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Photovoltaic system performance – Part 1: Monitoring

INTERNATIONAL
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COMMISSION

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CONTENTS

FOREWORD....6
INTRODUCTION....8
1 Scope....10
2 Normative references....10
3 Terms and definitions....11
4 Monitoring system classification....16
5 General....17
5.1 Measurement precision and uncertainty....17
5.2 Calibration....17
5.3 Repeated elements....17
5.4 Power consumption....17
5.5 Documentation....17
5.6 Inspection....18
6 Data acquisition timing and reporting....18
6.1 Samples, records, and reports....18
6.2 Timestamps....20
6.3 Parameter names....20
7 ~~Measured parameters~~ Required measurements....21
8 Irradiance....27
8.1 Sensor types....31
8.2 General requirements....31
8.2.1 Overview....31
8.2.2 Sensor requirements....31
8.2.3 Sensor locations....32
8.2.4 Recalibration....33
8.2.5 Soiling mitigation....33
8.2.6 Dew and frost mitigation....33
8.2.7 Inspection and maintenance....34
8.2.8 Sensor alignment....34
8.3 Measurements....34
8.3.1 Global horizontal irradiance....34
8.3.2 In-plane irradiance....34
8.3.3 In-plane rear-side irradiance....35
8.3.4 In-plane rear-side irradiance ratio....35
8.3.5 Horizontal albedo....35
8.3.6 Direct normal irradiance....35
8.3.7 Diffuse horizontal irradiance....35
8.3.8 Spectrally matched irradiance....35
8.3.9 In-plane irradiance for concentrator systems....36
8.3.10 Spectral irradiance for concentrator systems....37
8.3.11 Circumsolar ~~ratio~~ measurements for concentrator systems....37
8.3.12 Satellite remote sensing of irradiance....38
9 Environmental factors....39
9.1 PV module temperature....39
9.2 Ambient air temperature....41

9.3 Wind speed and direction 42
9.4 Soiling ratio 42
9.5 Rainfall 45
9.6 Snow 45
9.7 Humidity 45
10 Tracker system 45
10.1 Single-axis trackers 45
10.2 Dual-axis trackers ~~for >20x systems~~ 45
10.2.1 Monitoring 45
10.2.2 Pointing error sensor alignment 45
11 Electrical measurements 46
11.1 Inverter-level measurements 46
11.2 Plant-level measurements 47
12 Data processing and quality check 48
12.1 ~~Daylight hours~~ Night 48
12.2 Quality check 48
12.2.1 Removing invalid readings 48
12.2.2 Treatment of missing data 49
13 Calculated parameters 49
13.1 Overview 49
13.2 Summations 50
13.3 Irradiation 50
13.4 Electrical energy 51
13.4.1 General 51
13.4.2 DC output energy 51
13.4.3 AC output energy 51
13.5 Array power rating 51
13.5.1 DC power rating 51
13.5.2 AC power rating 52
13.6 Yields 52
13.6.1 General 52
13.6.2 PV array energy yield 52
13.6.3 Final system yield 52
13.6.4 Reference yield 52
13.6.5 Bifacial reference yield 53
13.7 Yield losses 53
13.7.1 General 53
13.7.2 Array capture loss 53
13.7.3 Balance of systems (BOS) loss 53
13.8 Efficiencies 54
13.8.1 Array (DC) efficiency 54
13.8.2 System (AC) efficiency 54
13.8.3 BOS efficiency 54
14 Performance metrics 54
14.1 Overview 54
14.2 Summations 55
14.3 Performance ratios 55
14.3.1 Performance ratio 55

14.3.2 Temperature-corrected performance ratios 56
14.3.3 Bifacial performance ratios 58
14.4 Performance indices 59
15 Data filtering 59
15.1 Use of available data 59
15.2 Filtering data to specific conditions 59
15.3 Reduced inverter, grid, or load availability 59
Annex A (informative) Sampling interval 61
A.1 General considerations 61
A.2 Time constants 61
A.3 Aliasing error 61
A.4 Example 62
Annex B (informative) Module ~~backsheet~~ temperature sensor selection and attachment 63
B.1 Objective 63
B.2 Sensor and material selection 63
B.2.1 Optimal sensor types 63
B.2.2 Optimal tapes 63
B.2.3 Cyanoacrylate adhesives and backsheet integrity 64
B.3 Sensor attachment ~~method~~ 64
B.3.1 Permanent versus temporary 64
B.3.2 Attachment location 64
B.3.3 ~~Sensor attachment~~ Bifacial modules 64
B.3.4 Method 64
Annex C (normative) Soiling measurement using clean and soiled PV reference device pair 67
C.1 Overview 67
C.2 Equipment 67
C.3 Normalization 67
C.4 Measurement method 1 – max power reduction due to soiling 68
C.5 Measurement method 2 – short-circuit current reduction due to soiling 68
C.6 Non-uniform soiling 68
C.7 Daily average value 69
C.8 Renormalization 69
Annex D (informative) Derate factors 70
Annex E (normative) Systems with local loads, storage, or auxiliary sources 72
E.1 System types 72
E.2 Parameters and formulas 74
Bibliography 81

Figure 1 – Possible elements of PV systems 8
Figure 2 – Samples, records and reports 19
Figure B.1 – Sensor attachment, permanent 65
Figure B.2 – Sensor attachment, temporary 65
Figure B.3 – Sensor element wire strain relief 66
Figure E.1 – Energy flow between possible elements of different PV system types 72

