



Product Service

Compliance Document

No. D 126875 0024 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.

Tested according to: C10/11:2021

This Compliance document confirms the compliance with the listed standards on a voluntary basis. It refers only to the sample submitted for testing and certification and does not certify the quality or safety of the serial products. For details see: www.tuvsud.com/ps-cert

Test report no.: 704092520327-00

Date, 2025-04-30

(Zhengdong Ma)



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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

Specific technical requirement (e.g. grid codes)		EN 50549-1:2019, C10/11:2021			
Clause(s) / subclause(s) of EN 50549-1:2019	Parameter	Remarks/ additional information	Configurable value range	Tested parameters or parameters sets (minimum and maximum) according to EN 50549-10	Default values used for Belgium according to C10/11:2021
4.4.2 Operating frequency range /	47.0 – 47.5 Hz Duration	--	0 – 20 s	Proven to meet the requirement through a 47 Hz@20 s verification test.	Unlimited with protection setting only
	47.5 – 48.5 Hz Duration	--	30 – 90 min	Proven to meet the requirement through a 47.5 Hz@5 min verification test. Note: The associated time duration will be limited to 5 min if the manufacturer specified a longer duration and to the declared maximum duration otherwise.	Unlimited with protection setting only
	48.5 – 49.0 Hz Duration	--	30 – 90 min	Proven to meet the requirement through a 47.5 Hz@5 min verification test. Note: The associated time duration will be limited to 5 min if the manufacturer specified a longer duration and to the declared maximum duration otherwise.	Unlimited
	49.0 – 51.0 Hz Duration	--	not configurable	unlimited	Unlimited
	51.0 – 51.5 Hz Duration	--	30 – 90 min	Proven to meet the requirement through a 51.5 Hz@5 min verification test. Note: The associated time duration will be limited to 5 min if the manufacturer specified a longer duration and to the declared maximum duration otherwise.	Unlimited with protection setting only
	51.5 – 52 Hz Duration	--	0 – 15 min	Proven to meet the requirement through a 52 Hz@5 min verification test. Note: The associated time duration will be limited to 5 min if the manufacturer specified a longer duration and to the declared maximum duration otherwise.	Unlimited with protection setting only
4.4.3 Minimal requirement for active power delivery at underfrequency	Reduction threshold	--	not configurable	No reduction	No reduction
	Maximum reduction rate	--	not configurable	N/A	N/A
4.4.4 Continuous operating voltage range	Upper limit	--	not configurable	110% Un	110% Un
	Lower limit	--	not configurable	85% Un	85% Un



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4.5.2 Rate of change of frequency (ROCOF) immunity	ROCOF withstand capability (defined with a sliding measurement window of 500 ms)	1.5 – 5 Hz/s by manufacturer	not configurable	2 Hz/s	2 Hz/s
4.5.3.2 Under-voltage ride through (UVRT) Generating plant with non-synchronous generating technology	Maximum power resumption time Voltage-Time-Diagram	--	not configurable See figure 6 default requirement curve of EN 50549-1:2019	1 s Time [s] U [p.u.] 0.0 0.05 0.25 0.05 3 0.85	1 s Time [s] U [p.u.] 0.0 0.15 0.2 0.15 1.5 0.85
4.5.4 Over-voltage ride through (OVRT)	Voltage-Time-Diagram	--	not configurable See figure 8 of EN 50549-1:2019	As in below Time [s] U [p.u.] 0 1.25 0.1 1.25 0.1 1.20 5.0 1.20 5.0 1.15 60 1.15 60 1.00	As in below Time [s] U [p.u.] 0 1.25 0.1 1.25 0.1 1.20 5.0 1.20 5.0 1.15 60 1.15 60 1.00
4.6.1 Power response to overfrequency	LFSM-O Threshold frequency f1 Droop Power reference Intentional delay Deactivation threshold fstop Deactivation time tstop Acceptance of staged disconnection	-- -- -- -- -- -- -- --	-- 50.2 Hz – 52 Hz 2 % – 12 % PM Pmax 0 – 2 s 50.0 Hz – f1 0 – 600 s yes no	a) b) c) 50.2 Hz 50.5 Hz 50.2 Hz 5 % 2 % 12 % Pmax Pmax Pmax 0 s 0 s 2 s Deactivated 50.5 Hz 50.05 Hz Deactivated 1 s 600 s no	Settings 50.2Hz 5% Pmax 0 Deactivated 0 No
4.6.2 Power response to underfrequency	LFSM-U Threshold frequency f1 Droop Power reference Intentional delay	-- -- -- -- --	-- 49.8 Hz – 46 Hz 2 – 12 % PM Pmax 0 – 2 s	a) b) c) 49.8 Hz 49.5 Hz 49.8 Hz 5 % 2 % 12 % Pmax Pmax Pmax 0 s 0 s 2 s	Settings 49.8 Hz 5% Pmax 0
4.7.2.2 Voltage support by reactive power - Capabilities	Active factor / Reactive power (%Pd) range overexcited Active factor / Reactive power (%Pd) range underexcited	-- --	0.8 – 1 / 60 %Pd – 0 0.8 – 1 / 60 % Pd – 0	0.8 and 1 / 60 % Pd and 0 0.8 and 1 / 60 % Pd and 0	1 / 0 1 / 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. Q(U) Cos φ setp. Cos φ (P)	Cos φ setp.
4.7.2.3.2 Voltage support by reactive power - Setpoint control modes	Q setpoint and excitation cos φ setpoint and excitation	-- --	0 – 60 % Pd 1 – 0.8	0 and 60 % Pmax 1 and 0.8	Not required 1



