The Black Box ToolKit

Serious about science: Serious about timing

The Black Box ToolKit v2

Inverted Robotic Key Actuator Guide

Credits:

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Covers the following hardware:

The Black Box ToolKit v2 Robotic Key Actuator

For the following platforms:

Microsoft Windows XP SP3, Vista SP2 (32/64), Windows 7 SP1 (32/64)
Windows 8 (32/64)

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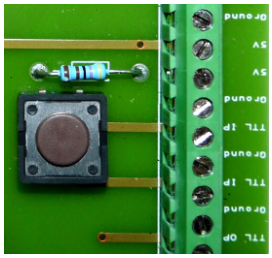
1. Calibrating an Inverted RKA

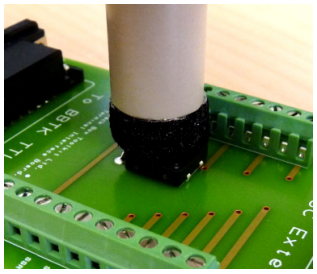
Because of the way the inverted RKA is configured, i.e. energised and pressing when there is no TTL signal on TTL Out 2, you cannot use the standard RKA calibration software to assess release latency, i.e. solenoid recoil time. Instead you must calibrate it manually using DSCAR. The standard calibration procedure should still be used with the normal RKA.

To calibrate the inverted RKA begin by connecting the RKA to the BBTK breakout board via the special double headed TTL Trigger Lead (labelled normal and inverted). The actual RKA's are identical with the only difference being some additional electronics in the leads hood. The normal Trigger Lead connects to the RKA you want to press when it receives a TTL signal on TTL Out 1. The "inverted" Trigger Lead connects to the RKA you want to release when it receives a TTL signal on TTL Out 1.

Warning: As the inverted RKA will constantly be energised, i.e. pressing when powered on, the solenoid and enclosure will heat up over time. You are advised to run the inverted RKA for no longer than 20 minutes at a time. When not in use you should ensure that the power is disconnected to prevent overheating.

The Black Box ToolKit Ltd cannot be held liable for any damage caused as a result of leaving the inverted RKA powered and energised for prolonged periods. Excess build up of heat may also detrimentally affect timing accuracy.

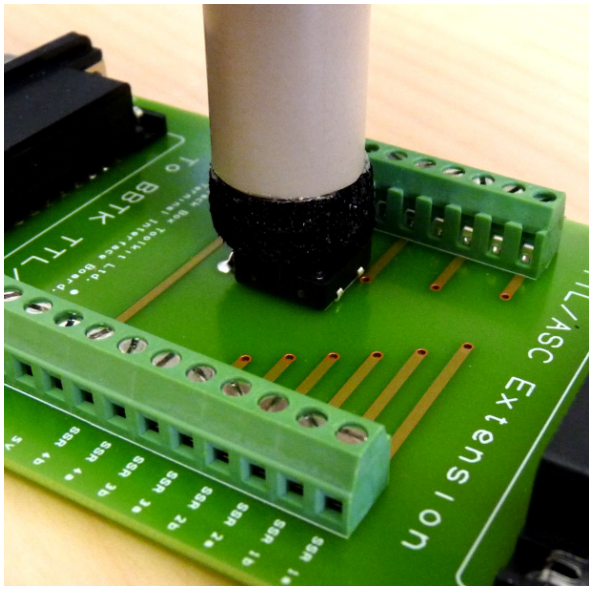




To begin position the RKA plunger centrally above the Calibration Button on the Breakout Board.

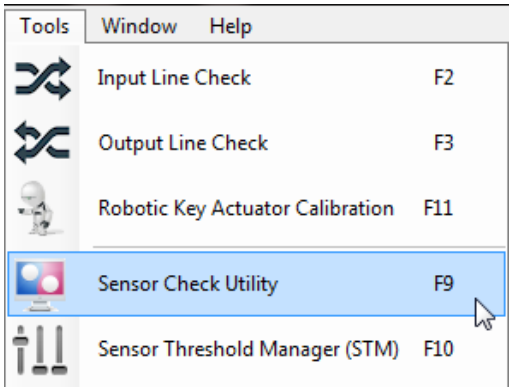
Power on the inverted RKA so that the plunger activates to its default pressed position.

