

SPI – fast chip-to-chip bus (our "spine")

Serial Peripheral Interface · synchronous · master + slaves

HOW IT WORKS

One MASTER (the MCU), one or more SLAVES (chips). The master provides a CLOCK; on each clock tick one bit goes out and one comes in. Two SEPARATE data wires (out + in) = full-duplex (both directions at once). The master picks WHICH slave by pulling that slave's Chip-Select (CS) line low – only the selected chip listens.

THE WIRES

SCLK = clock (master drives)
MOSI = Master Out, Slave In (data to the chip)
MISO = Master In, Slave Out (data from the chip)
~CS = chip-select, ONE PER SLAVE (active low)

KEY FACTS

Fast: tens of MHz. Simple, no addressing, no pull-ups.
Cost: needs a separate CS wire for every chip → pin-hungry.

SPI vs I2C (the one-liner)

SPI = FAST + more wires (a CS per chip, separate in/out).
I2C = only 2 wires shared by everyone, but slower + addressed.
Rule of thumb: SPI for speed/few chips, I2C to save pins/many chips.

WHERE WE USE IT

SPI is our "SPINE": one SCLK/MOSI/MISO shared by the PCA9745B + both MCP3208 ADCs (and the W5500 on the Brain), each with its own CS. Going SPI fixed the C3 pin crunch AND dodged the noisy on-chip ADC – the single most consequential wiring decision on the main board.