











Products that help you improve your millisecond timing accuracy

	BBTK v3	mBBTK v2 (event marking version)	USB TTL module	TTL to USB keys module	1-5 button pressure sensitive force activated USB response pad	1-8 button USB response pad	1-8 button USB response pad with voice key	1-4 button USB response pad with slider/fader	4 port USB response box	Hand-held USB response button
										
Main function	Presentation, synchronization & response timing validation.	Complex real time timestamping and TTL event marking/TTL triggers.	Basic event marking.	Turns a TTL signal into a keystroke.	Accept pressure sensitive force responses on up to 5 buttons.	Accept responses on up to 8 buttons.	Accept responses on up to 8 buttons or vocal response via voice key mic.	Accept responses on up to 4 buttons and up to 1024 positions on a linear slider/fader.	Accept responses on up to 4 external buttons or hand-held triggers.	Accept response on one hand-held button.
Example usage	Independently checks onsets and durations of stimulus images, sounds or event marks against responses. Lets you tune your experiments accuracy by simulating a human participant that is millisecond accurate. Modify onsets, delays and RT's so that they are accurate in the real world.	Independent timing critical TTL event marking of stimulus images, sounds, TTL inputs or response pad button presses on EEG machines or eye trackers. Create TTL triggers quickly, easily and reliably in EEG, fMRI or any cognitive paradigm.	Acts as a USB parallel port replacement to allow basic TTL event marking/TTL triggers from any Experiment Generator that supports a serial port.	Converts any TTL input into a keyboard keystroke or value if a TTL pattern is detected.	Turns a button press into a pressure sensitive force curve whilst at the same time generating a USB keyboard keystroke for ease of integration with your own experiments. Can also stream live button forces to your experiment.	Turns a button press into a USB keyboard keystroke as if a key had been pressed on a real keyboard.	Turns a button press or vocal response into a USB keyboard keystroke as if a key had been pressed on a real keyboard.	Turns a button press into a USB keyboard keystroke as if a key had been pressed on a real keyboard. Produces keystrokes for each position on the slider/fader for Likert Scales (2-32 positions) or for finer grain judgements types numbers 0-1023.	Turns an external button or hand-held trigger press into a USB keyboard keystroke as if a key had been pressed on a real keyboard.	Turns a button press into a USB keyboard keystroke as if a key had been pressed on a real keyboard.
I/O options	<ul style="list-style-type: none">• 1-4x Opto-detectors• 1-2x Mics• 1x Audio in/out pass-through• 1-2x TTL trigger in (2 bit port)• 1-2x TTL trigger out (2 bit port)• 16x TTL I/O (2x 8 bit ports)• 1-4x Active Switch Closure• 1-4x button response pad• 1x Robotic Key Actuator (press keys or touchscreens)	<ul style="list-style-type: none">• 1-4x Opto-detectors• 1-2x Mics• 1x Audio in/out pass-through• 36x TTL trigger in (24 bit + 8 bit port)• 24x TTL trigger out (24 bit event marking port)• 1-8x button response pad• 1x shared TTL in for voice key trigger or patient button	<ul style="list-style-type: none">• 8x TTL trigger in (8 bit port)• 8x TTL trigger out (8 bit port)	<ul style="list-style-type: none">• 8x TTL trigger in (8 bit port)• 2x TTL trigger in (2 bit port on rear 2.5 mm stereo connector)	<ul style="list-style-type: none">• 1-5x built-in pressure sensitive force buttons (3 Kgs/3000 g/27.40 N/6.61 lb max)• 0.3 g/0.0029 N/0.00066 lb granularity• 1-5x optional LED indicators which illuminate when threshold reached• 5x TTL trigger out (5 bit port)• 2x External TTL trigger in (2 bit port)	<ul style="list-style-type: none">• 1-8x built-in buttons (4x std)• Choose color, size & location• 8x TTL trigger out (8 bit port)• 1x shared TTL trigger out (50 ms blip)• 1-8x external button inputs or hand-held triggers (4x std)	<ul style="list-style-type: none">• 1-8x built-in buttons (4x std)• Choose color, size & location• 8x TTL trigger out (8 bit port)• 1x shared TTL trigger out (50 ms blip)• 1x Mic input• 1-8x external button inputs or hand-held triggers (4x std)	<ul style="list-style-type: none">• 1-4x built-in buttons• Choose color, size & location• 4x TTL trigger out (4 bit port)• 5x TTL trigger out port for slider/fader positions 1-32 (5 bit port)• 2x TTL trigger in (2 bit port)• 1-4x external button inputs or hand-held triggers	<ul style="list-style-type: none">• 1-4x external buttons or hand-held triggers• 1x shared TTL trigger out (50 ms blip)	<ul style="list-style-type: none">• 1x built-in button• USB A lead with option to use an adapter on tablets or phones running Apple iOS or Android
