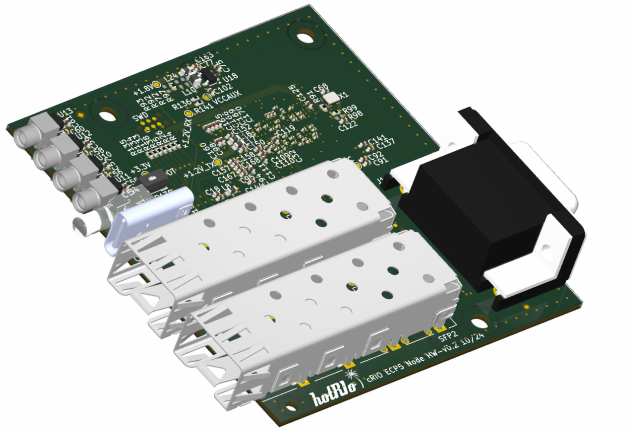
cRIO SERIES

F-HCC-IPA

HotRIO cRIO Controller board

- Compatible controller for NI CompactRIO (cRIO) platforms
- Enables HotRIO-to-cRIO integration as a protocol gateway
- Two SFP ports for high-speed data transfer
- Supports master and slave HotRIO modes



The HotRIO F-HCC-IPA board (codename Ipanema) is a controller board developed by Fusion for Energy (F4E) for seamless integration with National Instruments CompactRIO (cRIO) systems. Designed as an interface between the HotRIO protocol and the cRIO environment, the board operates as a cRIO module, enabling reliable data exchange between HotRIO-based devices and cRIO platforms. This solution allows users to access HotRIO data within NI cRIO systems with minimal modifications and investment, facilitating efficient integration of HotRIO infrastructure into existing cRIO-based applications.

At the heart of the board is a Lattice Semiconductor LFE5UM5G-85F FPGA, which provides robust communication and data-processing capabilities. This FPGA manages the HotRIO protocol, operating as either a master or slave within a HotRIO system, and facilitates seamless data transfer between the SFP communication interfaces and the cRIO interface. By leveraging this architecture, developers can efficiently bridge data between HotRIO-based devices and NI cRIO systems, enabling integration with minimal hardware changes.

Serving as a HotRIO system master, the board allows users to extend the functionality of existing NI cRIO setups by incorporating HotRIO's high-speed, fiber-optic communication—ideal for applications requiring electrical isolation or long-distance data transmission. The board can be installed directly into a cRIO chassis, acting as a protocol gateway that enables cRIO-based applications to interact with a network of HotRIO-capable devices, thus expanding system flexibility and scalability.

Technical Specifications

Form factor	cRIO module (66 x 73 mm)
FPGA	LFE5UM5G-85F
FPGA interfaces	cRIO-compatible interface (D-sub 15 connector)
Communication interfaces	2 x SFP modules (up to 1 Gbps each)
Clocks	50 MHz internal oscillator, 2x MMCX clock inputs, 2x MMCX clock outputs
Power supply	5 V DC through cRIO connector or USB

It is important to note that the F-HCC-IPA board does not provide direct I/O capabilities or support for direct connection to HotRIO expansion boards. Its primary function is to serve as a protocol gateway, facilitating data exchange exclusively between the SFP communication interfaces and the cRIO interface. All data processed by this board must pass through these interfaces; the board itself does not generate or consume user I/O data beyond protocol conversion and data handling between HotRIO and cRIO systems.

This design choice ensures a clear separation of roles within the HotRIO ecosystem, with the F-HCC-IPA board dedicated to protocol translation and system integration tasks. Users seeking direct I/O expansion or additional peripheral connectivity should consider pairing the F-HCC-IPA with other HotRIO modules specifically designed for those purposes. By focusing on reliable protocol bridging, the F-HCC-IPA simplifies the integration of HotRIO networks into cRIO environments, supporting robust and scalable system architectures.

open source hardware

Warning: This document exclusively describes the hardware detailed herein. Any reference to software or firmware used to operate this hardware is outside the scope of this document.

Developers are advised to consult separate documentation for any information related to software or firmware functionality.

1 Detailed description

1.1 Board Overview

The F-HCC-IPA (Ipanema) is a specialized HotRIO controller board designed by Fusion for Energy to enable seamless protocol bridging between HotRIO networks and National Instruments CompactRIO (cRIO) systems. At its core, the board features a Lattice ECP5 (LFE5UM5G-85F) FPGA, which manages all HotRIO protocol operations and data handling. Complementing the FPGA is a dedicated manager microcontroller that oversees board management tasks, configuration, and system monitoring.

Equipped with two SFP cages, each supporting SFP modules up to 1 Gbps, the Ipanema board facilitates high-speed, fiber-optic communication between HotRIO devices and the cRIO platform. The FPGA orchestrates efficient data transfer between the SFP interfaces and the cRIO-compatible connector, ensuring reliable, low-latency communication for demanding control and data acquisition applications.

The F-HCC-IPA is engineered to operate as a protocol gateway within a cRIO chassis, translating and forwarding data between HotRIO and cRIO environments. Its architecture is optimized for robust integration, allowing users to extend cRIO system capabilities with HotRIO's high-speed communication while maintaining clear separation of protocol and management functions. This makes the Ipanema board an ideal solution for applications requiring secure, isolated, and scalable connectivity between cRIO-based systems and HotRIO networks.

1.2 FPGA

1.3 Manager microcontroller

2 License