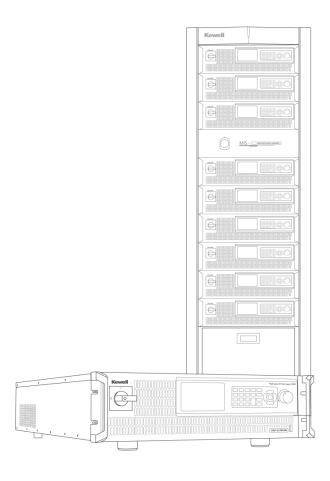
Stock Code: 688551

# **Kewell**



# **S7000 SERIES** REGENERATIVE PROGRAMMABLE DC POWER SOURCE

Jan. 2023 Version: A/6.1

KEWELL TECHNOLOGY CO,.LTD.

www.Kewelltest.com



# CONTENTS

1 Summary	1
2 External Conditions	1
3 Product Features	2
4 Typical Application	3
5 Product Specifications	4
6 Product Introduction	6
7 Product Design	12
8 Parallel Solutions	16
9 Reference Standards	20



## 1 Summary

S7000 Series is a high precision DC power source(hereinafter referred to as S7000 supporting energy regenerative feature.

As a DC source, it supports dual quadrant energy flow.

High conversion efficiency and high-power density. 3U-sized enables it to power up to 30kW and output voltage up to 2000V. Support parallel operation of multiple machines. Human-computer interface: Colorful touchscreen and knob. Can be applied in battery testing, battery storage inverter testing, electronic testing of EV etc.





## 2 External Conditions

To ensure that the equipment has suitable ambient conditions, the following items need to be met:

#### • Installation environment

The equipment protection level is IP20, please find a suitable place, and avoid dusty, dripping and raining.

The installation site needs to consider load bearing and size issues.

#### • Temperature

The storage temperature is  $-25^{\circ}$ C ~  $+50^{\circ}$ C, and the ambient temperature is  $0^{\circ}$ C ~  $+40^{\circ}$ C. Please ensure that the space has good ventilation conditions.

#### Humidity

The equipment should be used in a humidity environment of 0~90%RH, 25°C without condensation.

#### Altitude

The equipment should be used at an altitude lower than 2000m. For high altitude applications, it may cause overheating protection, which requires derating operation.

#### • Grid parameters

Three-phase four-wire system, rated voltage  $342 \sim 528$ Vac, grid frequency  $50 \pm 3$ Hz, grid capacity needs to meet the peak power of test power supply and auxiliary equipment.

## **3 Product Features**

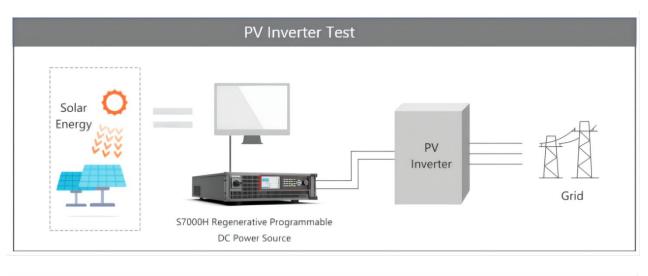
- Seamless bidirectional energy flow
- Output energy is efficiently fed back to the grid, energy saving and environment friendly
- High power density in 3U
- Human-computer interface: Colorful touchscreen and keypad
- Support standard RS485/CAN/LAN/USB communication interface, other interfaces could be modified
- Support AC voltage input world wildly: 342 VAC ~528 VAC
- High precision voltage and current output. Low ripple
- Comprehensive protection including OCP/OVP/OPP/OTP/input protection/ anti-islanding protection/ power fail protection etc.
- Multiple modes, constant voltage, constant current, multiple steps, etc.
- Support CC/CV setting
- Master/slave parallel expansion function
- Support solar panel I-V curve simulation
- Support battery charge and discharge test
- Support battery simulation

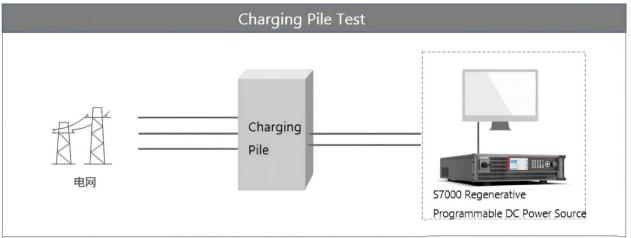
Kewell

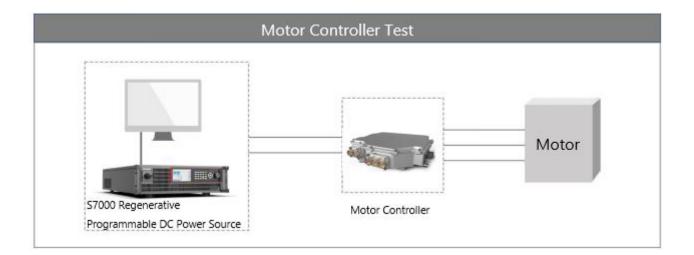


# **4** Typical Application

S7000 is mainly used for PCS test, photovoltaic inverters, energy storage converters, charging pile module test, motor controller test, it is an ideal power source for solar photovoltaic system testing and new energy vehicle testing.