Loosen the thumb wheel to move the solenoid enclosure and plunger left and right across the gantry and vertically up and down. When you are happy tighten the thumb wheel.



The foam should rest on the button and activate it whilst the RKA is powered on and energised, i.e. pressing. When the button is pressed the TTL In 1 LED will illuminate on the front panel of the BBTK.

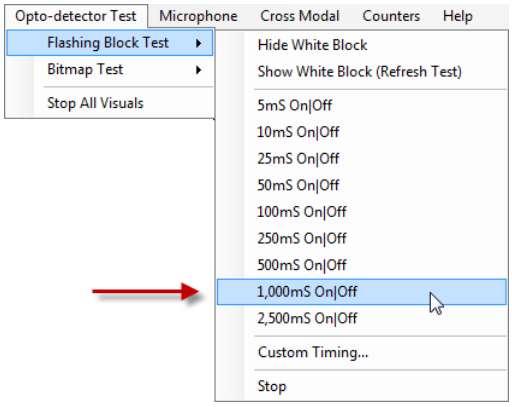
Note: When you test your own response device key/button you should ensure you position the plunger using this method to ensure consistency.



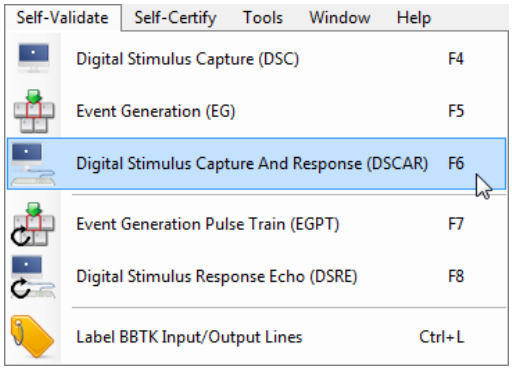
Next start the Sensor Check Utility from the Tools menu or press F9.

Position Opto 1 so that it will trigger when the central block flashes white.

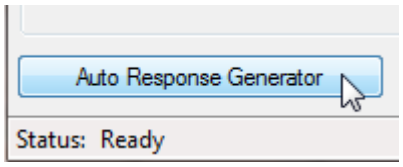
If you need to adjust the activation threshold do so now using the Sensor Threshold Manager as detailed in the BBTK User Guide.



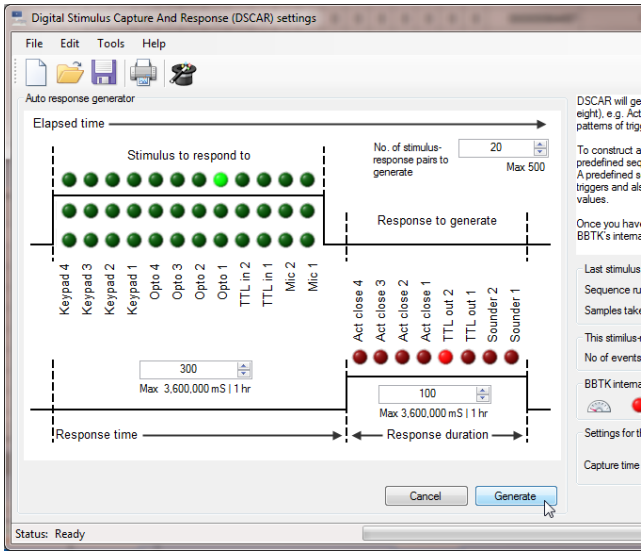
Select the Flashing Block Test where it flashes every 1,000ms.



Start DSCAR from the Self-Validate menu or press F6.

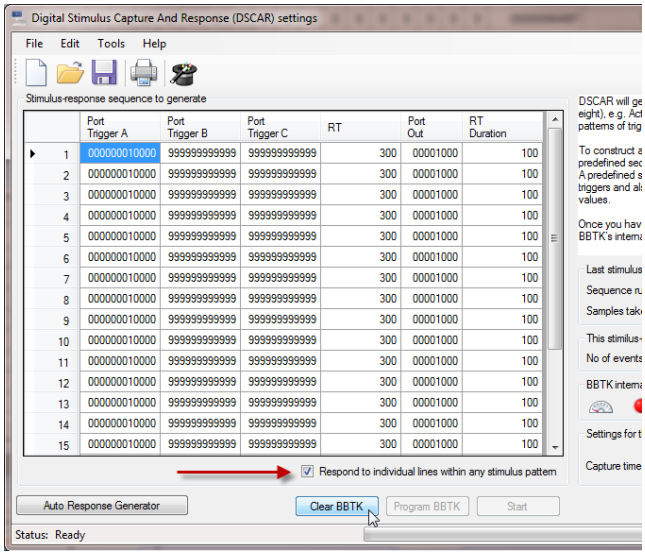


Click on the Auto Response Generator button.



