Technical Note 049

Fan array starting methods
Drive setup instructions

Fan arrays are common in air handlers for their increased redundancy and efficiency. A fan array is defined as using more than one fan/motor in parallel to move air. Many installations use a single variable frequency drive to control all or some of the motors in a fan array. The initial run command can be a challenge for a single drive in these applications if multiple motors are free spinning at the time of the run command. This technical note will discuss the preferred starting method to use for single drive multiple motor applications.

One drive operating multiple motors starts and stops all the motors at the same time, while operating them at the same speed. Motors cannot be independently controlled.

In fan applications there is a potential for the fan to be free spinning due to system dynamics, even though the drive is not actively controlling the motor. If the correct starting method is not used on a free spinning motor, the VFD can trip out on a fault, such as overcurrent. The default starting method for the ACH580 drive is *Flying start*. The Flying start control algorithm can catch a free spinning motor and ramp the motor to the correct speed. However, the Flying start algorithm is optimized when a drive is controlling a single motor.

The Flying start algorithm functions by sending out quick pulses of energy to the motor, and then by monitoring the back EMF the drive determines the speed and direction of the motor. Once the drive knows the approximate motor speed, the drive outputs an appropriate voltage and frequency to "catch" the motor. In a fan array application, the drive still sends pulses of energy out to multiple motors, just like the drive would for a single motor application, and in most cases the drive successfully catches the motors. However, in scenarios with multiple motors free spinning at different speeds, the measured back EMF signal the drive detects is an average value, and may not be accurate for any individual free spinning motor. The drive then tries to catch the entire fan array based on this averaged value, and if individual motors are too far off from this averaged value, those motors will draw excessive current and the drive may experience an overcurrent fault. It should be noted many fan arrays currently operate without any issues using the Flying start algorithm.

The ACH580 incorporates a starting method called *Constant time* that provides a more reliable starting method for fan array applications. The Constant time starting method first brings the motors to a stop before accelerating the motors to setpoint. The drive brings the motors to a stop by magnetizing the motors in a way which causes free spinning motors to decelerate to a stop. After the period of adjustable magnetizing time has expired the drive will start ramping the motors up from zero speed. The magnetization time should be set long enough for all the free spinning motors to come to a complete stop. If the motors are already stopped the additional magnetization of the motor will not damage it.

The following steps outline selection of the starting method to Constant time:

Step 1: Set Parameter 21.19 = "Const time"

Step 2: Set Parameter 21.02 (Magnetization time) for how long the drive will be magnetizing (braking) the motor. The units of 21.02 are in milliseconds (ms). The maximum time for motor magnetization is 10,000 ms or 10 sec.

Pro tip: Set parameter 21.02 = 3000 ms to start with. If the motors cannot come to a complete stop in 3000 ms then increase the time in increments of 1000 ms. If you reach the maximum setting of 10,000 ms for parameter 21.02 and the motors will not come to a complete stop, then some other force is acting on the fans that needs to be investigated.

The ACH580 has several start methods, with Flying start being one of the most popular starting methods due to the ability of the drive to catch a spinning motor. However, for applications with a single drive powering multiple motors, the Constant time method provides more consistent results because the motors are first brought to a stop. Bringing the motors all to a stop provides a more reliable starting solution in applications where multiple motors may be free spinning at different speeds.