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Date: 29 January 2021

Origin: European

Latest date for receipt of comments: 23 March 2021

Project No. 2020/03370

Responsible committee: PEL/85 Measuring equipment for electrical and electromagnetic quantities

Interested committees:

Title: Draft BS EN IEC 60688 Electrical measuring transducers for converting AC and DC electrical quantities to analogue or digital signals.

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Introduction

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/Figure/ Table/Note	Type of comment	Commend (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	

COMMITTEE DRAFT FOR VOTE (CDV)

PROJECT NUMBER:

IEC 60688 ED4

DATE OF CIRCULATION:

2021-01-29

CLOSING DATE FOR VOTING:

2021-04-23

SUPERSEDES DOCUMENTS:

IEC TC 85 : MEASURING EQUIPMENT FOR ELECTRICAL AND ELECTROMAGNETIC QUANTITIES	
SECRETARIAT: China	SECRETARY: Ms Guiju HAN
OF INTEREST TO THE FOLLOWING COMMITTEES: TC 13, SC 23K, TC 38, TC 66	PROPOSED HORIZONTAL STANDARD: ☐ Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.
FUNCTIONS CONCERNED: ☐ EMC ☐ ENVIRONMENT ☐ QUALITY ASSURANCE ☐ SAFETY	
☒ SUBMITTED FOR CENELEC PARALLEL VOTING Attention IEC-CENELEC parallel voting The attention of IEC National Committees, members of CENELEC, is drawn to the fact that this Committee Draft for Vote (CDV) is submitted for parallel voting. The CENELEC members are invited to vote through the CENELEC online voting system.	☐ NOT SUBMITTED FOR CENELEC PARALLEL VOTING

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TITLE:

Electrical measuring transducers for converting AC and DC electrical quantities to analogue or digital signals

PROPOSED STABILITY DATE: **2023**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**ELECTRICAL MEASURING TRANSDUCERS FOR CONVERTING AC AND DC
ELECTRICAL QUANTITIES TO ANALOGUE OR DIGITAL SIGNALS**

FOREWORD

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International Standard 60688 has been prepared by IEC technical committee 85: Measuring equipment for basic electrical quantities.

This fourth edition cancels and replaces the third edition published in 2012. It constitutes a technical revision

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

- updating normative references;
-
- additional requirements for specific transducers used for LV monitoring applications
- creation of interface coding to ease selection by the end-user

The text of this standard is based on the following documents:

FDIS

Report on voting

85/XX/FDIS	85/XX/RVD
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274
275 Full information on the voting for the approval of this standard can be found in the report on
276 voting indicated in the above table.

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

278 In this standard, the following print types are used:

- 279 – requirements and definitions: in roman type;
280 – NOTES: in smaller roman type;
281 – *compliance: in italic type.*

282 The committee has decided that the contents of this publication will remain unchanged until
283 the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data
284 related to the specific publication. At this date, the publication will be

- 285 • reconfirmed,
286 • withdrawn,
287 • replaced by a revised edition, or
288 • amended.

289

290 The National Committees are requested to note that for this publication the stability date is
291 2023

292 THIS TEXT IS INCLUDED FOR THE INFORMATION OF THE NATIONAL COMMITTEES AND WILL BE
293 DELETED AT THE PUBLICATION STAGE.

294

295

INTRODUCTION

New transducers can now be equipped with microprocessors that utilise digital data processing, communication methods and auxiliary sensors. This makes them more complex than conventional analogue transducers and gives them considerable added value.

The class index system of classification used in this standard is based upon the IEC 60051 series: *Direct acting indicating analogue electrical measuring instruments and their accessories*. Under this system, the permitted variations of the output signal due to varying influence quantities – ambient temperature, voltage, frequency, etc., – are implicit in the classification.

For those unfamiliar with the class index system, a word of warning is necessary. If, for example, a transducer is classified as Class 1, it does not mean that the error under practical conditions of use will be within ± 1 % of the actual value of the output or ± 1 % of the full output value. It means that the error should not exceed ± 1 % of the fiducial value under closely specified conditions. If the influence quantities are varied between the limits specified by the nominal ranges of use, a variation of amount comparable with the value of the class index may be incurred for each influence quantity.

