智光电气
Zhiguang Electric

ZG-SPS智能船舶岸电系统

ZG-SPS Intelligent Ship Shore Power System

广州智光电气技术有限公司
Guangzhou Zhiguang Electric Technology Co., Ltd.

综合能源技术与服务提供商

Integrated Energy Technology & Service Provider

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广州智光电气技术有限公司成立于2002年，注册资金2亿元，是广州智光电气股份有限公司【股票代码：002169，以下简称智光】的全资子公司，是智光在综合能源技术与服务战略发展方向专业从事柔性电力技术研究的核心成员企业。

公司自成立以来一直专注于以大功率电力电子为核心技术的电气控制装备技术研究，在先进电源技术、智能电网、分布式微网、储能、电机控制与节能、电能质量控制等领域开展技术研究与产业化应用。主营产品包括智能船舶岸电系统、直流电源系统、配网中性点接地装置、高压变频调速装置、门机势能回馈产品、冷箱节储能电源系统、储能系统、动态无功发生装置（SVG）、自动化产品、电能治理装置及大型工业智慧型UPS等。

公司产品已在全国实现地区性覆盖，并远销至数十个海外国家和地区，为全球节能减排及绿色电能事业做出巨大的贡献。公司以私有云平台、大数据为技术手段，充分发挥“互联网+”的优势，建立了以重点行业、重点区域、大客户为中心的营销与服务平台，为包括港口、电力、建材、冶金、化工、煤炭、市政、新能源等行业数千个客户提供产品、技术及综合技术解决方案。

Guangzhou Zhiguang Electric Technology Co., Ltd., established in 2002 with a registered capital of 200 million yuan, is a wholly-owned subsidiary of Guangzhou Zhiguang Electric Co., Ltd. [stock code: 002169, hereinafter referred to as Zhiguang]. It is a core member company of Zhiguang, which is specializing in flexible power technology research in the direction of integrated energy technology and service strategy development.

Since its establishment, the company has been focusing on the research of electrical control equipment technology with high-power electronics as its core technology, and conducting technical research and industrial applications in the fields of smart grid, distributed micro-grid, energy storage, motor control and energy conservation, power quality control, advanced power technology, etc.

The main products include intelligent ship shore power system, DC power system, distribution neutral grounding device, high voltage frequency converting system, gate machine potential energy feedback products, cold box section energy storage power system, energy storage system, static var generator(SVG), automation products, power management device and large-scale industrial intelligent UPS.

The company's products have achieved regional coverage in the country and are exported to dozens of overseas countries and regions, contributing to the global energy conservation and emission reduction and green energy industry. The company uses the private cloud platform and big data as its technical means to give full play to the advantages of the “Internet +”， and establishes a marketing and service platform centered on key industries, key regions and major customers, providing products, technologies and comprehensive technical solutions to thousands of customers in the port , power, building materials, metallurgy, chemical, coal, municipal, and new energy industries.

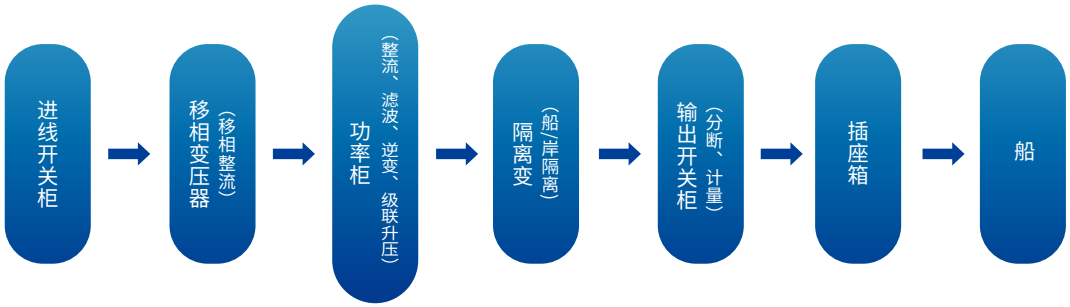
ZG-SPS智能船舶岸电系统介绍
Introduction of ZG-SPS Intelligent Ship Shore Power System

