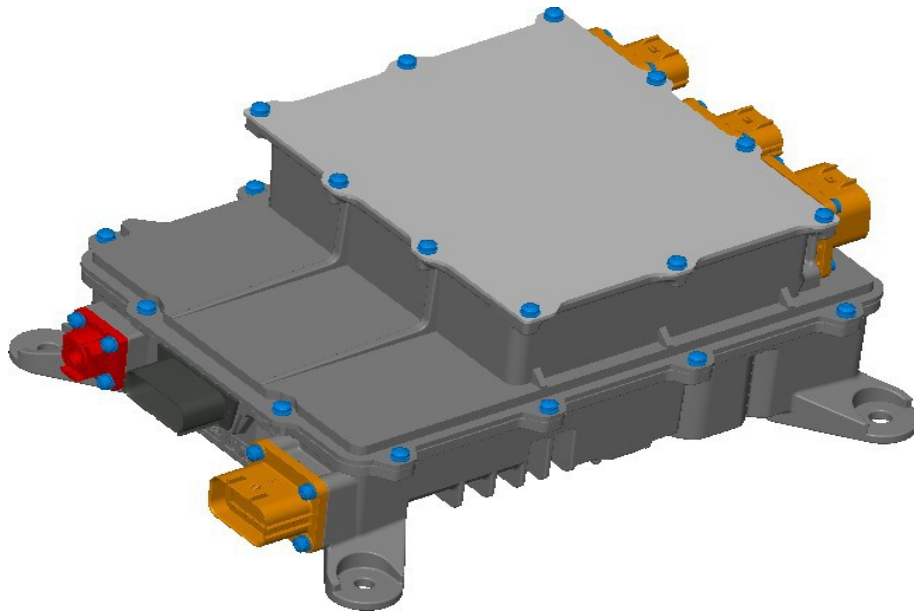




3 in 1 PDU+1KW DC/DC + 3.3KW OBC 96V Forced air cooling system **ATPD1KC3K3-96S12-A-CDU66332102**



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1. Overview

1.1 Summary

This product is a three-in-one assembly of on-board charging, DCDC converter and Power Distribution Unit developed for new energy vehicles, with the characteristics of high integration and high power density. The main function of the on-board charger (OBC) is to obtain energy from the 220V AC power supply to charge the high-voltage power battery in the vehicle. During the charging process, the power battery management system monitors the charging status in real time. The OBC responds to the voltage and current commands given by the BMS, and provides status feedback to achieve self-diagnosis. The main function of the DC/DC is to convert the high-voltage DC power of the power battery pack into 13.8V low-voltage DC power to charge LV battery and power the vehicle accessory system. The main function of the PDU is to integrate the high-voltage power distribution system of the entire vehicle. The product uses a cast aluminum shell and connectors, and the protection level reaches IP67.

1.2 Industry Terminology

Serial number	Terms or abbreviations	illustrate
1	BMS	Battery Management System
2	ADS	Auto-Disconnect System
3	SOC	State of Charge
4	CAN	Controller Area Network
5	ECU	Electronic Control Unit
6	EV	Electric Vehicle
7	OBC	On Board Charger
8	DCDC	DC-DC Converter
9	PDU	Power Distribution Unit



10	HV	High Voltage
11	LV	Low Voltage
12	CC	Constant Current
13	CV	Constant Voltage
13	MCU	Motor Control Unit
14	VCU	Vehicle Control Unit
15	CAN	Controller Area Network
16	UDS	Unified Diagnostic Services
17	ASIL	Automotive Safety Integrity Level
18	HVIL	High Voltage Interlock Loop

1.3 Introduction to the main functions of the system 1.3.1

1.31.OBC Module Function

OBC is mainly used to realize power conversion control, convert AC power into DC power to charge the power battery, and realize basic charging functions.

The main functions include: power on and off function, enable output wake-up function, disconnect output wake-up function, CC detection function, CP detection function, S2 switch control function, maximum output capacity judgment function, charging start and time control function, charging end and current cut-off control function, charging input current control function, charging output current and voltage control function, charging mode confirmation and switching function, power grid power failure recovery function, charging interoperability requirements, temperature detection function, normal power supply detection function, CAN communication function, Bootloader program flashing and UDS diagnosis function, fault handling function, self-holding function, self- sleep function and CC-OUT self-output function.

1.3.2 DC-DC Converter Function

DC/DC is mainly used to convert the high-voltage DC power of the power battery into low- voltage DC power to charge the 12V battery and power the low-voltage electrical appliances in the car.

The main functions include: power on and off function, on and off control function, temperature detection function, normal power supply detection function, CAN communication function, Bootloader program flashing and UDS diagnosis function, fault handling function, self-holding function and self-sleep function.

