

INTERNATIONAL STANDARD



**Interoperability specifications and communication method for external power
supplies used with computing and consumer electronics devices**

(<https://standards.iteh.ai>)
Document Preview

[IEC 63002:2021](#)

<https://standards.iteh.ai/catalog/standards/iec/0f932dac-150f-46c0-8589-404c4f87755f/iec-63002-2021>



THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2021 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 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
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 corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

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 It also gives information on projects, replaced and withdrawn publications.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 online collection - oc.iec.ch

Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

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 once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 18 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

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: sales@iec.ch.

International Standards
standards.iteh.ai)
Document Preview

[IEC 63002:2021](#)

<https://standards.iteh.ai/catalog/standards/iec/0f932dac-150f-46c0-8589-404c4f87755f/iec-63002-2021>

INTERNATIONAL STANDARD



**Interoperability specifications and communication method for external power
supplies used with computing and consumer electronics devices**

Document Preview

[IEC 63002:2021](https://standards.iteh.ai/catalog/standards/iec/0f932dac-150f-46c0-8589-404c4f87755f/iec-63002-2021)

<https://standards.iteh.ai/catalog/standards/iec/0f932dac-150f-46c0-8589-404c4f87755f/iec-63002-2021>

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 31.020; 35.200

ISBN 978-2-8322-9822-0

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

CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references	8
3 Terms, definitions and abbreviated terms	8
3.1 Terms and definitions.....	8
3.2 Abbreviated terms.....	10
4 EPS interoperability based on USB technologies	10
4.1 Overview.....	10
4.2 General.....	10
4.3 USB standard charging summary and interoperability	12
4.4 USB Type-C® Current	13
4.5 USB Power Delivery (USB PD)	13
5 External power supply (EPS) specification.....	14
5.1 General hardware specification	14
5.1.1 General	14
5.1.2 AC input characteristic.....	14
5.1.3 Environmental specification	14
5.1.4 EPS detection.....	14
5.2 EPS protection.....	15
5.3 Important characteristics of an external power supply	15
5.3.1 General	15
5.3.2 Positive identification of a unique power source model	15
5.3.3 Static characteristics of the external power source performance and design	15
5.3.4 Example usage scenarios of enhanced reporting from the power source	18
Annex A (informative) Open issues related to arbitrary combinations of power source and device	21
A.1 EMC, safety, and performance	21
A.2 Authentication, attestation, and data integrity protection	21
A.3 Conducted noise from the EPS	22
Annex B (informative) USB Type-C and USB Power Delivery robustness and interoperability	23
B.1 Overview.....	23
B.2 USB Type-C Cable and Connector (IEC 62680-1-3)	23
B.2.1 General	23
B.2.2 Current capacity and cable identity	23
B.2.3 Interoperability.....	23
B.2.4 Legacy support.....	24
B.3 USB Power Delivery (IEC 62680-1-2).....	24
B.3.1 General	24
B.3.2 Robustness	24
B.3.3 Error detection and recovery.....	25
Annex C (informative) USB charging profiles and device charging performance.....	26
C.1 Overview.....	26
C.2 USB Type-C and USB PD power capabilities model	26

C.3	Battery charging performance	28
C.4	Fixed Supply charging versus PPS charging	29
Annex D (informative)	Common charging interoperability use cases	30
D.1	General.....	30
D.2	Examples of device use cases	30
D.2.1	General	30
D.2.2	Smartphone.....	30
D.2.3	Higher power computing devices (tablets, notebook computers, etc.)	30
D.2.4	Other consumer electronics devices (smart watches, electric toothbrushes, etc.).....	31
D.3	Examples of consumer use cases	31
Annex E (informative)	Conformance and market considerations.....	32
E.1	General.....	32
E.2	Summary of reported items and test references	32
E.3	USB-IF Compliance Program [7]	33
E.4	General regulatory compliance for a power source.....	34
E.5	Other considerations for system testing	35
E.6	After-market firmware updates to power source	35
Bibliography	36
Figure 1	– Scope of the identification, communication and control method.....	7
Figure 2	– USB EPS charging application model.....	11
Figure 3	– Measurement of holdup time	16
Figure C.1	– Source power rules for Fixed Supply operation	27
Figure C.2	– Source power rules for PPS operation	28
Figure C.3	– 30 W PDP PPS example.....	28
Figure E.1	– USB certified charger logos	34
Table 1	– USB standard power modes and charging interoperability	12
Table E.1	– Summary of reported parameters from USB PD power source and their test references.....	32
Table E.2	– Examples of current regulations and standards in the US and EU applicable to external power supplies used with devices (non-exhaustive list).....	34

