized Control

Built for higher flexibility, controllability and protection, the PowerFlex 7000 marine drive provides load sharing control for various propulsion schemes – and is ideal for redundant propulsion drive systems.

To help prevent blackout conditions, the drive features a unique built-in power limit interface that manages the drive power consumption with respect to the load and available generation capacity. And if your application requires dynamic braking, it can be designed into the drive with an optional integrated package.

Seaworthy Packaging

Sea conditions, propeller blade frequency and other equipment operation cause unique shock and vibration conditions aboard ships. The PowerFlex 7000 marine drive incorporates sheet metal, bracing and mechanical modifications specifically designed to meet shipboard installation, mitigate vibration – and comply with marine standards.

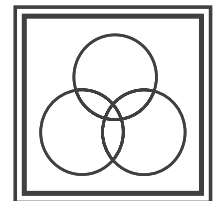
Easy-to-Use. Easy-to-Maintain.

From initial system programming to operation and maintenance, the PowerFlex 7000 marine drive is designed for ease-of-use and maintainability. Installation and set-up wizards simplify commissioning and start-up. And the integral, multi-lingual operator interface delivers online messaging and system alerts to make it easy to control and monitor your system.

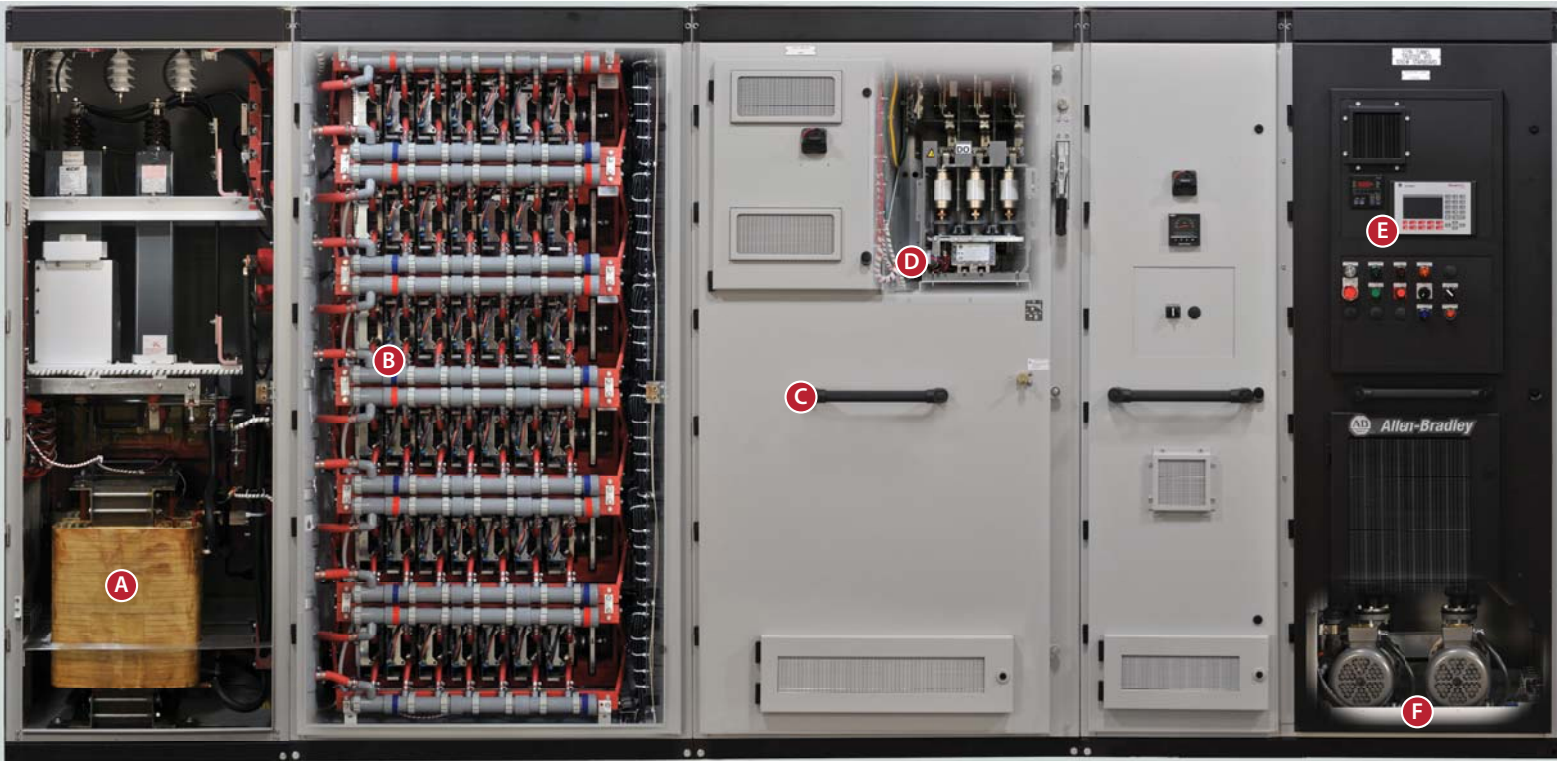
A straightforward design and front access to the equipment – plus simplified tools and instruction sets – reduces Mean Time to Repair (MTTR). Our patented PowerCage® enables power semiconductor device change-out in less than ten minutes.



