H28573 **Fast Timer** **NFU 317**

Purpose

The UNILAB Fast Timer is a versatile instrument for timing brief events. Two switch selectable ranges are provided, 1 to 999.9 milliseconds and 1 to 9999 microseconds. Out of range measurements are indicated by the appearance of a colon (:) at the centre of the display.

The timer can be started and stopped by either manual switches or electronic sensors, for which a 5 volt low current output (max 5mA) is provided. All connections are made via 4mm sockets. The unit requires a 9V, PP3 battery which is not included. The battery holder can be accessed by removing the plastic housing on the left hand side.

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The Front Panel

a) 4 digit LCD display; 0.1 to 999.9 milliseconds (ms) OR 1 to 9999 microseconds (µs). Please note the display will read (:) when the timer is out of range, for example. 77:2.4

b) Millisecond/microsecond selection switch for **(a)**

c) Reset button, which clears the display to zero. Once a measurement has been taken, using any of the start and stop methods, the reading is held.

d) Gate input socket used for stopping. Requires a rise of at least 50mV.

e) Gate input socket used for starting. Requires a rise of at least 50mV. Must be used in conjunction with **(d)**

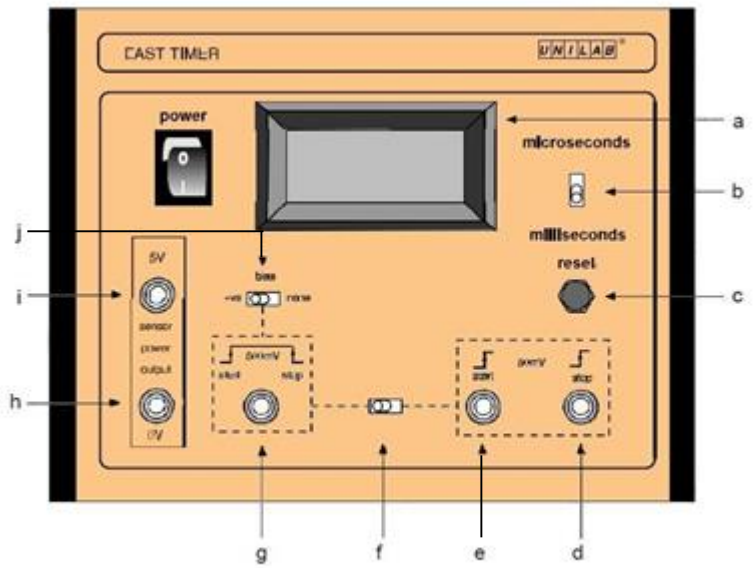
f) Selector switch, immediately below the display, giving either a single gate controlling start and stop, or separate gates for start and stop.

g) Single gate input socket, which starts the timer when the input rises by 500mV or more, and stops the timer when the input falls again. Mechanically switched signals applied to this input need to be debounced.

h) 0V reference.

i) 5V output, for connection to a phototransistor or light gate assembly. A separate 12 V supply will be needed for the light source or lamp.

j) Bias switch, which can modify the action of the single gate input, in conjunction with the 5V supply.



