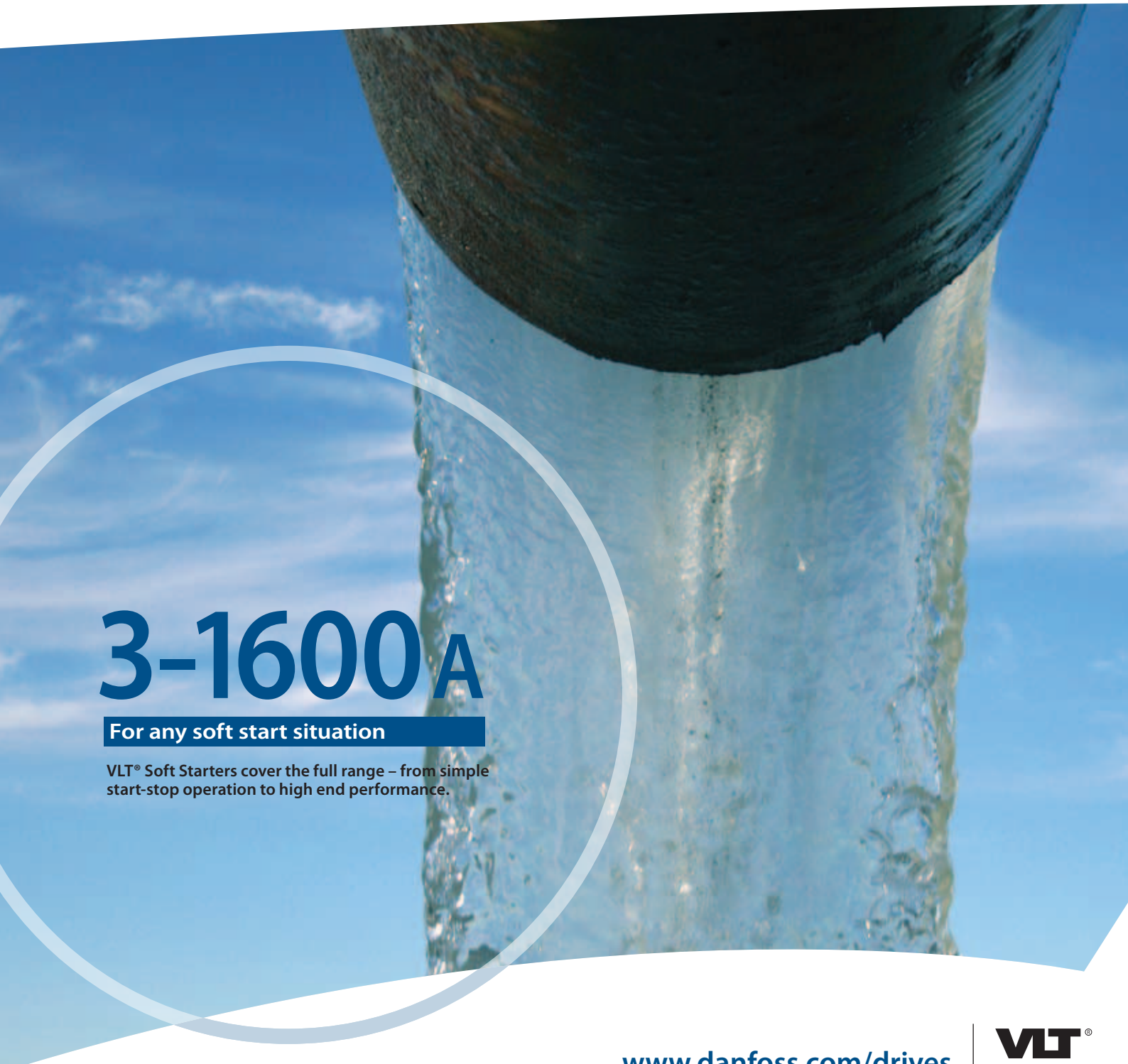
MAKING MODERN LIVING POSSIBLE

Danfoss VLT® Soft Starter
The single speed drive



3-1600A

For any soft start situation

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

www.danfoss.com/drives

VLT® 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.

