Power System Enterprise Solution

ETAP is the most comprehensive analysis platform for the design, simulation, operation, control, optimization, and automation of generation, transmission, distribution, and industrial power systems.
Customize ETAP to fit your needs, from small to large power systems

ETAP Enterprise Suite provides one solution to your power system design, analysis, and operation needs. ETAP offers a comprehensive suite of analysis modules that can be configured to suit your specific needs. This modular approach allows you to purchase only the modules you need.

Featured in this brochure:

- **Dynamics & Transients**
  - Transient Stability
  - Generator Start-Up
  - Wind Turbine Generator
  - User-defined Dynamic Model
  - Parameter Estimation

- **Renewable Energy**
  - Wind Turbine Generator
  - Wind Farm
  - Photovoltaic Array

- **DC Systems**
  - Load Flow
  - Short-Circuit
  - Control System Diagram
  - Battery Discharge
  - Battery Sizing

- **Power Quality**
  - Harmonic Load Flow
  - Frequency Scan
  - Harmonic Filters

- **Intelligent Substation**
  - Substation Automation
  - Switching Management
  - Load Management
  - Smart Grid
  - Micro Grid

- **Energy Management System**
  - Automatic Generation Control
  - Economic Dispatch
  - Supervisory Control
  - Interchange Scheduling
  - Reserve Management

- **Network Analysis**
  - Short Circuit – ANSI
  - Short Circuit – IEC
  - Load Flow
  - Motor Acceleration

- **Ground Grid Systems**
  - Finite Element Method
  - IEEE 80 Method
  - IEEE 665 Method

- **Data Exchange**
  - DataX
  - MS Access® & Excel®
  - CAD Interface
e-DPP® Interface
  - SmartPlant® Interface
  - Third-Party Software

- **Base Package**
  - Cable Ampacity & Sizing
  - Transmission Line Constants
  - Report Manager
  - Project Management Wizards
  - Multi-Dimensional Database Libraries

- **Distribution**
  - Unbalanced Load Flow
  - Optimal Power Flow
  - Transformer Tap Optimization
  - Switching Sequence Mgmt.
  - Reliability Assessment
  - Optimal Capacitor Placement
  - GIS View

- **Intelligent Load Shedding**
  - Adaptive Load Shedding
  - Automatic Islanding
  - Load Preservation & Management System Restoration & Control
  - Load Shedding Validation

- **Star Protective Devices**
  - Protection Coordination & Selectivity
  - Sequence-of-Operation
  - Relay Test Set Interface

- **Monitoring & Simulation**
  - Real-Time Monitoring
  - State Estimation
  - Energy Accounting
  - Predictive Simulation
  - Event Playback
  - Load Forecasting

- **Transmission Line**
  - Line Constants
  - Line Ampacity
  - Mutual Coupling
  - Sag & Tension
  - HV DC Transmission Link

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  - Load Flow
  - Short-Circuit
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  - Underground Thermal Analysis
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- **Panel Systems**
  - ANSI Panel
  - IEC Panel
  - Code Factors
  - Schedule Reports

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ETAP Star protection and device coordination program provides an intuitive and logical approach to Time Current Characteristic (TCC) analysis. Enhanced features and capabilities, such as graphical user interface, true-to-the-form protective devices modeling, extensive Verified & Validated (V&V) device library, and integrated rule-based design, creates a desired working environment for protection and power system engineers.

Embedded analysis modules, such as Sequence of Protective Device Operation, helps the efficiency and accuracy of coordination study of protection devices.

Using intelligent one-line diagrams, comprehensive device libraries, and a three-dimensional database, ETAP Star offers insight into troubleshooting false trips, relay mis-operation, and mis-coordination.
Cooperation

Protective Device Coordination & Selectivity

Capabilities
- AC & DC coordination
- ANSI & IEC coordination & protection standards
- Phase & ground coordination modes
- Graphically adjustable device settings
- Comprehensive V&V device libraries
- Integrated with one-line diagram
- Intelligent alert view for troubleshooting
- Embedded short circuit analysis
- Embedded motor acceleration analysis
- Modeling of multi-function & multi-level relays
- Graphical combination of protection functions & segments
- Virtual animation of sequence-of-operation playback
- Normalized plots shifted based on fault contributions
- Flexible user-definable display & plot options
- Extensive damage curve modeling & plotting
- Professional time current characteristic plots
- Detailed device setting reports
- Built-in interface with relay test set
- Intelligent protection zone selection and viewer

Protective Device Handling
- High impedance & percentage differential relay (87)
- Phase, ground, & directional overcurrent relay (51/50, 67)
- Detailed implementation of voltage restraint & control relay (51V)
- Comprehensive modeling of electronic & hydraulic reclosers (79)
- Overload relay - CT based & Inline relays (49)
- Comprehensive relay interlocks
One Action Resulting in a Complete Solution

