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DAkkS Deutsche Akkreditierungsstelle D-ZE-11321-01-00

TÜV SÜD Product Service

Certificate of Conformity

No. ESY 126875 0020 Rev. 00

Holder of Certificate: **Atmoce Holding B.V.**
Singel 250
1016 AB Amsterdam
THE NETHERLANDS

Product: **Energy Storage System**

Model(s): **MS-7K-U**

Parameters: See next pages.

Applicable standards: EN 50549-1:2019
EN 50549-10:2022

This Certificate of Conformity confirms the compliance with the above listed standards on a voluntary basis. It refers only to the sample submitted to TÜV SÜD Product Service GmbH and does not certify the quality or safety of the serial products. It was issued according to TÜV SÜD Product Service certification program Photovoltaics and Grid Integration. For details see: www.tuvsud.com/ps-cert

Test report no.: 704092520323-00

Date, 2025-04-25

(Kai Zhao)

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Parameters:

Model	MS-7K-U
Battery Input / Output:	
Nominal Battery Voltage	DC 25.6 V
Battery Voltage range	DC 20.4 V, …, 28.8 V
Max. Battery Continuous Charging Current	DC 235 A
Max. Battery Continuous Discharging Current	DC 270 A
AC parameters (Grid side):	
Input / Output Nominal Voltage	1/N/PE ~ 230 V (single-phase mode) or 3/N/PE ~ 230/400 V (three-phase mode)
AC Max. Output Current (Discharging)	AC 21.74 A@230V (single-phase mode) or AC 7.25 A@230/400V (three-phase mode)
AC Max. Input Current (Charging)	AC 16.3 A@230V (single-phase mode) or AC 5.41 A@230/400V (three-phase mode)
Max. Output Power (Overload)	5 kW
Max. Continuous Output Power	4.5 kW
Max. Continuous Input Power	3.75 kW
Nominal Frequency	50 Hz
Power factor range	-0.8, …, 1, …, +0.8
Number of Phases	1 a.c. or 3 a.c.
Remark: Operating mode at single-phase or three-phase depends on field wiring connection according to user manual	

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Evaluated protection function and operational capabilities

Clause(s) / subclause(s) of EN 50549-1:2019	Applicable clause(s) / subclause (s) of this document	Remarks, optional modes and constraints	Verdict
4.4.2 Operating frequency range	5.2.1 Frequency operating range	--	Pass
4.4.3 Minimal requirement for active power delivery at underfrequency	5.2.1 Frequency operating range	--	Pass
4.4.4 Continuous operating voltage range	5.2.2 Voltage operating range	--	Pass
4.5.2 Rate of change of frequency (ROCOF) immunity	5.3.1 Immunity to disturbances – Rated of change of frequency (ROCOF)	--	Pass
4.5.3.2 Generating plant with non-synchronous generating technology	5.3.3 Immunity to disturbances - Fault ride through, over-voltage (OVRT) and under-voltage (UVRT)	--	Pass
4.5.4 Over-voltage ride through (OVRT)	5.3.3 Immunity to disturbances - Fault ride through, over-voltage (OVRT) and under-voltage (UVRT)	--	Pass
4.6.1 Power response to overfrequency	5.4 Active response to frequency deviation	--	Pass
4.6.2 Power response to underfrequency	5.4 Active response to frequency deviation	--	Pass
4.7.2.2 Voltage support by reactive power, Capabilities	5.5.1 Power capabilities assessment	--	Pass
4.7.2.3 Voltage support by reactive power, Control modes	5.5.2 Voltage support by reactive power - test to determine the reactive power control modes	Q setp. Q(U) Cos φ setp. Cos φ (P)	Pass
4.7.2.3.2 Set point control modes	5.5.2.3 Verification procedure for set point control	Q setp. Cos φ setp.	Pass
4.7.2.3.3 Voltage related control modes	5.5.2.5 Verification procedure for power related control modes for reactive power	Q(U)	Pass
4.7.2.3.4 Power related control mode	5.5.2.5 Verification procedure for power related control modes for reactive power	Cos φ (P)	Pass
4.7.3 Voltage related active power reduction	5.6 Voltage related active power reduction - P(U)	P(U)	Pass
4.7.4.2.2 Zero current mode for converter connected generating technology	5.3.3 Immunity to disturbances - Fault ride through, over-voltage (OVRT) and under-voltage (UVRT)	--	Pass
4.9.3 Requirements on voltage and frequency protection	5.8.3 Verification procedure for generating plants to be connected to a LV distribution network with Interface protection as internal device	--	Pass
4.9.4 Means to detect island situation	5.8.6 Islanding detection	Active methods tested with a resonant circuit	Pass

