

Fibre optic wavelength switches — Generic specification

The European Standard EN 62099:2001 has the status of a British Standard

ICS 33.180.99

National foreword

This British Standard is the official English language version of EN 62099:2001. It is identical with IEC 62099:2001.

The UK participation in its preparation was entrusted by Technical Committee GEL/86, Fibre optics, to Subcommittee GEL/86/2, Interconnecting devices and passive components, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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English version

**Fibre optic wavelength switches –
Generic specification
(IEC 62099:2001)**

Commutateurs de longueur d'onde
à fibres optiques –
Spécification générique
(CEI 62099:2001)

Lichtwellenleiter - Wellenlängenschalter -
Fachgrundspezifikation
(IEC 62099:2001)

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

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Foreword

The text of document 86B/1454/FDIS, future edition 1 of IEC 62099, prepared by SC 86B, Fibre optic interconnecting devices and passive components, of IEC TC 86, Fibre optics, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 62099 on 2001-06-01.

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) 2002-03-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2004-06-01

Annexes designated "normative" are part of the body of the standard.
In this standard, annex ZA is normative.
Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 62099:2001 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60068 (series)	NOTE: Harmonized as EN 60068 (series) (not modified).
IEC 61300 (series)	NOTE: Harmonized as EN 61300 (series) (not modified).
IEC 61753 (series)	NOTE: Harmonized as EN 61753 (series) (not modified).
IEC 61754 (series)	NOTE: Harmonized as EN 61754 (series) (not modified).
IEC 62005 (series)	NOTE: Harmonized as EN 62005 (series) (not modified).

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INTRODUCTION

This standard, which is a generic specification, is divided into three clauses.

Clause 1, entitled "General", contains general information which pertains to this generic specification.

Clause 2, entitled "Requirements", contains all of the requirements to be met by switches covered by this standard. Among other requirements, those for classification, the IEC specification system, documentation, materials, workmanship, quality, performance, identification, and packaging are described.

Clause 3, entitled "Quality assessment procedures", contains all of the procedures to be followed for proper quality assessment of products covered by this standard.

FIBRE OPTIC WAVELENGTH SWITCHES – GENERIC SPECIFICATION

1 General

1.1 Scope

This International Standard applies to fibre optic wavelength switches. The term "fibre optic wavelength switch" can be used to describe a wide range of devices, assemblies and systems both active and passive. Therefore, it is necessary to elaborate on the scope and object of this standard. This specification is intended to cover those devices and assemblies which have the following attributes.

- While the switch actuation means is by necessity active, the optical paths through the switch are passive. Thus, neither optical amplification nor opto-electronic conversion is encompassed.
- The switch function is restricted to the routing of light rather than intentional power division plus routing. Thus, signal broadcast functions are not encompassed.
- They have two or more ports for the transmission of optical power and have two or more states in which power may be routed or blocked between these ports.
- The ports are optical fibres or optical fibre connectors.

Wavelength switching normally involves separation of the individual wavelength streams of light which are re-routed and then recombined. Thus, wavelength switches may involve multiple optical junctions and multiple-stage switching layouts interior to the switch. However, the specifications relate to the optical performance from port to port of the overall assembly.

System control and monitoring with their related electronics and software are not covered by this specification. The switch assembly may have optical means to facilitate such functionality (such as optical taps or wavelength monitoring means), but any related degradation in switch performance should be covered by the overall switch specifications.

This specification deals with switches that incorporate passive optical paths, and, therefore, it may be assumed that the signal performance, other than through attenuation, is independent of the signal format. However, particularly in the case of wavelength switching, some technologies for switching and for wavelength discrimination may have an influence on the signals being carried on the channels. Some factors that must be considered are: spatial crosstalk, crosstalk in the wavelength domain, and polarization effects.

This standard establishes uniform requirements for the following points:

- fibre optic wavelength switch requirements;
- quality assessment procedures.

1.2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard 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 IEC and ISO maintain registers of currently valid International Standards.

