

The Black Box ToolKit

1-5 Button Pressure Sensitive Force Activated USB Response Pad v1

Cheat Sheet



IMPORTANT

The response pad self-calibrates/tares for 40 seconds after its USB leads are first plugged-in. During this period do not press any buttons and ensure that there are no vibrations around the response pad. At all times the response pad should be located on a flat hard surface.

Whilst self-calibrating unladen weights the response pad will not respond to any serial commands or to the BBTK partner App. If required the response pad firmware can be updated during the first 10 seconds.

Rev. RC1 (20220920)

Credits:

Author: Dr. Richard R. Plant, C.Psychol, CSci, AFBPsS

Covers the following hardware:

The Black Box ToolKit 1-5 Button Pressure Sensitive Force Activated USB Response Pad v1

For the following platforms:

Microsoft Windows XP SP3, Vista SP2 (32/64), Windows 7 SP1 (32/64) Windows 8 (32/64), Windows 8.1 (32/64), Windows 10 (32/64), Windows 11 (64) Mac OS 8/9, OS-X Linux 2.4 and greater

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Please read this manual fully before using the 1-5 button pressure sensitive force activated USB response pad. Improper connections to the input ports can cause the response pad to reset, or even cause permanent damage. Damage caused by over, or reverse, voltage conditions resulting from improper wiring to the ports is not covered under the warranty.

When not in use you are advised to disconnect it from your equipment.

IMPORTANT

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Background

The BBTK 1-5 button pressure sensitive force activated USB response pad allows you to easily integrate force measurements with standard keyboard keystroke responses.

Each force sensor comes with your choice of standard Cherry MX linear button switch with tactile feedback (like a standard keyboard key) or Isometric non-moving button (like pushing your finger against a hard surface). But you can choose to have a spare replacement so you could swap between each type to determine which works best in your experiment.

The PSURP connects to your PC using two USB ports. The first, a serial port, streams live force data from each button to the PC. The second, a standard USB Keyboard HID, sends keystrokes to the PC when a set force threshold is passed, i.e. a key down is sent which appears as though as a key had been pressed and held down on a second keyboard. The key is held down until the threshold is not met due to the force button being released.

You should not confuse the PSURP with a set of weighing scales. Weighing scales weigh static weights, placed in a perpendicular manner over multiple force sensors and average between them over relatively long periods.

The PSURP should be thought of as being more like a relative force measuring device versus an absolute weighing machine. Physics means that if two people press the same force sensitive button they will each press it in a different way. One may press it at 90 degrees downwards whilst the other may press it with more of a sideways force. In both cases the force sensor will react slightly differently based on the finger position and how the force is applied through the button as the diagrams below show. The same person will probably press differently between trials too.



Under ideal conditions you should aim for Example 2 when pressing force sensitive buttons, i.e. apply a perpendicular force at 90 degrees (<u>https://www.grc.nasa.gov/www/k-12/airplane/torque.html</u>). Consider point p as being the force sensor.



Simple Physics suggests that to aid consistency try to ensure button presses are perpendicular, i.e. at an angle of 90 degrees, to the button.

The best way to think of force data is in terms of relative EEG data where data is averaged rather than absolute voltages compared between two people even where an electrode is placed in the same location.

You should ensure that the PSURP is placed on a flat, hard and level surface when in use. Even desks which may appear flat might contain imperfections which can impact on the reliability and repeatability of force measurements.

Each time the PSURP is powered on by plugging the USB lead in, each force sensor will automatically retare itself, i.e. self-recalibrate to zero. Depending on atmospheric conditions, e.g. heat and cold variation, you are advised to leave the PSURP in the room where you intend to use it for the sensors to acclimatise. In addition before each use or between participants you are advised to re-tare the unit by powering off by removing both USB leads and then replugging.

Ensure that when the PSURP is powered on by plugging the USB leads in and it is re-taring that no weights or forces are exerted on the sensors, otherwise a false zero self-calibration value will be obtained and the tare value will be inaccurate meaning that any forces measured will also be inaccurate. Self-taring or zeroing is what all electronic scales do when first powered on.

Key features

- Sleek carbon fiber enclosure (300 mm x 250 mm LW)
- Choice of 1 to 5 pressure sensitive force activated buttons
- Each button can detect between 0 & 3000 g
 / 29.4 N / 6.61 lb of force (1 Gram = 0.0098 Newtons) – If forces exceed 3000g they will be reported as 3000g
- 0.3 g / 0.0029 N / 0.00066 lb granularity
- Button layout can be customized to meet your needs
- Choice of standard Cherry MX linear switch with tactile feedback (like a standard keyboard key) or Isometric non-moving button (like pushing your finger against a hard surface)
- Clear cap buttons allow you to put your own labels under a tamper-proof clear plastic cover
- Each button can have its own unique light/LED indicator which activates when a set threshold is reached
- Works out of the box with PCs/Macs/Linux
- iOS & Android compatible for tablets and phones
- Compatible with all Psychology experiment generators, e.g. E-Prime, SuperLab, Presentation, Inquisit, DMDX, ERTS, DirectRT, PsyScope, PsychoPy etc.
- Fully plug in & play
- Appears as a second keyboard for ease of integration with existing experiments
- Map buttons to any keystroke you need (keystroke held down when a threshold you set is met)
- Full-speed USB 2.0 (compatible with USB 3.0)
- 250 Hz sampling rate (4 mS) @ 230400 baud serial speed
- 125 Hz sampling rate (8 mS) @ 115200 baud serial speed

- Guarantee millisecond precise responses*
- Built-in TTL event marking/TTL triggers for EEG, biofeedback, fMRI and time audit
- Works with the Black Box ToolKit v2 and mBBTK v2 (event marking version)
- Partner App captures timestamped streamed pressure/force data from each button and stores it to disk whilst your experiment simply needs to look for keystrokes as if a key had been pressed on a standard USB keyboard
- App allows you to quickly and easily time lock your RT results to pressure/force data
- Settings stored in non-volatile RAM once set using the App, e.g. activation thresholds, keystrokes to output, set TTL inputs and outputs etc.
- Platforms supported:
 - Microsoft Windows XP SP3, Vista SP2 (32/64), Windows 7 SP1 (32/64), Windows 8 (32/64), Windows 8.1 (32/64), Windows 10 (32/64), Windows 11 (64 bit)
 - o macOS[#]
 - Linux#

[#]BBTK Microsoft Windows software Apps not supported directly. Full API provided for control over serial regardless of platform used. USB Keyboard HID natively supported via Plug and Play (PnP).

Example Technical Base Labels for the PSURP

BBTK 1-5 button pressure sensitive force activated USB response pad key features Overview: The BBTK PSURP streams serial force data in grams in base 71 over serial using two bytes

Overview: The BBTK PSURP streams serial force data in grams in base 71 over serial using two bytes for each button, i.e. 10 bytes. The 11th byte gives status of the two TTL Input lines on RJ45 port. Keyboard HID Keystrokes held down once force threshold met, released on up threshold.

To aid consistency ensure button presses are perpendicular, i.e. at an angle of 90 degrees, to the button. Ensure no weight is on any buttons when first plugged into USB as the PSURP will automatically re-tare. Prior to operation please consult full manual.

Reset: First press starts streaming | Second press = stop | 10 Secs = Factory defaults & set to 115,200 (125 Hz sampling rate).

TTL RJ 45: Pins 1-5 = buttons 0-4, +5 V when down threshold passed, 0 V up. Pins 6 & 7 TTL Input lines, Pin 8 GND.

Keyboard USB: Keyboard HID keystroke held down whilst down threshold passed, released on up.

Serial USB: Connect to the correct Virtual COM Port (VCP) using the settings below. Before connecting ensure that driver latency is set to 1 mS & serial to 230,400 (250 Hz sampling rate).

Bits per second = 230,400 | Data bits = 8 | Parity = none | Stop bits = 1 | Flow control = none

Abbreviated terminal commands: **CONN** = Check connection | **RUNE** = RUN Experiment and start streaming data/send keystrokes when thresholds reached | **X** = Stop | **DBTx** = x button number, down button threshold in grams | **CHBx** = USB key code to type | **CHTx** = TTL x 0/1 key code to type | **HIDC** = HID keyboard on (1)/off (0) | **TICH** = TTL keyboard on/off | **KDEB** = Keyboard debounce mS | **STRC** = Stream all forces from 0 g + TTL | **REST** = soft reset | **SERS** = serial speed to 230 or 115 | **GSET** = Get all settings | **SAVE** = Save settings | **MODL** = Model | **FIRM** = Firmware version

Status LED: Orange = ready; Green = streaming data.

Fault LED: Red = fault, e.g. button pressed at startup.

Firmware Updates & Support: www.blackboxtoolkit.com

Full option list set via the BBTK PSURP Microsoft Windows App and stored on PSURP in NVR.

(PSURP)

Part No: PSURP | Made in the UK



This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference; and (2) this device must accept any interference reserved, including interference that may cause undexide operation. Changes or modifications not expressly approved by the party responsible for compliance could wold the user's authority to operate the equipment.

Black Box ToolKit Pressure Sensitive USB Keyboard Response Pad

Calibration Report

Device Name:

Organization: Device Serial Number: Date of Test: Site Temperature (deg C):

GXIEC-GROTK-KLFHU-FECQY-JTKYW 18 May 2022 24

BBTK (RRP) - Internal Use Only

Description: Tolerance:

Sensor 0			
Calibration	Sensor		
Weight	Reading		
(g)	Raw		
0	7013		
50	7467		
100	7956		
200	8927		
500	11899		
1000	16687		
2996	35245		

Sensor	3
Calibration	Sensor
Weight	Reading
(g)	Raw
0	8405
50	8899
100	9385
200	10331
500	13193
1000	18156
3018	36260

Standard 5 button PSURP 1% -/+ 2g Sensor 1 Calibration Sensor

Reading

Raw

8749

9222

9702

10681

13554

18679

37020

Sensor

Reading

Raw 7034

7520 7997

8976

11906

16932 35041

Weight

(g)

0

50

100

200

500

1000

3031

Weight

Sensor Calibration

(g)

100

200 500

1000

3026

0 50

Sens	
Calibration	Sensor
Weight	Reading
(g)	Raw
0	7032
50	7505
100	8006
200	8990
500	11944
1000	17154
3035	35543

The Black Box ToolKit

Serious about science: Serious about timing

-

Example Calibration Report



1. Installing Drivers for the Virtual Serial Port

Plug in the Serial lead, but leave the Keyboard lead unplugged for now.

Download and install the VCP drivers for your OS, i.e. Windows (Desktop) from:

https://ftdichip.com/drivers/vcp-drivers/

Once installed you should have a Virtual Communications Port on your computer through which the PSURP will stream force data back to the PC.

Before you use it for the first time however you need to set the latency of the communications to 1mS as the default is 16mS which is too slow.

Locate the COM port in Computer Management in Windows. In the example below COM 4 this is COM 4.



Right click on the COM port and then left click on Properties.

