INTERNATIONAL STANDARD

ISO/IEC 11801

1995

AMENDMENT 2
1999-12

Amendment 2

Information technology –
Generic cabling for customer premises

Amendement 2

Technologies de l'information –
Câblage générique des locaux d'utilisateurs

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FOREWORD

Amendment 2 to International Standard ISO/IEC 11801 was prepared by subcommittee 25: Interconnection of information technology, of ISO/IEC joint technical committee 1: Information technology.

Attention is drawn to the possibility that some of the elements in this amendment may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

General

Update references to tables, the numbers of which have been changed.

Page 2

Insert, in the existing list, the titles of the following standards:

IEC 60793-1 (all parts), *Optical fibres – Part 1: Generic specification*

IEC 60874-19 (all parts), *Connectors for optical fibres and cables*

IEC 61035-1, *Specification for conduit fittings for electrical installations – Part 1: General requirements*

IEC 61280-4 (all parts), *Fibre optic communication subsystem basic test procedures – Part 4: Fibre optic requirements*

IEC 61935-1,— *Generic specification for the testing of generic cabling in accordance with ISO/IEC 11801 – Part 1: Test methods* [1)]

Page 5

3.1 Definitions

Add a new definition and renumber the following ones:

3.1.34
permanent link
the transmission path between two mated interfaces of generic cabling, excluding equipment cables, work area cables and cross-connections

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[1)] To be published.

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4 Conformance

Add the following new paragraph:

References to the requirements and classifications specified in this International Standard shall specifically differentiate components and systems conforming to ISO/IEC 11801 (1995) from those that are qualified according to ISO/IEC 11801 (1995), including amendment 1 (1999) and amendment 2 (1999), by specifically referencing ISO/IEC 11801 (1995), including amendment 1 (1999) and amendment 2 (1999). For the purpose of component marking and system identification, it is appropriate to directly reference the year of publication of the second amendment, or to use a specific designation that provides linkage to it.

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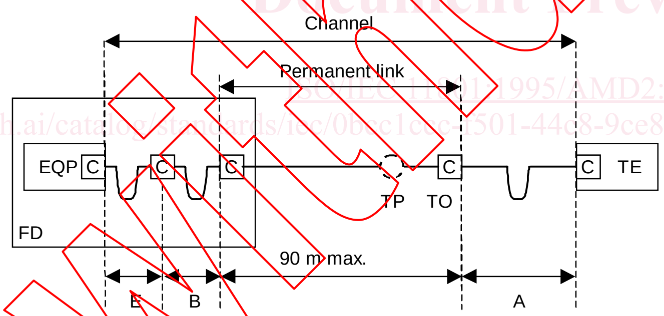
6.1.1 Horizontal distances

Replace the entire subclause by the following new subclause:

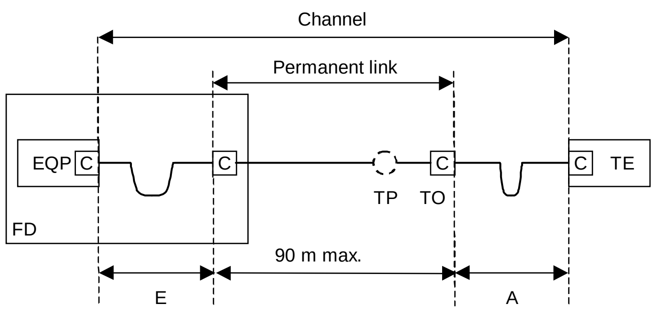
The maximum horizontal cable length shall be 90 m independent of medium (see figure 6). This is the cable length from the mechanical termination of the cable in the floor distributor to the telecommunications outlet in the work area.

In establishing the maximum length of the horizontal channel, the optional use of a crossconnect or an interconnect places different requirements on the total length of the flexible cables used. Figure 7 shows examples of horizontal channel implementations which reflect these differing requirements of maximum cable length.



