इंटरनेट मानक

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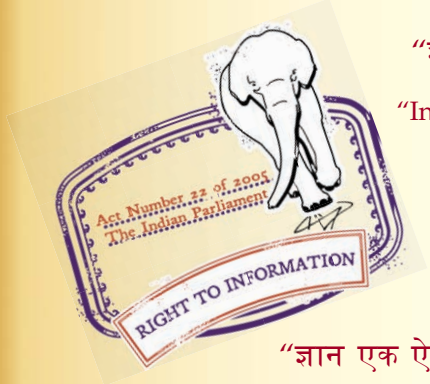
IS 15572 (2005): Audio, Video and Audiovisual Systems - Interconnections and Matching Values - Preferred Matching Values of Analogue Signlas [LITD 7: Audio, Video and Multimedia Systems and Equipment]



"ज्ञान से एक नये भारत का निर्माण"
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"ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है"
Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

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IS 15572 : 2005
IEC 61938 (1996)
[Superseding IS 9302 (Part 10) : 1980]

भारतीय मानक

ऑडियो, विडियो एवं ऑडियोविजुअल तंत्र — अंतरासंयोजन एवं मैचिंग मान — समधर्मी संकेतों के अधिमान्य मैचिंग मान

Indian Standard

AUDIO, VIDEO AND AUDIOVISUAL SYSTEMS — INTERCONNECTIONS AND MATCHING VALUES — PREFERRED MATCHING VALUES OF ANALOGUE SIGNALS

ICS 33.160.01

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

June 2005

Price Group 8

NATIONAL FOREWORD

This Indian Standard which is identical with IEC 61938 (1996) 'Audio, video and audiovisual systems — Interconnections and matching values — Preferred matching values of analogue signals' issued by the International Electrotechnical Commission (IEC) was adopted by the Bureau of Indian Standards on the recommendations of the Acoustics and Recording Sectional Committee and approval of the Electronics and Telecommunication Division Council.

Existing IS 9302 (Part 10) : 1980 'Characteristics and methods of measurements for sound system equipment: Part 10 Preferred matching values for the interconnection of sound system components' is based on IEC 60268-15 which has been withdrawn and replaced by IEC 61938. This revision has been undertaken to harmonize the Indian Standard with the IEC Standard.

The text of the IEC Standard has been approved as suitable for publication as an Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.

b) Comma (.) has been used as a decimal marker while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

In this adopted standard, reference appears to certain International Standards for which Indian Standards also exist. The corresponding Indian Standards which are to be substituted in their places are listed below along with their degree of equivalence for the editions indicated:

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
IEC 38 (1983) IEC standard voltages — Part 1 : General conditions and requirements	IS 12360 : 1988 Voltage bands for electrical installations including preferred voltages and frequency	Technically equivalent
IEC 107-6 (1989) Recommended methods of measurement on receivers for television broadcast transmission — Part 6 : Measurement under conditions different from broadcast signal standards	IS 4545 (Part 11) : 1992 Methods of measurement on receivers for television broadcast transmissions: Part 11 Measurement under conditions different from broadcast signal standards	Identical
IEC 268-5 (1989) Sound system equipment — Part 5 : Loudspeakers	IS 9302 (Part 4) : 2005 Sound system equipment: Part 4 Loud-speakers (*first revision*)	do
IEC 268-7 (1984) Sound system equipment — Part 7 : Headphones and headsets	IS 9302 (Part 6) : 2005 Sound system equipment: Part 6 Headphones and earphones (*first revision*)	do
IEC 617[1)] (All Parts) Graphical symbols for diagrams	IS 12032 (All Parts) Graphical symbols for diagrams in the field of electrotechnology	do

[1)] Since revised.

(*Continued on third cover*)

Indian Standard

AUDIO, VIDEO AND AUDIOVISUAL SYSTEMS — INTERCONNECTIONS AND MATCHING VALUES — PREFERRED MATCHING VALUES OF ANALOGUE SIGNALS

1 General

1.1 *Scope*

This International Standard applies to electrical matching values for the interconnection of analogue signals amongst audio, video and AV system equipment.

This standard includes audio but not video signals for broadcast and similar use. Interconnections using the 21 contact connector described in IEC 807-9 are not included in this standard.

Matching values for vehicle applications are excluded.

For the interconnection of digital signals, it is necessary to refer to IEC 958.

NOTE – A diagram showing possible interconnections, with cross-references to the appropriate clauses, is given in figure 1.

1.2 *Normative references*

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents listed below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 27: *Letter symbols to be used in electrical technology*

IEC 38: 1983, *IEC standard voltages, Part 1: General conditions and requirements*

IEC/DIS 50(723): *International Electrotechnical Vocabulary (IEV) – Chapter 723: Broadcasting: Sound, television and data*

IEC 94-2: 1994, *Magnetic tape sound recording and reproducing systems – Part 2: Calibration tapes*

IEC 107-6: 1989, *Recommended methods of measurement on receivers for television broadcast transmission – Part 6: Measurement under conditions different from broadcast signal standards*

IEC 268-5: 1989, *Sound system equipment – Part 5: Loudspeakers*

IEC 268-7: 1984, *Sound system equipment – Part 7: Headphones and headsets*

IEC 268-11: 1987, *Sound system equipment – Part 11: Application of connectors for the interconnection of sound system components*

IEC 268-12: 1987, *Sound system equipment – Part 12: Application of connectors for broadcast and similar use*

IEC 417: 1973, *Graphical symbols for use on equipment*

IEC 617: *Graphical symbols for diagrams*

IEC 807-9: 1993, *Rectangular connectors for frequencies below 3 MHz – Part 9: Detail specification for a range of peritelevision connectors*

IEC 958: 1989, *Digital audio interface*

IEC 1293: 1994, *Marking of electrical equipment with ratings related to electrical supply – safety requirements*

ISO/IEC 2382-9: 1995, *Data processing – Vocabulary – Part 9: Data communication*

ITU-R BT.470-4: 1995, *Television systems*

2 General conditions and definitions

2.1 *General conditions*

All voltages are r.m.s. voltages, unless otherwise indicated.

