

EN.SURE RTTR – THERMAL RATING SOFTWARE



EN.SURE RTTR is the state-of-the-art real-time thermal rating software package fully dedicated for optimum use of temperature information gained by EN.SURE DTS (distributed temperature sensing) systems. It comprises:

- Calculations of conductor temperature (CT) profiles along power cables from DTS and load history data, and
- Predictions on conductor temperature, time and transient ampacity for different load scenarios.

The EN.SURE CT software package calculates the CT profiles, identifies critical locations and triggers (pre-)alarms when the respective thresholds for CT are reached. The full software package EN.SURE RTTR in addition offers powerful prediction capabilities. All thermal models used in the rating are validated by FEM (finite element method) calculations before shipment and the accuracy is proven for various load scenarios in a detailed test report.

EN.SURE RTTR is fully integrated with the user-friendly and easy-to-learn Charon4 database and visualization software. All readings from multiple EN.SURE DTS and point sensors as well as the rating results are stored together in a modern SQL database. Powerful CHARON4 visualization tools enable multiscreen visualization of temperature profiles and histories, current data as well as intuitive, custom visualization of all data on maps, pictures or drawings of the full power cable installation.



Charon4 visualization showing tree view, conductor temperature job properties, rating summary, conductor temperature profile and conductor temperature history windows



Technical Background

The ampacity (maximum constant current load) of an insulated power cable is limited by the maximum temperature of the conductor that does not affect the insulation material. EN.SURE DTS is a powerful tool to monitor the temperature along insulated power cables. The EN.SURE DTS system measures the temperature at the position of a fibre-optical sensor. This sensor can be located in the screen, on the jacket or at a location more distant from the insulated power cable.

For the steady-state, there exists a simple estimation for the difference between EN.SURE DTS and conductor temperatures. However, this estimation is only valid, if a constant current load has been applied to the cable for a time period long enough to reach constant temperatures in each layer of the cable (thermal equilibrium).

If the current is not constant over time, the Thermal Rating software package EN.SURE CT is required for precise calculation of conductor temperatures based on measured EN.SURE DTS temperatures and current load data. EN.SURE CT calculates in real-time conductor temperature profiles along the full length of a power cable. Pre-alarm and alarm thresholds for the maximum conductor temperature can be set and enable a safe operation of the power cable at any time.

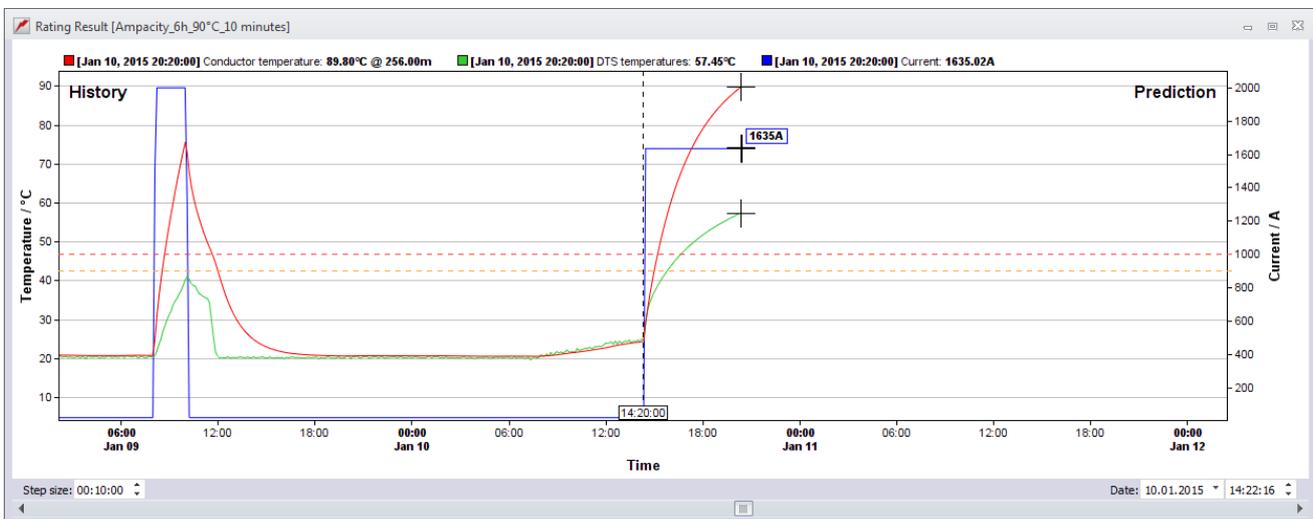
The full Thermal Rating software package EN.SURE RTTR in addition allows for emergency calculations to predict the permitted future current load. Predictions can be used to determine:

- The time when the maximum conductor temperature is reached with a certain current load,
- The conductor temperature that is reached after a certain time with a certain current load, and
- The current that can be applied to reach a certain conductor temperature in a certain time.

