



BSI Standards Publication

Microgrids

Part 2: Guidelines for operation

National foreword

This Published Document is the UK implementation of IEC 62898-2:2018+A1:2023. It supersedes PD IEC TS 62898-2:2018, which is withdrawn.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to IEC text carry the number of the IEC amendment. For example, text altered by IEC amendment 1 is indicated by A1 A1.

The UK participation in its preparation was entrusted to Technical Committee GEL/8, Systems Aspects for Electrical Energy Supply.

A list of organizations represented on this committee can be obtained on request to its committee manager.

Contractual and legal considerations

This publication has been prepared in good faith, however no representation, warranty, assurance or undertaking (express or implied) is or will be made, and no responsibility or liability is or will be accepted by BSI in relation to the adequacy, accuracy, completeness or reasonableness of this publication. All and any such responsibility and liability is expressly disclaimed to the full extent permitted by the law.

This publication is provided as is, and is to be used at the recipient's own risk.

The recipient is advised to consider seeking professional guidance with respect to its use of this publication.

This publication is not intended to constitute a contract. Users are responsible for its correct application.

This publication is not to be regarded as a British Standard.

© The British Standards Institution 2023
Published by BSI Standards Limited 2023

ISBN 978 0 539 18794 6

ICS 29.240.01

Compliance with a Published Document cannot confer immunity from legal obligations.

This Published Document was published under the authority of the Standards Policy and Strategy Committee on 30 September 2018.

Amendments/corrigenda issued since publication

Date	Text affected
30 November 2023	Implementation of IEC amendment 1:2023



IEC TS 62898-2

Edition 1.0 2018-09

TECHNICAL SPECIFICATION



Microgrids – Part 2: Guidelines for operation

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 29.240.01

ISBN 978-2-8322-6042-5

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references	7
3 Terms and definitions	8
4 Operation modes	13
4.1 General.....	13
4.2 Non-isolated microgrid	13
4.2.1 General	13
4.2.2 Grid-connected mode	13
4.2.3 Island mode.....	14
4.2.4 Mode transfer of non-isolated microgrids	14
4.3 Isolated microgrid	15
4.3.1 General	15
4.3.2 Structure of the isolated microgrids	15
4.3.3 Voltage response characteristics	16
4.3.4 Frequency response characteristics.....	16
5 Control of microgrids	16
5.1 General.....	16
5.2 Control of the non-isolated microgrid	18
5.2.1 Control of the grid-connected mode	18
5.2.2 Control of the island mode	19
5.3 Control of the isolated microgrid	20
6 Communication and monitoring.....	21
6.1 General.....	21
6.2 Communications of microgrids	22
6.2.1 General	22
6.2.2 Communications between non-isolated microgrids and the utility grid	22
6.2.3 Communications inside the microgrids.....	22
6.3 Monitoring the DER.....	22
6.4 Monitoring the switching devices for non-isolated microgrids	22
6.5 Monitoring the switching devices for isolated microgrids	23
7 Electrical energy storage	23
7.1 General.....	23
7.2 EES in non-isolated microgrids	23
7.2.1 Requirements for EES in grid-connected mode	23
7.2.2 Requirements for EES in island mode.....	23
7.2.3 Requirements for EES in mode transfer	24
7.3 EES management	24
8 Protection principle for microgrids.....	24
8.1 General.....	24
8.2 Principle for protection in a non-isolated microgrid	25
8.3 Reclosing with synchronization in a non-isolated microgrid	25
8.4 Principle for protection in an isolated microgrid.....	25
9 Power quality and EMC of microgrids	25
9.1 Power quality in non-isolated microgrids	25

9.2	Power quality in isolated microgrids	26
9.3	EMC in microgrids.....	26
10	Maintenance and test of microgrids	26
10.1	General.....	26
10.2	Maintenance	26
10.3	Test	27
	Annex A (informative) Business use case A: Improving reliability and securing the energy supply by islanding.....	28
	Annex B (informative) Business use case B: Electrifying remote areas and using renewable energy sources	31
	Annex C (informative) Business use case C: Reducing energy costs for microgrid users	33
	Annex D (informative) Business use case D: Optimizing local resources to provide services to the grid/disaster preparedness	35
	Annex E (informative) Example of power factor requirements cited in some standards.....	36
	Bibliography.....	37
	Figure 1 – Example for a non-isolated microgrid	17
	Figure 2 – Example for an isolated microgrid	18
	Figure 3 – The P-f control in isolated microgrid	20
	Figure B.1 – One of the actual examples of mainly-isolated microgrids used for electrification in far rural area	32
	Figure C.1 – Principle scheme of customer energy management and information exchange with upstream grid	34
	Table 1 – Example for the isolated microgrid frequency response of 50 Hz	21
	Table E.1 – Power factor requirements	36

