



**Environmental Engineering (EE);  
Power distribution to telecommunications  
and datacom (ICT) equipment**

**Document Preview**

<https://standards.iteh.ai/etsi-ts-102-121-v1-4-1-2025-02>

<https://standards.iteh.ai/etsi-ts-102-121-v1-4-1-2025-02>

Reference
RTS/EE-027015
Keywords
distribution, earthing, power, power supply, system

**ETSI**

650 Route des Lucioles  
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - APE 7112B  
Association à but non lucratif enregistrée à la  
Sous-Préfecture de Grasse (06) N° w061004871

***Important notice***

The present document can be downloaded from the  
[ETSI Search & Browse Standards](#) application.

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the prevailing version of an ETSI deliverable is the one made publicly available in PDF format on [ETSI deliver](#) repository.

Users should be aware that the present document may be revised or have its status changed,  
this information is available in the [Milestones listing](#).

If you find errors in the present document, please send your comments to  
the relevant service listed under [Committee Support Staff](#).

If you find a security vulnerability in the present document, please report it through our  
[Coordinated Vulnerability Disclosure \(CVD\)](#) program.

<https://standards.iteh.ai/catalog/standards/ctsi/0b7615c1-51bb-45c4-8771-1826100ca547/etsi-ts-102-121-v1-4-1-2025-02>

***Notice of disclaimer & limitation of liability***

The information provided in the present deliverable is directed solely to professionals who have the appropriate degree of experience to understand and interpret its content in accordance with generally accepted engineering or other professional standard and applicable regulations.

No recommendation as to products and services or vendors is made or should be implied.

No representation or warranty is made that this deliverable is technically accurate or sufficient or conforms to any law and/or governmental rule and/or regulation and further, no representation or warranty is made of merchantability or fitness for any particular purpose or against infringement of intellectual property rights.

In no event shall ETSI be held liable for loss of profits or any other incidental or consequential damages.

Any software contained in this deliverable is provided "AS IS" with no warranties, express or implied, including but not limited to, the warranties of merchantability, fitness for a particular purpose and non-infringement of intellectual property rights and ETSI shall not be held liable in any event for any damages whatsoever (including, without limitation, damages for loss of profits, business interruption, loss of information, or any other pecuniary loss) arising out of or related to the use of or inability to use the software.

***Copyright Notification***

No part may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm except as authorized by written permission of ETSI.

The content of the PDF version shall not be modified without the written authorization of ETSI.

The copyright and the foregoing restriction extend to reproduction in all media.

© ETSI 2025.  
All rights reserved.

# Contents

Intellectual Property Rights .....	5
Foreword.....	5
Modal verbs terminology.....	5
Introduction .....	5
1 Scope .....	6
2 References .....	6
2.1 Normative references .....	6
2.2 Informative references.....	7
3 Definition of terms, symbols and abbreviations.....	8
3.1 Terms.....	8
3.2 Symbols .....	8
3.3 Abbreviations .....	8
4 Types of power supply systems.....	9
4.0 Introduction .....	9
4.1 DC supply.....	9
4.1.1 Mains operation .....	9
4.1.2 Battery operation .....	9
4.1.3 Floating/Parallel operation.....	10
4.1.3.0 General principles .....	10
4.1.3.1 DC switch operation.....	10
4.1.3.1.0 Operation between rectifier and battery .....	10
4.1.3.1.1 Switch operation with interruption .....	11
4.1.3.1.2 Switch operation without interruption .....	11
4.1.3.2 DC converter operation .....	11
4.1.3.3 Redundant DC distribution .....	11
4.2 AC supply.....	12
4.2.1 Mains operation .....	12
4.2.2 Inverter operation.....	12
4.2.3 AC switch operation .....	12
4.2.3.1 AC switch operation with interruption .....	12
4.2.3.2 AC switch operation without interruption (STS) .....	13
4.2.3.3 AC uninterruptible power supply systems (UPS) .....	13
4.2.4 Reliability and redundancy .....	18
5 Power supply interfaces in telecommunication installations.....	18
5.0 Basic forms of Power Supply Interfaces .....	18
5.1 PSI 1 interface between primary power and telecommunication installations and equipment.....	19
5.1.0 Definition.....	19
5.1.1 Connection conditions .....	19
5.1.2 Harmonics and superimposition .....	20
5.1.3 Radio interference.....	20
5.1.4 Disturbances on the customer installation .....	20
5.1.5 Further sources of supply voltage .....	20
5.2 PSI 2 interface .....	20
5.2.0 Definition.....	20
5.2.1 Connection conditions .....	20
5.2.2 Radio interference.....	21
5.2.3 Interference voltage .....	21
5.3 PSI 3 interface between telecommunication installations or equipment and the telecommunication networks .....	21
5.3.0 Definition.....	21
5.3.1 Connection conditions .....	21
5.3.2 Operation with remote power feeding of current.....	21
5.3.3 Operation with ringing AC voltage.....	21

