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Edition 1.0 2016-10

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Identification and communication interoperability method for external power supplies used with portable computing devices

Méthode d'identification et d'interopérabilité des communications des alimentations externes utilisées avec les dispositifs informatiques portatifs

IEC 63002:2016-10(en-fr)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

IDENTIFICATION AND COMMUNICATION INTEROPERABILITY METHOD FOR EXTERNAL POWER SUPPLIES USED WITH PORTABLE COMPUTING DEVICES

FOREWORD

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The text of this standard is based on the following documents:

CDV	Report on voting
100/2595A/CDV	100/2700/RVC

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

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

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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- withdrawn,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

INTRODUCTION

The objective of this International Standard is to support interoperability of external power supplies used with the increasing variety of portable computing devices that implement the IEC 62680-1-2: USB Power Delivery with the IEC 62680-1-3: USB Type-C™ [1] connector standards. Broad market adoption of this International Standard is expected to make a significant contribution to the global goals of consumer convenience and re-usability of power supplies by building on the global market ecosystem of IEC 62680 compliant devices and facilitating interoperability across different product categories.

IEC 62680-1-2 is expected to enjoy significant adoption in global markets for all kinds of portable computing devices requiring less than 100 watts including notebook computers, tablets, smartphones and other related devices. This International Standard enables the reporting of the identity and power characteristics of external supplies supported by IEC 62680-1-2 (USB Power Delivery) and specifies additional interoperability guidelines for external power. The method for identification of a specific external power supply (EPS) will enable equipment manufacturers to ensure compliant operation of an EPS using IEC 62680-1-2; and promotes data communication that can be used by the portable computing device to predict and mitigate interoperability concerns when an unfamiliar or incompatible external power supply is connected to the device by a user.

This International Standard specifies the minimum technical requirements for interoperability and includes recommendations for EPS functionality and the portable computing device. The approach taken by this International Standard, focusing on common charging interoperability, will allow manufacturers to innovate in aspects such as design, system performance, and energy efficiency.

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

Other international and regional standards, recommendations and regulatory policies for “universal adapters” or “common product chargers” that reference this International Standard should take into account open technical and regulatory compliance issues that are associated with untested or arbitrary combinations of EPS and devices such as those identified in Annex A. For clarity, this International Standard does not take the approach of specifying “universal” or “common product adapters” because of these open issues and limitations to satisfy market requirements. Instead, it focuses on interoperability specifications in order to support global industry in developing interoperable charging solutions that meet regulatory compliance and market requirements.

1 USB Type-C™ and USB-C™ are trademarks of the Universal Serial Bus Implementers Forum (USB-IF).

IDENTIFICATION AND COMMUNICATION INTEROPERABILITY METHOD FOR EXTERNAL POWER SUPPLIES USED WITH PORTABLE COMPUTING DEVICES

1 Scope

This International Standard defines interoperability guidelines for external power supplies used with portable computing devices that implement the IEC 62680-1-2: Universal Serial Bus Power Delivery Specification with the IEC 62680-1-3: Universal Serial Bus Interfaces for data and power-Common Components- Type-C™ Type-C Cable and Connector Specification.

This International Standard defines normative requirements for an EPS to ensure interoperability, in particular it specifies the data communicated from an EPS to a portable computing device (Figure 1). The scope does not apply to all aspects of an EPS. This International Standard does not specify normative requirements for the portable computing device but provides recommendations for the behaviour of a portable computing device when used with an EPS compliant with this International Standard.