Why buy a drive phase shifting transformer if you don't need one?



Transformers typically weigh 4 500 kgs (9 920 lbs) or more and take up more than 5 m³ (180 sq feet) of ship space.

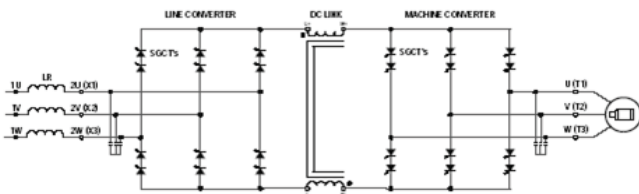


The PowerFlex 7000 MV marine drive conserves space and streamlines installation and maintenance, thanks to a straightforward, transformerless design and simplified cabling.

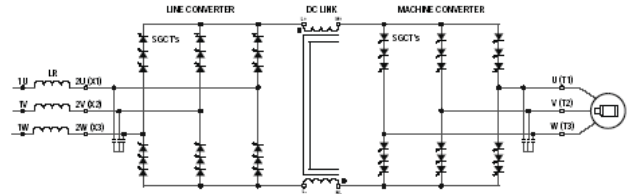
- A** Integral line reactor eliminates the need for an isolation transformer.
- B** PowerCage allows fast semiconductor change-out, less than 10 minutes.
- C** Grab handles designed for shipboard installation.
- D** Output contactor & isolating switch provide ability to isolate motor.
- E** Multi-lingual, user-friendly operator terminal.
- F** Redundant pump for liquid-cooling system.

Simple Power Structure

A space-saving topology minimizes the design footprint and drives reliability with a low component count. And the "3 cables in, 3 cables out" configuration reduces installation time.

