

The Black Box ToolKit

Serious about science: Serious about timing

The Black Box ToolKit v3

Addendum

Introduction

The BBTK v3 software is virtually identical to the v2 and so the manual for the BBTK v2 remains relevant until it is updated.

The new v3 hardware may look slightly different but functionality remains largely the same with a couple of additions or changes, e.g. the BBTK v3 uses a new design of Opto sensors.

This addendum outlines the major changes which include the use of a new Virtual Communications Port chip for the interface between the BBTK v3 and your PC together with the new Opto sensors and how to set their sensitivity for optimally detecting visual events on screen.

Installing the FTDI VCOM Drivers and Checking Which COM Port the BBTK v3 is Installed on

Installing VCOM Drivers

Before you can use the BBTK v3 you need to make sure that you have installed the Virtual COM port (VCP) drivers that cause the USB device to appear as an additional COM port available to the PC.

Before connecting and powering on the BBTK v3 for the first time you should ensure that you are logged on to the local PC with Administrator rights.

If you are connected to the Internet the first time you power on the BBTK v3 and connect it to a USB port Windows should attempt to download and install the drivers automatically.

Should you not be connected to the Internet or if this does not happen you can find a copy of the drivers on the BBTK v3 distribution media under the Drivers folder.

Alternatively you can download the latest Future Technology Devices International VCOM drivers from:

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

FTDI are the makers of the interface chip we use to connect the BBTK v3 to your PC.

If the drivers are not automatically installed you should follow the installation instructions provided by FTDI on the link below after choosing the most appropriate drivers from your Operating System:

https://ftdichip.com/document/installation-guides/

Unless the drivers have been automatically installed or you have installed them manually you will not have access to a VCOM port and you will not be able to communicate with the BBTK v3.

Checking Which VCOM Port the BBTK v3 is Connected to

To use the BBTK v3 you will need to tell it which VCOM port it is connected to. Once the drivers are installed, the BBTK v3 is connected and powered on you will need to open the Computer Management console in Windows.

You can do this in multiple ways, e.g.

Press the Windows Key & X together, release and then press G

Or

Press the Windows Key and R and type compmgmt.msc into the Open text box and then click on OK.

Once the Computer Management console appears expand the Ports (COM & LPT) section so that you can see all Communications Ports as shown below:



Ideally you should do this with your BBTK v3 powered off so that you can identify the VCOM port it is on when you switch it on.

In the example above there is already a COM port, COM 1.

If you switched your BBTK v3 on you should see the COM port it is on appear in the list, e.g.



As can be seen above a USB Serial Port (COM3) has appeared when the BBTK v3 is powered on and connected by USB.

Hence you know that your BBTK v3 is connected to COM3.

All that remains is for you to tell the BBTK v3 software that you are connected to it via COM 3. To do this install the BBTK v3 software onto the Windows PC you wish to host the BBTK v3 on.

As with installing the VCOM drivers you should do this when logged into the local PC with Administrator rights.

Once the BBTK v3 software is installed and you run it for the first time you will be prompted to choose a VCOM port.

The Black Box ToolKit v3

tll Sensor Sei	nsitivity Manag	er (SSM)									? ×
File Help											
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Current sense	or sensitivity valu	es						The Sensor Sensitivit	y Manager (SSM) lei	ts you set the activat	ion point for BBTK
Mic 1/APT L	Mic 2/APT R	Sounder 1	Sounder 2	Opto 1	Opto 2	Opto 3	Opto 4	microphones, sounde sensors are set optim	rs and opto-detecto ally for this session.	rs. The SSM helps yo For sounders sensitiv	ou ensure that your ity sets the volume.
130 -	130 -	130 -	130 -	130 -	130 -	130 -	130 -	To adjust a specific s	ensor click the Adju	st Sensitivity toolbar l	outton and then
120 -	120 -	120 -	120 -	120 -	120 -	120 -	120 -	use the knob on the value. Digital values	BBTK to select the s range between 0 an	pecific sensor and se d 127. Factory defau	et the sensitivity It sensitivity is set at
110 -	110 -	110 -	110 -	110 -	110 -	110 -	110 -	64, or 50%.			,
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70 -	70 -	70 -	70 -	💌	our bork hard	appear to exist	t on your comp	outer. Please	ensitivity values fro set the BBTK to its	om the RTL file curre default sensitivity se	ntly loaded click attings click "Use
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20 -	20 -	20 -	20 -	20-	20-	20-	20-		sensitivity values		a
10 -	10 -	10 -	10 -	10 -	10 -	10 -	10 -	Mic 2/APT R	Sounder 2	Opto 2	Opto 4
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								Mic 1/APT L	Sounder 1	Opto 1	Opto 3
0	0	0	0	0	0	0	0	64	64	64	64
								Lise Factory Defaul	te RTI Seneiti	vity Cancel	Done
WARNING: If y	ou adjust sensiti	vity but don't s	ave values th	e next time you	use the BBTK	you will need to	alter them agai	n. Cost ractory berau		Caricer	Done
Status: Ready											

To choose the COM port click on OK and then on Cancel.

