

International Telecommunication Union

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

K.65

(01/2011)

SERIES K: PROTECTION AGAINST INTERFERENCE

Overvoltage and overcurrent requirements for termination modules with contacts for test ports or surge protective devices

Recommendation ITU-T K.65



International
Telecommunication
Union

Document Sharing Hub

Recommendation ITU-T K.65

Overvoltage and overcurrent requirements for termination modules with contacts for test ports or surge protective devices

Summary

Recommendation ITU-T K.65 specifies the overvoltage requirements and test procedures for termination modules, with contacts for test ports or surge protective devices (SPDs), used for symmetric pair conductors subjected to overvoltages and overcurrents.

Overvoltages or overcurrents covered by this Recommendation include surges due to lightning on or near the line plant, short-term induction of alternating voltages from adjacent power lines or railway systems, earth potential rise due to power faults, and direct contacts between telecommunication lines and power lines.

Major changes compared with the 2004 version of this Recommendation include:

- the addition of a mains contact test to the equipment side of a module with series elements;
- a reduction of the current magnitude for test Figure C.2 and for the customer side test for test Figure C.3 (tests 2.2 and 2.3);
- a revision of Figure E.1 – 10/350 μ s current generator to be in line with Recommendation ITU-T K.44, Figure II.4-1 – 10/350 μ s current surge generator;
- the addition of information on the use of fail-safes;
- the addition of a coordination test, for modules with series elements, to check that surges under the firing voltage of the gas discharge tube (GDT) will not damage the series elements;
- the addition of a high voltage a.c. test to simulate a voltage > 230 V a.c. which will operate a 600 V GDT.

History

Edition	Recommendation	Approval	Study Group
1.0	ITU-T K.65	2004-12-14	5
2.0	ITU-T K.65	2011-01-13	5

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications, information and communication technologies (ICTs). The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

Compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure, e.g., interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words "shall" or some other obligatory language such as "must" and the negative equivalents are used to express requirements. The use of such words does not suggest that compliance with the Recommendation is required of any party.

INTELLECTUAL PROPERTY RIGHTS

ITU draws attention to the possibility that the practice or implementation of this Recommendation may involve the use of a claimed Intellectual Property Right. ITU takes no position concerning the evidence, validity or applicability of claimed Intellectual Property Rights, whether asserted by ITU members or others outside of the Recommendation development process.

As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at <http://www.itu.int/ITU-T/ipr/>.

© ITU 2011

All rights reserved. No part of this publication may be reproduced, by any means whatsoever, without the prior written permission of ITU.

Table of Contents

	Page
1 Scope	1
2 References.....	2
3 Definitions	2
3.1 Terms defined elsewhere	2
3.2 Definitions	2
4 Abbreviations.....	8
5 Conventions	8
6 Service and test conditions	8
6.1 Service conditions	8
6.2 Test temperature and humidity	9
6.3 Termination module and SPD testing.....	9
6.4 Termination module preparation	9
6.5 Test methods.....	10
6.6 Termination module/SPD performance: pass/failure criteria.....	10
6.7 Determining the required tests.....	11
6.8 Acceptance test requirements for termination modules/SPDs in MDFs which meet certain conditions	11
7 General requirements.....	12
7.1 Manufacturer declaration.....	12
7.2 Use of fail-safes	12
7.3 Breakdown voltage of the termination	12
7.4 Caution	12
7.5 Ball bearings.....	13
Annex A – Dimensioning of terminating wires for all voltage/current tests	19
Annex B – Connection details for voltage tests on termination modules	20
Annex C – Connection details for current tests on termination modules	25
Annex D – Test method for tests in aqueous solution	29
Annex E	30
Appendix I – Information on how to test termination modules with SPDs.....	31
I.1 Introduction	31
I.2 Termination modules used in the access network	31
I.3 Termination modules used in MDFs in operator buildings and customer premises.....	32

	Page
Appendix II – Application	34
II.1 Environment	34
II.2 Termination module and SPD types.....	34
II.3 Dry termination module and SPD tests	34
II.4 Filled termination module and SPD tests	34
II.5 Application	34
Bibliography.....	35

Recommendation ITU-T K.65

Overvoltage and overcurrent requirements for termination modules with contacts for test ports or surge protective devices

1 Scope

This Recommendation specifies the requirements and test procedures for termination modules with contacts for test ports or SPDs (see clause 3.2.15) used for symmetric pair conductors subjected to overvoltages and overcurrents.

