

H29280

S-Range Digicounter

NFU 551



Purpose

A versatile digital instrument capable of performing the functions of a:

- Precision stopclock for all laboratory timing applications
- Precision digital frequency meter capable of operation from d.c. to 5MHz typical
- Period measuring instrument, enabling accurate measurement of low frequencies
- Radioactivity counter and digital ratemeter for use with Geiger-Müller tubes

Apparatus details

The unit is housed in a metal case with moulded plastic ends, which are easily removable for fuse replacement. All the controls are situated on the front panel of the instrument. The instrument is mains operated via three-core mains lead with IEC connector and moulded on mains plug (240V version).

The bright orange/red LED display has six digits, 14 mm high, making it suitable for individual or class use. The number of digits illuminated can vary from one to six. The unused digits automatically turn on when required.

All the functions of the instrument are controlled by a quartz crystal oscillator, operating at a frequency of 100 kHz, with a typical accuracy of $0.005\% \pm 1$ count at 25°C . The oscillator output is divided down to give gating periods from 100ms to 100s for frequency measurement, 1s to 1000s for radioactivity measurements, and standard frequencies from 10kHz to 10Hz for period and timing measurements.

Selection of the desired mode of use is made by setting the FUNCTION SWITCH to one of four positions, whilst the RANGE switch also provides four positions.

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In the radioactivity mode, the built in EHT supply provides voltages between 300 and 500V for a GM Tube and Holder. Audible indication of counting can be obtained by connecting a loudspeaker to the audio output sockets.

In the frequency mode, three inputs are provided, selected by a three-position slide switch:

- Low frequency d.c. to 5MHz typical, which will operate with TTL inputs, light gates etc.
- High frequency, capacitively coupled 50Hz to 5MHz typical
- High gain, utilising an additional high gain amplifier intended as a microphone or general purpose preamplifier over the audio range

The period mode has separate input sockets. This input will also accept a light gate for special timing functions. The period input sockets can also be used with the FUNCTION SWITCH at RADIOACTIVITY or at FREQUENCY, to obtain an infinite counting period.

In the timing mode, the display features most significant digit blanking, so that if a count is less than 1s only one zero is shown before the decimal point. The clear display reads in seconds from 0.000 up to 999.999 and increments in ms.

Output sockets provide 2V or 6V a.c. at 0.5A supplies for use with lamps or light gates.



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| <p>1 Counting LED: Illuminated when any function other than TIMING is in progress</p> <p>2 Single/Continuous Reading: Selects single readings requiring manual reset between readings, or continuous automatic re-cycling readings and resetting</p> <p>3 GM Tube variable power supply control</p> <p>4 BNC connection for GM Tube Holder</p> <p>5 Manual timing start/stop</p> <p>6 Triggered timing inputs</p> <p>7 Triggered off/on switch: Selects manual or triggered timing modes</p> <p>8 2V lamp supply</p> | <p>9 LED display</p> <p>10 Timer reset button</p> <p>11 Function selection: Radioactivity/frequency/period/timing</p> <p>12 Range selection</p> <p>13 Mains on/off switch</p> <p>14 Mains connection</p> <p>15 Frequency inputs and selection</p> <p>16 Period inputs</p> <p>17 6V lamp supply</p> <p>18 Loudspeaker output for radioactivity measurement</p> |
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Ratings

Mains input:	220 – 240V 50/60Hz
Power consumption:	9W
Mains plug Fuse:	5A
Internal fuse:	T50mA required
Display:	6 digit (14mm LED)
Timing oscillator:	100kHz
Periods:	Frequency mode – 100ms to 100s Radioactivity mode – 1s to 1000s Period and timing modes – 10kHz to 10Hz standard frequency
Accuracy:	0.005% ± 1 count typical (at 25°C)
Radioactivity inputs:	GM tube via BNC socket with integral 300-500V variable supply.
Frequency inputs:	LF - d.c. to 3MHz typical, will operate with TTL of CMOS logic inputs and light operated switches Impedance 20kΩ HF – 20Hz to 5MHz typical, input amplitude 0.2 to 2V RMS up to 3MHz reducing to 30 to 50mV RMS at 3 to 5MHz Impedance 100 kΩ HIGH GAIN – 20Hz to 20kHz, input amplitude 0.3 to 3V RMS Impedance 100 kΩ
Timing inputs:	Manually switched stop/start Light gate operated stop/start Mechanical switch closure stop/start Triggered timing start/stop (momentary interruption of light beam)
Timing intervals:	0.1, 1, 10, and 100ms
Outputs:	2V and 6V, 0.5A a.c. Loudspeaker output via 4mm sockets
Dimensions:	W380 x D140 x H165 mm

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Operating Procedure

Below are descriptions of how to set up each mode of operation, the numbers in brackets correspond to the numbers on the device description on page three.

