AGENT BRIEFING NOTES

Physical Computing Test Board Instructions

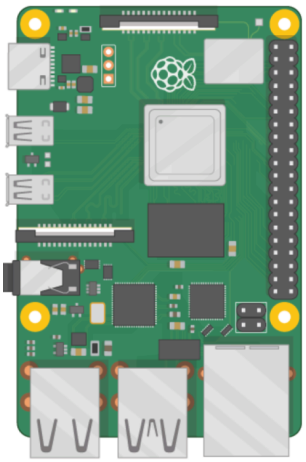
This package contains a physical computing test board. Follow these instructions to connect the board to your Raspberry Pi and assess its functionality.

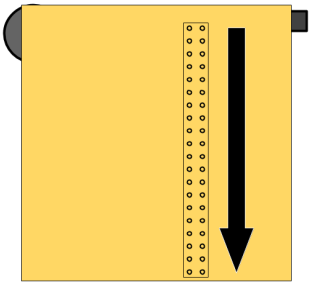
Connection instructions

Connect the test board to the Raspberry Pi using the connection cable. It is important that the test board and the Raspberry Pi are both the right way round. You may damage both units if you connect them incorrectly.

Plug the socket labelled Raspberry Pi into the TOP of the Raspberry Pi, with the arrow on the socket pointing towards the network socket on the Raspberry Pi.

Plug the socket labelled “GPIO Board” into the BOTTOM of the Test Board, aligning the arrow on the socket with the arrow on the board





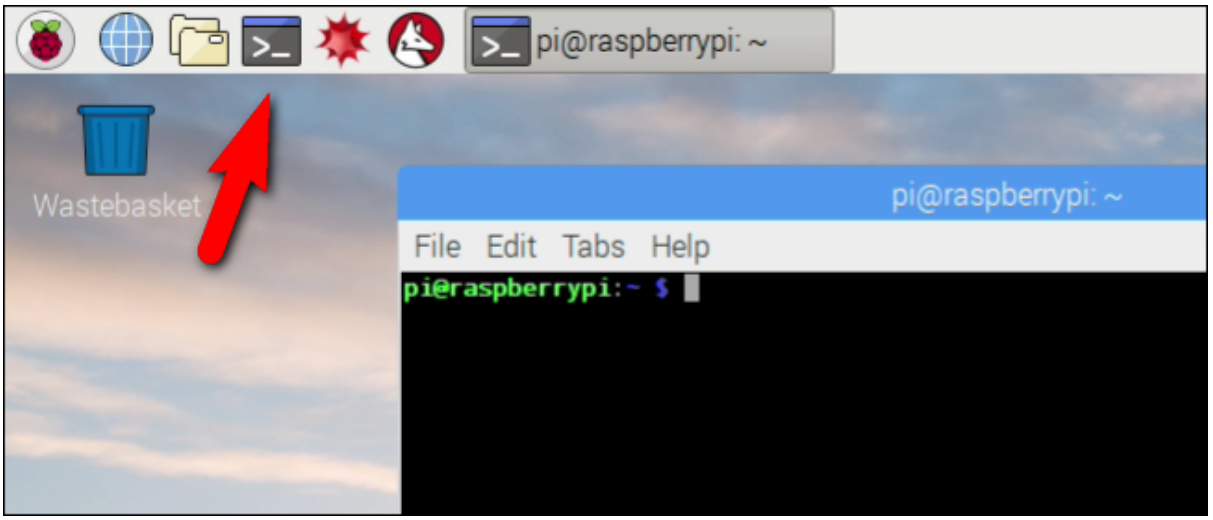
Test instructions

Turn on the Raspberry Pi

Double-click the "Update gpio-playground" icon. This will download the latest version of the control software designed to exercise the functionality of the test board.

Double-click the "Run gpio-playground" icon. This will execute the test code.

