BS EN 60512-99-001:2012

BSI Standards Publication

Connectors for electronic equipment — Tests and measurements

Part 99-001: Test schedule for engaging and separating connectors under electrical load — Test 99a: Connectors used in twisted pair communication cabling with remote power

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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.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Published by BSI Standards Limited 2012.

ISBN 978 0 580 66656 8

ICS 31.220.10

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 November 2012.

Amendments issued since publication

Amd. No.	Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 60512-99-001

October 2012

ICS 31.220.10

English version

Connectors for electronic equipment - Tests and measurements - Part 99-001: Test schedule for engaging and separating connectors under electrical load - Test 99a: Connectors used in twisted pair communication cabling with remote power

(IEC 60512-99-001:2012)

Connecteurs pour équipements électroniques - Essais et mesures - Partie 99-001: Programme d'essai relatif aux connexions et déconnexions sous charge électrique - Essai 99a: Connecteurs utilisés dans le câblage de communication à paires torsadées permettant une alimentation à distance
(CEI 60512-99-001:2012)

Steckverbinder für elektronische Einrichtungen - Mess- und Prüfverfahren - Teil 99-001: Prüfablaufplan für Steckverbinder zum Stecken und Ziehen mit elektrischer Belastung - Prüfung 99a: Steckverbinder für die Anwendung in paarverseilter Kommunikationsverkabelung mit Fernspeisung
(IEC 60512-99-001:2012)

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Ref. No. EN 60512-99-001:2012 E

Foreword

The text of document 48B/2291/FDIS, future edition 1 of IEC 60512-99-001, prepared by 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 60512-99-001:2012.

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)	2013-06-17
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The text of the International Standard IEC 60512-99-001:2012 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 60512-1-1	NOTE	Harmonised as EN 60512-1-1.
IEC 60512-2-1	NOTE	Harmonised as EN 60512-2-1.
IEC 60512-3-1	NOTE	Harmonised as EN 60512-3-1.
IEC 60512-4-1	NOTE	Harmonised as EN 60512-4-1.
IEC 60512-11-7	NOTE	Harmonised as EN 60512-11-7.

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.

Publication	Year	Title	EN/HD	Year
IEC 60512	Series	Connectors for electronic equipment - Tests and measurements	EN 60512	Series
IEC 60512-1-100	-	Connectors for electronic equipment - Tests and measurements - Part 1-100: General - Applicable publications	EN 60512-1-100	-
IEC 60512-9-3	2011	Connectors for electronic equipment - Tests and measurements - Part 9-3: Endurance tests - Test 9c: Mechanical operation (engaging and separating) with electrical load	EN 60512-9-3	2011
IEC 61156	Series	Multicore and symmetrical pair/quad cables for digital communications	-	-

CONTENTS

CONNECTORS FOR ELECTRONIC EQUIPMENT – TESTS AND MEASUREMENTS –

Part 99-001: Test schedule for engaging and separating connectors under electrical load – Test 99a: Connectors used in twisted pair communication cabling with remote power

1 Scope and object

This part of IEC 60512 is used for the assessment of connectors within the scope of SC 48B that are used in twisted pair communication cabling with remote power, such as ISO/IEC 11801 Class D, or better, balanced cabling in support of IEEE Std 802.3at™-2009 (PoE Plus – Power over Ethernet Plus).

The object of this standard is to detail a test schedule to determine the ability of connectors to withstand a minimal number of engagements and separations when an electrical current is being passed through the connector in accordance with IEC 60512-9-3.

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 60512 (all parts): *Connectors for electronic equipment – Tests and measurements*

IEC 60512-1-100: *Connectors for electronic equipment – Tests and measurements – Part 1-100: General – Applicable publications*

IEC 60512-9-3:2011*, Connectors for electronic equipment – Tests and measurements – Part 9-3: Endurance tests – Test 9c: Mechanical operation (engaging and separating) with electrical load*

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

3 General

The current carrying capacity of a mated connector, including the corresponding current de-rating for temperature, shall be specified in the detail specification. Although many applications are configured such that the current is not drawn until after full engagement of the connector has been achieved (i.e. the connector does not “make” the current), this test schedule is suitable for verification of engaging and separating of connectors under PoE Plus load conditions where this may occur in practice.

An application specific current, and associated open circuit voltage, is specified that corresponds with the current and voltage of the supported application.

The circuitry and test conditions given in this standard correspond to the conditions associated with ISO/IEC 11801 Class D, or better, balanced cabling in support of IEEE 802.3at (PoE Plus – Power over Ethernet Plus)

Further information on the possible effects of such operations may be found in IEC TR 62652.