Select Opto 1 as the stimulus to respond to and TTL Out 2 as the response. Initially leave the RT and duration at the defaults of 300 and 100 respectively.

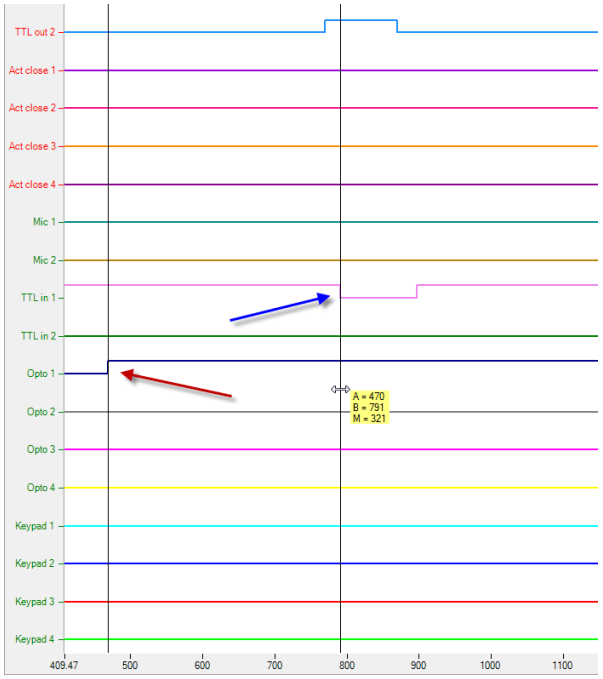
Finally click Generate.



Ensure you tick Respond to individual lines within any stimulus pattern.

This is because as the inverted RKA is energized, i.e. pressing by default, TTL In 1 will generally be active. Thus even though you are triggering on Opto 1 in reality the BBTK will register Opto 1 AND TTL In 1 and therefore will not detect a pattern match. Hence the need to trigger on Opto 1 within any stimulus pattern.

To start calibrating click, Clear, Program and Start as normal.

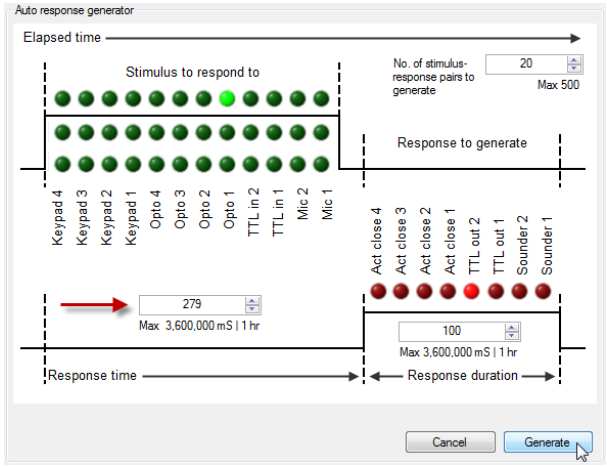


The simplest way to determine what the recoil delay is when the inverted RKA is sent a TTL Out 2 signal, i.e. stops pressing, is to use the Logic Analyzer.

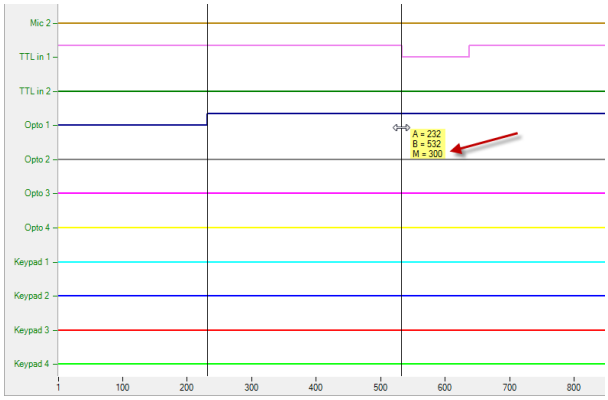
Press M to bring up the measurement cursors. Drag Cursor A to the onset of the Opto event. Drag the Cursor B to the point where TTL In 1 (the calibration button) goes low, i.e. the button is released by the inverted RKA.