If these steps fail, open a terminal prompt by clicking the icon shown below

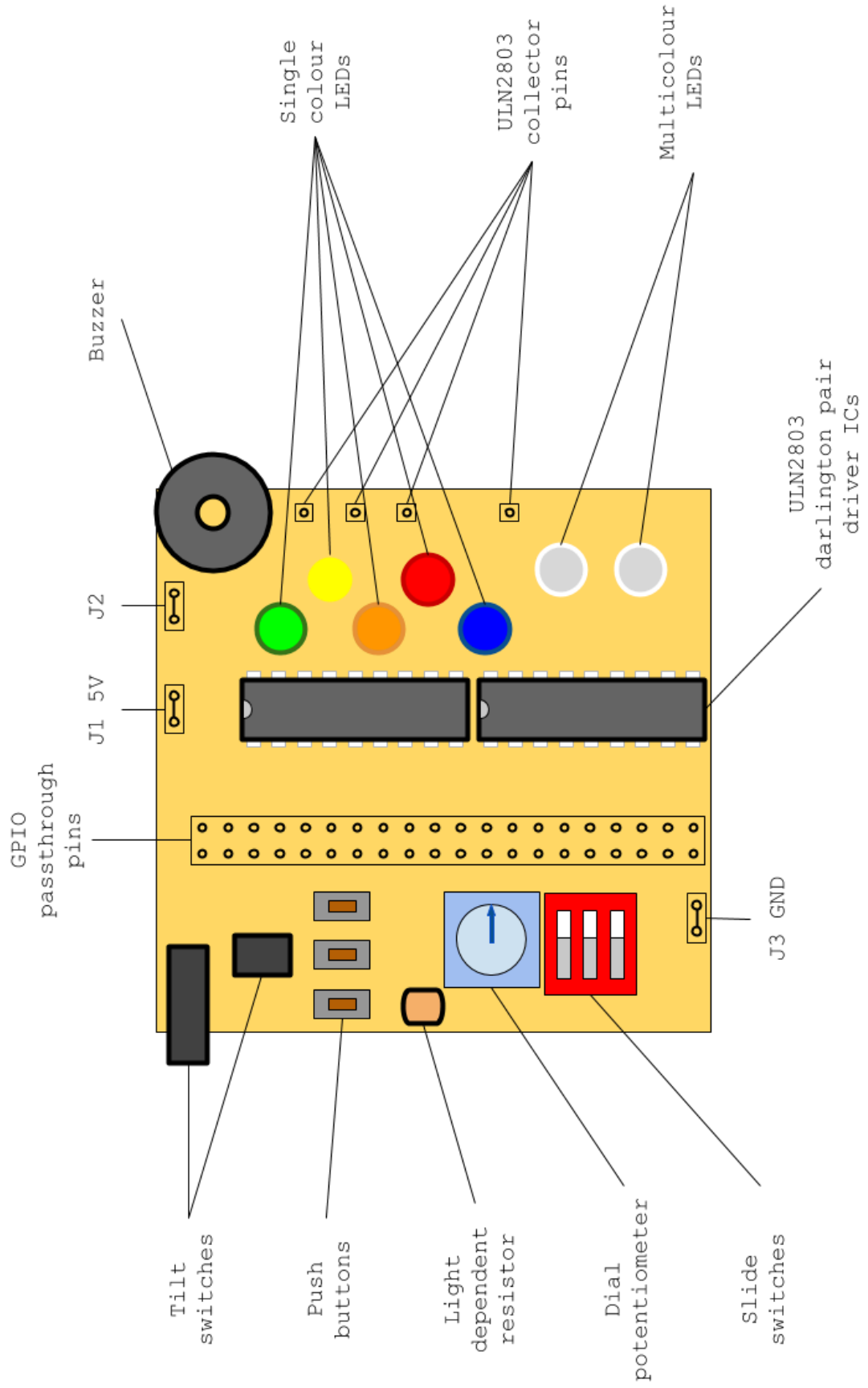


Type the following commands

```
cd gpio-playground
git fetch origin
git checkout origin/published
python3 ./python/hat.py
```

If this also fails, contact Secret Headquarters for further guidance.

