etap® 18
Convergence of Power & Intelligence

Features & Capabilities
Intelligent System Modeling & Network Management
etapAPP™, Plot Manager, New Elements & Libraries

Advanced Power System Analysis Modules
Time Series Power Flow, ArcFault™, Distance Relay Protection, Renewable & Microgrid, eTraX™

Innovative Power Management & Automation Solutions
Advanced Distribution Management System, Switch Order Management, SCADA Protocols, Dashboard Views

Major Capabilities

**etap iCE™ - Intelligent Control Enterprise Hardware**
Programmable control and Remote Terminal Unit hardware integrated with ETAP applications. Verified & Validated with ETAP Real-Time™ solutions for optimal performance, fast response, and cyber security.

**etapAPP™ - Field Data Collection & Synchronization**
ETAP application designed for field data collection & simultaneous user project management that synchronizes information with ETAP.

**ArcFault™ - Arcing Fault Hazard Evaluation**
LG, LL & 3-phase arc fault analysis for systems up to 800 kV. New module provides incident energy results for open air and enclosed equipment with bolted fault currents up to 60 kA.

**StarZ™ - T&D Protection & Coordination**
T&D network protection & coordination software to examine the performance of relay functions including Distance, Directional, Load Encroachment & other protective devices.

**eTraX™ - Rail Traction System**
Most accurate, user-friendly & flexible software tools for analyzing, managing, and simulating low & medium voltage train power systems.

**TDLF - Time Domain Load Flow**
Solve power flows based on time-varying load & generation for 3-phase, 2-phase, 1-phase AC & DC networks simultaneously in radial or looped configurations.
One-Line Diagram
- Enhanced auto-build & layout
- Enhanced batch print & zoom views
- Synchronized presentation views
- Region classifications & coloring New
- Paste data to multiple elements New
- Remote connectors
  - Support remote connection for CT & VTs New
  - Split-differential protection schemes across nested networks New
  - Avoid intersections for multiple input configuration

Plot Manager New
- Plot & view results from multiple studies
- User-configurable plots & settings
- Customize properties & save as template
- Works with all ETAP modules
- User-defined application styles
- Automatic data fit to plot
- Automatic label layout
- Zoom, pan, tile, etc.

Geospatial Diagram
- Intelligent Geospatial Diagram
- Feeder & Substation Diagrams New
- Geospatial model manager
- Import from third-party geodatabases
- Synchronized with one-line diagram
- Download background map tiles from Bing or Google Maps using ETAP MapServer™ (requires API key)
- Edit Geospatial Diagram similar to the one-line diagram, such as add, modify, & reconnect elements
- Circuit & feeder tracing
- Decluttering, color themes, user-defined symbols
- Graphical display of study results & alerts
- Study result & alert animation
- Automatic incremental updates

Datablock
- Expanded input data & study results
- Arc Flash results New
- Display results, input, tags
- User-defined templates
- Auto-adjusting protective device settings
- Independent tooltip & display New
- Duplicate datablocks across multiple views

ETAP Application
- Installation Wizard New
- Keyless License Manager
- Ribbon bar for Ground Grid & Cable Pulling New
- Windows Active Directory authentication New
- Library defragmentation & compaction New
- Improved performance & analysis run-time New
Elements

- **Series Capacitor**
  - User-selectable capacitor location
  - Calculate degree of compensation
  - Consider MOV protection & bypass

- **Switched Capacitor**
  - Automatic control modes: voltage, current, power factor
  - Control buses & branches

- **Distribution Voltage Regulator**
  - Automatic control modes: forward, reverse
  - Include Line Drop Compensation (LDC)
  - Per-phase voltage regulator adjustment
  - Control based on load side voltage requirements

- **ZigZag Grounding Transformer**
  - Consider effect in unbalanced studies & harmonics
  - Alert based on nameplate rating