The permissible error of a transducer under working conditions is the sum of the permissible intrinsic error and of the permissible variations due to each of the influence quantities. However, the actual error is likely to be much smaller because not all of the influence quantities are likely to be simultaneously at their most unfavourable values and some of the variations may cancel one another. It is important that these facts be taken into consideration when specifying transducers for a particular purpose.

Furthermore, some of the terms used in this standard are different from those used in IEC 60051 due to the fundamental differences between indicating instruments and measuring transducers.

All statements of performance are related to the output which is governed by two basic terms:

- "the nominal value", which may have a positive or a negative sign or both;
- "the span", which is the range of values of the output signal from maximum positive to maximum negative, if appropriate.

ELECTRICAL MEASURING TRANSDUCERS FOR CONVERTING AC AND DC ELECTRICAL QUANTITIES TO ANALOGUE OR DIGITAL SIGNALS

1 Scope

This International Standard applies to transducers with electrical inputs and outputs for making measurements of AC or DC electrical quantities. The output signal may be in the form of an analogue direct current, an analog direct voltage or in digital form. In this case, that part of the transducer utilized for communication purposes will need to be compatible with the external system.

This standard applies to measuring transducers used for converting following electrical quantities such as:

- current,
 - voltage,
 - active power,
 - reactive power,
 - power factor,
 - phase angle,
 - frequency,
 - harmonics or total harmonic distortion,
 - apparent power
- to an output signal.

This standard is not applicable for:

- instrument transformers that complies with IEC 61869 series;
- transmitters for use in industrial process application that complies with IEC 60770 series.;
- performance measuring and monitoring devices (PMD) that comply with IEC 61557-12.

Within the measuring range, the output signal is a function of the measurand. An auxiliary supply may be needed.

This standard applies:

- a) if the nominal frequency of the input(s) lies between 0 Hz and 1 500 Hz;
- b) if a measuring transducer is part of a system for the measurement of a non-electrical quantity, this standard may be applied to the electrical measuring transducer, if it otherwise falls within the scope of this standard;
- c) to transducers for use in a variety of applications such as telemetry and process control and in one of a number of defined environments.

This International Standard is intended:

- to specify the terminology and definitions relating to transducers whose main application is in industry;
- to unify the test methods used in evaluating transducer performance;
- to specify accuracy limits and output values for transducers.

2 Normative references

The following referenced documents are indispensable for the application 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 60051-1:1997, *Direct acting indicating analogue electrical measuring instruments and their accessories – Part 1: Definitions and general requirements common to all parts*

IEC 60068-2-6, *Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60068-2-27, *Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock*

IEC 60255-151, *Measuring relays and protection equipment – Part 151: Functional requirements for over/under current protection*

IEC 61010 (all parts), *Safety requirements for electrical equipment for measurement, control and laboratory use*

IEC 61010-1:2010, *Safety requirements for electrical equipment for measurement, control and laboratory use – Part 1: General requirements*

IEC 61010-1:2010/AMD1:2016

IEC 61010-2-030:2017, *Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 30 Special requirements for testing and measuring circuits*

IEC 61326-1:2020, *Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements*

IEC 61557-12, *Electrical safety in low voltage distribution systems up to 1 000 V AC and 1 500 V DC. – Equipment for testing, measuring or monitoring of protective measures – Part 12: Performance measuring and monitoring devices (PMD)*

3 Terms and definitions

For the purpose of this document the following terms and definitions apply:

3.1 General terms

3.1.1

(electrical measuring) transducer

TRD

device for converting an AC or DC measurand to a direct or alternative current, a direct or alternative voltage or a digital signal for measurement purposes

3.1.2

(electrical measuring) transducer type 1

TRD1

conventional transducer

NOTE – Transducers type 1 are using conventional interface outputs and are generally single-function devices

3.1.3

(electrical measuring) transducer type 2

TRD2

single-function transducer used in LV monitoring applications

NOTE – Transducers type 2 are using specific interface outputs and are generally more accurate

3.1.4

single-function device

device performing the measurement of a single electrical quantity (e.g. current, power factor, THD, ...) in a single form (e.g. RMS or peak or average, ...) but not both

3.1.5**analogue transducer**

device for converting an AC or DC. measurand to a direct or alternative current, a direct or alternative voltage for measurement purposes

3.1.6**digital transducer**

device for converting an AC or DC. measurand to a digital signal for measurement purposes

3.1.7**auxiliary supply**

AC or DC electrical supply, other than the measurand, which is necessary for the correct operation of the transducer

3.1.8**auxiliary circuit**

circuit which is usually energized by the auxiliary supply.

