ENGINEERING
TOMORROW

# **Optimize processes** and save energy with dedicated chemical VLT® drives solutions

Achieve sustainable success with a single supplier

**690V**
**drives solutions**
**in the complete power range reduce costs and increase efficiency in any motor driven chemical plant application.**

www.danfoss.com/drives

VLT®
THE REAL DRIVE

# Modular and adaptable Tailored solutions for any application

Drives solutions for reduced system costs and optimal plant security

## Be more competitive

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

As a supplier of drive technology, Danfoss offers over 40 years of experience as a global partner. Whether you need a module, a control cabinet or a complete drive system including motor, Danfoss' specialists are available to supply tailored solutions based on your specific plant data:

- professional design of your drive by Danfoss specialists
- a competitive quotation
- implementation of your equipment by Danfoss and its experienced system partners
- instruction and specific solution training
- comprehensive service with short response times, even during ongoing operation

The advanced platform concept of the VLT® AutomationDrive allows all drive requirements to be fulfilled economically, without any compromises, for everything from standard to high peformance drives.

After you select your configuration, Danfoss supplies a fully assembled and tested unit from its advanced production facility.

*The new D-frame enclosures are the smallest in their class.*

VLT® AutomationDrive units are all built on a modular design concept that makes them extraordinarily versatile. With a power range of up to 1.4 MW the drives can be expanded with a wide range of additonal features that make them especially suitable for the chemical industry.

The frequency converters combine a flexible system architecture, which allows them to be adapted to specific applications, with a uniform user interface across all power classes.

### 690 V

With the new 690 V versions of VLT® AutomationDrive units for the power range from 1.1 kW up to 75 kW, you can choose from a broad variety of compact, reliable and efficient drives for demanding production facilities operating from 690 V mains networks.

The new 690 V drives are among the smallest available.

### Small frame – high performance

The new D frame versions of VLT® AutomationDrives are 25 to 68% smaller than their equivalent predecessors.

These size reductions are the result of innovative power modules and efficient heat management.

The champion in size reduction is the 250 kW frequency converter, which also are among the smallest in its power class, features an impressive IP 54 enclosure rating.

Despite the compact dimensions, all units are nevertheless equipped with integrated DC link chokes and EMC filters to minimise mains interference and EMC problems.

All new D frame enclosures are available in IP 20 and IP 21/IP 54 versions.

The IP 20 version is optimised for cabinet mounting and features covered power terminals to prevent accidental contact. The unit can also be ordered with optional fuses or circuit breakers in the same package size. The control and power cables are fed in separately at the bottom.

## Power ratings

VLT® AutomationDrive frequency converters are available with the following power or voltage ratings:

3 x 200 – 240 V .....0.25 – 37 kW
3 x 380 – 500 V .. 0.37 – 1100 kW
3 x 525 – 600 V .....0.75 – 75 kW
3 x 525 – 690 V .....1.1 – 1400 kW

# Increase safety
# Options and accessories

VLT® AutomationDrive frequency converters are future-proof and can be individually configured with the additional safety functions required in the chemical industry through special options and accessories.

## Coated circuit boards

The VLT® AutomationDrive FC 302 is supplied as standard with coated circuit boards conforming to class 3C2 (IEC 60721-3-3). If used in especially harsh ambient condition, it is possible to choose a special coating that conforms to class 3C3. All 690 V versions conform to class 3C3.

## Made-to-measure functional safety

The drive delivered as standard with the Safe Stop (Safe Torque Off) function in compliance with EN ISO 13849-1 PL d and SIL 2, according to IEC 61508 low demand and high demand mode. The safety functions can optionally be extended to include SS1, SLS, SMS, SSM, safe jog mode, etc. with the VLT® Safety Option Module MCB 140 Series and VLT® Safety Option Module MCB 150 Series.

The MCB 140 option provides complete segregation of the safety and drive parameters, as well as the internal processor architecture for the drive. The module can be used in high demand applications according to ISO 13849-1 up to PL e, providing functions such as Safe Stop 1 (SS1), Safe Limited Speed (SLS) and Safe Maximum Speed (SMS), control of external contactors and safety door monitoring and unlocking.

By contrast, the MCB 150 series is integrated directly in the frequency converter and is ready for future connection to common safety bus systems. The module is certified according to ISO 13849-1 as well as IEC 61508 for use in high and low demand applications, and provides SS1 and SLS functionality.

