

ENGINEERING  
TOMORROW

*Danfoss*

# When **high-quality AC drives** matter We keep you going

Experience best-in-class performance and efficiency with Danfoss Drives.

## Reduce

total cost of  
ownership  
with energy-efficient  
AC drives



VACON  
DANGER

[drives.danfoss.com](http://drives.danfoss.com)

**VLT** **VACON**





## Reliable plant operation - day in, day out

In the chemicals industry, we know your plant never sleeps. It simply needs to keep working reliably, day in, day out, in the toughest environments and without any unexpected downtime. At Danfoss Drives, we enable just that with the highest-quality AC drives to keep you going, while at the same time lowering your energy consumption.

## AC drives that enable peak performance

For your chemical plant to run at its absolute best, you need drives that enable peak performance. Designed with decades of industry know-how, our quality AC drives deliver best-in-class reliability and robustness. Their leading energy efficiency lowers your total cost of ownership and makes a positive contribution to reaching the world's climate goals. Further, predictive and condition-based monitoring are built into our drives to give you the intelligence you need to future-proof your systems. Our drives are also fully compatible with any motor or system, so you're free to run the optimal system for your plant.

Choose Danfoss as your AC drives partner and rely on us to keep you going.

# Enhance your competitiveness

Whether you are commissioning a new plant or converting an existing one, drawing on the expertise and experience of a supplier during the planning and implementation phase is the only way to arrive at fast and effective drive solutions.

We offer more than 50 years of experience as a global AC drives partner. So, no matter if you need a module, a control cabinet or a complete drive system including motor, Danfoss' specialists supply tailored solutions based on your specific chemical plant data:

- a professional design of your drive
- implementation of your equipment by Danfoss and our experienced system partners
- instruction and specific solution training
- comprehensive service package with DrivePro® Life Cycle Services with short response times, even during ongoing operation.

Our advanced product portfolio allows all drive requirements to be fulfilled without any compromises, for everything from standard to high-performance drives. After you select your configuration, we supply a fully assembled and tested unit.

# Modular and adaptable solutions for any chemical plant application

All our AC drive units are built on a modular design concept that makes them extraordinarily versatile. With a power range of up to 5.3 MW, the drives can be expanded with a wide range of additional features that make them especially suitable for the chemical industry. The AC drives combine a flexible system architecture, which allows them to be adapted to specific applications, with a uniform user interface across all power classes. Their easy integration into any plant's automation system is possible thanks to fast fieldbus options and exceptional programming flexibility.

## Full voltage range

All drives, modules and systems are available in different voltage ranges from 200-690 V to cover different needs in terms of grid conditions and configurations of the chemical industry. With different front-end topologies like 6/12-pulse, Active Front End and low-harmonic versions, the drives can be configured to meet local and global specifications. Exceptional performance guaranteed.

## Small frame size – high performance

The VLT® AutomationDrive and the VACON® product portfolio deliver the highest performance with the lowest footprint. The reduction in frame sizes is the result of innovative power modules and the most efficient heat management.

Despite compact dimensions, all units are nevertheless equipped with integrated DC link chokes or external

AC chokes and EMC filters to minimize mains interference and EMC challenges.

To meet the various requirements in terms of central or decentral plant designs, the drives are available in different enclosure ratings from IP00 up to IP66. Options like fuses, circuit breaker, different harmonic mitigation concepts and output filter are easily configurable.

## Powerful performance in extreme conditions

The combination of increasingly crowded conditions in cabinets, high packing density of power electronics due to extremely compact AC drives, and correspondingly high-power dissipation in tight spaces poses quite a challenge in many plants. For reliable and safe operation, this requires high cooling capacity and effective heat dissipation. One possible solution to this issue is liquid cooling.

With one of the best power/size ratios, VACON® NXP Liquid-cooled drives are ideal for applications where space is at a premium or air cooling is difficult. Heavy industries with harsh operating conditions, such as chemical environments benefit from the drive's compact design and robust reliability.

