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SERIES L: CONSTRUCTION, INSTALLATION AND
PROTECTION OF CABLES AND OTHER ELEMENTS OF
OUTSIDE PLANT

External universal power adapter solutions for stationary information and communication technology devices

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Recommendation ITU-T L.1001

External universal power adapter solutions for stationary information and communication technology devices

Summary

Recommendation ITU-T L.1001 provides requirements for a universal power adapter solution (UPA) for stationary information and communication technology (ICT) devices that will reduce the number of produced power adapters by widening their application to more devices, enabling their reuse and increasing their lifetime.

The solution also aims to reduce energy consumption. The longer life cycle and possibility of avoiding device duplication reduces the demand on raw materials and limits the amount of e-waste.

The universal power adapter solution for stationary ICT equipment is designed to serve the vast majority of ICT devices.

Keywords

Ecodesign, energy efficiency, power adapter, power supply.

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Introduction

This Recommendation defines the requirements for a universal power adapter solution for ICT devices. It also takes into consideration energy efficiency, emissions reduction and the use of scarce and raw materials.

It has been estimated [b-GeSI-ITU-T Study] that the widespread adoption of an energy efficient universal power adapter solution for ICT devices will result in more than 50 per cent reduction in standby energy consumption that, together with the even higher energy savings due to higher efficiency AC/DC converters, will contribute to the reduction of CO₂ emission.

The universal power adapter solution will achieve several objectives: it will be more convenient to reuse for consumers who will be able to power their ICT devices from any available universal power adapter and it will enable the sharing of power adapters among more existing and future ICT devices. This will considerably eliminate the number of duplicate stationary power adapters.

It is noted that the environmental impact of any universal power adapter solution should be considered over its entire life cycle and that the transition towards a universal power adapter solution does not aim to replace the existing adapters immediately, as billions of them are currently in use and billions of external power adapters are being introduced for new devices or to replace old ones.

This Recommendation is designed to ensure that the universal power adapter solution operates within the recognized current and voltage safety parameters by adopting existing ICT device technologies and taking into account operators, manufacturers and associations close to the market.

It should be noted that lifetime, safety, electromagnetic compatibility (EMC) and environmental issues have been considered in the drafting of this Recommendation.

It is important to propose a low voltage DC interface to directly power ICT devices, especially for emerging countries that show fast mobile and Internet development despite the absence of a reliable AC grid. Considering the rapid increase of the cost of fossil fuel used in engine generators and the reduction of the cost of renewable energy sources, this kind of energy solution is developing fast and is among the main enablers of ICT deployment in such regions. The use of DC is much more efficient and increases the overall reliability as it allows removing the DC/AC inverters and insulated AC/DC adapters. A simple (and low cost) detachable cable could then be sufficient to power ICT devices. In some cases, only a DC/DC converter with very high efficiency would be used to adapt voltage, e.g., 12 or 24 V to 5 V. This solution is also considered in developed countries for home DC networks (see appendices I and V).

Multi-output UPA solutions could be built based on a single DC output interface that will improve user experience by reducing the amount of power adapter blocks, wires and AC plugs. This additionally reduces the environmental impact by using less material and offering the higher efficiency of an adapter rated for higher power. The ICT devices can be sold just with only the detachable cable or the end connector adapter.

Recommendation ITU-T L.1001

External universal power adapter solutions for stationary information and communication technology devices

1 Scope

This Recommendation defines the requirements for a universal power adapter solution (UPA) designed for ICT devices for stationary (non-portable) use.

This Recommendation also takes into consideration energy efficiency improvement, greenhouse gas (GHG) emission reductions and optimization in the use of scarce and raw materials.

The UPA is an external power adapter that interfaces to the low voltage input of an ICT device by converting the AC mains voltage to a low DC voltage output.

UPA is applicable to stationary ICT devices at home, where normal operation requires a permanent connection to a household AC power source.

Stationary means that the ICT device does not have an integral battery as the primary power source and would not be expected to be transported by the user on an everyday basis in normal operation. However, it includes ICT devices with battery backup in case of power supply failure.

UPA does not provide any charge control for rechargeable batteries.

This Recommendation is complementary to [ITU-T L.1000] and aims to cover the widest range possible of ICT devices for stationary use within the defined voltage and power ranges. It considers basic configurations and general requirements for the UPA and their interfaces, including cables, connectors, voltage, current, ripple, noise, energy efficiency, safety, electromagnetic compatibility, resistibility and eco-environmental specifications.

Future revisions could include compatibility with [ITU-T L.1200] DC interfaces or with SELV DC to maximize efficiency and use of the UPA. These DC sources can be made available on renewable energy systems or on power sockets that may be found in transportation systems (boats, trains, planes, buses, etc.).

