International Standard

ISO 25178-602

Second edition
2025-02

Geometrical product specifications (GPS) — Surface texture: Areal —

Part 602: Design and characteristics of non-contact (confocal chromatic probe) instruments

Spécification géométrique des produits (GPS) — État de surface: Surfacique —

Partie 602: Conception et caractéristiques des instruments sans contact (à capteur confocal chromatique)

Reference number
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Foreword

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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 document 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 213, *Dimensional and geometrical product specifications and verification*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 290, *Dimensional and geometrical product specification and verification,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 25178-602:2010), which has been technically revised.

The main changes are as follows:

— removal of the terms and the definitions now specified in ISO 25178-600;

— revision of all terms and definitions for clarity and consistency with other ISO standards;

— addition of Clause 4 for instrument requirements, which summarizes the normative features and characteristics of instruments;

— addition of Clause 5 on metrological characteristics;

— addition of Clause 6 on design features, which clarifies the types of instruments relevant to this document;

— addition of an information flow concept diagram in Clause 4;

— revision of Annex A describing the principles of instruments addressed by this document.

A list of all parts in the ISO 25178 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.

Introduction

This document is a geometrical product specification (GPS) standard and is to be regarded as a general GPS standard (see ISO 14638). It influences chain link F of the chains of standards on profile and areal surface texture.

The ISO GPS matrix model given in ISO 14638 gives an overview of the ISO GPS system of which this document is a part. The fundamental rules of ISO GPS given in ISO 8015 apply to this document and the default decision rules given in ISO 14253-1 apply to the specifications made in accordance with this document, unless otherwise indicated.

For more detailed information on the relation of this document to other standards and the GPS matrix model, see Annex C.

The principle of confocal chromatic probe can be implemented in various set-ups. The configuration described in this document comprises three basic elements: an optoelectronic controller, a linking fibre optic cable and a chromatic objective (sometimes called “optical pen”).

Several techniques are possible to create the axial chromatic aberration or to extract the height information from the reflected light. In addition to implementations as point sensors, chromatic aberration can be integrated into line sensors and field sensors. Annex A describes confocal chromatic imaging and its implementation into distance measurement probes in detail.

This type of instrument is mainly designed for areal measurements, but it is also able to perform profiling measurements.

This document describes the design and the metrological characteristics of an optical profiler using a confocal chromatic probe based on axial chromatic aberration of white light, designed for the measurement of areal surface texture.

For more detailed information on the confocal chromatic probe instrument technique, see Annex A. Reading this annex before the main body can lead to a better understanding of this document.

Geometrical product specifications (GPS) — Surface texture: Areal —

Part 602:
Design and characteristics of non-contact (confocal chromatic probe) instruments

1 Scope

This document specifies the design and metrological characteristics of a particular non-contact instrument for measuring surface texture using a confocal chromatic probe based on axial chromatic aberration of white light. Additional metrological characteristics can be found in ISO 25178-600. Because surface profiles can be extracted from areal surface topography data, the methods described in this document are also applicable to profiling measurements.

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 25178-600:2019, *Geometrical product specifications (GPS) — Surface texture: Areal — Part 600: Metrological characteristics for areal topography measuring methods*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 25178-600 and the following apply.

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

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

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

3.1
chromatic aberration
<confocal chromatic probe> optical effect of a lens that focuses light at different lengths depending on the wavelength

Note 1 to entry: Chromatic aberration can be axial (on the optical axis) or lateral (off the optical axis). It is also defined in ISO 10934:2020, 3.1.4.2.

3.2
chromatic objective
objective with axial *chromatic aberration* (3.1)

3.3
confocal chromatic probe
device that senses surface heights using a *chromatic objective* (3.2) mounted into a confocal setup

Note 1 to entry: Various optical configurations are discussed in Annex A.

3.4
confocal chromatic microscopy
surface topography measurement method consisting of a confocal microscope with *chromatic objective* (3.2) integrated with a spectrometer whereby the surface height at a single point is sensed by the wavelength of light reflected from the surface

[SOURCE: ISO 25178-6:2010, 3.3.7, modified — "a detection device (e.g. spectrometer)" has been replaced by "a spectrometer". Note 1 to entry has been deleted.]

