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**Geometrical Product Specifications  
(GPS) — Surface texture: Profile method;  
Measurement standards —**

**Part 2:  
Software measurement standards**

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*Spécification géométrique des produits (GPS) — État de surface: Méthode  
du profil: Étalons —*  
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*Partie 2: Étalons logiciels*

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## 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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO 5436 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 5436-2 was prepared by Technical Committee ISO/TC 213, *Dimensional and geometrical product specifications and verification*.

This first edition, together with ISO 5436-1, replaces ISO 5436:1985, which has been technically revised.

ISO 5436 consists of the following parts, under the general title *Geometrical Product Specifications (GPS) — Surface texture: Profile method; Measurement standards*:

- Part 1: Material measures [https://standards.iteh.ai/catalog/standards/sist/5bb9a36a-4c3d-4533-81bd-  
ea2031603c86/iso-5436-2-2001](https://standards.iteh.ai/catalog/standards/sist/5bb9a36a-4c3d-4533-81bd-<br/>ea2031603c86/iso-5436-2-2001)
- Part 2: Software measurement standards

Annexes A and B of this part of ISO 5436 are for information only.

## Introduction

This part of ISO 5436 is a geometrical product specification (GPS) standard and is to be regarded as a general GPS standard (see ISO/TR 14638). It influences link 6 of the chain of standards on roughness, waviness and primary profile.

For more detailed information on the relationship of this part of ISO 5436 to other standards and the GPS matrix model, see annex B.

This part of ISO 5436, together with ISO 5436-1, introduces two new measurement standards: Type E, for calibrating the profile co-ordinate system, and Type F, for calibrating software. This part of ISO 5436 is concerned with software measurement standards.

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# Geometrical Product Specifications (GPS) — Surface texture: Profile method; Measurement standards —

## Part 2: Software measurement standards

### 1 Scope

This part of ISO 5436 defines Type F1 and Type F2 software measurement standards (etalons) for verifying the software of measuring instruments. It also defines the file format of Type F1 software measurement standards for the calibration of instruments for the measurement of surface texture by the profile method as defined in ISO 3274.

NOTE 1 Throughout this part of ISO 5436, the term “softgauge” is used as a substitute for “software measurement standard Type F1”.

NOTE 2 Formerly, “measurement standards” were referred to as “calibration specimens”.

NOTE 3 ISO 3274 only refers to instruments with independent reference datums.

### 2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 5436. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 5436 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 3274:1996, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Nominal characteristics of contact (stylus) instruments*

ISO 5436-1:2000, *Geometrical Product Specifications (GPS) — Surface texture: Profile method; Measurement standards — Part 1: Material measures*

ISO 11562:1996, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Metrological characteristics of phase correct filters*

ISO 12085:1996, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Motif parameters*

ISO/TS 17450-2:—<sup>1)</sup>, *Geometrical Product Specifications (GPS) — General concepts — Part 2: Basic tenets, specifications, operators and uncertainties*

*Guide to the expression of uncertainty in measurement (GUM)*. BIPM, IEC, IFCC, ISO, IUPAC, IUPAP, OIML, 1st edition, 1995.

1) To be published.

*International vocabulary of fundamental and general terms in metrology (VIM)*. BIPM, IEC, IFCC, ISO, IUPAC, IUPAP, OIML, 2nd edition, 1993.

### 3 Terms and definitions

For the purposes of this part of ISO 5436, the terms and definitions given in ISO 3274, ISO 5436-1, ISO 11562, ISO 12085, VIM, and the following apply.

#### 3.1 software measurement standard

reference data or reference software intended to reproduce the value of a measurand with known uncertainty in order to verify the software used to calculate the measurand in a measuring instrument

#### 3.2 ASCII string

array of ASCII characters terminating in <ASCII 0>

#### 3.3 integer

2-byte representation of whole number

NOTE 1 Integers have a minimum value of – 32 768 and a maximum value of + 32 767.

NOTE 2 The less significant bytes are stored in memory addresses lower than those in which are stored the more significant bytes.

#### 3.4 unsigned integer

2-byte representation of a positive whole number ISO 5436-2:2001

NOTE 1 Unsigned integers have a minimum value of 0 and a maximum value of 65 535.  
<https://standards.iteh.ai/catalog/standards/sist/5bb9a36a-4c3d-4533-81bd-ca2031605c66/ISO-5436-2-2001>

NOTE 2 The less significant bytes are stored in memory addresses lower than those in which are stored the more significant bytes.

#### 3.5 long integer

4-byte representation of a whole number

NOTE 1 Long integers have a minimum value of – 2 147 483 648 and a maximum value of + 2 147 483 647.

NOTE 2 The less significant bytes are stored in memory addresses lower than those in which are stored the more significant bytes.

#### 3.6 single precision float

4-byte representation consisting of a sign bit, an 8-bit excess – 127 binary exponent and a 23-bit mantissa representing numbers between 1,0 and 2,0

NOTE 1 Since the high-order bit of the mantissa is always 1, it is not stored in the number.

NOTE 2 Single precision float have an approximate range of  $\pm 1,17^{-38}$  to  $\pm 3,4e^{+38}$ .

