D-VAR VVO® FAQs

Product overview frequently-asked questions:

1) **Does the D-VAR VVO use superconductors?**

No, superconductors are not used in the D-VAR VVO product. The D-VAR VVO relies upon AMSC's proven grid power electronics technology. AMSC has over 20 years of experience in the design and manufacturing of utility-scale power electronics solutions. AMSC has deployed over 10 GigaWatts of utility-scale wind turbine power converters, and over 2.5 GigaVar of power electronic-based reactive compensation solutions.

2) **Does the D-VAR VVO use batteries?**

No, batteries are not used in the D-VAR VVO. The D-VAR VVO uses power electronics to provide continuous and step-free reactive power (inductive or capacitive) to the grid. For applications that require voltage regulation and/or power factor control, the D-VAR VVO is typically ***10 times lower cost*** than a solution based on a Lithium Ion battery technology. In addition, the VVO has substantially lower liability risk than battery systems including no explosion hazards.

3) **How is it possible for the D-VAR VVO to control volt/VAR so rapidly?**

The D-VAR VVO is a shunt-connected, power-electronics based solution and does not rely upon any mechanical parts or moving parts for operation. The solution is driven by a powerful control unit that performs corrective control actions thousands of times per second.

4) **Is the D-VAR VVO available in a pad-mounted or metal-enclosed configuration?**

The D-VAR VVO is initially available in the pole-mounted form factor. AMSC plans to support additional installation formats based on the common D-VAR VVO platform, including metal-enclosed options. Please contact your local sales representative for more information.

5) **Is the D-VAR VVO available for voltage classes other than 15KV?**

The D-VAR VVO is a standardized product solution and is designed for direct-connection (i.e., no external transformer) in 15KV class distribution systems. Applications at increased distribution voltages (e.g., 25KV) can be accommodated with an external step-up transformer.

6) **How long does it take to install the D-VAR VVO?**

Minimal time is required to install the D-VAR VVO; the time required is comparable to the installation of a step voltage regulator by a trained utility line crew. ***Installation of D-VAR VVO sites is much safer than installing step voltage regulators because of the shunt connection to the grid.*** Installation of the DVAR VVO requires no special tools and is compatible with existing installation standards for voltage regulation equipment.

7) **How long does it take to commission the D-VAR VVO?**

Minimal time is required to commission a D-VAR VVO; the time required is comparable to commissioning of a step voltage regulator. ***Commissioning of D-VAR VVO sites is much safer than commissioning step voltage regulators because of the shunt connection to the grid.*** The D-VAR VVO solution incorporates a PC-based auto-commissioning tool to establish equipment operation by a trained utility line crew. Operators can then custom-configure and tune the system remotely via the SCADA link.

8) **What are the maintenance requirements for the D-VAR VVO product?**

The D-VAR VVO ***requires no routine maintenance*** and is designed to achieve very low operational costs during the lifetime of the equipment. The D-VAR VVO is engineered and tested to meet stringent design standards for distribution class equipment. No routine maintenance is achieved because the unique D-VAR VVO design does not rely on any fans, pumps, nor any moving parts in the equipment. In addition, there are no batteries and no toxic materials relied upon in the system.

9) **How are spare components handled for the D-VAR VVO system?**

Standard operational practice for distribution voltage regulation equipment requires proper planning for spare and/or replacement components. For typical utility applications, AMSC recommends holding spare inventory to support multiple installation sites. AMSC's highly experienced global service personnel can assist in providing the proper spare parts strategy for your needs.

Application frequently-asked questions:

1) **How do I determine the proper size D-VAR VVO for my application?**

Since the D-VAR VVO is a shunt reactive current source, sizing of the D-VAR VVO is straightforward and is analogous to the well-known guidelines for capacitor banks. For example, in a voltage regulation application the fault power (sometimes referred to as fault duty) of the installation location is typically sufficient to determine the voltage regulation range.

