PRISM™ Advanced Distribution Management System

ACS

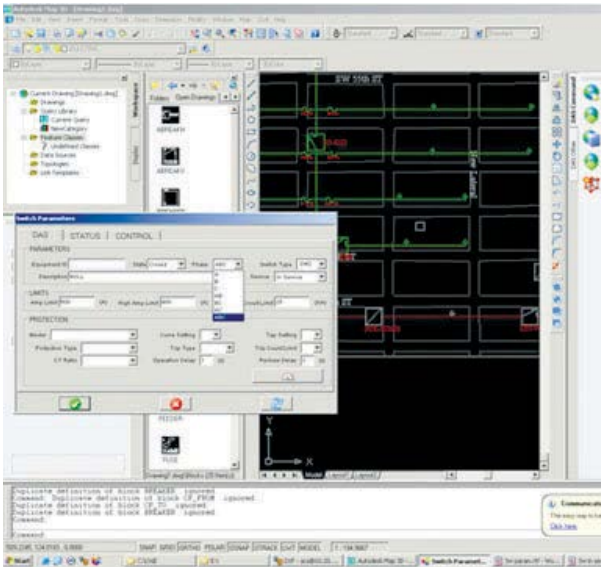
An Indra company

PRISM Advanced Distribution Management System

Distribution utilities today are dealing with new realities and evolving standards for automation and the integration of multiple systems between what used to be operational silos. Managing today's distribution network demands powerful and flexible solutions that blend Information Technology with Operations Technology, integrating ever increasing volumes of real-time data into the utility enterprise. Demands for increased energy efficiency and system reliability mean that what worked even five years ago won't cut it in today's evolving market.

Today's utilities recognize that customers have different needs and are acutely aware of the definition of "service reliability" as it pertains to various customer classes. Each of these customer types may require a different type of solution to deliver the expected level of service and power quality. The proliferation of intelligent devices and sensors on the network, and the wide-scale deployment of smart meters also demand an operational system that provides a more holistic and efficient view of the network in real-time. And the increasing penetration of distributed generation and renewable energy sources presents its own set of challenges in the operation of a stable and secure grid. As a result, a unique blend of network modeling, automation and analysis tools is needed–one that transcends the typical distribution SCADA system, and even the traditional idea of distribution management.

What today's utility demands is Advanced Distribution Management–combining real-time data acquisition, distribution automation, system analysis and outage management into a true Smart Grid operations system. When disparate systems are implemented to achieve these functions, less than optimal interfaces and integration methods can yield undesirable results. That is why a common, integrated platform for advanced DMS is now the solution of choice.



GIS source data input with DASmap

Key operational benefits

Enhanced situational awareness

Make more informed decisions through superior visibility of distribution system status and operational data in real-time, including powerful mobile presentation.

Improved reliability and power quality

Fault Location Isolation and Service Restoration (FLISR) provides automated response to faults, significantly reducing outage duration and scope.

Enables delivery efficiency

Integrated Volt/VAR control (IVVC) enables configurable voltage optimization, loss minimization and peak demand reduction.

DERMS ready

Analyze, control and manage increasingly complex networks with DERs and two-way power flow. Safely optimize PV injection on the network and avoid potential violations with powerful decision support tools.

Integrated outage management

Outage analysis, ticket management and customer service are dramatically improved through integration of OMS with real-time distribution management.

Scalability

PRISM is a common platform serving systems from thousands to millions of meters, with no design limitations on number of devices or database points.

Security

PRISM DMS provides secure access authority controls and is hardened to facilitate compliance with applicable NERC CIP standards.

The most advanced, complete solution

Advanced Control Systems (ACS) offers one of the most advanced and integrated suite of applications available today for distribution network management.

