Technical instruction
ACS250 micro drives, 500-600 V
Using multiple motors in parallel

Overview

In some applications it is possible to operate multiple motors connected to a single ACS250. This technical instruction describes the considerations and guidelines that should be given to such applications in order to select the correct drive and to operate it successfully.

All drives used for multiple motor applications must be configured for V/F speed control only (parameter 9903=2). The AutoTune function in sensorless vector control mode may cause the drive to fault when attempting to analyze multiple motors. Only standard industrial AC induction motors should be used for multiple motor applications.

Wiring configurations

Configurations no.1 and no. 2 show a common installation setup where a single drive is used to control a larger (>1) number of smaller rated motors.

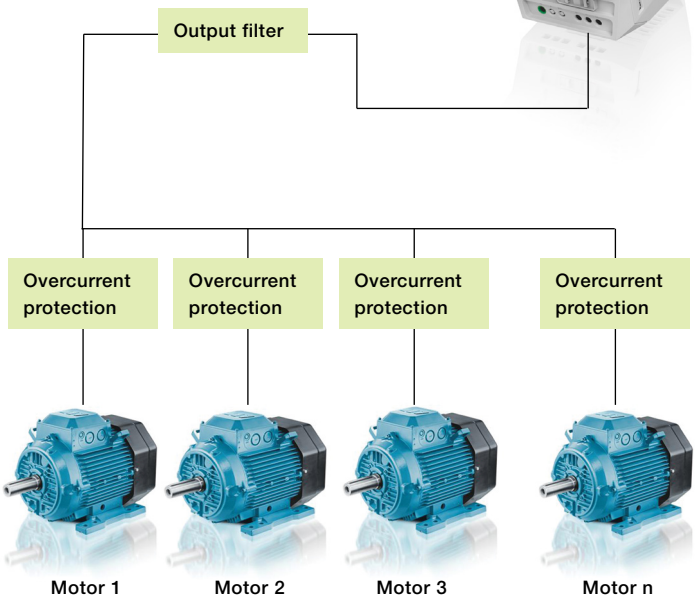
With this connection method (configuration no. 1) a single motor cable is run between the drive and the first motor and connection is then daisy chained from one motor to the next. The cable from the drive to the first motor is therefore typically long and is required to be rated to the combined current [A] ratings of all of the overcurrent protection devices. This configuration typically results in the overcurrent protection being located close to the motor it protects, making the cable run between the overcurrent protection and the associated motor very short.

The output filter is required only when the accumulative motor cable length is greater than the maximum motor cable length

Configuration no. 1
Series connection

Optional output filter

(Not required if total motor cable length is less than maximum specified in user's manual)



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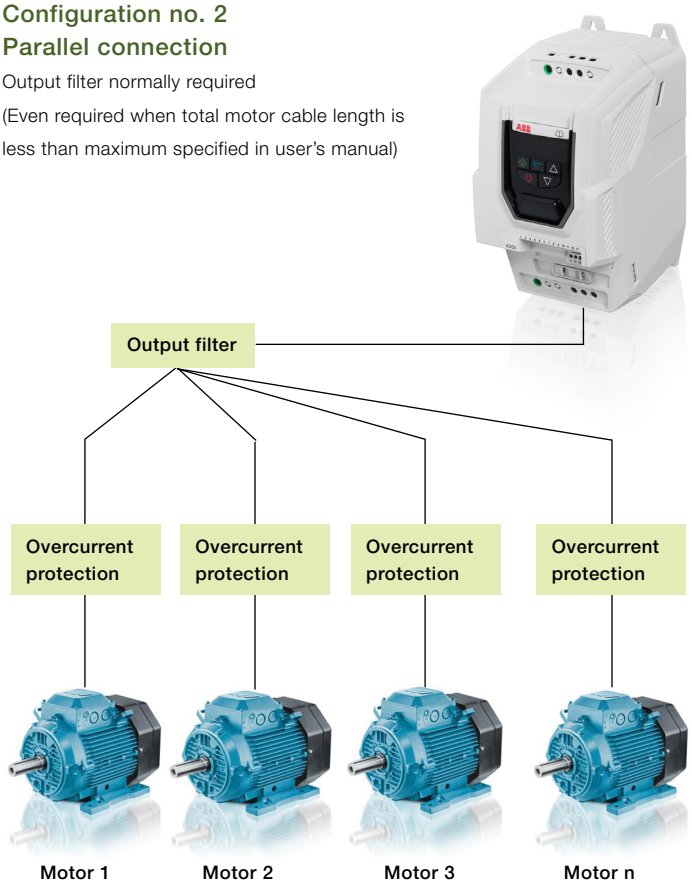
Configuration no. 2
Parallel connection

