Calibration and User Interface

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The need for calibration is unique to absolute pointer devices, such as a touch screen or white board. Unlike mouse or keyboard applications where the cursor is part of the image, a touch screen is a physical overlay or layer with an independent coordinate system. Only by knowing the position of the image can the touch screen coordinates be converted into image coordinates, hence the need to align the two different co-ordinate systems.

Besides the differences in touch screens and controllers, calibration also compensates for the variation in video image among displays. The image is affected by horizontal and vertical adjustments on the monitor and by the physical mounting of the touchscreen.

Additional calibration complications include image blooming, where bright-colored images expand, and the "pin cushion" effect, which causes the corners of the display to be stretched. Poor display linearity can cause similarly-sized boxes to be larger at the edges of the screen than they are in the middle, or vice-versa. The displayed image can also be tilted. Even changing video modes can affect the screen size. If images are projected onto a white board from the side, top or bottom of the board then the image will not always be perfectly rectangular, this is known as keystone image.

Perfect calibration cannot be achieved in all circumstances. For example, the user can encounter parallax problems with a change in position, or because the present user is not the same stature as the person who calibrated the screen. Even the most sophisticated calibration techniques can only partially overcome such variations. To cater for the controller and video variations UPDD uses a number of calibration techniques to ensure best results for any given combination and this document covers all aspects of UPDD calibration issues.

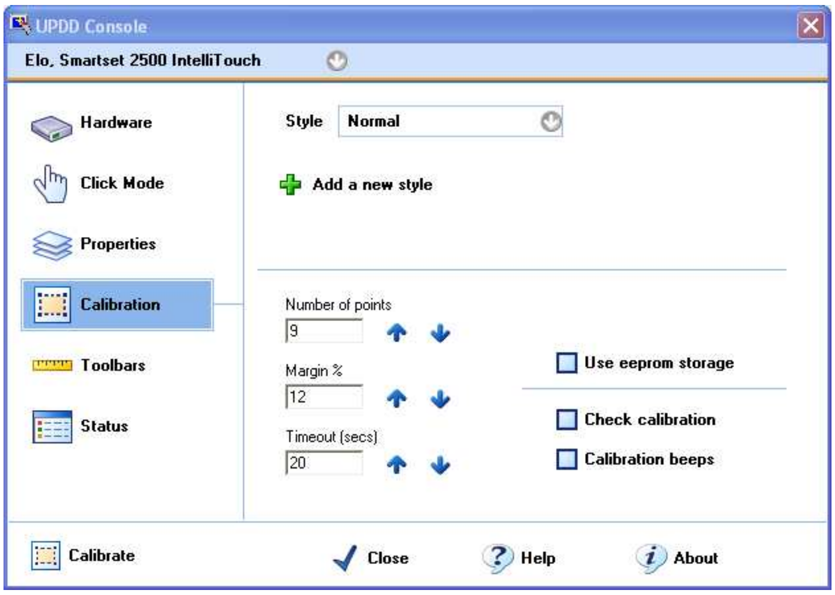
As discussed, calibration is required to align the pointer device co-ordinate system with the video co-ordinate system. When using an absolute pointer device the mouse cursor should normally position itself under the stylus when it is in contact with the pointer device. If this is not the case then calibration will be required. The UPDD driver also supports Toolbars, which also require calibrating, and this is covered in full in a separate Toolbar document. This document covers the new calibration feature in UPDD Version 4.

Under UPDD the calibration program used to perform manual calibration is called TBcalib. Other ways of achieving calibration are discussed in the notes section of this document.

Given that TBcalib is a common component across all platforms and is utilised in all environments we have also exposed in this program common UPDD User Interface calls as a simple method for changing some of the UPDD settings that would normally be changed from applications using the UPDD API interface.

Defining Calibration

For Windows, Mac OS X and Linux, manual calibration settings can be configured in the UPDD Console, Calibration dialog:

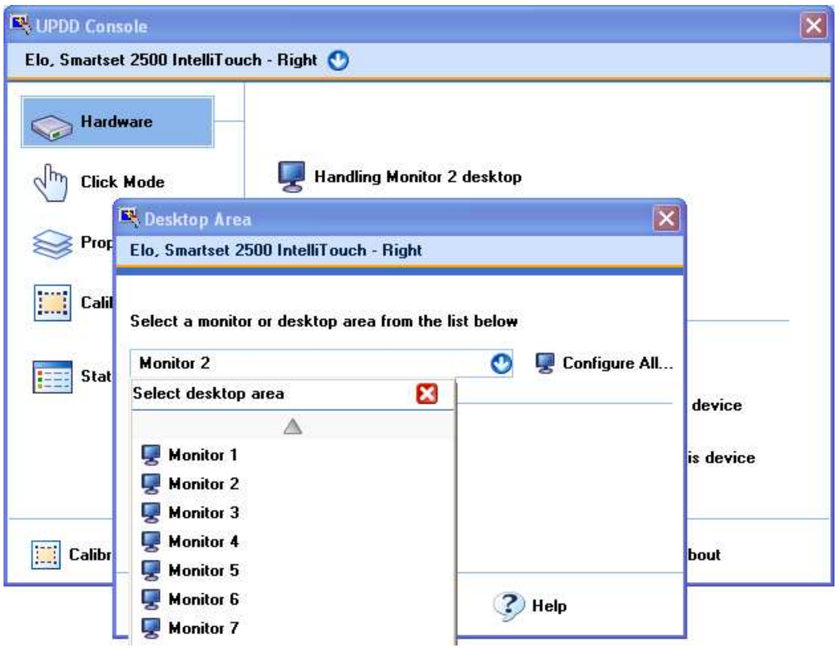

UPDD Console
Elo, Smartset 2500 IntelliTouch
Style: Normal
Number of points: 9
Margin %: 12
Timeout (secs): 20
Use eeprom storage: unchecked
Check calibration: unchecked
Calibration beeps: unchecked

This dialog defines the number of calibration points, the calibration timeout and the margin percentage. These settings are defined for each defined device and calibration style.

UPDD Devices

Each UPDD configured pointer device will be listed in the UPDD Console. Each device is given a 'name' and the current device is listed in the console program. Each device is associated with a Desktop segment which indicates the area of the desktop handled by the pointer device.

In this example the devices has been named 'Elo, Smartset 2500 IntelliTouch - Right ' to indicate to the user it is associated with the right hand monitor in a multi-monitor configuration and has been associated with desktop segment 'Monitor 2'.



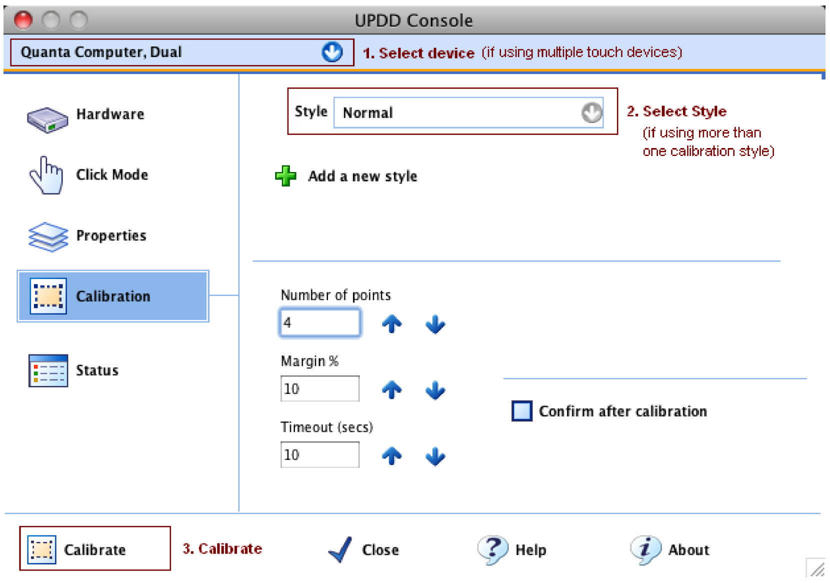
Each device is also allocated a unique internal device handle which is held in the UPDD configuration file and available via the UPDD API to applications that interface directly with the devices.

