VLT® Soft Start Controller MCD 100

VLT® Compact Starter MCD 200

VLT® Soft Starter MCD 3000

Soft starts

Protect Gear, Goods, Equipment and 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 11kW
- Extremely robust SCR design with heavy ratings as standard
- Unlimited number of starts per hour
- Contactor style design for easy selection, installation and commissioning

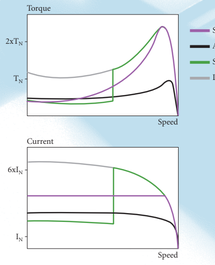
MCD 200:
- Compact Soft Starter for motors up to 110kW
- Voltage ramps, current limit start and intregrated motor protection
- Integral bypass design reduce heat dissipation
- Wide power range with advanced accessory modules

MCD 3000:
- Fully featured Soft Starter for motors up to 800kW
- Total motor starting solution
- Advanced start, stop and protection features
- Local programming keypad and display

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 functionality	**VLT® Soft Starter MCD 3000** - the total motor starter solution providing numerous functionality to control starting and stopping and protection of motor as well as application
Concept	Soft start Soft stop 0.1 - 11kW @ 400V 208 - 600V mains voltage 24 - 480 V AC/DC control voltage	Soft start Soft stop 7.5 - 110kW @ 400V 200 - 575V mains voltage 110 - 440V AC or 24V AC/DC control supply	Current limit start Soft stop Motor protection 7.5 - 110kW @ 400V 200 - 575V mains voltage 110 - 440V AC or 24V AC/DC control supply	Enhanced soft start and soft stop Motor and system protection 7.5 - 800kW @ 400V 200 - 690V mains voltage 110 - 400V AC control supply
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	Current limit start Initial current ramp-up Torque control Torque boost Dual parameter function
	Timed voltage ramp-down	Timed voltage ramp-down	Timed voltage ramp-down	Linear voltage ramp-down Three auto-adjustable voltage ramps DC brake function Soft brake function
Protection			Motor overload (adjustable trip class) Excess start time Reverse phase rotation Motor thermistor input Shorted SCR - no start Supply fault - no start	As MCD 202 + Under current Instantaneous overload Starter overtemperature Restart delay Warning before trips Adjustable phase imbalance sensitivity
Outputs		One output relay: Line contactor control	Two output relays: Line contactor control Run contactor or trip function	Three output relays: Line contactor control Run contactor or trip function DC brake contactor
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	Local key pad 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 - 55kW @ 400V) IP 00 (75 - 110kW @ 400V)	Integral SCR bypass for minimum physical size and heat dissipation during nominal operation LED status indication IP 20 (7.5 - 55kW @ 400V) IP 00 (75 - 110kW @ 400V)	Built in bars for easy connection of bypass contactor. All motor protection functions are retained in bypass mode Inside delta wiring kit (132 - 800kW) Automatic reset function Password parameter protection Trip log function LED status indication IP 21 (7.5 - 132kW @ 400V) IP 20 (185 - 800kW @ 400V)

Advantages of Soft starting over Star/ Delta and Auto transformer starting

Soft Starters are a far better alternative to star/delta and auto transformer starters. The star/delta starter reduces start current but introduces a damaging torque transient when switching from star to delta connection. Furthermore star/delta starting does not always allow selection of the best start current level. This sometimes means the load cannot accelerate to full speed in star configuration thereby making the star/delta starter totally ineffective. A star/delta starter does not impact the way the motor stops, thus leaving the voltage ramp down with no control. The auto transformer reduces start current but also allows some control over the level of start current. Auto transformer starters do not however eliminate the risk of a jump in torque when shifting voltage.



Benefits:

Pumps
- Reduced hydraulic shocks in pipelines during start and stop
- Minimized mechanical stress on motor shaft
- Reduced starting current
- Undercurrent protection preventing damage from blocked pipe or low water situations (MCD3000)
- Automatic reset functionality ensures continued operation of unmanned pump stations (MCD3000)
- Phase rotation protection prevents damage from reverse pump rotation (MCD202 and MCD3000)
- Instantaneous overload protection prevents damage from debris drawn into the pump (MCD202 and MCD3000)

Conveyors
- Controlled start without mechanical shocks causing damage to products and application
- Minimized belt stretch. Reduced counter balance stress
- Controlled stop without mechanical shocks
- Optimum soft start even with varying starting loads, e.g. coal conveyors starting loaded or unloaded (MCD202 and MCD3000)
- Extended mechanical lifetime

Compressors
- Reduced mechanical shocks extend the life of the compressor, couplings and motor
- Limited start current enables large compressors to be started even when maximum power capacity is limited
- Phase rotation protection prevents operation in reverse direction (MCD202 and MCD3000)
- Instantaneous overload protection prevents possible damage from liquid ammonia entering the compressor screw (MCD202 and MCD3000)

Fans
- Smooth application of torque preventing mechanical stress
- Reduced starting times over star/ delta starting

Centrifuges
- Smooth application of torque preventing mechanical stress
- Reduced starting times over star/ delta starting
- Reduced stopping times thanks to DC brake and soft braking (MCD3000)

Band saws
- Reduced time for saw band replacements since the soft braking function stops the motor quickly (MCD3000)
- Extended saw band life thanks to eliminated torque shocks during start
- Easier saw band alignment. Slow acceleration allows saw bands to be 'tracked' without jogging
- Maximum overload capability available for ride-through of operating overloads (MCD3000)
- The motor thermal model (MCD202 and MCD3000) accounts for the actual overload capability of the connected motors and will trip only if absolutely necessary.

