UNITROL® 6000 Medium excitation systems
Proven flexible solutions
Setting the standard

ABB is the world leading volume supplier of UNITROL® excitation systems for any type and size of power plant - known to provide a high return on investment since many years.

UNITROL® 6000 Medium is designed for small to medium power applications and brings a new benchmark in flexibility, reliability and connectivity.

Tailor-made system
UNITROL® 6000 Medium uses well-proven prefabricated functional modules. With single/double channel configuration (additional backup channel on request) and a wide selection of thyristor bridge modules, the system can be configured to meet all field data and availability requirements.

Main features
+ Selectable redundancy for control, power module, cooling, I/O, communication and auxiliary power
+ Improved HMI
+ 64 bit floating point CPU
+ No restrictions regarding data scaling and range
+ Fast and precise measurements and control scheme
+ Compliant with international and local standards
+ Complete range of functionality to cover any grid codes
+ IEC 61131 application software programming with ABB Control Builder M
+ Fully compatible with ABB’s Extended Automation System 800xA

Selected applications
+ Hydro power plant
+ Pumped storage power plant
+ Combined cycle power plant
+ Nuclear power plant AVR, Ifn 180A, 400 Hz supply
+ Engineered solutions
  + Pole changing for dual speed machines
  + Online supply transfer
  + Electric braking
  + Sheet metal partitions between channel and control compartments

Key benefits
+ Ultimate control performance keeps generator within safe limits
  High performance control platform AC 800PEC
+ Improved HMI allows fast operation, monitoring and maintenance
  User-friendly excitation control terminal (ECT)
+ Short delivery time
  Uses well-proven prefabricated functional modules
+ Optimized contribution to network stability
  Integrated power system stabilizer (PSS) options
+ Compact design, space saving installation
  No rear access required – can be positioned close to a wall or back-to-back
+ Offline tuning with closed loop real time generator simulator
  Offline system tuning and testing of severe system conditions (integrated or external option)
+ Efficient product life cycle management
  Extended life time of assets with minimum costs
+ Technical support always within your reach
  ABB’s global excitation service network
UNITROL® 6000 Medium is the customizable solution of UNITROL® excitation systems

UNITROL® 6000 Medium systems can be built with up to three control / converter channels: Two fully featured channels and one backup channel for emergency generator control. Each channel is able to handle the maximum field current and provides diagnostic and maintenance functions including transient recorder. The power interface (PIN) and gate driver interface (GDI) provide potential barriers inside the power converter. At system level, combined input/output (CIO) devices are used to interface with internal and external analog and digital I/O signals. These devices are fully redundant, if required.

UNITROL® 6000 Medium is the fully customizable solution for any customer’s needs.

<table>
<thead>
<tr>
<th></th>
<th>UNITROL® 6000 Medium</th>
<th>UNITROL® 6000 Light</th>
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</thead>
<tbody>
<tr>
<td>Closed-loop control</td>
<td>Single channel</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Double channel</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Backup channel</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
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</tr>
<tr>
<td>Converter module type</td>
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<td>Converter redundancy</td>
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<td></td>
<td>1+1+(1)</td>
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<tr>
<td>Input data</td>
<td>Max. AC voltage</td>
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<td></td>
<td>Rated frequency</td>
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<tr>
<td>Max. output data</td>
<td>Cont. DC current</td>
<td>1,600 A</td>
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<td></td>
<td>Ceiling voltage</td>
<td>850 V</td>
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</table>

1) >50/60 Hz for AVRs only; single phase supply for AVRs also available
Overview

UNITROL® 6000 Medium excitation systems are engineered to meet individual operational and environmental conditions as well as international and local standards. All systems undergo a 100 percent functional test before leaving the factory.

Flexible I/O ports and communication
- High number of I/O ports, fully redundant on request
- Ethernet network
- Selection of fieldbus protocols

Field suppression
Field breaker, discharge resistor and crowbar for fast de-excitation also in fault condition

Local excitation control terminal
- Basic service control panel
- Easy to use excitation control terminal

AC input
Power and control cable entry from bottom or top

Field flashing
Enables voltage build-up in case of low residual generator voltage

Left: UNITROL® 6000 Medium
Thermal power plant, 121 MVA / 10.5 kV, SES

Right: UNITROL® 6000 Medium
Thermal power plant, 47.75 MVA / 10.5 kV, AVR
Control electronics
Compact control electronics / power converters

Excitation transformer
A cast-coil dry type excitation transformer is recommended. It has proven its suitability in many installations and has advantages over other types of transformers.

