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Electrical safety – Classification of interfaces for equipment to be connected to information and communications technology networks

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International Electrotechnical Commission, 3, rue de Varembé, PO Box 131, CH-1211 Geneva 20, Switzerland
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: inmail@iec.ch Web: www.iec.ch

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRICAL SAFETY – CLASSIFICATION OF INTERFACES FOR EQUIPMENT TO BE CONNECTED TO INFORMATION AND COMMUNICATIONS TECHNOLOGY NETWORKS

FOREWORD

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IEC 62102, which is a technical report, was prepared by IEC technical committee 108: Safety of electronic equipment within the field of audio/video, information technology and communication technology, previously organized as IEC technical committee 74: Safety and energy efficiency of IT equipment.

This second edition cancels and replaces the first edition published in 2001. This edition constitutes a technical revision. The principal changes in this edition as compared with the first edition of IEC 62102 are as follows (small changes are not listed):

– this 2nd edition was updated to accord with IEC 60950-1:2001;
– RFT (remote feeding telecommunication) circuits from IEC 60950-21 have been added;

– in Annex B more interfaces have been added;

– in Annex B the category of xDSL interfaces have replaced ADSL interfaces.

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
108/128/DTR	108/130/RVC

Full information on the voting for the approval of this technical report 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.

Terms printed in **bold** in the text are defined in Clause 3.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result 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- withdrawn,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.

A bilingual version of this document may be published at a later date.

INTRODUCTION

This technical report is a guide to the determination of the interface requirements for equipment in terms of safety. It lists a number of interfaces and indicates the safety category of each listed interface. This technical report does not contain sufficient detail for conformance testing purposes, except when used in conjunction with product standards such as IEC 60950-1 and IEC 60950-21.

The equipment safety standards IEC 60950-1 and IEC 60950-21 specify the requirements for categories of circuits as **SELV circuits**, **TNV circuits, RFT circuits** and **hazardous voltage circuits** (among others). For stand-alone equipment it is a relatively simple matter to determine the different categories of circuits. However, an equipment which has data port interfaces is intended to be connected to other equipment, either locally or via a network. In this case, the safety categories of the interfaces which will be connected together have to be compatible with each other. Furthermore, the category of the interface of the remote equipment may be unknown. This is the case in systems where telecommunication equipment and data processing equipment are connected together via different types of interfaces and networks.

To overcome this situation it is necessary to classify the interfaces of equipment in such configurations according to the application and to select the safety category for the interfaces of the equipment and for the type of the network. Similarly, the interfaces have to be classified for protection against damage of the equipment and of the network. Aspects of protection are dealt with in the ITU-T K series of recommendations.

ELECTRICAL SAFETY – CLASSIFICATION OF INTERFACES FOR EQUIPMENT TO BE CONNECTED TO INFORMATION AND COMMUNICATIONS TECHNOLOGY NETWORKS

1 Scope

This technical report applies to equipment interfaces. These interfaces within the equipment may be connected to **telecommunication networks**, may form part of the **telecommunication network** infrastructure or may provide localized transfer of data. This technical report provides guidance on the classification of interfaces in accordance with the circuit types defined in IEC 60950-1 and IEC 60950-21 following an analysis of the **telecommunication network** characteristics.

This technical report only covers equipment appropriately interconnected. Furthermore, it does not address damage caused by one equipment to another equipment to which it is connected. Exceptionally, interfaces may be designed for higher or lower levels for special applications. In such cases it should be ensured that only interfaces having the same safety category and protection level are connected together. This is based on the available specifications of the equipment manufacturers and network providers, and on information regarding the installation category of the mains interface.

This technical report is intended to be used by equipment designers, network operators, network regulators/authorities, standards writers and network installers. It is applicable to various interfaces of equipment. Network presentations are not equipment and so are not covered by IEC 60950-1 and IEC 60950-21; hence they are also not covered by this technical report. However, it is necessary to consider the characteristics, installation and presentation of **telecommunication networks** when determining what equipment interface requirements apply (for example, **SELV circuit**, **TNV-1 circuit**, **TNV-2 circuit**, **TNV-3 circuit** etc.).

If a standard other than IEC 60950-1 or IEC 60950-21 is used for designing the equipment and its interface (for example, IEC 62151 in conjunction with other product safety standards), then the corresponding requirements of these other standards are to be preferred.

If there is a conflict between this technical report and a more detailed specification, the latter prevails.

This technical report applies regardless of ownership or responsibility for installation and maintenance of the equipment or network.

NOTE Terminal equipment is often connected to customer premises cabling when used in a business environment, and there are standards covering such cabling.

2 Normative references

The following referenced documents are indispensable for the application 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 60950-1:2001, *Information technology equipment – Safety – Part 1: General requirements*

IEC 60950-21:2002, *Information technology equipment – Safety – Part 21: Remote power feeding*

3 Terms and definitions

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

3.1 Definitions from IEC 60950-1

3.1.1
a.c. mains supply
a.c. power distribution system external to the equipment for supplying power to a.c. powered equipment. These power sources include public or private utilities and, unless otherwise specified in the standard, equivalent sources such as motor-driven generators and uninterruptible power supplies

[IEC 60950-1, definition 1.2.8.1]

3.1.2
hazardous voltage
voltage exceeding 42,4 V peak, or 60 V d.c., existing in a circuit which does not meet the requirements for either a **limited current circuit** or a **TNV circuit**

[IEC 60950-1, definition 1.2.8.5]

3.1.3
limited current circuit
circuit which is so designed and protected that, under both normal operating conditions and single fault conditions, the current which can be drawn is not hazardous

[IEC 60950-1, definition 1.2.8.8]

3.1.4
primary circuit
circuit which is directly connected to the **a.c. mains supply.** It includes, for example, the means for connection to the **a.c. mains supply**, the primary windings of transformers, motors and other loading devices

[IEC 60950-1, definition 1.2.8.3]

3.1.5
secondary circuit
circuit which has no direct connection to a **primary circuit** and derives its power from a transformer, converter or equivalent isolation device, or from a battery

