Evaluation Kit
User Guide

AI-Powered UltraTouch Technology
for Smart Devices

Cambridge Touch Technologies PH

Thank you for purchasing the Cambridge Touch Technologies Evaluation Kit (EVK). It is designed to demonstrate the capabilities of Cambridge Touch Technologies UltraTouch products by providing a stand-alone and fully functional true touch panel right out of the box that is easy and quick to set up. More advanced functions are available by connection to a PC.
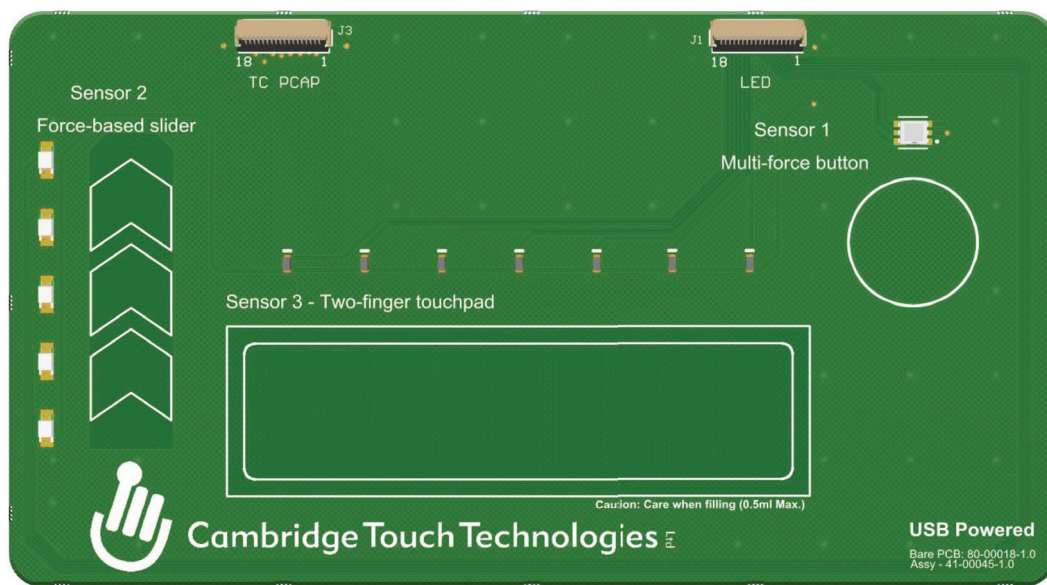
The EVK provides designers and engineers with a platform on which they can experience and configure a true touch-based user interface. This is exemplified by the ability of the EVK to detect multiple levels of force, the position of gloved fingers and the extreme case of underwater operation in a specially designated test area (certain models of EVK only).

This user guide provides instructions for how to set up and use the EVK, both in stand-alone mode and in advanced mode when connected to a PC. Cambridge Touch Technologies UltraTouch Studio provides detailed and real-time information as touch occurs on the EVK, and permits the user to change various parameters to explore different use cases, for example by altering force detection thresholds. The software can be downloaded from the Cambridge Touch Technologies website.

Detailed information on the different sensors on the EVK and their modes of operation can be found in the companion application note, which is available to download on the Cambridge Touch Technologies website.

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Applicable product range

Cambridge Touch Technologies manufactures a range of EVKs, each having different feature sets in hardware, firmware and software. This user guide applies to:

* Hardware – 1.0
* Firmware – 0.4
* Software version number 1.1.1

Unboxing

Cambridge Touch Technologies EVK comprises:

* 1 x Cambridge Touch Technologies EVK board
* 1 x USB A to micro USB B cables
* 1 x pipette (certain models of EVK only)
* 1 x quick start guide
* 1 x desiccant sachet

If any contents are missing or damaged, please contact us. Kindly respect the environment when disposing of packaging materials.

No software is required to use the EVK in stand-alone mode. To activate the advanced modes and reconfigure the EVK from the default settings, refer to the UltraTouch Studio section of this guide.

Quick start

Please refer also to the Quick Start Guide shipped with the EVK.

The EVK requires a 5 V supply capable of 100 mA peak, 80 mA sustained. Most USB chargers and computer USB sockets should be able to satisfy this requirement.

To operate, the micro B end of the USB cable must be inserted into the socket on the bottom right-hand side of the EVK, and the USB A plug inserted into a suitable powered socket. Some, but not all, of the LEDs on the top side of the board will light briefly. On the underside of the EVK the LED marked DS3 will shine green once the power-up sequence has initiated, and this indicates that the power supply meets the minimum requirements and there are no hardware faults. This should happen straight away.

*The underside of the EVK after successful power-up with LED DS3 – top left, constant green.
LEDs DS1 and DS2 are not used in stand-alone mode and blink green.*

During the power-up sequence no touch should occur on the EVK. This is because the boot sequence includes an auto-calibration routine to 'zero' the no-force level.

The EVK provides for three types of touch user interface:

- Sensor 1 is a single-finger multi-force button. Three levels of force can be detected, with the colour of the LED changing green-orange-red with increasing force accordingly.
- Sensor 2 is a single-finger force-based slider that determines the location and force applied by a single finger. The LED adjacent to the finger location lights dimly or brightly, corresponding to the force detected.
- Sensor 3 responds to touch by two fingers simultaneously, typical of a two-finger multi-force touch pad. The LEDs closest to each finger light either dimly or brightly depending on the force applied.

All three sensors will behave identically if the user is wearing thin gloves. On some models of EVK this capability extends to industrial hand wear and leather driving gloves.

Certain models of the EVK have a dam surrounding Sensor 3. This can be filled with water, using the pipette provided, to show that operation is unchanged when the touch panel is wet or submerged.

CAUTION: The EVK is only protected against water within the dam area. Water spillage on other areas of the touch panel may cause permanent damage. If *spillage* occurs, disconnect power immediately and remove as much of the liquid as possible by blotting with a paper towel. Allow the EVK to dry thoroughly before reuse. Water damage is not covered under warranty.