3.5
light source
<confocal chromatic probe> source of light containing a continuum of wavelengths in a predefined spectral region

Note 1 to entry: The spectral region emitted by the source should be compatible with the spectral bandwidth of the optical system and the detector.

Note 2 to entry: Usually, this spectral region extends within the visible light, between wavelength values 0,4 µm to 0,8 µm.

3.6
light source pinhole
small hole placed following the *light source* (3.5), to make it a point light source

Note 1 to entry: The system contains two pinholes. The first one is the light source pinhole. It defines a small spot of light that acts as the point light source for the instrument. The second one is the *discrimination pinhole* (3.7). It limits the transmitted beam to the part that is in focus on the sample surface and is reflected by it along the optical axis (see Figure A.1).

Note 2 to entry: In practice, the pinholes are obtained by using a fibre optic which provides spatial discrimination and allows the optical head to be used away from the optoelectronic controller.

3.7
discrimination pinhole
small hole placed in front of the detector, providing depth discrimination on a beam reflected from the sample surface by blocking defocused light

Note 1 to entry: Notes 1 and 2 to entry in 3.6 also apply to the discrimination pinhole.

3.8
vertical range
<confocal chromatic probe> distance measured between the focal point of the shortest wavelength and the focal point of the longest wavelength detected on the spectrometer

Note 1 to entry: The vertical range depends on the depth of field and on the spectral range of the spectrometer.

3.9
optical pen
part of a *confocal chromatic probe* (3.3) that contains a *chromatic objective* (3.2) and that is located close to the surface during the measurement

Note 1 to entry: The optical pen is usually connected to an opto-electronic box through a fibre optic.

3.10
stray light
signal composed of the stray light entering the *discrimination pinhole* (3.7), sensed by the detector when no sample is present, and the internal signal produced by the detector itself

Note 1 to entry: The stray light signal is generally captured during a calibration procedure and subtracted to subsequent measurements.

4 Instrument requirements

An instrument conforming to this document shall perform two operations.

a) A spectral encoding of the measurement space. This encoding is performed by stretching focus points using axial chromatic aberration of the illuminating beam in a controlled manner. It is usually realized using a chromatic objective and a white light source.

b) A spectral decoding of the reflected beam. This decoding identifies the focused wavelength, usually using a spectrometer. Wavelength is then converted to height by a software using calibrated data.

These operations are part of the information flow described in Figure 1. The scale-limited surface obtained at the end of the information flow is used to calculated areal surface texture parameters, according to ISO 25178-2.

Such an instrument is usually referred to as a confocal chromatic profilometer, and the technique is called confocal chromatic microscopy.

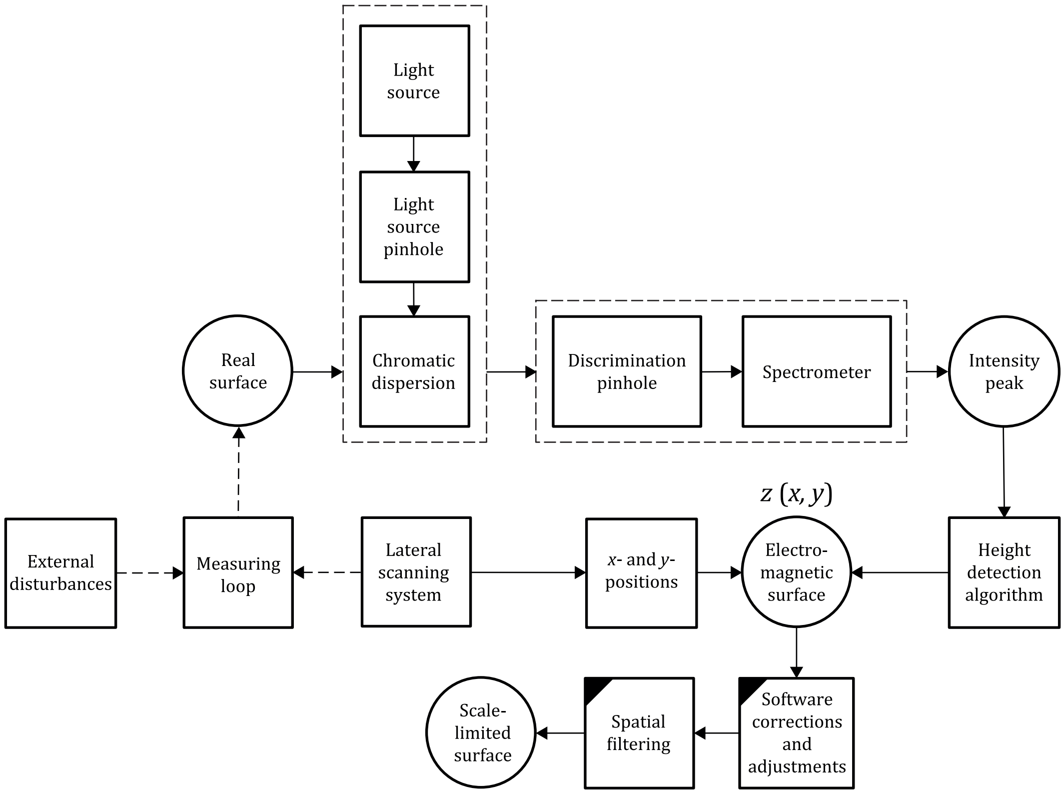
The confocal setup is usually realized using a fibre optic that acts as a source pinhole and as a discrimination pinhole. It also allows the objective to be close to the surface while the rest of the opto-electronic device (light source, spectrometer, power source, ventilation) is installed elsewhere.