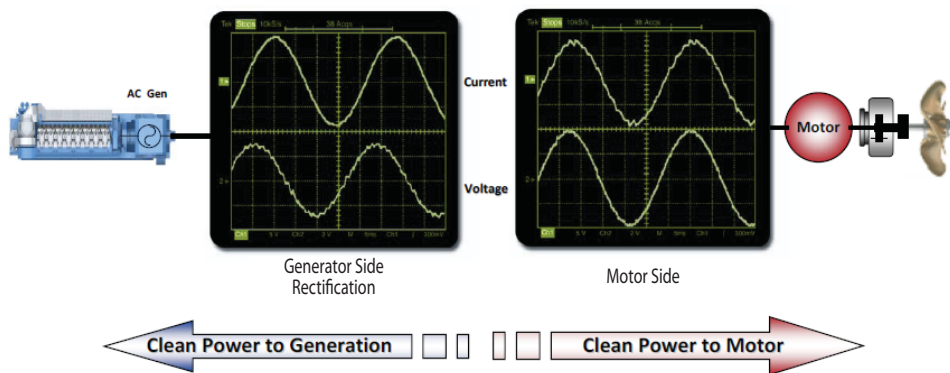


3300-4160V: 12 Rectifier Devices + 12 Inverter Devices = 24 total devices



6000-6600V: 18 Rectifier Devices + 18 Inverter Devices = 36 total devices

Active Front End (AFE) Technology



PowerFlex 7000 AFE technology mitigates input harmonics, providing compatibility with shipboard generation supply networks.

Near sinusoidal output current and voltage waveforms result in compatibility with new or existing standard motors (inverter duty motors not required).



The semiconductors, cooling system and gate connections are all packaged in a patented molded housing – the PowerCage.

- *Easy access for maintenance and repair with simple tools*
- *No need to remove any water connections or large power modules.*

Ensuring the Voyage

When you work with Rockwell Automation, you engage a dedicated marine team including industry sales specialists, commercial engineering managers, project managers and application engineers – all focused on the challenges you face.

We'll work with you and your partners – your prime contractor, shipyard or marine integrator. Or, we'll build an extended team by tapping the marine expertise that resides within our PartnerNetwork™ program. Our program provides you with access to a global network of best-in-class companies including distributors, system integrators, machine builders, alliances and complementary product providers.

Beyond our solution delivery capabilities, we will assess your entire operation and recommend the right mix of services and support to meet your everyday technical needs and maximize your automation investment.



*From project concept through support, our team provides a full scope of capabilities to deliver value to your marine application – **at sea or in port.***

Meeting your everyday technical needs

- Online and Phone Support
- Training Services
- OnSite Support
- Repair Services

Maximizing your automation investment

- MRO Asset Management
- Network and Security Services
- Safety and Energy Services
- InSite Managed Services