 Your default sensor se 	nsitivity values		
Mic 2/APT R	Sounder 2	Opto 2	Opto 4
64	64	64	64
Mic 1/APT L	Sounder 1	Opto 1	Opto 3
64	64	64	64
Use Factory Defaults	RTL Sensitivity	Cancel	Done
		6	

Next choose Startup Options... from the Tools menu.

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				Keypa	Keypa	Keypa	Keypa	Opto 4	Opto 3	Opto 2	Opto 1	TTL in	TTL in	Mic 2#	Mic 18	Act clo	\odot	Automatically Set Opto Sensitivity (ASOS) Ctrl+F9	
	F	I															1	Sensor Check Utility F9	
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																	Ŀ	Microphone/APT L&R Smoothing	
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																		DEBUG Ctrl+D	

Drop down the combo box to choose the VCOM port you made a note of in the Computer Management console.

Startup Options	G	?	×
BBTK Lines Line Labels DSC DSCAR			
CRT Refresh Correction (Blocking)			
🗹 Opto 1 🗹 Opto 2 🗹 Opto 3 🗹 Opto 4			
Microphone Smoothing			
Mic 1/APT L Mic 2/APT R			
USB/COM Port The BBTK Is Hosted On			
COM port @ 115200 Check For BBTK	Rescan		
Default BBTK Start-up mode			
Mode BBTK v2 Elite ~			
		Apply	
Use Factory Defaults	Cancel	ОК	

You can check if the BBTK v3 is connected and functioning correctly by clicking on Check for BBTK.

USB/COM Port The BBTK Is Hosted On	
COM port COM3 ~ @ 115200	Check For BBTK Rescan

If the BBTK v3 is connected to the correct VCOM port you should see the LCD screen show an about message and a dialog box will appear confirming you are connected.



Finally to save the setting you will need to click on OK & then Apply.



Close down the software and restart it to use the new COM port setting you chose.

When you restart the BBTK v3 software the Sensor Sensitivity Manager (SSM) will start, connect to the BBTK and retrieve the current sensor sensitivity values.

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File Help							
🗋 📂 🛄 🛉	II Ċ.						
Mic 1/APT L Mic 2/APT	TR Sounder 1	Sounder 2	Opto 1	Opto 2	Opto 3	Opto 4	The Sensor Sensitivity Manager (SSM) lets you set the activation point for BBTK microphones, sounders and opto-detectors. The SSM helps you ensure that your sensors are set optimally for this session. For sounders sensitivity sets the volume.
130 - 130 - 120 - 120 - 110 - 110 - 100 - 100 - 90 - 90 - 80 80 - 80 - - 60 - 60 - - 50 - 50 - -	130 - 120 - 110 - 90 - 80 - 70 - 60 - 50 -	130 - 120 - 110 - 90 - 80 - 70 - 60 - 50 -	130 - 120 - 110 - 90 - 80 - 70 - 60 - 50 -	130	130	130 - 120 - 110 - 100 - 90 - 80 - 70 - 60 - 50 -	To adjust a specific sensor click the Adjust Sensitivity toolbar button and then use the knob on the BBTK to select the specific sensor and set the sensitivity value. Digital values range between 0 and 127. Factory default sensitivity is set at 64, or 50%. Once you are happy with your sensitivity click "Done". This applies the sensitivity values for the time the BBTK is powered on or until it is reset. These sensitivity values will be saved with the Real Time Log file so you can recall them later to set your sensors to the same sensitivity. If you wish to use the sensitivity values from the RTL file currently loaded click "RTL Sensitivity" or to set the BBTK to its default sensitivity settings click "Use Factory Defaults". Press F1 for help.
40 - 40 - 30 - 30 - 20 - 20 -	40 - 30 - 20 -	40 - 30 - 20 -	40 - 30 - 20 -	40 - 30 - 20 -	40 - 30 - 20 -	40 - 30 - 20 -	Your default sensor sensitivity values
10 - 10 - 10 - 10 - 10 - 10 - 10 - 10 -	10 - 0 -	10 - 0 -	10 - 0	10 - 0 -	10 - 0 -	10 - 0 -	Mic 2/APT R Sounder 2 Opto 2 Opto 4 64 64 64 64 Mic 1/APT L Sounder 1 Opto 1 Opto 3
64 64	64	64	64	64	64	64	64 64 64
WARNING: If you adjust se Status: Ready	nsitivity but don't s	save values the	next time you	use the BBTK	you will need to	o alter them agai	n. Use Factory Defaults RTL Sensitivity Cancel Done

You have now successfully connected your BBTK v3 to your POC and are now ready to make use of it.