2		
>	🖵 Network adapters	
~	🛱 Ports (COM & LPT)	
	🛱 Communications Port (COI	V1)
	🛱 USB Serial Port (COM4)	
>	📇 Print queues	Update driver
>	📇 Printers	Disable device
>	Processors	Uninstall device
>	Software devices	Uninstan device
>	🐐 Sound, video and game co	Scan for hardware changes
>	Storage controllers	
>	to System devices	Properties
>	Universal Serial Bus controllers	13 ²

Next click on the Port Settings tab and then on the Advanced... button.

USB Serial Port (COM4) Properties		
General Port Settings Driver Details Events		
Bits per second: 115200		~
Data bits: 8		\sim
Parity: None		\sim
Stop bits: 1		\sim
Flow control: None		\sim
Advanced	Restore Def	aults
ок	C	ancel

Drop down the Latency Timer (msec) combo and select 1 mS and then click on OK. Finally click on OK again.

Advanced Settings for COM4			G	?	×
COM Port Number: COM4 USB Transfer Sizes Select lower settings to correct perform Select higher settings for faster perform Receive (Bytes): Transmit (Bytes):	ance problems a hance. 4096 ~ 4096 ~	at low baud rates.		OK Cancel Defaults	
BM Options Select lower settings to correct respons	e problems. 🖌	Miscellaneous Options Serial Enumerator Serial Printer		Ē	
Latency Timer (msec):	16 ~ 1 ^	Cancel If Power Off Event On Surprise Remo	oval	[
Timeouts	2 K3 3 4	Set RTS On Close Disable Modem Ctrl At S	tartup]	
Minimum Read Timeout (msec):	5 6	Enable Selective Suspen	d	[
Minimum Write Timeout (msec):	7 8 9 10	Selective Suspend Idle 1	Timeout (secs):	5	~

Now that you have a COM port setup you will be able to communicate with the PSRUP and stream Force Data back.

Make a note of the COM port number so you know which port the PSURP is installed on.

2. The BBTK Pressure Sensitive URP Configuration & Test Utility

Install the BBTK Pressure Sensitive URP Configuration & Test Utility using the setup EXE provided.

Ensure you install the software for All Users and that you have Administrator Rights to the PC when you install.

The software has multiple roles and is designed to make your life easier.

It is designed to:

- 1. Let you test that the PSURP is functioning correctly and streaming force data and HID keyboard keystrokes when set predefined force thresholds are passed.
- 2. Enable you to configure the PSURP, e.g. force thresholds for streaming data or pressing keyboard keystrokes.
- 3. Capture force data while you run an experiment, i.e. capture force data independently of your experiment and store it to a PSL file, i.e. a Pressure Sensitive Log File.
- 4. Load and preview stored force data from a PSL file.
- 5. Time lock timestamped force data from a PSL file to the presentation and RT data from your own experiment, i.e. synchronize RT's with force data. Currently examples are only provided for PsychoPy.

BBTK Pressure Sensitive URP Configuration & Test Utility		E – 🗆 X
File Tools View Help		
i 🕲 😂 🛃 🔀 者 🖂 🔗 🕜 🕼 🔛		
Current driver settings	Button force curves	Keyboard HID preview
Serial ports Speed Latency timer (mS) [COMX 230400 1 Connect		Î.
Connected Mode Streaming Update GUI every 25 mS		1 1 2 3 4 5 6 7 8 9 0 ■ ● ● 100 Q W E R T Y U 0 P 1 1 100 Q W E R T Y U 0 P 1 1 100 A S D F G H U L 1 1
TTLIN BUTTON1 BUTTON2 BUTTON3 BUTTON4 BUTTON5		Ls \L Z X C V B N M < > / ms Lc LW AG SPACE AG mw Ms mc
		Received (RX) Ulew RX Data
Max force		
Samp n/a Samp n/a		
· · · · ·		Send (TX) Copy Clear CONN
Сору Сору Сору Сору		Send Copy Clear
Status:		.:

2.1. Check the PSURP is Working Correctly

Start the Configuration & Test Utility and select the Serial port your PSURP is connected to and then click on Connect.

🚯 BBTK Pressure Sensitiv	e URP Configuration 8	t Test Utility	
File Tools View	Help		
i 💿 😑 🕁 💽 🖸 🗖	📍 🖉 🗇 🖑 💆		
Current driver settings			
Serial ports	Speed Latence	y timer (mS)	V
COMX ~	230400 ~ 1	~	Connect
COM4	Mode	Streaming	
COMX 220400	Unknown	۵ 🔴	Update GUI every 25 mS
230400			Set

If you successfully connect the green connection LED will be illuminated and a dialog box will pop-up.

Click on OK to start using the utility.

By default the PSURP starts in command mode meaning that it is ready to accept commands from your PC over the serial connection.



To start streaming force data click on the Start button.



If you press button 1 on the PSURP the virtual button will go up and down as force data is streamed from the PSURP. The Mode LED will turn green as will the streaming LED.



When the PSURP button is released the virtual button will be shown as up and the Streaming LED will go red.



To add in more detail click on the View menu. In this case we want to see Individual Button Readouts in Grams.



Now when a button is pressed you will be able to see the forces applied to the button in Grams.



If you wish to plot live curves then add Individual Button Force Graphs from the View menu. The force curve for button one will then be plotted.

Note that the Y axis refers for forces in Grams and that the X axis refers to sample number. Remember that the PSURP samples at 400 Hz or every 2.5 mS so 100 on the force graph below is a time period of 250 mS or 100 samples.



At this point you could plug in the Keyboard HID USB lead. This will let the PSURP send keystrokes to the PC as though keys on a second keyboard had been pressed. Once a given force threshold is reached a key will be pressed and held down until that button is released.

Again click on View and Keyboard HID Preview.



BBTK Pressure Sensitive URP Configuration & Test Utility

As the button is pressed and the force threshold surpassed the linked keyboard key will be pressed and held down until the button is released.

In the example shown below the threshold is set at 25 g and when 25 g is reached the letter "a" is held down.



To stop streaming force data and to go back into Commands mode click on the Stop button.

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2.2. Configuring the PSURP

To configure the PSURP ensure that you are in Command Mode, i.e. you have pressed the Stop button. Then click on the Configuration & Running Settings toolbar icon.

sitive URP Configuration & Test Utility

	Help			
] 🖪	🎦 🗹 🖉 🚺	1 📓		
		13	-	
	Speed	Configuratio	on & R	unning Settings
~	230400 ~	1	~	Disconnect
		_		

The settings you can change are shown in the right panel below.

🔍 Configuration & Running Settings	G X
This settings page lets your zero each button and calibrate with a known weight if needed. You can also alter the keystrokes sent when a button reaches an activation force.	If you wish to send keyboard keystrokes to your experiment when a given button pressure is reached you can set the threshold here. You can also assign the keystroke to be pressed an held down until an up pressure is reached.
* To zero a button click on Zero, i.e. when the button has no weight on it as when first powered-on. * To calibrate a button with a known weight, put the weight on the button and click Cal (default 500g). Do not do this unless you have a calibraton weight vaniable. * To measure the current force on any button press the round button on-screen for an instant read out.	You can make these the currently Running Settings to test them out and then Save As Power-on Defaults. Once saved as Power-on Defaults these will be stored in the PSURP even when powered off.
Running tare weights (zero or no load) and raw calibration valies (calibrated weight)	Currently running and power-on settings you can change
BUTTON 1 BUTTON 2 BUTTON 3 BUTTON 4 BUTTON 5	What is the weight of the calibration weight you are using to calibrate buttons? 500 Image: Constantly stream serial data regardless of thresholds set ? Image: Constantly stream serial data regardless of thresholds set ? Image: Constantly stream serial data regardless of thresholds set ? Image: Constantly stream serial data regardless of thresholds set ? Image: Constantly stream serial data regardless of thresholds set ? Image: Constantly stream serial data regardless of threshold reached ? Image: Constantly series of the constant set of the constant s
✓ Installed ✓ Installed ✓ Installed	BUTTON 1 BUTTON 2 BUTTON 3 BUTTON 4 BUTTON 5 Down Button Threshold 25 <
Zero Zero Zero Zero Zero Grams Cal Cal Cal Cal Grams Grams BUTTON 1 BUTTON 2 BUTTON 3 BUTTON 4 BUTTON 5	The dauptas for each obtain treasholds The dauptas for each obtain threaholds The dauptas for each obtain threaholds is reached? The hydrodus of the daupta for each button Keystroke to hold down when button force activation point reached BUTTON 1 BUTTON 2 BUTTON 3 BUTTON 4 BUTTON 5
Bol Town Bol Town Bol Town Bol Town Bol Town Tare weight (saw from sensor) 6618 8127 6501 7531 6585 Calibration weight (saw from sensor) 10955 12472 10826 11752 10925 Scaling factor 0.1133 0.1151 0.1156 0.1185 0.1152 Calibration weight (calculated) 500 500 500 500 Grams Calibration weight (calculated) 500 500 500 500 Grams	Key to type a b c d e HID keyboard output for each TTL in event mark. Keystroke to hold down when there is an event mark on TTL in 1 or 2 TTL IN 1 TTL IN 2 Key to type g h - Confirmed Senal Speed 230400 Model BBTK PSURP V1.0 Firmware version 20220214 Reset to Factory Defaults Get Running Settings Make Running Settings Load Power on Defaults Save Ar Power on Defaults Save Ar Power on Defaults
Status: Ready	

The most common settings you might alter are the button force activation thresholds. Generally these should be the same for both Down and Up.

Next is the Keys to type when those force thresholds are surpassed, e.g. when BUTTON 1 has a force of 25 g or more applied to it the letter "a" will be held down and only released when the force applied is less than 25 g.

You can also set the letters that are typed is either of the two TTL input lines go from 0V to 5V. These might be TTL input triggers from a BBTK v2 or mBBTK v2, e.g. a TTL trigger that is tied to a visual stimulus being displayed on screen. By combining the PSURP with other BBTK hardware this allows you to measure responses with millisecond accuracy relative to stimulus onsets in the real world.

For now do NOT alter any other settings.

When you are happy with your settings click on Make Running Settings and/or Save As Power-on Defaults.

BBT	K PSURP V1.0 Firmware	version 20220214	
	Get Running Settings	Make Running Settings	
	Load Power-on Defaults	Save As Power-on Defaults	
		4	.::

3. Manually Capture Force Data

There are two ways to capture data. One which is manual and one which is automatic and controlled from your own experiment generator.

To help understand the process it's useful to try the manual method first.

To begin choose a Pressure Sensitive Log file, or PSL file, to save the force data to as you press buttons.



The short filename will be shown in the title bar.

🚺 BB.	TK Pressure Ser	nsitive URP Configu	uration Utility - test.psl	-	
File	Tools View	v Help			
0) 🕁 💽 🕻	2 者 🗷 🔿 «	# 💆		
Curren	t driver settings				В
Serial p	oorts	Speed	Latency timer (mS)		
COM4	ļ	< 230400 √	1 ~	Disconnect	

Ensure that you have clicked the green play button and that the PSURP is in Force mode.

Finally click on the record button.



Any force data will now be streamed and recorded to the PSL file you chose.

To stop click on the Stop button so that the hourglass stops spinning.



Below we can see an example file.

