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SERIES L: CONSTRUCTION, INSTALLATION AND
PROTECTION OF CABLES AND OTHER ELEMENTS OF
OUTSIDE PLANT

Managing active electronics in the outside plant

Recommendation ITU-T L.70

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Managing active electronics in the outside plant

Summary

Recommendation ITU-T L.70 refers to the application of active electronics in outdoor environments. It covers mechanical and environmental protection as well as electrical powering and cooling. It also pays attention to maintenance, security and environmental aspects.

Source

Recommendation ITU-T L.70 was approved on 6 November 2007 by ITU-T Study Group 6 (2005-2008) under Recommendation ITU-T A.8 procedure.

FOREWORD

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Introduction

In order to obtain maximum reliability at a minimal cost, network electronics are generally centralized in locations with controlled environments. This is also typical for the initial lay out of copper networks for plain old telephone service (POTS). However, with the increasing demand for connections and bandwidth, operators often face the need to apply active electronics at remote locations. These active nodes cannot always be located inside buildings. This Recommendation focuses on the aspects of active electronics, located at outside plant locations.

Active network nodes in outside plant have a number of characteristics that make their design and maintenance more complex than that of passive nodes:

- active nodes perform a transformation between input and output signal;
- active nodes require electrical powering;
- active nodes dissipate heat.

Recommendation ITU-T L.70

Managing active electronics in the outside plant

1 Scope

This Recommendation lists the elements to consider when applying network electronics in outside plant locations (both in above ground and in underground applications):

- mechanical and environmental protection and related sealing requirements;
- thermal management;
- electrical powering;
- safety and environmental aspects;
- maintenance aspects.

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.

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| [ITU-T K.34] | Recommendation ITU-T K.34 (2003), <i>Classification of electromagnetic environmental conditions for telecommunication equipment – Basic EMC Recommendation.</i> |
| [ITU-T K.35] | Recommendation ITU-T K.35 (1996), <i>Bonding configurations and earthing at remote electronic sites.</i> |
| [ITU-T K.44] | Recommendation ITU-T K.44 (2008), <i>Resistibility tests for telecommunication equipment exposed to overvoltages and overcurrents – Basic Recommendation.</i> |
| [ITU-T K.45] | Recommendation ITU-T K.45 (2008), <i>Resistibility of telecommunication equipment installed in the access and trunk networks to overvoltages and overcurrents.</i> |
| [ITU-T K.48] | Recommendation ITU-T K.48 (2006), <i>EMC requirements for telecommunication equipment – Product family Recommendation.</i> |
| [ITU-T K.50] | Recommendation ITU-T K.50 (2000), <i>Safe limits of operating voltages and currents for telecommunication systems powered over the network.</i> |
| [ITU-T K.51] | Recommendation ITU-T K.51 (2000), <i>Safety criteria for telecommunication equipment.</i> |
| [ITU-T K.55] | Recommendation ITU-T K.55 (2002), <i>Overvoltage and overcurrent requirements for insulation displacement connectors (IDC) terminations.</i> |
| [ITU-T K.64] | Recommendation ITU-T K.64 (2004), <i>Safe working practices for outside equipment installed in particular environments.</i> |
| [ITU-T K.65] | Recommendation ITU-T K.65 (2004), <i>Overvoltage and overcurrent requirements for termination modules with contacts for test ports or SPDs.</i> |

[ITU-T K.69]	Recommendation ITU-T K.69 (2006), <i>Maintenance of protective measures.</i>
[ITU-T L.51]	Recommendation ITU-T L.51 (2003), <i>Passive node elements for fibre optic networks – General principles and definitions for characterization and performance evaluation.</i>
[IEC 60529]	IEC 60529 (2001), <i>Degrees of protection provided by enclosures (IP Code)</i> < http://webstore.iec.ch/webstore/webstore.nsf/artnum/026766 >.
[IEC 60950-1]	IEC 60950-1 (2005), <i>Information technology equipment – Safety – Part 1: General requirements.</i> < http://webstore.iec.ch/webstore/webstore.nsf/artnum/035320 >
[IEC 60950-21]	IEC 60950-21 (2002), <i>Information technology equipment – Safety – Part 21: Remote power feeding.</i> < http://webstore.iec.ch/webstore/webstore.nsf/artnum/029602 >
[IEC 62262]	IEC 62262 (2002), <i>Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code).</i> < http://webstore.iec.ch/webstore/webstore.nsf/artnum/028473 >

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 IP 55 [IEC 60529]: Enclosures protected against dust and resistant to jets of water.

3.1.2 IP 68 [IEC 60529]: Enclosures suitable for permanent submersion.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 active electronics: Electronics requiring a source of electricity (other than the actual signal) in order to execute its function.

3.2.2 active node: Network node, including active electronics as well as the packaging required to protect it sufficiently from external influences as they occur in the environment in which it resides.