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

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| [ITU-T K.21] | Recommendation ITU-T K.21 (2011), <i>Resistibility of telecommunication equipment installed in customer premises to overvoltages and overcurrents.</i> |
| [ITU-T K.44] | Recommendation ITU-T K.44 (2012), <i>Resistibility tests for telecommunication equipment exposed to overvoltages and overcurrents— Basic Recommendation.</i> |
| [ITU-T K.74] | Recommendation ITU-T K.74 (2008), <i>EMC, resistibility and safety requirements for home network devices.</i> |

[ITU-T K.85]	Recommendation ITU-T K.85 (2011), <i>Requirements for the mitigation of lightning effects on home networks installed in customer premises.</i>
[ITU-T L.1000]	Recommendation ITU-T L.1000 (2011), <i>Universal power adapter and charger solution for mobile terminals and other handheld ICT devices.</i>
[ITU-T L.1410]	Recommendations ITU-T L.1410 (2012), <i>Methodology for the assessment of the environmental impact of information and communication technology goods, networks and services.</i>
[ETSI ES 202 874-1]	ETSI ES 202 874-1 V1.2.1 (2012), <i>Access, Terminals, Transmission and Multiplexing (ATTM) External Common Power Supply for Customer Premises Network and Access Equipment Part 1: functional requirement.</i>
[ETSI TS 102 874-2]	ETSI TS 102 874-2 V1.1.1 (2010), <i>Access, Terminals, Transmission and Multiplexing (ATTM); External Common Power Supply for Customer Premises Network and Access Equipment; Part 2: Integrated Broadband Cable and Television Networks.</i>
[ETSI TS 102 874-3]	ETSI TS 102 874-3 V1.2.1 (2012), <i>Access, Terminals, Transmission and Multiplexing (ATTM); External Common Power Supply for Customer Premises Network and Access Equipment. Part 3: CPS Type 1 implementation details.</i>
[ETSI TS 102 874-4]	ETSI TS 102 874-4 V1.2.1 (2012), <i>Access, Terminals, Transmission and Multiplexing (ATTM); External Common Power Supply for Customer Premises Network and Access Equipment. Part 4: CPS Type 2.b implementation details.</i>
[ETSI TS 102 874-5]	ETSI TS 102 874-5 V1.2.1 (2012), <i>Access, Terminals, Transmission and Multiplexing (ATTM); External Common Power Supply for Customer Premises Network and Access Equipment; Part 5: CPS Type 2.c implementation details.</i>
[ETSI TS 102 874-6]	ETSI TS 102 874-6 V1.1.1 (2012), <i>Access, Terminals, Transmission and Multiplexing (ATTM); External Common Power Supply for Customer Premises Network and Access Equipment; Part 6: CPS Type 2.d implementation details.</i>
[CISPR 22]	CISPR 22 (2006), <i>Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement.</i>
[CISPR 24]	CISPR 24 (2010), <i>Information technology equipment – Immunity characteristics – Limits and methods of measurement.</i>
[CISPR 32]	CISPR 32 (2012), <i>Electromagnetic compatibility of multimedia equipment – Emission requirements.</i>
[IEC 60068-2-38]	IEC60068-2-38 (2009), <i>Environmental testing - Part 2-38: Tests - Test Z/AD: Composite temperature/humidity cyclic test.</i>
[IEC 60320-1]	IEC 60320-1 (2007), <i>Appliances couplers for household and similar general purposes – Part 1: General requirements.</i>
[IEC 60950-1]	IEC 60950-1 (2005), <i>Information technology equipment – Safety – Part 1: General requirements.</i>

[IEC 61000-3-2]	IEC 61000-3-2 (2009), <i>Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)</i> .
[IEC62301]	IEC 62301 ed2.0 (2011), <i>Household electrical appliances –Measurement of standby power</i> .
[IEC 62684]	IEC 62684 (2010), <i>Interoperability specifications of common external power supply (EPS) for use with data-enabled mobile telephones</i> .
[EN 50563]	CENELEC EN 50563 (2011), <i>External a.c. - d.c. and a.c. - a.c. power supplies – Determination of no-load power and average efficiency of active modes</i> .
[ISO/IEC guide 51]	ISO/IEC guide 51 (1999), <i>Safety aspects – Guidelines for their inclusion in standards</i> .
[ISO/IEC guide 104]	ISO/IEC guide 104 (2010), <i>The preparation of safety publications and the use of basic safety publications and group safety publications</i> .
[ITU-T L.1200]	Recommendation ITU-T L.1200 (2012), <i>Direct current power feeding interface up to 400 V at the input to telecommunication and ICT equipment</i> .
[IEC 60038]	EN 60038 (2009), <i>Standard voltages</i> .

3 Definitions

3.1 Terms defined elsewhere

None.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 captive cable: A cable integral to the universal power adapter (UPA).