As a specific example, if the fault duty at a proposed feeder installation site is 20MVA, a +/-1MVAR D-VAR VVO can provide +/-5% voltage regulation range. Additionally, AMSC application engineers are ready to assist you with sizing and integration questions.

2) **Can I replace step voltage regulators with the D-VAR VVO?**

For downline feeder locations (typically >5 miles from a substation), a D-VAR VVO can readily replace a step voltage regulator. Voltage regulators that operate frequently (e.g., 25 times or more in a day) are good candidates for replacement, especially on feeders with intermittent loads or distributed generation such as solar. Replacement of line regulators with a D-VAR VVO can substantially improve feeder power quality and voltage regulation, as well as eliminate the maintenance cost associated with frequent operation of regulator tap-changing mechanisms.

3) **Can I replace capacitor banks with the D-VAR VVO?**

Fixed capacitor banks that provide compensation for average VAR loading on a circuit typically should remain installed. Removing switched capacitors after a D-VAR VVO is installed is generally beneficial, as removing switched capacitors will eliminate the known power quality problems caused by switched capacitor banks.

Problems caused by switched capacitor banks include and are not limited to: excessive voltage step change due to capacitor switching, excessive inrush currents, increased circuit THD, circuit resonance, failed vacuum switches, switch restrike transients, and nuisance blown fuses.

4) **How much can I increase solar installations on a feeder with the D-VAR VVO?**

The D-VAR VVO is a highly cost-effective solution for increasing the solar hosting capacity of distribution feeders (i.e., the number of solar installations that can be accommodated on a utility circuit). A typical D-VAR VVO solution increases hosting capacity by 2-3MW per VVO installation, while simultaneously improving the power quality for customers on the circuit.

5) **For solar applications, can I use customer inverters instead of a D-VAR VVO?**

"Smart" inverters are required for many new customer solar installations. Because customer inverters are lower-grade equipment (e.g., residential grade) and are not utility-owned assets, utilities cannot rely upon them to provide utility-grade system voltage regulation and power quality.

An approach that employs the certainty of utility-owned D-VAR VVO systems while leveraging customer-owned advanced solar inverters is a highly-reliable and broadly-scalable approach for increasing circuit DG/solar hosting capacity.

6) **How much can I improve CVR (conservation voltage reduction) with the D-VAR VVO?**

Substation CVR (conservation voltage reduction) deployments can be limited by relatively few feeder-level voltage bottlenecks. These bottlenecks can easily upend the effectiveness of CVR programs, causing substantial shortcomings in projected energy savings or peak demand savings.

CVR bottlenecks include weak single-phase laterals, and increasingly, the broad adoption of PV and distributed generation which ***increases*** voltage. These bottlenecks cannot be addressed using conventional mechanical equipment (voltage regulators and cap banks), nor can they be addressed by pure software-based CVR solutions.

The dynamic and bi-directional voltage regulation capability of the D-VAR VVO is a highly cost-effective solution to directly eliminate these bottlenecks. Depending on the root cause of the bottleneck, the D-VAR VVO can be deployed to achieve up to a 4% voltage reduction.

7) **Can I integrate the D-VAR VVO with my existing Volt/VAR Optimization System?**

Yes, the D-VAR VVO can receive dispatched volt/var set points from a central VVO algorithm. In the time-intervals between set point commands, the D-VAR VVO continues to provide local autonomous dynamic response to load changes.

AMSC works with VVO software vendors to incorporate a D-VAR VVO control interface into the vendor's supported devices. The standard SCADA protocol is DNP3.0 (including support for DNP3.0-SA) and other protocols can be readily supported. AMSC application engineers are ready to assist with specific Volt/VAR optimization objectives and system integration needs.

8) **Can I integrate the D-VAR VVO with my existing EMS or DMS System?**

Yes, see the answer to #7 above. AMSC application engineers are ready to assist with specific SCADA integration needs.