3.2.3 temperature-hardened equipment: Electronic equipment that has been designed or adapted to operate in outdoor temperature conditions (e.g., from –40°C to +65°C).

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

DSLAM	Digital Subscriber Line Access Multiplexer
EMC	Electromagnetic Compatibility
IDC	Insulation Displacement Connector
IP	Ingress Protection (rating)
OA	Outdoor Above ground level (aerial)
OG	Outdoor Ground level
OS	Outdoor Below ground level (subterranean)
SPD	Surge Protective Device

5 Packaging for environmental and mechanical protection

Any node in the outside plant needs to be packaged properly to protect its content from the influences of the environment.

5.1 Environments

Active nodes in outside plant may be located in three typical locations:

- OA: Outdoor above ground level (aerial), mounted on a wall or pole or hanging from an aerial cable.
- OG: Outdoor at ground level, stored in a cabinet or pedestal, standing on the ground, with a base that may reside partially underground.
- OS: Outdoor below ground level (subterranean), stored in an underground man-hole, hand-hole or directly buried.

The typical properties of these environments can be found in Annex A.

Compared to passive network nodes (e.g., as described in [ITU-T L.51] on passive optical nodes), a certain amount of heat is generated inside the enclosure by the electronics. Hence, a more detailed approach concerning operating temperatures is required. This is covered in more detail in clause 6 and in Appendices I and II.

5.2 Sealing against ingress of solids and fluids

For nodes above or at ground level (OA and OG), the minimum recommended protection level against ingress of objects and water is IP 55 according to [IEC 60529] (protected against dust and resistant to jets of water).

For nodes at ground level (OG), it is recommended to provide a separation plate with cable entrance seals to avoid intrusion of dirt, water, rodents or insects via the bottom.

For nodes below ground level (OS), the recommended sealing level is IP 68 according to [IEC 60529] (suitable for permanent submersion). Required submersion depth should be at least 1 m above the top of the enclosure, but may be more if applied in deep manholes (in this case, the maximum required submersion depth is to be agreed explicitly between user and supplier in order to obtain proper sealing performance and structural strength).

5.3 Resistance to aggressive agents

The enclosure containing the electronics should be resistant to the most common aggressive agents as they may occur in the outdoor environments.

For all outdoor environments (OA, OG and OS):

- all materials (metals) should be resistant to corrosion;
- all materials should be resistant to micro organisms (fungi/bacteria).

For nodes above or at ground level (OA and OG):

- all external (polymeric) materials, including surface coatings, should be resistant to UV radiation.

For underground nodes (OS):

- all external materials should be resistant to accidental exposure chemical agents that may occur in underground along side roads, such as oil, diesel, kerosene, acids, bases and surfactants (detergents).

5.4 Mechanical protection

The enclosure should be resistant to the mechanical loads and influences that it may encounter in the outdoor environment.

For nodes above or at ground level (OA and OG):

- a minimum recommended protection level against impact of IK 10 according to [IEC 62262];
- the enclosures, including fixation system, should resist loads induced by wind.

For underground nodes (OS):

- Enclosure should be resistant to accidental impact from above.
- Enclosure should be resistant to a static load on top equivalent to the weight of at least one installer.
- Node should be resistant to vibration and shock.
- Cables must be properly attached to resist axial tension, flexure and torsion loads that may occur during typical installation and maintenance.

6 Thermal management

The temperature inside the enclosure (T_{inside}) must be kept within the operational temperature range of the electronics.

6.1 Thermal model

The temperature inside an above ground active enclosure will be determined by a number of factors:

- the air temperature of the environment (T_{air}) (as measured in a thermometer hut);
- solar radiation;
- the heat dissipated by the electronics (Q);
- the construction of the enclosure.

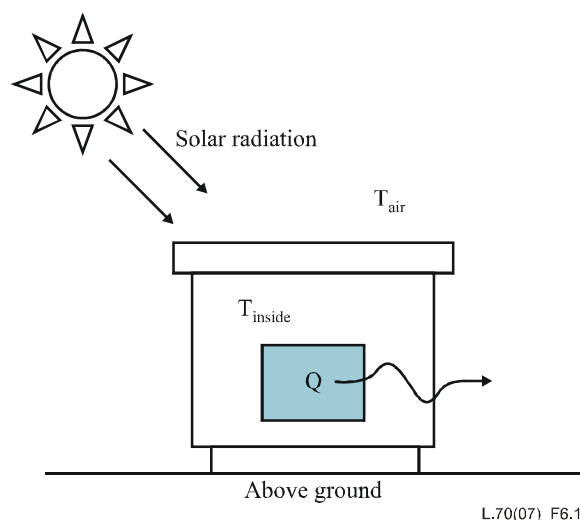


Figure 6-1 – Above ground active node