

TECHNICAL REPORT

REDLINE VERSION

Touch and interactive displays -
Part 1-3: Generic - ~~General introduction to~~ Overview of pen touch technology

get full document from standards.iteh.ai



THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2026 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Secretariat
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search -
webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch

Discover our powerful search engine and read freely all the publications previews, graphical symbols and the glossary. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 500 terminological entries in English and French, with equivalent terms in 25 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD	3
INTRODUCTION	5
1 Scope	6
2 Normative references	6
3 Terms, definitions and abbreviated terms	6
3.1 Terms and definitions	6
3.2 Abbreviated terms	6
4 Generic information on pen touch technology	7
4.1 General	7
4.2 Classification	7
4.3 Sensing technology for touch pen	9
4.3.1 General	9
4.3.2 Resistive type panel structure and sensing method	9
4.3.3 Capacitive type panel structure and sensing method	10
4.3.4 EMI type panel structure and sensing method	10
4.3.5 Optical type panel structure and sensing method	11
4.3.6 Ultrasonic type panel structure and sensing method	11
4.4 Touch pen architecture	12
4.4.1 General	12
4.4.2 Passive stylus pen	12
4.4.3 Active stylus pen	13
5 Pen touch characteristics	17
5.1 General	17
5.2 Basic characteristics of pen touch	17
5.3 Unique and important characteristics of pen touch	17
5.3.1 General	17
5.3.2 Tracking speed	18
5.3.3 Writing comfort characteristics	18
5.3.4 Position parallax	18
5.3.5 Minimum area and minimum pressure	20
5.3.6 Pressure sensitivity	20
5.3.7 Tilt angle	21
6 Application example for each pen touch technology	21
6.1 General	21
6.2 Passive stylus pen	21
6.3 Active stylus pen	21
6.3.1 General	21
6.3.2 EMI pen	22
6.3.3 Universal pen for PCAP type	23
6.3.4 Type MPP	23
6.3.5 Type AP	23
6.3.6 Type WA Active ES stylus	23
6.3.7 Type U (multiple use)	23
7 Issue of future pen touch technology	24
7.1 General	24
7.2 Tracking speed	24

7.3	Writing comfort	24
7.4	Combinational use of finger and pen touch	25
7.5	Palm rejection area and pen positional relationship.....	25
8	Collaboration of hardware and software.....	25
Annex A (informative) Example of use-case: touch display used in the classroom.....		27
A.1	Impact of glare on the viewing distance and the posture of the students	27
A.2	Writing and Optical characteristics of anti-glare screen	28
Bibliography.....		31
Figure 1 – Resistive type panel structure		9
Figure 2 – Capacitive type panel structure		10
Figure 3 – EMI type panel structure		11
Figure 4 – Optical type panel structure		11
Figure 5 – Ultrasonic type panel structure.....		12
Figure 6 – Example of conductive fibre tip		13
Figure 7 – Example of transparent disk tip		13
Figure 8 – Example of exclusive pen.....		13
Figure 9 – Example of EMI pens (Type WE).....		15
Figure 10 – Example of frictional response between different pen tips and screens		19
Figure 11 – Example of frictional response between paper and pencil, AGL and touch pen, and glass and touch pen		19
Figure 12 – Position parallax		20
Figure 13 – Pen tablet for animation/illustration		22
Figure 14 – Examples of notebook PCs		24
Figure 15 – Example of drawing settings for a software simulating several pen types		26
Figure A.1 – Ambient light sources in the classroom		27
Figure A.2 – Examples of poor postures of the students caused by the glare		28
Figure A.3 – Example of the screen with AGL (left) and without AGL (right)		28
Figure A.4 – Unwanted reflection from measured samples		29
Figure A.5 – Writing and optical characteristics of the measured samples.....		29
Figure A.6 – Examples of scoring the writing and optical characteristics with the different types of screens.....		30
Table 1 – Comparison among pointing devices		8
Table 2 – Classification of touch pens.....		8
Table 3 – Correspondence between touch panel and touch pen.....		9
Table 4 – Performance comparison of touch pens for PCAP/EMI		16
Table 5 – Basic pen touch characteristics		17
Table 6 – Unique and important characteristics of touch pen		18

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**Touch and interactive displays -
Part 1-3: Generic ~~General introduction to~~ Overview of pen touch
technology**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at <https://patents.iec.ch>. IEC shall not be held responsible for identifying any or all such patent rights.

