HIPASE

THE NEW GENERATION OF INTEGRATION

ANDRITZ

HIPASE – The new generation of integration

ANDRITZ has many years of experience in the automation of hydropower plants ranging from machine-level protection and control systems to the overall plant control as well as high-level control center systems. This extensive know-how is reflected by the product platform HIPASE which is harmonized across all fields of application.

The HIPASE platform combines powerful embedded devices, specifically developed for electrical protection, excitation, turbine control and synchronization, with a modern, highly scalable SCADA system.
A carefully designed unified engineering tool ensures a harmonized engineering workflow across the whole platform.

HIPASE DEVICES

The innovative HIPASE embedded devices are specifically designed for use in hydropower plants and cover the following applications:

- Excitation (AVR) HIPASE-E
- Electrical protection HIPASE-P
- Synchronization HIPASE-S
- Turbine governor HIPASE-T

The high-performance HIPASE hardware allows for the combination of multiple applications in a single physical device:

- Excitation (AVR) and turbine control HIPASE-ET
- Electrical protection and synchronization HIPASE-PS

All HIPASE applications are based on harmonized, modular hardware. A HIPASE device generally consists of a processor board including communication interfaces, configurable analog and digital I/O boards including power supply, and application-specific modules.

This globally unique modular approach allows synergies to be exploited at all levels, from hardware design, to software application, to engineering workflow, to maintenance and life-cycle management.

The highly innovative HIPASE embedded devices are equipped with a modern, fully graphical touch panel optimized for ergonomic on-site operation. Thanks to its user interface, which is individually adapted to all applications, it offers intuitive and efficient operation perfectly tailored to the needs of plant operating staff.

CONTROL CENTER SYSTEM HIPASE-250

The state-of-the-art control center system HIPASE-250 is fully integrated into the HIPASE platform and optimized for use in the hydropower sector. It offers comprehensive functions for operating, monitoring, and controlling the entire technological process. Its scalability allows it to be used at all automation levels, from individual machine control to central control rooms.

Optimized ergonomic controls and displays provide a quick, reliable real-time process overview. The interface follows modern industrial design standards, focusing on essential elements to ensure an optimal user experience.

HIPASE-250 is a multi-hierarchical SCADA system that can be used at all levels of the hydropower process due to its excellent scalability. The field of application for HIPASE-250 ranges from touch devices, singular and redundant PC systems to distributed client/server configurations.

CYBERSECURITY

HIPASE embedded devices are optimally protected against unauthorized external and internal access through a comprehensive and consistent hardware-supported security architecture. Core elements include an internal device firewall and the strict separation of application processing from communication interfaces. These tasks are performed by two independent processors in the HIPASE embedded device, providing an additional layer of security.

Furthermore, comprehensive system hardening ensures HIPASE embedded devices as well as HIPASE-250 control center system to be robust and resilient against potential threats. The overall HIPASE platform meets current security standards and is reliably protected against unauthorized access. Regularly provided security updates ensure continuous compliance with future security requirements.

HIPASE Engineering – A harmonized workflow

The HIPASE Engineering Tool is the optimal tool for the simple and efficient configuration of HIPASE products. It offers uniform operation across the entire HIPASE platform and tailored functionality for the respective specialized applications, from electrical protection, synchronization, excitation, and turbine control, to the SCADA system.

The HIPASE Engineering Tool offers a uniform look-and-feel and intuitive user experience across all product applications of the entire platform. The user interface has been carefully developed according to the latest standards of industrial design. A strong focus on ergonomics as well as a strict reduction to essentials elements enable an optimal and efficient engineering workflow from the test and commissioning phase to ongoing operation and maintenance.
The cross-platform functions of the HIPASE Engineering Tool include:

- Harmonized project engineering
- Process operation and monitoring tools
- System management
- Multi language capability
- Context-sensitive help

In addition to the cross-platform functions, the HIPASE Engineering Tool offers a variety of tailored functions for both the embedded devices and the SCADA system.

CONTROL CENTER SYSTEM HIPASE-250

The HIPASE Engineering Tool is specifically optimized for the challenges of SCADA system engineering. It offers innovative solutions for handling large amounts of data and multi-hierarchical system topologies. An ergonomic image editor, developed according to the latest industrial design standards, enables specialized visualization of the hydropower process. In addition to numerous standardized image elements, customized graphics such as turbine flow, generator diagram, and gate representations are available.