NOTE The auxiliary circuit is sometimes energized by one of the input quantities.

3.1.9**transducer with offset zero (live zero)**

transducer that gives a predetermined output signal other than zero when the measurand is zero

3.1.10**transducer with suppressed zero**

transducer for which zero output signal corresponds to a measurand greater than zero

3.1.11**total distortion factor**

ratio of the r.m.s. value of the total distortion content to the r.m.s. value of an alternating quantity

NOTE – The total distortion factor depends on the choice of the fundamental component. If it is not clear from the context which one is used an indication should be given.

3.1.12**output load (for analogue signals only)**

total resistance of the circuits and apparatus connected externally across the output terminals of the transducer

3.1.13**ripple content (of an analogue output signal)**

with steady-state input conditions, the ratio of the peak-to-peak value of the fluctuating component of an analogue output signal, expressed in percentage, to the fiducial value

3.1.14**output signal**

an analogue or digital representation of the measurand

3.1.15**output power**

power at the transducer output terminals

3.1.16**output current (voltage) (for analogue signals only)**

current (voltage) produced by the transducer which is an analogue function of the measurand

3.1.17**reversible output current (voltage) (for analogue signals only)**

output current (voltage) that reverses polarity in response to a change of sign or direction of the measurand

3.1.18**measuring element of a transducer**

unit or module of a transducer that converts the measurand, or part of the measurand, into a corresponding signal

3.1.19**single element transducer**

transducer having one measuring element

3.1.20**multi-element transducer**

transducer having two or more measuring elements. The signals from the individual elements are combined to produce an output signal corresponding to the measurand

3.1.21**combined transducer**

transducer having two or more measuring circuits for one or more functions

3.1.22**response time**

time from the instant of application of a specified change of the measurand until the output signal reaches and remains at its final steady value or within a specified interval centred on this value

3.1.23**compliance voltage**

accuracy limiting output voltage

For variable output load transducers having a current output, the value of the voltage appearing across the output terminals up to which the transducer complies with the requirements of this standard

3.1.24**(output) series mode interference voltage**

unwanted alternating voltage appearing in series between the output terminals and the load

3.1.25**(output) common mode interference voltage**

unwanted alternating voltage that exists between each of the output terminals and a reference point

3.1.26**storage conditions**

conditions, defined by means of the ranges of the influence quantities, such as temperature or any other special condition, within which the transducer may be stored (non-operating) without damage

3.1.27**stability**

ability of a transducer to keep its performance characteristics unchanged during a specified time, all influence quantities remaining within their specified ranges

3.1.28**short-term stability**

stability over a period of 24 h

3.1.29**long-term stability**

stability over a period of one year

3.1.30**usage group**

group of transducers capable of operating under a specified set of environmental conditions

3.1.31**pulse density output**

digital representation of the measurand, where the relative density of the output pulses corresponds to the analog signal amplitude

3.2 Description of transducers according to the measurand**3.2.1****voltage transducer**

transducer used for the measurement of AC or DC voltage

3.2.2**current transducer**

transducer used for the measurement of AC or DC current

3.2.3**apparent power transducer**

transducer that is used for the measurement of the apparent power

3.2.4**active power transducer**

transducer used for the measurement of active electrical power

3.2.5**reactive power transducer**

transducer used for the measurement of reactive electrical power

3.2.6**frequency transducer**

transducer used for the measurement of the frequency of an AC electrical quantity

3.2.7**phase angle transducer**

transducer for the measurement of the phase angle between two AC electrical quantities having the same frequency

