

MAKING MODERN LIVING POSSIBLE



# Danfoss VLT<sup>®</sup> Soft Starter

## The single speed drive



**3–1600 A**

**For any soft start situation**

VLT<sup>®</sup> Soft Starters cover the full range – from simple start-stop operation to high end performance.

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

**VLT<sup>®</sup>**  
THE REAL DRIVE

# Soft starts: Protect gear, goods, equipment and the environment

**An AC motor switched directly on to the mains power supply will struggle to reach its nominal speed as quickly as possible.**

This draws maximum current from the power supply and accelerates the application with its maximum torque. Depending on the application, this can cause different problems.

Applications like pumps, conveyers, centrifuges and bandsaws must be started slowly, and sometimes stopped slowly, to prevent mechanical shocks such as water hammer, and strains on bands, couplings and shafts.

## **Principle of Phase Angle Control**

A soft starter is an electronic device that regulates the voltage to the motor and this provides a smooth transition from standstill to full speed operation of the application.

VLT® Soft Starters all use the principle of phase angle control: Back-to-back coupled thyristors ramp up the motor voltage.

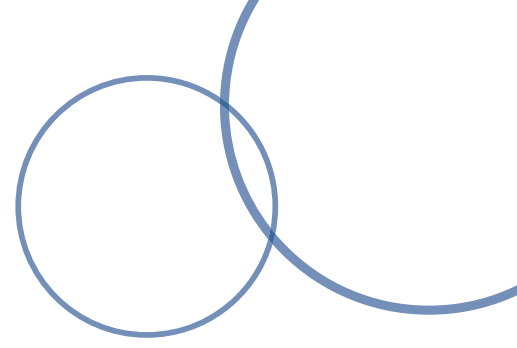
In some VLT® Soft Starters, current transformers measure the motor current, providing feedback for starting current control but also for numerous motor and application protection functions.

## **VLT® Soft Starters cover a comprehensive range**

Soft starting and stopping can be controlled in a number of ways depending on the application. Some applications require non-linear voltage ramp-up and the voltage ramp is therefore related to the actual current drawn. Conversely, a band-saw usually requires a quick stop function provided by a DC brake.

Then again, a number of applications require a kick-start torque for an instantaneous period of time followed by a soft ramp-up acceleration. VLT® Soft Starters cover all of these applications and much more.





VLT® Soft Starter MCD 500	VLT® Compact Starter MCD 200	VLT® Soft Starter MCD 100
<ul style="list-style-type: none"><li>■ Fully featured Soft Starter for motors up to 850 kW</li><li>■ Total motor starting solution</li><li>■ Advanced protection features</li><li>■ Adaptive Acceleration Control</li><li>■ Inside Delta connection</li><li>■ 4 line graphical display</li><li>■ Multiple programming setup menus</li></ul>	<ul style="list-style-type: none"><li>■ Compact Soft Starter for motors up to 110 kW</li><li>■ Voltage ramps, current limit start and integrated motor protection</li><li>■ Integral bypass design reduces heat dissipation</li><li>■ Wide power range with advanced accessory modules</li></ul>	<ul style="list-style-type: none"><li>■ Micro Soft Start controller for motors up to 11 kW</li><li>■ Extremely robust SCR design with heavy ratings as standard</li><li>■ Unlimited number of starts per hour</li><li>■ Contactor style design for easy selection, installation and commissioning</li></ul>



# VLT® Soft Starter MCD 500

**VLT® Soft Starter MCD 500 is a total motor starting solution. Current transformers measure motor current and provide feedback for controlled motor ramp profiles.**

AAC, the Adaptive Acceleration Control, automatically employs the best starting and stopping profile for the application. Adaptive Acceleration Control means that for each start and stop, the soft starter compares and adapts the process to the chosen profile best suited to the application.

The VLT® Soft Starter MCD 500 has a four-line graphical display and a logic keypad making programming easy. Advanced setup is possible displaying operational status.

Three menu systems: Quick Menu, Application Setup and Main Menu provide optimum programming approach.