# **5** Product Specifications

The specifications of the S7000 Regenerative Programmable DC Power Source are as follows:

Мс	odel	S7000- 15K-0750-00 80-G	S7000- 30K-0750-01 20-G	S7000- 15K-1500-00 40-G	S7000- 21K-2000-00 40-G	S7000- 30K-2000-00 40-G	S7000- 30K-2000-00 60-G
Datad	Voltage	750V	750V	1500V	2000V	2000V	2000V
Rated Values	Current	80A	120A	40A	40A	40A	60A
values	Power	15kW	30kW	15kW	21kW	30kW	30kW
Readba	Voltage	0.0	)1V		0	.1V	
ck	Current			0.0	01A		
Resoluti on	Power			1	W		
Accurac	Voltage			≤0.0	5%F.S.		
у	Current			≤0.1	% F.S.		
Line	Voltage			≤0.0	2%F.S.		
Regulati on	Current			≤0.0.	2%F.S.		
Load	Voltage			≤0.0	5%F.S.		
Regulati on	Current			≤0.0	5%F.S.		
	Voltage Vpp	< 3000mV					
Ripple	Voltage (rms)	< 300mV	< 300mV	< 400mV	< 400mV	< 400mV	< 400mV
	Current (rms)	< 100mA	< 100mA	< 35mA	< 35mA	< 35mA	< 60mA
	Voltage (No load)	0.001V/ms ~ 200V/ms					
Slew Rate	Voltage (Full load)	0.001V/ms	s ~ 30V/ms		0.001V/m	s ~ 90V/ms	-
	Current	0.001 ~ 40A/ms	0.001 ~ 60A/ms	0.001 ~ 20A/ms	0.001 ~ 20A/ms	0.001 ~ 20A/ms	0.001 ~ 20A/ms
Dynamic Time	Response		1	<	1ms	1	1
Voltage F (with load	luctuation	15%	15%	15%	10%	10%	15%
1.6	Voltage		1	342VAC	~ 528VAC		
AC Input	Freque ncy			47Hz	~ 63Hz		



	Maxim						
	um Cur	27A	53.8A	27A	37.8A	53.8A	53.8A
	rent						
	Maxim						
	umApp	16kVA	32kVA	16kVA	22.4kVA	32kVA	32kVA
	arent	IOK V/ C	JERVIN	IONVIA	LL.TRV/	SERVI	JERVIN
	Power						
Efficiency				≈S	95%		
Power Fac	ctor			> (	0.99		
Protection	١		OVP、OCP、OPP、	OTP、Anti-islanding	g protection、Revers	e polarity protection	
Communi	ication				JSB/Others (custom)		
Interface				K3403/LAN/CAN/C	JSB/Others (custoin)		
Ambient				0 ~	40°C		
Temperati	ure			0~	40 C		
Dimensior	ns (mm)			733(D)*445	(W)*132.5(H)		
Weight		≈45kg	≈50kg	≈45kg		≈50kg	

\*1: Voltage fluctuation amplitude for 0-50% sudden loading of resistive loads (voltage slope set to Max.)

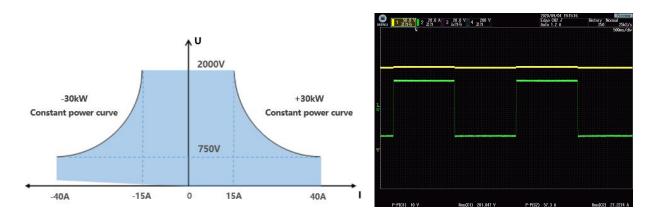
The above specifications are subject to change without notice.

## **Kewell**

## **6** Product Introduction

#### • Bidirectional DC power source

S7000 can effectively avoid voltage and current overshooting, and is widely applied in test of batteries, charging piles, energy storage converters, PCS and other fields.



#### • Multi-step operation:

Up to 999 work steps editable, work steps can be set in cycles.

Kowoll					ne interval 1	s 🔽 Sav	e Paramete	r Debug			🗢 Back
ower state Standby	DC source	Reading chart	IV curve								
Run Sys. sta.		0.	00	1	ſ	0.00	0		0		
			V			A			W		
Vork mode											
Stop CV	DC source	V simulation(IV)	Battery test(B	T) Battery s	imulation(BS)						
Stop CV CC	DC source	IV simulation(IV)		T) Battery s	imulation(BS)						
Stop CV CC Load		IV simulation(IV)	Battery test(B	T) Battery s	imulation(BS)				cle times 1	\$	
Stop CV CC	CV Mode CC Mode						) Current+(A) Curr	Cy ent (A) Power+(W)		un time(S)	1
Stop CV CC Load	CV Mode	cv	сс		<b></b>		) Current+(A) Curr				-
Stop CV CC Load	CV Mode CC Mode	<b>CV</b> U 0.0	cc t v	-	<b></b>		) Current - (A) Curr				-
Stop CV CC Load IV BT	CV Mode CC Mode	CV U 0.0 I(+) 0.00	CC V A	+	- Add		) Current - (A) Curr				Apply
Stop CV CC Load IV BT	CV Mode CC Mode	CV U 0.0 I(+) 0.00 I(-) 0.00	CC V A A	+	- Add		) Current+(A) Curr				Apply

#### • Battery simulation

Standard mode: parameter: [Initial Soc], [Discharge Limit], [Charge Limit], [Full Voltage], [Empty Voltage], [Battery Internal Resistance], [Capacity], [Number in Parallel], [Number in string] could be set for testing.