The instrument requires a lateral scanning system as follows:

— In the case of a point sensor, it can be mounted on a lateral scanning system in order to measure a profile (along *x*-axis) or a surface (in *x*-axis and *y*-axis).

— In the case of a line sensor, it can be mounted on a lateral scanning system that moves in *y*-axis, while the sensor directly measures a line segment in *x*-axis.

NOTE A point sensor can also be associated with a rotary table in order to realize a non-contact roundness measuring instrument.



Key

measurand

operator with intended modification

operator without intended modification

Figure 1 — Information flow concept diagram for confocal chromatic probe instruments

5 Metrological characteristics

The standard metrological characteristics for areal surface texture measuring instruments specified in ISO 25178-600 shall be considered when designing and calibrating the instrument.

Annex B describes sources of measurement error that can influence the calibration result.

6 Design features

Standard design features described in ISO 25178-600 shall be considered in the design.

Annex A provides examples of specific design features of confocal chromatic instruments.

7 General information

The relationship between this document and the GPS matrix model is given in Annex C.

Annex A
(informative)

Principles of confocal chromatic profilometry for areal surface topography measurement

A.1 General

The idea of using axial chromatic dispersion to code surface heights was developed in the 1980s by several authors (see References [10] and [11]) and later implemented in scanning profilometers (see References [12], [13] and [14]). Nowadays, several commercial optical profilometers use this technique for the measurement of areal surface topography and even form deviation (roundness) or form [coordinate measuring machine (CMM)].

A confocal chromatic probe senses one single surface point at a time, and is moved by a lateral scanning system, either along one axis (*x*-axis) to scan profiles, or along two orthogonal axes (*x*-axis and *y*-axis) to scan surfaces. It can also be installed on rotary axes to scan roundness profiles and cylinders.

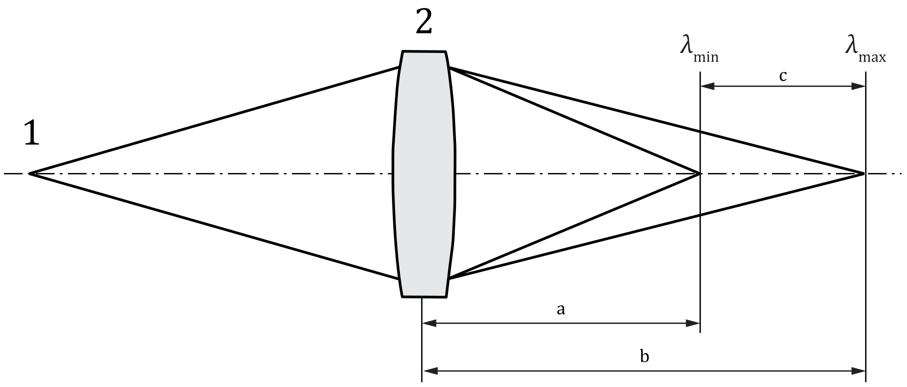
As it is non-contact, it can achieve fast lateral scans without damaging the surface.

