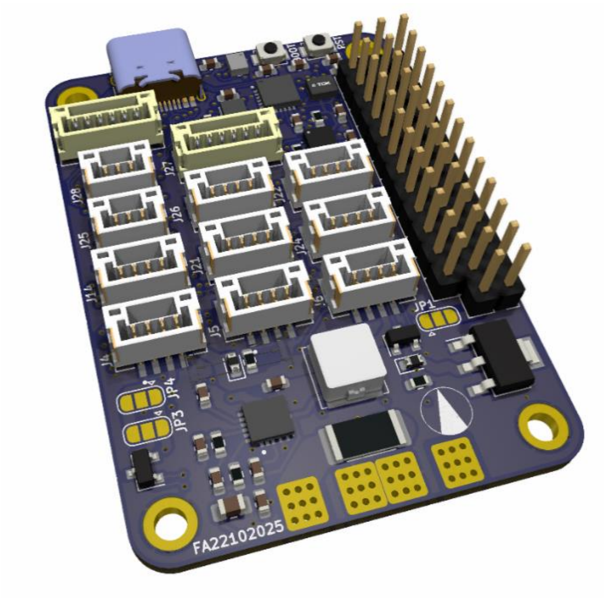
Ochin STM32H743 Wirings and Suggestion



Introduction

This manual is intended to simplify access to and usage of the STM32H743 platform by providing clear guidance on the main connection methods both to and from the board.

It highlights the recommended wiring approaches and typical interfacing modes, helping users quickly understand how to integrate the platform into their system architecture.

While this guide provides practical suggestions and usage-oriented information, it is still strongly recommended to consult the official schematic design files. The schematic offers a complete view of how all onboard components are interconnected and provides the most accurate reference for advanced integration and custom hardware configurations.

This document also explains the use of onboard SMD jumper configurations, which provide additional flexibility in hardware setup. These jumpers allow selection between different operating modes and interface routing options, enabling the platform to adapt to a wide range of application scenarios and system architectures.

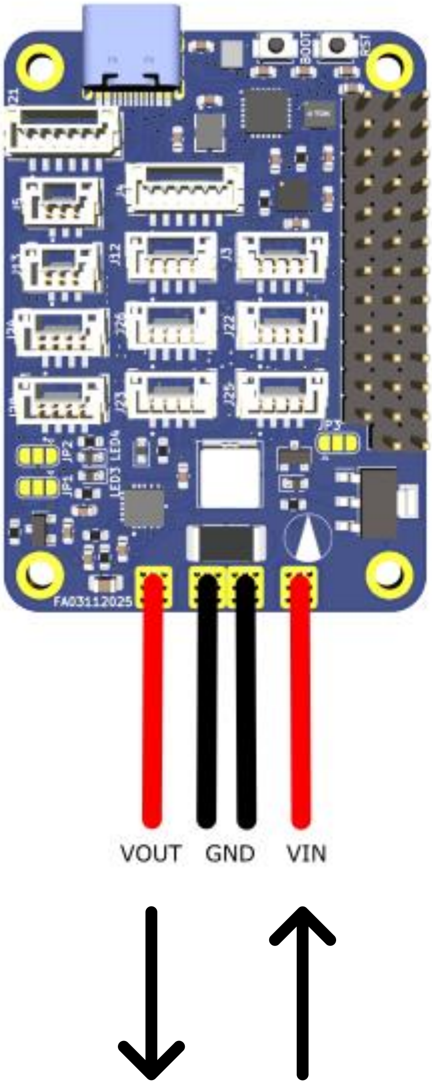
1. Power Architecture

System Power Input

The ochin_stm32h743 platform is powered through the dedicated power pads located on the top-right section of the board. These pads represent the primary system power input and must be used exclusively for powering the platform.

The input voltage is distributed internally to supply the ochin_stm32h743 microcontroller and all onboard peripherals, ensuring a unified and stable power domain for the embedded system.

After the onboard current sensing stage (shunt-based measurement), the power rail is also made available as a controlled output for external subsystems. This allows full system-level current monitoring, including downstream loads connected to the output power path.



