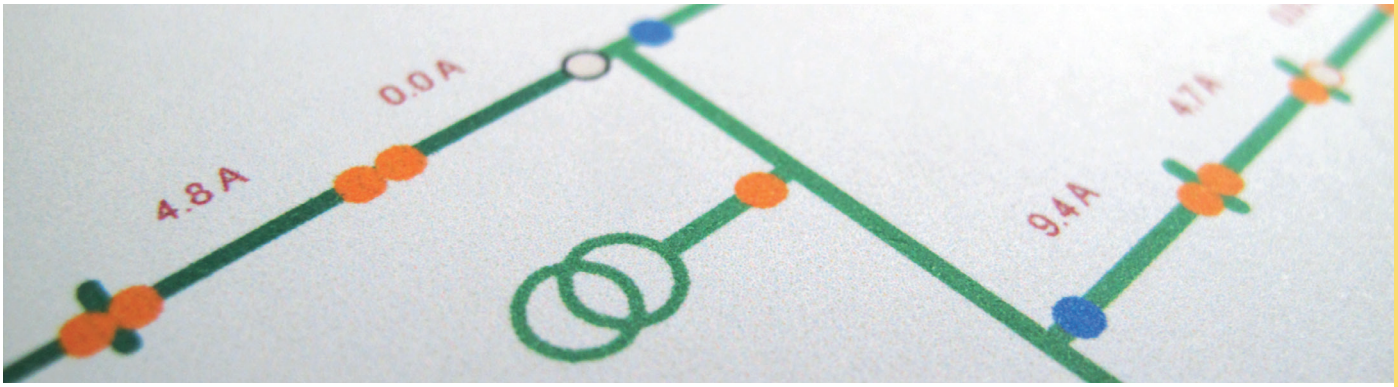
VIVAVIS

DECODING THE FUTURE



HIGH-LEIT

An open, scalable SCADA system for all infrastructure applications

The SCADA system for all sectors

During the ongoing digitization of the energy market, the challenges for grid operators continue to grow unabated. The desire for more productivity coupled with maximum supply reliability and IT security requires the use of a SCADA system that satisfies the most stringent requirements. Be on the safe side with the HIGH-LEIT.

The VIVAVIS HIGH-LEIT SCADA system is designed for use in the energy, water supply, waste water and environment sectors, associated utilities and industrial applications. As an open system with a client-server architecture, as well as standard SCADA functions it offers the user numerous sector-based functional modules and special industry-specific solutions.

Our expertise is confirmed by customers in Germany and around the world.

The advantages for you: Scalable and a secure investment
The multi-sector HIGH-LEIT SCADA system offers extensive SCADA* and HDO**functions for all sectors. It is intuitive to use and satisfies the most stringent requirements for IT security.

The HIGH-LEIT
- is highly scalable and continually expandable
- tried and tested software for all sectors (electricity, gas, water, district heating, ...)

The HIGH-LEIT offers
- modular, sector-specific applications (e.g. grid topologies, fault localization, grid calculation, simulation, forecasts)
- schematic and geographic grid representation
- IT security in conformity with the BDEW white paper „Requirements for Secure Control and Telecommunication Systems“
- user-friendly data exchange with external systems (e.g. GIS***, maintenance and outage management)
- seamless interaction between systems
- a number of communication interfaces

The HIGH-LEIT is
- continually being further developed and improved

Its profile is further enhanced by a secure update strategy.

Control and observation
The SCADA system assists the user with an extensive range of features for processing
- Binary process variables (signals and commands)
- Analog process variables (measured values, setpoints and counter values)
- Derived process variables (calculated values, operating hours counters, group commands, switching sequences, control programs, logical expressions, ...)

Laboratory values can be entered manually.
The user interface offers several features to enhance user comfort: Variable desktop layouts allow the user interface to be adapted and organized to suit individual needs. Geo images enable very large volumes of information to be managed and shown in a single process image. In combination with a large-screen projection, they permit fast and clear navigation of the modeled network.

The operator can quickly generate interactive analyses thanks to end-to-end connectivity features. All data can also be displayed on different monitors by means of multiscreening.

