ISO/IEC TS 29125

Edition 2.0 2017-04

TECHNICAL SPECIFICATION

colour inside

Information technology – Telecommunications cabling requirements for remote powering of terminal equipment



ISO/IEC TS 29125:2017-04(en)



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2017 ISO/IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about ISO/IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - www.iec.ch/searchpub

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,…). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing 20 000 terms and definitions in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

65 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

ISO/IEC TS 29125

Edition 2.0 2017-04

TECHNICAL SPECIFICATION

colour inside

Information technology – Telecommunications cabling requirements for remote powering of terminal equipment

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 35.200

ISBN 978-2-8322-4223-0

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD 4
INTRODUCTION 6
1 Scope 7
2 Normative references 7
3 Terms, definitions and abbreviated terms 7
3.1 Terms and definitions 7
3.2 Abbreviated terms 8
4 Conformance 8
5 Cabling selection and performance 9
6 Installation conditions 9
6.1 General 9
6.2 Ambient temperature 9
6.3 Temperature rise and current capacity 9
6.4 Factors affecting temperature increase 11
6.4.1 General 11
6.4.2 Installation near equipment 11
6.4.3 Cable count within a bundle 11
6.4.4 Reducing temperature increase 12
6.4.5 Cable bundle suspended in air 13
6.4.6 Administration 14
7 Remote power delivery over balanced cabling 14
8 Connecting hardware 15
Annex A (informative) Mitigation considerations for installed cabling 17
A.1 General 17
A.2 Minimum cabling class 17
A.3 Bundle size and location 17
A.4 Mitigation options 17
Annex B (informative) Modelling temperature rise for cable types, bundle sizes and installation conditions 18
B.1 Model basics 18
B.2 Power dissipated (P) 18
B.3 Temperature difference from ambient temperature to bundle surface (ΔT_u) 19
B.3.1 Model equations 19
B.3.2 Typical values for constant ρ_u 19
B.4 Temperature difference from bundle surface to bundle centre (ΔT_{th}) 19
B.4.1 Model equations 19
B.4.2 Typical values for constant ρ_{th} 19
B.5 Temperature variation within the bundle ($\Delta T(x)$) 20
B.6 Alternative presentation of the model 20
B.7 Adaptation model used to derive temperature rise vs. cables in a bundle 20
B.8 Calculations 21
B.9 Example 21
B.10 Coefficients for air and conduit 22
Annex C (informative) Transmission parameters related to remote powering 23
C.1 DC loop resistance 23

C.2 DC resistance unbalance (within pair) 23
C.3 DC resistance unbalance (pair to pair) 24
Annex D (informative) Illustrations of heating of various bundle sizes and configurations 26
D.1 Limiting cable bundle size 26
D.2 Separating into smaller bundles 27
Annex E (informative) Test protocol 28
E.1 Background 28
E.2 Test set-up 28
Annex F (informative) Detailed test procedure 30
F.1 General 30
F.2 Test set-up 30
F.2.1 Thermocouple placement 30
F.2.2 Measurement of cable bundle in air 31
F.2.3 Measurement of cable bundle in conduit 32
Bibliography 34

Figure 1 – Examples of end point powering systems using signal pairs (top) and spare pairs (bottom) 14
Figure 2 – Examples of mid-span powering systems 15
Figure B.1 – Temperature rise profile 18
Figure D.1 – 91-cable bundle 26
Figure D.2 – Three bundles of 37 cables 26
Figure D.3 – Three bundles of 37 cables with separation 27
Figure E.1 – 37-cable bundle and temperature location 28
Figure E.2 – "Perfect bundle" and thermocouple configuration 29
Figure E.3 – Conductor configuration 29
Figure F.1 – Placement of thermocouple 30
Figure F.2 – Securing of the thermocouple 31
Figure F.3 – Test set-up for cable bundles in air 32
Figure F.4 – Test set-up for cable bundles in conduit 33

Table 1 – Maximum current per conductor versus temperature rise in a 37-cable bundle in air and conduit (all 4 pairs energized) 10
Table 2 – Calculated worst case current per conductor versus temperature rise in a bundle of 37 4-pair cables (all pairs energized) 11
Table 3 – Temperature rise versus cable bundle size (500 mA per conductor) 12
Table 4 – Temperature rise for a type of cable versus the number of energized pairs in a 37-cable bundle (500 mA per conductor) 13
Table B.1 – Bundling coefficients for different types of cables and cords (all 4 pairs energized) 22
Table C.1 – Maximum DC loop resistance of channels 23
Table C.2 – DC resistance unbalance of cables, connecting hardware and channels 24
Table C.3 – DC resistance unbalance (pair to pair) 25

INFORMATION TECHNOLOGY –

TELECOMMUNICATIONS CABLING REQUIREMENTS FOR REMOTE POWERING OF TERMINAL EQUIPMENT

FOREWORD

1) ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

2) The formal decisions or agreements of IEC and ISO on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees and ISO member bodies.

3) IEC, ISO and ISO/IEC publications have the form of recommendations for international use and are accepted by IEC National Committees and ISO member bodies in that sense. While all reasonable efforts are made to ensure that the technical content of IEC, ISO and ISO/IEC publications is accurate, IEC or ISO cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.

4) In order to promote international uniformity, IEC National Committees and ISO member bodies undertake to apply IEC, ISO and ISO/IEC publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any ISO, IEC or ISO/IEC publication and the corresponding national or regional publication should be clearly indicated in the latter.

5) ISO and IEC do not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. ISO or IEC are not responsible for any services carried out by independent certification bodies.

6) All users should ensure that they have the latest edition of this publication.

7) No liability shall attach to IEC or ISO or its directors, employees, servants or agents including individual experts and members of their technical committees and IEC National Committees or ISO member bodies for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication of, use of, or reliance upon, this ISO/IEC publication or any other IEC, ISO or ISO/IEC publications.

