IEC 62908-12-20

Edition 1.0 2019-09

INTERNATIONAL STANDARD

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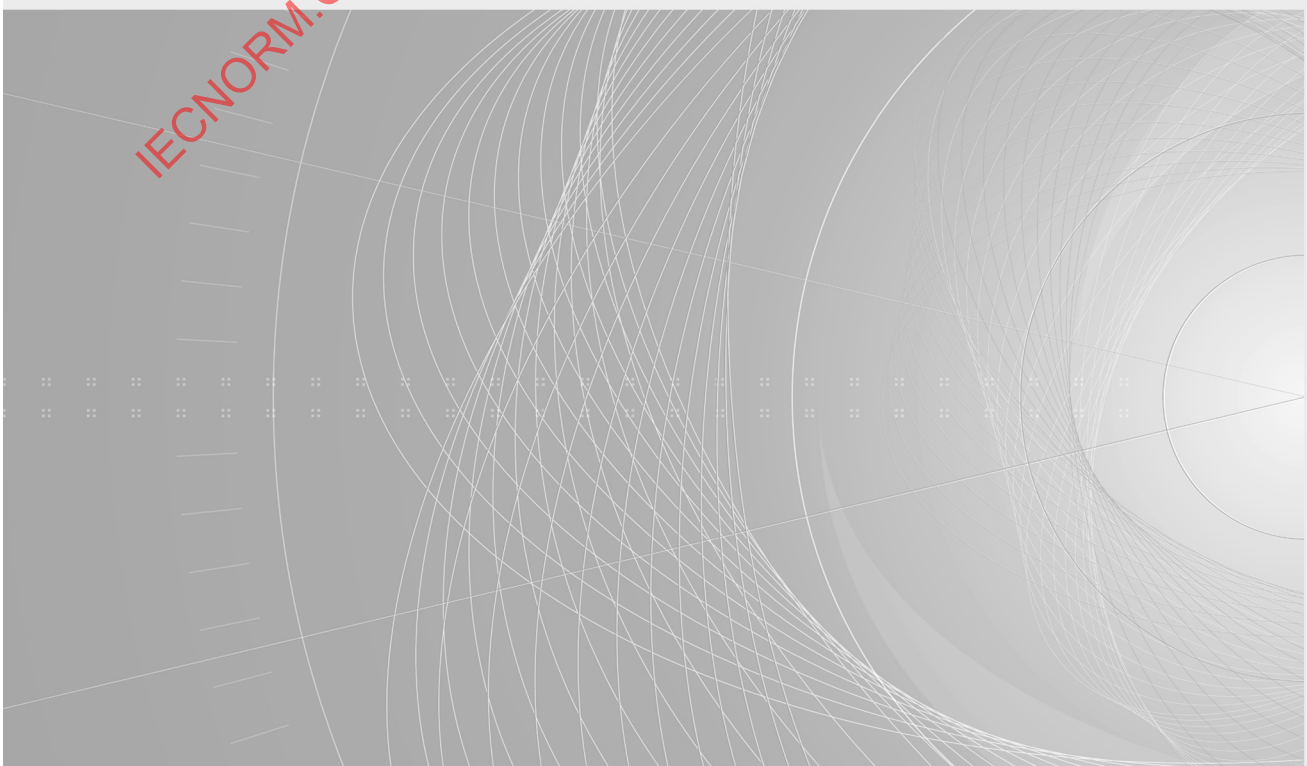
Touch and interactive displays –
Part 12-20: Measurement methods of touch displays – Multi-touch performance



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Part 12-20: Measurement methods of touch displays – Multi-touch performance

FOREWORD

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International Standard IEC 62908-12-20 has been prepared by IEC technical committee 110: Electronic displays.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
110/1129/FDIS	110/1148/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 62908 series, published under the general title *Touch and interactive displays*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

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TOUCH AND INTERACTIVE DISPLAYS –

Part 12-20: Measurement methods of touch displays – Multi-touch performance

1 Scope

This part of IEC 62908 specifies the standard measuring conditions and measurement methods for the multi-touch performance of a touch sensor module. This document is applicable to touch sensor modules, where the structural relationship between the touch sensor, touch controller, touch sensor module, display panel, touch display panel, and touch display module is defined in IEC 62908-1-2.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60068-1, *Environmental testing – Part 1: General and guidance*

IEC 62908-1-2, *Touch and interactive displays – Part 1-2: Generic – Terminology and letter symbols*

IEC 62908-12-10, *Touch and interactive displays – Part 12-10: Measurement methods of touch displays – Touch and electrical performance*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60068-1 and IEC 62908-1-2 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

4 Standard measuring conditions

4.1 Standard environmental conditions

Measurements shall be carried out under the standard environmental conditions:

– temperature: 25 ºC ± 3 ºC,
– relative humidity: 25 % RH to 85 % RH,
– atmospheric pressure: 86 kPa to 106 kPa.