To keep large plant images user-friendly, the HIGH-LEIT provides a great many additional features, e.g. (remote) zooming, scrolling and decluttering. What‘s more, notes, comments and markings can be inserted with ease.

**Supervisory Control and Data Acquisition*
*** Higher level Decision-making and Optimization functions*
****Geographic Information System*

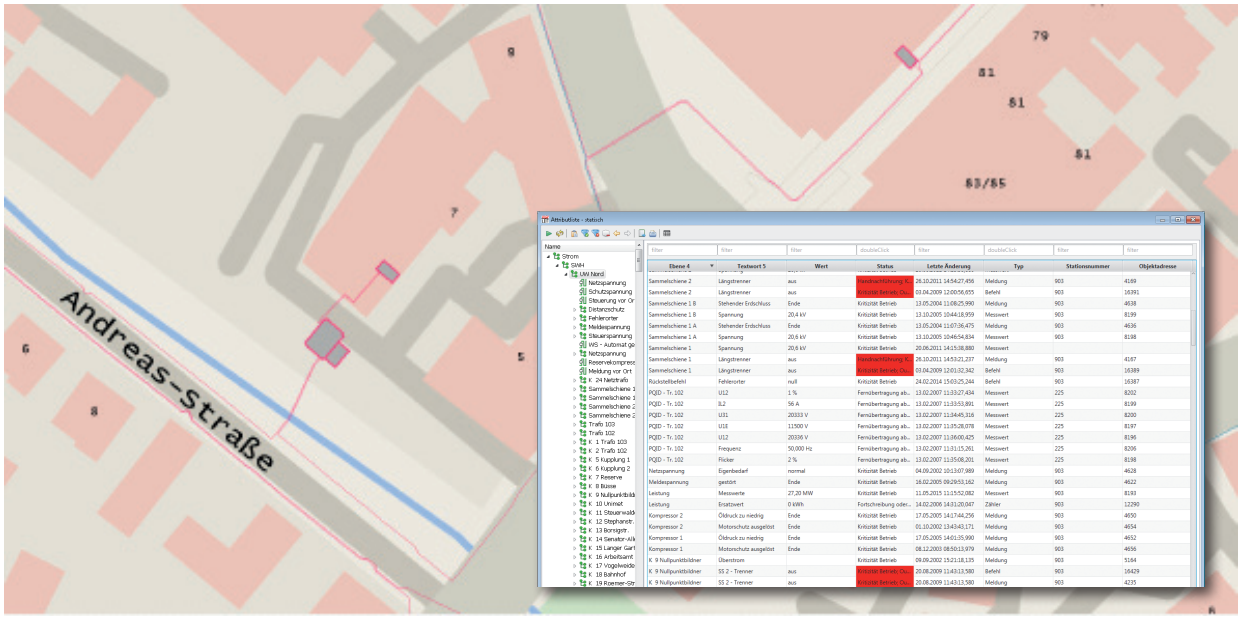
Geographic grid display
In normal operation, geographic visualization provides the user with an overview of the geographic position and surrounding area, e.g. in relation to streets and buildings, and even house numbers. This true-to-life representation enables more accurate estimation of distances, and the different colors of the individual network groups show precisely which areas are being supplied and from where.

For maintenance work, too, the geographic display provides an overview of pending service tasks. For example, it indicates what effects a scheduled switching operation will have on the affected supply areas.

In the event of an acute incident, the affected area of the grid is shown in the relevant color, as in the schematic grid diagram. The combined display of geographic and dynamically colored grid information enables employees to be ideally prepared for their work and the situation on the ground.

Signals and alarms
All process and system events are logged chronologically in the clearly organized event log. The alarm list provides an overview of all current faults. The event log and alarm list boast numerous filtering and setting options, as well as automatic filtering. The alarm bar can be configured to suit areas and types of fault.

In the electronic shift log, the user can clearly document all events, e.g. signals, operating instructions, shift handover. The contingency service can be alerted by a choice of phone, voice output, text or pager.



