IR Interference Mitigation with Multiple Screens

AN-HW-008

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DOCUMENT REVISION HISTORY

Revision	Date	Author	Comments
1.0	Feb\25\2020	Adam Devecseri	Created the document
2.0	Feb\26\2020	Rafay Rashid	Reviewed and updated

1.0 INTRODUCTION

When multiple ShadowSense™ touch frames are in use in the same area it is important to note that in certain orientations, infrared (IR) light from one frame can interfere with the other touch screen. This interference will cause ghost touches and other performance issues.

ShadowSense touch frames use infrared LEDs that strobe IR Light from the right, bottom, and left sides. The top bars have sensors that detect the IR light level. When multiple monitors are placed next to each other angled inwards, by nature of how ShadowSense functions, **IR light will shine from one touch frame's LEDs into the adjacent frame's sensors**. This causes a great amount of noise and false data in both monitors, which the ShadowSense algorithm might interpret as a touch or hover point.

There are two different paths that the IR light can take when shining into the neighboring touch frame's sensors:

Direct IR, this happens when the frames are facing inwards and the IR light shines into the adjacent frame's sensors along a direct path.

Reflected IR, the IR light bounces off the screen or glass overlay, and a more diffuse source of IR light shines into the adjacent frame's sensors. In the case of a glass overlay on the monitor, if the glass is not flat (curved or rippled) then IR is reflected and then enters the adjacent frame's sensors.

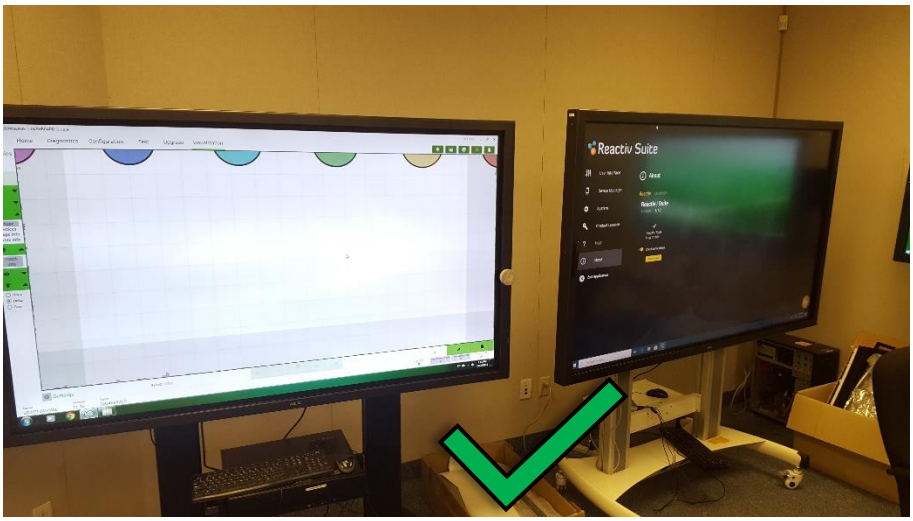
Be sure to inspect the glass on both touchscreens and look for ripples from the side. Deviations and warping (ripples) in glass causes more IR reflections in all directions and it is hard to debug or fix. Replace the glass in this case.

2.0 REDUCE IR INTERFERENCE WITH MECHANICAL ADJUSTMENTS

The best way to eliminate IR Interference is with mechanical adjustments by changing the angles between the two touch frames or by changing orientation of the touch screens.

2.1 SUGGESTED MONITOR ORIENTATION (FACING AWAY/OUTWARDS)

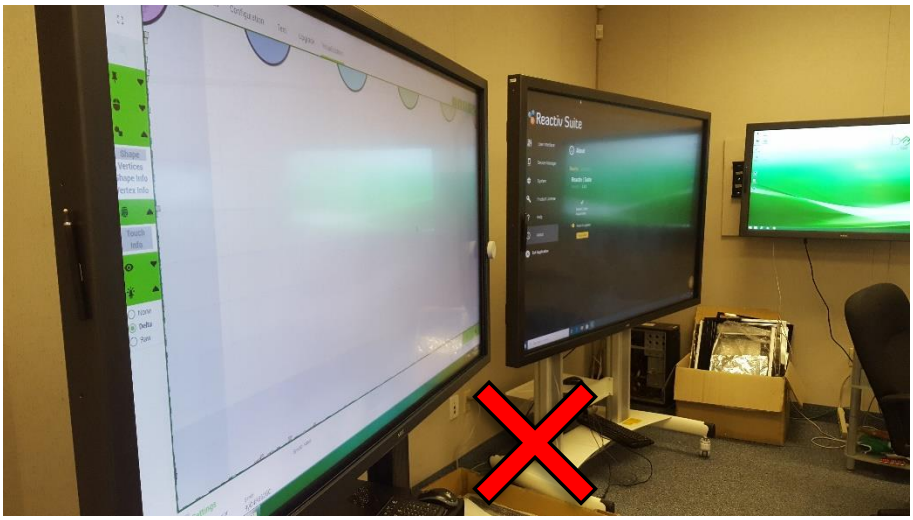
When using a multiple touch frame setup, it is important to **aim the screens away from each other**:



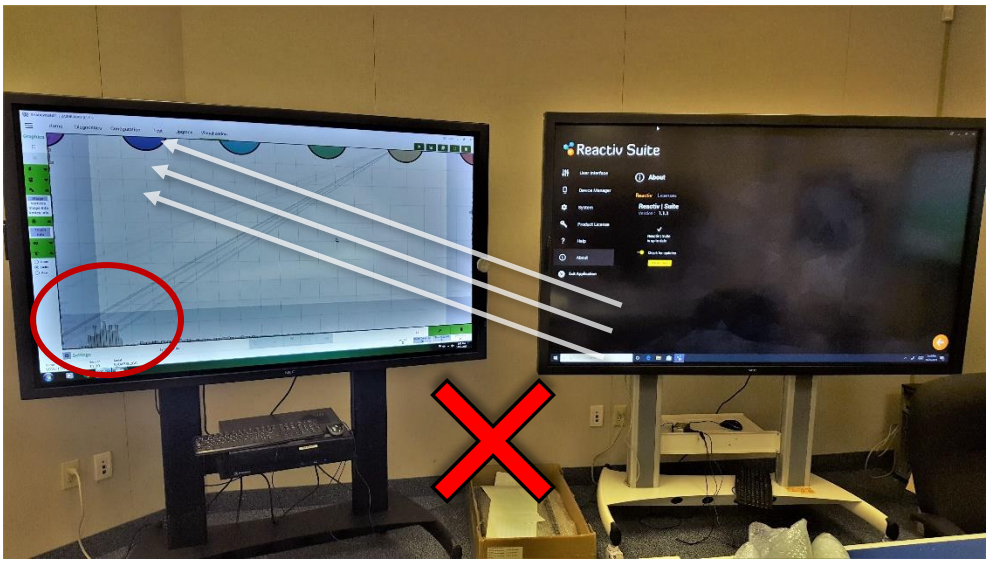
Another tactic to avoid IR Interference is to offset the monitors in the Z-direction (depth direction), and advance one closer to the user:

2.2 INTERFERENCE-PRONE ORIENTATION, TRY TO AVOID (FACING TOWARDS/INWARDS)

When touch frames face each other inwards, **this will cause IR bleed and false data/touches to the adjacent touch frame**:



Notice there is a false shadow detection shown on the visualizer (left) that is being caused by the IR light bleed from the touch frame on the right:



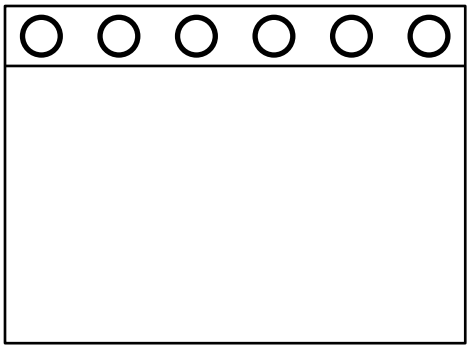
2.3 ADJACENT ORIENTATION

Two touchscreens can be placed adjacent to one another and not have any interference if they are in the same plane (flat, and not angled inwards or outwards). In this configuration, the angle between the two screens is 180 degrees. The reason this configuration works is because IR light from one screen cannot make it into the sensor of the second touch screen, as the two screens are exactly in the same plane. The bezels are able to block the light path between the two sets of sensors and LEDs.