[IEC 60950-1, definition 1.2.8.4]

3.1.6
SELV circuit
secondary circuit which is so designed and protected that under normal operating conditions and single fault conditions, its voltages do not exceed a safe value

[IEC 60950-1, definition 1.2.8.7]

3.1.7
TNV circuit (including TNV-1 circuit, TNV-2 circuit, TNV-3 circuit)
circuit that is in the equipment and to which the accessible area of contact is limited and that is so designed and protected that, under normal operating conditions and single fault conditions, the voltages do not exceed specified limit values

[IEC 60950-1, definition 1.2.8.10]

3.1.8
telecommunication network
metallically terminated transmission medium intended for communication between equipment that may be located in separate buildings, excluding:

– the mains system for supply, transmission and distribution of electrical power, if used as a telecommunication transmission medium;

– **cable distribution systems**;

– **SELV circuits** connecting units of data processing equipment

NOTE 1 The term **telecommunication network** is defined in terms of its functionality, not its electrical characteristics. A **telecommunication network** is not itself defined as being either an **SELV circuit** or a **TNV circuit**. Only the circuits in the equipment are so classified.

NOTE 2 A **telecommunication network** may be:

– publicly or privately owned;

– subject to transient overvoltages due to atmospheric discharges and faults in power distribution systems;

– subject to longitudinal (common mode) voltages induced from nearby power lines or electric traction lines.

NOTE 3 Examples of **telecommunication networks** are:

– a public switched telephone network;

– a public data network;

– an Integrated Services Digital Network (ISDN);

– a private network with electrical interface characteristics similar to the above.

[IEC 60950-1, definition 1.2.13.8]

3.1.9
cable distribution system
metallically terminated transmission medium using coaxial cable, mainly intended for transmission of video and/or audio signals between separate buildings or between outdoor antennas and buildings, excluding:

– the mains system for supply, transmission and distribution of electric power, if used as a communication transmission medium;

– **telecommunication networks**;

– **SELV** circuits connecting units of information technology equipment

NOTE 1 Examples of **cable distribution systems** are:

– local area cable networks, community antenna television systems and master antenna television systems providing video and audio signal distribution;

– outdoor antennas including satellite dishes, receiving antennas, and other similar devices.

NOTE 2 **Cable distribution systems** may be subjected to greater transients than **telecommunication networks**.

[IEC 60950-1, definition 1.2.13.14]

3.1.10
service person
person having appropriate technical training and experience necessary to be aware of hazards to which that person may be exposed in performing a task and of measures to minimize the risks to that person or other persons

[IEC 60950-1, definition 1.2.13.5]

3.1.11
user
any person, other than a **service person**

[IEC 60950-1, definition 1.2.13.6]

3.2 Definitions from IEC 60950-21

3.2.1
RFT circuit
remote feeding telecommunication circuit
a **secondary circuit** within the equipment, intended to supply or receive d.c. power via a **telecommunication network** at voltages equal to or exceeding the limits for **TNV circuits**, and on which overvoltages from **telecommunication networks** are possible

[IEC 60950-1, definition 3.1]

3.2.2
RFT-C circuit
an **RFT circuit** which is so designed and protected that under normal operating conditions and single fault conditions, the currents in the circuit do not exceed defined values

[IEC 60950-1, definition 3.2]

3.2.3
RFT-V circuit
an **RFT circuit** which is so designed and protected that under normal operating conditions and single fault conditions the voltages are limited and the accessible area of contact is limited

[IEC 60950-1, definition 3.3]

3.3 Additional definitions for this document

3.3.1
antenna interface
a port for connection of a radio frequency antenna to equipment

3.3.2
coaxial cable interface
a port for connection of a coaxial cable providing for asymmetrical transmission to equipment

NOTE In this technical report the use of both indoor and outdoor coaxial cables is considered separately.

3.3.3
network termination point
the physical point at the boundary of a network intended to accept the connection of a terminal equipment or to be interconnected to another network

3.3.4
paired conductor interface
a port for connection of a cable providing for symmetrical transmission (for example, twisted pair) to equipment

NOTE In this technical report the use of both indoor and outdoor twisted pair cables is considered separately.

3.3.5
terminal connection point
the physical point of the terminal equipment intended to be connected to a network

3.4 Abbreviations

For the purposes of this technical report, the following abbreviations apply to Clause 4, Annex B and Annex C:

ADSL	Asymmetric Digital Subscriber Line
DLL	Digital Local Line
DSL	Digital Subscriber Line
ESD	Electrostatic Discharge
HPNA	Home Phone-Line Networking Architecture
ISDN	Integrated Services Digital Network
KYBD	Keyboard
LAN	Local Area Network
LEPM	Primary Multiplex
LPZ	Lightning Protection Zone
LTU	Line termination unit
NCP	Network Connection Point
NO	Network Operator
NT	Network Termination
NTBA	Network Termination, Basic Access
NTP	Network Termination Point
NTU	Network Terminating Unit
PABX	Private Automatic Branch Exchange
PC	Personal Computer
PCM	Pulse Code Modulation
PNO	Public Network Operator
POTS	Plain Old Telephone Service
PSTN	Public Switched Telephone Network
RFT	Remote Feeding Telecommunication
RPS	Remote Power Supply
RS	Recommended Standard
SDH	Synchronous Digital Hierarchy
TA	Terminal Adapter
TCP	Terminal Connection Point
TE	Terminal Equipment
USB	Universal Serial Bus
VGA	Video Graphics Array
ZWRBA	Regenerator, Basic Access

4 Reference configuration

Figure 1 illustrates a hypothetical configuration of "network clouds" giving examples of the types of equipments covered by this technical report. Certain of these equipments will only have one or two interface types, others may have many. Certain of the "network clouds" will be elements within the PSTN (where the possibility of more than one network operator exists) and others may be private networks. The equipment connected to this "network cloud" and part of the "network cloud" itself can be any type covered by the scope of this technical report.

This technical report provides a framework for safety requirements and protection levels by reference to the particular examples given in Figures 1 and 2. Configurations not covered should be treated using the same principles.