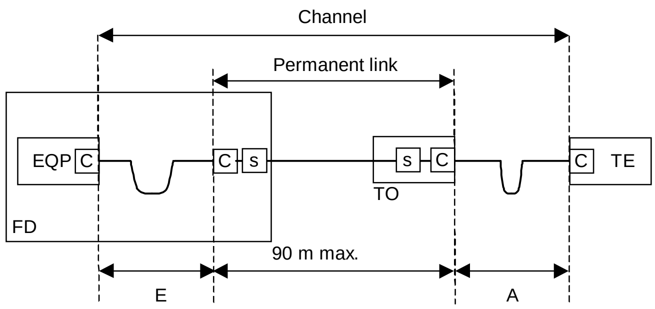
A + B + E = 9 m maximum

Figure 7a – Balanced copper horizontal cabling (with crossconnect)



A + E = 10 m maximum

Figure 7b – Balanced copper horizontal cabling (with interconnect)



A + E = 10 m maximum

Figure 7c – Optical fibre cabling (with interconnect)

Key

C connection (e.g. plug and jack or mated optical connection)

S optical fibre splice

EQP application specific equipment

NOTE 1 All lengths are mechanical lengths.

NOTE 2 See annex C for further information on flexible cables.

Figure 7 – Examples of horizontal channel implementation

In figure 7a, the maximum total length of work area cable, equipment cable and patch cord is 9 m based upon flexible cables with 50 % greater attenuation than the horizontal cable and includes a crossconnect in the floor distributor. In figure 7b, the maximum total length of work area cable and equipment cable is 10 m also based upon flexible cables with 50 % greater attenuation than the horizontal cable and includes an interconnect in the floor distributor. In both cases the transition point is optional. It is required that the performance of the horizontal cabling is not degraded by the inclusion of the transition point.

For optical fibre, the implementation is shown in figure 7c. An optical fibre splice, in accordance with clause 9, is allowed at both ends of the horizontal cable.

See clause 9 and annex C for requirements for patch cords and other flexible cables. In all cases, equipment cables that meet or have better performance characteristics than patch cord requirements are recommended.

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7 Link specifications

Replace the existing title and text of this clause by the following new text:

7 Permanent link and channel specifications

7.1 Permanent links and channels

7.1.1 General

This clause defines the permanent link and channel performance requirements of installed generic cabling. The performance of the cabling is specified for individual permanent links and channels and for two different media types (balanced cables and optical fibre). A tutorial on the material in this clause is provided in annex F.

The design rules of clause 6 can be used to create generic cabling links and channels containing components specified in clauses 8 and 9. It is not necessary to measure every parameter specified in this clause as conformance may also be proven by suitable design. The permanent link and channel specifications in this clause allow for the transmission of defined classes of applications over distances other than those of clause 6, and/or using media and components with different transmission performances than those of clauses 8 and 9.

The permanent link and channel performance requirements specified in this clause shall be met at each interface specified for each medium.

The performance requirements described in this clause may be used as verification tests for any implementation of this International Standard, using the test methods defined, or referred to, by this clause. The permanent link requirements are primarily intended to provide a basis for the acceptance testing of installed cabling. The channel requirements are primarily for application developers but are able to be used for troubleshooting where application support is under development.

Permanent link and channel performance specifications shall be met for all temperatures at which the cabling is intended to operate. Performance testing may be carried out at ambient temperature, but there shall be adequate margins to account for temperature dependence of cabling components as per their specifications. The effects of ageing should also be taken into account. In particular, consideration should be given to measuring performance at worst case temperatures, or calculating worst case performance based on measurements made at other temperatures.

Care should be exercised in the interpretation of any results obtained from alternative test methods or practices. When needed, correlation factors should be identified and applied.

7.1.2 Permanent links

The performance of a permanent link is specified at and between interfaces to the link. The permanent link comprises only passive sections of cable and connecting hardware. A transition point may also be included in the horizontal subsystem. Active and passive application specific hardware is not addressed by this International Standard (figure 11).