Connection	USB 2/3	USB 2/3	USB 2/3	USB 2/3	USB 2/3 (1x HID + 1x VCOM)	USB 2/3	USB 2/3	USB 2/3	USB 2/3	USB 2/3
Software	Full wizard-driven PC suite for programming, control and timing analysis. API available for advanced users.	Full wizard-driven PC suite for programming, control, event marking and response monitoring. Can also be used independently without a PC using 10 onboard profiles stored in RAM. API available for advanced users.	Basic configuration and latency testing PC software. Basic API available for event marking. Utility also allows testing of TTL input and output.	PC keystroke configuration utility (once configured stored on TTL to USB keys module).	Microsoft Windows configuration utility for setting thresholds and keystrokes etc. (once configured stored on response pad). PC App for streaming pressure sensitive force data to a file whilst your experiment is running and accepting standard keyboard keystrokes. Automatically time lock your data to pressure/force curves.	PC keystroke configuration utility (once configured stored on response pad).	PC keystroke configuration utility (once configured stored on response pad).	PC configuration utility sets one of three slider/fader modes (once configured stored on response pad) Utility also allows you to test button presses and slider position.	PC keystroke configuration utility (once configured stored on response box).	Keystroke configuration utility built-in to hand-held (once configured stored on response button). Can be configured using any text editor.
Platforms supported	Microsoft Windows*, macOS, iOS, Linux & Android. *BBTK software Windows only.	Microsoft Windows*, macOS, iOS, Linux & Android. *BBTK software Windows only.	Microsoft Windows*, macOS, iOS, Linux & Android. *BBTK software Windows only.	Microsoft Windows*, macOS, iOS, Linux & Android. *BBTK software Windows only.	Microsoft Windows*, macOS, iOS, Linux & Android. *BBTK software Windows only.	Microsoft Windows*, macOS, iOS, Linux & Android. *BBTK software Windows only.	Microsoft Windows*, macOS, iOS, Linux & Android. *BBTK software Windows only.	Microsoft Windows*, macOS, iOS, Linux & Android. *BBTK software Windows only.	Microsoft Windows*, macOS, iOS, Linux & Android. *BBTK software Windows only.	Microsoft Windows, macOS, iOS, Linux & Android.
Timing characteristics	Onboard timing chip for real time accuracy. Sub-millisecond accurate. Timing accuracy independent of PC or Experiment Generator used.	Onboard timing chip for real time event marking accuracy. Sub-millisecond accurate. Timing accuracy independent of PC or Experiment Generator used.	Hardware capable of sub-millisecond accuracy. Timing accuracy tied to PC and Experiment Generator used.	Full Speed USB keyboard HID with 1 ms latency (1,000 Hz). TTL event mark sent in real time with sub-millisecond accuracy. Response accuracy tied to PC and Experiment Generator used.	Samples at 250 Hz & transmits data to PC as an 11 byte serial stream. Keyboard keystrokes generated once force threshold reached. Full Speed USB keyboard HID and VCOM port with 1 ms latency (1,000 Hz). Response accuracy tied to PC and Experiment Generator used.	Full Speed USB keyboard HID with 1 ms latency (1,000 Hz). TTL event marks sent in real time with sub-millisecond accuracy. Response accuracy tied to PC and Experiment Generator used.	Full Speed USB keyboard HID with 1 ms latency (1,000 Hz). TTL event marks sent in real time with sub-millisecond accuracy. Response accuracy tied to PC and Experiment Generator used.	Samples at 500 Hz & transmits button and slider positional data to PC as keyboard keystrokes. Full Speed USB keyboard HID with 1 ms latency (1,000 Hz). Response accuracy tied to PC and Experiment Generator used.	Full Speed USB keyboard HID with 1 ms latency (1,000 Hz). TTL event mark sent in real time with sub-millisecond accuracy. Response accuracy tied to PC and Experiment Generator used.	Full Speed USB keyboard HID with 1 ms latency (1,000 Hz). Response accuracy tied to PC and Experiment Generator used.

Are you running psychology, neuroscience or vision experiments using a computer?

