Generator Control
The modular ABB solution for generators

Power and productivity
for a better world™

What is Generator Control?

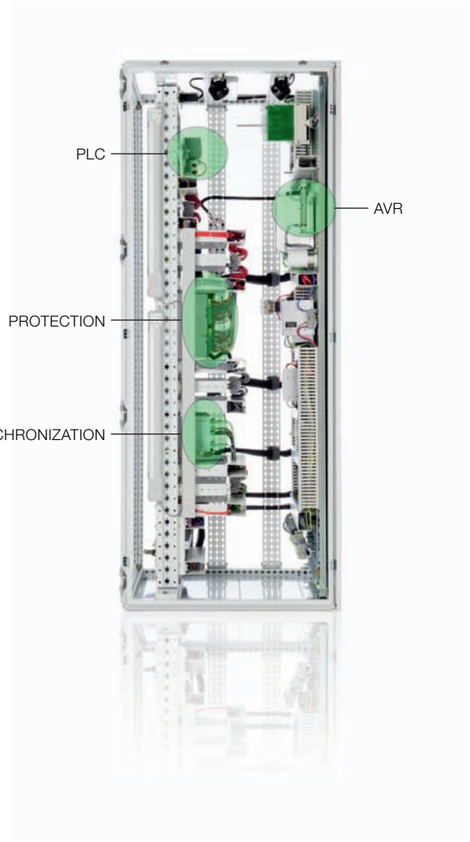
Generator Control is an integrated solution developed to cover all the control requirements of small to large generators for hydro, industrial and utility power plants. Generator Control features a proven modular combination of the generator Automatic Voltage Regulator (AVR), protection and synchronization in a single cabinet.

Benefits

Generator Control combines the advantages of our well-proven products with our strong expertise in process engineering – all delivered and commissioned by us.

- Market-leading ABB products assembled in a single cabinet
- Reduces project execution risk by limiting the number of interfaces – we take responsibility for the complete Generator Control system
- High degree of standardization enables fast project delivery
- ABB experts are available for support via the 24/7 hotline
- Maximizes synergies between AVR, protection and synchronization
- Requires only one outage for the entire generator control
- Generator Control fits in one cabinet

The Generator Control solution is optimized to ensure that all of the solution's standard devices fit into a single panel. The basic version includes market-leading ABB products, which offer excellent performance under all conditions. The time-tested mechanical and electrical components and devices used in the design are guaranteed to provide high reliability, durability and flawless operation. Generator Control's highly modular design makes it easy to adapt to various customer specifications and optimizes the space used in the cabinet. The resulting clearly laid out panel is also more flexible. The basic version of Generator Control contains.



Product features – Synchronization

Synchronization system to safely and quickly connect to the grid

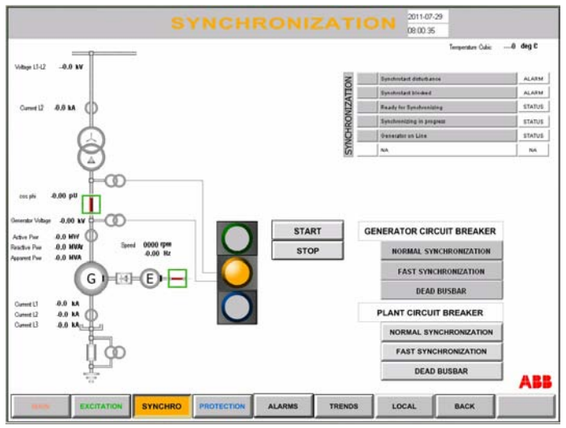
SYNCHROTACT 5 is fifth generation synchronizing equipment for automatic generator synchronization. It is widely used in power plants and industrial installations where generators need to be paralleled, as well as in power distribution systems. SYNCHROTACT 5 guarantees safe and reliable synchronization, is 100-percent compliant with international guidelines and maximizes uptime. Our experienced in-house engineers can provide the optimum solution to comply with any specification.