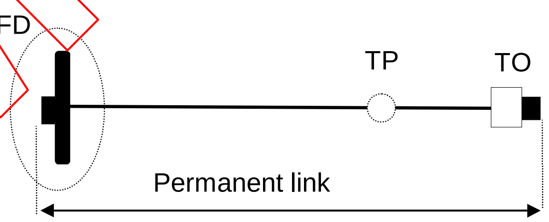


Figure 11 – Permanent link

Figure 12a shows an example of terminal equipment in the work area connected to a host using three links; two optical fibre links and a balanced cable link. The optical fibre and balanced cable links are connected together using an optical fibre to balanced cable converter, a cross-connect and two equipment cables. Interfaces to the cabling are at each end of a permanent link. Interfaces to the cabling are specified at the TO and at any point where application specific equipment is connected to the cabling; the work area and equipment cables are not included in the permanent link.

Interfaces to the cabling are at each end of a permanent link. Interfaces to the cabling are specified at the TO and at any point where application specific equipment is connected to the cabling; the work area and equipment cables are not included in the permanent link.

NOTE For balanced cabling the limits for the permanent link in this clause are calculated on the basis of 90 m of installed cable and two connections.

7.1.3 Channels

The performance of the channel is specified at and between interfaces to the channel. The cabling comprises only passive sections of cable, connecting hardware, work area cords, equipment cords and patch cords.

Figure 12b shows an example of terminal equipment in the work area connected to a host using two channels; an optical fibre channel and a balanced cabling channel. The optical fibre and balanced cabling channels are connected together using an optical fibre to balanced cable converter. There are four channel interfaces; one at each end of the copper channel, and one at each end of the optical fibre channel. Equipment connections are not considered to be part of the channel. All work area, equipment cables and patch cords are included in the channel.

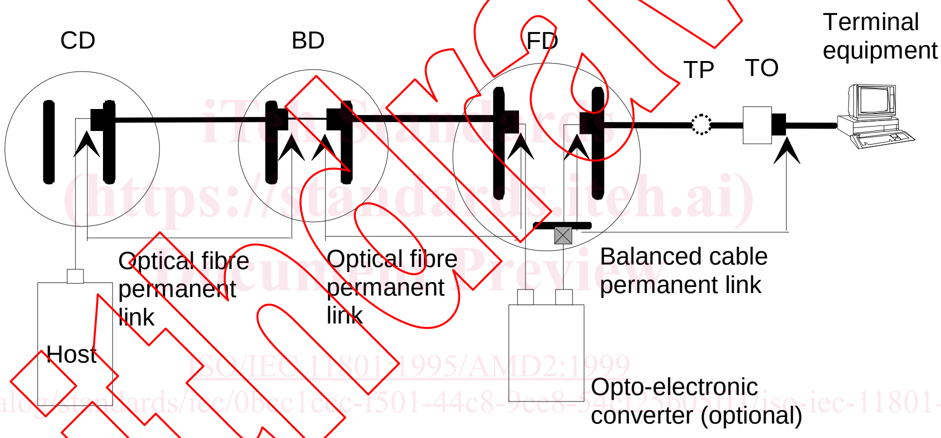


Figure 12a – Location of cabling interfaces and extent of associated permanent links

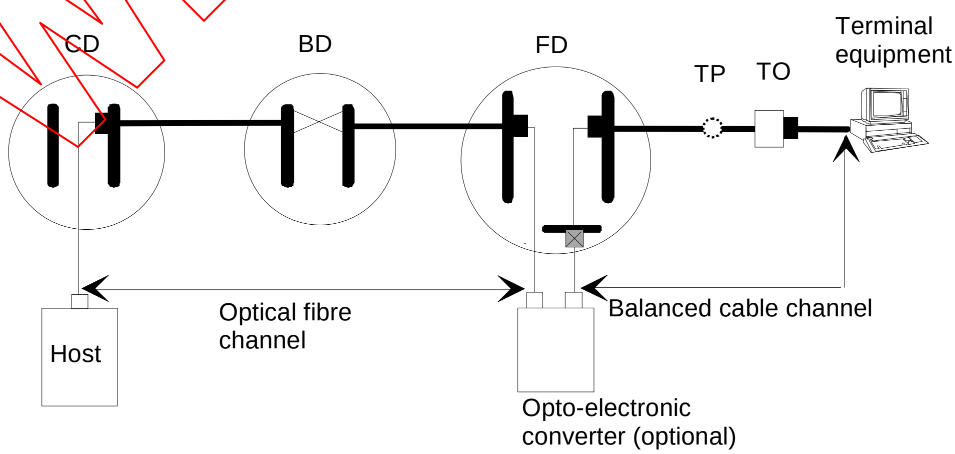
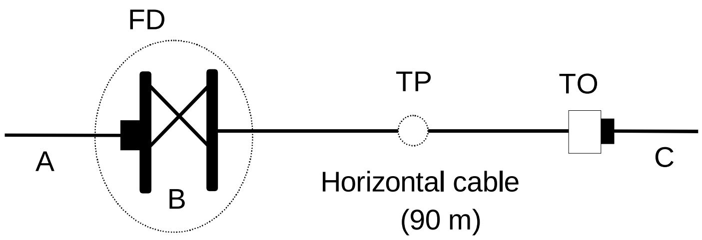