Our PRISM advanced DMS, which is based on more than 30 years of experience delivering "mission critical" real-time systems with an open architecture design, features maximum reliability and availability, and offers several key advantages over competing solutions:

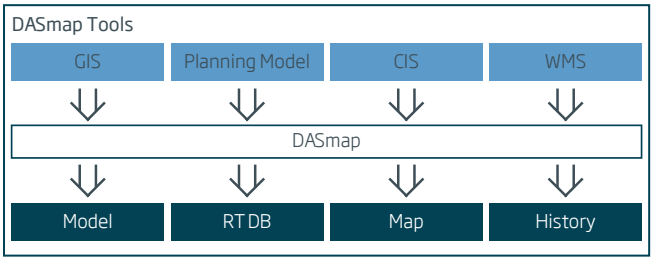
Load flow results

- Fully-integrated single database and network model, using the GIS and available planning data as the source
- Full suite of advanced applications for visualization, optimization, analysis and operation
- Completely integrated OMS suite that eliminates the need for costly and complex interfaces for data transfer between different SCADA/DMS/OMS platforms
- Unified and comprehensive user interface, providing safer and more efficient system control
- High-performance real-time engine for all Smart Grid functions, designed to deliver when you need it most
- Sophisticated simulator platform that enables training of operators and other personnel based on realistic operational scenarios and actual events captured from the operating system

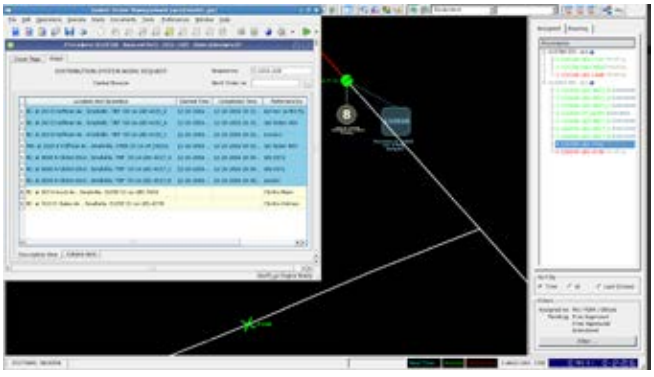
Our advanced DMS solutions are the result of years of development and innovation. Beginning with our delivery of the world's first fully-integrated distribution automation system to the Taiwan Power Company in 2001, ACS has led all vendors in the development of Advanced Distribution Management System solutions. We are the only technology supplier with a truly integrated SCADA/DMS/OMS solution that utilizes a single database and common network model.

That's because our platform has been developed from the ground up as a complete solution. Our PRISM solution platform represents the best solution for realizing the Smart Grid visions and goals of utilities worldwide.

PRISM DMS encompasses the best aspects of both traditional OMS technology and the more dynamic world of mission-critical real-time applications. Our distribution network model is created directly from the GIS system and is a real-time dynamic model. Our incremental update capability allows changes from the GIS to be made in a matter of minutes, versus the hours required in a traditional OMS. The database for Distribution SCADA, DMS, and OMS is developed from the GIS import and is a single database. This means that all tagging, switching, outage analysis, restoration, etc., are performed through a single operator interface – enhancing personnel safety and operational efficiency.



DASmap tools facilitate DB and model creation and updates



Switch Plan

PRISM Advanced Distribution Management System

Enhanced Visualization

- Integrated user interface
- GridVu™ with map/imagery overlays
- Dynamic colorization with tracing
- ReShape™ automatic schematic generator

Distribution Automation

- Data acquisition and control
- Fault Location Isolation and Supply Restoration (FLISR)
- Capacitor Bank Control
- Automatic Voltage Control
- Integrated Volt/VAR Control

Distribution Analysis

- Topology Processor
- Distribution Power Flow
- Load Estimation
- Short Circuit Analysis
- Optimal Capacitor Placement
- Optimal Switching
- Protection Coordination
- Switching Order Management
- Disturbance Analysis
- Load Forecasting / Management
- Real-time Red Line
- Performance Indices Calculation