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4.7.2.3.3 Voltage support by reactive power - Voltage related control modes	Characteristic curve – Q (U)	--	--	a)	b)	Settings	
	Point a	--	50%Un – 100%Un	93 %Un	90 %Un	92% Un	
	Point b	--	50%Un – 100%Un	94 %Un	100 %Un	94% Un	
	Point c	--	100%Un – 120%Un	106 %Un	110 %Un	106% Un	
	Point d	--	100%Un – 120%Un	108 %Un	-	108% Un	
	Min. reactive power	--	0 – 60 %Pd (Q _{max} under)	60 %P _{max}	6 %P _{max}	60 %P _{max}	
	Max. reactive power	--	0 – 60 %Pd (Q _{max} over)	60 %P _{max}	6 %P _{max}	60 %P _{max}	
	Time constant	--	3 s – 60 s	3 s	20 s	3.33 s	
	Min cos φ	--	0.0 – 1	0.4 and 1	Deactivated	0.4	
	Lock in power	--	0 % – 20 %	Deactivated	20%	Deactivated	
Lock out power	--	0 % – 20 %	Deactivated	5%	Deactivated		
4.7.2.3.4 Voltage support by reactive power - Power related control mode	Characteristic curve – Cos φ (P)	Specified in C10/11:2021	--	a)	b)	c)	Settings
	Point a	--	0 – 100%Pn/ PF: -0.8, ..., +0.8	15 %Pn / PF= 0.8	0 % Pn / PF= 1	0 % Pn / PF= 1	15%Pn/ PF=0.8
	Point b	--	0 – 100%Pn/ PF: -0.8, ..., +0.8	20 %Pn / PF=1	50 %Pn / PF= 1	50 %Pn / PF= 1	20%Pn/ PF=1
	Point c	--	0 – 100%Pn/ PF: -0.8, ..., +0.8	80 %Pn / PF=1	100 %Pn/ PF= - 0.95	100 %Pn/ PF= -0.95	80%Pn/ PF=1
	Point d	--	0 – 100%Pn/ PF: -0.8, ..., +0.8	90 %Pn / PF= -0.8	100 %Pn/ PF= -0.95	100 %Pn/ PF= -0.95	90%Pn/ PF=-0.9
	Cos φ	--	0.8 – 1	0.8	0.95	0.95	0.8
	Time constant	--	3 s – 60 s	3 s	3.33 s	3.33 s	3.33 s
	Lock in voltage	--	105 %Un	Deactivated d	Deactivated d	105 %Un	Deactivated
	Lock out voltage	--	100 %Un	Deactivated d	Deactivated d	100 %Un	Deactivated
4.7.3 Voltage related active power reduction	Characteristic curve - P (U)	--	--	P (U) in junction with Q(U) a) setting			Settings
	Point a	--	0 – 100%Pn/ U:0 , ...,264.5 V	100%Pn/ U=207 V			100%Pn/ U=207 V
	Point b	--	0 – 100%Pn/ U:0 , ...,264.5 V	100%Pn/ U=230 V			100%Pn/ U=230 V
	Point c	--	0 – 100%Pn/ U:0 , ...,264.5 V	100%Pn/ U=253 V			100%Pn/ U=248.4 V
	Point d	--	0 – 100%Pn/ U:0 , ...,264.5 V	0%Pn/ U=264.5 V			56%Pn/ U=257.6 V
	Time constant	--	3 s – 60 s	3.33 s			3.33 s
4.7.4.2.2 Zero current mode for converter connected generating technology	Enabling	--	enable disable	disabled			disabled
	Static voltage range overvoltage	--	100 %Un – 120 %Un	120 %Un			120 %Un
	Static voltage	--	20 %Un –	85 %Un			85 %Un



