Application Note AN-VTC-36

Using Master / Slave mode for Cascade control

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- ***General:***

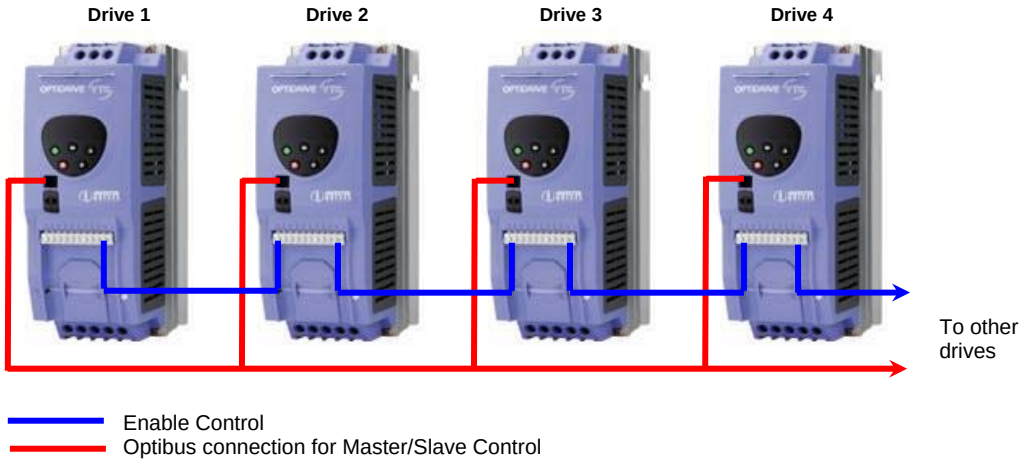
Optidrive VTC is capable of implementing a cascade control system where two or more drives are used with their respective motors or pumps to provide a means of minimising the number of drives running in a lightly loaded system, yet automatically starting successive drives when the load increases

Typical cascade control system applications include pressure control systems with multiple compressors or flow rate control etc.

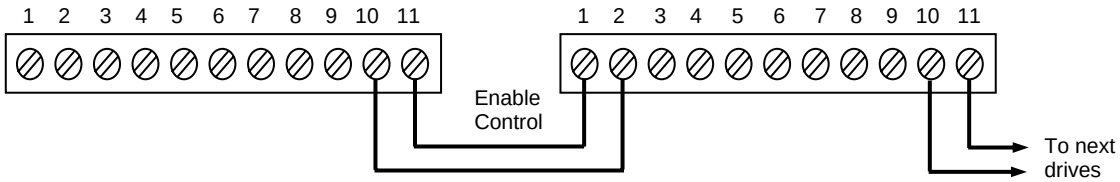
This document describes how to configure the Optidrive VTC to setup a cascade control system using the Master-Slave operating mode.

- ***Drive connection and wiring***

Drive connection



Optidrive Plus Terminal Connection



Drive 1 **Other drives**

- ***Description***

Usually in this type of application, there will be a master drive which runs from an external speed control reference or PID control. Each drive in the cascade will be able to start the next drive, thereby successively increasing the number of drives running if load increases.

Since the pressure or flow rate information is usually related to the motor speed or motor current, the drive can use this motor information to determine whether a successive drive should be started or not.

- ***Parameters***

P2-13 Relay output function select

This parameter should be set to 4 (motor speed) or 5 (motor current), configuring the relay output to change state depending on the motor motor speed or current. The switching limits for the relay output are configured in P2-14 (see below).

The relay output signal of each drive is connected to the enable input of the following drive in the cascade and is used to enable / disable that drive depending on the speed or current level.

P2- 14 Relay control limit

This parameter sets the levels at which the relay switches, as a percentage of the drive maximum output speed or motor rated current depending on the setting of P2-13.

Two limits must be set : the upper limit and the lower limit, effectively providing a configurable hysteresis band. A hysteresis band is always required for this kind of application.

P2-15 should be left to its default setting, ie Normally Open (N.O.)

Note that only one drive must be set up as a master drive. All other drives must be set up as slave drives with a different drive address. For information on how to setup a Master / Slave network, please refer to AN-VTC-27

- ***Example***

Consider a system with 3 drives and three fans providing air flow control into a common venting system. The first drive in the system uses PID control with a pressure / flow transducer to maintain the required air flow.

For drive one, the PID control mode is set up as usual (see AN-VTC-32). All slave drives are set in keypad control mode (P1-12=1). The remaining parameters are set as follows:

P2-13 = 4 (motor speed)
P2-14 (high) = 90% and P2-14 (low) = 60%

For the second drive, the parameters are set as follows:
P2-13 = 4 (motor speed)
P2-14 (high) = 90% and P2-14 (low) = 75%

If the output speed of the first (Master) drive needs to increase in order to provide the desired air flow, the drive relay output will close when the motor speed exceeds 90% of the maximum output speed (P1-01). This will automatically start the 2nd drive which will receive the speed reference of from the Master drive and will therefore operate at the same speed as the master drive. Usually the master speed will drop after the second drive kicks in since both drives share the load.

Similarly, if the drive output speed increase again over 90% of maximum speed of the second drive, the output relay on the second drive will close, which will result that the third drive being enabled.

If the motor speed drops under 75% of the maximum speed of the second drive, the relay output of the second drive will open and the third drive will ramp to stop.
If the motor speed drops under 60% of the maximum speed of the master drive, the master drive relay output will open and the second drive will ramp to stop.

The lower hysteresis speed limit for drive N in a multiple drive system is given by :

Lower hysteresis limit for drive N = Upper hysteresis limit x N / (N+1)

eg Consider upper hysteresis limit for all drives to be 90%

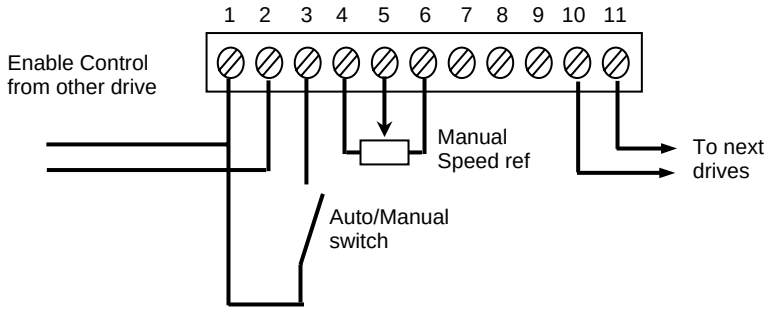
Lower hyseresis limit for specified drive is :

Drive 1	90% * 1 / 2	= 45%
Drive 2	90% * 2 / 3	= 60%
Drive 3	90% * 3 / 4	= 67.5%
Drive 4	90% * 4 / 5	= 72%

- ***Auto/Manual control***

Other than normal master/slave operation, each slave drive can be separately set up and wired for manual-override or “local” control.

For example set P2-01 = 17 on a slave drive. Then connect a switch between drive terminals 1 and 3 for auto (open) /manual (closed) selection.
A potentiometer between terminal 5, 6 and 7 can then be used for manual speed control reference. See the following diagram for wiring details :



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