

I2C

Protocols / SDA + SCL

Two shared signal lines, device addresses and compatible pull-ups.

01 Bus wiring

Signals

SDA = data; SCL = clock. Connect matching lines plus common ground.

Pull-ups

Both lines need pull-ups to a compatible logic rail; 4.7 kohm is a common short-bus starting point.

Addressing

Most devices use 7-bit addresses. Duplicate fixed addresses need a mux or separate bus.

02 Board examples

Uno / Nano

SDA A4, SCL A5; Arduino: `Wire.begin()`.

Classic ESP32

Example SDA 21, SCL 22; Arduino: `Wire.begin(21, 22)`.

Pico MicroPython

`I2C(0, sda=Pin(4), scl=Pin(5), freq=100000)`.

03 Bring-up

Scan first

Start at 100 kHz; scan addresses and compare with the device datasheet.

Multiple boards

Parallel breakout pull-ups reduce total resistance; check the combined value.

Debug

Idle SDA and SCL should be HIGH. Check power, ground, address and stuck-low lines.

Before you power on

Do not pull SDA/SCL to 5 V when attached to a 3.3 V-only MCU. Use an I2C-compatible bidirectional level shifter.

I2C / continued

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Datasheets & further reading

NXP I2C specification

<https://www.nxp.com/docs/en/user-guide/UM10204.pdf>

MicroPython RP2 reference

<https://docs.micropython.org/en/latest/rp2/quickref.html>