~~Table 1 – Monitoring system classifications and suggested applications .....~~

Table 1 – Sampling and recording interval requirements 20
Table 2 – Measured parameters and requirements ~~for each monitoring system class~~ 22
Table 3 – ~~Relation between system size (AC) and number of sensors for specific sensors~~ Multiplier referenced in Table 2 27
Table 4 – Irradiance sensor requirements 32
~~Table 5 – Sensor choices and requirements for in-plane and global irradiance ....~~
~~Table 6 – Irradiance sensor alignment accuracy ....~~
~~Table 7 – Irradiance sensor maintenance requirements ....~~
Table 5 – Inverter-level electrical measurement requirements 46
Table 6 – Plant-level AC electrical output measurement requirements 47
Table 7 – Calculated parameters 50
~~Table 8 – PV module temperature sensor maintenance requirements ....~~
Table 8 – Performance metrics 55
~~Table 9 – Ambient air temperature sensor maintenance requirements ....~~
~~Table 11 – Inverter-level electrical measurement requirements ....~~
~~Table 12 – Plant-level AC electrical output measurement requirements ....~~
~~Table 13 – Calculated parameters ....~~
~~Table 14 – Performance metrics ....~~
Table E.1 – Elements of different PV system types 73
Table E.2 – Parameters and formulas for different system types 74

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PHOTOVOLTAIC SYSTEM PERFORMANCE –

Part 1: Monitoring

FOREWORD

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- Soiling measurement is updated based on new technology.
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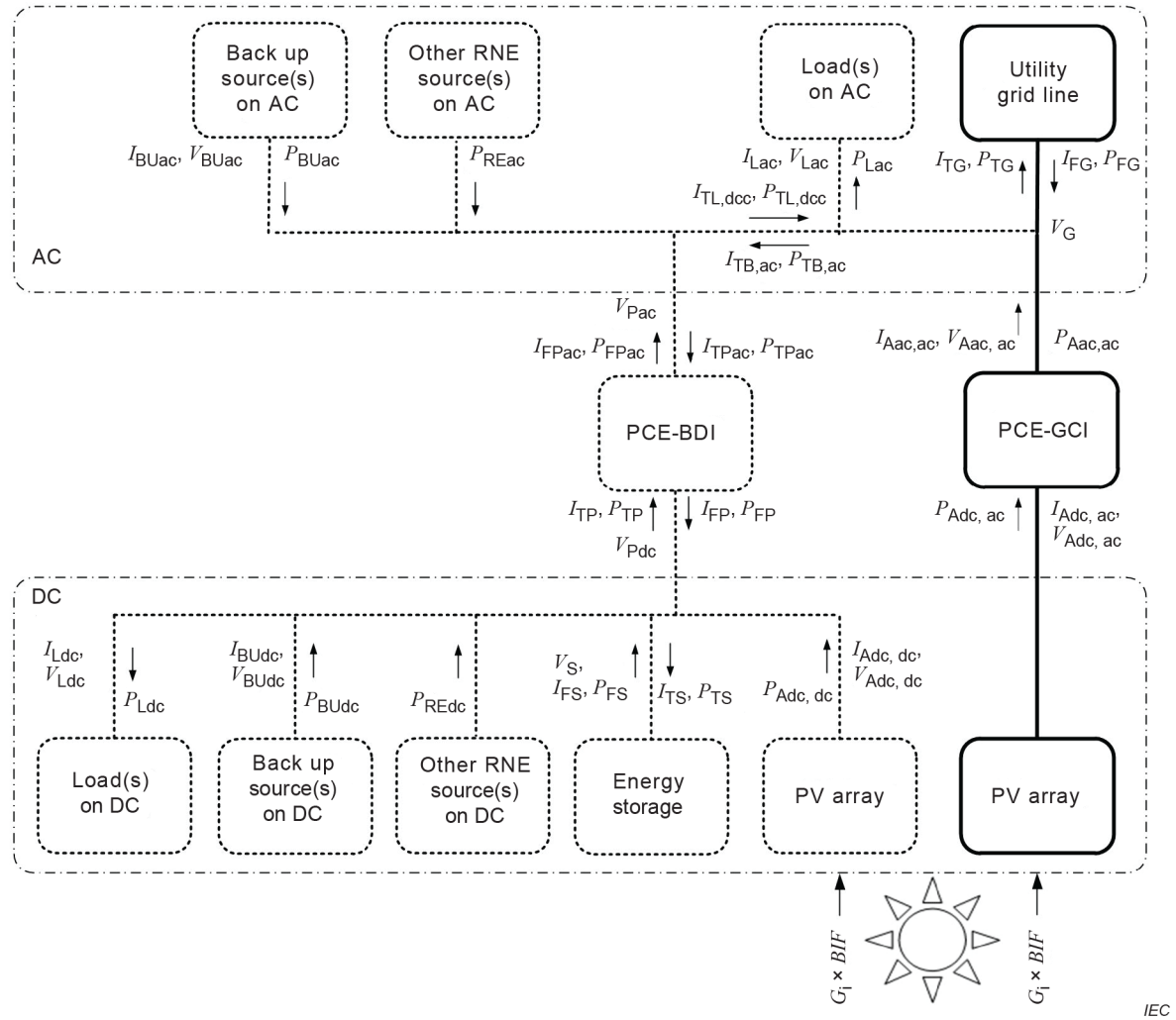
INTRODUCTION

This document defines classes of photovoltaic (PV) performance monitoring systems and serves as guidance for ~~various~~ monitoring system choices.