Impedances of audio circuits are valid in the frequency range of 20 Hz to 20 kHz, unless otherwise indicated.

2.2 *Definitions*

For the purposes of this International Standard, the following definitions apply:

2.2.1 **luminance signal:** An electrical signal representing the luminance of the television picture elements. [IEV 723-05-56]

2.2.2 **chrominance signal:** An electrical signal that is associated with the luminance signal to convey colour information. In practice this signal is made up of two components. [IEV 723-05-57]

2.2.3 **Y" signal, VBS signal:** The Y" signal is a combined signal consisting of

- a luminance signal;
- blanking and synchronizing signals.

NOTE – The Y" signal equals the composite video signal (CVBS signal) without the C" signal.

2.2.4 **colour signal, C" signal:** A chrominance signal with burst signal included, modulated on a subcarrier.

2.2.5 **blanking signal:** Signal used to control the suppression of the signal conveying picture information during certain parts of the scanning period, for example, during fly-back. [IEV 723-05-37]

2.2.6 **synchronizing signal:** A signal used to determine the timing for the scanning processes in transmission and reception. [IEV 723-05-36]

2.2.7 **composite video signal, composite video blanking synchronization or CVBS signal:** The composite video signal is a combined signal consisting of:

- a luminance signal;
- a colour signal;
- blanking and synchronizing signals.

2.2.8 **interface:** A shared boundary between two pieces of equipment, defined by functional characteristics, common physical interconnection characteristics, signal characteristics and other characteristics, as appropriate. [ISO/IEC 2382-9, modified]

2.2.9 **minimum output voltage:** The voltage measured across the rated load impedance of a piece of equipment, and related to a minimum input signal limited by signal to noise ratio.

2.2.10 **maximum output voltage:** The voltage measured across the rated load impedance of a piece of equipment and related to a maximum input signal limited by non-linearity.

2.2.11 **rated source impedance:** The internal impedance, stated by the manufacturer, of the source supplying the signal to the piece of equipment. Unless otherwise specified, the rated source impedance is assumed to be a constant pure resistance.

NOTES

1 The manufacturer may also give the range of source impedances which he considers tolerable in practice.

2 Multiple values, or a range of values, may be specified, providing the corresponding rated (distortion-limited) output voltages and/or powers are also stated.

2.2.12 **input impedance:** The internal impedance measured between the input terminal and its corresponding return of the piece of equipment.

2.2.13 **rated source e.m.f.:** The e.m.f. specified by the manufacturer which, when connected to the input terminals in series with the rated source impedance, gives rated distortion-limited output voltage across the rated load impedance at an appropriate setting of the controls.

2.2.14 **minimum source e.m.f. for rated output voltage:** The e.m.f. which, when connected to the input terminals in series with the rated source impedance, gives rated output voltage across the rated load impedance with the volume control(s), if any, set for maximum gain and the tone control(s), if any, set as specified for rated conditions.

2.2.15 **rated load impedance:** The impedance, specified by the manufacturer, to which the output terminals are to be connected for measuring purposes. Unless otherwise specified by the manufacturer, the rated load impedance shall be assumed to be a constant pure resistance.

NOTE – Multiple values, or a range of values, may be specified, providing the corresponding rated (distortion-limited) output voltages and/or powers are also stated.

2.2.16 **output source impedance:** The internal impedance measured between the output terminal and its corresponding return under specified conditions.

2.2.17 **rated output voltage:** The voltage specified by the manufacturer, measured across the rated load-impedance of a piece of equipment.

2.2.18 **overload source e.m.f.:** The maximum source e.m.f. for which a piece of equipment, connected as for rated conditions and with an appropriate setting of the volume control, can deliver an output voltage 10 dB below the rated distortion limited output voltage without exceeding the rated total harmonic distortion.

3 Power supply

3.1 *Alternating current (a.c.) power supply voltages and frequencies*

For a.c. power supply voltages and frequencies, reference is made to IEC 38.

For special applications, for example ships and aircraft, other voltages and/or frequencies and the permissible tolerances are subject to agreement between manufacturers and users.

3.2 *Direct current (d.c.) power supply voltages*

DC power supply voltages and the permissible tolerances are given in table 1. The equipment should operate over the range of voltages given, but may not necessarily meet all of its specifications at the given limits.

Table 1 – Direct current (d.c.) power supply voltages and tolerances

Type of power supply	Rated voltage/cell V	Operating voltage/cell V		
		Lower limit	Normal voltage	Upper limit
Primary batteries				
– Alkali-Manganese, zinc chloride-zinc	1,5	1,0	1,5	1,65
– Lithium (organic electrolyte)	3,0	2,0	3,0	3,7
Secondary batteries:				
– Lead-acid, except vehicle batteries	2,0	1,8	2,0	2,2
– Lead-acid, vehicle batteries	2,0	1,8	2,4	2,6
– Nickel-cadmium	1,2	1,1	1,2	1,4

3.3 *Power supply feed for microphones*

Reference is made to 7.3, 7.4 and 7.5.

4 Interconnections

4.1 *Connections*

Signal cables shall have the appropriate electrical characteristics to permit the transfer of signals between the parts of a system without unacceptable impairment.

NOTE – The degree of impairment which is unacceptable depends on the system specification and the need to comply with other international standards, such as those concerning electromagnetic compatibility.

4.1.1 *Characteristics of cables*

The following characteristics of cables should be taken into account.

4.1.1.1 *Resistance of the conductors*

A resistance of less than one-hundredth of the load impedance is usually acceptable for loudspeaker connections. For other applications, values of one-tenth are acceptable.

NOTE – Long cables may therefore require conductors of larger cross-section area than those of short cables.

