

MAKING MODERN LIVING POSSIBLE

*Danfoss*



## VLT® Multi-function Cascade Controller

**VLT**®  
THE REAL DRIVE

# Multi-function Cascade Controller

– for the VLT® AQUA Drive



*VLT® AQUA Drive covers  
the full power range from  
0.37 kW to 1.2 MW and  
the supply voltage range  
up to 690 V AC*



Our proven AQUA experience ranges from Athens Wastewater Treatment Plant, Greece to plants in Mexico, China and Australia.

The controller provides accurate flow, pressure, and level control that make your multiple pump or blowers systems work in an optimised efficient way.

The VLT® AQUA Drive has a basic cascade function embedded in the drive itself that controls up to three pumps.

Cascade control of more than three pumps require the Multi-function Cascade Controller option.

The VLT® Cascade Controller controls speed and sequence of up to eight pumps or blowers in three modes.

#### Standard cascade mode

- Variable speed of one motor and on/of control of the rest

#### Mixed pump mode

- Variable speed of a few pumps and on/of control of the rest

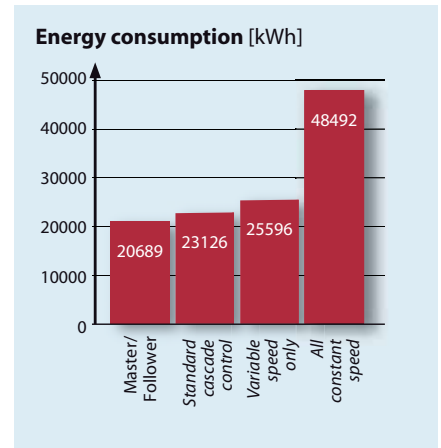
#### Master/Follower mode

- Controls all pumps with optimised speed. This mode is the most energy optimised solution.
- Ensures maximum performance with minimum pressure surges.

In all three modes, pumps are staged on or off depending on the need.

#### Run-time balancing

The cascade controller can be used to balance the run-time for each pump in a system.



Using Master/Follower mode can reduce the energy consumption to less than half compared to traditional across the line on/off cycling of pumps/blowers and valve throttling.

#### Built for:

- Water distribution and booster pumps
- Wastewater Lift stations (normal or inverse)
- Aeration blowers
- Irrigation pumps

#### Who benefits?

- Pump and blower OEMs with multiple pump/blower systems
- System integrators/installers
  - booster set manufacturers
  - pump skid manufacturers
- Anyone interested in a high level of process control and energy conservation in multi-pump or blower systems



# Maximum flexibility with VLT® Cascade Controller

– customised for up to 3, 6 or 8 pumps



## Basic – up to **3** pumps

The Basic Cascade Controller is built in all VLT® AQUA Drives. It controls up to three pumps or blowers.



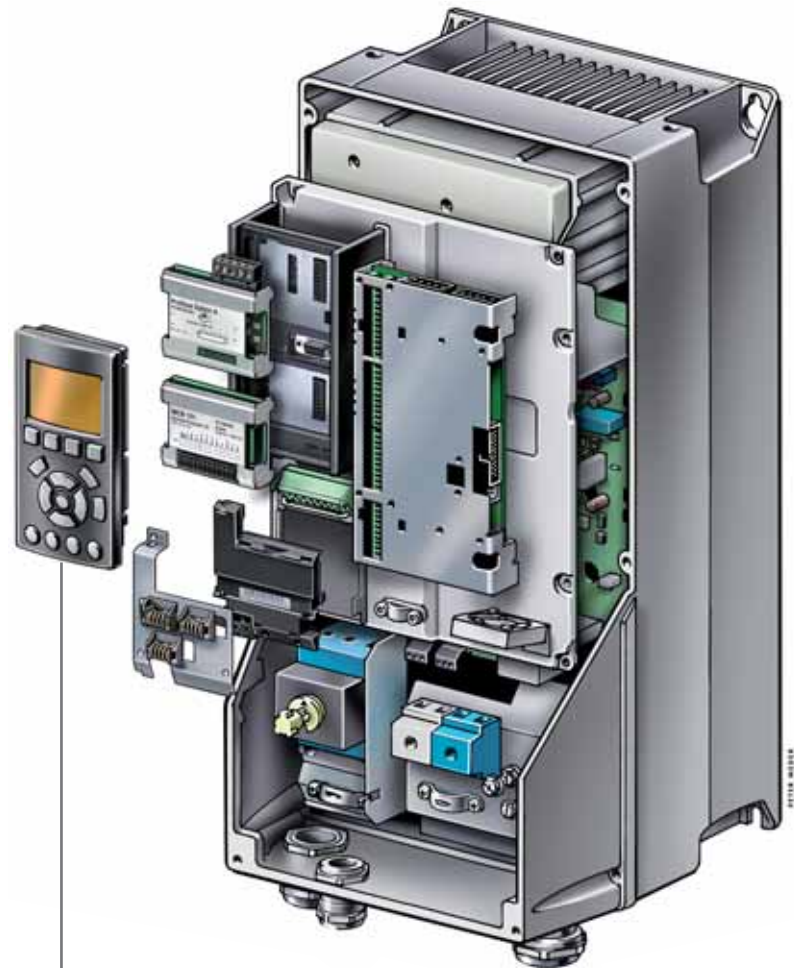
## Extended – up to **6** pumps

The VLT® Extended Cascade Controller option MCO 101 controls up to six pumps or blowers.