1.3.3 PDU Function

Distributes power for high-voltage electrical equipment in the vehicle (air conditioning, PTC, OBC & DC/DC), integrating PTC relays, copper bars, and fuses for various high-voltage modules.

1.3.4 Cooling method: Forced air cooling



2. Reference Standards.

The reference standards of this technical requirement include but are not limited to the following standards. Regardless of whether the following standard documents are marked with a date, the latest version

(including all amendments) applies to this technical requirement.

Serial number	Standard/Document No.	Standard/File Name	Remark
1	GB 14023	Limits and methods of measurement of radio disturbance characteristics of vehicles, ships and internal combustion engines for the protection of off-board receivers	Latest version
2	GB/T 17619	Electromagnetic radiation immunity limits and measurement methods for electronic and electrical components in motor vehicles	Latest version
3	GB/T 18384.1	Electric vehicles - Safety requirements - Part 1: On-board energy storage devices	Latest version
4	GB/T 18384.2	Electric vehicles - Safety requirements - Part 2: Functional safety and fault protection	Latest version
5	GB/T 18384.3	Electric vehicles - Safety requirements - Part 3: Protection of persons against electric shock	Latest version
6	GB/T 18387	Limits and measurement methods for electromagnetic field emission intensity of electric vehicles, width, 9KHz~30MHz	Latest version
7	GB/T 18487.1	Electric vehicle conductive charging system Part 1: General requirements	Latest version
8	GB/T 2423.1	Environmental testing for electrical and electronic products Part 2: Test methods Test A: Low temperature	Latest version
9	GB/T 2423.2	Environmental testing for electric and electronic products Part 2: Test methods Test B: High temperature	Latest version
10	GB/T 2423.10	Environmental testing for electrical and electronic products Part 2: Test methods Test Fc: Vibration (sinusoidal)	Latest version
11	GB/T 2423.17	Environmental testing for electrical and electronic products Part 2: Test methods Test Ka: Salt spray	Latest version
12	GB/T 2423.22	Environmental testing for electric and electronic products Part 2: Test methods Test N: Temperature change	Latest version
13	GB/T 24347-2009	Electric Vehicle DC/DC Converter	Latest version



14	GB/T 25085	Road Vehicles 60V and 600V Single Core Cables	Latest version
15	GB/T 28046.2	Road vehicles Environmental conditions and testing for electrical and electronic equipment Part 2 Electrical loads	Latest version
16	GB/T 31465.6	Road vehicles - Fuses - Part 6: Bolt-on high- voltage fuses	Latest version
17	GB/T 37133	Technical requirements for high voltage and high current wiring harnesses and connectors for electric vehicles	Latest version
18	GB/T 4094.2	Signs for electric vehicle controls, indicators and signal devices	Latest version
19	QC/T 1037	High voltage cables for road vehicles	Latest version
20	QC/T 29106	Technical requirements for automotive wiring harnesses	Latest version
21	QC/T 413-2002	Basic technical requirements for automotive electrical equipment	Latest version
22	QC/T 895-2011	Conductive on-board charger for electric vehicles	Latest version
23	IEC 61851-1	Technical Committee on Electric Road Vehicles - General Requirements for Charging Systems	Latest version

3. Application Environment

The operating environment conditions of the assembly are as follows:

Items	project	Parameter	unit	Remark
1	Operating temperature	-40~+55	°C	
2	Storage temperature	-40~+95	°C	The power supply is not on
3	Relative humidity	5~95	%RH	No condensation
4	Protect on level	IP67		
5	Cooling method	Forced air cooling		
6	Vibration level	10~25Hz amplitude 1.2mm, 25 ~ 500Hz 30m/s ² , XYZ directions, 8 hours in each direction		
7	Noise level	≤65	dB	Under normal input and full load
8	Salt spray level	NaCl, 50g/l, PH: 6.5 ~7.2, continuous spraying for 48h		
9	Altitude	≤2000	m	



4. Technical Specifications

4.1 OBC electrical performance requirements

Item		Min	Typ	Max	Unit	Conditions
OBC Electrical Characteristics						
1、 Input characteristics						
Rated input voltage		-	220	-	Vac	
Input voltage range		90	-	264	Vac	Normal operating voltage range
Maximum input current		-	-	16	A	
AC input voltage frequency		47	50	63	Hz	
Power Factor (PF)		0.98	-	-	-	@50%~100% load
Static power consumption when not in operation		-	-	8	W	
Starting surge current (%)		-	-	150	%	Charger startup surge current (input current) Should not be greater than the % of the maximum input current during operation
Discharge capacity of input capacitor		-	2	-	S	Under AC input, the voltage drops to 60V within 3S after power failure.
2、 Output Characteristics						
High voltage output	Rated output voltage	115			Vdc	
	Output voltage range	60	-	144	Vdc	The output will automatically reduce power when the input is 110Va. The output can run at full power when the input is 220Vac
	Output current range	0	-	34	A	
	Output rated power	-	3.3	-	kW	
	Output ripple and noise	-	±4	-	%Vo	
	Start-up time	-	4	-	S	After OBC receives the charging request from BMS, the output voltage rises from 10% to 90%