4.1.1.2 *Insulation resistance*

An insulation resistance of 50 MΩ is usually acceptable.

4.1.1.3 *Inductance of conductors*

This is normally only important for very long cables.

The acceptable value varies too widely to give more than general guidance. In the absence of particular requirements, the inductive reactance should not exceed one third of the load impedance at the highest frequency of interest.

NOTES

1 The inductance of an isolated single conductor (of typical length to diameter ratio of the type of cable normally used in these applications) is approximately 2 μH/m.

2 The requirement ensures less than approximately 1 dB loss at the highest frequency of interest.

4.1.1.4 *Capacitance between conductors*

The acceptable value varies too widely to give more than general guidance. For conductors carrying different audio signals, and in the absence of particular requirements, the capacitive reactance should exceed 1000 times the load impedance at the highest frequency of interest.

NOTE – This ensures that the relative crosstalk level is approximately –60 dB if the two conductors carry signals at similar levels.

4.1.1.5 *Capacitance from conductor to screen*

The acceptable value varies too widely to give more than general guidance. In the absence of particular requirements, the capacitive reactance should exceed three times the source impedance at the highest frequency of interest.

NOTE – This ensures less than approximately 1 dB loss at the highest frequency of interest.

4.1.1.6 *Characteristic impedance*

This is usually only important for high-frequency signals (such as digital signals in accordance with IEC 958).

4.1.1.7 *Continuity of screening*

In some applications, screening should be connected to contacts of connectors at both ends of the cable. In other cases, screening should be connected at one end of the cable only (for example to eliminate circulating currents). Cable and connector assemblies preferably should be marked to show which practice has been applied.

The screening of signal cables and connectors shall not be used as a means for the preservation of safety earth continuity for the prevention of electric shock hazard.

4.1.1.8 *Efficiency of screening*

The use of screening is meant to reduce the unwanted effects of electromagnetic disturbances, such as:

a) in reducing crosstalk between conductors in the same cable;

b) in reducing emission of unwanted signals from the cable;

c) in maintaining immunity from external signals entering via the cable.

NOTE – These characteristics are related, but good performance in one respect does not ensure good performance in another.

4.2 *Connectors*

For connectors used within the system, reference shall be made to the reference documents given in 1.2.

5 Marking and symbols for marking

5.1 *Marking*

Terminals and controls shall be adequately marked to give information regarding their function, characteristics and polarity.

The marking shall be such that it is possible to adjust the controls and to identify their positions with sufficient accuracy in connection with the information given in the user instructions.

5.2 *Symbols for marking*

Marking preferably should be composed of letter symbols, signs, numbers and colours, which are internationally intelligible. Reference is made to IEC 27, IEC 417, IEC 617 and IEC 1293.

Markings not included in the above-mentioned standards shall be clearly explained in the user instructions.

6 Electrical matching values

6.1 *General purpose output/input*

In order to preserve the maximum flexibility of use and compatibility in the design of equipment, all inputs of destination equipment, and all outputs of source equipment for general applications shall have the same specifications. These are termed "general purpose input/output".

The manufacturer may choose to designate some or all of these input/outputs for particular purposes, for example the general purpose input/output for audio signal would be designated for tuner, for tape recorder, or for auxiliary input, in order to simplify the operation, but the specification of all such inputs and outputs nevertheless shall be identical.

6.2 *General purpose audio output/input*

Values for general purpose audio input/output are given in table 2, and in accompanying notes.

Table 2 – General purpose matching values for audio signals

Table 2a – General purpose matching values for audio signals for audio-only interfaces for consumer equipment

Output (note 1)		Input	
	Matching values		Matching values
Output source impedance	≤ 2,2 kΩ	Rated source impedance	2,2 kΩ
Rated load impedance	22 kΩ	Input impedance	≥22 kΩ
Rated output voltage	0,5 V (note 2)	Rated source e.m.f.	0,5 V (note 5)
Minimum output voltage	0,2 V (note 3)	Minimum source e.m.f. for rated output voltage	0,2 V
Maximum output voltage	2 V (note 4)	Overload source e.m.f.	≥2,8 V (note 6)
For notes, see following pages.			

Table 2b – General purpose matching values for audio signals for professional (non-broadcasting) interfaces, and for interfaces on consumer equipment where audio and video signals are present on the same connector or cable

Output (note 1)		Input	
	Matching values		Matching values
Output source impedance	≤ 1 kΩ	Rated source impedance	1 kΩ
Rated load impedance	10 kΩ	Input impedance	≥10 kΩ
Rated output voltage	0,5 V (note 2)	Rated source e.m.f.	0,5 V (note 5)
Minimum output voltage	0,2 V (note 3)	Minimum source e.m.f. for rated output voltage	0,2 V
Maximum output voltage	2 V (note 4)	Overload source e.m.f.	≥2,8 V (note 6)
For notes, see following pages.			

NOTES to tables 2a and 2b

1 The output voltages are measured with the rated load impedance connected.

2 The value corresponds to:

a) – an aerial input level of 40 dB (pW) for FM radio tuners, i.e. 0,86 mV across 75 Ω or 1,73 mV across 300 Ω. The modulation factor is 54 %;

– an aerial input e.m.f. of 1 mV for AM radio tuners. The modulation factor is 30 %;

– a vision carrier input level of 70 dB (μV) for TV sound tuners, having the sound to vision carrier ratio of the relevant television system (see ITU-R BT.470-4). The modulation factor is 54 % for both AM and FM.

The modulation factor of the above signals is based on the average modulation factor of the relevant emissions, averaged over at least 15 s;

b) the output of a tape player or monitor, when reproducing a calibration tape in accordance with IEC 94-2;

c) the output of a digital audio source (see note 7), when reproducing a sinewave signal recorded at a level 12 dB below "full scale" (see note 4c) recorded digital signal;

d) a source level equal to the average level of the system in other cases.