Invoking Calibration

Manual calibration can be invoked in various ways:

- **Calibrate option in the UPDD Console**

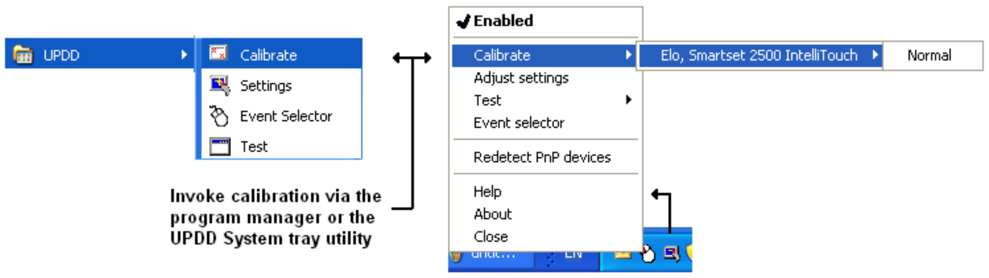
  This will calibrate the currently selected device and calibration style.



Note: When calibrating for the first time in a multi-monitor environment all devices will be calibrated in such a way as to also set up desktop / touch device relationships. Note – this is triggered if any of the devices are set to 'Whole' desktop segment.

- **Directly calling the calibration program manually**

  Windows options



Desktop short cut

May exist under Mac OS X and Linux on the desktop after install. On Mac OS X a shortcut is also placed in the utilities folder. Depending on the Linux Desktop Manager in use this is not always setup automatically by the install procedure. Should be seen if using KDE.

UPDD Calibrate

These methods of invoking the UPDD Calibrate program (which does not pass any control parameters) invokes calibration for the current device and its calibration styles and toolbars (unless they are defined relative to the main video calibration). Control parameters that can be passed to the UPDD calibration program to perform other calibration options are discussed below:

Manually calling TBcalib program (only method available in OS where UPDD Console not available)

The calibration program is located in the UPDD application folder and can be invoked manually as shown:

OS	**Command line via a terminal window or shortcut**
Windows	C:\Program Files\UPDD\tbcalib.exe
Linux	/opt/tbupddlx/upddcalib (Linux script to invoke the tbcalib application)
Mac OS X	UPDD version 4: /tbupddmx/tbcalib.app/Contents/MacOS/tbcalib
	UPDD version 5: /Applications/Utilities/UPDD\ Calibration.app/Contents/MacOS/tbcalib

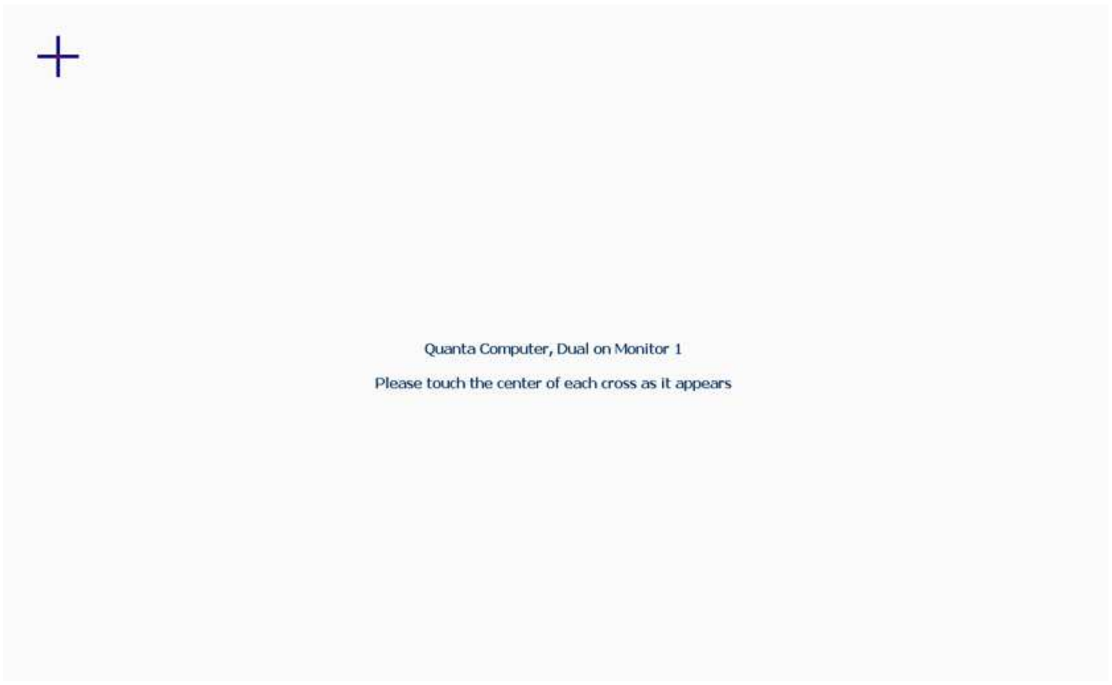
Passing TBcalib parameters if/as required.

- **Program control via the UPDD calibration API calls**

  In the unlikely event that TBcalib cannot be called from a program to perform calibration, calibration procedures can be embedded in user written applications using UPDD API calls. Refer to the Calibration API document or email the technical support team at technical@touch-base.com for additional information.

Calibration Procedure

Once invoked the calibration screen is displayed requesting that each calibration point be selected in turn.



Quanta Computer, Dual on Monitor 1

Please touch the center of each cross as it appears

The number of points shown and the position of the points are defined by the calibration settings in the UPDD Console, Calibration dialog. If the margin% setting is less than 5% arrows will be shown for points along the edges of the screen rather than crosses. Various sizes of crosses are employed depending on the pixel width of the calibration area. The larger the width the greater the size of cross is used. If calibration is aborted or times out the driver discards the updated calibration data and reverts back to the previous data.

The calibration data is calculated for each calibration point based on an averaged sample of 10 touch data packet unless a delta mode touch device is in use (Lift off time setting = 0) in which case calibration is taken on a single sample.

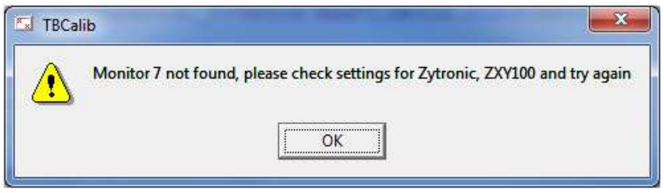
Important notes:

1. If the pointer is moving (especially during calibration) but the calibration touches are ignored it is likely that a different driver is in control of the device, not UPDD.

2. If the calibration screen is not drawn full screen or is distorted or offset in anyway then it is likely that the graphics system does not supported the method employed to force full screen drawing. In this case a different approach is needed as described in the Calibration Notes, Calibration Style entry below.

3. If using EEPROM calibration on devices where the calibration pattern is dictated by the firmware in the controller, the firmware may return a failed status to the calibration program if the touches on the calibration crosses are calculated to have not been in the correct relative position. E.g the 3M SCxxx 3 point EEprom calibration is based on a triangle and trigonometry is used by the firmware to calculate quite accurately where the 2nd and 3rd touches should be occurring. Recalibrate if a failed status is seen until calibration is accepted.

