

Integration requirements for battery energy storage system (BESS)

Original text as published before the redesign of this article. Wording unchanged.

Archived: 28 October 2026

This article follows the [device integration introduction article](#). Please check that article first.

The battery energy storage system BESS (comprising the battery pack, Battery Management System [BMS], and Power Conversion System [PCS]) **must support communication via the Modbus protocol**. The manufacturer must provide a complete register map that allow both **monitoring of system parameters** and **control of operational states**. The table below shows the typical registers of a BESS system.

Name	Description	Requirement Level	Data Type / Format	Unit	Read/Write Type
Battery Active Power	Measured DC active power of the battery system (positive = discharge, negative = charge)	Mandatory	INT16 / UINT16	kW	Read-only (Input Register)
Battery Voltage	Measured DC bus voltage of the battery system	Optional	INT16 / UINT16	V	Read-only (Input Register)
Battery Current	Measured DC current (positive = discharge, negative = charge)	Optional	INT16	A	Read-only (Input Register)
State of Charge (SOC)	Remaining battery capacity as percentage of nominal capacity	Mandatory	UINT16	%	Read-only (Input Register)
Battery capacity	Total capacity of the battery	Optional	INT16 / UINT16	kWh	Read-only (Input Register)
State of Health (SOH)	Long-term battery condition indicator	Optional	UINT16	%	Read-only (Input Register)
Remote/VPP control - Enable / Disable Command	A command to enable or disable the remote control (via Modbus)	Mandatory	BOOL (coil)	—	Write (Coil)
Power Setpoint	Requested active power = command to charge/discharge (positive = discharge, negative = charge)	Mandatory	INT16	kW	Read/Write (Holding Register)
Reactive Power Setpoint	Requested reactive power injection/absorption	Optional	INT16	kvar	Read/Write (Holding Register)
Temperature (Cell Avg.)	Average cell temperature	Optional	INT16	°C	Read-only (Input Register)
Min SOC	Minimal recommended state of charge	Optional	INT16	%	Read-only (Input Register)
Max SOC	Maximal recommended state of charge	Optional	INT16	%	Read-only (Input Register)
Max charge power	Maximum charging power on AC and/or DC site	Optional	INT16	%	Read-only (Input Register)
Max discharge power	Maximum discharging power on AC and/or DC site	Optional	INT16	%	Read-only (Input Register)
Firmware Version	Current firmware version of BMS/PCS	Optional	String / UINT16	—	Read-only (Input Register)
System Status	Operating mode (idle / charge / discharge / fault)	Mandatory	UINT16 (coded)	—	Read-only (Input Register)
Alarm / Fault Codes	Active alarms or fault identifiers	Mandatory	Bitfield / UINT16	—	Read-only (Input Register)

Additionally, the manufacturer must clearly specify the process and a list of registers that need to be set in order to achieve the desired charging/discharging operation. That usually includes setting a register to a remote control/VPP mode, enabling battery operation, providing regular heartbeat signal etc.

Inverters supporting operational modes

More advanced BESS systems might also provide an internal EMS capable of performing operational modes like self-consumption, peak shaving, max production, max consumption, VPP etc. For that an additional electricity meter must be supplied and usually connected to the grid. This feature is more common with hybrid inverters, but it's not rare also in battery inverters. More details on the operating modes can be found in [Integration requirements for hybrid inverters](#)

In case the BESS supports operating modes and is equipped with a electricity meter, it's important to also provide the electricity measurement as:

Name	Data Type / Format	Unit	Read/Write Type
Meter Total power	INT16 / UINT16	kW	Read-only (Input Register)
Meter Import Active Power per phases L1, L2, L3	INT16 / UINT16	kW	Read-only (Input Register)
Meter Export Active Power per phases L1, L2, L3	INT16 / UINT16	kW	Read-only (Input Register)
Meter Import Reactive Power per phases L1, L2, L3	INT16 / UINT16	kW	Read-only (Input Register)
Meter Export Reactive Power per phases L1, L2, L3	INT16 / UINT16	kW	Read-only (Input Register)
Meter Import Active energy	INT16 / UINT16	kW	Read-only (Input Register)
Meter Import Reactive energy	INT16 / UINT16	kW	Read-only (Input Register)
Meter Export Active energy	INT16 / UINT16	kW	Read-only (Input Register)
Meter Export Reactive energy	INT16 / UINT16	kW	Read-only (Input Register)
Meter Frequency	INT16 / UINT16	Hz	Read-only (Input Register)
Meter Currents per phases L1, L2, L3	INT16 / UINT16	A	Read-only (Input Register)
Meter Voltages	INT16 / UINT16	V	Read-only (Input Register)
Meter limit active import power	INT16	kW	Read/Write (Holding Register)
Meter limit active export power	INT16	kW	Read/Write (Holding Register)