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**Fibre optic active components and devices – Test and measurement
procedures –
Part 6: Universal mezzanine boards for test and measurement of photonic
devices**

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IEC 62150-6:2022

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CONTENTS

FOREWORD.....	3
INTRODUCTION.....	5
1 Scope.....	6
2 Normative references	6
3 Terms and definitions	6
4 Mezzanine board requirements.....	7
4.1 Functional description	7
4.2 Critical dimensions.....	9
4.3 Daughtercard and extended system	11
4.4 Power and signal flows	15
Annex A (informative) International collaborative research and development	18
A.1 Overview.....	18
A.2 European FP7 PhoxTroT project	19
A.3 European H2020 Nephele project	19
A.4 European H2020 COSMICC project	19
A.5 Benefit of universal test board.....	20
Bibliography.....	21
Figure 1 – Outlines of mezzanine test boards	7
Figure 2 – Attachment of PDS onto M2 board	8
Figure 3 – Mezzanine board 1 (M1) – Relative positions of power and low speed signal connectors on top and bottom surfaces and mezzanine board origin.....	9
Figure 4 – Mezzanine board 2 (M2) – Relative positions of power and low speed signal connectors on top and bottom surfaces and mezzanine board origin.....	10
Figure 5 – Power distribution and sensor board (PDS) – Relative positions of power and low speed signal connectors on bottom surfaces and mezzanine board origin.....	10
Figure 6 – Outline dimensions of extended double Eurocard form factor daughtercard with electrical edge connectors and cut-outs to accommodate optical backplane connectors	12
Figure 7 – Attachment of M2 boards onto daughtercard	13
Figure 8 – Extended double Eurocard form factor daughtercard with two M2 boards attached.....	14
Figure 9 – Extended double Eurocard form factor daughtercard with four M1 boards attached.....	14
Figure 10 – Extended double Eurocard form factor daughtercard with two M1 boards and one M2 board attached	15
Figure 11 – Functional diagram showing power and low speed signal distribution between PDS, M1/M2, daughtercard and backplane	16
Figure 12 – Multiple daughtercards populated with M1/M2 and PDS in multiple slots on a system backplane	17
Figure A.1 – Example of cross-project deployment of mezzanine test card [3].....	18
Figure A.2 – Examples of M2 test boards developed on EU H2020 COSMICC project.....	20
Table 1 – Critical relative dimensions.....	11
Table 2 – Voltages and low-power signal designations.....	16

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**FIBRE OPTIC ACTIVE COMPONENTS AND DEVICES –
TEST AND MEASUREMENT PROCEDURES –****Part 6: Universal mezzanine boards for test and
measurement of photonic devices**

FOREWORD

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IEC 62150-6 has been prepared by subcommittee SC 86C: Fibre optic systems and active devices of IEC technical committee 86: Fibre optics. It is an International Standard.

The text of this International Standard is based on the following documents:

Draft	Report on voting
86C/1721/CDV	86C/1752/RVC

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

The language used for the development of this International Standard is English.

A list of all parts in the IEC 62150 series, published under the general title *Fibre optic active components and devices – Test and measurement procedures*, can be found on the IEC website.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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

This document defines a generic electro-optic mezzanine board for the test and measurement of micro-optical and micro-photonic devices, including a wide diversity of photonic integrated circuit (PIC) technologies including, but not limited to, transceivers, switches, sensors, neuromorphic networks, LiDAR and quantum integrated circuits. The board size and shape would allow two mezzanine boards to be mounted, side-by-side, on a larger Eurocard form factor daughtercard, which itself can be docked into and powered from a backplane system. Alternatively, each mezzanine board can be operated alone, for example on a lab bench powered from a bench supply.

The purpose of this generic mezzanine board concept is to allow like-for-like comparative characterisation of devices under test (DUTs) with respect to one another and to measure the performance of DUTs within larger test environments, relevant to their targeted application, such as data centre systems, high performance computers, automotive or 5G cabinets. The mezzanine board PCB will be designed to accommodate very high-speed electronic signals and a high-speed electronic signal interface to allow external test equipment such as test pattern generators, bit error rate testers and communication signal analysers to drive the device under test (DUT).

This approach will be instrumental in accelerating commercial adoption of micro-photonic devices as they will provide a common benchmark, against which to evaluate the true performance of a DUT. For example, power consumption is an increasingly important figure of merit for optical micro-transceivers in ICT systems; however, the declared values of power consumption as interpreted by the developer often do not reflect the true power consumption of a device under test in operation. The mezzanine board will therefore include provision for a smaller detachable power distribution and sensor mezzanine board allowing multiple tuneable voltages to be provided to the device under test and real-time current or power measurement for each voltage.