Liquid-cooled AC drives can be used in many combinations, from a single dedicated AC drive to large-scale common DC bus systems. Packed with features, these fully standardized drives maximize the utilization of space while minimizing overall life cycle costs. As a high degree of protection (IP54 or higher) is easily achieved with these drives, they can be installed almost anywhere in a plant. This eliminates the load on air-conditioning systems in electrical rooms reducing costs and installation time and makes them ideal for retrofitting.

# Four key areas in the chemical industry

To meet the needs of the chemical industry, our AC drives focus on four key areas to ensure higher performance and lower operating costs.



## Reliability & robustness

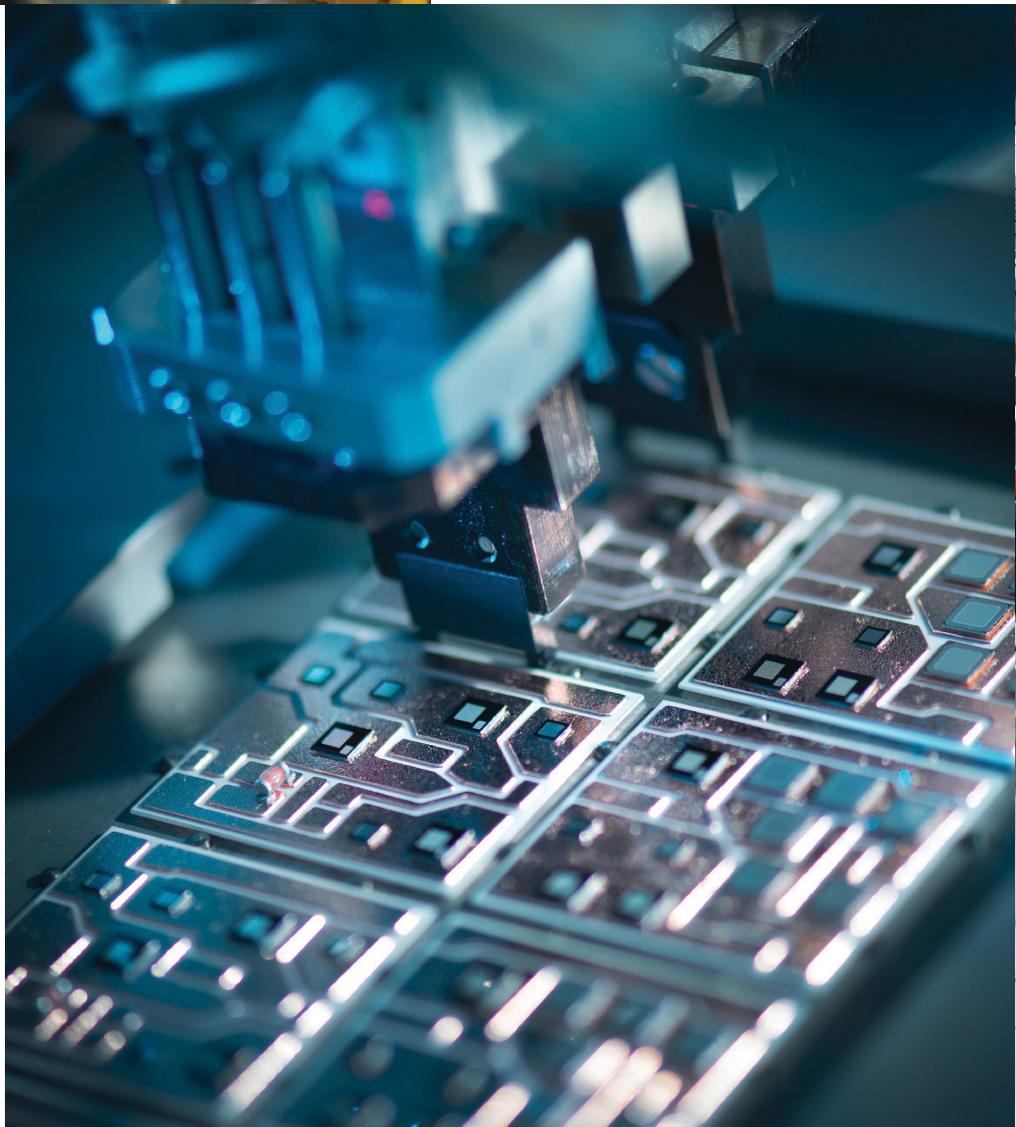
Life in a chemical plant is tough. Aggressive gases can damage components while cooling air contamination can cause PCB tracks and door seals to decompose. Knowing your drives are reliable and durable enough to handle the rigors of chemical production is therefore key. That's why all our drives have at least conformal coated circuit board as standard, with the option of a reinforced conformal coating, high IP ratings, are ATEX compliant, and can withstand high ambient temperatures of up to 50 °C.

