

Hybrid Systems - Register and Control Requirements

Fillable manufacturer questionnaire for PV, battery and AC-terminal control

IMPORTANT - COMPLETE CONTROL SEQUENCES REQUIRED

Provide **verified register addresses, data types, scaling, write values, required modes, direction selection and readbacks**. A setpoint address without the enable steps or operating-mode logic is not sufficient. Declare actual AC-terminal response capabilities in Section 7: **VDE-AR-N 4105 applications: 500 ms; VDE-AR-N 4110 applications: 200 ms.**

1. System Data

Manufacturer / system		Hybrid inverter model / type	
Firmware / software version		System configuration	
Register document / version		Address base / notation	

2. Communication and Contact

Supported interface(s): ☐ Modbus TCP ☐ Modbus RTU ☐ Other documented protocol

TCP Port		Unit ID / Slave ID	
Read / write function codes		Byte / word order	
P sign convention		Q sign convention	
Recommended write cycle		Watchdog / comms failure	

Direct technical contact (development / interface)

Name	E-mail	Phone / Teams

3. PV Active Power Limitation - Generating Unit [AC]

WHAT THIS CONTROL MUST DO

We specify a **maximum permissible active power** at the hybrid inverter AC terminals. The inverter may coordinate PV and battery internally, but **actual AC active power must not exceed this limit**. This is an upper limit, not a fixed power setpoint. The PCC / utility meter is not the control point. The response-time criteria and measurement definition in Section 7 apply.

Manufacturer confirmation:

☐ Yes

☐ No

☐ Partially

If partially:

Required registers and write sequence

Only enter steps actually required.

#	Required step / complete write sequence	Register / address / FC	Value / type / scaling
1	Enable external / remote control		
2	Select AC generating-unit P limitation mode		
3	Write maximum active power limit		
4	Set ramp / priority if required		
5	Execute Apply / Enable / Heartbeat if required		

Readback / verification

Value to verify	Register / address / FC	Data type / scaling / unit
Actual active power at generating unit [AC]		
Active AC P limit / mode / limit status		

Notes / fallback / special considerations

4. PV Active Power Limitation - Generating Unit [DC]

WHAT THIS CONTROL MUST DO

Limit **only total PV DC / MPPT power**, independently of the battery charging or discharging command. This limitation must not overwrite an external battery setpoint. Provide the register that physically reduces PV production, not only net AC export.

Verification: use PV DC / MPPT measurements; AC power alone can be masked by battery operation.

Manufacturer confirmation:

☐ Yes

☐ No

☐ Partially

If partially:

Required registers and write sequence

Only enter steps actually required.

#	Required step / complete write sequence	Register / address / FC	Value / type / scaling
1	Enable external / remote control		
2	Select PV / MPPT DC power limitation mode		
3	Write total PV DC power limit		
4	Assign MPPT / strings if required		
5	Execute Apply / Enable / Heartbeat if required		

Readback / verification

Value to verify	Register / address / FC	Data type / scaling / unit
Actual total PV DC / MPPT power		
Active PV DC limit / operating mode		

Notes / fallback / special considerations

5. PV Reactive Power Setpoint - Generating Unit [AC]

WHAT THIS CONTROL MUST DO

Our EMS directly specifies the **reactive power Q** at the hybrid inverter AC terminals: an absolute setpoint in var / kvar or a relative setpoint in %Qnom. **A cos phi / power-factor command alone is not sufficient.** Document the sign convention for inductive / capacitive (underexcited / overexcited) operation. Section 7 applies to actual AC-terminal Q.

Manufacturer confirmation:

☐ Yes

☐ No

☐ Partially

If partially:

Required registers and write sequence

Only enter steps actually required.

#	Required step / complete write sequence	Register / address / FC	Value / type / scaling
1	Enable external / remote control		
2	Select direct Q control mode		
3	Write Q setpoint [var / kvar / %Qnom]		
4	Set Qnom / scaling / priority if required		
5	Execute Apply / Enable / Heartbeat if required		

Readback / verification

Value to verify	Register / address / FC	Data type / scaling / unit
Actual reactive power at generating unit [AC]		
Active Q setpoint / Q control mode		

Notes / fallback / special considerations

6. Battery Charging / Discharging Power Control

WHAT THIS CONTROL MUST DO

Our EMS must specify **both charging and discharging active power** independently of any PV DC limitation. Grid charging or export must be enableable where supported and permitted. Provide the **complete direction-selection logic**: a signed common P setpoint, separate charge/discharge registers, or an additional direction / operating-mode register. **An unsigned common U32 register by itself does not identify charge vs. discharge.**

Manufacturer confirmation:

☐ Yes

☐ No

☐ Partially

If partially:

How is the charging / discharging direction selected?