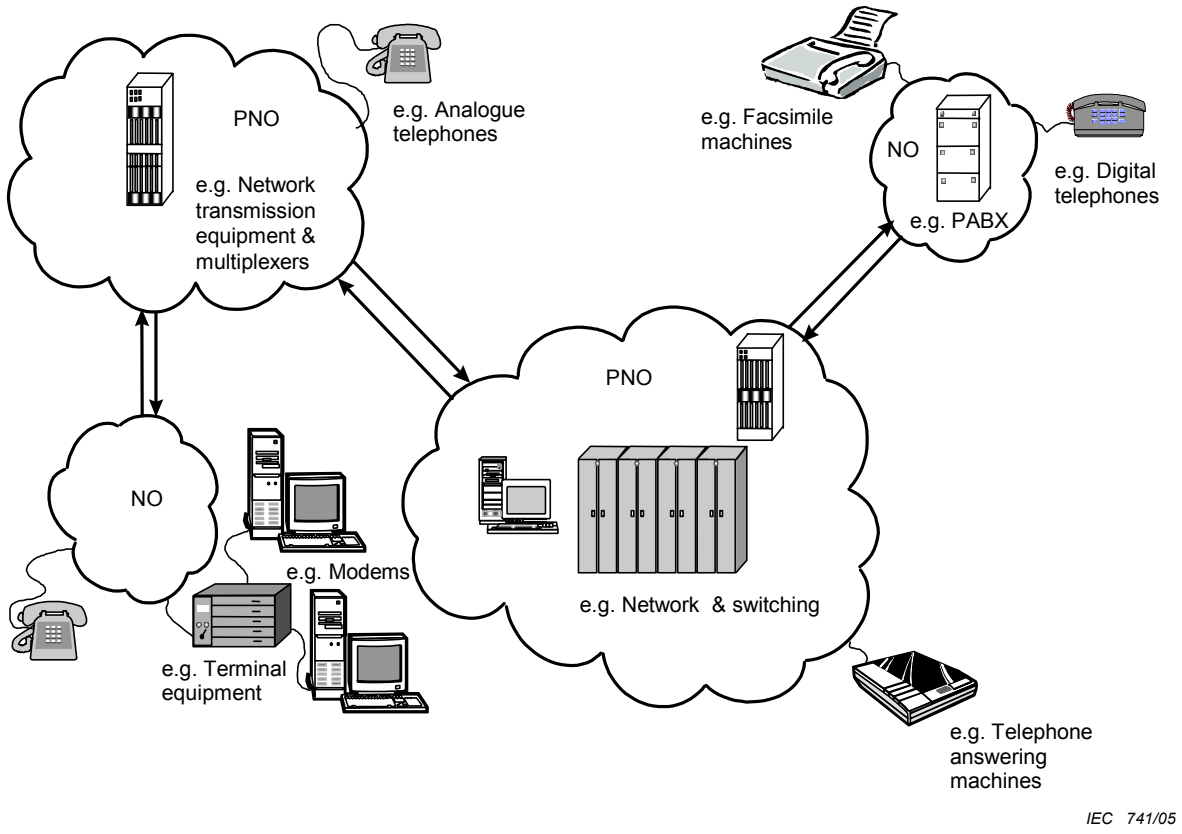
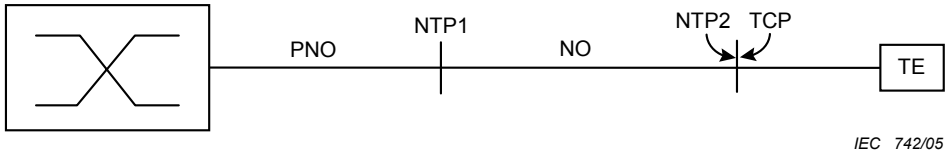


Figure 1 – Reference configuration

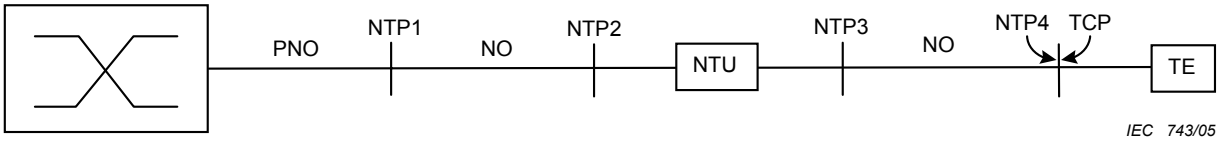
Where, in a practical situation, an equipment has two or more interfaces of different types, it is normally necessary to provide safety separation within the equipment between those interfaces in accordance with IEC 60950-1 and IEC 60950-21.

Figure 2 illustrates examples of possible network configurations. Included are some of the network elements involved in such networks and an indication of the various commercial organizations, both Public Network Operators (PNOs) and Network Operators (NOs) generally (public or private) that are involved in providing network infrastructures to service the end customer.

