The modular VLT® AutomationDrive:

Engineered for design simplicity and high performance with a vast array of customized features, upgrades and options.

Enclosure

Meets requirements for enclosure class Protected Chassis (IP 20). Optional NEMA 1 (IP 21), NEMA 12 (IP 55), NEMA12 (IP 54) and NEMA 4X (IP 66) available.

DC coil

Built-in DC coil ensures very low harmonic disturbance of the power supply, in accordance with IEC-1000-3-2. Compact design means no need for external modules.

Cold plate technology

Built on a solid aluminum base that is integrated with the back panel to provide high mechanical stability, efficient cooling and the option of cold plate operation.

Conformal coating

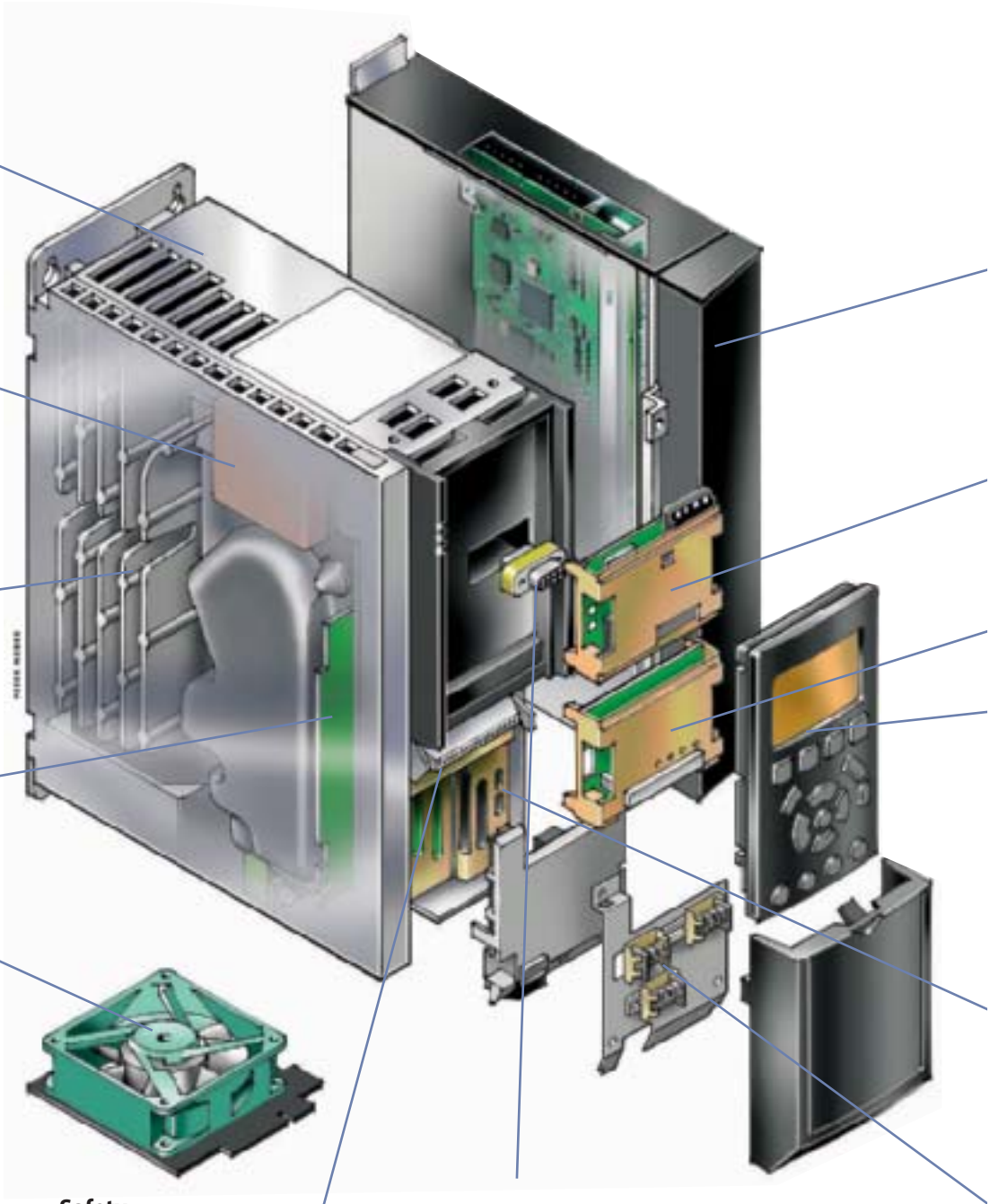
Available with a coated circuit board that makes the drive perfect for operation in harsh environments.

Removable fan

The fan can be quickly removed and remounted for easy cleaning.

RFI

RFI available with A1/B1 and A2, for compliance with IEC 61000 and EN 61800 standards.