Kowoll			Time interva	11 💌	Save Para	meter Deb	oug Fault clear	Help	🔹 Bac
wer state	DC source Re	ading chart IV curve							
Standby									
Run									
	- F							1	
Sys. sta.		0.00		0	000		0		
Com. sta.		0.00		0.	000		0		
		V			A		W		
ork mode							b.		
Stop CV									
Stop CV D	X source IV s	imulation(IV) Battery test	(BT) Battery simulation	(BS)					
Stop	X source IV s	imulation(IV) Battery test	(BT) Battery simulation	(BS)					
Stop CV D		imulation(IV) Battery test Parameter set	(BT) Battery simulation	(BS)			Proce	ess display	
Stop CV D CC Load	Basic	Parameter set Initial SOC						soc	
Stop CV D CC Load		Parameter set	(87) Battery simulation Full voltage		Capacity	0 0		soc	Start
Stop CV D CC Load	Basic	Parameter set Initial SOC			Capacity	0 0		soc	Start
Stop CV D CC Load	Basic Constant	Parameter set Initial SOC		1.00 ‡ V	Capacity Number of parall			soc	🖛 (Rests
Stop CV D CC D Load IV BT	Basic Constant	Parameter set Initial SOC 0 \$% Charge voltage	Full voltage	1.00 ¢ V				50C	

Fixed battery type mode: Lithium manganese oxide, lithium cobalt oxide, lithium iron carbonate, nickel-metal hydride batteries, ternary lithium, lithium titanate and other battery types under standard single cell voltage could be selected for simulation.

Kowell				al 1: 🔻						🗢 Bac
and advanta			and the second		26040		en ag	A STATE OF T		
ower state	DC source R	leading chart IV curve								
Standby										
Run			_			_	_			
Sys. sta.							1			
Com. sta.		0.00			0.000			0	)	
com. sta.								V		
		10 M D.			505 0					
Stop										
Stop	DC source IV	simulation(IV) Battery tes	t(BT) Battery simulatio	m(BS)						
Stop CV	DC source IV :	simulation(IV) Battery tes	t(BT) Battery simulatio	in(BS).						
Stop CV CC			(BT) Battery simulatio	m(BS).		Battery paramete	r set		Process display	
Stop CV CC Load	DC source IV s Basic	simulation(IV) Battery tes Parameter set Initial SOC	(BT) Battery simulatio	en(BS)		Battery paramete	r set		Process display	
Stop CV CC Load		Parameter set	(BT) Battery simulatio	LCO V	No	Battery paramete	r set	v	Process display SOC 100-	► Start
Stop CV CC Load	Basic	Parameter set Initial SOC						_	SOC 100-	
Stop CV CC Load IV BT	Basic Constant	Parameter set Initial SOC	Battery types	LCO •	No	minal total voltage	0	v	SOC	a lint
Stop CV CC Load IV BT	Basic Constant	Parameter set Initial SOC 0 0 0 % Charge voltage 0.00 0 A	Battery types Number of parallel Number of serial	LCO •	No Sta	minal total voltage minal total capacity ndard cell voltage	0	V Ah V	SOC 100- 0-	Start
Stop CV CC Load IV BT BS	Basic Constant	Parameter set Initial SOC 0 0 % Charge voltage	Battery types Number of parallel	LCO •	No Sta Ah Sin	minal total voltage	0	V Ah	5OC 100-	a lint

Custom battery type: At a given temperature and SoC, fill in the open circuit voltage and internal resistance in the form, or load the Excel file written in advance, then set other parameters to start running.

Kowell			Time interval	15 💌						
ower state	DC source R	Reading chart IV curve	é							
Standby										
Sys. sta.		0.00	7		~ ~			~	1	
Com. sta.		0.00		0.0				0		
								W	-	
ork mode										
Stop CV	DC source IV	simulation(IV) Battery tes	t(BT) Battery simulation(E	35)						
Stop CV CC	DC source IV	simulation(IV) Battery tes	t(BT) Battery simulation(B	35)						
Stop CV CC Load	DC source IV Basic	simulation(IV) Battery tes Parameter set Initial SOC	t(BT) Battery simulation(E Number of parallel	35) Voc set	R set	Model		Process		
Stop CV CC Load		Parameter set		Voc set	R set	Model	4 5		display SOC	► Start
Stop CV CC Load	Basic	Parameter set Initial SOC 0 \$% Charge voltage	Number of parallel	Voc set Soc(%) T(%) -10		Model	6 5	s		Start
Stop CV CC Load IV BT	Basic Constant	Parameter set Initial SOC	Number of parallel	Voc set Soc(%) T(°C) 0 -10 ▼ -9 -8		Model	4 5	100-	ioc	
Stop CV CC Load IV BT BS	Basic Constant	Parameter set Initial SOC 0 \$% Charge voltage	Number of parallel	Voc set Soc(%) T(°C) 0 -10 -9 -8 -7 -7		Model	4 5	s	0	- Resto

#### Battery Pack Charge-discharge Function

Static charging mode: parameters such as charging voltage, charging current and charging power can be set,

while the charging cut-off conditions including end-of-charge current, capacity and time can be set.

Kowoll					1s 🔻		Parameter				🗢 Back
ower state	DC source	Reading chart	IV curve								
Standby											
Run							_			_	
Sys. sta.			-								
Com. sta.		0.0	0			0.000					
					-					1 A A A A A A A A A A A A A A A A A A A	
ork mode											
Stop											
Stop	DC source	V simulation(IV) Ba	attery test(BT)	Battery simulation(	BS)						
Stop CV CC	DC source	V simulation(IV) Ba		Battery simulation(			Data di	splay			
Stop CV CC Load			set	Stop con	ditions	A			Ab		
Stop CV CC Load	Charging	Parameter Voltage 200.0	set		ditions	A	Capacity	0.00	Ah		► Start
Stop CV CC Load IV BT	Charging Discharging	Parameter Voltage 200.0 Current	set C v	Stop con Charge end current	ditions			0.00	Ah kwh		Start
Stop CV CC Load IV BT	Charging Discharging	Parameter Voltage 200.0 Current 0.00 Power limit	set C V C A	Stop con Charge end current Enable Ah lin Charge capacity End time limi	0.00         0)           nit         10.00         0)           it         10.00         0)	Ah	Capacity	0.00			
Stop CV CC Load IV BT BS	Charging Discharging	Parameter Voltage 200.0 Current 0.00 Power limit	set v A	Stop con Charge end current Enable Ah lin Charge capacity End time limi	0.00 C	Ah	Capacity Energy	0.00	kWh		a Restore

Static discharging mode: parameters such as discharge current and discharge power can be set, as well as discharge cut-off conditions including end-of-discharge voltage, capacity and time.