3.2.8**power factor transducer**

transducer used for the measurement of the power factor of an AC circuit

3.2.9**harmonics transducer**

transducer that is used for the measurement of the harmonics or the total harmonic distortion of an AC circuit

3.2.10**TRD2-PFA**

power factor (arithmetic method) transducer for LV monitoring applications

3.2.11**TRD2-PFV**

power factor (vector method) transducer for LV monitoring applications

3.2.12**TRD2-THDU**

voltage THD transducer for LV monitoring applications

3.2.13**TRD2-THDI**

current THD transducer for LV monitoring applications

3.2.14**TRD2-UAC**

voltage transducer for LV monitoring applications that is used for the measurement of AC voltage

3.2.15**TRD2-UDC**

voltage transducer for LV monitoring applications that is used for the measurement of DC voltage

3.2.16**TRD2-IAC**

current transducer for LV monitoring applications that is used for the measurement of AC current

3.2.17**TRD2-IDC**

current transducer for LV monitoring applications that is used for the measurement of DC current

3.3 Description of transducers according to their output load**3.3.1****fixed output load transducer**

transducer that complies with this standard only when the output load is at its nominal value, within specified limits

3.3.2**variable output load transducer**

transducer that complies with this standard when the output load has any value within a given range

3.4 Nominal values**3.4.1****nominal value**

value, or one of the values, indicating the intended use of a transducer

NOTE The lower and upper nominal values of the measurand are those which correspond to the lower and upper nominal values of the output signal.

3.4.2**output span** (hereinafter designated "span")

algebraic difference between the upper and lower nominal values of the output signal

3.4.3**fiducial value**

value to which reference is made in order to specify the accuracy of a transducer

NOTE The fiducial value is the span, except for transducers having a reversible and symmetrical output signal when the fiducial value may be half the span if specified by the manufacturer.

3.4.4**circuit insulation voltage** (nominal circuit voltage)

highest circuit voltage to earth on which a circuit of a transducer may be used and that determines its voltage test

3.4.5**nominal power factor**

factor by which it is necessary to multiply the product of the nominal voltage and nominal current to obtain the nominal power

603 **Nominal power factor** =
$$\frac{\text{nominal power}}{\text{nominal voltage} \times \text{nominal current}}$$

604 When the current and voltage are sinusoidal quantities, the nominal power factor is $\cos \varphi$
605 where φ is the phase difference between the current and the voltage. For reactive power
606 transducers, the nominal power factor is $\sin \varphi$.

607 **3.4.6**
608 **maximum permissible values of input current and voltage**

609 values of current and voltage assigned by the manufacturer as those which the transducer will
610 withstand indefinitely without damage

611 **3.4.7**
612 **limiting value of the output (current or voltage) signal**

613 upper limit of output (current or voltage) signal which cannot, by design, be exceeded under
614 any conditions

615 **3.4.8**
616 **measuring range**

617 range defined by two values of the measurand within which the performance complies with the
618 requirements of this standard (see 2.4.3 of IEC 60051-1:1997)

619 **3.4.9**
620 **nominal value of the measured voltage**

621 nominal value of the voltage of the external circuit (e.g. the secondary winding of a voltage
622 transformer) to which the voltage input circuit of the transducer is to be connected

623 **3.4.10**
624 **nominal value of the measured current**

625 nominal value of the current in the external circuit (e.g. the secondary winding of a current
626 transformer) to which the current input circuit of the transducer is to be connected

627 **3.4.11**
628 **nominal value of the measurand**

629 for active power and reactive power transducers, the value of the measured quantity corres-
630 ponding to the nominal values of the measured voltage and current, and the power factor

631 **3.5 User adjustment**

632 Transducers can be supplied with provision to be adjusted by the user. (It should be noted
633 that power sources and measuring equipment having adequate stability and accuracy are
634 required). The following definitions apply to these transducers

635 **3.5.1**
636 **calibration value**

637 value of a quantity to which the nominal value is changed by user adjustment for a specific
638 application