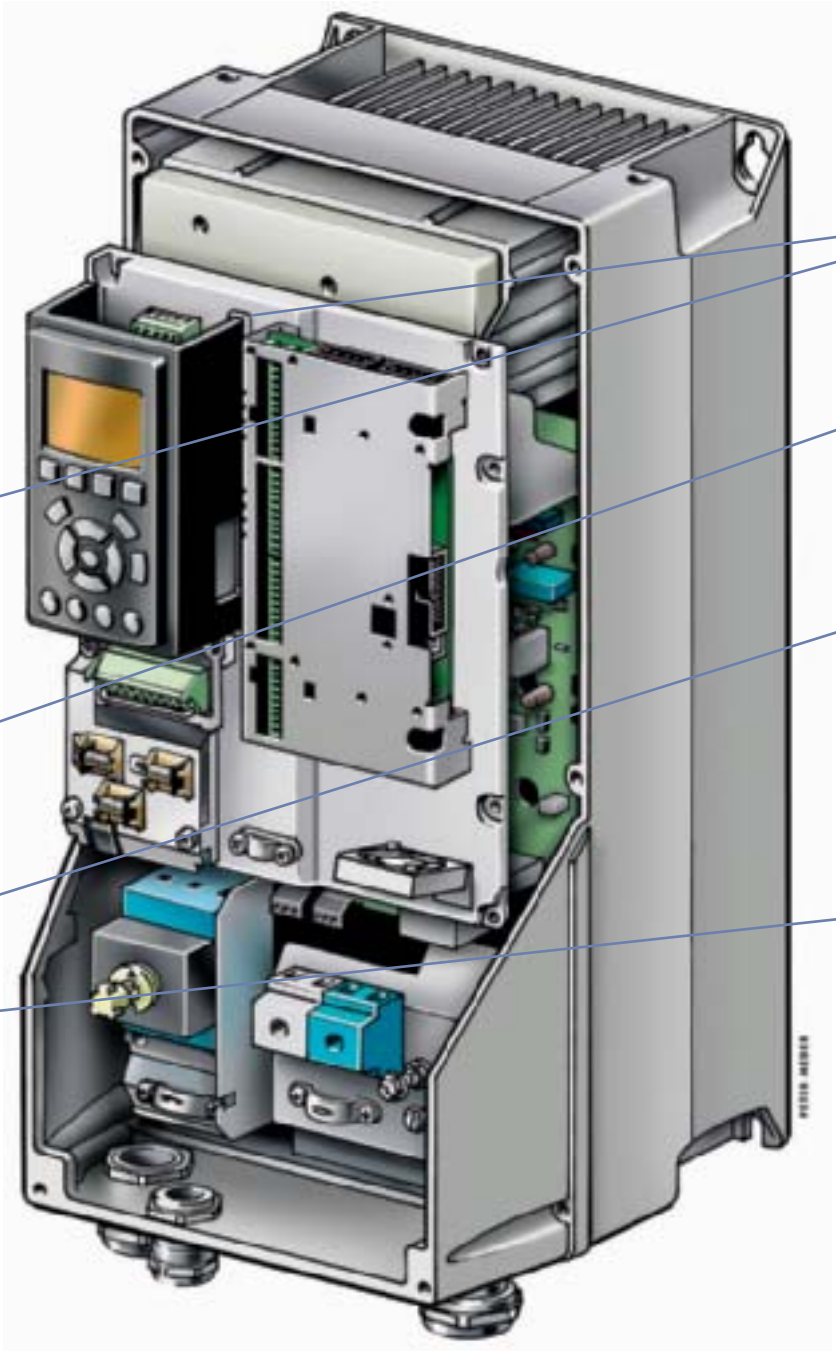


Safety

The VLT® AutomationDrive FC 302 comes standard with the safe stop functionality suitable for category 3 installations in accordance with EN 954-1. This feature prevents the drive from starting unintentionally. Profisafe is available as an option.

Hot-pluggable LCP

The Local Control Panel (LCP) can be plugged in or unplugged during operation. Settings are easily transferred via the control panel from one drive to another or from a PC with MCT-10 setup software.



24 V

24 V supply keeps the VLT® AutomationDrive logic "alive" when the AC power supply is removed.

Control terminals

Specially developed spring-loaded cage clamps enhance reliability and facilitate easy commissioning and service.

Advanced option

Free programmable MCO 305 option for synchronization, positioning, cam control and more.

Fieldbus option

Options for bus communication (Profibus, Devicenet, CanOpen etc.), synchronization, user programs, etc., are delivered ready to go.

Application option

- General purpose I/O
- Cl encoder
- Resolver
- Relay options
- Safe interface

Display options

Input from our extensive user group significantly influenced the design and function of the new generation Local Control Panel. The removable LCP now comes with an improved user interface. Choose between six built-in languages (including Chinese) or have it customized with any language you like. Two of the languages can be changed by the user.