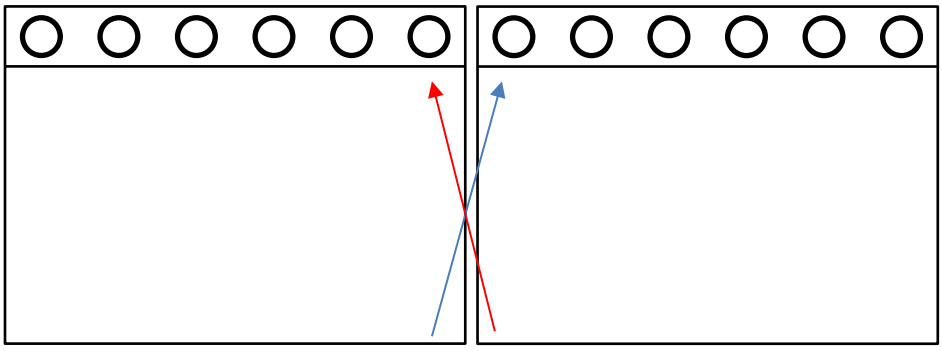
2.4 ROTATED ORIENTATION

If the two screens are facing **inwards**, then the best way to reduce IR Interference is to physically rotate one of the touch frames by 180 degrees, so the adjacent frame has the sensors on the bottom of the screen.

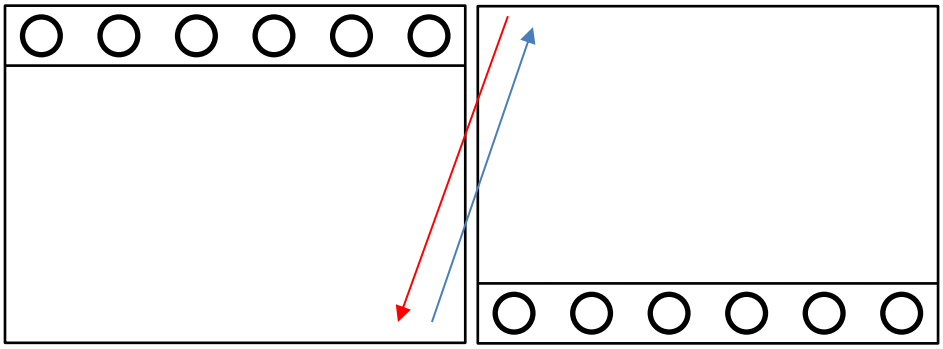
To illustrate why this works we represent a single touch screen as shown below. Notice this touch screen has 6 sensors all located at the top by circles. This touch screen is in the default orientation Landscape.



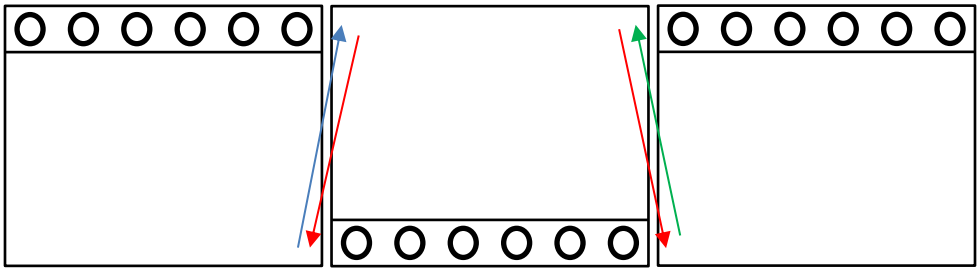
When two touch screens are facing inwards and located in Landscape configuration beside each other. The IR rays (blue) from the bottom right corner of left touch screen gets reflected from the glass, shines straight into the neighboring touch screen sensor. Similarly, the IR rays (red) from the bottom left corner of the right touch screen reflects off the glass and shines straight into the sensor of the neighboring touch screen.



To fix this IR interference. Rotate the touch screen on the right side by 180 degrees (Landscape flipped orientation). Now both of the reflected IR rays do not enter the sensors of the neighboring touch screens:



Similarly, if you have three touch screens beside each other all facing inwards it is recommended to rotate the middle touch screen by 180 degrees as shown below:



Note: For the rotated touchscreen to function in the correct orientation, the Screen Rotation settings in Dashboard must be set to 'Landscape Flipped'. (Menu > Transforms > Screen Rotation)

3.0 REDUCE IR INTERFERENCE WITH SOFTWARE CONFIGURATION

Adjusting software parameters is not the most effective way to eliminate IR interference issues. Nevertheless, you can minimize IR Interference by adjusting the following software parameters:

3.1 ACTIVE POWER MODE SETTINGS

LED BRIGHTNESS: This parameter controls the brightness, and resulting current required, of the LEDs located in the perimeter of the screen. Lowering the value results in a dimmer LED and lowers the operating current of the system while in Active Mode. By lowering the brightness, the signal to noise ratio is effectively lowered and it results in more noise in the system. This means if high ambient light rejection is required or if the screen is operated in an environment susceptible to dirt, debris or other contaminants, a high LED brightness value will be required for proper performance.

