

Using Opto 22 Analog Modules with VFDs

Introduction

Variable frequency drives (VFDs) control output speed and torque on an AC motor, adjusting the motor's output to match requirements.

VFDs are often installed to save energy. VFDs save energy in two ways: by ramping the motor up instead of abruptly starting it (which takes less energy and reduces stress on the motor), and by running the motor only at the level required for current needs. Because VFDs save electrical energy, many utility companies offer rebates if customers add them to their motors.

Typically VFDs are used with three-phase motors. You can choose from a wide variety of VFDs to handle various motor sizes, designs, and applications.

A VFD can be automated so it controls the motor based on specific conditions or processes. For example, you could automate a VFD to control the motor of an air handling unit in response to the value from a thermocouple input or even as part of a PID (proportional integral derivative) loop.

This technical note briefly discusses how to use Opto 22 analog modules for this purpose. In addition, it discusses two methods to minimize electrical noise from the VFD and therefore produce more accurate readings.

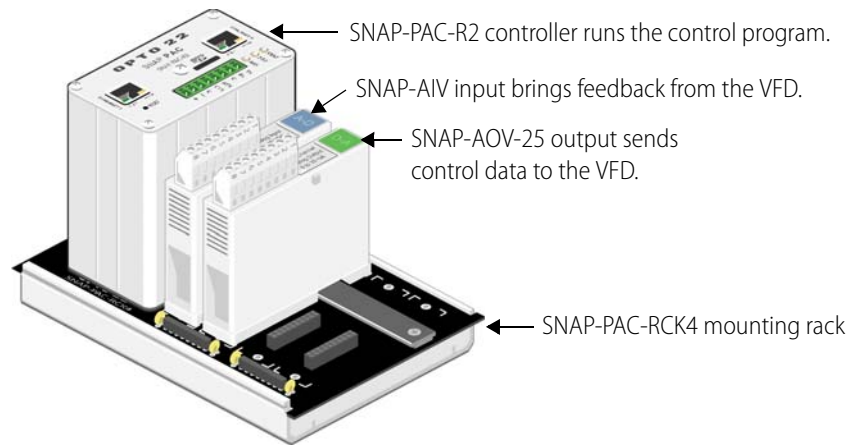
Controlling VFDs

An Opto 22 I/O processor (SNAP PAC rack-mounted controller or brain) and SNAP I/O analog modules are frequently used to control VFDs. Older model analog I/O modules such as G4 or G1 and compatible brain boards and controllers can also be used.

Consult the user's guide for the VFD model you have. The guide should show wiring and options for controlling the drive using an external source. Usually you can control VFDs to change speed based on an analog input value such as 0–10 VDC or 4–20 mA. Then connect an analog output module to the VFD control circuit as shown in the VFD manual. Program the I/O based on the details of your application.

SNAP I/O Example

For example, you could use a [SNAP-PAC-R2](#) rack-mounted controller and a [SNAP-PAC-RCK4](#) mounting rack, with a [SNAP-AIV](#) (0-10 VDC) for speed feedback from the VFD and a [SNAP-AOV-25](#) (0-10 VDC) for the drive signal into the VFD. This combination is illustrated on the following page.



Wire the I/O to the VFD as shown in the VFD's manual. Program the controller using free [PAC Project control software](#) (HMI is also included if you need it).

Additional points on the I/O modules can be used for the inputs that determine motor requirements, for more VFDs, or for other application needs. Additional I/O modules can be added and a larger rack used if required.

Reducing Electrical Noise

Variable frequency drives (VFDs) are inherently noisy devices. When an analog module is used to interface with a VFD, the electrical noise from the VFD can sometimes cause interference with the analog module. The VFD adds high-frequency distortion to the signal that the Opto 22 analog module expects.

The best solution to this noise problem is to shield and ground each cable of the VFD installation. Alternatively (or in addition), you can add a low-pass filter to the analog signal circuit, as close as possible to the analog module.

