



NEONODE® Touch Sensor Module Specifications

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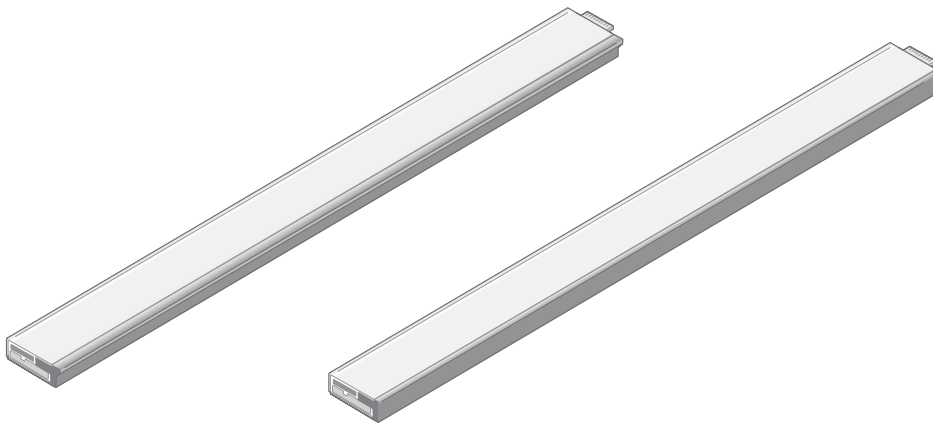
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2 Introduction

2.1 Product Overview

The Neonode Touch Sensor Module is a laser light based touch sensor module that can be integrated and used in various applications. The sensor module's characteristics are high scanning frequency, low latency, good touch accuracy and it can be used on any surface or even in-air. The Touch Sensor Module can be connected to the host system through a standard connector and communicate through a standard I2C or USB interface.



2.1.1 Main Features

- Enables touch on any surface or in-air
- Dual touch support
- High scanning frequency – up to 200Hz or more depending on sensor modules length
- Low touch latency
- High touch accuracy
- Idle mode for reduced current power consumption
- Configurable touch active area
- I2C and USB interface
- Standard 5V power supply

2.2 Product Variants

In order to fit in a wide range of applications, the Touch Sensor Module exists in two types, one for horizontal and one for vertical integration, and a number of different lengths.



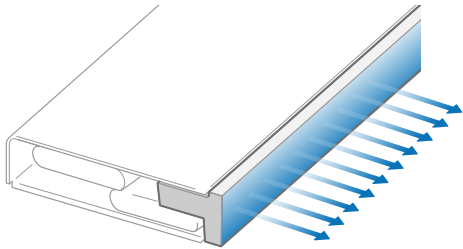
If the variant you are interested in is not available for purchase from your distributor, please contact the distributor or a Neonode sales representative (refer to www.neonode.com¹) for more information.

¹ <http://www.neonode.com/>

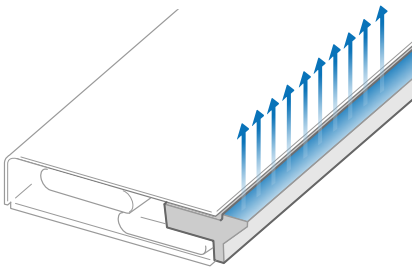
2.2.1 Sensor Module Orientation

The Touch Sensor Module is available in two types, one where the active area emerges straight out from the sensor module (0° type) and one where it emerges out from the sensor module at a 90° angle (90° type). This enables both vertical and horizontal integration.

0° Type



90° Type



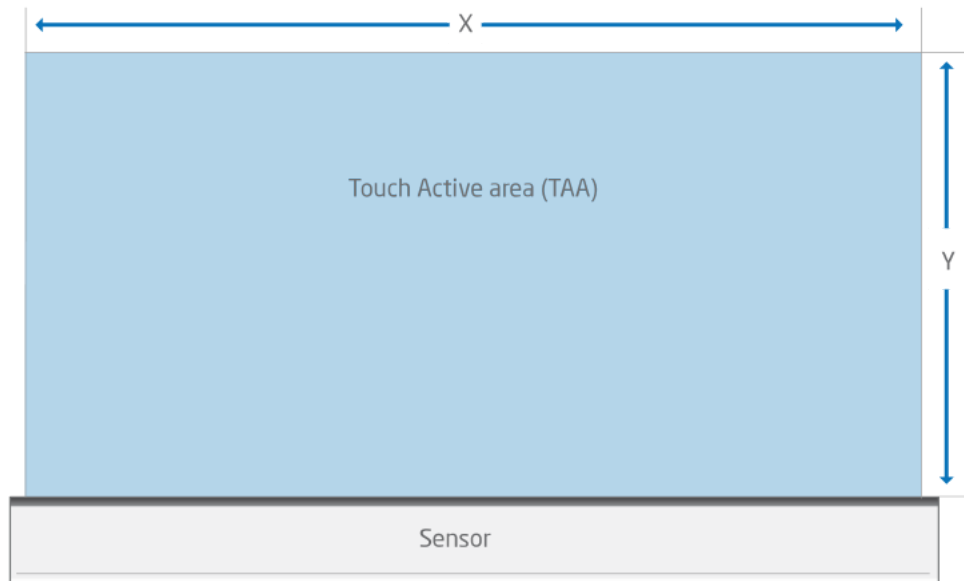
2.2.2 Sensor Module Length

The Touch Sensor Module is available in 43 different lengths. The length affects the Touch Active Area (TAA) in both X and Y directions.

2.2.3 Touch Active Area

The tables list all product variants, the product number, the TAA, and, if applicable, the TAA with Extended Range for each variant. See also [Mechanical Data \(see page 24\)](#).

Sensor modules with $X \geq 237.6$ mm are long enough to use a scanning pattern that extends the active area in the Y-direction. The use of the Extended Range scanning pattern is supported from different firmware versions for different product variants, see the following tables.. Extended Range can affect the power consumption and the accuracy.



| Product Number | | TAA (mm) | |
|----------------|---------------|----------|-------|
| 0° Type | 90° Type | X | Y |
| NNAMC0430PC01 | NNAMC0431PC01 | 43.2 | 14.9 |
| NNAMC0500PC01 | NNAMC0501PC01 | 50.4 | 29.8 |
| NNAMC0580PC01 | NNAMC0581PC01 | 57.6 | 29.8 |
| NNAMC0640PC01 | NNAMC0641PC01 | 64.8 | 44.7 |
| NNAMC0720PC01 | NNAMC0721PC01 | 72 | 44.7 |
| NNAMC0790PC01 | NNAMC0791PC01 | 79.2 | 59.6 |
| NNAMC0860PC01 | NNAMC0861PC01 | 86.4 | 59.6 |
| NNAMC0940PC01 | NNAMC0941PC01 | 93.6 | 74.5 |
| NNAMC1010PC01 | NNAMC1011PC01 | 100.8 | 74.5 |
| NNAMC1080PC01 | NNAMC1081PC01 | 108 | 89.4 |
| NNAMC1150PC01 | NNAMC1151PC01 | 115.2 | 89.4 |
| NNAMC1220PC01 | NNAMC1221PC01 | 122.4 | 104.3 |
| NNAMC1300PC01 | NNAMC1301PC01 | 129.6 | 104.3 |