MCD 100:
- Micro Soft Start controller for motors up to 11 kW
- Extremely robust SCR design with heavy ratings as standard
- Unlimited number of starts per hour
- Contactor style design for easy selection, installation and commissioning

MCD 200:
- Compact Soft Starter for motors up to 110 kW
- Voltage ramps, current limit start and intregrated motor protection
- Integral bypass design reduces heat dissipation
- Wide power range with advanced accessory modules

MCD 500:
- Fully featured Soft Starter for motors up to 850 kW
- Total motor starting solution
- Advanced protection features
- Adaptive Acceleration Control
- Inside Delta connection
- 4 line graphical display
- Multiple programming setup menus

Serial communication

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

- DeviceNet
- Profibus
- Modbus RTU
- USB

	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			•

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

Features	Benefits
User friendly	
• 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

Power range

21 – 1600 A, 7,5 – 850 kW
(1,2 MW inside Delta Connection)
Versions for 200 – 690 VAC

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				
84, 89 and 105	4.9			213	
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	302	G4
595, 619, 790 and 927	45				
1200, 1410 and 1600	120	856	585	364	G5

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 x I_e for 6 seconds).

Heavy starting ratings at 4x I_e for 20 seconds.

Compatible with grounded delta power systems.

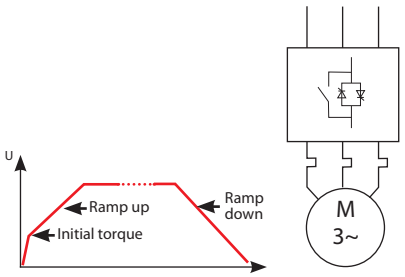
The perfect match for:

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

Power range:

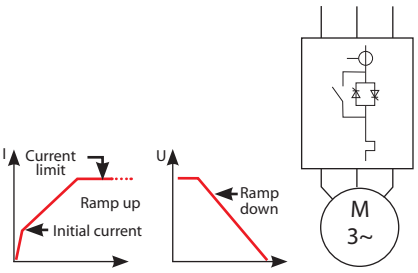
- 7.5 – 110 kW

MCD 201



MCD 202

MCD 202 provides enhanced soft start functionality and various motor protection features



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

Remote operation

Remote operation of MCD 201, MCD 202 and MCD 500 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.

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.

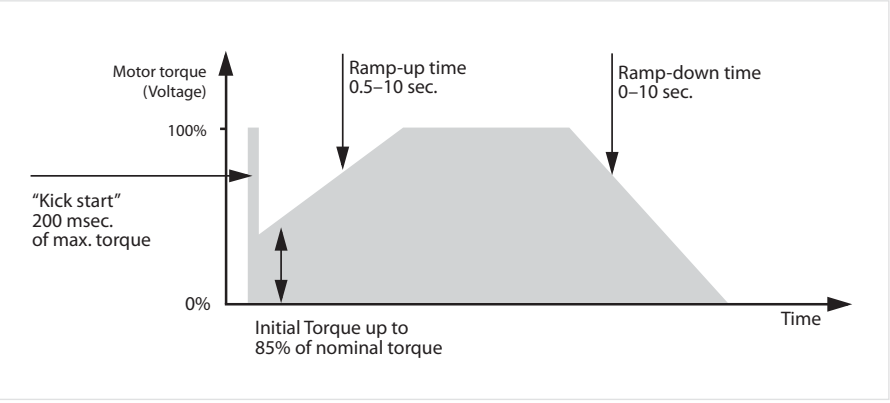
The perfect match for:

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

Power range:

- 1.5 kW (MCD 100-001)
- 7.5 kW (MCD 100-007)
- 11 kW (MCD 100-011)