Read off what the Measurement M time is. In this example it is 321ms. This implies that the recoil delay is 21ms as the target RT in DSCAR was 300ms.

This is the figure you will need to correct for in the software you are testing, i.e. true release times will be 21ms longer due to the inverted RKA recoil delay of 21ms.

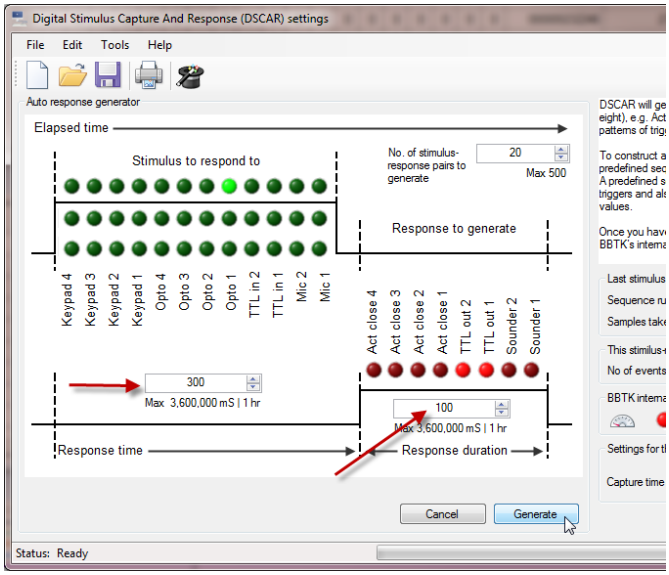


If you need to have an accurate release of 300ms you can subtract 21ms from 300ms and enter 279ms into the RT box in DSCAR.



When you rerun DSCAR with those parameters and subsequently reanalyze the events a true release RT of 300ms should have been produced.

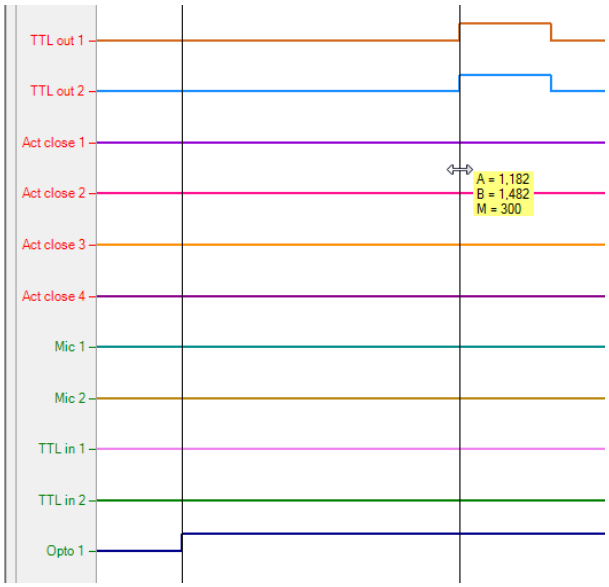
2. Using Two RKA's Simultaneously to Test Timing



If you are using two RKA's to test your own paradigm remember to enter calibrated RT and duration figures. Also ensure you **select TTL Out 1 and TTL Out 2** for the response, i.e. both RKA's at once.

Generally the corrected RT figures will be for the RKA which is making the normal response, i.e. not inverted and pressing when sent a TTL signal.

You cannot correct for the timing variation of both RKA's simultaneously in DSCAR. Therefore for the inverted RKA you should subtract the calibration figure from the recorded release RT in your software to calculate the true release RT, e.g. -21ms.



When you examine the Logic Analyzer both TTL Out signals will have been generated simultaneously.

This has the effect of making the normal RKA press its plunger at the RT chosen and the inverted RKA release its plunger, i.e. the opposite action.

The duration of the plunger press on the normal RKA will be for the duration chosen and the duration of the release on the inverted RKA will be roughly equivalent.

