SLOVENSKI STANDARD
oSIST prEN IEC 61514:2024

01-september-2024

Sistemi za upravljanje industrijskih procesov - Postopki za ocenjevanje lastnosti pozicionirnikovz ventili s pnevmatskimi izhodi

Industrial-process control systems - Methods of evaluating the performance of valve positioners with pneumatic outputs

Systeme der industriellen Prozesstechnik - Methoden der Beurteilung des Betriebsverhaltens von Ventilstellungsreglern mit pneumatischen Ausgängen

Systèmes de commande des processus industriels - Méthodes d'évaluation des performances des positionneurs de vannes à sorties pneumatiques

Ta slovenski standard je istoveten z: **prEN IEC 61514:2024**

ICS:

23.060.99	Drugi ventili	Other valves
25.040.40	Merjenje in krmiljenje industrijskih postopkov	Industrial process measurement and control

oSIST prEN IEC 61514:2024 **en,fr,de**

65B/1256/CDV

COMMITTEE DRAFT FOR VOTE (CDV)

PROJECT NUMBER: **IEC 61514 ED2**	
DATE OF CIRCULATION: **2024-07-05**	CLOSING DATE FOR VOTING: **2024-09-27**
SUPERSEDES DOCUMENTS: **65B/1202/RR, 65B/1249/CC**	

IEC SC 65B : MEASUREMENT AND CONTROL DEVICES	
SECRETARIAT: United States of America	SECRETARY: Mr Wallie Zoller
OF INTEREST TO THE FOLLOWING COMMITTEES:	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:

Industrial-process control systems - Methods of evaluating the performance of valve positioners with pneumatic outputs

PROPOSED STABILITY DATE: 2027

NOTE FROM TC/SC OFFICERS:

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

INDUSTRIAL-PROCESS CONTROL SYSTEMS –

Methods of evaluating the performance of valve positioners with pneumatic outputs

FOREWORD

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International Standard IEC 61514 has been prepared by subcommittee 65B: Devices, of IEC technical committee 65: Industrial-process measurement and control.

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

FDIS	Report on voting
65B/394/FDIS	65B/403/RVD

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 3.

The committee has decided that the contents of this publication will remain unchanged until 2006. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

INDUSTRIAL-PROCESS CONTROL SYSTEMS –

Methods of evaluating the performance of valve positioners with pneumatic outputs

1 Scope and object

This International Standard specifies tests designed to determine the static and dynamic performance of single-acting or double-acting analogue positioners. The tests may be applied to positioners which receive standard analogue input signals (as specified in IEC 60381 and IEC 60382) and have a pneumatic output.

Positioners with pulsed or digital input signals, positioners with digital controllers and positioners with pulsed outputs are outside the scope of this standard.

Testing may be conducted either on a positioner alone, independently of an actuator, or on a positioner mounted and connected to a specific actuator, as a combined unit. The text makes clear where different approaches are required.

The methods of evaluation given in this standard are intended for use by manufacturers to determine the performance of their products, and by users, or independent testing establishments, to verify manufacturers' performance specifications.

The closest liaison should be maintained between the evaluating body and the manufacturer. Note should be taken of the manufacturer's specifications for the instrument when the test programme is being decided, and the manufacturer should be invited to comment on both the test programme and the results. His comments on the results should be included in any report produced by the testing organization.

This standard is intended to provide definitions of positioner elements, actions, and characteristics, to specify uniform methods of measuring performance errors and effects of influence quantities on those characteristics, and to describe methods of reporting and evaluating the results of the measurement data obtained.

The test conditions described in this publication (for example range of ambient temperatures and power supply) relate to conditions which commonly arise in use. Consequently, the values specified shall be used where no other values are specified by the manufacturer or user. If other values are used, they should be stated. It is recognized that the manufacturer's specifications and instructions for installation and operation should apply during all steps.

The tests specified in this standard are not necessarily sufficient for instruments specifically designed for unusually arduous conditions. Conversely, a reduced series of tests may serve adequately for instruments designed to perform within a more limited range of conditions.

When a full evaluation, in accordance with this standard, is not required or possible, those tests which are required should be performed and the results reported in accordance with the relevant parts of this standard. In such cases, the test report should state that it does not cover the full number of tests specified herein.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050, *International Electrotechnical Vocabulary (IEV):*

- *Part 311: Electrical and electronic measurements - General terms relating to electrical measurements*
- *Part 351: Control technology*

IEC 60068-2-1, Environmental testing – Part 2-1: Tests. Test A: Cold

IEC 60068-2-2, *Environmental testing – Part 2-2: Tests. Test B: Dry heat*

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

IEC 60068-2-31, Environmental testing - Part 2-31: Tests - Test Ec: Rough handling shocks, primarily for equipment-type specimens

IEC 60068-2-78, *Environmental testing – Part 2-78: Tests. Test Cab: Damp heat, steady state*

IEC 60079 (all parts), *Electrical apparatus for explosive gas atmospheres*

IEC 60381-1, *Analogue signals for process control systems – Part 1: Direct current signals*

