

BS EN 60512-28-100:2013



BSI Standards Publication

Connectors for electrical equipment — Tests and measurements

Part 28-100: Signal integrity tests
up to 1 000 MHz on IEC 60603-7
and IEC 61076-3 series connectors
— Tests 28a to 28g

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The UK participation in its preparation was entrusted to Technical Committee EPL/48, Electromechanical components and mechanical structures for electronic equipment.

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**Connectors for electronic equipment -
Tests and measurements -
Part 28-100: Signal integrity tests up to 1 000 MHz on IEC 60603-7
and IEC 61076-3 series connectors - Tests 28a to 28g
(IEC 60512-28-100:2013)**

Connecteurs pour équipements
électroniques - Essais et mesures -
Partie 28-100: Essais d'intégrité
des signaux jusqu'à 1 000 MHz
sur les connecteurs des séries
CEI 60603-7 et CEI 61076-3 -
Essais 28a à 28g
(CEI 60512-28-100:2013)

Steckverbinder für elektronische
Einrichtungen -
Mess- und Prüfverfahren -
Teil 28-100: Signalintegritätsprüfungen
bis 1 000 MHz an Steckverbindern der
Reihen IEC 60603-7 und IEC 61076-3 -
Prüfungen 28a bis 28g
(IEC 60512-28-100:2013)

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Foreword

The text of document 48B/2322/FDIS, future edition 1 of IEC 60512-28-100, prepared by SC 48B "Connectors" of IEC/TC 48 "Electromechanical components and mechanical structures for electronic equipment" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60512-28-100:2013.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2013-12-13
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2016-03-13

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The text of the International Standard IEC 60512-28-100:2013 was approved by CENELEC as a European Standard without any modification.

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60050-581	-	International Electrotechnical Vocabulary (IEV) - Part 581: Electromechanical components for electronic equipment	-	-
IEC 60512-1	-	Connectors for electronic equipment - Tests and measurements - Part 1: General	EN 60512-1	-
IEC 60512-26-100	2008	Connectors for electronic equipment - Tests and measurements - Part 26-100: Measurement setup, test and reference arrangements and measurements for connectors according to IEC 60603-7 - Tests 26a to 26g	EN 60512-26-100	2008
IEC 60603-7	Series	Connectors for electronic equipment	EN 60603-7	Series
IEC 61076-1	-	Connectors for electronic equipment - Product requirements - Part 1: Generic specification	EN 61076-1	-
IEC 61076-3-104	-	Connectors for electronic equipment - Product requirements - Part 3-104: Detail specification for 8-way, shielded free and fixed connectors for data transmissions with frequencies up to 1 000 MHz	EN 61076-3-104	-
IEC 61076-3-110	-	Connectors for electronic equipment - Product requirements - Part 3-110: Detail specification for shielded, free and fixed connectors for data transmission with frequencies up to 1 000 MHz	EN 61076-3-110	-
IEC 61156	Series	Multicore and symmetrical pair/quad cables - for digital communications - Part 1-2: Electrical transmission characteristics and test methods of symmetrical pair/quad cables	-	-
IEC 61156-6	-	Multicore and symmetrical pair/quad cables - for digital communications - Part 6: Symmetrical pair/quad cables with transmission characteristics up to 1 000 MHz - Work area wiring - Sectional specification	-	-

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61169-16	-	Radio-frequency connectors - Part 16: RF coaxial connectors with inner diameter of outer conductor 7 mm (0,276 in) with screw coupling - Characteristic impedance 50 ohms (75 ohms) (Type N)	EN 61169-16	-
IEC 62153-4-12	-	Metallic communication cable test methods - - Part 4-12: Electromagnetic compatibility (EMC) - Coupling attenuation or screening attenuation of connecting hardware - Absorbing clamp method		-
ISO/IEC 11801	-	Information technology - Generic cabling for - customer premises		-

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CONNECTORS FOR ELECTRONIC EQUIPMENT – TESTS AND MEASUREMENTS –

Part 28-100: Signal integrity tests up to 1 000 MHz on IEC 60603-7 and IEC 61076-3 series connectors – Tests 28a to 28g

1 Scope

This part of IEC 60512 specifies the test methods for transmission performance for IEC 60603-7 and IEC 61076-3 series connectors up to 1 000 MHz. It is also suitable for testing lower frequency connectors, however the test methodology specified in the detailed specification for any given connector remains the reference conformance test for that connector.

The test methods provided here are:

- insertion loss, test 28a;
- return loss, test 28b;
- near-end crosstalk (NEXT) test 28c;
- far-end crosstalk (FEXT), test 28d;
- transverse conversion loss (TCL), test 28f;
- transverse conversion transfer loss (TCTL), test 28g.

For the transfer impedance (ZT) test, see IEC 60512-26-100, test 26e.