☑ D:\PSURP Test\test.psl - Notepad++	Metadata about the PSURP settings are
File Edit Search View Encoding Language Settings Macro Run Plugins Window ?	stored at the start of the file
	stored at the start of the file.
🔚 test.psl 🗵	
1 [Mode1]	Each sample is stored as an incrementing
2 BBTK PSURP V1.0 3 [Buttons Installed]	row.
4 True, True, True, True	
5 [Firmware]	Data is stored in base 71 encoding as the
6 20220214 7 [Serial Speed]	arrow chows
8 230400	
9 [Stream Constantly]	
10 True 11 [Stream When Threshold Reached]	The first two bytes are for button 1,
12 True	bytes 3 & 1 for button 2 and so on The
13 [Button Down Thresholds]	
14 25, 25, 25, 25, 25 15 [Button Un Thresholds]	last bytes on the right is for the two TTL
16 25, 25, 25, 25, 25	input lines.
17 [TTL Event Mark When Threshold Reached]	
18 True 19 [Individual LEDS On When Threshold Reached]	Note that in manual mode because the
20 True 21 [Type Keystroke When Button Threshold Reached]	buttons go up on down on the GUI
22 True 23 [Keyboard Characters Debouncing Window]	preview data is not stored at the exact
24 50 25 [Keyboard Characters To Type When Button Threshold Reached]	time each button is pressed.
26 a, b, c, d, e	
27 [Type Keystroke For TTL Ins] 28 True	However each row is a sample every 2.5
29 [Keyboard Characters To Type When TTL In Onset]	mS or 400 Hz
30 g, h	
31 [Calibration Weight] 32 500	
33 [Tare Values For Each Button]	Because the interface is being updated
34 6635, 8151, 6513, 7648, 6638	data cannot always be dumped fast
35 [Calibration Values For Each Button] 36 10955 12472 10826 11752 10925	enough
37 [START]	enough.
38 1,2022/03/01 15:38:55.693,25342.2407,1L000000000	
39 2,2022/03/01 15:38:55.703,25345.5546,2k000000000 40 3,2022/03/01 15:38:55 703,25345 5818,26000000000	
41 4,2022/03/01 15:38:55.703,25346.4898,1!010000000	
42 5,2022/03/01 15:38:55.703,25349.4859,1G000000000	
43 6,2022/03/01 15:38:55.703,25351.4895,1G000000000	
45 8,2022/03/01 15:38:55.713,25356.4625,2900000000	
46 9,2022/03/01 15:38:55.713,25359.4657,2t000000000	
47 10,2022/03/01 15:38:55.713,25361.4771,2H00000000	
49 12,2022/03/01 15:38:55.723,25364.4695,22000000000 49 12,2022/03/01 15:38:55.723,25366.4741,3c000000000	
50 13,2022/03/01 15:38:55.723,25369.4631,3A00000000	
51 14,2022/03/01 15:38:55.723,25371.4651,3Q000000000	
52 15,2022/03/01 15:38:55.733,25375.8677,3000000000 53 16,2022/03/01 15:38:55.733,25376.4314,4q000000000	
54 17,2022/03/01 15:38:55.733,25379.4295,4I000000000	
55 18,2022/03/01 15:38:55.733,25381.4283,52000001000	
57 20,2022/03/01 15:38:55.743,25386.429,5G000000000	
58 21,2022/03/01 15:38:55.743,25389.4418,6000000000	
59 22,2022/03/01 15:38:55.743,25391.4225,6g000000000	
61 24.2022/03/01 15:38:55.753.25394.4623,6600000000	
62 25,2022/03/01 15:38:55.753,25399.4236,74000000000	
63 26,2022/03/01 15:38:55.753,25401.4265,7r000000000	
64 27,2022/03/01 15:38:55.763,25404.4232,7H000000000 65 28.2022/03/01 15:38:55.763,25406.4039.7*000000000	
66 29,2022/03/01 15:38:55.763,25409.3989,8e000000000	
67 30,2022/03/01 15:38:55.763,25411.3854,8t00000000	
69 32.2022/03/01 15:38:55.773,25415.9122,8000000000 69 32.2022/03/01 15:38:55.773,25416.4309.8%000000000	
70 33,2022/03/01 15:38:55.773,25419.3894,9f000000000	
71 34,2022/03/01 15:38:55.773,25421.3802,9r000000000	
72 35,2022/03/01 15:38:55.783,25424.3847,9H000000000 73 36,2022/03/01 15:38:55.783.25426.3996.9700000000	
74 37,2022/03/01 15:38:55.783,25429.3782,a500000000	
75 38,2022/03/01 15:38:55.783,25431.3731,an00000000	
<pre>/6 39,2022/03/01 15:38:55.793,25434.4218,aC000000000 77 40.2022/03/01 15:38:55.793.25436.3775 aN000000000</pre>	
78 41,2022/03/01 15:38:55.793,25439.345,b1000000000	
79 42,2022/03/01 15:38:55.793,25441.3455,b700000000	
80 43,2022/03/01 15:38:55.803,25444.3634,bw000000000 81 44 2022/03/01 15:38:55.803 25446 3792 bT000000000	
82 45,2022/03/01 15:38:55.803,25449.3449,b500000000	

To decode this data stream an Excel Macro-Enabled Worksheet is provided.

PBM Prototypes > PSURP > Manual > SHIPPING > How to decode raw data						
Name	^	Date modified	Туре	Size		
Example rav	v data decode v9.xlsm	08/12/2021 09:19	Microsoft Excel Macro-Enabled Worksheet	413 KB		

To be able to use the spreadsheet you will need to enable Macros by clicking on Enable Content.

E	3	5-6-=																	
Fi	ile	Home	Inse	ert	Pa	ge Layo	out	Form	nulas		Data	Re	view	١	View	A	valara	Add	l-ins
Pas	te	X Cut È⊡ Copy ≠ ≪ Format Pain	nter	Aria B	I	<u>U</u> -	• 1	0 -	A A	A			≫	• •≡		Wrap Merg	Text e & Center	Ŧ	Geni
	-	Clipboard	- Fai			F	ont			E.			1	Align	ment			E.	
1	S	ECURITY WARN	IING	Mac	ros h	nave be	en disa	abled.		Ena	ble Co	ntent							
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2		Data from DCI	file									larged	fore	o dat			(base 71)	B	
3		Data from PSI	Lille								F	arseu	TOTCE	e uai	ld		(base /1)	u)	ase /
4		1 2021/00/22 (0.17	- 40 0	20 /	1005 0	550 M	10002	0-000	0	0	1/0002	0-00	0			0\/		00
6		2 2021/09/23 0	09.17 10-17	.40.0 -/10 9	23,4	+025.0	223,01	10002	00000	0 1	1	100002	0000	0			11		00
7		3 2021/09/23 (10.17	.40.0 -40.0	131,4	1020.7	711.25	=00000	00070	, n	2	E0000	00070	0			2E	-	00
8		4 2021/09/23 (09.17	·40.0	36.4	1032.7	977 5	N0003	20909	0	5	W000	20900	90			5W		00
0		4,202 1100/20 (,-	1002.1	577,51			· · ·	-		20000					_	00
9		5.2021/09/23 (09:17	:40.8	39.4	4035.6	609.4t	00000)b0a0		4	t00000)b0a0)			4t		00

Once you have enabled Macros you can copy and paste the rows of data into the spreadsheet.

To open large *.PSL files we use Notepad++ and copy and paste from that into Excel.

This will then be automatically parsed into two bytes for each button and also converted to Grams and Newtons. The status of the two TTL input, or trigger lines, will also be parsed as off (0V) or on (+5V). Finally a force graph for the button will be shown.

In the example below only the first 100 samples or 250 mS are shown.