When different environmental conditions are used, they shall be noted in the measurement report.

4.2 Measuring equipment

The measuring equipment consists of two or more test bars, a moving arm and a stage, as shown in Figure 1. The measuring equipment provides the actual touched coordinates, and the touch sensor module reports the touched coordinates detected. The moving speed of the arm is controlled by a motor and can be set up before the test. All of the measuring items in this document are conducted on this kind of equipment, and any additional equipment parts used in measurement shall be reported.

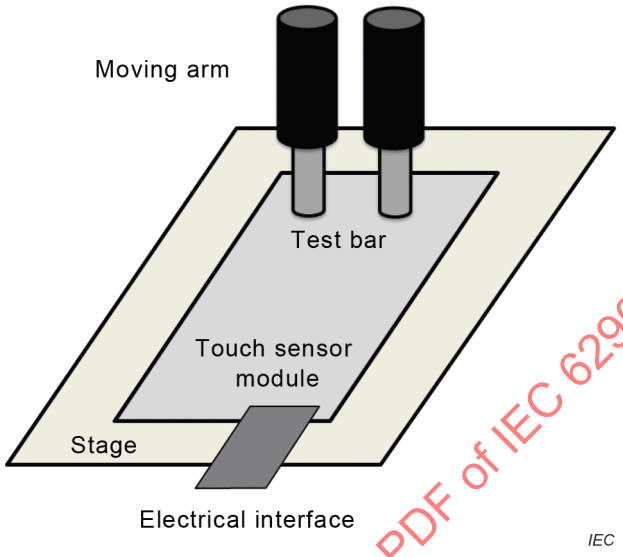


Figure 1 – Composition of measuring equipment

4.3 Test bar

The test bar is selected depending on the requirements and shall be reported. Details shall include:

1) the shape of the test bar, for example, half-sphere type, cylinder type, as shown in Figure 2;
2) the material of the test bar, for example, brass or conductive polyamide resin;
3) the diameter of the test bar, for example: 4 mm, 5 mm, 6 mm, 7 mm, 8 mm, 9 mm, 12 mm, 15 mm.

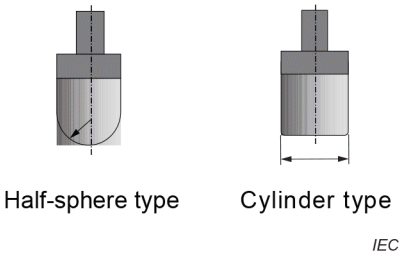
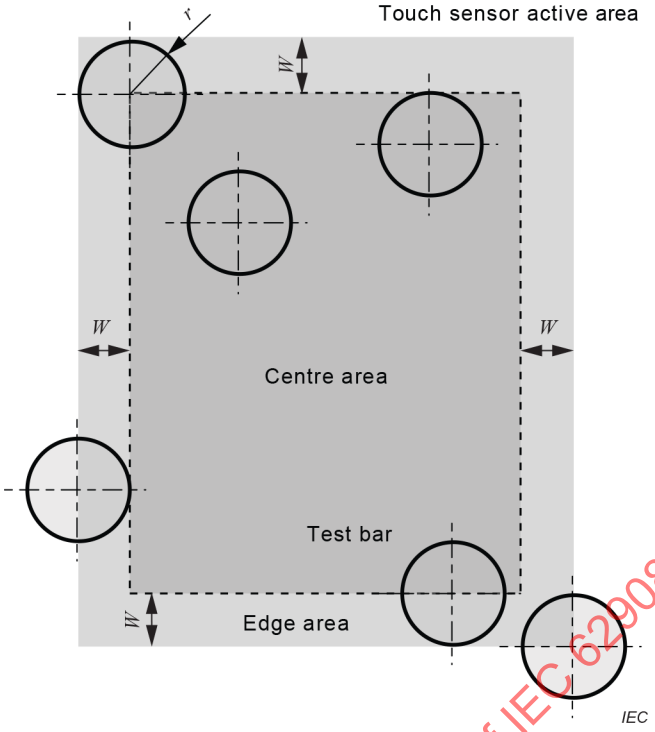


Figure 2 – Examples of test bars

4.4 Test bar position

The active area is defined as the area where touch is recognized. The centre area is defined as the rest of the active area without the edge area as shown in Figure 3. The edge area is defined as an area with the width of W from the edge of the active area. The origin and axis direction shall be defined.