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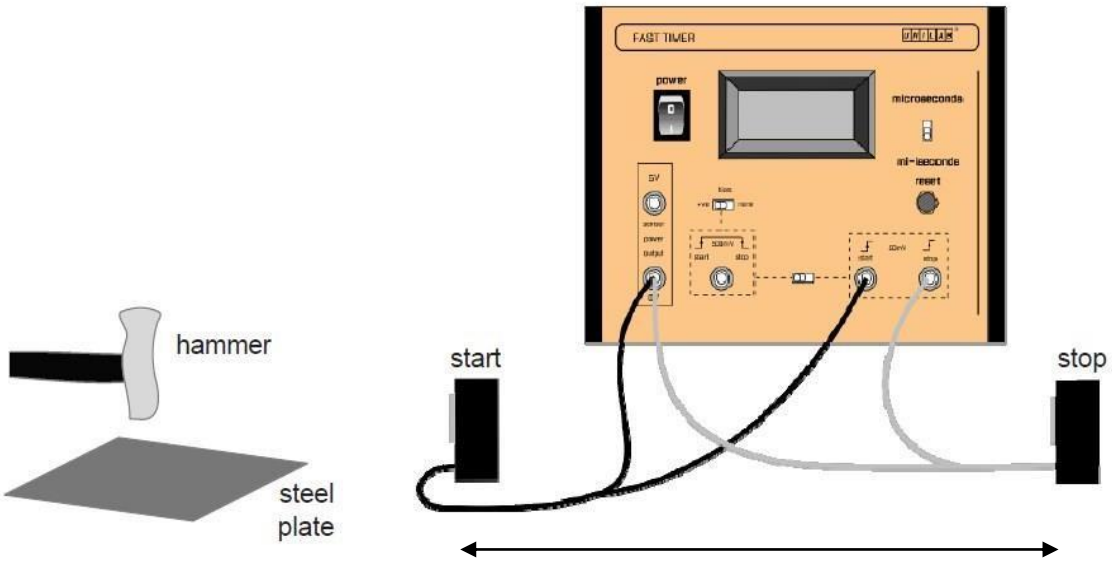
Experiments

Speed of Sound

Use two microphones (H27581) and connect one to the timer sockets (e) and (h), and the other to (d) and (h), the polarity is unimportant. With switch (b) set for microseconds, the speed of sound in air can be measured by placing the microphones a distance apart and making a loud sharp sound (using the hammer and anvil supplied in the Speed of Sound kit) close to the 'start' microphone. The sound starts the clock running. When the sound reaches the 'stop' microphone it stops the clock. The time, shown in microseconds, is the time it has taken for the sound to travel between the microphones. Measure the distance between the front faces of the microphones.

The speed of sound in air is then calculated by dividing the distance by the time. A reading of (very) approximately 2915µs is usually observed if the microphone faces are 1m apart. If the reset button is pressed then the experiment can be repeated and an average time calculated.

A further development allows the speed of sound in different materials to be calculated. Lay the microphones face downwards on the bench at the same distance apart. If the bench is now tapped (hard) the sound travels through the bench and should give a different time. Instead of the bench other materials can be substituted (glass plate, retort stand rod etc.). The speed of sound through water can be calculated by wrapping the microphones in plastic bags and sealing them with tape. The microphones are then immersed in a large container of water and the experiment repeated.



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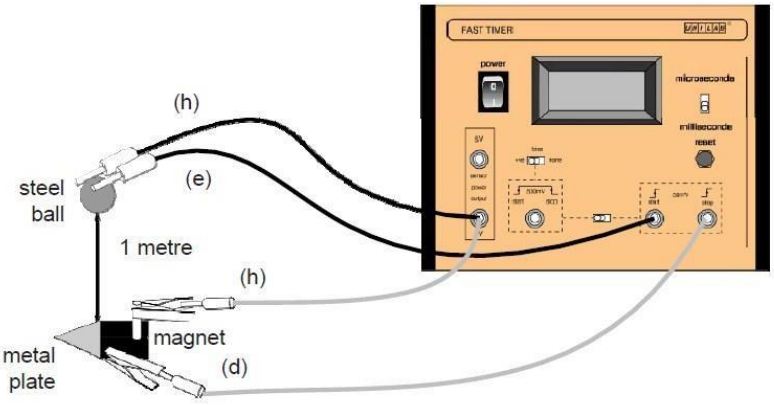
Event Timing

Stopping and Starting Using Separate Gates/Switches

The selector switch (f) must be set to the right. Using two switches, which may be momentary or latched types, the starting switch is connected from the 5V output (i) to the gate input socket (e), and the stop switch is connected from the 5V output (i) to the gate input socket (d). This gives 'make to start' and 'make to stop' control of the timer, which is ideal for reaction timing. One person presses a concealed switch to start the timer while a second person observes the display and tries to stop the timer as quickly as possible by pressing their switch.



g by Free Fall

By using the 0V reference (h) instead of the 5V output, the control is changed to 'break to start' and 'break to stop'. This is appropriate for the 'g by free fall' experiment, using a steel ball. The ball is released from a position where it is in contact with two 4mm plugs on long leads, connected to sockets (h) and (e), thus breaking the start circuit. It is allowed to fall through a 'trapdoor switch', connected to sockets (h) and (d), which breaks the stop circuit. An alternative is to use a microphone (H27581) connected to sockets (d) and (h) to stop the timer, by detecting the impact of the ball on a hard surface. Any combination of make and break, starting and stopping can be used.