8	5. C													lecode v9.xb									
File	Home Insert Page Layout Formulas Di	sta Review View i	Avalara	Add-ins	Team (7 Tell me v	what you war																
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BS	* : × ✓ f* 1,2022/03/01 15:38:	55.693,25342.2407,1L00000	0000																				
AA	B	С	d	E	F	G	H	1 1	JK	L	М	N	0	Р	Q	R	8	T	U	V	W	Х	Y
2	RAW DATA RECORDED BY PSURP PA	DINED APP		PAW	ATA BY BU	TTON IN	BASE 71	-			WEIG	SHT IN GR	AMS			1	*		FOR	CE IN NEW	TONS		
	INTERNAL CONDED BY SOIL TH		Raw	Raw	Raw	Raw	Raw		Button	1 Button 2	Button 3	Button 4	Button 5	1					101	CE IN NEN			
	and the second second		Button 1	Button 2	Button 3		Button 5	Raw TTL	weight	weight	weight	weight	weight	TTL In 1	TTL In 2	But	tton 1	Button 2	Button 3	Button 4	Button 5	TTL In 1	TTL In 2
3	Data from PSL file	Parsed force data	(base 71)	(base 71)	(base 71)	(base 71)	(base 71)	In status	(g)	(g)	(g)		(g)	status	status	for	ce (N)	orce (N)	force (N)	force (N)	force (N)	status	status
4																	1551						
6	2 2022/03/01 15 38 55 703 25345 5546 260000000	1200000000	1L 2k	00	00	00	00	1	118	0	0	0	0	1	0	1	1564 5876	0.0000	0.0000	0.0000	0.0000	1	0
7	3.2022/03/01 15 38 55 703 25345 5818 26000000000	26000000000	26	00	00	00	00	2	148	0	Ő	0	0	0	1	1.	4504	0.0000	0.0000	0.0000	0.0000	0	1
8	4,2022/03/01 15:38:55:703,25346:4898,11010000000	1101000000	1!	01	00	00	00	3	133	1	0	0	0	1	1	1.3	3034	0.0098	0.0000	0.0000	0.0000	1	1
9	5.2022/03/01 15 38 55 703 25349 4859 1G00000000	1G00000000	1G	00	00	00	00	4	113	0	0	0	0	0	0	1.	1074	0.0000	0.0000	0.0000	0.0000	0	0
10	6,2022/03/01 15:38:55:703,25351 4895,1G000000000 7:2022/03/01 15:38:55:713 25354 4892 1D00000000	1G000000000	1G 1D	00	00	00	00	5	113	0	0	0	0	0	0	1.	2152	0.0000	0.0000	0.0000	0.0000	0	0
12	8 2022/03/01 15 38 55 713 25356 4625 29000000000	29000000000	29	00	00	00	00	7	151	0	0	0	0	0	0	1	4798	0.0000	0.0000	0.0000	0.0000	0	0
13	9,2022/03/01 15 38 55 713,25359 4657,21000000000	21000000000	21	00	00	00	00	8	171	0	0	0	0	0	0	1.	6758	0.0000	0.0000	0.0000	0.0000	0	0
14	10,2022/03/01 15 38 55 713,25361.4771,2H000000000	2H00000000	2H	00	00	00	00	9	185	0	0	0	0	0	0	1.	8130	0.0000	0.0000	0.0000	0.0000	0	0
15	11,2022/03/01 15:38:55.723,25364 4695,2800000000	2800000000	28	00	00	00	00	10	208	U	0	0	U	0	0	2	2050	0.0000	0.0000	0.0000	0.0000	0	0
17	13.2022/03/01 15.38 55 723.25369.4631.3A000000000	3A000000000						But	ton 1 Fo	rce						2	4402	0.0000	0.0000	0.0000	0.0000	0	0
18	14,2022/03/01 15 38 55 723,25371 4651,3Q000000000	3Q00000000	12.0	000												2	5970	0.0000	0.0000	0.0000	0.0000	0	0
19	15,2022/03/01 15:38 55.733,25375.8677.3)000000000	3)000000000			1											2	7636	0.0000	0.0000	0.0000	0.0000	0	0
20	16.2022/03/01 15:38:55 733.25376 4314.4q000000000	4000000000			1											3.	0380	0.0000	0.0000	0.0000	0.0000	0	0
22	18 2022/03/01 15 38 55 733 25381 4283 52000001000	52000001000			1	0										3	4986	0.0000	0.0000	0.0000	0.0000	0	0
23	19,2022/03/01 15:38:55:743,25384.4302.5n000000000	5m000000000	10.0	000	• /	1										3.	7044	0.0000	0.0000	0.0000	0.0000	0	0
24	20,2022/03/01 15:38:55:743,25386:429,5G000000000	5G00000000			/											3.1	8906	0.0000	0.0000	0.0000	0.0000	0	0
25	21,2022/03/01 15:38:55 743,25389 4418,6000000000 22,2022/03/01 15:38:55 743,25389 4418,60000000000	6000000000														4	1748	0.0000	0.0000	0.0000	0.0000	0	0
20	23 2022/03/01 15 38 55 743 25391 4225 6g000000000 23 2022/03/01 15 38 55 753 25394 4623 6G000000000	6G000000000			1	1										4.	5864	0.0000	0.0000	0.0000	0.0000	0	0
28	24.2022/03/01 15:38:55:753.25396.4406.6Y000000000	6Y00000000	8.0	000		1										4.	7628	0.0000	0.0000	0.0000	0.0000	0	0
29	25,2022/03/01 15:38 55:753,25399.4236,74000000000	74000000000				1										4.9	9098	0.0000	0.0000	0.0000	0.0000	0	0
30	26 2022/03/01 15 38 55 753 25401 4265 7r000000000	7/000000000														5.	1352	0.0000	0.0000	0.0000	0.0000	0	0
32	28 2022/03/01 15:38:55 763 25404 4232 71000000000	7*00000000	(N)		1											5.	2920 5272	0.0000	0.0000	0.0000	0.0000	0	0
33	29.2022/03/01 15:38 55:763.25409.3989.8e000000000	8e000000000	50 6.0	000	1											5.	7036	0.0000	0.0000	0.0000	0.0000	0	0
34	30,2022/03/01 15:38:55.763,25411 3854,8t000000000	8:000000000	ewt		1											5.	8506	0.0000	0.0000	0.0000	0.0000	0	0
35	31,2022/03/01 15:38 55:773 25415 9122,8000000000	8000000000	2													6.	0564	0.0000	0.0000	0.0000	0.0000	0	0
37	32 2022/03/01 15:38:55 773 25416 4309 8%000000000 33 2022/03/01 15:38:55 773 25419 3894 9#000000000	9600000000														6.	4092	0.0000	0.0000	0.0000	0.0000	0	0
38	34.2022/03/01 15:38:55 773.25421 3802.9r000000000	9:000000000	4.0	100		-										6.	5268	0.0000	0.0000	0.0000	0.0000	0	0
39	35,2022/03/01 15:38:55:783,25424:3847.9H000000000	9H00000000		1												6.1	6836	0.0000	0.0000	0.0000	0.0000	0	0
40	36,2022/03/01 15:38:55 783,25426 3996 9200000000	9200000000		1												6.	8600	0.0000	0.0000	0.0000	0.0000	0	0
41	38 2022/03/01 15 38 55 783 25429 3762 85000000000 38 2022/03/01 15 38 55 783 25431 3731 an000000000	an000000000														7	1834	0 0000	0.0000	0.0000	0.0000	0	0
43	39.2022/03/01 15:38 55 793.25434 4218.aC000000000	aC000000000	2.0	200												7.	3304	0.0000	0.0000	0.0000	0.0000	0	0
44	40,2022/03/01 15:38:55 793,25436.3775,aN000000000	aN00000000		M												7.	4382	0.0000	0.0000	0.0000	0.0000	0	0
45	41,2022/03/01 15 38 55 793 25439 345,b100000000	b100000000		۰V												7.	6636	0.0000	0.0000	0.0000	0.0000	0	0
40	43 2022/03/01 15:38:55 /33.25441 3455.67000000000	bw00000000														7.	9674	0.0000	0.0000	0.0000	0.0000	0	0
48	44 2022/03/01 15 38 55 803 25446 3792 bi000000000	6000000000	0.0	000		L										8	0850	0.0000	0.0000	0.0000	0.0000	0	0
49	45,2022/03/01 15:38 55 803,25449 3449,bS000000000	bS000000000		1 12	31 21 21 21 21 21 21 21 21 21 21 21 21 21	81 91 101	111 121 131 131 141 141	161 171 181 191 191 201	211 221 231 231 241	251 261 271 281 281 281 281	301 331 331 331 331	351 351 351 351 351 351 351 351 351 351	391 391 401 411 411	431 441 451 451 451 451	471	8.	1830	0.0000	0.0000	0.0000	0.0000	0	0
50	46,2022/03/01 15:38:55:803,25451 3455,c000000000	c0000000000							Sample Nun	nber at 400 Hz						8.	3496	0.0000	0.0000	0.0000	0.0000	0	0
51	47,2022/03/01 15:38:55:813,25454 4526 ce000000000	ce000000000		00	00	00	00	47	200	0	0	0	0	0	0	8.	4868	0.0000	0.0000	0.0000	0.0000	0	0
53	49.2022/03/01 15:38:55:813.25459.3389 cH00000000	cH000000000	cx	00	00	00	00	48	895	0	0	0	0	0	0	8	7710	0.0000	0.0000	0.0000	0.0000	0	0
54	50.2022/03/01 15 38 55 813.25461 3105.cS000000000	cS00000000	cS	00	00	00	00	49	906	0	0	0	0	0	0	8.	8788	0.0000	0.0000	0.0000	0.0000	0	0
55	51,2022/03/01 15:38:55.823,25464.3162.d1000000000	d100000000	d1	00	00	00	00	50	924	0	0	0	0	0	0	9.1	0552	0.0000	0.0000	0.0000	0.0000	0	0
56	52,2022/03/01 15:38:55:823,25466:3101,da000000000	da000000000	da	00	00	00	00	51	933	0	0	0	0	0	0	9.	1434	0.0000	0.0000	0.0000	0.0000	0	0
58	54 2022/03/01 15:38:55 823 25471 3265 #4000000000	4400000000	dA	00	00	00	00	53	950	0	0	2	0	0	0	9.	3982	0.0000	0.0000	0.0000	0.0000	0	0
59	55,2022/03/01 15 38 55 833,25474 3787 dM000000000	dM000000000	dM	00	00	00	00	54	971	0	Ő	0	0	0	0	9.	5158	0.0000	0.0000	0.0000	0.0000	0	0
60	56,2022/03/01 15 38 55 833,25476 3127,dY000000000	dY000000000	dY	00	00	00	00	55	983	0	0	0	0	0	0	9.	6334	0.0000	0.0000	0.0000	0.0000	0	0
61	57,2022/03/01 15:38:55:833,25479 3063,dj000000000	d)000000000	d)	00	00	00	00	56	992	0	0	0	0	0	0	9.	7216	0.0000	0.0000	0.0000	0.0000	0	0
62	p0,2022r03r01 15:38:55.833,25481.305,er00000000	e/00000000	er	00	00	00	00	5/	1001	U	U	U	U	U	U	9.1	00,38	0.0000	0.0000	0.0000	0.0000	U	U

If you click on the Base 71 decode tab you can see how Base 71 is converted to Decimal. You will need to do this if you read streamed force data live into MATLAB for example.



Although the BBTK PSURP partner App makes capturing and storing force curves a breeze, advanced users might prefer to read the streamed data directly, e.g. if they want to provide live feedback to participants. Remember though to keep it simple you can still accept keyboard keystrokes if you wanted.

For the more technically minded the PSURP streams data over a Virtual USB COM Port, AKA a serial port, at a 230,400 Baud rate. Serial is a widely implemented industry standard communications protocol and is easily understood.

11 bytes of data are sent every 2.5 mS which gives a sampling rate of 400 Hz. The first 10 bytes, or characters, are pairs of force values in grams for each of up to five buttons. The last byte to the right is the status of the two TTL input event marking lines. These event marking or trigger input lines might be from Opto-detectors, Mic or your own equipment.

Each button force is encoded in base 71 to allow for more data in each byte pair. This means you will need to convert it to base 10 before reading off the force value in grams.

So to take an example force data stream for one sample, e.g. gG000000000:

gG is the raw force value for button1

00 00 00 00 afterwards means that buttons 2 to 5 are not pressed

0 the final zero means that there are no TTL input event markers or triggers

The first step in the process is to convert the raw force value from base 71 into decimal.

0 = 0	11 = b	21 = 1	31 = v	41 = F	51 = P	61 = 7
1 = 1	12 = c	22 = m	32 = W	42 = G	52 = Q	62 = !
2 = 2	13 = d	23 = n	33 = x	43 = H	53 = R	63 = \$
4 = 4	14 = e	24 = o	34 = y	44 =	54 = S	64 = %
c 5 = 5	15 = f	25 = p	35 = z 36 - A	45 = J 46 - K	55 = T	65 = ^ 66 - &
6 = 6	17 = h	20 = q 27 = r	37 = B	47 = L	50 = 0 57 = V	67 = *
7 = 7	18 = i	28 = s	38 = C	48 = M	58 = W	68 = (
9 = 9	19 = j	29 = t	39 = D	49 = N	59 = X	69 =)
10 = a	20 = k	30 = u	40 = E	50 = O	60 = Y	70 = [

To do this simply take the first byte, i.e. "g" and look-up on the chart above. This gives a decimal value of 16. Next multiply this by 71 to give, 16 * 71 = 1,136. Next take the second byte "G" which gives 42 in decimal (no multiplication for the second byte). Then finally add the decimal values of the two bytes together to give the force in grams:

g = 16 * 71 = 1,136

G = 42

Force = 1,136 + 42 = 1,178 g

If you want to convert grams to Newtons simply apply the following post hoc conversion:

1,178 g * 0.0098 = 11.5444 N

We provide an Excel spreadsheet that lets you decode the PSL files (Pressure Sensitive Log) which our PSURP partner App captures when it records force curves for each button press.

For the status of the two input TTL event marking lines or triggers, simply look up the decimal value:

.

Decimal Value at Byte 11	TTL in 1	TTL In 2
0	0	0
1	0	1
2	1	0
3	1	1

If you use an industry standard serial terminal such as Tera Term you can see the raw data stream.

It is this serial stream that you need to process in your own experiments if you wish to use live force data as the buttons are pressed. Remember you will need to convert from base 71 to Grams as explained above and demonstrated in our sample Excel spreadhseets.