Variants of these mezzanine boards have been successfully developed and adopted within the European research and development projects European FP7 project PhoxTrot [1]¹, European H2020 Nephele [2] and European H2020 COSMICC [3]. Annex A provides an introduction to these projects.

¹ Numbers in square brackets refer to the Bibliography.

FIBRE OPTIC ACTIVE COMPONENTS AND DEVICES – TEST AND MEASUREMENT PROCEDURES –

Part 6: Universal mezzanine boards for test and measurement of photonic devices

1 Scope

This part of IEC 62150 specifies a generic mezzanine board system to support test and measurement of devices based on micro-optical and micro-photonic technologies, including but not limited to photonic integrated circuit (PIC) devices.

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.

IEC 60050-731, *International Electrotechnical Vocabulary – Part 731: Optical fibre communication* (available at www.electropedia.org)

IEC 62150-1, *Fibre optic active components and devices – Test and measurement procedures – Part 1: General and guidance*

IEC TR 63072-1, *Photonic integrated circuits – Part 1: Introduction and roadmap for standardization*

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3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-731, IEC 62150-1, IEC TR 63072-1 and the following apply.

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

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1

mezzanine board

electronic, optical, or electro-optical printed circuit board designed to be docked onto a larger board such that the surfaces of the mezzanine board and larger board are parallel

3.2

photonic integrated circuit

PIC

integrated circuit that contains optical structures to guide and process optical signals

Note 1 to entry: See IEC TR 63072-1.

3.3

device under test

DUT

single component or combination of components as defined to be tested

4 Mezzanine board requirements

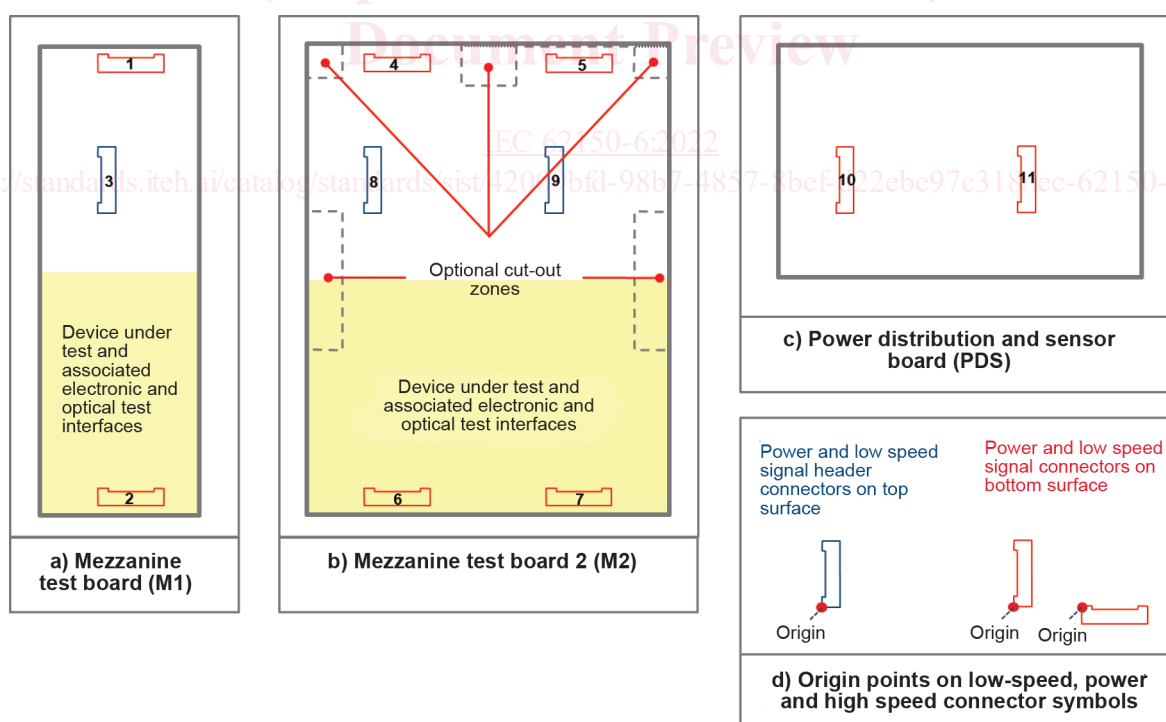
4.1 Functional description

This document specifies three categories of mezzanine boards:

- half-width mezzanine test board 1 (M1);
- full-width mezzanine test board 2 (M2);
- power distribution and sensor board (PDS).