Example 1



Example 2



Example 3

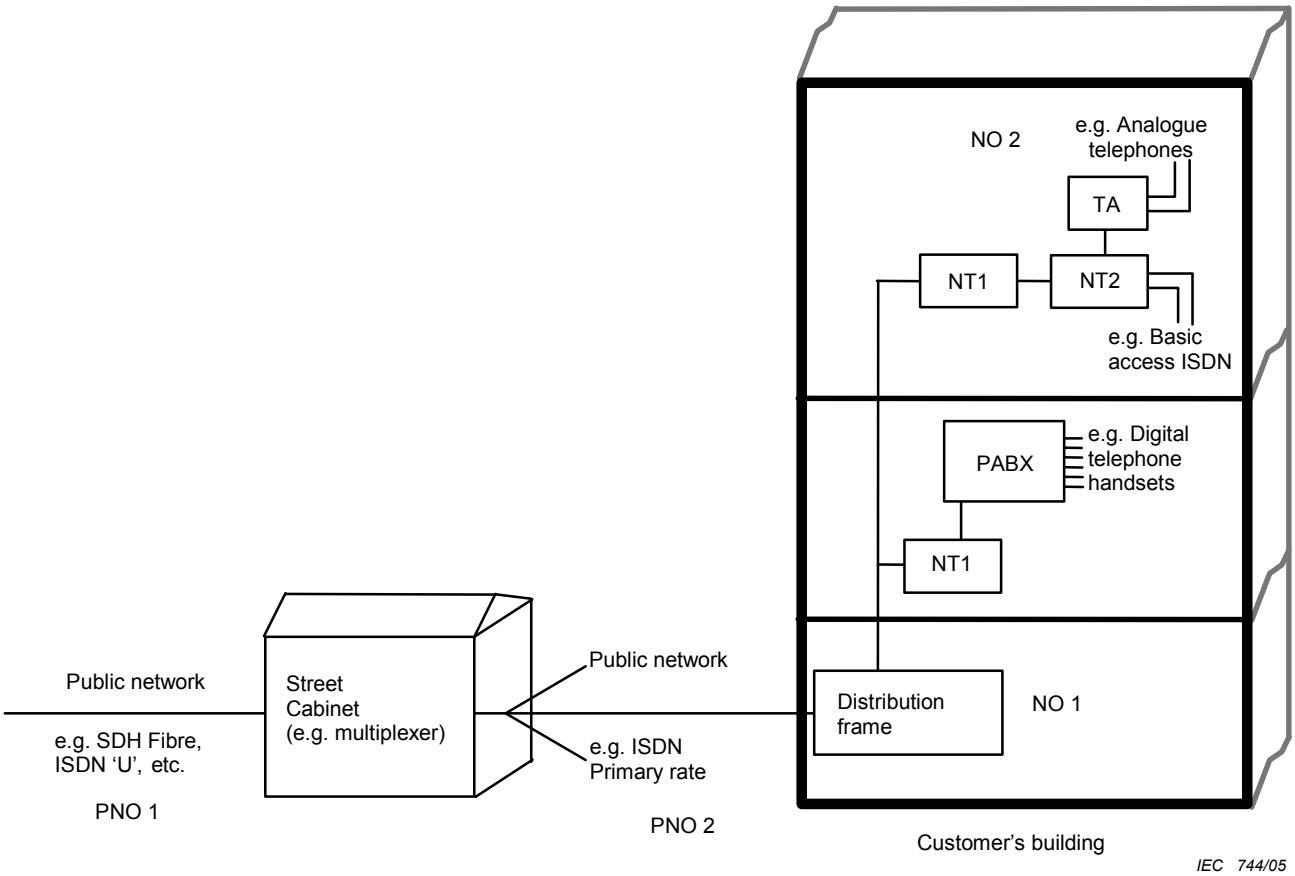


Figure 2 – Examples of network configurations

5 Safety categories of interfaces provided for connection to an information and communications technology network

NOTE Both **primary circuits** and **secondary circuits** can be subject to transient overvoltages. Refer to IEC 60950-1.

5.1 SELV circuits

The requirements for **SELV circuits** are as specified in IEC 60950-1.

5.2 TNV circuits

The requirements for **TNV circuits** are as specified in IEC 60950-1. **TNV circuits** are further sub-divided into **TNV-1 circuits**, **TNV-2 circuits** and **TNV-3 circuits,** depending on their nominal operating voltage and on the likelihood of their being subject to overvoltages.

5.3 User information

The safety classification (for example, **SELV circuit**, **TNV-1 circuit**, **TNV-2 circuit** or **TNV-3 circuit**) of ports for networks, and any restrictions applicable to the network topology (for example, whether they are in a Network Environment 0 or Network Environment 1, see 6.1 and 6.2) are to be stated in the manufacturer's documentation supplied with the equipment if confusion could result in a safety hazard (see 1.7.2 of IEC 60950-1).

NOTE Depending on the design of the interface, it is possible for one port to be suitable for connection to more than one type of circuit in other equipment. For example, consider circuitry in an equipment which meets the requirements for a **SELV circuit** and where the telecommunication interface port is separated from this circuitry in accordance with 6.2.1 of IEC 60950-1; this telecommunication interface port would be suitable for connection to either a **SELV circuit** or a **TNV-1 circuit**.

For equipment intended to be installed by the **user** it is recommended to either:

– provide telecommunication interface ports with circuitry intended for connection to a Network Environment 1 (for example, a **TNV-1 circuit** instead of a **SELV circuit,** or a **TNV-3 circuit** instead of a **TNV-2 circuit**); or

– provide sufficient information in the instructions to the **user** to avoid connection to a **telecommunication network** in a Network Environment 1.

5.4 RFT circuits

The requirements for **RFT circuits** are as specified in IEC 60950-21.

6 Phenomena affecting the safety of interface ports

Annex A identifies a number of phenomena, some of which can affect a **telecommunication network** in such a way that an overvoltage can be induced and transmitted to the interface port of the equipment. These phenomena are typically independent of the normal operating voltage on the circuit, but can be affected by the circuit impedance.

To determine the safety status of circuits within the equipment for connection to a particular network it is necessary to know:

– the normal operating voltage on the circuit (due to the circuit under consideration and any voltages coming from the **telecommunication network**);

– the severity and frequency of overvoltages;

– if the circuit presents an energy hazard;

– if the circuit is supplied from a limited power source.

6.1 Network Environment 0

A **telecommunication network** is considered to be in a Network Environment 0 if the following conditions apply to all parts of that network:

a) the possible effect of indirect lightning has been reduced (for details see Annex C, point 1);

b) the possibility of having different earth potentials has been reduced (for details see Annex C, point 2);

c) the possibility of power cross/contact has been reduced (for details see Annex C, point 3);

d) the possibility of induced transients and voltages has been reduced (for details see Annex C, points 4 and 5).

6.2 Network Environment 1

A **telecommunication network** is considered to be in a Network Environment 1 if one or more of the requirements for a Network Environment 0 are not fulfilled.