## The perfect solution, also for more severe applications:

- Pumps
- Conveyors
- Fans
- Mixers
- Compressors
- Centrifuges
- Mills
- Saws
- And many more

## Power range

21 – 1600 A, 7.5 – 850 kW  
(1.2 MW inside Delta Connection)  
Versions for 200 – 690 VAC



Features	Benefits
<b>User friendly</b>	
AAC Adaptive Acceleration Control	– Automatically adapts to the chosen starting and stopping profile
Adjustable bus bars allow for both top and bottom entry (360 – 1600 A, 160 – 850 kW)	– Space saving, less cable cost and easy retrofitting
DC injection braking distributed evenly over three phases	– Less installation cost and less stress on the motor
Inside Delta (6-wire connection)	– Smaller soft starter can be selected for the application
Log menus, 99 events and trip log provide information on events, trips and performance	– Eases analysis of the application
Auto Reset	– Less down-time
Jog (slow-speed operation)	– Application flexibility
Second-order thermal model	– Allows motors to be used to their full potential without damage from overloading
Internal bypass contactors (21 – 215 A, 7.5 – 110 kW)	– Save space and wiring compared to external bypass – Very little heat dissipates when running. Eliminates costly external fans, wiring or bypass contactors
Auto-start/stop clock	– Application flexibility
Compact size – amongst the smallest in their class	– Saves space in cabinets and other application setups
4-line graphical display	– Optimum programming approach and setup for viewing operational status
Multiple programming setup (Standard Menu, Extended Menu, Quick Set)	– Simplifies the programming, but still holding to maximum flexibility
Multiple languages	– Serving the whole world

## Dimensions

Current rating [A]	Weight [kg]	Height [mm]	Width [mm]	Depth [mm]	Frame size
21, 37, 43 and 53	4.2	295	150	183	G1
68	4.5			213	
84, 89 and 105	4.9				
131, 141, 195 and 215	14.9	438	275	250	G2
245	23.9	460	390	279	G3
360, 380 and 428	35	689	430	300.2	G4
595, 619, 790 and 927	45				
1200, 1410 and 1600	120				
		856	585	364	G5

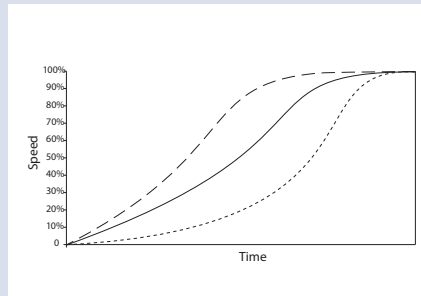
## MCD 500 operation options

### Starting:

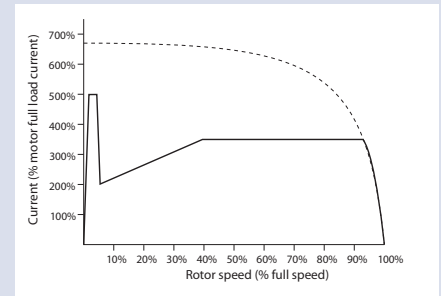
- AAC Adaptive Acceleration
- Control
- Current Ramp
- Constant Current
- Kickstart

### Stopping:

- Coast to stop
- TVR soft Stop
- AAC Adaptive deceleration Control
- Brake



Three Adaptive Acceleration Control (AAC) start profiles; early, constant and late acceleration



Constant current/ current ramp – here shown with kickstart

## Control Panel VLT® LCP 501



With the Control Panel VLT® LCP 501 being a full function interface, everything you can do on the VLT® Soft Starter MCD 500 is possible via the LCP 501.

The screen view set-up is selected from 7 standard views and one user programmable.

### Language selection:

English, Chinese, German, Spanish, Portuguese, French, Italian, Russian.

The VLT® LCP 501 is connected to the MCD 500 by using a 3 m cable using 9 pin (D-sub) plug and 3 m cable provided with the IP 65 (NEMA 12) door-mount kit.

Once connected, the soft starter asks whether you want to copy parameters from LCP to starter or starter to LCP (if different).