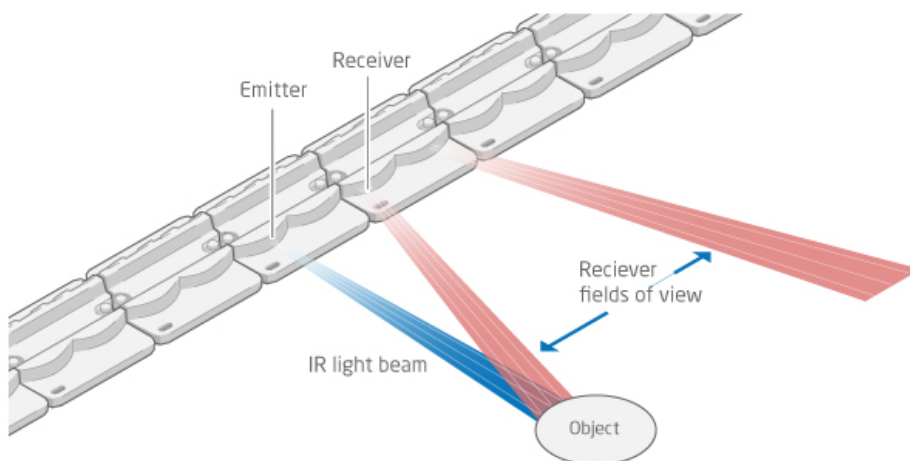
| Product Number | | TAA (mm) | |
|----------------|---------------|----------|-------|
| 0° Type | 90° Type | X | Y |
| NNAMC1370PC01 | NNAMC1371PC01 | 136.8 | 119.2 |
| NNAMC1440PC01 | NNAMC1441PC01 | 144 | 119.2 |
| NNAMC1510PC01 | NNAMC1511PC01 | 151.2 | 134.0 |
| NNAMC1580PC01 | NNAMC1581PC01 | 158.4 | 134.0 |
| NNAMC1660PC01 | NNAMC1661PC01 | 165.6 | 148.9 |
| NNAMC1730PC01 | NNAMC1731PC01 | 172.8 | 148.9 |
| NNAMC1800PC01 | NNAMC1801PC01 | 180 | 163.8 |
| NNAMC1870PC01 | NNAMC1871PC01 | 187.2 | 163.8 |
| NNAMC1940PC01 | NNAMC1941PC01 | 194.4 | 178.7 |
| NNAMC2020PC01 | NNAMC2021PC01 | 201.6 | 178.7 |
| NNAMC2090PC01 | NNAMC2091PC01 | 208.8 | 193.6 |
| NNAMC2160PC01 | NNAMC2161PC01 | 216 | 193.6 |
| NNAMC2230PC01 | NNAMC2231PC01 | 223.2 | 208.5 |
| NNAMC2300PC01 | NNAMC2301PC01 | 230.4 | 208.5 |

| Product Number | | TAA (mm) | | TAA, Extended Range (mm) | | |
|----------------|---------------|----------|-------|--------------------------|---|-----------------------|
| 0° Type | 90° Type | X | Y | X | Y | From Firmware Version |
| NNAMC2380PC01 | NNAMC2381PC01 | 237.6 | 208.5 | Available on request | | |
| NNAMC2450PC01 | NNAMC2451PC01 | 244.8 | 208.5 | Available on request | | |
| NNAMC2520PC01 | NNAMC2521PC01 | 252 | 208.5 | Available on request | | |
| NNAMC2590PC01 | NNAMC2591PC01 | 259.2 | 208.5 | Available on request | | |
| NNAMC2660PC01 | NNAMC2661PC01 | 266.4 | 208.5 | Available on request | | |
| NNAMC2740PC01 | NNAMC2741PC01 | 273.6 | 208.5 | Available on request | | |
| NNAMC2810PC01 | NNAMC2811PC01 | 280.8 | 208.5 | Available on request | | |

| Product Number | | TAA (mm) | | TAA, Extended Range (mm) | | |
|----------------|---------------|----------|-------|--------------------------|-------|-----------------------|
| 0° Type | 90° Type | X | Y | X | Y | From Firmware Version |
| NNAMC2880PC01 | NNAMC2881PC01 | 288 | 208.5 | Available on request | | |
| NNAMC2950PC01 | NNAMC2951PC01 | 295.2 | 208.5 | Available on request | | |
| NNAMC3020PC01 | NNAMC3021PC01 | 302.4 | 208.5 | Available on request | | |
| NNAMC3100PC01 | NNAMC3101PC01 | 309.6 | 208.5 | Available on request | | |
| NNAMC3170PC01 | NNAMC3171PC01 | 316.8 | 208.5 | Available on request | | |
| NNAMC3240PC01 | NNAMC3241PC01 | 324 | 208.5 | Available on request | | |
| NNAMC3310PC01 | NNAMC3311PC01 | 331.2 | 208.5 | Available on request | | |
| NNAMC3380PC01 | NNAMC3381PC01 | 338.4 | 208.5 | Available on request | | |
| NNAMC3460PC01 | NNAMC3461PC01 | 345.6 | 208.5 | 345.6 | 327.7 | v1.49 |

Basic Principles

The Neonode Touch Sensor Module detect and trace objects by detecting diffusely reflected infrared light. The sensor module comprises an optical system arranged to combine emitted IR beams and receiver fields of view within the same apertures. IR light beams are emitted perpendicular to the output window, while receivers field of view is centered at a certain angle left and right.

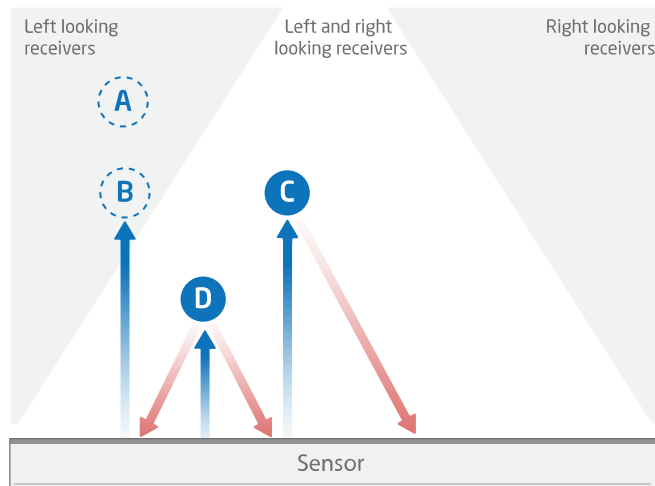


Each emitter-receiver combination covers a narrow region on the active area. An object present in the active area will affect several emitter-receiver channels, and the reported coordinates is the outcome of a center of gravity calculation on these signals.

2.3 Multi-Touch Functionality

The Touch Sensor Module determine an object's position by signals derived from emitter-receiver pairs and have the capacity to detect and track several objects at the same time. Both the hardware and the software have been optimized in order to support standard touch gestures like, pinch-to-zoom, rotate, swipe and tap. However, some combinations of two or more objects might require special consideration, which is described in more detail below.

2.3.1 Shadows



- An object directly behind another object cannot be illuminated. In the figure above, object A will not be detected since illumination is blocked by object B.
- The correct receiver must have a clear field of view. Object B is in a region covered only by left looking receivers. Object B will not be detected because its field of view is blocked by object D.
- Object C may be seen by both left and right looking receivers. Although the right looking field of view is blocked by object D, object C is detected by the left looking receiver.
- Object D is detected by both left and right looking receivers.

