

ATP SCR Thyristor-Based Rectifier/Charger



The ATP Battery Charger Rectifier is an electronic device based on a static converter, primarily designed to recharge electrical accumulators by supplying energy to a battery bank connected to the system. The equipment is also capable of simultaneously powering DC loads during the battery charging process, ensuring operational continuity in critical applications. When supplied as a package with a battery bank, the assembly functions as an Uninterruptible DC Power Supply System (DC UPS), maintaining operation during AC grid failures. Furthermore, the system's primary mission remains focused on the controlled and efficient recharging of batteries. Powering DC loads is a complementary functionality incorporated into the charger, and the project is designed with a focus on reliability, robustness, and precision in process control.

Features:

The ATP SCR Rectifier/Charger line combines the robustness and reliability of thyristors with the latest in digital driving, control, monitoring, and communication techniques.

- High level of integration: Reduced number of boards.
- Flexible Alarms: User-adjustable timing.
- Active Current Limitation: Digitally controlled closed-loop limitation for both rectified and battery current.
- CAN bus Communication: Reduced wiring and lower control/supervision costs.
- Active Protection: Short-circuit protection for both consumer and battery outputs.
- Phase Monitoring: Detection and protection against phase failure and excessive voltage imbalance.
- Grid Protection: Protection against under/overvoltage and under/overfrequency.
- Battery Test: Discharge current test measuring autonomy time, Ah capacity, and kWh energy.
- Temperature Compensation: Voltage setpoint compensation based on battery temperature.
- Charge Modes: Manual modes with programmable and "economic" timing.
- Maintenance Tools: Operating hour meter for preventive maintenance and battery recharge cycle counter.
- Synchronization: PLL (Phase-Locked Loop) for phase sequence and synchronism, operating automatically in both positive and negative sequences.
- Thyristor Driving: Based on the fundamental voltage component angle, supporting high grid distortion (THDv up to 20%).
- Compatibility: Supports various communication protocols (DNP3, MODBUS TCP, IEC61850, etc.) via gateway.
- Emergency Operation: Ability to operate without the HMI in emergency situations.
- Thermal Derating: Safe operation continues even during fan failure.

- Sensor Redundancy: Protection against loss of voltage feedback.
- Advanced UDQ: Asymmetric multi-stage Voltage Dropping Diode Unit (UDQ) technology.
- Hysteresis Control: Strategy to prevent contactor oscillation and failure.
- Soft Start: Gradual startup and dynamic compensation for supply frequency oscillations, compatible with small generators.
- Fast Dynamics: Quick response to load steps.
- AC Failure Protection: Protection against cyclic reoccurrence of AC supply failure.

Technological Differentiators



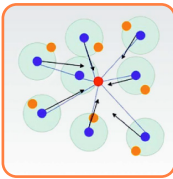
Robustness and Reliability

- Thyristorized ATP SCR (6 or 12 pulses) fully controlled, ensuring low ripple, excellent static/dynamic regulation, and high reliability.
- It offers reliable operation even in poor quality grids with high harmonic distortion.



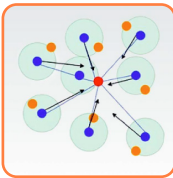
Precise Synchronization via PLL

- Utilizes advanced digital PLL to guarantee grid synchronization even under severe harmonic distortion, regardless of phase sequence



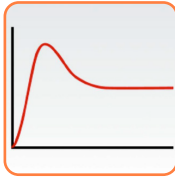
PSO-Optimized Control Algorithms

- Using Particle Swarm Optimization (PSO), the equipment achieves an advanced dynamic response, balancing the speed of static and dynamic regulation with stable operation.



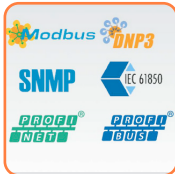
Short-Circuit Protection

- Thanks to the robustness of thyristor technology combined with advanced digital control, the ATP SCR can withstand a short circuit at the consumer output and the battery output without damage, even during operation, preventing equipment damage in extreme situations.



Support for High Levels of Harmonic Distortion

- The ATP SCR is designed to withstand high levels of harmonic distortion at the input without compromising output stability.
- This capability makes it ideal for substations and industrial plants operating on low-quality grids or environments with a strong presence of harmonics.



Integration with Supervisory Systems

Available in the following protocols:

- Modbus RTU
- Modbus TCP
- DNP3
- SNMP (v1, v2c y v3)
- MMS IEC 61850
- Profibus
- Profinet, among others.



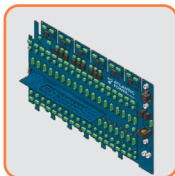
Graphical Human-Machine Interface (HMI)

- Equipped with a 128 x 64 pixel graphical HMI, it provides a clear visualization of electrical parameters and operating statuses. With intuitive menus and an event log, it improves operability and facilitates diagnostics.