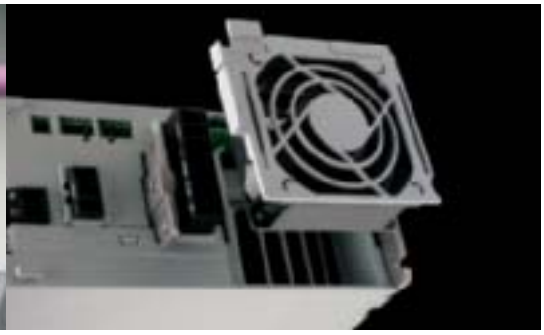
The info button accesses virtually all information contained in the printed operation manual.

The Automatic Motor Adaptation (AMA), Quick Setup menu and large graphic display make commissioning and operation convenient and easy.

The LCP also comes with a choice of numerical display, graphical display or blind cover.

Press, place, and release—that's all it takes for a reliable control cable connection that never needs servicing.

The VLT® AutomationDrive supports all PROFIdrive profiles for automation.



The fan is easily removed for cleaning of the heatsink.

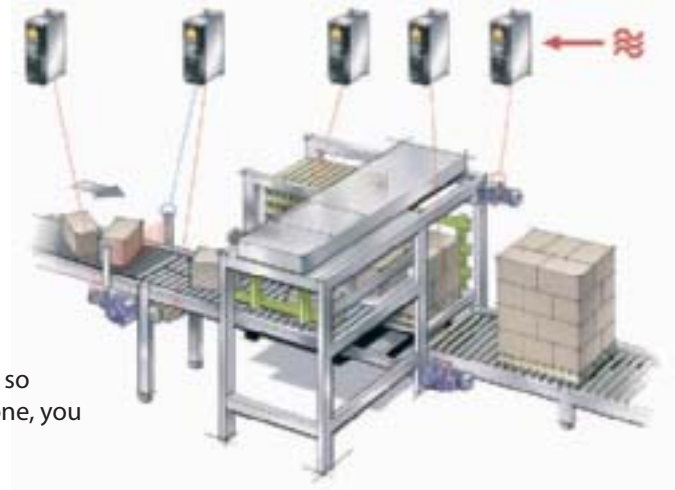
Just one drive

to run a complete production line

The VLT® AutomationDrive is a single drive concept that controls all operations from standard to servo motors on any machine or production line. The standard versions cover a wide range of functions such as PLC functionality, automatic fine-tuning of motor control and self-analysis of performance.

Positioning, synchronizing, load estimation and even servo performance are also available.

All versions share an identical user interface, so once you've operated one, you can use them all.



Add flexibility to precision

The new VLT® AutomationDrive lets you alter production speed without rebuilding the conveyor. The Precise Pulse Stop feature ensures that products are always where they should be on the line.

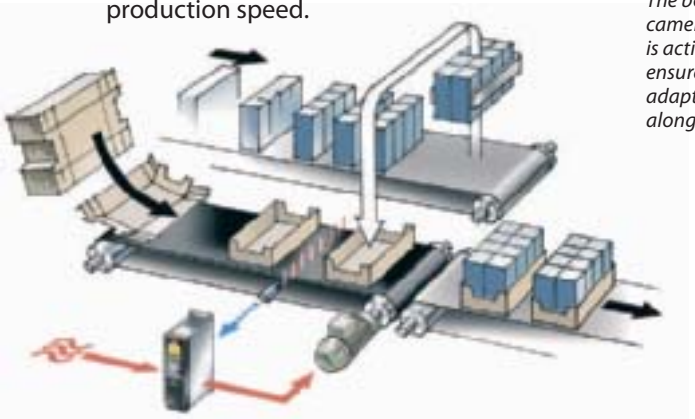
Accelerate or slow the entire line

Production speed can be changed at any time, even if the application involves several parts. The Precise Pulse Reference feature ensures that all conveyors are in sync by designating a master conveyor, which all other conveyors follow.

Benefits:

- The conveyor can be stopped at a precise location using an open loop system independent of production speed.
- Precise Pulse Stop compensates for the speed of the object when it passes the stop sensor. This results in a precise stop, regardless of production speed.

The bottle is beneath the inspection camera at the exact moment the flash is activated. The VLT AutomationDrive ensures that production speed is adapted, even in complex operations along the entire production line.



To disconnect wires, simply unplug the terminal blocks.

Plug-and-play is the way with the AutomationDrive. Even the power supply, sensor cables and looping connections are convenient plugs.

The fieldbus option plugs in beneath the front panel. It can be turned upside down to allow for cable entry on top.