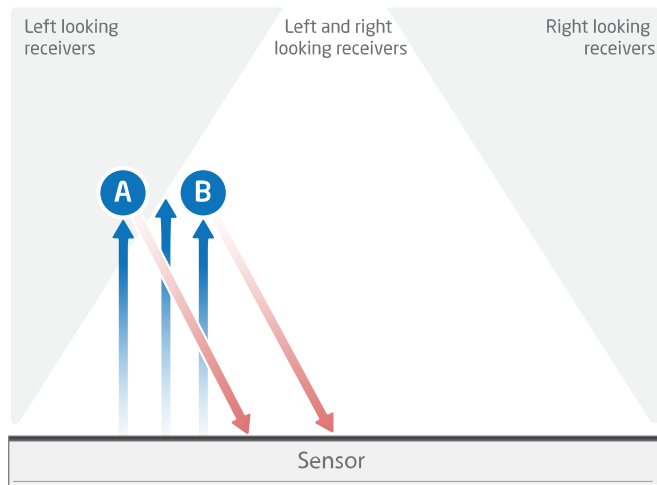
Shadow Trick

Note that in most cases, user experience is not affected by the shadow situations mentioned above. This is because of a functionality implemented in the sensor module's firmware called "shadow trick", which e.g. generates a smooth "rotate" feeling despite one touch object being shadowed during the rotate gesture. A previously detected object that can no longer be detected is still reported as present if:

- The object was last seen close to a location where it could be shadowed by another object.
- The potentially shadowing object is still detected and hasn't moved away from a shadowing location.

The shadow trick make multi-touch gestures such as "rotate" and "pinch-to-zoom" work better.

2.3.2 Adjacent Objects

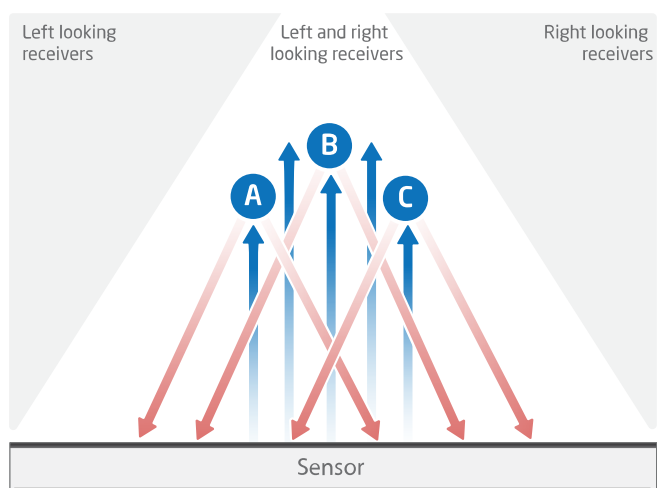


- In order to recognize two objects close to each other (A and B), a separation must allow at least one emitter-receiver channel (~10 mm) to pass freely between them. Otherwise, the two objects will be reported as one large object.

2.3.3 More Than Two Objects

When more than two objects are being tracked the likelihood that an object ends up being in the shadow of another object increases. Therefore, it is only recommended to enable more than two tracked objects if, for example:

- it is not vital to track all detected objects 100% in all possible combinations and locations at all time.
- When all objects are likely to be detected by the sensor module, for example when it is expected that all objects will be placed along a line that is parallel to the sensor module, as in the example below.



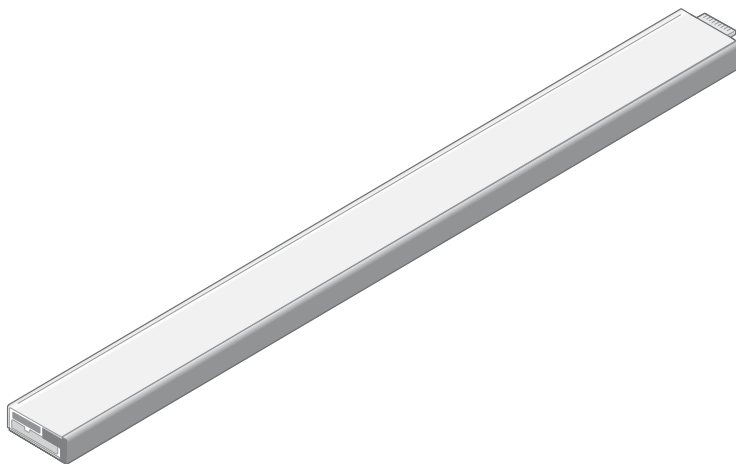
2.4 Applications

The Touch Sensor Module can be integrated for a wide range of applications, such as:

- PCs/Tablets
- TVs/Monitors
- Printers
- Mechanical key replacement
- White goods
- Smart furniture
- Interactive mirrors
- Elevator panels
- eReaders
- Instruments
- Vending Machines
- ATM/POS terminals
- Robotics
- Range finders
- Collision detectors
- ... and much more

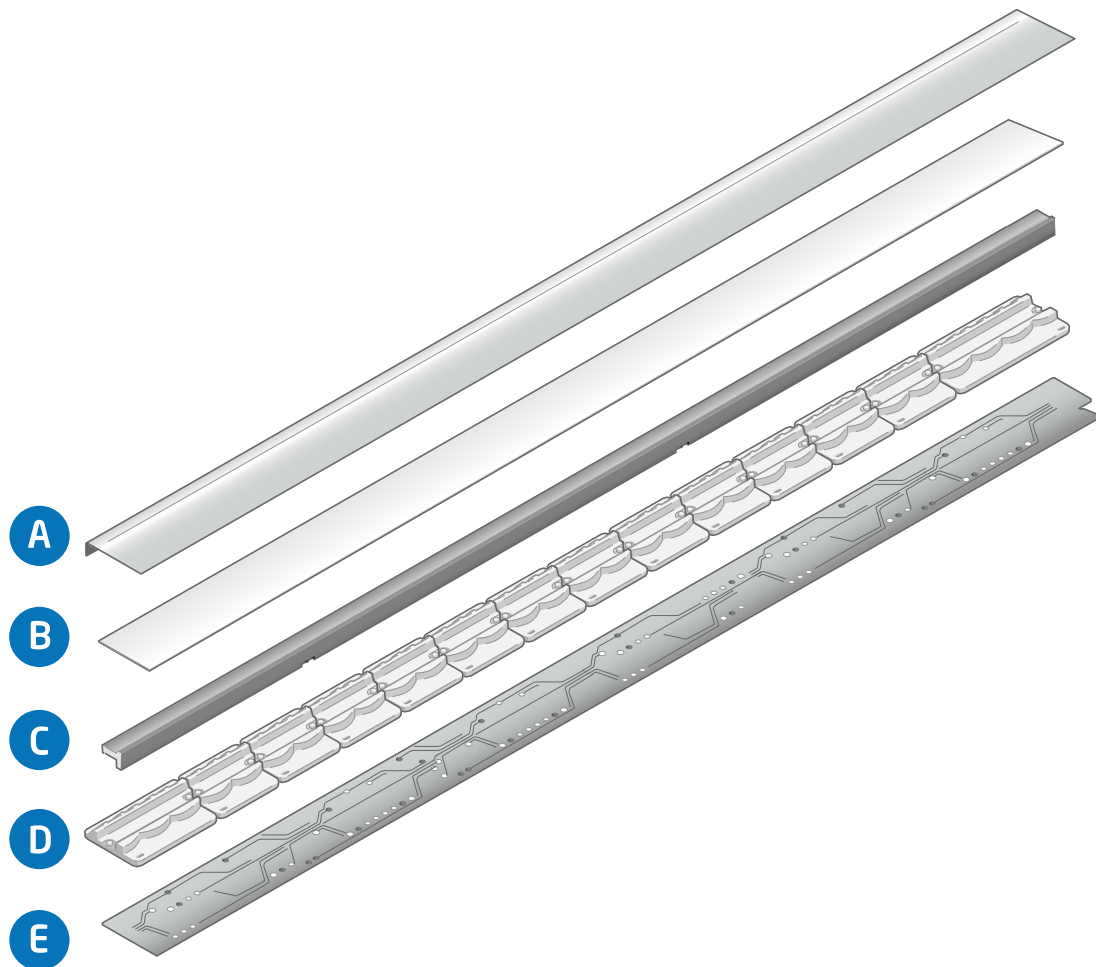
2.5 Sensor Module Design and Components

The Touch Sensor Module is a laser light based touch sensor module that can be used for various touch and in-air detection applications. The image below show the sensor module design (0° type). The connector is shown to the far right.