## Energy efficiency

All our AC drives are highly energy efficient, helping increase plant ROI and reduce total cost of ownership (TCO). They have excellent back-channel cooling, the latest heat pipe technologies or offer liquid cooling, reducing the need for air conditioning, as well as smart tools that lower energy use and application wear. Higher power density also means you can say goodbye to oversized drives.

Danfoss can help you:

- Save energy on the production line through the application of high-efficiency drives
- Prolong drive lifetime, thus optimizing use of resources and enabling advance planning
- Minimize cost of unexpected downtime due to condition monitoring and predictive maintenance
- Reduce stock of spare parts



## Simpler, more cost-efficient systems

Our drives can be used with 150 m shielded or 300 m unshielded cable without any additional output filters for motor connections. This saves your investment, makes additional space requirement obsolete, lowers total losses in the system and provides full output torque on the motor shaft by avoiding voltage drop over the filter.



## Predictive & condition-based monitoring

We keep you going for longer with predictive and condition-based monitoring capabilities that are embedded into our drives and work independently from any external cloud system. The drive is used as a sensor in your application as it detects faults or irregularities in your processes at an early stage. This means you can schedule maintenance operations in advance, reduce unexpected downtime and costs, extend the lifetime of your applications and help to future-proof your system.

Integrated condition-based monitoring lets you react quickly to critical situations like motor winding failure, vibration wear, mechanical misalignments and wear-out.

Cloud-free artificial intelligence embedded in the drive defines operating baseline parameters corresponding to specific applications at all speeds and real-life operating cycles. Reduced installation time and predictive maintenance lower your operating costs and boost uptime.



# Increase safety with tailored options and accessories

Danfoss AC drives can be individually configured with the additional safety functions required in the chemical industry through special options and accessories.

## Coated circuit boards

The lifetime of an AC drive and its critical components is extended as a result of coated printed circuit boards that offer reliable protection against dust, gases and moisture.

The VLT® AutomationDrive FC 302 is supplied as standard with conformal coated printed circuit boards. If used in especially harsh ambient conditions, opting for a reinforced special coating can further increase the lifetime of the drive. All 690 V versions comes already with the reinforced special coating. Conformally coated circuit boards are provided as standard for NXP power modules (FR7 - FR14).

The upgraded boards offer reliable protection against dust and moisture and extend the lifetime of the drive and critical components.

## Made-to-measure functional safety

The VLT® AutomationDrive FC 302 comes with the standard feature STO (Safe Torque Off) function in compliance with EN ISO 13849-1 PL d Cat. 3 and SIL 2, according to IEC 61508 low demand and high demand mode.

The safety functions can be extended to include SS1, SLS, SMS, safe jog mode with the VLT® Safety Option Module MCB 150 and MCB151 (see table below). When the VLT® Safety Option MCB 151 is combined with the built-in VLT® Sensor-less Safety MCB 159 option, an external sensor is no longer required for safe speed monitoring.

The VLT® Safety Option MCB 152 operates the STO function via the PROFIsafe fieldbus. All MCB 150 options are fully integrated in the AC drive.