NOTE The diameter of test bar is $2r$ mm, and the width of edge area is W mm. The edge area is the area within W mm from the edge of the touch sensor's active area. The centre area is the rest of the edge area.

Figure 3 – Location of edge area and centre area

5 Touch performance measuring methods

5.1 Multi-touch support

5.1.1 Purpose

The purpose of this test is to measure the maximum number of test bars that the touch sensor module can support at the same time.

5.1.2 Test procedure

The touch sensor module under test should be connected to the measuring equipment by the electrical interface. When test bars touch (tap and slide at random) the active area of the touch sensor module simultaneously, the position coordinates of the touched points shall be reported. Test bars shall be separated by a distance greater than or equal to the adjacent touch distance in 5.2. The number of test bars shall increase by one each time until the increased test bar's coordinates cannot be reported.

5.1.3 Report

The maximum number of test bars whose coordinates can be reported normally at the same time shall be reported. The report rate of maximum touch points shall be reported.

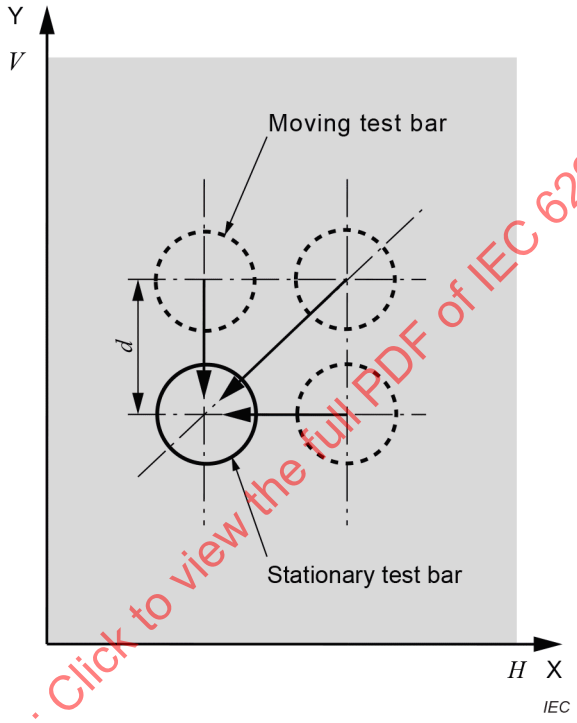
5.2 Adjacent touch distance

5.2.1 Purpose

The purpose of this test is to measure the smallest possible distance between two adjacent touch points that would allow the touch sensor module to report each coordinate separately.

5.2.2 Test procedure

The touch sensor module under test should be connected to the measuring equipment by the electrical interface. Two test bars with the same properties should be fitted to the moving arm. The centre-to-centre distance between the two test bars is d, and d should be greater than the diameter of the test bar and less than or equal to min(V, H) / 3, where V and H are the length and the width of the touch sensor module, respectively (see Figure 4). One of the test bars is stationary while the other moves towards it until the test bars' coordinates cannot be reported separately; then record the distance between the last reported points. The measurement should be done in three directions (horizontal, vertical and 45° direction), as shown in Figure 4. The test bar's moving speed can range from 1 mm/s to 5 mm/s depending on the test equipment design and measuring requirements. The adjacent touch distance is the maximum recorded distance among the three directions.



NOTE V, H: length and width of the touch sensor module, respectively.

Figure 4 – Example of adjacent touch distance

5.2.3 Report

The selected diameter of the test bar, the type of the test bar, the test bar's moving speed and the adjacent touch distance shall be reported together with test bar position.

5.3 Adjacent touch accuracy

5.3.1 Purpose

The purpose of this test is to measure the adjacent touch accuracy for the case where fingers touch at adjacent points simultaneously. The touch sensor module shall report the accurate coordinates of each adjacent touch point.

5.3.2 Test procedure

The touch sensor module under test should be connected to the measuring equipment by the electrical interface. Two test bars with the same properties should be fitted to the moving arm. The distance between the two test bars, d_m, should be equal to two times the test bar's diameter. The test bars should be positioned sequentially along the horizontal direction and vertical direction to measure the adjacent touch accuracy in both directions. Figure 5 shows an example of two test bars in the horizontal direction. The two test bars shall remain stationary at each target and the touch reports shall be collected fifty times.