Additional details on the confocal chromatic probe can be found in Reference [15].

A.2 Principles of axial chromatic aberration

In a confocal chromatic probe, the position of the image of any given point source depends on the wavelength of the light source. When the light source is polychromatic, the confocal chromatic probe generates a continuum of images corresponding to the spectral content of the source.

Axial chromatic aberration is a physical property inherent in all refractive, diffractive and gradient index imaging systems. Figure A.1 illustrates this property.



Key

1 point light source

2 chromatic objective lens

a Focal distance of the shortest optical wavelength (λ_{min}).

b Focal distance of the longest optical wavelength (λ_{max}).

c Axial chromatic aberration.

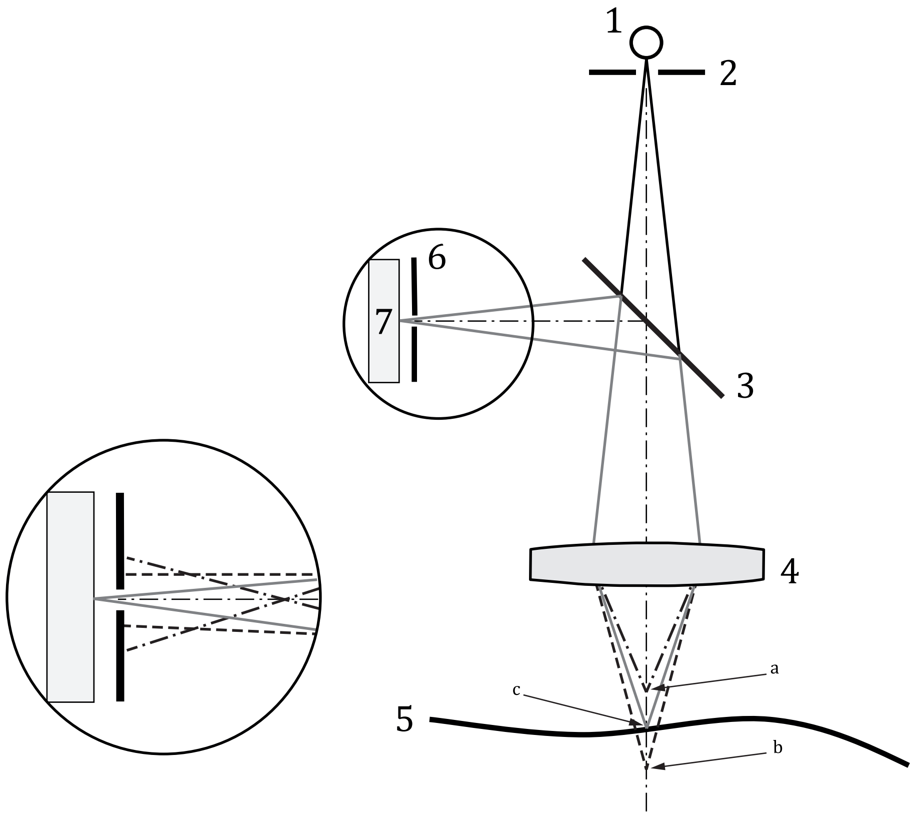
Figure A.1 — Principle of axial chromatic aberration

The shortest focal distance (a in Figure A.1) is also the working distance of the device, which is the closest distance between the objective and the workpiece. The light source is usually a wide band white light source (halogen, xenon, LED, etc.). However, some systems use a swept source where the light wavelength is shifted periodically within a given spectral band (see References [16] and [17]).

In practice, pinholes are frequently realized using fibre optics, which have the advantage to separate the optical pen from the light source and the detector electronics. A fibre coupler is then used instead of a semi-transparent beam-splitter.

A.3 Confocal chromatic setup

A simplified description of the confocal chromatic setup is shown in Figure A.2.



Key

1 light source
2 light source pinhole
3 semi-transparent mirror
4 chromatic objective
5 workpiece
6 discrimination pinhole
7 spectrometer
a Focus point of light at the shortest optical wavelength (λ_{min}).
b Focus point of light at the longest optical wavelength (λ_{max}).
c Beam focused on workpiece.