### 100% easy connection

- The Modbus, Profibus and Device net modules use another port on the MCD 500 (at the side of the soft starter)
- Separate LCP 501 output at the bottom for 9 pin plug and 3 m cable
- One ordering number (LCP with door-mount kit and cable)
- Plug & play connection (also if soft starter is powered up)
- One cable for power and communication
- Powered up by soft starter
- Copy of parameter set-up

# VLT® Compact Starter MCD 200

## VLT® Compact Starter MCD 200 from Danfoss includes two families of soft starters in the power range from 7.5 – 110 kW.

The series offers easy DIN rail mounting for sizes up to 30 kW, 2-wire or 3-wire start/stop control and excellent starting duty ( $4 \times I_e$  for 6 seconds).

Heavy starting ratings at  $4 \times I_e$  for 20 seconds.

Compatible with grounded delta power systems.

### The perfect match for:

- Pumps
- Fans
- Compressors
- Mixers
- Conveyors
- And many more

### Power range:

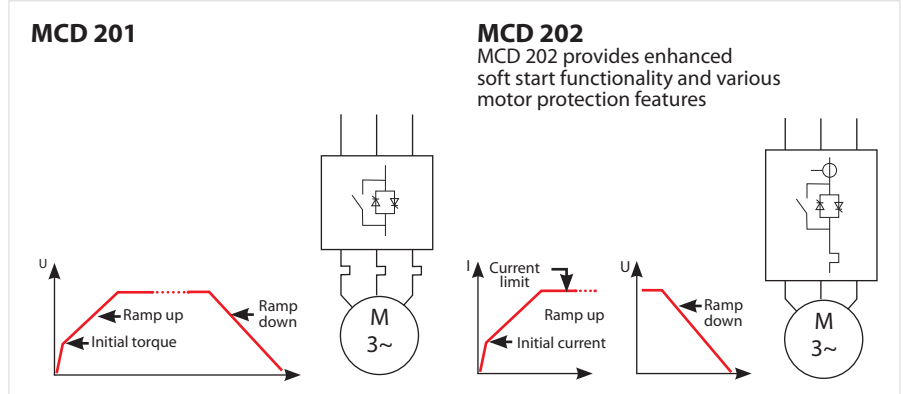
- 7.5 – 110 kW



## Remote operation

Remote operation of MCD 201 and MCD 202 is facilitated by the dedicated remote operator kit.

The operator (IP 54/NEMA 12) is mounted on the cabinet front and allows remote control, status indication and motor monitoring of an individual VLT® Soft Starter using RS485 serial communication.



Features	Benefits
Small footprint and compact size	– Saves panel space
Built-in bypass	– Minimises installation cost and eliminates power loss – Reduces heat build up. Savings in components, cooling, wiring and labor
Advanced accessories	– Allows enhanced functionality
Advanced SCR control algorithms balance output waveform	– Allowing more starts per hour, accepting higher load
Reliable	Maximum up-time
Essential motor protection (MCD 202)	– Reduces overall project investment
Max. ambient temperature 50°C without derating	– No external cooling or oversizing necessary
User friendly	Save commissioning
Easy to install and use	
Easy DIN rail mounting for sizes up to 30 kW	– Saves time and space



## Dimensions

Power range (400 V)	7 – 30 kW	37 – 55 kW	75 – 110 kW
Height [mm]	203	215	240
Width [mm]	98	145	202
Depth [mm]	165	193	214

# VLT® Soft Starter MCD 100

**VLT® Soft Start Controller MCD 100 is a cost effective and extremely compact soft starter for AC motors up to 11 kW, due to a unique semiconductor design.**

MCD 100 is a true “fit and forget” product. Selection can be made on the basis of the motor power – exactly as with traditional contactors.

