



**Environmental Engineering (EE);
Impact on ICT equipment architecture of multiple AC,
-48 VDC or up to 400 VDC power inputs**

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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).

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Introduction

With the advantages of the emerging up to 400 VDC power distribution along with the continued use of the legacy AC and -48 VVD power distribution for telecom and Information and Communication Technology (ICT) power feeding, a new ICT power interface is defined as being a combination of the standardized AC and DC power interfaces (AC, -48 V, up to 400 VDC). In general case, the power configuration combination will be made of up to two of these three power interfaces and is identified as dual power inputs interface of an ICT system.

The present document also provides details showing the ICT equipment front end power architectures that includes the on board converter and the interconnection options between the converter and the ICT interface. These include interface switch selector and diode combiner solutions for multiple power input feeds.

With the increase in the variation of potential power feeds to ICT equipment especially with the emergence of up to 400 VDC power networks, a clear indication of how a multiple input power feed is to be referenced and how these multiple power feeds can be best managed, is crucial in ensuring that common and recognized approaches are adopted in the installation and configuration of future ICT equipment.

Annex B presents options for the installation of a switch selector within ICT equipment and its operational attributes targeted for its reliable operation.

The present document was developed jointly by ETSI TC EE and ITU-T Study Group 5 and published respectively by ETSI and ITU-T as ETSI Standard ETSI TS 103 531 and as Recommendation ITU-T L.1206, which are technically equivalent.

1 Scope

The present document is applicable to the case of multiple power feeding configurations at the input of ICT equipment in ICT system.

The present document describes the combination of three power interfaces as A (-48 V), P or A3 (up to 400 VDC) and A3ac (AC) that could potentially be used for each input.

The present document also provides details of the power structure within the ICT equipment, between the ICT equipment interfaces and ICT equipment system loads that is inclusive of system power converters.

The input power configurations are categorized to allow for better understanding and identification of the each new multiple power feeding interface, providing details of the impacts and benefits of adopting them. Information is also provided on the impact on battery test function when used with the different dual power inputs combinations.

Lastly requirements are given for avoiding the potential risk of voltage back feeding from one input to the other and for general isolation requirements in all multiple power feeding configurations.

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 at <https://docbox.etsi.org/Reference/>.

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] Recommendation ITU-T L.1200: "Direct current power feeding interface up to 400 V at the input to telecommunication and ICT equipment".
- [2] 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)".
- [3] ETSI EN 300 132-3-1: "Environmental Engineering (EE); Power supply interface at the input to telecommunications and datacom (ICT) equipment; Part 3: Operated by rectified current source, alternating current source or direct current source up to 400 V; Sub-part 1: Direct current source up to 400 V".

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.

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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] ETSI EN 300 132-1: "Environmental Engineering (EE); Power supply interface at the input to Information and Communication Technology (ICT) equipment; Part 1: Operated by Alternating Current (AC) source".

- [i.2] IEC 60445: "Basic and safety principles for man-machine interface, marking and identification - Identification of equipment terminals, conductor terminations and conductors".
- [i.3] ISO/IEC 2382-14: "Information technology - Vocabulary - Part 14: Reliability, maintainability and availability".

3 Definitions, symbols and abbreviations

3.1 Definitions

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

combined power feeding: function by which two power inputs feeds to ICT equipment is managed such that one input is always available to power a single power module within the ICT equipment e.g. by using the reverse bias characteristic of a two diodes common cathode module or a dual MOSFET

combiner: device achieving the combined power feeding function

dependant power feed: power feed associated with a single interface on the ICT equipment but jointly associated to another power feed with a single power module within the ICT equipment via a managed power interface (switched or combined power feed)

hot standby state: standby state providing for immediate operation upon demand

NOTE 1: This is the hot standby mode of an equipment or a system as defined in ISO/IEC 2382-14 [i.3].

NOTE 2: A hot standby state may apply to redundant or stand-alone items.

NOTE 3: In some applications, an item in a hot standby state is considered to be operating.

independent power feed: power feed associated with a single interface on the ICT equipment and a single power module within the same ICT equipment used in a multiple power feeding interface

interface "A": ICT equipment -48 VDC power interface as defined in ETSI EN 300 132-2 [2]

interface "A3": ICT equipment up to 400 VDC power interface as defined in ETSI EN 300 132-3-1 [3]

interface "A3ac": ICT equipment AC power interface as defined in ETSI EN 300 132-1 [i.1]

interface "P": ICT equipment up to 400 VDC power interface as defined in Recommendation ITU-T L.1200 [1]

switched power feeding: method by which two power inputs feeds to ICT equipment is managed such that one input is always available to power a single power module within the ICT equipment with the use of a switch

switch selector: device achieving the switched dependant power feed selection by a power switch

