

INTERNATIONAL STANDARD

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**Calibration of wavelength/optical frequency measurement instruments –
Part 2: Michelson interferometer single wavelength meters**

**Étalonnage des appareils de mesure de longueur d'onde/appareil de mesure
de la fréquence optique –
Partie 2: Appareils de mesure de longueur d'onde unique à interféromètre de
Michelson**



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CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references.....	7
3 Terms and definitions.....	7
4 Preparation for calibration.....	11
4.1 Organization.....	11
4.2 Traceability.....	11
4.3 Advice for measurements and calibrations.....	11
4.4 Recommendations to customers.....	12
5 Single wavelength calibration.....	12
5.1 General.....	12
5.2 Establishing calibration conditions.....	12
5.3 Calibration procedure.....	13
5.3.1 General.....	13
5.3.2 Measurement configuration.....	13
5.3.3 Detailed procedure.....	15
5.3.4 Stability test (if necessary).....	15
5.3.5 "On/Off repeatability" measurement (optional if a specification is available).....	16
5.3.6 Wavelength dependence measurement (optional).....	18
5.3.7 Connector repeatability measurement (optional).....	19
5.4 Calibration uncertainty.....	20
5.5 Reporting the results.....	21
6 Absolute power calibration.....	21
Annex A (normative) Mathematical basis.....	22
Annex B (informative) Rejection of outliers.....	25
Annex C (informative) Example of a single wavelength calibration.....	27
Annex D (informative) ITU wavelength bands.....	30
Annex E (informative) Atomic and molecular reference transitions.....	31
Annex F (informative) Reference locked laser example.....	42
Annex G (informative) Balance between accuracy and calibration time.....	44
Bibliography.....	46
Figure 1 – Example of a traceability chain.....	10
Figure 2 – Wavelength meter measurement using a lock quality monitor signal.....	14
Figure 3 – Wavelength meter measurement using a reference wavelength meter.....	14
Figure F.1 – Typical measurement arrangement to lock laser to gas absorption line.....	43
Table 1 – Typical parameters to calculate the "On/Off repeatability" measurement duration.....	17
Table B.1 – Critical values Z_c as a function of sample size N	26
Table C.1 – Type A uncertainty contributions for a stability measurement.....	27
Table C.2 – Uncertainty contributions for a "On/Off repeatability" measurement.....	28

Table C.3 – Uncertainty budget for wavelength dependence	28
Table C.4 – Uncertainty budget for the wavelength meter calibration.....	29
Table D.1 – The ITU-T bands in different units	30
Table E.1 – Helium-neon laser lines	32
Table E.2 – Centre vacuum wavelengths for Acetylene $^{12}\text{C}_2\text{H}_2$	33
Table E.3 – Frequency and vacuum wavelength values for the $\nu_1 + \nu_3$ and $\nu_1 + \nu_2 + \nu_4 + \nu_5$ bands of $^{13}\text{C}_2\text{H}_2$	35
Table E.4 – List of H^{13}CN transitions.....	38
Table E.5 – List of $^{12}\text{C}^{16}\text{O}$ transitions.....	40
Table E.6 – Excited state optogalvanic transitions	41
Table G.1 – Summary of choices.....	45

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**CALIBRATION OF WAVELENGTH/OPTICAL FREQUENCY
MEASUREMENT INSTRUMENTS –**
Part 2: Michelson interferometer single wavelength meters

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International Standard IEC 62129-2 has been prepared by IEC technical committee 86: Fibre optics.

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

FDIS	Report on voting
86/395/FDIS	86/399/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 2.

The list of all parts in the IEC 62129 series, published under the general title, *Calibration of wavelength/optical frequency – Measurement instruments*, can be found on the IEC website.

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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
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INTRODUCTION

Wavelength meters, often based on the Michelson interferometer, are designed to measure the wavelength of an optical source as accurately as possible. Although the wavelength meters contain an internal absolute reference, typically a Helium-Neon laser, calibration is required to achieve the highest accuracies. The instrument is typically used to measure wavelengths other than that of the internal reference. Corrections are made within the instrument for the refractive index of the surrounding air. A precise description of the calibration conditions must therefore be an integral part of the calibration.

This international standard defines all of the steps involved in the calibration process: establishing the calibration conditions, carrying out the calibration, calculating the uncertainty, and reporting the uncertainty, the calibration conditions and the traceability.

The calibration procedure describes how to determine the ratio between the value of the input reference wavelength (or the optical frequency) and the wavelength meter's result. This ratio is called *correction factor*. The measurement uncertainty of the correction factor is combined following Annex A from uncertainty contributions from the reference meter, the test meter, the setup and the procedure.

The calculations go through detailed characterization of individual uncertainties. It is important to know that:

- a) estimations of the individual uncertainties are acceptable;
- b) a detailed uncertainty analysis is only necessary once for each wavelength meter type under test, and that all subsequent calibrations can be based on this one-time analysis;
- c) some of the individual uncertainties can simply be considered to be part of a checklist, with an actual value which can be neglected.

A number of optical frequency references can be used to provide a traceable optical frequency. These are based on absorption by gas molecules under low pressure and using excited-state opto-galvanic transitions in atoms. Annex E lists the lines.

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CALIBRATION OF WAVELENGTH/OPTICAL FREQUENCY MEASUREMENT INSTRUMENTS –

Part 2: Michelson interferometer single wavelength meters

1 Scope

This part of IEC 62129 is applicable to instruments measuring the vacuum wavelength or optical frequency emitted from sources that are typical for the fibre-optic communications industry. These sources include Distributed Feedback (DFB) laser diodes, External Cavity lasers and single longitudinal mode fibre-type sources. It is assumed that the optical radiation will be coupled to the wavelength meter by a single-mode optical fibre. The standard describes the calibration of wavelength meters to be performed by calibration laboratories or by wavelength meter manufacturers. This standard is part of the IEC 62129 series on the calibration of wavelength/optical frequency measurement instruments. Refer to IEC 62129 for the calibration of optical spectrum analyzers.

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 60050-300:2001, *International Electrotechnical Vocabulary – Electrical and electronic measurements and measuring instruments – Part 311: General terms relating to measurements – Part 312: General terms relating to electrical instruments – Part 313: Types of electrical measuring instruments – Part 314: Specific terms according to the type of instrument*

IEC 61315 :2005, *Calibration of fibre-optic power meters*

IEC/TR 61931:1998, *Fibre optic – Terminology*

ISO/IEC 17025:2005, *General requirements for the competence of testing and calibration laboratories*

ISO/IEC Guide 99:2007, *International vocabulary of metrology – Basic and general concepts and associated terms (VIM)*

ISO/IEC Guide 98-3:2008, *Uncertainty of measurement – Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

accredited calibration laboratory

calibration laboratory authorized by the appropriate national organization to issue calibration certificates with a minimum specified uncertainty, which demonstrate traceability to *national standards*