SYNCHROTACT 5 is suitable for the following applications:

- Automatically synchronizing and paralleling synchronous generators with transmission lines and bus bars

Various options available (E. g.):

- Connection of de-energized circuits (dead bus)
- Automatic redundant dual channel system for higher uptime
- Up to seven different parameter sets for different paralleling that synchronize up to seven power circuit breakers



SYNCHROTACT® 5

Product features – Automatic Voltage Regulator (AVR)

Automatic voltage regulator for excellent stability and performance under all conditions

ABB's UNITROL system has been based on digital technology since the 1980s; as a result, its simulation models and tools are highly advanced. The UNITROL is an optimum replacement for all types of voltage regulators. It can be customized to meet the needs of a specific plant.

All excitation components are inside the enclosure, and it features the most advanced microprocessor technology and IGBT semiconductors, which make it suitable for a wide range of applications.

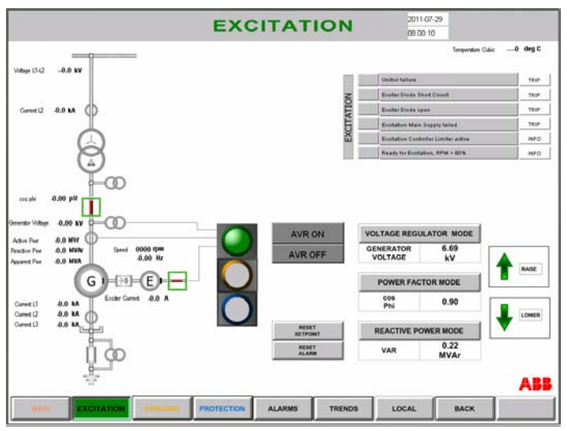
The single standard module includes:

- Voltage regulator
- Power factor (cos) regulator
- Reactive power regulator
- Manual control (excl. current):
- Wide input power supply range
  All required software features (control modes, etc)
- Standard reference applications
- International certifications
- Variety of functions – limiters for excitation current, V/Hz, reactive current, stator voltage and stator current, etc

ABB works in close cooperation with the international standards associations and has direct access to the latest trends and developments. Our local experts work through a worldwide network to provide high quality support and startup services. Decades of experience provide assurance that the technology is proven. The compact product comes with an extensive standard software system to keep engineering costs low.

Various options available (E.g.):

- Range extender up to 40 A output max 40 A output
- Redundant configuration
- If excitation current exceeds 40 A, static excitation is available
- Power system stabilizer



UNITROL

Product features – Protection

Safe and reliable protection of your installed assets

For the past 20 years, ABB has been the leading developer of digital protection and control systems. ABB's REG family is the most powerful intelligent electronic protection device available today. It is the first truly hard-ware-independent modular concept for all power system applications.

The extremely fast detection capabilities make it ideal for generator differential protection applications. The detection parameters can be adjusted to create intelligent, application-specific functions that enhance the protection system and meet very specific requirements. The product's excellent performance, flexibility and scalability fulfill demanding specifications in every corner of the world. It is suitable for both new installations and retrofits. Time between fault detection and clearing is very short. The unique key protection functions can be set to selectively detect and clear all types of faults on any part of the stator winding.

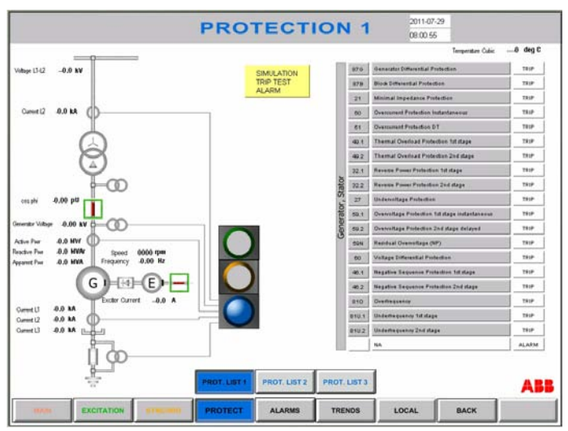
When it comes to engineering and maintenance, users will greatly value the savings achievable made possible by the common hardware platform. The generator differential protection system is extremely fast, with typical operating times of 15 ms. This in no way compromises the device's high reliability. The REG family integrates paralleling algorithms with advanced logic and communication.