Figure A.2 — Principle of a confocal chromatic probe

A.4 Detector

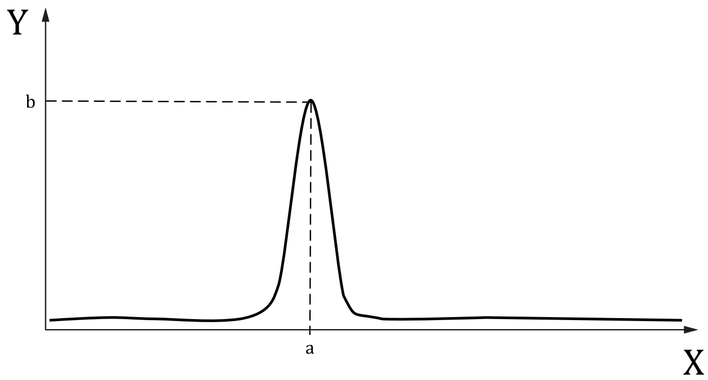
There are different ways to analyse the spectral content of the light beam that is filtered by the discriminating pinhole. One of them is a traditional spectrometer comprising a dispersive element (a grating or a prism) and a linear detector array.

The relative height of the surface, at any given point *x* of a profile, or position (*x*, *y*) of a surface, is obtained from the spectrometer data as follows:

— the light reflected by the surface is sent to the spectrometer through the discrimination pinhole which eliminates most wavelengths except those close to the focused wavelength;

— in the spectrometer, the focused wavelength will have a higher intensity than the defocused ones and will produce a peak in the spectrometer curve (see Figure A.3);

— if the sensor has been calibrated, the wavelength at the peak of the spectrometer curve can be converted into a distance from a pre-defined reference plane.



Key

X wavelength axis (pixels of the detector in the spectrometer)/focal point distance

Y intensity axis (arbitrary units)

a Position of the focused wavelength.

b Intensity of the peak.

Figure A.3 — Intensity peak on the spectrometer curve

The vertical range of the sensor (in the *z*-direction) is equal to the axial chromatic aberration observed between the shortest and longest wavelengths by the detector. This type of sensor is able to achieve vertical ranges of relative surface texture heights from several tens of micrometres to several millimetres, depending on the objective lens.

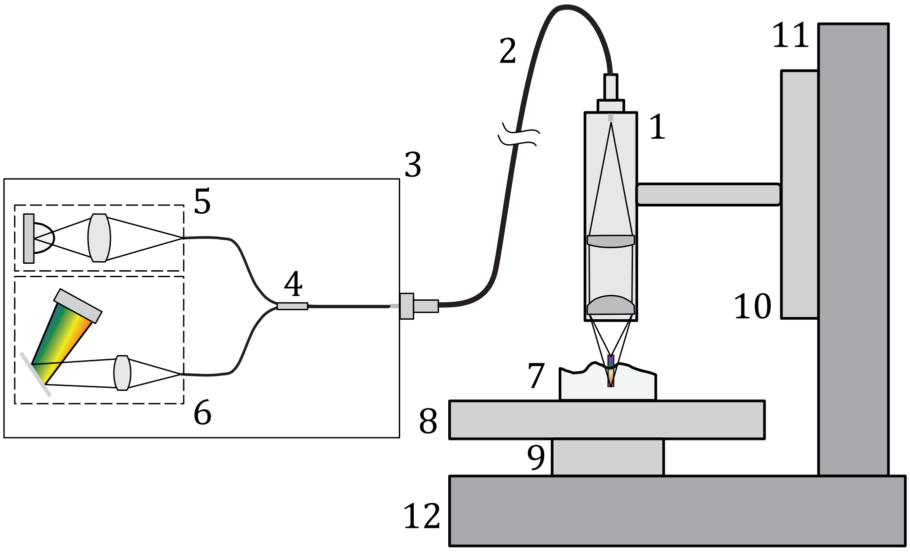
Since the sensor measures the height at a single point on the workpiece, it is possible to use it to measure a profile or a surface. *x*-axis shall be scanned to get a profile and *x*-axis and *y*-axis to get an areal topographic image.

The advantage of this sensor is that it does not include any mechanical vertical scanning device, so the measurement noise generated by the sensor is smaller and the measurement faster than in point autofocus probe instruments (see ISO 25178-605).

The width of the spectral peak is determined by the size of the pinholes, the numerical aperture of the chromatic objective and the amount of chromatic aberration.