5.3.4	Radio interference.....	22
5.3.5	Interference voltage .....	22
5.4	Cabling and routing .....	22
6	Earthing and equipotential bonding.....	22
7	Electrical Safety requirements.....	22
<b>Annex A (normative):</b>	<b>Principle of artificial DC mains network for measurement of disturbance .....</b>	<b>23</b>
<b>Annex B (informative):</b>	<b>Power supply considerations.....</b>	<b>24</b>
History .....		25

# iTeh Standards

## (<https://standards.iteh.ai>)

### Document Preview

[ETSI TS 102 121 V1.4.1 \(2025-02\)](https://standards.iteh.ai/catalog/standards/etsi/9b7615c1-5dbb-45c4-a877-1836b09ca547/etsi-ts-102-121-v1-4-1-2025-02)

<https://standards.iteh.ai/catalog/standards/etsi/9b7615c1-5dbb-45c4-a877-1836b09ca547/etsi-ts-102-121-v1-4-1-2025-02>

---

# Intellectual Property Rights

## Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The declarations pertaining to these essential IPRs, if any, are publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the [ETSI IPR online database](#).

Pursuant to the ETSI Directives including the ETSI IPR Policy, no investigation regarding the essentiality of IPRs, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

## Trademarks

The present document may include trademarks and/or tradenames which are asserted and/or registered by their owners. ETSI claims no ownership of these except for any which are indicated as being the property of ETSI, and conveys no right to use or reproduce any trademark and/or tradename. Mention of those trademarks in the present document does not constitute an endorsement by ETSI of products, services or organizations associated with those trademarks.

**DECT™, PLUGTESTS™, UMTS™** and the ETSI logo are trademarks of ETSI registered for the benefit of its Members. **3GPP™, LTE™** and **5G™** logo are trademarks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners. **oneM2M™** logo is a trademark of ETSI registered for the benefit of its Members and of the oneM2M Partners. **GSM®** and the **GSM** logo are trademarks registered and owned by the GSM Association.

---

## Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Environmental Engineering (EE).

---

## Modal verbs terminology

In the present document "shall", "shall not", "should", "should not", "may", "need not", "will", "will not", "can" and "cannot" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

"must" and "must not" are NOT allowed in ETSI deliverables except when used in direct citation.

---

## Introduction

The present document gives guidance on installation, connection and operation of power supply systems for telecommunication / datacom (ICT) systems and equipment. Also are considered items of equipment with their own power supply, which are connected to form a complete system.

# 1 Scope

The present document gives guidance on installation, connection and operation of power supply systems for telecommunication / datacom installations and equipments. Also are considered items of equipment with their own power supply, which are connected to form a complete system installation.

The present document contains definitions for power supply and distribution systems in complement to power interfaces standards ETSI EN 300 132 series [5], [6], [26].

# 2 References

## 2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found in the [ETSI docbox](#).

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

- [1] [IEC EN 60038](#): "IEC standard voltages".
- [2] [ETSI EN 300 386](#): "Telecommunication network equipment; ElectroMagnetic Compatibility (EMC) requirements; Harmonised Standard covering the essential requirements of the Directive 2014/30/EU".
- [3] [EN 60950-1](#): "Information technology equipment - Safety - Part 1: General requirements", (produced by CENELEC).
- [4] [EN 60896-21](#): "Stationary lead-acid batteries - Part 21: Valve regulated types - Methods of test", (produced by CENELEC).
- [5] [ETSI EN 300 132-1](#): "Environmental Engineering (EE); Power supply interface at the input to Information and Communication Technology (ICT) equipment; Part 1: Alternating Current (AC)".
- [6] [ETSI EN 300 132-2](#): "Environmental Engineering (EE); Power supply interface at the input to telecommunications and datacom (ICT) equipment; Part 2: Operated by -48 V direct current (DC)".
- [7] [ETSI EN 302 099](#): "Environmental Engineering (EE); Powering of equipment in access network".
- [8] [ETSI EN 300 253](#): "Environmental Engineering (EE); Earthing and bonding of ICT equipment powered by -48 VDC in telecom and data centres".
- [9] [Recommendation ITU-T K.20](#): "Resistibility of telecommunication equipment installed in a telecommunications centre to overvoltages and overcurrents".
- [10] [Recommendation ITU-T K.21](#): "Resistibility of telecommunication equipment installed in customer premises to overvoltages and overcurrents".
- [11] [Recommendation ITU-T K.45](#): "Resistibility of telecommunication equipment installed in the access and trunk networks to overvoltages and overcurrents".
- [12] [HD 384 \(all parts\)/HD 60364](#): "Electrical installations of buildings", (produced by CENELEC).