Kowell			Time interval 🚺 🔽 Sav	e Parameter	Debug Fault clea	ar Help <table-cell-rows> B</table-cell-rows>	Back
ower state	DC source	Reading chart IV curve					
Standby							
Run				_		_	
Sys. sta.		0.00	0.00				
Com. sta.		0.00	0.00				
ork mode							
Stop							
Stop							
	00		The second s				
cv	DC source	V simulation(IV) Battery test(E	Battery simulation(BS)				
cv	DC source	V simulation(IV) Battery test(E Parameter set	BT Battery simulation(BS) Stop conditions	Data display			
CV CC Load		Parameter set Voltage		Data display Capacity 0.00	Ah	► Sta	art
CV CC Load	Charging	Parameter set	Stop conditions Charge end current 0.00 C A Enable Ah limit				
CV CC Load IV BT	Charging Discharging	Parameter set Voltage 200.0 V Current 0.00 A	Stop conditions Charge end current 0.00 2 A Charge capacity 10.00 2 A	Capacity 0.00 Energy 0.00	kWh	ei Re	store
CV CC Load IV BT	Charging Discharging	Parameter set Voltage Current 0.00 \$ A Power limit	Stop conditions Charge end current 0.00 C A Enable Ah limit Charge engacity 10.00 C Ah End time limit	Capacity 0.00 Energy 0.00 Elapsed time 00.00	kWh		store
CV CC Load IV BT BS	Charging Discharging	Parameter set Voltage 200.0 V Current 0.00 A	Stop conditions Charge end current 0.00 2 A Charge capacity 10.00 2 A	Capacity 0.00 Energy 0.00 Elapsed time 00.00	kWh	ei Re	istore use

The battery test mode: allows to set parameters such as static charging and discharging mode and resting time to simulate several operating conditions.

Kowoll					Time interv	al 1s 💌	Save	Parameter	Debug	Fault clear	Help	🔹 Baci
wer state	DC source	Reading char	t IV curve									
Standby												
Run				_				_	_		_	
Sys. sta.			1000	7			2000			1000		
Com. sta.		(	0.00				0.000			0		
			V				A			W		
		100 C				0						
ork mode												
Stop												
Stop CV	DC source	IV simulation(I	V) Battery test	(BT) Batte	ry simulation	n(BS)						
Stop CV CC			V) Battery test		ry simulation	n(BS)		Step para. End o	cond.			
Stop CV CC Load	Charging	Charge Dis Voltage					0.00 Ah	Step para. End o	cond.	Cycle time	s 1 ¢	]
Stop CV CC Load	Charoing	Charge Dis Voltage	charge Standing			t capacity (	0.00 Ah Parameter set	Test energy [		Cycle time	s 1 🗘	
Stop CV CC Load	Charging	Charge Dis Voltage	charge Standing 0.0 C V 0.00 C A 0 C W		Tes	t capacity (		Test energy [	0.00 kWh	Cycle time		
Stop CV CC Load IV BT	Charging Discharging	Charge Dis Voltage Current Power limit End time limit	0.0 ℃ V 0.00 ℃ A 0 ℃ W 1 ℃ s		Tes	t capacity 0		Test energy [	0.00 kWh	Cycle time		
Stop CV CC Load IV BT	Charging Discharging	Charge Dis Voltage Current Power limit End time limit End curr.	ohange         Standing           0.0         \$           0.00         \$           0         \$           0         \$           0         \$           0         \$           0         \$           0         \$           0         \$           0         \$           0         \$           0         \$           0         \$	1 0	Tes + Add Insert	t capacity 0		Test energy [	0.00 kWh	Cycle time		
ork mode Stop CV CC Load IV BT BS	Charging Discharging	Charge Dis Voltage Current Power limit End time limit	0.0 ℃ V 0.00 ℃ A 0 ℃ W 1 ℃ s		Tes	t capacity 0		Test energy [	0.00 kWh	Cycle time		

