



SLOVENSKI STANDARD
oSIST prEN ISO 22232-1:2018
01-oktober-2018

Neporušitveno preskušanje - Ugotavljanje značilnosti in overjanje naprav za ultrazvočno preskušanje - 1. del: Aparati (ISO/DIS 22232-1:2018)

Non-destructive testing - Characterization and verification of ultrasonic test equipment - Part 1: Instruments (ISO/DIS 22232-1:2018)

Zerstörungsfreie Prüfung - Charakterisierung und Verifizierung der Ultraschall-Prüfausrüstung - Teil 1: Prüfgeräte (ISO/DIS 22232-1:2018)

Essais non destructifs - Caractérisation et vérification de l'appareillage de contrôle par ultrasons - Partie 1: Appareils (ISO/DIS 22232-1:2018)

Ta slovenski standard je istoveten z: prEN ISO 22232-1

ICS:

19.100 Neporušitveno preskušanje Non-destructive testing

oSIST prEN ISO 22232-1:2018

en,fr,de

DRAFT INTERNATIONAL STANDARD

ISO/DIS 22232-1

ISO/TC 135/SC 3

Secretariat: DIN

Voting begins on:
2018-07-19Voting terminates on:
2018-10-11

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*

ICS: 19.100

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[SIST EN ISO 22232-1:2020](https://standards.iteh.ai/catalog/standards/sist/78bd8dd7-6c2e-4d06-94b5-382a6dbd46ee/sist-en-iso-22232-1-2020)

<https://standards.iteh.ai/catalog/standards/sist/78bd8dd7-6c2e-4d06-94b5-382a6dbd46ee/sist-en-iso-22232-1-2020>

THIS DOCUMENT IS A DRAFT CIRCULATED FOR COMMENT AND APPROVAL. IT IS THEREFORE SUBJECT TO CHANGE AND MAY NOT BE REFERRED TO AS AN INTERNATIONAL STANDARD UNTIL PUBLISHED AS SUCH.

IN ADDITION TO THEIR EVALUATION AS BEING ACCEPTABLE FOR INDUSTRIAL, TECHNOLOGICAL, COMMERCIAL AND USER PURPOSES, DRAFT INTERNATIONAL STANDARDS MAY ON OCCASION HAVE TO BE CONSIDERED IN THE LIGHT OF THEIR POTENTIAL TO BECOME STANDARDS TO WHICH REFERENCE MAY BE MADE IN NATIONAL REGULATIONS.

RECIPIENTS OF THIS DRAFT ARE INVITED TO SUBMIT, WITH THEIR COMMENTS, NOTIFICATION OF ANY RELEVANT PATENT RIGHTS OF WHICH THEY ARE AWARE AND TO PROVIDE SUPPORTING DOCUMENTATION.

This document is circulated as received from the committee secretariat.

ISO/CEN PARALLEL PROCESSING



Reference number
ISO/DIS 22232-1:2018(E)

© ISO 2018

iTeh STANDARD PREVIEW (standards.iteh.ai)

SIST EN ISO 22232-1:2020

<https://standards.iteh.ai/catalog/standards/sist/78bd8dd7-6c2e-4d06-94b5-382a6dbd46ee/sist-en-iso-22232-1-2020>



