Hardware Competition Timer:
Wiring and Code

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1 Wiring Diagram

The foot pedal switch is in place of the standard button.

![Wiring diagram](image)

Figure 1: Wiring diagram

2 Code

Main code used with the Raspberry Pi Pico W. To upload code to your microcontroller, you must first install Micropython on the device.

2.1 main.py

```python
import time
from time import sleep
import tm1637
from machine import Pin

tm = tm1637.TM1637(clk=Pin(27), dio=Pin(26))
led = Pin(22, Pin.OUT)

TM1637.BRIGHTNESS(1)

interrupt_flag=0
debounce_time=0
```

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stop = Pin(5, Pin.IN, Pin.PULL_UP)

def callback(stop):
    global interrupt_flag, debounce_time
    if (time.ticks_ms()-debounce_time) > 500:
        interrupt_flag= 1
        debounce_time=time.ticks_ms()

stop.irq(trigger=Pin.IRQ_FALLING, handler=callback)

start = Pin(9, Pin.IN, Pin.PULL_UP)
min = 0
sec = 0
led.value(0)
is_counting = True
while True:
    tm.numbers(min, sec)
    if start.value() == 0:
        is_counting = True
        min = 0
        sec = 0
        tm.numbers(min, sec)
        led.value(1)

    for i in range(1,4):
        for x in range(1, 60):
            sleep(1)
            if interrupt_flag is 1:
                interrupt_flag=0
                print("Interrupt Detected")
                is_counting = False
                led.value(0)
                break
            sec = x
            tm.numbers(min, sec)

    if not is_counting:
        break

    sec = 0
    min = i
    tm.numbers(min, sec)
    if start.value ==1 and not is_counting:
        min = 0
        sec = 0

    led.value(0)
2.2 tm1637.py

This code is the library that the timer will use to drive the seven segment display. Please keep in mind that the code wraps around. For example _SEGMENTS is a single line

"""
MicroPython TM1637 quad 7-segment LED display driver
https://github.com/mcauser/micropython-tm1637

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"""

__version__ = '1.3.0'

from micropython import const
from machine import Pin
from time import sleep_us, sleep_ms

TM1637_CMD1 = const(64) # 0x40 data command
TM1637_CMD2 = const(192) # 0xC0 address command
TM1637_CMD3 = const(128) # 0x80 display control command
TM1637_DSP_ON = const(8) # 0x08 display on
TM1637_DELAY = const(10) # 10us delay between clk/dio pulses
TM1637_MSB = const(128) # msb is the decimal point or the colon depending on your display

# 0-9, a-z, blank, dash, star
_SEGMENTS = bytearray(b'\x3F\x06\x5B\x4F\x66\x6D\x7D\x07\x7F\x6F
\x77\x7C\x39\x5E\x79\x71\x3D\x76\x06\x1E\x76\x38\x55\x54\x3F

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class TM1637(object):
    """Library for quad 7-segment LED modules based on the TM1637 LED driver."""
    def __init__(self, clk, dio, brightness=7):
        self.clk = clk
        self.dio = dio

        if not 0 <= brightness <= 7:
            raise ValueError("Brightness out of range")
        self._brightness = brightness

        self.clk.init(Pin.OUT, value=0)
        self.dio.init(Pin.OUT, value=0)
        sleep_us(TM1637_DELAY)

        self._write_data_cmd()
        self._write_dsp_ctrl()

def _start(self):
    self.dio(0)
    sleep_us(TM1637_DELAY)
    self.clk(0)
    sleep_us(TM1637_DELAY)

def _stop(self):
    self.dio(0)
    sleep_us(TM1637_DELAY)
    self.clk(1)
    sleep_us(TM1637_DELAY)
    self.dio(1)

def _write_data_cmd(self):
    # automatic address increment, normal mode
    self._start()
    self._write_byte(TM1637_CMD1)
    self._stop()

def _write_dsp_ctrl(self):
    # display on, set brightness
    self._start()
    self._write_byte(TM1637_CMD3 | TM1637_DSP_ON | self._brightness)
    self._stop()

def _write_byte(self, b):
    for i in range(8):
        self.dio((b >> i) & 1)
    sleep_us(TM1637_DELAY)
self.clk(1)
sleep_us(TM1637_DELAY)
self.clk(0)
sleep_us(TM1637_DELAY)
self.clk(0)
sleep_us(TM1637_DELAY)
self.clk(1)
sleep_us(TM1637_DELAY)
self.clk(0)
sleep_us(TM1637_DELAY)