VT	COM4	- Tera Te	rm VT			
File	Edit	Setup	Control	Window	Help	
RUN	E					
a0s	0000	00000	0			
810	0000	00000				
5q0	1010	00000				
2S0	0000	00000				
2т0	0000	00000				
220	0000	00000				
2C0	0000	00000				
2n0	0000	00000				
210	0000	00000				
2p0	0000	00000				
2t0	0000	00000				
2t0	0000	00000				
200	0000	00000				
200	0000	00000				
200	0000					
200	0000					
200	0000	00000				
290	0000					
1*0	0000	00000				
1 1 1 1 1	0000	00000				
1 1 0	0000	00000				
1v0	0000	00000				
1p0	0000	00000				
1a0	0000	00000				
0)0	0000	00000				
0R0	0000	00000				
0н0	0000	00000				
0110	0000	0000				

The settings used for serial communications and streaming are shown below in Tera Term.

To access these choose, Setup and then Serial port...

	/4 - Tera Term VT				
File Edi	t Setup Control Wi	ndow Help			
a0t000	000000				
0u00G	Fera Term: Serial port setu	р		E	X
010000					
00000	Port:	COM4	\sim	ОК	
06000	Baud rate:	230400	~	JK	
оноос		200 100	-		
000M0	Data:	8 bit	\sim	Cancel	
00000	Parity:	none	\sim		
08000	,.			Haln	
0x000	Stop:	1 bit	\sim	псір	
01000	Flow control:	none	\sim		
0\$00¢					
00030	Transmit delay	/			
0 ^ 00¢	0		-	مالام	
00000	u msec	actiar 0	mse	quine	
00020					
03000	200000				
00000	00000				

You also need to ensure that your terminal settings match the PSURP. To select these chose, Setup and Terminal...

🔟 COM	14 - Tera Term VT		$\triangleleft \triangleright$
File Edit	t Setup Control Window Help		
a0t000	000000		
Oulogen	100000 · · · · ·		
0x0(^{lera}	a lerm: lerminal setup		E ×
0y00 0c00 [Terminal size	New-line	OK
0G00	73 × 33	Receive: LF ~	
омо	🗹 Term size = win size	Transmit: CR+LF 🗸	Cancel
0000	Auto window resize		
0800			Heln
0000 -	Terminal ID: VT100 🗸	🗹 Local echo	
0100	Answerback:	Auto switch (VT<->T	EK)
0\$00	Coding (receive)	Coding (transmit)	
0200			
0^00	011-0 ~		
0&00	locale: american	CodePage: 6500)1
0:0000	00000		
000000	00000		

To start streaming force data type RUNE followed by Transmit (CR+LF), i.e. enter.

To stop streaming send a capital X.

Single Sample versus Streaming or Threshold Mode

A new single sample mode allows you to request the status of all load cells and TTL inputs as a single sample by sending a capital W.

To start single sampling on request type RUNW followed by Transmit (CR+LF), i.e. enter.

Here we can see the command RUNW issued in Tera Term to start single sampling.

Next to request a sample across all load cells a capital W is sent. Immediately after the status of all the connected load cells and TTL Input lines is returned. Note that W is not followed by a Transmit (CR+LF), i.e. enter, it is simply a single W byte, i.e. a keyboard press. Each time a W is sent 11 bytes will be returned as the downward pointing arrow shows.

You should wait until all 11 bytes are returned, i.e. terminated in LF, before sending another request.

Typically at 230400 baud a request can be made every 4 mS or 250 Hz and at 115,200 baud every 8 mS or 125 Hz. These correspond to streaming mode sampling speeds.



To stop single sampling mode send a capital X.

4. Load and Preview Stored Force Data From a PSL File

You can load and preview stored force data from a PSL file by clicking on the chart icon from the toolbar.

🚺 BB	TK Pressu	ire Sensi	ive URP Configuration Utility	
File	Tools	View	Help	
0) 🕁 [• •	<mark>≁</mark> <u>⊑</u> ⊘ & <u>2</u>	
Curren	nt driver se	ettings		
Serial	ports		Speed	
COM	4	~	230400 V 1 V Disconnect	

Then to open a PSL file click on File | Open...

Pressure Sensitive Log Analysis	♦ E - D X
File Ealt Jools View Window Help PSL File MetaData & Settings	
Setting Value Description	E 10 - E 5 - E
∰ Button 1 □ <th□< th=""> □ <th□< th=""><th>∰ Button 4 □ <th□< th=""> □ <th□< th=""></th□<></th□<></th></th□<></th□<>	∰ Button 4 □ <th□< th=""> □ <th□< th=""></th□<></th□<>
BI Force PC RTC Elapsed Windows HPC (mS) TTL in 1 TTL in 2	B4 Force PC RTC Elapsed Windows HPC (mS) TTL in 1 TTL in 2
Button 2 E 10	Button 5
B2 Force PC RTC Elapsed Windows HPC (mS) TTL in 1 TTL in 2	B5 Force PC RTC Elapsed Windows HPC (mS) TTL in 1 TTL in 2
Status: Ready	RAM: - / CPU: -

Once loaded the force graph will be plotted along with a data table/spreadsheet below on a per button basis as shown.



To see more of the force graph or go full screen click on each plots maximize button.



Further options are available via a context sensitive menu that can be accessed by right clicking on the plot and then left clicking, e.g. to show a cursor.



You can also press the shortcut key to achieve the same result, e.g. pressing H to highlight data on the spreadsheet based on where the cursor is on the force plot.

You can also double click on a sample row for the cursor to be shifted to that point on the force plot.



5. Time Lock Timestamped Force Data From a PSL File to the Presentation and RT Data From Your Own Experiment

If you are not live streaming force data directly into your own experiment the easiest and most reliable way to capture force data alongside RT's is to use our App but in "Runner mode". This is where your experiment is only interested in looking for and reacting to keystrokes to capture RT's whilst at the same time our App is capturing force data that can be Time Locked after your experiment has finished.

This is the preferred way of running experiments unless you are a competent programmer in whichever Experiment Generator you have choosen to use.

A complete example is provided for PsychoPy but the same rationale can be applied to other Experiment Generators such as MATLAB, E-Prime, Presentation etc.

To use runner mode connect to the PSURP via the App as normal.

Initially "Runner mode" will be off and the runner toolbar icon will be red as show.

🚺 BBTK Pressure Sensitive URP Configuration & Test



Click on the runner so that it turns amber and "Runner mode" is displayed in the Mode panel.

🚺 BBTK Pressure Sensiti	ve URP Configuration & Test Utility	
File Tools View	Help	
0 😑 🕁 🖸 🖸	<mark>*</mark> 🖉 🔗 🖑 📓	
Current driver settings		
Serial ports	Speed Latency timer (mS)	
COM4 ~	230400 ~ 1 ~	Disconnect
Connected COM4 230400	Mode Streaming	Update GUI every 25 mS

When the running man is amber a file in the folder: "C:\BBTK PSURP" is monitored.

A single file called: PSURP_runner.txt is used to control the PSURP and the data file which the force data is written to. In this mode no GUI updates are performed force data is directly streamed and timestamped to another file named in "PSURP_runner.txt".

PSURP runner.txt	01/10/2021 14:27	Text Document	1 KB
	01/10/2021 1421	Text Document	1100

Your Experiment Generator should write the filename to store the force data to, i.e. the Pressure Sensitive Log file (PSL) on the first line and then the second line tells our App whether to capture the force data, i.e. is the experiment running, 1 for True and 0 for False.



For the filename a fully qualified path needs to be saved by your experiment.

The file you write from your own script must be called, "PSURP_runner.txt" and be in the folder, "C:\BBTK PSURP".

When you change from 0 to 1 on the second line of the file the running man icon will change to green as force data is streamed to the filename you choose.

Remember once you have written the runner control file you need to make sure you close it in your own scripts before starting your experiment.

All your experiment need do then is present an image for example and monitor for a keystroke. In the PsychoPy example provided RT's are recorded on the first passing of the force threshold set when the down keystroke is sent and the trial advances when the an up keystroke is sent, i.e. when the force sensitive button is released.

Although our App records the force sensitive presses and timestamps all the data your Experiment Generator needs to record it's own data in a specially formatted text file, i.e. a file with all the trials and RT's in it.

In the PsychoPy example provided this is stored in a CSV file that PsychoPy writes after each trial is completed.

PBM Prototypes > PSURP > Manual > SHIPPING > PsychoPy v2021.2.2 Example > data											
Name	Date modified	Туре	Size								
🚯 Test_Simple BBTK PSURP Experiment_2021_Nov_16_1003.csv 🛛 🔫 🛶 🛶	16/11/2021 10:04	Microsoft Excel C	4 KE								
Test_Simple BBTK PSURP Experiment_2021_Nov_16_1003.log	16/11/2021 10:04	Text Document	11 KE								
Test_Simple BBTK PSURP Experiment_2021_Nov_16_1003.psl	16/11/2021 10:07	PSL File	638 KE								
Test_Simple BBTK PSURP Experiment_2021_Nov_16_1003.psydat	16/11/2021 10:04	PSYDAT File	8 KE								
Test_Simple BBTK PSURP Experiment_2021_Nov_16_1003.xlsx	16/11/2021 10:04	Microsoft Excel W	7 KE								

This is stored in the "data" folder of the PsychoPy experiment.

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PBM Prototypes > PSURP > Manual > SHIPPING > PsychoPy v2021.2.2 Example >

Name	Date modified	Туре	Size
pycache	16/11/2021 11:23	File folder	
📙 data 🛛 🗲 🗕	16/11/2021 11:23	File folder	
images	16/11/2021 11:23	File folder	
🍿 BBTK PSURP Example Experiment.psyexp	16/11/2021 10:01	PsychoPy Experim	32 KB
📴 BBTK PSURP Example Experiment_lastrun.py	16/11/2021 10:03	PY File	31 KB
📴 bbtk_psurp.py	09/08/2021 17:33	PY File	2 KB
conditions.xlsx	16/11/2021 09:10	Microsoft Excel W	9 KB
readme.md	16/11/2021 09:17	MD File	0 KB

You should ensure that the BBTK Python library is in the same folder as your experiment as that helps you write the control and data files.

PBM Prototypes > PSURP > Manual > SHIPPING > PsychoPy v2021.2.2 Example

Date modified	Туре	Size
16/11/2021 11:23	File folder	
16/11/2021 11:23	File folder	
16/11/2021 11:23	File folder	
16/11/2021 10:01	PsychoPy Experim	32 KB
16/11/2021 10:03	PY File	31 KB
09/08/2021 17:33	PY File	2 KB
16/11/2021 09:10	Microsoft Excel W	9 KB
16/11/2021 09:17	MD File	0 KB
	Date modified 16/11/2021 11:23 16/11/2021 11:23 16/11/2021 11:23 16/11/2021 10:01 16/11/2021 10:03 09/08/2021 17:33 16/11/2021 09:10 16/11/2021 09:17	Date modified Type 16/11/2021 11:23 File folder 16/11/2021 11:23 File folder 16/11/2021 11:23 File folder 16/11/2021 11:23 File folder 16/11/2021 10:01 PsychoPy Experim 16/11/2021 10:03 PY File 09/08/2021 17:33 PY File 16/11/2021 09:10 Microsoft Excel W 16/11/2021 09:17 MD File

The PsychoPy data file with presentation info and RT's basically consists of one trial per row.