- **Traction Power Elements**
  - Rectifier - Controlled & uncontrolled
  - Transformers - Booster, Auto, Scott-T
  - Speed, elevation, signal, etc.
  - Insulator & isolators

- **Distribution Elements**
  - Jumper, cut & open point
  - Distributed load

- **Busway (trunking busbar)**
  - User-defined or typical impedance
  - Alert based on nameplate rating

Elements - Dynamics & Safety Modeling

- **Busbar**
- **Inverter**
- **Wind Turbine Generator**
- **Photovoltaic Array Inverter**
- **HVDC - Voltage Source Converter (VSC)**

Rule Book - Harmonic Compliance Limits

- ANSI/IEEE 519-2014
- IEC 61000-3-6: 2008
- User-defined grid code & local standards

Engineering Libraries

- Distance relay
- Distribution transformer
- Train rolling stock
- Traction rectifier library
- Sector & profile library
- Over 450 new V&V protective device models
- Over 40 detailed distance relay models with manufacturer-specific settings

Equipment Warehouse

- Overhead line – phase, ground, tower/pole
- Overhead catenary
- Power cables
- Distribution transformer
- Low-voltage circuit breakers
- Power fuses
- Railway track
- Equipment reliability
Collection & Verification
- Collect data, verify existing data & transfer to ETAP
- View ETAP data on mobile device
- Create new one-line diagrams on mobile device or append to existing
- Smart connections including auto-insert
- Layered diagram using composite networks

Mobile App
- Geotag asset information including pictures & synchronize with ETAP model
- Windows authentication for data security
- Synchronizes data with ETAP over the network
- Designed for tablets running MS Windows® or Apple® iOS

Data Exchange - DataX™

Autodesk Revit® New
- Import Revit drawings to ETAP
- Supports incremental Revit model import
- Support for RVT v2017 – v2019
- Identify & alert modeling issues
- Auto-generation of one-line diagram
- Smart Connect: Revit Plug-in to ETAP

MultiSpeak® New
- Import & export power system data
- User-defined mapping of elements & properties
- Supports MultiSpeak v3.0 & v4.0

Universal Mapping New
- Powerful element & property mapping
- Customizable logic & pre-defined power functions
- Supports CIM, ESRI ArcGIS, MultiSpeak, MS Excel

Common Information Model, CIM New
- Import & export data from ETAP using CIM XML
- User-defined mapping of elements & properties
- IEC 61970 & IEC 61968 standard

ArcGIS® Import & Export New
- Import ESRI ArcGIS electrical information
- Map ArcGIS attributes with ETAP elements & properties
- Database mapping via graphic user interface
- Export ETAP GIS electrical data to XML
- Support for ESRI ArcGIS 10.x

EMTP - Electromagnetic Transient Program New
- Dedicated module for EMT analysis
- Export ETAP electrical data to PSCAD® & EMTP-RV
- Automatic mapping of attributes

Model Conversion from SKM PTW New
- Detailed built-in conversion tool from SKM PowerTools®
- Converts SKM PTW versions 6.x to 8.x
- One-line diagram conversion based on original layout
- Data consistency checking & validation
- Automatic protective device settings mapping
- Create & save device library mapping as templates
- Import of user-created Time-Current Characteristic (TCC) curves
- Support for multiple one-line drawings and MCCs into composite networks
Unified Power Flow New
- Solve AC & DC systems together
- Solve LV power panel, UPS circuits & facility network simultaneously
- Handle load & source connection below panel
- Allows for panel & UPS loop connections
- Enhanced current limit modeling for inverters
- Optimized for multi-core CPU

TDLF - Time Domain Load Flow New
- Simultaneous time series simulation of AC & DC networks
  - Demand & generation
  - Diversity factor, demand factor, unbalance factors, etc.
  - Voltage drop, energy losses, yield, and costs
- Time series behavior of adjustable devices
  - Transformer load tap changers
  - Switched capacitor
  - Voltage regulator
- Single & multi-year load growth analysis
- Irradiance, temp & load profile library