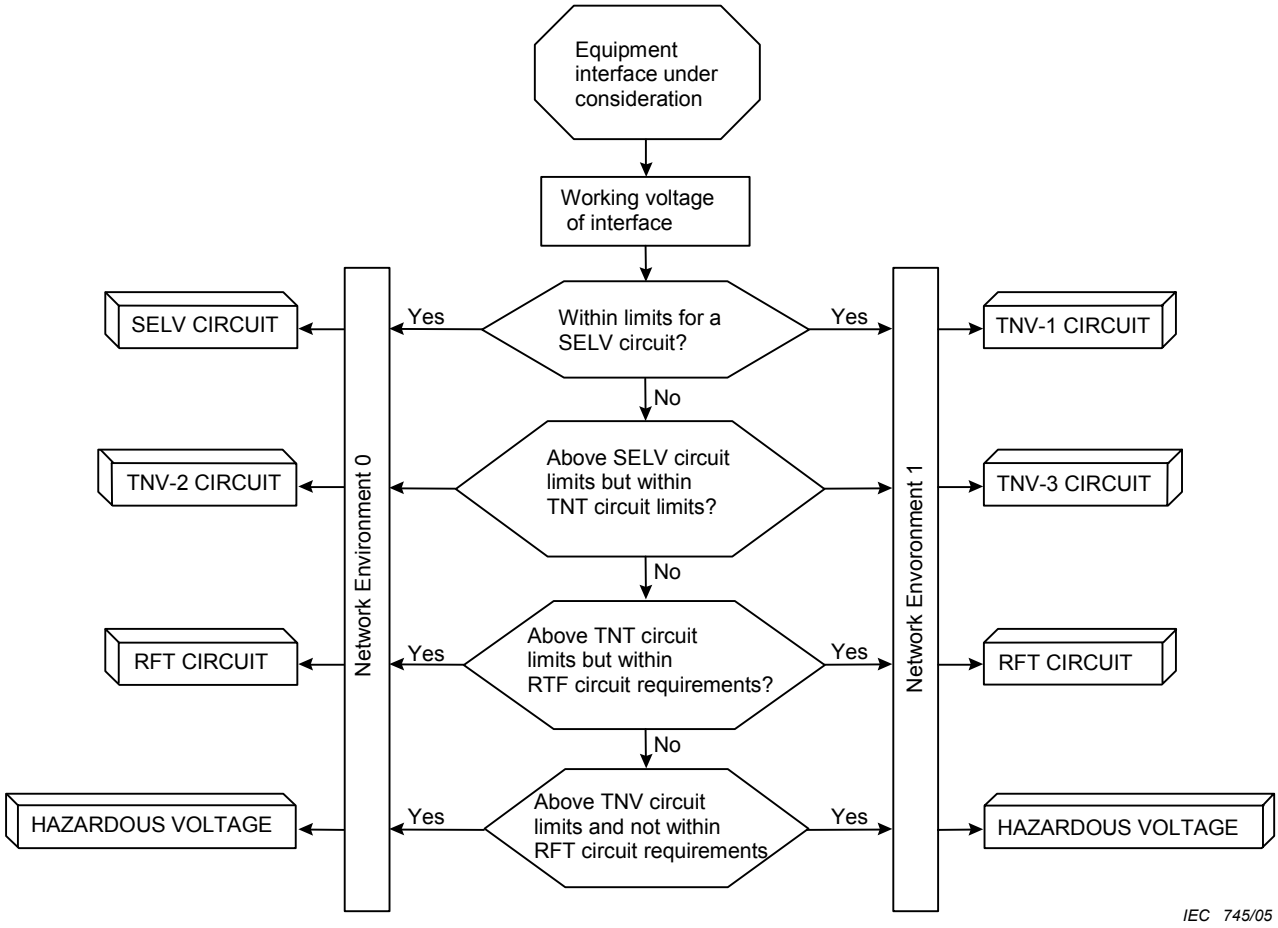
7 Determination of circuit type

In order to determine which circuit type is applicable to a particular interface it is necessary to know:

– the operating voltage (or current for certain circuits) under normal and single fault conditions within the equipment; and

– if the network is a Network Environment 0 or a Network Environment 1.

This is shown in Figure 3.



NOTE 1 The requirements for separating **SELV circuits, TNV circuits** and **RFT circuits** from **hazardous voltages** are as specified in IEC 60950-1 and IEC 60950-21. A **hazardous voltage** can exist in a **primary circuit** or a **secondary circuit.**

NOTE 2 Characterization of circuit types involves more than the voltage characteristics used to illustrate networks, such as isolation method, current limits, energy limits, overvoltages and transients. Refer to the circuit requirements for proper details.

Figure 3 – Flowchart for determination of circuit type

Examples of certain network interfaces are shown in Annex B. Voltage ranges of SELV circuits and TNV circuits are indicated in Annex D.

Annex A
(informative)

Consideration of interface phenomenon

Table A.1 – Consideration of interface phenomenon

Phenomenon	Interface port to be covered	Existing standards/Other documents	Safety considerations
Normal operating voltage	Outdoor **paired conductor**		TNV-1 circuit (if within limits for a SELV circuit) or TNV-3 circuit (if within limits for a TNV-3 circuit), or RFT circuits (if within the limits of **RFT circuits**) due to induced overvoltages or hazardous voltage.
	Outdoor **coaxial cable**		TNV-1 circuit (if within limits for a SELV circuit) or TNV-3 circuit (if within limits for a TNV-3 circuit), due to induced overvoltages or hazardous voltage.
	Indoor **paired conductor**		Could be SELV circuit, TNV-1 circuit, TNV-2 circuit, TNV-3 circuit, or RFT circuits or hazardous voltage.
	Indoor **coaxial cable**		Could be SELV circuit, TNV-1 circuit, TNV-2 circuit, TNV-3 circuit or hazardous voltage.
	AC mains supply		Primary circuit, hazardous voltage.
	Outdoor **antenna**	IEC Guide 112	Covered by the surge test of IEC 60065, 10.1. Could be TNV-1 circuit (if within voltage limits for a SELV circuit) or TNV-3 circuit (if within limits for a TNV-3 circuit).
Induced disturbance due to lightning	Outdoor **paired conductor**		Network installation must limit transients to 1,5 kV per IEC 60950 series.
	Outdoor **coaxial cable**		Network installation must limit transients to 4,0 kV, if for signals, and 5,0 kV, if for powering repeaters, and 10 kV if connected to an outdoor antenna per IEC 60950 series.
	Indoor **paired conductor**	IEC 61312-1	Covered by 1,5 kV transient requirement of IEC 60950 series for TNV-1 circuits and TNV-3 circuits if the installation provides adequate protection means.
	Indoor **coaxial cable**	IEC 61312-1	Covered by 1,5 kV transient requirement of IEC 60950 series for TNV-1 circuits and TNV-3 circuits if the installation provides adequate protection means.
	AC mains supply		This is covered by IEC 60664-1.

