BeeSpi V

The BeeSpi V (Figure 1) is a relatively inexpensive, self-contained light gate and time-speed unit made by the NaRiKa Corporation of Japan. Usually when we review a device like this our biggest challenge would be to test the accuracy of the timer. Here, we had an additional issue. How do you actually pronounce BeeSpi V? We decided on "Bee Spy Vee", though some asked whether the final letter was a V or a nu.

Figure 1 - BeeSpi V straddling a stunt car track.

If we turn the unit upside down (Figure 2), we see that it has a pair of infrared light gates separated by approximately 3.9 cm. The picture also shows the sliding lid of the compartment for two AAA batteries.

Using the BeeSpi V could hardly be simpler. Position it so that the object whose speed is to be measured can pass through both light gates and press START. The device lets you know that it is expecting to take a measurement by flashing the units (e.g. m/s) at the bottom right of its display. When both light gates have been broken, the speed is displayed. The BeeSpi V can record 5 events, with the SELECT button being used to cycle through the measurements. Holding down the SELECT button cycles through different options for units of measurement - m/s, cm/s and km/h. It is claimed that it can measure speeds of up to 99.99 ms^{-1}.

Figure 2 - the BeeSpi V has a pair of light gates.

The BeeSpi V can also be set to measure lap time. To put it in this mode, the START button is held down until the units change from m/s to sec (sic). It is important to note that it does not display the time to travel between light gates - in this mode, the time is taken from when one light beam is interrupted until the same beam is interrupted again.

Just when we were turning metaphorical cartwheels at the usefulness and ease of use of the BeeSpi V, we came across the following phrase on the instruction sheet:

Measurement results may differ slightly from actual speeds.

Hmm…

When did you last buy a thermometer that claimed, "*Measurement results may differ slightly from actual temperatures*"?

Of course, all readings from measuring instruments are subject to uncertainties. The phrase did have us wondering whether or not those of the BeeSpi V were too large for serious use. How to test? We wondered about using another device with light gates before and after the BeeSpi V to compare results, but we realised that we had not recently tested any other time-speed equipment for accuracy. Figure 3 shows the solution we devised.

Having masked the BeeSpi V's LEDs, we used a BBC micro:bit to drive two infrared LEDS. These were carefully positioned opposite the BeeSpi V's light sensors, which we assumed to be photodiodes or phototransistors. The micro:bit was programmed to switch off one, then the other LED. This mimicked the first then second light gate being interrupted. The micro:bit pins used to drive the LEDs were connected to separate channels on our calibrated twin channel 10 MHz USB oscilloscope. We were thus able to measure the time between each event. Knowing the sensor separation, we could calculate the speed that should be displayed on the BeeSpi V and compare this with the actual reading. If an object passed between the device's light gates at the maximum speed of 99.99 ms^{-1}, the time between light gates would be around 400 microseconds. Whilst the measured time is short enough for there to be a risk of LED and >>

photodetector response times being long enough to have a significant effect on it, the chances of being able to make an object move at this sort of speed in the lab are vanishingly small. Our micro:bit program allowed us to alter the switch-off time between the two LEDs. We repeated our investigation several times for a number of intervals ranging from 20 ms to 1000 ms. We concluded the measurement could be assumed to be accurate to ± the smallest scale division, i.e. ± 0.01 s.

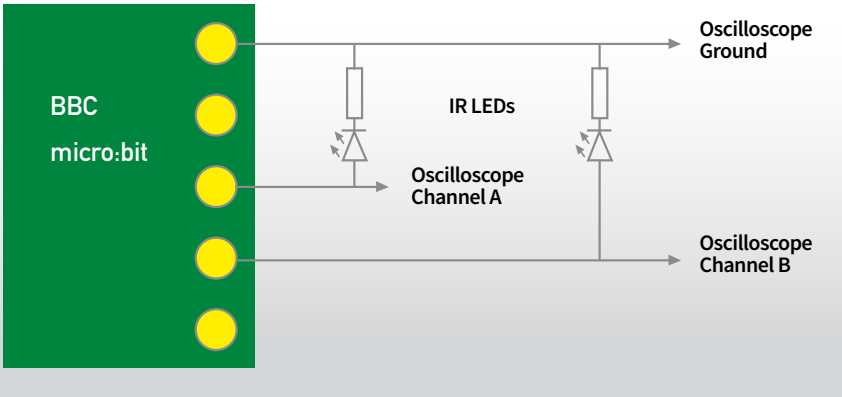

Figure 3 - Light gate test circuit.

At the time of writing, the BeeSpi V costs £22.77 (excl. VAT) from Scientific and Chemical. We liked the device enough to partner with IoP Scotland and give one away to every school that sent a teacher to the Institute of Physics Stirling Meeting 2018. We can see the device being particularly useful for practical work in National 5 Assignments. If you get one, please let us know what you use it for. <<

STEM Inspiration Awards

The STEM Inspiration awards are a free award scheme, designed to celebrate individuals and organisations working to inspire young people in STEM subjects.

What's involved?

Once you've completed our application form, a shortlist will be drawn up and you will be invited to attend our national award ceremony. The winners will be announced at a prestigious awards event at the Houses of Parliament.

Outstanding STEM Technician

This award recognises efforts to inform and inspire young people with apprenticeships and technician careers. It is aimed at those working in STEM who have a technical, non-graduate background and have used this to help inspire the next generation of technicians.

Outstanding STEM Club

This is award is designed to reward sustained and long-term engagement through a STEM Club.

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Applicants can be individuals or organisations involved in the project, but we would recommend you coordinate with partners to ensure a single application is made. This may include the number of people working as STEM Ambassadors as a proportion of the workforce, the ways the organisation supports its Ambassadors, and evidence of sustained engagement over the long-term (200 words).

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Nominees in this category need not necessarily be engaged in delivering to young people themselves, they may be in a role in which they enable and encourage others to do so. <<

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