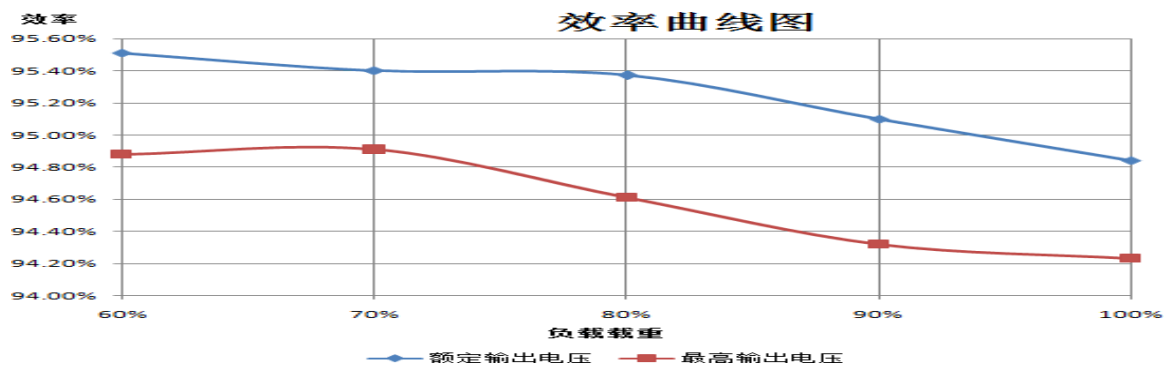


	Output Fall Time	-	500	-	mS	After receiving the shutdown command, the current drops below 10% within 300ms and drops to 0A within 500ms	
	Switching overshoot	-	-	5	%Vo		
	Output constant voltage accuracy	-	-	1	%		
	Output current accuracy	-	-	4	%	Maximum not exceeding $\pm 0.5A$	
	Static current consumption	-	-	1	mA	Sleep mode without gun plugged in, consumes KL30 normal current	
	Maximum efficiency of the whole machine	-	94	-	%		
3、Protection features							
	Input overvoltage protection	-	264	-	Vac		
	Input overvoltage recovery	-	259	-	Vac		
	Input undervoltage protection	-	90	-	Vac		
	Input undervoltage recovery	-	95	-	Vac		
	Input overcurrent protection	-	-	16	A	The input maintains the input current no more than 15A and automatically adjusts the output power.	
High voltage output	Output overvoltage protection	144	-	149	Vdc		
	Output undervoltage protection	55	-	60	Vdc		
	Output overcurrent protection	-	-	34	A		
	Output short circuit protection	have			-	OBC output current \geq (maximum output current *1.5) and OBC output voltage \leq 10V	
	Output reverse polarity protection	have			-	Output is reversed, high voltage output does not start, after troubleshooting, normal operation resumes	



Communication fault protection	have			-	Automatically stops output when CAN communication fails
Over temperature protection	-	85	-	°C	Detect the internal temperature of the OBC. When the internal temperature of the CPU is higher than 85 degrees, the power will be reduced and a fault will be reported.
	-	90	-		Detect the internal temperature of OBC. When the internal temperature of CPU is higher than 85 degrees, it starts to reduce power. However, when the temperature continues to rise to 90 degrees, OBC shuts down.

OBC output efficiency and temperature derating curve



OBC efficiency curve

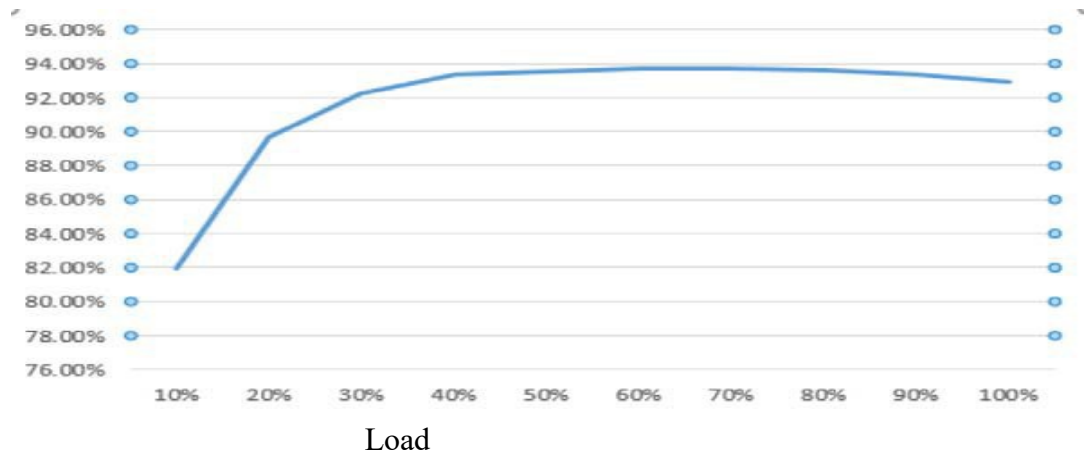
4.2 DC/DC Converter performance requirements