Figure 1 shows the outline shapes of these three mezzanine boards with electric power and other low-speed electric connectors on the top and bottom surfaces.

This document defines the outline boundary of the three boards, as shown by the solid thick line in Figure 1, but the designer is free to adopt any shape within the defined boundary, as long as it does not interfere with the positions of the power and low-speed connectors on the top and/or bottom surfaces. M2 is shown with optional example cut-outs along the edges. The purpose of such cut-outs typically is to allow the user to access components on the underlying host board over which the mezzanine board is attached. For example, during operation, the user may require transient access to connectors on the underlying host board for low-speed diagnostic read-outs from the PDS.



IEC

Figure 1 – Outlines of mezzanine test boards

M1 and M2 are mezzanine test boards with areas assigned for micro-optical or micro-photonic devices under test (DUTs) and the associated electronic and optical test interfaces.

For example, the DUT on a mezzanine test board (M1 or M2) could be an experimental photonic integrated circuit (PIC) optical transceiver. The associated electronic test interface could be a high RF electronic signal header connector array through which high-speed test signals generated from an external electronic signal pattern generator could be conveyed to the optical transmit section of the transceiver DUT and through which electronic high-speed signals generated from the optical receiver section of the transceiver DUT could be conveyed off the mezzanine test board to an external electronic communications signal analyser or bit error rate tester. The associated optical test interface could be an optical array connector attached by an optical fibre ribbon to the optical transceiver DUT through which high-speed optical signals from an external optical signal pattern generator could be conveyed to the optical receiver section of the transceiver DUT and through which optical high-speed optical signals generated from the optical transmit section of the transceiver DUT could be conveyed off the mezzanine test board to an external optical communications signal analyser or optical bit error rate tester.

The PDS is a power distribution and sensor board that attaches onto a full width mezzanine card (M1) or across one or two half-width mezzanine test boards (M1) and provides the requisite voltage or separate voltages to the device under test on its host mezzanine test board or boards. In addition, the PDS provides a current sensor for each voltage provided to the mezzanine test board(s), allowing the power consumption of the corresponding DUT to be measured. Typically, the current sensor will communicate the readings of current in real-time across a low-speed signal interface, for example a serial wire interface such as I2C. Figure 2 shows a PDS attaching to an M2 board.