Stand-alone operation

The Cambridge Touch Technologies EVK is configured to operate as a touch panel without any external support. Following power-on, it is recommended to gain familiarity with the possible modes of operation in the following order:

## Sensor 1, single-finger multi-force button

The active area of the sensor is the white circle at the top right of the touch panel. Immediately above the sensor is a tri-colour LED. The default status for the LED with no force applied is unlit. Using a single finger centred in the white circle, apply a low level of force. Above a preset level, the LED will shine green. Increase the force exerted on the touch panel and the LED will shine orange, then finally red with even more force. With force applied so that the LED is shining either orange or red, decreasing the force to the level below will cause the LED to turn off. This one-way sequence of increasing force detection is programmed in the firmware, because humans find it very difficult to unload a force in a controlled manner.
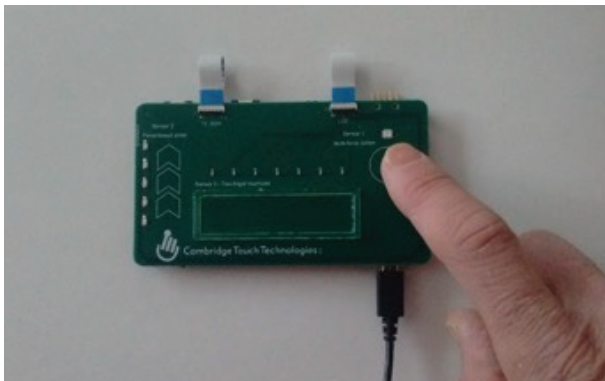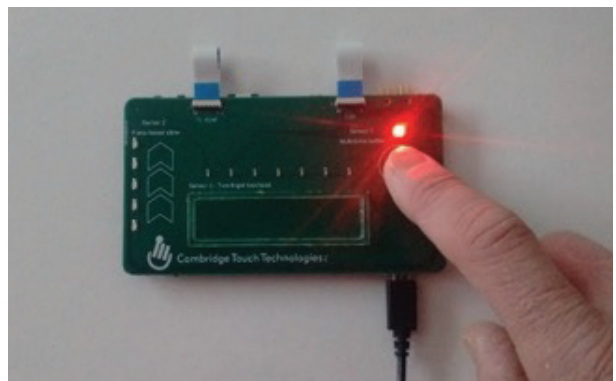

*LED off – none or very low force applied*
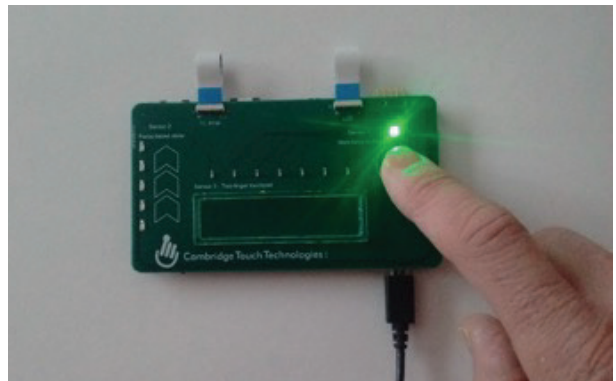
LED green – low force
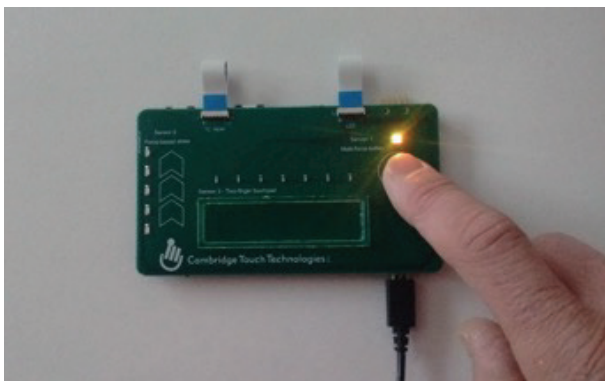
LED orange – medium force

LED red – high force

Sensor 2, single-finger force-based slider

The EVK can demonstrate simultaneous detection of force and location. Sensor 2 replicates a slider button controlled by one finger. Within the chevron is a continuous sensor. Interpolation is used to determine which LED is closest to the finger location. Once the applied force exceeds the detection threshold, the green LED closest to the centre of the force will light. Two levels of force can be detected – low and high – with the LEDs changing brightness accordingly. As the finger is moved up and down the slider, the LED that is closest to the finger is illuminated and will change to follow suit.
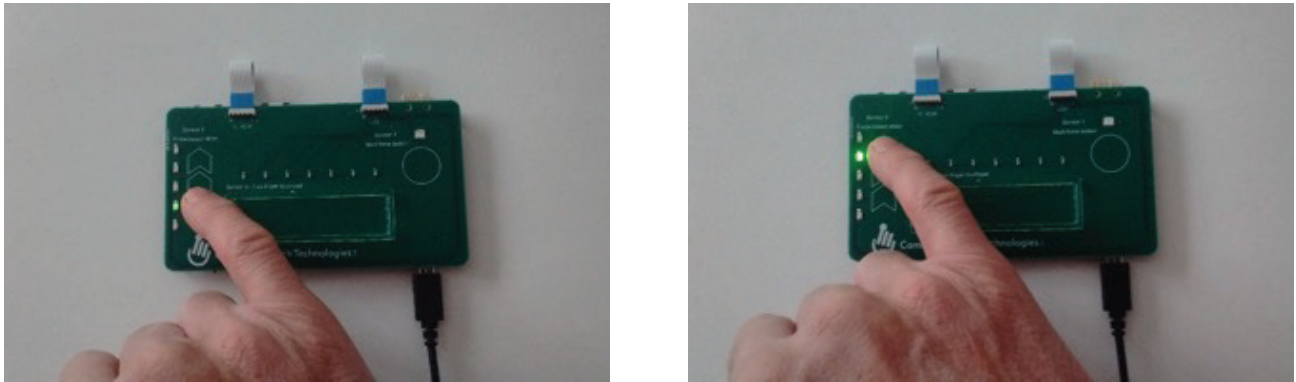

Slider with light force (left) and high force (right)

As with the multi-force button, the applied force can be increased during sliding, but a reduction will turn the LEDs off. If two fingers are placed on the slider area the lit LED will only jump to the location of the second finger once the force applied by the first finger has decreased sufficiently to extinguish the corresponding status LED.