Typical generator protection functions:

- Protection can be extended to cover the complete unit
- Overcurrent protection functions (instantaneous/DT)
- Directional power flow protection
- Pole slip
- Over/under excitation
- 100 % stator ground fault THD
- etc

Various options available (E.g.):

- Additional analog input/digital output cards
- REG670 B30 for step-up and auxiliary transformer protection functions. Up to 24 analog inputs are available for integrating primary and backup protection in one intelligent device
- Generator differential protection



Relion REG

Control and visualization package

A user-friendly touch panel is mounted on the face of the cubicle to facilitate standard visualization, control and operation.

The touch panel displays the single line diagram, key measured values and signals, firmware parameters, trends and recorded events. A scalable PLC (programmable logic controller) make it possible to control and operate either locally or via the plant control system (DCS).

Communication

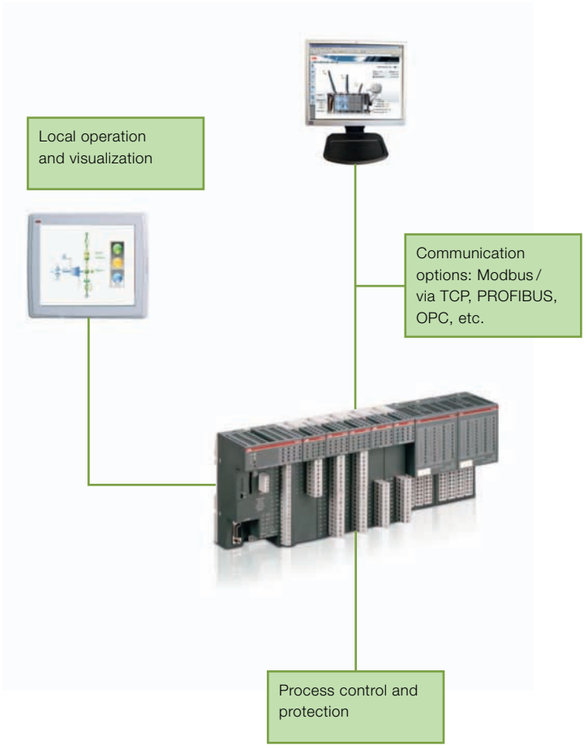
– The system can communicate with any brand of the plant's DCS, SCADA and visualization systems.

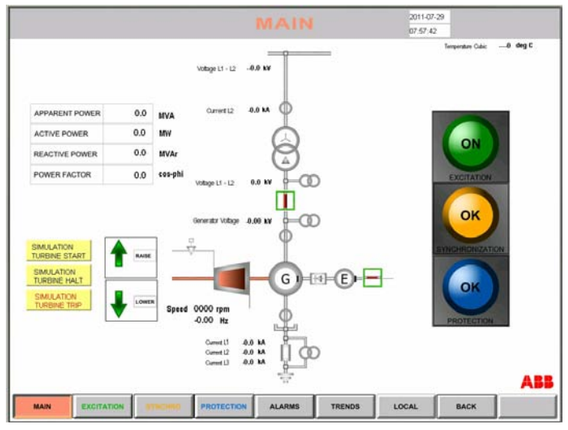
Visualization

– All types of process variables such as generator electrical values, winding temperature, vibration, breaker positions, alarms and trends can be displayed.

Control and protection

– Any related processes such as generator cooling water, synchronization or excitation can be controlled from the panel. Generator stator temperature, vibration and other types of protection are integrated into the system.





Upgrades with Generator Control

There are many reasons for upgrading current systems.