Harmonics & Power Quality
- Compliance with power quality standards
  - IEEE 519-2014
  - IEC 61000-3-14
  - IEC 61000-3-6
- Global, local & individual location compliance rule book for voltage & current distortion
- New skin effect models for motors & transformers
- Enhanced current distortion alerts
- Automatic TDD current distortion limit evaluation
- Enhanced voltage & current alerts with percentile multipliers
- Enhanced load equipment cable modeling

Star™ - Protection & Coordination
- Up to 6 settings group with labels & copy/paste New
- Sorting & filtering for device settings report New
- Settings report based on substation / bus ID New
- Globally include one-line diagram during batch print
- Expanded current & voltage inputs
- Phase current summation
- Ground & neutral protection for overload function

Motor Starting
- Enhanced inverter model
- Plot Manager interface New

Short Circuit
- Compliance with IEC 60909-2016 Ed. 2.0 New
- Variable fault current vs. voltage
- LV to EHV system fault current calculation

Reliability Assessment
- Reliability warehouse New
- Multiple-phase configurations
- GIS system element handling
- Unbalanced system reliability calculation
- Reliability new indices
  - CTAIDI New
  - ALII New
  - ACCI New
- Reliability momentary indices
  - MAIFI New
  - MAIDI New
- Optimized for multi-core CPU

Transient Stability
- Line-line & line-line-ground fault actions New
- Improved synchronous machine saturation modeling
- Enhanced frequency-dependent network & generator models
- Enhanced Motor Parameter Estimation & Tuning (MPET)
- Enhanced built-in excitation system models

LV & Cable Systems
- Ground Grid & Cable Pulling user interface
- User-defined Final Temperature for cable damage curve plotting New
ArcFlash™ - NESC C2 - Up to 800 kV New
- Arcing fault hazard evaluation
- Model line-ground & line-line arc faults in open air
- Model 3-phase arc faults in open air
- Protective device sequence of operation for line-ground, line-line & 3-phase arc faults
- Auto-gap, working distance & auto-selection of minimum approach distance per NESC C2 2012/2017
- Minimum approach distance with or without tools
- Altitude & transient overvoltage correction factors
- Automatic or user-defined distance parameters
- Integrated with Arc Flash Result Analyzer
- Customizable coefficient editors
- User-definable PPE requirement editor
- Auto-update for worst-case incident energy
- Global or individual typical input data
- Integrated with Arc Flash datablocks
-Verified & Validated against industry standards

Arc-in-a-Box - 15 to 36 kV New
- Extended IEEE 1584-2002 model for 'Arc-in-a-Box'
- Typical and user-defined gaps between conductors
- Conversion factors from High Voltage Arc Flash (HVAF) to Arc-in-a-Box
- Incident energy reflectivity factors for box size
- Enhanced arc flash analysis data for equipment > 15 kV
- Designed for HVAF in renewable energy collector systems

Damage Point for Arc Resistant Switchgear New
- Maximum arc current indicator & label
- Maximum arcing duration indicator & label
- Show arc resistant switchgear damage point on Star TCC plots
- Evaluate margin with actual arc current on TCC plots for compliance with IEEE C37.20.7-2007
- Designed-based on IEEE PCIC-2017-03

Arc Flash - IEEE 1584 & NFPA 70E
- Compliance with NFPA 70E 2018 standard New
- Customizable X-factors based on IEEE 1584-2002
- Inverter modeling for renewable systems New
- Label formats for arc flash boundaries (ft.in, ft, in) New
- Enhanced reports & labels for 64-bit MS Office
- User-defined arc flash boundary threshold
- Enhanced one-line diagram annotations
- Arc Flash Result Analyzer fields New
**Protective Relay Performance & Evaluation**
- Simulate model-specific protection settings & functions including distance, directional & load encroachment
- Plot R-X characteristics & seen impedances
- In-depth performance evaluation of impedance relays
- Evaluate protective device operation & coordination
- Intelligent alert viewer to identify & resolve setting & logic errors
- Virtually animate protective devices operation
- Breaker failure & relay communication
- User-editable scheme logic
- Use real-time operational data for system evaluation
- Intuitive relay setting editor
- Primary & secondary relay settings based on actual model
- Comprehensive relay library