#### • IV simulation

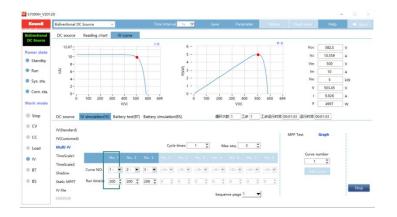
Photovoltaic array simulation

Three modes: single-point, double-point and multi-point setting

Cowoll	Bidirectional DC St	surce	<u>×</u>	Time inte	erval 1s. 💌	Stop	Parameter	Celana.	Fault clear.	н	leip	04.00
lirectional C Source		leading chart	IV curve	1-V				P-V				
wer state	12.13*				6 -				Voc	520.4	49	v
	10-				5 -			1	Isc	10.1	12	A
Standby	8-			1	4 -		/		Vm	500	0	v
Run	₹ 6-				6 MM				Im	10	1	A
Svs. sta.	4-				2 -	/			Pm	5		kW
	2-				1-				v	496.0	64	v
Com. sta.	0-,				0 - 1		300 400			10.05	52	A
rk mode	0	100 200	V(V)	00 624.6	0	100 200	300 400 V(V)	500 624.6	P	499	12	w
rk mode Stop CV CC		simulation(IV)								499 Graph	12	w
Stop CV CC	DC source IV IV(Standard)	simulation(IV) Single I	V(V) Battery test(BT) Double Multi				V(V)	lata I	P MPP Test	Graph	12	w
Stop CV CC Load	DC source IV IV(Standard) IV(Customed) Multi-IV	simulation(IV) Single I Standard Ve	V(V) Battery test(BT) Double Multi m 500 V	Battery simula Irr.	tion(BS)	Batt	V(V) eery data Cycle d 520,49	lata I V Tot	P MPP Test	Graph		w
Stop CV CC Load	DC source IV IV(Standard) IV(Customed) Multi-IV TimeScale1	simulation(IV) Single I Standard Vr 3-points In	V(V) Battery test(BT) Double Multi m 500 V n 10 A	Battery simula Irr.		Batt Voc Isc	V(V) ery data Cycle d 520.49 10.112	lata I V Tot A Elaj	P MPP Test tal time psed time	Graph 300		w
Stop CV CC Load	DC source IV IV(Standard) IV(Customed) Multi-IV TimeScale1 TimeScale2	simulation(IV) Single I Standard Ve	V(V) Battery test(BT) Double Multi m 500 ° V m 10 ° A F 0.95 °	Battery simular	tion(BS)	Batt	V(V) ery data Cycle d 520.49 10.112	lata Tot A Elaj V Effi	P MPP Test Lal time psed time iciency	Graph 300 300 99.84	: : %	
Stop CV	DC source IV IV(Standard) IV(Customed) Multi-IV TimeScale1	simulation(IV) Single I Standard Vr 3-points In	V(V) Battery test(BT) Double Multi m 500 V n 10 A	Battery simula Irr. TC	tion(BS)	Batt Voc Isc Vm	V(V) ery data Cycle d 520.49 10.112 500	lata Tot A Elaj V Effi A P.A	P MPP Test tal time psed time	Graph 300 300	::	Apply

#### • Multi-step IV mode

Up to 100 IV curves can be set up, with the option to import IV curve files to run.



#### • Shadow condition (Multimodal shadow curve) function

S7000 can simulate the IV curve (Multimodal shadow curve) under the shade of the solar panel. The user can set the irradiance, temperature, array type and shadow movement direction of different components.

	Bidirectional DC	Source ~		Time interva	1s 💌	Stop	Parameter 0		100	Help	<ul> <li>Last</li> </ul>
rectional Source	DC source	Reading chart	IV curve								
	17.1-			1-V	4.6 -			P-V	Voc	560.92	v
er state	15-				4 -	/	•		Isc	14.248	A
itandby	10.				3 -	/	1		Vm	313.58	v
tun	₫ 7.5-				(WX)d 2 -	/			Im	12.12	A
ys. sta.	5-				1 -	/			Pm	3.801	kW
om. sta.	2.5-				/		1		v	310.24	v
.om. sta.	0-,	100 200 300	400 500	600 673.1	0 - 0	100 200 30	400 500	600 673.1	10	12.223	A
k mode			V(V)				V(V)		P	3792	w
Stop	DC source	Parameter set	attery test(BT) B	attery simulation	,85)		Shadow Moving	MPP Test		Graph	
C	IV(Customed)	Irr.		string Num. of PV		Contraction and	shadow moving				
oad	Multi-IV	1000 💲 W/m	6 📮	16 🚆	Clear	ClearAll	Data size	Total time	10	10 🛟 s	
v	TimeScale1	TC					128 ~ Shadow color	Elapsed time	1	00 s	
	TimeScale2	25 🛟 °C Voc		╺┝╼╁╾╋╼╋	╅┽┿┿╸			Efficiency	95	96	
*							Shadow Irr.	P Average	3.	799 ki	Apply
	Shadow	40 🗘 V									
at BS	Shadow Static MPPT	40 C V Vm 30 C V					0 C	W/m <sup>2</sup> Energy	0	.11 ki	Mh



### • Time scaling

S7000 can simulate the typical output changes of solar panels in a given time to shorten the test time. The characteristic mode, array type, irradiance change and temperature parameters can be set.

	Bidirectional DC Source v	Time Interval 1s Stop Parameter	Debug Fault clear	Help 🔷 Tack
directional OC Source	DC source Reading chart IV curve			
AC Source	12.13*	1-V 3.6 =	P-V Voc	312.3 V
wer state	10-	3-	lsc	10.112 A
Standby	8-	25 -	Vm	300 V
Run	₫ 6-	60 2 - 92 1.5 -	Im	10 A
Sys. sta.	4-	1.	Pm	3 kw
	2-	0.5 -	v	298.14 V
Com. sta.	0- 0 50 100 150 200 250 300	374.8 0 50 100 150 200 250 300	374.8	10.014 A
ork mode	0 50 100 150 200 250 300 V(V)	374.8 0 50 100 150 200 250 300 V(V)	374.0 P	2985 W
CC Load	IV(Customed)         Biggle         Double         Multi           Multi-IV         Image: Could and the second ando	Setting Battery data Cycle times 1 2 Correct Curved	Elapsed time	Graph 100 \$ s 100 \$ 99.33 % 2.98 kW Appy
BT	Shadow IF Cars \$		Energy	0.08 kWh

#### • Static MPPT test

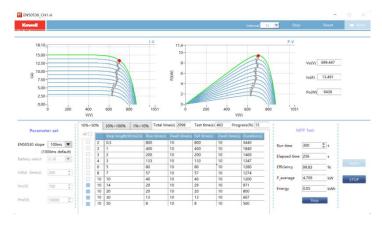
Single or multi-step configuration mode can be set to test static MPPT performance.