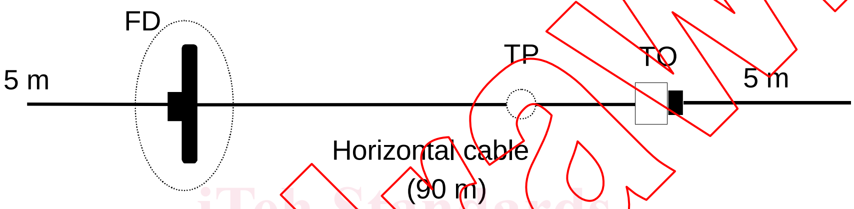
Figure 12b – Location of cabling interfaces and extent of associated channels



A + B + C = 9 m

NOTE For balanced cabling, this example assumes the use of flexible cables with 50 % greater attenuation (dB/m) than the horizontal cable, and a cross-connection in the floor distributor, thus 3 connections. In this case, the maximum length of work area, equipment, and patch cable is 9 m. A longer channel length may be achieved by using flexible cables with better attenuation performance.

Figure 12c – Class D channel implementation (with cross-connection)



NOTE For balanced cabling, this example assumes the use of flexible cables with 50 % greater attenuation (dB/m) than the horizontal cable. In this case, the maximum length of work area and equipment cables is 10 m. This example results in a calculated channel attenuation of 23,9 dB at 100 MHz using category 5 component requirements.

Figure 12d – Class D channel implementation (with interconnection)

Key

■ Interface to the generic cabling

☒ Optional interface when using a crossconnection

Figure 12 – Examples of cabling systems

7.2 Classification of applications, links and channels

7.2.1 Application classification

Five application classes for cabling have been identified for the purposes of this International Standard. This ensures that the limiting requirements of one system do not unduly restrict other systems.

The application classes are:

Class A includes speech band and low-frequency applications. Copper cabling permanent links and channels supporting* Class A applications are referred to as Class A permanent links and Class A channels respectively.

Class B includes medium bit rate data applications. Copper cabling permanent links and channels supporting* Class B applications are referred to as Class B permanent links and Class B channels respectively.

Class C includes high bit rate data applications. Copper cabling permanent links and channels supporting* Class C applications are referred to as Class C permanent links and Class C channels respectively.

Class D includes very high bit rate data applications. Copper cabling permanent links and channels supporting* Class D applications are referred to as Class D permanent links and Class D channels respectively.

Optical Class includes high and very high bit rate data applications. Optical fibre permanent links and channels supporting* Optical Class applications are referred to as Optical Class permanent links and Optical Class channels respectively.

NOTE *Permanent link specifications are provided for field test verification. Channel values provide minimum requirements for application support.

Annex G gives examples of applications that fall within the various classes.

7.2.2 Link and channel classification

Generic cabling, when configured to support particular applications, comprises one or more permanent links and channels. Five permanent link and channel classes are defined, which relate to the application classes as indicated in 7.2.1.