3.2 Symbols

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

A+	Pole plus of input A
A-	Pole minus of input A
B+	Pole plus of input B
B-	Pole minus of input B

3.3 Abbreviations

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

AC	Alternating Current
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CONV	CONVerter
D	Diode
DC	Direct Current
EMC	ElectroMagnetic Compatibility
ICT	Information and Communication Technology
MOSFET	Metal Oxide Semiconductor Field Effect Transistor
swSelect	switch Selector
TC	Technical Committee
VAC	Volt AC
VDC	Volt DC

4 Definition and requirement of the multiple power interface configuration at the input power feeds of ICT equipment

4.1 Individual power interface used for multiple power interface configuration

The power supply interfaces presented in Figures 1 to 6, are the physical inter-connection points to which all the requirements are related. These points are situated between the power supply system(s) and ICT equipment.

Definitions of configurations in which "A", "P(A3)" and "A3ac" interfaces presented as individual interface references can be found in the following documents:

- ETSI EN 300 132-1 [i.1], annex C (AC supply) - A3ac interface
- ETSI EN 300 132-2 [2], annex E (-48 VDC supply) - A interface
- Recommendation ITU-T L.1200 [1], P interface (up to 400 VDC supply) - equivalent to ETSI EN 300 132-3-1 [3], annex B - A3 interface

NOTE: Subject to the installation preconditions, this point may be located at any other point between the power supply system and ICT equipment by mutual agreement of the relevant parties.

4.2 Multiple power interface configurations and requirements

4.2.1 Identification of multiple interface inputs options

For the case of multiple inputs configurations occurring on ICT equipment, (e.g. power supply unit with dual feeds) each power interface shall comply with at least one of the applicable interface detailed in clause 6.

The multiple power interfaces shall be identified by using each of the individual interface definitions in sequence, for example, an ICT interface comprising of one AC supply (A3ac) and one AC supply (A3ac) shall be named A3ac/A3ac.

In respect of the contents presented within the present document, interface "A3ac/A3ac", "A3ac/A3", "A3/A3", "A3ac/A", "A/A", and "A/A3" are located at the power terminals of the ICT equipment or system as defined by the manufacturer in accordance with IEC 60445 [i.2].

Table 1 presents all the interface options for multiple power feeds to ICT equipment. This table makes the initial assumption that a maximum of only two power feeds are used at the interface. Power interfaces will be configured for any ICT equipment installation and the individual interface shall be in accordance with the input power feed selected.

Table 1: Interface configuration options for multiple power feed of ICT equipment

	AC	400 VDC	48 VDC
AC	A3ac/A3ac (Figure 1)	A3ac/A3 (Figure 2)	A3ac/A (Figure 4)
400 VDC	A3ac/A3 (Figure 2)	A3/A3 (Figure 3)	A3/A (Figure 6)
-48 VDC	A3ac/A (Figure 4)	A3/A (Figure 6)	A/A (Figure 5)

4.2.2 Configuration AC/AC

Figure 1 presents the interface A3ac/A3ac for a multiple power feed consisting of two AC power feeds.

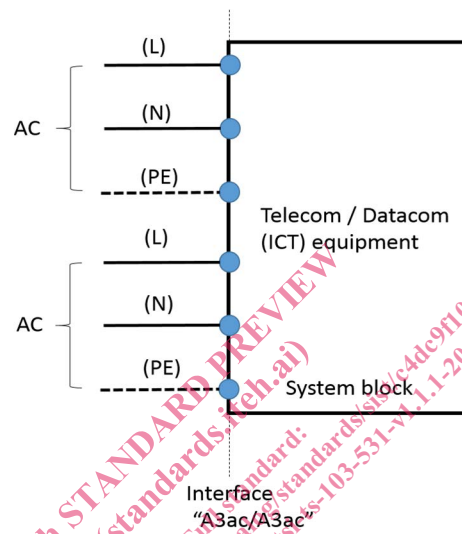


Figure 1: General identification of the A3ac/A3ac interface for multiple power feeds for dual AC inputs

The interface and the operational voltage characteristics for an AC power feed are detailed within document [i.1].

4.2.3 Configuration AC/400 VDC

Figure 2 presents the interface "A3ac/A3" for a multiple power feed consisting of one AC power feed and one up to 400 VDC power feed. The AC interface and the interface for up to 400 VDC power feeds have the interface references of "A3ac" and "A3" respectively and as such the combination of these two reference interfaces when used together on ICT equipment is presented as "A3ac/A3".