Physical schematic



Output device specifications

Buzzer

GPIO pin: 2

2.3 kHZ miniature electronic buzzer.

Can be used to emit a constant tone, or can play poor quality audio using pulse width modulation (PWM)

Disconnecting jumper J2 disables this device.

Single coloured LED

GPIO pins

- Green: 14
- Yellow: 18
- Orange: 23
- Red: 19
- Blue: 8

Standard single colour LEDs. Can be made to glow at various intensities using pulse width modulation (PWM).

Multicolour LED

GPIO pins

RGB LED 1		RGB LED 2	
Red:	12	Red:	20
Green:	25	Green:	21
Blue:	26	Blue:	16

Contains red, green and blue LEDs in a single package. Can be made to glow any colour by illuminating the internal LEDs independently.

For example, to make RGB LED 1 glow red:

GPIO 12 (red): on
GPIO 25 (green): off
GPIO 26 (blue): off

To make REG LED 1 glow purple:

GPIO 12 (red): on
GPIO 25 (green): off
GPIO 26 (blue): on

ULN2803 collector pins
GPIO pins: 15, 2, 24, 7

Darlington pair driver IC outputs.

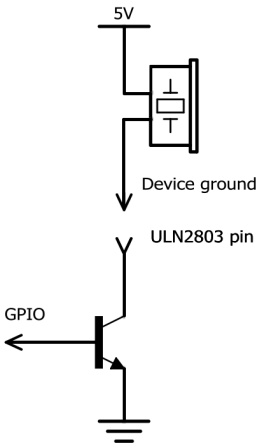
Used to allow high-power output devices to be controlled by the Raspberry Pi. Each pin acts as an electrically controlled switch to ground.

Each pin can sink up to 500mA and can support driving a load powered from up to 50V.

Connect the device to be controlled to a power supply and connect its ground connection to the ULN20801 pin.

To turn the device on, set the GPIO pin high. This allows current to flow from the power supply, through the device, and then through the ULN2801 to ground.

To turn the device off, set the GPIO pin to low. This stops the current flowing.



Power supply header pins
Jumper banks J1 and J3 provide access to the power supply allowing additional devices to be connected to the test board.

J1: +5V
J3: GND

GPIO passthrough pins
The GPIO header passthrough pins allow direct access to the underlying Raspberry Pi GPIO pins.

Input device specifications

All input device GPIO pins should be configured to use pull-up resistors unless otherwise specified.

Tilt switches

GPIO pins
  Horizontal: 9 (configure GPIO pin to use pull-down resistor)
  Vertical: 4

These input devices can be used to determine the orientation of the test board.

The horizontal switch is disconnected if the board is tilted down on the left hand side, and connected if the board is tilted down on the right hand side.

The vertical switch is connected when the board is facing upwards, and disconnected if the board is upside down.

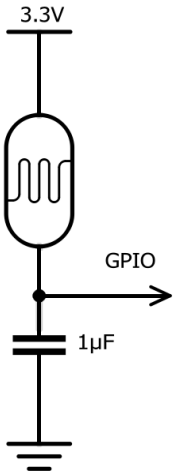
Push buttons

GPIO pins 17, 27, 22

Micro push buttons. GPIO is connected to ground when the button is pressed.

Light dependent resistor

GPIO pin 10



The resistance of the light dependent resistor (LDR) varies depending on the light shining on it. A darker environment results in a higher resistance.

The LDR is connected to a capacitor which will charge at a rate that will vary with the resistance of the LDR. By timing how long it takes for the capacitor to charge enough to appear as "on" to the GPIO input, the resistance (and thus the light level) can be estimated.

Using this input device is made easier with the gpiozero.LightSensor class in Python.

Dial potentiometer
GPIO pin 11

The resistance of the dial potentiometer (pot) varies depending on how far it is turned. Turning the dial clockwise increases the resistance.

It is connected in the same configuration as the LDR, and can be measured in the same way.

Slide switches
GPIO pins: 13, 6, 5

Micro slide switches. GPIO is connected to ground when the switch is in the “on” position.