A.5 Instrument design

A typical configuration of a confocal chromatic profilometer is shown in Figure A.4. This configuration differs between manufacturers, but they usually have the same main components.



Key

1	optical pen	7	workpiece
2	fibre optic	8	*x*-axis scanning stage
3	opto-electronic controller	9	*y*-axis positioning stage (optional)
4	beam splitter (optical coupler)	10	*z*-axis positioning stage (optional)
5	light source	11	*z*-axis column
6	spectrometer	12	granite base

Figure A.4 — Typical design of a confocal chromatic profilometer

A.6 Line sensors

If the workpiece is illuminated by a line of light instead of a point light source, it is possible to measure a profile at once. The spectrometer used to detect heights shall use an image detector (such as a camera detector) instead of a line detector. Light wavelengths will be spread in a direction defined by the grating or prism, and the image detector has one axis aligned with that spreading direction (usually the small side of the detector). The perpendicular direction will be used to detect the position along the profile measured on the workpiece. The number of measured points depends of the number of pixels on the large side of the detector.

When used with a *y*-axis scanning stage, an areal measurement can be done in one scan, leading to faster measurements of surfaces (compared to point sensors that require scanning in *x*-axis and *y*-axis).

A.7 Non-measured points (missing data)

Non-measured points are covered in ISO 25178-700:2022, 3.1 and 6.3. This clause is specific to confocal chromatic probes.

Non-measured points are usually generated when the processing unit cannot identify any peak in the spectrum, i.e. in one of the conditions given in Table A.1.

Table A.1 — Possible explanations for why there can be non-measured points

Condition	Comment	Solution
The workpiece is too dark	The intensity of the reflected light is too low	Increase the integration time or increase light source power
The workpiece is too shiny	The intensity of the reflected light is too high and saturates the detector	Decrease the integration time or decrease light source power
The local slope is too high	Most reflected light is sent outside the discrimination pinhole	None
Out of range	The peak is on the edge of the spectrum or outside the discrimination pinhole	None
NOTE Non-measured points can also be reconstructed by an interpolation technique.		

A.8 Outliers

Outliers are invalid points generated when the sensor misinterprets the spectrometer data.

They occur, for example, in the following cases:

— steep slopes;

— sudden height transition (step);

— semi-transparent particles;

— low intensity of the reflected signal (poor signal to noise ratio);

— spurious focus caused by surface curvature;

— heterogeneous surface conditions within the spot size.

These outliers usually appear as positive or negative peaks around step-type transitions, or around non-measured areas.

These points should be eliminated or corrected before proceeding to a calculation (roughness parameter). They sometimes explain deviations observed in surface parameters when comparing with a stylus measurement.

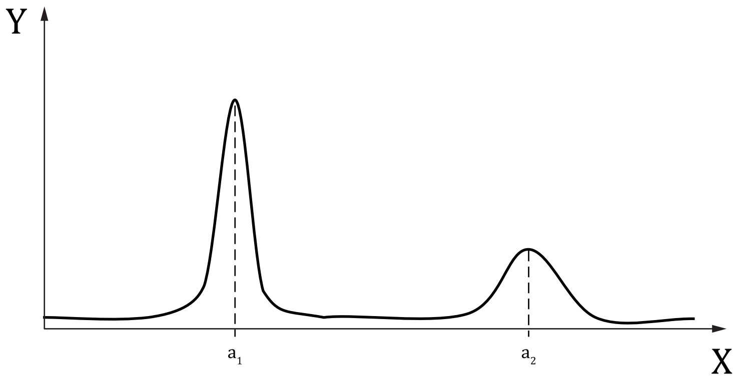
A.9 Measurement of transparent materials

The confocal chromatic probe generates one intensity peak on the spectrometer for the focused wavelength. If more than one wavelength is focused in the range of the detector, such as in the case of a transparent layer, it is possible to identify the position of the two (or more) peaks. See Figure A.5.

Instead of detecting the two interfaces, it is possible to retain only one of the two (e.g. the second interface). This ability allows the sensor to measure topography below a transparent layer (a film of oil, varnish, etc.).

The transparent material usually has a different refraction index than the one in the medium above the surface (usually air). The position of the second peak is compensated by the ratio of the two refraction indices, in order to obtain a correct distance.