COPYRIGHT PROTECTED DOCUMENT

© ISO 2018

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

	Page
Foreword	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Symbols	3
5 General requirements of conformity	4
6 Manufacturer's technical specification for ultrasonic instruments	4
7 Performance requirements for ultrasonic instruments	7
8 Group 1 tests	9
8.1 Equipment required for group 1 tests	9
8.2 Battery operational time	9
8.2.1 Procedure	9
8.2.2 Acceptance criterion	10
8.3 Stability after warm-up time	10
8.3.1 Procedure	10
8.3.2 Acceptance criteria	10
8.4 Stability against temperature	10
8.4.1 Procedure	10
8.4.2 Acceptance criterion	11
8.5 Stability against voltage variation	11
8.5.1 Procedure	11
8.5.2 Acceptance criterion	11
8.6 Time base deviation	12
8.6.1 Procedure	12
8.6.2 Acceptance criterion	12
8.7 Transmitter pulse parameters	12
8.7.1 General	12
8.7.2 Pulse repetition frequency	12
8.7.3 Effective output impedance	13
8.8 Receiver	13
8.8.1 General	13
8.8.2 Cross talk from transmitter to receiver during transmission	13
8.8.3 Dead time after transmitter pulse	14
8.8.4 Dynamic range	14
8.8.5 Receiver input impedance	15
8.8.6 Time-corrected gain (TCG)	15
8.8.7 Temporal resolution	16
8.9 Gates	17
8.9.1 General	17
8.9.2 Gates with value output	17
8.9.3 Gates with analogue output	18
8.9.4 Gates with alarm output	20
8.10 Digital processing	21
8.10.1 Digitisation sampling error	21
8.10.2 Response time of digital ultrasonic instruments	22
9 Group 2 tests	22
9.1 Equipment required for group 2 tests	22
9.2 Physical state and external aspects	23
9.2.1 Procedure	23
9.2.2 Acceptance criterion	23
9.3 Transmitter voltage, pulse rise time and duration	23

ISO/DIS 22232-1:2018(E)

9.3.1	Procedure.....	23
9.3.2	Acceptance criteria.....	23
9.4	Receiver.....	24
9.4.1	General.....	24
9.4.2	Frequency response.....	24
9.4.3	Noise.....	25
9.4.4	Gain linearity.....	26
9.4.5	Vertical linearity.....	26
10	Figures.....	28
Annex A (normative) Special conditions for ultrasonic instruments with logarithmic amplifiers		40
Bibliography.....		41

iTeh STANDARD PREVIEW (standards.iteh.ai)

SIST EN ISO 22232-1:2020

<https://standards.iteh.ai/catalog/standards/sist/78bd8dd7-6c2e-4d06-94b5-382a6dbd46ee/sist-en-iso-22232-1-2020>

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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on 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 the following URL: www.iso.org/iso/foreword.html.

The committee responsible for this document is ISO/TC 135 *Non-destructive testing, SC 3 Ultrasonic testing*.

ISO 22232 consists of the following parts, under the general title *Non-destructive testing — Characterization and verification of ultrasonic test equipment*:

- Part 1: Instruments;
- Part 2: Probes;
- Part 3: Combined equipment.

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

Part 1: Instruments

1 Scope

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

Ultrasonic instruments for continuous waves are not included in this document.

Ultrasonic phased array instruments are not included in this document, see e. g. ISO 18563-1. If a phased array instrument has dedicated connectors for single or dual-element 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*

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:

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

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-element probe)

3.3

calibrated dB-switch

device controlling the overall gain of the ultrasonic instrument calibrated in decibels

ISO/DIS 22232-1:2018(E)**3.4****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

3.5**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 of analogue output**

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

3.9**hold time of switched outputs**

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

3.10**hold time of analogue output**

time for which the analogue output is above 90 % of its peak 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, measured in decibels

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.

3.13**noise of analogue output**

measure of the noise of analogue output

3.14**receiver input impedance**

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

3.15**response time of digital ultrasonic instrument**

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

3.16**rise time of analogue output**

time it takes the proportional gate output to rise from 10 % to 90 % of its peak value

3.17**temporal resolution**

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

3.18**short pulse**

unrectified pulse which has fewer than 1,5 cycles in the time interval over which the pulse amplitude exceeds half of its peak amplitude

3.19**switching hysteresis**

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

4 Symbols**Table 1 — Symbols**

Symbol	Unit	Meaning
A_o, A_n	dB	Attenuator settings used during tests
C_{max}	pF	Parallel capacity of receiver at maximum gain
C_{min}	pF	Parallel capacity of receiver at minimum gain
D_S	dB	Cross talk during transmission
Δf_g	Hz	Frequency bandwidth measured at proportional gate output
f_{go}	Hz	Centre frequency measured at proportional gate output
f_{gu}	Hz	Upper frequency limit at -3 dB, measured at proportional gate output
f_{gl}	Hz	Lower frequency limit at -3 dB, measured at proportional gate output
f_{gmax}	Hz	Frequency with the maximum amplitude in the frequency spectrum measured at proportional gate output
f_o	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}	V / \sqrt{Hz}	Equivalent input noise
R_l	Ω	Termination resistor
R_{max}	Ω	Input resistance of receiver at maximum gain
R_{min}	Ω	Input resistance of receiver at 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_o	s	Time to the start of a distance-amplitude curve