INTERNATIONAL ELECTROTECHNICAL COMMISSION

MICROGRIDS –**Part 2: Guidelines for operation****FOREWORD**

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

The main task of IEC technical committees is to prepare International Standards. In exceptional circumstances, a technical committee may propose the publication of a technical specification when

- the required support cannot be obtained for the publication of an International Standard, despite repeated efforts, or
- the subject is still under technical development or where, for any other reason, there is the future but no immediate possibility of an agreement on an International Standard.

Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC TS 62898-2, which is a technical specification, has been prepared by subcommittee 8B: Decentralized Electrical Energy Systems, of IEC technical committee 8: Systems aspects of electrical energy supply.

The text of this technical specification is based on the following documents:

Enquiry draft	Report on voting
8B/3/DTS	8B/13B/RVDTS

Full information on the voting for the approval of this technical specification 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 62898 series, published under the general title *Microgrids*, can be found on the IEC website.

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

- transformed into an International standard,
- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

Microgrids can serve different purposes depending on the primary objectives of their applications. They are usually seen as means to facilitate the management of grid contingency and the local optimization of energy supply by controlling distributed energy resources (DER). Microgrids also present a way to provide electricity supply in remote areas and to use clean and renewable energy as a systemic approach for rural electrification.

IEC TS 62898 series is intended to provide with comprehensive guidelines and requirements for microgrid projects.

IEC TS 62898-1 mainly covers the following issues:

- 1) determination of microgrid purposes and application;
- 2) preliminary study necessary for microgrid planning, including resource analysis, load forecast, DER planning and power system planning;
- 3) principles of microgrid technical requirements that should be specified during planning stage;
- 4) microgrid evaluation to select an optimal microgrid planning scheme.

IEC TS 62898-2 mainly covers the following issues:

- a) response characteristic requirements of microgrids under different operation modes;
- b) the basic control strategies and methods under different operation modes;
- c) the requirements of electrical energy storage (EES), communication and monitoring under different operation modes;
- d) the principle of relay protection under different operation modes;
- e) basic requirements of synchronization and reclosing during mode transfer;
- f) principle for power quality, EMC, maintenance and test of microgrid.

Microgrids can be stand-alone or be the sub-system of the smart grid. The technical requirements in this document are intended to be consistent and in line with:

- system requirements from IEC System Committee Smart Energy (e.g. Use Cases “microgrid” to come);
- IEC 62786 requirements for connection of generators intended to be operated in parallel with the grid;
- basic rules from IEC TC 64 and TC 99 for safety and quality of power distribution within installations (essentially through coordination of protective devices in the different operation modes);
- IEC TS 62257 series (IEC TC 82) with respect to rural electrification;
- IEC TS 62749 with respect to power quality.

MICROGRIDS –

Part 2: Guidelines for operation

1 Scope

The purpose of this document is to provide guidelines for operation of microgrids. Microgrids considered in this document are alternating current (AC) electrical systems with loads and distributed energy resources (DER) at low or medium voltage level. This document does not cover direct current (DC) microgrids.

Microgrids are classified into isolated microgrids and non-isolated microgrids.

Isolated microgrids have no electrical connection to a larger electric power system and operate in island mode only.

Non-isolated microgrids may act as controllable units to the electric power system and can operate in the following two modes:

- grid-connected mode;
- island mode.

The 62898 series is intended to provide guidelines and the basic technical requirements to ensure the security, reliability and stability of microgrids.

IEC TS 62898-2 applies to operation and control of microgrids, including:

- operation modes and mode transfer;
- energy management system (EMS) and control of microgrids;
- communication and monitoring procedures;
- electrical energy storage;
- protection principle covering: principle for non-isolated microgrid, isolated microgrid, anti-islanding, synchronization and reclosing, power quality;
- commissioning, maintenance and test.

NOTE 1 Safety for personnel is outside the scope of this document, and such information is referred to in IEC TC 64 and TC 99 publications.

NOTE 2 Local laws and regulations can overrule the requirements of this document.

NOTE 3 ^{A1)} The principles for main types of protections in microgrid, fault analysis for converter type and rotating machines type, protection type selection, general technical requirements, setting value principles and so forth are in IEC TS 62898-3-1¹⁾. ^{A1)}

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.

¹⁾ Under preparation. Stage at the time of publication: IEC/CD TS 62898-3-1:2018.