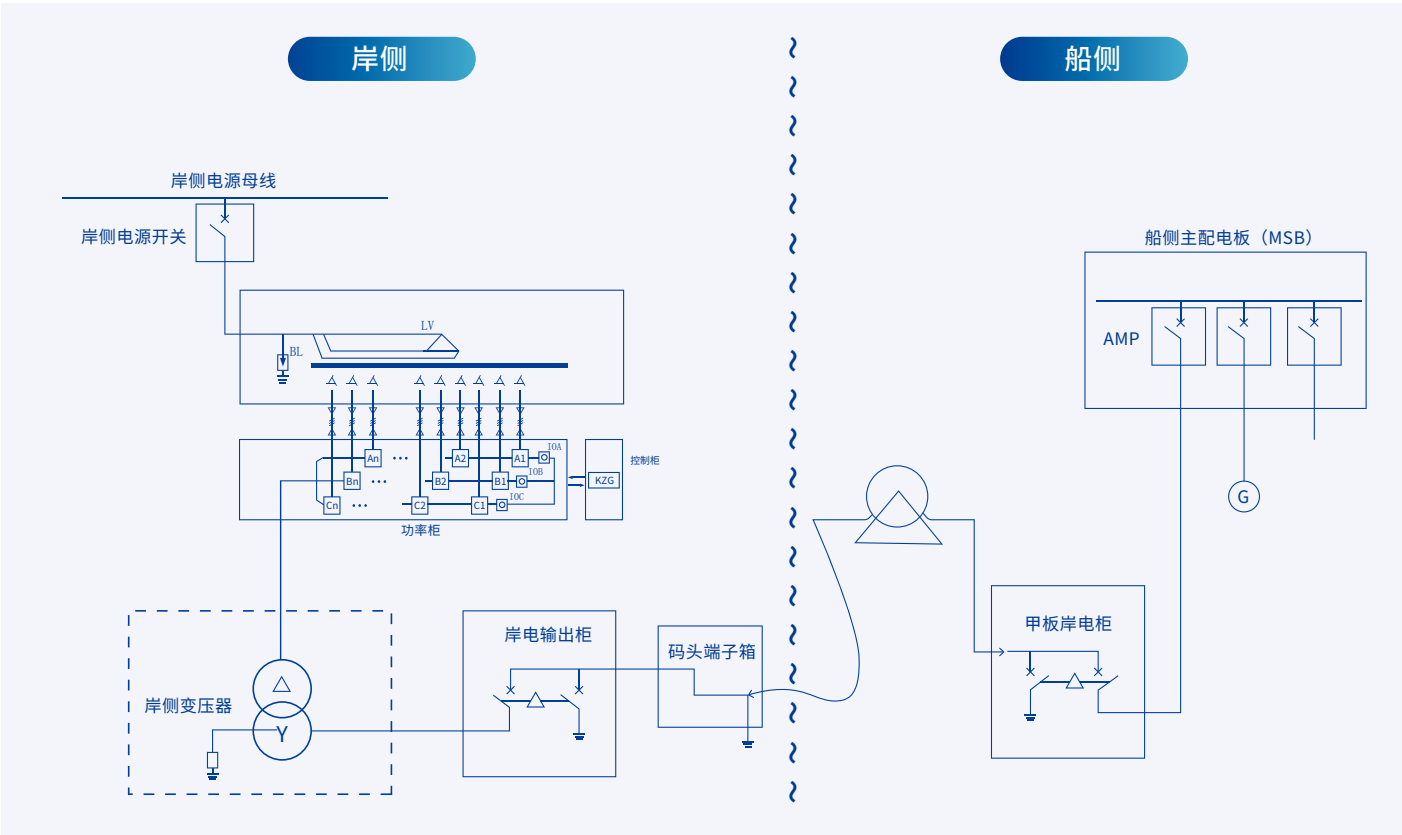
智光通过以变频电源为核心自主研发的智能船舶岸电系统,有效解决船舶停靠码头时传统依靠重油发电而造成的巨大噪音污染以及硫化物、氮氧化物和颗粒物对生态环境所造成的污染问题。

智能船舶岸电系统主要由如下主要设备组成:进线开关、变频电源系统、隔离变压器、输出开关、岸电管理系统、岸电插座箱等。(高压系统包括:中性点保护系统、滤波及励磁涌流抑制系统)

Through the inverter power supply as the core, Zhiguang independently researched and developed the intelligent ship shore power system, which effectively solves the problem of huge noise caused by the traditional reliance on heavy fuel oil to generate electricity, as well as the pollution problems of sulfide, nitrogen oxides and particulate matter to the ecological environment when the ship is docked at the wharf.

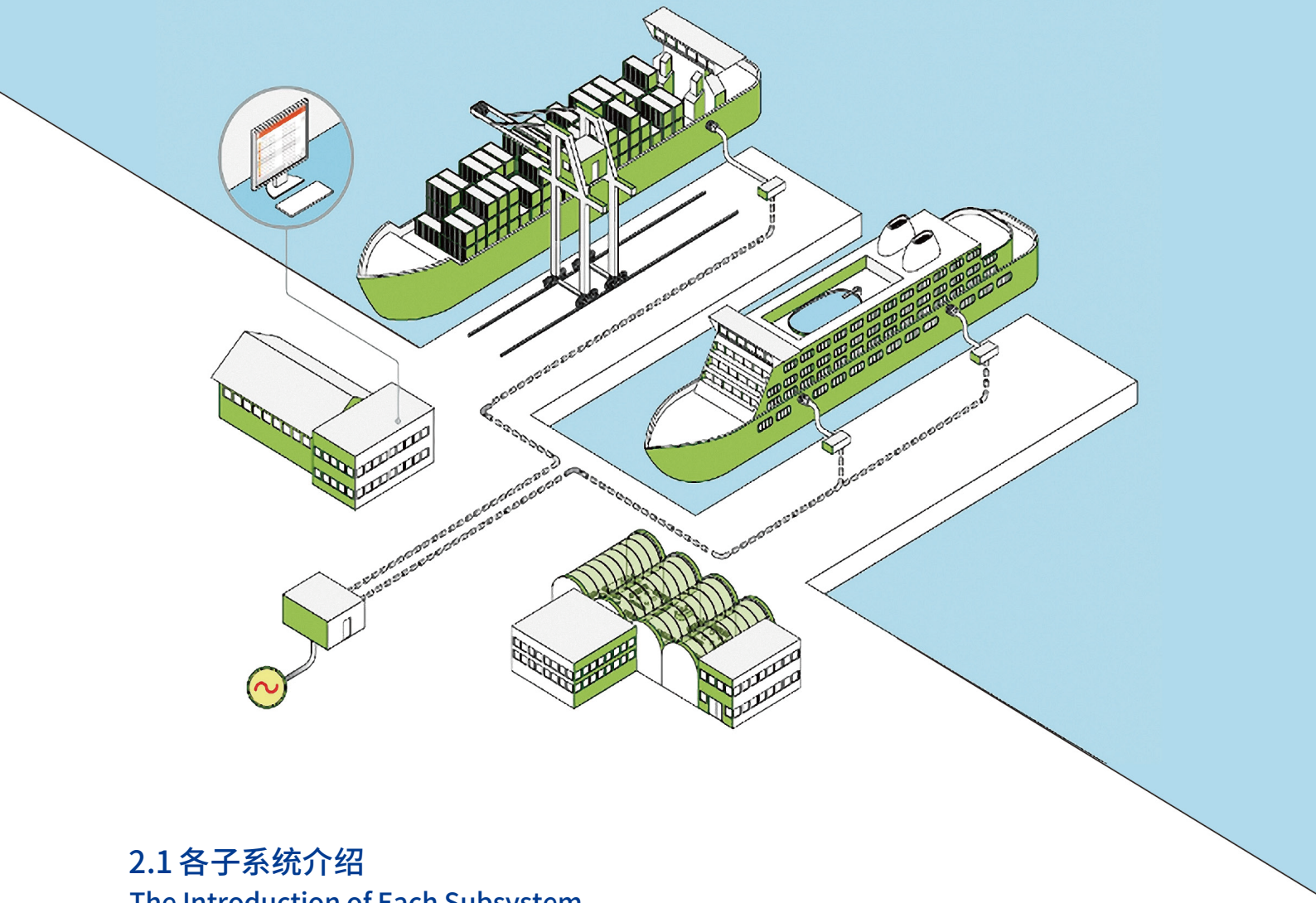
ZG-SPS mainly consists of the following main equipment: inlet switchgear, phase-shifting transformer, inverter power cabinet, isolation transformer, output switchgear, shore power socket box, and so on.(High voltage systems include:transformer neutral resistance cabinet, filtering and excitation inrush suppression system)