4. Under Windows, if the defined monitor is not found on the system the following message is displayed:


TBCalib

Monitor 7 not found, please check settings for Zytronic, ZXY100 and try again

Calibration Notes

Calibration is a fundamentally important feature for pointer devices as successful usage is reliant on correct desktop alignment. UPDD implements some important features to ensure the calibration procedure produces the best possible results.

Where the following notes refer to calibration settings as held in the system the following applies;

UPDD version	**Operating system**	**Location**
UPDD 3.x.x and 4.0.x	Windows	registry at HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\TBUPDD
UPDD 3.x.x and 4.0.x	Linux and Mac OS X	tbupdd.reg
UPDD 4.1.x	All OS	tbupdd.ini

The following issues should be considered when setting up UPDD's calibration features:

- **Calibration methods**
  Installing UPDD for the first time will require that the device is in some way calibrated and a number of options exist as discussed below:

  Manual Calibration. The user executes the calibration program and touches a series of displayed points on the screen. For embedded environments data recorded in this way may be lost when the device is reset (if the UPDD settings are is not held in persistent memory) unless the data is stored in the touch controller's EEPROM. An OEM using manual calibration, where the calibration data is lost over a reboot, needs to decide on a strategy for initiating the manual calibration. E.g. executing the calibration program at start-up, or placing an icon on the desktop.

  1st Touch calibration. Builds of the software can be supplied with a setting such that the first touch on the touch device after install will invoke manual calibration – this is currently a Windows only option.

  Auto-calibration. If a calibration has not been performed the driver will try and scale the received co-ordinate with the desktop area. The calibration calculation is based on the maximum theoretical range of values (from the number of bits in the touch data packet) assuming that the available touch area is exactly the same size as the visible desktop area. This relies on the correct range of data bits being defined in the UPDD controller definition and that the orientation of the touch screen matches the UPDD invert X, Y settings and Swap XY settings.

  Pre-calibration. Builds of the software can be supplied with pre-defined calibration data. The calibration data is determined for a device – or class of device - and stored in the initial UPDD settings file and installed as part of the install procedure. See dump4tba calibration option below for further details.

  Hardware – Some controllers, once calibrated using a controller specific hardware calibration, will output scaled co-ordinates. UPDD invokes this type of calibration for some controllers – see EEprom document for more information.

  EEprom – Calibration is stored in controller eeprom and retrieved by running TBcalib eeprom at system startup. UPDD stores calibration data for some controllers - see EEprom document for more information.

- **Calibration Style**
  Each UPDD device can have any number of calibration styles. In most cases a device will have a single style. However, some pointer devices can legitimately have more than one style, with each mode being calibrated separately. For example, a whiteboard can be used for drawing to the extreme corners and would be calibrated to the corners to ensure the whiteboard was fully calibrated. However, a desktop could be projected onto the whiteboard such that it did not fully cover the entire whiteboard area and therefore would need a different calibration to be accurate when used in projected mode. In this scenario, two calibration styles could be defined, say Whiteboard and Projected, and calibrated separately, thus avoiding recalibration every time usage of the board is switched. Switching stylus can be handled manually, command line interface, toolbar or via the UPDD API.

  Reserved style names
  A number of style names have been used to cater for certain unique calibration features as described below:

Style name	**Purpose**
Custom2Point Custom4Point	This style has been reserved for situations whereby a system cannot handle the methods used by the calibration program to force full screen with unpredictable results. In this situation define a style called Custom2Point whereby calibration does not attempt full screen mode (and therefore cannot draw accurate calibration points) but instead requests that the top left and bottom right corners of the calibration area be used as the calibration reference points. No other calibration patterns are catered for.
RXXXXxYYYY (e.g. R1024x768)	On most monitors the desktop display is shown in exactly the same place irrespective of video resolution and therefore in most cases a single calibration is all that is required to cater for calibration in all video resolutions. However, in some circumstances, an unusual video mode may result in the display shifting to a new position and therefore, on a touch monitor, the calibration will be inaccurate whilst in this resolution. This style name is used to associate a calibration to a specific video resolution. The name of the style indicates the associated resolution, i.e. R1024x768 and will be automatically selected when the resolution is active. Once the driver has automatically selected a resolution specific style it will only ever switch to a new style in a different resolution if an associated style is found.

	Notes: Dropped from version 4.1.10 as with modern monitors and video cards the image was normally in the same location, irrespective of resolution, so we thought this function to be redundant. However, this function has been re-instated in 5.0.2 (Oct 13) with the following considerations: To enable this function within the driver setting upddvideores should be defined in the tbupdd.ini file and set to 1. This can be performed with command "tbutils nodevice setting dw upddvideores 1" This only works in Windows on single monitor systems.
Rotate0,90,180,270	On most monitors the desktop display is shown in exactly the same place irrespective of the degree of rotation and therefore automatic adjustment (90°,180°,270°) of the calibration data taken from a single calibration is all that is required to cater for all rotated video resolutions. However, in some circumstances a rotate may result in the display shifting to a new position and therefore, on a touch monitor, the calibration will be inaccurate whilst rotated. These style names are associated to a specific degree of rotation and will be automatically selected when the rotation is active. Names are case sensitive. If defining a style for 90,180 or 270 then a Rotate0 style must also be defined to allow the driver to switch back to a style associated with standard Landscape (0° mode).

- **Cursor movement**
  No cursor movement will take place if a stylus selects any area outside the main calibrated area or within a calibrated toolbar. This is now configurable. By default, no cursor movement takes place except in the main calibrated area but this can be configured otherwise if required.

- **Calibration data storage**
  Calibration settings and the actual calibration data is held within the system or on the touch controller's EEPROM (where available and supported). When stored in the system, and depending on the OS and the UPDD version in use, it is either held in the registry under Windows or a UPDD settings file.

  EEPROM
  Some controllers can store the data on the onboard EEPROM and if this is available a EEPROM check box will be shown on the calibration dialog. Your specific usage of the calibration data will determine what setting to select. Using EEPROM calibration may restrict the calibration points to specific locations as dictated by the controller's EEPROM calibration procedure.

  If EEPROM is used:
  UPDD 3.x or 4.0 the UPDD registry entry or registry file setting
  HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\TBUPDD\Parameters\{guid}\{Device Number}\EEPROM Calibration will be set to 1.
  or
  UPDD 4.1.x the [UPDD\parameters\{Device Number}\EEprom Calibration] entry in the UPDD settings will be set to 1.

  EEPROM usage and considerations are explained in full in the separate EEPROM document

  System
  If EEPROM is not supported or not enabled then the calibration data it is either held:

  UPDD 3.x or 4.0 the UPDD registry entry or registry file setting
  HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\TBUPDD \Parameters\{guid}\{device number}
  UPDD 4.1.x [updd\parameters\{device number}]

  The specific values used are: -
  Number Of Calibration Points
  RefX0, RefX1, RefY0, RefY1 *
  CalX0, CalX1, CalY0, CalY1*
  InvertX, InvertY, SwapXY

  *If "Number Of Calibration Points" is greater than 2 then there will be correspondingly more of these values.

- **Absolute pointer devices**
  Calibration is only required for absolute pointer devices. Relative pointer devices such as mice and touch pads do not require calibration.

- **Calibration Bounce**
  A calibration point is processed when stylus contact is removed (pen up) and the next calibration point is displayed. If a stylus 'bounces' on a calibration point, thus producing two pen up's, then the next calibration point will be satisfied by the erroneous second pen up requiring the calibration process to be restarted – which can be annoying if calibrating with many calibration points. This is known as 'Calibration bounce'. To avoid this problem UPDD implements a setting called 'Min Cal Delta'. This value indicates the number of co-ordinates that must differ between the calibration points for the next point to be accepted. If this value is set to zero this feature is effectively disabled.