639 **3.5.2**
640 **calibration value of the measured voltage**

641 value of the voltage applied to the voltage input circuit of the transducer

642 **3.5.3**
643 **calibration value of the measured current**

644 value of the current applied to the current input circuit of the transducer

645 **3.5.4**
646 **calibration value of the measurand**

647 value of the measurand resulting from user adjustment

3.5.5**calibration value of the output signal**

value of the output signal of the transducer corresponding to the calibration value of the measurand after adjustment

3.5.6**adjustment range**

possible range of adjustment values of the measured current or voltage

3.5.7**conversion coefficient**

relationship of the value of the measurand to the corresponding value of the output signal

3.6 Influence quantities and reference conditions**3.6.1****influence quantity**

quantity (other than the measurand) that may affect the performance of a transducer

3.6.2**reference conditions**

specified conditions under which the transducer complies with the requirements concerning intrinsic errors

NOTE These conditions may be defined by either a reference value or a reference range.

3.6.2.1**reference value**

specified single value of an influence quantity at which the transducer complies with the requirements concerning intrinsic errors

3.6.2.2**reference range**

specified range of values of an influence quantity within which the transducer complies with the requirements concerning intrinsic errors

3.6.3**nominal range of use**

specified range of values over which it is intended that an influence quantity can assume without the output signal of the transducer changing by amounts in excess of those specified

3.7 Errors and variations**3.7.1****error**

actual value of the output signal minus the intended value of the output signal, expressed algebraically

3.7.2**error expressed as a percentage of the fiducial value**

one hundred times the ratio of the error and the fiducial value

3.7.3**intrinsic error**

error determined when the transducer is under reference conditions

3.7.4**variation due to an influence quantity**

difference between the two values of the output signal for the same value of the measurand when an influence quantity assumes successively two different specified values

3.7.5**variation due to an influence quantity expressed as a percentage of the fiducial value**

one hundred times the ratio of the variation due to an influence quantity and the fiducial value

3.8 Accuracy, accuracy class, class index

3.8.1

accuracy

accuracy of a transducer is defined by the limits of intrinsic error and by the limits of variations

3.8.2

accuracy class

class of transducers for which the accuracy of all can be designated by the same number if they comply with all the requirements of this standard

3.8.3

class index

number which designates the accuracy class

NOTE 1 The class index is applicable to the intrinsic error as well as to the variations.

NOTE 2 Throughout this standard, the phrase "x % of the class index" denotes "x % of the limits of error relating to the class index".

4 General

4.1 Transducer general architecture

Organisation of the measurement chain: the electrical quantity to be measured may be either directly accessible, as it is generally the case in low-voltage systems, or accessible via measurement sensors like voltage sensors (VS) or current sensors (CS).

Figure 1 below shows the common organisation of a transducer (TRD).