Permanent link/channel class A	specified up to 100 kHz
Permanent link/channel class B	specified up to 1 MHz
Permanent link/channel class C	specified up to 16 MHz
Permanent link/channel class D	specified up to 100 MHz
Optical permanent link/channel class	specified to support applications specified at 10 MHz and above.

For copper cabling, a class A to D permanent link or channel is specified so that channels will provide the minimum transmission performance to support applications of the related application class. Links and channels of a given class will support all applications of a lower class. Permanent link/channel class A is regarded as the lowest class.

Optical parameters are specified for single-mode and multimode optical fibre permanent links and channels.

Class C and D permanent links and channels correspond to full implementations of category 3 and category 5 horizontal cabling subsystems respectively, as specified in 6.1.[1]

Table 2 relates the permanent link and channel classes to the categories of clauses 8 and 9. This table indicates the channel length over which the various applications may be supported.

The distances presented are based on NEXT loss (for copper cables), bandwidth (for optical fibre cables), and attenuation limits for various classes. Other characteristics of applications, for example propagation delay, may further limit these distances.

[1] The use of link in clause 6 allows for a wider range of configurations than a permanent link in this amendment.

Table 2 – Channel lengths achievable with different categories and types of cabling

Medium	Channel length				
	Class A	Class B	Class C	Class D	Optical class
Category 3 balanced cable (8.1)	2 km	200 m	100 m [1]	–	–
Category 4 balanced cable (8.1)	3 km	260 m	150 m [2]	–	–
Category 5 balanced cable (8.1)	3 km	260 m	160 m [2]	100 m [1]	–
150 Ω balanced cable (8.2)	3 km	400 m	250 m [2]	150 m [2]	–
Multimode optical fibre (8.4)	N/A	N/A	N/A	N/A	2 km [3]
Singlemode optical fibre (8.5)	N/A	N/A	N/A	N/A	3 km [4]

[1] The 100 m distance includes a 90 m length permanent link and a maximum allowance of 10 m of flexible cable for patch cords/jumpers, work area and equipment connections.

[2] For distances greater than 100 m of balanced cable in the horizontal cabling subsystem, the applicable application standards should be consulted.

[3] The minimum bandwidth for a 2 km multimode optical link is specified in 7.4.2. Multimode applications may be limited to distances shorter than 2 km. Consult application standards for limitations.

[4] 3 km is a limit defined by the scope of the International Standard and not a medium limitation.

Consideration should be given, when specifying and designing cabling, to the possible future connection of cabling subsystems to form longer links and channels. The performance of these longer links and channels will be lower than that of any of the individual subsystem links and channels from which they are constructed. Measurement of permanent links and channels should be made initially, upon installation of each cabling subsystem. Testing of combined subsystems should be performed as required by the application.

7.3 Balanced cabling permanent links and channels

7.3.1 General

The parameters specified in this subclause apply to permanent links and channels with shielded or unshielded cable elements, with or without an overall shield, unless explicitly stated otherwise. Unless stated otherwise, outline test configurations for all measurements on balanced cabling are given in annex A. Specialised test instruments are required for high frequency field measurements on balanced cabling. The maximum application frequencies are based on required permanent link and channel characteristics, and are not indicated by the maximum specified frequency for the cabling. In the following tables, the requirements for attenuation, NEXT loss, Power Sum NEXT loss, ACR, Power Sum ACR, ELFEXT and Power Sum ELFEXT are given for discrete frequencies only. Transmission requirements shall also be met for all intermediate frequencies. Requirements at intermediate frequencies are derived by linear interpolation between frequencies on a semi-logarithmic (NEXT loss, Power Sum NEXT loss, ACR, Power Sum ACR, ELFEXT and Power Sum ELFEXT) or logarithmic (attenuation) scale.

7.3.2 Nominal impedance

The designed nominal impedance of a permanent link and channel shall be 100 Ω, 120 Ω, or 150 Ω. The nominal impedance of permanent links and channels should be achieved by suitable design, and the appropriate choice of cables and connecting hardware.

The variation of the input impedance of a permanent link and channel is characterised by the return loss. The characteristic impedance of cables used in a permanent link and channel shall be in accordance with the requirements of clause 8.

