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TECHNICAL REPORT

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

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FOREWORD

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

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

Draft	Report on voting
110/1311/DTR	110/1331/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/standardsdev/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

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INTRODUCTION

With the spread of smartphones in recent years, finger touch technology has become widespread throughout the world. The field of popularization has started from smartphones, and has spread from 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 has several challenges, such as malfunction due to usage environment, such as wearing of gloves or water droplets, in addition to the difficulty of fine drawing with finger touch, signature input, and so on.

Initially, for the pen touch, the operating system and application software supported only the same function as finger touch, but recently a new concept of digital ink has enabled to use not only the data of the entered trajectory, but also the progressing data such as writing pressure, pen angle and drawing, being 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 trends of pen touch technology.

TOUCH AND INTERACTIVE DISPLAYS –

Part 1-3: Generic – General introduction to pen touch technology

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 documents 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 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

3.2 Abbreviated terms

AES	Active electrostatic
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 circuit
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 between 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.

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 most suitable for drawing pictures and signs, and also most suitable for manual input letters without using a keyboard.

Table 1 – Comparison of pointing devices

	Finger	Pen	Mouse
Coordinates	Absolute coordinates	Absolute coordinates	Relative coordinates
Positional accuracy	Poor	Excellent	Fair
Multi points	Available	Available	N.A.
Gesture operation	Excellent	Fair	Poor
Drawing performance	Fair	Excellent	Poor
Conformance of the signature	Fair	Excellent	Poor
Compatibility with digital ink	N.A.	Available	N.A.

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

Table 2 – Classification of touch pen

Circuits built-in or not	Pen touch sensing method	Pen type/ protocol[1]	Unidirectional or bidirectional
Passive pen (without circuits)	Resistive	General commercial pen	Unidirectional
	PCAP	General commercial pen	Unidirectional
Active pen (built-in circuits)	PCAP	Type MPP	Bidirectional
		Type WA	Bidirectional
		Type AP	Bidirectional
		Type USI	Bidirectional
		Universal pen	Bidirectional
	EMI	Old type	Bidirectional
		Type WE	Unidirectional
	Optical	Exclusive	Bidirectional

The active stylus pen which supports the PCAP touch panel is most in use for smartphones, tablets, and note PCs. Some companies have recently developed their own methods which compete with each other.

The optical pen is developed exclusively for a specific system, and there are many types, but in this document the detailed technology is omitted.

4.3 Sensing technology for touch pen

4.3.1 General

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

1) Use of the touch panel sensing method (resistive type, capacitive type, optical type, or ultrasonic type).
2) Use of the additional digitizer panel sensing method (EMI method).

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

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

[1] Microsoft Pen Protocol, Apple Pencil, 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.

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	N.A.
Active stylus pen	Available	Mainly Used	Available	N.A.	N.A.
EMI pen	Available	N.A.	N.A.	N.A.	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 can be 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, which is shown in Figure 1, is configured with two resistive films and a gap between these films.

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

The pen has sufficient rigidity to short the two layers of resistive film electrically.

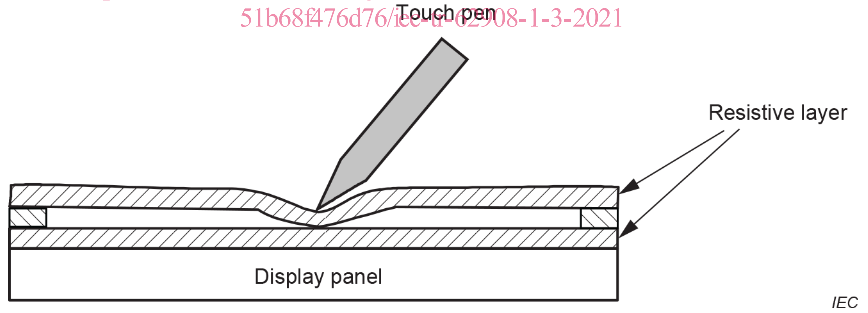

Figure 1 – Resistive type panel structure

4.3.3 Capacitive type panel structure and sensing method

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

Since the two types of the adjacent electrodes are capacitively coupled, and the capacitive component of the human body changes a parasitic capacitance of the point where a finger or a pen touches, then the drive circuit detects this point.

In the case of the passive stylus pen, this pen needs the conductivity in order 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