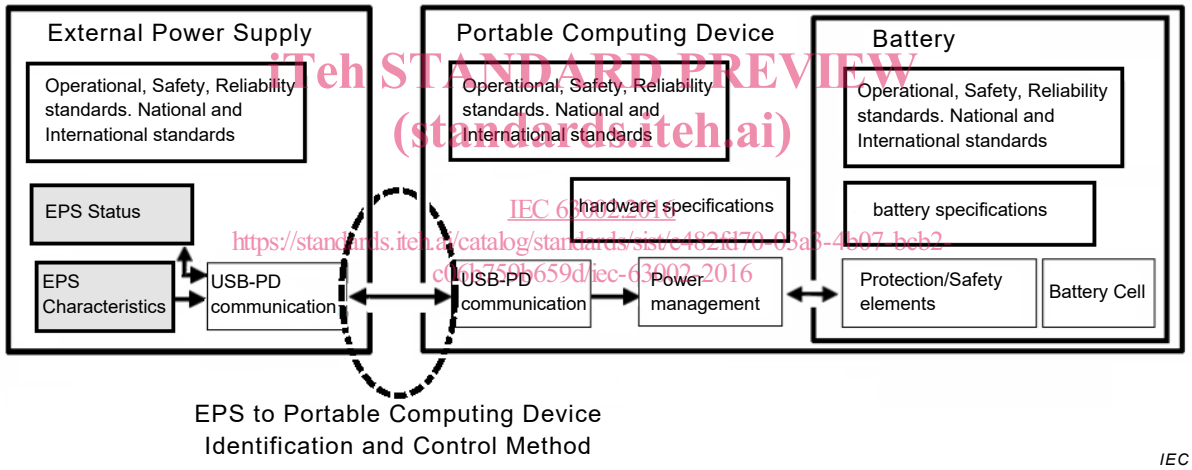

Figure 1 – Scope of the identification and communication method

This International Standard specifies the data objects used by a portable computing system using IEC 62680-1-2 to understand the identity, design and performance characteristics, and operating status of an external power supply. This International Standard is applicable to external power supplies under 100 watts for portable computing devices, with a focus on power delivery application for notebook computers, tablets, smartphones and other related multimedia devices.

This International Standard relies on established mechanical and electrical specifications, and communication protocols established by IEC 62680-1-2 and IEC 62680-1-3. This International Standard proposes methods supported by IEC 62680-1-2 to mitigate problems caused by the connection of untested combinations of EPS and portable computing devices with the aim of improving consumer satisfaction.

In addition, as given in Annex C, this International Standard provides interoperability guidelines for an EPS supporting charging using USB Type-C current when IEC 62680-1-2 functionality is not enabled. Considerations for captive and removable cable are presented in Annex B.

An EPS is expected to follow the applicable global standards and regulatory compliance requirements. Examples of those standards are given in Annex F.

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

IEC 62680-1-2, *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

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
portable computing device
computing device that is easily moved and can operate on battery power

3.1.3
power source
device designed to comply with a IEC 62680-1-2 device that supplies power over V_{BUS}

3.1.4
power sink
device designed to comply with IEC 62680-1-2 that receives and consumes power

EXAMPLE Portable computing device.

3.1.5
external power supply
EPS
equipment contained in a separate physical enclosure external to the computer casing and designed to convert mains power supply to lower DC voltage(s) for the purpose of powering the computer

Note 1 to entry: An external power supply is not built into the device in a way that the power consuming device inherently knows the identity of the power supply.

3.2 Abbreviated terms

AC	alternating current
DC	direct current
V	voltage, V
A	current, A
W	watt
Hz	hertz
IoC	contracted operating current in IEC 62680-1-2
LPS	limited power source
VAC	volts alternating current
EPS	external power supply
USB	universal serial bus
USB PD	universal serial bus power delivery
USB-IF	Universal Serial Bus Implementers Forum
PDO	power data object
VID	vendor identification
PID	product identification

4 Important characteristics of an external power supply

4.1 General

Untested combinations of an EPS and a portable computing device will benefit from some reporting of the EPS identity, characteristics and status to the portable computing device. The portable computing device is recommended to use such information to confirm operation of the EPS, modify its operation with the EPS, or to reject usage of the EPS. Examples of common usage cases expected for EPS are given in Annex E, and examples of the application of the EPS identity and characteristics in Annex D.

4.2 Positive identification of a unique EPS model

The specific model number of the EPS might be recognized by the portable computing device to allow optimized and compliant operation. The portable computing device can benefit by the ability to distinguish whether the power supply is generic or known.

The hardware version might affect the quality and performance of the EPS. Some provision reporting the date of manufacture or a hardware version allows the portable computing device to identify an EPS whose performance characteristics might vary.

The EPS shall use the USB-IF VID to identify its specific vendor. The EPS should also report a PID unique to the model of the EPS. Lastly, the OEM may report information that helps identify hardware version of the model of the EPS or serial number. The contents of the OEM-

specific identifier and hardware version are not standardized by this International Standard, but might be read by any portable computing device.

4.3 Static characteristics of the external power supply performance and design

4.3.1 General

IEC 62680-1-2 enables identification of the voltage and power capabilities of the power source and also some key electrical parameters for voltage tolerance. This International Standard extends the range of the EPS capabilities that are communicated to the portable computer.