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**INTEROPERABILITY SPECIFICATIONS AND COMMUNICATION METHOD
FOR EXTERNAL POWER SUPPLIES USED WITH COMPUTING AND
CONSUMER ELECTRONICS DEVICES**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC 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.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC 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 undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is 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 its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees 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, use of, or reliance upon, this IEC Publication or any other 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 IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

This document has been prepared by technical area 18: Multimedia home systems and applications for end-user networks, of IEC technical committee 100: Audio, video and multimedia systems and equipment. It is an International Standard.

This second edition cancels and replaces the first edition published in 2016. This edition constitutes a technical revision.

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

- a) title is changed from *Identification and communication interoperability method for external power supplies used with portable computing devices*;
- b) Clause 4, *EPS interoperability based on USB technologies*, is added;
- c) Clause 5, *EPS specification*, adds hardware and protection requirements; overvoltage protection is changed from optional to normative;

- d) Annex B and Annex C are added, providing an explanation of the design features in USB Power Delivery that enhance reliability and an explanation of the concepts of charge rate and power.

The text of this International Standard is based on the following documents:

CDV	Report on voting
100/3463/CDV	100/3540B/RVC

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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

The objective of this document is to enable common charging interoperability of external power supplies (EPSs) used with the increasing variety of computing and consumer electronics devices that implement IEC 62680-1-3 (USB Type-C¹ Cable and Connector Specification) and IEC 62680-1-2 (USB Power Delivery). Broad market adoption of this document is expected to make a significant contribution to the global goals of consumer convenience and re-usability of power supplies by expanding common charging interoperability across different product categories while preserving backwards compatibility with the installed base of billions of IEC 62680 compliant devices worldwide.

This document specifies the minimum technical requirements for interoperability and includes recommendations for EPS functionality when used with computing and electronics devices. The approach taken by this document, focused on enabling common charging interoperability, can allow manufacturers to innovate in aspects such as technical design, system performance, and energy efficiency. Furthermore, common charging interoperability enables manufacturers to design specific EPSs that match the requirements of target devices (functionality, cost, etc.) and use cases, while at the same time enabling consumers to use the EPS for charging other IEC 62680 compliant devices, across various product types.

IEC 62680-1-3 adoption is well underway in global markets for a wide range of devices using as much as 100 W, including notebook computers, tablets, smartphones, small form-factor desktop computers, and other consumer electronics devices. This document enables the reporting of the identity and power characteristics of power sources (EPSs and other Sources) supported by IEC 62680-1-3 (USB Type-C) and specifies interoperability guidelines when using IEC 62680-1-2 (USB Power Delivery). The method for identification of a specific power source can enable equipment manufacturers to ensure compliant operation using these specifications and promotes data communication that can be used by the device to predict and mitigate interoperability concerns when an unfamiliar or incompatible EPS is connected to the device. EPS power delivery applications can in the future extend beyond 100 W given updates to IEC 62680 that appropriately address the needs of higher-power products in the computing and consumer device market.

IEC 63002:2021

This document also provides important information regarding consumer safety, system reliability as well as relevant global standards and regulatory compliance.

Other international and regional standards, and government policies for "universal" or "common power adapters" that reference this document are expected to take into account open technical and regulatory compliance issues that are associated with untested or arbitrary combinations of EPSs and devices such as those identified in Annex A, as well as the limitations and issues with approaches to define "common chargers" in meeting market needs. For clarity, this document focuses on interoperability specifications in order to support global industry in developing safe, convenient, environmentally conscious, and end-to-end interoperable charging solutions that meet regulatory compliance and market requirements.