ZG-SPS智能船舶岸电系统由9个子系统组成:高低压配电子系统、变频稳压子系统、变压及电网隔离子系统、中性点安全接地子系统、电能质量优化子系统、电气综合保护子系统、数据综合监控子系统、系统温度控制子系统、船岸连接子系统等。

ZG-SPS consists of nine sub-systems, including high and low voltage power distribution subsystem, variable frequency voltage regulator subsystem, transformer and grid isolation subsystem, neutral point safety grounding subsystem, power quality optimization subsystem, electrical comprehensive protection subsystem, and data integrated monitoring subsystem, temperature control subsystem and ship-shore connection subsystem.



2.1 各子系统介绍
The Introduction of Each Subsystem

2.1.1高低压配电子系统
High and Low Voltage Power Distribution Subsystem

系统输入侧配电系统根据常规配电设备规范要求设计，输出侧配电系统根据岸电设备规范要求设计。两套配电子系统均可设置监控、计量、通信相关的设备和接口，便于对供电情况和设备运行情况进行监控和计量。

The power distribution system at the input side of the system is designed according to the specifications of the conventional power distribution equipment, and the power distribution system at the output side is designed according to the specifications of the shore power equipment. Both sets of the power distribution subsystems can be equipped with monitoring, metering, and communications-related equipment and interfaces to facilitate monitoring and metering of power supply and equipment operation.

2.1.2 变频稳压子系统
Variable Frequency Voltage Regulator Subsystem

变频稳压子系统的核心设备是变频电源，其功能特点如下：

The core equipment is a high-voltage variable frequency power supply, and its functional characteristics are as follows:

无滤波装置谐波小
NO.1

Low harmonics without filter device

采用多脉波、移相整流技术，输出电压谐波低于3%（无滤波装置时）；采用多电平移相叠加变压变频技术，通过隔离变可直接输出接近正弦波的400V/440V、6.6kV/6kV和11kV电压。

Adopting multi-pulse wave and phase-shift rectification technology, the output voltage harmonic is lower than 3% (when there is no filtering device); adopting multi-level phase-shift superimposed transformer frequency conversion technology, through the isolation transformer can directly output close to sinusoidal 400V/440V, 6.6kV/6kV and 11kV voltage.

频率电压一键切换
NO.2

One-click Switching of Frequency and Voltage

变频电源具备频率、输出电压微调设置功能和输出相序一键切换功能，可以大大提高系统灵活性，缩短岸电接入时间。

The variable frequency power supply has the function of fine-tuning the setting of frequency and output voltage and the one-key switching function of output phase sequence, which can greatly improve the flexibility of the system and shorten the access time of shore power.

逆功率处理与保护
NO.3

Reverse Power Processing and Protection

变频电源具备逆功率处理与保护功能，当并网和解列过程中，电源系统检测到发生逆功率时，自动调整系统输出电压，消除逆功率；如消除失败，系统发出跳闸保护。

The variable-frequency power supply has reverse power processing and protection functions. When reverse power is detected in the power system during grid-connection and de-linking, the system output voltage is automatically adjusted to eliminate the reverse power; if the power fails, the system issues trip protection.

2.1.3 变压及电网隔离子系统
Transformer and Power Grid Isolation Subsystem

隔离变压器采用D,yn11接法的设计，50/60Hz双频工作模式，额定电压按照60Hz电制设置，通过设置变频电源输出电压值实现不同频率下系统输出电压切换功能。

The isolation transformer adopts the D,yn11 connection design, 50/ 60Hz dual-frequency working mode, the rated voltage is set according to the 60Hz electrical system, and the system output voltage switching function at different frequencies is achieved by setting the output voltage value of the variable frequency power supply.