Figure 1 illustrates ~~possible~~ major elements comprising different PV system types.

The main clauses of this document are written for grid-connected systems without local loads, energy storage, or auxiliary sources, as shown by the bold lines in Figure 1. Annex E includes some details for systems with additional components.

The PV array may include both fixed-axis and ~~tracking~~ tracker systems and both flat-plate and concentrator systems. ~~Module-level electronics, if present, may be a component of the monitoring system.~~



Key

RNE: renewable energy

PCE: power conditioning equipment

BDI: bi-directional inverter

GCI: grid-connected inverter

Bold lines denote simple grid-connected system without local loads, energy storage, or auxiliary sources.

Figure 1 – Possible elements of PV systems

The purposes of a performance monitoring system are diverse and ~~can~~ could include ~~the following:~~

~~• identification of performance trends in an individual PV system;~~

~~• localization of potential faults in a PV system;~~

~~• comparison of PV system performance to design expectations and guarantees;~~

~~• comparison of PV systems of different configurations; and~~

~~• comparison of PV systems at different locations.~~

comparing performance to design expectations and guarantees as well as detecting and localizing faults.

~~These diverse purposes give rise to a diverse set of requirements, and different sensors and/or analysis methods may be more or less suited depending on the specific objective. For example,~~ For comparing performance to design expectations and guarantees, the focus should be on system-level data and consistency between prediction and test methods~~, while for analysing performance trends~~.

For detecting and localizing faults there ~~may~~ should be ~~a need for~~ greater resolution at sub-levels of the system and an emphasis on measurement repeatability and correlation metrics ~~rather than absolute accuracy~~.

The monitoring system should be adapted to the PV system's size and user requirements. In general, larger ~~and more expensive~~ PV systems should have more monitoring points and higher accuracy sensors than smaller and lower-cost PV systems. ~~This document defines three classifications of monitoring system with differentiated requirements which are appropriate to a range of purposes.~~

PHOTOVOLTAIC SYSTEM PERFORMANCE –

Part 1: Monitoring

1 Scope

This part of IEC 61724 outlines terminology, equipment, and methods for performance monitoring and analysis of photovoltaic (PV) systems. ~~It addresses sensors, installation, and accuracy for monitoring equipment in addition to measured parameter data acquisition and quality checks, calculated parameters, and performance metrics.~~ It also serves as a basis for other standards which rely upon the data collected.

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.

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~~IEC 60904-3, *Photovoltaic devices – Part 3: Measurement principles for terrestrial photovoltaic (PV) solar devices with reference spectral irradiance data*~~

IEC 60904-5, *Photovoltaic devices – Part 5: Determination of the equivalent cell temperature (ECT) of photovoltaic (PV) devices by the open-circuit voltage method*

IEC 60904-7, *Photovoltaic devices – Part 7: Computation of the spectral mismatch correction for measurements of photovoltaic devices*

~~IEC 60904-10, *Photovoltaic devices – Part 10: Methods of linearity measurement*~~

IEC 61215 (all parts), *Terrestrial photovoltaic (PV) modules – Design qualification and type approval*

IEC 61557-12, *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)*

IEC TS 61724-2, *Photovoltaic system performance – Part 2: Capacity evaluation method*

IEC TS 61724-3, *Photovoltaic system performance – Part 3: Energy evaluation method*

IEC TS 61836, *Solar photovoltaic energy systems – Terms, definitions and symbols*

~~IEC 62053-21, *Electricity metering equipment (a.c.) – Particular requirements – Part 21: Static meters for active energy (classes 1 and 2)*~~

IEC 62053-22, *Electricity metering equipment – Particular requirements – Part 22: Static meters for AC active energy (classes 0,1S, 0,2S and 0,5S)*

IEC 62670-3, *Photovoltaic concentrators (CPV) – Performance testing – Part 3: Performance measurements and power rating*

IEC 62817:2014, *Photovoltaic systems – Design qualification of solar trackers*

ISO/IEC Guide 98-1, *Uncertainty of measurement – Part 1: Introduction to the expression of uncertainty in measurement*

ISO/IEC Guide 98-3, *Uncertainty of measurement – Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

ISO 9060:2018, *Solar energy – Specification and classification of instruments for measuring hemispherical solar and direct solar radiation*

ISO 9488, *Solar energy – Vocabulary*

~~ISO 9846, *Solar energy – Calibration of a pyranometer using a pyrheliometer*~~

~~ISO 9847, *Solar energy – Calibration of field pyranometers by comparison to a reference pyranometer*~~

~~WMO No. 8, *Guide to meteorological instruments and methods of observation*~~

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Photovoltaic system performance – Part 1: Monitoring

Performances des systèmes photovoltaïques – Partie 1: Surveillance



IEC 61724-1:2021-07(en-fr)