Table A.1 *(continued)*

Phenomenon	Interface port to be covered	Existing standards/Other documents	Safety considerations
Direct lightning stroke	Outdoor **paired conductor**		The voltages expected as a result of a direct lightning stroke on a paired conductor cable are in excess of those considered by IEC 60950 series and so are beyond the scope of this technical report.
	Outdoor **coaxial cable**		Covered by earthing practices of the network operator which are beyond the scope of this technical report.
	Antenna		Outdoor antennas require protective earthing, the provision of which is covered by earthing practices of the network operator or the national code which are beyond the scope of this technical report.
Induced by electric power and traction systems	Outdoor **paired conductor**		Requirements of ITU-T Directives, volume VI, were considered when writing IEC 60950 series and so no further action is required for TNV-1 circuits, TNV-3 circuits and RFT circuits.
	Outdoor **coaxial cable**		Requirements of ITU-T Directives, volume VI, were considered when writing IEC 60950 series and so no further action is required for TNV-1 circuits and TNV-3 circuits.
ESD			Beyond the scope of this technical report.
Surges due to high voltage switching	AC mains supply	IEC 60664-1	Covered by IEC 60664-1.
Differences in earth potential	Outdoor **paired conductor**		Ensure that interfaces are separated from earth in accordance with 6.2.1 c) of IEC 60950-1.
	Outdoor **coaxial cable**		Ensure that either the installation meets ITU-T Recommendation K.27 or ITU-T Recommendation K.31, as applicable to the installation, or that interfaces are separated from earth in accordance with 6.2.1 c) of IEC 60950-1.
	Indoor **paired conductor**		Covered by consideration of Network Environment, which cross-refers to equipotential bonding per IEC 60364. For Network Environment 1, the interfaces should be treated as for outdoor paired conductors.
	Indoor **coaxial cable**		Covered by consideration of Network Environment, which cross-refers to equipotential bonding per IEC 60364. For Network Environment 1 the interfaces should be treated as for outdoor coaxial cables.

Phenomenon	Interface port to be covered	Existing standards/Other documents	Safety considerations
Power cross (direct contact)	Outdoor **paired conductor**	ITU-T Recommendations K.20, K.21	
	Outdoor **coaxial cable**		
Mains induced	Outdoor **paired conductor**		Ensure that the installation meets ITU-T Recommendation K.27 or ITU-T Recommendation K.31, as applicable to the installation.
	Outdoor **coaxial cable**		Ensure that the installation meets ITU-T Recommendation K.27 or ITU-T Recommendation K.31, as applicable to the installation.
	Indoor **paired conductor**		Ensure that the installation meets ITU-T Recommendation K.27 or ITU-T Recommendation K.31, as applicable to the installation.
	Indoor **coaxial cable**		Ensure that the installation meets ITU-T Recommendation K.27 or ITU-T Recommendation K.31, as applicable to the installation.

Annex B
(informative)

Worked examples of certain network interfaces

Table B.1 provides some worked examples of common network interfaces. This table recognizes that interfaces for information and communications technology networks are often standardized regionally or nationally, rather than internationally. It is not intended for this list to be exhaustive.

Table B.1 – Worked examples of certain network interfaces

Interface or connection point	Documents relevant for the interface	Approximate operating voltage	Earthing [a]	Network environment per Clause 6	IEC 60950 series circuit category
"48 V" station battery [b]	ETSI EN 300 132-2, ANSI T1.315-1994	max. -57 V d.c.	yes/no	0	**SELV**
"60 V" station battery [b]	ETSI EN 300 132-2	max. -75 V d.c.	yes/no	0	**TNV-2**
1394a	IEEE 1394a and 1394-1995 (IEEE 1394ta)	30 V d.c.	yes	0	**SELV**
1394b	IEEE 1394b (IEEE 1394ta)	30 V d.c.	no	1	**TNV-1**
Analogue PSTN 48 V battery	ETSI EN 300 001 ETSI TBR21	-57 V d.c. 80 V [c] a.c.	yes/no	1	**TNV-3**
Analogue PSTN 60 V battery	ETSI EN 300 001 ETSI TBR 21	-75 V d.c. 80 V a.c. [c]	yes/no	1	**TNV-3**
Centronics/ parallel interface (PC)	Manufacturer's specification	5 V d.c.	yes/no	0	**SELV** [d]
[Unstructured] E1	ETSI EN 300 416, ETSI EN 300 247	± 2 V d.c.	no	1/0	**TNV-1/SELV** [d]
Ethernet 10Base2	ISO/IEC 8802-3	± 2 V d.c.	no	0	**SELV**
Ethernet 10Base5	ISO/IEC 8802-3	± 2 V d.c.	no	1	**TNV-1**
Ethernet 10BaseT	ISO/IEC 8802-3	± 2 V d.c.	no	0	**SELV**
G.703	ITU T Rec. G.703	± 3 V d.c.	yes/no	1/0	**TNV-1/SELV** [d]
HPNA	HPNA 1M8 PHY spec	80 V a.c. -75 V d.c.	yes/no	1	**TNV-3**
ISDN DLL (former ISDN UK0)	ETSI TS 102 080	115 V d.c.	yes/no	1	**TNV-3**
ISDN S0 bus	ETSI EN 300 012-1	40 V d.c.	no	1/0	**TNV-1/SELV** [d]
KYBD (PS/2, 6 pin DIN Type)	Manufacturer's specification	± 5 V d.c.	yes	0	**SELV**
LEPM V2M (LTU side)	ETSI EN 300 233 ITU-T Rec. G.703	± 3 V d.c.	no	0	**SELV**
Monitor (VGA DB-15 connector)	Manufacturer´s specification	5 V d.c.	yes	0	**SELV**
MOUSE (PS/2, 6 pin DIN Type)	Manufacturer´s specification	± 5 V d.c.	yes	0	**SELV**
PCM11TA Tln (NTU side) Analogue PSTN	ETSI EN 300 001 ETSI TBR 21	31 V d.c. 40 V a.c. [c]	no	1	**TNV-3**
PCM11V A Tln (LTU side)	ETSI EN 300 001 ETSI TBR 21	-75 V d.c. 80 V a.c. [c]	yes	0	**TNV-2**