  UPDD 3.x or 4.0 the UPDD registry entry or registry file setting
  HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\TBUPDD\Parameters\{guid}\{Device Number}\Min Cal Delta.
  UPDD 4.1.x [updd\parameters\{device number}\ Min Cal Delta]

- **Check Calibration**
  At the end of the calibration process the new calibration data is stored and used immediately. If the calibration procedure produces poor calibration, possibly due to calibration bounce or inaccurate calibration point selection, then recalibration will be needed. However, if the calibrated device is the only pointer device in use then it may not be possible to invoke the calibration procedure due to poor calibration! A catch 22 situation! To avoid this problem a 'Check Calibration' option can be enabled in the calibration dialog, such that the 'Confirm' button shown at the end of calibration must be selected for the new calibration to be used. Failure to select the confirm button within a certain time will result in the new calibration data being discarded.

  UPDD 3.x or 4.0 the UPDD registry entry or registry file setting
  HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\TBUPDD\Parameters\{guid}\Check Calibration
  UPDD 4.1.x [updd\parameters\Check Calibration]

- **Calibration Timeouts**
  The Calibration procedure will automatically terminate if the calibration point or confirm button (if enabled) is not selected within the timeout threshold setting.

  UPDD 3.x or 4.0 the UPDD registry entry or registry file setting
  HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\TBUPDD\Parameters\{guid}\Calibration timeout
  UPDD 4.1.x [updd\parameters\Calibration timeout]

  Since 4.1.6 a setting of zero disables timeout.

- **Calibration Beeps**
  The Calibration Beeps option (if available) will generate a sound when the calibration point has been selected. Useful if calibration is being done remotely from the system or desktop.

  UPDD 3.x or 4.0 the UPDD registry entry or registry file setting
  HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\TBUPDD\Parameters\{guid}\Calibration Beeps.
  UPDD 4.1.x [updd\parameters\Calibration Beeps]
  Under Linux the calibration beeps require a soundcard as we have not been able to access the internal pc speaker in Linux. The playback is performed using a sound utility called "sox" which seems to be installed by most mainstream Linux distributions. We play a sound file called beep.wav to emulate the sound is of a "click".

- **Pointer Device Orientation**
  UPDD expects pointer devices to be orientated such that the 0,0 (origin) co-ordinate is being generated from a known point on the device. If the device is incorrectly fitted, say in the case of a touch screen attached to a monitor, and it has been fitted 'upside-down' then the cursor will move in the opposite direction to that expected. If the number of calibration points is 4 or more then the calibration procedure will automatically calculate the orientation. Using 2 or 3 point patterns will require that the pointer device is fitted correctly with the origin co-ordinate being generated from the expected position. **It is for this reason that we recommend a 4 point or more calibration pattern is used.**

- **Calibration Algorithms**
  UPDD employs four calibration algorithms;

  1. A standard algorithm that works well for devices with good linear characteristics. This algorithm is used with all calibration patterns except 4, 9 and 25 points.

  2. An advanced algorithm that works best on devices with poor linear characteristics. The advanced algorithm is used when the device is calibrated with 4 (except 20% in – see below) or 9 point calibration patterns. This algorithm is more dependant on the accuracy with which the calibration is done so it is very important to calibrate with a stylus that can select the exact centre of the calibration cross or tip of the calibration arrow (in 0% in calibration).

  3. 4 point XY coefficient algorithm. This algorithm, introduced with UPDD version 3.8.24, is used when the touch media has linear distortion, such as shearing or keystoning. Typically used when projecting images onto electronic whiteboards from the side, top or bottom. This algorithm is invoked when the calibration pattern 4 point with 20% margin is specified.

  4. 25 point distortion algorithm. This algorithm caters for severe non-linear distortion.

  Importand note: UPDD supports calibration segments which are intended to support cases where a touch interface does not cover the whole of the operating system desktop or the whole of a physical monitor. For example where a video splitter splits the OS desktop to 2 touch monitors, or where a touch screen smaller than the physical monitor is used, perhaps as a soft keypad in part of a larger display. When used as described above there are no known issues with this feature.

  However we are aware that some users test this feature on systems that are not configured as described as above. In some cases unusual results can be seen, in particular when certain calibration patterns are used. With 2,4,9 & 25 point patterns no problem should be seen. For other patterns the calibration algorithm is based on screen zones and the nearest zone to a touched point is used. When a point > 100% outside the calibrated area is touched this algorithm is ineffective and the touch result is incorrect.

  This only occurs on a system not configured as intended for this feature. In the unlikely event that a user has a real need to use such a configuration then the problem can be avoided by selecting 2,4,9 or 25 point calibration. Another possibility depending on the required usage is to use the UPDD toolbar feature to mask off unused areas of the screen.

  The algorithm used for 4,9, 25 point calibration is in fact the most accurate in most cases, so this should not present a problem.

- **Rotational Software**
  Software can be used to rotate desktops through 0, 90, 180 and 270 degrees. UPDD can automatically cater for rotated desktops and readjust calibration. See the rotate documentation.

- **Multiple monitor and devices**
  UPDD can support any number of pointer devices and desktop segments. A desktop segment is the area of the desktop associated with the device. E.g. In a two monitor system, both with touch screens fitted, the entire desktop could be spread over the two monitors. In this case each touch screen is associated with one monitor being half the desktop. The calibration procedure will take place on the individual desktop segment associated with the device and cursor movement will be restricted to that desktop segment when the device is in use. See the multi-monitor and device documentation for further details.

- **Video Resolution**
  Windows: .Windows calibration is based on a 'virtual' desktop resolution that represents the physical desktop resolution and calibration data is relative to the virtual resolution. In most cases a single calibration is all that is required to cater for calibration in all video resolutions as changing screen resolution does not normally require a recalibration as the video display is normally in the exact same position and therefore the 'virtual' and 'real' resolution relationship produces accurate calibration. However, on some systems a new calibration may need to be performed in the new resolution if the resolution switch results in a repositioning of the video display.

  Rather than manually recalibrating every time a video display shift occurs we have introduced resolution specific calibration styles that can be created for a specific resolution such that they will be selected when the resolution is active. The name of the style indicates the associated resolution, i.e. R1024x768. In this case the style is created and selected in the UPDD Console, the resolution is switched into 1024 x 768 and calibrated. Thereafter any switch to 1024 x

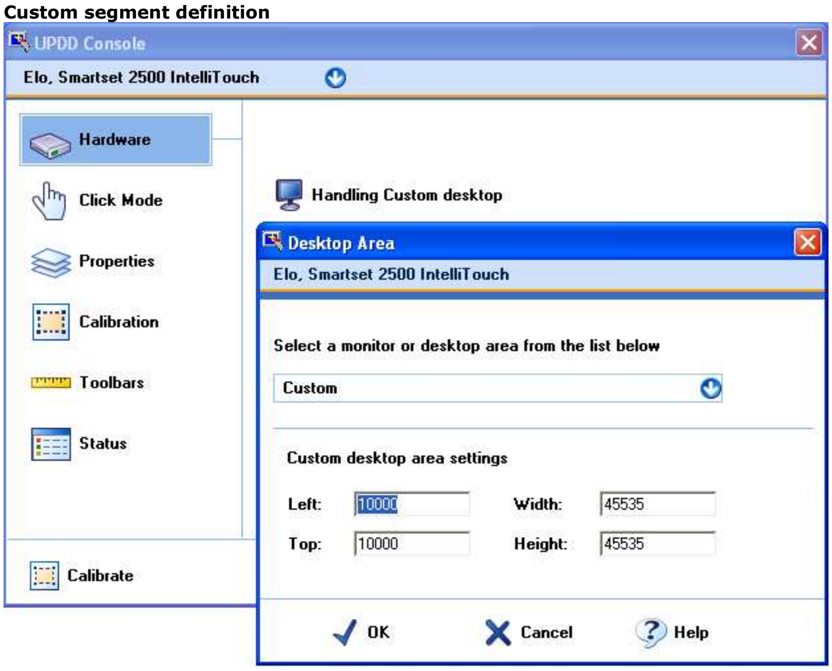
768 will use the calibration data associated with the resolution related calibration style. Styles not in this format are not associated with a specific resolution. An internal switch is used to show the current active style for the current resolution of the system. Once the driver has automatically selected a resolution specific style it will only ever switch to a new style in a different resolution if an associated style is found.