CONTENTS

FOREWORD....6
INTRODUCTION....8
1 Scope....10
2 Normative references....10
3 Terms and definitions....11
4 Monitoring system classification....15
5 General....16
5.1 Measurement precision and uncertainty....16
5.2 Calibration....16
5.3 Repeated elements....16
5.4 Power consumption....16
5.5 Documentation....16
5.6 Inspection....16
6 Data acquisition timing and reporting....16
6.1 Samples, records, and reports....16
6.2 Timestamps....18
6.3 Parameter names....18
7 Required measurements....18
8 Irradiance....23
8.1 Sensor types....23
8.2 General requirements....23
8.2.1 Overview....23
8.2.2 Sensor requirements....23
8.2.3 Sensor locations....24
8.2.4 Recalibration....25
8.2.5 Soiling mitigation....25
8.2.6 Dew and frost mitigation....25
8.2.7 Inspection and maintenance....26
8.2.8 Sensor alignment....26
8.3 Measurements....26
8.3.1 Global horizontal irradiance....26
8.3.2 In-plane irradiance....26
8.3.3 In-plane rear-side irradiance....27
8.3.4 In-plane rear-side irradiance ratio....27
8.3.5 Horizontal albedo....27
8.3.6 Direct normal irradiance....27
8.3.7 Diffuse horizontal irradiance....27
8.3.8 Spectrally matched irradiance....27
8.3.9 In-plane irradiance for concentrator systems....28
8.3.10 Spectral irradiance for concentrator systems....29
8.3.11 Circumsolar measurements for concentrator systems....29
8.3.12 Satellite remote sensing of irradiance....30
9 Environmental factors....31
9.1 PV module temperature....31
9.2 Ambient air temperature....31

9.3 Wind speed and direction 32
9.4 Soiling ratio 32
9.5 Rainfall 33
9.6 Snow 33
9.7 Humidity 33
10 Tracker system 33
10.1 Single-axis trackers 33
10.2 Dual-axis trackers 33
10.2.1 Monitoring 33
10.2.2 Pointing error sensor alignment 33
11 Electrical measurements 34
11.1 Inverter-level measurements 34
11.2 Plant-level measurements 34
12 Data processing and quality check 35
12.1 Night 35
12.2 Quality check 35
12.2.1 Removing invalid readings 35
12.2.2 Treatment of missing data 35
13 Calculated parameters 36
13.1 Overview 36
13.2 Summations 36
13.3 Irradiation 36
13.4 Electrical energy 37
13.4.1 General 37
13.4.2 DC output energy 37
13.4.3 AC output energy 37
13.5 Array power rating 37
13.5.1 DC power rating 37
13.5.2 AC power rating 38
13.6 Yields 38
13.6.1 General 38
13.6.2 PV array energy yield 38
13.6.3 Final system yield 38
13.6.4 Reference yield 39
13.6.5 Bifacial reference yield 39
13.7 Yield losses 39
13.7.1 General 39
13.7.2 Array capture loss 39
13.7.3 Balance of systems (BOS) loss 40
13.8 Efficiencies 40
13.8.1 Array (DC) efficiency 40
13.8.2 System (AC) efficiency 40
13.8.3 BOS efficiency 40
14 Performance metrics 41
14.1 Overview 41
14.2 Summations 41
14.3 Performance ratios 41
14.3.1 Performance ratio 41

14.3.2 Temperature-corrected performance ratios 42
14.3.3 Bifacial performance ratios 44
14.4 Performance indices 44
15 Data filtering 45
15.1 Use of available data 45
15.2 Filtering data to specific conditions 45
15.3 Reduced inverter, grid, or load availability 45
Annex A (informative) Sampling interval 46
A.1 General considerations 46
A.2 Time constants 46
A.3 Aliasing error 46
A.4 Example 47
Annex B (informative) Module temperature sensor selection and attachment 48
B.1 Objective 48
B.2 Sensor and material selection 48
B.2.1 Optimal sensor types 48
B.2.2 Optimal tapes 48
B.2.3 Cyanoacrylate adhesives and backsheet integrity 49
B.3 Sensor attachment 49
B.3.1 Permanent versus temporary 49
B.3.2 Attachment location 49
B.3.3 Bifacial modules 49
B.3.4 Method 49
Annex C (normative) Soiling measurement using clean and soiled PV reference device pair 52
C.1 Overview 52
C.2 Equipment 52
C.3 Normalization 52
C.4 Measurement method 1 – max power reduction due to soiling 53
C.5 Measurement method 2 – short-circuit current reduction due to soiling 53
C.6 Non-uniform soiling 53
C.7 Daily average value 54
C.8 Renormalization 54
Annex D (informative) Derate factors 55
Annex E (normative) Systems with local loads, storage, or auxiliary sources 57
E.1 System types 57
E.2 Parameters and formulas 59
Bibliography 66

Figure 1 – Possible elements of PV systems 8
Figure 2 – Samples, records and reports 17
Figure B.1 – Sensor attachment, permanent 50
Figure B.2 – Sensor attachment, temporary 50
Figure B.3 – Sensor element wire strain relief 51
Figure E.1 – Energy flow between possible elements of different PV system types 57

Table 1 – Sampling and recording interval requirements 18

Table 2 – Measured parameters and requirements 20
Table 3 – Multiplier referenced in Table 2 23
Table 4 – Irradiance sensor requirements 24
Table 5 – Inverter-level electrical measurement requirements 34
Table 6 – Plant-level AC electrical output measurement requirements 34
Table 7 – Calculated parameters 36
Table 8 – Performance metrics 41
Table E.1 – Elements of different PV system types 58
Table E.2 – Parameters and formulas for different system types 59