NOTE The above documents are not essential for the application of this standard but are given as source of information, as such, they may be found in the Bibliography.

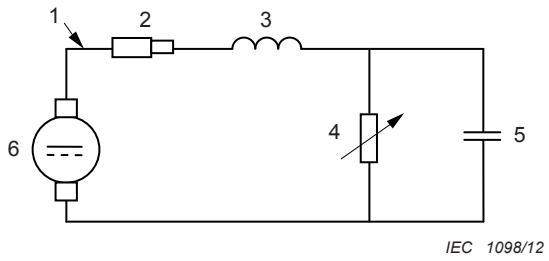
4 Preparation of specimen

Each specimen shall consist of a mated connector with its terminations. Specimens shall be conformant to the relevant IEC connector standards. Each free connector and each fixed connector shall be terminated with 3 m (max.) of the maximum conductor size cable for which it is intended to be terminated, according to IEC 61156 series. For each specimen, all of the circuits (mated contacts) shall be wired in parallel, as given in IEC 60512-9-3, and all of the circuits shall be tested (see Figure 1). If necessary, a printed circuit board may be used which shall not influence the test results.

5 Test circuit requirements

5.1 General

The values for the circuit components and the details of the test circuit, referenced in IEC 60512-9-3, shall be as shown in Figure 1.



Key

1 Cables in accordance with 4.1

2 Connector under test

3 Inductor 100 µH

4 Variable resistor (e.g. 50 Ω to 300 Ω)

5 Capacitor 5 µF

6 Power source

NOTE 1 Only one circuit of the connector under test, as referenced in IEC 60512-9-3, is shown for clarity. Items 1, 3, 4, 5, and 6, are replicated for each circuit (engaged contacts) of the connector. Item 6 may be single or multiple. Each circuit of the specimen shall be wired in parallel with the other circuits of the specimen, and all circuits of each specimen shall operate simultaneously.

NOTE 2 The variable resistor(s) are used to adjust the current(s) to the specified value.

Figure 1 – Test circuit details

5.2 Voltage and current

The variable resistor(s) shall be set so that the electrical current in each circuit (mated contacts) of the specimen is 0,6 A. When specimen is unmated, the ‘open circuit’ voltage, in all circuits, shall be 55 V d.c. See Annex A.

IEEE 802.3 at specifies a maximum current of 0,3 A per conductor and an open circuit voltage of 55 V d.c. The test current has been doubled to 0,6 A in order to represent the high

probability that one contact of any given pair will separate before the other. Therefore as in the cited application, where current is carried by pairs of contacts in multiple parallel circuits, the last contact to break will do so carrying all the current (twice the nominal).

5.3 Auxiliary equipment

The test laboratory may choose to use switches to reverse polarity. However, use of such switches shall not influence the test parameters.

6 Tests and test schedule

6.1 Test group UEL 1

A minimum number of 8 specimens shall be prepared for this group; then tested according to Table 1.

Table 1 – Test group UEL 1

Test Phase	Test				Measurement to be performed	
	Title	IEC 60512 test No.	Severity or condition of test	Title	IEC 60512 test No.	Requirements
UEL 1.1	General examination	1		Visual examination	1a	There shall be no defects that would impair normal operation
UEL 1.2		Contact resistance		Millivolt level method	2a	Contact resistance 20 mΩ maximum
UEL 1.3			100 V d.c. Method A Mated connectors	Insulation resistance	3a	500 MΩ minimum
UEL 1.4			Contact to contact All signal contacts to shield and test panel, as applicable Method A Mated connectors	Voltage proof	4a	1 000 V d.c. or a.c. peak 1 500 V d.c. or a.c. peak
UEL 1.5			An electrical load, current and open circuit voltage, as detailed in Clause 5, shall be applied to each specimen. For the purpose of this test one connector shall be fixed and the other disengaged at a speed of 150 ± 10 mm/s. One engagement and one separation constitute one cycle. 25 cycles shall be performed. The polarity of the d.c. source (direction of the electrical current) shall be reversed and 25 further cycles performed.	Mechanical operations with electrical load	9c	