Note, other Recommendations exist, such as [ITU-T K.12] and [ITU-T K.28], specifying characteristics for surge protective components (SPCs).

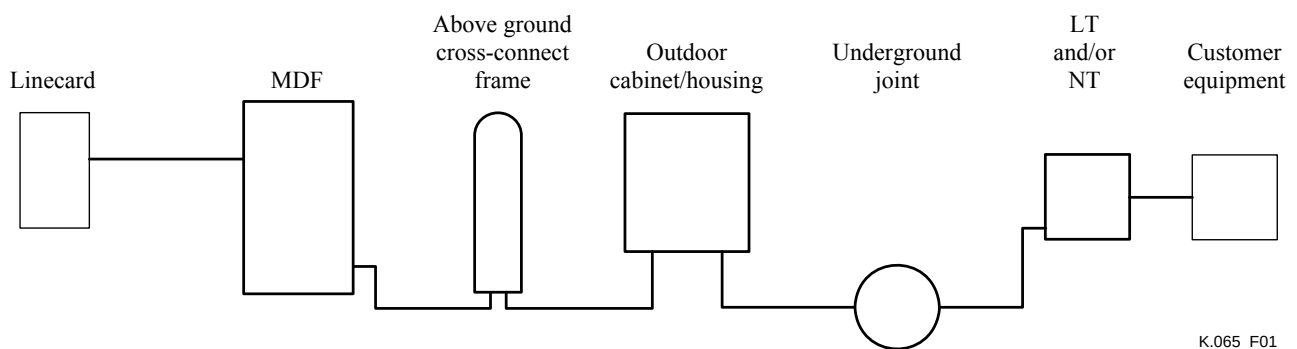
An example of where termination modules included in the scope of this Recommendation may be used is given in Figure 1. The following types of terminating modules covered by this Recommendation are:

- a termination module with terminals but without the facility for an SPD;
- a termination module with terminals and the facility for an SPD;
- an integral termination module/SPD. The termination module and SPD are not meant to be separated.

This Recommendation does not cover the requirements of termination modules used in equipment. These are covered by the relevant equipment Recommendations, i.e., [b-ITU-T K.20], [b-ITU-T K.21] or [b-ITU-T K.45]. It does not cover either the requirements of insulation displacement connectors or termination modules without contacts. These are covered by [ITU-T K.55].

Refer to Appendix I for information on when and how to test termination modules.

Basic Recommendation [ITU-T K.44] (test methods and test circuits) is an integral part of this Recommendation. This Recommendation should be read in conjunction with [ITU-T K.11], [ITU-T K.39], [ITU-T K.46], [ITU-T K.47] and [IEC 61643-21].



Termination modules in equipment are covered by the relevant equipment Recommendations

Figure 1 – Example of where termination modules are used in the network

2 References

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

- [ITU-T K.11] Recommendation ITU-T K.11 (2009), *Principles of protection against overvoltages and overcurrents*.
- [ITU-T K.12] Recommendation ITU-T K.12 (2010), *Characteristics of gas discharge tubes for the protection of telecommunications installations*.
- [ITU-T K.28] Recommendation ITU-T K.28 (1993), *Characteristics of semi-conductor arrester assemblies for the protection of telecommunications installations*.
- [ITU-T K.39] Recommendation ITU-T K.39 (1996), *Risk assessment of damages to telecommunication sites due to lightning discharges*.
- [ITU-T K.44] Recommendation ITU-T K.44 (2008), *Resistibility tests for telecommunication equipment exposed to overvoltages and overcurrents – Basic Recommendation*.
- [ITU-T K.46] Recommendation ITU-T K.46 (2008), *Protection of telecommunication lines using metallic symmetric conductors against lightning-induced surges*.
- [ITU-T K.47] Recommendation ITU-T K.47 (2008), *Protection of telecommunication lines using metallic conductors against direct lightning discharges*.
- [ITU-T K.55] Recommendation ITU-T K.55 (2002), *Overvoltage and overcurrent requirements for insulation displacement connectors (IDC) terminations*.
- [ITU-T K.77] Recommendation ITU-T K.77 (2009), *Characteristics of metal oxide varistors for the protection of telecommunications installations*
- [ITU-T K.82] Recommendation ITU-T K.82 (2010), *Characteristics and ratings of solid-state, self-restoring overcurrent protectors for the protection of telecommunications installations*.
- [IEC 61643-21] IEC 61643-21 ed1.0 (2009), *Low voltage surge protective devices – Part 21: Surge protective devices connected to telecommunications and signalling networks – Performance requirements and testing methods*.
- [IEC 60695-2-10] IEC 60695-2-10 ed1.0 (2000), *Fire hazard testing – Part 2-10 Glowing/hot-wire based test methods – Glow-wire apparatus and common test procedure*.