Front access
All parts can be serviced through the front doors. This enables space saving cabinet location close to a wall.

Cubicle protection degree
Standard up to IP52, IP54 on request

Cooling air flow
Natural or forced air cooling with front air inlet and front or top air outlet
Control functions

The well-structured standard firmware includes all regulation, protection and monitoring functions required for the secure operation of the excitation systems. It can be, however, adapted to specific customer requirements by extending the number of I/O signals or adding optional software functions.

Closed-loop control
- Voltage regulator with PID filter (AUTO operating mode)
- Field current regulator with PI filter (MAN operating mode)
- Reactive and/or active current droop compensation
- Limiter circuits for
  - Maximum and minimum field current
  - Maximum stator current, dependent on machine cooling media temperature
  - P/Q under-excitation
  - Volt/Hertz
- Manual restrict
- Power factor/reactive load control
- Power system stabilizer

Data and event recording
The internal event recorder function can handle and store up to 2,000 events, each provided with a real-time stamp. The data recorder contains a preconfigured part that can record 30 signals / 1,500 data points each, and a freely configurable part for 8 signals / 1,500 data points each.

The display and analysis of the recorded data is done by means of the excitation control terminal software.

If the AVR/SES is equipped with an excitation control terminal, the recorded data are downloaded into its memory to be available independently of the main controller.

System time synchronization
The system clock of all the controllers can be synchronized with a time source by SNTP (simple network time protocol) with an accuracy better than 1 ms.

The time signal can be sourced internally (from the excitation control terminal) or externally from the plant LAN (Ethernet).

With an optional receiver, GPS (global positioning system), DCF77 (Europe) or IREG-B (Asia, the USA) signals can be used as well.

Protection and monitoring functions
Monitoring and protection functions can be freely configured on three different action levels:
- Alarm signal only
- Changeover of redundant circuits
- Instantaneous excitation trip for protection purposes

Major available functions
- Overcurrent protection (instantaneous/inverse time)
- Volt/Hertz protection
- Loss of field protection
- Rotor temperature
- Thyristor conduction monitoring
- Actual value monitoring
- Field flashing time limit

Sample of fast trending record for closed-loop AVR test
Power system stabilizer (PSS)
For many years, ABB has been involved in the development and application of power system stabilizers. The PSS function improves the stability of the generator and the transmission system as a whole by using the excitation to damp power oscillations.

PSS types optionally available for UNITROL® 6000 Medium:
- According to IEEE standard 421.5-2005 PSS 2A/2B
- According to IEEE standard 421.5-2005 PSS 4B multiband PSS (on request)
- Adaptive PSS (APSS) developed by ABB in Switzerland

Synchronous machine transient simulator – real time (SMTS-RT 6000)
The new SMTS-RT 6000 simulates a generator/motor, its turbine/load and the grid. The simulator is connected to the excitation system for closed-loop tests to analyze its stationary and transient behavior. A bidirectional fiber optic cable is the only connection needed to link the simulator to the UNITROL® 6000 Medium system. SMTS-RT 6000 can reduce the testing time of your machine, save costs and serve as a perfect training tool for maintenance and operation personnel. Commissioning time can be further reduced by tuning control parameter sets in advance, using the simulator and a UNITROL® Medium control device.

Grid codes
UNITROL® 6000 Medium control functionality is prepared to support any grid code. The extensive pre-set testing functions and powerful data recorders of the excitation control terminal (ECT) serve to test, tune and prove the performance of control, stabilizer and limiter functions. System frequency response can be analyzed quickly and accurately using the built-in white noise generator. This method allows minimum testing time and grid disturbance.

Data records are stored in the ECT’s dedicated memory and can be easily copied and integrated into electronic documents.