This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC TR 62908-1-3:2021. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

IEC TR 62908-1-3 has been prepared by IEC technical committee 110: Electronic displays. It is a Technical Report.

This second edition cancels and replaces the first edition published in 2021. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) add writing characteristics as physical properties of interaction between a pen and a surface of a screen;
- b) add example of frictional response between paper and pencil, AGL and touch pen, and glass and touch pen;
- c) add example of touch display used in the classroom regarding writing and optical characteristics.

The text of this Technical Report is based on the following documents:

Draft	Report on voting
110/1834/DTR	110/1849/RVDTR

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this Technical Report is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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 webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

INTRODUCTION

With the spread of smartphones in recent years, finger touch technology has become widespread throughout the world. The field of popularization has started with smartphones and has spread out with information terminals such as notebook (laptop) PCs and tablets to kiosks, ATMs, sales equipment in the field of social infrastructure, medical equipment for professional use, and construction-related items.

Finger touch **technology** faces several challenges, such as malfunction due to usage environment, wearing of gloves or water droplets, in addition to difficulty of fine drawing with finger touch, signature input, and so on.

In the early stage of the pen touch **technologies**, the operating system and application software only supported the same function as finger touch, ~~but recently~~. However, a new concept of digital ink has enabled to ~~use not only the data of the entered trajectory, but also~~ treat the progressing data, such as writing pressure, pen angle, and drawing, ~~being~~ in addition to the **data of the entered trajectory**. These are digitized and saved together with the trajectory data. This means that a new technique with pen input has been developed, which goes beyond the conventional technology of finger touch input.

Based on the above situation, this document aims to focus on the issues related to future standardization by summarizing the sensing methods of pen touch, the types of touch pens and the corresponding technologies, and the market's trend of pen touch technology.

Sample Document

get full document from standards.iteh.ai

1 Scope

This part of IEC 62908, which is a technical report, provides general information on pen touch technology with the aim toward standardization. This document includes an overview of the pen touch technology, critical performance characteristics, issues of characteristics measurements, and other information.

The purpose of this document is to provide an overview of the different products available in pen touch technology.

NOTE—The companies and products named in this document do not constitute an endorsement by IEC of these products.

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*

3 Terms, definitions and abbreviated terms

3.1 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 terminology databases for use in standardization at the following addresses:

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

3.2 Abbreviated terms

AES	active electrostatic
AGL	anti-glare layer
AP	Apple pencil
API	application program(ing) interface
AR/VR	augmented reality/virtual reality
ATM	automated [automatic] teller machine
DSC	Digital Stationery Consortium
EMI	electromagnetic induction
EMR	electromagnetic resonance
ES	electrostatics
IC	integrated circuits
MPP	Microsoft Pen Protocol

OS	operating system
PCAP	projected capacitive touch panel
SDK	software developer's kit
SNR	signal-to-noise ratio
USI	Universal Stylus Initiative
WA	Wacom AES
WE	Wacom EMR

4 Generic information on pen touch technology

4.1 General

In Clause 4, the classification of pen types, the corresponding sensing technology, and the touch panel structure and principle are described.

4.2 Classification

To clarify the performance of the touch pens, a comparison is made among a finger touch, a pen touch, and a mouse as a pointing device, as shown in Table 1.

~~The first major difference is that the finger touch and pen touch specify the absolute position of the screen, but the mouse specifies the relative position of the screen, because it operates at a different place from the screen.~~

~~The next point is regarding the accuracy of the position. the pen touches directly a specific position of the screen, so the pen touches have the highest position accuracy. The second highest accuracy is the mouse, because the mouse can control the precise position, and the lowest accuracy is the finger touch, because the point area of a finger is larger than a certain area on the screen.~~

The main difference is that finger touch and pen touch indicate an absolute position of the screen, whereas a mouse indicates a relative position, because it is operated away from the screen.

