Rasberry Pi Pico Universal Robot board

Introduction:

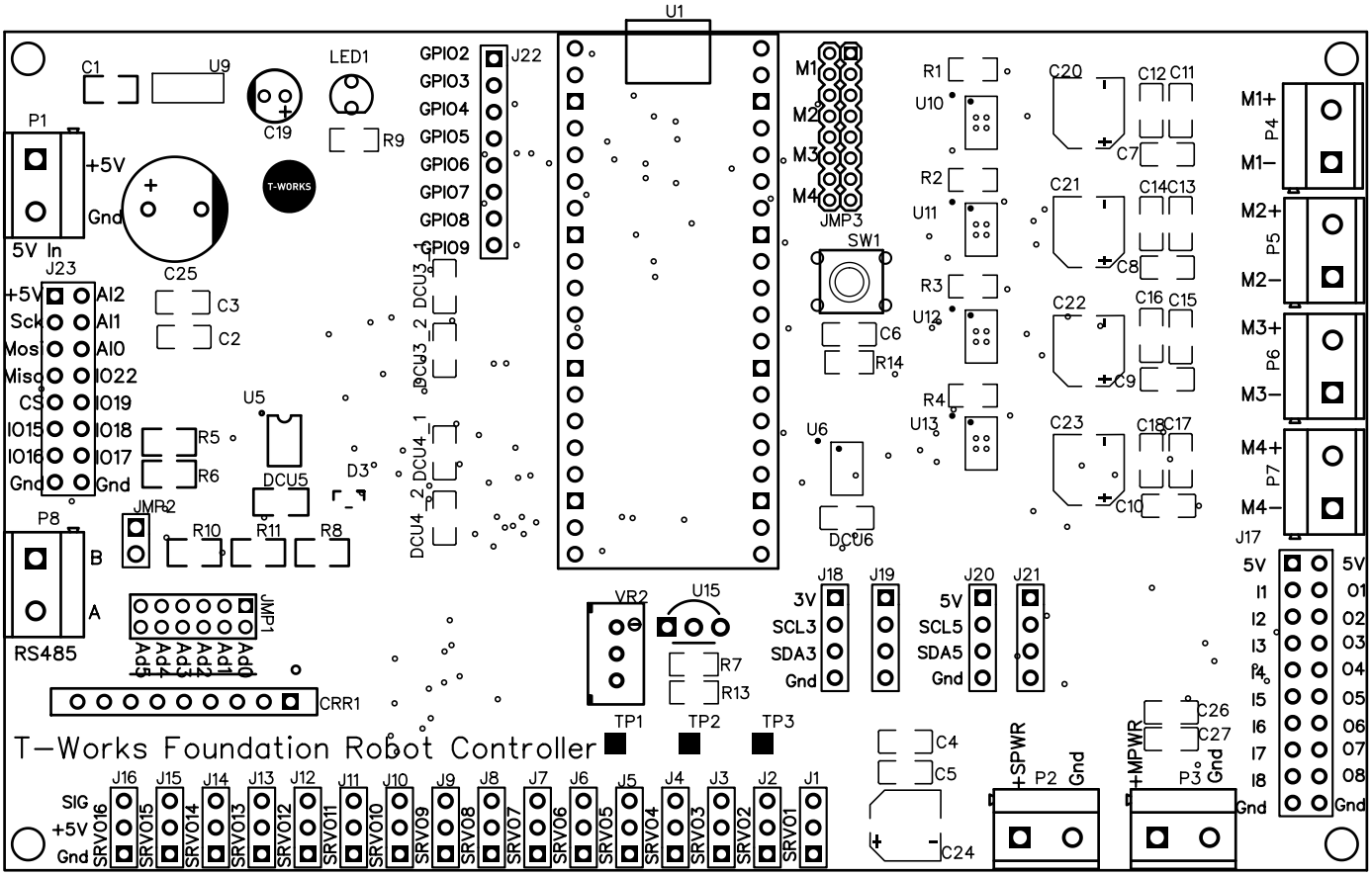
The Pi Pico universal robot control board is the third board designed in the rapid prototyping series. It was designed for the Hyderabad Maker Faire 2023. This board is designed specifically for building hobby robotic applications.

The board features 4 DRV8870 brushed DC motor drivers that can handle motor voltages between 6.5 to 45 V DC with a current of 3.6A each. Also 16 hobby servos can be controlled through PCA9685, i2c based 12bit PWM controller.

By changing jumper configuration JMP3, GPIO2-GPIO9 maybe employed for controlling external high power drivers in lieu of the 4 brushed DC motor drives.

The board has a power input of 5V for the logic part with an onboard 3.3V power regulator capable of delivering500mA. Also the board has separate power inputs for the 4 DC motors and the servo motors respectively. The Dual pay DC motors may be used to implement Differential steering.