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		according to EN 62116	
4.10.2 Automatic reconnection after tripping	5.9.3 Automatic reconnection after tripping	--	Pass
4.10.3 Starting to generate electrical power	5.9.4 Starting to generate electrical power	--	Pass
4.11.1 Ceasing active power	5.10 Active power reduction on set point	--	Pass
4.11.2 Reduction of active power on set point	5.10 Active power reduction on set point	--	Pass
4.12 Remote information exchange	5.11 Remote information exchange	Standardized communication protocol not provided by manufacturer	N/A
4.13 single fault tolerance of interface protection system and interface switch	5.12 Requirements regarding single fault tolerance of interface protection system and interface switch	--	Pass

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Evaluated parameter and parameter range

Specific technical requirement (e.g. grid codes)		EN 50549-1:2019			
Clause(s) / subclause(s) of EN 50549-1:2019	Parameter	Remarks/ additional information	Configurable value range	Default value	
4.4.2 Operating frequency range	47.0 – 47.5 Hz Duration	--	0 – 20 s	Unlimited with protection setting only	
	47.5 – 48.5 Hz Duration	--	30 – 90 min	Unlimited with protection setting only	
	48.5 – 49.0 Hz Duration	--	30 – 90 min	Unlimited	
	49.0 – 51.0 Hz Duration	--	not configurable	Unlimited	
	51.0 – 51.5 Hz Duration	--	30 – 90 min	Unlimited with protection setting only	
	51. 5 – 52 Hz Duration	--	0 – 15 min	Unlimited with protection setting only	
4.4.3 Minimal requirement for active power delivery at underfrequency	Reduction threshold	--	not configurable	No reduction	
	Maximum reduction rate	--	not configurable	N/A	
4.4.4 Continuous operating voltage range	Upper limit	--	not configurable	110% U_n	
	Lower limit	--	not configurable	85% U_n	
4.5.2 Rate of change of frequency (ROCOF) immunity	ROCOF withstand capability (defined with a sliding measurement window of 500 ms)	--	not configurable	2 Hz/s	
4.5.3.2 Under-voltage ride through (UVRT) Generating plant with non-synchronous generating technology	Maximum power resumption time	--	not configurable	1 s	
	Voltage-Time-Diagram	--	See figure 6 default requirement curve of EN 50549-1:2019	Time [s]	U [p.u.]
				0.0	0.05
				0.25	0.05
				3	0.85
4.5.4 Over-voltage ride through (OVRT)	Voltage-Time-Diagram	--	not configurable See figure 8 of EN 50549-1:2019	Time [s]	U [p.u.]
				0.0	1.25
				0.1	1.25
				0.1	1.20
				5.0	1.20
				5.0	1.15
				60	1.15
				60	1.10
4.6.1 Power response to overfrequency	Threshold frequency f_1	--	50.2 Hz – 52 Hz	50.2 Hz	
	Droop	--	2 % – 12 %	5 %	
	Power reference	--	P_M | P_{max}	P_{max} for ESS	
	Intentional delay	--	0 – 2 s	0s	
	Deactivation threshold f_{stop}	--	50.0 Hz – f_1	deactivated	
	Deactivation time t_{stop}	--	0 – 600 s	-	
	Acceptance of	--	yes | no	No	

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	staged disconnection			
4.6.2 Power response to underfrequency	Threshold frequency f_1	--	49.8 Hz – 46 Hz	49.8 Hz
	Droop	--	2 – 12 %	5 %
	Power reference	--	P_M | P_{max}	P_{max}
	Intentional delay	--	0 – 2 s	0 s
4.7.2.2 Voltage support by reactive power - Capabilities	Active factor / Reactive power (%Pd) range overexcited	--	0.8 – 1 / 60 %P_D – 0	0.8 – 1 / 60 %P_D – 0
	Active factor / Reactive power (%Pd) range underexcited	--	0.8 – 1 / 60 %P_D – 0	0.8 – 1 / 60 %P_D – 0
4.7.2.3 Voltage support by reactive power - Control modes	Enabled control mode	--	Q setp. Q(U) Cos φ setp. Cos φ (P)	Q setp.
4.7.2.3.2 Voltage support by reactive power - Setpoint control modes	Q setpoint and excitation	--	0 – 60 % P_D	0
	cos φ setpoint and excitation	--	1 – 0.8	1
4.7.2.3.3 Voltage support by reactive power - Voltage related control modes	Characteristic curve – Q (U)	--	--	Indicate default characteristic
	Point a	--	50%Un – 100%Un	93 %Un
	Point b	--	50%Un – 100%Un	94 %Un
	Point c	--	100%Un – 120%Un	106%Un
	Point d	--	100%Un – 120%Un	108 %Un
	Min. reactive power	--	0 – 60 %Pd ($Q_{max\ under}$)	60 %Pd
	Max. reactive power	--	0 – 60 %Pd ($Q_{max\ over}$)	60 %Pd
	Time constant	--	3 s – 60 s	3.0 s
	Min cos φ	--	0.0 – 1	0.4
	Lock in power	--	0 % – 20 %	20%
	Lock out power	--	0 % – 20 %	5%
4.7.2.3.4 Voltage support by reactive power - Power related control mode	Characteristic curve – Cos φ (P)	--	--	Indicate default characteristic
	Point a	--	0 – 100%Pn/ PF:-0.8, …,+0.8	15%Pn/ PF=0.8
	Point b	--	0 – 100%Pn/ PF:-0.8, …,+0.8	20%Pn/ PF=1
	Point c	--	0 – 100%Pn/ PF:-0.8, …,+0.8	80%Pn/ PF=1
	Point d	--	0 – 100%Pn/ PF:-0.8, …,+0.8	90%Pn/ PF=-0.8
	Cos φ	--	0.8 – 1	0.8
	Time constant	--	3 s – 60 s	3.33 s
	Lock in voltage	--	105 %Un	deactivated
	Lock out voltage	--	100 %Un	deactivated
4.7.3 Voltage related active power reduction	Characteristic curve - P (U)	--	--	Indicate default characteristic
	Point a	--	0 – 100%Pn/ U:0 V, …,264.5 V	100%Pn/ U=207 V
	Point b	--	0 – 100%Pn/ U:0 V, …,264.5 V	100%Pn/ U=230 V
	Point c	--	0 – 100%Pn/ U:0 V, …,264.5 V	100%Pn/ U=253 V