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



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
MCD100	1.5	3 A: 5-5:10 (AC 53b)	102x22,5x124	UL, CSA, CE
	7.5	15 A: 8-3: 100-3000 (AC 53a)	110x45x128	
	11	25 A: 6-5:100-480 (AC 53a)	110x90x128	

Specifications and ordering typecodes

VLT® Compact Starter MCD 200

MCD | 2 | 0 | | – | | | | – | T | | – | C | V | |

Series

Soft start/stop	1
Soft start/stop + protection	2

Nominal Motor kW, 400 V

E.g. 55 kW	055
110 kW	110

Line Supply Voltage

200 – 440 V	4
200 – 575 V	6

Control Supply Voltage

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 |

MCD5, 500 Series

FLC, [A]
0021
0037
0043
0053
0068
0084
0089
0105
0131
0141
0195
0215
0245
0360
0380
0428
0595
0619
0790
0927
1200
1410
1600

Bypass indication
B: With Internal Bypass Contactor
C: Without Internal Bypass Contactor (Continuous)

Supply Voltage
T5, 200 – 525 VAC
T7, 380 – 690 VAC

Enclosure
G1, Frame size 1
G2, Frame size 2
G3, Frame size 3
G4, Frame size 4
G5, Frame size 5
(X, not Used)

IP Rating
00, IP 00
20, IP 20

Control Voltage
CV1, 24 VAC or 24 VDC
CV2, 110 or 220 VAC

Size indication for VLT® Compact Starter MCD 200

Model	Power size (kW)	Rated current AC-53b* (Amps)	Dimensions (mm)HxWxD	Approvals
MCD201/ MCD202	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		
	37	75 A: 4-6: 594	215 x 145 x 193	
	45	85 A: 4-6: 594		
	55	100 A: 4-6: 594		
	75	140 A: 4-6: 594	240 x 202 x 214	
	90	170 A: 4-6: 594		
	110	200 A: 4-6: 594		

** Example: AC53b: 42A: 4-6: 354 starting current max. 4 times FLC (42A) 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
MCD100	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
55	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 by-passed	External by-pass	Not by-passed	External Bypass	Not by-passed	External by-pass
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		6	930	**927**	930	800	829	644	661
650	G5x	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 Start Controller MCD 100 A true "fit and forget" soft starter for DIN rail mount, MCD 100 provides basic soft start and stop function	**VLT® Compact Starter MCD 201** – a physically compact starter providing basic soft start and stop functionality	**VLT® Compact Starter MCD 202** – physically similar to MCD 201 but providing enhanced soft start functionality and various motor protection functions	**VLT® Soft Starter MCD 500** – the total motor starter solution. Provides advanced control methods for starting and stopping and protection of motor and application
Concept			
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	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	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
Start/stop			
Timed voltage ramp-up Adjustable start torque Selectable kick-start function	Timed voltage ramp-up Adjustable initial torque	Current limit start Initial current ramp-up	Adaptive Acceleration Control (AAC) Current limit start Current ramp start Dual parameter function Kick-start Jog
Timed voltage ramp-down	Timed voltage ramp-down	Timed voltage ramp-down	Adaptive Deceleration Control (AAC) TVR soft stop (Timed Voltage Ramp) Coast to stop DC brake function – three phase Soft brake function Jog
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	As MCD 202 + 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			
	One output relay: Line contactor control	Two output relays: Line contactor control Run contactor or trip function	Three programmable output relays: Programmable analogue output Motor thermistor
Control			
Universal two-wire control Programmable via 3 rotary switches	Two- or three-wire control Programmable via 3 rotary switches Reset push button **Optional:** Modules for serial communication Remote operator kit PC software	Two- or three-wire control Programmable via 8 rotary switches Reset push button **Optional:** Modules for serial communication Remote operator kit PC software	8 language graphical display and keypad Quick menu and appplication menu Buttons for start, stop, reset and remote control Inputs for two- or three-wire control **Optional:** Modules for serial communication Remote operator kit PC software
Other features			
Extremely robust SCR design for unlimited number of starts per hour, LED indication, IP 20	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	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

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 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® 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.