The default mode of operation of the EVK is a hybrid mode in which finger location is determined by a PCAP controller and the force by UltraTouch technology. The firmware is configured so that the PCAP co-ordinate system is only enable once a certain minimum force is detected. This simple strategy is very effective at preventing the PCAP system reporting false or so-called ghost touches.

Sensor 3, two-finger multi-force touch pad

The third gesture the EVK can demonstrates exemplifies the use case of a two-finger touch pad. Functionally it is the same as the single-finger slider, with the position indicated by the adjacent red LED and the force by two levels of brightness. The difference with the single-finger slider is that for this sensor the EVK firmware is configured to respond to two simultaneous, but totally independent, inputs. This permits dual-finger as well as single-finger operation.
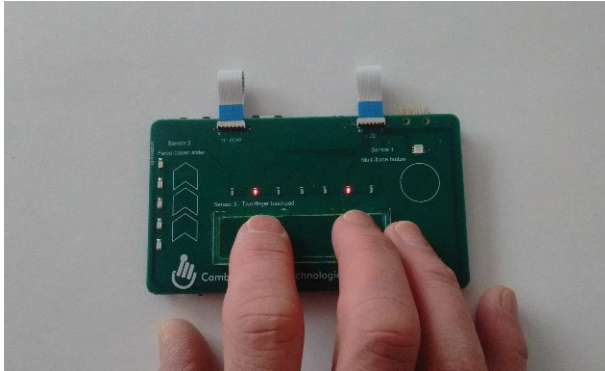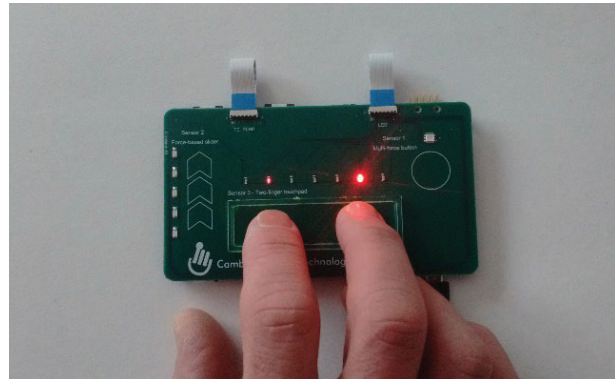

Both fingers low force
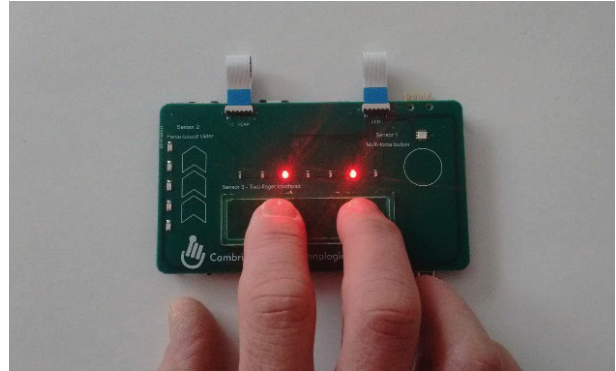
Both fingers high force
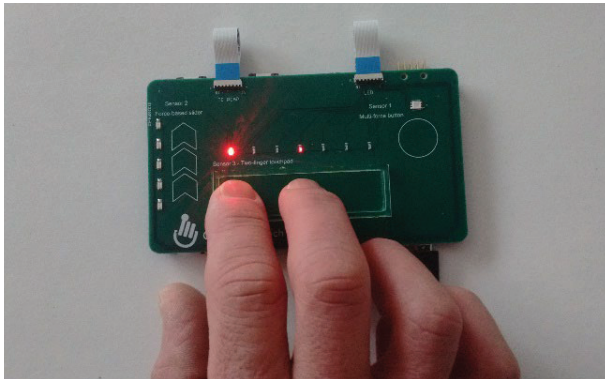
Left finger high force, right finger low force

*Left finger low force, right finger high force*

In the Sensor 3 active area the presence of three fingers is deemed a fault condition, and the firmware will hold all LEDs off until the anomaly is removed.

Gloved hand

The EVK is a true touch panel so responds to the location and amount of force, provided the application of force has the tell-tale signature of being applied by a human finger. Thus the EVK will function exactly as described above while the user is wearing gloves. Operation by stylus is only possible if it mimics a human finger so must have an area of at least 11 mm^2 and similar modulus to a fingertip for a touch event to be registered.

> **CAUTION:** The EVK is intended only for operation by human fingers. Attempting to trigger touch detection using hard or sharp objects may cause permanent damage. Hard and sharp object damage is not covered under warranty.
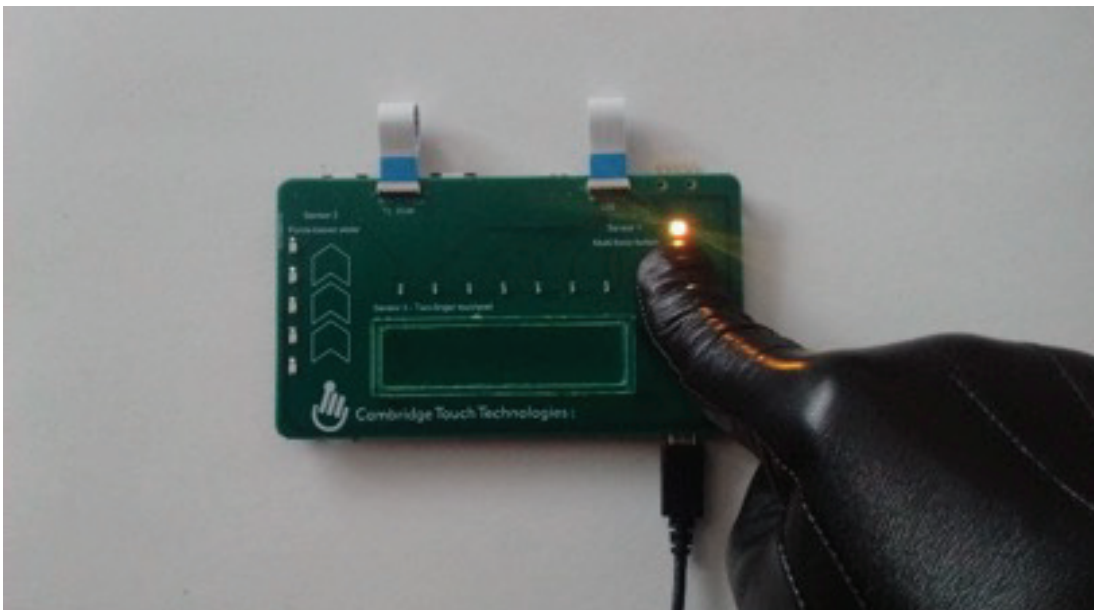
*Touch panel operation demonstrated while wearing thick leather gloves*

