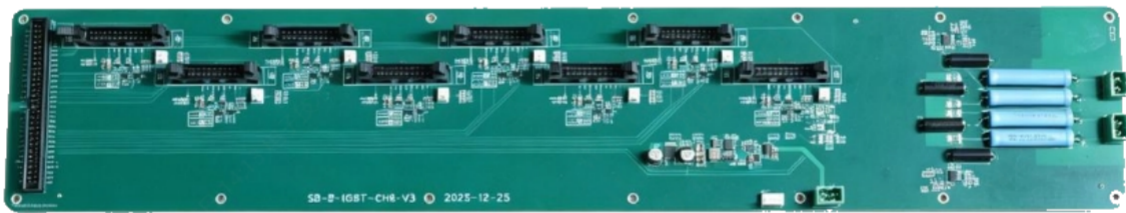
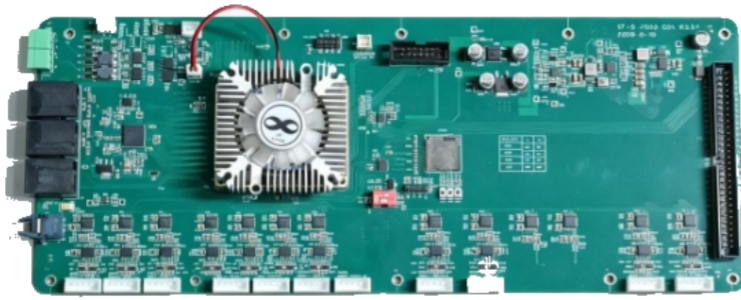


通用电源模块电源控制器

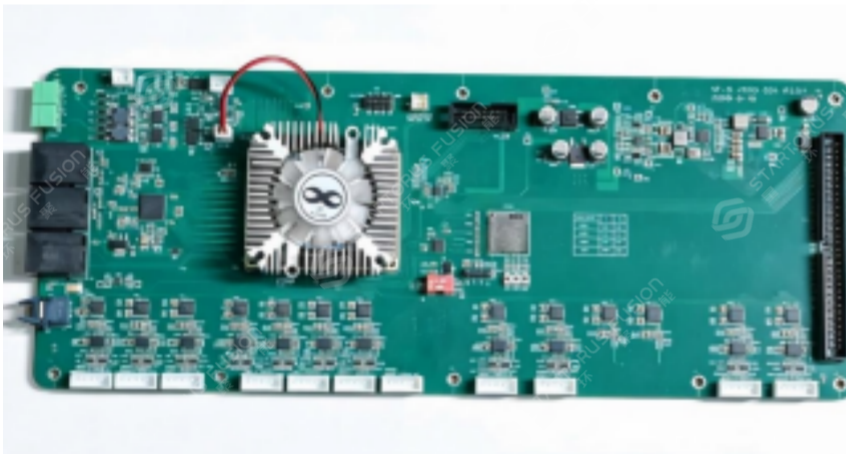
Introduction

The Multi-Channel H-Bridge Controller is a high-reliability digital control core for the magnet power supply systems of nuclear fusion devices. It was originally designed for the Poloidal Field (PF) coil power supply of the SUNIST-2 device, where it controls the state of the PF power supply H-bridges in order to precisely regulate the discharge waveform. The design is portable and can also be applied to other high-power pulsed power supply control scenarios, including CS power supplies, MC power supplies, and plasma acceleration.

The product uses a modular chassis-based design with an FPGA as its control core, and comprises six functional modules: the FPGA main control module, the communication module, the power supply module, the link module, the optical-port signal output module, and the signal acquisition module. All modules are interconnected through a backplane and are hot-swappable, which ensures reliable power delivery and signal transmission while keeping maintenance and upgrades convenient. In addition to controlling the output current waveform, the controller performs multi-point acquisition and real-time monitoring of voltage and current signals at various points in the power supply. The acquired signals are compared against preset thresholds to determine whether a fault exists at each monitoring point, thereby achieving fault localization and real-time protection, and safeguarding both the electrical supply and the equipment.



