

TECHNICAL SPECIFICATION



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

standards.iteh.ai

ISO/IEC TS 29125:2017

<https://standards.iteh.ai/catalog/standards/sist/cf3960a7-4fe8-4daf-b054-8ad34d5b9cbb/iso-iec-ts-29125-2017>



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 Varembe
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.

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 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 It also gives information on projects, replaced and withdrawn publications.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 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 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.

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.

IEC'S STANDARD PREVIEW
(standards.itec.ai)
ISO/IEC TS 21125:2017
https://standards.itec.ai/catalog/standards/tstdoc/8ad34d5b9cbb-iso-iec-ts-21125-2017

TECHNICAL SPECIFICATION



Information technology – Telecommunications cabling requirements for remote
powering of terminal equipment
ITeh STANDARD PREVIEW
(standards.iteh.ai)

[ISO/IEC TS 29125:2017](https://standards.iteh.ai/catalog/standards/sist/cf3960a7-4fe8-4daf-b054-8ad34d5b9cbb/iso-iec-ts-29125-2017)
[https://standards.iteh.ai/catalog/standards/sist/cf3960a7-4fe8-4daf-b054-
8ad34d5b9cbb/iso-iec-ts-29125-2017](https://standards.iteh.ai/catalog/standards/sist/cf3960a7-4fe8-4daf-b054-8ad34d5b9cbb/iso-iec-ts-29125-2017)

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.

iTeh STANDARD PREVIEW (standards.iteh.ai)

[ISO/IEC TS 29125:2017](https://standards.iteh.ai/catalog/standards/sist/cf3960a7-4fe8-4daf-b054-8ad34d5b9cbb/iso-iec-ts-29125-2017)

<https://standards.iteh.ai/catalog/standards/sist/cf3960a7-4fe8-4daf-b054-8ad34d5b9cbb/iso-iec-ts-29125-2017>

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.

ISO/IEC TS 29125:2017

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.

<https://standards.iteh.ai/catalog/standards/sist/cf3960a7-4fe8-4daf-b054-8ad34d5b9cbb/iso-iec-ts-29125-2017>

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".]

<https://standards.iteh.ai/catalog/standards/sist/cf3960a7-4fe8-4daf-b054-8ad34d5b9cbb/iso-iec-ts-29125-2017>

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.

5 Cabling selection and performance

Cabling for remote powering should be implemented using 4-pair balanced cabling.

This cabling will be used simultaneously to support signal transmission and remote power feeding for the terminal equipment. This document assumes the use of balanced cabling components specified in the reference implementation clause of the relevant design standards of the ISO/IEC 11801 series.

The transmission parameters of balanced cables related to remote powering can be found in Annex C.

6 Installation conditions

6.1 General

Cabling may be installed in different types of continuous and non-continuous pathway systems as described in ISO/IEC 14763-2. The installation of a cable within the pathway systems should take into account the specified operating temperature of the cable. Due to the Joule effect, each energized conductor has a temperature rise. Larger cable bundles have more heat generation and therefore the temperature rise is worse than smaller cable bundles.

The cable bundle size is limited by the current capacity in 6.3 and the induced temperature rise that results in an operating temperature of the cable, not to exceed its temperature rating.

The following guidelines for pathway selection and installation should be considered:

- a) installation design including the type of pathways selected, the pathway fill factor, whether the pathway is sealed at both ends,
- b) the pathway environment and whether the pathway goes through thermally insulated areas, in which case the type of insulation will be a significant factor. For optimal thermal performance, pathway design should avoid any insulated areas,
- c) thermal aspects of the entire pathway (e.g. open tray, closed tray, ventilated, non-ventilated, plastic conduit, metal conduit, fire barriers) should be taken into account.

6.2 Ambient temperature

Different segments of a link can have different ambient temperatures, which can influence the amount of remote power that can be delivered. Therefore the ambient temperature in different length segments of a link or channel has a direct impact on the operating temperature of the cable used for the link or channel and can limit the capability of the cable for remote power delivery to powered terminal equipment. The worst case installed cabling condition with respect to the maximum ambient temperature shall be used to determine the maximum operating temperature for a link or channel when subject to remote powering.

6.3 Temperature rise and current capacity

When remote power is applied to balanced cabling, the temperature of the cabling will rise due to resistive heat generation (Joule effect) in the conductors. Depending on cable construction and installed cabling conditions, the heat generated will be dissipated into the surrounding environment until a steady state is reached with the temperature of the cable bundle (operating temperature) higher than the ambient temperature of the surrounding environment. The maximum temperature of any cable shall not exceed the temperature rating of the cable. The standards in the ISO/IEC 11801 series require this temperature to be 60 °C (minimum).

Temperature rise in the cable will lead to an increase in insertion loss as indicated in the reference implementations of the ISO/IEC 11801 series standards and should be taken into account when selecting cables and using them in links or channels. The maximum length of the channel or link should be reduced based on the maximum temperature of the cable using the de-rating factors in ISO/IEC 11801-1.

The maximum current per conductor for different temperature rise in a bundle of 37 cables of 4-pair Category 5 cables with solid conductors, and 37 cords of 4-pair 0,40 mm stranded cords with all pairs energized is shown in Table 1.

Annex B provides an engineering model that may be used for specific cable types, cable constructions, and installation conditions to derive the bundle size for a particular current per conductor. Clause B.7 describes a simplified version of the engineering model in Annex B and was used to derive the worst case values in Tables 1, 2, 3 and 4 based on constants calculated from measurements of typical cables for each cable category. The measurement procedures used to determine the constants are detailed in Annex F.

Table 1 – Maximum current per conductor versus temperature rise in a 37-cable bundle in air and conduit (all 4 pairs energized)

Temperature rise °C	Current per conductor 0,4 mm cords mA		Current per conductor Category 5 cables mA	
	air	conduit	air	conduit
5	278	223	341	287
7,5	340	273	418	351
10	393	315	482	406
12,5	439	352	539	453
15	481	386	591	497
17,5	520	417	638	537
20	556	446	682	574

Temperature rise above 10 °C shown in grey background is not recommended.

NOTE These values are based on conductor temperature measurement of typical cables and cords.

Table 2 shows current capacity for different categories of cable, independent of construction, for a given temperature rise.