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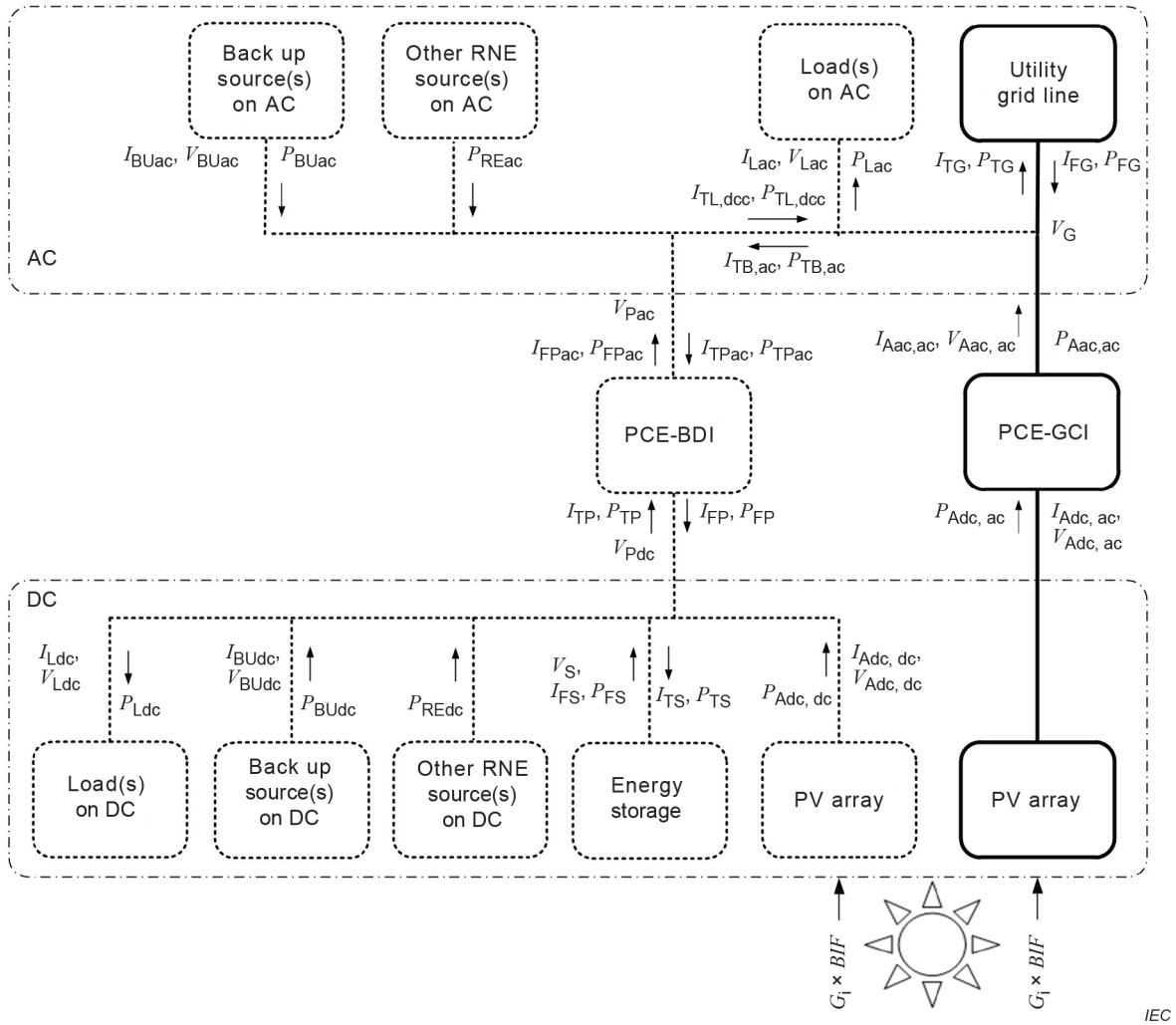
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IEC 61557-12, *Electrical safety in low voltage distribution systems up to 1 000 V AC and 1 500 V DC – Equipment for testing, measuring or monitoring of protective measures – Part 12: Power metering and monitoring devices (PMD)*

IEC TS 61724-2*, Photovoltaic system performance – Part 2: Capacity evaluation method*

IEC TS 61724-3, *Photovoltaic system performance – Part 3: Energy evaluation method*

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IEC 62053-22, *Electricity metering equipment – Particular requirements – Part 22: Static meters for AC active energy (classes 0,1S, 0,2S and 0,5S)*

IEC 62670-3, *Photovoltaic concentrators (CPV) – Performance testing – Part 3: Performance measurements and power rating*

IEC 62817:2014, *Photovoltaic systems – Design qualification of solar trackers*

ISO/IEC Guide 98-1, *Uncertainty of measurement – Part 1: Introduction to the expression of uncertainty in measurement*

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SOMMAIRE

AVANT-PROPOS 72
INTRODUCTION 74
1 Domaine d'application 76
2 Références normatives 76
3 Termes et définitions 77
4 Classification des systèmes de surveillance 82
5 Généralités 82
5.1 Fidélité et incertitude de mesure 82
5.2 Étalonnage 83
5.3 Éléments répétés 83
5.4 Consommation d'énergie 83
5.5 Documentation 83
5.6 Inspection 83
6 Temporisation et rapport de l'acquisition des données 83
6.1 Échantillons, enregistrements et rapports 83
6.2 Horodatages 84
6.3 Noms de paramètres 85
7 Mesurages exigés 85
8 Éclairement énergétique 89
8.1 Types de capteurs 89
8.2 Exigences générales 89
8.2.1 Aperçu 89
8.2.2 Exigences relatives aux capteurs 89
8.2.3 Emplacements des capteurs 90
8.2.4 Réétalonnage 91
8.2.5 Atténuation de l'encrassement 91
8.2.6 Atténuation de la rosée et du gel 92
8.2.7 Inspection et maintenance 92
8.2.8 Alignement des capteurs 92
8.3 Mesurages 93
8.3.1 Éclairement énergétique horizontal global 93
8.3.2 Éclairement énergétique dans le plan 93
8.3.3 Éclairement énergétique arrière dans le plan 93
8.3.4 Coefficient d'éclairement énergétique arrière dans le plan 94
8.3.5 Albédo horizontal 94
8.3.6 Éclairement énergétique normal direct 94
8.3.7 Éclairement énergétique horizontal diffus 94
8.3.8 Éclairement énergétique adapté spectralement 94
8.3.9 Éclairement énergétique dans le plan pour les systèmes à concentration 95
8.3.10 Éclairement énergétique spectral pour les systèmes à concentration 96
8.3.11 Mesurages circumsolaires pour les systèmes à concentration 96
8.3.12 Télédétection par satellite de l'éclairement énergétique 97
9 Facteurs environnementaux 98
9.1 Température des modules PV 98

