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KINGBROTHER:

The Superior Choice for Power Transmission & Energy Storage

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KINGBROTHER On Power Transmission

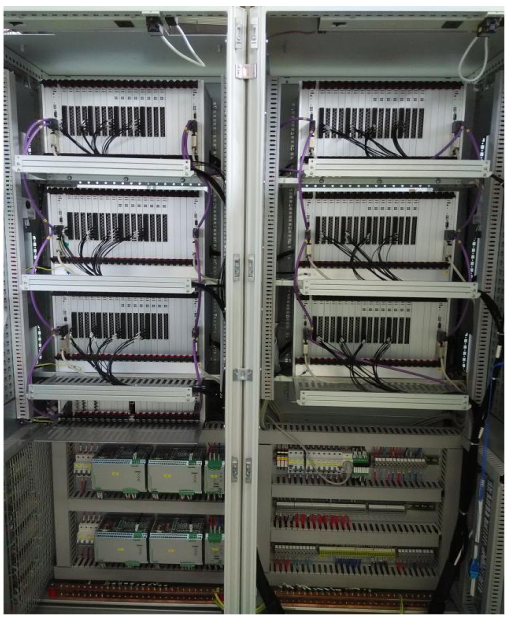
KINGBROTHER's cooperation with State Grid and other related fields began around the year 2000, with the main customers being leading domestic power grid companies. The focus is primarily on custom processing of products such as power transmission and distribution measurement and control protection devices, including products like converter valve control and monitoring equipment, electrically triggered thyristors, and thyristors control and monitoring equipment.

HVDC Thyristor Converter Valve

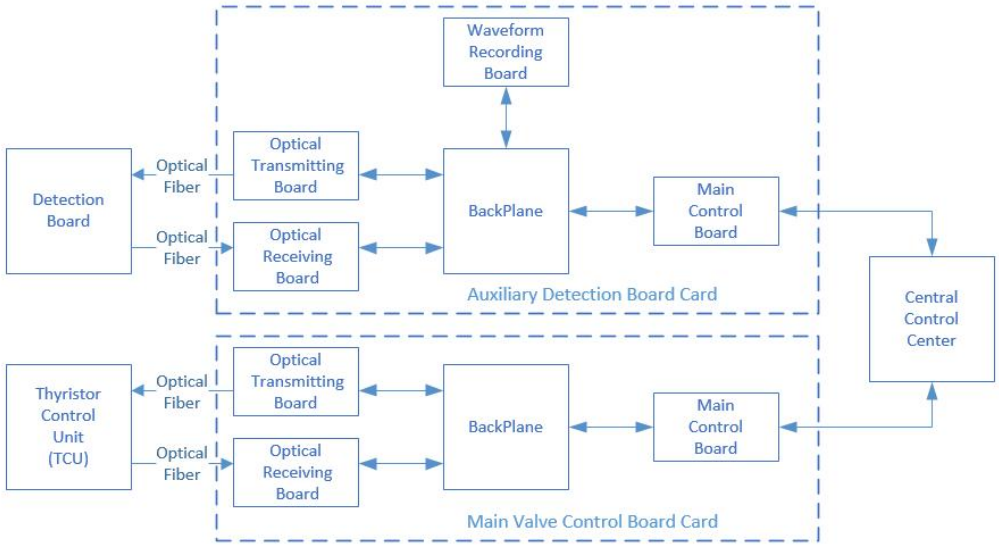
- **Rated DC Voltage:** ±10kV ~ ±1100kV
- **Rated DC Current:** 50A ~ 6250A
- **Converter Capacity:** 10MW～5000MW
- **Fault Current Withstand Capability:** up to 63kA
- **Triggering Methods:** optical or electrical triggering

Converter Valve Control and Monitoring Equipment

- **Precise triggering:** Accurately trigger thyristors based on control commands to control the flow of current.
- **Comprehensive protection:** Provides various protections such as over-current and over-voltage to ensure system safety.
- **Real-time monitoring:** Continuously monitors the status of the converter valve, including key parameters like current and voltage.
- **Redundant design:** Employs redundant design to enhance system reliability and fault tolerance.
- **Fault diagnosis:** Capable of fault identification and localization for quick maintenance.