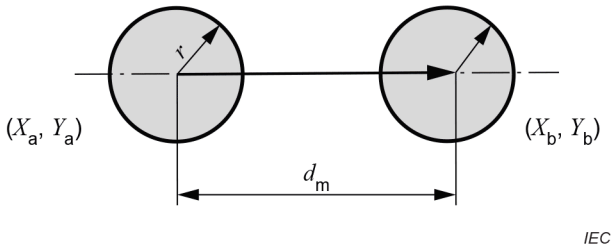


Figure 5 – Example of adjacent test bars on the X axis

5.3.3 Report

The test bar type and the selected diameter of the test bar shall be reported together with the test bar position. The adjacent touch accuracy, D_A, is calculated by the distance deviation. The calculation formula is as follows:

$$
\begin{aligned}
D_A &= \max(|d_m - d'_{mmax}|, |d_m - d'_{mmin}|) \\
d_m &= \sqrt{(X_a - X_b)^2 + (Y_a - Y_b)^2} \\
d'_{mmax} &= \max_{i=1,2,\ldots,50} \left(\sqrt{(X_{a,i} - X_{b,i})^2 + (Y_{a,i} - Y_{b,i})^2}\right) \\
d'_{mmin} &= \min_{i=1,2,\ldots,50} \left(\sqrt{(X_{a,i} - X_{b,i})^2 + (Y_{a,i} - Y_{b,i})^2}\right)
\end{aligned}
\tag{1}
$$

where

d_m is the real distance between the two test bars,

d_{mmax}' is the maximum reported distance between the two test bars,

d_{mmin}' is the minimum reported distance between the two test bars.

5.4 Rotation

5.4.1 Purpose

Rotation is a motion between two fingers, where the angle of the vector from one finger to the other changes monotonically while the distance between them is fixed. The purpose of this test is to check how precisely the positions are reported during rotation motions.

5.4.2 Test procedure

The touch sensor module under test should be connected to the measuring equipment by the electrical interface. Two test bars with the same or different diameters should be fitted to the moving arm. The minimum distance between the centres of the two test bars should be greater than the adjacent touch distance. Both of the test bars should rotate 360° around the centre of rotation which is the centre of the two test bars, and return to their original points, as shown in Figure 6. The centre of rotation should be positioned at P_0, P_1, …, P_4 successively, as shown in Figure 7. The test bars' linear speed is the same and can range from 5 mm/s to 50 mm/s depending on the test equipment design and requirements.