NOTE: Only controls relevant to the activity are shown on diagrams.

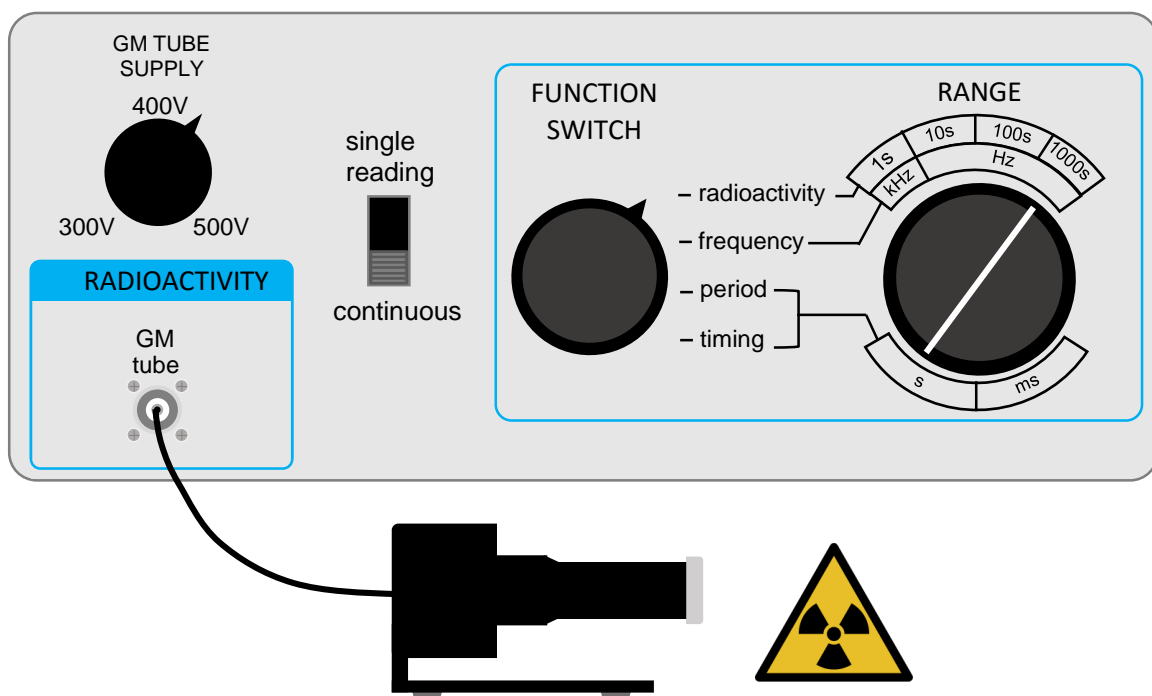
Radioactivity measurements

Connect a GM tube to the BNC socket (4) and set the GM tube supply dial (3) to the recommended supply voltage (usually around 420V).

If required, connect a loudspeaker of impedance 3Ω to 50Ω to the loudspeaker sockets (18).

Set the function switch (11) to **radioactivity**. And select your desired count range (12). Switch on the mains switch (13) and depress the reset button (10) to zero the display.

Set the display switch (2) to continuous hold the radioactive material close to GM tube, as per below fig. The display will start counting, and the loudspeaker will click (if connected to the loudspeaker socket). When radioactive material is moved away from the GM tube, the count will stop (except background radiation.)