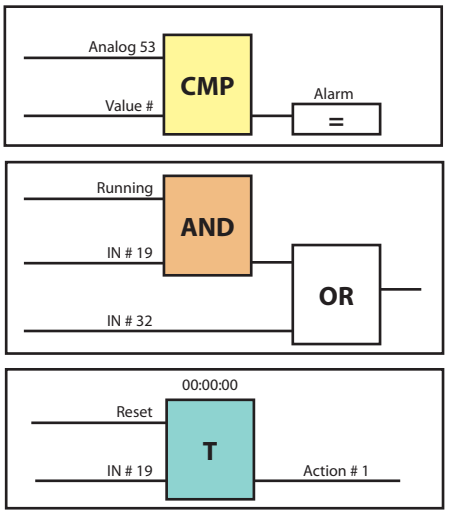
Built-in Smart Logic Controller

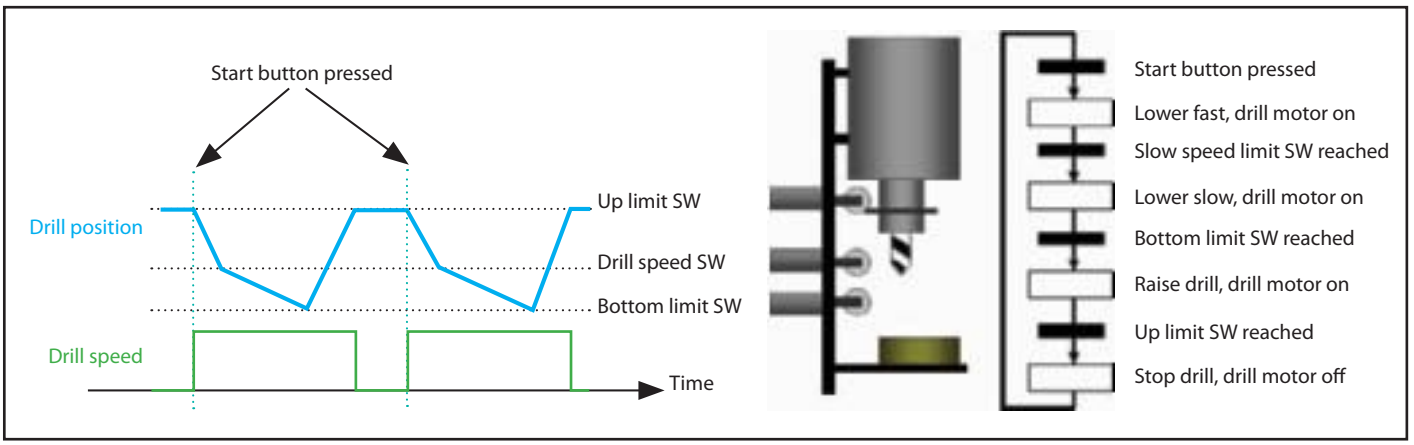
The smart logic controller is a simple but clever way to keep your drive, motor and application working together. The controller monitors a specified event. When the event occurs, the controller triggers a specified act and starts monitoring the next event, continuing for up to 20 different steps before returning to step one.

The smart logic controller is able to monitor any parameter that can be defined as "true" or "false."

This includes not only digital commands, but also logic expressions, allowing even sensor outputs to influence the operation. Temperature, pressure, flow, time, load, frequency, voltage and other parameters combined with the operators ">,""<, ""=,""and" and "or" forms logical statements.

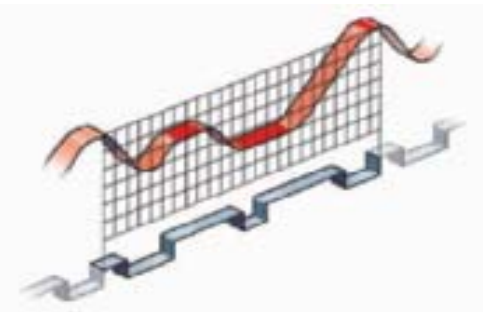
That's why Danfoss calls it a "logic" controller; because you can program the controller to react to almost any event you choose.





VLT® MCO 305 Motion Controller

The MCO 305 is an integrated programmable Motion Controller. It adds even more functionality and flexibility to the VLT® AutomationDrive. With the MCO 305, the VLT® AutomationDrive becomes an intelligent drive, featuring highly accurate, dynamic motion control, synchronization (electronic shaft), positioning and electronic cam control. And, programmability lets you implement a variety of application functions, such as monitoring and intelligent error handling.



Three panel options: graphical, numerical, blind cover.

The VLT® AutomationDrive is controlled locally via a control panel. This is plugged in directly or connected via a cable.

The VLT® AutomationDrive can be remote commissioned and monitored via a USB cable or bus communication. Special software is available: Wizards, Data Transfer Tool, VLT® Setup Software, MCT 10 and Language Changer.