Item	Min	Typ	Max	Unit	Conditions
DC/DC Electrical Performance					
1、 Input characteristics					
Input voltage range	60	-	144	Vdc	
2、 Output Characteristics					
Output voltage range	13.6	13.8	14.0	Vdc	
Rated output current	-	72	-	A	
Peak output current	-	86	-	A	1.2 times the rated output current
Output Power	-	1000	-	W	
Peak Power	-	-	1200	W	Working time ≥ 6 minutes
Peak noise voltage	-	-	200	mVp - p	The test end is connected in parallel with a 10uF electrolytic capacitor and a 0.1uF ceramic chip capacitor, and the bandwidth is limited to 20M
DC efficiency	-	90	-	%	



Output voltage rise time			300	mS	The time it takes for the output voltage to rise from 10% to 90%	
Output quiescent current	-	-	1	mA	Output voltage is 14V	
3、Protection						
Input overvoltage protection point	144	-	149	V _{dc}	Turn off output	
Input overvoltage recovery point	139	-	144	V _{dc}		
Input undervoltage protection point	55	-	60	V _{dc}	Turn off output	
Input undervoltage recovery point	60	-	65	V _{dc}		
Output overvoltage protection point	-	-	16	V _{dc}	>16V shutdown protection, <16V self-recovery	
Output undervoltage protection point	7	-	-	V _{dc}	≤7VDC shutdown protection, >7.5VDC self-recovery	
Over temperature protection	-	90	-	°C	CPU over-temperature protection when over 90°C, recovery when below 85°C	

efficiency



DC efficiency curve



4.3 Safety performance and others

Items		Technical indicators	unit	Rema rk	
5、 Safety features					
Diele ctric stren gth	Input to housing	2000VAC, 3s, leakage current ≤ 20mA		No breakdown or arcing	
	Output to housing	2000VAC, 3s, leakage current ≤ 10mA		No breakdown or arcing	
	Input to Output	2000VAC, 3s, leakage current ≤ 10mA		No breakdown or arcing	
Insulation resistance	Input to output DC high voltage - DC low voltage (shell ground)	Resistance ≥ 20MΩ, test voltage 500VDC		No breakdown or arcing	
Ground resistance	Ground wire to shell - DC low voltage (shell ground)	≤0.1	Ω	The resistance between the ground point and the heat sink is less than 100 milliohms, thetest current is 25A AC	
Creep age clear ance		≥4mm			
Elect rical clear ance		≥3mm			
MTBF		150000	h		

4.4 Electromagnetic compatibility

Test items	Reference Standards	Performance Indicators	Criteria	Remark	
1、EMI Testing					
Conducted disturbance (CE)	GB/T 18487.3-2001			Tested for OBC only	
Radiated disturbance	GB/T 18487.3-2001				



(RE)				
Conductive Electromagne tic Contact (CE)	GB/T18655-2010	Level 3		For DCDC testing only
Fallout (RE)	GB/T18655-2010	Level3		
2、EMS test★				
surge	GB/T18487.3-2001GB/T17626.5-2008	Input differential mode 1KV 1.2/50us Input common mode 2KV 1.2/50us		Tested for OBC only
EFT	GB/T18487.3-2001GB/T17626.4-2008	2KV/5KHz/1min		
ESD	GB/T18487.3-2001	Contact 4KV/Air 8KV		
	GB/T 17626.1-1998			
CS		10LIVE30.15-80MHz		
RS	GB/T 18487.3-2001	3V/m80-1000MHz		
	GB/T17626.3-2006	10V/m80-1000MHz		
DIP	GB/T18487.3-2001	Drop to 70% U(T), time 10ms; Drop to 50% U(T), time 100ms; Drop to 95% U(T), time 5000ms; Drop to 70% U(T), time 10ms; Drop to 50% U(T), time 10ms	B	
Voltage fluctuation and flicker Voltage fluctuation and flicker		A Voltage fluctuation and flicker limit for products of this category		