The base model of EVK works with bare fingers as well as thin gloves. Examples include disposable vinyl, nitrile or latex medical-grade personal protective equipment (PPE). Certain models of EVK can also determine finger location by force alone. This means full functionality is possible when the user has far more substantial hand garments such as leather driving gloves or industrial-thickness PPE.

Water mode

The majority of touch panels, exemplified by mobile phones and laptops, use PCAP technology to determine the location of fingers on the screen. If the touch panel becomes wet through condensation or is completely submerged in water then the PCAP controller will either function erratically or cease operation all together. This is because water is a partial conductor, like human skin, so to the controller it appears that the screen has been covered by a giant hand. Because it is built using Cambridge Touch Technologies technology, the EVK detects only force and the location of the force. Consequently it will continue to function normally with water on the sensor surface.

On some models of EVK Sensor 3 is provided with a dam surrounding the active area. Using the pipette provided, this sensor can be covered with droplets of water or the dam filled completely so the sensor is submerged. It can then be shown that the functionality of Sensor 3 is unchanged in both cases.

Note that by default the EVK is supplied programmed to operate in hybrid mode. That is, finger location is determined by PCAP and force by Cambridge Touch Technologies technology. Some models of EVK can operate in a force-only mode, where the PCAP controller is disabled and finger location (XY) determined from the force signal. Switching between modes is accomplished through the UltraTouch Studio application.
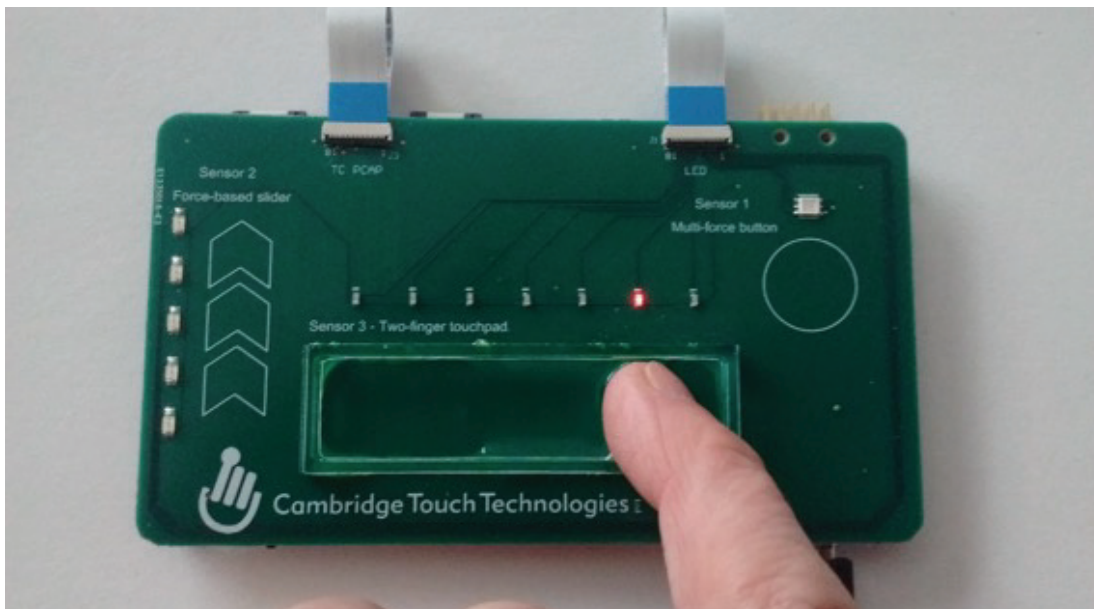
EVK operation with water in the dam area

After evaluation most of the water should be sucked into the pipette, and a paper towel used to absorb the remainder.

UltraTouch Studio

A software application accompanies the Cambridge Touch Technologies EVK. UltraTouch Studio provides engineers with more detailed information about the nature of the touch waveform in a time domain and enables alteration of some parameters, such as the force thresholds for each sensor.

Software requirements are Windows 10 or above, and 45 MB free space. There are no system dependencies other than a USB port, which should be automatically detected on most computers. There is entitlement to one user licence per EVK.

The UltraTouch Studio application is maintained and therefore subject to revision, so it is worth checking that you have the latest version before installation.