Parameter configuration is fully integrated into the Danfoss VLT® MCT 10 frequency converter engineering tool and enables simple start-up and easy maintenance.

Key advantages are easy diagnosis and certification documentation necessary for safety acceptance tests, which are supported by the engineering tool.

## Safety solutions

- VLT® Safe Option MCB 140/MCB 150
- VLT® PTC Thermistor Card MCB 112
- ATEX certified
- Protect Ex motors regardless of supplier

## Integrated, expandable safety

The PTB-certified VLT® PTC Thermistor Card MCB 112 option can be used to monitor both Ex d and Ex e motors, and is certified according to IEC 61508 for use in low demand applications

Developed by Danfoss in collaboration with Ziehl Industrieelektronik the option can be used as the sole protective device for an explosion-proof motor suitable for use with frequency converters. This reduces the external component count, saves expensive cabinet space and reduces cabling.

The MCB 112 is suitable for connecting and monitoring PTC sensors compliant with DIN 44081 and DIN 44082.

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

## ATEX certification for Ex e motors

VLT® AutomationDrive FC 302 frequency converters can also be used to control ATEX-certified, frequency converter compatible motors from any desired manufacturer for operation in zones 1 and 2 (gas) as well as zones 21 and 22 (dust). With the MCB 112 PTC option, users can now implement the required ATEX-certified temperature monitoring directly in the frequency converter.

In addition, the FC 302 provides a specific monitoring function that enables the operation of ATEX-certified Ex e motors suitable for use with frequency converters. The data necessary for the monitoring function is present on the nameplates of approved Ex e motors. The user can simply enter this data during commissioning using the control panel or the VLT® Motion Control Tool MCT 10 programming software.

## 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 frequency converter, 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.

# Designed to protect
# Chemical module

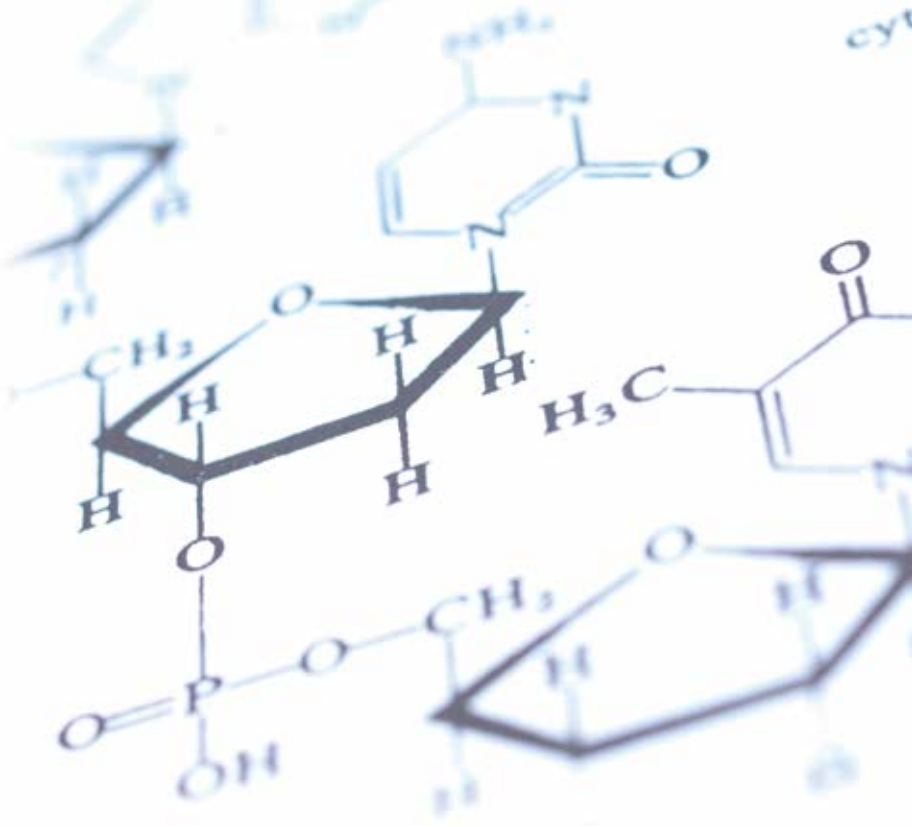
The chemical module is a package specifically aligned to the needs of the chemical industry, and provides all of the protective devices necessary for the operation of EEx d motors.