Distribution Simulation / Training

- System Study mode
- Dynamic dispatcher training simulator

Enterprise Integration / Business Intelligence

- GIS source database conversion with incremental update
- Work Management System integration
- CIS integration
- Historical archiving
- Enterprise reporting tools/dashboard

DER Integration

- Emergency Load Transfer
- Maximum Injection Capability
- Feeder Injection Test / Forecast
- Storage Optimization

It starts with the model

Effectively monitoring and managing the distribution system using today's advanced DMS applications involves a sophisticated electrical model that is more complex than those needed for static, balanced transmission systems. Real-time power flow and load estimation for an unbalanced, three-phase network must incorporate telemetered data from a variety of sources on the system, along with information from GIS and planning models. Data from sources such as AMI, line sensors, and an array of intelligent controls (breakers, switches, capacitors, regulators, etc.) must all be processed quickly and efficiently to allow the system to react in real-time to changing system conditions.

The system must always be able to accurately represent the state of the network at any given time, as the distribution automation and analysis functions and applications all rely on this network model. The PRISM DMS also utilizes this model to allow the system dispatcher to perform ad-hoc load flow queries on the system.

To facilitate creation of the distribution model, the PRISM DMS includes DASmap–a powerful GIS import and model creation tool that enables utilities to automatically create the real-time database, system model and operational displays from GIS and engineering model source data. DASmap even supports incremental updates from the GIS, simplifying the change synchronization process significantly. As well as incorporating external data sources, DASmap enables the addition of useful information during the import that may not be included in the source data.

Powerful, real-time data acquisition

A true advanced distribution management system isn't built by bolting DMS applications onto another SCADA platform. System operators and engineers need a single system with a common real-time database that is available to the distribution applications without the need for expensive and complex middleware or other data links. PRISM DMS has evolved through our more than 30 years of experience in mission-critical SCADA systems for electric utilities. PRISM includes front end configurations that support redundant paths and flexible interfaces for compatibility with virtually any communication infrastructure. And it is based on an open-architecture design that adheres to industry standards for availability and security.

A complete suite of advanced applications

PRISM DMS offers a full-featured suite of applications for operation and analysis of the network, enabling utilities to effectively deliver reliable, high-quality power to their customers. From automation of the network for reliability and efficiency to coordinated analysis applications and a powerful training simulator that is invaluable for operator training and "what-if" scenarios, PRISM DMS is a complete grid management system. The system is flexible and modular, with applications deployed only as needed, and all accessing the same topology and load flow model built with the help of DASmap.

Enhanced situational awareness

A key advantage of the PRISM DMS integrated platform is its unique graphical capability, enabling the operator/ dispatcher to effectively monitor the real-time state of the system while also directing the outage restoration processes within a unified Graphical User Interface (GUI). The objective is to provide the optimum in user interface information and intelligence, using a combination of visual tools and techniques to convey the system information in a meaningful manner.

Graphical performance is a critical consideration in supplying a system fit for optimal use in the operational environment. Also critical are intuitive user interface features that permit the display of the data required while using minimal keystrokes and/or mouse clicks.

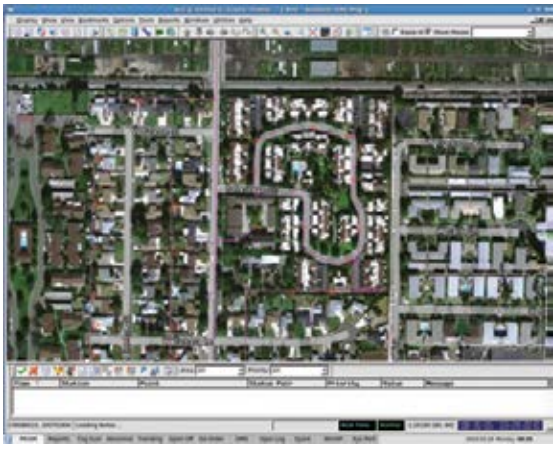
The PRISM DMS operator interface provides superior situational awareness of the real-time state of the distribution network, combining the information from different utility systems and subsystems such as:

- Real-time telemetry from SCADA
- Feeder and substation information
- Load flow analysis
- Crew information
- Outage ticket information
- Customer call information
- AMI and IVR details
- Application generated data
- Reports of surveyed field damage

The data is filtered, scaled, colorized and overlaid on a dynamic network diagram. The end result is a consolidated visualization of the network, with field information that is used to convey to the operator the optimum restoration steps and work activities during both normal and storm conditions.