Features

- Illustrate system wide coordination
- Click & drag curves to adjust settings
- Automatic current & voltage scaling
- Customizable curve layout with embedded one-line diagram
- Automatic layout of the one-line diagram in Star TCC View
- Integration of short circuit analysis with protective devices
- Motor starting curves based on motor acceleration studies
- Integration of arc flash analysis results on Star TCC View
- Multi-axis time current curves
- Automated color sequencing of curves
- Graphical curve tracker with cross lines & time gap tools
- Time difference calculator
- Adjustable magnifying-glass zoom view
- User-definable curves & fault arrows
- Transformer damage curve & inrush curve modeling
- Generator decrement & damage curves
- Multiple motor starting curves based on starting voltage
- Motor & stator damage curves
- Automatic clipping of curve based on calculated or user-defined fault current
- Minimum fault calculation & TCC marker
- Comprehensive print functionality, legends, & device labeling
- Batch print TCC plots & diagrams for various paper sizes
- Graphical printing & plotting
- Customizable reports

Benefits

- Enables system engineers to easily & efficiently perform protective device coordination studies
- Provide an accurate & realistic operating characteristic, time, & state of protective devices
- Offers insight into troubleshooting false trips, relay mis-operation, & mis-coordination
- Aids system engineers & planners to quickly realize possible design issues & make informed decisions

Protection Zone Viewer

Protection Zone Viewer (Zone Viewer) provides the tool that defines a path and related zones of protections which will allow the user to create Star Views.

Path Detection Tools

The Path Detection Tools provide an easy way to automatically identify and define a protection / coordination path.

- Extend Path to Nearest Source
- Shortest Connecting Path
- Extend Path by Bus Level
Star Plot Options

Star Plot Options tool provides all the necessary options to customize the display of the Star TCC curve. You can customize the display of current and time axes, legend, grid, curve plotting properties, and more.

Graphical Adjustment

Device curves can be graphically adjusted in the Star View. Handles are provided on the device characteristic curves to identify adjustable regions. Available ranges for a selected curve can be displayed and identified by clicking the Hide/Show Range button. The available ranges are grayed out when an adjustable curve is selected.
Fully Integrated Module

**Intelligent Alert View**

With ETAP Star you can troubleshoot your device coordination studies for any Star View. The Alert View button, on the Star View, provides a summary of alerts or messages (low priority alerts) that provides hints as to how and why a particular device curve is not being displayed or missing information regarding a device.

**Integration of Arc Flash Analysis & Star View**

ETAP Arc Flash is a fully integrated module that takes advantage of all the capabilities already built into Star. The program calculates the individual arcing current contributions and arc fault clearing time of all the protective devices involved in the arc fault by interfacing with Star.

The calculated and allowable incident energy curves can be plotted in Star View as a function of time and current.

**Generator Decrement Curve**

Star provides plotting of the generator decrement curve and display both the symmetrical and asymmetrical decrement curve based on generator no-load or full-load conditions. Excitation system field forcing capability, used to speed up the response of the generator, is also considered when plotting the generator decrement curve.
Multiple Motor Starting & Damage Curves

A motor starting curve can be plotted on a Star view for the purpose of determining overload settings for motor protection devices. Constant Terminal Voltage can be used to plot the motor starting curve based on a constant voltage at the motor terminal.

The motor curves have been enhanced by including stator damage curve or running overload curve into Star. Stator curves can be plotted based on multiples of machine full-load amps or actual amp values.

Device Setting Report

Star Device Coordination Reports Manager provides comprehensive and customizable device setting reports. The manager allows you to preview and print the protective device setting data, using the Crystal Reports® formats.

Device Setting Report: Customize reports and export to Microsoft® Excel
Sequence-of-Operation

Star Sequence-of-Operation evaluates, verifies, and confirms the operation and selectivity of the protective devices for various types of faults for any location directly from the one-line diagram and via normalized TCC curve views.

Sequence-of-Operation provides a system-wide solution for an accurate and realistic operating time and state of protective devices, such as relay, fuse, circuit breaker, trip devices, contactor, etc. The operation time is calculated for each protective device based on its settings, time current characteristic, and interlocks for a specified fault location and type.