 Image: State of the s

6	H N 5 6 H K N N N N N N N N N N N N N H
🔚 Test_	Simple BBTK PSURP Experiment_2021_Nov_16_1003.csv 🗵
1	<pre>imageFile,corrAns,stimType,trials.thisRepN,trials.thisTrialN,trials.thisN,trials.thisIndex,</pre>
2	,,,,,29.91465619999508,None,space,3.0837449000100605,29.91465619999508,None,,,,,,,,,,,,,
3	images/green.jpg,a,happy,0,0,0,0,0,,,,,,29.91465619999508,None,33.03496729998733,None,35.069
4	images/red.jpg,s,sad,0,1,1,1,,,,,,,35.65373979999276,None,37.65532359998906,None,37.65532
5	<pre>images/green.jpg,a,happy,0,2,2,2,,,,,,,38.105698999992455,None,40.10732779999671,None,40.1</pre>
6	images/red.jpg,s,sad,0,3,3,3,,,,,,,40.62438090000069,None,42.625949999986915,None,42.6259
7	<pre>images/green.jpg,a,happy,0,4,4,4,,,,,,43.07636549999006,None,45.07792419999896,None,45.0</pre>
8	<pre>images/red.jpg,s,sad,0,5,5,5,,,,,,,45.62839959998374,None,47.62999129999662,None,47.6299</pre>
9	images/green.jpg,a,happy,0,6,6,6,,,,,,,48.08094049998908,None,50.08192579999741,None,50.0
10	images/red.jpg,s,sad,0,7,7,7,,,,,,50.59904079999251,None,52.600641599987284,None,52.6006
11	images/green.jpg,a,happy,0,8,8,8,,,,,,53.0843778999988,None,55.08592489999137,None,55.08
12	images/red.jpg,s,sad,0,9,9,9,,,,,,,55.5697736999864,None,57.571262400000705,None,57.57126:
13	

This can be loaded into Excel if you wish to preview it.

Each line of the file, or trial, is also timestamped.

Because PsychoPy and the BBTK PSURP App are running on the same stim computer they both have access to the same Real Time Clock and should have roughly the same timestamp.

With this in mind our App allows automatic time locking of data so that you can combine the PsychoPy data file with presentations and RT's with our Pressure Sensitive Log file (PSL) so that you can easily see force curves for each response.

To time lock the two data files click on the clock icon on the toolbar.

View	Help				
3 🖸	4 🗷 Ĉ				
ings					But
	Speed	Timelock PS	SURP PSL file a	and Experiment Results	
~	230400	~ 1	~	Disconnect]

You then need to open the PsychoPy Experiment Data File, i.e. the CSV file that was written as each trial was presented. Next you need to open the PSL file where the force or pressure data was stored.

Timelock Experiment Data to PSURP Log File							dÞ	Ð	- 0	×
File Edit Tools View Window Help										
🥩 Open Experiment Data File (*.csv)										
Open PSURP Log File (*.psl)										
Export Experiment Spreadsheet to TAB File (*.txt)										
Export Timelocked Spreadsheet to TAB File (*.txt)										
Export Experiment Spreadsheet to Excel File (*.xlsx)										
Export Timelocked Spreadsheet to Excel File (*.xlsx)										
Close										
[]										
PSURP Log & Timelocked Data										
		8	8 8	8 8	5 - 2					
BBTK PSURP	PC PTC	Elapsed Windows	33 Fo	34 Fo		First Key Down RTC	Ever Care Barry	All Keys	Up RTC	
1	PCRIC	HFC (III3) W		<u> </u>	Exp Gen Now	(Exp Gen)	Exp Gen How	(EX)	(Gen)	
💯 Button Force Activity Plotted Against PSURP Log Sample Number										8
									B	utton No
2 8 -										<mark>∨</mark> 1
- 6-										2
8 4-										3
5 2 -										4
		4 5		6	7 7			10	10	5
1 2 2 3	3 4	PSLIDPL on St	o o	0	/ /	0 0	, ,	10	10	• •
		1 30111 209 38	impro ritumbol							

Here we can see the PsychoPy data file loaded into the top spreadsheet and the PSURP PSL file into the middle spreadsheet.