2.1.4 中性点安全接地子系统
Neutral Point Grounding Safely Subsystem

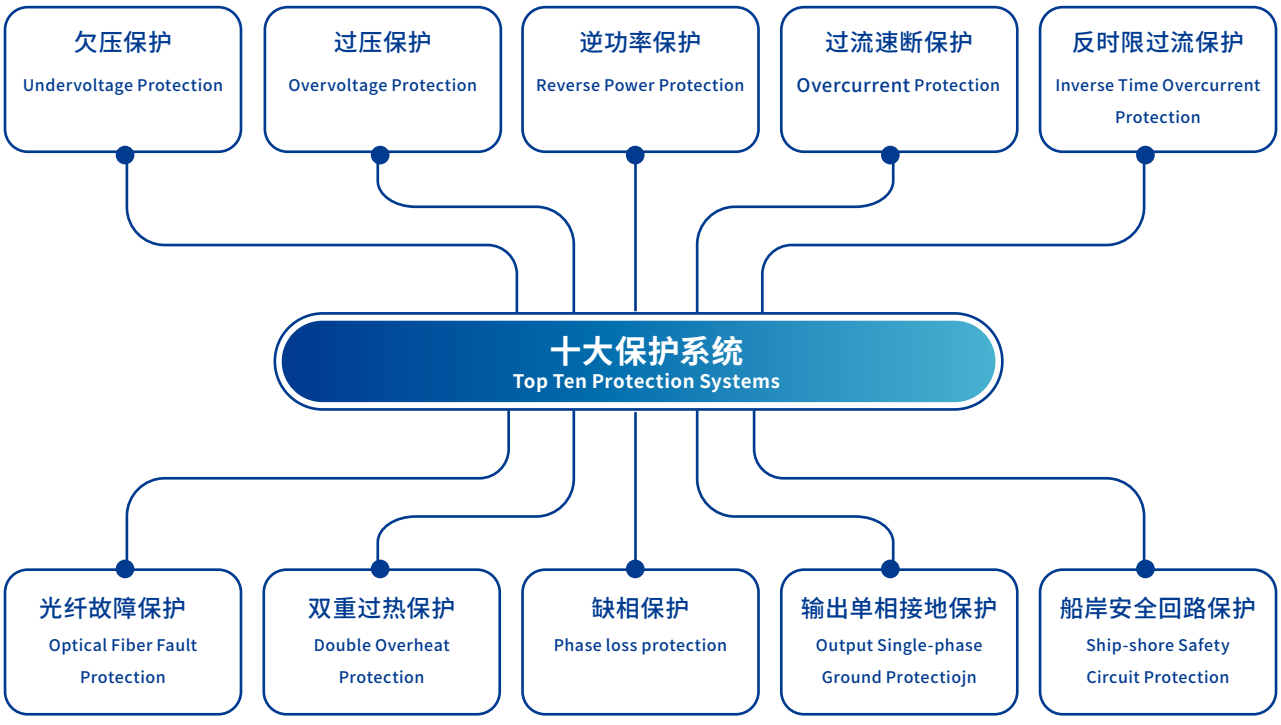
智光电气是国内中性点接地设备行业标准起草单位，也是国内中压电网中性点接地设备的主要制造商。隔离变压器中性点采用电阻接地，并在输出开关柜采用零序保护，限制岸电供电过程中船侧接地时的故障电流，为船上设备和人员提供安全保护。

Zhiguang Electric is the drafting unit of domestic neutral grounding equipment industry standard, and is also the main manufacturer of neutral grounding equipment for domestic medium voltage grid. The neutral point of isolation transformer adopts resistance grounding and zero sequence protection in the output switchgear, limiting the fault current when the ship side is grounded during the shore power supply process and providing safety protection for the equipment and personnel on board.

2.1.5 电气综合保护子系统
Electrical Integrated Protection Subsystem

电气综合保护子系统设置接地开关机械锁钥匙与码头插座箱插座钥匙交换盒，确保在插座无电压，输出开关柜接地刀闸合闸状态下才能插拔码头插座电缆插头。

The electrical comprehensive protection subsystem is provided with a mechanical lock key for the grounding switch and a key exchange box for the dock socket box socket key to ensure that the dock socket cable plug can only be plugged and unplugged when there is no voltage at the socket and the grounding switch of the output switch cabinet is closed.



2.1.6 电能质量优化子系统
Power Quality Optimization Subsystem

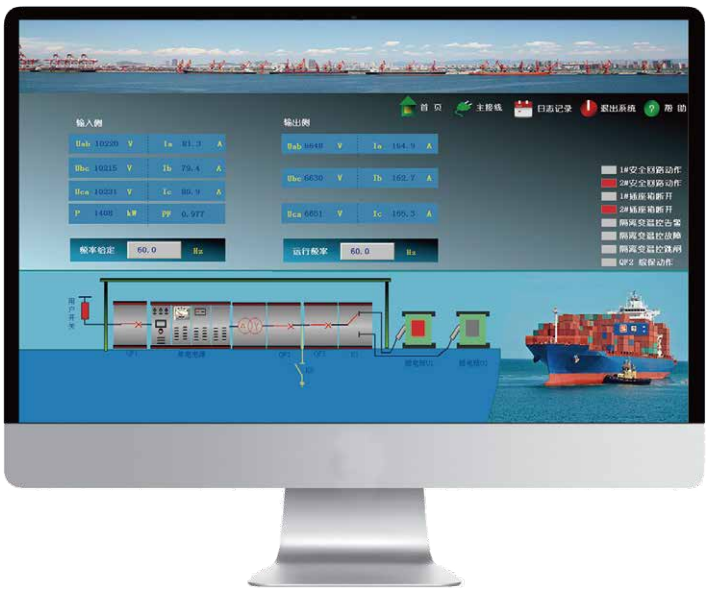
电能质量优化子系统采用多**脉波、移相整流技术**，不配置滤波装置时**输出电压谐波低于3%**，符合IEC80005-1标准对岸电系统谐波的限制要求。对于需要更纯净电源质量的场合，可以选配滤波柜，进一步降低系统输出谐波。

The power quality optimization subsystem uses multi-pulse, phase-shift rectification technology, and the output voltage harmonics are less than 3% when no filtering device is configured, which meets the requirements of the IEC80005-1 standard for shore power system harmonics. For occasions requiring a purer power quality, a filter cabinet can be selected to further reduce system output harmonics.

2.1.7 数据综合监控子系统
Data Integrated Monitoring Subsystem

数据综合监控子系统不仅监控各设备，也与码头监控系统通信，便于操作人员掌握设备运行情况。监控系统应记录供电期间输出电压、电流数据（含必要波形），便于供电发生异常中断时，追溯故障发生时的状态，分析故障原因。

The data comprehensive monitoring subsystem not only monitors each device, but also communicates with the terminal monitoring system, which is convenient for the operator to grasp the operation status of the device. The monitoring system should record the output voltage and current data (including the necessary waveforms) during power supply, so that when the power supply is abnormally interrupted, the state of the fault can be traced back and the cause of the fault can be analyzed.



岸电系统监测
Shore Power Monitoring System

2.1.8 系统温度控制子系统
Temperature Control Subsystem

系统内部大量的电力电子元件对工作温度比较敏感，因此必须对系统运行的环境温度进行实时监测和控制。在多重设计环节均采用独特高效的散热方案。

A large number of power electronic components inside the system are sensitive to the operating temperature, so the ambient temperature of the system operation must be monitored and controlled in real time.Unique and efficient heat dissipation schemes are adopted in multiple design links.