Using Two Light Gates

Connect one light gate's photodiode (+) to socket (e) on the timer and the photodiode (-) to 0V, socket (h) on the timer. The other light gate's photodiode is connected to sockets (d) and (h). The selector switch (f) must be set to the right. After pressing the reset button (c), momentarily blocking the first light gate starts the timer and momentarily blocking the second stops it. With this arrangement, it is possible to time the motion of an air track vehicle, or other opaque object passing through both gates. The leading edge acts as the trigger. If instead the photodiodes have their (+) sockets connected to the 5V output socket (i) and their (-) sockets connected to timer sockets (e) and (d), the above actions are reversed. Starting with both light gates obstructed, press reset, now unblocking the first light gate

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starts the timer and unblocking the second stops it. In this way the trailing edge of a moving object can start and stop the timer.

Stopping and Starting Using the Single Gate

The selector switch (f) must be set to the left. A single light gate can be used, with the photodiode (+) socket connected to timer socket (g) and the photodiode (-) socket connected to 0V, socket (h). The bias switch (j) must be set to '+ve'. After pressing reset, the light gate starts the timer when it is obstructed and stops the timer when the obstruction is removed. Dropping a piece of heavy card 10cm long through the light gate will provide a start and stop signal, and from the time measured, the "instantaneous" speed of the card can be calculated. For a crude determination of *g*, the card could be held with its lower end just above the light gate's light path and then released. Dropping the card from above the light gate will facilitate calculation of the speed of the card after falling a given distance. This arrangement can also be used to measure the speed of an air-track vehicle carrying an interrupter. Using the FAST TIMER, the action of a light gate can be inverted, as follows: With the light gate's photodiode (+) socket connected to the 5V socket (i) and the (-) socket connected to timer socket (g), set the bias switch (j) to 'none'. Obstruct the light gate, press reset, and observe that the timer is started and stopped by removing and replacing the obstruction

Using Signals from 'MFA' or Alpha Boards

The Fast Timer is ideal for timing pulses produced by 'MFA' or Alpha circuits, to calibrate their action. It could also be used to calibrate a signal generator at very low frequencies. For any of these applications a clean rise and fall in the signal voltage is essential.

Warnings

For your safety, this product should be used in accordance with these instructions, otherwise the protection provided may be impaired.

Cleaning

The front panel membrane conceals and protects switches and LEDs. It may be wiped clean using a damp cloth. Be sure to disconnect the unit from the mains before cleaning, and do not use any abrasive cleaners or organic solvents.

Warranty, repairs and spare parts

The Fast Timer is guaranteed for a period of one year from the date of delivery to the customer. This warranty does not apply to defects resulting from the action of a user such as misuse, improper wiring, any operations outside of its specification, improper maintenance or repair, or unauthorized modification.

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Our liability is limited to repair or replacement of the product. Any failure during the warranty period should be referred to Customer Services.

In the event of a fault, apart from replacing the instrument fuse in the IEC socket, the power supply should be referred to the Philip Harris recommended repair agent.

Please contact Customer Services or techsupport@philipharris.co.uk for advice

Disposal of Waste Electrical and Electronic Equipment (WEEE)

Do not dispose of this product with household waste

- For the proper treatment, recovery and recycling please take this product to an appropriate collection point.
- If you are unsure where this is, contact your Local Authority
- By disposing of this product correctly you will be providing positive help to the environment.

Supplier details

Philip Harris Education, 2 Gregory Street, Hyde, Cheshire SK14 4RH

Orders and Information:
Tel: 0845 120 4521
Fax: 0800 138 8881

Repairs:
Tel: 0845 120 3211

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