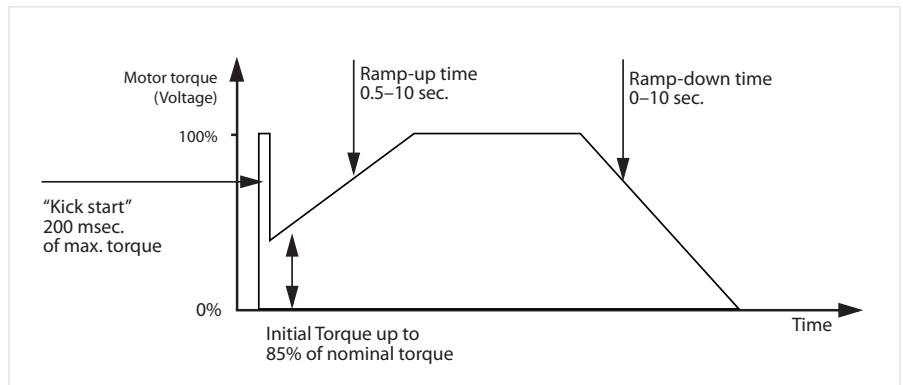
MCD 100 products provide timed voltage ramp up and down. Ramp time can be individually adjusted with rotary switches from 0.4 to 10 seconds.

The start torque can be adjusted from 0 to 85% of the direct on-line torque.

All sizes are rated for line voltage up to 600 V AC.

## The perfect match for:

- Pumps
- Fans
- Compressors
- Mixers
- Conveyors
- and many more



Features	Benefits
Small footprint and compact size	– Saves panel space
Selection can be based on motor power	– Easy selection
Universal control voltage	– Simplifies selection – Keeps stock at a minimum
“Fit and forget” contactor design	– Simplifies installation – Reduces required panel space
Reliable	Maximum up-time
Robust semiconductor design	– Reliable operation
Almost unlimited number of starts per hour without derating	– Prevents unauthorized changes
Max. ambient temperature 50°C without derating	– No external cooling or oversizing necessary
User-friendly	Save commissioning and operating cost
Easy to install and use	– Saves times
Digitally controlled rotary switches	– Secures precise settings and simplifies installation
Easy DIN rail mounting for sizes up to 30 kW	– Saves time and space



## Dimensions

Model	Power size (kW)	Rated current (Amps)	Dimensions (mm) H x W x D	Approvals
MCD 100	1.5	3 A AC-53b: 4-10: 110	102 x 22.5 x 123.5	UL, CSA, CE
	7.5	15 A AC-53a: 8-3: 100-3000 AC-58a: 6-6: 100-3000	110 x 45 x 128.1	
	11	25 A AC-53a: 8-3: 100-3000 AC-58a: 6-6: 100-3000	110 x 90 x 128	

# Serial communication

MCD 201, MCD 202 and MCD 500 come with optional plug-in modules for serial communication.

- DeviceNet
- Profibus
- Modbus RTU
- USB

	MCD 100	MCD 201	MCD 202	MCD 500
Start/stop, reset	■	■	■	■
LED for start, run, trip	■	■	■	■
Trip codes	■	■	■	■
Current display			■	■
Motor temp. display			■	■
4 – 20 mA output			■	■
Programming keypad, graphical display				■

## Ordering type codes

### VLT® Compact Starter MCD 200

MCD	2	0	-	-	T	-	C	V
<b>Series</b>								
Soft start/stop	1							
Soft start/stop + protection	2							
<b>Nominal Motor kW, 400 V</b>								
E.g. 55 kW		055						
110 kW		110						
<b>Line Supply Voltage</b>								
200 – 440 V					4			
200 – 575 V					6			
<b>Control Supply Voltage</b>								
24 V AC/DC								1
110 – 240 V AC and 380 – 440 V AC								3

### VLT® Soft Starter MCD 500

MCD	5	-	-	T	-	G	X	-	-	C	V
<b>MCD5, 500 Series</b>											
<b>FLC, [A]</b>											
0021											
0037											
0043											
0053											
0068											
0084											
0089											
0105											
0131											
0141											
0195											
0215											
0245											
0360											
0380											
0428											
0595											
0619											
0790											
0927											
1200											
1410											
1600											
<b>Bypass indication</b>											
B: With Internal Bypass Contactor											
C: Without Internal Bypass Contactor (Continuous)											
<b>Supply Voltage</b>											
T5, 200 – 525 VAC											
T7, 380 – 690 VAC											
<b>IP Rating</b>											
00, IP 00											
20, IP 20											
<b>Enclosure</b>											
G1, Frame size 1											
G2, Frame size 2											
G3, Frame size 3											
G4, Frame size 4											
G5, Frame size 5											
(X, not Used)											
<b>Control Voltage</b>											
CV1, 24 VAC or 24 VDC											
CV2, 110 or 220 VAC											