Functionalities
- User-definable fault insertion location
- View device operation sequence graphically
- Device failure & back-up operation
- Detailed relay actions (27, 49, 51, 51V, 59, 67, 79, 87)
- Sequence of event viewer
- Normalized (shifted) TCC curves
- Phase & Ground faults (symmetrical & asymmetrical)
- Flashing protective device via the one-line diagram

Drag & Drop a Fault
- Phase & ground faults
- Display fault currents on the one-line diagram
- Illustrate system wide coordination
- Tabulate operating times via an event viewer
- Customizable reports
Graphical Animation of Protective Device Operation

Coordinate via One-Line Diagram

- Graphically place a fault anywhere on the one-line diagram
- Automatically calculate & display the fault current contributions on the one-line diagram
- Evaluate the operating time & state of devices based on the actual fault current contribution flowing through each individual device
- Graphical animation of protective device operation
- Globally view post fault actions & associated operating time via a tabulated event viewer
- Examine the operation of protective devices via the one-line diagram

Normalized TCC Curve

Normalized (Shifted) TCC mode is an analysis feature in ETAP Star View, which is based on Sequence-of-Operation calculation. This analysis mode provides a graphical view of the operation times of protective devices based on their corresponding settings and characteristics for specified fault location and type. Normalized TCC mode graphically displays the TCC curves of protective devices in relation to one and another for a given fault.

Sequence of Event Viewer

The sequence of operation of protective devices are automatically calculated and listed in an Event Viewer, which is dynamically linked with the one-line diagram. This one-step concept utilizes the intelligent one-line diagram and performs a complete set of actions to determine the operation of all protective devices. This includes internal shifting (normalizing) of each TCC curve based on the individual fault contribution level.
Verified & Validated Device Libraries

Extensive Protective Device Library
- Library copy & merge manager
- Most comprehensive & up-to-date protective device information
- Verified & validated libraries using published manufacturer data
- User-definable libraries – easily create & add new devices
- Digitalization points & equation based relays
- True-to-the-form modeling of protective devices
- Legacy as well as state-of-the-art device manufacturer models
- Customized library – user curve library

Protective Device Libraries
- Fuse
- Relay (OCR, OLR, DIF)
- Recloser
- Electronic Controller
- HV Circuit Breaker
- LV Circuit Breaker
- Solid State Trip
- Electro-Mechanical
- Thermal Magnetic
- Motor Circuit Protector
- Overload Heater
Library Merge
ETAP allows merging of library files using the copy and merge functions. The merge function allows you to merge a partial or complete library file from one to another, making it simple to manage the content from various library files.

Library Merge Manager

Library Checker
The checker access level is provided for verification of changes to project engineering properties and libraries data. This allows for control and validation of library data.

Library Checker: Track and verify library changes

Accuracy & Reliability
ETAP is a high-impact electrical engineering software to comply with widely accepted and firmly established quality standards and regulations. Every release of ETAP is verified and validated (V&V) against field results, real system measurements, established programs, and hand calculations in order to ensure its technical accuracy. The V&V process includes the entire ETAP Library including the device libraries.
Precise, Flexible, Accurate

Relay Testing Interface

The ETAP Advanced Relay Testing and Transient Simulator (ARTTS) interface combines the short-circuit and protection device coordination capabilities of ETAP with the relay testing hardware. It provides actual steady-state and transient responses of relays for comparisons with the manufacturers published data.

- Fully integrated protective relay historical testing & maintenance database with ETAP Star
- Export short circuit data, relays settings to relay test set
- Plot device steady-state response
- Compare relay response with manufacturer published data
- Analyze deviation from nominal values
- Display relay actual transient response
- Analyze relay false trips & mis-operation
- Comtrade export of time domain fault currents & voltages

Test Results Comparison: Compare test results with published curves
Relay Actual Response

Steady-State Response
ETAP Star exports the relay settings and parameters for current injection into the relay. Based on the required range of the overcurrent and/or fault current, the relay test set injects multiple currents (single-phase or three-phase) into the relay in order to reconstruct the relay TCC curve based on the actual relay response. Test points are then imported to ETAP Star for plotting and comparison with the manufacturer published data.

Transient Response
The ability to simulate relay response under steady-state and transient conditions, during both fault and normal system operating conditions, provides the necessary tools for protection engineers and technicians to confidently determine and evaluate the design and operation of protection system. Steady-state fault current provides only a snapshot operation of the relay based on sustained current. Transient fault simulation is necessary to determine the actual response time of the relay based on the distributed through fault containing AC and DC decay current.

The waveforms are generated from ETAP and are pragmatically played into the relay through. This allows for verification of the relay operation under conditions matching actual system faults. By comparing these sets of curves, Star visually indicates the discrepancies and deviation between the actual (field setting) versus design (intended / ideal) device response characteristics.
Quality Assurance Commitment

ETAP is Verified and Validated (V&V) against field results, real system measurements, established programs, and hand calculations to ensure its technical accuracy. Each release of ETAP undergoes a complete V&V process using thousands of test cases for each and every calculation module. ETAP Quality Assurance program is specifically dedicated to meeting the requirements of:

- ISO 9001:2009
- 10 CFR 50 Appendix B
- ANSI/ASME N45.2
- ANSI/ASME NQA-1
- ANSI/IEEE 730.1
- CAN/CSA-Q396.1.2
- ANSI N45.22

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