8) Attention is drawn to the normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.

9) Attention is drawn to the possibility that some of the elements of this ISO/IEC publication may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

The main task of the joint technical committee is to prepare International Standards. In exceptional circumstances, the joint technical committee may propose the publication of a Technical Specification when

- the required support cannot be obtained for the publication of an International Standard, despite repeated efforts, or
- when the subject is still under technical development or where, for any other reason, there is the future but not immediate possibility of an agreement on an International Standard.

Technical Specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

ISO/IEC TS 29125, which is a Technical Specification, has been prepared by subcommittee 25: Interconnection of information technology equipment, of ISO/IEC joint technical committee 1: Information technology.

This first edition cancels and replaces ISO/IEC TR 29125:2010. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) extension of the current per conductor from 300 mA to 500 mA;
b) provision of additional details of installation conditions that were not described in ISO/IEC TR 29125:2010;
c) inclusion of guidelines for cords;
d) inclusion of a model to calculate temperature rise in different bundle sizes.

This Technical Specification has been approved by vote of the member bodies, and the voting results may be obtained from the address given on the second title page.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

This document specifies the use of generic balanced cabling for customer premises, as specified in the ISO/IEC 11801 series, for remote powering of terminal equipment. It provides guidance on new cabling installations and renovations. The customer premises may encompass one or more buildings or may be within a building that contains more than one organization. The cabling may be installed prior to the selection of remote powering equipment or powered terminal equipment.

ISO/IEC 11801-1 specifies a structure and performance requirements for cabling subsystems that support a wide range of applications. They provide appropriate equipment interfaces to the cabling infrastructure in equipment rooms, telecommunications rooms and work areas.

A growing number of organizations employ equipment at locations that require the provision of remote powering. This document was created to provide supplementary information to ISO/IEC 11801-1 to implement remote powering over generic balanced cabling as specified in ISO/IEC 11801-1.

This document provides additional guidance for remote powering on the use of balanced cabling systems as specified in ISO/IEC 11801-1 and guidance on different installation conditions that require special considerations:

- information to bring together all the considerations about remote powering in a single document;
- guidance on mating and un-mating of connectors that convey remote power.

This document does not include requirements from national or local safety standards and regulations.

This document was developed based on a number of contributions describing remote powering over telecommunications cabling under different installation conditions. The relevant safety standards and regulations, application standard, and equipment manufacturers give guidance on factors that should be taken into account during design of the generic balanced cabling that supports the distribution of remote powering.

This document extends the current per conductor specified in ISO/IEC TR 29125:2010 from 300 mA to 500 mA. This document covers additional details of installation conditions that are not described in ISO/IEC TR 29125:2010. This document includes guidelines for cords.

INFORMATION TECHNOLOGY –

TELECOMMUNICATIONS CABLING REQUIREMENTS FOR REMOTE POWERING OF TERMINAL EQUIPMENT

1 Scope

This document

a) addresses the support of safety extra low voltage (SELV) and limited power source (LPS) applications that provide remote power over balanced cabling in accordance with the reference implementations of ISO/IEC 11801 series standards using currents per conductor of up to 500 mA and targets the support of applications that provide remote power over balanced cabling to terminal equipment,

b) covers the transmission and electrical parameters needed to support remote power over balanced cabling,

c) covers various installation scenarios and how these may impact the capability of balanced cabling to support remote powering,

d) specifies design and configuration of cabling as specified in ISO/IEC 11801-1.

NOTE SELV requirements specify a maximum voltage of 60 V DC and LPS is understood in the applications referenced to be up to 100 W supplied within 4-pair cabling.

This document includes a mathematical model to predict the behaviour of different bundle sizes, various cabling constructions, and installation conditions for different current capacities.

Safety (e.g. electrical safety and protection and fire) and electromagnetic compatibility (EMC) requirements are outside the scope of this document, and are covered by other standards and regulations. However, information given by this document can be of assistance.

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.

ISO/IEC 11801-1, *Information technology – Generic cabling for customer premises – Part 1: General requirements*

ISO/IEC 14763-2, *Information technology – Implementation and operation of customer premises cabling – Part 2: Planning and installation*

ISO/IEC TR 24746, *Information technology – Generic cabling for customer premises – Mid-span DTE power insertion*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 11801-1, ISO/IEC 14763-2 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

3.1.1
power source equipment
equipment that provides power

3.1.2
cable bundle
several cables tied together or in contact with one another in a parallel configuration for at least 1 m, with the cross-section profile of the arrangement basically circular

3.1.3
conductor
element intended to carry electric current

[SOURCE IEC 60050-151:2001, 151-12-05, modified – The 3 Notes have been deleted.]

3.1.4
current carrying capacity
maximum current a cable circuit (one or several conductors) can support resulting in a specified increase of temperature of the conductor beyond the ambient temperature, not exceeding the maximum allowed operating temperature of the cable

[SOURCE: IEC 61156-1:2007/AMD1:2009, 3.24, modified – "increase of temperature" has replaced "increase of the surface temperature".]

3.1.5
remote powering
supply of power to application specific equipment via balanced cabling

3.1.6
temperature rise
difference in temperature between the initial temperature of the conductor without power and the final temperature of the powered conductor at steady state

3.2 Abbreviated terms

EMC electromagnetic compatibility

FD floor distributor

HVAC heating, ventilation and air conditioning

PTZ pan, tilt, zoom

WAP wireless access point

4 Conformance

For cabling to comply with this document, the following applies:

a) the design of the cabling shall comply with the relevant cabling design standard of the ISO/IEC 11801 series;

b) the installation shall comply with ISO/IEC 14763-2 as amended by the additional requirements of this document.