# Size indications

## Size indication for VLT® Compact Starter MCD 200

Model	Power size (kW)	Rated current AC-53b* (Amps)	Dimensions (mm) H x W x D	Approvals
MCD 201/ MCD 202	7.5	18 A: 4-6: 354	203 x 98 x 165	UL C – UL CE CCC C-tick Lloyds
	15	34 A: 4-6: 354		
	18	42 A: 4-6: 354		
	22	48 A: 4-6: 354		
	30	60 A: 4-6: 354	215 x 145 x 193	
	37	75 A: 4-6: 594		
	45	85 A: 4-6: 594		
	55	100 A: 4-6: 594	240 x 202 x 214	
	75	140 A: 4-6: 594		
	90	170 A: 4-6: 594		
110	200 A: 4-6: 594			

\* Example: AC 53b: 42 A: 4-6: 354 starting current max. 4 times FLC (42 A) in 6 seconds. 354 seconds minimum between starts.

## Size indication for VLT® Soft Starter MCD 100

Model	Power size (kW)	Rated current (Amps)	Dimensions (mm) H x W x D	Approvals
MCD 100	1.5	3 A: 5-5:10 (AC 53b)	102 x 22,5 x 124	UL, CSA, CE
	7.5	15 A: 8-3: 100-3000 (AC 53a)	110 x 45 x 128	
	11	25 A: 6-5:100-480 (AC 53a)	110 x 90 x 128	

## Size indication for VLT® Soft Starter MCD 500

Motor size (kW) @ 400 V	Frame size code	Starts per hour	Max. FLC	Rated FLC (40° C, 1000 m), outside delta motor connection					
				Light 300%, 30s, Internal bypass		Medium 400%, 20s, Internal bypass		Heavy 450%, 30s, Internal bypass	
11	G1 (no fan)	10	23	21		17		15	
18.5		10	43	37		31		26	
22		10	50	43		37		30	
25		10	53	53		46		37	
30	G1	6	76	68		55		47	
37		6	97	84		69		58	
45		6	100	89		74		61	
55		6	105	105		95		78	
60	G2	6	145	131		106		90	
75		6	170	141		121		97	
90		6	200	195		160		134	
110		6	220	215		178		149	
Motor size (kW) @ 400 V	Frame size code	Starts per hour	Max. FLC	Not bypassed	External bypass	Not bypassed	External bypass	Not bypassed	External bypass
132	G3x	6	255	245	255	195	201	171	176
185	G4x	6	360	360	360	303	310	259	263
200		6	380	380	380	348	359	292	299
220		6	430	428	430	355	368	301	309
315		6	620	595	620	515	540	419	434
335		6	650	619	650	532	561	437	455
445		6	790	790	790	694	714	567	579
500	G5x	6	930	927	930	800	829	644	661
650		6	1200	1200	1200	1135	1200	983	1071
750		6	1410	1410	1410	1187	1319	1023	1114
850		6	1600	1600	1600	1433	1600	1227	1353

Note: Optimise your selection with WinStart Soft Starter PC tool.