- [13] [ETSI EN 301 489-1](#): "ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements; Harmonised Standard for ElectroMagnetic Compatibility".
- [14] [EN 61000-3-2](#): "Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions (equipment input current  $\leq 16$  A per phase)", (produced by CENELEC).
- [15] [EN 61000-3-3](#): "Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current  $\leq 16$  A per phase and not subject to conditional connection", (produced by CENELEC).
- [16] [Recommendation ITU-T P.53](#): "Psophometer for use on telephone-type circuits".
- [17] [EN 50310](#): "Application of equipotential bonding and earthing in buildings with information technology equipment", (produced by CENELEC).
- [18] [EN 61000-4-11](#): "Electromagnetic compatibility (EMC) - Part 4-11: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests", (produced by CENELEC).
- [19] [EN 50174-2](#): "Information technology - Cabling installation - Part 2: Installation planning and practices inside buildings", (produced by CENELEC).
- [20] [EN 62040-1-1](#): "Uninterruptible power systems (UPS) - Part 1-1: General and safety requirements for UPS used in operator access areas", (produced by CENELEC).
- [21] [EN 62040-1-2](#): "Uninterruptible power systems (UPS) - Part 1-2: General and safety requirements for UPS used in restricted access locations", (produced by CENELEC).
- [22] [EN 60896-11](#): "Stationary lead-acid batteries - Part 11: Vented types - General requirements and methods of tests", (produced by CENELEC).
- [23] [EN 62310-1](#): "Static transfer systems (STS) - Part 1: General and safety requirements", (produced by CENELEC).
- [24] [EN 60896-22](#): "Stationary lead-acid batteries - Part 22: Valve regulated types - Requirements", (produced by CENELEC).
- [25] [ETSI EN 301 605](#): "Environmental Engineering (EE); Earthing and bonding of 400 V DC data and telecom (ICT) equipment".
- [26] [ETSI EN 300 132-3 \(V2.3.1\) \(2023-01\)](#): "Environmental Engineering (EE); Power supply interface at the input of Information and Communication Technology (ICT) equipment; Part 3: Up to 400 V Direct Current (DC)".

## 2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

- [i.1] IEC 60050-601: "International Electrotechnical Vocabulary. Chapter 601: Generation, transmission and distribution of electricity - General".
- [i.2] EN 62368-1 Ed. 1.0: "Audio/Video, Information and Communication Technology Equipment - Part 1: Safety requirements", (produced by CENELEC).

- [i.3] IEC EN 60445: "Basic and safety principle for man-machine interface, marking and identification-Identification of equipment terminals, conductor terminations, and conductors".
- [i.4] ETSI TR 100 283: "Environmental Engineering (EE); Transient voltages at Interface "A" on telecommunications direct current (DC) power distributions".
- [i.5] 19 Pfl1: "Voltage limits for 60 V consumers in telecommunication installations of the Deutsche Telekom".

## 3 Definition of terms, symbols and abbreviations

### 3.1 Terms

For the purposes of the present document, the following terms apply:

**current-using equipment:** either a further power supply system or a telecommunication equipment

**NOTE:** The telecommunication equipment with associated power supply may be considered as telecommunication installation or telecommunication equipment.

**disturbance:** electromagnetic disturbance having components in the radio frequency range

**immunity:** ability of a device, equipment or system to perform without degradation in the presence of an electromagnetic disturbance

**power supply system:** electrical equipment, which makes available energy obtained from a primary power source (e.g. AC distribution) in a form suitable for the current-using equipment

**radio interference:** degradation of the reception of a wanted signal caused by radio frequency disturbance

**supply voltage:** voltage preferably obtained from the public distribution system or other primary electric power sources

**Transfer Switch (TS):** integrated automatic bypass switch used in the UPS, which can be fully static, fully electromechanical or hybrid

[ETSI TS 102 121 V1.4.1 \(2025-02\)](#)

### 3.2 Symbols

Void.

