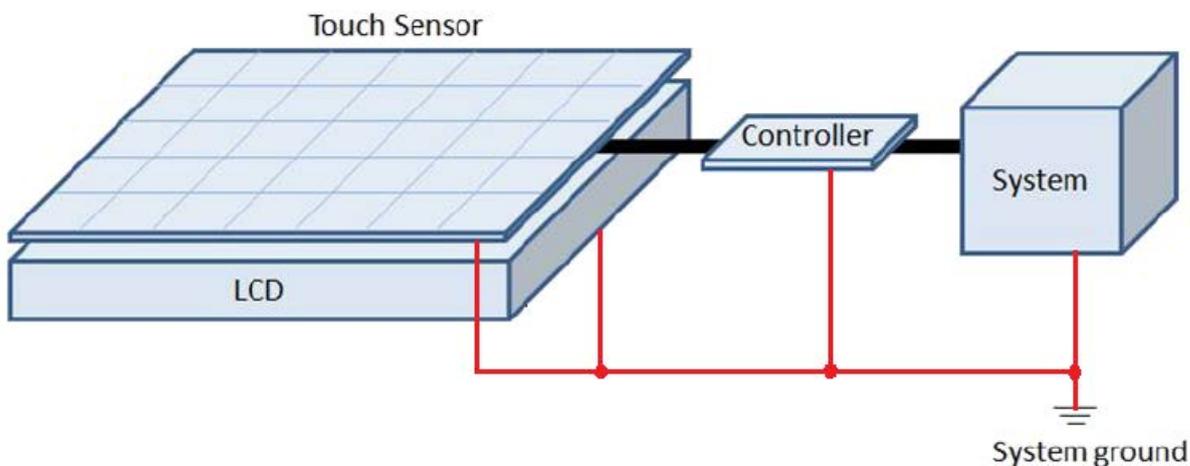


Technical Bulletin: EMI Shielding with PCT Sensors

All Dawar PCT sensors with any existing type of controller (EXC7200, EXC3000, SSD2541/SSD2543) can have an EMI shield added to the rear of the sensor to help achieve better EMI performance. This paper describes the influence of EMI shielding. Variables of the touch sensor design and intended use, such as cover lens thickness, bare finger touch or thick glove touch, and panel size are discussed with regard to touch performance.

Adding a shielding layer on the back of the panel is one of the effective methods to reduce electromagnetic interference (EMI), whether it is radiated from within the device or entering the device from the outside.

Proper grounding provides a discharge path for induced charge on any conductive part that does not belong to the electronic circuit. The touch panel shield layer and LCD bezel must be reliably connected to the system ground (usually the earth ground).



- Because the shielding layer is at ground and is close to the touch screen, it can change the touch panel's stray capacitance, causing the baseline signal (without touch) to increase. In some cases this stray capacitance could result in saturation of the signal. Higher driving voltages and a proper signal conditioning circuit can avoid this saturation problem. This is usually accomplished through the fine tuning process. It will be discussed in detail for the 7200 controller below.

- In larger panel sizes, the far end has the longest ITO channel length and the near end has shortest ITO channel length. Therefore, the far end has larger channel resistance than the near end, causing the touch signal strength to not be evenly distributed. This can also be solved by the fine-tuning process.
- Thicker cover lenses or thick gloves will weaken the touch signal. A thicker cover lens together with a thick glove makes the touch signal extremely weak. During the tuning process, signal strength, noise margin and touch threshold settings are closely related. The touch threshold must be lower than the minimum touch signal strength and higher than the maximum noise level. Because the signal strength is weak, the noise margin is small. See Figure 1. All three controllers (EXC7200, EXC3000, SSD2541/SSD2543) have a low noise margin compared to bare-finger application cases. In a noisy environment, if the maximum noise level is greater than the threshold, false touches can occur.



The paragraph written in an internal tuning document cited below can be used as a rule of thumb for thick glove applications in both shielded and un-shielded cases.

“..... In glove application, the controller needs to be adjusted to a more sensitive level. As a result, the controller is also more sensitive to noise. The customer should separate the normal finger application and glove application; avoid glove application in a noisy environment.”.



- Driver signal amplitude and waveform

| | | |
|----------------------|-------------------|--------------------------------------|
| EXC3000 | EXC3000 | SSD2541/2543 |
| 3.3V square waveform | 18V sine waveform | 5.5V ~ 9V square waveform selectable |

The following shielded panels were bench-tested and touch performance is acceptable. Please notice that it is tested under a less-noisy condition (sensor only bench test and without LCD).

EXC7200:

- DW00011: 12.1" X35/Y22 panel, COF, 3mm cover lens, thick glove.
- DW00017: 19" X51/Y41 panel, 1+3 board, 2mm integrated cover lens, thick glove.
- DW00017: 19" X51/Y41 panel, 1+3 board, 2mm integrated + extra 1.1mm cover, thick glove.

EXC3000:

- DW01127: 10.1"W X28/Y18 panel, COF, 1.1mm cover lens, thick glove.
- DW00015: 17" X51/Y41 panel, MCU+1(EX5418)+2(EX5962) board, 3mm cover, thick glove.

