ACS
Advanced Control Systems

PRISM™ Integrated Volt/VAR Control

Faced with tightened budgets and regulatory mandates for energy efficiency, today's electric utility is increasingly in need of ways to optimize power delivery and increase reliability while reducing peak demand and consumption. Doing these things successfully can result in prolonged asset life, the deferral of capital investment in additional capacity, and significant savings from reduced energy losses. Carefully coordinated control of voltage and VAR resources on the network is the best way to accomplish these objectives. Unlike traditional methods that focus only on voltage reduction or on VAR compensation for power factor control, PRISM Integrated Volt/VAR Control (IVVC) delivers coordinated operation of feeder voltage and reactive power devices, enabling you to:

- Flatten the feeder voltage profile
- Reduce energy losses (improved power factor)
- Increase substation/feeder capacity
- Reduce peak demand and consumption

IVVC objectives

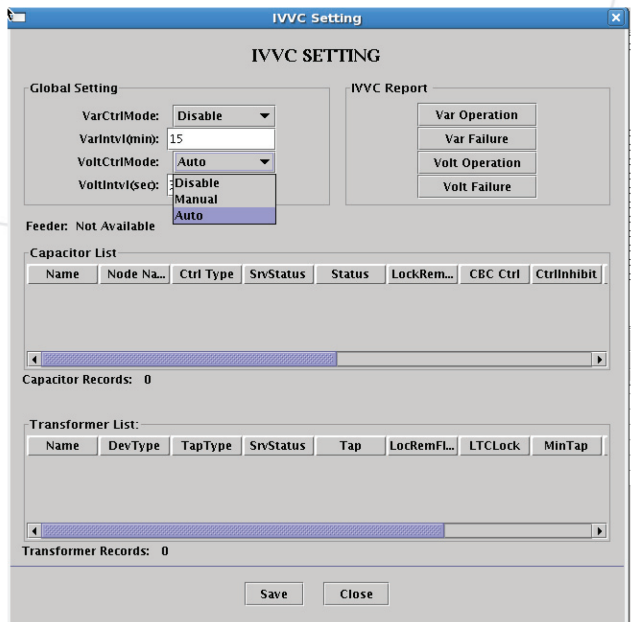
The primary objective of PRISM IVVC is to reduce electric feeder losses while minimizing distribution voltage within acceptable operating limits. Inherently the IVVC application improves energy conservation by reducing load demand on the distribution system. The load demand reduction is achieved through minimizing the power loss while maintaining voltage as low as possible without violating distribution voltage constraints. IVVC attains power loss reduction by setting transformer taps and controlling capacitor banks while feeder voltages are kept above the low limit through a coordinated adjustment of voltage regulators.

Power flow solution

The PRISM IVVC solution is a model-driven solution using a three-phase unbalanced power flow with distribution state estimation. Real-time system load data and power flow calculations are used to determine the optimal settings for capacitor bank switches and voltage regulators (both mid-line regulators and substation on-load tap changers). Based upon successive scenario iterations, IVVC control actions have the effect of first flattening and improving the feeder voltage profile and then raising or lower feeder voltages as required and as permitted by bus and feeder voltage limits. The power flow solution ensures optimal results are obtained using the least number of control actions.

Because PRISM IVVC utilizes a real-time topology model and distribution power flow, it can readily adapt to topology changes and determine appropriate optimization solutions even when the network is in an abnormal state due to temporary switching, cuts or jumpers.

PRISM IVVC Display with Geographic Feeder



PRISM IVVC Configuration Tools

IVVC benefits

Utilities benefit from IVVC by reducing demand while increasing efficiency and reliability. The return on investment for Volt/VAR optimization projects is usually two years or less as a result of cost savings achieved through reduced system losses and lower generation costs. Another attractive element of this solution for utilities is that IVVC provides a solution for demand reduction that does not require any active participation on the part of the consumer. Other benefits to the utility from IVVC include increased life for distribution system components and avoidance of peak demand charges, where applicable. For the consumer, savings on the monthly bill through can be realized due to decreased consumption resulting from voltage optimization.