Geo feeder display with schematic generator

Improve situational awareness with GridVu



GUI supports dynamic feeder display with aerial imagery

Improved reliability and power quality

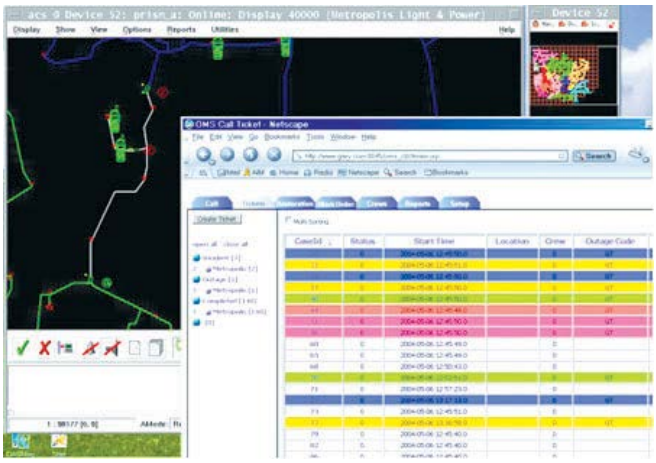
Fault Location Isolation and Service Restoration (FLISR) is an extremely important application in the deployment of today's smart distribution network. Using FLISR, utilities can dramatically improve system reliability and performance, delivering the quality of service demanded by consumers and C&I customers alike. Shorter outages, improved performance indices and better operational efficiencies are just some of the benefits that can result in substantial economic savings to the utility.

FLISR provides the decision support and procedures necessary to restore power to faulted feeder sections in as little as 20 seconds of fault detection (actual restoration times depend on the number of tie-switches and feeder sections in the restoration path). There is no fixed limit on the number of simultaneous feeder faults that FLISR can process. It works on radial or open-loop distribution systems with 1-, 2- or 3-phase feeder sections.

FLISR provides these fundamental control functions:

- Detects and isolates feeder faults within seconds, based on telemetered data and fault detectors
- Automatically restores service to the feeder sections upstream of the fault
- Automatically restores service to the feeder sections downstream of the fault, based on available ties and real-time load flows that verify capacity is available and that no loading or voltage violations will occur

Dynamic feeder view with outage tickets and customer calls



Integrated user interface for DMS and OMS ticket management

- Can automatically transfer load from the energized portion of the feeder to other adjacent circuits in order to effectively restore the maximum number of customers
- Can automatically restore the network to pre-fault configuration when faults have been repaired and the feeder sections are again available for service

Enabling delivery efficiency with IVVC

PRISM DMS includes Integrated Volt/VAR Control (IVVC) for improving power delivery efficiency through loss minimization and the coordinated control of both voltage and reactive power devices for demand reduction. The primary objective of the IVVC application is to reduce electric feeder losses while minimizing distribution voltage within acceptable operating limits. The controls generally used to achieve these objectives are transformer Load Tap Changer controls (LTCs), substation and feeder capacitor banks, plus substation and feeder voltage regulators.

IVVC improves energy conservation by reducing load demand in both peak and non-peak conditions 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 by controlling capacitor banks, while feeder voltages are kept above the low limit through a coordinated adjustment of voltage regulators.

The DMS three-phase unbalanced distribution power flow is used in order to determine an optimum control strategy using regulator tap settings and capacitors. As the real-time condition changes over time, the IVVC function can be run periodically at a user-adjustable time interval.