☐ Signed common setpoint

☐ Separate mode + unsigned setpoint

☐ Separate setpoint registers

Required registers and write sequence

#	Required step / complete write sequence	Register / address / FC	Value / type / scaling
1	Enable external battery / remote control		
2	Select charge / discharge operating mode and direction		
3	Enable grid charge / export where required		
4	Write charging power setpoint		
5	Write discharging power setpoint		
6	Execute Apply / Enable / Heartbeat if required		

Readback / verification

Value to verify	Register / address / FC	Data type / scaling / unit
Actual battery charging / discharging power [AC]		
SOC / available charge and discharge / status		

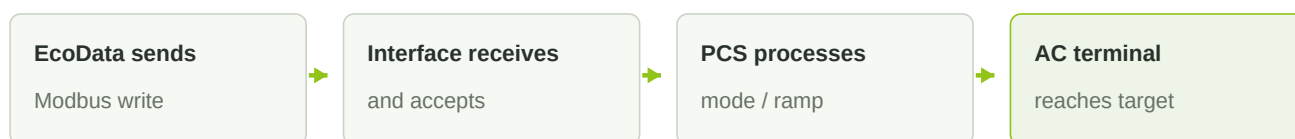
Direction logic / data types / value examples / notes

7. Response Time - AC-Terminal Setpoint Verification

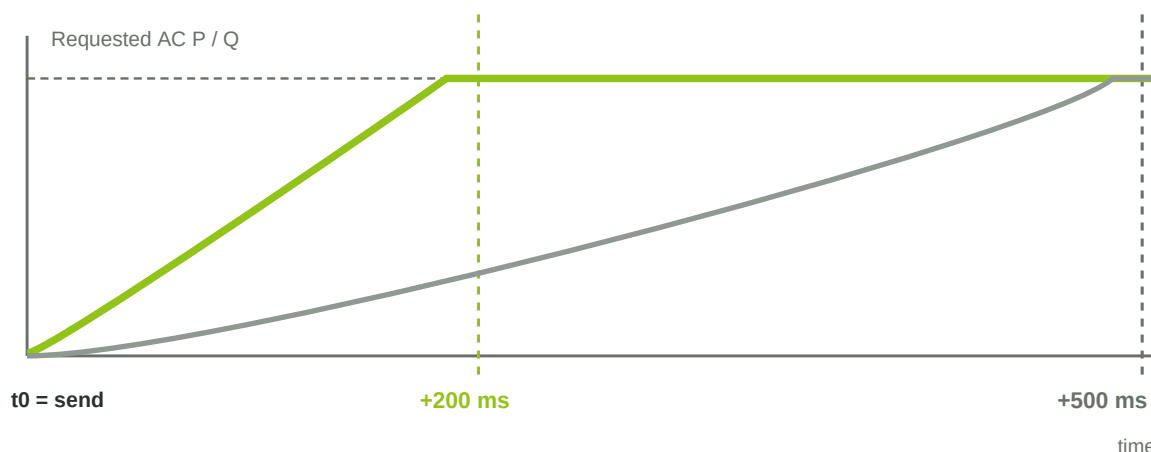
MEASUREMENT START / END - COMPLETE COMMAND-TO-POWER CHAIN

t0 = EcoData transmits the Modbus write command. The elapsed time includes communication, write acceptance, internal processing, ramps and power conversion. The requested **actual active or reactive AC power must be physically measurable at the inverter AC terminal within the selected time limit.** A Modbus acknowledgement, updated target register or merely starting the change is **not** sufficient.

Complete command-to-power chain (all steps included)



Illustrative step response - requested power must already be achieved at the deadline



Manufacturer confirmation - actual physical response at the AC terminal

VDE-AR-N 4110 application / EcoData requirement

Maximum 200 ms after command transmission

☐ Yes

☐ No

VDE-AR-N 4105 application / EcoData requirement

Maximum 500 ms after command transmission

☐ Yes

☐ No

Measured maximum total response time:

ms

Applies to P-limit changes, battery charging/discharging and direct Q setpoints (including both Q directions), unless exceptions are described on page 7. For PV DC limitation, verify the PV DC/MPPT value separately.

8. Dynamic Behaviour, Validation and Confirmation

REQUIRED TECHNICAL DECLARATION

Provide technically verified values for the exact model, firmware and system topology. **The manufacturer is responsible for correct register documentation and performance statements.** Marking a response-time option is a capability declaration, **not automatic approval or certification** for a particular installation. EcoData will evaluate applicability and may require a live test.

8.1 Dynamic limits and technical dependencies

- ☐ P setpoints work without restrictive internal ramp
- ☐ Q setpoints work without restrictive internal ramp
- ☐ Internal ramp / smoothing / delay / filter is present

Worst-case charge ramp: kW/s or %Pn/s

Worst-case discharge ramp: kW/s or %Pn/s

Details / limitations / firmware prerequisites / speed exceptions:

8.2 Verification and integration prerequisites

- ☐ Operational test system is available for integration and response measurement
- ☐ Interface engineer can support tests and understands registers / modes
- ☐ Complete register map with data types, scaling and direction logic supplied

Relevant register-map version / test report reference:

8.3 Manufacturer confirmation

The undersigned confirms that the register assignments, control sequences, direction handling and response-time claims above have been checked for the specified configuration.

Technical approver name

Company / position

Place / date