Archiving and reporting
Process variables can be stored in time and event-based archives:

- Event archive for all events, with comments
- Numerical archives for analog process data
- Short-time archives for analog process data
- Event-based archives

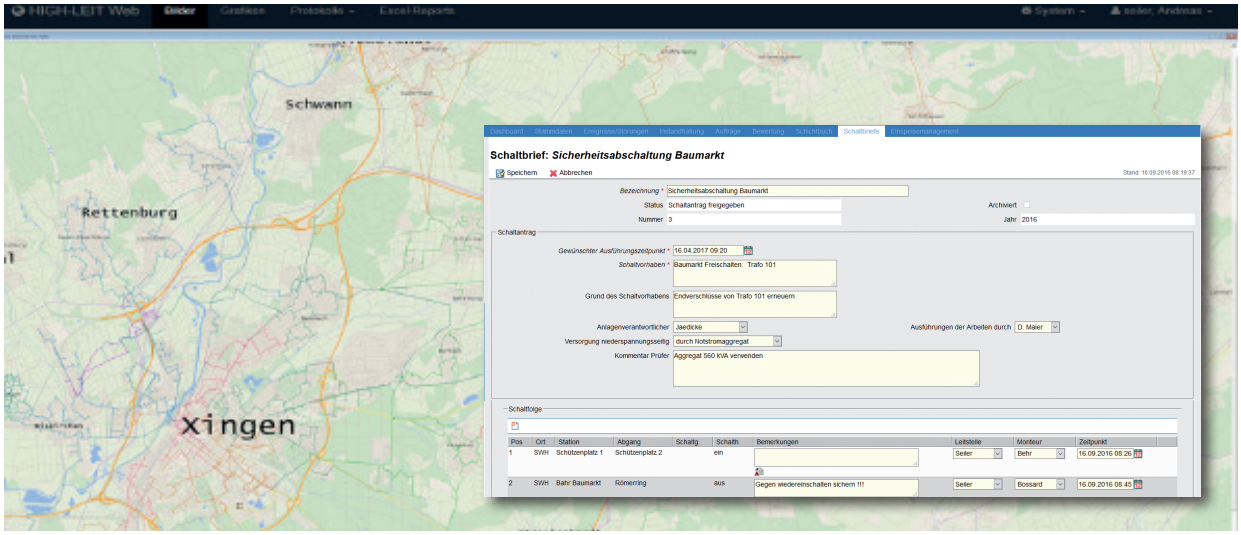
Data backup takes place in regular cycles. The archived data are evaluated using graphs that can be generated freely as desired.

Standardized reports are used for setting out data in tabular form. On top of all this, the integrated Excel Reports offer further evaluation and display options.

Multi-client capability
The HIGH-LEIT is a multi-client system and as such can process data from different plants separately. The user can configure access permissions himself – organized by workstation, function, user, plant operator, area and client.

Reliable switching
During the operation of electrical grids and pipe networks, several people – from the plant manager to the work supervisor – are involved in the process chain, from the switching application to executing switching operations right through to evaluation using switching reports. The web-based switching module supports the user at every step and can partially automate grid operation:

- Recording the switching application, with desired overall measure and time
- Documenting the switching application and forwarding to the responsible work supervisors
- Making a decision on the switching application
- Determining the required switching measures
- Technical planning and time scheduling of individual measures
- Producing the switching record
- Implementing the measures
- Documenting all the steps of a switching report