FRAME TIME: This parameter controls the time interval where the touchscreen scans for touch events while in Active Power Mode. The lower the frame time, the faster the screen is being scanned. This results in a higher current draw, but the latency of the system is minimized. Higher values will result in slower scans, which decreases the current draw at a cost of a higher latency.

For IR interference, try decreasing the LED Brightness down to 75%-60% (below 50% there might not be a signal strong enough for touch function). Set the Frame Time on one of the screens to a few milliseconds higher (11-13 ms) than the default (10 ms).

3.2 NEW TOUCH DELAY PARAMETERS

NEW TOUCH DELAY: This parameter controls the delay, or latency, between a new touch event and when the touchscreen reports the data. The lower the touch delay, the faster the screen reports new touch events. The higher the touch delay, the longer the screen waits to confirm that the new touch event is valid and doesn't disappear. This parameter is useful when trying to eliminate glitches or erroneous touches caused by environmental contamination such as splashing rain etc. This parameter is also useful when the application requires a certainty that a touch event was intended by the user, such as a financial application. Here are some sample values for various use conditions:

Value	Result
0	Can detect a credit card tapping or bouncing off the screen
3	Can detect a finger tapping or bouncing off the screen
5	Requires the user to intentionally press down
10+	Requires a touch with a noticeable delay

For IR interference, try setting New Touch Delay to 1-2 frames. This parameter will reduce the random ghost touches that occur due to IR Interference.

3.3 LIQUID PARAMETERS

Since ShadowSense technology is capable of detecting the transparency of a touch, it is able to differentiate between a solid object like a user's finger and a drop of water or translucent liquid. This is particularly useful in applications where ghost touches and errors caused by liquid, rain and other contaminants need to be rejected.

The **Liquid Rejection** Algorithm automatically configures the screen to reject the rain/liquid and switch back to normal operation in ideal conditions. There are three modes for the algorithm:

- DISABLED – Algorithm never turns on.
- AUTO DETECT LIQUID – Automatically detects liquid based on a set of conditions and turns on the high noise liquid rejection algorithm.
- ALWAYS ON – Permanently keeps the high noise liquid rejection algorithm on. If the algorithm is left on during normal operation, it can severely impact the multi touch performance of the screen when rain is not present.

If the user selects AUTO DETECT option, additional parameters can be configured. The liquid auto-detection algorithm works by trying to understand when the touch screen is subjected to water and other liquid contaminants. In general, rain or water will cover a large area of the screen in a short period of time, versus a user's finger which is a localized touch that does not cover a large percentage of the screen. The transparency of objects in the touch area is used to distinguish liquids from solid objects.

For IR interference, try setting Liquid Rejection Mode to 'Always On'. This is recommended for applications where PEN and Eraser are not needed.

3.4 IR FREQUENCY MODIFIER PARAMETER (FIRMWARE 10.01 AND ABOVE)

FREQUENCY MODIFIER: This parameter adds a special modifier to the touch frame LED strobe frequency. Adjust this slider to reduce the interference between an IR remote and the touch frame.

Note: Every 9 counts of this parameter add 1 µs to the IR strobe wavelength.

(The IR Frequency Modifier is intended to reduce interference between the frame's IR light and an IR remote control, sometimes adjusting this parameter can help reduce interference between adjacent touch frames.)

For IR interference, try setting the IR Frequency Modifier to a different setting on the adjacent (or middle screen for 3 monitor setups), but leave the other screen(s) on the default setting.

3.5 MINIMUM SHADOW

MINIMUM SHADOW: This parameter defines the edges of the shadow and controls the point at which the shadow ends and becomes background ambient light. The background levels can be noisy due to environmental factors such as water droplets, dust and high ambient light. In this situation, noise can be introduced into the calculation of the touch point as well. The lower this value, the more accurate the system will be as a large percentage of the energy of the shadow was used for calculation. The higher this value, the stability of the touch point will be increased in a noisy environment at the loss of resolution and accuracy of the touch data.

Value	Result
2%	Highly accurate, but small drops of water can result in noisy data.
5%	Impervious to small drops of water and contaminants.
10%	Insensitive to large drops of splashing water and other dark liquids such as coffee etc.

For IR interference, try increasing the Minimum Shadow to 11-15%.