The ability to measure surface height through a transparent material makes it possible to compensate for the lateral scanning system straightness, using a glass flat above the surface (see Reference [16]).



Key

X distance to the surface

Y intensity of the reflected light

a_1 first detected peak (upper interface)

a_2 second detected peak (lower interface)

Figure A.5 — Detection of the two interfaces of a transparent layer

Annex B
(informative)

Source of measurement error for confocal chromatic probe instruments

B.1 Metrological characteristics and influence quantities

ISO 25178-600:2019, 3.1.28 defines a specific set of metrological characteristics for areal surface topography measuring instruments. These metrological characteristics capture influence quantities, factors that can influence a measurement result and can be propagated through an appropriate measurement model to evaluate measurement uncertainty. See ISO 25178-700 and ISO 12179 for methods for calibration, adjustment and verification of the metrological characteristics.

In this annex, influence quantities are described that affect the metrological characteristics. Knowledge of these influence quantities is not needed for uncertainty analysis if it is feasible to perform a direct calibration of the corresponding metrological characteristics. However, knowledge of influence quantities can be useful for optimizing measurements and minimizing sources of error.

Table B.1 summarizes the influence quantities discussed in this annex.

Table B.1 — Summary of influence quantities and related metrological characteristics

Item	Influence quantity	Relevant metrological characteristics	
B.2	Spot size	W_l	width limit for full height transmission
		D_{LIM}	lateral period limit
		T_{FI}	topography fidelity
B.3	Numerical aperture	Φ_{MS}	maximum measurable local slope
B.4	Chromatic aberration power	α_z	amplification coefficient
		l_z	linearity deviation
B.5	Local slope	Φ_{MS}	maximum measurable local slope
B.6	Dark signal	l_z	linearity deviation
B.7	Stray light	l_z	linearity deviation
		T_{FI}	topography fidelity
B.8	Sampling interval	D_x	sampling interval
		D_y	sampling interval
		D_{LIM}	lateral period limit
B.9	Surface absorption	F_z	response function
		l_z	linearity deviation
B.10	Transparent layer thickness	α_z	amplification coefficient

B.2 Spot size

The spot size is the illuminated area on the workpiece that reflects the light back to the detector. The surface height measured at a given position (x, y) is the result of complex reflections within the spot area, which limits the lateral resolution. Different surface points within the spot area have different heights, leading to multiple focus points and larger peaks on the spectrometer.

The spot size is the result of several factors: the intensity of the light source, the diameter of the fibre, the numerical aperture A_N of the chromatic objective and the quality of all the optical elements in the sensor.

Spot size is an influence quantity for:

— the width limit for full height transmission W_l defined in ISO 25178-600:2019, 3.1.23;

— lateral period limit D_{LIM} (ISO 25178-600:2019, 3.1.21);

—the topography fidelity T_{FI} (ISO 25178-600:2019, 3.1.26).

B.3 Numerical aperture

The numerical aperture A_N directly limits the maximum measurable slope Φ_{MS} on specular surfaces. Higher numerical aperture results in a higher the maximum measurable slope (see Table B.2).

Table B.2 — Relation between numerical aperture and maximum slope

Numerical aperture	Maximum measurable slope
0,3	18°
0,4	24°
0,5	30°
0,6	37°
0,7	44°

Table B.2 provides a theoretical limit obtained on specular surfaces in certain conditions. In most cases, with engineered surfaces, roughness creates scattering that will result in a higher slope limitation. The choice of numerical aperture should not be driven solely by the need for high slope limit, as it has other impacts on the ability to measure surface texture.

Numerical aperture is an influence quantity for the maximum measurable local slope Φ_{MS} (ISO 25178-600:2019, 3.1.24).

B.4 Chromatic aberration power

The chromatic aberration power is the distance between focal points of the smallest and largest wavelengths that can be detected on the spectrometer. It depends on the aberration power of the optics, which usually depends on the material (glass, PMMA, silica, etc.).

The nonlinearity of the aberration creates a nonlinearity of the height detection.

Chromatic aberration power is an influence quantity for the amplification coefficient α_z (ISO 25178-600:2019, 3.1.10) and the linearity deviation l_z (ISO 25178-600:2019, 3.1.11).

