

RAV 1101 – RAV 1111

Static Digital Excitation System

Description

The RAV 1101/1111 static excitation system is designed to operate with Generators ranging from a few Mega Watts up to 600MW regardless of the rotor's characteristic (Brushless or direct excitation type).

The system basically consists on an excitation transformer that is connected to the Generator's output, an enclosure with the regulation electronics, the Power Converter or Stack, the ancillary CTs and PTs for metering and the Remote Logic Control.

The excitation transformer, feeds the RAV 1101/1111 through the Generator's voltage terminals, as shown on the Block Diagram.

The transformer's secondary voltage is specified to achieve the maximum voltage specified by the Power Stacks that correspond to the top admissible voltage according to the Generator's characteristics.

The RAV 1101 / 1111 is comprised of several functional modules that work together to perform the following tasks in a coordinated manner:

- Unit start-up, excitation of the generator using the utility's batteries, adjusting the generator's voltage to nominal value in a minimum amount of time in a controlled manner.
- In normal operation, it rectifies excitation transformer's voltage to apply it to the generator's rotor and control the output power (automatic channel) or excitation current (manual channel).
- Maintain the generator's voltage within the limits of normal operation controlling excitation and without exceeding the generator's capability limits.
- Stabilize dynamic conditions of the interconnected systems and participate in the voltage regulation of the system.
- Supervise the functional state of the regulator alarming or triggering if operating conditions are not normal.
- Transfer from Automatic to Manual channel if excitation voltage or current stepout of their normal operation range.
- Prepare automatic transfer from voltage regulator (auto channel) to current regulator (manual channel) in case of fault, positioning the trigger angle using a follower circuit.





RAV 100 – RAV 1111

Static Digital Excitation System

Functional Description

AUTOMATIC CHANNEL

Microprocessed Unit (Programmable Logic Controller) DRIVE MASTER PLUS constitutes a digital control system that allows for voltage regulation at the synchronous generator's terminals keeping in within its normal operation parameters in a safe way using the compensators and limiters included in the automatic channel.

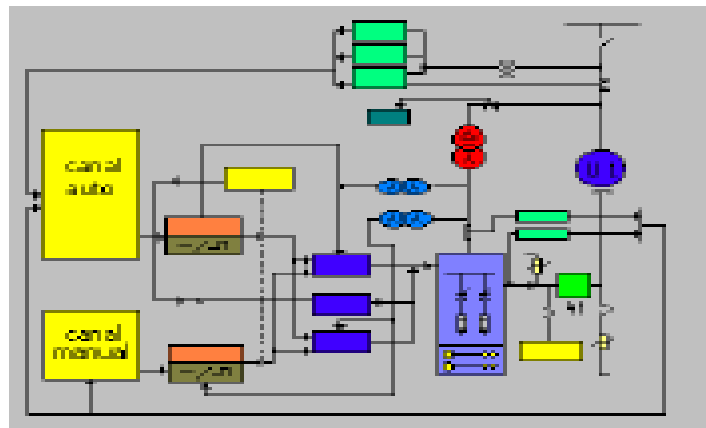
The Programmable Logic Controller (DRIVE MASTER PLUS) has a microprocessor that executes functions through the PLC's I/O. Standard configuration is: 64K memory, 1024 registers, Ladder Logic programming language, Instruction list and SFC, 0.15ms/k speed, 2 configurable serial RS232 or RS485 c ports, floating point math, RAM and clock back-up battery communication through serial ports or through LAN Ethernet (TCP/IP).

MANUAL CHANNEL

Similar to the automatic channel, the manual channel has its own PLC. The only difference is that the manual channel controls the excitation current as opposed to the auto channel which controls the voltage on the generator's terminals. For model RAV 1111, the two channels are independent.

BACK-UP CHANNEL

An additional channel is allocated in case both auto and manual channels should fail. This back-up channel actually acts on the manual channel's pulse generator.