9.2 Température de l'air ambiant 99
9.3 Vitesse et direction du vent 99
9.4 Coefficient d'encrassement 100
9.5 Précipitations 100
9.6 Neige 100
9.7 Humidité 100
10 Suiveur solaire 100
10.1 Systèmes monoaxiaux de suivi de trajectoire du soleil 100
10.2 Systèmes biaxiaux de suivi de trajectoire du soleil 101
10.2.1 Surveillance 101
10.2.2 Alignement des capteurs d'erreurs de pointage 101
11 Mesurages électriques 101
11.1 Mesurages au niveau de l'onduleur 101
11.2 Mesurages au niveau de la centrale 102
12 Traitement des données et contrôle qualité 102
12.1 Nuit 102
12.2 Contrôle qualité 103
12.2.1 Suppression des valeurs relevées invalides 103
12.2.2 Traitement des données manquantes 103
13 Paramètres calculés 104
13.1 Aperçu 104
13.2 Sommations 104
13.3 Irradiation 105
13.4 Énergie électrique 105
13.4.1 Généralités 105
13.4.2 Énergie de sortie en courant continu 105
13.4.3 Énergie de sortie en courant alternatif 105
13.5 Puissance assignée du groupe 106
13.5.1 Puissance assignée en courant continu 106
13.5.2 Puissance assignée en courant alternatif 106
13.6 Productivités 106
13.6.1 Généralités 106
13.6.2 Productivité énergétique du groupe PV 106
13.6.3 Productivité finale du système 107
13.6.4 Productivité de référence 107
13.6.5 Productivité de référence bifaciale 107
13.7 Pertes de productivité 108
13.7.1 Généralités 108
13.7.2 Pertes dans le groupe photovoltaïque 108
13.7.3 Perte des éléments du système PV hors modules (BOS) 108
13.8 Rendements 108
13.8.1 Rendement du groupe (en courant continu) 108
13.8.2 Rendement du système (en courant alternatif) 108
13.8.3 Rendement des éléments du système hors modules 109
14 Mesures des performances 109
14.1 Aperçu 109
14.2 Sommations 110
14.3 Coefficients de performance 110

14.3.1 Coefficient de performance 110
14.3.2 Coefficients de performance compensés en température 111
14.3.3 Coefficients de performance bifaciaux 112
14.4 Indices des performances 113
15 Filtrage des données 114
15.1 Utilisation des données disponibles 114
15.2 Filtrage de données dans des conditions spécifiques 114
15.3 Disponibilité réduite des onduleurs, du réseau électrique ou des charges 114
Annexe A (informative) Intervalle d'échantillonnage 115
A.1 Considérations générales 115
A.2 Constantes de temps 115
A.3 Erreur de repliement spectral 115
A.4 Exemple 116
Annexe B (informative) Choix et fixation des capteurs de température de la face arrière du module 117
B.1 Objectif 117
B.2 Choix des capteurs et des matériaux 117
B.2.1 Type optimal de capteur 117
B.2.2 Rubans adhésifs optimaux 117
B.2.3 Adhésifs à base de cyanoacrylate et intégrité des couches arrière 118
B.3 Fixation des capteurs 118
B.3.1 Permanente par opposition à temporaire 118
B.3.2 Emplacement de la fixation 118
B.3.3 Modules bifaciaux 118
B.3.4 Méthode 118
Annexe C (normative) Mesurage de l'encrassement avec une paire de dispositifs PV de référence, l'un propre, l'autre encrassé 121
C.1 Aperçu 121
C.2 Équipement 121
C.3 Étalonnage 121
C.4 Méthode de mesure 1 – réduction de la puissance maximale en raison de l'encrassement 122
C.5 Méthode de mesure 2 – réduction du courant de court-circuit en raison de l'encrassement 122
C.6 Encrassement non uniforme 122
C.7 Valeur quotidienne moyenne 123
C.8 Réétalonnage 123
Annexe D (informative) Facteurs de réduction de caractéristiques 124
Annexe E (normative) Systèmes à charges locales, stockage ou sources auxiliaires 126
E.1 Types de systèmes 126
E.2 Paramètres et équations 128
Bibliographie 136

Figure 1– Éléments possibles des systèmes PV 74
Figure 2 – Échantillons, enregistrements et rapports 84
Figure B.1 – Méthode de fixation des capteurs, permanente 119
Figure B.2 – Méthode de fixation des capteurs, temporaire 119
Figure B.3 – Relaxation des contraintes sur les fils du capteur 120

Figure E.1 – Flux d'énergie entre les éléments possibles des différents types de systèmes PV 126