The next point is regarding the positional accuracy. As the pen directly touches a specific position of the screen, it therefore has the highest positional accuracy. The second highest positional accuracy is the mouse, because it can control a precise position. Finger touch has the lowest positional accuracy because the finger's contact area is much larger than the precise point where the user wants to touch on the screen.

On the other hand, the finger touch is suitable for multi-point designation and intuitive gesture motion.

In addition, as a pen is "a general writing tool", the pen touch is the most suitable tool for drawing pictures and signs, and also most suitable for manual input of letters without using a keyboard.

Table 1 – Comparison among pointing devices

	Finger	Pen	Mouse
Coordinates	Absolute coordinates	Absolute coordinates	Relative coordinates
Positional accuracy	Poor	Excellent	Fair
Multi-points	Available	Available	Not applicable
Gesture operation	Excellent	Fair	Poor
Drawing performance	Fair	Excellent	Poor
Conformance of the signature	Fair	Excellent	Poor
Compatibility with digital ink	Not applicable	Available	Not applicable

Next, the types of touch pens can be classified as shown in Table 2: the first category is whether the pen has a **built-in** electrical circuit or not. The next category is about the **sensing** method of ~~detecting~~ the pen touch. In the third category, there are two types of **communications**: one-way communication (unidirectional) and two-way communication (bidirectional) between the pen and the ~~detection~~ sensing panel or the system ~~side~~.

Table 2 – Classification of touch pens

Built-in circuits or not	Pen touch sensing method	Pen type/Protocol¹	Unidirectional or bidirectional communication
Passive stylus pen (without circuits)	Resistive	General commercial pen	Unidirectional
	PCAP	General commercial pen	Unidirectional
Active stylus pen (built-in circuits)	PCAP	Type MPP	Bidirectional
		Type WA	Bidirectional
		Type AP	Bidirectional
		Type USI	Bidirectional
		Universal pen	Bidirectional
		EMI	Old type
	Type WE		Unidirectional Bidirectional
	Optical	Exclusive	Bidirectional

The active stylus pen which supports the PCAP touch panel is mostly used with smartphones, tablets, and notebook PCs (**laptops**). Some companies have recently developed their own methods which compete with each other.

The optical pen is developed exclusively for specific systems. There are many types of them, however the detailed technology is omitted in this document.

¹ Microsoft Pen Protocol, Apple Pencil, and Wacom AES and Wacom EMR are examples of suitable products available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of these products.

4.3 Sensing technology for touch pen

4.3.1 General

There are two types of panel structure for the sensing touch pen:

- use of the touch panel sensing method (resistive type, capacitive type, optical type, or ultrasonic type);
- use of the additional digitizer panel sensing method (EMI method).

Table 3 summarizes the relationship between the touch panel system and the touch pen.

From 4.3.2 to 4.3.6, the structure of each touch panel and the ~~detection~~ sensing method are described.

Table 3 – Correspondence between touch panel and touch pen

Type	Resistive panel	Capacitive panel	Optical panel	Ultrasonic panel	EMI panel
Passive stylus pen	Mainly used	Mainly used	Available	Available	Not applicable
Active stylus pen	Available	Mainly used	Available	Not applicable	Not applicable
EMI pen	Available	Not applicable	Not applicable	Not applicable	Mainly used

NOTE 1 An electronic circuit is not included in the "passive stylus pen" (e.g. resonant circuits).

NOTE 2 Depending on the material of the passive stylus pen, ~~detection~~ sensing can be done by an optical method or an ultrasonic method.

NOTE 3 Active stylus pens are generally made for capacitive type panel.

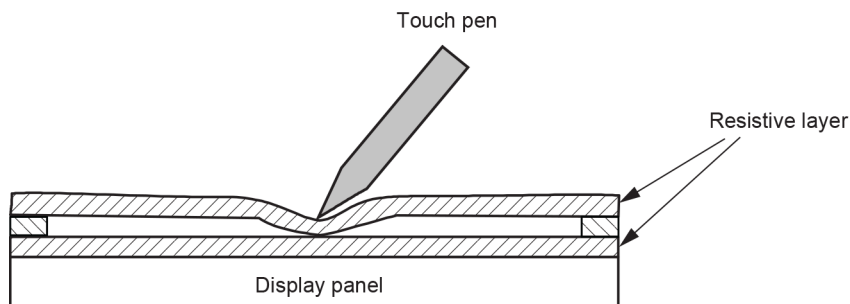
NOTE 4 There are also special pens for specific products on the market.

