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Electrical safety in low voltage distribution systems up to 1 000 V AC and 1 500 V DC. – Equipment for testing, measuring or monitoring of protective measures –

Part 12: Power metering and monitoring devices (PMD)

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Sécurité électrique dans les réseaux de distribution basse tension jusqu'à 1 000 V c.a. et 1 500 V c.c. – Dispositifs de contrôle, de mesure ou de surveillance de mesures de protection –

Partie 12: Dispositifs de comptage et de surveillance du réseau électrique (PMD)



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**Electrical safety in low voltage distribution systems up to 1 000 V AC and 1 500 V DC. – Equipment for testing, measuring or monitoring of protective measures –**

**Part 12: Power metering and monitoring devices (PMD)**

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**Partie 12: Dispositifs de comptage et de surveillance du réseau électrique (PMD)**

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**ELECTRICAL SAFETY IN LOW VOLTAGE DISTRIBUTION  
SYSTEMS UP TO 1 000 V AC AND 1 500 V DC. –  
EQUIPMENT FOR TESTING, MEASURING OR  
MONITORING OF PROTECTIVE MEASURES –****Part 12: Power metering and monitoring devices (PMD)**

## FOREWORD

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International Standard IEC 61557-12 has been prepared by IEC technical committee 85: Measuring equipment for electrical and electromagnetic quantities.

This second edition cancels and replaces the first edition published in 2007. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) PMD-A has been withdrawn due the fact these devices are now mainly covered by the IEC 62586 series of standards.
- b) Three categories of PMD have been created with a list of minimum required functions for each category.

- c) Added a new Annex A explaining the different applications linked to the relevant standards and devices, and another new Annex C about the power factor conventions.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
85/644/FDIS	85/649/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 61557 series, published under the general title *Electrical safety in low voltage distribution systems up to 1 000 V AC and 1 500 V DC – Equipment for testing, measuring or monitoring of protective measures*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

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## INTRODUCTION

Energy distribution systems need to guarantee energy efficiency, availability and network performances in order to address the following challenges:

- sustainable development requirements where energy measurement, for instance, is recognised as an essential element of energy management, part of the overall drive to reduce carbon emissions and to improve the commercial efficiency of manufacturing, commercial organizations and public services;
- technological evolutions (electronic loads, electronic measuring methods, etc.);
- end-users needs (cost saving, compliance with aspects of building regulations, etc.) regarding electrical energy management as well as other energies, or fluids. Other functionalities involving several non electrical parameters are often needed in parallel;
- safety and continuity of service;
- evolution of installation standards, for instance over-current detection is now a new requirement for the neutral conductor due to harmonic content.

Monitoring electrical quantities in internal networks allows to address these challenges.

The devices on the current market have different characteristics, which need a common system of references. Therefore there is a need for this document in order to facilitate the choices of the end-users in terms of performance, safety, interpretation of the indications, etc. This document provides a basis by which such devices can be specified and described, and their performance evaluated.

In order to fulfil the requirements of the energy efficiency project, many PMD measuring electrical parameters can also collect data (water, air, gas, temperature...) coming from other sensors or meters inside building or plant areas. In order to be able to transmit all these data to a supervision software it will be relevant to equip the PMD with a communication bus. The supervision software will then manage all the collected data in order to monitor them and produce useful reports for energy usage and consumption analysis.

# ELECTRICAL SAFETY IN LOW VOLTAGE DISTRIBUTION SYSTEMS UP TO 1 000 V AC AND 1 500 V DC. – EQUIPMENT FOR TESTING, MEASURING OR MONITORING OF PROTECTIVE MEASURES –

## Part 12: Power metering and monitoring devices (PMD)

### 1 Scope

This part of IEC 61557 specifies requirements for power metering and monitoring devices (PMD) that measure and monitor the electrical quantities within electrical distribution systems, and optionally other external signals. These requirements also define the performance in single- and three-phase AC or DC systems having rated voltages up to 1 000 V AC or up to 1 500 V DC.

These devices are fixed or portable. They are intended to be used indoors and/or outdoors.

Power metering and monitoring devices (PMD), as defined in this document, give additional safety information, which aids the verification of the installation and enhances the performance of the distribution systems.

The power metering and monitoring devices (PMD) for electrical parameters described in this document are used for general industrial and commercial applications.

This document does not address functional safety and cyber security aspects.

This document is not applicable for:

- electricity metering equipment that complies with IEC 62053-21, IEC 62053-22, IEC 62053-23 and IEC 62053-24. Nevertheless, uncertainties defined in this document for active and reactive energy measurement are derived from those defined in IEC 62053 (all parts);
- the measurement and monitoring of electrical parameters defined in IEC 61557-2 to IEC 61557-9 and IEC 61557-13 or in IEC 62020;
- power quality instrument (PQI) according IEC 62586 (all parts);
- devices covered by IEC 60051 (all parts) (direct acting analogue electrical measuring instrument).

NOTE 1 Generally such types of devices are used in the following applications or for the following general needs:

- energy management inside the installation, such as facilitating the implementation of documents such as ISO 50001 and IEC 60364-8-1;
- monitoring and/or measurement of electrical parameters;
- measurement and/or monitoring of the quality of energy inside commercial/industrial installations.

NOTE 2 A measuring and monitoring device of electrical parameters usually consists of several functional modules. All or some of the functional modules are combined in one device. Examples of functional modules are:

- measurement and monitoring of several electrical parameters simultaneously;
- energy measurement and/or monitoring, as well as sometimes compliance with aspects of building regulations;
- alarms functions;
- demand side quality (current and voltage harmonics, over/under voltages, voltage dips and swells, etc.).