B.5 Local slope

A rough surface can locally have steep slopes that will reflect the incoming beam outside the objective, preventing the spectrometer to detect any peak, and resulting in a non-measured point.

Local slope is an influence quantity for the maximum measurable local slope Φ_{MS} (ISO 25178-600:2019, 3.1.24).

B.6 Dark signal

The dark signal is an electronic signal produced by the sensor when it is obturated and no external light is received. It is composed of the following components:

— internal reflections from the light source to the spectrometer;

— electronic offset signal on the detector of the spectrometer.

Dark signal is an influence quantity for the linearity deviation l_z (ISO 25178-600:2019, 3.1.11).

B.7 Stray light

Stray light is external light entering into the objective and the detector, and creating offsets and false peaks on the spectrum, leading to bias or false detections.

Stray light is an influence quantity for the linearity deviation l_z (ISO 25178-600:2019, 3.1.11) and the topography fidelity T_{FI} (ISO 25178-600:2019, 3.1.26).

B.8 Sampling interval

Depending on the smallest step of the lateral scanning system and on the sampling interval selected by the user, greater or fewer details will be measured on the surface.

Intervals smaller than the spot size will not increase the lateral discriminating power of the instrument. Intervals much larger than the spot size will miss information on the surface.

Sampling interval is an influence quantity for lateral period limit D_{LIM} (ISO 25178-600:2019, 3.1.21).

B.9 Surface absorption

When the material of the workpiece has a strong absorption on wavelengths emitted by the light source, the reflected beam will be altered and the peak on the spectrometer will be deformed, leading to detection errors. In the worst-case scenario, a strong absorption completely eliminates light within a range of wavelengths, preventing the instrument from measuring the surface within a range of heights.

Surface absorption is an influence quantity for the response function F_z (ISO 25178-600:2019, 3.1.9) and the linearity deviation l_z (ISO 25178-600:2019, 3.1.11).

B.10 Transparent layer thickness

Transparent layers create multiple peaks on the detector. When they are too close to each other on the spectrometer detector, they cannot be discriminated and the two interfaces are mixed together, leading to wrong heights or steps due to alternate detection between the upper and lower interfaces.

Transparent layer thickness is an influence quantity for the amplification coefficient α_z (ISO 25178-600:2019, 3.1.10).

Annex C
(informative)

Relationship to the GPS matrix model

C.1 General

The ISO GPS matrix model given in ISO 14638 gives an overview of the ISO GPS system of which this document is a part.

The fundamental rules of ISO GPS given in ISO 8015 apply to this document and the default decision rules given in ISO 14253-1 apply to specifications made in accordance with this document unless otherwise indicated.

C.2 Information about this document and its use

This document specifies the methods, specific terminology and exemplary influence quantities for confocal chromatic probe instruments used to measure profile and areal surface texture.

C.3 Position in the GPS matrix model

This document is a general ISO GPS standard which influences chain link F of the chains of standards on profile and areal surface texture in the GPS matrix model, as shown in Table C.1. The rules and principles given in this document apply to all segments of the ISO GPS matrix which are indicated with a filled dot (•).

Table C.1 — Relationship to the ISO GPS matrix model

	Chain links						
	A	**B**	**C**	**D**	**E**	**F**	**G**
	Symbols and indications	**Feature requirements**	**Feature properties**	**Conformance and non-conformance**	**Measurement**	**Measurement equipment**	**Calibration**
Size							
Distance							
Form							
Orientation							
Location							
Run-out							
Profile surface texture						•	
Areal surface texture						•	
Surface imperfections							

C.4 Related International Standards

The related International Standards are those of the chains of standards indicated in Table C.1.

Bibliography

[1] ISO 8015, *Geometrical product specifications (GPS) — Fundamentals — Concepts, principles and rules*

[2] ISO 10934:2020, *Microscopes — Vocabulary for light microscopy*

[3] ISO 14253-1, *Geometrical product specifications (GPS) — Inspection by measurement of workpieces and measuring equipment — Part 1: Decision rules for verifying conformity or nonconformity with specifications*

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[5] ISO 25178-2, *Geometrical product specifications (GPS) — Surface texture: Areal — Part 2: Terms, definitions and surface texture parameters*

[6] ISO 25178-6:2010, *Geometrical product specifications (GPS) — Surface texture: Areal — Part 6: Classification of methods for measuring surface texture*

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