For the coupling attenuation, see IEC 62153-4-12.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050-581, *International Electrotechnical Vocabulary (IEV) – Part 581: Electromechanical components for electronic equipment*

IEC 60512-1, *Connectors for electronic equipment – Tests and measurements – Part 1: General*

IEC 60512-26-100:2008, *Connectors for electronic equipment – Tests and measurements – Part 26-100: Measurement setup, test and reference arrangement and measurements for connectors according to IEC 60603-7 – Tests 26a to 26g*

IEC 60603-7 (all parts), *Connectors for electronic equipment*

IEC 61076-1, *Connectors for electronic equipment – Product requirements – Part 1: Generic specification*

IEC 61076-3-104, *Connectors for electronic equipment – Product requirements – Part 3-104: Detail specification for 8-way, shielded free and fixed connectors for data transmissions with frequencies up to 1 000 MHz*

IEC 61076-3-110, *Connectors for electronic equipment – Product requirements – Part 3-110: Detail specification for shielded, free and fixed connectors for data transmission with frequencies up to 1 000 MHz*

IEC 61156 (all parts), *Multicore and symmetrical pair/quad cables for digital communications*

IEC 61156-6, *Multicore and symmetrical pair/quad cables for digital communications – Part 6: Symmetrical pair/quad cables with transmission characteristics up to 1 000 MHz – Work area wiring – Sectional specification*

IEC 61169-16, *Radio-frequency connectors – Part 16: RF coaxial connectors with inner diameter of outer conductor 7 mm (0,276 in) with screw coupling – Characteristic impedance 50 ohms (75 ohms) (Type N)*

IEC 62153-4-12, *Metallic communication cable test methods – Part 4-12: Electromagnetic compatibility (EMC) – Coupling attenuation or screening attenuation of connecting hardware – Absorbing clamp method*

ISO/IEC 11801, *Information technology – Generic cabling for customer premises*

3 Terms, definitions and acronyms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions of IEC 60050(581), IEC 61076-1, IEC 60512-1, IEC 60603-7, IEC 61076-3-104 and IEC 61076-3-110 as well as the following, apply.

3.1.1

mixed mode (parameter or measurement)

parameters or measurements containing differential mode, common mode, and intermodal S-matrices

3.1.2

intermodal (parameter or measurement)

a parameter or measurement that either sources on the common mode and measures on the differential mode or, sources on the differential mode and measures on the common mode

3.2 Acronyms

For ease of reference acronyms used in this document are given below.

CM	common mode
DM	differential mode
DUT	device under test
FEXT	far-end crosstalk loss
IEC	International Electrotechnical Commission
LCL	longitudinal conversion loss
LCTL	longitudinal conversion transfer loss
NEXT	near-end crosstalk loss
TCL	transverse conversion loss

TCTL	transverse conversion transfer loss
SE	single ended
Z_T	transfer impedance

4 Overall test arrangement

4.1 Test instrumentation

All test instrumentation shall be capable of performing measurements over the frequency range of 1 MHz to 1 000 MHz.

The test procedures hereby described require the use of a vector network analyser. The analyser should have the capability of full 2-port calibrations. The analyser shall cover the frequency range of 1 MHz to 1 000 MHz at least.

Measurements are to be taken using a mixed mode test set-up, which is often referred to as an unbalanced, modal decomposition or balun-less setup. This allows measurements of balanced devices without use of an RF balun in the signal path.

Such a configuration also allows testing with either a common or differential mode stimulus and responses, ensuring that intermodal parameters can be measured without reconnection.

A 16 port network analyser is required to measure all combinations of a 4 pair device without external switching, however the network analyser shall have a minimum of 2 ports (including one bi-directional port) to enable the data to be collated and calculated.

It should be noted that the use of a 2 port analyser will involve successive repositioning of the measurement port in order to measure any given parameter.

A 4 port network analyser is recommended as a practical minimum number of ports, as this will allow the measurement of the full 16 term mixed mode S-parameter matrix on a given pair combination without switching or reconnection in one direction.

In order to minimise the reconnection of the DUT for each pair combination the use of an RF switching unit is also recommended.

Each conductor of the pair or pair combination under test shall be connected to a separate port of the network analyser, and results are processed either by internal analysis within the network analyser or by an external application.

Reference loads and through connections are needed for the calibration of the set-up. Requirements for the reference loads are given in 4.8. Termination loads are needed for termination of pairs, used and unused, which are not terminated by the network analyser. Requirements for the termination loads are given in 4.7 and 4.10.

4.2 Measurement precautions

To ensure a high degree of reliability for transmission measurements, the following precautions are required.

- Consistent and stable resistor loads shall be used throughout the test sequence.
- Cable and adapter discontinuities, as introduced by physical flexing, sharp bends and restraints shall be avoided before, during and after the tests.
- Consistent test methodology and termination resistors shall be used at all stages of transmission performance qualifications.