2.5.1 Exploded view

The image below shows the sensor module (0° type) in an exploded view.



| Part | Description |
|------|--|
| A | Cover |
| B | Adhesive |
| C | Front light pipe – straight shooting or 90 degree shooting depending on sensor module's type |
| D | Lenses - the amount depends on sensor module's length |
| E | PCBA |

2.5.2 Sensor Module Components

The PCBA is equipped with both active and passive components, for example:

- MCU
- Co-processor, a Neonode proprietary scanning IC
- Optical lenses, made out of polycarbonate
- VCSELs
- Photodiodes
- Other passive components

2.6 Product Integration

The Touch Sensor Module can be integrated into any host system through a physical connector with 8 contact pads. The connector supports both I2C and USB HID.

The sensor module communicates with messages that are defined in ASN.1-notation. ASN.1 is a standardized way (ISO/IEC 8824) to describe data regardless of language implementation, hardware system and operation system. The host system can communicate with the sensor module using the [zForce communication protocol](https://support.neonode.com/docs/display/AIRTSUsersGuide/zForce+Communication+Protocol).²

To facilitate integration, Neonode has developed function libraries that are available for download.

² <https://support.neonode.com/docs/display/AIRTSUsersGuide/zForce+Communication+Protocol>

3 Specifications

3.1 Specifications Summary

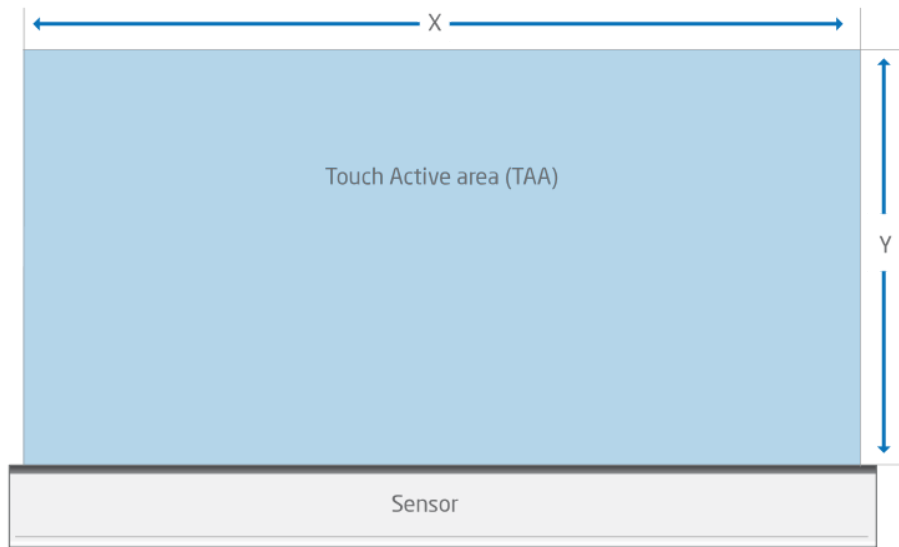
3.1.1 Touch Performance Specification

| Item | Specification |
|--------------------------------|---|
| Input methods | Finger, hand or glove. |
| Minimum object size (diameter) | 5 mm |
| Number of touch objects | 1, 2, or more, depending on application |
| Touch resolution | 0.1 mm |
| Touch activation force | 0 N (no activation force required) |
| Touch Active Area | Up to 345.6 x 327.7 mm. For details, refer to information on product variants in Introduction (see page 5). |
| Response time | ~50 ms (initial touch, at 33 Hz in idle mode) 10 ms (continuous tracking, at 100 Hz in active mode) |
| Scanning frequency | Configurable up to 900 Hz, depending on product variant. For details, refer to Touch Performance (see page 18). |

Touch accuracy

The specified values are valid for the used test setup. For more information, refer to [Performance Test Methods](#)³. The touch accuracy is measured inside the TAA, using a silicone based cylindrical test rod with a diameter of 16 mm.

³ <http://confluence.neonode.local/display/AIRTSUsersGuide/Performance+Test+Methods>



Touch Accuracy for Normal Range Sensor Modules of the 90° and 0° Types

| Product Number | Typical Value (mm) | $\mu \pm 2\sigma$ (mm) |
|----------------|--------------------|------------------------|
| NNAMC346XPC01 | 1.5 | 3.5 |
| NNAMC310XPC01 | 1.5 | 3.5 |
| NNAMC295XPC01 | 1.5 | 3.5 |
| NNAMC230XPC01 | 1.5 | 3.5 |
| NNAMC209XPC01 | 1.5 | 3.5 |
| NNAMC180XPC01 | 1.5 | 3.5 |
| NNAMC158XPC01 | 1.5 | 3.5 |
| NNAMC122XPC01 | 1.5 | 3.5 |
| NNAMC115XPC01 | 1.5 | 4 |

Typical Value: The accuracy on average, within the TAA.

$\mu \pm 2\sigma$: 95% of reported touch positions deviate less than this value. (2σ standard deviation).

Product number: "X" indicates if the sensor module is of type 0° ("0") or 90° ("1").

The accuracy specification (normal range, 0° and 90°) is valid for units produced from 15th January 2020. Please contact our support team for specification regarding earlier produced sensor modules, or general questions about the accuracy specification.

Touch Accuracy for Extended Range Sensor Modules of the 90° and 0° Types

| Product Number | Typical Value (mm) | $\mu \pm 2\sigma$ (mm) |
|----------------|--------------------|------------------------|
| NNAMC346XPC01 | 2.5 ^[1] | 5 ^[1] |

Typical Value: The accuracy on average, within the TAA.

$\mu \pm 2\sigma$: 95% of reported touch positions deviate less than this value. (2 σ standard deviation).

Product number: "X" indicates if the sensor module is of type 0° ("0") or 90° ("1").

[1] Preliminary value.

The accuracy specification (extended range, 0° and 90°) is valid for units produced from 15th January 2020. Please contact our support team for specification regarding earlier produced sensor modules, or general questions about the accuracy specification.

Technical Specification

| Item | Sensor module Variant | Specification |
|---|--|--|
| Module size (LxHxW) | 0° Type | L x 3.46 x 14.5 mm L depending on product variant. |
| | 90° Type | L x 3.46 x 16.05 mm L depending on product variant. |
| Power consumption I2C interface Active mode (100 Hz) | NNAMC0720PC01, NNAMC0721PC01 | 57 mW |
| | NNAMC2090PC01, NNAMC2091PC01 | 80 mW |
| | NNAMC3460PC01, NNAMC3461PC01 | 104 mW |
| | NNAMC3460PC01, NNAMC3461PC01, Extended Range | 135 mW |
| Power consumption I2C interface Idle mode (33 Hz) | NNAMC0720PC01, NNAMC0721PC01 | 44 mW |
| | NNAMC2090PC01, NNAMC2091PC01 | 45 mW |
| | NNAMC3460PC01, NNAMC3461PC01 | 47 mW |

| Item | Sensor module Variant | Specification |
|------|--|---------------|
| | NNAMC3460PC01, NNAMC3461PC01, Extended Range | 61 mW |

3.2 Touch Performance

3.2.1 Touch Object Requirement

The Neonode Touch Sensor Module detect and trace objects by detecting diffusely reflected infrared light.

Requirements on the object to detect include:

- A minimum reflectance of 30% in the near IR-spectrum is needed for proper signal levels, that is, the object can not be too dark.
- Object surface must be diffuse. A glossy or mirror-like object may not scatter enough light towards correct receivers in order to generate a reliable detection.
- An object must be ≥ 5 mm to ensure sufficient signal levels. This is closely related to reflectance. A white, diffuse object may be smaller than a dark, glossy one.

