Volt-VAr Management Software (VVMS) for smart grid distribution automation applications
ABB proudly offers the VVMS software product for Volt-VAr Control (VVC) as a new addition to our smart grid portfolio. VVMS is for use in combination with our high-quality capacitor banks, highly-reliable and safe vacuum capacitor switches, and advanced capacitor controls.

In addition, our VVMS software has the capability to interface with many other manufacturers’ controllers.

**What is VVMS?**
VVMS is centralized distribution automation software that optimizes circuit VAr flow and circuit voltages. Optimized VAr flow improves power factor and can result in substantial savings in cost of energy and infrastructure utilization. Optimized voltage improves power quality by preventing over-under voltage conditions and by achieving flatter voltage profile along circuits. VVMS incorporates “CVR”, an advanced conservation voltage reduction strategy which reduces real power demand by lowering customer voltages within approved limits.

VVMS is mature, utility-grade, automation software that is proven in 24x7 use by major utilities across the U.S. It leverages over 15 years of capacitor control experience provided by Radio Control Central Stations (RCCS). This solution is scalable and appropriate for smaller as well as very large utilities. VVMS is a system of closed-loop voltage and VAr control. It continually samples loads and voltages along feeder circuits and when appropriate switches compensating devices; such as, capacitors, regulators and LTC’s, to improve power factor and power quality.

VVMS can operate as a “stand-alone” Volt-VAr control solution or it can be functionally integrated with a SCADA or DMS system. The VVMS is capable of interoperating with many models of Scada, DMS, control hardware, and communications infrastructures. Our approach offers three unique benefits for our utility customers: 1) freedom to use the most appropriate hardware and communications products, 2) short lead time to deployment, and 3) protection of investments in capitalized infrastructure.

A key feature of VVMS is its comprehensive web based GUI. Through the web GUI, authorized users can view the system’s well organized, real time Volt-VAr application displays and reports. Engineers and crews can view status of substation, feeders, capacitors and voltage devices, set control constraints, and operate switches manually. Capacitor switch states, loads, voltages, and circuit “VAr Loss Performance” statistics are conveniently at their fingertips.
Features and benefits

**Savings**
Savings in excess of $4-$6 million annually have been reported by medium to large utilities managing 2000-3000 switched capacitors. Improved power factor reduces the cost of energy needed to produce a given customer revenue. Improved power factor releases infrastructure capacity making it possible to defer or to better control substation and feeder construction projects. VVMS software also encourages more efficient use of crew resources through best-effect maintenance prioritization.

**Deployment speed**
VVMS can begin delivering savings right away. Depending on your distribution automation and communication choices, VVMS can be operational in as little as a month. We work with your technology staff (IT, Scada, and communications) and with a cap controller vendor that you select to configure VVMS compatibly within your organization's distribution automation plan.

VVMS acquires load, voltage and connectivity data from Scada, PI Historian, two-way DNP3 devices as well as from AMI metering, GIS/OMS and other relevant resources. Our staff consults with your staff to determine the most beneficial integration.

Utility crews have found VVMS contributes to rapid deployments. Cap crews at CenterPoint Energy, Houston, for example, recently installed 5000 capacitor controllers at the remarkable rate of 30 caps per day. This rate was accomplished inclusive of inspecting and rehabbing existing capacitor assets and installing new capacitor banks.

**Hardware compatibility**
VVMS automation may be used with cap controllers and voltage control hardware (LTC’s and VR’s) from all major hardware suppliers, for example:
- ABB
- Beckwith Electric
- HD Electric
Communications alternatives
ABB’s VVMS interoperates with many types of networking technologies for two-way or one-way monitoring and controlling of Capacitors, Transformer LTCs and Voltage Regulators. These technologies include:
- TCP/IP, UDP/IP
- DNP3
- FHSS (GE MDS, Freewave, etc.)
- Public Cellular (Verizon®, etc.)
- Private Cellular
- Power Line Carrier
- SilverSprings Networks
- Telemetric
- Utilinet
- Cellnet
- Direct VHF
- Flex Paging
- and more

Utilities may choose to concurrently utilize any combination of these technologies for accessibility to remote equipment in all locations.

Operation with paging and VHF radio systems
VVMS uses SNPP protocol to communicate directly with paging servers and commercial paging services equipped to send Flex or other pager protocols. VVMS has considerable experience with VHF radio systems. We consult your radio shop to understand your FCC license provisions, transmitter configuration and we assess its suitability for use with VVMS.

By supporting both legacy one-way technologies and newer two-way capabilities simultaneously, the ABB VVMS enables utilities to migrate to the new technologies at their own pace while managing only one Volt-Var system.

Connectivity Model management
Our “asset update” can automatically build and maintain your VVMS application database from your utility’s equipment records (Asset Management System) and then automatically adjust to connectivity reconfigurations from your GIS/OMS data source.

Web ready
VVMS facilities are conveniently accessible to authorized viewers from anywhere via internet browser. Our web client provides comprehensive design and operating facilities with easy to follow real-time graphic display of stations, feeders, LTC and cap conditions. (See Figures 1-3.) It incorporates our intuitively powerful “Reactive Report Generator” that sorts out historic and real time information as you wish and delivers it on-line or downloaded to your own computer.

Figure 1 VVMS Substation screen depicting LTC, Feeder and Capacitor association.