变频电源柜体冷却设计
Cooling Design of Variable Frequency Power Cabinet

系统采用独特的功率单元体双侧布置设计方案，缩短空气流程、降低空气阻力，提升系统散热效果。

The system adopts a unique double-sided layout design of the power unit body to shorten the air flow, reduce the air resistance, and improve the system's heat dissipation effect.

功率单元冷却设计
Cooling Design of Power Unit

电力电子器件并列均匀布置在散热器表面，避免串联布置方案存在的散热短板问题，根据变换功率大小的差异，可以采用空冷型、纯水冷却型散热方案。

Power electronic devices are arranged in parallel and evenly on the surface of the radiator to avoid the problem of short heat dissipation in the series arrangement. According to the difference in the power conversion, air-cooled or pure water-cooled heat dissipation schemes can be used.

设备外部环境制冷系统设计
Cooling Design of the Equipment External Environment

智光多年的大功率器件制冷设计工程经验，可为不同的现场工况提供适应实际需求的散热设计和运行维护方案。

Zhiguang’s many years of experience in the design and engineering of high-power device cooling can provide heat dissipation design and operation and maintenance programs adapted to the actual needs of different on-site working conditions.

2.1.9 船岸连接子系统
Ship-shore Connection Subsystem

邮轮专用码头插座箱
Special Dock Socket Box for Cruise

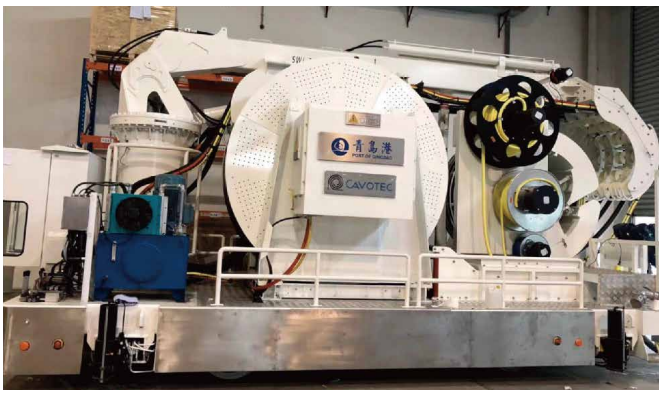
集装箱船专用码头插座箱
Special Dock Socket Box for Container Ship

船岸连接子系统主要包括码头插座箱和电缆管理系统（部分船型需要）两部分。码头插座箱安装在码头前沿，通过插接电缆方式建立船-岸电气回路，缩短接驳时间。码头插座箱检修门设置行程开关，联锁对应输出开关，为检修工作提供联锁保护。

电缆管理系统集电力传输、智能控制、安全可靠于一体，由液力耦合驱动单元驱动电缆转盘，实现电缆智能收放，保证收放拉力始终低于电缆最大承受力，保证岸电电缆使用安全；另外电缆转盘带限位动作，输出紧急切断岸电信号，避免电缆带电被拉断。

The ship-shore connection subsystem mainly includes two parts: dock socket box and cable management system (required for some types of ship). The dock socket box is installed at the front of the dock, and the ship-shore electrical circuit is established by plugging in cables to shorten the connection time. The dock socket box maintenance door is provided with a travel switch and an interlock corresponding output switch to provide interlock protection for the maintenance work.

The cable management system that integrates power transmission, intelligent control, safety and reliability and other functions. The hydraulically coupled drive unit drives the cable turntable to realize intelligent cable retraction and ensure that the retraction tension is always lower than the cable's maximum bearing capacity, and the safe use of shore power cables. In addition, the cable turntable has a limit action, which outputs an emergency cut-off shore power signal to avoid the live cable being pulled off.



邮轮专用电缆管理系统
Special Cable Management System for Cruise

2.2技术参数表
Technical Parameters

输出 output	过载能力 overload capacity	以额定输出电流计算，110%的额定输出电流时可正常运行60分钟；200%及以上输出电流时反时限保护。 Normal operation is possible for 60 minutes at 110% of rated output current based on the rated output current; inverse time limit protection at 200% and above output current.
	额定电压/频率 Rated voltage/frequency	6kV/50Hz或6.6kV/60Hz、400V/50Hz或440V/60Hz （可一键切换Switchable with one click）
	三相电压不平衡度 Three-phase voltage unbalance	≤2%
	三相电流不平衡度 Three-phase current unbalance	≤30%（特殊要求可定制customizable）
	负载稳压率 Load stabilization rate	输出电压6.6kV，0-100%负载变化时，输出电压稳压率：-1%≤静态≤ 1%，-3%≤动态≤3%； Output voltage 6.6kV, when 0-100% load change Output voltage stabilization rate: -1%≤static≤1%, -3%≤dynamic≤3%;
	输出电压谐波（空载） Output voltage harmonics (no load)	≤1%（滤波状态filter state）
	输出频率 output frequency	精度0.01Hz 输出频率60Hz/50Hz，0-100%负载变化时， 输出频率变化率≤0.1% Accuracy 0.01Hz Output frequency 60Hz/50Hz, when 0-100% load change Output frequency change rate ≤0.1%
输入 Input	相数、频率 Phase, Frequency	三相three-phase：50/60Hz
	允许频率波动 Allowable frequency fluctuations	-5 ～ +5%
	输入电压 Input Voltage	10kV；-15 ～ +15%以内正常运行 Normal operation within -15 to +15%
	输入功率因数 Input power factor	>0.96（20%负荷以上overloaded）
	整流电路 rectifier circuit	36脉波（6级串联） 36 pulse wave (6 levels in series)
	输入电流谐波 Input current harmonics	<3%（额定负载rated load）
控制 Control	系统控制器 System controller	TI公司电机控制专用高速DSP芯片 TI's motor control special high-speed DSP chip
	控制电源 Control power	AC380V，交流电源为三相电源，功率10kVA AC380V, AC power supply is a three-phase power supply with a power of 10kVA
	输入/输出接口 Input/Output Interface	16数字量输入/16数字量输出；2模拟量输入 2模拟量输出（4～20mA或0～10V信号）； 以上为基本配置，可选更多路，以订货技术协议为准。 16 digital inputs/16 digital outputs 2 analog inputs/2 analog outputs (4～20mA or 0～10V signal) The above is the basic configuration, more optional, subject to the technical agreement of the order.
	通讯接口 communication interface	RS232，RS485，CAN，Profibus