Power Distribution to OCHIN CM4 System

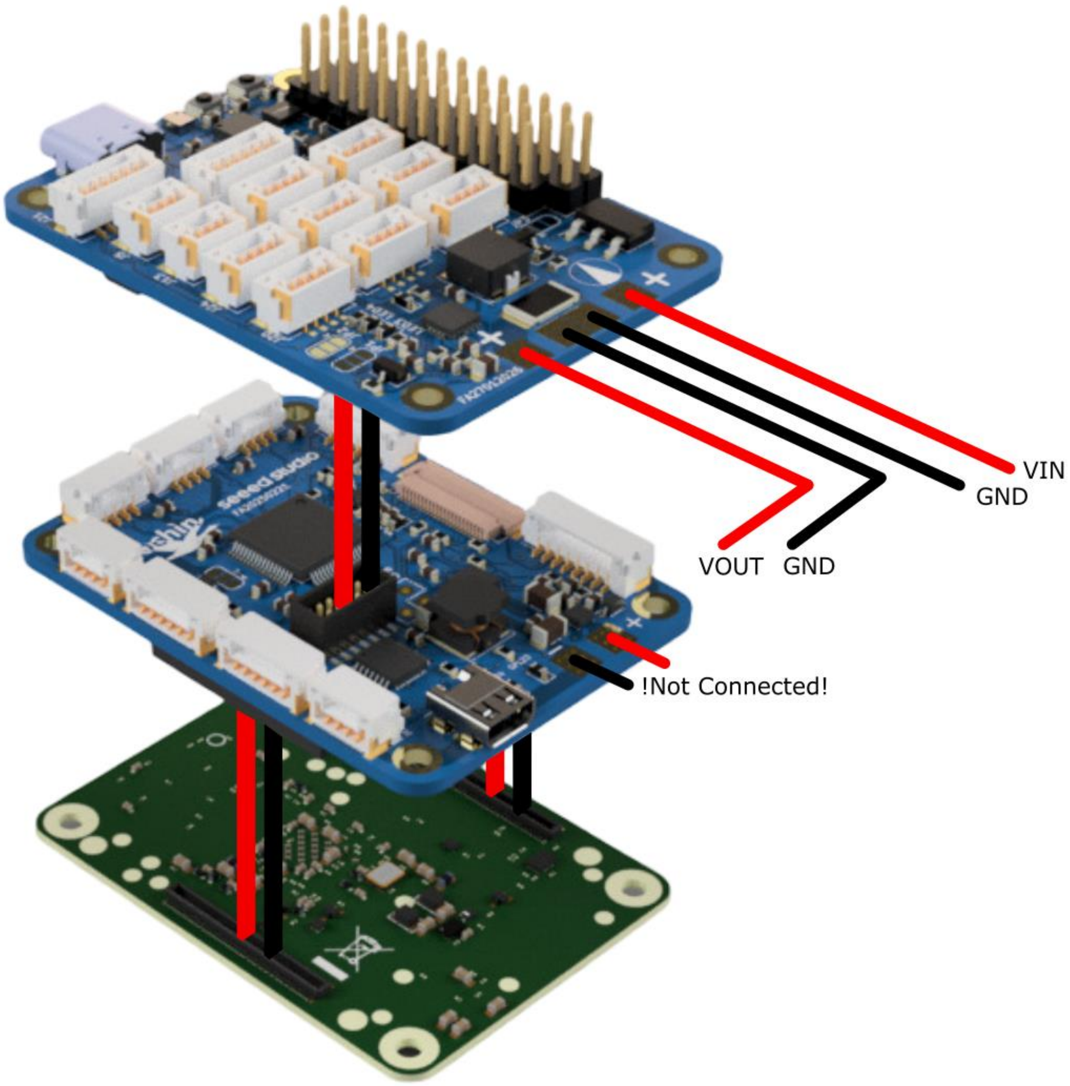
When the ochin_stm32h743 is mechanically and electrically coupled with the ochin_CM4 carrier via the dedicated mezzanine connector (bottom interface), power distribution is extended across both boards.

In this configuration, the ochin_stm32h743 platform acts as the primary power entry and distribution node for the system. The incoming supply applied to the ochin_stm32h743 is routed through the mezzanine connector, which directly provides regulated system power to the ochin_CM4 board. The ochin_CM4 in turn supplies the Raspberry Pi Compute Module (CM4/CM5), depending on the installed configuration.

As a result, when both boards are used in the stacked configuration:

- The ochin_CM4 does not require separate power input via its own power pads
- Power is supplied directly through the ochin_stm32h743 mezzanine interface
- The entire system operates from a single centralized power input

This architecture simplifies system wiring and ensures consistent power distribution across the full embedded stack.