A seamless connection of the image editor with an integrated data point management enables efficient engineering of large amounts of process data points and process images.

Excitation – HIPASE-E

HIPASE-E is a voltage regulator for static and brushless excitation systems used for all types of synchronous machines (generator, motor, or synchronous condenser). HIPASE-E features all regulator operating modes and limiting functions, as well as a power system stabilizer according to the latest industry standards. The integrated firing pulse controller allows use for synchronous single-phase and three-phase machines over a wide frequency range.

The development of the ANDRITZ product portfolio is based on extensive long-term experience and a broad installed base in the field of excitation systems. The HIPASE-E voltage regulator features a configurable control structure that meets current industry standards. Extensive limiting functions and a power system stabilizer ensure safe operation within the defined working range according to the latest requirements of the energy sector.

A flexible configuration of the control structure enables the user to configure operating modes and limiting functions according to the plant requirements. The touch panel enables simple and secure configuration of control and regulation functions by a seamless user management featuring ergonomic on-site operation and extensive integrated testing capabilities.

All core functions of a thyristor excitation system are combined in the application module of HIPASE-E consisting of the firing pulse controller for the thyristor bridge and the required measurement inputs, such as field current, field voltage, or bridge temperatures. Analog and digital signal processing is available through respective analog and digital modules.

When using the compact housing (½ 19-inch housing), up to 16 digital inputs and outputs can be processed.

For applications with a higher number of digital input and output signals, a full-width 19-inch housing is used.

SMART BRIDGE

Smart Bridge is the preferred solution for ANDRITZ excitation systems. It comprises a six-pulse fully controlled thyristor bridge, specifically developed for the requirements of excitation systems. It is characterized by a simple maintenance concept, redundant fan concepts, and high availability.

TECHNICAL DATA

Supply voltage	24 VDC–250 VDC
Voltage measurement	100–125 VAC / 3 VA Cl.1, 3-phase or 1-phase
Current measurement	1 A or 5 A / 3 VA, Cl.3, 3-phase or 1-phase
Voltage regulator range	0.9–1.1 UGN
Control accuracy	<= +-0.2%
Power system stabilizer	PSS2A/B, PSS4B
Generator rated frequency	16.7 Hz–400 Hz
Generator working range	10–440 Hz
Digital inputs	24 VDC–250 VDC
Digital outputs	250 VDC, 8 A permanent
Test voltage	2 kVrms according to EN 50178/1997
EMC resistance	IEC 61131-2
Communication protocols	IEC 60870-5-104 IEC 61850 Modbus TCP OPC UA

Electrical Protection – HIPASE-P

HIPASE-P is the optimal solution for state-of-the-art, high-performance generator and transformer protection at various rated frequencies (50 Hz, 60 Hz and 16.7 Hz).

HIPASE-P has a modular structure with over 100 protection functions. A special application module was developed for generator protection which generates and processes analog signals for specific protective functions.

Examples of these protective functions are:

- Rotor earth fault
- Stator earth fault with external frequency shift
- Shaft current with adjustable harmonic wave assessment
- SFC overcurrent
- SFC earth fault
- Temperature measurement

When using the compact housing (½ 19" housing), up to 32 digital inputs and outputs can be processed. For more extensive applications with a higher number of digital inputs and output signals, a full-width 19" housing is available. Specifically, generator protection requires a variety of functions needed for complex applications such as pump turbines and large thermal blocks.

The HIPASE Engineering Tool supports the protection engineer with familiar and proven elements such as the software trigger matrix, test inputs for protection functions, and easy testing of the interfaces.

The configuration of the protection function is done by a simple selection of all protective functions available for HIPASE-P. With this action, all steps required for the project planning are carried out fully automatically, up to the creation of the process displays for the full-graphic touch panel.

In addition, there is a parameter window that allows clear and easy adjustment of the parameters.