3 Definitions

3.1 Terms defined elsewhere

The majority of definitions used in this Recommendation are defined in [ITU-T K.44].

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 above ground: A termination module/surge protective device is considered to be above ground if the joint enclosure is not normally exposed to water.

3.2.2 below ground: A termination module/surge protective device is considered to be used below ground when the joint enclosure may be exposed to damp or wet conditions on a regular basis, e.g., a direct buried joint or a joint in a pit or manhole. A joint installed in a building basement or an enclosure is not considered below ground if flooding and water ingress is prevented.

3.2.3 controlled environment: The humidity is controlled using energy, e.g., air-conditioning.

3.2.4 earthing bar: A part or parts intended for providing an earthing connection from the earth pin of the SPD to earth. This bar may be an integral part of the termination module or a separate component when SPDs are installed.

3.2.5 fail-safe: A device used in conjunction with a surge protective device (SPC) to prevent excessive temperature rise of the SPC. If the SPC reaches a set temperature, due to the current being conducted, the fail-safe will operate and short out the SPC.

3.2.6 insulation displacement connector (IDC): An IDC is an interconnecting or terminating element for symmetric pair conductors where the insulation is mechanically displaced during the termination process.

A 2-wire connector is used to connect two wires together.

A 3-wire connector is used to connect a conductor or tap from the main conductor.

A modular connector, or multi-pair connector, is a connector containing more than one termination.

Connectors can be either "dry" or "filled". A filled connector is filled with grease or gel to make it moisture resistant.

3.2.7 insulation resistance (IR): Insulation resistance is the resistance from one connection point to an adjacent connection point or earth.

3.2.8 protection circuit (PCT): A protection circuit contains one or more surge protective devices or protective components. It may include a printed circuit board.

3.2.9 protection holder: A component used to support and electrically connect to a protection circuit (PCT). The protection holder and PCT may be integral (not separable). The combination of protection holder and PCT is a surge protective device (SPD). Different holders may be required for matching to the different types of termination modules. The termination module and SPD may also be integral (not separable).

3.2.10 protective component (PC): A protective component is any component used in a protection circuit which cannot be classified as a surge protective device (SPC). Examples of PCs are resistors, PTCs and fail-safes.

3.2.11 semi-controlled environment: An attempt has been made to control the environment by passive means, e.g., by sealing to reduce the probability of water ingress, or by ventilation to reduce the probability of water condensation.

3.2.12 surge: Temporary excessive voltage or current, or both, coupled on a telecommunication line, from an external electrical source.

NOTE 1 – Typical electrical sources are lightning and AC/DC power systems.

NOTE 2 – Electrical source coupling can be one or more of the following: electric field (capacitive), magnetic field (inductive), conductive (resistive), electromagnetic field.

3.2.13 surge protective component (SPC) (adapted from [b-IEC Electropedia], 151-11-21): Constitutes part of a surge protective device which cannot be physically divided into smaller parts without losing its protective function.

NOTE – The protective function is non-linear. Amplitude restriction effectively begins when the amplitude attempts to exceed the predetermined threshold value of the component.

3.2.14 surge protective device (SPD): Device that restricts the voltage of a designated port or ports, caused by a surge, when it exceeds a predetermined level.

