Overload Protection in Multi-motor Applications with VFD

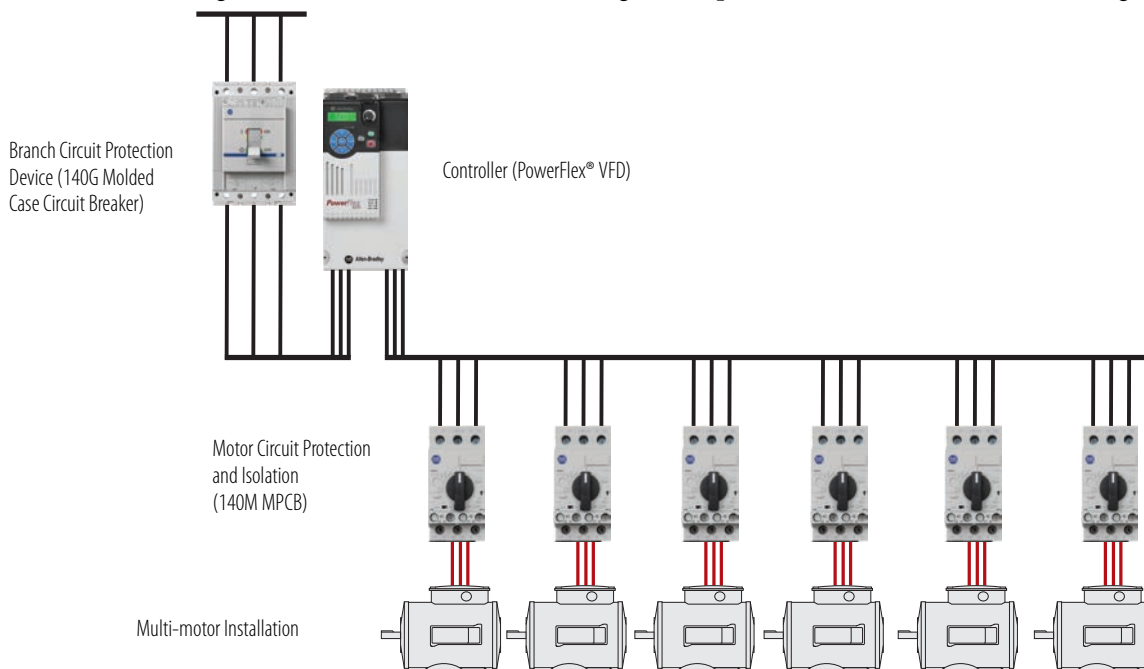*Motor Protection Circuit Breakers are now suitable for this application*

Customer Need

Many applications can use multiple motors of the same capacity operating in parallel at the same speed. In such applications, you can use one variable-frequency drive (VFD) to control multiple motors.

In this type of multiple motor applications, NEC requires individual motor overload protection (thermal) on the load side of a VFD. This load-side protection is required because a single VFD can sense only its total connected load and cannot sense which individual motor is drawing high current. This means that, in this instance, the VFD cannot provide appropriate overload protection.

The following describes some challenges for overload protection devices at the output of VFDs:

- For electronic overload relays, their current sensor technology may not be able to measure the load current and harmonics correctly when operating at frequencies outside their nominal sensing range.
- For standard motor protection circuit breakers (MPCBs), the challenges are related to reflection of voltage pulse that causes high dielectric stress on the MPCB magnetic trip coils, which results in accelerated aging.

Branch Circuit Protection Device (140G Molded Case Circuit Breaker)

Controller (PowerFlex® VFD)

Motor Circuit Protection and Isolation (140M MPCB)

Multi-motor Installation

Note: With the PowerFlex 525 Low Voltage Drive, we do not recommended going below 3 Hp in multi-motor applications due to the cable charging current.

Component Solution

Bulletin 140M-D8V MPCBs are suitable for application at the output of VFDs in multi-motor installations. These MPCBs are designed with lower surge impedance, so the reflected voltage pulse phenomena does not significantly affect them. When applying a 140M-D8V, make sure that following conditions are met for robustness of installation:

- PWM frequency ≤ 4 kHz
- VFD output frequency ≤ 400 Hz
- Maximum cable length, found in the drive instruction manual, is applied

These MPCBs provide overload protection to individual motors and short-circuit protection for individual motor circuit tap conductors where required. These MPCBs also provide disconnect functionality for maintenance purposes.

You must also properly size the VFD in this type of application. The following guidelines are recommended:

- Add full-load current (FLA) of all the motors and add 20% (to accommodate lower leakage inductance) to select the VFD size
- Set correct current ratings
- On some drives, we recommended against sizing below 3 Hp due to capacitive coupling (cable charging current)
- Adding a common mode core and using XLPE cable will help to minimize cable charging current
- Set drives in V/Hz motor control
- We recommend against motor "line start/stop" when the VFD is running

Summary

In a multi-motor application at the output of a VFD, 140M-D8V MPCBs provide overload protection to individual motors and short circuit protection for individual motor circuit tap conductors where required. Using VFDs to control multiple motors with right design consideration helps to reduce cost, foot print, and control complexity. Learn more about the use of MPCBs with VFDs in white paper publication [140M-AT002](#).

Product Selection

Description	Catalog Number
Bulletin 140M Motor Protection Circuit Breakers	140M-D8V

www.rockwellautomation.com