⚠️ Important System Note

When operating in stacked configuration (ochin_stm32h743 + ochin_CM4):

- Only the ochin_stm32h743 power input pads must be used as the main power entry point
- The ochin_CM4 power inputs must remain unpowered and unused
- Power must be routed exclusively through the mezzanine connector

Incorrect simultaneous powering of both boards can result in:

- Back-powering between domains
- Uncontrolled current paths
- Potential damage to power regulation circuitry

System Power Concept

This architecture is designed to implement a single-entry power system model, where:

- ochin_stm32h743 acts as primary power and control node
- ochin_CM4 acts as distributed compute subsystem
- Raspberry Pi CM4/CM5 acts as high-level processing unit
- This ensures a clean separation between:
- Real-time control domain (ochin_stm32h743)
- Compute and orchestration domain (Linux / ROS 2)

Recommended Power Practices

To ensure correct system operation:

Use a single regulated DC supply for the entire stack

- Ensure sufficient current capability for both compute and control subsystems
- Maintain a shared ground reference across all interconnected boards
- Avoid external powering of the ochin_CM4 when stacked with ochin_stm32h743
- Verify power integrity under peak load conditions (boot, communication, actuation)

2. Servo Interface and Power Configuration

Servo Connector Layout

The STM32H743 platform provides twelve dedicated servo interface connectors labeled S1 to S12, located on the right side of the board.

These connectors are designed for direct interfacing with standard RC servos, PWM-controlled actuators, and other low-voltage control devices.

Each connector follows the same pin arrangement:

- Left column: STM32 GPIO signal line (S1 → S12)
- Center column: Positive servo supply rail (V_SERV)

- Right column: Ground (GND)

The signal pins are connected to STM32H743 GPIOs and can be internally mapped to hardware timer peripherals for PWM generation. This enables deterministic servo pulse generation with low CPU overhead and precise timing control.

In addition to PWM functionality, these pins retain their alternative STM32 peripheral functions and may also be configured as general-purpose GPIOs depending on the firmware architecture and application requirements.

Servo Power Architecture (VSERV)

The servo connectors use a dedicated power rail identified as VSERV.

This rail can be configured to operate from either:

- The onboard regulated 5 V supply generated by the STM32H743 platform
- An externally supplied servo power source

Selection between these two operating modes is performed through the onboard SMD jumper JP3.

JP3 Configuration

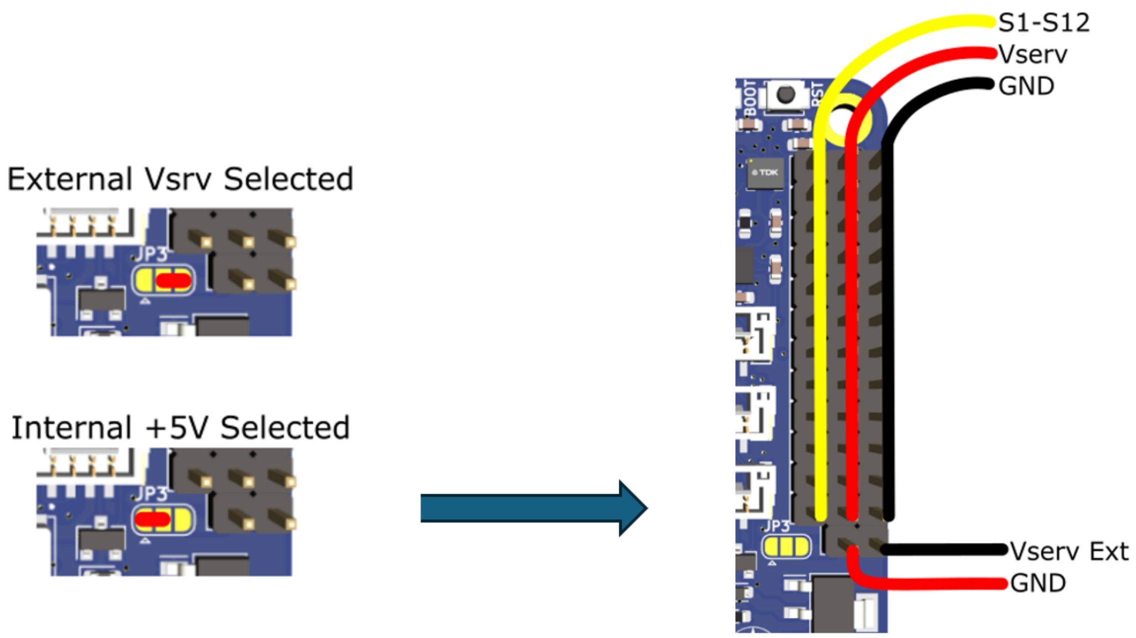
JP3 is used to select the source of the VSERV rail.