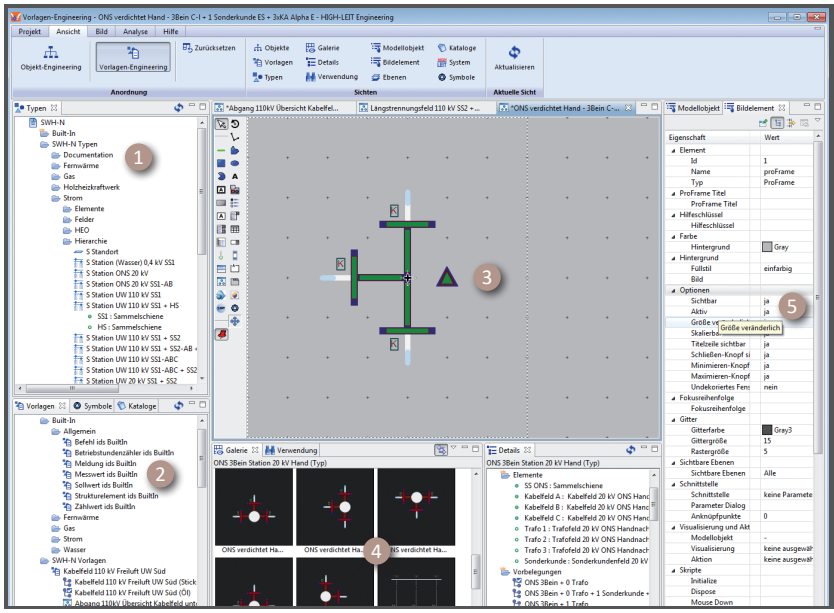
HIGH-LEIT Web
HIGH-LEIT Web offers easy access to images, graphs, logs and Excel Reports. It also provides employees outside the grid with all the information they need. An extensive user management feature enables staff to be individually assigned access permissions, so that each employee can only access data approved for him. The web interface does not allow switching operations. HIGH-LEIT Web can be used via HTTPS using a secure connection.

Interfaces
In addition to communication interfaces for secure data transmission to IEC 60870-5-104, the HIGH-LEIT also offers communication in accordance with IEC 61850, IEC 60870-5-101/103 via a gateway, as well as Modbus and many manufacturer-specific protocols.

Data is exchanged with third-party systems via OPC* or TASE.2. The HIGH-LEIT can also exchange data with neighboring IT systems via its API**, e.g.

- Replication of process and archive data in a central data warehouse
- Synchronization of equipment and cable data from the GIS
- Data exchange with grid planning systems

** Open Platform Communications*
*** Application Programming Interface*



1 Standardization of objects
2 Variants of types
3 Graphic modelling
4 Multiple visualizations of types
5 Tabular Editing

System configurations
The scalable and expandable SCADA system can be used in the following system configurations:

- Single-user system for local control and observation systems
- Dual-processor system with very high availability
- Site redundancy with 3 and 4-processor systems

IT security has top priority
In our interconnected world, the threat of cyber-attacks is growing for energy supply companies, too. Therefore, secure communication with external networks has top priority for us.

VIVAVIS offers the following services:

- Ensuring the
  - maximum availability and confidentiality of all data
  - Authenticity and integrity, e.g. with OSSEC HIDS*
- Hardening of all system components
- Configuration and installation
  - IPSec encryption of communication between workstation computers and servers
  - Virtual Local Area Network (VLAN)
  - Vertical and horizontal network segmentation
  - Virus scanner and firewall with the latest signatures

Furthermore, the HIGH-LEIT provides a central Windows Server Update Service (WSUS) for distributing operating system patches.

Object-oriented engineering
With the HIGH-LEIT, the SCADA system engineering is typed, which considerably reduces configuration time and prevents errors. Based on default values (e.g. limit values) and visualization types (e.g. busbars), all objects are consistently typed and structured hierarchically. The network model layout is simplified by different displays and type variations. Modeling is graphic. The user can topologically link objects very easily in an image using drag & drop. In this way, he can copy and paste entire branches of the tree.