TECHNICAL DATA

Rated frequencies	50/60/16.7 Hz
Current transformer	Quantity 12/24 I_n = 1 A and 5 A
Voltage transformer	Quantity 8/16 U_n = 100–125 VAC
Digital wide-range inputs	Quantity 8-64 U_n = 24–250 VDC
Digital outputs	Quantity 8–72 trigger and signal contacts
Protective functions	Generator and transformer protection (modular)
Communication protocols	IEC 61850 Ed 2.0 IEC 60870-5-103 IEC 60870-5-104 Modbus TCP

Turbine Governor – HIPASE-T

HIPASE-T considers the requirements of various turbine types (Francis, Kaplan, Pelton and pump turbines) by a scalable, modular application.

The turbine governor is an essential component of the electrohydraulic unit, responsible for efficiently converting the available hydraulic energy into electrical energy. It ensures a stable turbine speed in no-load and isolated operation and adherence to the set points during grid operation.

The algorithm takes into account the increasing challenges for the turbine governor with regard to frequency and primary control for grid services.

To ensure easy connection of the digital turbine governor with project-specific interfaces, the application module supports all types of input and output signals. Therefore, connections for speed sensors and generator voltage are provided to determine turbine speed, as well as analog inputs for position measurement and current/voltage inputs for power measurement.

The analog outputs can be configured as voltage or current signals with variable limits to control all types of servo valves.

TECHNICAL DATA

Speed/ frequency inputs	max. 8, passive or active, VT
Analog inputs/outputs	max. 24 inputs und 28 outputs, -20...20 mA, -10...10 V
Binary inputs/outputs	max. 64
Speed deadband	0.02%
Measurement range speed measurement	1.2-10,000 Hz
Resolution speed measurement	0.01%
International standards	IEC 61362, IEC 60308
Communication protocols	IEC 60870-5-104 IEC 61850 GOOSE und MMS Modbus TCP

Synchronization – HIPASE-S

HIPASE-S is a state-of-the-art synchronization device which meets all the requirements of the energy market.

HIPASE-S is a fast, highly accurate, and universal synchronization system for parallel connection of networks, lines (loaded/unloaded), generators, motors (pumps), and synchronous condensers, covering all application areas of power generation.

An integrated full-graphic touch panel shows all important status variables in a menu-guided manner and supports the test and commissioning phase by determining the optimal synchronization parameters in a time-saving manner.

In addition to extensive event logging, a high-resolution analysis tool with multi-stage automatic curve recording enables a detailed history of the last 100 synchronization processes. Built-in logging functions show process sequences and events, while high-resolution curve recordings enable quick and accurate diagnostics.

HIPASE-S is available in the following configurations:

- 2 circuit breakers, single-phase measurement for 50 Hz or 60 Hz
- 7 circuit breakers, single-phase measurement for 50 Hz or 60 Hz
- 2 circuit breakers, three-phase measurement for 50 Hz or 60 Hz
- 7 circuit breakers, three-phase measurement for 50 Hz or 60 Hz
- 7 circuit breakers for railway applications

In all configurations, an optimized frequency adjustment not only accelerates the synchronization process but also reduces the mechanical stress during switching to an absolute minimum.

TECHNICAL DATA

Supply voltage	24 VDC–250 VDC
Rated frequency	50 / 60 / 16.7 Hz
Voltage measurement	single / 3-phase
Phase angle limits	1 .. 30 °el – Gen / grid 1 .. 80 °el – Grid / grid 1 .. 10 °el – SFC / grid
Frequency limits	0.01 .. 0.5 Hz
Digital inputs (all)	Un = 24–250 VDC (Wide-range inputs)
Digital outputs (all)	250 VAC / 230 VDC max. 8 A (ohmic load)
Current measurement channel	for synchronizer assessment
Remote selection inputs	2 or 7
Circuit breaker operating time measurement	10–1000 ms
Communication protocols	IEC 60870-5-104 Modbus TCP

Control Center System HIPASE-250

The control center system HIPASE-250 offers comprehensive functions for the operation, monitoring and control of hydropower plants. It is a multi-hierarchical system, characterized by its excellent scalability and can be used at all levels of the hydropower process. An outstanding feature is the seamless integration of the turbine and unit control system right through to the central control room.

The user interface of the visualization has been carefully designed according to the latest state-of-the-art industrial design. Focusing and simplifying the visualization to its essential elements results in an optimal user experience.

The Engineering Tool of the HIPASE platform enables a fast, ergonomic and efficient workflow. Changes in the data model can be transferred to the SCADA systems at any time without interrupting the process. Furthermore, the integrated version decoupling provides the possibility to operate the deployed systems in different software versions.