Linux and Mac: Calibration data is based on the physical screen resolution and a recalibration will be required when switching resolutions as we do not currently automatically track resolution changes.

- **Custom Desktop segments**

  If available in the desktop list, custom segments can also be defined to associate a touch screen with a specific area of a desktop segment. A full desktop calibration screen has a virtual co-ordinate size of 65535 x and y. Custom calibration areas are based on these co-ordinate values. The example below shows a custom calibration area where there is a 10000 co-ord boarder such that calibration is restricted to a central area on the desktop:

Custom segment definition



Select a monitor or desktop area from the list below

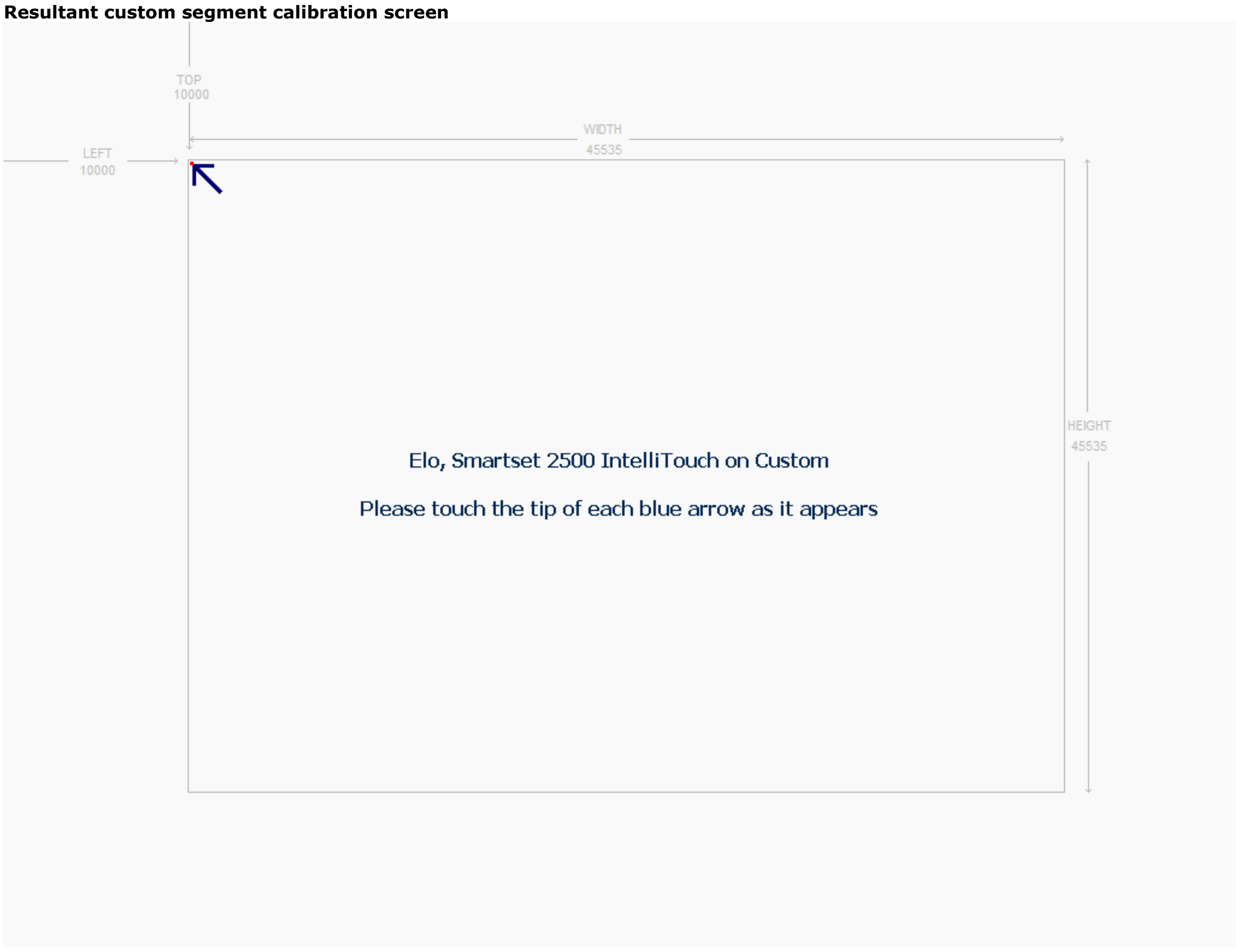
Custom

Custom desktop area settings

Left: 10000 Width: 45535

Top: 10000 Height: 45535

Resultant custom segment calibration screen



Elo, Smartset 2500 IntelliTouch on Custom

Please touch the tip of each blue arrow as it appears

The grey lines are not actually shown on the calibration screen but have been superimposed to show the calculations used by the calibration procedure. After touching each point (in this case the calibration pattern was set to 4 points, 0% margin) the touch area will be restricted to within the custom area. Touches outside this area will be ignored. The calibration background covers the entire desktop but the arrows)or crosses) are placed in accordance with the defined custom area.

Starting with UPDD build 5.0.2.469 custom desktop segments are supported on multiple monitors.
To use this feature set the setting MonitorNumberForSegment to identify the monitor to be used.

NB the monitor number is the UPDD monitor number, not the Windows number.

E.g.

tbutils setting dw MonitorNumberForSegment 2

The custom settings are set the same as for the primary monitor, even when the resolutions differ the range to describe the whole monitor is 0 – 65535

- **Default calibration settings**
  UPDD can be supplied with default calibration data. This is particular useful in complex configurations, especially when many toolbars are defined and UPDD is being used on a preconfigured system. This allows for the display and the toolbars to be calibrated 'out the box'. See dump4tba calibration option below for further details.

- **Raw and Calibrated data description**
  The driver can deliver, via the API, raw and calibrated touch data. Here is an explanation of what is actually meant by these terms:

  Raw data
  Raw touch data is data that is sent from the controller and received by the driver - **data in**. This is data that has not been adjusted in any way by the driver (other than to convert the bits in the data packet to x and y values according to the protocol definition) and will represent co-ordinate data sent by the controller covering the full physical touch area of the touch screen. If the controller's firmware is also not adjusting the data in any way then the data is in its total raw form. However, if the controller has been hardware calibrated then the data will also be adjusted by the firmware and in this sense is calibrated data (aligned to the video area) delivered directly from the controller.

  Calibrated data
  This is translated raw touch data that has been is manipulated by the driver and delivered to the OS (to move the system pointer) and / or applications via the UPDD API. This can be considered to be data that is output by the driver - **data out**. A better term for this data may be normalised or adjusted rather than calibrated as calibration is just one adjustment made to the data. Other adjustments taken into consideration are the invert X and Y settings, current rotation and calibration data etc.