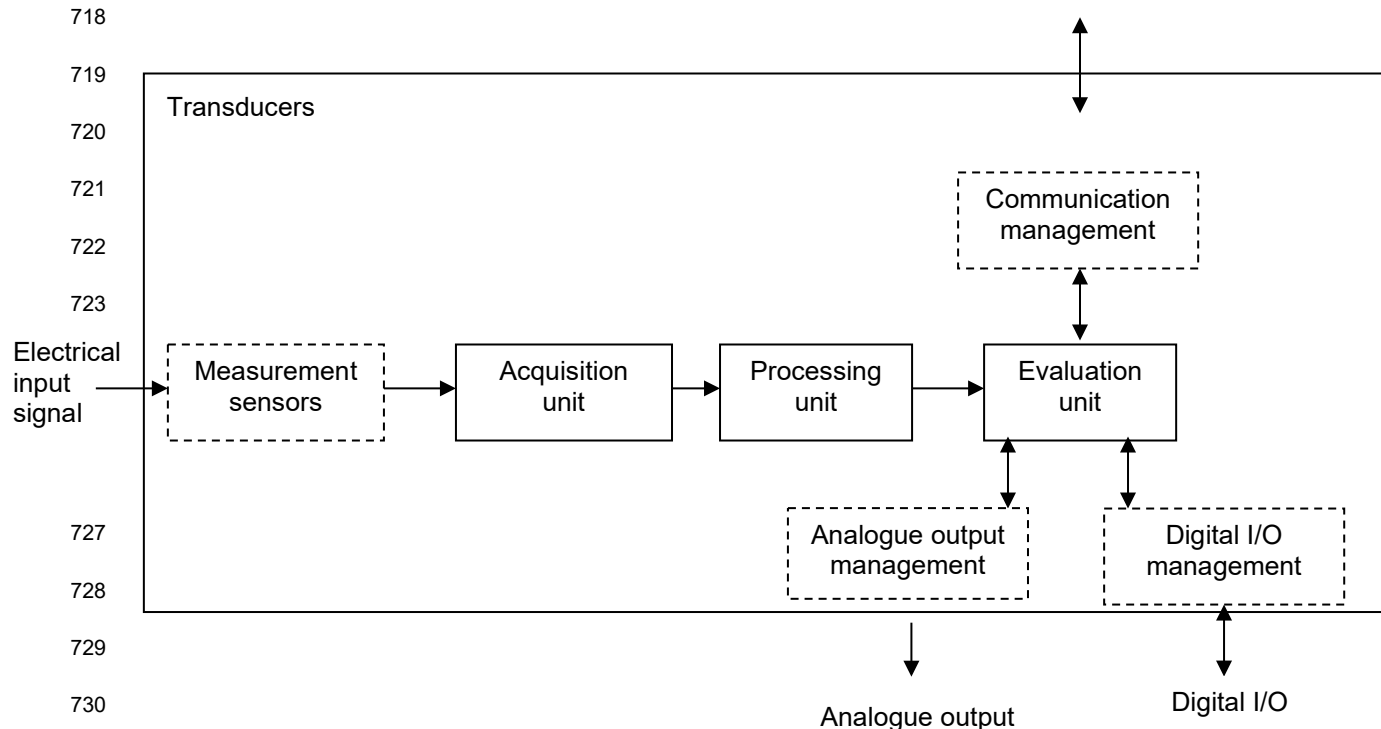


Figure 1 – Transducer (TRD) architecture**4.2 Classification of transducers (TRD)**

Transducers are classified according to the applications as defined in Table 1.

Table 1 – Functional classification of Transducers with minimal required functions

Requirements	Transducers type	
	TRD1	TRD2
See clause 5	■	
See Annex A		■

5 Requirements for TRD1**5.1 Safety requirements: Clearances and creepage distances**

Transducers shall comply with safety requirements of IEC 61010 series, and in addition with the requirements of the following subclauses.

Clearances and creepage distances shall be selected at least in accordance with:

- pollution degree 2,
- measurement category III for measuring input circuits,
- overvoltage category III for mains circuits.

NOTE 1 Measurement category is defined in IEC 61010-2-030.

5.2 EMC requirements**5.2.1 Immunity**

For High frequency disturbance test, see the IEC 61326 series.

If, by agreement, other tests are required, then TRD1 with active electronic components may comply with clause 6 of IEC 61326-1.

NOTE – These requirements are consistent with those of clause 6.20 and clause 6.22

5.2.2 Emission

If, by agreement, other tests are required, then TRD1 with active electronic components may comply with either class A or class B limits as defined in clause 7 of IEC 61326-1 applies.

NOTE – This requirement is consistent with the one of clause 6.22

5.3 Class index requirements**5.3.1 Class index**

The class index for a transducer shall be chosen from those given in Table 1.

This class index definition only applies for the analogue output of the transducers.

Table 1 – Relationship between the limits of intrinsic error, expressed as a percentage of the fiducial value, and the class index

Class index	0,2	0,5	1	2	2,5	3	5	10	20
Limits of error	±0,2 %	±0,5 %	±1 %	±2 %	±2,5 %	±3 %	±5 %	±10 %	±20 %

NOTE Class indices of 0,3 and 1,5, although non-preferred, may be used.

5.3.2 Class index for transducer used with sensors

If the transducers are used with sensors the manufacturer shall specify the accuracy class of the whole system transducer & sensor.

In some cases when a transducer does not include the sensors, their associated uncertainties are not considered. When a transducer includes the sensors, their associated uncertainties are considered.

5.3.3 Intrinsic error

When the transducer is under reference conditions, the error at any point between the upper and lower nominal values of the output signal shall not exceed the limits of the intrinsic error given in Table 1 expressed as a percentage of the fiducial value.