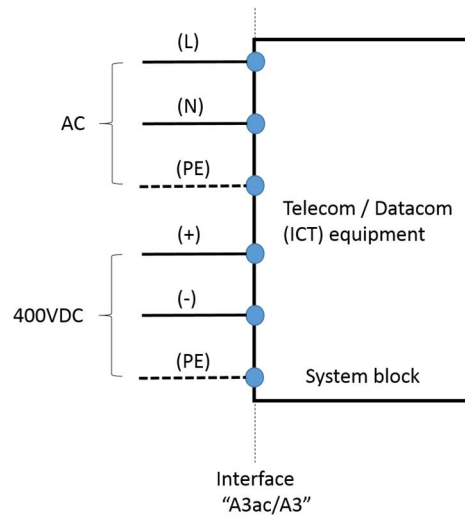


Figure 2: General identification of the A3ac/A3 interface for multiple power feeds for AC and up to 400 VDC inputs

The interface and the operational voltage characteristics for an AC power feed are detailed within ETSI EN 300 132-1 [i.1] and the interface and the operational voltage characteristics for up to 400 VDC power feed shall be as detailed within ETSI EN 300 132-3-1 [3].

4.2.4 Configuration 400 VDC/400 VDC

Figure 3 presents the interface "A3" for a multiple power feed consisting of two up to 400 VDC power feeds.

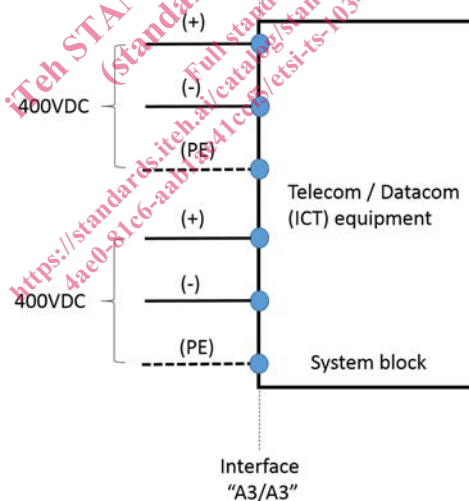


Figure 3: General identification of the A3 interface for multiple power feeds for dual of up to 400 VDC inputs

The interface and the operational voltage characteristics for up to 400 VDC power feed shall be as detailed within ETSI EN 300 132-3-1 [3].

4.2.5 Configuration AC/-48 VDC

Figure 4 presents the interface "A3ac/A" for a multiple power feed consisting of one AC power feed and one -48 VDC power feed. In this instance the AC and -48 VDC interfaces have interfaces structures which are termed as "A3ac and A" respectively.

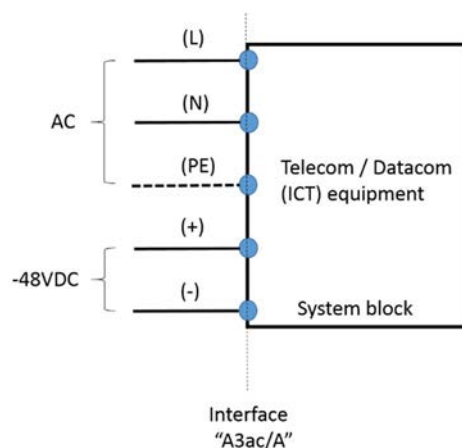
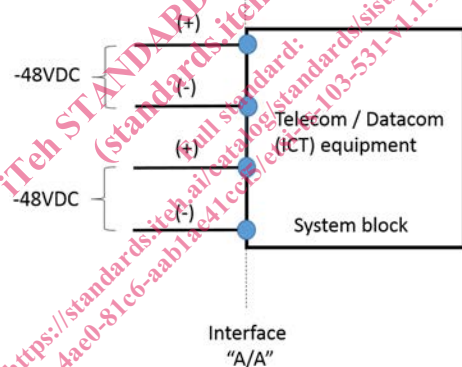


Figure 4: General identification of the A interface for multiple power feeds for AC and -48 VDC inputs

The interface and the operational voltage characteristics for an AC power feed are detailed within document [i.1] and the interface and the operational voltage characteristics for the -48 VDC power feed shall be as detailed within ETSI EN 300 132-2 [2].

4.2.6 Configuration -48 VDC/-48 VDC

Figure 5 presents the interface "A" for a multiple power feed consisting of two -48 VDC power feeds.



NOTE: It is possible that some energy conversion parts be upstream from the interface A, please refer to annex D for detailed information.

Figure 5: General identification of the A interface for multiple power feeds for dual -48 VDC inputs

The interface and the operational voltage characteristics for a -48 VDC power feed shall be as detailed within ETSI EN 300 132-2 [2].

4.2.7 Configuration 400 VDC/-48 VDC

Figure 6 presents the interface "A/A3" for a multiple power feed consisting of one up to 400 VDC power feed and one -48 VDC power feed. The -48 VDC interface and the interface for up to 400 VDC power feeds have the interface references of A and A3 respectively and as such the combination of these two reference interfaces when used together on ICT equipment is presented as "A/A3".