These include the PTC option, which provides safe shutdown in the event of faults to protect the motor. Forced mains disconnect is also available as an alternative. The standard integrated DC link chokes and filters enable the VLT® AutomationDrive FC 302 to be used with very long motor cables, allowing the frequency converter to be located outside the explosion hazard area.

The motor cable length is 150 m with shielded cable or up to 300 m with unshielded cable. The sine-wave filter integrated in the chemical module allows unshielded cable to be used while complying with all radio interference suppression requirements for EN 55011 Class A1 operation. This also reduces the voltage stress on the motor and thereby conforms to NAMUR Recommendation 38.

A relay option with eight floating contacts and extra analogue outputs can also be mounted on the side if desired. This extension enables the implementation of NAMUR terminal assignments in accordance with NAMUR Recommendation 37.

*Danfoss' Chemical module provides the necessary protection when used with Ex motors.*



# Optimal EMC protection for reliable and uninterrupted plant operation

As a user or plant engineer, you can employ two means to ensure electromagnetic compatibility.

The first option is to suppress interference at the source by minimising or eliminating interference emissions. The second is to increase the interference immunity of the device or system, in order to eliminate or significantly reduce susceptibility to interference.

## EMC-compliant configuration as standard

The VLT® AutomationDrive FC 302 contains all modules necessary for compliance with EMC limits A1/B1 and A2 as specified by the EN 55011 and EN 61800-3 standards. The integrated DC link chokes ensure low harmonic distortion in the mains network, in accordance with IEC 10000-3-2, thereby increasing the service life of the DC link capacitors.

## VLT® Advanced Harmonic Filter AHF 005 and AHF 010

Danfoss type AHF 005 and AHF 010 VLT® Advanced Harmonic Filters minimise harmonic distortion on the mains network. They are specifically matched to VLT® frequency converters and use a patented technique to achieve high attenuation of mains harmonics.

Using an AHF filter reduces total harmonic distortion (THD) levels in the mains network to less than 10% or 5%. This allows complex 12-pulse or 18-pulse input rectifiers to be replaced by less costly alternatives.

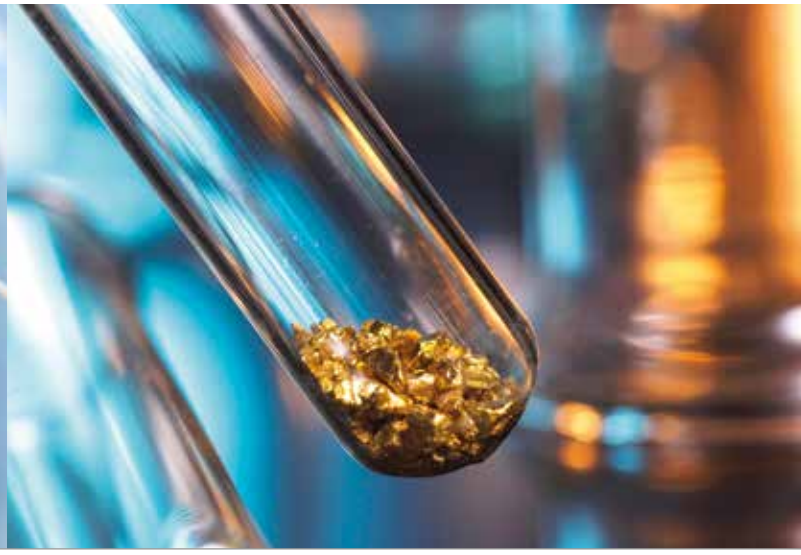
## VLT® Advanced Active Filter AAF 006

VLT® Advanced Active Filter AAF units share the modular structure of Danfoss high-power frequency converters. They provide high energy efficiency, user-friendly interfaces, rear-panel cooling and high enclosure protection ratings.

These filters can be used to compensate for harmonic distortion from VLT® frequency converters or used as stand-alone solutions to compensate for other interference sources.

For this purpose, the filter generates currents that mirror the harmonics and feeds them into the mains network, thereby cancelling the harmonics. This restores the original sinusoidal waveform and eliminates the need for complex 12-pulse or 18-pulse input rectifier circuits.

Another advantage is full freedom of the location of the connection between the filter and the mains network to be compensated.



## VLT® Low Harmonic Drive

A VLT® Low Harmonic Drive is a VLT® frequency converter augmented by a built-in VLT® active filter acting on the mains side.