7.3.3 Return loss

The return loss of a permanent link and channel shall meet or exceed the values shown in tables 3 and 4. The return loss shall be measured according to IEC 61935-1. The return loss shall be measured from both ends to allow a correct evaluation of the permanent link or channel. Terminations that are matched to the nominal impedance of the cable (specifically 100 Ω, 120 Ω, 150 Ω) shall be connected to the cabling elements under test at the remote end of the permanent link or channel.

Table 3 – Minimum return loss for permanent link

Frequency MHz	**Minimum return loss** dB	
	Class C	**Class D**
1 ≤ *f* < 16	15	17
16 ≤ *f* < 20	N/A	17
20 ≤ *f* ≤ 100	N/A	17-7 log(*f*/20)

Table 4 – Minimum return loss for a channel

Frequency MHz	**Minimum return loss** dB	
	Class C	**Class D**
1 ≤ *f* < 16	15	17
16 ≤ *f* < 20	N/A	17
20 ≤ *f* ≤ 100	N/A	17-10 log(*f*/20)

7.3.4 Attenuation (insertion loss)

The attenuation of a permanent link and channel shall not exceed the values shown in tables 5 and 6 respectively, and shall be consistent with the design values of cable length and cabling materials used. The attenuation of the permanent link or channel shall be measured according to IEC 61935-1, except that the measured attenuation shall not be scaled to a standard length. Class D permanent links and channels should comprise cables, which closely follow the square root of frequency attenuation characteristic above 1 MHz.

The values in tables 5 and 6 are based on the requirements of the applications listed in annex G.

Table 5 – Maximum attenuation values for a permanent link

Frequency MHz	**Maximum attenuation** dB			
	Class A	**Class B**	**Class C**	**Class D**
0,1	16,0	5,5	N/A	N/A
1,0	N/A	5,8	3,1	2,1
4,0	N/A	N/A	5,8	4,1
10,0	N/A	N/A	9,6	6,1
16,0	N/A	N/A	12,6	7,8
20,0	N/A	N/A	N/A	8,7
31,25	N/A	N/A	N/A	11,0
62,5	N/A	N/A	N/A	16,0
100,0	N/A	N/A	N/A	20,6

Table 6 – Maximum attenuation values for a channel

Frequency MHz	Maximum attenuation dB			
	Class A	**Class B**	**Class C**	**Class D**
0,1	16,0	5,5	N/A	N/A
1,0	N/A	5,8	4,2	2,5
4,0	N/A	N/A	7,3	4,5
10,0	N/A	N/A	11,5	7,0
16,0	N/A	N/A	14,9	9,2
20,0	N/A	N/A	N/A	10,3
31,25	N/A	N/A	N/A	12,8
62,5	N/A	N/A	N/A	18,5
100,0	N/A	N/A	N/A	24,0

7.3.5 NEXT loss

7.3.5.1 Pair-to-pair NEXT loss

The pair-to-pair NEXT loss of a permanent link and channel shall meet or exceed the values shown in tables 7 and 8 respectively, and shall be consistent with the design values of cable length and cabling materials used. The NEXT loss shall be measured according to IEC 61935-1 except that the measured NEXT loss shall not be adjusted for length. The NEXT loss shall be measured from both ends to allow a correct evaluation of the permanent link or channel. See also A.1.1.

The values in tables 7 and 8 are based on the NEXT loss requirements of the applications listed in annex G.

Table 7 – Minimum NEXT loss for a permanent link

Frequency MHz	Minimum NEXT loss dB			
	Class A	**Class B**	**Class C**	**Class D**
0,1	27,0	40,0	N/A	N/A
1,0	N/A	25,0	40,1	61,2
4,0	N/A	N/A	30,7	51,8
10,0	N/A	N/A	24,3	45,5
16,0	N/A	N/A	21,0	42,3
20,0	N/A	N/A	N/A	40,7
31,25	N/A	N/A	N/A	37,6
62,5	N/A	N/A	N/A	32,7
100,0	N/A	N/A	N/A	29,3