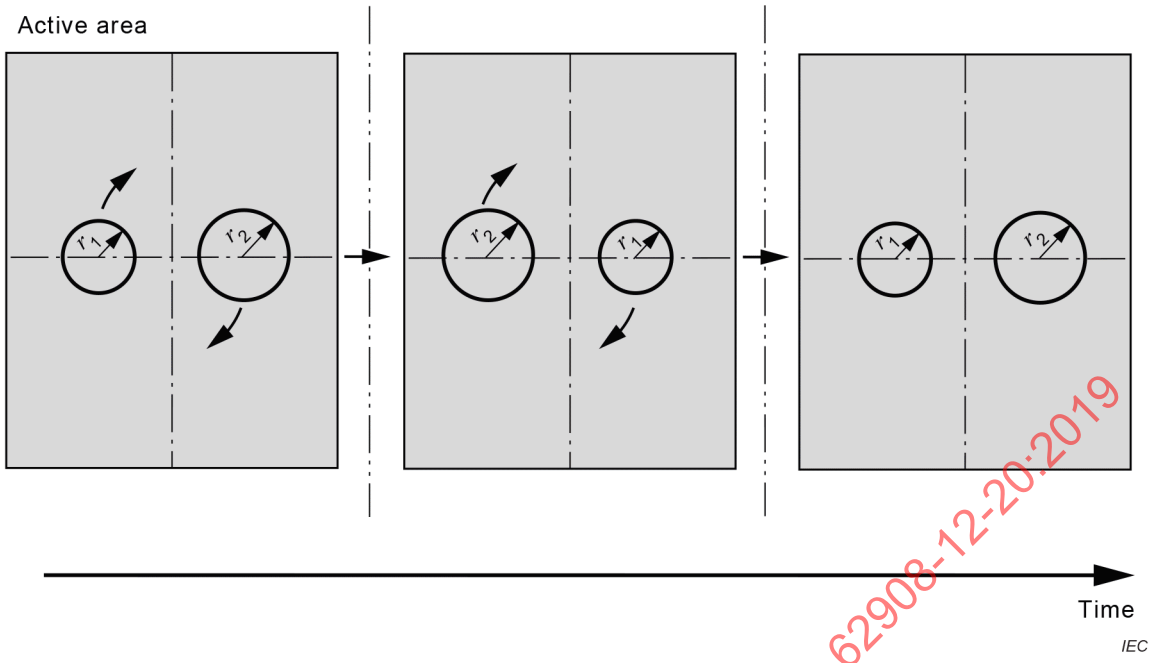


Figure 6 – Example of full circular rotation

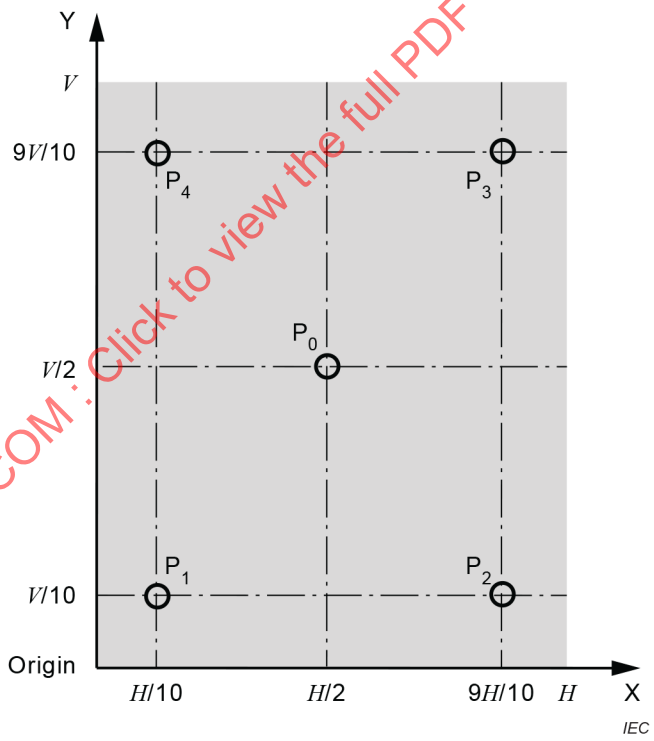


Figure 7 – Position of the centre of rotation

The centre of rotation is specified as follows:

If

$$\frac{\min(H,V)}{10} < \frac{r_1 + r_2 + D}{2} \leq \frac{\min(H,V)}{2} \quad (2)$$

then,

for P_1, the centre of rotation is

$$\left(\frac{r_1+r_2+D}{2},\frac{r_1+r_2+D}{2}\right) \tag{3}$$

for P_2, the centre of rotation is

$$\left(H-\frac{r_1+r_2+D}{2},\frac{r_1+r_2+D}{2}\right) \tag{4}$$

for P_3, the centre of rotation is

$$\left(H-\frac{r_1+r_2+D}{2},V-\frac{r_1+r_2+D}{2}\right) \tag{5}$$

for P_4, the centre of rotation is

$$\left(\frac{r_1+r_2+D}{2},V-\frac{r_1+r_2+D}{2}\right) \tag{6}$$

for P_0, the centre of rotation is

$$\left(\frac{H}{2},\frac{V}{2}\right) \tag{7}$$

If

$$\frac{r_1+r_2+D}{2}\le\frac{\min(H,V)}{10} \tag{8}$$

then,

for P_1, the centre of rotation is

$$\left(\frac{\min(H,V)}{10},\frac{\min(H,V)}{10}\right) \tag{9}$$

for P_2, the centre of rotation is

$$\left(H-\frac{\min(H,V)}{10},\frac{\min(H,V)}{10}\right) \tag{10}$$

for P_3, the centre of rotation is

$$\left(H-\frac{\min(H,V)}{10},V-\frac{\min(H,V)}{10}\right) \tag{11}$$

for P_4, the centre of rotation is

$$\left(\frac{\min(H,V)}{10},V-\frac{\min(H,V)}{10}\right) \tag{12}$$

for P_0, the centre of rotation is

$$\left(\frac{H}{2},\frac{V}{2}\right) \tag{13}$$

where

r_1 is the radius of the test bar 1,

r_2 is the radius of the test bar 2,

D is the distance between the centres of the two test bars,

H is the length of the active area (the horizontal direction of the touch sensor module),

V is the width of the active area (the vertical direction of the touch sensor module).