续表
Continued

	信号隔离方式 Signal isolation	光电隔离 opto-isolation
	控制信号传输 Control signal transmission	光纤传输，编码转换 Fiber Optic Transmission, Code Conversion
显示 Display	显示，计量 Display, Metering	输出：频率、电压、电流、有功功率、无功功率、功率因数、三相不平衡度、有功电镀、无功电度；故障/报警及其记录；参数设定 Output: frequency, voltage, current, active power, reactive power, power factor, three-phase unbalance, active plating, reactive power degree; fault/alarm and its record; parameter setting
运行 Running	运行操作 Running Operations	面板按键、远端开关指令控制 Panel keys, remote switch command control
	频率设定 Frequency setting	面板设定、远端电流模拟控制 Panel setting, remote current analog control
	运转状态输出 Operation status output	故障、报警接点输出 Fault and alarm contact outputs
故障切换 failover	单元旁路功能 Unit Bypass Function	
安全防护 safety protection	防护措施 protective measure	电气五防、闭锁 Electrical five prevention, lockout
	内部接地电阻 Internal grounding resistance	≤0.1Ω
噪音 noises	电磁噪声小于75dB，总噪声小于80dB Electromagnetic noise less than 75dB, total noise less than 80dB	
环境要求 environment requirements	使用场所 Location	室内，海拔1000m以下（高海拔需定制），无腐蚀性、爆炸性气体、灰尘，无阳光直射。 Indoors, at an altitude of less than 1000m (high altitude needs to be customized), no corrosive, explosive gases, dust, and no direct sunlight.
	温度/湿度 Temperature/Humidity	－5～+45°C； 湿度Humidity：20～95%，无凝露non-condensing
	振动 Vibration	10～150Hz，＜0.5g
	存放条件 Storage conditions	-20~70°C
外壳防护等级 Enclosure protection class	IP20（户内型indoor），IP55（户外型outdoor）	

2.3 船岸并网关键技术
Key Technologies for Ship-to-shore Grid Connection

可靠的相序检测与整定技术
Reliable Phase Sequence Detection and Rectification Technology

ZG-SPS智能船舶岸电系统采用**输出端电源相位跟踪技术**(STT专有技术)，可随时跟踪输出端电源状态，自动调整相序功能，可以接受来自船舶的调相指令，自动调整输出相序；或者通过检测输出端分析船舶电网电压，计算船电系统的相序，根据船电相序调整岸电相序，自动调整输出相序。现场施工时，选择其中一种相序检测调整方案实施。

ZG-SPS Intelligent Shore Power System adopts the phase tracking technology of power supply at output end (STT proprietary technology), which can track the status of power supply at output end at any time, and the function of automatic adjustment of phase sequence, which can accept the phase adjustment instruction from the ship to adjust the output phase sequence automatically;
Or analyze the voltage of the ship's power grid by detecting the output end, calculate the phase sequence of the ship's power system, adjust the phase sequence of the shore power according to the phase sequence of the ship's power, and automatically adjust the output phase sequence. One of the phase sequence detection and adjustment programs is selected for implementation during on-site construction.

优异的高低电压穿越技术
Excellent High and Low Voltage Ride-through Technology

通过**多路控制电源独立冗余技术和输出电压补偿稳定技术**，使系统具备了优异的高低电压穿越性能。

85%～115%Un：全容量向船舶供电并保持电压和频率稳定；

65%～85%Un：自动降额向船舶供电并保持电压和频率稳定；

＜65%Un：通过参数设置选择“维持热运行”模式或保护跳闸模式，保障整体系统安全。

Through the independent redundancy technology of multiple control power supplies and output voltage compensation stabilization technology, the system has excellent high and low voltage ride-through performance.
85%～115%Un: supplying power to ships at full capacity and keeping voltage and frequency stable;
65%～85%Un: automatically derate the power supply to the ship and keep the voltage and frequency stable;
<65%Un: selecting the mode of "maintaining hot operation" or protection trip mode through parameter setting to ensure the safety of the whole system.

高精度稳压稳频控制技术
High-precision Control Technology for Voltage and Frequency Regulation

ZG-SPS智能船舶岸电系统实时检测输出电压和单元直流电压进行**分相电压闭环控制**，实现输出电压的稳定控制；电源频率由高精度数字量精确控制，**输出频率精度达0.01Hz**。

The ZG-SPS detects the output voltage and DC voltage of the unit in real time for closed-loop control of the split-phase voltage to achieve stable control of the output voltage; the power supply frequency is precisely controlled by a high-precision digital quantity with an output frequency accuracy of 0.01Hz.

船岸无缝切换技术
Seamless Ship-to-shore Switching Technology

ZG-SPS智能船舶岸电系统可适应船侧工作模式和岸侧工作模式下自动同步功能，实现船侧发电机和岸电供电的快速同步和电源无缝切换。

ZG-SPS can adapt to the automatic synchronization function in ship-side operating mode and shore-side operating mode to achieve rapid synchronization and seamless power switching between ship-side generators and shore-side power supply.

2.4系统安装形式
System Installation Form

ZG-SPS智能船舶岸电系统有室内安装和室外集装箱安装两种方式可供用户选择。

The ZG-SPS intelligent high-voltage shore power system is available for both indoor installation and outdoor container installation.

2.4.1室内安装
ndoor Installation

室内安装方式适合空间较大的现场。系统装在专用岸电电源室或者码头前沿变电所内，室内有充足的空间，现场维护操作空间大，散热条件较好。

The indoor installation is suitable for sites with large spaces. The system is installed in the onshore power supply room or terminal front substation, and there is plenty of space for on-site maintenance and operation, but the equipment can’ t be moved.

2.4.2室外集装箱安装
Outdoor Container Installation

室外集装箱安装方式，适用于场地有限、不适合建设永久配电房的场合，系统占地面积相对较小。

The outdoor container installation method is suitable for occasions where the site is limited and is not suitable for the construction of permanent power distribution rooms. The system covers a relatively small area.