IEC 60027 (all parts), *Letter symbols to be used in electrical technology*

IEC 60050(731), *International Electrotechnical Vocabulary (IEV) – Chapter 731: Optical fibre communication*

IEC 60410, *Sampling plans and procedures for inspection by attributes*

IEC 60617 (all parts), *Graphical symbols for diagrams*

IEC 60695-2-2, *Fire hazard testing – Part 2: Test methods – Section 2: Needle-flame test*

IEC 60825-1, *Safety of laser products – Part 1: Equipment classification, requirements and user's guide*

IEC 61748, *Manufacturing line approval (QML) for MCM ¹⁾*

IEC QC 001001, *IEC Quality Assessment System for Electronic Components (IECQ) – Basic Rules*

IEC QC 001002 (all parts), *IEC Quality Assessment System for Electronic Components (IECQ) – Rules of procedure*

IEC Guide 102, *Electronic components – Specification structures for quality assessment (Qualification approval and capability approval)*

ISO 129, *Technical drawings – Dimensioning – General principles, definitions, methods of execution and special indications*

ISO 286-1, *ISO system of limits and fits – Part 1: Bases of tolerances, deviations and fits*

ISO 1101, *Technical drawings – Geometrical tolerancing – Tolerancing of form, orientation, location and run-out – Generalities, definitions, symbols, indications on drawings.*

ISO 8601, *Data elements and interchange formats – Information interchange – Representation of dates and times*

¹⁾ To be published.

1.3 Definitions

For the purposes of this International Standard, the definitions given in IEC 60050(731) apply, together with the following definitions.

1.3.1

optical switch

passive component possessing one or more ports which selectively route or block optical power in an optical fibre transmission line

1.3.2

wavelength switch

switch which is designed to operate in two or more defined wavelength bands of operation and which can selectively route or block light in one or more of the bands of operation as a function of the wavelength band

1.3.3

port

optical fibre or optical fibre connector attached to a passive component for the entry and/or exit of optical power

1.3.4

switch state

particular optical configuration of a switch, whereby optical power is transmitted or blocked between specific ports in a predetermined manner

1.3.5

actuation mechanism

physical means (mechanical, electrical, acoustic, optical, etc.) by which a switch is designed to change between states

1.3.6

actuation energy

input energy required to place a switch in a specific state

1.3.7

transfer matrix

optical properties of a fibre optic switch which can be defined in a $n \times n$ matrix of coefficients (n is the number of ports)

NOTE The T matrix represents the on-state paths (worst-case transmission), and the T° matrix represents the off-state paths (worst-case isolation). Normally, there is a separate transfer matrix for each defined wavelength band of operation.

1.3.8

transfer coefficient

element t_{ij} or t°_{ij} of the transfer matrix. The index i refers to the input ports N , running from the numbers 1 to N . The index j refers to the output ports M , running from the number $N + 1$ to $N + M$

NOTE Each coefficient t_{ij} is the worst-case (minimum) fraction of power transferred from port i to port j for any state with path ij switched on. Each coefficient t°_{ij} is the worst-case (maximum) fraction of power transferred from port i to port j for any state with path ij switched off.

1.3.9

logarithmic transfer matrix

in general, the logarithmic transfer matrix is

$$a_{ij} = -10 \log t_{ij}$$

where

a_{ij} is the optical power reduction in decibels out of port j with unit power into port i ;

t_{ij} is the transfer matrix coefficient.

Similarly, for the off state

$$a_{ij} = -10 \log t_{ij}$$

1.3.10

attenuation

element a_{ij} (where $i \neq j$) of the logarithmic transfer matrix. It is the reduction in optical power between an input and output port of a passive component expressed in decibels. It is defined as

$$a_{ij} = -10 \log (P_j/P_i)$$

where P_i is the optical power launched into the i port and P_j is the optical power received from the j port. The insertion loss values depend on the state of the switch

1.3.11

return loss; reflection loss

element a_{ij} (where $i = j$) of the logarithmic transfer matrix. It is the fraction of input power that is returned from the input port of a passive component. It is defined as

$$RL_i = -10 \log (PR_i/P_i)$$

where P_i is the optical power launched into the i port and PR_i the optical power received back from the i port.

The return loss values depend on the state of the switch

1.3.12

operating wavelength band

nominal wavelength band at which the wavelength switch is designed to operate with the specified performance

1.3.13

operating wavelength range; bandpass

specified range of wavelengths from $\lambda_{i \min}$ to $\lambda_{i \max}$ about a nominal operating wavelength λ_i , within which the wavelength switch is designed to operate with the specified performance. A wavelength switch normally has more than one operating wavelength range

1.3.14

connected ports

two ports between which the attenuation is nominally zero in a given state of the switch