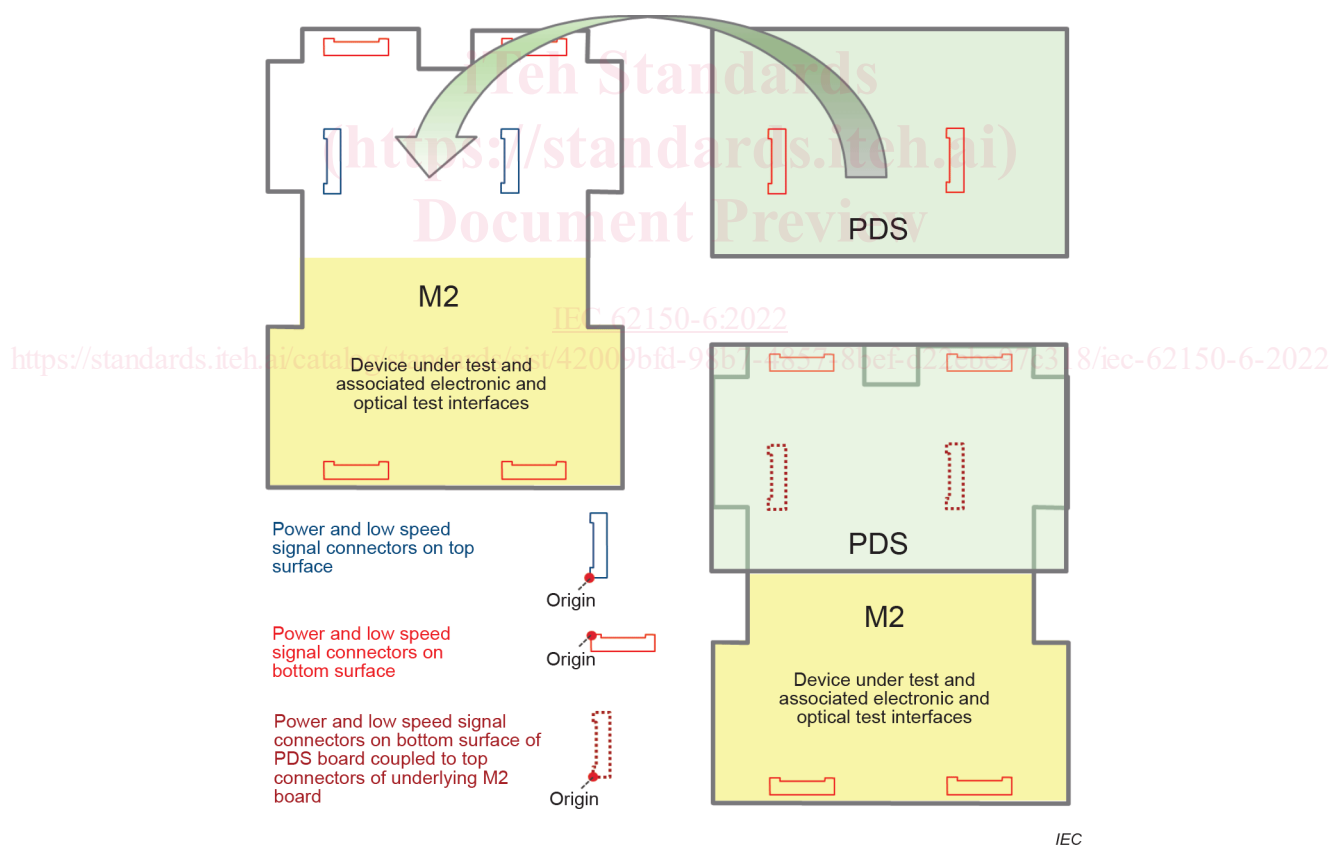


Figure 2 – Attachment of PDS onto M2 board

4.2 Critical dimensions

This document defines the outline board dimensions and the relative positions of the origin points of the power and low-speed signal connectors on the top and bottom surfaces with respect to one another and the board origin points. The connector origin points are always defined by the centre position of pin 1. In Figure 2, as well as in Figure 3 to Figure 10, the connector origin points are represented by a corner of the package shape itself, but as connectors may vary, the package sizes may also vary.

Figure 3 shows the relative positions of the origin points of the power and low-speed signal connectors on top and bottom surfaces and the mezzanine board origin point on M1.

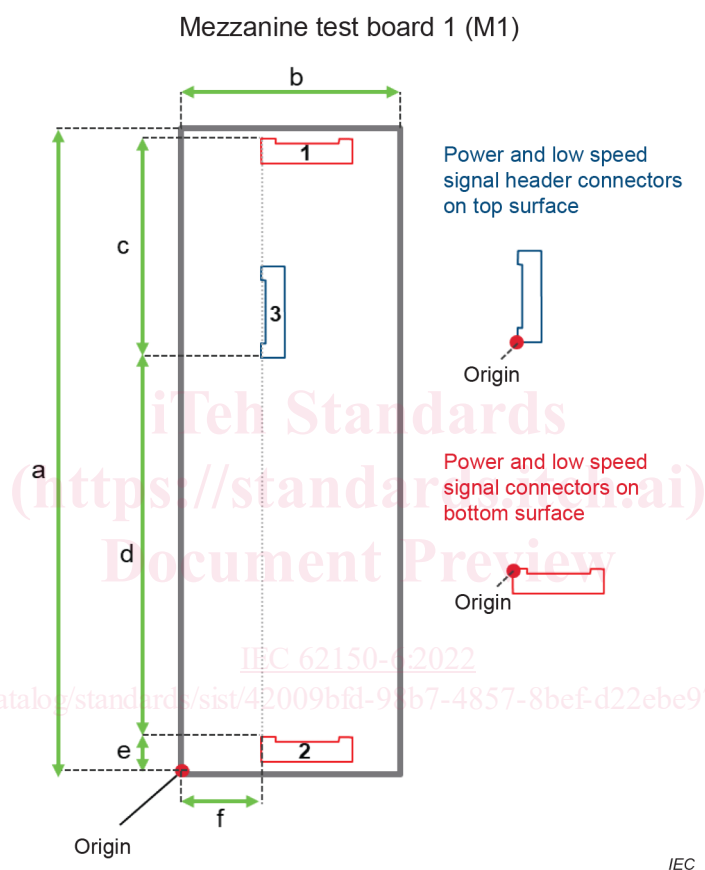


Figure 3 – Mezzanine board 1 (M1) – Relative positions of power and low speed signal connectors on top and bottom surfaces and mezzanine board origin

Figure 4 shows the relative positions of the origin points of the power and low-speed signal connectors on top and bottom surfaces and the mezzanine board origin point on M2.