3 The value corresponds to:

a) a level of 8 dB below the recording level given in 2b) above, in the case of a tape player or monitor;

b) the minimum source e.m.f. to the input of the system (8 dB below the rated source e.m.f.) in other cases.

The value as shown is not specified for tuners.

In the case of a digital audio source (see note 7), it is not necessary to define a minimum output voltage since it is directly related to the rated output voltage.

4 The value corresponds to:

a) the maximum r.f. input signal level and maximum modulation in the case of tuners. In some countries, FM emissions may exceed the rated maximum system deviation, while in others this is not permitted. AM emissions employing high-efficiency modulation techniques may produce at the receiver an audio output voltage corresponding to an apparent modulation of more than 100 %, up to approximately 150 %;

b) the maximum recording level in the case of a tape player or monitor;

c) the "full scale" level, which is the sinewave signal having positive and negative peak values represented by the digital values of 7FFFH and 8001H in a 16 bit system in the case of a digital audio source (see note 7). In the compact disc specification, these values correspond to a maximum (r.m.s.) analogue output voltage of 2 V ± 3 dB;

d) the input of the system when applying the overload source e.m.f. (12 dB above the rated source e.m.f.) in other cases.

5 In the case of a tape recorder, the value which produces the same intensity of the magnetic field as that of the calibration tape in accordance with IEC 94-2.

6 For inputs intended only for the connection of analogue sources, the value is greater than or equal to 2,0 V. For inputs intended for the connection of analogue outputs of digital audio sources (see note 7), the value is greater than or equal to 2,8 V.

7 The digital audio source may be a compact disc (CD) player, a digital audio tape (DAT/DCC) recorder or player, a television receiver with digital sound reception facilities or a receiver for digital audio broadcast (see note 8)

8 For NICAM receivers, the relationship between the levels of alignment level tones transmitted by the broadcasting authorities and the maximum digital coding level, and between the levels of alignment level tones in mono and stereo modes, may vary in different countries. See:

a) EBU Techn. SPB 424 (3rd. Ed.)

b) NICAM 728: Specification for two additional digital sound channels with system I television, IBA, BREMA and BBC, London 1988.

6.3 *General purpose video input/output*

Values for general purpose video input/output are given in table 3 and in accompanying notes.

Table 3 – General purpose matching values for video signals

Input/output	Matching values		
	NTSC	PAL	SECAM
Rated impedance (note 1)	75 Ω		
Composite video signal (note 2)	1 V_{p-p} ± 3 dB		
- Y' signal (notes 2, 5 and 6)	1 V_{p-p} ± 3 dB		
- C' signal (notes 3 and 6)	0,286 V_{p-p} ± 3 dB	0,3 V_{p-p} ± 3 dB	Not applicable
Primary colour (RGB) signal (note 4): difference between peak value and blanking level	0,7 V ± 0,1 V (notes 4 and 6)		
Superimposed d.c. component	–	0 to +2 V	

NOTES

1 The specified signal voltages should be measured under matched conditions.

2 Difference between peak white level and synchronizing level. Synchronizing level should comply with ITU-R BT.470-4, Table II and III. For the possible effects of non-standard synchronizing level, see IEC 107-6.

3 The values given in the table are the standard peak-to-peak amplitudes of the colour reference burst (for NTSC and PAL) and of the unmodulated D_B chrominance carrier (for SECAM). The corresponding amplitude for PAL 100/0/100/0 colour bars is 885 mV, and for NTSC 100/7,5/100/7,5 colour bars the amplitude is 835 mV.

4 For the analogue monochrome signals, the difference between any two primary colour signals and other parameters such as Y and vision colour signal shall not exceed 0,5 dB. The peak values of primary colour signals are those that give rise to a peak white luminance signal.

5 The Y' signal consists of the composite signal according to ITU-R Report 624-4 without the burst and chrominance signals or colour subcarrier.

6 The permitted tolerances on the component signal levels should not be applied differentially. For example, a degraded picture quality is likely if the Y' signal level is at the minimum limit of tolerance and the C' signal at the maximum limit.

7 Matching of microphones and amplifiers

7.1 *Microphones (excluding piezoelectric types)*

Matching values for microphones are given in table 4.

Table 4 – Matching values for microphones and amplifiers

Microphone	Amplifier	Matching values		
Output	Input for microphones	Electrodynamic microphones	Electrostatic microphones	
			Professional use air- and electret-dielectric microphones	Consumer use electret microphones
Rated impedance	Rated source impedance	200 Ω	200 Ω	1 kΩ
Rated load impedance	–	1 kΩ	1 kΩ	5 kΩ
–	Input impedance (note 1)	≥ 1 kΩ	≥ 1 kΩ	> 5 kΩ
Rated output voltage (note 2)	Rated source e.m.f.	0,2 mV	1,0 mV	2 mV
–	Minimum source e.m.f. for rated output voltage	0,08 mV	0,4 mV	0,8 mV
Maximum output voltage (note 3)	Overload source e.m.f. for broadcasting and sound reinforcement use (note 3)	0,2 V	1 V	NA
Maximum output voltage (note 4)	Overload source e.m.f. for household use (note 4)	20 mV	NA	200 mV

NOTES

1 The values of the impedance apply over the frequency range 40 Hz to 16 kHz.

2 In accordance to 11.2 of IEC 268-4.

a) the values given relate to 0,2 Pa sound pressure (80 dB (20 µPa) sound pressure level);

b) for close-talking microphones, the rated output voltage is related to 3 Pa sound pressure (104 dB (20 µPa) sound pressure level), and for this class of microphones, the values of output voltage should be 20 dB above those listed;

c) for electret microphones, the value varies from 0,2 mV to 2,0 mV, dependent on type;

d) for certain types of highly directional microphones the value may be as high as 100 mV.