4.3.2 Load current step performance of the EPS

The power consumption of a portable computing device can change dynamically. The ability of the EPS to regulate its voltage output might be important if the portable computing device is sensitive to fluctuations in voltage. Transient changes in the system load with a fixed-voltage EPS will result in changes to the load current from the EPS. The ability of the EPS to respond to transient changes in power sink load is known as “load current step” and capabilities are expressed as the magnitude of current change and also the rate of current change (“slew rate”).

The EPS should announce its guaranteed load current step performance.

a) The default load current step magnitude in IEC 62680-1-2 is established at 25 % of contracted current. The EPS may report a capability of up to 90 % of the full load output, including from both no load and 10 % initial load. An EPS reporting capability greater than the default shall support changes in both positive and negative load current steps from 1 Hz to 5 000 Hz.

b) The default load current step slew rate capability for an IEC 62680-1-2 EPS is established at 150 mA per microsecond. The EPS may report higher capabilities, specifically guaranteeing 500 mA/microsecond, 1 A/microsecond, or 2 A/microsecond slew rates.

4.3.3 Holdup time

The acceptable holdup time capability of the EPS (the condition of voltage regulation being disturbed by a distortion of the AC input on the primary) might depend on whether the portable computing device has its own battery or capacitive backup.

The EPS may report its guaranteed holdup time, from 3 ms to 16 ms. The holdup time, T_{holdup}, is measured at 115 VAC r.m.s. and 60 Hz (or 230 VAC r.m.s. and 50 Hz for an EPS that does not support 115 VAC mains) with the load at rated maximum. The reported time describes the maximum length of time from the last completed cycle until when the output voltage, V_{out}, decays below the guaranteed voltage regulation (Figure 2).

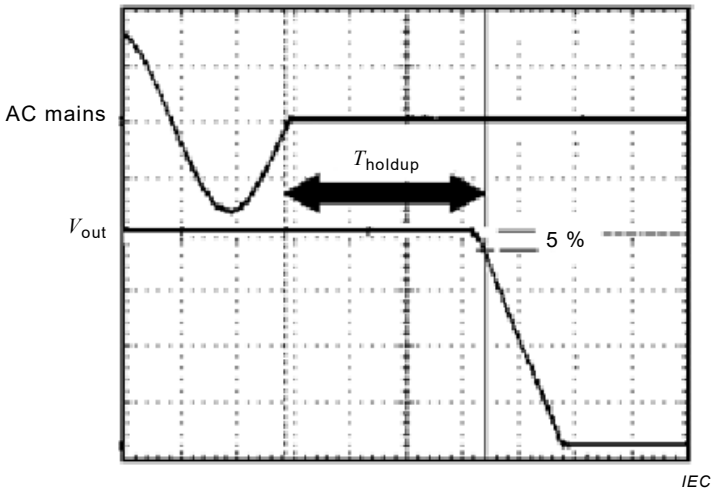

Figure 2 – Measurement of holdup time

4.3.4 Limited power source (LPS) compliance

According to the requirements of IEC 60950-1, a portable computing device that was tested and certified with an LPS EPS is prohibited to use a non-LPS EPS. An alternative, IEC 62368-1, classifies power sources according to their maximum, constrained power output (PS1 or PS2).

An EPS shall report its level of compliance to LPS, PS1 or PS2 to the portable computing device. Since the EPS could have several potential output voltage and current settings, all of the available voltage sources shall be compliant to LPS, PS1 or PS2 requirements in order for the EPS to announce corresponding compliance.

4.3.5 Touch current

Touch current relates to both ergonomic and functional aspects of the portable computing device. Touch current results from leakage that is below safety limits but might still be perceived by the user, usually when touching the metallic chassis on the portable computing device, and worsened by high (250 VAC r.m.s.) AC mains. Touch current also affects the performance of capacitive touch input devices such as touchscreens, touchpads, and capacitive buttons.

The EPS may identify itself as a low touch current EPS. Low touch current is leakage less than 65 µA r.m.s when the EPS's maximum nominal power capability is less than or equal to 30 W, or less than 100 µA r.m.s. when its power capability is between 30 W and 100 W. The total combined leakage current is measured in accordance with IEC 60950-1 when tested at 250 VAC r.m.s and 50 Hz.

The EPS shall report whether a ground pin exists, and shall report whether the ground pin is intended for functionality only or is relied upon as a protective earth for safety.