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	Point d	--	0 – 100%Pn/ U:0 V, …,264.5 V	0%Pn/ U=264.5 V
	Time constant	--	3 s – 60 s	3.33 s
4.7.4.2.2 Zero current mode for converter connected generating technology	Enabling	--	enable | disable	disabled
	Static voltage range overvoltage	--	100 %U_n – 120 %U_n	120 %U_n
	Static voltage range undervoltage	--	20 %U_n – 100 %U_n	85 %U_n
4.9.3 Requirements on voltage and frequency protection	Threshold for protection as dedicated device [in A or kW. kVA]	--	16 A – 250 kVA	Not specified, inverter integrated as default
	Undervoltage threshold stage 1	--	0.2 U_n – 1 U_n	0.85Un
	Undervoltage operate time stage 1	--	0.1 s – 100 s	100 s
	Undervoltage threshold stage 2	--	0.2 U_n – 1 U_n	0.5Un
	Undervoltage operate time stage 2	--	0.1 s – 5 s	5 s
	Overvoltage threshold stage 1	--	1.0 U_n – 1.2 U_n	1.2Un
	Overvoltage operate time stage 1	--	0.1 s – 100 s	100 s
	Overvoltage threshold stage 2	--	1.0 U_n – 1.3 U_n	1.3Un
	Overvoltage operate time stage 2	--	0.1 s – 5 s	5 s
	Overvoltage threshold 10 min mean protection	--	1.0 U_n – 1.15 U_n	1.1Un
	Underfrequency threshold stage 1	--	47.0 Hz– 50.0 Hz	47.5 Hz
	Underfrequency operate time stage 1	--	0.1 s – 100 s	100 s
	Underfrequency threshold stage 2	--	47.0 Hz – 50.0 Hz	47 Hz
	Underfrequency operate time stage 2	--	0.1 s – 5 s	5 s
	Overfrequency threshold stage 1	--	50.0 Hz – 52.0 Hz	51.5Hz
	Overfrequency operate time stage 1	--	0.1 s – 100 s	100 s
	Overfrequency threshold stage 2	--	50.0 Hz – 52.0 Hz	52Hz
	Overfrequency operate time stage 2	--	0.1 s – 5 s	5 s
	ROCOF protection	1.5 – 5 Hz/s by manufacturer	--	2.5 Hz/s
	ROCOF operate time	--	0 - 1 s	0.6 s

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4.10.2 Automatic reconnection after tripping	Lower frequency	--	47.0 Hz – 50.0 Hz	49.5 Hz
	Upper frequency	--	50.0 Hz – 52.0 Hz	50.2 Hz
	Lower voltage	--	50 %U_n – 100 %U_n	85 %U_n
	Upper voltage	--	100 %U_n – 120 %U_n	110 %U_n
	Observation time	--	10 s – 600 s	60 s
	Active power increase gradient	--	5% – 3000%/min	10 %/min
4.10.3 Starting to generate electrical power	Lower frequency	--	47.0 Hz – 50.0 Hz	49.5 Hz
	Upper frequency	--	50.0 Hz – 52.0 Hz	50.1 Hz
	Lower voltage	--	50 %U_n – 100 %U_n	85 %U_n
	Upper voltage	--	100 %U_n – 120 %U_n	110 %U_n
	Observation time	--	10 s – 600 s	60 s
	Active power increase gradient	--	5% – 3000 %/min	disabled
4.11.1 Ceasing active power	Activation option	--	Can be achieved by atmozen APP or atmoce cloud, acceptance should be made by the DSO and responsible party	
4.11.2 Reduction of active power on set point	Activation option	--	Can be achieved by atmozen APP or atmoce cloud, acceptance should be made by the DSO and responsible party	
4.12 Remote information exchange	Available communication standards	--	Standardized communication protocol not provided by manufacturer	