

Hello FPGA Kit · SmartFusion2 M2S010-VF256

USB Mini-B → MCP2221A → PIC32 → SF2 (Robot PC, /dev/ttyACM0)

Arduino headers = female sockets → use Dupont jumper wires (m/f)

3.3 V levels (IOREF = 3P3V) · Arduino A0-A5 go to the PIC32 → do not use

J8 · Digital 0-7

	Ball	Assignment
1	IO0 / RX	F3 UART RX (spare)
2	IO1 / TX	G3 UART TX (spare)
3	IO2	P6 -
4	IO3 ~	N7 SERVO-PWM
5	IO4	R9 CS5 → A4 (J5)
6	IO5 ~	P10 CS4 → A3 (J4)
7	IO6 ~	T8 CS3 → A2 (J3)
8	IO7	T7 CS2 → A1b (J2)

J7 · Digital 8-15

	Ball	Assignment
1	IO8	R10 CS1 → A1a (J2)
2	IO9 ~	P9 -
3	IO10 / SS	M10 CS0 → A0 (J1)
4	IO11 / MOSI	R11 SPI MOSI
5	IO12 / MISO	T11 SPI MISO
6	IO13 / SCK	R13 SPI SCK
7	GND	- GND
8	AREF	- do not use
9	IO14 / SDA	P8 - (I²C later)
10	IO15 / SCL	R8 - (I²C later)

J9 · Power

	Ball	Assignment
1	NC	-
2	IOREF	- = 3.3 V (I/O level!)
3	RESET	R12 do not use
4	3V3	- VIO drivers
5	5V	- do not use
6	GND	- GND
7	GND	- GND
8	VIN	- NC

Spare: USB-UART cable 3.3 V (e.g. FTDI TTL-232R-3V3)

TXD → IO0/RX (J8-1) · RXD ← IO1/TX (J8-2) · GND → J9-7

connect only if the host link via the PIC32 is insufficient

PSU 24 V / ≥ 320 W

e.g. Mean Well LRS-350-24

minus = GND star point

(connect to kit GND J9-6)

DC/DC 24 → 6 V ≥ 5 A

servo supply only

Note on modules

Pin names per Watterott

SilentStepStick TMC5160

v1.5 (SD_MODE jumper).

Other module (e.g. BTT):

verify pinout.

No limit switches (stage 1)

Mechanics provide no switches.

Open-loop position, as on the

original Moveo:

1. Move arm to the defined start

pose by hand (power off)

2. Power up: firmware sets

XACTUAL = 0 on all axes

3. Joint ranges as software limits

(firmware / ros2_control)

REFL/REFR (STEP/DIR pins) tied

to GND, SW_MODE stops disabled.

Servo MG996R

signal (orange) ← IO3

+ (red) ← 6 V BEC

- (brown) → GND

Wiring list (Dupont m/f, logic wires ≤ 30 cm)				
Kit pin	Arduino	Ball	Signal	Destination
J7-6	IO13	R13	SPI SCK	→ SCK of all 6 modules
J7-4	IO11	R11	SPI MOSI	→ SDI of all 6 modules
J7-5	IO12	T11	SPI MISO	← SDO of all 6 modules
J7-3	IO10	M10	CS0	→ CSN A0 (J1 base)
J7-1	IO8	R10	CS1	→ CSN A1a (J2 shoulder a)
J8-8	IO7	T7	CS2	→ CSN A1b (J2 shoulder b)
J8-7	IO6	T8	CS3	→ CSN A2 (J3 elbow)
J8-6	IO5	P10	CS4	→ CSN A3 (J4 forearm roll)
J8-5	IO4	R9	CS5	→ CSN A4 (J5 wrist)
J8-4	IO3	N7	SERVO-PWM	→ servo signal
J8-1	IO0	F3	UART RX	← TXD USB-UART (spare)
J8-2	IO1	G3	UART TX	→ RXD USB-UART (spare)
J9-4	3V3	-	VIO	→ VIO of all 6 modules
J9-6/7, J7-7	GND	-	GND	→ GND modules, servo, UART, PSU minus

Fixed wiring on the modules & notes

1 TMC5160 in motion-controller mode (SD_MODE=0, SPI_MODE=1): ramps run in the driver,

the FPGA only needs SPI + 6 CS. No STEP/DIR, EN or DIAG from the kit.

2 Per module: EN → GND, CLK → GND. Power stage stays off after reset (CHOPCONF.TOFF=0)

until the firmware enables it via SPI.

3 No limit switches: STEP/DIR (= REFL/REFR) → GND, SW_MODE stops off; start pose by

hand before power-up, XACTUAL = 0 at start-up, software joint limits.

4 SPI mode 3, max. 2 MHz (Dupont wires); SDO is high-Z while CSN=HIGH → shared MISO is OK.

5 MSS SPI_0 and MMUART_0 are wired to the PIC32 → in Libero route MSS SPI_1 / MMUART_1

through the fabric to these pins (or use CoreSPI/CoreUART).

6 Only 3.3 V signals to the kit; leave J9-5 (5 V) and J9-3 (RESET) unconnected.

7 Never route VM/motor phases via breadboard/Dupont; never plug motors while powered.

8 Shoulder: configure A1a/A1b identically, write target positions back-to-back.

9 SPI bus to the 6 modules: Dupont splitter or breadboard (logic only).

Company	bavariamatic
Project	19 Robot Arm Demonstrator
Content	Direct wiring, stage 1
Controller	Hello FPGA Kit (M2S010-VF256)
Drivers	6× TMC5160, SPI only
Pin source	Hello FPGA Schematics Rev. 1, p. 11
Date	2026-10-07 · Rev. D (draft)
Supersedes	Rev. C (with home switches)
Status	for review - not released