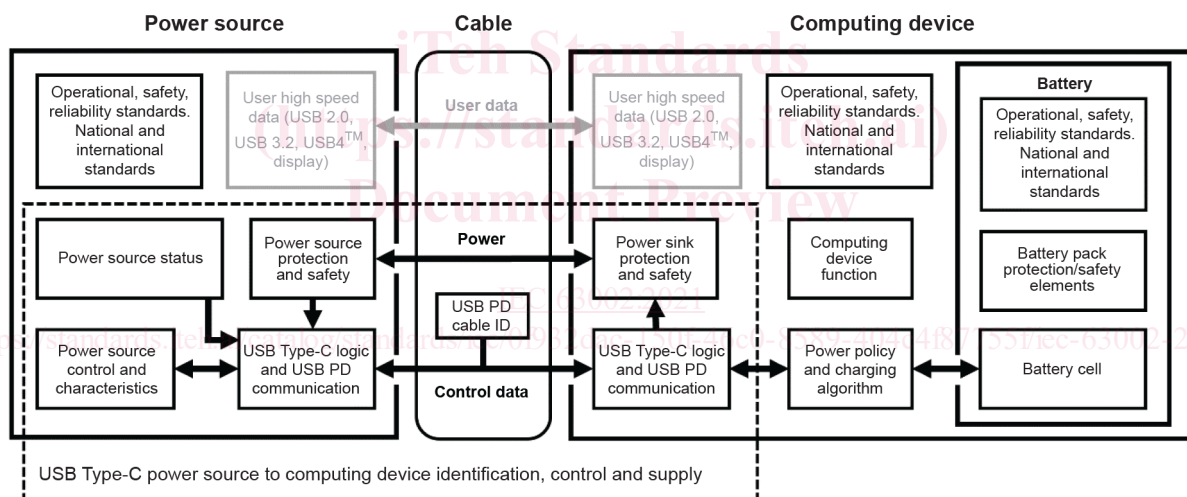
¹ USB4™ and USB Type-C® are trademarks of the Universal Serial Bus Implementers Forum (USB-IF). This information is given for the convenience of users of this document and does not constitute an endorsement by IEC.

INTEROPERABILITY SPECIFICATIONS AND COMMUNICATION METHOD FOR EXTERNAL POWER SUPPLIES USED WITH COMPUTING AND CONSUMER ELECTRONICS DEVICES

1 Scope

This document defines common charging interoperability guidelines for power sources (external power supplies (EPSs) and other Sources) used with computing and consumer electronics devices that implement IEC 62680-1-3 (USB Type-C Cable and Connector Specification).

This document defines normative requirements for an EPS to ensure interoperability; in particular, it specifies the data communicated from a power source to a device (Figure 1) and certain safety elements of the EPS, cable, and device. While the requirements focus of this document is on the EPS and the behaviour at its USB Type-C connector interface, it is also important to comprehend cable assembly and device capabilities and behaviours in order to assure end-to-end charging interoperability. This document does not apply to all design aspects of an EPS. This document does not specify regulatory compliance requirements for aspects such as product safety, EMC or energy efficiency.



IEC

Figure 1 – Scope of the identification, communication and control method

This document provides recommendations for the behaviour of a device when used with a power source compliant with this document. It specifies the minimum hardware specification for an EPS implementing IEC 62680-1-3. This document also specifies the data objects used by a charging system utilizing IEC 62680-1-2 to understand the identity, design and performance characteristics, and operating status of an external power supply. IEC 62680-1-2 focuses on power delivery applications ranging to 100 W for a variety of computing and consumer electronics devices including notebook computers, tablets, smartphones, small form-factor desktops, monitor displays and other related multimedia devices.

This document relies on established mechanical and electrical specifications, and communication protocols specified by IEC 62680-1-2 and IEC 62680-1-3. These specifications support methods for establishing the best performing interoperability between untested combinations of EPS and devices with the aim of improving consumer satisfaction.

Information describing the USB charging interoperability model, overview of USB Type-C and USB Power Delivery specifications, and factors for charging performance are also provided to support implementation of this document.

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.

IEC 60950-1, *Information technology equipment – Safety – Part 1: General requirements*

IEC 60990, *Methods of measurement of touch current and protective conductor current*

IEC 62368-1:2018, *Audio/video, information and communication technology equipment – Part 1: Safety requirements*

IEC 62680-1-1, *Universal Serial Bus interfaces for data and power – Part 1-1: Common components – USB Battery Charging Specification, Revision 1.2*

IEC 62680-1-2:2021, *Universal Serial Bus interfaces for data and power – Part 1-2: Common components – USB Power Delivery specification*

IEC 62680-1-3, *Universal Serial Bus interfaces for data and power – Part 1-3: Common components – USB Type-C Cable and Connector Specification*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

[IEC 63002:2021](https://standards.iteh.ai/catalog/standards/iec/00932dac-150f-46c0-8589-404c4f87755f/iec-63002-2021)

For the purposes of this document, the following terms and definitions 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

vendor identification

VID

unique 16-bit unsigned value assigned by the USB-IF to a given vendor

3.1.2

power source

power supply

Source

device designed to comply with IEC 62680-1-2 that supplies power over V_{BUS}

EXAMPLE A USB connector on a PC, laptop computer, vehicle, AC outlet, docking station, battery pack, or EPS.