Integrated outage management

Developed from the outset as a high-performance, real-time solution for both distribution management and outage management, PRISM DMS offers several distinct advantages over the traditional stand-alone Outage Management System (OMS) architecture:

- Safety: By using a common, integrated interface for SCADA/DMS/OMS, the operator knows in a glance the status of the network and crew activities. This integrated presentation of information helps avoid confusion while maximizing personnel safety, particularly during storm events. Device tagging and device control is unified through a common platform, eliminating the confusion and potential danger to crews that results from sharing the tagging function across different operational systems.
- Real-time Performance: All distribution applications operate from a common, high performance database and model. This data model is updated with all known network information, regardless of source. This includes SCADA telemetry, manually updated information, customer call information and AMI data. As changes occur to the database, the network topology is re-calculated in real-time, reflecting the accurate, current state of the network. PRISM has been successfully tested at over 500 sustained events per second and 150,000 outage calls per hour.
- Real-time Graphics: The same integrated system display can show traditional SCADA information (such as analog values, device status, tags, and colorization) in addition to distribution load flow results, outage tickets, customer calls and crew information. The real-time data can be supplemented with geographically accurate aerial images with vital land base information, providing the most complete picture of the system to the operator. Through this advanced capability, the OMS graphical map can serve as a navigation tool for all other distribution management displays (e.g., embedding station one-line diagrams into the map at different de-clutter levels).
- Real-time Indices Calculation: IEEE 1366 Performance Indices are calculated in real-time, factoring in the partial outages and restoration of feeders using real-time tagged events. The three-phase real-time network topology takes into consideration all network information, alarms and events when logging customer load status and calculating the indices. A complete restoration log of all time-tagged events is automatically maintained. And since the system logs all events in a single database, the indices are calculated using the actual telemetered field event time.
- Real-time Redlining: It is often necessary to modify the network with emergency or short-term network changes such as cuts and jumpers. The PRISM DMS/OMS supports these changes directly through the operator user interface. The corresponding connectivity changes are accurately performed "on the fly" and are reflected in the network model for all applications using topology and power flow, including OMS. Since the database and model are common to all functions, the redline changes don't have to be passed between systems or entered on them separately.
- Common Maintenance: Since a common geographic network map and database is used, a single point of maintenance updates is provided for all real-time operational information. This significantly minimizes O&M costs and reduces the potential for errors.

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Powerful training and simulation tools

Proper training and experience are key components of realizing the full benefits of any utility operational system. This is no different with today's advanced DMS and OMS deployments. In order to provide utilities with the capability to effectively train personnel to manage their distribution system effectively, ACS provides a dynamic Dispatcher Training Simulator (DTS) as an optional component of the PRISM DMS. The PRISM DTS serves as a replica of the installed system, realistically modeling the operation of the distribution power system as a dynamic transient real-time simulation. The accuracy of the simulator is a result of the three-phase unbalanced load flow simulation of the target distribution and sub-transmission network. It creates an environment for dispatchers to have "hands-on" training under simulated normal, emergency and restorative operating conditions, and to learn the use of the SCADA/DMS/OMS functions and displays.

The simulator consists of the following components:

- Control Center Model
- Power System Model
- Event Scheduler and Simulation Control (Trainer Interface)
- Case Saving/Retrieving

The Control Center Model is a duplicate of the operational DMS, with the "field" data provided through a telemetry simulator. The Power System Model simulates the responses of the actual distribution network. It reproduces the responses of the distribution power system to load changes, trainee-entered controls, trainer-entered events and scheduled events. The Event Scheduler and Simulation Control provides the capability for the trainer to create simulation scenarios, add and delete simulation events, and maintain full control of the simulation process (e.g., start, pause, speed, etc.). The Case Saving/Retrieving module provides the capability for the trainees or the trainer to save or retrieve a saved simulation case, which can come directly from the operational system.

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