PowerFlex 7000 Medium Voltage Marine Drive

Technical Specification

| Drive Designs | 18-Pulse | | Transformerless Active Front End (AFE) Rectifier | | |
|---|---|------------------|---|------------------|-----------------|
| Output Power Range (Induction Machine Ratings) | Input Voltage | 4160 V | 6600 V | 4160 V | 6600 V |
| | Single Power Unit | 800 Kw – 3.6 MW | 800 Kw – 6 MW | 800 Kw – 3.25 MW | 800 Kw – 5.2 MW |
| | Double Power Units | 1.6 MW – 7.2 MW | 1.6 MW – 12 MW | 1.6 MW – 6.5 MW | 1.6 MW – 10 MW |
| | Quad Power Units | 3.2 MW – 14.4 MW | 3.2 MW – 24 MW | 3.2 MW – 13 MW | 3.2 MW – 2 1MW |
| Main Supply Voltage (50/60 Hz) | | 4160 V | 6600 V | 4160 V | 6600 V |
| Motor Voltage | | 4000 V | 6600 V | 4000 V | 6300 V |
| Line Input Power Factor | 0.95 | | 1.0 (Unity) | | |
| Efficiency at Rated Load | > 96. % | | > 97.5% | | |
| Impedance Device | Multi-Phase Shifted Transformer | | Line Reactor | | |
| Inverter Output Frequency | 50 / 60 HZ Max 75 Hz Please contact Rockwell Automation for lower design base frequency. | | | | |
| Output Power Factor | Asynchronous motor (Induction) : typically > 0.84; Synchronous motor (AC Brushless) : .95 | | | | |
| Auxiliary Control Voltages | 3 x 400 to 690 V AC – 50 / 60 Hz | | | | |
| | 1 x 120/230 V AC from external uninterrupted power supply | | | | |
| External Cooling Water (Customer Supplied) | Inlet Temperature: min. 5°C, max. 36°C (max. 42°C with derating) | | | | |
| | Pressure Drop: 7 to 43 kPa depending on heat exchanger design | | | | |
| | Customer Supplied Fresh Water Flow Rate: 100 – 300 Liters per minute depending of power converter topology Heat Exchanger placement integrated into pumping cell | | | | |
| General Design Features | | | | | |
| Protection Class (Cabinetry) | IP21 , IP42 , Optional IP44 , with Gasketing , with Key interlocking system | | | | |
| Power Cable Entry / Exit | Top or bottom | | | | |
| Control Cable Entry / Exit | Top or bottom | | | | |
| Cooling Supply | Top, bottom or side | | | | |
| Applicable Standards | IEC 61800-3, 61800-4, 61800-5-1, EMC Directive 89 / 336 /EEc, CE, UL 508C, UL347A, IEC 60068-2-6 (Fc) | | | | |
| Operating Ambient Temperature | Min. + 5°C, max. +45°C Operation below 0 °C. Please contact Rockwell Automation for lower design rating. | | | | |
| Cabinetry Color | RAL 7035 Light Sandtex Gray, RAL 9004 Black: Control Doors and Wireway Covers | | | | |
| Weight | Approx. 1500 kg/m length | | | | |
| Control Interfaces | I/O - Digital Control | | | | |
| Analog Interfaces | 4 Selectable and Scalable Channels (0-10 V , 4 – 20 MA) | | | | |
| Serial Communications Interfaces | Options: Ethernet , Profibus, Modbus. Please contact Rockwell Automation for information on other industry-standard communications interfaces. | | | | |
| Marine Design Features | | | | | |
| Marine Standards | IEC 6000092m UEC 721-3-6m UEC 68-2-(1,2,6,30,52). | | | | |
| Marine Certification | CE marking according to EU directives Available for Lloyd's, DNV, ABS, BV and others upon request | | | | |
| Standard Design Features | Local Control Hardware – Operator Interface, Stop, Start, E stop, speed reference, Auto – Manual, Local – Remote | | | | |
| Hardware | Vibration Design .7 G in frequency range of 13.2 – 100 Hz | | Door Positioners | | |
| | Maritime Handgrips for Doors | | Flame-retardant Properties | | |
| | Anti-condensation Heaters | | Halogen-free Wiring | | |
| | Conformal Coating | | Grounding Balls | | |
| | Drip Shields | | Cabling Compartments with Power Bus and Grounding Bus | | |
| | PMS Control Interface I/O | | 25 Degree Inclination | | |

Choose Rockwell Automation for a Complete Marine Solution

To complement our medium voltage solutions, Rockwell Automation provides the additional capabilities you need for a complete control and information solution aboard your vessels. Through our Integrated Architecture system, we will help you apply one scalable infrastructure to drive efficiency, flexibility and productivity across your ship – and while in port.

Capabilities include:

Programmable Controllers

Allen-Bradley® programmable controllers are built for reliable performance on land and sea – and are available in a variety of controller types and sizes to fit your specifications.

- Easy to configure, alarm and monitor
- 300+ types of hot swappable cards
- Compatible with standard open networks
- One third the size of legacy systems

Condition Monitoring

Real-time monitoring puts shipboard asset health information at your fingertips.

- Monitors vibration, wear, oil, current and heat
- Predictive capabilities help eliminate unnecessary maintenance

Visualization

Visualization products provide windows into critical control information shipboard or in port.

- High Brightness displays for day and night deck use
- Keypad and touch screen interfaces

Variable Speed Drives

The Allen-Bradley PowerFlex family of AC drives offers a broad range of control modes, features, options and packaging for coordinated control of your pump, fan and air handling systems, winches, cargo pumps and compressor systems.

Products Certified by Premiere Marine Testing Agencies

Rockwell Automation has served the marine industry for decades with products and systems certified by the world's premiere certifying agencies.

Det Norske Veritas, Korean, RINA, Bureau Veritas, Lloyds, American Bureau Shipping, Russian Maritimes Registrar of Shipping



Russian Maritime Register of Shipping



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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 Kleetlaan 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