Kowoll	Bidirectional DO	Source	×			iterval <u>Ts</u>							1.000
idirectional DC Source	DC source	Reading char	rt IV	curve									
	3.64;				I-V	1.2 -			P-V	v	oc [	411.57	v
ower state	3-	_	-	-		1 -		1			Isc	3.037	A
Standby	2.5-					0.8 -					m	350	v
Run	3 2-					(M) 0.6 -		/	1		Im	2.857	A
Sys. sta.	1-					0.4 -	/			F	m	1	kW
Com. sta.	0.5-					0,2 -	/				v	351.68	v
	0-					0		5 A 1 1 1 A 1			ъE	2.845	4
		100	200	300 400	493.9	0	100						
Vork mode	ō		v	300 400 N)	493.9	ō	100	200 300 V(V)	400 493.5		P	1000	w
Vork mode Stop CV CC	ō		V V) Batte		attery simula	ō			工步运行时间 0		間 00:0 G	1000 04:00 iraph	w
Stop CV CC	0 DC source IV(Standard)	V simulation( Parameter r Irr.	V Batte	W) ry test(BT) Ba Config mode [] tep run time []	attery simula	0 lation(BS)	Man 🔻 )	V(V)	工步运行时间 0 hefa マ	0.04:00 (\$179)	图 00:0	1000 04:00 ireph	w
Stop CV CC Load	0 DC source IV(Standard) IV(Customed)	V simulation( Parameter r Irr.	V Batte	W) ny test(BT) Ba lonfig mode [])	attery simula	0 lation(BS) MPPT enable [	Man 🔻 )	VIV)	工步运行时间 00 	0.04:00 (\$1787 MPP Test	間 00:0 G	1000 04:00 iraph 0 0 5	w
Stop CV CC Load	0 DC source IV(Standard) IV(Customed) Multi-IV	V simulation() Parameter 1 Irr. 1000 TC	V Batte	W) ny test(8T) Ba Config mode [N tep run time [1] evel(V)	attery simula	0 lation(BS) MPPT enable [	Man 🔻 )	VIV)	工建造行时间 00 efa ▼ 0 ① Te Ela	MPP Test	間 00:0 G 100	1000 04:00 iraph 0 \$ \$ 20 \$	
CV CC Load	Ö DC source IV(Standard) IV(Customed) Multi-IV TimeScale1	V simulation() Parameter 1 Irr. 1000 * TC 25 * Fre	V Batte	M) ny test(81) Ba lonfig mode [] tep run time [] evel(V) 2	attery simula	0 lation(BS) MPPT enable [	Man 🔻 )	VIV)	Ibitikijatum (od organizacija organizacija biti bitikijatum bitiki	MPP Test tal time	G 100 100	1000 04:00 iraph 0 \$ \$ 20 \$ .96 \$6	
D Stop CV	0 DC source IV(Standard) IV(Customed) Mubi-IV TimeScale1 TimeScale2	V simulation() Parameter 1 Irr. 1000 * TC 25 * Fre	V Batte	M) ry test(BT) Ba config mode N tep run time 11 evel(V) D	attery simula	0 lation(BS) MPPT enable [	Man 🔻 )	VIV)	Ibrikifetia o o c c c c c c c c c c c c c c c c c c	MPP Test tal time [ ficiency [	間 00:0 G 100 10 99.	1000 04:00 iraph 0 \$ \$ 30 \$ 96 %	Appl

Static MPPT test

#### • Dynamic MPPT test

The built-in dynamic test environment according to EN 50530, with three power bands "1%-10%", "10%-50%" and "30%-100%", enables detailed testing of the dynamic tracking performance of the PV inverter.

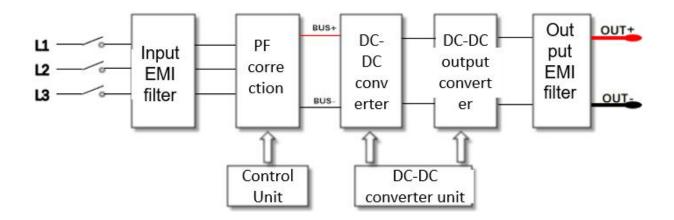


Dynamic MPPT test

## 7 Product Design

## 7.1 Main Electrical Units

The system topology is divided into four stages. From left to right, are input EMI filter unit, power correction unit, DC-DC converter unit and output EMI filter unit.



#### 7.1.1 Input EMI Filter Unit

The input EMI filter circuit includes anti-inrush devices, differential mode, common mode filters, etc. In the event of lightning strikes or other high-voltage inrush, varistors and transient voltage suppressors can protect the converter from it. The differential mode filter and common mode filter can effectively suppress the high-frequency noise generated inside the module, prevent the interference from the input side from affecting the operation of the unit.

### 7.1.2 Power Factor Correction Unit

The three-phase power factor calibration unit is based on the dq control model, which realizes bi-directional energy flow by changing the phase of the inverter side, and the power factor >0.99 under full power. By harmonic compensation processing, it could achieve THD <5% under full range (380VAC or 480VAC input).

#### 7.1.3 DC-DC Converter Unit

This unit improves the power density, reduces the output leakage voltage and output ripple. Make it is possible to switch, upgrade, and expand different modes.

Output EMI Filter Unit

The multi-level LC parallel structure and the multi-level EMC filter circuit are configured on the output EMI filter board, which can achieve voltage ripple less than 0.2% F.S. and current ripple less than 50mA (RMS).

### 7.2 Software Introduction

The power source has multiple operation modes like: local operation, remote operation and integrated control (via communication protocol).

#### 7.2.1 Local Operation

The power source is equipped with LCD screen. The operation modes include DC power source, battery simulation, battery pack charge-discharge, IV simulation etc.

#### 7.2.2 Remote Operation

The power source is equipped with an Ethernet interface and the software adopts the Modbus TCPIP communication protocol. Seamless connection to software based on the standard Modbus communication protocol.

The power source is equipped with RS-485/USB interface and the software adopts the Modbus RTU communication protocol. Seamless connection to software based on the standard Modbus communication protocol.