periment	Data - Test_Simple BBTK	PSURP Experiment_2021	1_Sep_23_	0917.csv															
	imageFile	corrAns		stimType	tria	als.thisRepN	trials.	thisTrialN	tr	ials.thisM	N	trials.t	isIndex	instructText.	started	instructTe	ext.stopped	re	eady
1														31.6964689996	0935	None		space	
2	images/green.jpg	а	happy		0		0		0			0							
3	images/red.jpg	s	sad		0		1		1			1							
4	images/green.jpg	а	happy		0		2		2			2							
-	imanes/red ind	•	sad				*		4			4							
SURP Log 8	& Timelocked Data - Test	t_Simple BBTK PSURP Ex	cperiment	_2021_Sep_23_0	917.psl		rce	rce	2 2	rce	-	2							
SURP Log &	& Timelocked Data - Test	t_Simple BBTK PSURP Ex	(periment	_2021_Sep_23_0	917.psl	Elapsed Windor HPC (mS)	5% B1 Force	B2 Force	B4 Force	B5 Force	TTLAT	Exp. Gen	Fi	irst Key Down RT	C Exp	Gen Row	All Keys (Exp	Up RTC Gen)	
URP Log &	& Timelocked Data - Test E 24,2021/09/23 09:1	L_Simple BBTK PSURP Ex NBTK PSURP Raw Data 7:40.886.4082.6648,6K00	(periment	_2021_Sep_23_0 PC RT0 2021/09/23 09	917.psl C 1:17:40.886	Elapsed Windo HPC (mS) 5 4082.60	euo 18 648 47	0 B2 Force	B4 Force	B5 Force	8 0 11Lin 1	Exp Gen	Row	irst Key Down RTI (Exp Gen)	C Exp	> Gen Row	All Keys (Exp	Up RTC Gen)	
URP Log 8	& Timelocked Data - Test E 24,2021/09/23 09:1 25,2021/09/23 09:1	L_Simple BBTK PSURP Ex BBTK PSURP Raw Data 7:40.886.4082.6648,6K00 7:40.889.4085.6379,6T00	operiment	2021_Sep_23_0 PC RTC 2021/09/23 09 2021/09/23 09	917.psl C 1:17:40.886 1:17:40.889	Elapsed Windo HPC (mS) 6 4082.60 9 4085.63	ws 1648 47. 379 48	0 1 0	0 0 B4 Force	B2 Force	8 0 7 0	Exp Gen	Row	irst Key Down RTi (Exp Gen)	C Exp	Gen Row	All Keys (Exp	Up RTC Gen)	
1 2 3	& Timelocked Data - Test E 24,2021/09/23 09:1 25,2021/09/23 09:1 26,2021/09/23 09:1	Simple BBTK PSURP Ex BBTK PSURP Raw Data 7.40.886,4082,6648,6K00 7.40.889,4085,6379,6T00 (7.40.891,4087,7318,7500	00006080 00006080 0000a070	2021_Sep_23_0 PC RT0 2021/09/23 09 2021/09/23 09 2021/09/23 09	917.psl C 9:17:40.886 9:17:40.889 9:17:40.891	Elapsed Windo HPC (mS) 6 4082.61 9 4085.63 1 4087.73	ws E 648 47. 379 48 318 50	2 0 2 0 2 0 2 0 2 0	0 0 0 83 Force	111 10	8 0 7 0 7 0	Exp Gen	Row	irst Key Down RTi (Exp Gen)	C Exp) Gen Row	All Keys (Exp	Up RTC Gen)	
1 2 3 4	& Timelocked Data - Test 24,2021/09/23 09:1 25,2021/09/23 09:1 26,2021/09/23 09:1 27,2021/09/23 09:1	ESIMPLE BBTK PSURP EX BBTK PSURP Raw Data 7.40 886,4082,6548,6K00 7.40 889,4085,6379,6T00 7.40,891,4087,7318,7500 7.40,891,4087,7318,7500	xperiment	PC RT0 2021/09/23 09 2021/09/23 09 2021/09/23 09 2021/09/23 09 2021/09/23 09	917.psl C 9:17:40.886 9:17:40.889 9:17:40.891 9:17:40.894	Elapsed Windo HPC (mS) 4082.60 4085.63 4087.73 4090.77	648 47. 379 48 318 50. 535 51	0 2 0 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	8 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	11 10 11	8 0 7 0 9 0	Exp Gen	Row	irst Key Down RTi (Exp Gen)	C Exp	Gen Row	All Keys (Exp	Up RTC Gen)	
1 2 3 4 5	& Timelocked Data - Test 24,2021/09/23 09:1 25,2021/09/23 09:1 27,2021/09/23 09:1 28,2021/09/23 09:1 28,2021/09/23 09:1	CSIMPLE BBTK PSURP Ex BBTK PSURP Raw Data 7:40 886,4082 6548,6K00 7:40,889,4085,6379,6T00 7:40,889,4097,7318,7500 7:40,891,4090,7535,7900 7:40,896,4092,6464,7v00	00006080 0000a070 000a070 0000a070 00006090	2021_Sep_23_0 PC RTC 2021/09/23 09 2021/09/23 09 2021/09/23 09 2021/09/23 09 2021/09/23 09	917.psl C 17:40.886 17:40.889 17:40.891 17:40.896	Elapsed Windo HPC (mS) 4082.60 4085.63 4087.73 4090.74 54092.64	648 47. 379 48 318 50. 535 51. 464 52	0 85 Lorce 0 1 0 2 0 3 0 0 3 0 8 0 8	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	11 10 10 11	8 0 7 0 9 0 7 0	Exp Gen 0 0 0 0	Row	irst Key Down RTI (Exp Gen)	C Exp	o Gen Row	All Keys (Exp	Up RTC Gen)	
URP Log 8 1 2 3 4 5 tton Force	& Timelocked Data - Test 24 2021/09/23 09:1 25 2021/09/23 09:1 27 2021/09/23 09:1 28 2021/09/23 09:1 28 2021/09/23 09:1 28 Activity Plotted Agains	Csimple BBTK PSURP Ex BBTK PSURP Raw Data 7:40.886,4082.6548,6K00 7:40.889,4085.6379,6T00 7:40.881,4080,7535,7g00 7:40.891,4092,6454,7v00 PSURP Log Sample Nu.	00006080 00006080 00000070 00006070 00006090 00006070	2021_Sep_23_0 PC RTC 2021/09/23 09 2021/09/23 09 2021/09/23 09 2021/09/23 09 2021/09/23 09	917.psl C :17:40.886 :17:40.889 :17:40.891 :17:40.896 :17:40.896	Elapsed Windo HPC (mS) 6 4082.6(1 4087.7) 4 4090.72 6 4092.64	ws 648 47, 379 48 318 50, 535 51, 464 52	2 0 1 0 2 0 3 0 8 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	11 10 10 11	8 0 7 0 7 0 9 0 7 0	Exp Gen 0 0 0 0 0 0	Row	irst Key Down RTI (Exp Gen)	C Exp	o Gen Row	All Keys (Exp	Up RTC Gen)	
1 2 3 4 5 wtton Force	& Timelocked Data - Test B 24,2021/09/23 09:1 25,2021/09/23 09:1 26,2021/09/23 09:1 27,2021/09/23 09:1 28,2021/09/23 09:1 28,2021/09/23 09:1 28,2021/09/23 09:1	Simple BBTK PSURP Ex BBTK PSURP Raw Data 7-40 886,4082 6648,6K00 7-40 889,4086,6379,6T00 7-40 881,4087,7318,7600 7-40 894,4090,7535,7g00 7-40 896,4092,6464,7v00 t PSURP Log Sample Nu	0000b080 0000a070 0000a070 0000a070 0000b090 0000b090 0000b070	2021_Sep_23_0 PC RTC 2021/09/23 09 2021/09/23 09 2021/09/23 09 2021/09/23 09 2021/09/23 09	917.psl C 17:40.886 17:40.889 17:40.891 17:40.894 17:40.896	Elapsed Windo HPC (mS) 4 4082 6i 4085 6i 4087.73 4 4090.72 5 4092 6i	ws 648 47 379 48 318 50 535 51 464 52	0 52 0 52 0 53 0 53 0 54 0 54 0 55 0 55 0 55 0 55 0 55 0 55	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	11 10 10 11	8 0 7 0 9 0 7 0	Exp Gen 0 0 0 0	Row	irst Key Down RTI (Exp Gen)	C Exp	o Gen Row	All Keys (Exp	Up RTC Gen)	© But
1 2 3 4 5 *********************************	& Timelocked Data - Test	Simple BBTK PSURP Ex BBTK PSURP Rew Data 740 886 4085 6378 6700 740 881 4087 7318 7500 740 891 4087 7318 7500 740 891 4087 7318 7500 740 894 4090 7535 7000 7740 895 4092 6464 7v00 4 PSURP Log Sample Nu	0000b080 0000a070 0000a070 000b090 000b090 000b090 umber	PC RTC 2021_Sep_23_0 PC RTC 2021/09/23 09 2021/09/23 09 2021/09/23 09 2021/09/23 09	917.psl C 17:40.886 17:40.889 17:40.891 17:40.894 117:40.894 117:40.896	Elapsed Windo HPC (mS) 4082.61 4085.62 4087.72 4090.72 4090.75	ws 4 648 47 379 48 318 50 535 51 464 52	0 82 0 85 0 85 0 85 0 1 0 1 0 2 0 1 0 2 0 2 0 2 0 2 0 2 0 2 0 2 0 2 0 2 0 2	0 0 00 00 00 00 00 00 00 00 00 00 00 00	11 10 10 11 11 11 11 11 11 11 11 11 11 1	8 0 7 0 9 0 7 0 9 0	Exp Gen 0 0 0 0	Row	irst Key Down RT (Exp Gen)	C Exp	o Gen Row	All Keys (Exp	Up RTC Gen)	e
1 2 3 4 5 *********************************	& Timelocked Data - Test 24.2021/09/23 09:1 25.2021/09/23 09:1 26.2021/09/23 09:1 27.2021/09/23 09:1 28.2021/09/23 09:1 28.2021/09/23 09:1 28.2021/09/23 09:1	Simple BBIX PSURP Ex- BBIX PSURP Rev Data 740 889,4025 643,6K00 740 889,4025 6379,6T00 740 881,4087,7318,7500 740 881,4007,3753,760 740 889,4092,644,7v00 t PSURP Log Sample No	00006080 0000a070 0000a070 00006090 00006070 umber	2021_Sep_23_0 PC RTC 2021/09/23 09 2021/09/23 09 2021/09/23 09 2021/09/23 09 2021/09/23 09	917.psl C 17:40.886 17:40.889 17:40.891 17:40.894 117:40.896	Elapsed Windo HPC (mS) 4082.6(4087.7; 4080.7; 4090.7; 54092.6(648 47 379 48 318 50 535 51 464 52	0 95 0 10 0 2 0 0 3 0 0 3 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	B2 Force	8 0 7 0 9 0 7 0 9 0	Exp Gen 0 0 0 0 0	Row	irst Key Down RT (Exp Gen)	C Exp	o Gen Row	All Keys (Exp	Up RTC Gen)	e But
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1 2 3 4 5 5 0 10 	& Timelocked Data - Test B 24.2021/09/23 09-1 25.2021/09/23 09-1 26.2021/09/23 09-1 27.2021/09/23 09-1 28.2021/09/23 09-1 28.2021/09/23 09-1 28.2021/09/23 09-1	Simple BBTK PSURP Ex BBTK PSURP Rev Data 740 889,4025 6379,6700 740 889,4026 6379,6700 740 889,4026 6379,6700 740 894,4090,7335,7000 740 894,4090,7335,7000 740 894,4090,7335,7000 740 895,4092 646,700 4 PSURP Log Sample No.	0000b080 000a070 000a070 000b090 000b090 000b070	2021 Sep_23_0 PC RTC 202109/23 09 202109/23 09 202109/23 09 202109/23 09 202109/23 09	917.psl	Elapsed Windo HPC (mS) 5 4082.66 9 4005.65 4007.75 5 4090.75 5 4092.66	ws 648 47, 379 48 318 50, 535 51, 464 52	2 0 2 0 3 0 8 0	0 0 00 00 00 00 00 00 00 00 00 00 00 00	111 110 111	8 0 7 0 9 0 7 0	Exp Gen 0 0 0 0	Row	irst Key Down RTT (Exp Gen)	C Exp	o Gen Row	Ali Keys (Exp	Up RTC Gen)	
1 2 3 4 5 10 - 8 - 6 - 4 - 2 -	& Timelocked Data - Test 24.2021/09/23 09:1 25.2021/09/23 09:1 26.2021/09/23 09:1 27.2021/09/23 09:1 28.2021/09/23 09:1 28.2021/09/23 09:1 28.2021/09/23 09:1	Simple BBIX PSURP Ex BBIX PSURP Rev Data PA 086 4022 645,6K00 740 891,4087,718,7500 740 891,4087,718,7500 740 891,4087,738,700 740 896,4092 644,7v00 t PSURP Log Sample No	0000b080 000a070 000a070 000a070 000b090 000b070	2021 Sep. 23.0 PC RTG 2021/09/23 09 2021/09/23 09 2021/09/23 09 2021/09/23 09 2021/09/23 09	917.psl	Elspeed Windo HPC (mS) 9 4085.65 1 4087.73 4 4090.73 4 4090.75 6 4092.64	ws 47. 379 48 318 50 535 51 464 52	0 5 0 2 0 3 0 4 0 5 0 4 0 5 0 4 0 5 0 4 0 4 0 4 0 4 0 4 0 4 0 4 0 4 0 4 0 4	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	11 10 10 11 11	8 0 7 0 7 0 9 0 7 0	Exp Gen 0 0 0 0 0	Row	irst Key Down RTI (Exp Gen)	C Exp	o Gen Row	Ali Keys (Exp	Up RTC Gen)	

To time lock the files together click on the time lock button from the toolbar.

🔿 Tir	melock E	Experime	ent Data	to PSURP Lo	g File		
File	Edit	Tools	View	Window	Help		
2) 🔿	<u>~</u>					
Ex	perime	Timeloc	k Experir	nent Data to	PSURP Log	File 2021_S	ep_23_0917.csv
	ļ		imag	geFile	cor	rAns	stimType
	1						
	2	im	ages/gre	en.jpg	а		happy

We can see below where the response was registered, i.e. where the key down keystroke was sent to PsychoPy by the PSURP. We can also see the force data in Grams in the column labelled B1 Force in green.



If we click on the plot icon from the toolbar we can plot the forces for each button.

1 age 50 01 45

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If we double click on a trial in the middle spreadsheet we can see the point in the force graph where the key down keystroke was sent to PsychoPy.



This enables you to see force curves for each trial.

As before context menus on spreadsheets and graphs can be accessed by right clicking on the spreadsheet or the plot.



Key features

- Sleek carbon fiber enclosure (300 mm x 250 mm LW)
- Choice of 1 to 5 pressure sensitive force activated buttons
- Each button can detect between 0 & 3000 g / 29.4 N / 6.61 lb of force (1 Gram = 0.0098 Newtons) – If forces exceed 3000g they will be reported as 3000g
- 0.3 g / 0.0029 N / 0.00066 lb granularity
- Button layout can be customized to meet your needs
- Choice of standard Cherry MX linear switch with tactile feedback (like a standard keyboard key) or Isometric non-moving button (like pushing your finger against a hard surface)
- Clear cap buttons allow you to put your own labels under a tamper-proof clear plastic cover
- Each button can have its own unique light/LED indicator which activates when a set threshold is reached
- Works out of the box with PCs/Macs/Linux
- iOS & Android compatible for tablets and phones
- Compatible with all Psychology experiment generators, e.g. E-Prime, SuperLab, Presentation, Inquisit, DMDX, ERTS, DirectRT, PsyScope, PsychoPy etc.
- Fully plug in & play
- Appears as a second keyboard for ease of integration with existing experiments
- Map buttons to any keystroke you need (keystroke held down when a threshold you set is met)
- Full-speed USB 2.0 (compatible with USB 3.0)
- 250 Hz sampling rate (4 mS) @ 230400 baud serial speed
- 125 Hz sampling rate (8 mS) @ 115200 baud serial speed

- Guarantee millisecond precise responses*
- Built-in TTL event marking/TTL triggers for EEG, biofeedback, fMRI and time audit
- Works with the Black Box ToolKit v2 and mBBTK v2 (event marking version)
- Partner App captures timestamped streamed pressure/force data from each button and stores it to disk whilst your experiment simply needs to look for keystrokes as if a key had been pressed on a standard USB keyboard
- App allows you to quickly and easily time lock your RT results to pressure/force data
- Settings stored in non-volatile RAM once set using the App, e.g. activation thresholds, keystrokes to output, set TTL inputs and outputs etc.
- Platforms supported:
 - Microsoft Windows XP SP3, Vista SP2 (32/64), Windows 7 SP1 (32/64), Windows 8 (32/64), Windows 8.1 (32/64), Windows 10 (32/64), Windows 11 (64 bit)
 - o macOS[#]
 - Linux[#]

[#]BBTK Microsoft Windows software Apps not supported directly. Full API provided for control over serial regardless of platform used. USB Keyboard HID natively supported via Plug and Play (PnP).

RJ45 TTL IO Pinouts

The PSURP has a TTL output for each force sensor so that you can Event Mark on systems that can accept TTL inputs on digital ports, e.g. EEG machines.

Pin	Colour	Description
1	Orange / White	Button 0 TTL Out
2	Orange	Button 1 TTL Out
3	Green / White	Button 2 TTL Out
4	Blue	Button 3 TTL Out
5	Blue / White	Button 4 TTL Out
6	Green	TTL 1 In
7	Brown / White	TTL 2 In
8	Brown	Ground GND

The TTL signal is active high, +5 V, once the force threshold you have set is passed. This is generally when a keystroke is being output on the keyboard HID.