5.4.3 Report

The diameters of the test bars and linear speed shall be reported. The target coordinates of the test bars and the reported coordinates which are detected by the touch sensor module shall be reported. The distance between the centres of the two test bars and the deviation D_R shall be reported. The calculation formula of D_R is as follows.

$$D_R = \max\left(\left|R_{1ref}-R_{1max}\right|,\left|R_{1ref}-R_{1min}\right|,\left|R_{2ref}-R_{2max}\right|,\left|R_{2ref}-R_{2min}\right|\right) \tag{14}$$

where

R_{1min} is the minimum distance between the reported points of test bar 1 and the centre of rotation,

R_{1ref} is the distance between the target point of test bar 1 and the centre of rotation,

R_{1max} is the maximum distance between the reported points of test bar 1 and the centre of rotation,

R_{2min} is the minimum distance between the reported points of test bar 2 and the centre of rotation,

R_{2ref} is the distance between the target point of test bar 2 and the centre of rotation,

R_{2max} is the maximum distance between the reported points of test bar 2 and the centre of rotation.

The definition of R_{min}, R_{ref} and R_{max} is shown in Figure 8.

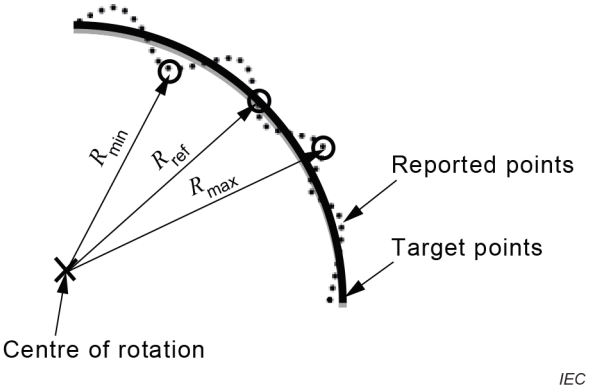


Figure 8 – Definition of R_{min}, R_{ref} and R_{max}

5.5 Pinch motion drifting

5.5.1 Purpose

Pinch is a motion between two fingers that come closer monotonically on a line. The purpose of this test is to check how precisely the positions are reported in pinch motions.

5.5.2 Test procedure

The touch sensor module under test should be connected to the measuring equipment by the electrical interface. Two test bars with the same properties should be fitted to the moving arms. The test bars shall move towards each other in the same lines along the horizontal, vertical and diagonal direction, respectively, on the touch sensor module, at the same speed. The moving speed during the test is in the range of 5 mm/s to 50 mm/s depending on the test equipment design and requirements. The two test bars start to move from the points shown in Figure 9 and stop when the distance of the two test bars is two times the test bar's diameter. Figure 10 shows examples of pinch motion drifting in the horizontal direction.