def brightness(self, val=None):
    """Set the display brightness 0-7."""
    # brightness 0 = 1/16th pulse width
    # brightness 7 = 14/16th pulse width
    if val is None:
        return self._brightness
    if not 0 <= val <= 7:
        raise ValueError("Brightness out of range")
    self._brightness = val
    self._write_data_cmd()
    self._write_dsp_ctrl()

def write(self, segments, pos=0):
    """Display up to 6 segments moving right from a given position.
The MSB in the 2nd segment controls the colon between the 2nd
and 3rd segments."""
    if not 0 <= pos <= 5:
        raise ValueError("Position out of range")
    self._write_data_cmd()
    self._start()
    self._write_byte(TM1637_CMD2 | pos)
    for seg in segments:
        self._write_byte(seg)
    self._stop()
    self._write_dsp_ctrl()

def encode_digit(self, digit):
    """Convert a character 0-9, a-f to a segment."""
    return _SEGMENTS[digit & 0x0f]

def encode_string(self, string):
    """Convert an up to 4 character length string containing 0-9, a-z,
space, dash, star to an array of segments, matching the length of the
source string."""
    segments = bytearray(len(string))
for i in range(len(string)):
    segments[i] = self.encode_char(string[i])
return segments

def encode_char(self, char):
    """Convert a character 0-9, a-z, space, dash or star to a segment."""
    o = ord(char)
    if o == 32:
        return _SEGMENTS[36] # space
    if o == 42:
        return _SEGMENTS[38] # star/degrees
    if o == 45:
        return _SEGMENTS[37] # dash
    if o >= 65 and o <= 90:
        return _SEGMENTS[o-55] # uppercase A-Z
    if o >= 97 and o <= 122:
        return _SEGMENTS[o-87] # lowercase a-z
    if o >= 48 and o <= 57:
        return _SEGMENTS[o-48] # 0-9
    raise ValueError("Character out of range: {:d} '{:s}'".format(o, chr(o)))

def hex(self, val):
    """Display a hex value 0x0000 through 0xffff, right aligned."""
    string = '{:04x}'.format(val & 0xffff)
    self.write(self.encode_string(string))

def number(self, num):
    """Display a numeric value -999 through 9999, right aligned."""
    # limit to range -999 to 9999
    num = max(-999, min(num, 9999))
    string = '{0: >4d}'.format(num)
    self.write(self.encode_string(string))

def numbers(self, num1, num2, colon=True):
    """Display two numeric values -9 through 99, with leading zeros
    and separated by a colon."""
    num1 = max(-9, min(num1, 99))
    num2 = max(-9, min(num2, 99))
    segments = self.encode_string('{}0: >2d}{1:0>2d}'.format(num1, num2))
    if colon:
        segments[1] |= 0x80 # colon on
    self.write(segments)

def temperature(self, num):
    if num < -9:
        self.show('lo') # low
    elif num > 99:
        self.show('hi') # high
else:
    string = '{0: >2d}'.format(num)
    self.write(self.encode_string(string))
    self.write([_SEGMENTS[38], _SEGMENTS[12]], 2) # degrees C

def show(self, string, colon=False):
    segments = self.encode_string(string)
    if len(segments) > 1 and colon:
        segments[1] |= 128
    self.write(segments[:4])

def scroll(self, string, delay=250):
    segments = string if isinstance(string, list) else self.encode_string(string)
    data = [0] * 8
    data[4:0] = list(segments)
    for i in range(len(segments) + 5):
        self.write(data[0+i:4+i])
        sleep_ms(delay)

class TM1637Decimal(TM1637):
    """Library for quad 7-segment LED modules based on the TM1637 LED driver.

    This class is meant to be used with decimal display modules (modules
    that have a decimal point after each 7-segment LED).
    """

def encode_string(self, string):
    """Convert a string to LED segments.
    Convert an up to 4 character length string containing 0-9, a-z,
    space, dash, star and '.' to an array of segments, matching the length of
    the source string."""
    segments = bytearray(len(string.replace('.',',')))
    j = 0
    for i in range(len(string)):
        if string[i] == '.' and j > 0:
            segments[j-1] |= TM1637_MSB
            continue
        segments[j] = self.encode_char(string[i])
        j += 1
    return segments