Award-winning control panel

Graphical display

- Shows bars and graphs
- Displays international letters and symbols
- Easy overview
- Select from 27 languages

Other benefits

- Removable during operation
- Upload and download parameter sets from one drive to another via the keypad
- IP65 rating when mounted in panel door
- Numerical version also available

Illumination

- Selected LEDs are illuminated when active

Menu structure

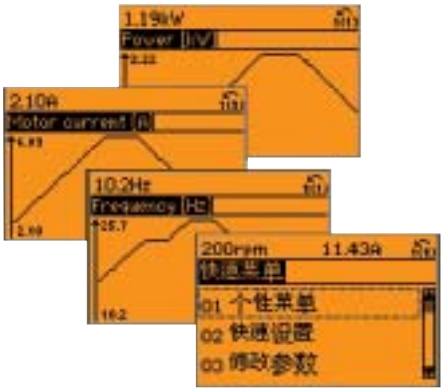
- Based on the matrix system, well known from previous VLT® Series drives
- Easy shortcuts for experienced users
- Edit and operate in different setups simultaneously

Quick Menus

- Danfoss-defined Quick Menu
- Personalized Quick Menu
- Changes Made Menu lists parameters unique to your application
- Application Setup Menu provides quick setup for specific applications

New buttons

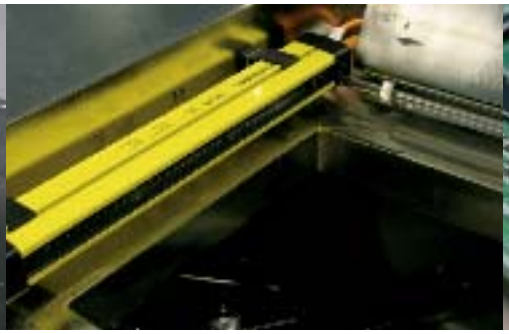
- Info ("on board manual")
- Cancel ("undo")
- Alarm log (quick access)



design award winner 2004

The VLT® AutomationDrive Local Control Panel won the international iF design award in 2004. The Danfoss LCP beat out 1000 entries from 34 countries in the "interface in communication" category.

DC coils reduce harmonic noise and protect the drive.



Safety installations can be connected directly to the VLT® AutomationDrive.

Coated control boards are avilable for harsh environments.

Intelligent heat management

Cooling can take place in two ways for different benefits

Total separation between cooling air and electronics allows for solutions where heat is removed outside cabinets.

With VLT® AutomationDrive, a flanged heatsink kit is available for mounting the drive in the backplate of a cabinet.

Forced convection cooling

A fan blows cold air through the cooling ribs of the aluminum base. The channel is easily cleaned without touching electronics.

Cold plate cooling

External cooling is possible through the back side of the aluminum base.

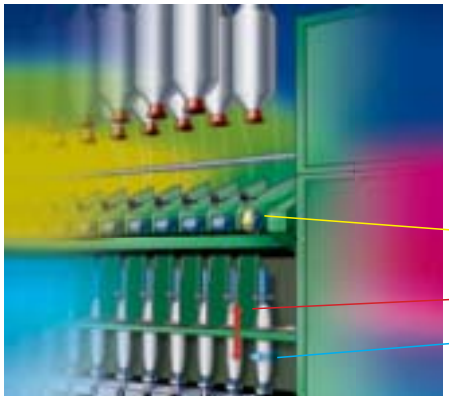
Wall mounted with forced cooling through the heatsink.

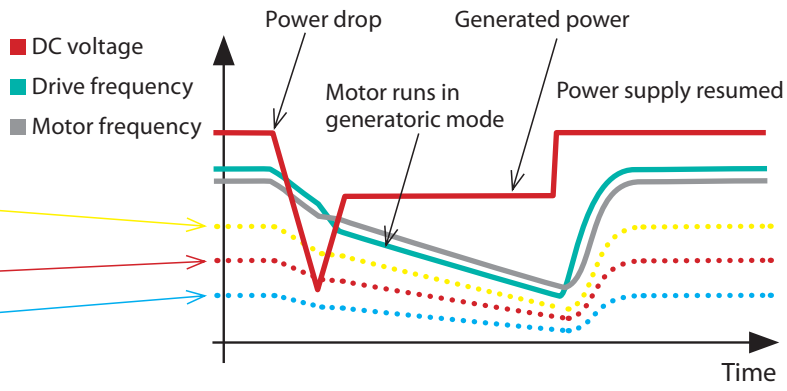
Flanged heatsink

A smart, dedicated kit allows D1 and D2 enclosures to be mounted in Rittal cabinets so cool air removes 85% of excess heat without contact to the electronics.

Kinetic backup

The VLT® AutomationDrive can utilize power generated from kinetic energy for controlled ramp-down in case of power loss. The application is ready for quick restart when the power returns.