> For Microsoft Defender SmartScreen, click 'More info' then 'Run anyway'. Installation on some corporate PCs may require assistance from your IT department to enable the relevant privileges
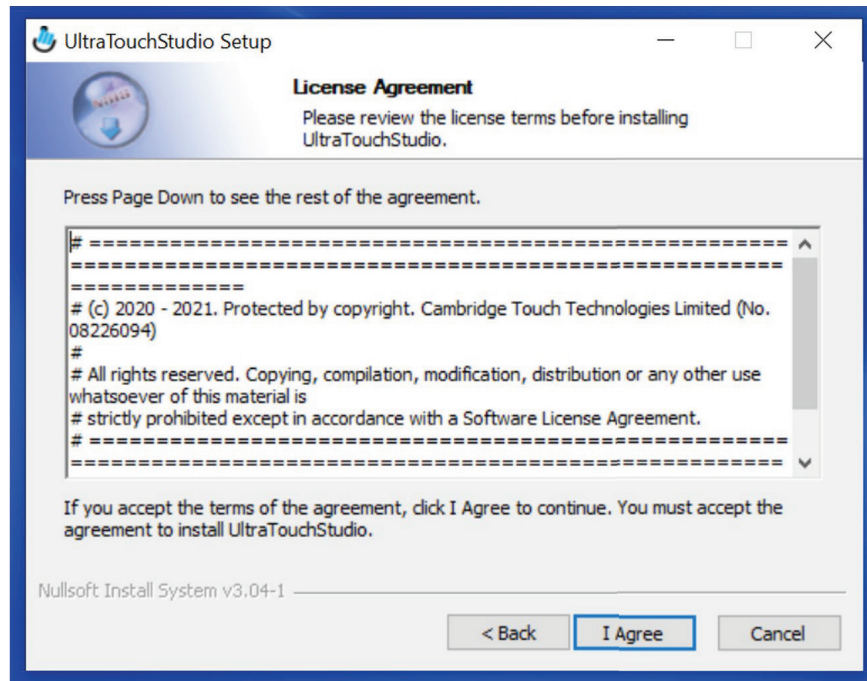
Installation

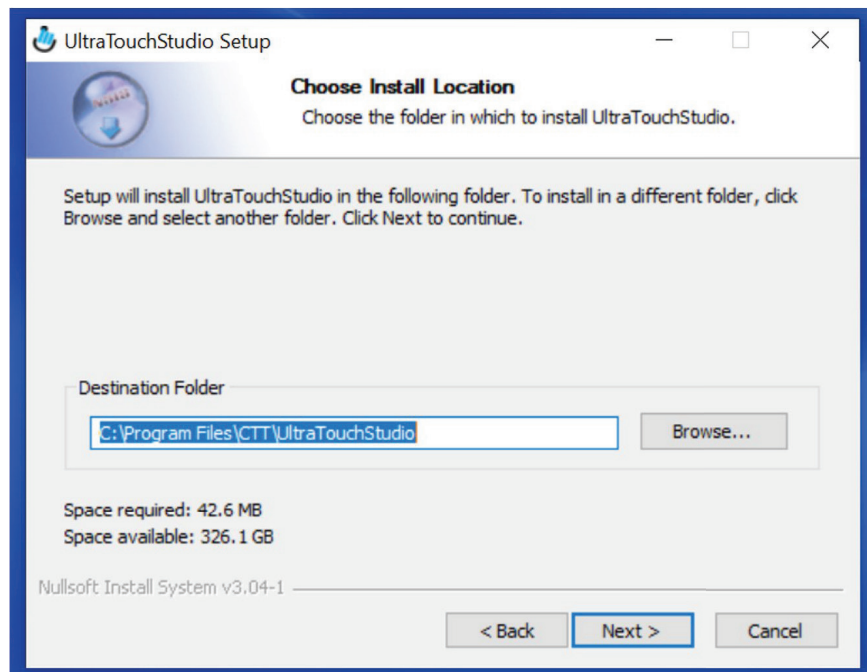The UltraTouch Studio application is provided as a standard self-extracting Windows installer.