In combination with SMTS-RT 6000 it is possible to simulate the most critical plant or grid situations, which are typically impossible to test with a real generator.
Control
A member of the AC 800PEC control platform is integrated in the UC D240 control, communication and measurement board (CCM). It excels in high processing speed, providing:
- Fast analog and digital process I/Os with a typical cycle time of 400 µs
- Fast closed-loop control and regular process logic implemented in a single controller
- Low-speed I/Os with a typical cycle time of 10 ms
- Very fast programmable logic for converter pulse control and optical communication with cycle time down to 25 ns

Main features
- Single or three phase AC supply voltage up to 1,080 V
- Rated supply frequency from 50 to 480 Hz (16 2/3 Hz on request)
- Low noise level of cooling fans ≤70 dB(A)
- Compact, fully integrated converter, control and panel units (D1 to D4)

Power converter
The power converter of each channel is selected to meet the system requirements with respect to maximum field current and voltage. Stringent availability requirements are fulfilled with up to three redundant channels and provisions for online maintenance (optional). ABB has developed a range of thyristor power converters dedicated to direct (static) and indirect excitation systems, for example D1 to D5.

Hardware components
The system is based on the AC 800PEC high performance processor family. It is an extension of ABB’s 800xA control platform, developed to meet the fast control requirements of power electronics.
Communication features

The communication features of UNITROL® 6000 Medium systems ensure simple and user-friendly human machine interaction, whether it comes to system commissioning or integration into the plant control system.

Excitation control terminal (ECT)
The ECT is a user-friendly human machine interface, which enables operation, monitoring and maintenance of the system. It is a powerful industrial grade touch screen PC that runs independently of the system’s controller. Events and system data can be recorded over a long period of time. The LCD touch screen provides the operator with a range of selectable screens showing information on the actual status of the system in graphical and numerical form.

Integration into the plant control system
Ethernet and fieldbus protocols Modbus-RTU, Modbus-TCP and Profibus DP-V0 are the main choices for communication with the plant control system. Emergency control signals can be hardwired directly to the control board.

Remote services
Remote services and troubleshooting help to reduce costs associated with mean time to repair and service. UNITROL® 6000 Medium is prepared to support remote access. Thus the local maintenance staff can get all necessary support from ABB service specialists.
Software tools

Dedicated software tools simplify the everyday use of the system and allow additional programming if required.

**Excitation control terminal (ECT) software**

The ECT software is a valuable tool that enables commissioning, operation, monitoring and maintenance of the system. It can be either loaded on the excitation control terminal or installed on any PC operating under Windows.

The software has built-in user documentation in various languages that simplifies the troubleshooting procedure. Using the events screen the system operator can directly access the events description and get troubleshooting instructions.

**Control Builder M**

Control Builder M is an IEC 61131 compliant tool to manage and customize AC 800PEC application software. It is part of ABB’s Extended Automation system 800XA and runs on Windows PC’s.
Service and support

For life cycle management or technical support, the worldwide network of UNITROL specialists is at your service.

Installation and commissioning
The professionalism, extensive experience and multilingual skills of ABB’s engineers ensure a satisfactory installation and commissioning.

Training
ABB university offers standard and customized training courses for UNITROL® 6000 Medium excitation systems. On-site training options are also available. For detailed training programs, visit www.abb.com/abbuniversity.

Life cycle management
ABB’s excitation systems life cycle management model helps the customers to extend and maximize the life cycle of their assets at minimum costs. Depending on the product’s life cycle phase, the service specialists recommend necessary actions and approach the clients pro-actively to inform them on all maintenance, service and upgrade necessities.

Examples of life cycle services:
- Technical support for optimized reliability
- Remote services
- Maintenance and repairs
- Extension, upgrades and retrofits

For urgent technical assistance, please call the hotline:
+41 (0)844 845 845 (365 days /24 hours)
or contact ABB by e-mail: unitrol.supportline@ch.abb.com

ABB life cycle management model

- Active: UNITROL with complete life cycle services is available for purchase.
- Classic: UNITROL with complete life cycle services is available for plant extensions.
- Limited: Spare parts, maintenance and repair services are available as long as materials can be obtained.
- Obsolete: ABB cannot guarantee availability of life cycle services for technical reasons or within reasonable cost.

Complete life cycle services are guaranteed for the active and classic phases. As soon as the system enters the limited phase, it is recommended to upgrade, retrofit or replace the equipment with the latest technology available in the active phase.