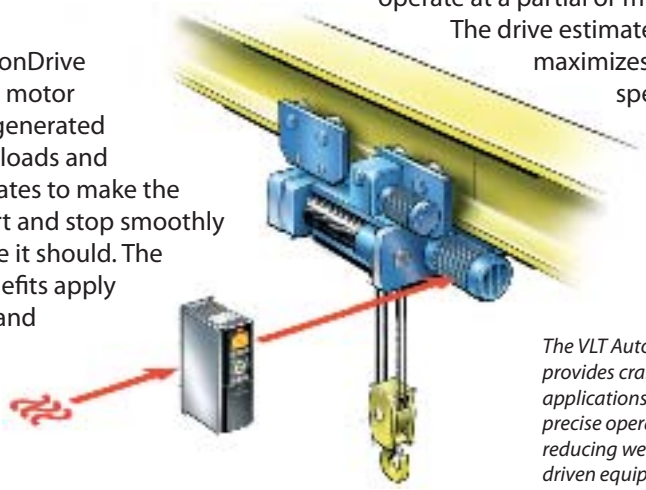


Built for a variety of applications...

Reliable, accurate load handling

Changing conditions influence the operation of cranes and other equipment. Depending on position and load, a crane tends to shake when stopping or starting, because it's calibrated to an average load.

The VLT® AutomationDrive estimates motor currents generated by actual loads and compensates to make the crane start and stop smoothly just where it should. The same benefits apply to hoists and elevators.



The VLT AutomationDrive provides crane and hoist applications with smooth, precise operation while reducing wear and tear on driven equipment.

Small loads handled more quickly

Equipment is typically sized to handle a maximum load, and speed is usually determined by this maximum load.

The ability to change speed automatically allows equipment to operate at a partial or minimum load. The drive estimates the load and maximizes production speed.

Gentle on goods—and brakes

When stopped, the AutomationDrive will slow a hoist to zero before activating the mechanical brake. This results in gentler handling, and virtually eliminates wear on the brake.

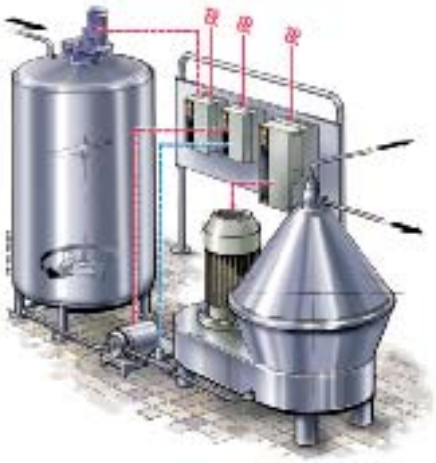
Benefits:

- Low torque ripple gives smooth operation
- Precise load estimation allows for precise positioning regardless of load
- Load estimation saves time and speeds up production safely and intelligently
- Full holding torque capability at 0 RPM gives a smooth ride and reduces mechanical wear on gears and brakes, minimizing maintenance and maximizing production uptime

NEMA 4X (IP 66) for harsh environments

All VLT® AutomationDrives have manganic phosphor rear bodies. The backs of NEMA 4X (IP 66) enclosures are dip-coated with epoxy or polyester spray finish (60–100 µm). The cover is powder coated (80–100 µm).

The silicone gasket is tested with various detergents.



Small footprint

Throughout the entire power range, all sizes of VLT® AutomationDrives are even smaller than comparable previous dri ves. No dimension has increased, and volumes are typically 20% smaller.

Conversion kit

A conversion kit is available to facilitate exchange from previous generation VLT® drives.

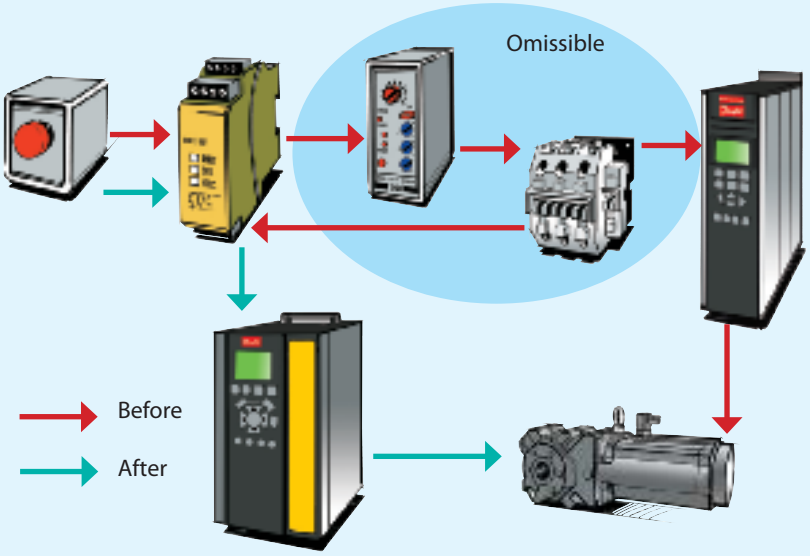
The backplate has predrilled holes. Cabling from VLT® 3000 and VLT® 5000 Series drives can be reused with the terminal adapter.