While the VLT® AutomationDrive FC 302 comes with Safe Torque Off (STO) as a standard, for VACON® products, an option for STO must be added. The VACON® OPT-AF and OPT-BJ board provides STO and an ATEX thermistor input.

Other functional safety options are more advanced in the VACON® NXP portfolio, as depicted in the table below. The VACON® Advanced Safety Options OPT-BL, OPT-BM and OPT-BN operate the safety functions via the PROFIsafe fieldbus or I/O control. They improve flexibility by connecting safety devices within a plant.

To customize the safety application to your specific needs, the VACON® Safe PC tool is available free of charge.

Functional Safety feature	VLT® FC302	VACON® NXP	VACON® 100
<b>Safe Stop functions</b>			
STO (Safe Torque Off)	■	■	■
SS1 (Safe Stop 1)	■	■	■
SS2 (Safe Stop 2)		■	
<b>Safe Speed functions</b>			
SLS (Safe Limited Speed)	■	■	
SMS (Safe Maximum Speed)	■	■	
SLS (Safe Limited Speed) Open Loop	■		
SMS (Safe Maximum Speed) Open Loop	■		
SSM (Safe Speed Monitor)		■	
SBC (Safe Brake Control)		■	
SQS (Safe Quick Stop)		■	
SSR (Safe Speed Range)		■	
PROFIsafe via PROFINet	■	■	
PROFIsafe via PROFIBUS		■	
ATEX approved thermistor input for Ex d motors	■	■	■
ATEX approved thermistor input for Ex e / Ex n motors	■		

■ Standard function  
 ■ Option

Functional safety parameter configuration is fully integrated into the Danfoss VLT® MCT 10 AC drive engineering tool and enables simple start-up and easy maintenance.



### **Integrated, expandable safety**

The PTB-certified VLT® PTC Thermistor Card MCB 112 option, the VACON® OPT-AF or OPT-BJ board can be used to monitor Ex d motors and are certified according to IEC 61508 for use in low demand applications.

These options can be used as the sole protective device for an explosion-proof motor suitable for use with AC drives. This reduces the external component count, saves expensive cabinet space and reduces cabling.

Naturally, sensor circuit monitoring for short-circuit and open-circuit conditions is integrated.

### **ATEX certification for Ex e / Ex n motors**

VLT® AutomationDrive FC 302, VACON® NXP and VACON® 100 series

can also be used to control ATEX-certified, AC drive-compatible motors from any desired manufacturer for operation in zones 1 and 2 (gas) as well as zones 21 and 22 (dust). With dedicated PTC options, users can implement the required ATEX-certified temperature monitoring directly in the AC drive.

In addition, the VLT® AutomationDrive FC 302 provides a specific monitoring function (ETR function) that enables the operation of ATEX-certified Ex e / Ex n motors suitable for use with AC drives without the need for any additional approval of motor + AC drive combination ("matched pair approval").

The data necessary for the monitoring function is found on the nameplates of approved Ex e / Ex n motors. Simply enter this data during commissioning.

### **Universal residual current monitoring**

The external fault current monitoring module reliably detects insulation faults in equipment operating from IT or TN mains systems. In addition to providing protection against sudden insulation faults, the module supports preventive maintenance by detecting gradual insulation deterioration in the equipment.

To ensure operational reliability, this small module even monitors itself. Not only can it monitor a single AC drive, the module can also protect entire drive groups if necessary.

The fully pre-configured connection kit makes commissioning quick and easy. There is no need to configure monitoring parameters.