Current harmonic emission	GB/T18487.3-2001	A Harmonic current limits for Class A products			
Electrostatic Disturbance (ESD)	GB/T19951-2005	Contact discharge of the whole machine (powered on): $\pm 6KV$ Air discharge: $\pm 8KV$	B		
		Contact discharge of the whole machine (not powered on): $\pm 6KV$ Air discharge: $\pm 15KV$	C		
Radiated electromagnetic field immunity Free field method (RS)	GB/T17619-1998		A		
Radiated electromagnetic field immunity Bulk current injection (BCI)	GB/T17619-1998		A		
Immunity to transient conducted disturbance s along the power lines (CS)	GB/T 21437.2- 2008 (ISO7637-2)	level4	Pulse 1, Pulse 2b are D, Pulse s2a , Pulse 3a/3 b are A		
Electrical fast transient pulse group immunity (EFT)	GB/T 17626.4- 2008 (IEC61000-4-4)	$\pm 4KV$, 5KHz/100KHz	B		



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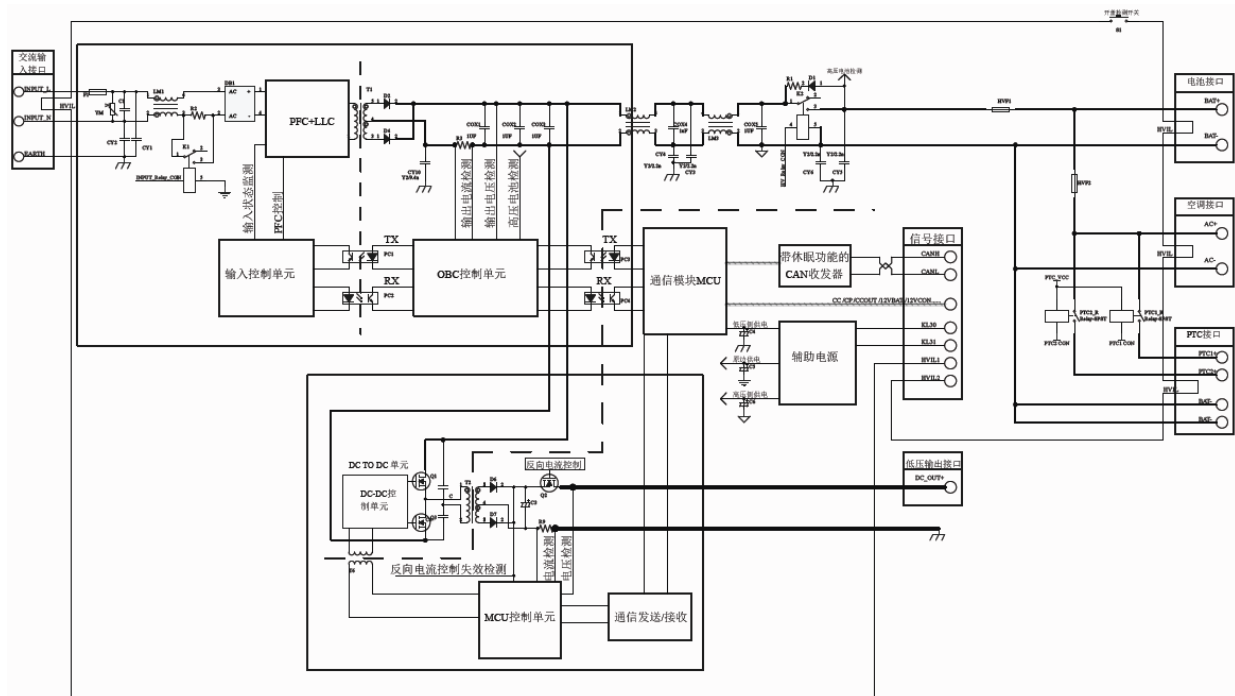
Criteria definition:

A: The test process indicators are within the specification range

B: After the test is completed, they can automatically return to the specification range

C: After the test is completed, it can be restored to the specification range manually