– Higher risk of non-process-related trips due to equipment aging
– Outdated analog technology requires regular calibration because of drifting parameters, which can cause nuisance tripping or even worse prevent proper tripping
– Dried out capacitors or potentiometer drift
– High maintenance cost of frequent recalibration
– Spare parts expensive or no longer available
– Experts who can commission or troubleshoot the old system are no longer available
– Emergency repair, troubleshooting and spare parts are often more expensive than a retrofit solution and lengthy equipment outages are costly

The basic Generator Control pre-engineered solution provides recommended protection functions, excitation and synchronization, with a variety of possible extensions available to configure everything from single channel to fully independent two-channel solutions. Standardization eliminates operating errors and improves protection through enhanced monitoring possibilities for event analysis. This ensures not only improved operating efficiency and plant reliability, but also higher availability. Simplified spare parts sourcing reduce operating and maintenance costs, while at the same time extending plant service life. A worldwide network of experienced local experts delivers commissioning and support services.

ABB quality is recognized everywhere. Generator Control improves uptime and cuts maintenance costs. It reduces risk exposure and extends the life of the systems for decades. A life extension package ensures reliable plant operation and provides predictable results. Furthermore, the entire Generator Control solution is engineered and commissioned by a single entity. This has several significant advantages, including lower risk for project execution thanks to reduced interfacing. ABB takes responsibility for the complete Generator Control system. The high degree of standardization makes it possible to fast-track your project.

An upgrade/retrofit solution extends the life of your plant by 20 years and provide trouble-free operation

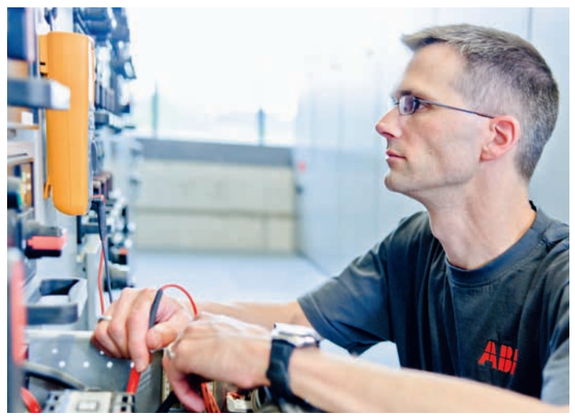
Key competencies

Design and engineering
- Research and development: from first concept to the product launch phase – to keep plants competitive
- Plant-specific basic engineering and preparation of the engineering documentation
- Comprehensive service documentation including engineering, quality assurance and operation & maintenance (O & M) documentation

Manufacturing and procurement
- Manufacturing or procurement of components
- Supervision of assembly and engineering
- Pre-assembled container solutions
- Final witness test in accordance with international standards

Implementation, setup and commissioning
- Installation of new components in the existing cabinet or in a new cabinet
- Field wiring
- Testing the functionality of the new components at the plant
- Adaptation of operational documentation