# DrivePro<sup>®</sup> Life Cycle Services

deliver a customized service experience

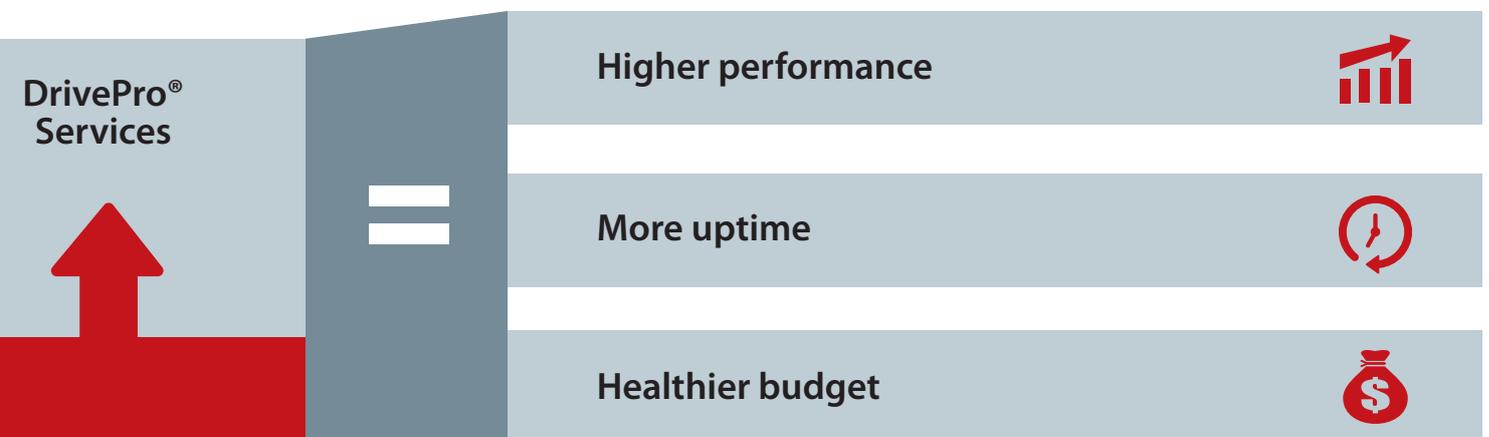
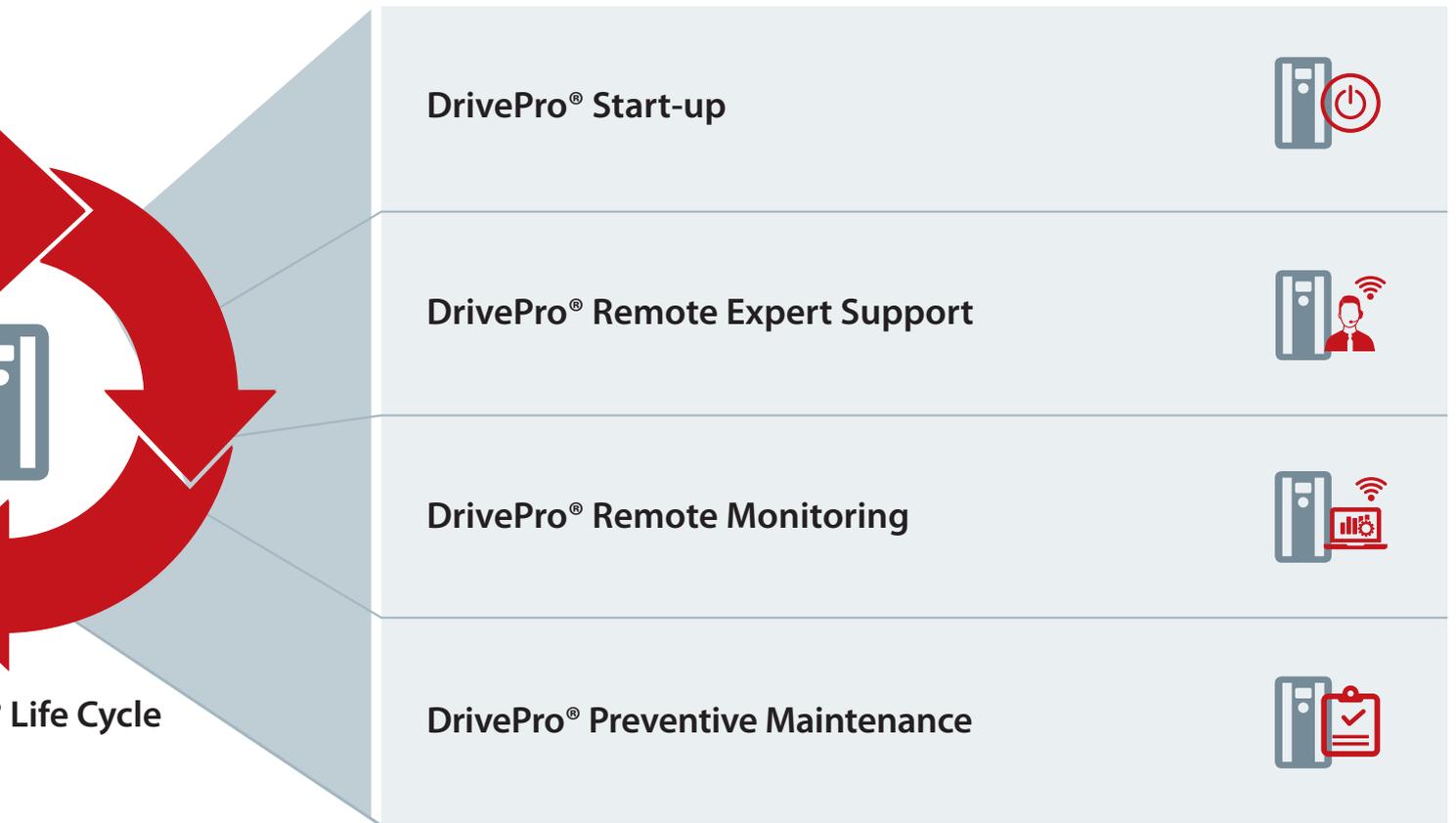
We understand that every application is different. Having the ability to build a customized service package tailored to the chemical industry is essential. DrivePro<sup>®</sup> Life Cycle Services is a collection of tailor-made products designed around you. Each one engineered to support your business through the different stages of your AC drive's life cycle.