4.5 Assembly principle block diagram (example, PDU part is not the actual situation)

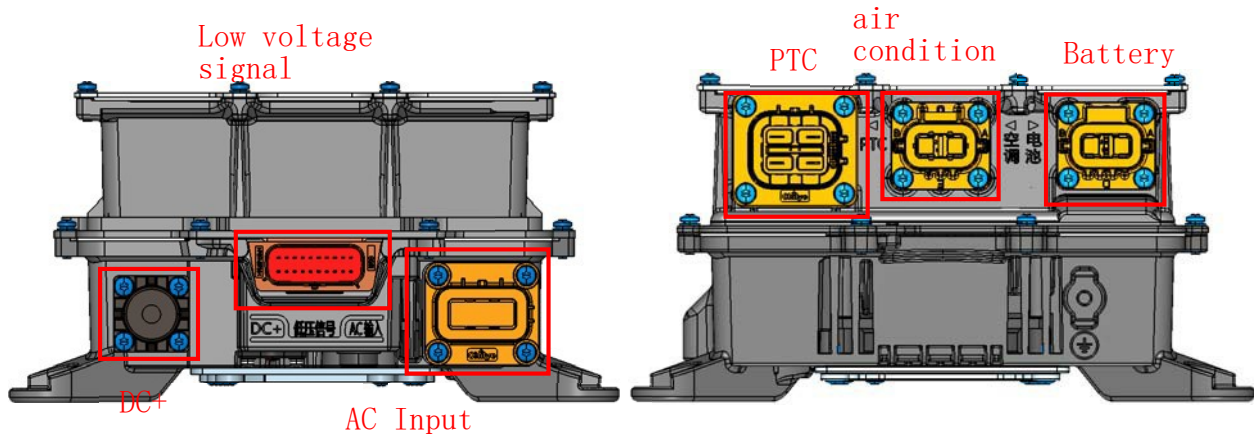




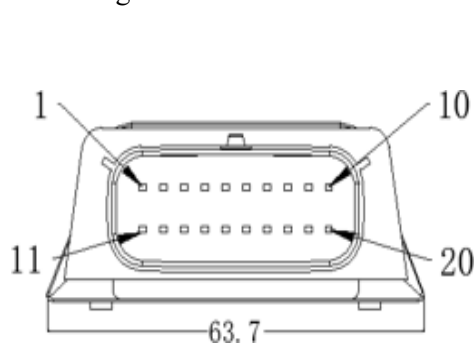
5 Interface requirements

5.1 General interface requirements

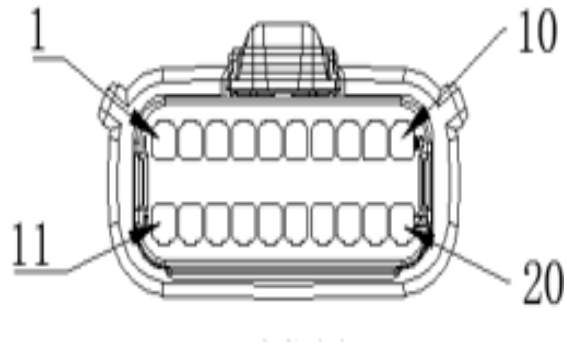
The CDU 3-in-1 mainly includes a low-voltage interface and a high-voltage interface. The model and position of the interface connector on the part are defined according to the vehicle layout.



5.2 Low voltage connector



a) Component side



b) Harness end



Connector Name		Component end plug-in		Matching end plug-in (wiring harness end)		Remark
		Part Number	supplier	Part Number	supplier	
Low voltage communication connector		34830 2001	Molex	334722006	Molex	
Serial number	Signal Bit number	name		Function	illustrate	
1	1	Thermistor 1-1		Temperature control		
2	2	Thermistor 1-2		Temperature control		
3	3	Thermistor 2-1		Temperature control		
4	4	Thermistor 2-2		Temperature control		
5	5	Charging connection confirmation signal CC		Used to detect whether the charging gun head is connected to the vehicle		
6	6	Charging Connection Control Guide CP		Used to submit the maximum current allowed by the charging station and detect the reliability of the grounding between the vehicle and the charging station		
7	7	KL30 Normal power input positive		+12V		
8	8	Electronic lock power positive		/		
9	9	Relay power supply positive		/		
10	10	Hardwire wake-up (ACC signal)		When the voltage is within the range, the wake-up is effective; when the output is 0V, the wake-up is invalid		
11	11	CAN-H		Connect to vehicle CAN-H		
12	12	CAN-L		Connect to vehicle CAN-L		
13	13	High voltage interlock +		Connect to the vehicle high voltage interlock detection circuit. When the high voltage connector is matched and assembled, the resistance between HVIL+ and HVIL- will be short-circuited, otherwise it will be open-circuited.		
14	14	High voltage interlock -				



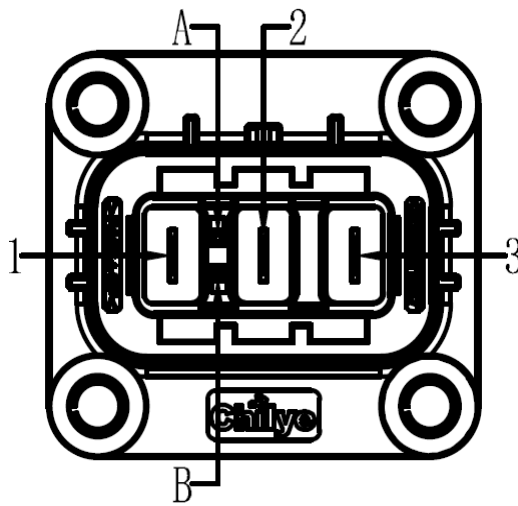
15	15	Electronic lock feedback line 2	/	
16	16	Electronic lock feedback line 1	/	
17	17	KL30 Normal power input negative	-12V	
18	18	Electronic lock power negative	/	
19	19	K6 Relay power supply negative 1	/	
20	20	K5 Relay power supply negative 2	/	