3.1.3

Sink

power sink

device designed to comply with IEC 62680-1-2 that receives and consumes power over V_{BUS}

EXAMPLE A computing device.

Note 1 to entry: Sometimes referred to as the device.

3.1.4

external power supply

EPS

power source contained in a separate physical enclosure external to the device casing and designed to convert mains power supply to lower DC voltage(s) for the purpose of powering the device

EXAMPLE A charging block.

3.1.5

Programmable Power Supply

PPS

optional capability in IEC 62680-1-2 where a device (Sink) can adaptively adjust the EPS (Source) output voltage in small increments and set maximum current within its advertised range

3.1.6

Fixed Supply

power source whose output voltage is regulated

Note 1 to entry: Standardized voltages in IEC 62680-1-2:2021 are 5 V, 9 V, 15 V and 20 V.

3.1.7

USB PD power

PDP

nominal power capacity of the charger defined by IEC 62680-1-2 for use to indicate to consumers

Note 1 to entry: The PDP rating is indicated both on the USB charger certification logo and within the USB PD source capabilities advertisement to the Sink. For any given PDP rating, the minimum capabilities in terms of supported voltages and currents are deterministic, as defined in IEC 62680-1-2.

3.1.8

charging cable

cable used between the EPS and device to be charged

Note 1 to entry: The cable connection to the EPS is a USB Type-C plug in accordance with IEC 62680-1-3. The cable connection to the device can be either a USB Type-C plug, a legacy USB plug (e.g. USB Micro-B in accordance with IEC 62680-2-2), or a non-USB device-specific connection (either permanent or detachable). Charging cables can be application-specific to enable interoperability between the USB Type-C-based EPS defined by this document and both existing and future devices and including devices that are not able to accommodate USB Type-C receptacles, e.g. smart watches.

3.1.9

captive cable

permanently attached cable

cable that has a USB Type-C plug on one end and is either hard-wired into a device on the other end or has a device-specific plug on the other end

Note 1 to entry: When a device-specific plug is used on one end, the cable can be detachable in a physical sense but is considered "functionally captive" to the device given it does not use a USB-defined connector on the device end but otherwise functions as a USB device. This definition has remained the USB definition since it was originally specified in IEC 62680-2-1 (USB 2.0).

3.2 Abbreviated terms

AC	alternating current
CC	configuration channel
CRC	cyclic redundancy check
DC	direct current
EMC	electromagnetic compatibility
EMI	electromagnetic interference
EPS	external power supply
IoC	contracted operating current
LPS	limited power source
OEM	original equipment manufacturer
OVP	overvoltage protection
PDO	power data object
PFC	power factor correction
PDP	USB PD Power
PID	product identification
PPS	Programmable Power Supply
VAC	volts alternating current
USB	universal serial bus
USB PD	universal serial bus power delivery
USB-IF	Universal Serial Bus Implementers Forum
VID	vendor identification

4 EPS interoperability based on USB technologies

4.1 Overview

Clause 4 describes the USB common charging interoperability model and provides a summary of the USB Type-C and USB Power Delivery technologies specified in IEC 62680-1-3 and IEC 62680-1-2, respectively.

4.2 General

Since its introduction over 20 years ago, USB charging technology has consistently provided 5 V DC power and relied on a common USB Standard-A connector on the power source. When used with defined legacy cables and adapters, USB Type-C-based power sources, including those that source higher voltages, remain electrically and mechanically interoperable with previous generation USB devices, while enabling new capabilities for devices that have evolved to align with these new capabilities.

Figure 2 illustrates the USB EPS charging application model consisting of the EPS (Source) with a USB Type-C receptacle, the device to be charged (Sink) and the charging cable connecting the device to the EPS. This model also enables compatibility with devices that are based on legacy USB connectors, have a permanently attached cable, or use a cable that is device specific. Several usage examples demonstrating end-to-end charging interoperability based on this comprehensive model are presented in Annex D.