TURBINE AND GATE CONTROL

For turbines and gate controls with a typical data volume of up to 1,000 process signals, HIPASE-250 is already well-suited in the smallest scaling variant. Control is carried out via Touch-PCs PCs or Box-PCs with touch screens of various sizes. Thanks to the integrated server/client configuration, the process can also be controlled without a connection to the central SCADA system.

UNIT CONTROL

In the next larger scaling variant, HIPASE-250 is excellently suited for unit control with up to 5,000 process signals.

An optimized detailed representation of the process flow of all conditions and states of the unit control is another integral component of HIPASE-250.

POWER PLANT CONTROL

HIPASE-250 is perfectly suitable for power plant control rooms, ranging from a single standard PC with up to four screens to redundant servers and workstations with up to eight screens. The data volume handled is between 10,000 and 30,000 process signals. The integrated Engineering Tool facilitates the possibility of distributing parameters and process displays to all HIPASE-250 systems without interruption. Focusing and simplifying the visualization to its essential elements results in an optimal user experience.

CENTRAL CONTROL ROOMS

The outstanding scalability of the HPASE-250 is particularly advantageous for applications in central control rooms. Handling a data volume exceeding 200,000 process signals is effortless. Thanks to the large number of workstations, the distribution of tasks for the operating staff can be optimized.
Test systems for validating data changes and software updates increase long-term stability. Emergency systems improve availability during critical situations. Remote alerting by text message and e-mail significantly reduces the response time in the event of faults.

Security is further enhanced by a variety of cybersecurity measures and support for Windows and Red Hat Enterprise Linux operating systems for SCADA servers and SCADA clients.

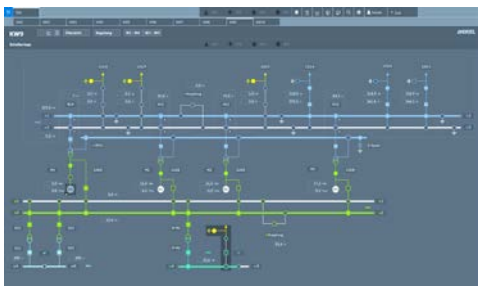
Remote desktop servers, database connections, and the provision of data via OPC UA are commonly used in central control rooms. With Multisync, all HIPASE-250 systems are synchronized continuously with each other, so that operator actions and archive data are automatically updated between the multi-hierarchical systems.

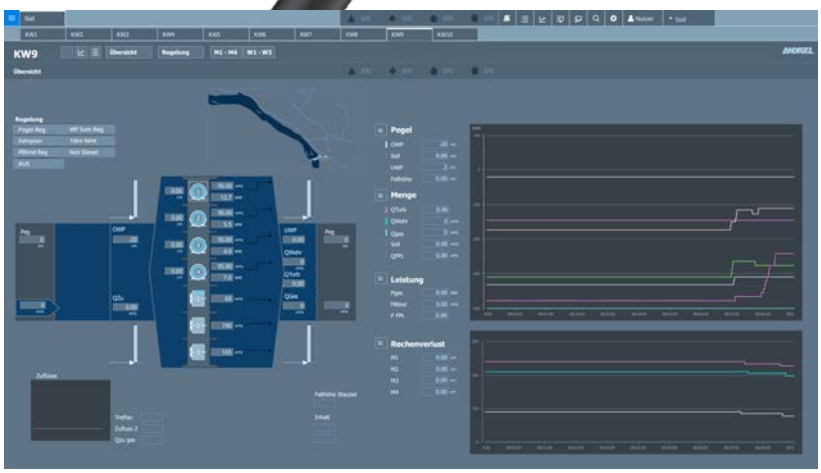
USER INTERFACE

The user interface has been designed according to the latest principles of industrial design, focusing on the visualization of key elements to provide an optimal user experience.

The design of the user interface follows the recommendations of the industrial guide “High Performance HMI” and the standards defined in “IEC 63303—Human-machine interfaces for process automation systems”, “IEC 62682—Alarm management in the process industry” and “ISA 101—Human-machine interfaces”.

Special visualization elements tailored to the requirements of hydropower optimally support the operating staff by displaying generator and turbine diagrams as well as CAM diagrams for Kaplan turbines.





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