# Specifications

Type	VLT® Soft Starter MCD 500	VLT® Soft Starter MCD 100
	The total motor starter solution. Provides advanced control methods for starting and stopping and protection of motor and application	A true "fit and forget" soft starter for DIN rail mount, MCD 100 provides basic soft start and stop function
Concept	Enhanced soft start and soft stop Motor and system protection 7.5 – 850 kW @ 400 V (21-1600A) 200 – 690 V mains voltage 110 – 220 V AC or 24V AC/DC control supply 3-phase SCR control	Soft start Soft stop 0.1 – 11 kW @ 400 V 208 – 600 V mains voltage 24 – 480 V AC/DC control voltage 2-phase SCR control
Start/stop	Adaptive Acceleration Control (AAC) Current limit start Current ramp start Dual parameter function Kick-start Jog	Timed voltage ramp-up Adjustable start torque Selectable kick-start function
	Adaptive Deceleration Control (AAC) TVR soft stop (Timed Voltage Ramp) Coast to stop DC brake function – three phase Soft brake function	Timed voltage ramp-down
Protection	Same as MCD 202 and: Under current Current imbalance Starter overtemperature Restart delay Warning before trips Adjustable phase imbalance sensitivity – Programmable input trip – Individual phase loss trips – Individual shorted SCR trips – Int. bypass relay overload – Int. bypass relay fail Fully adjustable protections Network communication timeout Heatsink overtemperature Battery/clock failure Supply frequency External trip	
Outputs	Three programmable output relays: Programmable analogue output Motor thermistor	
Control	8 language graphical display and keypad Quick menu and application menu Buttons for start, stop, reset and remote control Inputs for two- or three-wire control  <b>Optional:</b> Modules for serial communication Control Panel VLT® LCP 501 PC software	Universal two-wire control Programmable via 3 rotary switches
Other features	Bypass up to 110 kW Configurable bus bars from 360 A and up Operation timers Jog – slow speed operation Auto reset of fault situations Emergency run 99 event log Trip log User programmable metering and monitoring Simulation before connecting line voltage	Extremely robust SCR design for unlimited number of starts per hour, LED indication, IP 20

Type	VLT® Compact Starter MCD 201	VLT® Compact Starter MCD 202
	A physically compact starter providing basic soft start and stop functionality	Physically similar to MCD 201 but providing enhanced soft start functionality and various motor protection functions
Concept	Soft start Soft stop 7.5 – 110 kW @ 400 V 200 – 575 V mains voltage 110 – 440 V AC or 24 V AC/DC control supply 2-phase SCR control	Current limit start Soft stop Motor protection 7.5 – 110 kW @ 400 V 200 – 575 V mains voltage 110 – 440 V AC or 24 V AC/DC control supply 2-phase SCR control
Start/stop	Timed voltage ramp-up Adjustable initial torque	Current limit start Initial current ramp-up
	Timed voltage ramp-down	Timed voltage ramp-down
Protection		Motor overload (adjustable trip class) Excess start time Reverse phase rotation Motor thermistor input Shorted SCR – no start Supply fault – no start Instantaneous overload
Outputs	One output relay: Line contactor control	Two output relays: Line contactor control Run contactor or trip function
Control	Two- or three-wire control Programmable via 3 rotary switches Reset push button  <b>Optional:</b> Modules for serial communication Remote operator kit PC software	Two- or three-wire control Programmable via 8 rotary switches Reset push button  <b>Optional:</b> Modules for serial communication Remote operator kit PC software
Other features	Integral SCR bypass for minimum physical size and heat dissipation during nominal operation LED status indication IP 20 (7.5 – 55 kW @ 400 V) IP 00 (75 – 110 kW @ 400 V) Protection kit available	Integral SCR bypass for minimum physical size and heat dissipation during nominal operation LED status indication IP 20 (7.5 – 55 kW @ 400 V) IP 00 (75 – 110 kW @ 400 V) Protection kit available



# What VLT<sup>®</sup> is all about

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

## Environmentally responsible

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

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.

### EU Directives

All factories are certified according to ISO 14001 standard. All products fulfil the EU Directives for General Product Safety and the Machinery directive. Danfoss VLT Drives is, in all product series, implementing the EU Directive concerning Hazardous Substances in Electrical and Electrical Equipment (RoHS) and is designing all new product series according to the EU Directive on Waste Electrical and Electronic Equipment (WEEE).

### Impact on energy savings

One year's energy savings from our annual production of VLT<sup>®</sup> 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<sup>®</sup>.

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<sup>®</sup> 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.

<http://driveconfig.danfoss.com/>