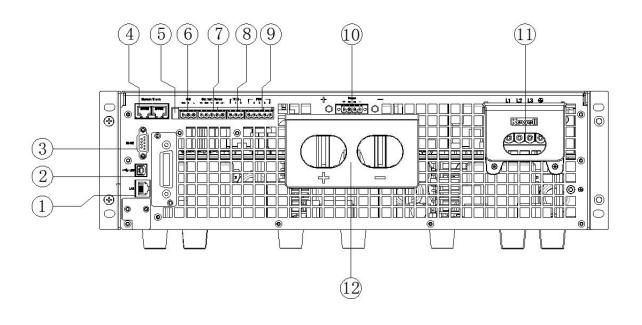
The Controller Area Network (CAN) is a serial communication protocol bus for real-time applications that uses twisted pair cables to transmit signals and is one of the most widely used fieldbuses in the world. The standard CAN communication interface allows the user to configure the functional parameters of the power source for remote control.

The power source supports the standard CAN 2.0 communication protocol using the extended frame type (CAN data frames using 29 bit identifiers). The data communication format is Intel format ( that is, the low byte comes first and the high byte comes second). The protocol is divided into two main types of data forms: status information uploaded by the communication board at regular intervals and parameters set by remote control via the upper computer.

The operating system's upper computer software is suitable for running on platforms such as Microsoft Windows, including Windows 7, Windows 10, etc.

## 7.3 Interface Introduction

S7000 Regenerative Programmable DC Power Source as Follows:

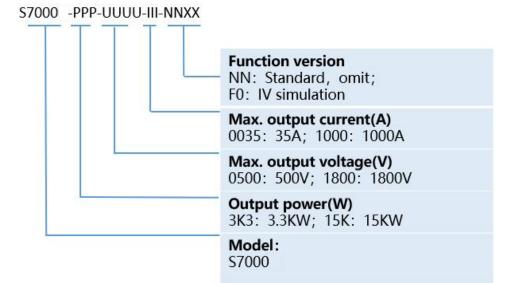


No.	Interface Figure	Description
1		CAN communication
2		LAN communication
3	R\$485 0	RS485 communication
4		DC output
5		DIP switch
6	Master/Slave	Parallel network



7	Current Sense	Total current sampling (Not open yet)
8	TRIG 123	synchronizing signal (Not open yet)
9	FUNC 1 2 3 4 5	External multi-function interface
10	Sense	Voltage drop compensation
11		AC input
12		DC output

## 8 Parallel Solutions



#### S7000 naming rule

Model	Voltage U	Current A	Power kW	Dimension
S7000-18K-0100-0600-G	100	600	18	3U
S7000-15K-750-0080-G	750	80	15	3U
S7000-30K-750-0120-G	750	120	30	3U
S7000-15K-1500-0040-G	1500	40	15	3U
S7000-21K-2000-0040-G	2000	40	21	3U
S7000-30K-2000-0040-G	2000	40	30	3U
S7000-30K-2000-0060-G	2000	60	30	3U

#### S7000 series stand-alone model

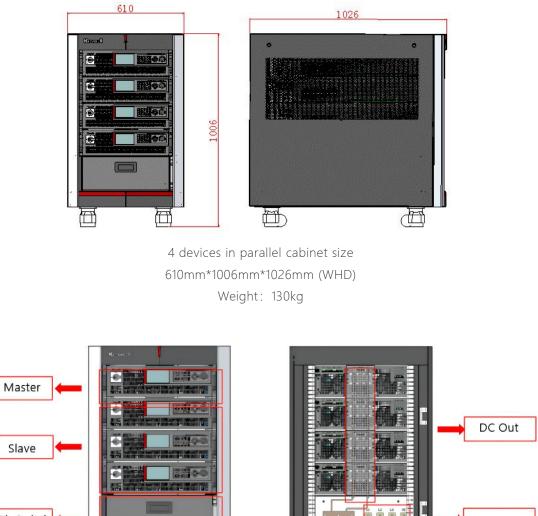
Model	Specification	Application
Cabinet	HK-15U Cabinet	for 2-4 parallel
Cabinet	HK-29U Cabinet	for 5-8 parallel
Cabinet	HK-42U Cabinet	for 9-10 parallel

S7000 parallel specifications

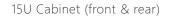
#### • Four devices in parallel

This solution consists of four S7000-30K and one HK-15U cabinet, total power 120kW and current up to 240A.

Component	Model	Quantity	Note
Degenerative DC Dewer			Voltage: 2000V
Regenerative DC Power	S7000-30K-2000-0040-G	4	Current: 60A
Source			Power: 30kW
Cabinet	HK-15U Cabinet	1	for 2-4 parallel



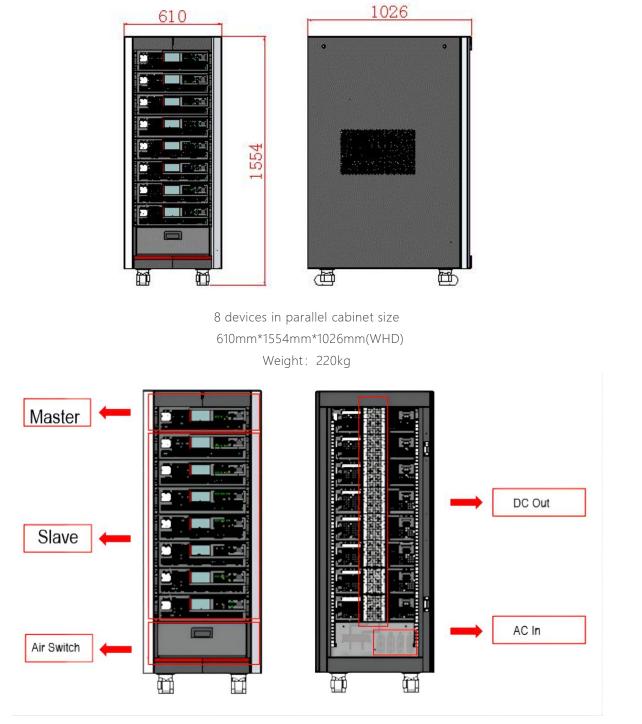




### • Eight devices in parallel

This solution consists of eight S7000-30K and one HK-29U cabinet, total power 240kW and current up to 480A.