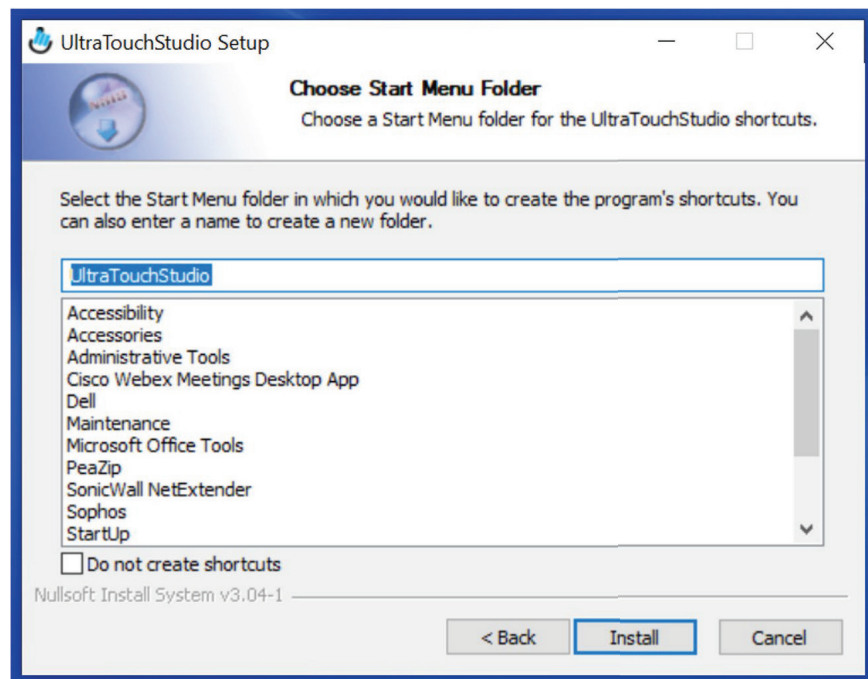Accept ('Yes' or 'Proceed') to User Account Control or other anti-virus software warnings.
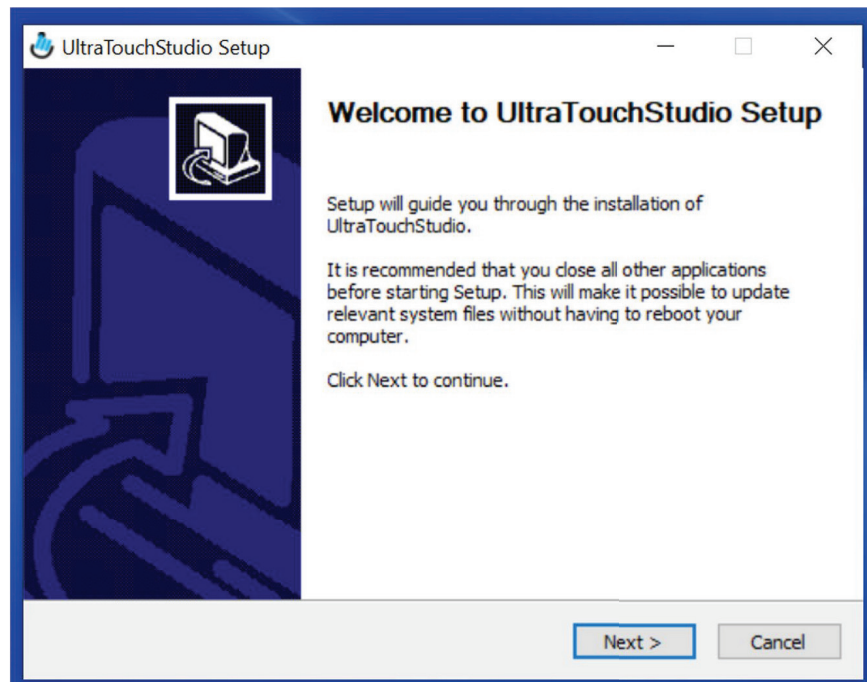
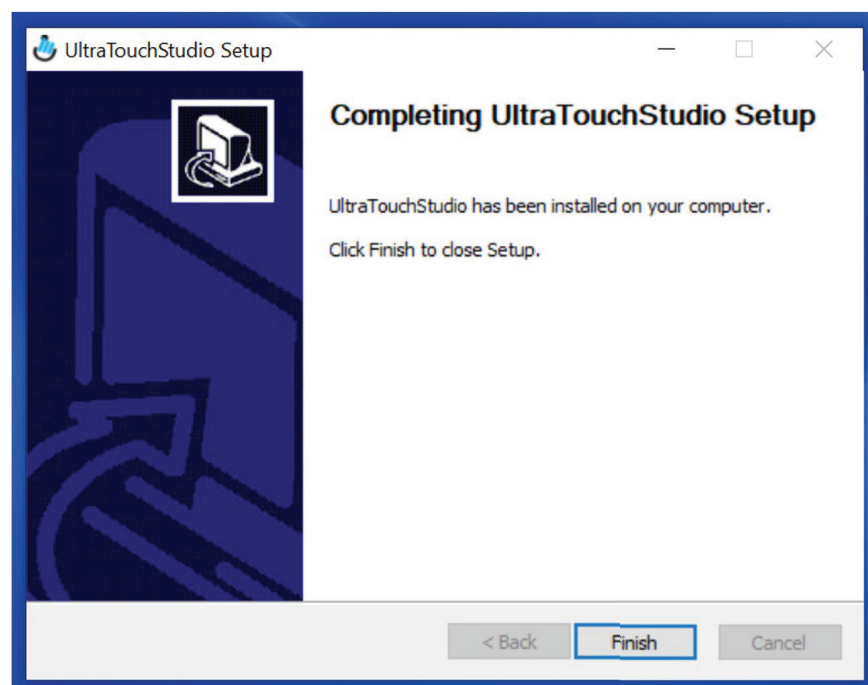*Select 'Next' at Welcome to UltraTouch Studio Setup screen.*

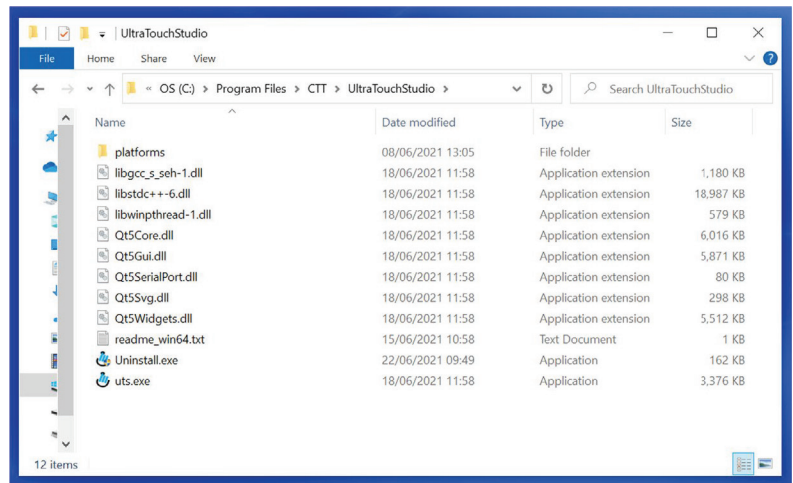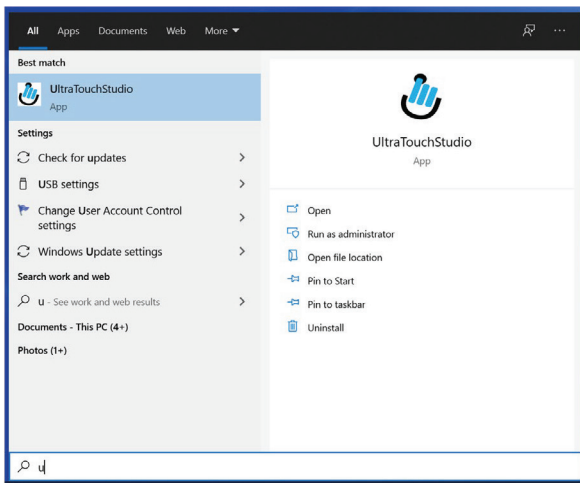*Select 'I Agree' at License Agreement screen.*

Choose Install Location (default Destination Folder is recommended) then 'Next'.

Choose Start Menu Folder, with or without shortcut according to personal preference.
Select 'Install'.

Select 'Finish' to complete installation.

To launch the UltraTouch Studio application, either use the Windows 10 start menu (search term 'U') or navigate to the install folder and double-click 'uts.exe'.

Now connect the EVK to the Windows 10 PC using the USB cable supplied.

Uninstallation

The current version of UltraTouch Studio should be uninstalled before upgrading. An 'Uninstall' application is provided for this purpose. Double-clicking will run the uninstaller and leave the \CTT folder empty. If any residual files remain these should be manually deleted before installing a new version of UltraTouch Studio.