Values stated in a table of corrections, if any, supplied with the transducer shall not be taken into account in determining the errors.

5.4 Conditions for the determination of intrinsic error

Prior to pre-conditioning and before determination of the intrinsic error, preliminary adjustments shall be carried out in accordance with the manufacturer's instructions. The transducer shall be at the reference temperature.

The transducer shall be left in circuit under the conditions specified in Table 2.

Table 2 – Pre-conditioning

Conditions	Values
Voltage (including any auxiliary supply)	Nominal value
Current	Nominal value
Frequency	Reference value
Power factor	Reference value
Time between connection into circuit and start of determination of errors	30 min

After the specified pre-conditioning, transducers having adjustments available to the user shall be adjusted in accordance with the manufacturer's instructions.

The reference conditions relative to each of the influence quantities are given in Table 3. The reference conditions relative to the measurand are given in Table 4.

Table 3 – Reference conditions of the influence quantities and tolerances or testing purposes

Influence quantity	Reference conditions unless otherwise marked	Tolerances permitted for testing purposes applicable to a single reference value (note 1)
Ambient temperature	To be marked in the type test report	$\pm 1\text{ }^{\circ}\text{C}$
Usage group (see 6.1.2)		—
I	K55	—
II	K70	—
III	Kx ⁽³⁾	
Frequency of the input quantity		
Non-frequency sensitive	Nominal value	$\pm 2\text{ }\%$
Frequency sensitive	To be marked in the type test report	$\pm 0,1\text{ }\%$
Waveform of the input quantity	Sinusoidal, except for harmonics transducers	The distortion factor $\times 100$ shall not exceed the class index, unless

		otherwise specified by the manufacturer
Output load		
Fixed output load transducers	Nominal value	± 1 %
Variable output load transducers	Mean value of the nominal range	± 1 %
Auxiliary supply		
Voltage AC	Nominal value	± 2 %
Voltage DC	Nominal value	± 1 %
Frequency	Nominal value	± 1 %
Distortion factor	0,05 maximum	—
Magnetic field of external origin	Total absence	40 A/m at frequencies from DC to 65 Hz in any direction (note 2)
NOTE 1 When a reference range is marked, no tolerance is allowed.		
NOTE 2 40 A/m is approximately the highest value of the earth's magnetic field		
NOTE 3 Kx stands for extended conditions.		

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Table 4 – Reference conditions relative to the measurand

Measurand	Reference conditions		
	Voltage	Current	Power factor, active or reactive
Apparent power	Nominal voltage ± 2 %	Any current up to the nominal current	$ \cos \varphi $ or $ \sin \varphi = 1,0$ to 0,8 lagging or leading
Active power	Nominal voltage ± 2 %	Any current up to the nominal current	$ \cos \varphi = 1,0$ to 0,8 lagging or leading
Reactive power	Nominal voltage ± 2 %	Any current up to the nominal current	$ \sin \varphi = 1,0$ to 0,8 lagging or leading (note 1)
Phase angle or power factor	Nominal voltage ± 2 %	40% to 100 % of the nominal current	—
Frequency	Nominal voltage ± 2 %	—	—
Polyphase quantities	Symmetrical voltages (note 2)	Symmetrical currents (note 2)	—
NOTE 1 Apparent, active power and reactive power transducers are normally used together and are connected to the same current and voltage transformers. It must be noted that $\sin \varphi = 1,0$ to 0,8 is used here for ease of testing only.			
NOTE 2 The difference between any two line-to-line voltages and between any two line-to-neutral voltages shall not exceed 1 % of the average (line-to-line and line-to-neutral voltages respectively). Each of the currents in the phases shall differ by not more than 1 % from the average of the currents.			
The angles between each of the currents and the corresponding phase-to-neutral (star) voltages shall differ by not more than 2° .			
Where interactions between the separate measuring elements of a multi-element transducer are adequately characterized, single-phase testing of the transducer is acceptable.			

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5.5 Auxiliary supply**5.5.1 General**

Some transducers dealt with in this standard may need an auxiliary supply. This is specified in two separate categories, DC and AC supplies.