## Advanced – up to **8** pumps

The VLT® Advanced Cascade Controller option MCO 102 controls up to eight pumps or blowers.



Pump status  
D = Pump on drive  
O = Pump off  
R = Pump on relay  
(Direct on line)





### Easy Commissioning and service

The VLT® Cascade controller can be commissioned from the drive display or using MCT10 PC software in its free of charge download version.

The MCT10 configuration tool makes setup of the cascade controller parameters child's play.

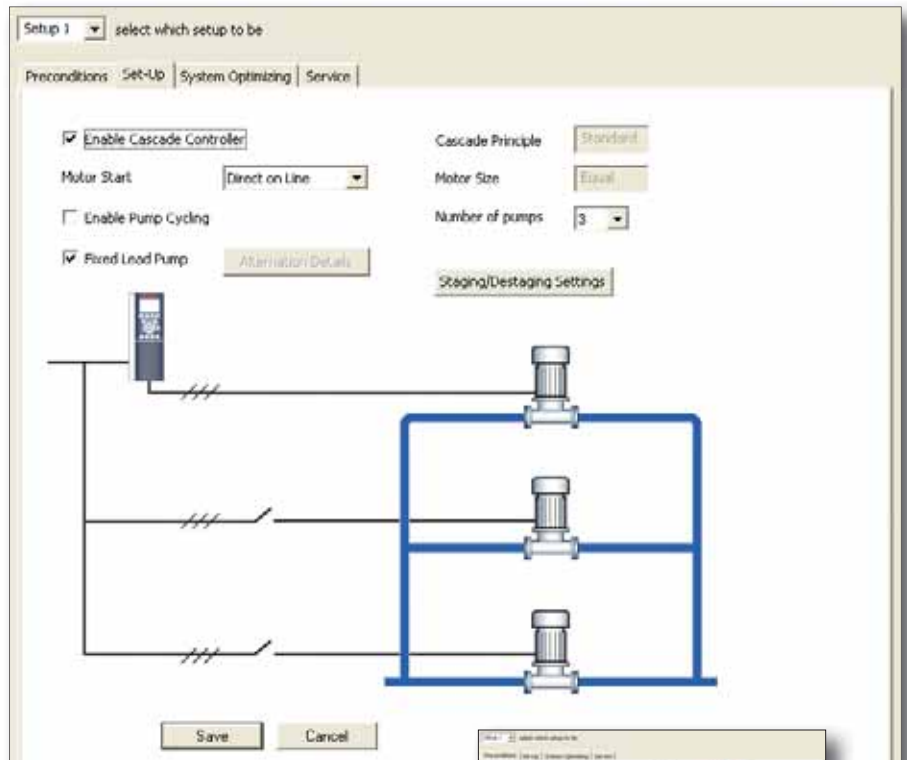
The pump status can be followed in the drive display during operation and the run time of each pump together with the numbers of starts are logged. System performance is easily tracked.

### Built in

The Multi-function Cascade Controller option is mounted directly in the drive and includes all kind of pump control features. This often eliminates the need for PLC's and other external control equipment.

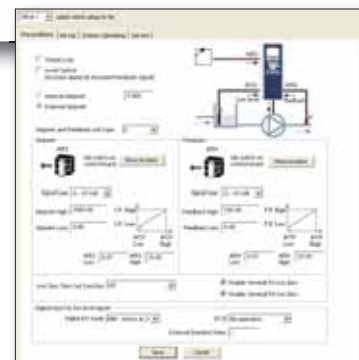
### Easy upgrade

With the VLT® plug and play flexibility in adding option cards in the drive, it is child's play to expand the Basic Cascade Controller. Minimum time and no space is required.



Screen shot of MCT 10 Cascade Controller configuration tool. A wizard to set up the controller.

*Mark the number of pumps and whether the lead pump has fixed speed etc. – and all parameters in the drive are set.*



### Same hardware up to 1.2 MW

The same cascade controller hardware goes for the entire power range up to 1.2 MW.

### Lead pump alternation

Lead pump alternation is possible with all VLT® Cascade Controllers, even the built-in Basic Cascade Controller.

The feature assures that up to eight pumps or blowers are used equally and ensures that pumps will not run for extended periods.

Alternation can be programmed to take place on digital input, when in sleep mode, when a pump is destaged, or at preset times.