Internal 5 V Supply Mode

When the center pad is shorted to the left pad, VSERV is connected to the internally generated 5 V rail of the board.

This configuration is suitable for:

- Low-power servos
- Logic-compatible PWM peripherals
- Development and validation setups



External VSERV Mode

When the center pad is shorted to the right pad, the V_ERV rail is disconnected from the onboard 5 V regulator and routed to the external servo power input connector.

An external supply voltage can then be provided through the dedicated 2-pin connector located directly below the servo connector bank.

This configuration is recommended when:

- Using multiple servos simultaneously
- Driving high-current actuators
- Operating servos requiring voltages different from 5 V
- Isolating actuator power from the main logic supply

⚠ Important Power Considerations

Servo motors can generate high transient currents during startup and dynamic load conditions.

When using external VSERV power:

- Ensure proper grounding between external supply and board ground
- Verify voltage compatibility with connected servos
- Avoid exceeding connector or trace current capabilities
- Use adequately dimensioned power wiring for high-current applications

Improper servo power configuration may lead to:

- Voltage instability
- Brownout conditions
- Noise injection into logic domains
- System resets during actuator activity

Design Intent

The servo subsystem is designed to support both:

- Direct low-power actuator integration using onboard regulation
- Scalable external actuator power architectures for robotics and motion-control systems

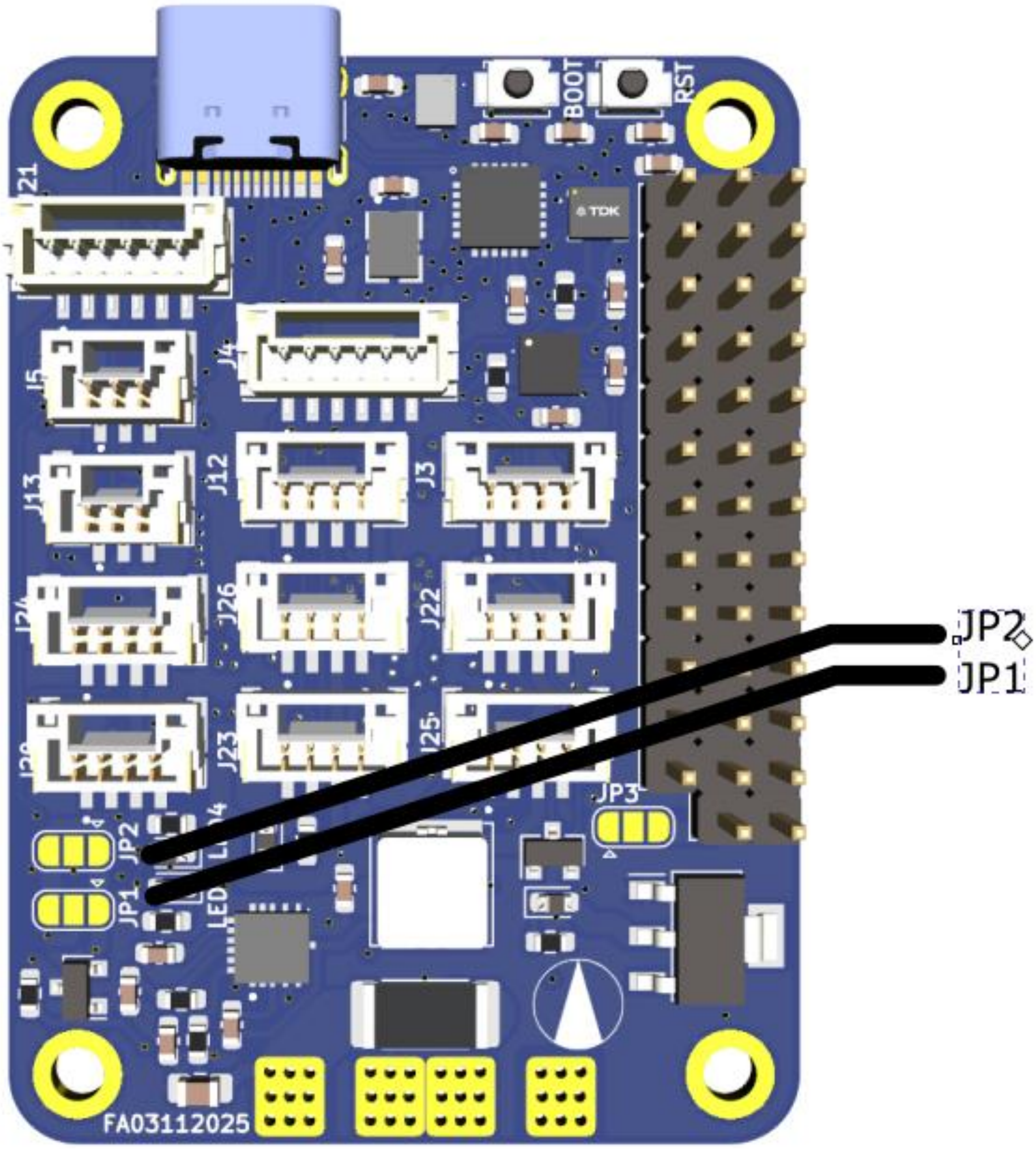
This flexibility allows the platform to adapt from compact embedded systems to distributed multi-actuator environments while maintaining centralized signal generation and deterministic timing control.