...with a wide range of advanced features

One-wire safety

The VLT® AutomationDrive FC 302 is equipped with safe stop functionality suitable for category 3 installations as defined by EN 954-1. This standard feature prevents a drive from starting accidentally. The FC 302 terminal 37 can be used as "safe coast" for this purpose—the stop function satisfies stop category 3 EN 60204-1.

Expensive and bulky external components can be omitted, wiring simplified, and downtime minimized with this solution. And the safety signals can be transferred via discrete signals wiring (in compact machinery) or safe bus communication (in extended manufacturing plants).

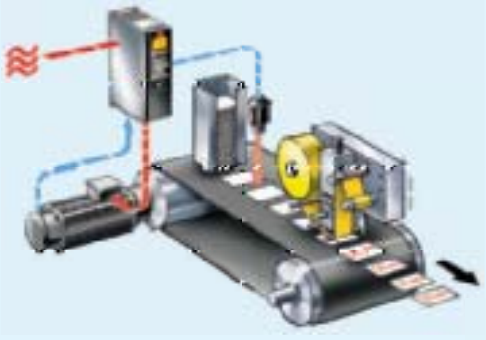


Since it's approved for safety category 3 applications, the VLT® AutomationDrive is the perfect match for the Pilz safety relay. The electrical connection is extremely simple—just one wire.

The VLT® AutomationDrive is approved for providing safe stop in category 3 installations without the need for feedback signals from the drive to the safety relay.

VLT® AutomationDrive FC 302 runs permanent magnet motors

VLT® AutomationDrive FC 302 harnesses the full potential of permanent magnet motors in highly dynamic applications. Fast processors enable it to precisely control position, acceleration and torque.



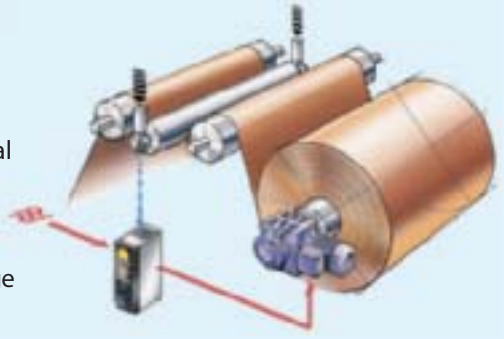
600 & 690 V

VLT® AutomationDrive FC302 comes in 600 and 690 V series typical for applications such as petrochemical, water and gas supply, mining, and forestry. 690 V versions are planned up to 1.2 MW.

When torque is the issue

In all winders, the torque required to accelerate and decelerate an application varies with the load. With center winders the required torque even varies with the dimension of the roll. Torque mode with high-precision torque control is needed.

It is essential in winding operations to fully control the tension of the material being wound. To maintain tangential tension independently of the line speed and roll diameter, the drive is able to dynamically follow a wide range of torque references.



One drive; two performance levels

Special needs require special features and performance.

	FC 301	FC 302
Power range 200–240 V [HP]	0.33–60	0.5–60
Power range 380–(480) 500 V [HP]	0.5–60	0.5–550
Power range 550–600 V [HP]	–	1–10
Power range 525–690 V [HP]	–	15–550
Ambient temp °C (average for 24 hours, without de-rating—IP21 enclosure)	45	45
Ambient temp °C max (IP21), without de-rating	50	50
Ambient temp °C max, with de-rating	55	55
IP21 / NEMA 1; IP55 / NEMA 12	√	√
IP66 / NEMA 4X	–	√
Smart Logic Control	√	√
Logic Rule Control	√	√
Safe Stop input function approved	–	√
Local Control Panel numerical or graphical	√	√
Info/Help function	√	√
Personal menu (macro)	√	√
Regional settings (US mode)	√	√
Language settings	√	√
Change made restore previous setting	√	√
Password protection	√	√
Analogue input	0 to +10 V	-10 to +10 V
Digital inputs	5	6
Digital transistor outputs [1)]	1	2
Relay outputs	1	2
Analogue output resolution	12 bit	12 bit
PC connection: RS 485 and USB	√	√
Default motor data	√	√
Permanent Magnet Motor algorithm	–	√
Process PID control	√	√
Precise Start/Stop	√	√
Preset references	8	8
Digipotmeter	√	√
Ramp functions: linear and S-ramps	√	√
Profibus, DeviceNet, CANOpen	√	√
ProfiSafe	–	√
Interface options:		
Extended input/outputs MCB 101	√	√
Encoders option MCB 102	√	√
Resolver option MCB 103	√	√
Relay option MCB 105	√	√
Safe PLC interface MCB 108	–	√
Motion Control Options: MCO 305	√	√
External 24 V backup option MCB 107	√	√
Cable length—screened/unscreened	50/75 m	150/300 m
RFI EN55011 cl A2 (Industry)	<5 m	<5 m
RFI EN55011 cl A1 (Industry)	<50 m	<150 m
RFI EN55011 cl B (Domestic)	<10 m	<50 m
Voltage Vector Control VVC+	√	√
Flux Vector Control	–	√
Automatic Energy Optimizing (AOE)	–	√
Controlled ramp down	–	√
Flying start—catch spinning motor		√
Variable switching frequency 1–16 kHz[2)]	√	√
Over Voltage Control	√	√
Fan replaceable	√	√