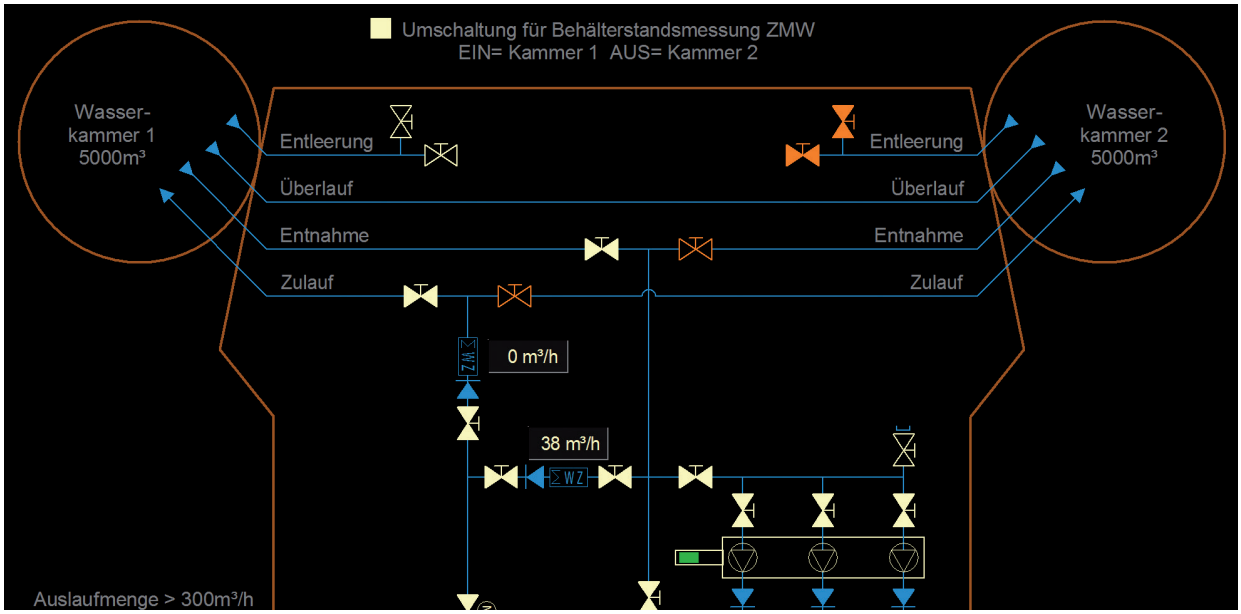
This consistently object-oriented approach takes up very little time, even for subsequent changes to the engineering – all objects of the same type are modified with just a few clicks. Engineering takes place offline and therefore has no direct influence on the database in the runtime system. Engineering changes are activated in the runtime system manually.

** Open Source HIDS SECurity*

Topology for pipe networks
Gas, water and heating pipe networks can be displayed in different colors based on their supply status. The calculations performed in order to display the network are based on the network topology, the states of the network elements, the supply area and the master data. Each source has its own defined supply area. The coloring of the network is based on the assignment of network elements to one or more supply areas. The topology colors special states so they are easily seen.

The pipe network topology offers a selection of coloring variations based on pressure, flow and pipe parameters. In addition, the plausibility of flows and valve positions is verified.

User friendliness is further enhanced by topological control programs.



Topology – Electricity and fault localization
The topology calculates the states of an electrical energy supply grid and displays it in process images. This presentation is based on a graphic edge-node model.

Upon changes of state, the topology automatically determines the new state of the electricity supply grid. Following calculation, the cables and switches are displayed in colors that indicate their new state. The color of live parts of the grid depends on the defined priorities of the individual supply areas and the current device states. In addition to this „normal“ topological coloring function, the HIGH-LEIT topology offers further coloring variations in parallel. Every process image can be individually switched to one of the coloring variations Upstream supplier, Grid group or Circuit. Before each switching operation, the topology checks its reliability and presents a switching preview.

In the overview, the system offers a compressed view based on zoom levels, in order to reduce complexity. Moreover, the topological functions are available for markings, temporary features and typed switching sequences.

The area suffering an outage is determined from the in-formation from ground fault indicators and steady-state ground fault relays, and shown in the grid view. To determine the most probable location of a short circuit, the information from trip signals, tripped switches, short-circuit indicators and distance protection equipment is analyzed using reactance measured values.