Figure 2 VVMS Feeder screen showing target vs. actual Power Factor

Figure 3 VVMS Capacitor screen
Reporting ability for one-way and two-way controllers
VVMS reports operational problems with capacitors and other equipment as soon as they are detected. It automatically tests circuit VAr change after issuing every capacitor switching command. It refreshes, recycles and also periodically exercises seldom switched capacitors. System alarm conditions can be viewed from any VVMS console or dispatched by e-mail. The versatile Reactive Report Generator gives engineers and planners freedom to design their own VVMS reports and to create Excel spreadsheets. Circuit and controller device conditions like over/under voltages, local/remote control mode, neutral current, reverse current are readily accessible on screen and via the Reactive Report Generator.

Performance reports
Performance reports are key to reducing losses and confirming highest level of VVMS performance. VVMS retains 15 minute circuit load history for all circuits and all switching activity. Daily circuit losses and load profile are immediately available for any day and any circuit. (See Figures 4 & 5.) VVMS VAr Loss performance reporting analyzes circuit performance (VAr losses) over extended time periods (month, quarter, year), thus promoting effective tuning for optimum efficiency.

Comprehensive service
We are committed to the success of your VVMS application. We provide support during planning, installation, startup, training, and long term maintenance.

High availability
Our Server Management Dashboard graphically reports the operational conditions of multiple VVMS application servers, mirrored database servers and control communications channels. Server roles, database backup/recovery functions, and communications facilities can be invoked or reconfigured directly from this Server Management Dashboard.

VVMS supports SQL, Oracle® and MS Access databases. Redundancy of an MS Access database is managed by VVMS server software. Redundancy of SQL and Oracle level database is accomplished through backup/recovery and mirroring services of the particular database product.
Power capacitors
These banks provide an economical way to apply capacitors to a distribution feeder system to provide voltage support, lower system losses, release system capacity and eliminate power factor penalties. They are factory pre-wired and assembled, ready for installation.

Available options:
- In-line aluminum or galvanized steel rack vacuum or oil switches
- Normal and heavy duty design capacitors
- Junction box
- Switching controller – local and remote
- Line and neutral current sensors
- Wildlife guards
- Insulated conductor
- Control power transformer
- Distribution class arresters
- Fused cutout
- Current limiting reactors

Qpole
The ABB ‘Qpole’ pole mounted capacitor system is an economical solution for shunt reactive compensation on overhead distribution networks. The Qpole is suitable for use in networks up to 34.5kV grounded.

Benefits:
- Power factor correction close to customer loads
- Voltage stability
- Increased network capacity
- Cost saving through lower losses

The Qpole is available as a fixed or switched system depending on the network profile. Fixed banks are for systems with relatively constant var loading, while switched banks are more suited for systems with variable var loading.

The fixed and switched system utilizes ABB single phase capacitors arranged in grounded Y, ungrounded Y or delta configurations.

The switched system utilizes the complete range of ABB components including capacitors, vacuum switches and var controller. Optional ABB equipment including potential transformers, current sensors, surge arresters and fuse cutouts are also available.

The Qpole is a factory pre-wired assembly with a welded aluminum rack, suitable for pole mounting. All high voltage wiring has insulated tubing and outdoor bushing terminals are provided with bird guards for increased safety and reliability.

The Qpole is unique in that it offers customers a complete ‘one stop shop’ solution which has all the major components manufactured by ABB. Each component is manufactured to a relevant international standard (IEEE-18, CSA, IEC, etc.).

Customers have peace of mind knowing that the Qpole has been manufactured to the highest quality and environmental standards with ISO9001 and ISO 14001 certified facilities.
PS15 capacitor switch
The PS15 is a solid dielectric vacuum switch suitable for use in distribution systems up to 38kV ungrounded (and 66kV grounded). The switch has been specifically designed and tested in accordance with ANSI C37.66 for heavy-duty operation in capacitor-switching applications for the harshest climatic conditions.

Benefits:
- Vacuum technology
- Superior HCEP solid dielectric insulator technology
- Magnetic actuator leads to few moving parts
- Maintenance free
- 50,000+ CO operations ensure long life
- Stainless steel 304 housing for normal and coastal locations

CQ900 Smart Controller
ABB’s CQ900, the next generation in smart controllers, is designed specifically for capacitor applications. They feature an extensive range of control modes including remote, automatic and manual control. The automatic mode includes VAR, time, temperature, current and/or voltage control, as well as combinations of these. In addition, the CQ900 includes measurement and monitoring capabilities and useful features such as a 10,000 event data log for easy analysis and troubleshooting.

The CQ900 is now equipped with communication via the RS232 and Ethernet interfaces which can be used with a wide range of modem devices. The main communication protocol is DNP3.0 with IEC 61850 to follow. The enclosure is designed to allow standard modems to be installed and powered from within.

Introducing ABB SmartLink
The CQ900 has a secure wireless feature allowing local control, interrogation and programming from a linesman’s vehicle, providing added safety and comfort for operators.

Other desirable features included on the controller are flash upgradable capability, a neutral current sensing option and test plugs, as well as a large, four-line LCD screen. The user-friendly interface and sizeable keypad allows for easy operation at any time of the day.

A durable IP 54 stainless steel enclosure provides added protection for even the harshest weather conditions, while the internal circuitry is protected by heavy duty surge protection. The unit is fully FCC (Part 15, class B) and ROHS component compliant.

The ABB CQ900 smart controller is an easy-to-use, feature-packed controller designed to offer customers true value through smarter management of their electrical systems and reliable integration with Smart Grid systems.