3.2.2 Touch Accuracy

Specification

Measured touch coordinate error in X and Y axis is less or equal than the specified value for about 95% of the cases.

Touch coordinate error data is calculated by subtracting the actual position and measured position in X and Y axis.

Definition

The touch accuracy of the Touch Sensor Module can be described statistically with the normal distribution and a standard deviation of 2 sigma. This means that the touch position reported by the sensor module will deviate less than the specified value in 95% of the cases.

3.2.3 Response Time

The specification of response time reflects the reaction speed of a Touch Sensor Module.

Specification

- **Initial touch:** ~50 ms, at 33 Hz scanning frequency (default frequency in idle mode).

- **Continuous tracking:** 10 ms, at 100 Hz scanning frequency (default frequency in active mode).

Increasing the scanning frequency decreases the response time.

Definition

Initial Touch

The specified response time for the **initial touch** starts from the instant an object is presented in the sensor module's touch active area and stops when the module starts to send the first touch notification for this object. The specified response time consists of two numbers reflecting the best case and the worst case, with the average response time right in the middle.

The response time (t) can be calculated for different idle mode frequencies (f) can be calculated by the formulas below:

Best case: $t = 16 \text{ ms}$

Worst case: $t = 1/f + 16 \text{ ms}$

Average: $t = (1/f + 32 \text{ ms}) / 2$

In touch applications, an object will be detected slightly before it reaches the touch surface, making the perceived response time shorter.

Continuous Tracking

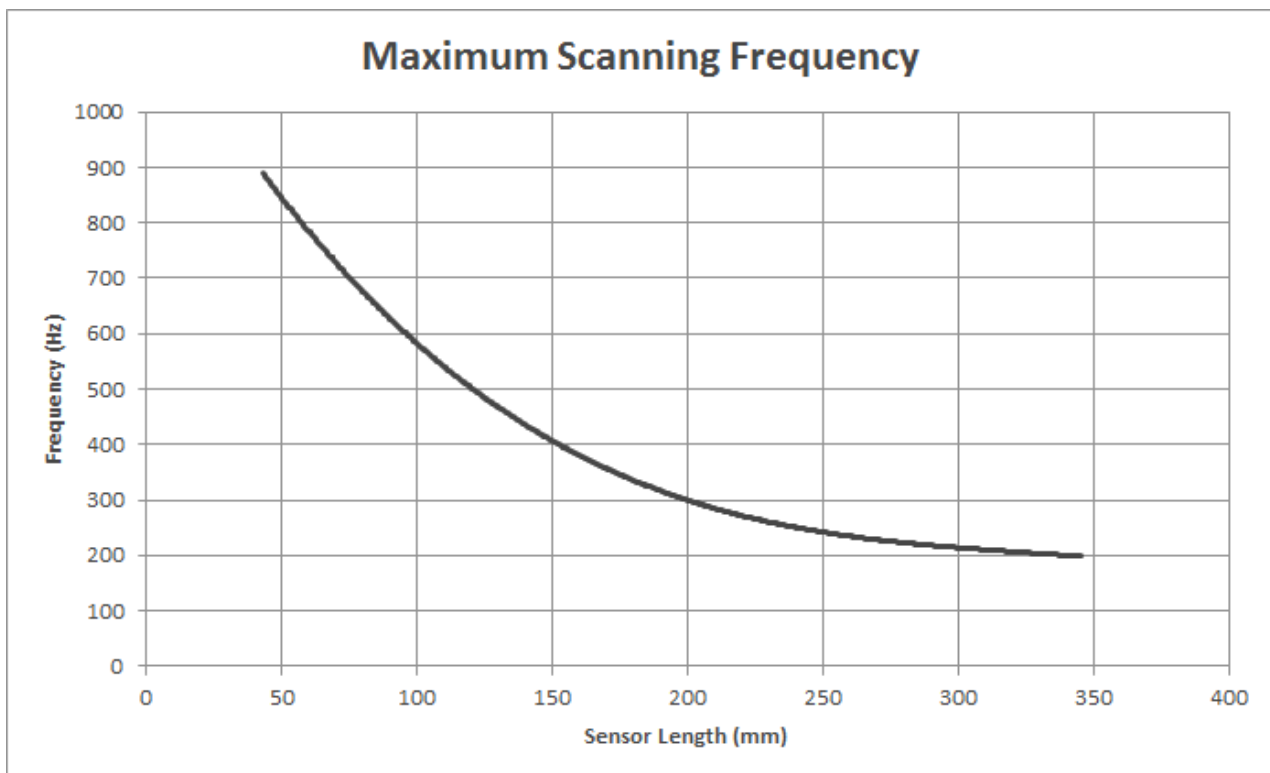
After the first touch notification, the sensor module will **continuously track** and send touch notifications to update the object position. The response time is therefore defined as the time between subsequent touch notifications.

The response time (t) can be calculated for different active mode frequencies (f) can be calculated by the formula below:

$$t = 1/f$$

3.2.4 Scanning Frequency

The scanning frequency can be set using the Neonode API. The default value is 100 Hz in active mode, that is, when an object is detected or tracked. The default value in idle mode, that is, when no object is detected or tracked, is 33 Hz. The maximum scanning frequency depends on the product variant (sensor module's length). See the following chart.

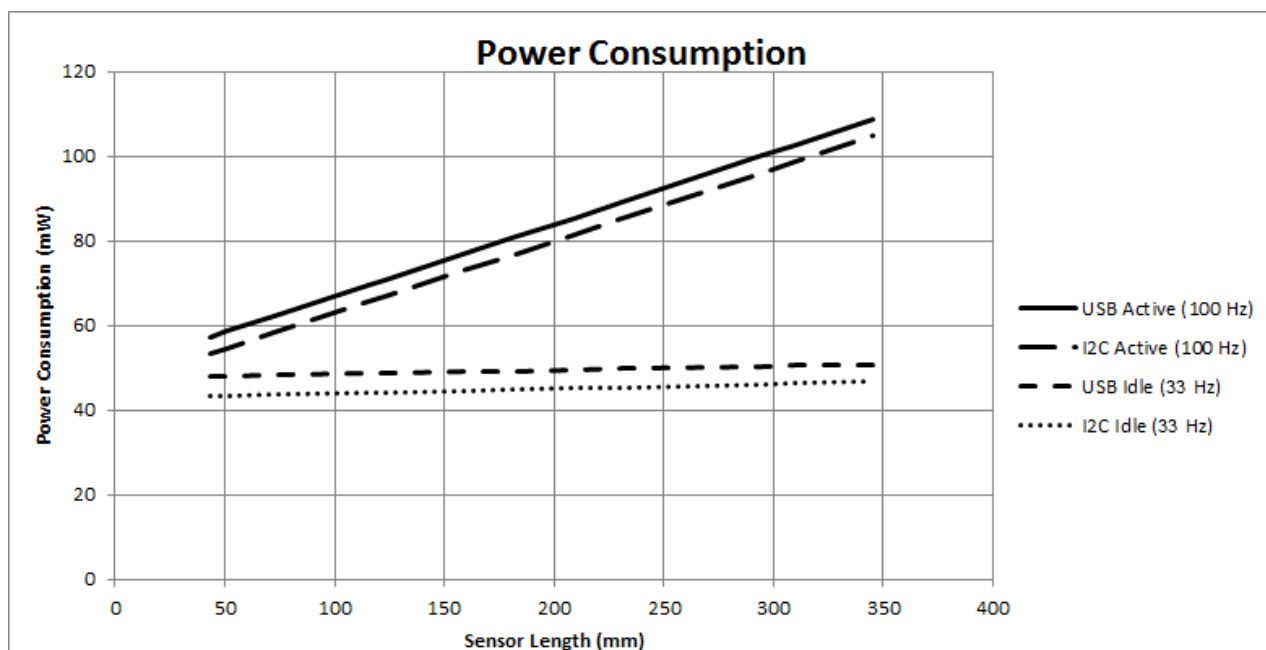


The maximum scanning frequency for product variants NNAMC3460PC01 and NNAMC3461PC01 with Extended Range is 175 Hz.