  Auto-calibrated mode
  Even if the touch coordinates have not been aligned or scaled to the video (known as calibration) by calibration data recorded during a UPDD Calibration (or predefined in the installation package) the driver will still apply some adjustment to the data. The calibration will be calculated based on the theoretical co-ordinate range of the controller (hopefully correctly defined in UPDD!) and the invert X and Y settings as well as screen orientation. To this end the touch screen could well be 'calibrated' after updd install and without performing a UPDD calibration in that the cursor will move very close to the point of touch.

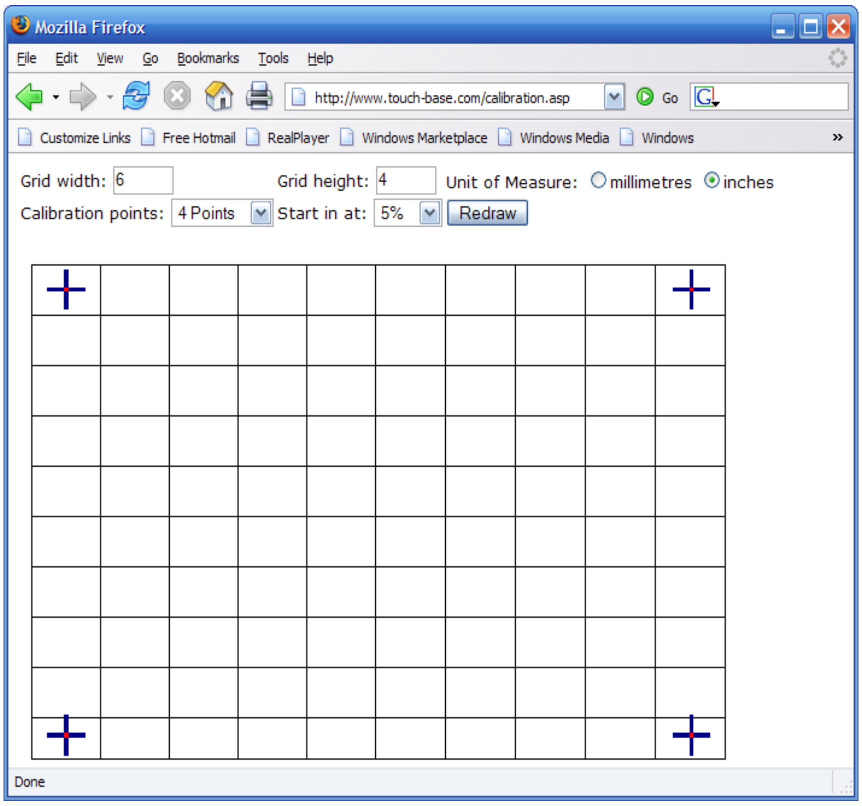
Calibration testing

A calibration test utility, UPDDdraw, is used to test devices in as much as it will draw a line as the pointer moves around to show the calibration accuracy. This is testing the route of the data from the device via the hardware port, processed by the UPPD driver and then fed into the system's low level mouse interface. See the UPDD Draw and Test utility document for further information.

Calibration pattern templates

For customers wishing to test touch hardware from a desktop (with the touch screen remote from the video display) we have created a template generator. The template combines the calibration pattern with the linearization grid. In the generator you simply specify the size of the template in imperial or metric dimensions, the number of calibration points and the % margin and request the template be drawn. The template can then be printed to a suitable printer (the browser printer driver or the printer should not attempt to rescale the HTML drawing!).

The following example shows a 6" x 4" template with 4 calibration points and a 5% margin:


Mozilla Firefox
File Edit View Go Bookmarks Tools Help
http://www.touch-base.com/calibration.asp
Go
Customize Links Free Hotmail RealPlayer Windows Marketplace Windows Media Windows
Done

Grid width: 6 Grid height: 4 Unit of Measure: millimetres [✓ inches]
Calibration points: 4 Points Start in at: 5% Redraw

Calibration parameters and User Interface calls

TBcalib has a number of calibration related parameters and also offers a command line interface to change various UPDD settings and can also be used to reinitialise the controller or reactivate the driver.

The calibration program exports this interface using the following syntax:

Windows	TBcalib {parameter} Note: Entering the commands from a Windows command line would be tbcalib "{parameters}"

Mac OS X	5.x.x: /Applications/Utilities/UPDD\ Calibration.app/Contents/MacOS/tbcalib {parameter}
	4.1.10: /tbupddmx/tbcalib.app/Contents/MacOS/tbcalib {parameters}

Linux	/opt/tbupddlx/upddcalib {parameter} or /opt/tbupddlx/tbcalib {parameter} This command may need to be run prior to calling tbcalib: export LD_LIBRARY_PATH=/opt/tbupddlx:$LD_LIBRARY_PATH'

Notes:

1) If the parameter affected has a space then the parameter value must be quoted, e.g. tbcalib Device=0 "/setting:calibration beeps=0"
2) **Win7 file write issue**: Some of the user interface calls create files in the UPDD application folder and under Windows 7 this folder may not have correct write permissions to allow for files to be created. In this case you may see an error or you may not find the file (it will be remapped elsewhere). When using functions that create files ensure you have administration rights.

Please note parameters are case sensitive and must be defined as shown below.

Calibration parameters	**Used with the calibration procedure**
None passed	will calibrate the first active device on the system.
Device=n	perform request on the specified updd device and, if calibrating, the currently selected calibration style, default first in list. Will also calibrate any defined toolbars unless 'Toolbar=ABogusValue' is used to disable toolbar processing. Normally used by calling programs to perform a given function against a specific device, such as the UPDD Console device calibration option. N=the device handle of the device as held by UPDD. This option is used by UPDD SDK based programs utilising the UPDD API to determine the device handle using related API calls such as TBAPIGetRelativeDevice. Controller UPDD associated device handles can be listed by using the tbutils list command.
Device=connected	Perform request on the first connected device.
"Segment=segment id" (UPDD ver 4.1.3 and above)	perform request on the updd device associated with the updd desktop segment identifier and, if calibrating, the currently selected calibration style, default first in list. Will also calibrate any defined toolbars unless 'Toolbar=ABogusValue' is used to disable toolbar processing Normally used by calling programs to perform a given function against a specific device, such as the UPDD Console device calibration option. e.g. Tbcalib "Segment=Monitor 2" /disable - would disable the updd device associated with Monitor 2.
Toolbar=whatever	only calibrate toolbar whatever
TOOLBAR	only calibrate toolbars
Style=stylename	calibrates a named style

/all	calibrates all active devices. Prior to 4.1.8 1865, build this parameter also calibrates any 'calibratible' toolbars. Post this version toolbars are not calibrated.
/assignall	Automatically associates a desktop (monitor) with the touch screen and performs calibration. Cycles through all monitors. **Very useful** in multiple touch monitor environments. See important note below in /configureall.
/configureall	Automatically associates a desktop (monitor) with the touch screen. Cycles through all monitors. **Very useful** in multiple touch monitor environments.
	Important note: *Called from the UPDD Console, Desktop Area, Configure All option to automatically configure desktop segments. Particularly useful in Window 7 systems where the monitor number shown to the user does not match the internal display reference number exposed to applications and unknown by end users. In XP and Vista these values are one of the same, not so in Win 7 !!!!! This option will set the desktop segment to that needed to correctly address the monitor during calibration and system pointer placement.*
User Interface Calls	*These are now documented in a separate user interface document*
/screenresupdate	MAC OS X only – Requests the driver to recalculate calibration mapping based one the current screen resolution. To be used where a system is calibrated in one resolution but uses other resolutions (especially useful where applications are changing resolution)
Equivalent API call	

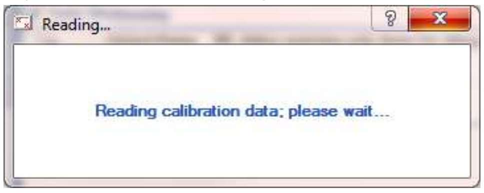
```
DWORD nDevices;
TBApiGetSettingDWORD(0, _T("Number Of Devices"), &nDevices);
for(unsigned j = 0; j < nDevices; ++j)
{
  int dev=0;
  dev = TBApiGetRelativeDevice(j);
  if(!dev)
  {
    continue;
  }
  else
  {
    SetupForMultiMonitor(dev,this);
  }
}
```

EEprom

eeprom

Retrieve UPDD calibration data from controller EEPROM. For further details see EEPROM documentation.

