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Neporušitvene preiskave - Ugotavljanje značilnosti in overjanje naprav za ultrazvočno preskušanje - 1. del: Aparati (ISO 22232-1:2020)

Non-destructive testing - Characterization and verification of ultrasonic test equipment - Part 1: Instruments (ISO 22232-1:2020)

Zerstörungsfreie Prüfung - Charakterisierung und Verifizierung der Ultraschall-Prüfausrüstung - Teil 1: Prüfgeräte (ISO 22232-1:2020)

Essais non destructifs - Caractérisation et vérification de l'appareillage de contrôle par ultrasons - Partie 1: Appareils (ISO 22232-1:2020)

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Non-destructive testing - Characterization and verification of ultrasonic test equipment - Part 1: Instruments (ISO 22232-1:2020)

Essais non destructifs - Caractérisation et vérification de l'appareillage de contrôle par ultrasons - Partie 1: Appareils (ISO 22232-1:2020)

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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EUROPÄISCHES KOMITEE FÜR NORMUNG

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Contents

Page

European foreword

This document (EN ISO 22232-1:2020) has been prepared by Technical Committee ISO/TC 135 "Non-destructive testing" in collaboration with Technical Committee CEN/TC 138 “Non-destructive testing” the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by February 2021, and conflicting national standards shall be withdrawn at the latest by February 2021.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

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The text of ISO 22232-1:2020 has been approved by CEN as EN ISO 22232-1:2020 without any modification.

INTERNATIONAL STANDARD

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Non-destructive testing — Characterization and verification of ultrasonic test equipment —

Part 1: Instruments

Essais non destructifs — Caractérisation et vérification de l'appareillage de contrôle par ultrasons — Partie 1: Appareils

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Contents

Page

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 135, *Non-destructive testing*, Subcommittee SC 3, *Ultrasonic testing,* in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 138, *Non-destructive testing,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

A list of all parts in the ISO 22232 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Non-destructive testing — Characterization and verification of ultrasonic test equipment —

Part 1: Instruments

1 Scope

This document specifies methods and acceptance criteria within the frequency range of 0,5 MHz to 15 MHz, for assessing the electrical performance of digital ultrasonic instruments for pulse operation using A-scan display, for manual ultrasonic non-destructive testing with single- or dual-transducer probes. This document is also applicable for multi-channel instruments. This document can partly be applicable to ultrasonic instruments in automated systems, but other tests can be needed to ensure satisfactory performance.

This document excludes ultrasonic instruments for continuous waves.

This document also excludes ultrasonic phased array instruments, see e.g. ISO 18563-1. If a phased array instrument has dedicated connectors for single- or dual-transducer probes this document is applicable for these channels.

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.

ISO 5577, *Non-destructive testing — Ultrasonic testing — Vocabulary*

ISO/IEC 17050-1, *Conformity assessment — Supplier's declaration of conformity — Part 1: General requirements*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5577 and the following apply.

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
analogue output
output from the ultrasonic instrument which gives a d.c. voltage nominally proportional to the amplitude of the largest received signal within a monitor gate

3.2
cross talk during transmission
amount of signal transfer from the transmitter output to the receiver input during the transmission pulse, with the ultrasonic instrument set for separate transmitter-receiver operation (dual-transducer probe)

3.3
dead time after transmitter pulse
time interval following the start of the transmitter pulse during which the amplifier is unable to respond to incoming signals, when using the pulse-echo technique, because of saturation by the transmitter pulse

3.4
digital output
output from the ultrasonic instrument which gives a low or high value depending if a signal is below or above a monitor gate threshold

3.5
digitisation sampling error
error introduced into the displayed amplitude of an input signal by the periodic nature of measurements taken by an analogue-to-digital converter

3.6
equivalent input noise
measure of the electronic noise level observed on the ultrasonic instrument screen, and defined by the input signal level, measured at the receiver input terminals, that would give the same level on the screen if the amplifier itself were noiseless

3.7
external attenuator
standard attenuator calibrated to a traceable source used to test the ultrasonic instrument

3.8
fall time
<analogue output> time it takes the proportional gate output to fall from 90 % to 10 % of its peak value

3.9
switched monitor gate signal hold time
time for which the switched output from a monitor gate remains above 50 % of its maximum output following a signal in the monitor gate which is above the threshold

3.10
hold time
<analogue output> time for which the *analogue output* (3.1) is above 50 % of its maximum output following a signal in the monitor gate

3.11
linearity of analogue output
measure of how close the voltage output from the proportional gate is to being directly proportional to the input signal amplitude

3.12
mid-gain position
ultrasonic instrument gain setting which is half way between the maximum and minimum gains

EXAMPLE For an ultrasonic instrument with a maximum gain of 100 dB and a minimum gain of 0 dB, the mid-gain position would be 50 dB.

Note 1 to entry: Mid-gain position is measured in decibels.

3.13
receiver input impedance
characterisation of the internal impedance of the receiver as a parallel resistance and capacitance

3.14
response time
time over which a signal has to be detected by an ultrasonic instrument before it is displayed at 90 % of its peak amplitude

3.15
temporal resolution
minimum time interval over which two pulses are resolved by a drop in amplitude of 6 dB

3.16
switching hysteresis
difference in amplitude between the signal which turns on and the signal which turns off a monitor gate

4 Symbols

Symbol	Unit	Meaning
A_o, A_n	dB	Attenuator settings used during tests
C_{max}	pF	Parallel capacity of receiver at the maximum gain
C_{min}	pF	Parallel capacity of receiver at the minimum gain
D_S	dB	Cross talk during transmission
Δf_g	Hz	Frequency bandwidth measured at the proportional gate output
f_{go}	Hz	Centre frequency measured at the proportional gate output
f_{gu}	Hz	Upper frequency limit at −3 dB, measured at the proportional gate output
f_{gl}	Hz	Lower frequency limit at −3 dB, measured at the proportional gate output
f_{gmax}	Hz	Frequency with the maximum amplitude in the frequency spectrum measured at the proportional gate output
f_0	Hz	Centre frequency
f_u	Hz	Upper frequency limit at −3 dB
f_l	Hz	Lower frequency limit at −3 dB
f_{max}	Hz	Frequency with the maximum amplitude in the frequency spectrum
Δf	Hz	Frequency bandwidth
G_D	dB	Dynamic range
I_{max}	A	Amplitude of the maximum current that can be driven by the proportional gate output
N	—	Number of measurements taken
n_{ein}	$nV/\sqrt{Hz}$	Equivalent input noise
R_l	Ω	Termination resistor
R_{max}	Ω	Input resistance of receiver at the maximum gain
R_{min}	Ω	Input resistance of receiver at the minimum gain
S	dB	Attenuator setting
ΔT	s	Time increment
t_A	s	Temporal resolution
t_d	s	Pulse duration
T_{final}	s	Time to the end of a distance-amplitude curve
T_0	s	Time to the start of a distance-amplitude curve
t_m	s	Measured rise time
t_r	s	Transmitter pulse rise time from an amplitude of 10 % to 90 % of the peak amplitude
t_s	s	Oscilloscope rise time
V_E	V	Input voltage at the receiver
V_{ein}	V	Equivalent input noise voltage
V_{in}	V	Input voltage
V_l	V	Proportional gate output voltage with load resistor
V_{max}	V	Maximum input voltage of the receiver
V_{min}	V	Minimum input voltage of the receiver