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	range undervoltage		100 %Un					
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, Energy Storage System integrated as default				Settings
	Undervoltage threshold stage 1	--	$0.2 U_n - 1 U_n$	0.2 Un	0.44 Un	0.68 Un	1.0 Un	0.8Un
	Undervoltage operate time stage 1	--	0.1 s – 100 s	0.1 s	30 s	60 s	100 s	0.1 s
	Undervoltage threshold stage 2	--	$0.2 U_n - 1 U_n$	0.2 Un	0.44 Un	0.68 Un	1.0 Un	--
	Undervoltage operate time stage 2	--	0.1 s – 5 s	0.1 s	1.5 s	3 s	5 s	--
	Overvoltage threshold stage 1	--	$1.0 U_n - 1.2 U_n$	1.0 Un	1.06 Un	1.12 Un	1.2 Un	1.15Un
	Overvoltage operate time stage 1	--	0.1 s – 100 s	0.1 s	30 s	60 s	100 s	0.1 s
	Overvoltage threshold stage 2	--	$1.0 U_n - 1.3 U_n$	1.0 Un	1.09 Un	1.12 Un	1.2 Un	--
	Overvoltage operate time stage 2	--	0.1 s – 5 s	0.1 s	1.5 s	3 s	5 s	--
	Overvoltage threshold 10 min mean protection	--	$1.0 U_n - 1.15 U_n$	1.1 Un	1.11 Un	1.13 Un	1.15 Un	1.1Un
	Underfrequency threshold stage 1	--	47.0 Hz– 50.0 Hz	47 Hz	47.9 Hz	48.8 Hz	50 Hz	47.5 Hz
	Underfrequency operate time stage 1	--	0.1 s – 100 s	0.1 s	30 s	60 s	100 s	0.1 s
	Underfrequency threshold stage 2	--	47.0 Hz – 50.0 Hz	47 Hz	47.9 Hz	48.8 Hz	50 Hz	--
	Underfrequency operate time stage 2	--	0.1 s – 5 s	0.1 s	1.5 s	3 s	5 s	--
	Overfrequency threshold stage 1	--	50.0 Hz – 52.0 Hz	50 Hz	50.6 Hz	51.2 Hz	52 Hz	51.5Hz
	Overfrequency operate time stage 1	--	0.1 s – 100 s	0.1 s	30 s	60 s	100 s	0.1 s
	Overfrequency threshold stage 2	--	50.0 Hz – 52.0 Hz	50 Hz	50.6 Hz	51.2 Hz	52 Hz	--
	Overfrequency operate time stage 2	--	0.1 s – 5 s	0.1 s	1.5 s	3 s	5 s	--
	ROCOF protection	1.5 – 5 Hz/s by manufacturer	0 - 2.5 Hz/s	2.0 Hz/s				2.5 Hz/s