三、典型应用案例
Typical Application Case

截止目前，智光自主研制的智能船舶岸电系统覆盖全国各大港口近300个泊位，已广泛应用于山东港口集团、河北港口集团、天津港、营口港、秦皇岛港、厦门港、广州港、深圳蛇口港、湛江港等国内主要大型港口，并在营口港、青岛港、秦皇岛港、厦门港、深圳蛇口港等多个港口进行常态化连船供电。

Up to now, Zhiguang's self-developed inteligent ship shore power system covers nearly 300 berths in major ports across China, which have been widely used in major domestic ports such as Shandong Port Group, Hebei Port Group, Tianjin Port,, Yingkou Port, Qinhuangdao Port, Xiamen Port, Guangzhou Port, Shenzhen Shekou Port, and Zhanjiang Port. In addition, the normalized supply of electricity by ships is carried out in several ports such as Yingkou Port, Qingdao Port, Qinhuangdao Port, Xiamen Port and Shenzhen Shekou Port.

3.1 青岛邮轮母港智能高压岸电系统

Qingdao Cruise Terminal Intelligent High-voltage Shore Power System

项目亮点：单机容量大、无需并联。预计一年可实现替代电量3000万千瓦时，减排二氧化碳3.6万吨，在青岛停靠邮轮可实现在港零排放。

Project highlights：Large stand-alone capacity without parallel connections. The shore power project is expected to replace 30 million kilowatt-hours of electricity a year, reduce CO_2 emissions by 36,000 tons, and achieve zero emissions for cruise ships docking in Qingdao.

项目规模：16000kVA/11kV/6.6kV ｜ Project size：16000kVA/11kV/6.6kV

3.2辽宁营口港智能高压岸电系统

Liaoning Yingkou Port Intelligent High-voltage Shore Power System

项目亮点：营口港目前有智光岸电装置19套，容量分别为2000KVA、3000KVA和4000KVA，所有泊位均能连接高压岸电。岸电系统可提供50Hz和60Hz两种制式的电源，满足各种船舶用电需求。

Project highlights：Yingkou Port currently has 19 sets of Zhiguang shore power installations with capacities of 2,000KVA, 3,000KVA and 4,000KVA respectively, and all berths can be connected to high voltage shore power. The shore power system can provide two types of power supply, 50Hz and 60Hz, to meet the needs of various ships' power consumption.

项目规模：2000kVA&3000kVA/6kV ｜ Project size：2000kVA&3000kVA/6kV

3.3厦门港嵩屿集装箱码头智能高压岸电系统

Intelligent High-voltage Shore Power System of Songyu Container Terminal in Xiamen Port

项目亮点：码头两套船舶岸电额定容量均为5000kVA，供3个泊位使用，满足两艘20万吨级的船舶同时靠泊时使用。岸电系统输出可工作在60Hz/50Hz，满足各种船舶用电要求，具备完善的保护功能，可限制船侧发生接地时的故障电流，保护船上人员和设备安全。

Project highlights：Installation of one set each of 2000kVA and 3000kVA.The operating vessels connected to this shore power system use a 6kV high-voltage embarkation mode. The ship is equipped with a step-down transformer, the ship's grid voltage is low voltage 400V, and the output power of the ship-side generator is 360kW when connected to the grid.

项目规模：5000kVA /6.6kV ｜ Project size：5000kVA /6.6kV

3.4 深圳蛇口集装箱码头智能高压岸电系统

Shenzhen Shekou Container Terminal Intelligent High-voltage Shore Power System

项目亮点：深圳蛇口集装箱码头共有3套智能高压岸电系统，分别为一期5MVA智能高压岸电系统、二期4MVA、三期4MVA，均为智光电气总承包项目。在功能上一、二、三期工程的智能岸电系统间实现互联互备模式。这三套岸电电源（一期+二期+三期）均能够向3#-9#泊位的任一个岸电插座箱供电。

Project highlights：Shenzhen Shekou Container Terminal has three sets of intelligent high-voltage shore power systems, respectively, the first phase of 5MVA intelligent high-voltage shore power system, the second phase of 4MVA, the third phase of 4MVA, all of which are Zhiguang Electric general contracting project. Functionally, the intelligent shore power systems of Phase I, II and III projects realize interconnection and mutual backup mode. These three sets of shore power supply (Phase I+Phase II+Phase III) are capable of supplying power to any one of the shore power socket boxes at berths 3#-9#.

项目规模：4000kVA/6.6kV ｜ Project size：4000kVA/6.6kV

3.5 厦门海通码头智能高压岸电系统

Xiamen Haitong Terminal Intelligent High-voltage Shore Power System

项目亮点：在海通码头配置安装容量2.5MVA+2.5MVA高压变频岸电电源系统装置，将10kV/50Hz工业电源转换成6kV/50Hz及6.6kV/60Hz船用电源，即2套2.5MVA的岸电电源系统可分别独立运行，也可在必要时并网运行组合成1套5MVA的岸电电源系统运行。

Project highlights：In Haitong terminal configuration and installation of 2.5MVA + 2.5MVA high-voltage inverter shore power system device, 10kV/50Hz industrial power supply into 6kV/50Hz and 6.6kV/60Hz marine power, that is, two sets of 2.5MVA shore power system can be operated separately and independently, or when necessary, parallel operation of the grid into a set of 5MVA shore power system.

项目规模：5000kVA/6.6kV ｜ Project size：5000kVA/6.6kV

3.6 河北港口集团智能船舶岸电系统

Hebei Port Group Intelligent Ship Shore Power System

项目亮点：在秦皇岛港二、六、七、九公司配置安装容量1250kVA智能船舶岸电系统6套，将10kV/50Hz工业电源转换成6kV/50Hz及6.6kV/60Hz船用电源，为秦皇岛港获评五星绿色港口助力。

Project highlights: 6 sets of 1250 kVA intelligent ship-to-shore power systems were installed in Qinhuangdao Port's 2nd, 6th, 7th and 9th companies to convert 10kV/50Hz industrial power supply into 6kV/50Hz and 6.6kV/60Hz marine power supply, which helped Qinhuangdao Port to be awarded as a five-star green port.


项目规模：1250kVA&1600kVA&2000kVA &3000kVA /6kV
Project Scale: 1250kVA&1600kVA&2000kVA &3000kVA /6kV

四、丰富的连船供电实践经验

Extensive Practical Experience in Power Supply with Connected Ships

据不完全统计，目前与智光岸电电源系统成功连接的中外船舶超过200艘，其中有多艘10000TEU以上的大型集装箱船，还有散货、客滚船、邮轮等，具体信息如下：

According to incomplete statistics, there are currently more than 200 Chinese and foreign ships connected to our shore power supply system. Among them, there are many large container ships above 10000TEU, as well as bulk cargo and ro-ro passenger ships, cruises, details are as follows:

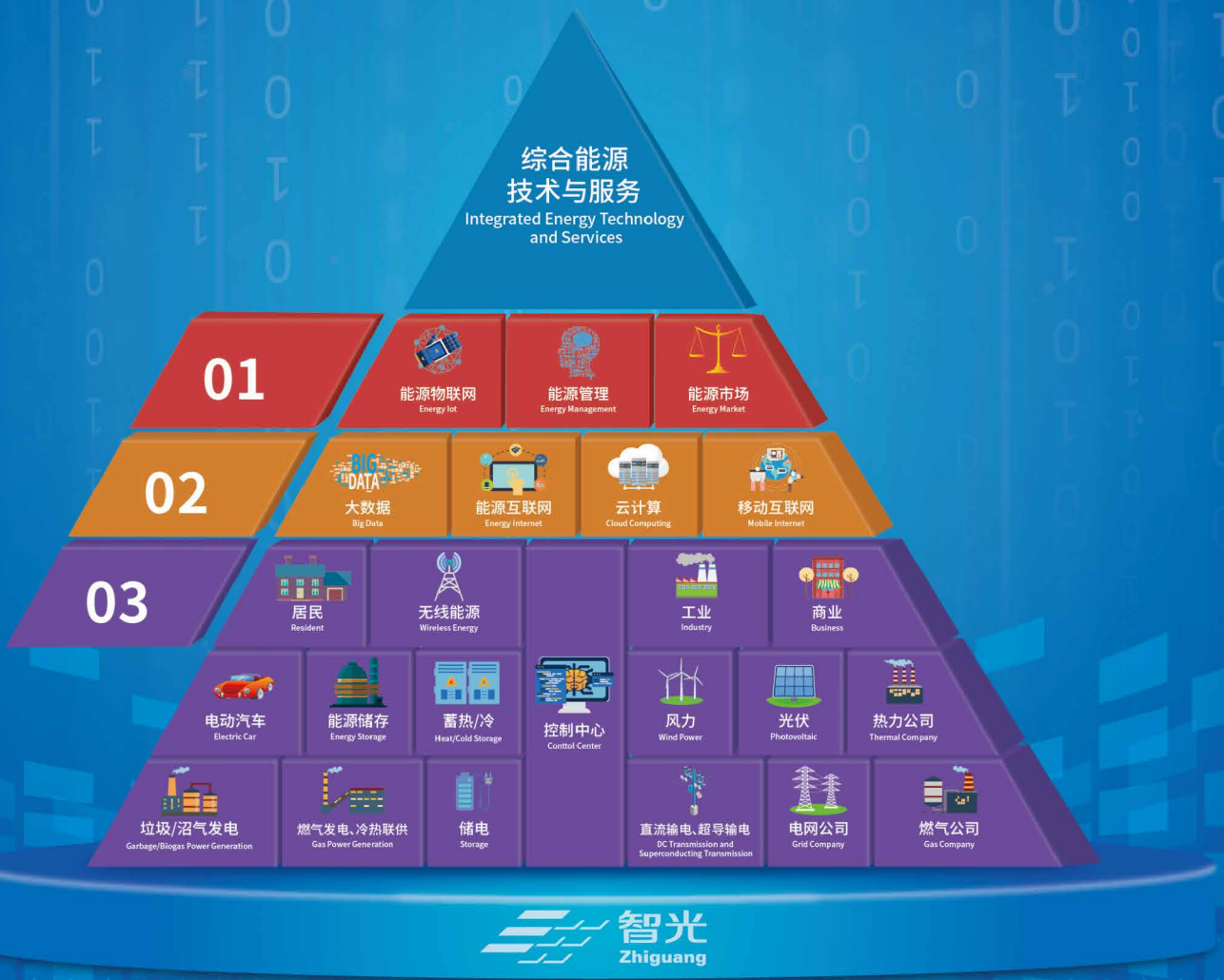
成功连接ZG-SPS智能高压岸电系统的中外轮船（部分）

Various types of ships (parts) successfully connected to ZG-SPS

型号 Model		型号 Model	
中远海运法国号 COSCO Shipping France	13386TEU	中远海运法国号 COSCO Shenhua Round 801	
中远海运荷兰号 COSCO Shipping Netherlands	13386TEU	长旺号	8000TEU
中远星座级人马座号 COSCO Constellation Sagittarius	20000TEU	中谷福州	4600TEU
中远星座级室女座号 COSCO Constellation Grand Virgo	20000TEU	长传	8452TEU
马士基爱丁堡号 Maersk Edinburgh	13000TEU	中谷西安	4636TEU
马士基恩塞纳达号 Maersk Ensenada	13000TEU	新明州98	1868TEU
古帝马士基号 Maersk Gudi	13000TEU	森罗釜山	5000TEU
马士基埃森号 Maersk Essen	13000TEU	宁远宁波	3300TEU
地中海 MSC DANIELA	14000TEU	中海印度洋	19000TEU
营口港紫丁香号客箱船 Yingkou Port Lilac Passenger Ship	常态连船供电 normal power supply with ship	宁远天津	3300TEU

智光·综合能源技术与服务提供商

Zhiguang·Integrated Energy Technology & Service Provider



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