3.3 Power Consumption

3.3.1 Specification

The graph below shows the power consumption for various sensor module's lengths, in active and idle mode. In active mode, the scanning frequency is set to 100 Hz, and one object is presented in active area. In idle mode the scanning frequency is set to 33 Hz, with a clean active area. With higher scanning frequency or more detected objects, the power consumption might slightly higher than the values in the graph. The sensor module will only be in active mode when a touch object is being detected or tracked.



From firmware version 1.49 and higher, the sensor module types NNAMC3460PC01 and NNAMC3461PC01 are provided with Extended Range, and their power consumption increases 30% in both USB active mode and USB idle mode. The power consumption for module types shorter than 237 mm is not affected by Extended Range.

3.3.2 Definition

The power consumption is calculated from the current consumption when supplying the sensor module with 5 V.

The current consumption is, in turn, defined as the average current that goes through a sensor module. This is measured from the +5V power pin and reflects how much electric energy that is consumed by the whole sensor module. In real time, the current is not a stable value. Since the Touch Sensor Module has a low power consumption design, the processor and some peripheral circuits will switch to sleep mode during the time between two scan periods, to save power. Therefore, the current is frequently changing during run time.

According to the different working modes of the Touch Sensor Module, the current consumption value also changes between Active mode and Idle mode.

3.4 Environmental Requirements

3.4.1 Operating and Storage Conditions

| Condition | Operation | Storage |
|-------------|----------------|----------------|
| Temperature | -20°C to +65°C | -40°C to +85°C |
| Humidity | 5% to 95% | 0% to 95% |

| Condition | Operation | Storage |
|-----------|-----------|---------|
| Altitude | ≤5000 m | ≤15 km |

3.4.2 ESD rating

EN55024

(61000-4-2)

Direct contact discharge: 4 kV

Indirect contact discharge: 4 kV

Air discharge: 8 kV

3.4.3 Agency Approvals

RoHS, IEC60825-1 Class 1

3.5 Electrical Requirements

3.5.1 Absolute Maximum Ratings

| Parameter | Max Rating | Unit |
|---------------------------|-------------|------|
| Supply voltage | -0.3 to 6.0 | V |
| Input voltage on I/O pins | -0.3 to 5.5 | V |

3.5.2 Recommended Operating Conditions

| Parameter | Min | Typ | Max | Unit |
|----------------|------|------|------|------|
| Supply voltage | 4.50 | 5.00 | 5.50 | V |

3.6 Optical Requirements on External Window

Most applications will require an outer cover window, for design cosmetics and protection against dust and humidity.

The optical properties on cover windows placed in front of the Touch Sensor Module are essential in order to maintain a high touch performance. If light is lost, scattered or diverted it will lead to shorter detection range and lower touch accuracy.

3.6.1 Optical Requirements

Window material must be optically clear, without absorption and have optical quality surfaces.

- Transmission: > **88 % at 945nm**
- Haze: < **3%**
- Surface finish: **SP1-A2 (max Ra 0.05µm).**

Proven plastic materials include optical grade acrylic (PMMA) and polycarbonate. For glass windows, transmission at 945 nm must be verified. Many borosilicate glasses (such as Borofloat) work well, but some common window glasses show substantial absorption due to high iron content.

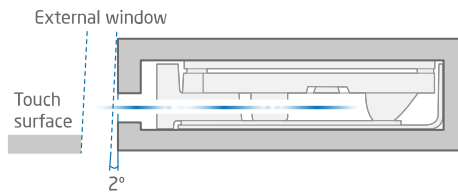
3.6.2 Geometrical Constraints

The Touch Sensor Module is an optical system that both emits and receives IR-light at different incident angles. When the light hits a transparent material, most of the light is transmitted through the material and exit on the other side. But in reality the amount of light being transmitted is angle dependent, why some shape constraints exist on windows placed in front of the sensor module:

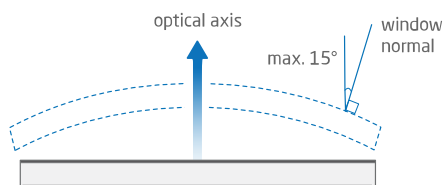
- **Window surfaces must be parallel.**

A wedge, or lens shaped window will shift light beams out of the active area.

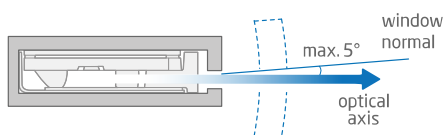
- It is a good practice to install the window at a slight angle ($\sim 2^\circ$) to reduce reflected stray light. See the image below. The angle can be up to approximately 30° without affecting performance.



- A slight curvature on the window can be allowed.
- In x-direction, a maximum angle of 15° between window normal and sensor module's optical axis is recommended, for all parts of the window within the sensor module's TAA.



- In z-direction, the angle should be maximum 5° .



, which corresponds to a minimum radius of 12 mm for the surface closest to the sensor module.

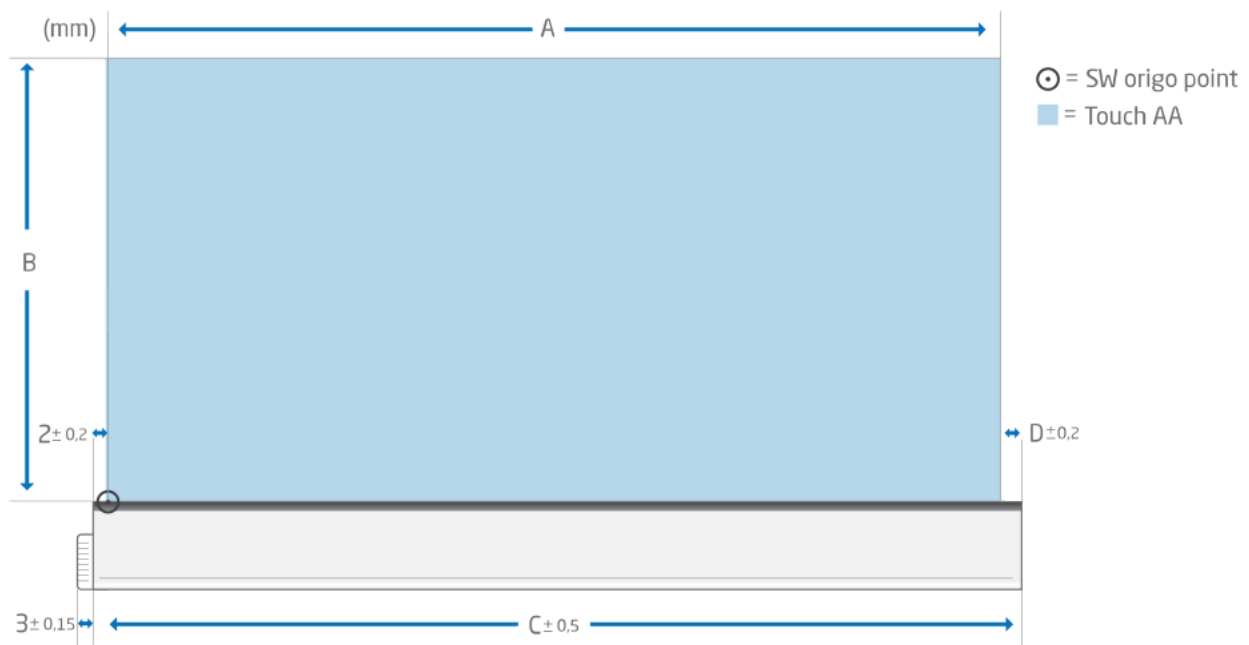
- Keep window thickness as small as mechanically feasible, to reduce absorption losses.