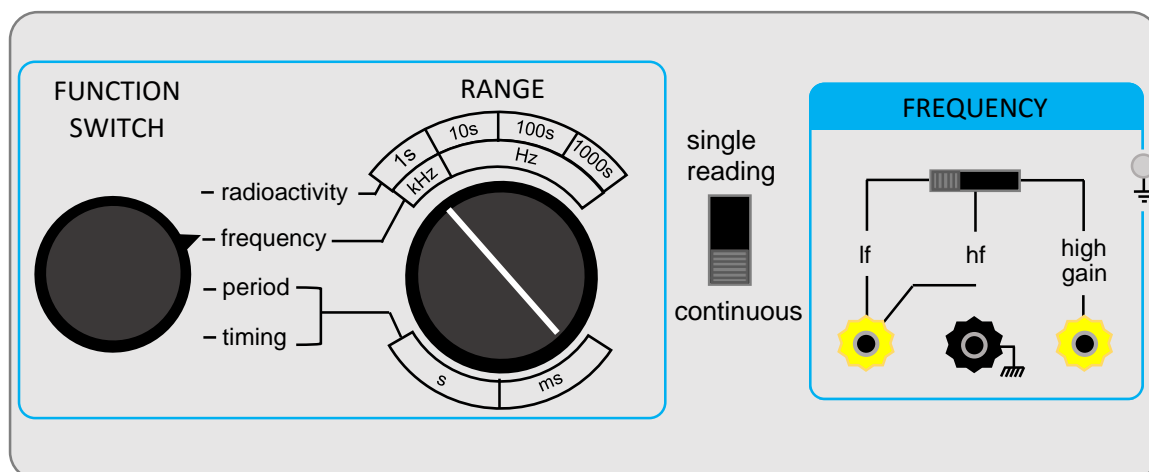
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Frequency Measurements

Set the function switch to **frequency**, and select the range you require (Hz or kHz).

Switch on the mains switch and depress the reset button to zero the display.

Set the display switch as required, and select the appropriate frequency range (lf, hf and high gain – see below). If using the low or high frequency setting, use the left yellow and black common sockets. If using the high gain setting, use the right yellow socket and the black common.



LF - d.c. to 3MHz typical, will operate with TTL or CMOS logic inputs and light operated switches (impedance 20k Ω).

HF – 20Hz to 5MHz typical, input amplitude 0.2 to 2V RMS up to 3MHz, then reducing to 30 to 50mV RMS at 3 to 5MHz (impedance 100k Ω).

HIGH GAIN – 20Hz to 20kHz, input amplitude 0.3 to 3V RMS (impedance 100k Ω). Please note, the high sensitivity of this input is susceptible to pick up and care must be exercised when connecting circuits to it. High impedance microphones are recommended to reduce the risk of picking up mains hum.

Period Measurements

The period facility allows the accurate period measurement of very low frequencies and for measuring the period between the interruption of a light beam obtained from a light gate, phototransistor, or cadmium sulfide cell.

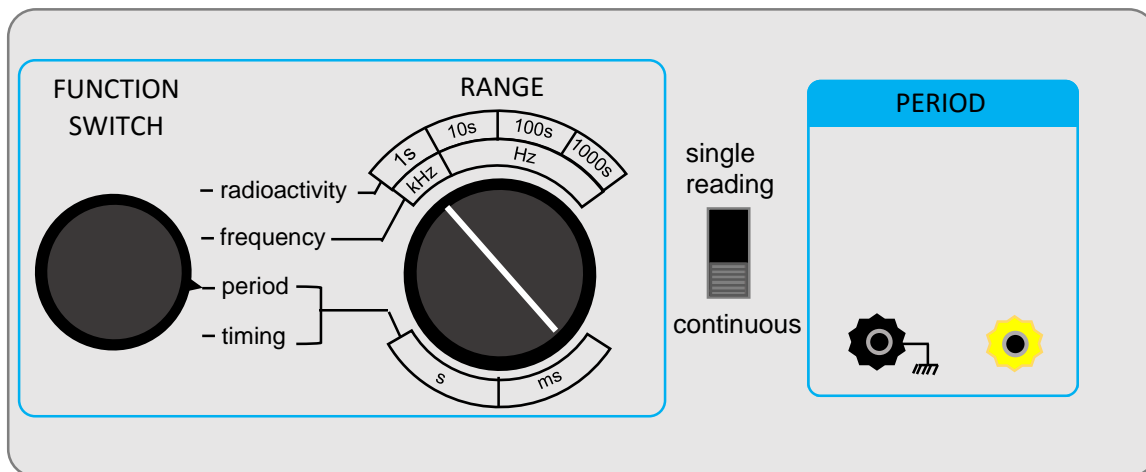
To measure the period of low frequency signals or TTL inputs in the range of 0.8 to 2V input: set the function switch to **period** and the range switch as required (s or ms). Connect the input circuit to the period input sockets (black and yellow). Select single reading, switch on the mains switch and depress the reset button to zero the display. The instrument will now measure and display the period of the input signals.