[1)] *Converting digital inputs*
[2)] *Power-size dependent*

Specifications

Mains supply (L1, L2, L3):

Supply voltage	FC 301 and FC 302: 200–240 V ±10%
Supply voltage	FC 301: 380–480 V / FC 302: 380–500 V ±10%
Supply voltage	FC 302: 550–600 V ±10%
Supply voltage	FC 302: 525–690 V ± 10%
Supply frequency	50/60 Hz
Displacement Power Factor (cos ϕ) near unity	(> 0.98)
Switching on input supply L1, L2, L3	2 times/min.

Output data (U, V, W):

Output voltage	0–100% of supply voltage
Output frequency	FC 301: 0.2–1000 Hz / FC 302: 0–1000 Hz
Switching on output	Unlimited
Ramp times	0.02–3600 sec.
Closed loop	0–132 Hz

Digital inputs:

Programmable digital inputs	FC 301: 4(5) > 5 / FC 302: 4(6) > 6
Logic	PNP or NPN
Voltage level	0–24 V DC
Voltage level, logic	'0' PNP logic < 5 V DC
Voltage level, logic	'1' PNP logic > 10 V DC
Voltage level, logic	'0' NPN logic > 19 V DC
Voltage level, logic	'1' NPN logic < 14 V DC
Maximum voltage on input	28 V DC
Input resistance, Ri	approx. 4 k Ω

Analog inputs:

Analog inputs	2
Modes	Voltage or current
Voltage level	FC 301: 0 to +10 V FC 302: -10 to +10 V (scaleable)
Current level	0/4 to 20 mA (scaleable)
Accuracy of analog inputs	Max. err. 0.5% of full scale
Scan interval	FC 301: 10 ms / FC 302: 1 ms

Pulse/encoder inputs:

Programmable pulse/encoder inputs	2/1
Voltage level	0–24 V DC (PNP positive logic)
Pulse input accuracy (0.1–110 kHz)	Max. error: 0.1% of full scale
Encoder input accuracy (1–110 kHz)	Max. error: 0.05% of full scale 32 (A), 33 (B) and 18 (Z)

Digital output:

Programmable digital/pulse outputs	FC 301: 1 / FC 302: 2
Voltage level at digital/frequency output	0–24 V DC
Max. output current (sink or source)	40 mA
Maximum output frequency at frequency output	32 kHz
Accuracy on frequency output	Max. error: 0.1% of full scale

Analog output:

Programmable analog outputs	1
Current range at analog output	0/4–20 mA
Max. load to common at analog output	500 Ω
Accuracy on analog output	Max. error: 1% of full scale

Onboard Power Supply:

Output voltage	10.5 V ±0.5 V
Max. load (10 V)	15 mA
Max. load (24 V)	FC 301: 130 mA / FC 302: 200 mA

Relay outputs:

Programmable relay outputs	FC 301: 1 / FC 302: 2
Max. terminal load (AC) on 1-3 (break), 1-2 (make), 4-6 (break) power card	240 V AC, 2 A
Max. terminal load (AC) on 4-5 (make) power card	400 V AC, 2 A
Min. terminal load on 1-3 (break), 1-2 (make), 4-6 (break), 4-5 (make) power card	24 V DC 10 mA, 24 V AC 100 mA

Cable lengths:

Max. motor cable length, screened (shielded)	FC 301: 50 m FC 302: 150 m
Max. motor cable length, unscreened (unshielded)	FC 301: 75 m FC 302: 300 m

Surroundings/ External:

Enclosure	IP 20/IP 21/IP 55
Vibration test	0.7 g
Max. relative humidity	5%–95% (IEC 721-3-3; Class 3K3 (non-condensing) during operation
Aggressive environment (IEC 721-3-3), uncoated class 3C2	
Aggressive environment (IEC 721-3-3), coated class 3C3	
Ambient temperature	Max. 50 °C
24-hour average	Max. 45 °C

Protection mode for longest possible uptime:

- Electronic thermal motor protection against overload
- Temperature monitoring of the heatsink ensures that the VLT® AutomationDrive cuts out if the temperature reaches 100 °C
- The VLT® AutomationDrive is protected against short circuits on motor terminals U, V, W
- Protection against mains phase loss
- The VLT® AutomationDrive is protected against ground fault on motor terminals U, V, W