The current used in predictions of time and conductor temperature must not necessarily be constant, but current profiles over a day or a week may also be applied.

Reactive current profiles may significantly contribute to cable heating at long submarine cables. EN.SURE RTTR has the capability to consider such reactive current profiles in the calculation of conductor temperatures and in the predictions.

If the DTS fibre is in the screen or attached to the power cable, the EN.SURE DTS temperature readings enable the separation of the thermal model used in conductor temperature calculations from everything outside the cable or formation. This enhances the accuracy of those calculations because they are not affected by less precisely known environmental parameters such as thermal resistivity of soil and ambient temperature.



Transient view of an ampacity rating job showing the history and the prediction for current, DTS and conductor temperatures



Features

- Merging of temperature data from multiple DTS
- Use of additional point temperature sensors
- Conductor temperature profiles
- Self-learning of variations of ambient parameters
- Temperature, time and current rating
- Rating with load profiles
- Calculation of cyclic rating and loss load factors
- Hot spot position of conductor
- Conductor temperature and rating histories
- Pre-alarms / alarms on temperatures and ratings
- Transient plot of prediction results
- Multiple circuits
- Various laying schemes
- Unlimited number of thermal sections
- Consideration of reactive current profiles
- FEM validation report on models
- High number of periodic rating jobs
- Periodic and manually triggered rating
- Huge database capacity
- Long-term visualization
- Communication to SCADA / DCS
- Optional client-server architecture



Enhanced View of a power cable installation showing the rating summary, the conductor temperature profile and a drawing of the installation with a false colour representation of conductor temperature along the cable



Technical Data

| Operating Systems | Installations |
|---|--|
| <ul style="list-style-type: none"> Windows 7 (Service Pack 1 or higher), 64-bit recommended Windows 8.1 Windows 10 Windows Server 2008 R2 and 2012 R2 | <ul style="list-style-type: none"> Buried group, (buried) pipe, encased pipe Thermal back-fill Multiple duct-banks Unfilled trough (with forced ventilation) Buried trough with sand Tunnel (with forced ventilation) Cables in water or air External heat sources and cable crossings Various fibre positions, further models on request |
| Hardware Requirements: EN.SURE RTTR and Database Server <ul style="list-style-type: none"> Server with high-end quad-core processor 4 GB of RAM memory (8 GB for better performance) 250 GB of free hard disk capacity RAID 1 or 5 UPS (uninterruptible power supply) Clock synchronization using NTP | Input Data <ul style="list-style-type: none"> EN.SURE DTS temperatures Analogue current / temp. sensors: 0(4)-20mA, 0-10V or Pt100 Digital sensors: MODBUS, IEC 60870, DNP3 or IEC 61850 protocols |
| Hardware Requirements: Visualization Client <ul style="list-style-type: none"> PC with dual-core processor 2 GB of RAM memory (4 GB for better performance) 5 GB of free hard disk capacity 19" or larger screen recommended | Output to SCADA or DCS <ul style="list-style-type: none"> Maximum conductor temperatures and dynamic rating results Pre-alarms, alarms and faults Protocols: IEC 60870, DNP3 (or IEC 61850) |
| Database Capabilities (performance depending on server hardware) <ul style="list-style-type: none"> > 1 TB of data Connections to multiple DTS and other data sources Connection to multiple clients (depending on license) Import, export, clean-up High availability and data safety with dual database setup | Advantages <ul style="list-style-type: none"> Compliant to IEC standards Multilayer soil model Self-learning of ambient temperature and thermal resistivity of soil Models validated by FEM simulation Continuous validation of rating accuracy Consideration of reactive current profiles |
| Visualization Capabilities <ul style="list-style-type: none"> Tree view for DTS, data sources, circuits, rating results and views DTS status Zone data, temperature profiles and history of data Visualization of structures monitored by multiple DTS Enhanced views with pictures of installations or maps Languages: EN, DE, CN, RUS, others on request Systems of units: SI, Imperial units | Results <ul style="list-style-type: none"> Conductor temperature over cable position Rating of temperature, current and time (constant or variable load) Steady-state ampacity of circuits Cyclic rating and loss load factors (M, μ) Pre-alarms and alarms on CT and rating results |
| Thermal Rating Packages <ul style="list-style-type: none"> EN.SURE CT (conductor temperature) EN.SURE RTTR (full rating) Optional client-server architecture | Data Export <ul style="list-style-type: none"> Measurement data in MX4 format Project and DTS configuration in PR4 and CG4 formats Enhanced views in EV4 format |

LIOS Technology GmbH

LINEAR OPTICAL SENSORS

Schanzenstrasse 39 Building D9-D13

51063 Cologne, Germany

Phone: +49 221 998870, Fax: +49 221 99887150

info@lios-tech.com

Further information on LIOS products and services: www.lios-tech.com