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Frequency, f , can be calculated from period, T , using:

$$f = \frac{1}{T}$$

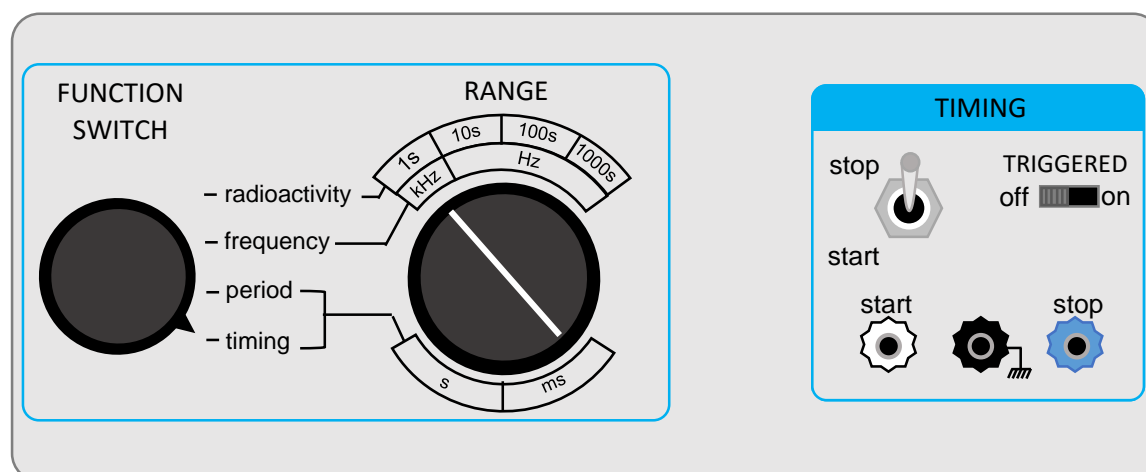
If continuous sampling of the period of the input signal is required, set the reading switch to “continuous” and depress the reset pushbutton (see below diagram).



Timing Measurements

1. Manual control

Set the function switch to **timing**, select the desired range (s or ms) and switch triggered timing off. Switch on the mains and depress the reset button to zero the display.



Timing is then **controlled by the stop/start switch**, and the instrument can be used this way for all experiments where a stopwatch or stopclock would normally be used. The display can count up in increments of 1 ms, to a maximum count of 999.999 s.

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2. Electrical control

Set the function switch to timing and select the desired range (s or ms). Set the stop/start switch to stop and switch triggered timing off. Switch on the mains and depress the reset button to zero the display.

Timing can now be controlled by switches, photo transistors, or light dependent resistors (such as cadmium sulfide cells) connected to the start and stop sockets. Timing will commence when the start sockets are closed and the stop sockets are open, and stop when the stop sockets are closed.

Force of a Kick - Football Practical

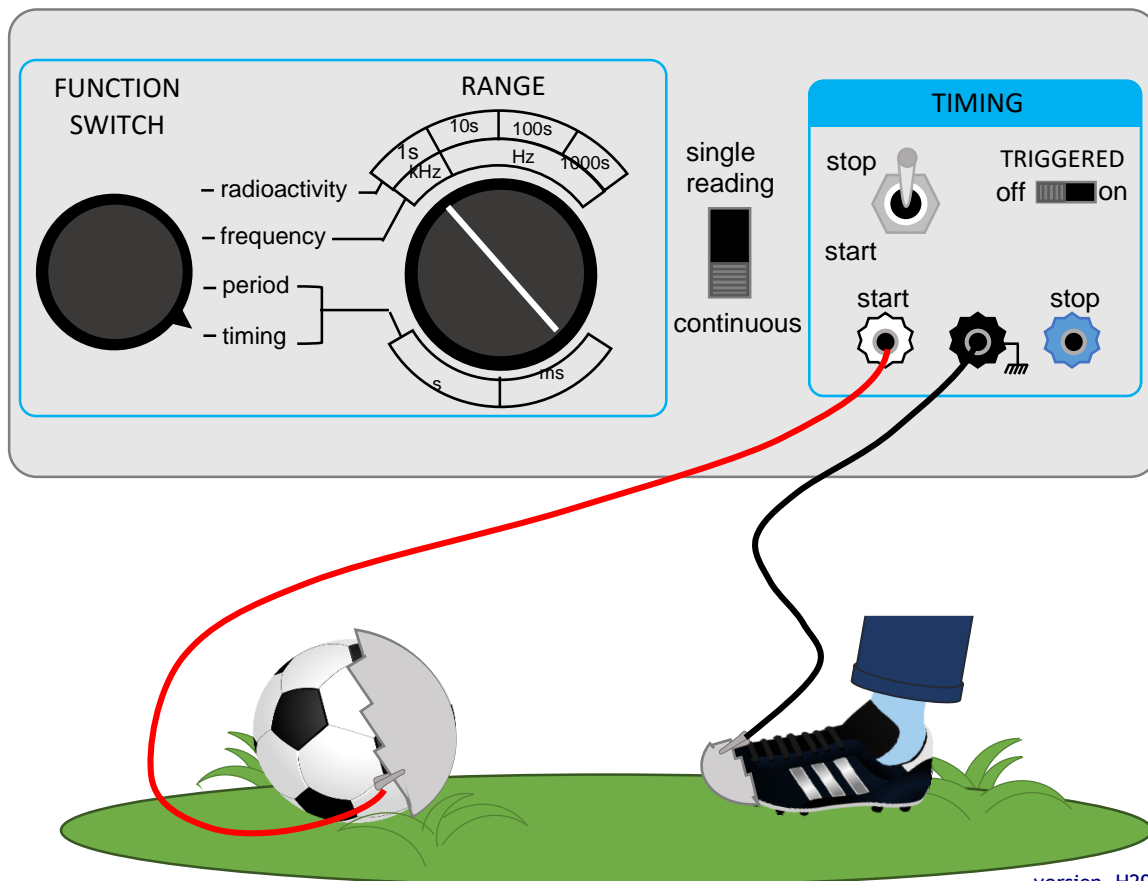
An example of using the timer with electrical control is the Football Practical, in which the force used to kick a football is calculated using the equation:

$$F \times t = m \times \Delta v$$

Where: F = impact force, t = time, m = mass, and v = velocity

By assuming the ball is in free fall once kicked, the time of flight can be calculated using the vertical distance it falls. Once you have measured the horizontal distance the ball travelled, the horizontal speed of the ball can be calculated.

In order to obtain the duration of contact between the foot and ball, the timer must be set up to start running when contact is made (between the foil on the shoe and ball) and stop when contact is broken. This can be done with the Digicounter with the below arrangement.

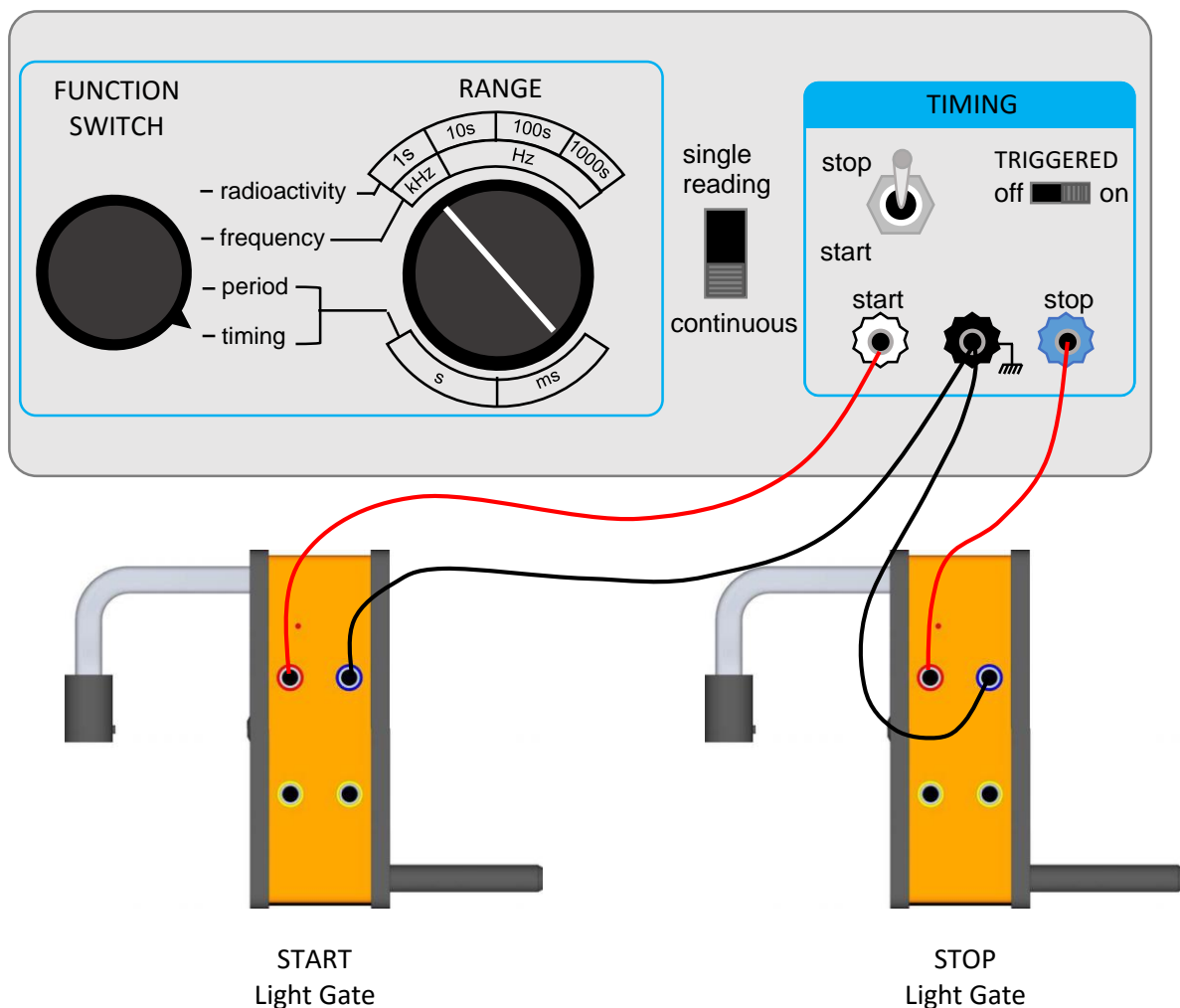


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3. Triggered timing with light gates

Set the function switch to **triggered timing** and the stop/start switch to stop. Set the triggered switch to on, and turn on the mains. Connect light gates to the start and stop sockets (the black socket is common – see below). Depress the reset button.

Momentarily breaking the start beam will commence the timing, and momentarily breaking the stop beam will stop the timing. Light must fall on the start beam again before the stop beam is interrupted, otherwise timing will not stop (i.e. please ensure the light gates are not “always blocked” – please see our Light Gate Notes for Use for more information).



EMC

This equipment is Class A according to the EMC standard EN55011 and is intended for use in a non-domestic environment only. Interference from nearby sources of RFI (radio frequency interference) may affect the output signals. Likewise, this equipment may affect other equipment: PC's, laptops, tablets and mobile phones may be affected.

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Warnings

For your safety, this product should be used in accordance with these instructions; otherwise, the protection provided may be impaired. Risk of shock if the unit is opened.

Use only the 3-core mains cable supplied with the unit. If the mains cable is replaced, the rating of the replacement must be the same or better than the original.

Do not open or remove covers or panels. Repairs and service may only be carried out by our repair agent, otherwise the warranty may be void.