Table 1 *(continued)*

Test Phase	Test				Measurement to be performed	
	Title	**IEC 60512 test No.**	**Severity or condition of test**	**Title**	**IEC 60512 test No.**	**Requirements**
UEL 1.6	Flowing mixed gas test. Method 1	11g	4 days. Half of the samples mated; half of the samples unmated		11g	
UEL 1.7				Contact resistance-Millivolt level method	2a	20 mΩ maximum change from initial
UEL 1.8			An electrical load, current and open circuit voltage, as detailed in Clause 5, shall be applied to each specimen. For the purpose of this test one connector shall be fixed and the other disengaged at a speed of 150 ± 10 mm/s. One engagement and one separation constitute one cycle. 25 cycles shall be performed. The polarity of the dc. source (direction of the electrical current) shall be reversed and 25 further cycles performed. The specified testing is done with voltage present during engagement. If a specimen does not “pass” the test sequence, the test shall be repeated with a new specimen, without applied voltage during engagement, but the appropriate voltage and current shall be applied during disengagement. A connector passing the test in this manner shall be reported as such in test reports. Further, this information shall be made evident in the all relevant documentation of the manufacturer and supplier regarding this mode of complying with this test schedule requirement.	Mechanical Operations with electrical load.	9c	

Table 1 *(continued)*

Test Phase	Test			Measurement to be performed		
	Title	**IEC 60512 test No.**	**Severity or condition of test**	**Title**	**IEC 60512 test No.**	**Requirements**
UEL 1.9	General examination	1		Visual examination	1a	There shall be no defects that would impair normal operation. However, physical deterioration of the contacts may be observed. Such deterioration shall not be cited as a failure of this test.
UEL 1.10			Contact resistance	Millivolt level method	2a	20 mΩ maximum change from initial
UEL 1.11			100 V d.c. Method A Mated connectors	Insulation resistance	3a	500 MΩ minimum
UEL 1.12			Contact to contact All signal contacts to shield and test panel, as applicable Method A Mated connectors	Voltage proof	4a	1 000 V d.c. or a.c. peak 1 500 V d.c. or a.c. peak.

Annex A
(informative)

Test voltage and current setting instructions

A.1 General

It is possible that confusion as to how to set the required voltages and currents may arise. Given below are a set of informative instructions as to how this may be achieved.

A.2 Rationale

The open circuit voltage requirement is stated such that during unmating under load, the stated voltage is available to 'drive' arcing.

Some power sources have an 'open circuit' setting which is used to clamp the voltage to prevent an over voltage condition. As no source voltage is stated for the supply in a constant voltage mode, an interpretation of the requirements could be to set some level of source voltage (the dc supply constant voltage setting) below (e.g.) 55 V, and to set the maximum open circuit voltage at (e.g.) 55 V. But, under this interpretation, upon unmating the constant voltage setting would not allow the voltage to reach the intended open circuit level.

A.3 Suggested setting instructions

The d.c. source voltage and variable resistors should be adjusted such that the current in each circuit (each mated pair of contacts within the connector under test) is the required value (e.g. 0,6 A) when mated and the open circuit voltage is the required value (e.g. 55 V) when unmated. For each test circuit the suggested setting instructions are as follows.

a) With the d.c. power supply off and all variable resistors adjusted at a suitably high value (e.g. 200 Ω), perform the initial mating of the connector.

b) Place the power supply in a constant voltage mode with the voltage adjustment set at 0 V, and the current adjustment at its maximum setting.

c) Turn on the power supply.

d) Adjust the constant voltage setting to the required voltage.

e) Reduce the resistance of the variable resistor in each circuit until the required current value is flowing in the circuit being adjusted.

Bibliography

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

IEC 60512-2-1, *Connectors for electronic equipment – Tests and measurements – Part 2-1: Electrical continuity and contact resistance tests – Test 2a: Contact resistance – Millivolt level method*

IEC 60512-3-1, *Connectors for electronic equipment – Tests and measurements – Part 3-1: Insulation tests – Test 3a: Insulation resistance*

IEC 60512-4-1, *Connectors for electronic equipment – Tests and measurements – Part 4-1: Voltage stress tests – Test 4a: Voltage proof*

IEC 60512-11-7, *Connectors for electronic equipment – Tests and measurements – Part 11-7: Climatic tests – Test 11g: Flowing mixed gas corrosion test*

IEC/TR 62652, Effects of *engaging and separating under electrical load* on connector interfaces used to support IEEE 802.3af Power-over-Ethernet (PoE) applications

ISO/IEC 11801:2002, *Information technology – Generic cabling for customer premises*
Amendment 1 (2008)

IEEE 802.3at : 2009, *IEEE Standard for Information technology – Local and metropolitan area networks – Specific requirements – Part 3 : CSMA/CD Access Method and Physical Layer Specifications – Amendment 3 : Data Terminal Equipment (DTE) Power via the Media Dependent Interface (MDI) Enhancements*

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