3.7 Mechanical Data

3.7.1 Physical Dimensions and Position of Origin

Top View

Dimensions **C** and **D** vary between the Touch Sensor Module types (0° and 90°) and therefore also the Touch Active Area (TAA) sizes (**A** and **B**). For Touch Sensor Module types with $A \geq 237.6$ mm, dimension B also depends on the installed firmware version.



| Product number | | Measurements (mm) | | | |
|----------------|---------------|-------------------|------|------|-----|
| 0° | 90° | A | B | C | D |
| NNAMC0430PC01 | NNAMC0431PC01 | 43.2 | 14.9 | 47.2 | 2 |
| NNAMC0500PC01 | NNAMC0501PC01 | 50.4 | 29.8 | 55.9 | 3.5 |
| NNAMC0580PC01 | NNAMC0581PC01 | 57.6 | 29.8 | 61.6 | 2 |
| NNAMC0640PC01 | NNAMC0641PC01 | 64.8 | 44.7 | 70.3 | 3.5 |
| NNAMC0720PC01 | NNAMC0721PC01 | 72 | 44.7 | 76 | 2 |

| Product number | | Measurements (mm) | | | |
|----------------|---------------|-------------------|-------|-------|-----|
| 0° | 90° | A | B | C | D |
| NNAMC0790PC01 | NNAMC0791PC01 | 79.2 | 59.6 | 84.7 | 3.5 |
| NNAMC0860PC01 | NNAMC0861PC01 | 86.4 | 59.6 | 90.4 | 2 |
| NNAMC0940PC01 | NNAMC0941PC01 | 93.6 | 74.5 | 99.1 | 3.5 |
| NNAMC1010PC01 | NNAMC1011PC01 | 100.8 | 74.5 | 104.8 | 2 |
| NNAMC1080PC01 | NNAMC1081PC01 | 108 | 89.4 | 113.5 | 3.5 |
| NNAMC1150PC01 | NNAMC1151PC01 | 115.2 | 89.4 | 119.2 | 2 |
| NNAMC1220PC01 | NNAMC1221PC01 | 122.4 | 104.3 | 127.9 | 3.5 |
| NNAMC1300PC01 | NNAMC1301PC01 | 129.6 | 104.3 | 133.6 | 2 |
| NNAMC1370PC01 | NNAMC1371PC01 | 136.8 | 119.2 | 142.3 | 3.5 |
| NNAMC1440PC01 | NNAMC1441PC01 | 144 | 119.2 | 148 | 2 |
| NNAMC1510PC01 | NNAMC1511PC01 | 151.2 | 134.0 | 156.7 | 3.5 |
| NNAMC1580PC01 | NNAMC1581PC01 | 158.4 | 134.0 | 162.4 | 2 |
| NNAMC1660PC01 | NNAMC1661PC01 | 165.6 | 148.9 | 171.1 | 3.5 |
| NNAMC1730PC01 | NNAMC1731PC01 | 172.8 | 148.9 | 176.8 | 2 |
| NNAMC1800PC01 | NNAMC1801PC01 | 180 | 163.8 | 185.5 | 3.5 |
| NNAMC1870PC01 | NNAMC1871PC01 | 187.2 | 163.8 | 191.2 | 2 |
| NNAMC1940PC01 | NNAMC1941PC01 | 194.4 | 178.7 | 199.9 | 3.5 |
| NNAMC2020PC01 | NNAMC2021PC01 | 201.6 | 178.7 | 205.6 | 2 |
| NNAMC2090PC01 | NNAMC2091PC01 | 208.8 | 193.6 | 214.3 | 3.5 |
| NNAMC2160PC01 | NNAMC2161PC01 | 216 | 193.6 | 220 | 2 |
| NNAMC2230PC01 | NNAMC2231PC01 | 223.2 | 208.5 | 228.7 | 3.5 |
| NNAMC2300PC01 | NNAMC2301PC01 | 230.4 | 208.5 | 234.4 | 2 |

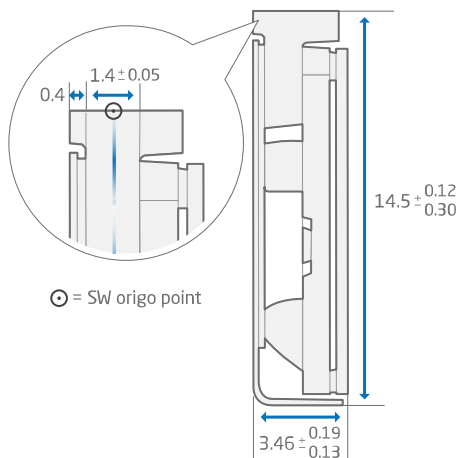
| Product number | | Measurements, Non-Extended Range (mm) | | | | | Measurements, Extended Range (mm) | | | | |
|-------------------|-------------------|---|-----------|-----------|---------|-------------------------------------|--------------------------------------|-------------------------|-----------|---------|-------------------------------------|
| 0° | 90° | A | B | C | D | From Firmw are Versio n | A | B | C | D | From Firmw are Versio n |
| NNAMC2380P C01 | NNAMC2381P C01 | 237 .6 | 208 .5 | 243 .1 | 3. 5 | v1.38 | 237 .6 | Available on request | 243 .1 | 3. 5 | TBA |
| NNAMC2450P C01 | NNAMC2451P C01 | 244 .8 | 208 .5 | 248 .8 | 2 | v1.38 | 244 .8 | Available on request | 248 .8 | 2 | TBA |
| NNAMC2520P C01 | NNAMC2521P C01 | 252 | 208 .5 | 257 .5 | 3. 5 | v1.38 | 252 | Available on request | 257 .5 | 3. 5 | TBA |
| NNAMC2590P C01 | NNAMC2591P C01 | 259 .2 | 208 .5 | 263 .2 | 2 | v1.38 | 259 .2 | Available on request | 263 .2 | 2 | TBA |
| NNAMC2660P C01 | NNAMC2661P C01 | 266 .4 | 208 .5 | 271 .9 | 3. 5 | v1.38 | 266 .4 | Available on request | 271 .9 | 3. 5 | TBA |
| NNAMC2740P C01 | NNAMC2741P C01 | 273 .6 | 208 .5 | 277 .6 | 2 | v1.38 | 273 .6 | Available on request | 277 .6 | 2 | TBA |
| NNAMC2810P C01 | NNAMC2811P C01 | 280 .8 | 208 .5 | 286 .3 | 3. 5 | v1.38 | 280 .8 | Available on request | 286 .3 | 3. 5 | TBA |
| NNAMC2880P C01 | NNAMC2881P C01 | 288 | 208 .5 | 292 | 2 | v1.38 | 288 | Available on request | 292 | 2 | TBA |
| NNAMC2950P C01 | NNAMC2951P C01 | 295 .2 | 208 .5 | 300 .7 | 3. 5 | v1.38 | 295 .2 | Available on request | 300 .7 | 3. 5 | TBA |
| NNAMC3020P C01 | NNAMC3021P C01 | 302 .4 | 208 .5 | 306 .4 | 2 | v1.38 | 302 .4 | Available on request | 306 .4 | 2 | TBA |
| NNAMC3100P C01 | NNAMC3101P C01 | 309 .6 | 208 .5 | 315 .1 | 3. 5 | v1.38 | 309 .6 | Available on request | 315 .1 | 3. 5 | TBA |
| NNAMC3170P C01 | NNAMC3171P C01 | 316 .8 | 208 .5 | 320 .8 | 2 | v1.38 | 316 .8 | Available on request | 320 .8 | 2 | TBA |
| NNAMC3240P C01 | NNAMC3241P C01 | 324 | 208 .5 | 329 .5 | 3. 5 | v1.38 | 324 | Available on request | 329 .5 | 3. 5 | TBA |
| NNAMC3310P C01 | NNAMC3311P C01 | 331 .2 | 208 .5 | 335 .2 | 2 | v1.38 | 331 .2 | Available on request | 335 .2 | 2 | TBA |