Output filter normally required

(Even required when total motor cable length is less than maximum specified in user's manual)



specified for the drive (given in the user's manual).

With this connection method (configuration no. 2) individual motor cables are run between the drive and each of the motors with a common connection (star) point located close to the drive. Overccurrent protection for this configuration is typically located near to the drive so that each motor cable down-stream from the overcurrent protection device is rated only for the motor it protects.

The output filter is normally required for this connection method, even when the accumulative motor cable length is less than the maximum motor cable length specified for the drive (given within the user's manual).

Multiple motor applications

Multiple motor with single drive operation is generally suited to applications where the motors are always required to run at approximately the same speed and where motor loads are not mechanically coupled together.

Drives can be used to run multiple motors in applications where slight motor speed variation (generally only a few percent) does not cause a problem in the overall process being performed (motors speeds are not required to be precisely synchronised). Typical applications might include fans, pumps, or conveyors where accurate speed synchronisation within the application is not a requirement.

Multiple motor with single drive applications require that the drive be in V/f speed control mode (9903 = 2). Such applications cannot be run with any other control mode or motor type (refer to drive operating instructions for detail).

General rules for multiple motor applications

- Providing that all the motors are permanently connected to the ACS250, the required drive can usually be selected based on the total of the motor current ratings connected.
- The total cable length required should not exceed the maximum allowed for the drive in use – refer to the user's manual for details of the maximum cable length. The allowed total cable length can be increased by 50 % if an output filter is used.
- To avoid possible motor damage, each individual motor must be protected by a thermal overload device. The drive overcurrent protection settings cannot be used to protect multiple motors.
- The drive should be operated in V/F Mode only. Other control modes cannot be used in this type of application.
- Only standard AC industrial three phase motors should be used. Other motor technologies are not suitable for multiple motor operation.
- The effective switching frequency parameter (2606) should be set to the minimum value (normally 4 kHz).
- The spin start function (2101) cannot be used.

Providing the above design rules are met and the motors are permanently connected to the drive, the drive should be sized based on the total nameplate current (not kW or hp) of the connected motors.

Example of drive sizing with permanently connected motors

An ACS250 is required to control four fan motors as follows.

- 2 x 0.75 kW/1 hp, 1.9 A FLC
- 2 x 2.2 kW/3 hp, 5.2 A FLC

The supply voltage is three phase 600 V. The cable length required is 10 m per fan, wired in series (configuration no. 1).

Total amps required: 1.9+1.9+5.2+5.2=10.9 A. Referring to the ACS250 user's manual, an 5.5 kW/7.5 hp 600 V drive will provide 39 A output current and would be suitable. The 'motor rated current' parameter (9906) should be set to 10.9 A. Each motor requires an individual overload device to protect it, and an output filter is not generally required as the motors are series connected and motor cable length is less than the maximum allowed for this drive model.

Applications where individual motors are not permanently connected to the drive

In some applications it might be desirable to use a single drive to operate multiple motors where all of the motors are not operating at the same time (are not always permanently connected to the drive output). Motors might be selected or deselected by means of contactors or switches located between the individual motors and the drive output.

In such cases the best solution is to design the control system in such a way that motors cannot be connected or disconnected while the drive is enabled and running. Attempting to start a motor by closing a contactor or switch on the output side of the drive while the drive is enabled is likely to cause overcurrent trips on the drive and prohibit operation.