Complete Isolation

- The design features isolation between the AC input and the DC consumer output, ensuring protection against power grid disturbances and contributing to operational continuity and stability.



Digital Control on a Proprietary Platform

- The control is fully implemented in a DSP (Digital Signal Processor), using a proprietary platform that allows for high precision, flexibility, and future expansions.

Advanced Features of the ATP SCR

Asymmetric Multi-stage UDQ

The Voltage Dropping Diode Unit (UDQ) ensures that the voltage supplied to the consumers always remains within safe limits, even when the battery banks are operating under high-voltage charging regimes.

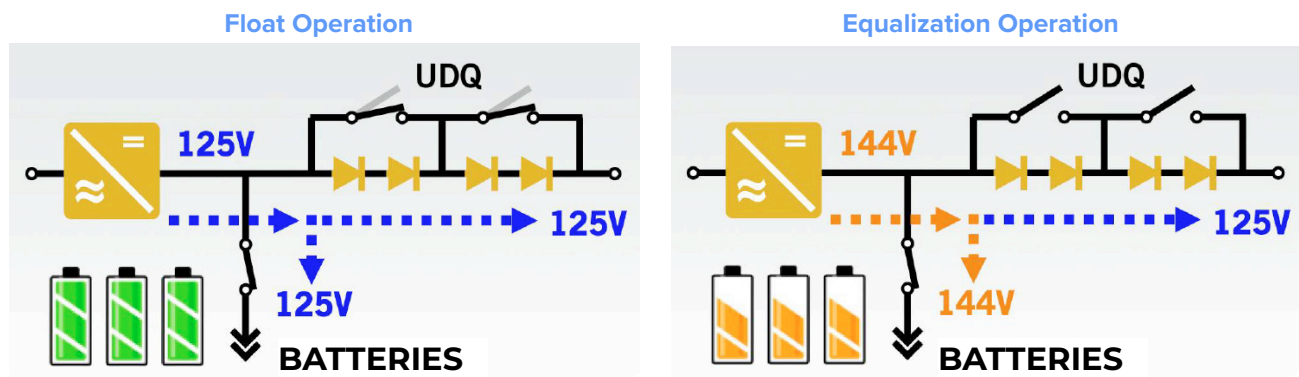
The technology developed by ATP provides:

Reduction in the number of contactors and an increase in regulation stages, according to the system's requirements.

Hysteresis strategy to prevent contactor oscillation and increase the service life of the assembly.

Protection against contactor failure, ensuring operational continuity.

Intelligent emergency mode, which performs an automatic bypass of the UDQ in the event of diode overtemperature, keeping the output voltage stable and safe even in critical situations.



Integrated Battery Test

The ATP SCR incorporates an exclusive battery test function that allows for the precise evaluation of the health and autonomy of the accumulator bank, reducing operational risks and guaranteeing reliability in emergency situations.

Active Current Control Mode

- Maintains a constant discharge current according to the parameters set in the rectifier.
- Ideal for standardized tests based on the manufacturer's discharge tables.
- Provides a precise evaluation of capacity (Ah) and autonomy (min).