Composition



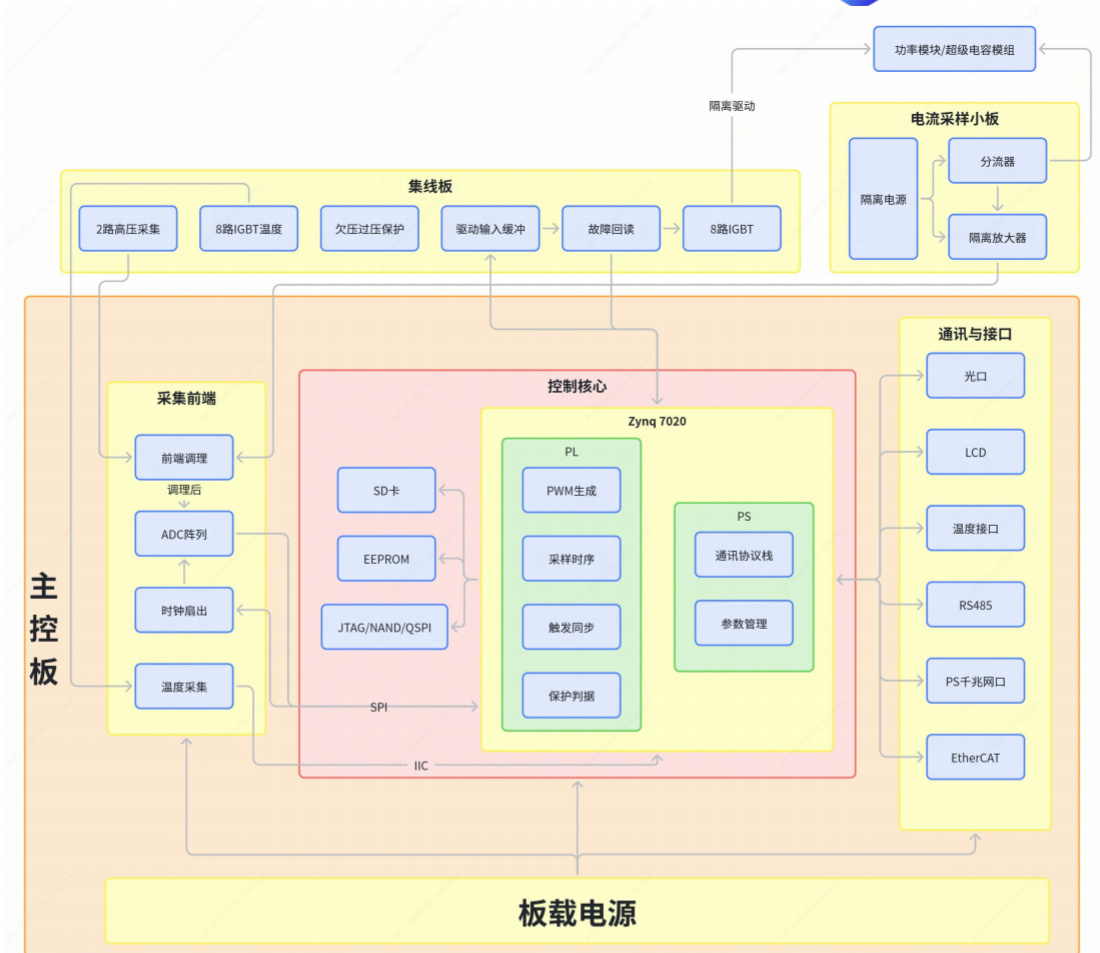
Main Control Board



Current Sampling Board



Hub Board



Board	Main Function
Main Control Board	Power supply monitoring, current acquisition, communication, pulse triggering and protection logic
IGBT Hub Board	Aggregation and distribution of IGBT drive signals; voltage acquisition
Current Sampling Sub-board	Current acquisition of the power circuit, with anti-magnetic-interference capability

A complete system consists of one main control board, one IGBT hub board and multiple current sampling sub-boards working together. The main control board provides externally 1 channel of EtherCAT, multiple channels of ADC acquisition, an external trigger optical port and 2 channels of RS485 communication. The IGBT hub board is responsible for the aggregation and distribution of 8 channels of IGBT control, and performs voltage acquisition. The current sampling sub-board is used together with the main control board: it acquires the power circuit current and transmits it to the ADC of the main control board.

Parameter

Parameter		Specification
Supply voltage		15 V DC
Rated power		15 W
Number of current acquisition channels		11 channels (main control board together with current sampling sub-boards)
Current acquisition range		± 5000 A
Current acquisition accuracy		0.5 A
Current acquisition isolation voltage		3000 V DC
Number of voltage acquisition channels		2 channels (located on the hub board)
Voltage acquisition range		± 3000 V
Voltage acquisition accuracy		1 V
Voltage acquisition isolation voltage		3000 V DC
Number of IGBT drive channels		8 channels
RS485 communication		2 channels, plug-in terminal blocks
Gigabit Ethernet (PS)		1 channel
EtherCAT communication		1 channel
Trigger optical port		1 channel
Dimensions	main control board	30.3 × 12 cm
	hub board	53 × 9.83 cm
	current sampling sub-board	6 × 6 cm
Operating temperature		≤ 60 °C

Application

1. Multi-module series/parallel power supply systems;
2. Supercapacitor energy storage system control;
3. Power electronics and IGBT drive control;
4. Power supply control with high real-time performance;
5. High-current acquisition and anti-magnetic-interference sampling;
6. Industrial high-voltage measurement and control systems.