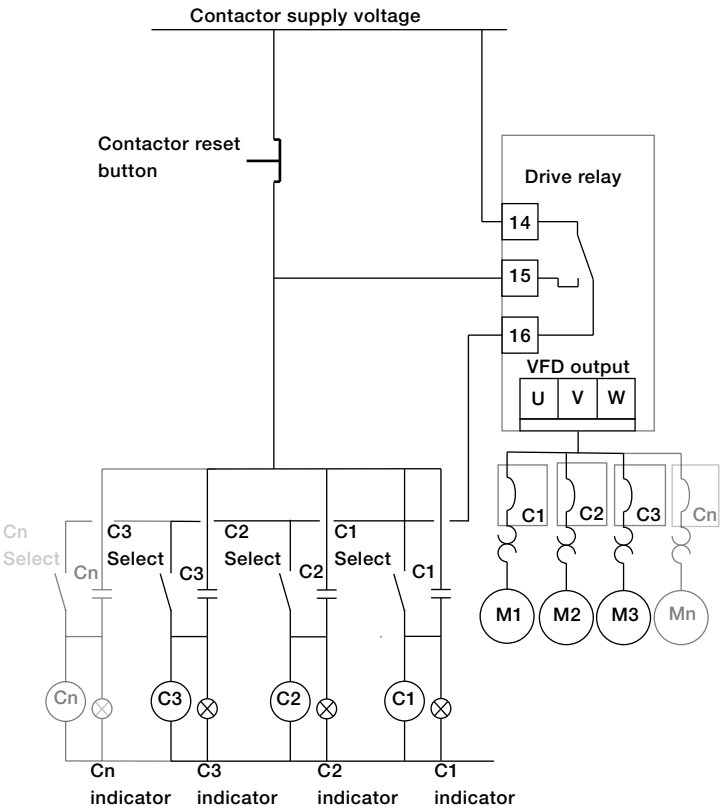
If an application requires that different motors are run at different times (for example: in a bank of six fans, any number or configuration of fans might be selected to run at any particular time) then the sequence for changing the motor fan bank configuration would be as follows:

- Disable the drive via the run/enable signal, and allow the drive to ramp the motors down to standstill.
- Operate the contactors to connect/disconnect the required motors to/from the drive.
- Re-enable the drive run signal to restart the system.

While this means that all motors must stop before the motor configuration can be changed, it ensures that nuisance overcurrent trips are not encountered.

Example interlock circuit to prevent motor switching while drive enabled

This circuit (shown below) requires an additional interim relay in addition to the drive user relay in order to provide normally open and normally closed contacts for the successful operation of the circuit.



To select a motor the appropriate contactor select switch is closed (C# select) while the drive is disabled. To deselect a motor the appropriate contactor select switch is opened and the contactor reset button pressed while the drive is disabled. Selected motors are shown by the corresponding indicators (C# indicator).

The drive relay will need to be set to switch on a drive enabled condition. This is done by setting 1401 to '0'.

Selecting or deselecting of motors is not possible once the drive is enabled/running and the drive relay closes.

The supply requirements to operate the contactors must not exceed the contact rating of the drive relay. The drive relay maximum rating is 250 V AC, 6 A/ 30 V DC, 5 A. An appropriately rated interim relay should be selected.

Applications where motors are connected while the drive is running

It is possible to connect and disconnect motors while the drive output is operating. However in such applications there is a need to oversize the drive, and as such it is often less costly to purchase individual drives for each motor.

Where individual motors need to be started or stopped without decelerating the drive to standstill (through switches or contactors on the output) the drive has to be oversized to allow for the maximum possible motor starting current. When motors are started in this way (referred to us Direct On Line starting) the inrush current can be up to seven times the full load current of the motor, and so the drive must be capable of delivering this current without tripping.

Because of the oversizing required for the drive in this sort of application, it is typically more cost effective to use individual drives with each motor. To size the drive properly for the worst case situation (one motor running and one or more additional being started simultaneously) the full load current rating of each motor is summed and multiplied by an overload factor of (n+1)x100 % where n is the total number of motors connected to the drive. Nuisance faults can also be an issue. For these reasons, this type of applications is not recommended.

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