3.2.2 detachable AC cable: A detachable cable used to connect the power adapter to the alternating current (AC) mains for powering through two connectors, one on the universal power adapter (UPA) side and one on the AC mains side.

3.2.3 detachable DC cable: A detachable direct current (DC) cable connects the power adapter to the ICT device for powering through two connectors, one on the universal power adapter (UPA) side and one on the ICT device side.

3.2.4 hiccup mode: The hiccup mode is a power supply over current protection mode stopping output and trying restart by intermittence.

3.2.5 power adapter: A device that converts mains AC power voltage at the input to low DC power voltage at the output or which converts DC power source, e.g., from Photo Voltaic source to another low voltage DC power output.

3.2.6 power adapter block: A block which includes a power adapter.

3.2.7 universal power adapter solution: Family of universal power adapters (UPAs) that defines the power supply solution for different ICT devices.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

AC	Alternating Current
ADSL	Asymmetric Digital Subscriber Line
DC	Direct Current
CTI	Comparative Tracking Index
EMC	Electromagnetic Compatibility
EUT	Equipment Under Test
FET	Field Effect Transistor
GPON	Gigabit Passive Optical Network
GHG	Greenhouse Gas emission
ICT	Information and Communication Technology
I-V	Current-Voltage
ONT	Optical Network Termination
ONU	Optical Network Unit
p-p	peak to peak
POL	DC/DC Point of Load Converter
POS	Point of Sale
PSE	Product Safety and Electrical appliance and material
PTI	Proof Tracking Index
PV	Photo Voltaic
SCCP	Short Chain Chlorinated Paraffin
SELV	Safety Extra-Low Voltage
STB	Set Top Box
UPA	Universal Power Adapter
UPTI	Universal Power and Telecom Interface
USB	Universal Serial Bus
VDSL	Very high speed Digital Subscriber Line

5 Conventions

None

6 Universal power adapter solutions

6.1 Basic configuration

Figure 1 reports the basic configuration of the universal power adapter (UPA) solution for stationary use. The basic UPA configuration consists of a UPA with a captive (non-detachable) input cable and a captive output cable to the ICT device (captive input can be a plug integrated in the adaptor housing)

Another option is a UPA with more than one output defined in a basic configuration.

NOTE 1 – Other configurations with detachable cable for stationary use are possible, but require further study. Appendix V shows several configurations with detachable cable that can be used in transportation systems or in solar power applications.

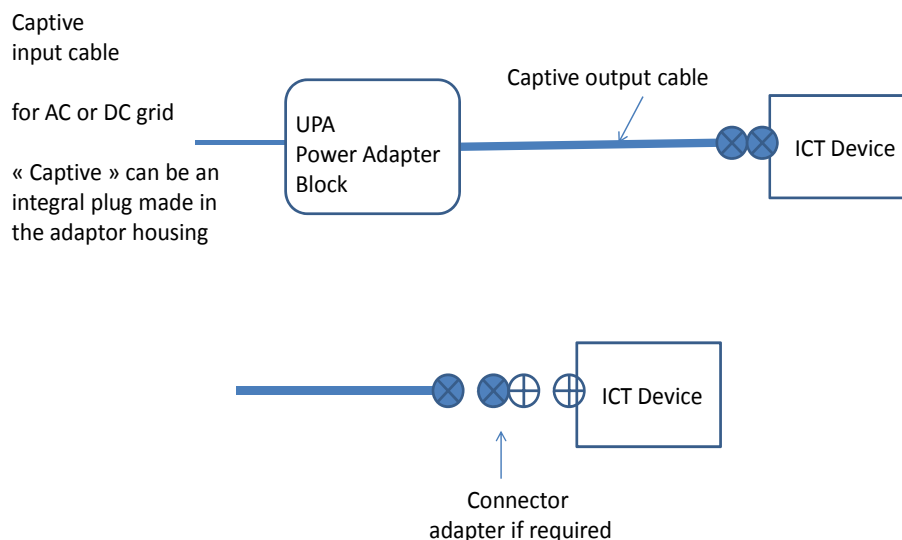


Figure 1 – Basic UPA configuration and connector change option

Each UPA configuration is shown with a connector adapter between the cable connector and the input of the device (Figure 1).

All UPA configurations are shown in the Recommendation with a power adapter block.

NOTE 2 – To allow more flexibility and reduce the number of UPA categories (see Table 1), an identification pin could be used to identify the UPA configuration.

NOTE 3 –Appendix I contains information on research performed on SELV DC room distribution using renewable energy sources and storage for powering ICT devices.

NOTE 4 – UPA could have input compliance with the [ITU-T L.1200] DC interface.