- 1) Secondary functions may be incorporated, such as a current limiting device to restrict a terminal current.
- 2) Typically, the protective circuit has at least one non-linear voltage-limiting surge protective component.
- 3) An SPD is a combination of a protection circuit and holder.

3.2.15 termination module: A termination module is a component used for terminating cable conductors and it contains one or more of the following components:

- an insulation displacement terminal or conductor terminal;
- contacts;
- test port; and/or
- contacts for at least one SPD. Requirements for SPDs are given in [IEC 61643-21].

Termination modules can be either "dry" or "filled". A filled termination module is filled with a grease or a gel to make it moisture resistant. There are three types of termination modules in use (see Figure 3-1).

3.2.15.1 termination module; connection-type: Line side and cross-connect side are permanently connected. Only overvoltage limiting SPDs may be used.

3.2.15.2 termination module; disconnection-type: Line side and cross-connect side are connected via a disconnectable contact. This allows the use of a test plug to open circuit the line and to allow testing in either direction. SPDs to limit overvoltages and to limit surge currents may be used.

3.2.15.3 termination module; switching-type: Line side and cross-connect side are only connected when a shorting plug is inserted. As for the disconnected type, a test plug and an SPD may be used.

3.2.16 test port: A test port is a port that allows a probe to make contact with the terminated conductor, either via an exposed terminal or a gel socket, without having to remove the conductor or damage the conductor insulation.

3.2.17 unit under test: Unit under test (UUT) is a generic term sometimes used to describe the part being tested.