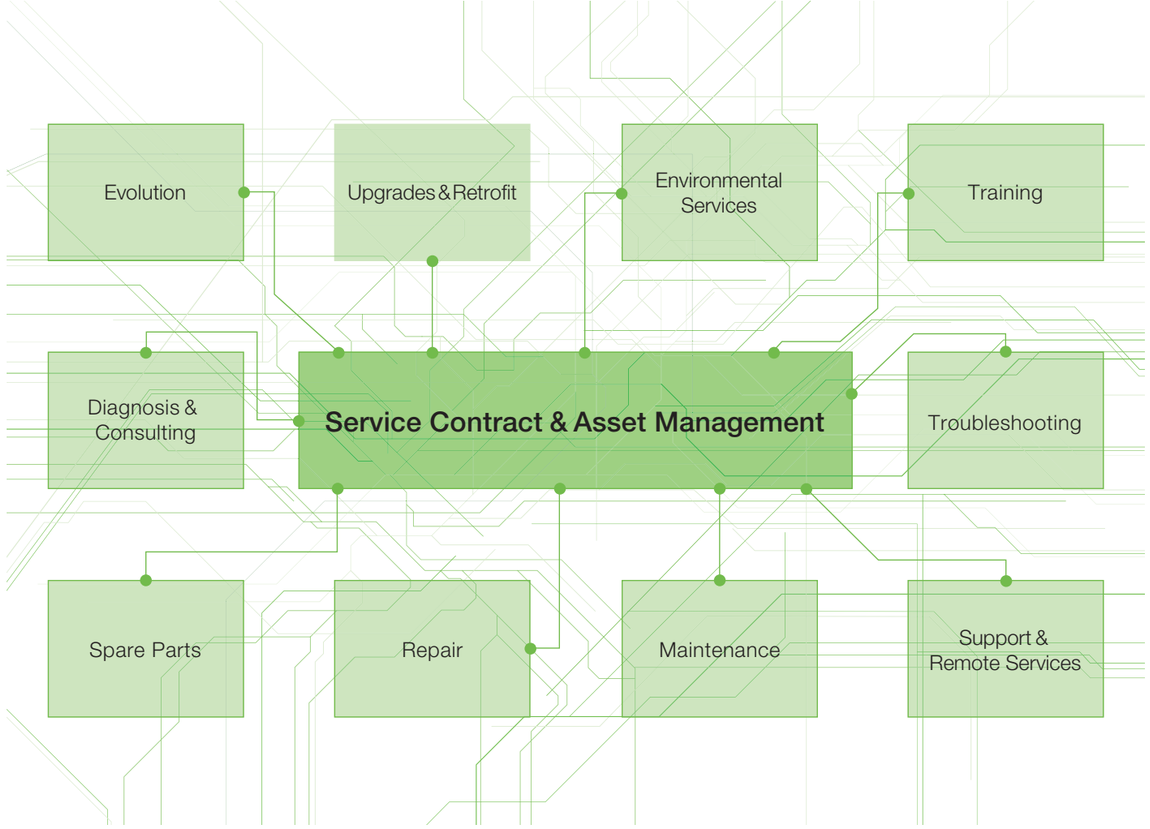
Support and troubleshooting
- Generator/transformer protection
- Excitation system
- Synchronizing/plant metering
- Training and operational support for the new systems
- Procurement or replacement of spare parts



Services

- Assistance during the tendering and evaluation process
- Project execution and management
- Support during design engineering
- Site support during installation and commissioning
- 24/7 hotline
- Local well-trained engineers for level one support
- Training and learning programs for executives, planning personnel, sales staff, system engineers, commissioning personnel, operators, service personnel, etc

As the OEM for all products and systems, we guarantee the long term functionality and safe operation of the system, providing services, spare parts, troubleshooting and product updates.



Generator Control system data

Generator Control Hardware	Standard Configuration
Cabinet	– Single cubicle (2200 x 800 x 800 mm) H x W x D, IP54 – Swing frame, bottom cable entry, RAL7032, front entry, top cooling grill (internal) – AC/DC power supply (110/220V AC/24V DC; others on request) – AC distribution – Ground copper bus – Internal lighting
Environmental conditions	– Ambient temperature 0 to 40°C – Humidity 5–95% non-condensing, in accordance with IEC 61131-2 level RH-2
Protections	Generator protection RELION® REG 650 Standard protection functions included (others available optionally): – 27 – Under voltage protection – 32 – Reverse power – 40 – Loss of excitation – 46 – Unbalanced load/negative phase sequence – 51/67 – Directional overcurrent protection – 59 – Over voltage protection – 81 – Under/over frequency function – 87G or 87B – Generator or Generator-Transformer set differential protection
Automatic Voltage Regulator (AVR)	UNITROL 1010 (BASIC version max. 10A) Standard functions included: – AVR/FCR, PF/Var regulator – Separate aux. supply for control – Current limiter for excitation – PQ/stator current limiter, V/Hz limiter
Synchronization	Synchronization of one circuit breaker with dual channel SYNCHROTACT® Standard functions included (others on request): – Automatic synchroniser – Synchrocheck
Communication and local operator interface	Communication (others on request): – Profibus-DP (slave) Touchscreen operation: – The Generator Control equipment can be operated via the particular graphical control screens. The touchscreen has a limited built-in data storage to store alarms and trends (analogue values)

Remark: All pictures and graphics in this brochure are sample illustrations.

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