4.3.6 Minimum capabilities for peak current and overcurrent protection

Portable computing devices are highly power managed and their power consumption is dynamic. Each EPS will have its own capabilities for supplying current at or in excess of the label rating, and power draw beyond those capabilities might result in overcurrent protection and surprise shutdown of the EPS. A surprise shutdown of the EPS might result in system slowdown if the portable computing device has a battery backup, or lost work or data if the portable computing device does not have battery backup. IEC 62680-1-2 allows optional reporting of peak current delivery in excess of the contracted amount reported in the source

PDO. Each source PDO may report a peak current field that describes overcurrent capability for up to 10 ms. Two bits of information are used to communicate these power source capabilities. The duration of peak current shall be compensated by an immediate consumption below the operating current (IoC) in order to maintain a 20 ms average power delivery below the IoC current.

The EPS may report its capability of peak current. The amount of peak current shall be reported as a percentage of the maximum nominal operating current offered by the EPS. For example, an EPS with a nominal 1,0 A IoC but with peak current capability of 1,3 A r.m.s shall report “130 %”.

The duration for the overcurrent (the blanking period) shall be a minimum uninterrupted trigger duration of 15 ms. Any decrease in power consumption below the reported peak current capability shall reset the trigger duration timer.

It is recommended that the EPS auto-restart after an overcurrent protection. An EPS that does not auto-restart after an overcurrent protection event (an EPS that requires manual intervention to restart after an overcurrent protection event) shall not report any greater capability of overcurrent tolerance (i.e. only report 100 % for this threshold).

4.3.7 Surface temperature of the enclosure of the EPS

Safety limits for EPS touch temperature are set in applicable product safety standards (e.g. IEC 60950-1 or IEC 62368-1). The EPS may report when its touch temperature performance conforms to the TS1 or TS2 limits described in IEC 62368-1.

4.3.8 Overvoltage protection in the EPS

Overvoltage of the EPS output might lead to damage of the portable computing device. The wide operating range allowed by IEC 62680-1-2 might be excessive for some portable computing devices. IEC 62680-1-2 includes protocol and detection methods to prevent the deliberate output voltage of the EPS from exceeding the explicit requirements of the portable computing device. However, component failures in an EPS might randomly occur and cause a voltage output that exceeds the voltage tolerance of the portable computing device.

The EPS should support and report the capability of overvoltage protection, whereby a detected voltage threshold of no more than 130 % of contracted V_{BUS} leads to an overvoltage protection event, whereby a voltage above the threshold value shall interrupt output current within 250 milliseconds.

It is recommended that the portable computing device consider its design capacity for overvoltage and include its own protective devices. The portable computing device should not consider overvoltage protection in the EPS as principal or redundant protection.

Annex A
(informative)

Open issues related to arbitrary combinations of EPS and portable computing device

A.1 EMC, safety and performance

Untested or arbitrary combinations of EPS and portable computing device cannot guarantee the same level of assurance for EMC and safety as that of the specific combinations that were tested by certification bodies.

EPSs supplied with portable computing devices are typically designed for use and tested together. System performance and reliability might be guaranteed only for those tested combinations.

A.2 Authentication, attestation, and data integrity protection

This International Standard relies on a foundation of trust between the EPS and the portable computing device. Functionality, EMC compliance and safety (and the mitigation methods suggested in this International Standard) assume that the information provided by the EPS is genuine. Counterfeit EPSs might masquerade and report the identity or characteristics of a trusted EPS, but not follow the quality of design or manufacturing that ensured the original's operation.

IEC 62680-1-2 has the communications capability believed to be appropriate for the portable computing device to authenticate the identity of the EPS. Establishing an industry standard authentication method, a method of surveillance that can help recognize clones, and identifying a supported set of policies for warning the user or revocation is beyond the scope of this International Standard. Future versions of this International Standard may recognize standardized authentication methods that are developed to support IEC 62680-1-2.

A.3 Conducted noise from the EPS

Common mode output noise might affect the operation of devices in the portable computing device, particularly capacitive sensors (touchscreen or touchpad) that rely on sensing a capacitive path to earth ground. Common mode noise is typically a product of the switching frequency of the conversion topology of the EPS. The EPS might have multiple stages of power conversion and each switching frequency might change dynamically, for example as a function of the output voltage, mains voltage, or activation of PFC. Reporting narrowband noise characteristics of the EPS could conceivably allow the portable computing device to "frequency hop" to avoid functional problems due to this interference. However, further work is needed in this area.