Table B.1 – (*continued*)

Interface or connection point	Documents relevant for the interface	Approximate operating voltage	Earthing [a]	Network environment per Clause 6	IEC 60950 series circuit category
PCM11VA SISA (LTU side)	QD2 TS 0076/96	± 1,5 V d.c.	yes	0	**SELV**
PCM11VA UB (LTU side)	ETSI EN 300 132-2	-75 V d.c.	yes	0	**TNV-2**
PCM2FA UK0	ITU-T Rec. G.703	115 V d.c.	no	1	**TNV-3**
PCM2TA TIn (NTU side)	ETSI EN 300 001 ETSI TBR 21 ETSI EN 300 659-2	31 V d.c. 40 V a.c. [c]	no	1	**TNV-3**
PCM2TA UK0 (NTU side)	ITU-T Rec. G.703	115 V d.c.	no	1	**TNV-3**
PCM2VA TIn (LTU side)	ETSI EN 300 001 ETSI TBR 21	-75 V d.c. 80 V a.c. [c]	yes	0	**TNV-2**
PCM2VA UK0 (LTU side)	ITU-T Rec. G.703	115 V d.c.	no	1	**TNV-3**
RFT-C Remote power feeding	IEC 60950-21	<1 500 V d.c.; 60 mA	yes/no	1	**RFT-C**
RFT-V Remote power feeding	IEC 60950-21	100 VA ± 200 V d.c. leakage current 10 mA by 10 kΩ after 10 s	yes/no	1	**RFT-V**
RFT-V Remote power feeding	IEC 60950-21	100 VA +140 V d.c.	yes/no	1	**RFT-V**
RPS Remote power supply	IEC 60950-21	110 V d.c.	no	1	**TNV-3**
RS 232 C/V.28	ITU-T Rec. V.28	± 15 V d.c.	yes/no	0	**SELV**
RS 422	ITU-T Rec. V.11	± 6 V d.c.	yes/no	1/0	**TNV-1/SELV** [d]
RS 423	ITU-T Rec. V.10	± 6 V d.c.	yes/no	1/0	**TNV-1/SELV** [d]
RS 485	ITU-T Rec. V.11	± 6 V d.c.	yes/no	1/0	**TNV-1/SELV** [d]
SCSI (standard, wide and ultrawide)	Small computer system interface (STA)	5 V d.c.	yes	0	**SELV**
USB (Universal Serial Bus)	Manufacturer's specification USB 1.0 or 2.0	± 5 V d.c.	no	0	**SELV**
V 5.1	ETSI EN 300 324-1	± 3 V d.c.	no	1	**TNV-1**
V 5.2	ETSI EN 300 347-1	± 3 V d.c.	no	1	**TNV-1**
Video interface (PC)	Manufacturer's specification	5 V d.c.	yes/no	0	**SELV**
X26/V10	ITU-T V.10	± 6 V d.c.	yes/no	1/0	**TNV-1/SELV** [d]
X27/V11	ITU-T V.11	± 6 V d.c.	yes/no	1/0	**TNV-1/SELV** [d]
xDSL	IEC TS 62367	<28 V a.c. peak	no	1	**TNV 1**
xDSL over ISDN or with power feeding for underlying or embedded systems/services	IEC TS 62367	<120 V d.c. + xDSL	no	1	**TNV 3**

Table B.1 – (*continued*)

Interface or connection point	Documents relevant for the interface	Approximate operating voltage	Earthing [a]	Network environment per Clause 6	IEC 60950 series circuit category
xDSL over POTS	IEC TS 62367	<75V d.c./ 90V a.c. + xDSL	no	1	**TNV 3**
USB, 1394a, VGA, KYBD, MOUSE and SCSI interfaces port all system power to the peripheral, hub or switch attached. Common designs provide a fuse or protective component that makes the circuit a limited power circuit. A “yes” in the "Earthing" column indicates that the interface is functionally earthed or provided with an earthed shield. Some PC audio circuits with integral amplifiers exceed the open circuit voltage limits of SELV. Consistent with IEC 60065, these outputs meet SELV limits when tested with typical speaker impedance networks. Voltage due to wire sharing with analogue PSTN and/or DSL. HPNA contribution <5 V.					
NOTE 1 The referenced document in column two may not contain the actual interface name as stated in column one, but may describe an equivalent interface. NOTE 2 **SELV** derived from an **a.c. mains supply** with capacitive filtering is considered to have insignificant transient levels. NOTE 3 In the United States, a network telecommunications conductor is considered to be Network Environment 1 when there is a possibility of accidental contact with an **a.c. mains supply** operating at greater than 300 V r.m.s. with respect to earth.					
[a] FPE (functional and protective earth), if not marked in table. [b] Interface for DC powering of any other equipment, for example, datacom equipment in telecommunication facilities, is also covered in ETSI EN 300 132-2. [c] Ringing signal. [d] Additional information may need to be provided by manufacturers, see 5.3.					