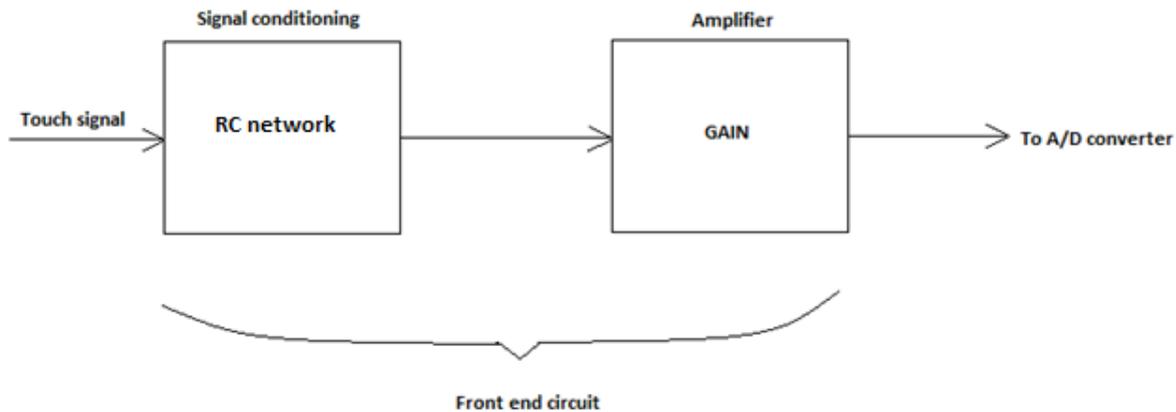
SSD2541/2543:

- CT10175: 7" X20/Y12 3mm cover lens, thick glove.
- CT10226: 15" X40/Y30 2mm cover lens, thick glove.

Special shielding considerations for different brand of controllers:

- **EXC7200**

Unlike the EXC3000 and SSD controllers, in which the A/D converter front-end circuit is embedded into chip and the front-end circuit parameters can be selected by tuning process, the EXC7200's front-end circuit is on the controller board and the signal conditioning RC values and amplifier's GAIN are fixed in a particular control board. See Figure 2. Moreover, the EXC7200 driver voltage is 3.3V only (EXC3000 is 18V and SSD is 5.5V—9V selectable). If the amplifier has a larger GAIN and the signal output from signal conditioning is larger, it is likely to result in saturation of the signals. However, it is possible to change the value of the front-end components to tailor the performance for a particular shielded application.



Note: The cover lens placement is critical. Improper placement will result in the edge channels becoming saturated. The earth ground connecting point should be made on a side opposite to the drive traces and away from the tails. A connection from any perimeter conductor on the circuits to ground should be avoided. For example, any grounded copper tape should be placed to avoid contacting ITO on the circuit glass surfaces.

- **EXC3000**

The ground connection requirement is very strict. Any un-reliable ground connection will cause the touch screen to malfunction. This system needs 3 tuning processes: 1. Panel with cover lens; 2. Panel + LCD; and 3. Entire system. Any change of condition will require the system to be re-tuned.

- **SSD2541/2543**

In the case of an unshielded sensor, the cover lens thickness should be less than 1.5mm for copper stick probe “touch”. It is possible to make an application using thick glove with 3mm cover lens function properly for a panel ≤ 12.1 ”, but a larger touch pressure is needed with a larger screen size and the noise margin is extremely low. It is possible to achieve proper sensor function for a 3mm lens with a bare finger and possible to tune an application using a thick glove with a 1.1mm cover lens.



Based on bench test results, the following table (see Table 1) can be used as a guide for determining the maximum cover lens thickness for bare finger or for a thick glove touch application. It is important to note that this is only a reference. In reality, there are many factors, such as noise level, glove type, touch pressure, etc., that will affect the cover lens thickness selection. The customer must determine the suitability for their end use of any particular PCT system design. Dawar recommends that a fully functional system be sent to Dawar for tuning and optimization by Dawar’s application engineers.

| cover lens thickness controller type | panel size | <=10.1" | | 10.4" ~ 12.1" | | >=15" | |
|---|------------|-------------|-------------|---------------|-------------|-------------|-------------|
| | | Bare finger | Thick glove | Bare finger | Thick glove | Bare finger | Thick glove |
| EXC7200 | | 3mm | 3mm | 3mm | 3mm | 3mm | 3mm |
| EXC3000 | | 3mm | 3mm | 3mm | 3mm | 3mm | 3mm |
| SSD2542/2543 | | 3mm | 1.5mm | 3mm | 1.5mm | 3mm | 1.5mm |

Table 1

The data, guidelines and suggestions in the foregoing document are based on extrapolations of bench testing of sensors and controllers laying on a flat test bench surface and not integrated with a display or any final unit. The variations of integrations are too numerous to be able to definitively determine the final performance of any particular design or integration. The customer must determine the suitability for their end use for any particular PCT system design.