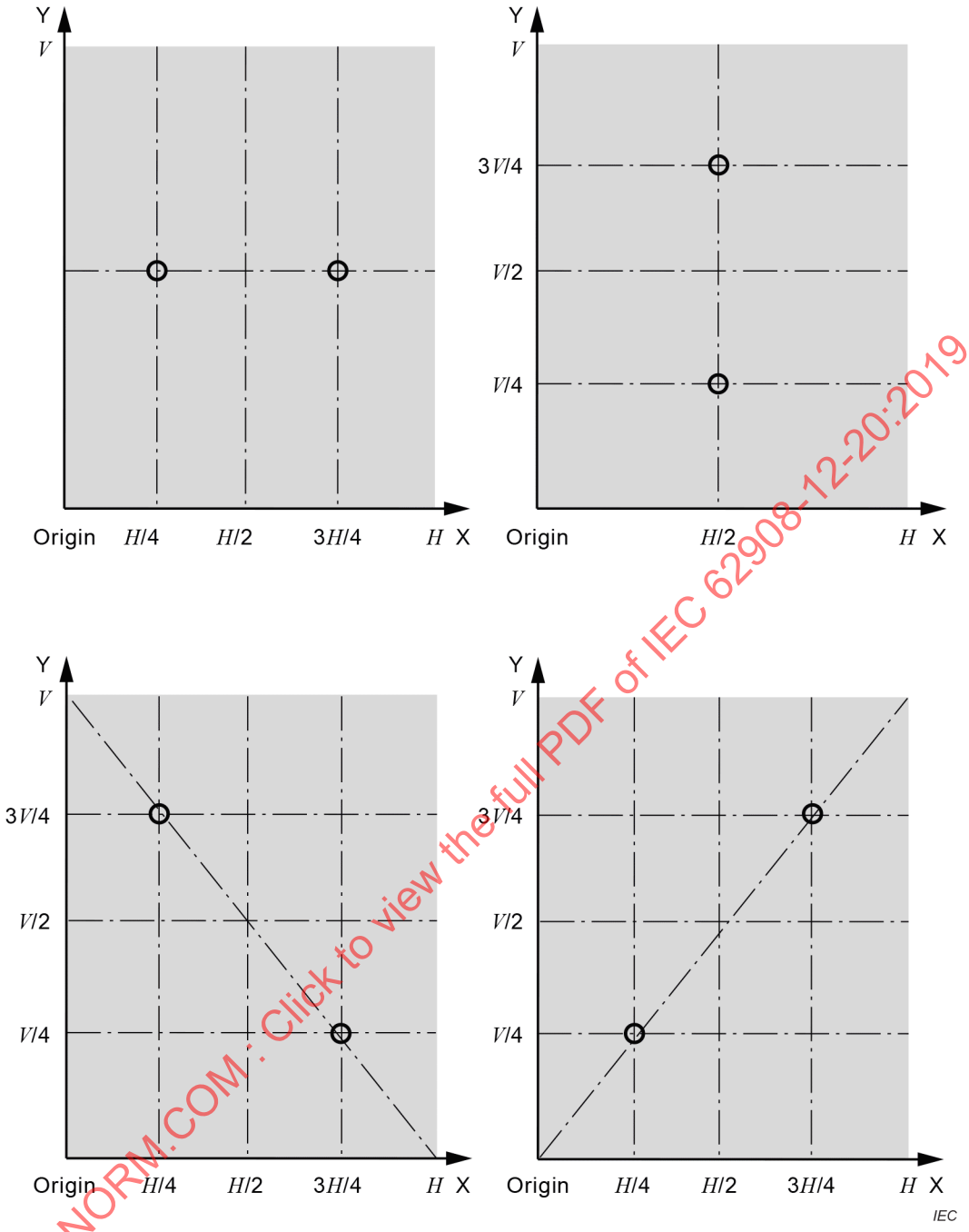


Figure 9 – Start points of test bars

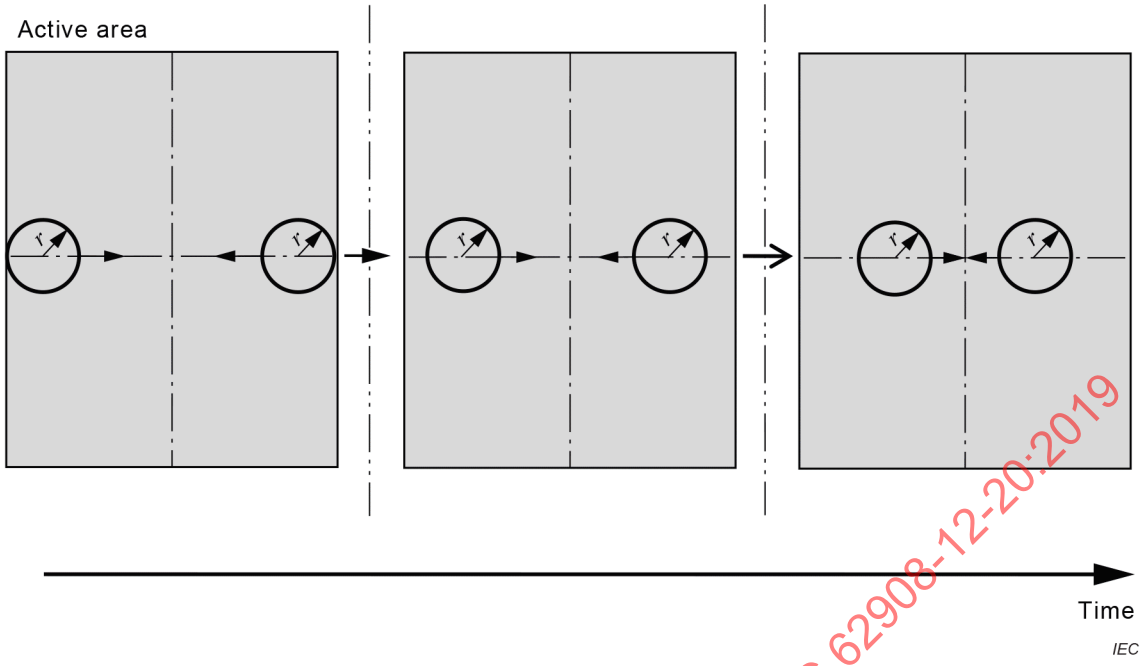


Figure 10 – Example of pinch motion drifting in the horizontal direction

5.5.3 Report

The diameter of the test bar and the moving speed shall be reported. The target coordinates of the test bars and the reported coordinates which are detected by the touch sensor module shall be reported. The deviation D_P shall be reported. The calculation formula of deviation D_P is as follows.

$$D_P = \max_{i=1,2,\ldots,n} \left(\sqrt{\left(x_{t,i} - x_{r,i}\right)^2 + \left(y_{t,i} - y_{r,i}\right)^2} \right) \quad (15)$$

where

n is the number of measured data,

x_r, y_r are the reported coordinates,

x_t, y_t are the target coordinates.

5.6 Multi-touch sliding

5.6.1 Purpose

The purpose of this test is to check the continuity when several test bars are sliding on the active area of the touch sensor module.

5.6.2 Test procedure

The touch sensor module under test should be connected to the measuring equipment by the electrical interface. Two or more test bars with the same properties should be fitted to the moving arm. The distance between the adjacent pairs of test bars should be more than the adjacent touching distance, and all of the test bars should have the same distance. The test bars move in straight lines along the horizontal, vertical and diagonal direction on the touch sensor module, respectively (see Figure 11). The moving speed is in the range of 5 mm/s to 50 mm/s depending on the test equipment design and requirements.