NOTE 3 PMD are historically called power meter, power monitor, power monitor device, power energy monitoring device, power analyser, multifunction meter, measuring multifunction equipment, energy meters.

NOTE 4 Metering, measuring and monitoring applications are explained in Annex A.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60068-2-1, *Environmental testing – Part 2-1: Tests – Test A: Cold*

IEC 60068-2-2, *Environmental testing – Part 2: Tests – Tests B: Dry heat*

IEC 60068-2-30, *Environmental testing – Part 2-30 – Tests – Test Db: Damp heat, cyclic (12 h + 12 h cycle)*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 61000-4-30:2015, *Electromagnetic compatibility (EMC) – Part 4-30: Testing and measurement techniques – Power quality measurement methods*

IEC 61010-1:2010, *Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements*

IEC 61010-1:2010/AMD1:2016

IEC 61010-2-030:2017, *Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 2-030: Particular requirements for testing and measuring circuits*

<https://standards.iteh.ai/catalog/standards/sist/ea96ab9c-d7eb-421a-86a3-04a5e0546475/iec-61557-12-2018>

IEC 61326-1:2012, *Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements*

IEC 62053-31:1998, *Electricity metering equipment (a.c.) – Particular requirements – Part 31: Pulse output devices for electromechanical and electronic meters (two wires only)*

## 3 Terms, definitions and notations

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

### 3.1 General definitions

#### 3.1.1

##### **power metering and monitoring device**

##### **PMD**

combination in one or more devices of several functional modules dedicated to metering and monitoring electrical parameters in energy distribution systems or electrical installations, used for applications such as energy efficiency, power monitoring and network performance

Note 1 to entry: Under the generic term “monitoring” are also included functions of recording, alarm management, etc.

Note 2 to entry: These devices may include demand side quality functions for monitoring inside commercial/industrial installations.

Note 3 to entry: This note applies to the French language only.

**3.1.2**  
**power quality assessment function**

power quality functions whose measurement methods are defined in IEC 61000-4-30

**3.1.3**  
**supply side**

part of the grid where electric energy is generated, transmitted and distributed to end-use customers through the public supply network

Note 1 to entry: This definition encompasses micro-grids, decentralised generators or renewable energy generators.

**3.1.4**  
**demand side**

part of the grid where electric energy is consumed by end-use customers within their electric distribution system

**3.1.5**  
**point of common coupling**  
**PCC**

point of a power supply network, electrically nearest to a particular load, at which other loads are, or may be, connected

Note 1 to entry: These loads can be either devices, equipment or systems, or distinct customer's installations.

Note 2 to entry: In some applications, the term "point of common coupling" is restricted to public networks.

[SOURCE: IEC 60050-161:1990, 161-07-15]  
<https://standards.iteh.ai/catalog/standards/sist/ea96ab9c-d7eb-421e-86c3-04e5a05d647b/iec-61557-12-2018>

**3.1.6**  
**power quality**

characteristics of the electric current, voltage and frequencies at a given point in an electric power system, evaluated against a set of reference technical parameters

Note 1 to entry: These parameters might, in some cases, relate to the compatibility between electricity supplied in an electric power system and the loads connected to that electric power system

[SOURCE: IEC 60050-617:2009, 617-01-05]

**3.1.7**  
**dedicated external sensor**

proprietary external sensor able to operate only with a range of PMD specified by the manufacturer

**3.1.8**  
**current sensor**  
**CS**

electrical, magnetic, optical or other device intended to transmit a signal corresponding to the current flowing through the primary circuit of this device

Note 1 to entry: A current transformer (CT) is in general a magnetic current sensor.

Note 2 to entry: This note applies to the French language only.

### 3.1.9

#### **compliance voltage**

value of the voltage that can be developed at the current analog output while conforming to the requirement of the uncertainty specification for that output

Note 1 to entry: This definition applies to current analog output signals.

### 3.1.10

#### **voltage sensor**

##### **VS**

electrical, magnetic, optical or other device intended to transmit a signal corresponding to the voltage across the primary terminals of this device

Note 1 to entry: A voltage transformer (VT) is in general a magnetic voltage sensor.

Note 2 to entry: This note applies to the French language only.

### 3.1.11

#### **self-powered PMD**

equipment where measuring terminals are also used for power supply

### 3.1.12

#### **auxiliary power supply**

external power supply, either AC or DC, that powers the PMD through dedicated terminals separated from the measurement inputs of the PMD

### 3.1.13

#### **transformer operated PMD**

PMD intended to be connected to the circuit(s) being measured via external instrument transformer(s)

<https://standards.iteh.ai/catalog/standards/sist/ea96ab9c-d7eb-421e-86c3-04c5a05d0470/iec-61557-12-2018>

Note 1 to entry: Transformer operated PMD corresponds to PMD Sx or PMD xS in this document.

### 3.1.14

#### **primary register**

register of an instrument transformer-operated meter which takes into account the ratios of all the transformers (voltage and current transformers) to which the meter is connected

Note 1 to entry: The value of the energy on the primary side of the transformers is obtainable from the direct reading of the register.

[SOURCE IEC 62053-52:2005, 3.4]

### 3.1.15

#### **half-primary register**

register of an instrument transformer-operated meter which takes into account either the ratio(s) of the current transformer(s) or the ratio(s) of the voltage transformer(s), but not both

Note 1 to entry: The value of the energy on the primary side of the transformer(s) is obtainable from the reading of the register multiplied by an appropriate factor.

[SOURCE IEC 62053-52:2005, 3.5]

## **3.2 Definitions related to uncertainty and performance**

### 3.2.1

#### **reference conditions**

appropriate set of specified values and/or ranges of values of influence quantities under which the smallest permissible uncertainties of a measuring instrument are specified