4.3.2 Resistive type panel structure and sensing method

The resistive type touch panel is configured with two resistive films and a gap between these films, which is shown in Figure 1.

By pressing the top resistive film with a finger or a pen, the pressed position is electrically short-circuited. The driving and controlling IC detect this short-circuited position by measuring the resistance value of this resistive film.

The pen is sufficiently rigid to electrically short the two layers of resistive film.



IEC

Figure 1 – Resistive type panel structure

4.3.3 Capacitive type panel structure and sensing method

The capacitive type panel has a structure in which two types of electrodes are arranged in a matrix, which is shown in Figure 2.

Since the two types of adjacent electrodes are capacitively coupled, any change in the parasitic capacitance at the point where a finger or pen touches is affected by the capacitive component of the human body. The drive circuit detects this change to identify the touch point.

In the case of the passive stylus pen, ~~this pen needs~~ the conductivity is crucial for this pen to transfer the parasitic capacitance of the human body to the touch panel.

In the case of the active stylus pen, it has a built-in circuit to change the electric field generated by the touch panel at a similar level as that of the finger touch. This touch pen has a conductivity that can transmit a sufficient signal to the touch panel. In addition, ~~there are~~ various structures forming can be used to form the two types of adjacent electrodes on a single substrate. For example, the electrodes ~~are~~ can be formed on two separate pieces of glass or film.

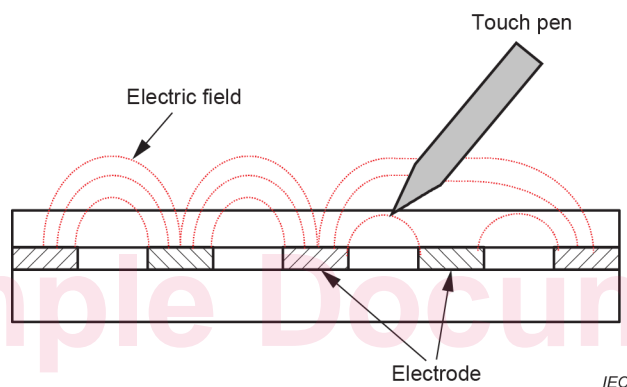


Figure 2 – Capacitive type panel structure

4.3.4 EMI type panel structure and sensing method

As shown in Figure 3, the EMI panel structure has a plurality of rectangular antenna coils arranged in parallel in a two-dimensional (X-axis, Y-axis) direction orthogonal to each other.

The ~~detection~~ sensing method of the digitizer uses the electromagnetic induction between a plurality of antenna coils stretched around the digitizer panel and a touch pen.

As shown in Figure 3 a), the initial touch pen has a transmitter coil, a power supply for continuously generating an alternating magnetic field from the coil, a driver circuit, and an oscillator circuit.

The digitizer's main body sequentially changes the switch of the antenna coil to scan the sensor panel surface. The position of the touch pen was calculated by using the signal level. Where the touch pen is closest to the panel, the strongest signal is detected from the antenna coil, and a relatively weak signal is from the coil adjacent to the pen.

Moreover, information such as the switch data of the touch pen and the writing pressure has been sent to the digitizer's main body by modulating the response signal from the touch pen side by changing the ~~capacity~~ capacitance inside the touch pen.

In recent years, the 'penable technology type digitizer' (see Figure 3 b) has been commercialized and occupies the market. In this method, the touch pen has no power source,

and the position is detected by exchanging electromagnetic energy between the touch pen and the antenna coil of the digitizer body [1]².