3 Values given relate to 100 Pa sound pressure (134 dB (20 µPa) sound pressure level), taking into account a 6 dB higher microphone sensitivity. The requirement for overload source e.m.f. may be met by means of an adjustable attenuator built into the pre-amplifier, preceding the gain control.

4 Values given relate to 10 Pa sound pressure (114 dB (20 µPa) sound pressure level), taking into account a 6 dB higher microphone sensitivity. For mains operated household equipment the values given for broadcasting and sound reinforcement may be required to avoid overload under extreme conditions.

7.2 *Microphones with built-in amplifier*

These microphones may be equipped with an adjustable attenuator or an electronic gain control circuit.

The output characteristics should comply either with the values for the appropriate type of microphone or those for general purpose output/input of audio equipment (see 6.2).

7.3 *Power supply feed for electret microphones fed by a separate conductor*

Power supply voltage U = 1,5 V to 12 V.

This requirement applies when use is made of the connector 130-9 IEC-20/21, as given in IEC 268-11.

7.4 *Phantom supply system*

7.4.1 *General*

In the phantom supply system, both signal conductors have the same d.c. potential. This allows the use of microphone connections either for microphones which do not need a power supply (for example dynamic types), or for microphones having a circuit fed from a separate supply. In either case, it is essential that the amplifier to which the microphone is connected has a balanced floating input.

7.4.2 *Supply voltage polarity*

The positive pole of the supply voltage shall be connected to the electrical centre of the signal conductors, the negative pole to the screen of the cable.

7.4.3 *Circuit diagram*

A typical circuit diagram for connection and power supply is given in figure 2. The resistors R_1 and R_2 shall be within ±10 % of their rated value, and shall be matched to within ±0,4 %.

Table 11 gives the required values for voltage and current and typical values for R_1 and R_2. Instead of the resistors and/or the transformers shown in the diagrams, other circuit components may be used, provided that the voltage and current requirements given in table 11 are met, and that the balance of the circuit is not disturbed.

NOTE – A centre-tapped transformer fed via a series resistor may be used.

7.4.4 *Marking*

The supply voltage shall be marked on the microphones using P12, P24, or P48.

If the microphone is designed to operate on more than one supply voltage, this should be indicated by a suitable marking, for example P48/12.

7.4.5 *Preferred value of the supply voltage*

Although 12 V and 48 V systems are still in use, 24 V systems are preferred for new developments.

7.5 *A-B supply system*

7.5.1 *General*

In the A-B supply system, the supply current flows through the signal conductors a and b only (see figure 3). Care should be taken to avoid incorrect operation by switching off the power supply before connecting microphones which do not need a d.c. power supply (for example dynamic types). If not built into the amplifier, suitable series capacitors shall be inserted in order to avoid d.c. magnetization of the input transformer.

7.5.2 *Output impedance of the microphone*

The output impedance of the microphone shall not exceed 200 Ω within the effective frequency range (40 Hz to 16 kHz).

7.5.3 *Circuit diagram*

The circuit diagram for connection and power supply is given in figure 3. The resistors R_1 and R_2 shall be within ± 10 % of the rated value, but if the power supply is connected to earth (see 7.5.4), they shall be matched to within 1 %.

Table 12 gives the required values for voltage and current and typical values for R_1 and R_2.

Instead of the resistors shown in the diagrams, other components may be used, provided they have the equivalent d.c. resistance.

7.5.4 *Connection of the power supply to earth*

The positive pole A or the negative pole B may be connected to earth.

7.5.5 *Marking*

Microphones for A-B supply shall be marked with the letters AB.

7.6 *Polarity of the audiofrequency voltage*

An inward movement of the microphone diaphragm (a positive instantaneous sound pressure) shall produce a positive instantaneous voltage on pin 2 (with respect to pin 3) of the connector according to IEC 268-12, or on pin 1 (with respect to pin 3) of the connector, according to IEC 268-11.

8 Matching of record-playing units (pick-ups) and amplifiers

Matching values for analogue record playing units and amplifiers are given in table 5.

Table 5 – Matching values for analogue record-playing units and amplifiers

Pick-up			Amplifier		
Output	Matching values		Input for pick-up	Matching values	
	Velocity sensitive			Velocity sensitive	
	High	Low		High	Low
Rated impedance	To be stated by the manufacturer		Rated source impedance	Series equivalent resistance: 2,2 kΩ The series equivalent inductance is also important	10 Ω
Rated load impedance	47 kΩ 420 pF (note 4)	100 Ω	Input impedance	47 kΩ in parallel with 220 pF	100 Ω
Rated output voltage (note 2)	5 mV	0,3 mV	Rated source e.m.f.	5 mV	0,3 mV
			Minimum source e.m.f. for rated output voltage	2,0 mV	0,12 mV
Maximum output voltage (note 3)	35 mV	2,8 mV	Overload source e.m.f.	≥ 35 mV	≥ 2,8 mV

NOTES

1 To determine the e.m.f. values given in the table, the following sensitivity ranges for pick-ups have been taken into account:

- high output: 0,7 mV/cm/s to 2 mV/cm/s;
- low output: 0,04 mV/cm/s to 0,16 mV/cm/s.

High output pick-ups are usually of the moving magnet type and low output pick-ups are usually of the moving coil type.

2 The values are related to a velocity of 7 cm/s and the lower sensitivity limits given in note 1.

3 The values are related to a velocity of 17,5 cm/s and the upper sensitivity limits given in note 1. The maximum output voltage values can be expected in the mid-frequency range between about 700 Hz and 3000 Hz.

4 This value is based on a parallel capacitance of 200 pF for the record-playing unit and its connecting cable, and 220 pF input capacitance of the amplifier.

9 Matching of loudspeakers and amplifiers

9.1 *Single unit loudspeakers*

The following values of rated impedance for single unit loudspeakers are preferred: 4 Ω, 8 Ω and 16 Ω.