IEC 60381-2, *Analogue signals for process control systems – Part 2: Direct voltage signals*

IEC 60382, *Analogue pneumatic signal for process control systems*

IEC 60529, *Degree of protection provided by enclosures (IP Code)*

IEC 60534-1, *Industrial-process control valves – Part 1: Control valve terminology and general considerations*

IEC 60654 (all parts), *Operating conditions for industrial-process measurement and control equipment*

IEC 60721-3, *Classification of environmental conditions – Part 3 Classification of groups of environmental parameters and their severities*

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

IEC 61032, *Protection of persons and equipment by enclosures – Probes for verification*

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

IEC 62828-1: 2017, *Reference conditions and procedures for testing industrial and process measurement transmitters – Part 1: General procedures for all types of transmitters*

3 Definitions

For the purpose of this standard, the terms and definitions given in IEC 60050 Part 311 and 351 as well as the following definitions shall be applied.

3.1
positioner
position controller connected to the moving part of a final control element or its actuator; automatically adjusts its output signal *Y* to the actuator in order to maintain a desired travel signal *X* that bears a predetermined relationship to the input signal *W*

NOTE In this standard, only positioners with pneumatic output signals *Y* are considered. The input signal *W* may be an air pressure (pneumatic positioner), or an electric current or voltage (electro-pneumatic positioner).

3.1.1

single-acting positioner

positioner (see figure 1a) having one output signal *Y* which acts on one side of the actuator. The returning force for the actuator is usually provided by springs

3.1.2

double-acting positioner

positioner (see figure 1b) providing two output signals Y_D and Y_R connected to opposite sides of the actuator diaphragm or piston

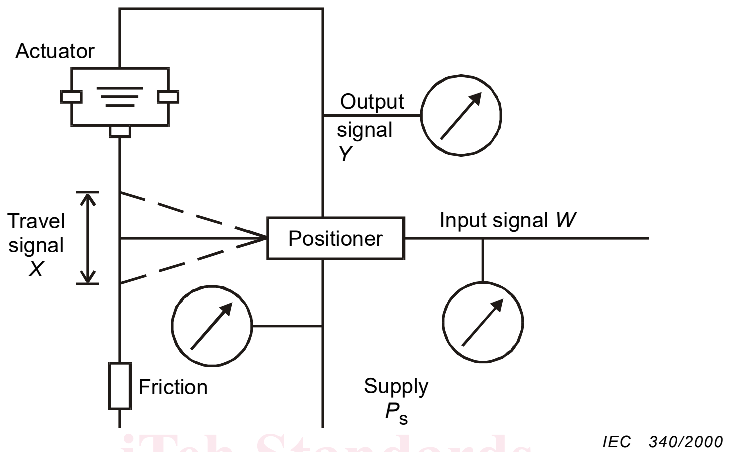


Figure 1a – Single-acting positioner/actuator

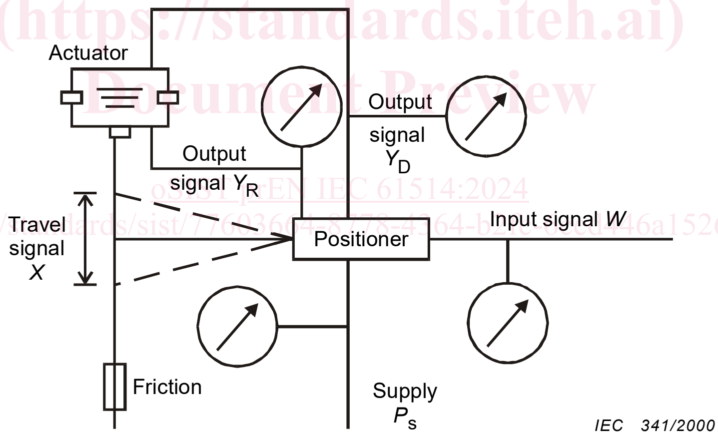


Figure 1b – Double-acting positioner/actuator

Figure 1 – Single- and double-acting positioner/actuator

3.2

input signal *W*

reference input signal which represents the desired position of the associated control element

3.3

travel signal *X*

signal which results from the linear or angular travel caused by movement of the final control element or its actuator

3.4

output signal *Y*

air pressure delivered to the actuator of the final control element

3.5
supply pressure P_s
air pressure at the supply connector of the positioner

3.6
action
action is direct when the output signal *Y* increases as the value of the input signal *W* increases. The action is reverse when the output signal *Y* decreases as the value of the input signal *W* increases

3.7
split ranging
special adjustment in which the full travel of the actuator is achieved from only part of the whole input range (for example 0 % to 50 % or 50 % to 100 %)

3.8
gain characteristic
relationship between input signal *W* and output signal *Y* with travel signal *X* kept constant (i.e. locked stem); see figure 2

Incremental gain $\Delta Y/\Delta W$ varies with pressure and the related pressure shall be stated.