3. Camera and VTX Power Jumper Configuration

The STM32H743 platform provides configurable power routing for external camera and VTX (Video Transmitter) subsystems through the onboard jumpers JP1 and JP2.

These jumpers allow selection of the supply voltage routed to the dedicated external connectors, enabling compatibility with different analog video and FPV subsystem requirements.

Proper jumper configuration must always be verified before connecting external devices.



JP1 – Camera Power Output Selection (J25)

JP1 selects the output voltage available on connector J25, intended for powering an external analog video source or camera module.

Available configurations:

- Pins 1–2 shorted:
  Output voltage = VIN
- Pins 2–3 shorted:
  Output voltage = +5V

This configuration allows the camera subsystem to operate either directly from the main input voltage rail or from the onboard regulated 5 V supply, depending on camera requirements.

⚠️ Always verify the voltage tolerance of the connected camera before applying power.

JP2 – VTX Power Output Selection (J26)

JP2 selects the output voltage available on connector J26, intended for powering an external video transmitter (VTX).

Available configurations:

- Pins 1–2 shorted:
  Output voltage = VIN
- Pins 2–3 shorted:
  Output voltage = +5V

This enables flexible integration of VTX modules requiring either direct battery voltage or regulated 5 V operation.

⚠️ Power Integration Notes

When using VIN-routed configurations:

- The output voltage follows the main system input voltage
- Voltage level depends directly on the external power supply connected to the system
- Compatibility with connected camera/VTX hardware must be verified carefully

Incorrect jumper configuration or voltage mismatch may permanently damage connected video equipment.