9.2 *Loudspeaker systems*

9.2.1 *Loudspeakers with built-in amplifier*

A loudspeaker system with a built-in amplifier shall be considered as a power amplifier. The values given in the right-hand part of table 9 apply.

9.2.2 *Impedance-defined loudspeaker systems*

Matching values for impedance defined loudspeaker systems are given in table 6.

Table 6 – Matching values for impedance-defined loudspeaker systems

Amplifier	Loudspeaker systems	Matching values		
Output for loudspeakers	Input			
Output source impedance	–	< 1/10 the rated load impedance over the rated frequency range		
Rated load impedance	Rated impedance	4 Ω	8 Ω	16 Ω

For electrostatic and piezoelectric loudspeakers, the rated impedance shall represent the impedance for correct interconnection, taking into consideration the capacitive character of the load presented to the amplifier.

9.2.3 *Constant voltage loudspeaker systems*

Matching values for voltage defined loudspeaker systems are given in table 7.

Table 7 – Matching values for constant voltage loudspeaker systems

Amplifier	Loudspeaker systems	Matching values				
Output for loudspeakers	Input					
Rated output voltage	–	25 V	35 V	50 V	70 V	100 V
–	Rated voltage	–	–	50 V	70 V	100 V
Output source impedance		< 1/2 of the rated impedance over the rated frequency range				

The lower voltages in the table apply for the common practice of using a larger number of these loudspeakers at reduced power, each loudspeaker covering a smaller area.

NOTE – The rated load impedance Z is calculated from the rated output power P of the amplifier and the line voltage V as given by $Z = V^2/P$.

The range of voltages may be extended to higher values for amplifiers designed for long distance distribution of power to a network of loudspeakers; for example, for line broadcasting in residential quarters from a central amplifying station.

9.3 *Voltage (or power) matching of amplifiers and loudspeakers*

9.3.1 *Introduction*

In order to achieve optimum matching of amplifiers and loudspeakers, with regard to the intended conditions for use, the following characteristics are specified.

a) Short-term maximum output voltage and power of an amplifier: see IEC 268-3.

b) Short-term maximum input voltage and power of a loudspeaker: see IEC 268-5.

c) Long-term maximum output voltage and power of an amplifier: see IEC 268-3.

d) Long-term maximum input voltage and power of a loudspeaker: see IEC 268-5.

9.3.2 *Matching requirements*

The matching requirements depend on the condition of operation of the equipment as follows.

In the case of:

a) low probability of incorrect operation leading to clipping of the amplifier (e.g. most hi-fi applications), and where the short-term and the long-term output voltages or powers of the amplifier differ by more than 3 dB:

– the short-term input voltage or power of the loudspeaker shall be greater than or equal to the short-term output voltage or power of the amplifier;

– the long-term input voltage of the loudspeaker shall be greater than or equal to one-half of the long-term output voltage of the amplifier;

NOTE – This implies that the long-term input power of the loudspeaker is greater than one quarter of the long-term output power of the amplifier.

b) low probability of incorrect operation leading to clipping of the amplifier (e.g. most hi-fi applications), and where the short-term and the long-term output voltages or powers of the amplifier are not substantially different (less than 3 dB):

– the long-term input voltage of the loudspeaker shall be greater than or equal to one-half of the long-term output voltage of the amplifier;

NOTE – This implies that the long-term input power of the loudspeaker is greater than one quarter of the long-term output power of the amplifier.

c) significant probability of clipping in the amplifier, (e.g. sound reinforcement and household use) but acoustic feedback or other types of oscillation are not taken into account:

– the long-term input voltage or power of the loudspeaker shall be greater than or equal to the long-term output voltage or power of the amplifier.

9.4 *Polarity of the sound pressure*

A positive instantaneous voltage at pin 1 with respect to pin 2 of the connector, according to IEC 268-11, shall produce an outward movement of the loudspeaker diaphragm (a positive instantaneous sound pressure).

10 Matching of headphones and amplifiers

This output is designed to produce, as far as possible, a constant sound pressure level in the headphones for a given setting of the volume control, irrespective of the impedance of the headphones over the range 8 Ω to 2000 Ω. The matching values are given in table 8.

Electrostatic headphones equipped with matching units should also comply with the requirements of this clause. Other types of electrostatic headphones are not covered by this standard.

Table 8 – General purpose matching values for headphones and amplifiers

Amplifier		Headphones	
Output for headphones	Matching values	Input from amplifier	Matching values
Output source impedance (note 1)	120 Ω	Rated source impedance (note 1)	120 Ω
Rated load impedance	8 Ω to 2000 Ω	Rated impedance	16, 32, 64, 200, 600 Ω (note 4)
Rated source e.m.f.	5 V max. (notes 2 and 3)	Rated input voltage (see IEC 268-7)	5 V

NOTES

1 For most types of headphones, the source impedance has very little effect on the performance.

2 For equipment having a low supply voltage, it may not be possible to produce 5 V. If the rated output voltage is less than 5 V, the ability to operate with high impedance headphones is restricted.

3 The 5 V (r.m.s.) represents a maximum signal voltage, on peaks of programme level. Signals at this voltage should not be clipped.

4 The interface is also satisfactory for headphones with rated impedance between 8 Ω and 2000 Ω.

11 Matching of amplifiers to amplifiers

11.1 *Pre-amplifiers and power amplifiers for general purpose and sound reinforcement*

Matching values for pre-amplifiers and power amplifiers are given in table 9.

Table 9 – Matching values for pre-amplifiers and power amplifiers

Pre-amplifier		Power amplifier (note 1)	
Output	Matching values	Input for pre-amplifier	Matching values
Output source impedance	≤ 1 kΩ	Rated source impedance	1 kΩ
Rated load impedance	10 kΩ (note 2)	Input impedance	≥ 10 kΩ
Rated output voltage (note 3)	1 V	–	–
–	–	Minimum source e.m.f. for rated output voltage	1 V
Rated distortion limited output voltage	≥ 3 V	–	–

NOTES

1 For power amplifiers which have no volume controls, the rated source e.m.f. is identical to minimum source e.m.f. for rated output voltage and the overload source e.m.f. does not apply.