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1. WHAT – If you are a psychologist, neuroscientist or vision researcher who reports timing accuracy in units of a millisecond, then it's likely your timings are wrong! This can lead to replication failure, spurious results and questionable conclusions. Timing error can affect your work even when you use an Experiment Generator like E-Prime, SuperLab, Inquisit, Presentation, Paradigm, OpenSesame or PsychoPy etc.

2. WHY – Modern hardware may be faster but millisecond timing accuracy is becoming harder to achieve: **"millisecond precision" does not equal "millisecond accuracy"**. Precision simply means timings are reported in units of a millisecond, not that they are accurate! Whatever Experiment Generator you use, it only knows when it requested a stimulus be shown and not the time when it physically appeared.

3. HOW – At the Black Box ToolKit we believe that you, the researcher, are the one best placed to detect and correct any timing errors in your own studies prior to publication. To enable you to accomplish this we have developed a range of easy to use hardware and software products that let you quickly improve your timing accuracy and consistency.

- Are you always carrying out the experiments you assume you are?
- Are you aware of millisecond timing error in your own experiments?
- Are you confident you can replicate experiments using different hardware and software in another lab?

The key question you should be asking yourself is, "Am I confident in my findings and would I be happy for a researcher in the same field to independently check my experiments?"

Are you putting your reputation at risk?

To find out more about how we could help you improve your research visit:

www.blackboxtoolkit.com

Serious about science: Serious about timing
The Black Box ToolKit

Focus on presentation, synchronization, response timing & event marking

Black Box Toolkit v3™

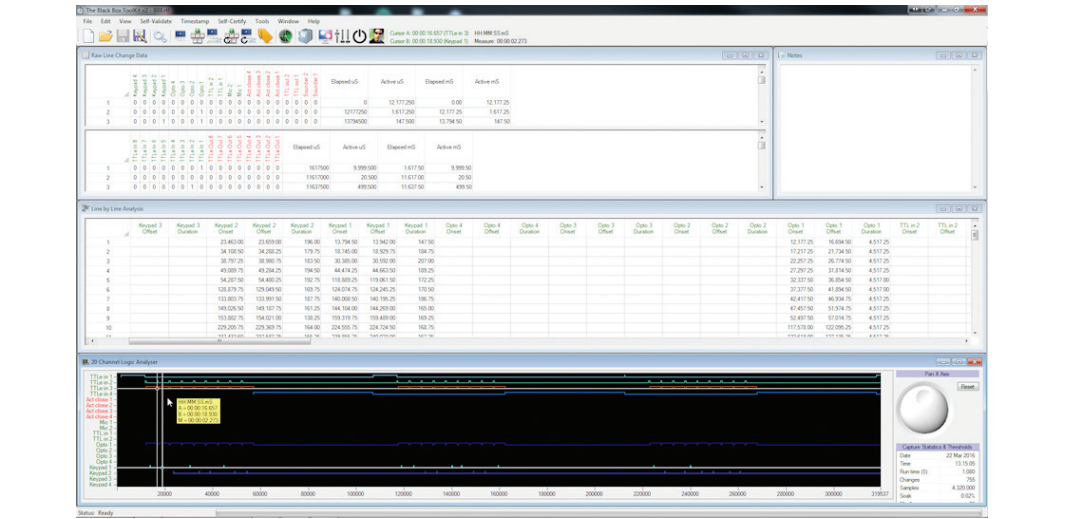


The gold standard for assessing millisecond timing accuracy and self-validation. Check experiments presentation accuracy, synchronization with other equipment and response timing independently

WARNING: You should be wary of placing blind faith in the notion that a given piece of software or simple experiment whose timing is accurate means that your study will be. This is especially true where our hardware has been used to tune another experiment but not your own. Will your own script be as simple, perform as well on your own hardware and have no bugs in it? Why not apply the Scientific Method to test, calibrate and refine your own experiment!

of your computer. The BBTK v3 lets you tune your Experiment Generators accuracy in a particular study by automatically simulating a human participant that is millisecond accurate. For example, it can respond to any stimulus and generate a response with a known RT as it steps through your psychology experiment. This enables you to modify onsets, delays and RT's so that they are accurate in the real world:

- **Set-up** – Hook up external stimulus sensors (opto-detectors, mics, TTL) and a response device (USB pad, Robotic Key Actuator, sounder, TTL)
- **Test** – Use a wizard to select a stimulus pattern to automatically respond to/event mark. Choose the exact RT, response device and duration
- **Analyze** – Check your stimulus, response and synchronization timings across up to 36 channels. Compare what your experiment recorded with what the BBTK saw



Wizard driven software makes benchmarking and calibrating your experiments timing quick and easy. For example, to check visual stimulus and RT accuracy simply attach an Opto-detector to your screen, select a real-world RT you would like the BBTK v3 to respond with and compare that with what your experiment presented and recorded. Be sure of your research results prior to publication.