Since UPDD 4.1.8, build id 1738 the following dialog is shown during the read process unless the UPDD setting eepromreadsilent is set to 1 (UPDD 4.1.10, build id 2342):

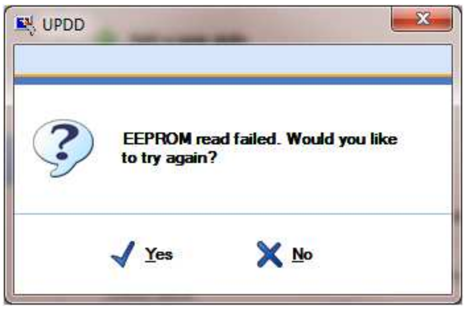


Reading calibration data; please wait...

If valid calibration data is held in the controller it is utilized otherwise calibration data held locally is used.

If Calibration settings (no. of points, margin etc) are also held in eeprom (space permitting) they are used as stored. If they are not held then the calibration values defined in the UPDD Console need to match the eeprom data reference points.

The read mechanism has a degree of auto retry and recovery code but repeat read failures or invalid CRC will result in the following dialogue being displayed:



EEPROM read failed. Would you like to try again?

This could happen whereby EEPROM setting is enabled but a new controller, without any valid calibration data is connected.

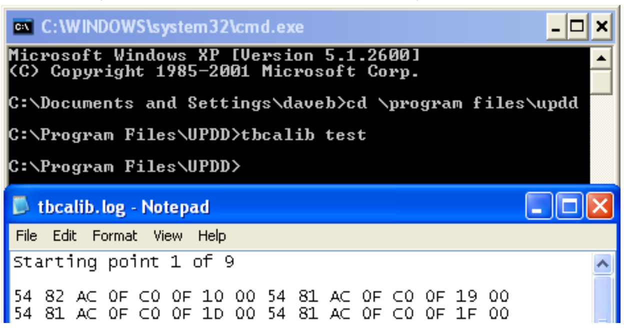
eepromwrite	Write the calibration data to eeprom. Typically used if an application has calibrated using the calibration API's and needs the updated data to be transferred to eeprom.
System calls	
test (see also diag below) (Win 7? – See note)	Captures the raw data output from a device at each calibration point and saves it to a log file, tbcalib.log. Useful in two circumstances: 1) To show that data is being sent from a controller. The 'touched' calibration point will only be accepted if some data is received from the controller. 2) To analyse the data being generated from a controller. Especially useful where no technical data is available for a controller that needs to be configured for use by the UPDD driver. The log data can be used to help configure the touch packet structure. For a USB device a special build of the UPDD driver will be supplied that is configured with the USB Vendor and Product id such that the UPDD driver is seen by the OS PnP manager as the device driver. This option can then be used to capture the data packet output from the device. *Important notes* *1) The test facility captures data being delivered from the com port or USB device,Interface 0, endpoint 1. If no data is seen then it is likely that either the device is not working, the device needs initializing before*

touch data is generated, the device needs to be placed into a special mode of operation or, for usb devices, the output is delivered on a different interface or endpoint.

2) *If executed on a multi monitor system only the first device is tested, or you can pass Device=n to define a device.*
3) *The log file is written to the current directory so the user must have write access*
   On a Windows systems ensure that you run the program as an administrator.
   On non-windows systems ensure that you run the program from a writeable directory, e.g. "~" (home).

Windows example

TBcalib has been invoked from a command window (tbcalib test), invoking the test option and has been run with 9 calibration points and the data stored in the log file as shown:

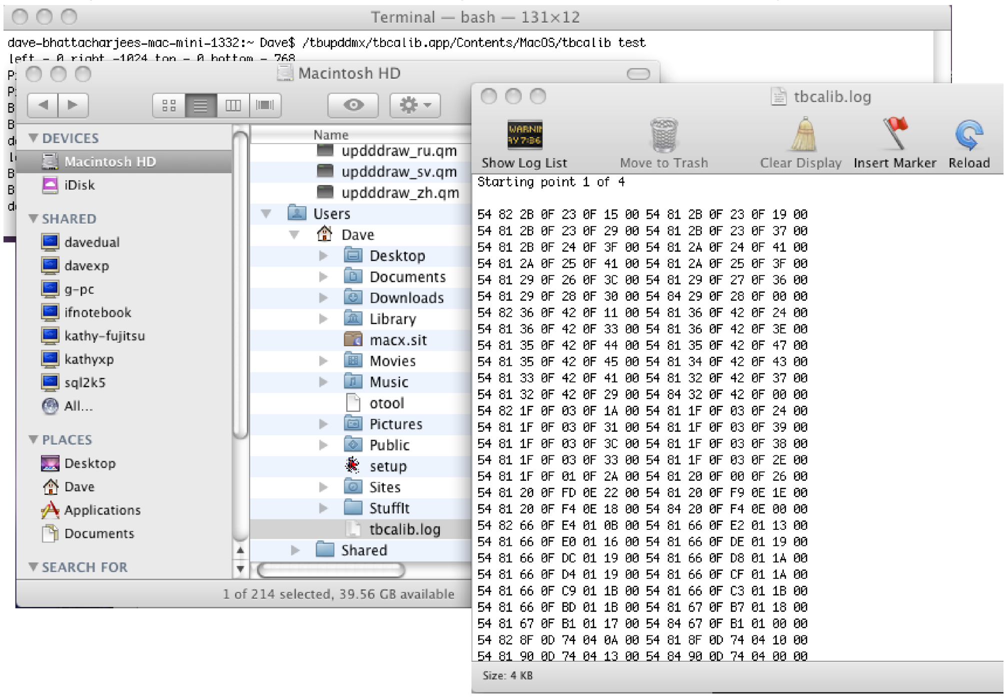


```
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

C:\Documents and Settings\daveb>cd \program files\updd

C:\Program Files\UPDD>tbcalib test

C:\Program Files\UPDD>
```

```
Starting point 1 of 9

54 82 AC 0F C0 0F 10 00 54 81 AC 0F C0 0F 19 00
54 81 AC 0F C0 0F 1D 00 54 81 AC 0F C0 0F 1F 00
```

Mac OS X example

TBcalib has been invoked from a terminal window (/tbupddmx/tbcalib.app/Contents/MacOS/tbcalib test), invoking the test option and has been run with 4 calibration points and the data stored in the log file as shown:



```
dave-bhattacharjees-mac-mini-1332:~ Dave$ /tbupddmx/tbcalib.app/Contents/MacOS/tbcalib test
left = 0 right =1024 top = 0 bottom = 768
```