Power amplifiers, however, may be provided with a volume control. In this case, the overload source e.m.f. should be ≥ 8 V.

2 The rated load impedance shall be 1 kΩ for pre-amplifiers for sound reinforcement. This permits up to 10 power amplifiers to be fed in parallel.

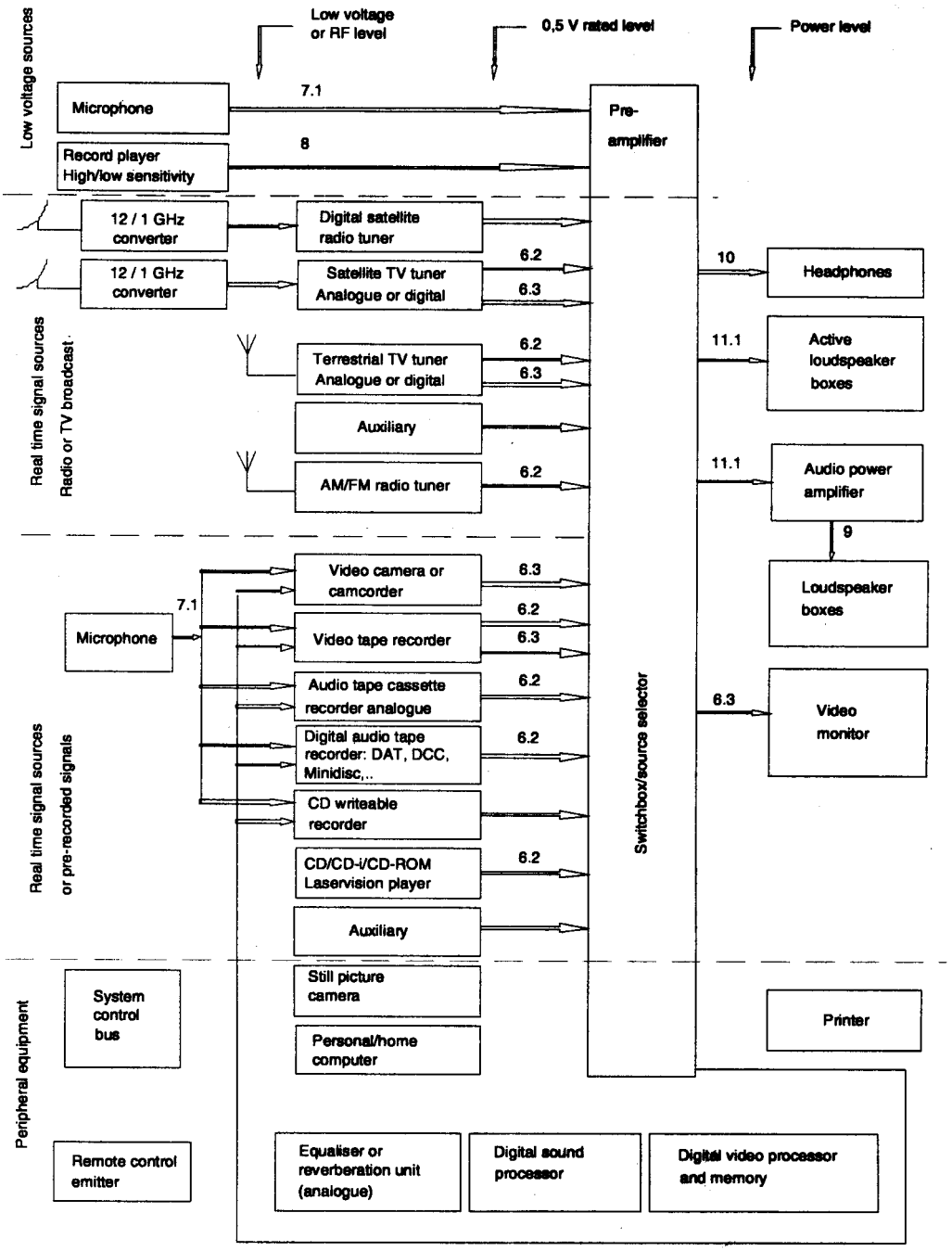
3 Applying the relevant minimum source e.m.f. for rated output voltage to the input of the pre-amplifier, with the gain control at maximum.

11.2 *Broadcast and similar line amplifiers*

Matching values for broadcast and similar line amplifiers are given in table 10.

Table 10 – Matching values for broadcast and similar line amplifiers

Input	Matching values	Output	Matching values
Rated source impedance	0 to 300 Ω	Output source impedance	Modulus ≤ 50 Ω Argument ≤45° between 10 Hz and 22,4 kHz
Input impedance	Modulus ≥ 10 kΩ Argument ≤ 45° between 40 Hz and 15 kHz	Rated load impedance	600 Ω
Rated source e.m.f.	1,95 V +8 dB (0,775 V)	Normal working output voltage	1,95 V +8 dB (0,775 V)
Overload source e.m.f.	3,88 V +14 dB (0,775 V)	–	–
Unbalance	≤ – 50 dB (22,4 Hz to 10 kHz)	–	–



The numbers above the arrows refer to the appropriate clauses of this standard.