Note: The silkscreen is wrong (on J23), please refer the Schematic for the connector details, the connector



Specifications:

Physical	**L x W xH (cm) 13.5 x 8.5 x 2**
Weight	
Power	Logic 5V DC Motors 6.5 - 45V Servos 6-9V
Microcontroller	RasPi Pico RP2040
I2C Bus	5V bus two ports, 3.3V bus two ports
EEPROM	I2C Bus 8KB
Voltage Reference	Precision band gap Programmablereference TL431 set through a POT
Brushed DC motor driver	4 DC motors, 3.6A each, 6.5 to 45 V o[perating voltage, PWM control interface, Separate DC input for DC motors
Hobby Servos	16 Channel, Separate power input for Servos 4.8 to 6.6V 12 bit PWM control through PCA9685
Digital Inputs	8Ch based on PCF8574 with Ext Interrupt
Digital Outputs	8ch based on PCF8574
Spare GPIO	12 GPIO, all 5V level shifted
Serial Interface	RS485

Connector Details:

P1 Terminal Block 2 Pin	5V Power Input
P1.1	5V DC
P1.2	Gnd

P2 Terminal Block 2 Pin	Servo Power 4.8V to 6.6 V DC
P2.1	4.8 to 6.6V
P2.2	Gnd

P3 Terminal Block 2 Pin	DC Motor Power 6.5V to 45V
P3.1	6.5V to 45V
P3.2	Gnd

P4 Terminal Block 2 Pin	DC Motor-01
P4.1	DC Motor-1 (+)
P4.2	DC Motor-1 (-)

P5 Terminal Block 2 Pin	DC Motor-1
P5.1	DC Motor-2 (+)
P5.2	DC Motor-2 (-)

P6 Terminal Block 2 Pin	DC Motor-2
P6.1	DC Motor-3(+)
P6.2	DC Motor-3(-)

P7 Terminal Block 2 Pin	DC Motor-3
P7.1	DC Motor-4(+)
P7.2	DC Motor-4(-)

P8 Terminal Block 2 Pin	Rs485
P8.1	B
P8.2	A

J1 - J16 Berg 3 Pin	Hobby Servo
J1-16.1	Gnd
J1-16.2	4.8 to 6.6V
J1-16.3	Servo Signal

J17 Berg 10 x 2	Inputs & Outputs
J17.1	5V
J17.2	5V
J17.3	Inp1
J17.4	Out1
J17.5	Inp2
J17.6	Out2
J17.7	Inp3
J17.8	Out3
J17.9	Inp4
J17.10	Out4
J17.11	Inp5
J17.12	Out5
J17.13	Inp6
J17.14	Out6
J17.15	Inp7
J17.16	Out7
J17.17	Inp8
J17.18	Out8
J17.19	Gnd
J17.20	Gnd

J18-J19 Berg 4 Pin	I2C Bus 3.3V
J18-19.1	3.3V
J18-19.2	SCL
J18-19.3	SDA
J18-19.4	Gnd

J20-J21 Berg 4 Pin	I2C Bus 5V
J20-21.1	5V
J20-21.2	SCL
J20-21.3	SDA
J20-21.4	Gnd

J22 Berg 8 Pin	GPIO
J22.1	GPIO2
J22.2	GPIO3
J22.3	GPIO4
J22.4	GPIO5
J22.5	GPIO6
J22.6	GPIO7
J22.7	GPIO8
J22.8	GPIO9

J23 Berg 8 x 2	GPIO
J23.1	5V
J23.2	AI0
J23.3	SCK
J23.4	Gnd
J23.5	MOSI
J23.6	AI1
J23.7	MISO
J23.8	Gnd
J23.9	CS
J23.10	AI2
J23.11	GPIO15
J23.12	Gnd
J23.13	GPIO20
J23.14	GPIO22
J23.15	Gnd
J23.16	GPIO21

Jumpers:

Jmp1 Berg 6 x 2 2 mm	**U7 PCA9685 I2C Address**
Jmp1.1	5V
Jmp1.2	U7A0 (Not Shorted 0V)
Jmp1.3	5V
Jmp1.4	U7A1 (Not Shorted 0V)
Jmp1.5	5V
Jmp1.6	U7A2 (Not Shorted 0V)
Jmp1.7	5V
Jmp1.8	U7A3 (Not Shorted 0V)
Jmp1.9	5V
Jmp1.10	U7A4 (Not Shorted 0V)
Jmp1.11	5V
Jmp1.12	U7A5 (Not Shorted 0V)

Jmp2 Berg 2 Pin	**RS485 Loop Resister 120 Ohms**
Jmp2.1	A
Jmp2.2	B

Jmp3 Berg 8 x 2 2 mm	GPIO for DRV8870 DC Motor Control
Jmp3.1	GPIO2 (5V)
Jmp3.2	M1IN1
Jmp3.3	GPIO3 (5V)
Jmp3.4	M1IN2
Jmp3.5	GPIO4 (5V)
Jmp3.6	M2IN1
Jmp3.7	GPIO5 (5V)
Jmp3.8	M2IN2
Jmp3.9	GPIO6 (5V)
Jmp3.10	M3IN1
Jmp3.11	GPIO7 (5V)
Jmp3.12	M3IN2
Jmp3.13	GPIO8 (5V)
Jmp3.14	M4IN1
Jmp3.15	GPIO9 (5V)
Jmp3.16	M4IN2