POWER STACK

The Power Stack and associated logic are governed by the automatic channel, the manual channel and the back-up channel. Each channel is independent and linked through a balancing circuit that allows to position the demand angle of each channel and does not allow any voltage variation on the generator's terminals when transfers are requested.

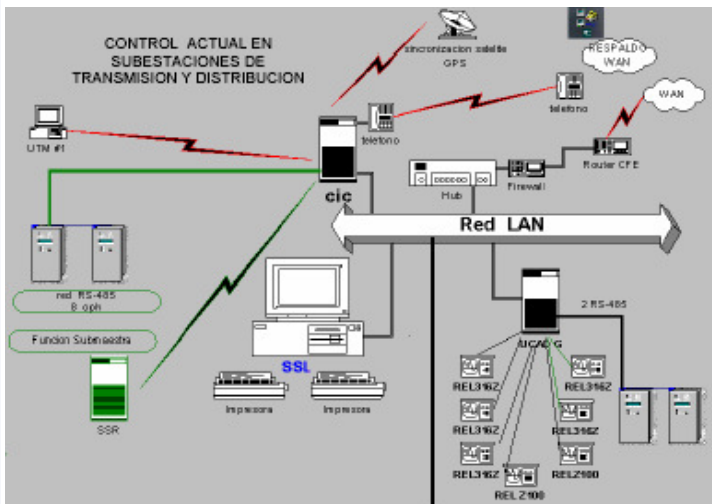
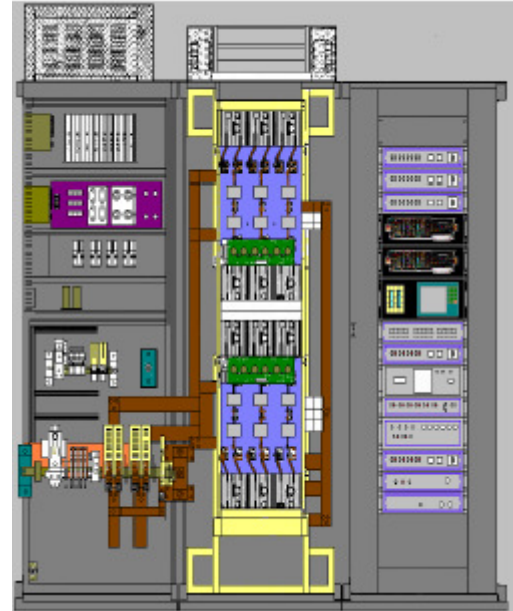
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Static Digital Excitation System

Algorithms Included in the Excitation System

- Reference potentiometer auto channel
- Voltage error amplifier
- Mixer
- PI filter
- Instant field current limiter
- Current error amplifier
- Automatic follower
- Limit detectors
- Scaling function
- Fast de-excitation
- Reactive current compensator
- Power System Stabilizer (PSS)
- V/Hz limiter
- Minimum excitation limiter (MEL)
- Over excitation limiter (OEL)
- Field overvoltage limiter (MXL)
- Field overvoltage protection (OXP)

Each of these functions can be adjusted to user requirements.

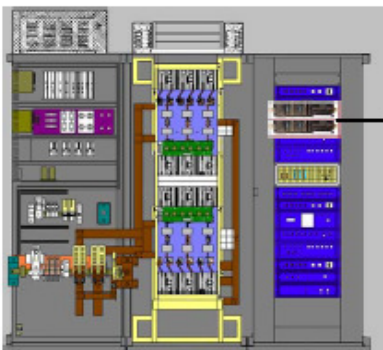


The Excitation Systems additionally have:

- Firing pulse schemes
- Power supplies
- Protection circuits
- Communication Features
- Metering and feedback

COMMUNICATIONS CAPABILITIES

With this new technology, the Excitation System can be integrated into a substation automation system or a plant distributed control system as an Intelligent Electronic Device (IED).



Communication through LAN Ethernet offers great advantages for applications such as:

- Monitoring of all variables of the AVR
- Supervision of generator's stability
- Remote settings
- PSS remote settings