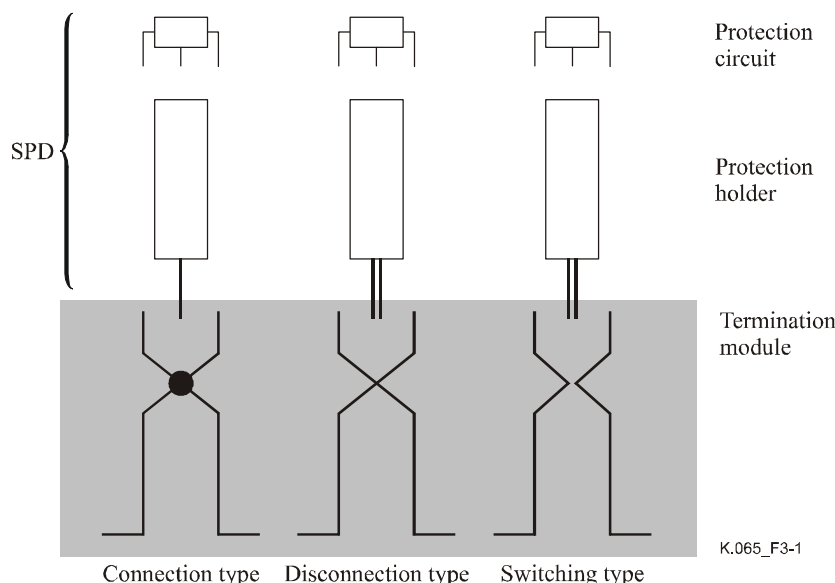
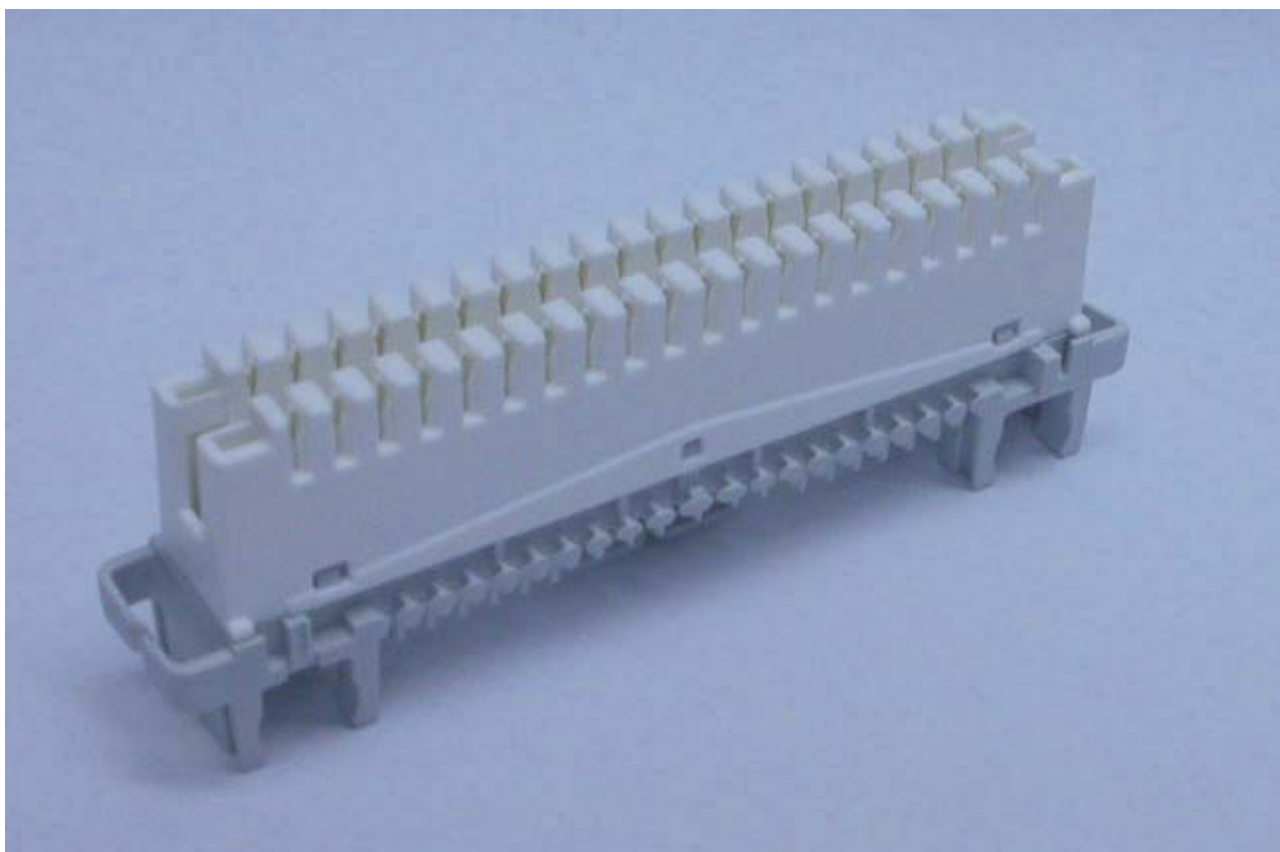
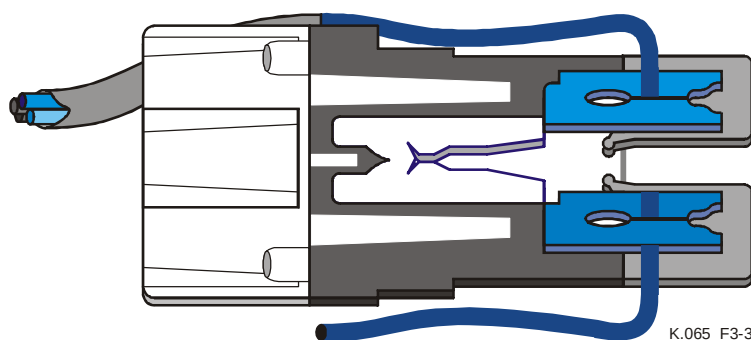