UltraTouch Studio application menus

The UltraTouch application presents a facsimile layout of the EVK, with the key difference being that Sensor 2 is now depicted as a slider. Arc bar graphs associated with each sensor provide an indication of the current force threshold detected as well as the recent peak force. The numbers associated with the sun cross symbol are the X or Y locations of the relevant finger.
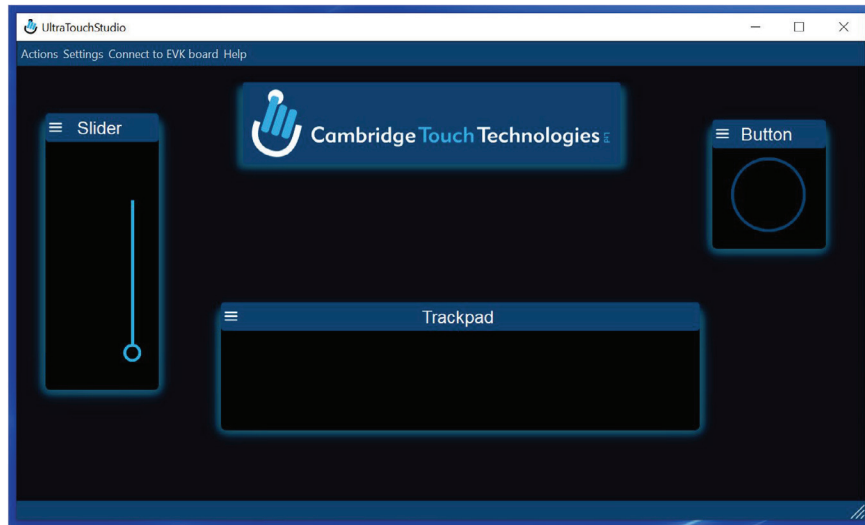
*Cambridge Touch Technologies UltraTouch Studio start-up screen*

The UltraTouch Studio has four drop-down menus; **Actions, Settings, Connect to EVK Board** and **Help**.

Actions

The sub-menus grouped under Actions provide set-up and other basic information about the EVK.
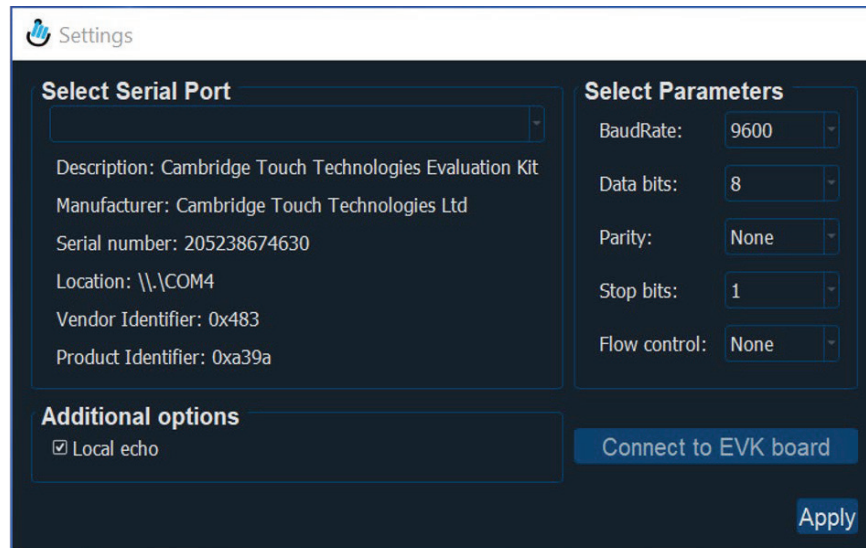
- **Connect/Disconnect.** These Actions toggle the status of the attached EVK. Only one will be available with the other greyed-out. This action only effects the status of the USB communication with the EVK, it does not interfere with the DC power.
- **Request firmware version.** This Action will report the version of firmware currently running on the EVK in a dialogue box. If no EVK is connected, selecting this item will result in no action.
- **Firmware upgrade.** This Action opens a dialogue box to permit the firmware installed on the EVK to be either changed to a different version or the current version re-installed. 'Open firmware file' opens a navigation pane from where the xxx.bin file can be selected. 'Load firmware file' will install the new firmware on the EVK. After installation it is necessary to power cycle the EVK for all the features in the new firmware to become operational.

- **Quit.** Exits the UltraTouch Studio application and releases the USB port, in the same manner as the Windows close [X] symbol.

UltraTouch Studio 'Actions' drop-down menu
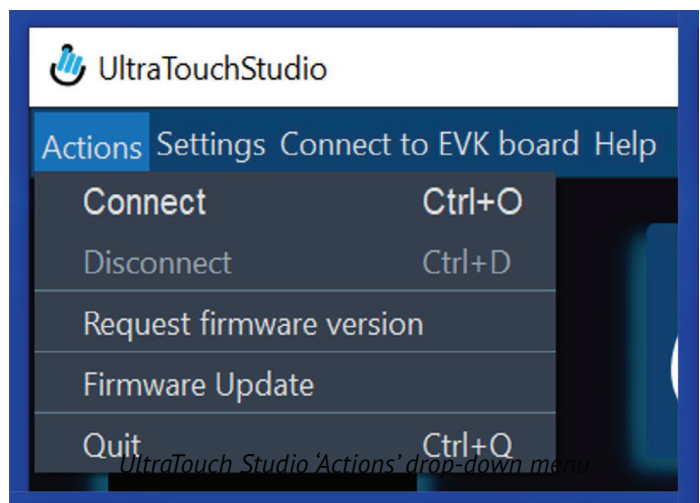
Settings

Configure COM. This menu provides access to the settings for USB communication between the computer and the EVK. The default settings will not normally need to be changed. On some computers the COM port might not be auto-detected. In this instance the port to which the EVK is registered can be identified from Windows Task Manager and entered in the dialogue box as 'COMx'. If any of the setting have changed, click 'Apply', otherwise click 'Connect to EVK'. If UltraTouch Studio fails to connect to the EVK a warning dialogue box will appear and different settings can be tried.