Figure 1 – Audio and video sources and destinations

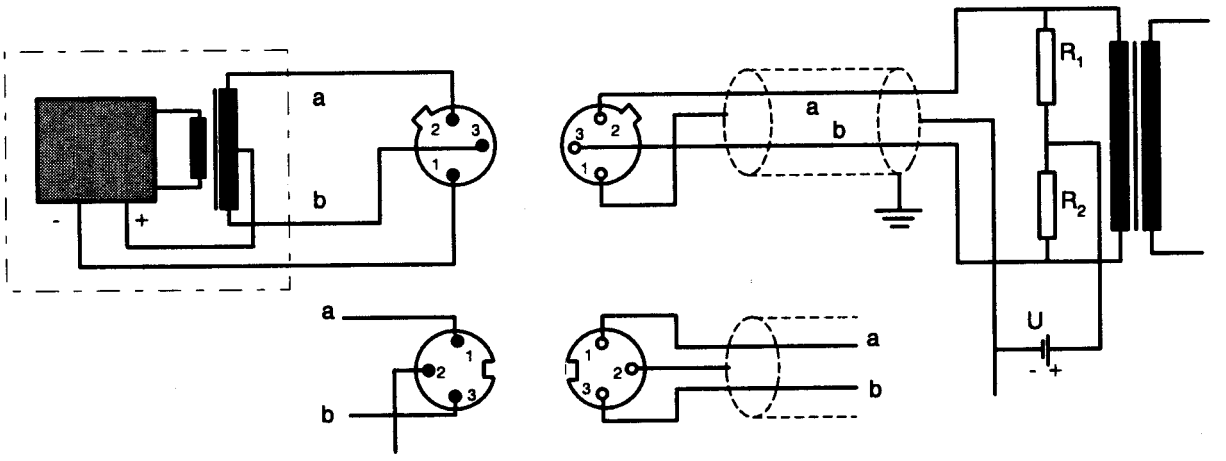


Figure 2 – Example of phantom power supply system

Table 11 – Required values for phantom supply systems

Supply voltage *U*	12 V ± 1 V	24 V ± 4 V	48 V ± 4 V
Supply current *I*	Max. 15 mA	Max. 10 mA	Max. 10 mA
R_1 and R_2 (typical values)	680 Ω	1,2 kΩ (see note)	6,8 kΩ
NOTE – Equipment fitted with 1,2 kΩ resistors is not compatible with some types of microphone designed for 12 V operation. Such microphones require resistors of at least 2,4 kΩ with a 24 V supply.			

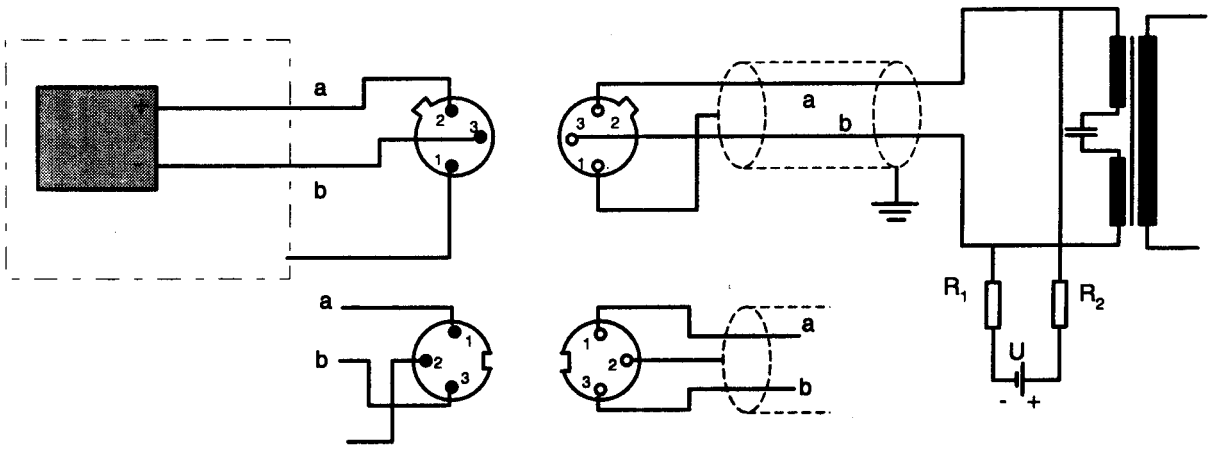


Figure 3 – Example of A-B power supply system

Table 12 – Required values for A-B power supply systems

Supply voltage *U*	12 V ± 1V
Supply current *I*	Max. 15 mA
R_1 and R_2	180 Ω

(*Continued from second cover*)

The concerned Technical Committee responsible for the preparation of this standard has reviewed the provisions of the following International Standards and has decided that they are acceptable for use in conjunction with this standard:

International Standard	*Title*
IEC 60027-1 (1997)	Letter symbols to be used in electrical technology — Part 1 : General
IEC 60027-2 (2000)	Letter symbols to be used in electrical technology — Part 2 : Telecommunications and electronics
IEC 60027-3 (2002)	Letter symbols to be used in electrical technology — Part 3 : Logarithmic and related quantities and their units
IEC 60027-4 (1985)	Letter symbols to be used in electrical technology — Part 4 : Symbols for quantities to be used for rotating electrical machines
IEC/DIS 50 (723)	International Electrotechnical Vocabulary (IEV) — Chapter 723 Broadcasting : Sound Television and data
IEC 94-2 (1994)	Magnetic tape sound recording and reproducing systems — Part 2 : Calibration tapes
IEC 268-11 (1987)	Sound system equipment — Part 11 : Application of connectors for the Interconnection of sound system components
IEC 268-12 (1987)	Sound system equipment — Part 12 : Application of connectors for broadcast and similar use
IEC 417 (1973)	Graphical symbols for use on equipment
IEC 807-9 (1993)	Rectangular connectors for frequencies below 3 MHz — Part 9 : Detail specification for a range of peritelevision connectors
IEC 958 (1989)	Digital audio interface
IEC 1293 (1994)	Marking of electrical equipment with ratings related to electrical supply — safety requirements
ISO/IEC 2382-9 (1995)	Data processing — Vocabulary — Part 9 : Data communications
ITU-R BT. 470-4 (1995)	Television systems

Only the English language text of the International Standard has been retained while adopting it in this Indian Standard.

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