# POWER

# INPUT

## Chat GPT:

To safely monitor a 24V input with a Raspberry Pi Pico W GPIO pin, follow this circuit design:

1. **Voltage Divider**:
   * Use two resistors to step down 24V to 3.3V.
   * Resistor values:
     + R1=10kΩR1 = 10k\Omega (connect to 24V).
     + R2=1.5kΩR2 = 1.5k\Omega (connect between R1 and ground).
     + The voltage at the junction (to GPIO pin) will be:  
       Vout=R2R1+R2⋅24V≈3.3VV\_{out} = \frac{R2}{R1 + R2} \cdot 24V \approx 3.3V.
2. **Protection Diode**:
   * Add a 3.3V Zener diode in parallel with R2R2 (cathode to GPIO, anode to ground) for overvoltage protection.
3. **Current-Limiting Resistor**:
   * Add a 1kΩ resistor between the divider output and the GPIO pin to limit current further.

**Connections**:

* 24V to R1R1.
* Junction of R1R1 and R2R2 to the GPIO pin via the 1kΩ resistor.
* R2R2 to ground.
* Zener diode across R2R2 (for extra protection).

This ensures the GPIO pin receives a safe 3.3V signal.

## Copilot:

Sure, I can help you design a circuit to step down your 24V signal to a 3.3V signal suitable for the GPIO input on a Raspberry Pi Pico. Here's a step-by-step guide:

**Components Needed:**

* Resistors (values calculated below)
* Zener diode (3.3V)
* NPN transistor (e.g., 2N2222)
* Raspberry Pi Pico

**Circuit Design:**

1. **Voltage Divider:**
   * Use a voltage divider to step down the 24V signal to a lower voltage that can be further regulated.
   * Choose resistors ( R1 ) and ( R2 ) such that the output voltage is around 5V.
   * For example, if ( R1 = 20k\Omega ) and ( R2 = 5k\Omega ), the output voltage ( V*{out} ) is: [ V*{out} = V\_{in} \times \frac{R2}{R1 + R2} = 24V \times \frac{5k\Omega}{25k\Omega} = 4.8V ]
2. **Zener Diode Regulation:**
   * Use a 3.3V Zener diode to regulate the voltage down to 3.3V.
   * Connect the Zener diode in reverse bias across the output of the voltage divider.
   * Place a current-limiting resistor ( R3 ) in series with the Zener diode to limit the current through it.
3. **Transistor Switching:**
   * Use an NPN transistor to interface the 3.3V signal with the GPIO pin.
   * Connect the base of the transistor to the output of the Zener diode through a base resistor ( R4 ).
   * The emitter of the transistor goes to ground, and the collector goes to the GPIO pin of the Raspberry Pi Pico.

**Example Values:**

* ( R1 = 20k\Omega )
* ( R2 = 5k\Omega )
* ( R3 = 1k\Omega ) (current-limiting resistor for Zener diode)
* ( R4 = 10k\Omega ) (base resistor for transistor)
* Zener diode: 3.3V
* NPN transistor: 2N2222

**Circuit Diagram:**

24V ---- R1 ----+---- R2 ---- GND

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+---- Zener Diode (3.3V) ---- GND

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+---- R3 ---- Base of NPN Transistor

Emitter ---- GND

Collector ---- GPIO Pin (Raspberry Pi Pico)

This circuit ensures that the voltage at the GPIO pin is 3.3V and the current is limited to safe levels for the Raspberry Pi Pico. Let me know if you need any further assistance!

# OUTPUT

Sure, I can help you design a circuit to control a 24V output using another GPIO pin on the Raspberry Pi Pico and a relay. Here's how you can do it:

**Components Needed:**

* NPN transistor (e.g., 2N2222)
* Resistor (for base of transistor)
* Relay (JQC3F-05VDC-C)
* Diode (for flyback protection, e.g., 1N4007)
* Raspberry Pi Pico

**Circuit Design:**

1. **Transistor as a Switch:**
   * Use an NPN transistor to drive the relay.
   * Connect the base of the transistor to the GPIO pin through a base resistor ( R1 ).
   * The emitter of the transistor goes to ground.
   * The collector of the transistor connects to one side of the relay coil.
2. **Relay Coil:**
   * Connect the other side of the relay coil to the 5V supply.
   * Place a flyback diode across the relay coil to protect against voltage spikes when the relay is turned off.
3. **Relay Contacts:**
   * Use the relay contacts to switch the 24V output.
   * Connect the common (COM) terminal of the relay to the 24V supply.
   * Connect the normally open (NO) terminal of the relay to the output load.

**Example Values:**

* ( R1 = 1k\Omega ) (base resistor for transistor)
* NPN transistor: 2N2222
* Relay: JQC3F-05VDC-C
* Diode: 1N4007

**Circuit Diagram:**

GPIO Pin ---- R1 ---- Base of NPN Transistor

Emitter ---- GND

Collector ---- Relay Coil ---- 5V

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+---- Diode (1N4007) ---- GND

24V ---- Relay COM

Relay NO ---- Output Load

**Explanation:**

* When the GPIO pin is set high, the transistor turns on, allowing current to flow through the relay coil, energizing it.
* The relay contacts close, connecting the 24V supply to the output load.
* The flyback diode protects the transistor from voltage spikes generated by the relay coil.

This setup allows you to control a 24V output using a GPIO pin on the Raspberry Pi Pico. Let me know if you need any further details or adjustments!