Component	Model	Quantity	Note
Degenerative DC Dewer			Voltage: 2000V
Regenerative DC Power Source	S7000-30K-2000-0060-G	8	Current: 60A
Source			Power: 30KW
Cabinet	HK-29U Cabinet	1	for 5-8 parallel



29U Cabinet (front & rear)

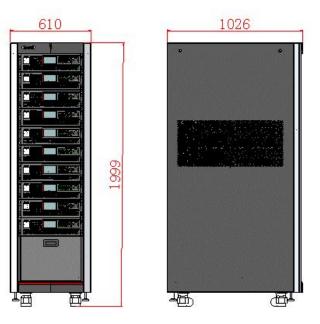
## • Ten devices in parallel

This solution consists of ten S7000-30K and one HK-42U cabinet, total power 300kW and current up to 600A.

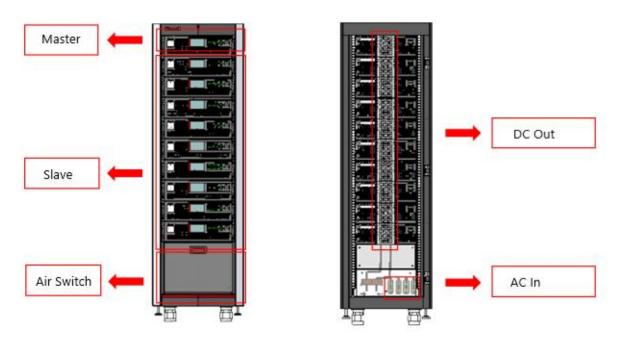
## Kewell

#### S7000 Series Regenerative Programmable DC Power Source

Component	Model	Quantity	Note
Demonstine DC Demon			Voltage: 2000V
Regenerative DC Power	S7000-30K-2000-0060-G	10	Current: 60A
Source			Power: 30KW
Cabinet	HK-42U Cabinet	1	for 9-10 parallel



10 devices in parallel cabinet size 610mm\*1999mm\*1026mm (WHD) Weight: 280kg



42U Cabinet (front & rear)



# 9 Reference Standards

No.	Standard/Document Number	Standard / File name
1		Code for Design of Electric Distribution of General-purpose Utilization
1	GB 50055-2011	Equipment
2	GB 50054-2011	Code for Design of Low Voltage Electrical Installations
2	CD/T 4700	Environmental Conditions Existing in the Application of Electric and Electronic
3	GB/T 4798	Products-Storage
4	GB/T 3859.1-2013	Semiconductor Convertors Specification of Basic Requirements
5	GB/T 3859.2-2013	Semiconductor Convertors Application Guide
6	GB/T 3859.3-2013	Semiconductor Convertors Transformers and Reactors
7	NB/T 32004-2018	Technical Specifications of PV Grid-connected Inverter
		Electrical Equipment of Industrial Machines Insulation Resistance Test
8	GB/T 24343-2009	Specifications
9	GB 4208-2008	Degrees of Protection Provided by Enclosure
10	CD/T 20050 2014	Safety of Machinery- Guidelines for the Understanding and Use of Safety of
10	GB/T 20850-2014	Machinery Standards
11	BSEN 62477-1-2012+A11-2014	Safety Requirements for Power Electronic Convertor Systems and Equipment
12	EN ISO 13849-1-2015	Safety of Machinery - Safety-related Parts of Control Systems - Part 1: General
12		Principles for Design
13	EN IEC 61000-6-2:2019	Electromagnetic compatibility (EMC) - Part 6-2: Generic
		standards - Immunity standard for industrial environments
14	EN IEC 61000-6-4-2019	Electromagnetic compatibility (EMC) - Part 6-4: Generic
		standards - Emission standard for industrial environments
15	IEC/EN 62477-1:2012	Safety requirements for power electronic converter systems and equipment
		–Part 1: General
16	EN ISO 13849-1:2015	Safety of machinery Safety-related parts of control systems Part 1 : General
		principles for design
47	15.5 51000 0 4 0000	Electromagnetic compatibility (EMC) –Part 2-4:
17	IEC 61000-2-4:2002	Environment – Compatibility levels in industrial
		plants for low-frequency conducted disturbances
18	EN 61800-3:2004+A1:2012	Adjustable speed electrical power drive systems —
		Part 3: EMC requirements and specific test methods
19	IEC/EN 61010-1:2020	Safety requirements for electrical equipment for measurement, control, and laboratory use Part 1: General requirements
		Uninterruptible power systems (UPS)
20	EN 62040-1:2008+A1:2013	Part 1: General and safety requirements for UPS
		Electromagnetic Compatibility (EMC) - Part 6-3: Generic Standards - Emission
21	IEC 61000-6-3:2011	Standard for Industrial Environments
22	IEC 61010-2:2010	Safety Requirements for Electrical Equipment for Measurement, Control, and
		, , , , , , , , , , , , , , , , , , ,



		Laboratory Use- Part 2: General Requirements
23	IEC 60204-1-2016	Safety of Machinery- Electrical Equipment of Machines- Part 1: General
25		Requirements