**Plots & Reports**
- Time state plots
- Time distance characteristic plots
- Time distance-resistance characteristic plots
- Detailed device setting reports
- Export relay settings to xml & Excel formats

**Distance Relay**
- Distance function
- Scheme logic (input, output, timer, latch, variables)
- Expanded current & voltage inputs
- Digital inputs
- Phase current summation
- Up to 6 setting groups with labels & copy/paste

**Embedded Fault Analyses & Power Flow**
- Sliding fault analysis
- Single fault analysis for unbalanced networks
- Unbalanced load flow & transmission line load-ability analysis
- Protective device sequence-of-operation
- Data communication between relays & interlocks
- Fault insertion between CT, VTs & CBs
- Multiple fault locations & resistances analysis in one-click
- Series compensated line evaluation with MOV protection
- Support mutually coupled lines & single-phase systems

**Distance Relay Library**
- Detailed distance protection element for over 40 relay models:
  - Schweitzer
  - GE Multilin
  - ABB
  - Schneider
  - Alstom/Areva
  - Siemens
  - ZIV
  - ERL Phase
  - ARCTEQ
  - Toshiba
  - Universal (Generic)
Wind Turbine Generator (WTG)
- Dynamic models based on IEC 61400-27-1-ed1
  - Type 3A
  - Type 3B
  - Type 4A
  - Type 4B
- Short circuit modeling per IEC 60909-2016
- Crowbar & current limit short circuit model with active & reactive
- Auto-trip voltage & duration for LVRT

Solar/Photovoltaic Inverter Modeling
- Current limit model for short circuit
- Reactive & power factor control with constant current limitation
- Minimum & maximum operating values for current limits
- Low-Voltage Ride Through (LVRT) auto-trip voltage & duration for incident energy reduction
- Enhanced current limit modeling for inverters
- Inverter modeling for Arc Flash in renewable energy systems

Microgrid Modeling
- Transient Stability (TS) to User-Defined Dynamic Model (UDM) network control signal types
- Internal or external inputs from:
  - Power system stability network
  - Real-time input measurements or tags
- TS voltage & power flows from network can be accessed by UDM Microgrid Controller
- User-defined renewable energy models for Wind Turbine Generator & Photovoltaic Array

Transient Stability
- Line-to-line fault event simulation
- Line-to-line-to-ground fault event simulation
- Improved synchronous machine saturation model
- Enhanced built-in excitation systems
- Enhanced frequency-dependent network & generator modeling
- Microgrid Controller network parameter inputs to UDM
- Improved inverter transient response
- Enhanced UDM model library
- Plot Manager interface
AC & DC Railway Simulation
- Tool for analysis & operation of tractions systems
- Solve transmission, distribution, traction, & signaling together
- Integrate GIS, planning, protection & operations
- Energy demand calculation based on train timetables
- Resolve challenges of unbalanced system operation
- Evaluate substation location & capacity
- Determine the impact of various rolling stock
- Determine capacity restrictions & analyze mitigation methods
- Determine impact of unplanned events on the traction power system using real-time data
- GIS for overhead catenary system
- Data exchange with third-party applications & templates
- Traction power equipment templates
- Utilize real-time data for Energy Forecasting & Switching Management
- Verified & Validated (V&V) against benchmarks