Using the New Design Opto-Detectors

Automatically Set Opto Sensitivity (ASOS)

The new ASOS module helps you automatically set the range over which the Optos operate and at which point they activate when an Opto Marker changes from black to white. The goal is to consistently detect an Opto marker as rapidly as possible on any device.

If you are using a Windows PC to run your experiment you can install a second copy of the BBTK v3 software on that PC. This lets you run the ASOS module and calibrate the Opto Sensors using on that screen when using a separate Host PC to run the BBTK v3 software.

Alternatively if you are using another display device/tablet/phone you can run the ASOS Module on the PC Hosting the BBTK v3 and be guided through the process of calibrating each Opto.

Walkthrough of Calibrating Opto Sensitivity

You can get a feel for setting the Opto sensitivity by initially setting them for the PC you are hosting the BBTK v3 on.

1. Start the ASOS utility by clicking on the toolbar icon or using the dropdown Tools menu.

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Fi	e Edit	View		Self-Va	alida	te	Tim	nesta	amp	S	elf-C	ertif	y	Тоо	ls	Wi	ndo	w	Н	lelp					
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	Raw Line	e Chang	e D	ata																	Autom	atically Adjust Opt	o Sensitivity (CTRL-	- F9)	
			Keypad 4	Keypad 3 Keypad 2	Keypad 1	Opto 4	Opto 3	Opto 2	Opto 1	TTL in 4	Mic 2/APT B	Mic 1/APT L	Act close 4	Act close 3	Act close 2	Act close 1	TTL out 2	TTL out 1	Sounder 2	Sounder 1	Elapsed uS	Active uS	Elapsed mS	Active mS	
	1																								

2. Once the ASOS module opens position the Opto using the bungee cord over the Opto patch within the bounding square as shown.

Opto 1	Opto 2	• Opto 3
Adjust	Adj. To Adjust A	dj. To Adjust A
To This	Remote To This R	emote To This R
Screen	Screen Screen S	creen Screen S
Current	116 Current	117 Current
sensitivity	sensitivity	sensitivity
Automatic	116 Automatic	117 - Automatic
sensitivity	sensitivity	sensitivity
Black	Black	Black
triggers Opt	triggers Opto	triggers Onto
White	White	White
triggers Op/	triggers Opto	triggers Opto
Sav is Defa	uit Save As Default	Save As Default

3. To automatically set the sensitivity on the screen you are hosting the BBTK v3 on, click on the "Adjust To This Screen" button.

🖲 Automatically	Set Opto Se	nsitivity (ASOS)						<u></u>
Opto 1	۲	Opto 2	٩	Opto 3	۲	Opto 4	۲	The Automatically Set Opto Sensitivity (ASOS) module lets you set the activation point for BBTK opto-detectors. ASOS helps you ensure that your sensor sensitivity is set optimally.
								To adjust a specific sensor you will need two patches/squares. One black and one white. Set your display to the brightness and contrast you wish to use in your experiment and then click on the "Adjust" button. You will be prompted to positon the optos. The BBTK will then attempt to find the average point at which a white opto block indicates the onset of a visual stimulus.
								To test an opto once set click on the opto box to turn the area under the opto white to ensure it triggers. Click a second time to turn it black to make sure it turns off Alternatively go from black to white on your remote display/tablet/phone.
Adjust To This Screen	Adj. To Remote Screen	If you wish to save a sensitivity value as a power on default click on the optos "Save As Default" button otherwise values will only be used for this session.						
Current sensitivity	116	Current sensitivity	117	Current sensitivity	117	Current sensitivity	117	Once you are happy with your sensitivity values click "Done". This applies these sensitivity values for the time the BBTK is powered on or until it is reset, i.e. this session.
Automatic sensitivity	116 🜩	Automatic sensitivity	117 🜩	Automatic sensitivity	117 🜩	Automatic sensitivity	117 🜩	To restore the BBTK to its default sensitivity settings click "Use Factory Defaults".
triggers Opto		triggers Opto		triggers Opto		triggers Opto		Press F1 for help.
White		White		White		White		- Vaur status default espeer constituity yaluse
uiggers opto		tilggers opto		uiggers opto		uiggers opto		Onto 1 Onto 2 Onto 3 Onto 4
Save As De	efault	Save As D	efault	Save As De	efault	Save As D	efault	64 64 64 64 Use Your Defaults
WARNING: If you	adjust sensitiv	rity values but don 't	Save them the	next time you use th	e BBTK you w	vill need to alter them	n again.	Use Factory Defaults Cancel Done
Status: Ready								





Automatically Set Opto Sensitivity (ASOS) Opto 2 Opto 1 Op Adjust Adiust Adj. To Adjust Adj. To To This Remote To This Remote To This Screen Screen Screen Screen Screen Current Current Current 116 117 sensitivity sensitivity sensitiv Automatic Automatic Automat 116 🌲 117 sensitivity sensitivity sensitivit Black Black Black 123 triggers Opto triggers Opto triggers White White White triggers Opto triggers Opto triggers Save As Default Save As Default Sa WARNING: If you adjust sensitivity values but don't Save them the next time ye Status: Ready

4. You will then be prompted to place the Opto over the patch/square shown in the photo.

4. You should ensure that you have already adjusted your monitor to the brightness and contrast levels you wish to use in your experiment.