Two other input lines, TTL 1 In and TTL 2 In, allow you to feed TTL signals into pins 6 & 7. So long as the active high voltage is between 3.3 V & 5 V, a decimal value will be produced at byte 11 of the output stream.

Sampling rates will be the same as the serial speed, i.e. 250 Hz or every 4 mS @ 230400 baud or 125 Hz @ 115,200 baud.

For the status of the two input TTL event marking lines or triggers, simply look up the decimal value:

Decimal Value at Byte 11	TTL In 1	TTL In 2
0	0	0
1	0	1
2	1	0
3	1	1

Troubleshooting

Recovering After a Hard Reset

- Plug in just the Serial USB lead
- Open up Tera Term
- Connect to the PSURP using the normal COM Port, but at 115,200
- Press and hold the reset button on the rear right of the PSURP
 - The orange LED will go out and after around 10 seconds it will go red
 - Let go of the reset button
 - Both LEDs will go red and you'll get something similar to the below in Tera Term:



• Type GSET (enter). This should give you something similar to the below in Tera Term:

M.	COM	3 - Tera Te	erm VT		
File	Edit	Setup	Control	Window	Help
FIR	M=2	02202	14		
CAL	W=3	650			
FA F	0=6	634			
FAR	1=8	413			
FA F	2=6	790			
FAR	3=7	985			
FA F	4=6	807			
CAL	0=4	0660			
CAI	1=4	1694			
CAL	2=3	8844			
CAI	3=3	9134			
CAL	4=3	9015			
DBI	0=2	5			
DBT	1=2	5			
DBI	2=2	5			
DBT	3=2	5			
DBI	4=2	5			
JBI	0=2	5			
JBI	1=2	5			
JBI	2=2	5			
JBI	3=2	5			
JBI	4=2	5			
KDE	B=2	5			
SER	C=1				
ΓTΙ	C=1				
HID	C=1				
LEI	C=1				
STR	C=1				
FIH	C=1				
CHE	0=5				
CHE	1=6				
CHE	2=7				
CHE	3=8				
CHE	4=9				
CHT	0=1	0			
CHT	1=1	1			
DIC	H=1	1111			
SER	S=1	15200	-	_	
STC	P		-		

- Note the slower serial speed
- Type SERS (enter) and then 230 (enter)
- Some gibberish will appear as you are now connected at the wrong serial speed:



• In Tera Term switch to the correct speed, i.e. 230,400:

Tera Term: Serial port setu	р	Ŀ ×						
Port:	СОМЗ ~	ОК						
Baud rate:	230400							
Data:	8 bit ~	Cancel						
Parity:	none ~							
Stop:	1 bit \sim	Help						
Flow control:	none ~							
Transmit delay O msec/char O msec/line								

- Hit enter a couple of times
- Type GSET (enter) to see the settings and note that the serial speed will have changed
- Finally type SAVE (enter) to save the new settings to working memory/NVR so when you next plug the PSURP in it is running at the correct serial speed

All the settings shown should match those on the label on the base.

Before using the PSURP for the first time you should unplug both USB leads so that it powers down and then re-plug so that it automatically self-calibrates or re-tares to zero. When you do this ensure that there are no weights or forces on the load cells/buttons.

How to Update Firmware in the PSURP

Copy the:

BBTK PSURP Flash

Folder to your boot drive, which is normally C:

📕 🖸 📑 👻 Manage	BBTK PSURP Flash			
File Home Share View Application Tool	5			
\leftrightarrow \rightarrow \checkmark \uparrow \blacksquare > i7-10 > Boot (C:) > BBTK PSURP	Flash			
	Name	Date modified	Туре	Size
	📓 config.ini	13/06/2022 14:40	Configuration settings	1 KB
	📓 firmwares.ini	16/05/2016 15:31	Configuration settings	2 KB
	🔄 piccodes.ini	11/07/2020 11:55	Configuration settings	17 KB
	PSURP_MAIN_V7.24.X.production.hex	09/06/2022 15:06	HEX File	86 KB
	ATinyMultiBootloader+.exe	27/03/2018 11:57	Application	137 KB

TinyMultiBooloader+.exe is the software that is used to flash and update your PSURP firmware.

The .hex file is the actual firmware you are flashing and the .ini files are configuration files.

How to flash

1. Before you begin you will need to make sure that the flashing software is configured correctly.

Start by clicking on the Configuration tab and ticking the Force use of "piccodes.ini" file tick box. Next click on Browse and select "piccodes.ini" from the BBTK PSURP Flash folder.

🧼 Tiny Multi Bootle	oader+ (v0.11.2.11)	🗗 – 🗆 X
Selected File: C:\BB	BTK PSURP Flash\PSURP_MAIN_V7.24.X.p	roduction.hex ~ Browse
Write Device Check Device Auto Conf COM	Messages Configuration Firmwares De "piccodes ini" file:	abug About
Abort	Read Time Out (ms): 200	Use calculated special Baud Rate
Baud Rate: 115200 ~	Delay between check (ms): 200 Number of checks: 10	Initial: 48000000 115200
Selected COM: COM3	RS232 powering:	Final: 20000000 48000 RTS (or DTR) Reset (on !MCLR pin):
Search COM Detected COM:	by RTS + DTR	RTS/DTR true (ms): 200
COM1 COM3	Remote Reset Signal: Remote Message: 65 66 67 Wait before programming (ms): 500	RIS/DIR false (ms): 100 true prog Reset Type: Manual RTS Remote Signal
Transfer options:] Check Hex File ∣ 🗹 Write Flash Program	I Write EEPROM Erase EEPROM
Show Help Tips	Online support Online Doc	

2. Switch back to the Messages tab and select the COM port the PSURP is plugged into, e.g. COM3 in this example.

🧼 Tiny Multi Bootl	oader+ (v0.1	1.2.11)			Ē	-		×
Selected File: C:\B	BTK PSURP	Flash\PSURP_I	MAIN_V7.24	.X.produc	tion.hex	~	Brow	se
Write Device	Messages	Configuration	Firmwares	Debug	About			
Check Device								\sim
Auto Conf COM								
Abort Comm Baud Rate: 115200 ~ Selected COM: COM3 Search COM Detected COM: COM1								
								~
Transfer options:	Check Hex	File 🗹 Writ	te Flash Prog	jram [Write EEPR	IOM 🗌 Era	ase EEPF	NOM
Show Help Tips	Online	support Onl	ine Doc					

3. Finally click on Browse and choose the version of the firmware you wish to flash into the PSURP. In the example above this is, "PSURP_MAIN_V7.24.X.production.hex".

Before flashing ensure that Write Flash Program is also ticked. Leave the Baud Rate set at 115200.

🧼 Tiny Multi	Bootlo	ader+ (v0.1	1.2.11)				ē	_		×
Selected File:	C:\BB	TK PSURP I	Flash\PSURP_	MAIN_V7.24	.X.produc	tion.hex		~	Brow	/se
Write Devi	ce	Messages	Configuration	Firmwares	Debug	About				
Check Devic	e									\sim
Auto Conf CC	M									
Abort Comm Baud Rate: 115200 Selected COM COM3 Search COM Detected COM COM1 COM3			• 1							
										~
Transfer optio	ns:	Check Hex	File 🗹 Wri	te Flash Prog	gram [Write E	EPROM	🗌 Era	ise EEPF	ROM
Show Hel	p Tips	Online s	support Onl	line Doc						

4. To actually flash the firmware into the PSURP, unplug the USB lead from the serial port and then re-plug. Once plugged in click on Write Device and wait for the firmware to be transferred to the PSURP and for it to be restarted.

🧼 Tiny Multi Bootlo	ader+ (v0.11.2.11) 🕞 - 🗌 🗙
Selected File: C:\BB	TK PSURP Flash\PSURP_MAIN_V7.24.X.production.hex
Write Device	Messages Configuration Firmwares Debug About
Check Device Auto Conf COM Abort Comm Baud Rate: 115200 Selected COM: COM3 Search COM Detected COM: COM1 COM3	Checking device Open COM3 serial port at 115200 Baud Rate Hardware RTS resetting device Device detected: 'BBTK PSURP PIC10F25K50 32KB flash/256B EEPROM' Source HEX file opened: C:\BBTK PSURP Flash \PSURP_MAIN_V7.24.X.production.hex Warning: User ID bytes found, just writing data Uploading flash Uploading program memory
Transfer options:	Check Hex File 🗹 Write Flash Program 🗌 Write EEPROM 🗌 Erase EEPROM
Show Help Tips	Online support Online Doc

As the firmware is being written to the PSURP you will be informed of progress. DO NOT UNPLUG THE USB whilst the update is taking place.

Once completed the COM port will be closed and you will receive confirmation that the update has completed.

🧼 Tiny Multi Bootl	oader+ (v0.11.2.11) 🕞 — 🗌 🗙
Selected File: C:\B	BTK PSURP Flash\PSURP_MAIN_V7.24.X.production.hex
Write Device	Messages Configuration Firmwares Debug About
Check Device Auto Conf COM Abort	Checking device Open COM3 serial port at 115200 Baud Rate Hardware RTS resetting device Device detected: 'BBTK PSURP PIC10F25K50 32KB flash/256B EEPROM' Source HEX file opened: C:\BBTK PSURP Flash
Comm Baud Rate: 115200 ~	\PSURP_MAIN_V7.24.X.production.hex Warning: User ID bytes found, just writing data Uploading flash Uploading program memory
COM3 Search COM	Upload was successful Closed COM3 serial port TinyBootLoader+ completed
COM1 COM3	
Transfer options:	Check Hex File 🗹 Write Flash Program 🗌 Write EEPROM 🗌 Erase EEPROM
Show Help Tips	Online support Online Doc

To confirm which version of the firmware you are running you can use a serial terminal like Tera Term and issue the CONN followed by the FIRM commands to get the internal date/ID of the firmware.

r

💆 COM3 - Tera Term VT							
	File	Edit	Setup	Control	Window	Help	
	CON	n ┥	_	_			
	BBT	K					
	FIR	м <	-	_			
	202	2053	31				

Alternatively you can run the PSURP App and check the configuration page.

_						
	🔍 Configuration & Running Settings					
	This settings page lets your zero, or re-tare, each button. You can also alter the keystrokes sent when a button reaches an activation force.	If you wish to				
	PSURP Model, Firmware version & Serial speed	You can also				
	Model BBTK PSURP V1.0 Firmware version 20220531 Confirmed Serial Speed 230400	You can mak				
		Once saved				
	Installed load cells, current forces & choose to zero / re-tare if required	Currently ru				
	Summary:	Consta				
	* To zero, or re-tare, a load cell click on Zero / Re-tare, i.e. when the button has no weight on it as when first powered-on. * Remember to save as power-on defaults if you want to use these new Tare values. Each time the PSURP is powered on new Tare values will be used to zero the buttons.					
	I o measure the current force on any button press the round on-screen virtual button for an instant read out.					
		Dowr				
	BULLING BULLING BULLING BULLING BULLING					

When you do a firmware update all settings that were previously saved to NVR as power-on defaults are retained and will be loaded at next power-on, i.e. when the USB leads are plugged in.