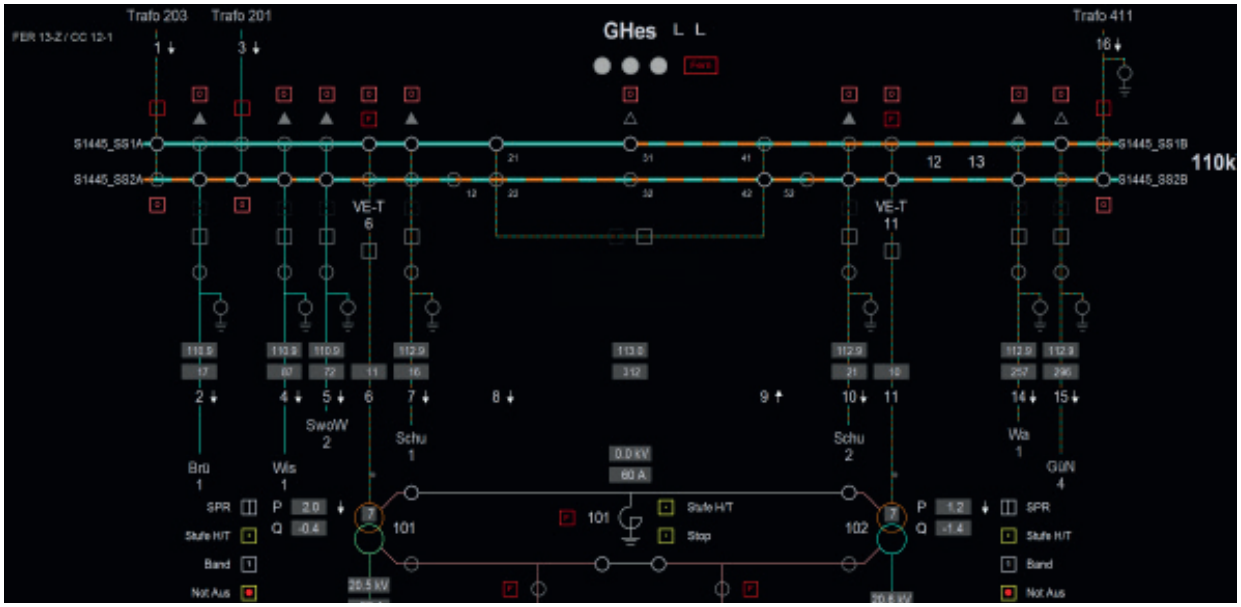
Grid and short-circuit current calculation
Grid calculation is used to determine equipment utilization and the voltage profile. It determines the active and reactive power flows in all branches of the grid, as well as grid losses and power balances. The grid topology, equipment data, loads and feeds are all variables that influence grid calculation.

In online mode, the power distribution and voltage profile are determined. Voltage band violations and equipment overloads are indicated in the plant image and logged.

The load flow calculation takes EEG (Renewable Energy Sources Act) compliant feeds into account, and recognizes feed-in into the transformer station. Before each switching operation, it calculates the currents and equipment utilization that would result, and displays them by means of target flashing. Overloads and voltage band violations are automatically included in the topological interlocking check. The load flow calculation is also available in Simulation mode, and therefore enables the user to safely prepare for grid switching measures.

The short-circuit current calculation takes place on all nodes using the Takahashi method. 3, 2 and 1-pole faults and 2-pole faults with ground contact are calculated in parallel, so that the results of each type of fault are available for visualization. Individual short-circuit situations can be calculated by setting a potential fault location in Simulation mode.

Before a switching operation takes place, overload, voltage limit and short-circuit withstand capability tests are performed as part of the switching authorization test. In the event of a limit violation, this is indicated by a warning and the display of the overload and of excessively high and low voltage.



ACOS NES – Training Simulator
Operators of electrical energy supply grids are under obligation to provide their staff with training on potential faults and how to correct them. With the ACOS NES Training Simulator, staff can learn how to remedy even those faults that seldom occur.

- Training takes place in real conditions, and even critical grid situations can be simulated. In Training and Simulation mode, the SCADA system is operated on a normal SCADA system workstation.
- The instructor is able to manipulate the equipment.
- The comprehensive simulation of all equipment, including protective devices, with real-time reactions enables training and simulation in realistic conditions.

Due to the diverse range of equipment that can be modeled, the Simulator is perfectly suitable for all areas and voltage levels – from the standalone industrial system to the municipal distribution grid, all the way to the the interregional transport network.

VIVAVIS AG Nobelstraße 18 | 76275 Ettlingen | Germany
T +49 7243 218 0 | F +49 7243 218 100 | E info@vivavis.com | W www.vivavis.com

(Status: 12.01.2021, Subject to modification)