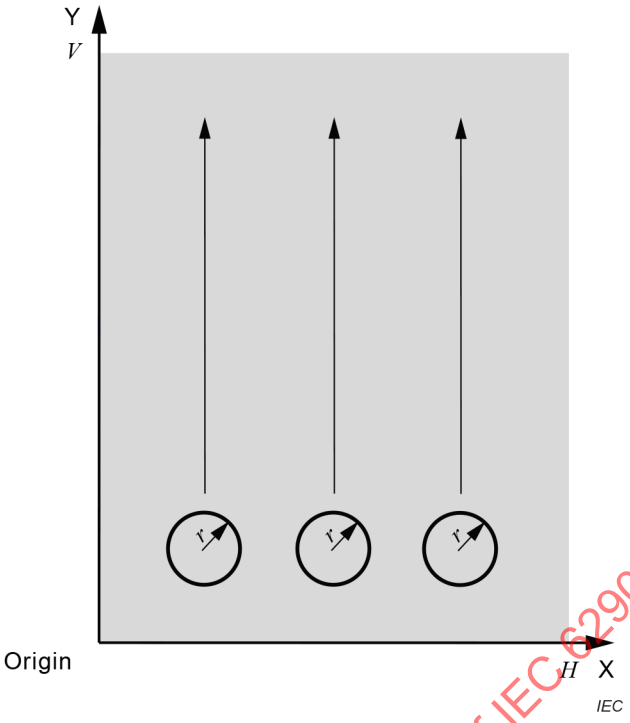


Figure 11 – Example of the multi-touch slide of three test bars in the vertical direction

5.6.3 Report

The diameter of the test bar, the number of test bars and the moving speed shall be reported together with test bar position. The actual touched coordinates of the test bars and the reported touched coordinates which are detected by the touch sensor module shall be reported. The linearity of each bar shall be reported. The calculation formula of linearity refers to IEC 62908-12-10.

5.7 Multi-touch crosstalk

5.7.1 Purpose

The purpose of this test is to check the multi-touch crosstalk when multiple points are simultaneously touched along the horizontal, vertical or diagonal direction.

5.7.2 Test procedure

The touch sensor module under test should be connected to the measurement equipment by the electrical interface. Two test bars with the same properties should be fitted to the moving arm. The original distance between the two test bars should be greater than three times the diameter of the test bar and less than or equal to min(V, H) / 3, where V and H are the length and the width of the touch sensor module, respectively. One of the test bars is stationary while the other moves towards it (see Figure 12) until the distance is less than the adjacent touch distance. The moving speed is in the range of 5 mm/s to 50 mm/s depending on the test equipment design and requirements. The measurement should be done in three directions, the horizontal direction, vertical direction and diagonal direction.