The unit must be earthed at all times. The unit is earthed/grounded through the 3-core main leads, so no additional earth connection is required.

This unit is intended for use in DRY conditions. Avoid spillage of water and other liquids on to the unit. If spillage occurs, disconnect the mains supply.

There is no specific requirement for insulation of external circuits as they cannot become hazardous live as a result of connection to this unit.

Care should be taken when connecting lamps and light gates to these sockets because it is possible to obtain 8V A.C. between one of the 6 V sockets and the grounded 2 V socket.

Always position the Digicounter so that it can be disconnected from the mains if an emergency arises.

Cleaning

The S-Range Digicounter 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.

Periodic testing

Check the mains lead and plugs at both ends for any damage.

Periodically check the earth bonding and insulation, by performing a Portable Appliance Test (PAT). Most schools and local authorities have a regular schedule for such testing.

Check that the fuse in the mains plug (5A recommended) and the T50mA internal PCB mounted fuse are of the correct rating. Please note the PCB mounted fuse T50mA is not user replaceable.

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.

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Warranty, repairs and spare parts

The S-Range Digicounter 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.

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

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

Instructions for authorized service technicians

Ensure that any replaceable mains cord is of the correct rating, and that all earth conductors and protective earth bonding is maintained after service work.

Please refer to the detailed service procedures, safe servicing and continued safety – contact techsupport@philipharris.co.uk for advice.

Please refer to product specific risks that may affect service personnel, the protective measures and verification of the safe state after repair.

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

Technical Support:

E-mail: techsupport@philipharris.co.uk

www.philipharris.co.uk

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