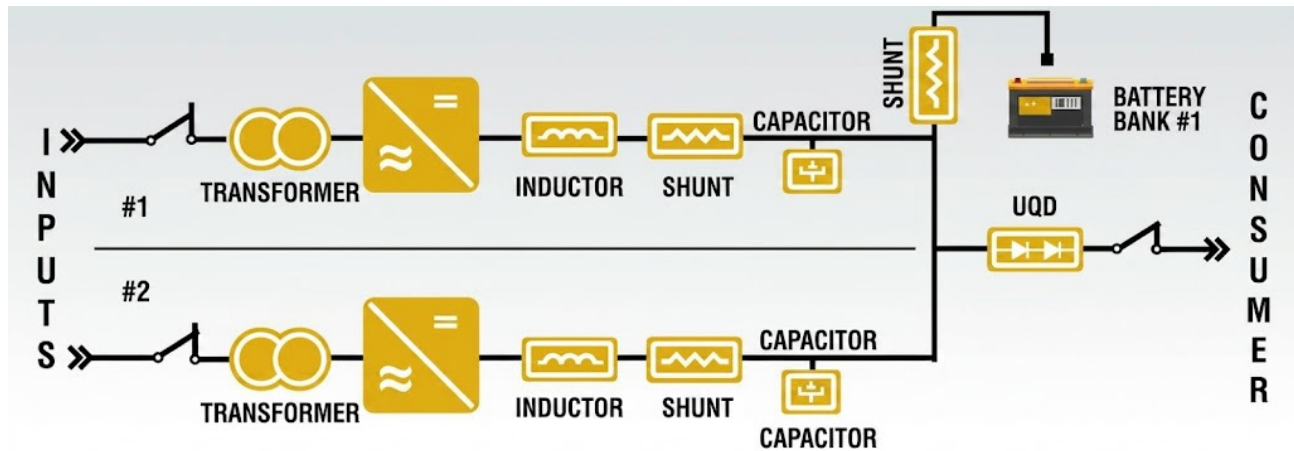
External Load Discharge Mode

- Precise evaluation of the real autonomy and capacity of the batteries.
- Verification of dynamic behavior during the discharge process.
- Allows for the assessment of real capacity and autonomy under actual operating conditions.

This integrated functionality transforms the ATP SCR into a comprehensive tool for preventive diagnostics, avoiding surprises in the field and optimizing the condition of the battery banks.

HOT-STANDBY CONFIGURATION

The Hot-Standby configuration of the ATP SCR is recommended for applications requiring high availability, ensuring an uninterrupted power supply to critical loads. With n+1 redundancy, it guarantees maximum operational reliability even in the event of a failure in one of the rectifiers.

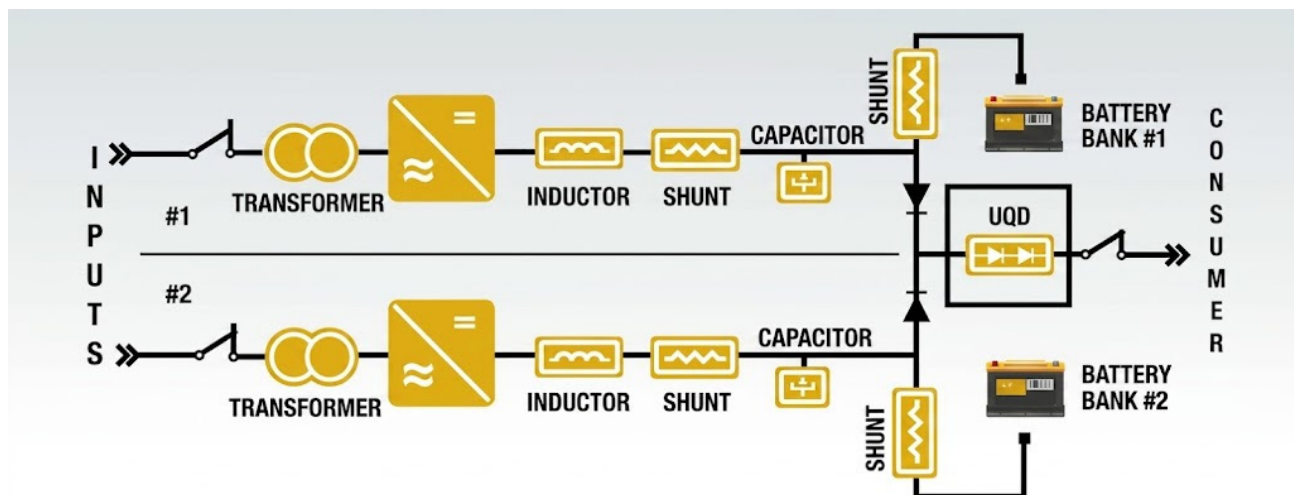


Hot-Standby with 01 Battery Bank

- One rectifier operates actively, supplying the critical loads and charging the battery bank.
- In the event of a failure, the standby rectifier takes over immediately, without interrupting the critical loads.

Hot-Standby with 02 Battery Banks

- Both rectifiers remain in simultaneous operation, each supplying its own battery bank.
- Critical loads are supplied jointly by both rectifiers.
- If a failure occurs in one of the rectifiers, the other automatically assumes the entire load, maintaining the system in continuous operation.

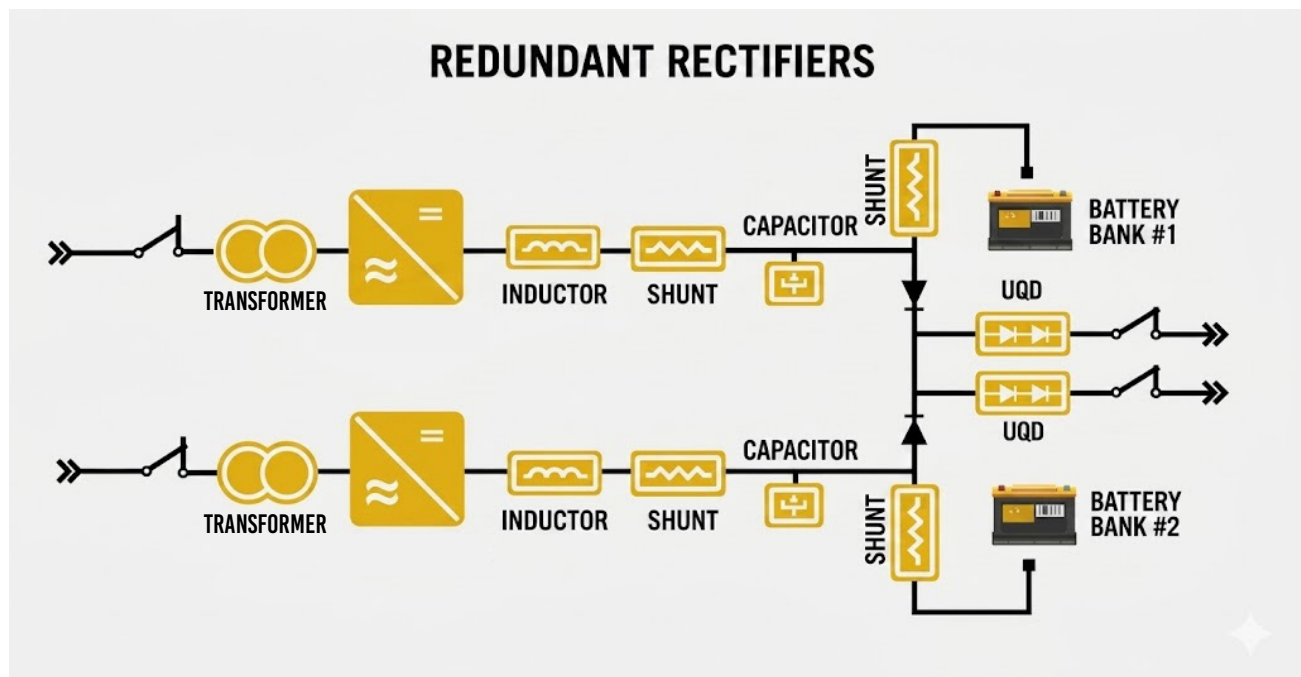


PARALLEL CONFIGURATION

The ATP SCR was developed to operate reliably in parallel with other rectifiers, expanding current capacity and ensuring greater flexibility in system expansion. This configuration can be supplied with a blocking diode, which ensures:

- Proper battery bank sharing, preventing unwanted current circulation between the rectifiers.
- Balanced consumer load sharing, preserving the service life of the equipment and guaranteeing stability in the DC bus.
- Additional security in critical applications, preventing reverse current in the event of a failure in one of the rectifiers.

Parallel operation enables everything from simple capacity expansion to the implementation of n+1 redundant architectures, making the ATP SCR a robust and scalable solution for mission-critical DC power systems



Technical Specifications

General Data	Power Range	According to customer requirements
	Topology	6-pulse / 12-pulse
	Technology	Industrial, SCR Rectifier
	Insulation	Galvanic, through Transformers (AC Input, DC Output)
AC Input	System	3F + PE
	Nominal Voltage	220 / 380 / 400 / 440 / 460 / 480 / 690 V *
	Nominal Frequency	50 / 60 Hz *
	Frequency Variation	± 5%
	Power Factor	Without power factor correction capacitor
	THDi	6-pulse: 30–35% / 12-pulse: 10–15%
	THDv Tolerance	up to 20%
DC Output	Nominal Voltage	12 / 24 / 48 / 110 / 125 / 220 / 250 V *
	Nominal Current	Up to 2000 A
	Voltage Ripple	< 1% Vrms
	Efficiency	> 90%
	Static Regulation	± 1%
	Dynamic Regulation	± 6% overshoot for 50%–100% or 100%–50% load variation; Stabilization time < 50 ms
System	Display	Graphic HMI 128 x 64 pixels
	Standard Communication Protocols	Modbus RTU - RS485 Dry Contact
	Ethernet Communication Protocols (optional)*	Modbus TCP DNP3 SNMP v1, v2c and v3 MMS IEC 61850 Profibus Profinet
	Additional Features	Current Limitation at Rectifier and Battery Output Automatic DC Pre-charge Battery Test Function / Hour Meter Recharge Cycle Counter Supervisory Access via USB
	Optional Features	Leakage Detector UDQ - Diode Drop Unit Battery Temperature Sensor Battery Disconnection via Contactor Battery Reverse Polarity Protection AC Pre-charge and Disconnection Output Relay Expansion
Environmental Conditions	Operating Temperature	0 ~ 45°C
	Humidity	5 ~ 95%

*Other options available upon request