Traction Elements
- Overhead Catenary System
- Track Resistance
- Traction Substation (TSS) & Switching Station (SSP)
- Traction Rectifier - Controlled & Uncontrolled
- Train Station & Platform
- Insulator, Insulated Overlap, Neutral Section & Isolator
- Substation & Traction transformers
  - Auto-transformer
  - Booster-transformer
  - Scott-T transformer
- Signal, Speed Limit, Level Crossing
- Distance, Elevation & Bend Radius

Traction Analysis
- Train Performance Calculation
- Solve unbalanced AC & DC systems together
- Unified AC & DC Time Series Power Flow
- Optimized for multi-core CPU

Interface
- Track Editor & Warehouse
- Line Editor & Warehouse
- Route & Timetable Editor
- Automatically generate train timetable based on number of trains, head-way, dwell time, etc.
- Import train schedule from Excel for faster data entry

Results & Plots
- Graphical plots using Plot Manager
  - Rail energy consumption including maximum, peak & average rolling demand
  - Trip profiles - acceleration, speed, elevation, etc.
  - Substation power flows & voltages
  - Train power flows & voltages per route
  - Rail voltage, track potential
- Alerts based on EN 50163 & EN 50329 standards
Advanced Distribution Management System
• Long-Term Load Forecasting New
• Automatically download weather data New
• Automatic incremental model updates
• Improved dispatcher training simulator
• Integrated restoration & isolation plans
• Historical, Library & Excel data sources

SCADA System & Architecture
• MCC / BCC redundancy with disaster recovery
• Encryption & authentication security
• Self-healing strategies
• Integrated front-end processor with native communication drivers
• Web services communication
• Automatic historical data replication
• Unlimited signals or measurements
• Native IEC 60870 protocol New
• Native ICCP protocol New
• Interface to ADMS & OMS

Visualization & Dashboards
• Common workstation & Web HMI
• HMI objects library
• Alarms & Events displays
• Service Tags / Operator Notes integrated with advanced applications New

Real-Time & Historical Reports New
• User-definable scheduled & on-demand reports
• Real-Time & historical data
• Customizable Alarms & Events reports
• Web-enabled reporting
• PDF & Excel formats

Intelligent Load Shedding Dashboard New
• Thin-client HMIs
• Monitor spinning reserve, load to shed, load status
• Automatic & manual trigger controls
• Graphical load shedding event analyzer & viewer
• Hardware communication dashboard

Load Preservation
• Steady-state & transient response
• Fast response time (10ms) with secured communication
• Priority optimization based on number of trips per time period

Switching Order Management New
• Mobile interface
• Crew assignment & field confirmation of actions
• Link switching sequences to orders
• Scheduled & active order viewer
• Control center confirmation of order
• Estimated time to completion
• Classification & User Access Management including Area of Responsibility (AOR)

Switching Sequence Management New
• Unbalanced system validation
• Transfer to Mobile Switching Order Management

Alarm Management
• Prioritizes events via graphical & tabular views
• Integrated SMS & e-mail services New

Generator Operations & Maintenance
• Track life operating time & cost
• Multiple maintenance levels notifications
• Alerts for due maintenance schedules

Control & RTU Hardware - etap iCE™ New

Controllers
• Substation Automation
• Intelligent Load Shedding
• Generation Control
• Data Acquisition
• Secure & Scalable Controller

Remote Terminal Units
• Data Acquisition & Control
• Field/pole mount RTUs
• Integrated RTU & fault detection

Communication Protocols
• IEC 60870-5-104/101
• DNP 3
• Modbus
• IEC 61850
• MMS/GOOSE
• GPRS, xDSL, VSAT, Tetra
Visit etap.com to view the current events schedule. Events are added throughout the year, so be sure to visit frequently for the latest updates.

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 9001:2015
- 10 CFR 50 Appendix B
- 10 CFR Part 21
- 10 CFR Part 50.55
- ANSI/ASME N45.2
- ASME NQA-1
- CAN / CSA-Q396.1.2
- ANSI / IEEE 730.1
- ANSI N45.2.2