Design Intent

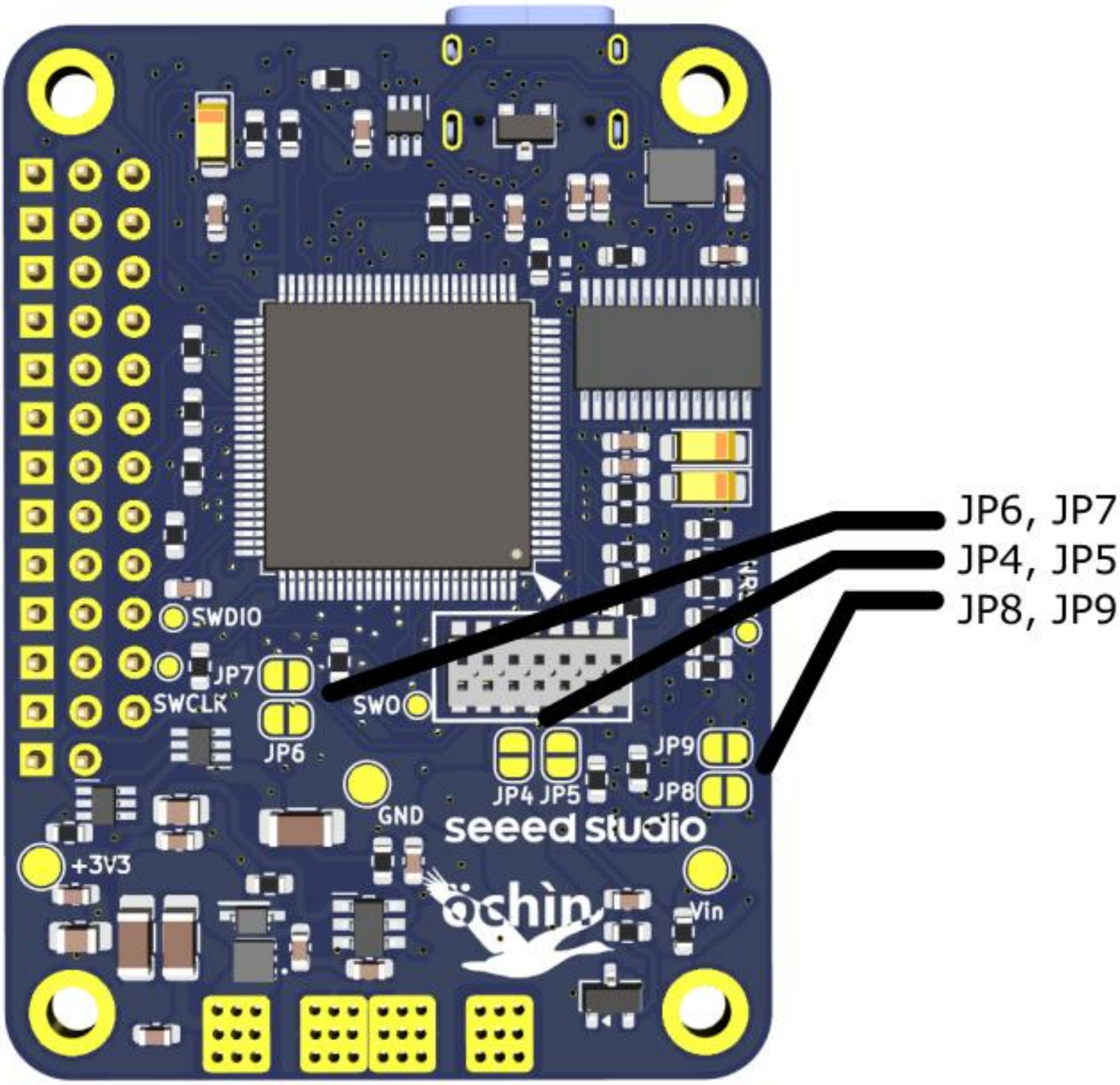
The camera and VTX power routing architecture is designed to support flexible integration of embedded vision and FPV subsystems within robotics, UAV, and distributed embedded platforms, while minimizing external power conversion requirements and simplifying system wiring.

4. CM4 Communication Routing Jumpers (UART / I2C)

The STM32H743 platform provides configurable routing jumpers for direct communication between the STM32 microcontroller and the OCHIN CM4 system through the onboard mezzanine interface.

These jumpers allow selective interconnection of UART and I2C buses between the Raspberry Pi Compute Module environment and the STM32H743, enabling flexible system integration depending on the target architecture.

By default, these routing paths can remain isolated, allowing the communication interfaces to be reassigned to external boards or custom intermediate modules.



JP4, JP5 – Routing CM4 UART4 to STM32 UART7

JP4 and JP5 are used to connect the Compute Module UART4 interface to the STM32 UART7 peripheral.

The routing is internally crossed (TX ↔ RX) to allow direct serial communication between the two systems.

Configuration:

- JP4:
  Connects RXD4_CM4 → TX7
- JP5:
  Connects TXD4_CM4 → RX7

These jumpers should be soldered only when direct communication between the CM4 environment and the STM32 UART7 interface is required.

If UART4 on the CM4 side is allocated to:

- A third-party expansion board
- An intermediate custom board
- External system communication

then JP4 and JP5 must remain open.

JP6, JP7 – Routing CM4 UART0 to STM32 UART1

JP6 and JP7 are used to connect the Compute Module UART0 interface to the STM32 UART1 peripheral.

The routing follows the same crossed TX/RX architecture used for direct serial communication.

Configuration:

- JP6:
  Connects RXD0_CM4 → TX1
- JP7:
  Connects TXD0_CM4 → RX1

These jumpers should only be populated when UART0 is intended for direct STM32 ↔ CM4 communication.

If UART0 is used by:

- Another mezzanine board
- A custom interface layer
- External communication peripherals

the jumpers must remain open to avoid bus conflicts or unintended signal contention.

JP8, JP9 – Routing CM4 I2C1 to STM32 I2C1

JP8 and JP9 are associated with the routing of the CM4 I2C1 bus to the STM32 I2C1 interface.

Unlike UART routing, these jumpers are intended for specialized integration scenarios and should normally remain open.

They should only be closed in the following situations:

- When integrating a custom intermediate board between the STM32H743 and OCHIN CM4 platforms that requires access to the STM32 I2C1 bus while isolating it from the CM4 I2C domain
- When configuring the STM32 I2C1 peripheral in slave mode for controlled communication with the Compute Module side

⚠ Important I2C Bus Warning

Improper closure of JP8 and JP9 may result in two independent I2C masters sharing the same bus simultaneously.