### 3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

AC	Alternating Current
DC	Direct Current
EMC	Electro Magnetic Compatibility
ERM	Electromagnetic Radio spectrum Matters
HD	Harmonization Document
ICT	Information and Communication Technology
MOS	Metal Oxide Semiconductor
PSI	Power Supply Interface
SBS	Systems Bypass Switch
SD	Safe Disconnection
STS	Static Transfer Switches (for the stand-alone static switches)
TS	Transfer Switch
UPS	Uninterruptible Power Supply

## 4 Types of power supply systems

### 4.0 Introduction

In telecommunication and datacom installations and equipment the designation of a power supply system refers to its output.

In this sense there are DC and AC supplies. The operating modes described below are basic forms, which may be developed into more complex arrangements.

### 4.1 DC supply

#### 4.1.1 Mains operation

The current-using equipment is supplied with DC voltage obtained by a rectifier from the AC system (see figure 1).

The nominal voltage is a normative definition used to enable differentiating power interfaces as defined in IEC 60050-601 [i.1].

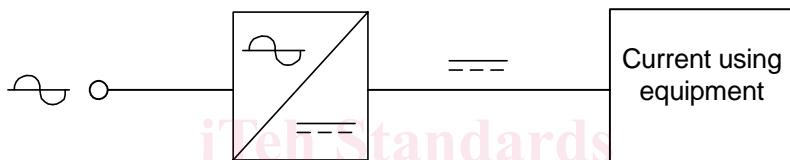


Figure 1: Principle of mains operation  
(<https://standards.iteh.ai>)

#### 4.1.2 Battery operation

The current-using equipment is supplied from a battery. Both primary and secondary cells (Accumulators) can be used as batteries. The Accumulator is disconnected from the current-using equipment for charging (see figure 2).

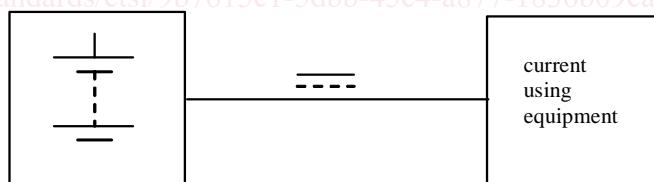
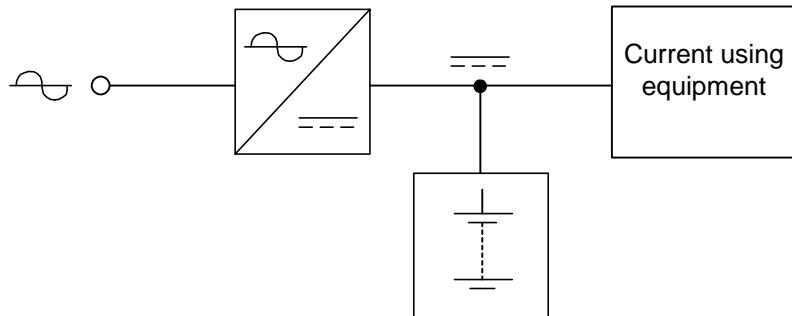


Figure 2: Principle of battery operation

## 4.1.3 Floating/Parallel operation

### 4.1.3.0 General principles

The current-using equipment is connected continuously to a rectifier and battery (see figure 3).



**Figure 3: Principle of parallel operation**

The current-using equipment is supplied in parallel operation; the rectifier being dimensioned in such a way that it can cover the total power consumption of the current-using equipment and in addition supply an appropriate charging current for the battery (see figure 3).

With this configuration the battery is continuously ready for operation in a fully charged condition. If the mains AC voltage is outside of the specification (e.g. fails, reduction of voltage, high harmonics), the current-using equipment continues to be supplied without interruption.

Parallel operation includes a very common charging mode known as floating mode and other charging modes such as intermittent charge.

Floating charge is a charging mode where the self-discharge of the battery is compensated by maintaining a sufficient voltage to the battery. The charging voltage can be varied due to temperature compensation.

Intermittent charge is a charging mode where the self-discharge of the battery is compensated by periodically raising the voltage of rectifiers for short periods. Between these periods the rectifier voltage is left lower than it should be in floating mode. The aim is to reduce plate corrosion and loss of water, as well as to reduce the risk of thermal runaway. This may help to prolong the life span of batteries used in outdoor equipments or areas with high ambient temperature.

### 4.1.3.1 DC switch operation

#### 4.1.3.1.0 Operation between rectifier and battery

The power requirement of the current using equipment is normally provided by a rectifier. A disconnected battery is maintained in a charged condition by a separate charger. If the rectifier fails, the current-using equipment is switched to the battery and supplied by the latter (see figure 4).