IVVC features

PRISM IVVC offers many advanced features that allow you to configure the application according to specific objectives and individual operating guidelines, as well as ensure reliable and safe operation:

- Configurable operating objectives
- Manual override during system emergencies
- Self–monitoring alarms provided for Volt/VAR device failure
- Fail-safe mode activated upon communication failure
- Selective enabling/disabling of individual Volt/VAR devices
- Manual/auto operation modes for optimization control actions
- Model-based solution supports feeder reconfiguration
- Supports modeling of Distributed Energy Resources
- Flexible deployment options: integrated with PRISM Advanced DMS; available as a stand-alone system on the Centrix™ Feeder Automation platform

IVVC operation

To achieve its configured operating objectives, PRISM IVVC continuously monitors several system parameters at both the substation and feeder level: per-phase voltage and current; kW; kVAR; kVA; power factor; and LTC/regulator tap position. This data is collected through real-time telemetry from these devices on the network:

- Substation voltage regulators and capacitor bank controls
- Feeder voltage regulators and capacitor bank controls
- Line voltage sensors
- Customer meters

IVVC control actions are transmitted to the existing local controllers using set-point changes, raise/lower and direct on/off control commands. PRISM IVVC easily accommodates control devices and power monitoring/communications equipment from manufacturers.

The IVVC function will run periodically at a user adjustable time interval, or when a significant change in feeder loafing occurs. It is also possible to initiate the IVVC upon operator demand. The operator also has the ability to selectively enable and disable monitoring and control of individual devices as well as the ability to activate and de-activate the IVVC function. IVVC automatically switches into 'failsafe' or 'off-line' mode when telemetry is lost for critical data such as feeder load or voltages.

The IVVC operator interface allows the dispatcher to easily determine system status, turn it on and off, and in some cases, manually operate switches, regulators, LTCs and capacitors. The primary system interface is a feeder one-line representation of the network showing complete colorization with telemetered values. An intuitive configuration interface allows you to easily set-up and modify operational parameters, and the PRISM DMS integrated reporting tools provide a virtually unlimited array of system reports and charts to easily visualize both real-time and historical performance.

Deploy with PRISM DMS or the Centrix™ platform

The IVVC application is fully integrated with our PRISM DMS platform, including a GIS interface and data conversion application to provide electric distribution system information needed to build the distribution system model used by IVVC. The GIS interface/modeling tool, DASmap™, enables simultaneous creation of the network model and operational geo-spatial system displays. DASmap also supports incremental updates from the GIS.

IVVC can also be deployed on our Centrix Feeder Automation platform as a stand-alone or add-on architecture that interfaces to an existing SCADA system. The Centrix SCADA interface is implemented via a "software RTU" that exchanges data using DNP3 protocol—no interface engineering is required. The interface provides real-time inputs to the IVVC algorithms, enabling real-time control of field devices. Pre-engineered templates greatly simplify network model creation for the Centrix platform, in addition to a custom spreadsheet entry form for electrical parameter data. A proprietary import/conversion tool combines the chosen template and supplied data to build the load flow model and operational schematic displays. No GIS source is required when using the Centrix solution.

Simulation tool for analysis and verification capability

Whether deployed with PRISM DMS or Centrix, we offer a powerful simulation tool that adds tremendous value over competing Volt/VAR optimization solutions. The distribution system simulator, XpertSim™, utilizes the same topology and power flow model of the area under consideration—modeling the performance of the network both before and after IVVC deployment. Prior to implementation, the area under consideration is modeled and an accelerated simulation is performed, using up to a year's worth of historical load data. The resulting performance and loss data is analyzed to create a baseline. The same model is then used in another simulation with IVVC activated, to accurately predict the real savings to be realized after deployment. This process provides critical information to help make an educated decision before making a significant investment in communications or other distribution infrastructure. This data proves invaluable—it helps provide a cost-benefit analysis and demonstrate savings and efficiency gains from the implementation.

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