This condition must be strictly avoided, as it can cause:

- Bus contention
- Communication instability
- Undefined signaling conditions
- Potential hardware stress or malfunction

Always verify the intended I2C topology before enabling these jumpers.

Design Intent

The communication routing jumper architecture is designed to support modular and scalable embedded systems where communication paths may vary depending on:

- System topology
- Presence of custom intermediate boards
- Robotics or automation communication requirements
- Multi-controller embedded architectures

This approach allows the STM32H743 platform and the OCHIN CM4 subsystem to operate either as tightly coupled nodes or as independently routed subsystems within larger embedded deployments.

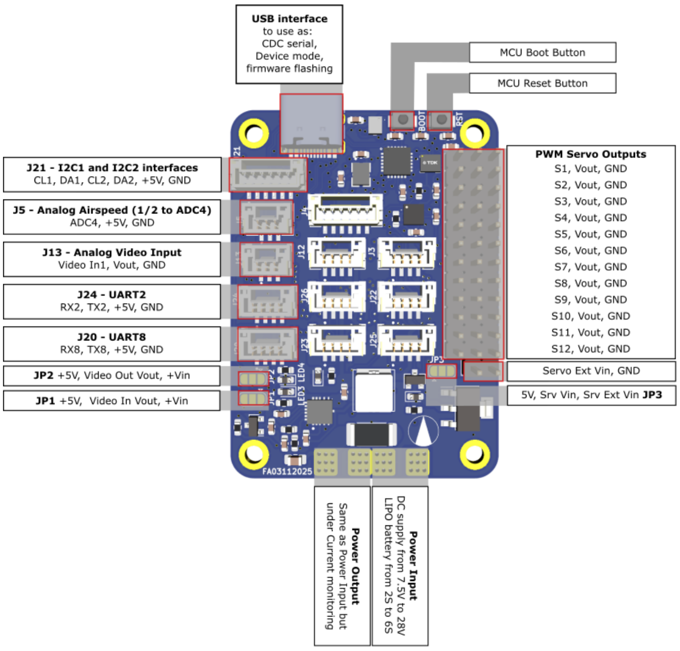
5. Connector Reference and Pin Mapping

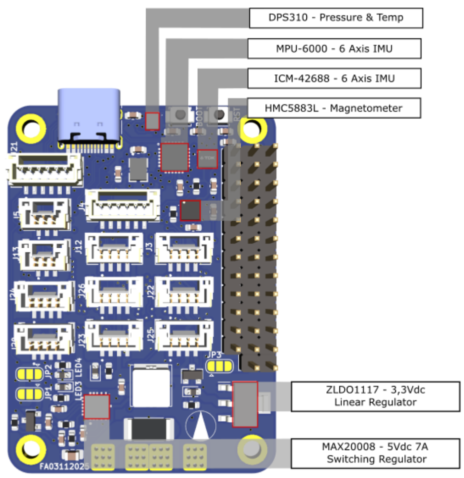
Overview

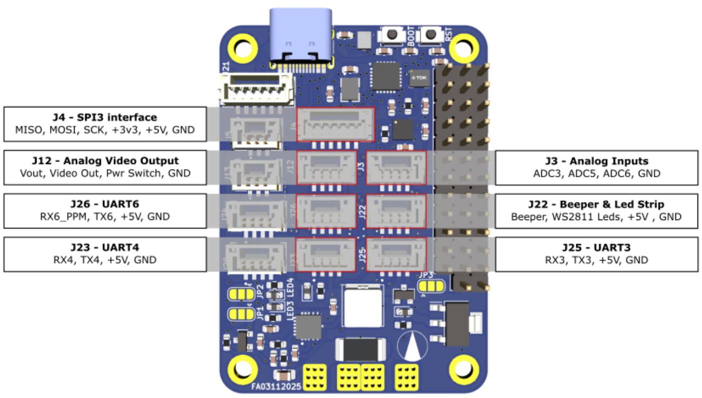
This chapter provides a consolidated reference for all connectors available on the ochin_STM32H743 platform.