Pressure sensitive force activated response pad

A wide variety of researchers could benefit by collecting force, or pressure sensitive data, in addition to more traditional reaction time measures, e.g. neuroscientists, cognitive psychologists, vision researchers etc. We appreciate that many may have used basic RT measures, but very few have currently used force data that tells them how hard a participant pressed a response button. This value-added data tells you much more than how hard a button was pressed. For example, it can tell you if there was any preresponse activity, the impact of preresponse cuing, whether cues effect reaction times and force curves, the certainty or uncertainty behind the RT and more.

Simply plug into a USB port on your PC/Mac/Linux system and our pressure sensitive force activated USB response pad (PSURP) will appear as a second keyboard. Press a button and a standard keystroke will be sent to your experiment. No need to recode! Works out of the box with any software that can accept standard keyboard responses. Simply choose a force threshold and the key to be typed once that threshold is passed. Our partner App enables you to quickly and easily integrate pressure sensitive measurements within your existing studies as it will record force data and time lock it to the key presses recorded by your experiment. This means that you will know exactly how hard someone pressed a button and for how long. If you want to go deeper you can choose to read the streamed serial force data directly into your own experiment.

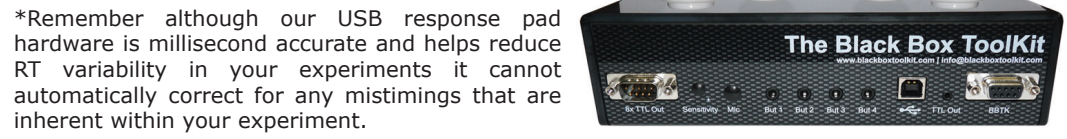


Finished in an attractive carbon fiber effect our response pad houses up to 5 pressure/force sensitive buttons with clear keycaps. If you opt for a custom laser cut version you are free to design your own button layout to make your response pad truly bespoke to you.

1-8 button USB response pad

Our millisecond accurate USB response pad is competitively priced and exceeds the specifications of any other response pad currently on the market. It appears to your experiment as a standard USB keyboard where a button response registers as a standard key press. What's more every button press also produces a TTL event mark/TTL trigger. Finished in an attractive carbon fiber effect, our response box houses up to 8 buttons in a range of colors and locations (also has sockets for up to 8 external buttons). A truly fit and forget solution to help you improve your response time accuracy on any platform, with any Experiment Generator*. If you can use a keyboard, you can use our response pad! Remember you can combine our USB response pad with either a BBTK v3 to check presentation and response timings or for when you need to TTL event mark stimuli and responses, the mBBTK v2 (event marking version).

What's more if your participants make a vocal response our voice key model also produces a standard key press and TTL event mark! Simple to use and simple to set up with tunable vocal activation, or crossing threshold. It's your choice whether to use it as a standard response pad or use it as a voice key.



1-4 button USB response pad with slider/fader

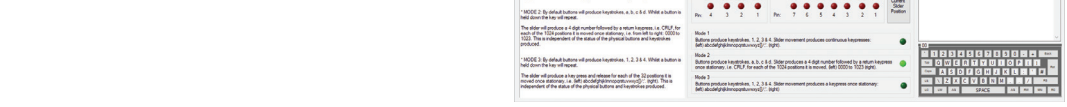
Often researchers need to measure more than simple button presses in Judgement and Decision Making studies. Currently there are no easy to use response pads for measuring finite judgements across Likert Scales.

Our new USB response pad with slider, or fader like those used in music recording studios, allows for up to 1024 positions over a 15 cm track. Slider position is reported as either a series of standard keystrokes or as a number between 0 and 1023 followed by return. For EEG studies TTL Event Marking lines allow for the position of the slider to be reported alongside button status.

By moving the slider left or right the participant has the opportunity to make finer decisions.

In addition to the slider up to four buttons can be located anywhere on the lid. A selection of colors and formats are available along with clear caps under which labels can be inserted.

There are also sockets for up to 4 external buttons.