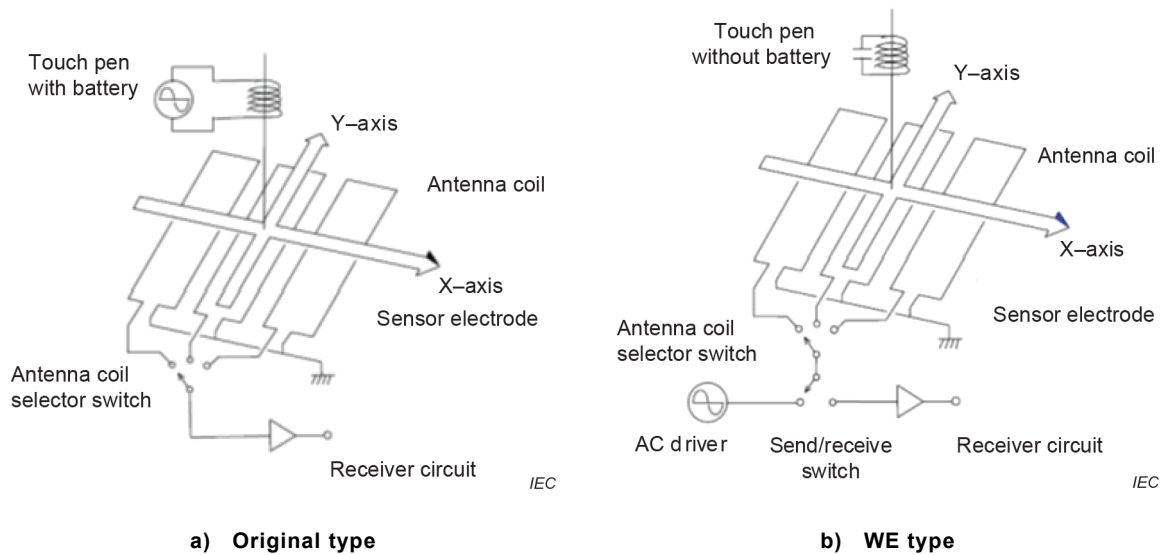


Figure 3 – EMI type panel structure

4.3.5 Optical type panel structure and sensing method

There are various types of optical panels, such as a scanning type, a projection type, and an image (camera) type. Among them, a scanning panel structure is a typical example. This type of panel has a structure in which a light emitting element array and a light receiving element array are arranged as a set on opposite sides, as shown in Figure 4.

As for the ~~detection~~ sensing method, the optical touch panel detects the position by shading the light at the place where the pen hits.

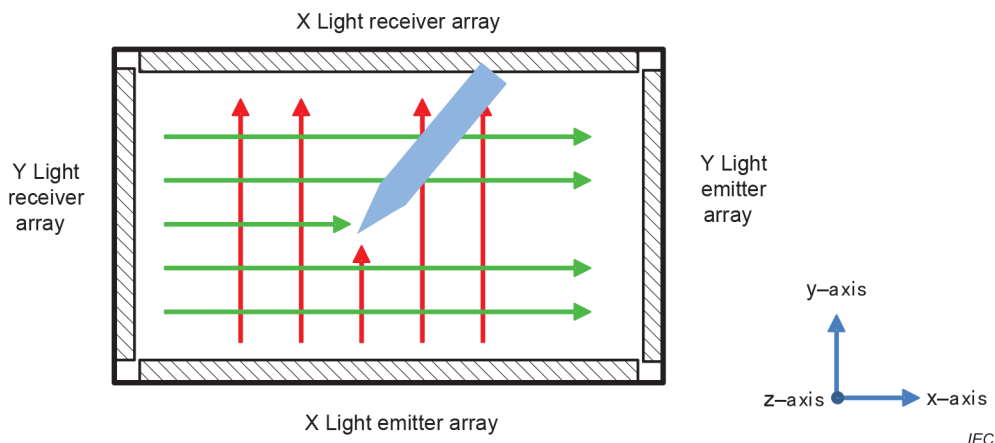


Figure 4 – Optical type panel structure

4.3.6 Ultrasonic type panel structure and sensing method

In the structure of the ultrasonic touch panel, as shown in Figure 5, ultrasonic transmitters and receivers are arranged on adjacent sides. The ultrasonic waves transmitted from each side are

² Numbers in square brackets refer to the Bibliography.

sequentially reflected by Reflector 1 at 90° from the side closer to the transmitter Y in Figure 5, and propagate to the panel. The ultrasonic wave received from the panel is reflected by Reflector 2 by 90° and propagates to the receiver in sequence.