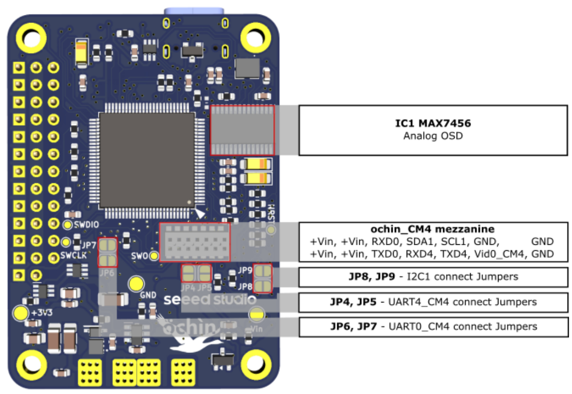
The purpose of this section is to provide a clear mapping between physical connectors, signal functions, and system-level interfaces in order to simplify hardware integration and system-level design.

The information reported here reflects the actual board silkscreen and connector labeling. For detailed electrical characteristics and internal routing, always refer to the official schematic documentation.









Power Connectors

Main Power Input (Bottom Pads)

The main system power input is located on the bottom side of the board.

Reference	Description
Power Input Pads (VIN / GND)	Primary system power input (7.5V – 28V DC)
Power Output (Post-Shunt)	System power output after current measurement stage

The input power is routed internally to supply the STM32H7 system and onboard peripherals. After the current sensing stage, the same power rail is made available as an output for external loads.

Servo Outputs (S1 – S12)

The platform provides 12 PWM-capable servo outputs located on the right side of the board.

Each servo connector follows the same pin structure:

- **Sx (Left column):** STM32 GPIO / PWM signal output
- **Vout (Center column):** Servo power supply rail
- **GND (Right column):** Ground

Where:

- S1 → S12 correspond to STM32 timer-capable GPIOs
- PWM signals can be generated via internal timer peripherals
- GPIOs may also be used for alternative STM32 functions when required

The servo power rail (Vout) is selectable via JP3.

Camera Interface (J13 / JP1)

The camera interface is located on connector **J25** and supports analog video input systems.

Pin	Function
Video In	Analog video input signal
+5V / VIN	Power supply (selected via JP1)
GND	Ground

JP1 – Camera Power Selection

JP1 defines the power source for J25:

- Pins 1–2 shorted → VIN
- Pins 2–3 shorted → +5V

VTX Interface (J12 / JP2)

The VTX interface is located on connector **J26** and is intended for video transmitter integration.

Pin	Function
Video Out	Analog video output signal
+5V / VIN	Power supply (selected via JP2)
GND	Ground

JP2 – VTX Power Selection

- Pins 1–2 shorted → VIN
- Pins 2–3 shorted → +5V

5.6 UART Interfaces

J24 – UART2

- RX2
- TX2
- +5V
- GND

J20 – UART8

- RX8
- TX8
- +5V
- GND

J23 – UART4

- RX4
- TX4
- +5V
- GND

J26 – UART6

- RX6
- TX6
- +5V
- GND

J25 – UART3

- RX3
- TX3
- +5V
- GND

All UART interfaces operate at 3.3V logic level.

SPI Interface

J4 – SPI3 Interface

Pin	Function
MISO	SPI Data Out
MOSI	SPI Data In
SCK	Clock
+3V3	Power
GND	Ground

Analog Interfaces

J3 – Analog Inputs

- ADC3
- ADC5
- ADC6

J5 – Analog Airspeed Input

- ADC4
- +5V
- GND

J12 – Analog Video Output

- Video Out
- Power Switch Control
- GND

Auxiliary Interfaces

J22 – Buzzer and LED Strip

- Buzzer output
- WS2812 LED control
- +5V
- GND

J21 – I2C Interfaces

- CL1
- DA1
- CL2
- DA2
- +5V
- GND

Supports dual I2C bus configuration.

Mezzanine Connector (ochin_CM4 Interface)

The bottom mezzanine connector provides system-level integration between:

- STM32H743 control platform
- OCHIN CM4 carrier board
- Raspberry Pi Compute Module (CM4 / CM5)

Functions include:

- Power distribution
- UART routing
- I2C routing
- System interconnect signals

System Integration Notes

When integrating external hardware:

- Verify voltage compatibility before connection
- Ensure correct power configuration via jumpers
- Avoid bus conflicts on shared communication lines
- Confirm UART/I2C routing when using CM4 integration mode
- Refer to schematic for full pin multiplexing details

Design Intent

The connector system is designed to support a modular embedded architecture enabling:

- Real-time control systems
- Robotics and automation platforms
- Multi-compute distributed systems (STM32 + Linux CM4)
- Flexible sensor and actuator integration
- Rapid system-level reconfiguration via jumper routing