From optimized spare part packages to condition monitoring solutions, our products can be customized to help you achieve your business goals.



We go beyond simple device maintenance, repairs and replacements to proactively offer you added value that directly improves your business. Our comprehensive service portfolio, that spans the entire life cycle of your AC drives, is based on extensive experience and expertise.

These services are customized to your requirements whenever and wherever you need them.





## A better tomorrow is **driven by drives**

**Danfoss Drives is a world leader in variable speed control of electric motors.**

We offer you unparalleled competitive edge through quality, application-optimized products and a comprehensive range of product life cycle services.

You can rely on us to share your goals. Striving for the best possible performance in your applications is our focus. We achieve this by providing the innovative products and application know-how required to optimize efficiency, enhance usability, and reduce complexity.

From supplying individual drive components to planning and delivering complete drive systems; our experts are ready to support you all the way.

You will find it easy to do business with us. Online, and locally in more than 50 countries, our experts are never far away, reacting fast when you need them.

You gain the benefit of decades of experience, since 1968. Our low voltage and medium voltage AC drives are used with all major motor brands and technologies in power sizes from small to large.

**VACON® drives** combine innovation and high durability for the sustainable industries of tomorrow.

For long lifetime, top performance, and full-throttle process throughput, equip your demanding process industries and marine applications with VACON® single or system drives.

- Marine and Offshore
- Oil and Gas
- Metals
- Mining and Minerals
- Pulp and Paper

- Energy
- Elevators and Escalators
- Chemical
- Other heavy-duty industries

**VLT® drives** play a key role in rapid urbanization through an uninterrupted cold chain, fresh food supply, building comfort, clean water and environmental protection.

Outmaneuvering other precision drives, they excel, with remarkable fit, functionality and diverse connectivity.

- Food and Beverage
- Water and Wastewater
- HVAC
- Refrigeration
- Material Handling
- Textile
- Chemical

**VLT® | VAGON®**

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