Annex C
(informative)

Conditions for Network Environment 0

1) The possible effect of indirect lightning (for example, lightning that does not directly strike the network conductors but which nevertheless induces a voltage in them) has been reduced by measures described in IEC 61312-1, protection zone LPZ 1.
2) The possibility of having different earth potentials existing at different points on the network has been reduced to a level where electric shock is unlikely, for example, by connecting all equipment within the network to the same equipotential bonding system (see IEC 60364).

   NOTE 1 Although an equipotential zone provides protection of people from electric shock, it does not necessarily protect the interconnecting cables from overcurrents. These overcurrents can cause overheating with the resultant risk of fire. Examples of measures that may be applied to prevent such overcurrents include reducing the level of potential difference by suitable building cable practice (see ITU-T Recommendation K.27 or ITU-T Recommendation K.31, as applicable to the installation) and isolation of the equipment interfaces from earth.

   NOTE 2 In the United States, a network telecommunications conductor is considered to be Network Environment 1 when there is a possibility of accidental contact with an **a.c. mains supply** operating at greater than 300 V r.m.s. with respect to earth.
3) The possibility of power cross/contact between the network and the **a.c. mains supply** is unlikely, for example, by preventing such an occurrence by appropriate installation practices or by ensuring that either the conductors of the **a.c. mains supply**, or the conductors of the network, or both, are insulated for the highest working voltage of the **a.c. mains supply**, as described in IEC 60364.
4) The possibility of **mains**-induced transients, surges and power faults, due to capacitive, inductive or common impedance coupling is unlikely due to electrical isolation from, and physical co-ordination of, the network conductors and the wiring of the **a.c. mains supply**.
5) The possibility of voltages induced by electrical traction is unlikely due to there being sufficient distance between the **telecommunication network** and such traction systems.

Annex D
(informative)

Voltage ranges of SELV circuits and TNV circuits

Table D.1 – Voltage ranges of SELV circuits and TNV circuits

Overvoltage from telecommunication network possible?	Normal operating voltage	
	Within SELV circuit limits	Exceeding SELV circuit limits but within TNV circuit limits
Yes	**TNV-1 circuit**	**TNV-3 circuit**
No	**SELV circuit**	**TNV-2 circuit**
NOTE Refer to IEC 60950-1 for further information.		

Bibliography

IEC 60065, *Audio, video and similar electronic apparatus – Safety requirements*

IEC 60364: (all parts), *Electrical installations of buildings*

IEC 60664-1, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

IEC 61312-1, *Protection against lightning electromagnetic impulse – Part 1: General principles*

IEC 62151 *Safety of equipment electrically connected to a telecommunication network*

IEC 62367, *Safety aspects for xDSL signals on circuits connected to telecommunication networks (DSL: Digital Subscriber Line)*

IEC Guide 112, *Guide on the safety of multimedia equipment*

ISO/IEC 8802-3, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications*

ITU-T Recommendation G.703, *Physical /electrical characteristics of hierarchical digital interfaces*

ITU-T Recommendation K.20, *Resistibility of telecommunication equipment installed in a telecommunications centre to overvoltages and overcurrents*

ITU-T Recommendation K.21, *Resistibility of telecommunication equipment installed in customer premises to overvoltages and overcurrents*

ITU-T Recommendation K.27, *Bonding configurations and earthing inside a telecommunication building*

ITU-T Recommendation K.31, *Bonding configurations and earthing of telecommunication installations inside a subscriber's building*

ITU-T Recommendation V.10, *Electrical characteristics for unbalanced double-current interchange circuits operating at data signalling rates nominally up to 100 kbit/s*

ITU-T Recommendation V.11, *Electrical characteristics for balanced double-current interchange circuits operating at data signalling rates up to 10 Mbit/s*

ITU-T Recommendation V.28, *Electrical characteristics for unbalanced double-current interchange circuits*

ANSI T1.315-2001, *Telecommunications – Voltage Levels for DC-Powered Equipment – Used in the Telecommunications Environment*

Deutsche Telekom AG, TS 0076/96, *QD2-Interface*

ETSI EN 300 001, *Attachments to the Public Switched Telephone Network (PSTN); General technical requirements for equipment connected to an analogue subscriber interface in the PSTN*

ETSI EN 300 012-1, *Integrated Services Digital Network (ISDN); Basic User Network Interface (UNI); Part 1: Layer 1 specification*

ETSI EN 300 132-2, *Environmental Engineering (EE); Power supply interface at the input to telecommunications equipment; Part 2: Operated by direct current (dc)*

ETSI EN 300 233, *Integrated Services Digital Network (ISDN); Access digital section for ISDN primary rate*

ETSI EN 300 247, *Business Telecommunications (BT); Open Network Provision (ONP) technical requirements; 2 048 kbit/s digital unstructured leased line (D2048U) Connection characteristics*

ETSI EN 300 324-1, *V interfaces at the digital Local Exchange (LE); V5.1 interface for the support of Access Network (AN); Part 1: V5.1 interface specification*

ETSI EN 300 347-1, *V interfaces at the digital Local Exchange (LE); V5.2 interface for the support of Access Network (AN); Part 1: V5.2 interface specification*

ETSI EN 300 416, *Network Aspects (NA); Availability Performance of Path Elements of International Digital Paths*

ETSI EN 300 659-2, *Access and Terminals (AT); Analogue Access to the Public Switched Telephone Network (PSTN); Subscriber Line Protocol over the Local Loop for Display (and Related) Services; Part 2: Off-Hook Data Transmission*

ETSI TBR 21, *Attachment requirements for pan-European approval for connection to the analogue Public Switched Telephone Networks (PSTNs) of TE (excluding TE supporting the voice telephony service) in which network addressing, if provided, is by means of Dual Tone Multi Frequency (DTMF) signalling*

ETSI TS 102 080, *Transmission and Multiplexing (TM); Integrated Services Digital Network (ISDN) basic rate access; Digital transmission system on metallic local lines*

IEEE 1394 series, *Standard for a High Performance Serial Bus*

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