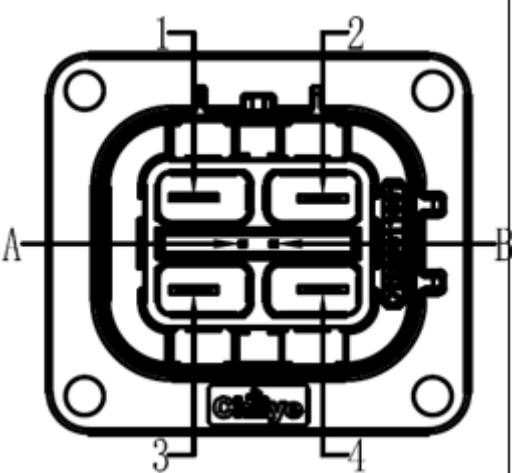
5.3 DC output positive pole disconnection

Connector Name	Component end plug-in		Matching end plug-in (wiring harness end)		Remark
	Part Number	supplier	Part Number	supplier	
DC+ terminal	DCO-11	TC	/	/	Mounting bolt: M8*16; Torque: 9-11N.m.

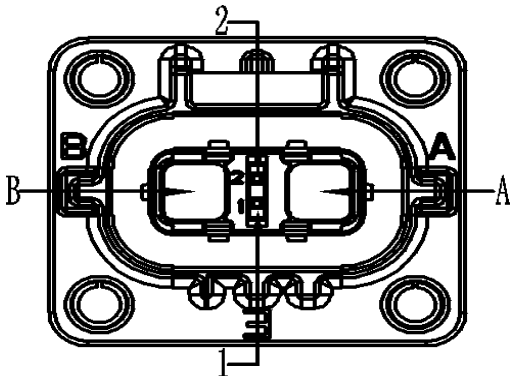


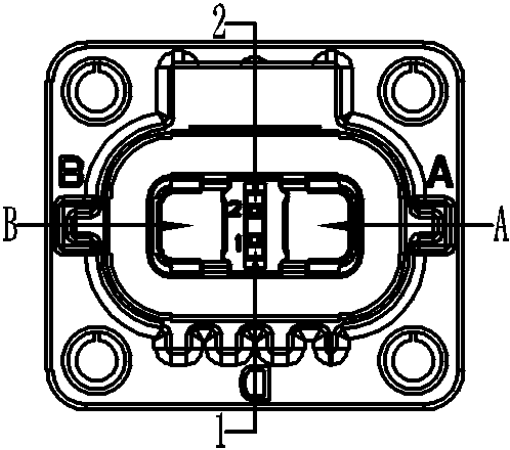
5.3 High voltage connector

Connector Name	AC input socket		Connector Model	socket	智绿 CL-HVC530-31A-02-N-WL
				plug	智绿 CL-HVC530-33A-02-N-WL
Terminal number	Wire diameter mm ²	Line Color	Function Definition		
1	2.5	blue	Neutral line (N)		
2	2.5	Yellow Green	Ground wire (PE)		
3	2.5	Brown	Fire Wire (L)		
A	0.5	black	Interlock		
B	0.5	black	Interlock		

Connector Name	PTC Sockets		Connector Model	socket	智绿 CL-HVC530-41A-02-WL
				plug	智绿 CL-HVC530-43A-02-WL
Terminal number	Wire diameter mm ²	Line Color	Function Definition		
1	2.5	black	PTC1-		
2	2.5	orange	PTC1+		
3	2.5	black	PTC2-		
4	2.5	orange	PTC2+		
A	0.5	black	Interlock		
B	0.5	black	Interlock		



Connector Name	Air conditioning socket		Connector Model	socket	中航光电 EVH2-M2ZJ-RE(SGMW)
				plug	中航光电 EVH2-M2TK-RDE(SGMW)
Terminal number	Wire diameter r mm ²	Line Color	Function Definition		
B	2.5	orange	AC+		
A	2.5	black	AC-		
1	0.5	black	Interlock		
2	0.5	black	Interlock		

Connector Name	Battery socket		Connector Model	socket	中航光电 EVH2-M2ZJ-SD(SGMW)
				plug	中航光电 EVH2-M2TK-SDD(SGMW)
Terminal number	Wire diameter r mm ²	Line Color	Line color function definition		
B	4	orange	just		
A	4	black	burden		
1	0.5	black	Interlock		
2	0.5	black	Interlock		