USB communications settings between UltraTouch Studio
and the EVK

Connect to EVK board

With the EVK powered and connected to the PC with UTS running, this menu provides a 'one-click' method to establish communications between the two. It automatically detects which USB port the EVK is connected to, applies the correct serial protocol and obtains the device identification code from the EVK.

If 'auto connect' fails to establish communication with the EVK the fault usually lies in a conflict over the USB port identity. Interrogating the PC hardware using the Device Manager application supplied with Windows 10 (accessible through 'Control Panel') can be helpful in identifying the problem.

Help

This menu has one sub-menu, About. This provides information on the version of UltraTouch Studio currently running.
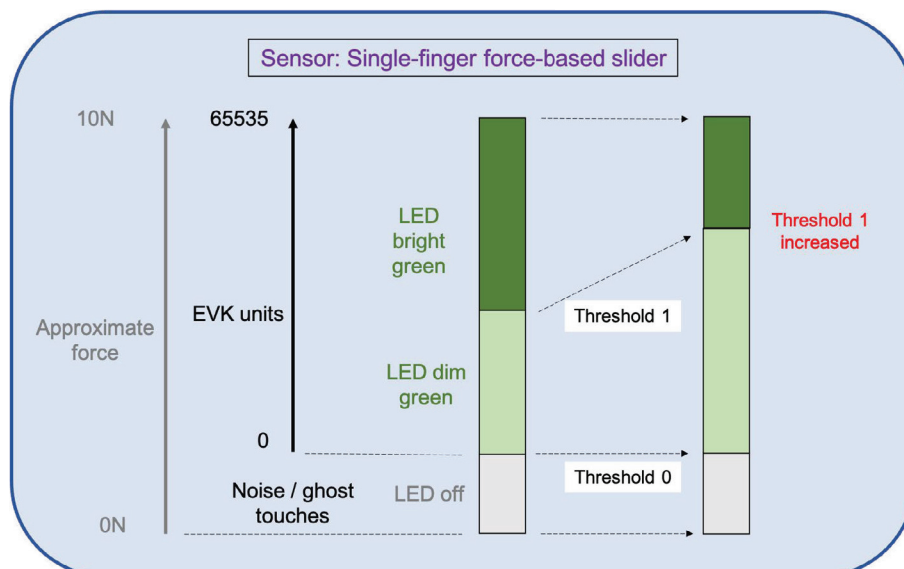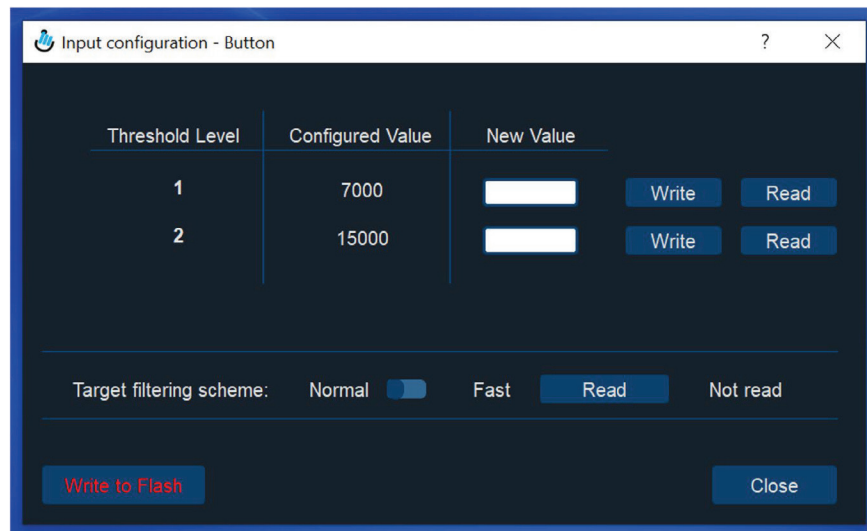
UltraTouch Studio application operation

Connect the EVK to the PC via the supplied USB cable. Provided the USB port can sink sufficient current the EVK should boot and be usable in manual mode as described above. The UltraTouch Studio application can now be started. The host OS should automatically detect the COM port and share this information with UltraTouch Studio. USB communication with the EVK can then be commenced by clicking 'Connect to EVK board'. UltraTouch Studio will now provide a detailed display whenever a touch event occurs on the EVK.

A two-finger touch event on the EVK touch pad displayed on the UltraTouch Studio application

The relationship between maximum pressure and index number and threshold value in the configuration settings is shown for the single-finger force-based slider in the pictogram below.

Input configuration options

Each of the three sensor windows on UltraTouch Studio is provided with a Windows-style three-line menu, also known as the hamburger icon. Clicking this will open a dialogue box that permits the force thresholds of the relevant sensor to be changed. The format is the decimal equivalent of a two-word binary number giving a minimum value of 0 and maximum of 65535. The relationship between force, EVK units and threshold value is illustrated for the force-based slider (Sensor 2) in the pictogram. Only the upper thresholds are accessible to the user via UltraTouch Studio.

'Read' will update the 'Configured value' to display the value currently in use on the EVK and within UltraTouch Studio.

'Write' opens a dialogue box where a new value can be entered. Correct entry of the new value can be verified by a subsequent 'Read' command.

If the default values are changed these will be lost when the EVK is power cycled. If persistence is required, the new values can be written to the EVK by clicking 'Write to flash'. The new values will then become the default settings and be used by the EVK even when operated in stand-alone mode without a connection to UltraTouch Studio.

This dialogue box also provides the option to change the 'Target filtering scheme'. The scheme currently in use can be 'Read' with the option to switch between 'Normal' and 'Fast'. The selection alters various parameters of the digital signalling pipeline and to the user has the apparent effect of changing the response time for detection of touch between 150 and 100ms. For most applications the 'Normal' setting is preferred, the 'Fast' option only being required for applications such as computer trackpads and keyboards.

Contact us

For further help and assistance with the EVK or the UltraTouch Studio application please email: customersupport@camtouch3d.com

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Cambridge Touch Technologies

154 Cambridge Science Park,
Cambridge, CB4 0GN, UK

info@camtouch3d.com

www.camtouch3d.com