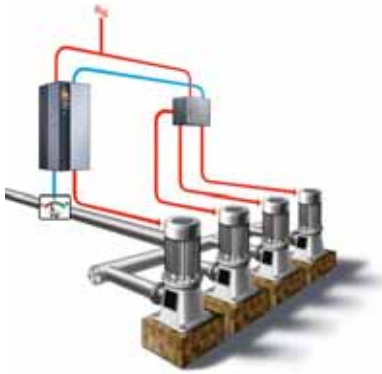
### Pump Interlocking

In case a pump or blower is out of order or being serviced the VLT® Cascade Controller can be set – manually or by digital input – in "Pump Interlocking".

The cascade controller will then skip the specific pump or blower in its staging sequences.

# Maximise energy savings

– control with standard, mixed or master/follower mode



## Standard cascade control mode

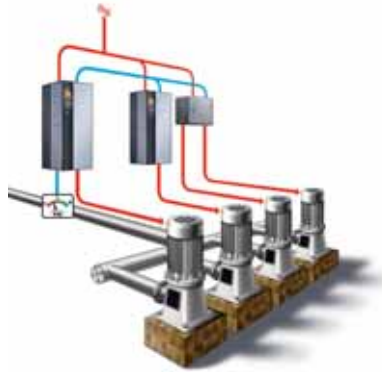
With standard cascade control only one VLT® AQUA Drive is needed to maintain a programmed flow or pressure in a multiple pump or blower system.

With feedback from a transmitter the drive controls the speed of one pump or blower. When demand exceeds the capacity of the variable speed pump or blower, the cascade controller stages and destages pumps or

blowers direct on line – one at a time – depending on the demand.

The system is able to handle soft starters and star/delta starts of the fixed speed pumps.

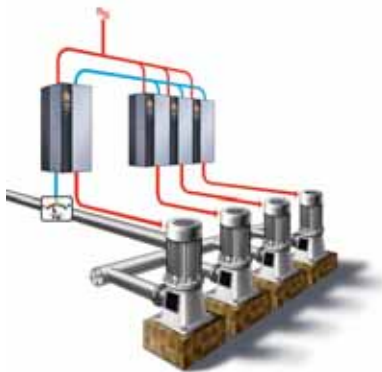
The VLT® cascade control controls the setpoint even if a drive trips. As long as the drive control card is powered up, the controller will maintain the head by staging/destaging pumps or blowers direct on line.



## Mixed pump or blower system mode

The VLT® Cascade Controller option is able to control a mix of drives and direct on line pumps or blowers. The VLT® Cascade Controller is able to control pumps of unequal sizes.

Assuming that the lead pump capacity is 100%, the next pumps can be programmed from 0-800% independently. The cascade controller will automatically adjust the speed of the variable speed pump when staging and destaging fixed speed pumps.



## Master/follower control mode

Master/follower control mode offers the best performance, accurate control and maximum energy savings. Master/follower systems control multiple blowers/pumps in parallel, running all blowers/pumps at the same speed. The controller stages the blowers/pumps on and off according to

system requirements which is continuously auto tuned in order to ensure optimised system efficiency.

This feature makes the drive compensate for reduced mechanical efficiency due to tear and wear.

Master/follower mode provides a reliable system with master redundancy.



### Standard cascade control mode

- Operates up to:
  - Basic Cascade – 3 pumps
  - Extended Cascade option – 6 pumps
  - Advanced Cascade option – 8 pumps
- Bandwidth controlled with staging delay timers
- De-stage timer to avoid frequent pump cycling
- Set point correction when the feed back sensor is near the pump
- Continued plant operation during drive “trip”
- Lead pump alternation function
- Allows the mixing of pump sizes
- Pump interlocking
- Direct on line pumps or blowers can be started with soft starter or Star/Delta

### Mixed pump or blower system mode

- For systems with more than one drive together with additional fixed speed pumps
- The same features as standard cascade mode

### Master/Follower control mode

- Available with extended (up to 6 pumps) or advanced (up to 8 pumps) option card
- Optimal plant efficiency by separate staging/destaging frequency operation.
- Lead pump alternation
- Runtime balancing
- 3 levels pump priority
- Auto tuned stage on/off speeds continuously optimises the system efficiency
- Smooth transition, which improve performance and saves wear and tear of weak pipe systems
- For initial settings, the Danfoss MUSEC software can be utilised

### Shared features

- Alternation of lead pump/blower based on hours of operation, external event, at staging or destaging.
- Service parameters provide access to hours of operation, number of starts and stops of a specific pump/blower in the system.
- Utilizes the internal PID controller of the new VLT® AQUA Drive
- Continued plant operation during drive trip

Download of MUSEC™ and MCT10 software:

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

--> Business Areas

--> Software Download

--> PC Software Download





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

# What VLT® is all about

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

### 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®.

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

### Intelligent and innovative

Developers at Danfoss 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 Drives' experts located in more than 100 countries are ready to support our customers with application advice and service wherever they may be.

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