NOTE 3 The less significant bytes are stored in memory addresses lower than those in which are stored the more significant bytes.



**3.7****double precision float**

8-byte representation consisting of a sign bit, an 11-bit excess – 1023 binary exponent, and a 52-bit mantissa, plus the implied high-order 1 bit

NOTE 1 Double precision float have an approximate range of  $\pm 2,22e^{-308}$  to  $\pm 2,22e^{+308}$ .

NOTE 2 The less significant bytes are stored in memory addresses lower than those in which are stored the more significant bytes.

**4 Type F software measurement standards****4.1 General**

These measurement standards are designed to verify the measuring instrument's software (i.e. filter algorithms, parameter calculations etc.)

The measurement standards can contain a form component which it shall be possible to remove.

**4.2 Type F1 — Reference data**

These measurement standards are computer data files that depict a digital representation of a total surface or profile in a suitable recording medium.

Type F1 measurement standards are used to test software by inputting them as data into the software under test/calibration and comparing the results from the software under test with the certified results from the calibration certificate of the softgauge.

NOTE The certified results for mathematically designed synthetic data can often be calculated directly without the need for certification by Type F2 measurement standards.

**4.3 Type F2 — Reference software**

These measurement standards are reference software. Reference software consists of traceable computer software against which software in a measuring instrument can be compared.

Type F2 measurement standards are used to test software by inputting a common data set into both the software under test/calibration and the reference software and comparing the results from the software under test with the certified results from the reference software.

NOTE Type F2 measurement standards can also be used to certify type F1 measurement standards.

Reference software values shall be traceable.

**5 File format for type F1 reference data****5.1 General**

The file extension of this file protocol is `.smd`. The file protocol for the softgauge is divided into four separate sections or records. Each record is composed of lines of information and within each line there are various "fields" in which the information is coded. The file format is in 7-bit ASCII character code. Each line is terminated by a carriage return, (`<cr>`), and line feed, (`<lf>`).

Each record is terminated by an end of record, (<ASCII 3>), with a carriage return, (<cr>), and line feed, (<lf>), and the last record is also further terminated by an end of file, (<ASCII 26>). For each field the separator is at least one space.

**5.2 Record 1 — Header**

The first record contains a fixed header that includes the following information:

- revision of the softgauge file format;
- file identifier;
- GPS feature type, number and name of the stored feature — axis information;
- number of data points in the profile;
- scaling of the data points;
- resolution of the data points.

The first line of record 1 contains two fields. These are

- The\_revision\_number, and
- File\_identifier.

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Table 1 gives valid options for these fields.

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**Table 1 — Fields for line 1 of record 1**  
<https://standards.iteh.ai/catalog/standards/sist/5bb9a36a-4c3d-4533-81bd-e7031603e86/iso-5436-2-2001>

Field name	Valid Options/Examples	Comment
The_revision_number	'ISO 5436 - 2000'	ASCII string
File_identifier	'XXXXXXX'	ASCII string

The second line of record 1 contains three fields. These are

- Feature\_type, and
- Feature\_number, and
- Feature\_name.

Table 2 gives valid options for these fields.

**Table 2 — Fields for line 2 of record 1**

Field name	Valid Options/Examples	Comment(s)
Feature_Type	'PRF'	Profile data {ie. (X,Z), (R,A) etc.}
	'SUR'	Surface data {ie. (X,Y,Z), (R,A,Z) etc.}
Feature_Number	0	Unsigned integer
Feature_Name	'ISO000'	ASCII string

Each of the remaining lines of record 1 contains at least six fields. These are

- Axis\_name, and
- Axis\_type, and
- -Number\_of\_points, and
- Units, and
- Scale\_factor, and
- Axis\_data\_type.

A seventh field, containing the incremental value is added if the axis type is incremental.

See Figure 1 for an example.

Each axis in the softgauge has a line allocated to it. Thus, for a profile there will be two remaining lines — one for the X-axis and one for the Z-axis.

Table 3 gives valid options for these fields.

**Table 3 — Fields for the remaining lines of record 1**

Field name	Valid Options/Examples	Comments
Axis_Name	'CX' 'CY' 'CZ' 'PR' 'PA'	Cartesian X axis Cartesian Y axis Cartesian Z axis Polar Radius Polar Angle
Axis_Type	'A' 'I' 'R'	Absolute data <sup>a</sup> Incremental data <sup>b</sup> Relative data <sup>c</sup>
Number_of_Points	4003	Number of data points (Unsigned long integer)
Units	'm' 'mm' 'um' 'nm' 'rad' 'deg'	metres millimetres micrometres nanometres radians degrees
Scale_factor	1.0e0	Scale to indicated units (double precision float)
Axis_Data_Type	'I' 'L' 'F' 'D'	Integer Long integer Single precision float Double precision float
Incremental_Value <sup>d</sup>	1e-3	Value of increment (double precision float)

<sup>a</sup> Absolute data: each data value is the distance along the axis to the axis origin.

<sup>b</sup> Incremental Data: assumes that the data is equally spaced in this axis so only an increment is required.

<sup>c</sup> Relative data: each data value is the distance along the axis to the previous data point. The first value is the distance to the axis origin.

<sup>d</sup> Axis type I only.