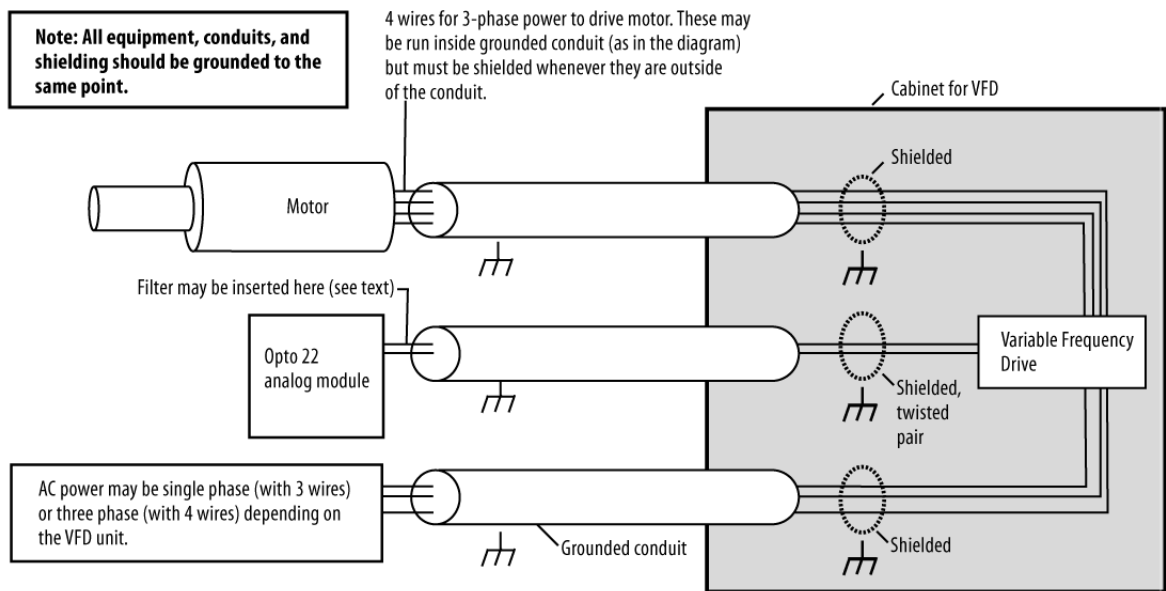
Start by reviewing the installation manual for your VFD for recommendations to minimize electrical noise.

Shield Wiring

Next, shield all of the wiring going into and out of the VFD's terminal strip, and ground the shields to the same earth point. Shielding the wiring up to the VFD cabinet enclosure is not enough; the shielding must be continued inside the VFD enclosure all the way up to the VFD terminal strip to minimize the noise effects.

Also, use *separate* grounded conduits or shielded cables for the power feeding the VFD, the power from the VFD to the motor, and the analog signal wires between the analog module and the VFD. Ensure that all equipment is tied in close proximity to the same earth ground.

The figure below illustrates these instructions for minimizing high-frequency interference from the VFD.



TIP: Do not run the power and control wires in parallel. If they are run in parallel (especially when close to each other), the harmonic noise from one wire is coupled to the other wire. Keep the power and control wires as far apart as possible. When they must cross, cross the power and control wires at 90-degree angles to prevent noise from being coupled to the control wires.

Add a Low-pass Filter

If shielding all of the cables to ground doesn't lower the VFD's noise effects enough, add a low-pass filter between the VFD and the Opto 22 analog module.

Radio frequency interference (RFI) power line filters can be used for this purpose and are readily available. One possibility is TE/Corcom part number 1VR1, which can be purchased through Newark Electronics (Newark part number 52K3854).

Connect the two line terminals on the filter to the output of the Opto 22 module, and connect the two load terminals to the analog input of the VFD. The ground terminal on the filter must also be grounded with all other equipment.

As shown in the figure above, insert this filter as close as possible to the Opto 22 analog module in order to minimize noise passed to the module.

For Help

For help using Opto 22 analog modules with VFDs, you can ask questions on the OptoForums (<http://www.opto22.com/community/forum.php>) or contact Opto 22 Product Support. Product Support is free.

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