Tableau 1 – Exigences relatives aux intervalles d'échantillonnage et d'enregistrement 84
Tableau 2 – Paramètres mesurés et exigences 86
Tableau 3 – Multiplicateur référencé dans le Tableau 2 89
Tableau 4 – Exigences relatives aux capteurs d'éclairement énergétique 90
Tableau 5 – Exigences relatives au mesurage électrique au niveau des onduleurs 102
Tableau 6 – Exigences relatives au mesurage de la puissance électrique en courant alternatif au niveau de la centrale 102
Tableau 7 – Paramètres calculés 104
Tableau 8 – Mesures des performances 109
Tableau E.1 – Éléments des différents types de systèmes PV 127
Tableau E.2 – Paramètres et équations pour les différents types de systèmes 128

COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

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PERFORMANCES DES SYSTÈMES PHOTOVOLTAÏQUES –

Partie 1: Surveillance

AVANT-PROPOS

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Cette deuxième édition annule et remplace la première édition parue en 2017. Cette édition constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

- Présentation de la surveillance des modules PV bifaciaux.
- Mise à jour des exigences relatives aux capteurs d'éclairement énergétique.
- Mise à jour du mesurage de l'encrassement pour tenir compte des nouvelles technologies.
- Suppression des systèmes de surveillance de classe C.

- Mise à jour de différentes exigences, recommandations et notes explicatives.

Le texte de cette norme est issu des documents suivants:

FDIS	Rapport de vote
82/1904/FDIS	82/1925/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à son approbation.

La langue employée pour l'élaboration de cette Norme internationale est l'anglais.

Ce document a été rédigé selon les Directives ISO/IEC, Partie 2, il a été développé selon les Directives ISO/IEC, Partie 1 et les Directives ISO/IEC, Supplément IEC, disponibles sous www.iec.ch/members_experts/refdocs. Les principaux types de documents développés par l'IEC sont décrits plus en détail sous www.iec.ch/standardsdev/publications.

Une liste de toutes les parties de la série IEC 61724, publiées sous le titre général *Performances des systèmes photovoltaïques*, peut être consultée sur le site web de l'IEC.

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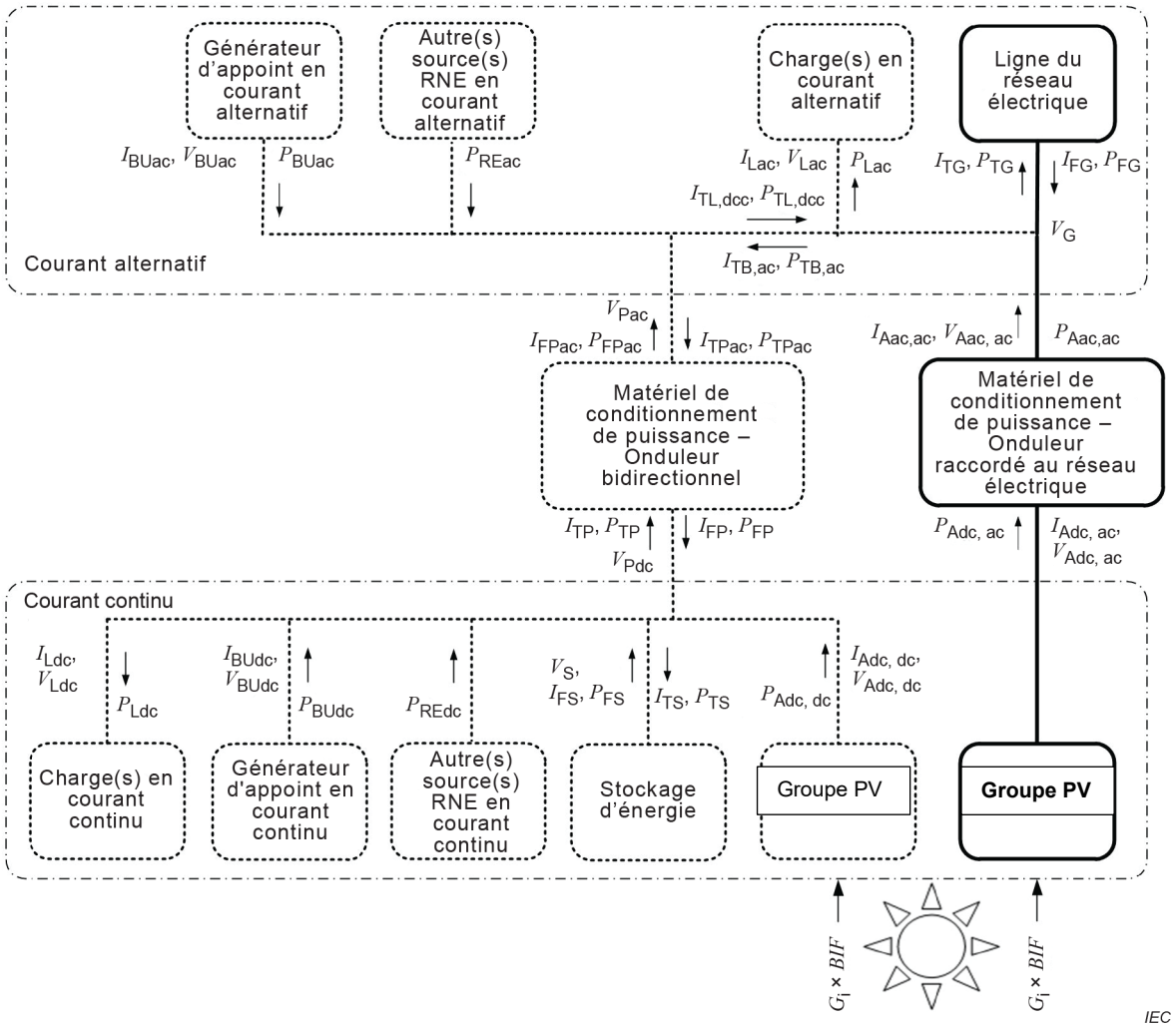
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INTRODUCTION

Le présent document définit les classes de systèmes de surveillance des performances des systèmes photovoltaïques (PV) et donne des recommandations relatives au choix des systèmes de surveillance.