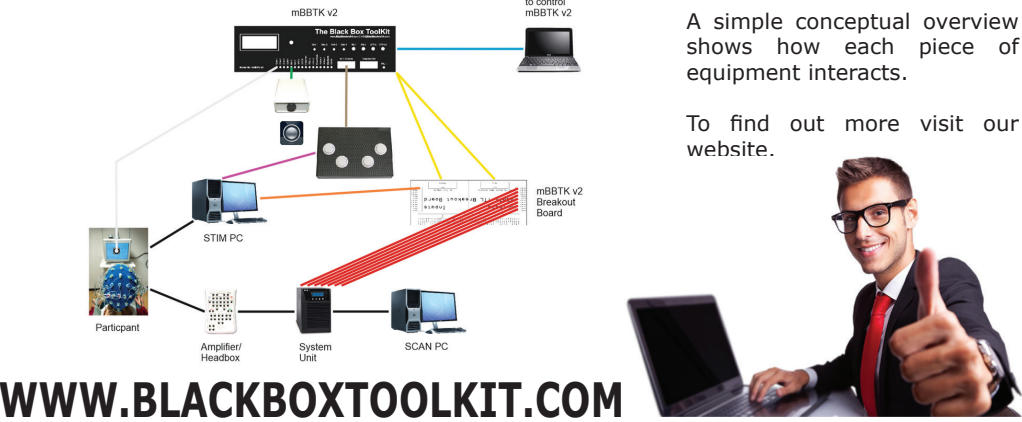
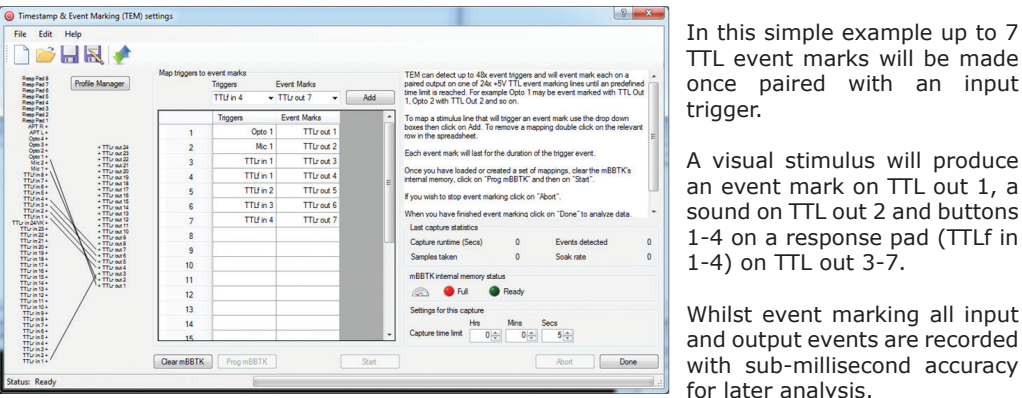


mBlack Box Toolkit v2™ (event marking model)

The mBBTK v2 is a dedicated self-contained hardware device that can be used to event mark or produce TTL triggers in EEG, neuroscience, eye tracking and any psychology experiment or cognitive paradigm. It is the gold standard for any experiment where you need to independently TTL event mark stimulus onsets, send synchronization signals or responses with sub-millisecond accuracy. All timing data and TTL triggers are logged in real time so that you can analyze performance later safe in the knowledge that your event marks were made at exactly the right time. Simple to use with a range of external sensors and intuitive software. For the ultimate in timing accuracy why not let your Experiment Generator handle the presentation, but let the mBBTK v2 event mark and collect RT data using a BBTK USB response pad.

The mBBTK v2 is designed to act as your eyes and ears and event mark exactly when a stimulus appears, a sound is made or a response button is pressed. Objective, independent and right first time every time. With up to 48 input channels there is a sensor to cover every type of stimulus. Any input channel or sensor can quickly be paired with any of the 24 TTL event marking/TTL trigger output lines using our PC Software.

If you want to run standalone without a PC, no problem. Simply download between 1-10 onboard profiles which can be run automatically to event mark with no specialist knowledge.



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In this simple example up to 7 TTL event marks will be made once paired with an input trigger.

A visual stimulus will produce an event mark on TTL out 1, a sound on TTL out 2 and buttons 1-4 on a response pad (TTLf in 1-4) on TTL out 3-7.

Whilst event marking all input and output events are recorded with sub-millisecond accuracy for later analysis.

A simple conceptual overview shows how each piece of equipment interacts.

To find out more visit our website.