5.5.2 DC supply

- a) The value of the voltage of the DC supply shall be as specified in 5.6.3.
- b) The battery supply may be earthed or floating. Suitable means shall be provided in the transducer to ensure isolation between the power supply and the input/output circuits of the transducer (for details of voltage tests, see 6.18).
- c) The transducer shall withstand any voltage ripple up to a maximum of 10 % peak to peak superimposed on the DC power supply.

d) The noise fed back to the battery from the transducer shall be limited to 100 mV peak to peak when measured with a specified source resistance at all frequencies up to 100 MHz.

In addition, when the battery feeding the transducer is also used for telephone equipment the noise shall not exceed 2 mV psophometric.

NOTE The psophometric weighting characteristic is given now specified in ITU-T *Recommendation O.41* .

5.5.3 AC supply

For the nominal value of the voltage of the AC supply, see 5.6. This voltage may be provided by a separate supply or may be derived from the measured voltage or current.

5.6 Input values

5.6.1 General

The nominal values of voltage, current, frequency and auxiliary supply shall be specified by the manufacturer.

5.6.2 Adjustment range for transducers that can be adjusted by the user:

a) for the input voltage: 80 % to 120 % of the nominal value;

b) for the input current: 60 % to 130 % of the nominal value.

This means that the nominal value of the output signal can be obtained for any adjusted value of the measurand within the ranges given above.

5.6.3 The preferred nominal value of DC auxiliary supplies shall be 24 V, 48 V or 110 V.

5.7 Analogue output signals

5.7.1 General

The lower and upper nominal values of the output signal and the compliance voltage shall be chosen from those given in 5.7.2 and 5.7.3 or 5.7.6.

5.7.2 Output current

The signal 4 mA to 20 mA is preferred.

NOTE The condition "0 mA" has a special meaning (IEC 60381-1).

Other permissible values are:

0 mA to 20 mA

0 mA to 1 mA

0 mA to 10 mA

–1 mA to 1 mA

–5 mA to 5 mA

– 10 mA to 10 mA

– 20 mA to 20 mA

5.7.3 Compliance voltage

10 V

15 V

5.7.4 Maximum output voltage

The manufacturer shall state the maximum value of the output voltage occurring under any conditions of output load and input. This voltage shall not exceed the limit of safety extra-low voltage.

5.7.5 Interference risk of output current

Attention is drawn to the interference problems which may result if the output current has a low value.

5.7.6 Output voltage

0 V to 1 V

0 V to 10 V

–1 V to 1 V

–10 V to 10 V

NOTE Transducers having a voltage output are non-preferred.

5.8 Output transfer function

For analogue transducers, the used transfer function shall be one of the following curves.

For analogue transducers, variables x , y , y_1 , y_2 can be adjustable

Curve A is described in Figure 2.

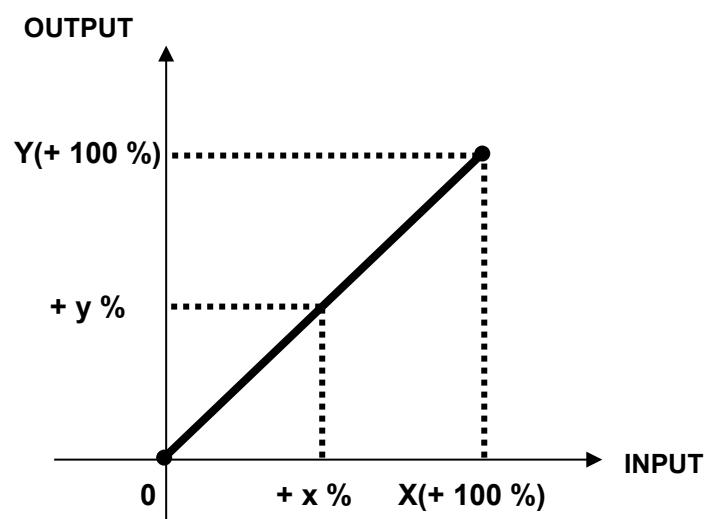


Figure 2 – Transfer function curve A

Curve B is described in Figure 3:

