

Charge controller

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A **charge controller**, **charge regulator** or **battery regulator** limits the rate at which electric current is added to or drawn from electric batteries.^[1] It prevents overcharging and may protect against overvoltage, which can reduce battery performance or lifespan, and may pose a safety risk. It may also prevent completely draining ("deep discharging") a battery, or perform controlled discharges, depending on the battery technology, to protect battery life.^{[2][3]} The terms "charge controller" or "charge regulator" may refer to either a stand-alone device, or to control circuitry integrated within a battery pack, battery-powered device, or battery charger.^[4]



A solar charge controller

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Stand-alone charge controllers

Charge controllers are sold to consumers as separate devices, often in conjunction with solar or wind power generators, for uses such as RV, boat, and off-the-grid home battery storage systems.^[1] In solar applications, charge controllers may also be called solar regulators. Some charge controllers / solar regulators have additional features, such as a low voltage disconnect (LVD), a separate circuit which powers down the load when the batteries become overly discharged (some battery chemistries are such that over-discharge can ruin the battery).^[5]

A **series charge controller** or **series regulator** disables further current flow into batteries when they are full. A **shunt charge controller** or **shunt regulator** diverts excess electricity to an auxiliary or "shunt" load, such as an electric water heater, when batteries are full.^[6]

Simple charge controllers stop charging a battery when they exceed a set high voltage level, and re-enable charging when battery voltage drops back below that level. Pulse width modulation (PWM) and maximum power point tracker (MPPT) technologies are more electronically sophisticated, adjusting charging rates depending on the battery's level, to allow charging closer to its maximum capacity.

A charge controller with MPPT capability frees the system designer from closely matching available PV voltage to battery voltage. Considerable efficiency gains can be achieved, particularly when the PV array is located at some distance from the battery. By way of example, a 150 volt PV array connected to an MPPT charge controller can be used to charge a 24 or 48 volt battery. Higher array voltage means lower array current, so the savings in wiring costs can more than pay for the controller.

Charge controllers may also monitor battery temperature to prevent overheating. Some charge controller systems also display data, transmit data to remote displays, and data logging to track electric flow over time.

Integrated charge controller circuitry

Circuitry that functions as a charge regulator controller may consist of several electrical components, or may be encapsulated in a single microchip, an integrated circuit (IC) usually called a charge controller IC or charge control IC.^{[2][7]}

Charge controller circuits are used for rechargeable electronic devices such as cell phones, laptop computers, portable audio players, and uninterruptible power supplies, as well as for larger battery systems found in electric vehicles and orbiting space satellites^[8]

See also

- Solar inverter
- Zener diode

Notes

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Categories: Integrated circuits | Electrical power control | Battery charging

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