3.9
proportional (average) gain factor K_p
gain over the full range of the actuator. The proportional gain factor for a single-acting positioner may be derived from the gain characteristic (figure 2a):

$$K_p = \frac{\Delta Y_{max}}{\Delta W_{max}}$$

where ΔW_{max} is the change of input signal *W* as a percentage of span required to change the output signal over the whole range (ΔY_{max} for 100 %). In this case ΔW_{max} (%) corresponds to the proportional band X_p (%). The output signal range ΔY_{max} is taken to be the nominal range stated by the manufacturer.

For a double-acting positioner, a gain factor for each output may be derived separately (see figure 2b):

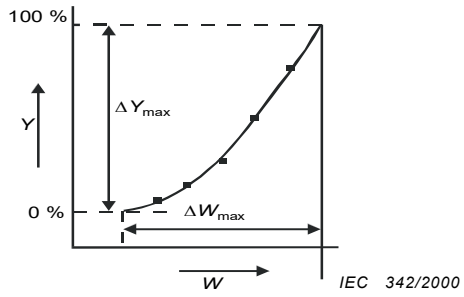
$$K_{pD} = \frac{\Delta Y_{max}}{\Delta W_{D\,max}} \qquad K_{pR} = \frac{\Delta Y_{max}}{\Delta W_{R\,max}}$$

The proportional gain factor K_p for a double-acting positioner may then be calculated as the summation of the two individual gain factors, i.e.:

$$K_p = K_{pD} + K_{pR}$$

or derived from the differential pressure characteristic ($Y_D - Y_R$); see figure 2b.

The balance pressure Y_B is the cross-over point of the direct Y_D and reverse Y_R characteristics. Generally, this value depends on the supply pressure applied to the positioner.



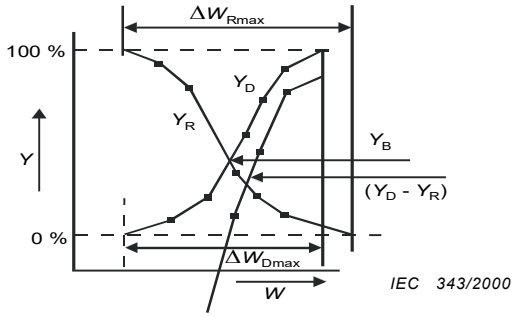


Figure 2a – Single-acting positioner

Figure 2b – Double-acting positioner

Figure 2 – Gain characteristic

3.10
proportional band X_p
the proportional band X_p is defined as

$$X_p\ (\%) = \frac{100\ \%}{K_p}$$

3.11
local gain factor K_l
slope of the gain characteristic at a specific input value

3.12
travel characteristic
closed-loop relationship of a positioner/actuator between the input signal W and the travel signal X

The intended relationship between input signal W and travel signal X (for example linear or equal percentage) determines the ideal characteristic.

3.13
travel factor U
ratio between the travel span and the corresponding input span. This may be adjustable.

3.14
maximum measured error
largest positive or negative value of error of the average up-scale or down-scale value at each point of measurement

4 General conditions for tests

4.1 Environmental test conditions

The tests shall be performed under the ambient test conditions recommended below:

Table 1 – Environmental conditions

Atmospheric test conditions	Temperature °C	Relative humidity %	Atmospheric pressure kPa
Standard reference atmosphere	20	65	101,3
Recommended limits	15 to 25	45 to 75	86 to 106
Referee measurements a:	20 ± 2	65 ± 5	86 to 106
b:	23 ± 2	50 ± 5	86 to 106

The test values shall be corrected back to the standard reference atmosphere conditions listed above. The standard reference atmosphere is equivalent to the normal reference operating conditions commonly identified by the manufacturer.

It is recognized that there may not be a factor to correct for humidity. When measurements within the recommended range of ambient conditions are unsatisfactory, and the correction factors to adjust parameters to the standard atmosphere are unknown, repeat measurements (referee measurements) may be conducted under the conditions listed in table 1, a or b, or other reference operating conditions identified by the manufacturer.

NOTE Special equipment may be required to maintain the basic test conditions within the limits specified.

4.1.1 Recommended limits of ambient conditions for test measurements

Electromagnetic field: value to be stated, if relevant.

Maximum rate of change of ambient temperature permissible during any test: 1 °C in 10 min, but not more than 3 °C/h.

4.2 Supply conditions

4.2.1 Reference values

Electrical supply: the values specified by the manufacturer.

Pneumatic supply: the values specified by the manufacturer, or a supply pressure of 4,0 bar (400 kPa).

4.2.2 Tolerances

The tolerances given below apply, unless closer tolerances are agreed between user and manufacturer.

a) Electrical supply

- Rated voltage: ±1 %.
- Rated frequency: ±1 %.
- Harmonic distortion (AC supply): less than 5 %.
- Ripple (DC supply): less than 0,1 %.

b) Pneumatic supply

- Rated pressure: ±3 %;
- Supply air temperature: ambient temperature ±2 °C.
- Supply air humidity: dew-point at least 10 °C below device body temperature.