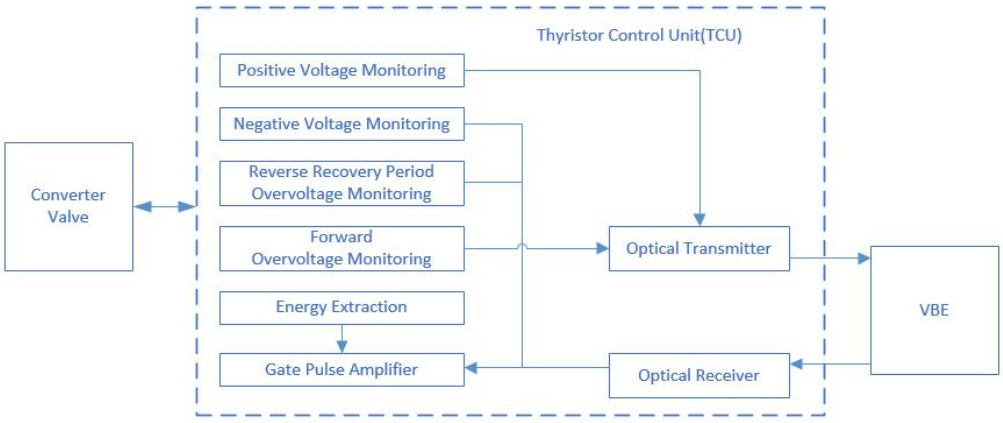


Valve Base Electronics(VBE), is a crucial component of the high-voltage direct current (HVDC) transmission converter valve control system, responsible for the triggering, protection, and related status detection of the converter valve. It is the sole interface device between the DC control and protection equipment and the converter valve, and is essential for the stable operation of the HVDC system.



Main Structure of VBE

Thyristor Control Unit (TCU) is the interface between the VBE and the converter valve itself, primarily used for electrically controlled small component converter valves like thyristors.



Functional Block Diagram of TCU

Its main function is to perform optoelectronic conversion of signals from the valve control and monitoring equipment, thereby achieving optical isolation between high and low voltage circuits, and providing triggering, detection, and protection for thyristors.

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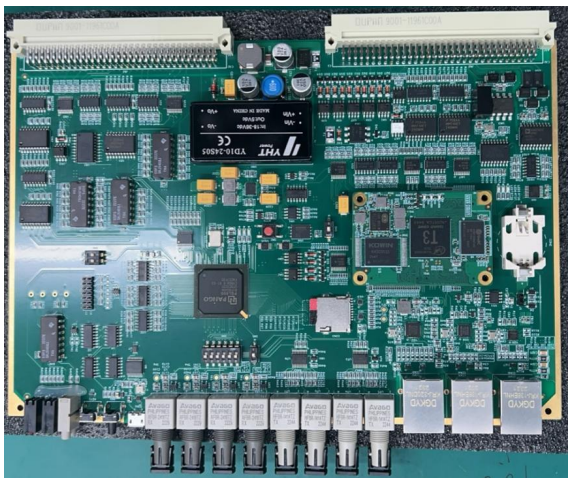
KINGBROTHER's Experience on Power Transmission PCB

VBE main control board, as a core component of the HVDC transmission system, requires extremely high reliability. The system design fully consider various fault modes and emergency measures to ensure stable operation even under complex and harsh working conditions.



VBE Main Control Board

We employ Redundant design, fault isolation, and diagnostic techniques, such as dual-system parallel design, hot standby, and cold standby. At the same time, rigorous reliability tests and verifications (SI/PI simulation) are conducted, high-temperature high-humidity aging tests (operate at 50℃ and 80% humidity for 168H), vibration tests (frequency 100Hz vibration), etc.

High-precision sensors and AD converters are used, in combination with advanced signal processing algorithms and filtering design, to accurately measure and process signals.

Rated DC Voltage	±10kV ~ ±1100kV
Rated DC Current	50A ~ 6250A
Converter Capacity	10MW～5000MW
Fault Current Withstand Capability	up to 63kA

VBE Main Control Board Specifications

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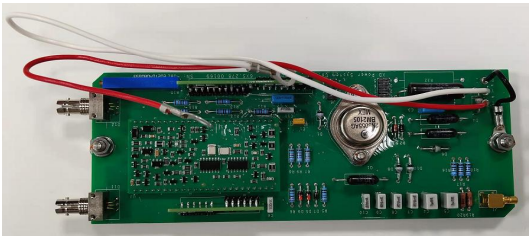
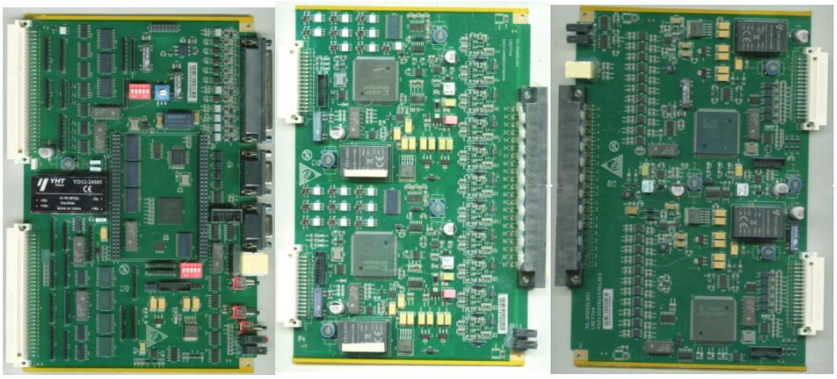


High-Voltage Transmission Board



Optical Transceiver and Main Control Board

N.O.	Item	Parameter
1	Material	Special high-voltage monitoring products: FR-4 (halogen-free)
2		Special high-voltage control products: FR-4 TG170
3	Layer	4 layers, 6 layers, 8 layers, 10 layers
4	Size	38*23mm、58*23mm、72*186mm、84*66mm
5		320*140mm、162*100mm、233*162mm
6	Board Thickness	1.6mm、1.7mm、2.0mm、2.3mm、2.4mm、2.5mm
7	Surface Process	Pure tin plating, gold plating
8	Vias	Cover resist, oil filling, hole filling
9	Copper Thickness	2OZ
10	Standard	IPC CLASS 3 Grade Standard

Key Parameters in Manufacturing Process for Power Transmission Product

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KINGBROTHER On Energy Storage

KINGBROTHER has cooperated with multiple leading domestic power companies, energy storage equipment firms, and electric vehicle battery manufacturers, mainly focusing on custom processing of products such as Battery Management Systems (BMS), Power Conversion Systems (PCS), and Energy Management Systems (EMS). We supplies PCB products and solutions for their energy storage devices, such as hybrid photovoltaic storage integrated units, and high-power energy storage integrated units.

Energy Storage Inverter

- Bus Voltage: 500~900Vdc
- Power Rating: 100KW
- Installation Method: Detachable
- Cooling Method: Air-cooled
- Dimensions: 390mm*315mm*220mm

Real-time multi-function control with constant voltage/current/power and automatic switching based on conditions and commands.

Full protection features:overload, over-current, short circuit, over-voltage, under-voltage, and over-temperature protection.

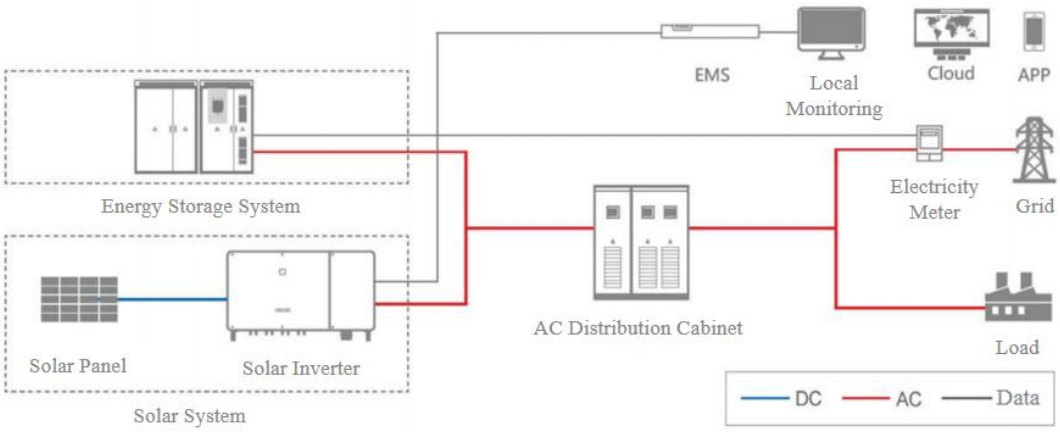
High-voltage high-frequency output using advanced IGBT modules and control algorithms for stable high-speed motor control.

Rapid and precise response to charging/discharging commands with high-accuracy voltage/current/power control.

- **Capacity:** 500kW
- **Voltage:** AC 380V, DC 800V
- **Energy Storage System:** 500kWh Lithium Iron Phosphate (LFP) battery and its Battery Management System (BMS)
- **Converter:** 550kW bidirectional energy conversion system for energy storage (PCS)
- **Monitoring System:** Thermal management system and Energy Management System (EMS)

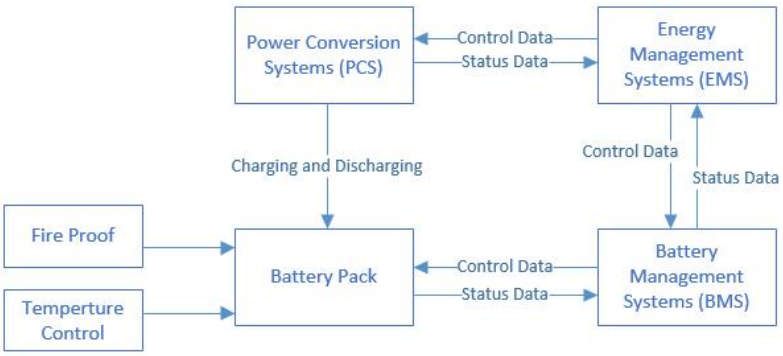
High-Power Energy Storage Integrated System

Photovoltaic energy storage systems typically use batteries to store electrical energy. After the photovoltaic cells generate direct current (DC) electricity, this energy needs to be stored. At this point, the electrical energy is converted into alternating current (AC) by an inverter and stored in the batteries. The energy stored can be used when solar power is insufficient to meet the electricity needs. The energy storage system can also engage in two-way communication with the power grid, allowing surplus electricity to be fed into the grid for use in other areas.



Photovoltaic Energy Storage System

Energy Storage System is widely used to enhance the matching of power grid output with load demand, reduce the fluctuation of grid output, decrease energy loss, and improve energy utilization efficiency. The main components of an energy storage system include battery packs, Battery Management Systems (BMS), Power Conversion Systems (PCS), Energy Management Systems (EMS), and other electrical equipment.



Energy Storage System

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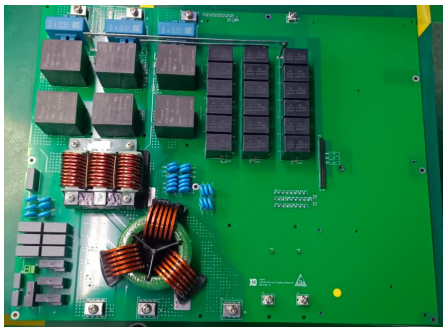
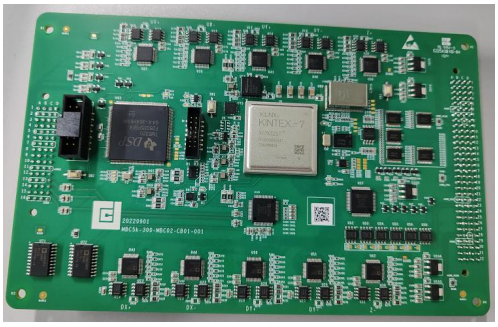
KINGBROTHER's Experience on Energy Storage PCB

PCS include key components such as AC/DC bidirectional converters and control units. The control unit receives backend control commands through communication, and controls the converter to charge or discharge the battery according to the sign and magnitude of the power command, thereby achieving regulation of active and reactive power on the grid.

Bidirectional AC/DC converters need to precisely control the direction and magnitude of power flow during the bidirectional conversion process to ensure the stability and efficiency of the converter. They also have a high current carrying capacity (up to 125KW) and great thermal performance (less than 40℃).

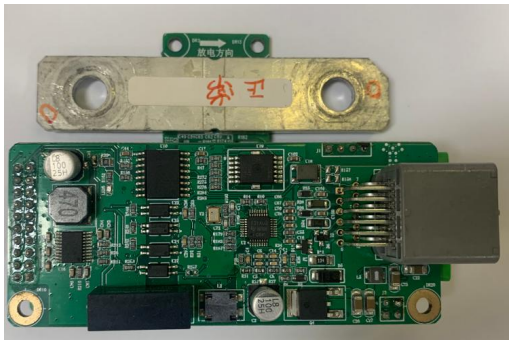


Bidirectional AC/DC Conversion Board



Control unit

BMS high-voltage control board is a key component in the battery management system, responsible for monitoring and managing parameters such as the voltage, current, and temperature of the battery pack to ensure the safe and efficient operation of the battery system. When designing it, we focus on protective measures for abnormal conditions such as overcharging and over-discharging, shielding measures against electromagnetic radiation, and high-temperature resistance performance.



BMS high-voltage control board

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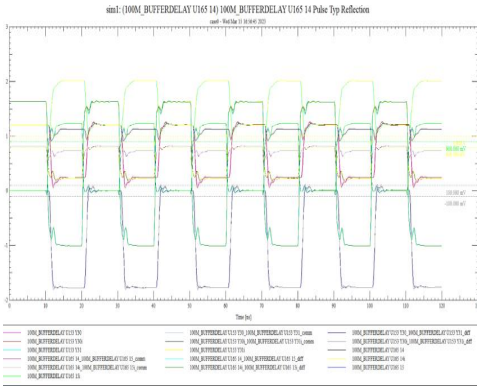
Technical Requirements and KINGBROTHER's Solutions

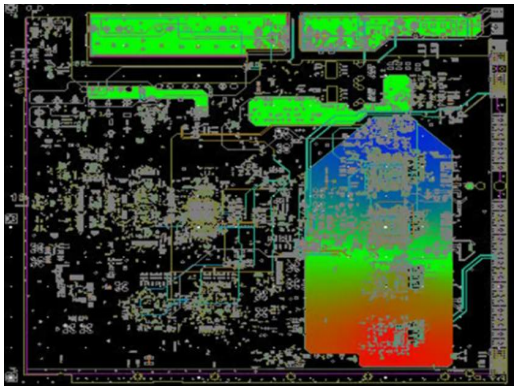
Efficiency and Precision of Data Transmission:

Control boards need to achieve high speeds, efficiency, and accuracy in transmitting data to accurately and quickly monitor and control power transmission, conversion, and energy storage.

During the design phase, we use *KBEDA SKILL*, a tool we have developed based on the Cadence software platform, which has over 400 different application functions for optimizing circuit layout and routing as well as 3D simulation and emulation. Particularly important is the technology of circuit topology, which uses tapered vias and micro blind vias to form complex circuit layouts, enabling high-speed transmission on a smaller footprint and with higher performance.



Signal Simulation



Power Simulation

And during manufacture high-speed circuit boards require multiple complex manufacturing processes, such as Non-Destructive Zone (NDZ), multi-layer stacking, and circuit topology. These advancements in manufacturing techniques directly enhance the transmission efficiency and performance of the Printed Circuit Boards (PCBs).

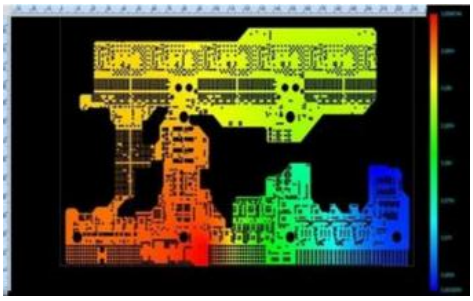
Operating Environment:

Outdoor climate (sand, humidity, salt fog, etc.), operating environment (different temperature, atmosphere and seasons), or complex electromagnetic environment are often the cause of high maintenance difficulty.

We use corrosion-resistant materials, moisture-proof materials and coatings to resist the effects of humidity and salt fog.

Also we focus on heat dissipation solutions, such as incorporating thermal dissipation

layers and utilizing materials with high thermal conductivity, to prevent performance degradation or damage due to overheating.
In PCB design we focus on EMC design and redundancy design to enhance the product's reliability and anti-interference capabilities.



Thermal Simulation Test

Coating Equipment

High Reliability and Long Durability:

Electrical energy is the most important and fundamental source of energy for industry and daily life. The reliability of power supply is crucial, especially for medium and large-scale power grid systems, where a failure at a single node can trigger a chain reaction that may lead to the collapse of the entire power grid system.
During the design, we utilize professional software to conduct signal, power, and thermal simulations to theoretically verify the product's reliability in advance.
After manufacturing we will subject the products to IPC standard testing, high-temperture-high-humidity 168-hour aging tests, 1100KV high-voltage tests, and other functional tests to ensure the reliability and durability of the products and to prevent failures.
And we make sure core product components for above high-voltage levels are required to meet a 25-year lifespan standard.

High-Voltage Test Device

High-Temperature Aging Room