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	ROCOF operate time	--	0 - 1 s	1 s	1 s
4.10.2 Automatic reconnection after tripping	Lower frequency	--	47.0 Hz – 50.0 Hz	49.5 Hz	49.9 Hz
	Upper frequency	--	50.0 Hz – 52.0 Hz	50.2 Hz	50.1 Hz
	Lower voltage	--	50 %Un – 100 %Un	85 %Un	85 %Un
	Upper voltage	--	100 %Un – 120 %Un	110 %Un	110 %Un
	Observation time	--	10 s – 600 s	60 s	60 s
	Active power increase gradient	--	5% – 3000%/min	10 %Pn/min	10 %/min
4.10.3 Starting to generate electrical power	Lower frequency	--	47.0 Hz – 50.0 Hz	49.5 Hz	49.9 Hz
	Upper frequency	--	50.0 Hz – 52.0 Hz	50.1 Hz	50.1 Hz
	Lower voltage	--	50 %Un – 100 %Un	85 %Un	85 %Un
	Upper voltage	--	100 %Un – 120 %Un	110 %Un	110 %Un
	Observation time	--	10 s – 600 s	60 s	60 s
	Active power increase gradient	--	5% – 3000 %/min	10 %Pn/min	10 %/min
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		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		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		Standardized communication protocol not provided by manufacturer



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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	
	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
4.5.4 Over-voltage ride through (OVRT)	Voltage-Time-Diagram	--	not configurable See figure 8 of EN 50549-1:2019	3	0.85
				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
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% U_n – 100% U_n	93 % U_n
	Point b	--	50% U_n – 100% U_n	94 % U_n
	Point c	--	100% U_n – 120% U_n	106% U_n
	Point d	--	100% U_n – 120% U_n	108 % U_n
	Min. reactive power	--	0 – 60 %Pd ($Q_{max \text{ under}}$)	60 %Pd
	Max. reactive power	--	0 – 60 %Pd ($Q_{max \text{ over}}$)	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% P_n / PF:-0.8, ..., +0.8	15% P_n / PF=0.8
	Point b	--	0 – 100% P_n / PF:-0.8, ..., +0.8	20% P_n / PF=1
	Point c	--	0 – 100% P_n / PF:-0.8, ..., +0.8	80% P_n / PF=1
	Point d	--	0 – 100% P_n / PF:-0.8, ..., +0.8	90% P_n / PF=-0.8
	Cos ϕ	--	0.8 – 1	0.8
	Time constant	--	3 s – 60 s	3.33 s
	Lock in voltage	--	105 % U_n	deactivated
	Lock out voltage	--	100 % U_n	deactivated
4.7.3 Voltage related active power reduction	Characteristic curve - P (U)	--	--	Indicate default characteristic
	Point a	--	0 – 100% P_n / U:0 V, ..., 264.5 V	100% P_n / U=207 V
	Point b	--	0 – 100% P_n / U:0 V, ..., 264.5 V	100% P_n / U=230 V
	Point c	--	0 – 100% P_n / U:0 V, ..., 264.5 V	100% P_n / U=253 V



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4.7.4.2.2 Zero current mode for converter connected generating technology	Point d	--	0 – 100%P _n / U:0 V, ...,264.5 V	0%P _n / U=264.5 V
	Time constant	--	3 s – 60 s	3.33 s
	Enabling	--	enable disable	disabled
	Static voltage range overvoltage	--	100 %U _n – 120 %U _n	120 %U _n
4.9.3 Requirements on voltage and frequency protection	Static voltage range undervoltage	--	20 %U _n – 100 %U _n	85 %U _n
	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	0.85U _n
	Undervoltage operate time stage 1	--	0.1 s – 100 s	100 s
	Undervoltage threshold stage 2	--	0.2 U _n – 1 U _n	0.5U _n
	Undervoltage operate time stage 2	--	0.1 s – 5 s	5 s
	Overvoltage threshold stage 1	--	1.0 U _n – 1.2 U _n	1.2U _n
	Overvoltage operate time stage 1	--	0.1 s – 100 s	100 s
	Overvoltage threshold stage 2	--	1.0 U _n – 1.3 U _n	1.3U _n
	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	1.1U _n
	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	