In the vicinity of the Y transmitter, the ultrasonic wave is immediately reflected by Reflector 1 at 90°, after being propagated to the panel; it will be again reflected at 90° by Reflector 2 near the Y receiver, and will be received by the Y receiver in a short time after transmission.

In an area far away from the Y transmitter, the propagation distance inside Reflector 1 and 2 becomes long, and the time until it is received by the Y receiver becomes long. Therefore, ultrasonic waves propagate through the entire surface of the panel with a time difference.

The ~~detection~~ sensing method attenuates the ultrasonic signal at the place where the pen touches, so the intensity of the ultrasonic wave at the time corresponding to this place is attenuated, and the position can be detected.

In this case, the necessary function of the pen is "coupled" with the substrate, such as glass, which propagates the ultrasonic waves.

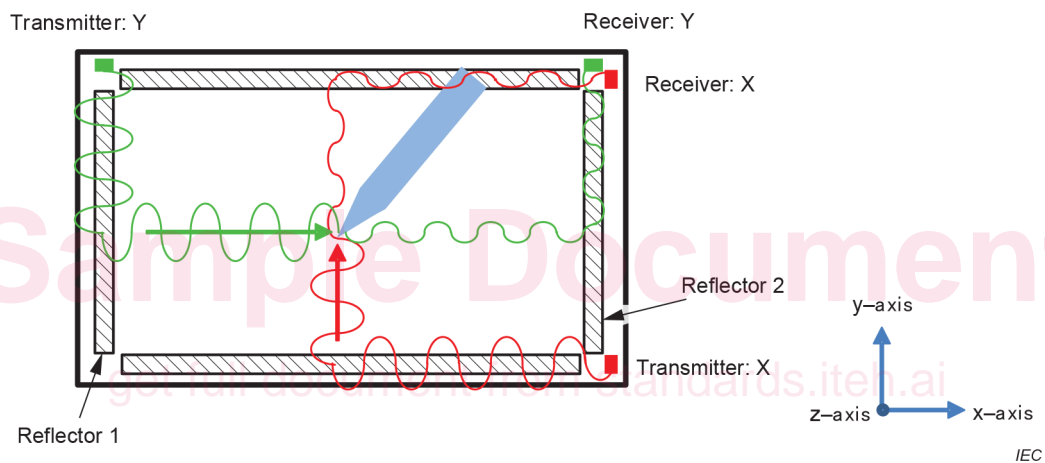


Figure 5 – Ultrasonic type panel structure

4.4 Touch pen architecture

4.4.1 General

4.4 describes the structure and features of each type of touch pen more specifically according to Table 2.

4.4.2 Passive stylus pen

A passive stylus pen is a pen without an electrical circuit inside. The pen tips have different shapes corresponding to the respective ~~detection~~ sensing methods.

The shape of the pen tip for the resistive type touch panel is generally a hard tip and often has a pointed shape.

The pen tip for a PCAP type touch panel has various tip (nib) shapes and materials, but each has a certain area or more to allow the touch panel to detect the ~~capacity~~ capacitance of the operating human.

In general, for general public terminals with optical or ultrasonic touch panels, such as ATMs and ticket vending machines, dedicated touch pens are not sold, but even passive stylus pens for PCAP can be used, if SNR level is sufficient.

This means that, when using a PCAP passive stylus pen for an optical touch panel, it can be used if the pen can sufficiently block the sensing light.

On the other hand, in the early days of personal products such as early mobile terminals and PDAs, resistive touch panels were mainly used, but recently smartphones, tablets, and notebook PCs have become popular, and along with these, the PCAP type has become the mainstream touch panel type.

Passive stylus pens for PCAP touch panels have now become mainstream, and a wide variety of those is now widely sold.

Examples of the material of the pen tip (nib) include silicone rubber, resin, fibre, transparent disk, among others. Figure 6, Figure 7 and Figure 8 are examples of different types of pens.



Figure 6 – Example of conductive fibre tip



Figure 7 – Example of transparent disk tip



Figure 8 – Example of exclusive pen

4.4.3 Active stylus pen

4.4.3.1 General

An active stylus pen is a pen that has an electronic circuit inside.