| Product number | | Measurements, Non-Extended Range (mm) | | | | | Measurements, Extended Range (mm) | | | | |
|----------------|----------------|---------------------------------------|--------|--------|-----|-------------------------|-----------------------------------|----------------------|--------|-----|-------------------------|
| 0° | 90° | A | B | C | D | From Firmw are Versio n | A | B | C | D | From Firmw are Versio n |
| NNAMC3380P C01 | NNAMC3381P C01 | 338 .4 | 208 .5 | 343 .9 | 3.5 | v1.38 | 338 .4 | Available on request | 343 .9 | 3.5 | TBA |
| NNAMC3460P C01 | NNAMC3461P C01 | 345 .6 | 208 .5 | 349 .6 | 2 | v1.38 | 345 .6 | 327.7 | 349 .6 | 2 | v1.49 |

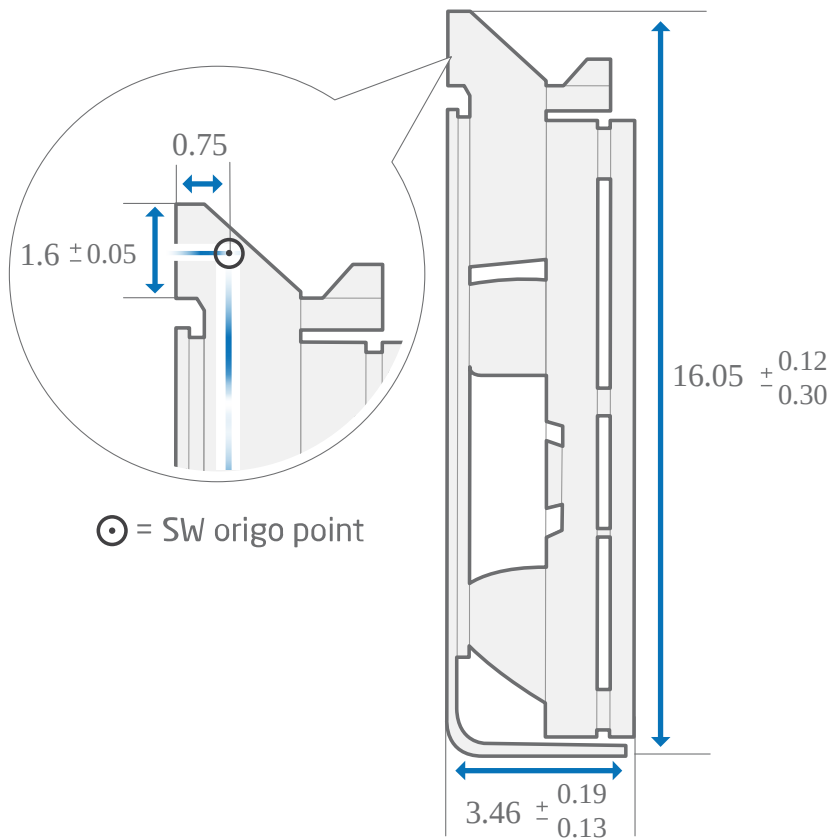
Side View

These measurements are identical for all sensor module's lengths but vary some between the 0° and 90 ° types. The position of origin is marked with "zero software".

0° Type



90 ° Type



3.7.2 Packaging

The Touch Sensor Modules are packed in trays stacked in cardboard boxes. The size of the sensor module determines which tray size that is used.

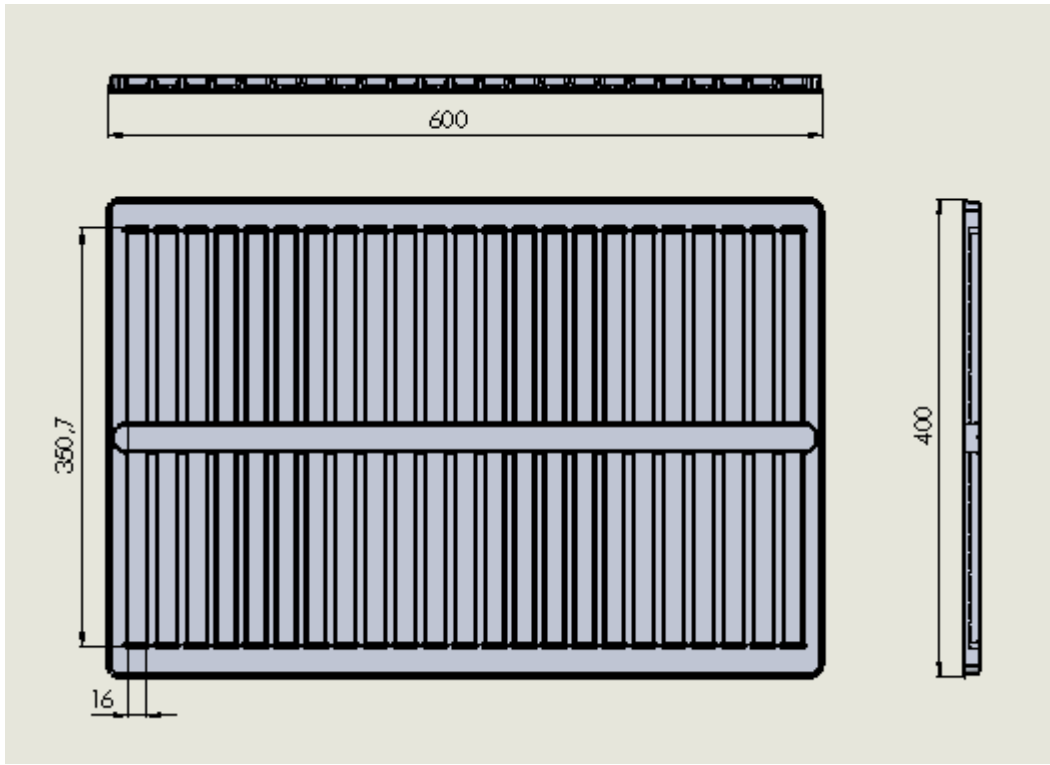
| Sensor Module size | Tray number | Blueprint (link) |
|--------------------|-------------|---|
| 043-122 | 36142 | 36142.EDRW⁴ |
| 130-158 | 36139 | 36139.EDRW⁵ |

⁴ <http://confluence.neonode.local/download/attachments/86937877/36142.EDRW?api=v2&modificationDate=1585822665653&version=1>

⁵ <http://confluence.neonode.local/download/attachments/86937877/36139.EDRW?api=v2&modificationDate=1585822665607&version=1>

| Sensor Module size | Tray number | Blueprint (link) |
|--------------------|-------------|--|
| 166- 266 | 36141 | 36141.EDRW⁶ |
| 274-346 | 36138 | 36138.EDRW⁷ |

The image below shows the tray with number 36138:



⁶ <http://confluence.neonode.local/download/attachments/86937877/36141.EDRW?api=v2&modificationDate=1585822665637&version=1>

⁷ <http://confluence.neonode.local/download/attachments/86937877/36138.EDRW?api=v2&modificationDate=1585822665590&version=1>