VLT® Low Harmonic Drives share both the modular structure of VLT® high-power frequency converters and their features, including high efficiency, cooling via a rear cooling channel and user-friendly operation. They also fulfil all harmonic distortion requirements and indicate device power with respect to the mains network and provide a graphic overview of mains power quality.

## VLT® du/dt Filter MCC 102

VLT® du/dt Filters reduce voltage rise on the motor terminals. This is particularly important with short motor cables. The du/dt filters protect ageing or inadquately insulated motors against breakdown. They are primarily recommended for retrofitting in older plants and motors.

Unlike sine-wave filters, du/dt filters cannot filter out the switching frequency of the inverter. However, these filters are less costly than sine-wave filters because they have smaller inductors and capacitors.

## VLT® Sine-wave Filter MCC 101

VLT® Sine-wave Filters generate a sinusoidal motor voltage between the phases. They reduce the stress on the motor insulation and decrease noise emissions by suppressing the switching frequency in the motor. They also reduce bearing currents, especially in motors with power ratings above 50 kW.

## VLT® Harmonic Calculation Software MCT 31

With VLT® MCT 31, you can determine whether harmonics will be an issue in your installation when drives are added.

## EMC and harmonics mitigation

- VLT® Advanced Harmonic Filter AHF 005
- VLT® Advanced Harmonic Filter AHF 010
- VLT® Low Harmonic Drive
- VLT® Advanced Active Filter AAF 006
- VLT® du/dt Filter MCC 102
- VLT® Sine-wave Filter MCC 101
- VLT® Harmonic Calculation Software MCT 31

The MCT 31 tool can easily be used to evaluate the expected grid quality and includes a range of passive and active counter-measures which can be selected to ease system stress.

The power quality impact of electronic devices can be estimated in the frequency range up to 2.5 kHz, depending on the system configuration and standard limits.

The analysis includes indication of compliance with various standards and recommendations.

# Made-to-measure drive solutions

For many years Danfoss has cooperated with system partners to supply modern, energy-efficient frequency converters and to integrate them into turnkey cabinet solutions. Our drive experts work together with customers to specify the requirements for the solution.

This is followed by construction of the corresponding cabinets, which can also be equipped with additional system components such as controllers or other external components, depending on the design and implementation. The customer then receives a ready-to-install solution exactly matching their wishes.

## Water cooling

The problem arises from the combination of increasingly crowded conditions in cabinets, high packing density of power electronics due to extremely compact frequency converters, and correspondingly high power dissipation in tight spaces. For reliable and safe operation, this requires high cooling capacity and effective heat dissipation.

Water cooling is one possible solution. Danfoss uses the new industrial Liquid Cooling Package from Rittal to keep its cabinet-mount units cool.

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# What VLT® is all about

Danfoss VLT Drives is the world leader among dedicated drives providers – and still gaining market share.

## Environmentally responsible

VLT® products are manufactured with respect for the safety and well-being of people and the environment.

All frequency converter factories are certified according to ISO 14001 and ISO 9001 standards.

All activities are planned and performed taking into account the individual employee, the work environment and the external environment. Production takes place with a minimum of noise, smoke or other pollution and environmentally safe disposal of the products is pre-prepared.

### UN Global Compact

Danfoss has signed the UN Global Compact on social and environmental responsibility and our companies act responsibly towards local societies.

### Impact on energy savings

One year's energy savings from our annual production of VLT® drives will save the energy equivalent to the energy production from a major power plant. Better process control at the same time improves product quality and reduces waste and wear on equipment.

### Dedicated to drives

Dedication has been a key word since 1968, when Danfoss introduced the world's first mass produced variable speed drive for AC motors – and named it VLT®.

Twenty five hundred employees develop, manufacture, sell and service drives and soft starters in more than one hundred countries, focused only on drives and soft starters.

### Intelligent and innovative

Developers at Danfoss VLT Drives have fully adopted modular principles in development as well as design, production and configuration.

Tomorrow's features are developed in parallel using dedicated technology platforms. This allows the development of all elements to take place in parallel, at the same time reducing time to market and ensuring that customers always enjoy the benefits of the latest features.

### Rely on the experts

We take responsibility for every element of our products. The fact that we develop and produce our own features, hardware, software, power modules, printed circuit boards, and accessories is your guarantee of reliable products.

### Local backup – globally

VLT® motor controllers are operating in applications all over the world and Danfoss VLT Drives' experts located in more than 100 countries are ready to support our customers with application advice and service wherever they may be.

Danfoss VLT Drives experts don't stop until the customer's drive challenges are solved.

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