6.2 ICT devices adopting the UPA

The UPA, as defined in this Recommendation, shall be used to power ICT devices for stationary use. Applicable ICT devices include VDSL modems, ADSL modems, home gateways, routers GPON/ONUs, fixed telephones, facsimiles, etc.

In cases where ICT devices include internal batteries, the UPA does not provide charging functions.

NOTE 1 – Battery-equipped ICT devices should contain battery control functions compliant with functional battery safety standards.

A UPA could power other ICT devices that have similar power requirements such as external hard disks, computer monitors, point of sale (POS) card readers, etc., if their power input interface is compatible with the specifications in this Recommendation.

ICT devices in [ITU-T L.1000] are not covered in this Recommendation.

In case of a multi-output UPA option, the sum of the maximum power on all outputs must not exceed 249 W.

NOTE 2 –The basic functions of a UPA are:

- a) UPA is available for different equipment for stationary use (Figure 2);

- b) UPA is available for equipment whose rated power is less than capacity of UPA (Figure 3).

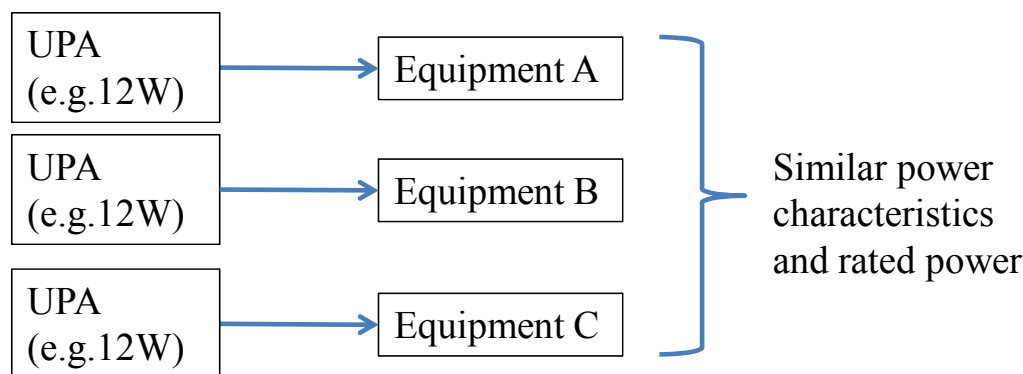


Figure 2 – Compatibility function for one same UPA shown with several devices with similar power characteristics

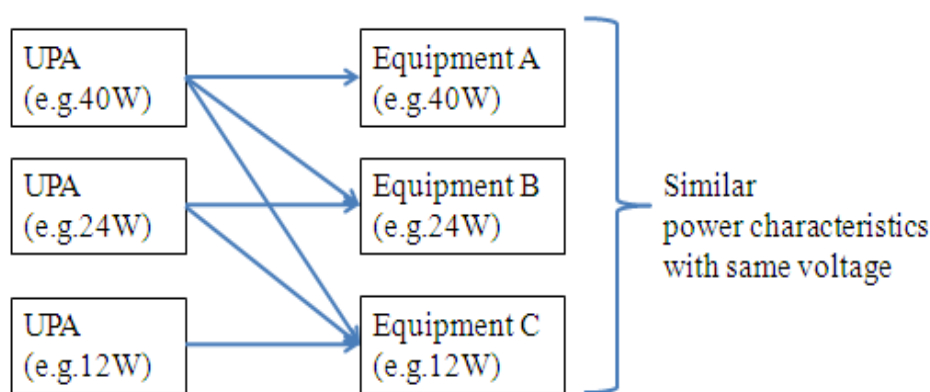


Figure 3 – Power compatibility function of a UPA (example based on a 12 V UPA)

NOTE –The compatibility function should be compliant with the efficiency target (i.e., UPA power should be comparable to the ICT requirement).

6.3 Compatibility with powered ICT equipment

Taking into consideration the ICT power rating, the correct UPA must be selected to comply with electrical safety standards and codes [IEC 60950-1].

NOTE – In [IEC 60950-1] the requirement is on input overcurrent protection.

In addition, an appropriate overcurrent protection device (e.g., fuse) should be included in the DC input circuit of the powered ICT equipment.

While the UPA can sense its own short-circuit or failure condition, it cannot sense a malfunction of the ICT device.

Figure 4 shows how the rated current and power of the ICT device relate to those of the UPA. An overcurrent condition of the UPA shall be at least 105% of the rated current. The variability of characteristics due to the tolerance of the UPA components shall be taken into account (e.g., temperature drift and reliability of the overcurrent protection device (e.g., fuse)).

ICT devices should be designed to ensure coordination between UPA power output capabilities and fuse characteristics (Appendix IV gives an example of various dimensioning effects). Proper design will help to detect when there is a failure and prevent damage to the ICT equipment.