Click on "Yes" when you are ready to begin.

5. ASOS will begin by working out where the black levels should be set by displaying a black patch.

Once set the virtual LED will illuminate and a black value will be shown.



7. Once ASOS has established black and white levels on your display device a message box will

appear.

If you wish to use it as the default at power on, click on Save As Default.



6. Next a white patch will be shown and the sensitivity will be increased until the white Opto Marker is detected.

When the white level has been set the virtual LED will illuminate and a white value will be shown.



8. In the "Current sensitivity" box the actual sensitivity will be displayed.

If you wish to save the Opto value click on "Save As Default".

If you save the sensitivity this will be the default for that Opto each time the BBTK v3 is powered on.

9. Once saved a message box will confirm.

10. The BBTK v3 will then confirm by showing what was set and saved as a default.

Release Candidate 1

Setting the sensitivity on a remote display device/tablet/phone

If you are using a second remote PC or other display device/tablet/phone you will need to set the sensitivity tailored to that screen.

In this example we will walkthrough setting the Opto sensitivity using an iPad.

Before you begin you will need a pure black and white patch/square to display on your device to mimic an Opto Marker in your experiment.

You can search for: "black white checkerboard" to find one or visit Wikipedia using a web browser.

https://en.wikipedia.org/wiki/Check %28pattern%29#/media/File:Checkerboard pattern.sv g



1. Before you begin place the Opto over a black patch on the device you wish to calibrate.





2. Once you are happy with your placement click on the "Adj. To Remote Screen" button.



4. When prompted ensure that your Opto is placed over a black patch and then click on Yes.

Automatically Set Opto Sensitivity (ASOS) Opto 3 Opto 1 Opto 2 • Opto 4 Automatically Set Opto Sensitivity (ASOS): WHITE Ð Place the opto on the remote display device/tablet/phone over a WHITE patch/square. ? Please ensure that brightness and contrast are set correctly on your device. Have you placed the opto over a WHITE patch/square? 116 No Cancel Ves Black rs Onto rs Onto ers Onto Onto White White White agers Opto s Onto WARNING: If you adjust sensitivity values but don't Save them the next time you use the BBTK you will need to alter the Status: Ready

Yes

No

Cancel

5. Once the black levels are set you will be prompted to move the Opto on to a white patch/square.



Automatically Set Opto Sensitivity (ASOS)

Opto 1	۹	Opto 2	۹	Opto 3	۹	Opto 4	
Adjust To This Screen	Adj. To Remote Screen	Ad Automatica	Illy Set Opto	Sensitivity (ASOS)		Ŀ ×	ij. T emo
Current sensitivity Automatic sensitivity	116 116	Curre sensi	Your opro ser If you wish to As Default.	nsitivity has now bee o use it as the defaul	n set. t at power o	n, click on Save	117
Black triggers Opto	123	Black trigge				ОК	
White triggers Opto	56	White triggers Opto		White triggers Opto		White triggers Opto	
Save As De	efault	Save As De	fault	Save As Defa	ault	Save As Defau	ult
WARNING: If you	adjust sensiti	ivity values but don't S	ave them the	next time you use the	BBTK you will	need to alter them ag	ain.
Status: Ready							

5. In the "Current sensitivity" box the actual sensitivity will be displayed.

If you wish to save the Opto value click on "Save As Default".

If you save the sensitivity this will be the default for that Opto each time the BBTK v3 is powered on.

	Automatically Set Opto Sensitivity (ASES)	×	 Once saved a message box will confirm.
	Set and saved Opto 1 sensitivity: 116		
	ОК	2 2	
	Press F1 for help.		7. The BBTK v3 will then confirm by showing what
	- Your startup default sensor sensitivity values - Opto 1 Opto 2 Opto 3 Opto 4		was set and saved as a default.
As Default	116 64 64 Use	(our Defaults	
them again.	Use Factory Defaults Cancel	Done	

The next time the BBTK is powered on these values will be used.

If you do not save the Opto, or other sensitivity values, they will only apply to your current session or until the BBTK v3 is reset or powered off.

Remember that these Opto sensitivity values only apply to the device screen which you have calibrated them to and are not a global setting for all displays.

If you use a new display device, or change the brightness or contrast, you should consider rerunning the ASOS module again.