6. Mechanical parameters

61. Installation dimensions and specifications See engineering drawings for details

6.2 Appearance

- a) The surface quality of the shell should meet the surface treatment technical requirements in the drawings. At the same time, there should be no bubbles, damage, edge defects or other defects. The outer surface of the assembly should be free of obvious scratches, bumps, delamination, burrs and other defects. The coating and plating should be uniform, without cracks, shedding, sagging, bottom exposure and other defects.
- b) The fastener connection should be firm.
- c) The lead wires and terminals should be intact, and the color and logo should be correct. d) The shell marking should be correct, clear, firm and durable. The handwriting and content of the nameplate should be clear and should not fall off. e) Interface identification should have clear input and output interface identification, and the logo should be installed correctly and firmly with clear handwriting.
- f) The input and output interfaces and accessory parts should be firmly connected with fasteners without defects and damage such as rust, burrs, cracks, etc. The connector sleeves and pins are intact and undamaged, and the components are firmly connected. g) Shell color: Color matching shall be carried out according to the color palette provided by Party A (the color shall be subject to the final actual vehicle evaluation result); orange high-voltage electrical connector color number: RAL2003; the metal connector shall be consistent with the shell color.

6.3 Weight

Serial number	Parts Name	Parts code	weight (kg)	Remark
1			≤6.5	

7. Warning label, packaging, transportation, storage警告标识



High voltage safety signa)

7.1. Paste location: High-voltage safety label is pasted on the upper shell surface b) Design size: 78mm * 45.5mm

7.2. Packaging and packaging diagram

The following markings should be marked on the outside of the packaging box: (1) product model, name and factory serial number; (2) product net weight and weight including packaging box



gross weight; (3) name and address of the consignee; (4) name and address of the manufacturer; (5) position mark "↑" and the word "up" written on the upper part of the arrow; (6) overall dimensions of the packaging box; (7) packaging date.

Product packaging must comply with relevant packaging and transportation specifications to ensure that the product is not mechanically damaged during transportation and storage, and has rain and dust protection capabilities.

List of accessories in the packaging box:

Serial number	name	quantity	unit	Remark
1	Low voltage three-in- one product	1	piece tower	
2	Test Report	1	piece	

7.3. Transportation

The product should be transported in a solid packaging box. The outside of the box should comply with the relevant national standards and should have signs such as "Handle with Care" and "Moisture-Proof". The packaging box containing the product can be transported by various means of transportation. It should be protected from direct rain, snow and mechanical impact during transportation.



Figure 12 Transport symbols

7.4. Storage

When the product is not in use, it should be stored in the packaging box. The warehouse environment temperature is -10~40°C and the relative humidity is not more than 80%. No harmful gases, flammable and explosive products and corrosive chemicals are allowed in the warehouse. There should be no strong mechanical vibration, impact and strong magnetic field. The packaging box should be at least 20cm above the ground and at least 50cm away from the wall, heat source, window or air inlet. The storage period under the specified conditions is generally 2 years. After more than 2 years, it should be re-inspected.

The product should be stored in a ventilated and dry place. At the same time, it must be kept away from high temperature sources, fire sources and chemicals. Store neatly and avoid throwing and smashing.



8. Safety Guide

Warning: Remind users that the operation is dangerous:

- * It is strictly forbidden to disassemble and modify the on-board charger for repair or debugging without authorization;
- * Do not place parts in rainy places;
- * Before installation, please confirm that the shell is intact. If damaged, please replace it immediately or contact after-sales;
- * Each plug and socket should be connected tightly. If damaged or loose, please replace it immediately;
- * It is strictly forbidden to plug and unplug the connector when the product is powered on, otherwise it may cause personal injury;
- * It is strictly forbidden to open the product shell during the power-on process of the product, otherwise it may cause personal injury;
- * It is strictly forbidden to touch the high-voltage live parts of the product with bare hands. Please wear insulating gloves, insulating shoes, and insulating clothes during inspection and maintenance. It is strictly forbidden to repair and inspect with power on;
- * When replacing fuses and contactors, it is strictly forbidden to operate rudely to avoid damaging the product and causing safety hazards;
- * For AC power supply, choose a three-core cable with a grounding wire and install the grounding wire correctly;
- * If the charger makes any abnormal sound or smell during operation, please unplug the power plug;
- * When the battery is charging normally, please keep away from fire and flammable and explosive items;
- * Never charge a damaged or unchargeable battery. Note: Remind the user that the following operations are important operations for this product:
 - * Do not block the air inlet and outlet of the charger to prevent overheating;
- * Please make sure that the output cable is not too long to avoid the impact of line voltage drop on charging;
- * Please disconnect the power cord and charging plug when moving the charger;
- * The battery voltage must match the nominal voltage of the charger;
- * Avoid collision, pressure, pulling, twisting or shaking the charging cable;
- * The product should be placed in a safe, ventilated, dust-free and rain-free environment;
- * Please pack it if it is not used for a long time.