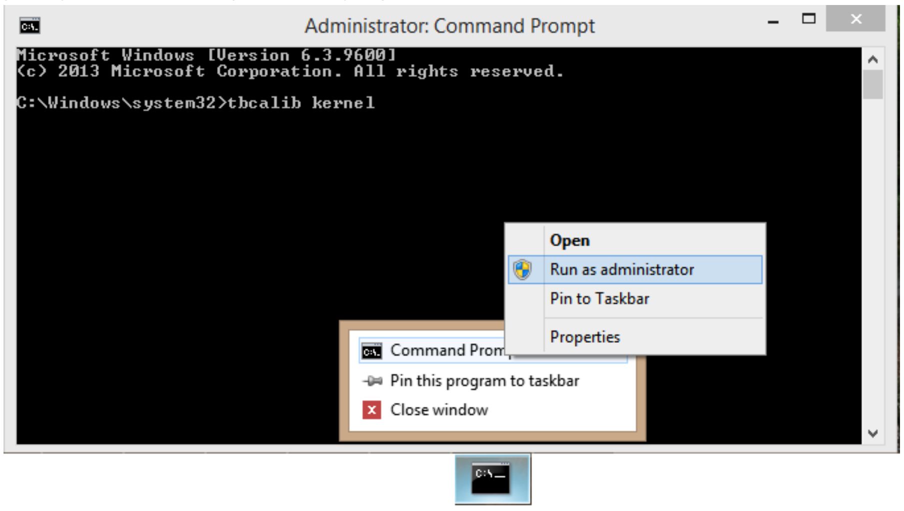
```
Starting point 1 of 4

54 82 2B 0F 23 0F 15 00 54 81 2B 0F 23 0F 19 00
54 81 2B 0F 23 0F 29 00 54 81 2B 0F 23 0F 37 00
54 81 2B 0F 24 0F 3F 00 54 81 2A 0F 24 0F 41 00
54 81 2A 0F 25 0F 41 00 54 81 2A 0F 25 0F 3F 00
54 81 29 0F 26 0F 3C 00 54 81 29 0F 27 0F 36 00
54 81 29 0F 28 0F 30 00 54 84 29 0F 28 0F 00 00
54 82 36 0F 42 0F 11 00 54 81 36 0F 42 0F 24 00
54 81 36 0F 42 0F 33 00 54 81 36 0F 42 0F 3E 00
54 81 35 0F 42 0F 44 00 54 81 35 0F 42 0F 47 00
54 81 35 0F 42 0F 45 00 54 81 34 0F 42 0F 43 00
54 81 33 0F 42 0F 41 00 54 81 32 0F 42 0F 37 00
54 81 32 0F 42 0F 29 00 54 84 32 0F 42 0F 00 00
54 82 1F 0F 03 0F 1A 00 54 81 1F 0F 03 0F 24 00
54 81 1F 0F 03 0F 31 00 54 81 1F 0F 03 0F 39 00
54 81 1F 0F 03 0F 3C 00 54 81 1F 0F 03 0F 38 00
54 81 1F 0F 03 0F 33 00 54 81 1F 0F 03 0F 2E 00
54 81 1F 0F 01 0F 2A 00 54 81 20 0F 00 0F 26 00
54 81 20 0F FD 0E 22 00 54 81 20 0F F9 0E 1E 00
54 81 20 0F F4 0E 18 00 54 84 20 0F F4 0E 00 00
54 82 66 0F E4 01 0B 00 54 81 66 0F E2 01 13 00
54 81 66 0F E0 01 16 00 54 81 66 0F DE 01 19 00
54 81 66 0F DC 01 19 00 54 81 66 0F D8 01 1A 00
54 81 66 0F D4 01 19 00 54 81 66 0F CF 01 1A 00
54 81 66 0F C9 01 1B 00 54 81 66 0F C3 01 1B 00
54 81 66 0F BD 01 1B 00 54 81 67 0F B7 01 18 00
54 81 67 0F B1 01 17 00 54 84 67 0F B1 01 00 00
54 82 8F 0D 74 04 0A 00 54 81 8F 0D 74 04 10 00
54 81 90 0D 74 04 13 00 54 84 90 0D 74 04 00 00
```

diag (see also test above) (Win 7? – See note)	Available in 4.1.8, (build 1837 and above) this option performs a similar option as the test option above and is invoked in exactly the same way. However, the diag option requests a five stage touch sequence to be performed so as to capture data to tbcalib.log file that is processed by our data packet analysis tool. *Important notes* 1) *The diag facility captures data being delivered from the com port or USB device, interface 0, endpoint 1. If no data is seen then it is likely that either the device is not working, the device needs initializing before touch data is generated, the device needs to be placed into a special mode of operation or, for usb devices, the output is delivered on a different interface or endpoint.* 2) *If executed on a multi monitor system only the first device is tested, or you can pass Device=n to define a device.* 3) *The log file is written to the current directory so the user must have write access* *On a Windows systems ensure that you run the program as an administrator.* *On non-windows systems ensure that you run the program from a writeable directory, e.g. "~" (home).*
dump4tba (Win 7? – See note)	Available in 4.1.6, (build 1117 and above) the option is used to create default calibration data from a calibrated system. The calibration data is written to file tbcalib.tba. The data is written in a format suitable for embedding in our software generation system such that the installation utilizes the default calibration data in the UPDD settings files. In this example a system has been calibrated with a 1 percent margin, 8 calibration points, 10 second timeout: Normal,1,8,10,0,0,15790,1223,15768,15642,885,1132,942,15756,12178,4929,12146,12180,4649,4959,4658,12040 There is an entry per touch controller configured on the system in the order they appear in the settings file. The tbcalib.tba file should be sent to Touch-Base for processing. *The log file is written to the current directory so the user must have write access* *On a Windows systems ensure that you run the program as an administrator.* *On non-windows systems ensure that you run the program from a writeable directory, e.g. "~" (home).*
kernel	Available in 4.1.8, (build 1784 and above) enables minimal kernel mode touch that can be used to provide basic

touch functions until the standard, user mode, driver is available. This is typically used in environments where the user mode driver (tbupddwu - which runs as a Windows service) start up is delayed, such as sysprep or WinPE.

Important note: This feature only work for single touch, non HID parsing configurations of the controllers. Multi-touch controllers with HID parsing configurations will need a new configuration to work with this feature.

To prepare for the kernel mode of operation, type this command on a system that has only the device in question installed and execute the special two point calibration that follows - this does not affect the current calibration settings. This prepares the required registry settings to be used in systems that require kernel mode to be enabled. Under Vista or Windows 7 this command must be run from a user account that has administrator privileges as it needs to update the registry.



```
Microsoft Windows [Version 6.3.9600]
(c) 2013 Microsoft Corporation. All rights reserved.

C:\Windows\system32>tbcalib kernel
```

The tbcalib kernel option runs a 2 point calibration procedure and prepares the registry settings required for this mode of operation based on a controller with the co-ordinate origin (0,0) at the top left and reporting x and y co-ordinates for horizontal and vertical axis respectively. If the controller does not follow this form then one or more manual changes to the created settings are required

1) If moving the touch in a vertical direction moves the cursor horizontally set swapxy = 1 then repeat the test before setting the following items.
2) If moving the touch to the right moves the cursor left exchange the values of CalX0 & CalX1
3) If moving the touch downwards moves the cursor up exchange the values of CalY0 & CalY1

Alternatively, for 2 or 3 above, repeat the command and touch the opposite axis corners to that requested. So, for example, if X axis is reversed, touch the top right corner when requested to touch the top left and the bottom left when requested to touch the bottom right.

Tbcalib return codes
These are the return codes from TBcalib and access to the code will be specific to the launch method used:

0	Success
2	Calibration timed out
3	Escape
4	Syntax error passing parameter
5	Failure to open API
6	Couldn't find a desktop segment
14	EEprom calibration read failure (e.g Checksum, eeprom access etc)
24	If launched with "eeprom" argument and the eeprom read succeeds but data is not in the expected format. (This only applies to controllers using the latest UPDD eeprom framework for calibration.)

In addition to the above return codes 14 and 24 status are mapped into tbupdd.ini setting "eepromreadstatus", 0 = fail, 1 = success.

Contact

For further information or technical assistance please email the technical support team at technical@touch-base.com