Model	Power size (kW)	Rated current (Amps)	Dimensions (mm)HxWxD	Approvals
MCD100	1.5	3A: 5-5:10 (AC53b)	102x22,5x124	UL, CSA, CE
	7.5	15A: 8-3:100-3000 (AC53a)	110x45x128	
	11	25A: 6-5:100-480 (AC53a)	110x90x128	

Model	Power size (kW)	Rated current AC-53b* (Amps)	Dimensions (mm) HxWxD	Approvals
MCD201/ MCD202	7.5	18A: 4-6: 354	203x98x163	UL C - UL CE CCC C-tick
	15	34A: 4-6: 354		
	18	42A: 4-6: 354		
	22	48A: 4-6: 354		
	30	60A: 4-6: 354		
	37	75A: 4-6: 594	215x145x191	
	45	85A: 4-6: 594		
	55	100A: 4-6: 594		
	75	140A: 4-6: 594	240x202x212	
	90	170A: 4-6: 594		
	110	200A: 4-6: 594		

** Example: AC53b: 42A: 4-6: 354 starting current max. 4 times FLC (42A) in 6 seconds. 354 seconds minimum between starts.*

Model	Power size (kW)	Rated current AC-53a* (Amps)	Dimensions (mm) HxWxD	Approvals
MCD3000	7.5	16A: 4-20: 50-10	530x132x270	UL C - UL CE CCC C-tick
	15	28A: 4-20: 50-10		
	18	33A: 4-20: 50-10		
	22	40A: 4-20: 50-10		
	30	54A: 4-20: 50-10		
	37	70A: 4-20: 50-10		
	45	76A: 4-20: 50-10		
	55	100A: 4-20: 50-10		
	75	110A: 4-20: 50-10		
	90	159A: 4-20: 50-10	530x264x270	
	110	188A: 4-20: 50-10		
	132	198A: 4-20: 50-10	530x396x270	
	185	299A: 4-20: 50-10	850x430x280	
	220	353A: 4-20: 50-10		
	300	455A: 4-20: 50-10		
	315	530A: 4-20: 50-10		
	400	666A: 4-20: 50-10		
	500	782A: 4-20: 50-10		
	600	985A: 4-20: 50-10	1000x560x315	
	700	1186A: 4-20: 50-10		
	800	1348A:4-20: 50-10		

** Example: AC53a: 70A: 4-20: 50-10 Starting current max. 4 times FLC (70A) in 20 seconds 50% on load duty cycle and max. 10 starts per hour.*

Rated currents in tables above are for max. 40°C ambient temperature. For other ratings contact Danfoss.

VLT® Compact Starter MCD 200

MCD 2 0 - - - T - C V

Series

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

Nominal Motor kW, 400V

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 - 440V AC	3

VLT® Soft Starter MCD 3000

MCD 3 - T - - - C V

Nominal Motor kW, 400V

E.g. 132 kW	132
800 kW	800

Line Supply Voltage

200 - 525 V	5
200 - 690 V	7

Enclosure

Bookstyle IP21 (MCD 3007-3055)	B21
Compact IP21 (MCD3075-3132)	C21
Compact IP20 (MCD3185-3800)	C20

Control Supply Voltage

110 - 230V AC	2
230 - 400V AC	4

Remote operation

Remote operation of MCD 201, MCD 202 and MCD 3000 is facilitated by the dedicated remote operator kit. The operator (IP54/NEMA12) 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. It incorporates the following features:

	MCD 201	MCD 202	MCD 3000
Start/stop, reset	•	•	•
LED for start, run, trip	•	•	•
Trip codes	•	•	•
Current display		•	•
Motor temp. display		•	•
4 – 20 mA output		•	•

IP54/NEMA12

Serial communication

MCD 201 and MCD 202 come with optional plug-in modules for serial communication.
- DeviceNet
- Profibus
- Modbus RTU
- AS-i*

Optional modules are available for serial communication with MCD 3000:
- DeviceNet
- Profibus
- Modbus RTU

(*as of May 2005)

Constant effort to improve

The focus is clear at Danfoss: as a leading supplier of drives solutions throughout the world, we have spent years accumulating our technological and application know-how.
Danfoss drives have been produced since 1968 and Danfoss Bauer geared motors since 1927.
Today, a long list of references indicates that the name of Danfoss is widely accepted as being synonymous with excellent quality and operational security. We have focused our professional resources on just one technological area for years: drives solutions.
Years of applying these resources to industrial production lines have given us a wealth of experience and expertise.
The results speak for themselves.
Danfoss has enjoyed great success, and we are proud of what we do.

VLT® Soft Starter

MCD 100, MCD 201, MCD 202, MCD 3000