Table 1 (continued)

Symbol	Unit	Meaning
t_r	s	Transmitter pulse rise time from an amplitude of 10 % to 90 % of the peak amplitude
V_E	V	Input voltage at the receiver
V_{ein}	V	Equivalent input noise voltage
V_{in}	V	Input voltage
V_1	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
V_o	V	Proportional gate output voltage with no load resistor
V_{50}	V	Voltage amplitude of the transmitter pulse with a 50 Ω loading of the transmitter
V_{75}	Ω	Voltage amplitude of the transmitter pulse with a 75 Ω loading of the transmitter
Z_o	Ω	Output impedance of transmitter
Z_A	Ω	Output impedance of analogue output

5 General requirements of conformity

An ultrasonic instrument complies with this document if it fulfils all of the following requirements:

- a) the ultrasonic instrument shall comply with [Clause 7](#);
- b) a declaration of conformity according to ISO 17050-1 shall be available, issued by either the manufacturer operating a certified quality management system (e.g. in accordance with ISO 9001) or by an organization operating an accredited test laboratory (e.g. in accordance with ISO/IEC 17025);
- c) the ultrasonic instrument shall be clearly marked to identify the manufacturer, and carry a unique serial number or show a permanent reference number from which information can be traced to the data sheet;
- d) a manufacturer’s technical specification corresponding to the ultrasonic instrument shall be available, which defines the performance criteria in accordance with [Clause 6](#).

6 Manufacturer’s technical specification for ultrasonic instruments

The manufacturer’s technical specification for an ultrasonic instrument shall contain, as a minimum, the information listed in [Table 2](#) (M = Measurement, OI = Other Information). The actual values quoted for the parameters listed in this clause shall be the results obtained from the tests described in [Clause 7](#), with tolerances given as indicated.

Where applicable, these details should also include sampling rates used, effect of pulse repetition frequency or display range on the sampling rate and response time. In addition, the principles of any algorithm used to process data for display shall be described and the version of any software installed shall be quoted.

Table 2 — Technical characteristics to be shown in the instrument’s technical specification

Information	Type of information	Remarks
General features		
Size	OI	Width (mm) × height (mm) × depth (mm)
Weight	OI	At an operational stage including all batteries
Type(s) of power supply	OI	—

Table 2 (continued)

Information	Type of information	Remarks
Type(s) of instrument sockets	OI	—
Battery operational time	M	At fully charged new batteries
Number and type of batteries	OI	—
Stability against temperature	M	—
Stability after warm-up time	M	—
Stability against voltage variations	M	—
Temperature and voltage (mains and/or batteries) ranges in which the instrument operates in accordance with the technical specification (operation and storage)	OI	When a warm-up time is necessary, its duration shall be stated
Form of indication given when a low battery voltage takes the ultrasonic instrument performance outside of specification	OI	—
Pulse repetition frequencies (PRFs)	M	Minimum and maximum values
Maximum power consumption	OI	VA (volt-ampere)
Protection grade	OI	—
Environment	OI	For example: restriction of hazardous substances (RoHS), explosive atmosphere (ATEX), vibration, humidity
Multi-channel configuration	OI	Number of channels controlled simultaneously (parallel operation) and number of available channels (multiplexed operation)
Extension of the number of channels by interconnection of instruments	OI	—
Available measurement units	OI	For example: mm, inches, %, dB, V
Display		
Screen size and resolution	OI	—
Range of sound velocities	OI	—
Time base delay range and depth	OI	—
List of available views	OI	—
Screen refresh rate for A-scan presentations	OI	—
Maximum digitization frequency without processing	OI	—
Digitization frequency with processing	OI	For example: interpolation
Digitizer vertical resolution	OI	In bits
Highest digitized frequency	OI	—
Time base deviation	M	—
Response time	M	—
Inputs/outputs		
Signal unrectified output (i.e. radio frequency, RF) and/or rectified available on the output socket	OI	—
Number and characteristics of logic and analogue control outputs	OI	Including the wiring diagram
Number and characteristics of encoder inputs	OI	Including the wiring diagram