Figure 3-1 – Types of termination modules shown with SPDs



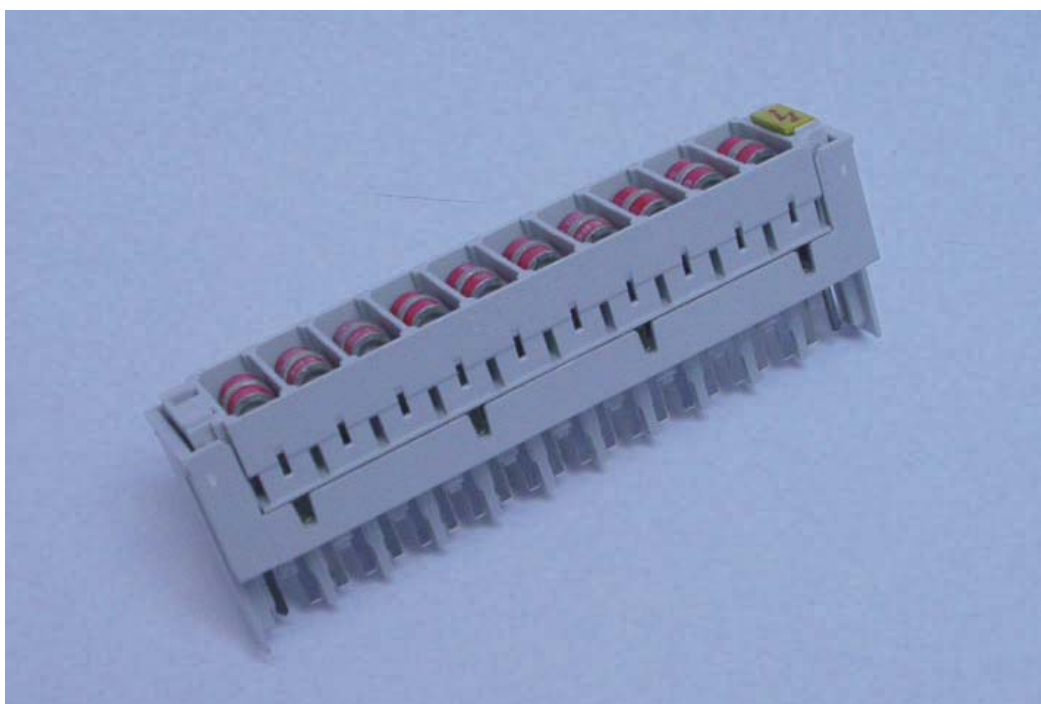
K.065_F3-2

Figure 3-2 – Example of a termination module



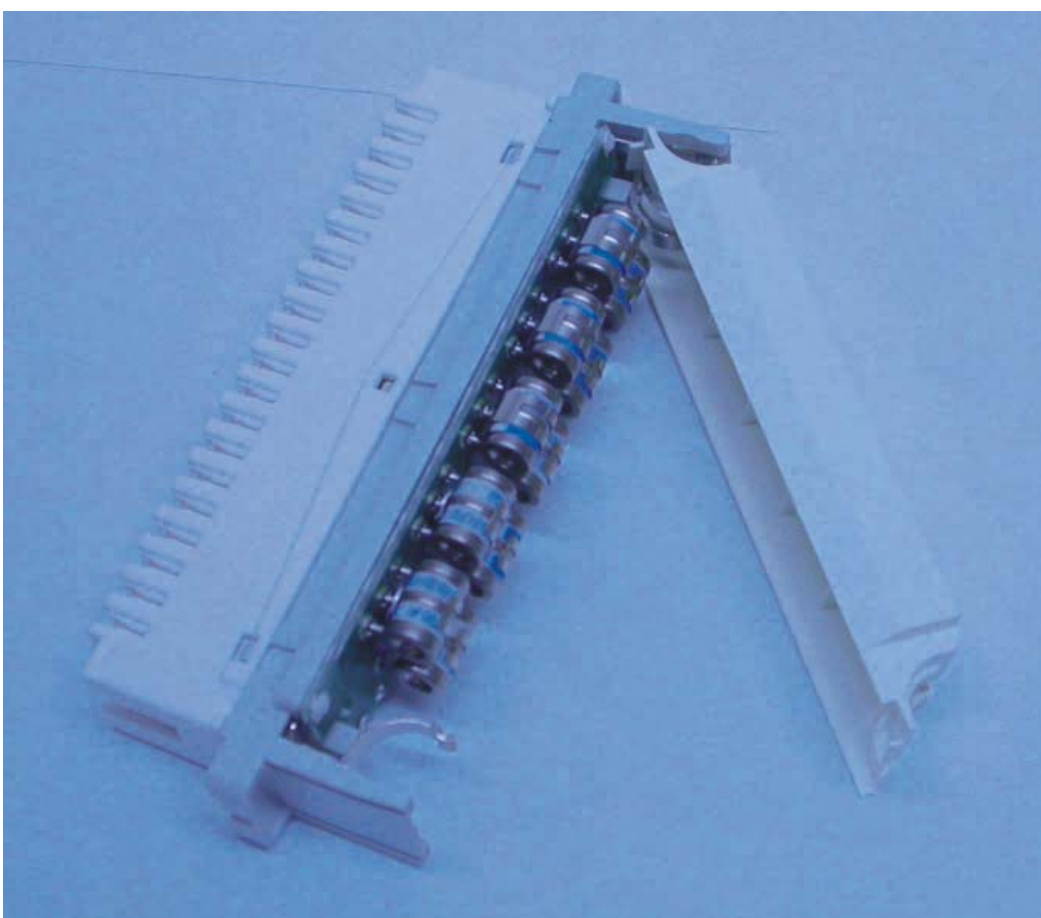
K.065_F3-3

Figure 3-3 – Example of contacts in a module



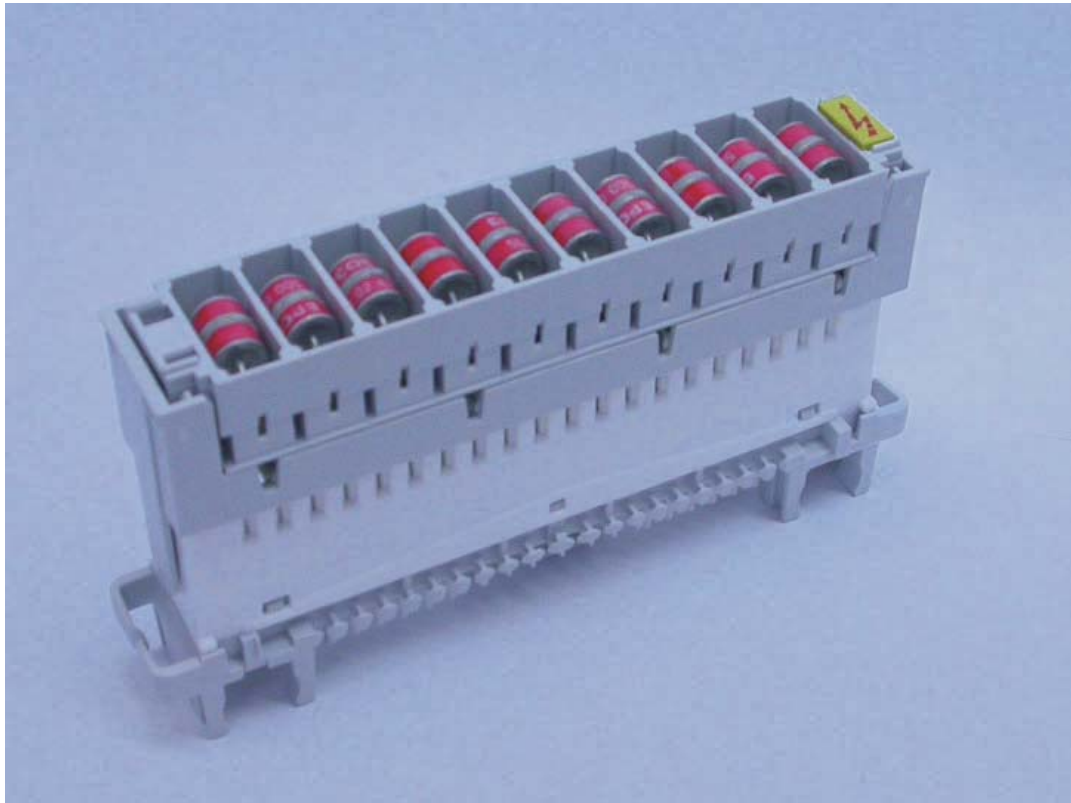
K.065_F3-4

Figure 3-4 – Example of a holder with removable SPCs



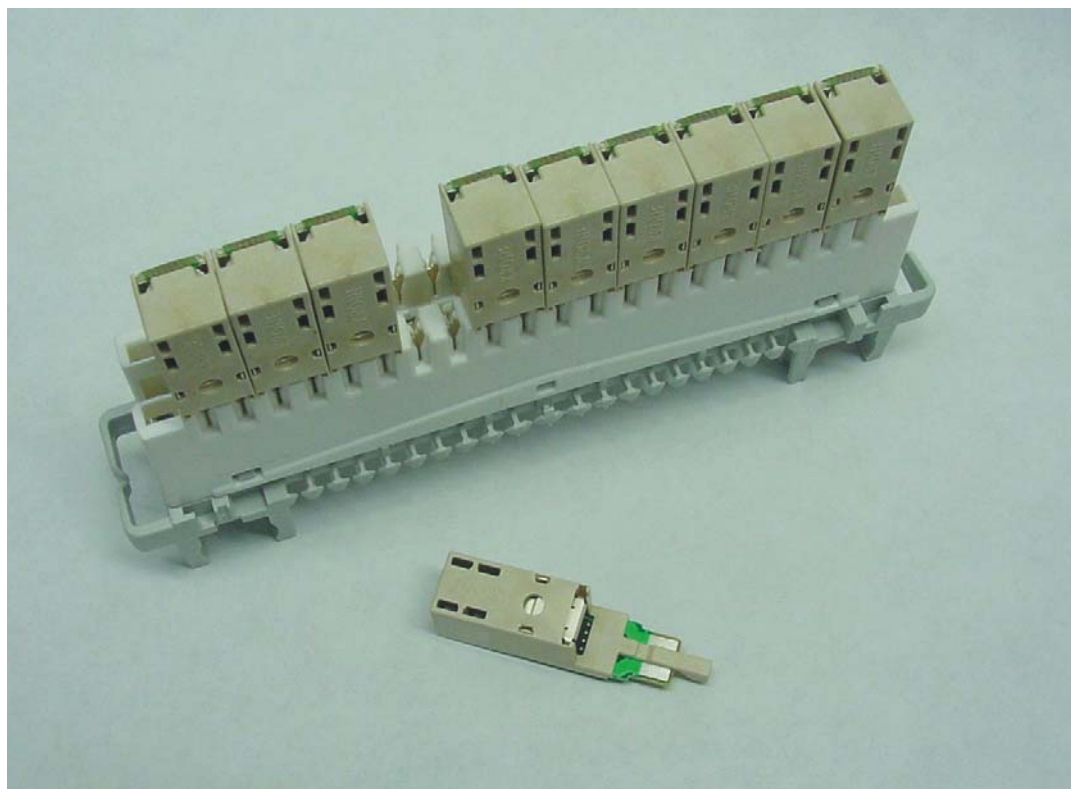
K.065_F3-5

Figure 3-5 – Example of an integral termination module and SPD



K.065_F3-6

Figure 3-6 – Example of a termination module with removable holder and removable SPDs



K.065_F3-7

Figure 3-7 – Example of a termination module with removable SPD (integral holder and PCTs)

4 Abbreviations

This Recommendation uses the following abbreviations:

IDC	Insulation Displacement Connector
IR	Insulation Resistance
LT	Line Termination
MDF	Main Distribution Frame
NT	Network Termination
PC	Protective Component
PCT	Protection Circuit
PTC	Positive Temperature Coefficient thermistor
SPC	Surge Protective Component
SPD	Surge Protective Device
SSA	Solid State Arrester
UUT	Unit Under Test

5 Conventions

This Recommendation uses the following conventions:

c	ground connection of the termination module; earthing bar (only applicable to termination modules with protection units)
xa ₁ , xb ₂ – xb _n	line side of the termination module
ya ₁ , yb ₂ – yb _n	cross-connect side of the termination module

6 Service and test conditions

General service and test conditions are outlined below.

6.1 Service conditions

6.1.1 Normal service conditions

Air pressure

Air pressure 80 kPa to 160 kPa. This air pressure represents an altitude of –500 m to +2 000 m.

Temperature and humidity service conditions

For an uncontrolled environment, the temperature range is between the values of –40°C and +70°C. The humidity range is between the values of 5% and 96% RH.

For a controlled environment, the temperature range is between the values of –5°C and +40°C. The humidity range is between the values of 10% and 80% RH.

6.1.2 Abnormal service conditions

Exposure of the termination module and SPD to abnormal service conditions may require special consideration in their design or application and shall be called to the attention of the manufacturer(s).