La Figure 1 représente des éléments majeurs de différents types de systèmes PV. Les principaux articles du présent document sont rédigés pour les systèmes raccordés au réseau électrique sans charge locale, stockage d'énergie ou source auxiliaire, comme cela est représenté par les lignes en gras à la Figure 1. L'Annexe E donne quelques informations relatives aux systèmes avec des composants complémentaires.

Les groupes photovoltaïques pris en considération dans ce document peuvent être constitués de modules plans montés sur support fixe ou sur suiveur solaire. Les systèmes à concentration sont aussi pris en considération.



Légende:

RNE: énergie renouvelable (renewable energy);

PCE: matériel de conditionnement de puissance (power conditioning equipment);

BDI: onduleur bidirectionnel (bi-directional inverter);

GCI: onduleur raccordé au réseau électrique (grid-connected inverter).

Les lignes en gras indiquent un système simple raccordé au réseau électrique sans charge locale, stockage d'énergie ou source auxiliaire.

Figure 1– Éléments possibles des systèmes PV

Les objectifs d'un système de surveillance de la performance sont variés et peuvent comprendre la comparaison des performances afin de concevoir les attentes et les garanties, ainsi que la détection et la localisation des pannes.

Pour comparer les performances afin de concevoir les attentes et les garanties, il convient de concentrer l'attention sur les données au niveau du système et sur la fidélité entre les prédictions et les méthodes d'essai.

Pour détecter et localiser les pannes, il convient qu'il y ait une plus grande résolution dans les sous-niveaux du système et que l'accent soit mis sur la répétabilité du mesurage et les mesures de corrélation.

Il convient d'adapter le système de surveillance à la taille du système PV et aux exigences des utilisateurs. En règle générale, il convient que les systèmes PV les plus grands soient équipés de davantage de points de surveillance et de capteurs de plus grande exactitude par rapport aux systèmes PV plus petits et moins coûteux.

PERFORMANCES DES SYSTÈMES PHOTOVOLTAÏQUES –

Partie 1: Surveillance

1 Domaine d'application

La présente partie de l'IEC 61724 présente une terminologie, des équipements et des méthodes relatifs à la surveillance des performances et à l'analyse des systèmes photovoltaïques (PV). Elle sert également de base à d'autres normes qui s'appuient sur les données collectées.

2 Références normatives

Les documents suivants sont cités dans le texte de sorte qu'ils constituent, pour tout ou partie de leur contenu, des exigences du présent document. Pour les références datées, seule l'édition citée s'applique. Pour les références non datées, la dernière édition du document de référence s'applique (y compris les éventuels amendements).

IEC 60050-131, *Vocabulaire électrotechnique international – Partie 131: Théorie des circuits*

IEC 60904-2, *Dispositifs photovoltaïques – Partie 2: Exigences applicables aux dispositifs photovoltaïques de référence*

IEC 60904-5, *Dispositifs photovoltaïques – Partie 5: Détermination de la température de cellule équivalente (ECT) des dispositifs photovoltaïques (PV) par la méthode de la tension en circuit ouvert*

IEC 60904-7, *Dispositifs photovoltaïques – Partie 7: Calcul de la correction de désadaptation des réponses spectrales dans les mesures de dispositifs photovoltaïques*

IEC 61215 (toutes les parties), *Modules photovoltaïques (PV) pour applications terrestres - Qualification de la conception et homologation*

IEC 61557-12*, 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)*

IEC TS 61724-2*, Photovoltaic system performance – Part 2: Capacity evaluation method* (disponible en anglais seulement)

IEC TS 61724-3, *Photovoltaic system performance – Part 3: Energy evaluation method* (disponible en anglais seulement)

IEC TS 61836, *Solar photovoltaic energy systems – Terms, definitions and symbols* (disponible en anglais seulement)

IEC 62053-22, *Équipement de comptage de l'électricité – Exigences particulières – Partie 22: Compteurs statiques d'énergie active en courant alternatif (classes 0,1 S, 0,2 S et 0,5 S)*

IEC 62670-3, *Concentrateurs photovoltaïques (CPV) – Essai de performances – Partie 3: Mesurages de performances et rapport de puissance*

IEC 62817:2014, *Systèmes photovoltaïques – Qualification de conception des suiveurs solaires*

Guide ISO/IEC 98-1, *Incertitude de mesure – Partie 1: Introduction à l'expression de l'incertitude de mesure*

Guide ISO/IEC 98-3, *Incertitude de mesure – Partie 3: Guide pour l'expression de l'incertitude de mesure (GUM:1995)*

ISO 9060:2018, *Solar energy – Specification and classification of instruments for measuring hemispherical solar and direct solar radiation* (disponible en anglais seulement)

ISO 9488, *Énergie solaire – Vocabulaire*