IEC TS 62898-3-2

Edition 1.0 2024-01

TECHNICAL SPECIFICATION

colour inside

Microgrids –
Part 3-2: Technical requirements – Energy management systems

IEC TS 62898-3-2:2024-01(en)

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 29.240.01

ISBN 978-2-8322-8075-1

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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FOREWORD

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IEC TS 62898-3-2 has been prepared by subcommittee 8B: Decentralized electrical energy systems, of IEC technical committee TC 8: System aspects of electrical energy supply. It is a Technical Specification.

The text of this Technical Specification is based on the following documents:

Draft	Report on voting
8B/153/DTS	8B/177/RVDTS

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this Technical Specification is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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 document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

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INTRODUCTION

Microgrids can serve various purposes depending on the primary objectives of their applications. They are usually seen as a technical means to manage reliability of supply and to facilitate local optimization of energy supply by controlling distributed energy resources (DER). Microgrids also present a way to provide electricity supply in remote areas, to use renewable energy as a systematic approach for rural electrification and to increase resiliency and security of supply to end users.

IEC TS 62898 series is intended to provide general guidelines and technical requirements for microgrid projects.

IEC TS 62898-1 mainly covers the following issues:

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

IEC TS 62898-2 mainly covers the following issues:

- operation requirements and control targets of microgrids under various operation modes,
- the basic control strategies and methods under various operation modes,
- the requirements of electrical energy storage (EES), relay protection, monitoring and communication under various operation modes,
- power quality.

IEC TS 62898-3-XX subseries technical specifications deal with the technical requirements of microgrids.

IEC TS 62898-3-1 covers the protection and dynamic control of microgrids.

The present document covers microgrid energy management systems (MEMS).

MICROGRIDS –

Part 3-2: Technical requirements – Energy management systems

1 Scope

The purpose of this part of IEC 62898 is to provide technical requirements for the operation of energy management systems of microgrids. This document applies to utility-interconnected or islanded microgrids. This document describes specific recommendations for low-voltage (LV) and medium-voltage (MV) systems.

This document focuses on developing standards of energy management systems aimed for microgrids integrated in decentralized energy systems or public distribution grids. It concerns some particularities that are not totally covered by the existing conventional energy system. The microgrid energy management systems are being studied by various actors (utilities, manufacturers, and energy providers) on actual demonstration projects and application use case. The aims of this document are to make the state of the art of existing energy management systems used in actual microgrids projects, to classify the relevant functions which can be accomplished by microgrid energy management systems, and to recommend necessary technical requirements for energy management systems of future microgrids.

This document includes the following items:

- main performances of key components of microgrid: decentralized energy resources, energy storages and controllable loads),
- description of main functions and topological blocks of microgrid energy management systems (MEMS),
- specification of information exchange protocol between main function blocks, linked to microgrid monitoring and control systems (MMCS).

Main functions of MEMS:

- power and energy management among different resources within microgrid including active and reactive power flows with different time scales,
- power and energy forecasts of microgrid,
- energy balancing between upstream grid and microgrid energy resources according to power and energy forecast and upstream and local constraints,
- economic and environmental optimization,
- possible service capacities such as capacity market auctions and resiliency anticipation: new business models,
- data archiving, trending, reporting and evaluation of operation capacities in various operation modes.

MEMS can have some other additional functions according to microgrid size and actual application cases:

- tariff and market trading management,
- utility ancillary services such as frequency regulation, voltage regulation, power quality and reliability improvement, demand response possibilities, change of operation modes linked to MMCS.

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 60364-8-82, *Low-voltage electrical installations − Part 8-82: Functional aspects − Prosumer's low-voltage electrical installations*

IEC TS 60364-8-3, *Low-voltage electrical installations – Part 8-3: Functional aspects – Operation of prosumer's electrical installations*

IEC 60870 (all parts), *Telecontrol equipment and systems*

IEC 60870-5-101, *Telecontrol equipment and systems – Part 5-101: Transmission protocols – Companion standard for basic telecontrol tasks*

IEC 60870-5-104, *Telecontrol equipment and systems – Part 5-104: Transmission protocols – Network access for IEC 60870-5-101 using standard transport profiles*

IEC 61850 (all parts), *Communication networks and systems in substations*

IEC 61850-8-1, *Communication networks and systems for power utility automation − Part 8-1: Specific communication service mapping (SCSM) − Mappings to MMS (ISO 9506-1 and ISO 9506-2) and to ISO/IEC 8802-3*

IEC 61850-8-2, *Communication networks and systems for power utility automation − Part 8-2: Specific communication service mapping (SCSM) − Mapping to Extensible Messaging Presence Protocol (XMPP)*

IEC TR 61850-90-1, *Communication networks and systems for power utility automation – Part 90-1: Use of IEC 61850 for the communication between substations*

IEC TR 61850-90-2, *Communication networks and systems for power utility automation – Part 90-2: Using IEC 61850 for communication between substations and control centres*

IEC 61970-1:2005, *Energy management system application program interface (EMS-API) − Part 1: Guidelines and general requirements*

IEC 62351, *Power systems management and associated information exchange – Data and communications security*

IEC 62443 (all parts), *Security for industrial automation and control systems*

IEC 62443-3-3, *Industrial communication networks – Network and system security – Part 3-3: System security requirements and security levels*

IEC 62443-4-2, *Security for industrial automation and control systems – Part 4-2: Technical security requirements for IACS components*

IEC TS 62898-1, *Microgrids – Part 1: Guidelines for microgrid projects planning and specification*

IEC TS 62898-2, *Microgrids – Part 2: Guidelines for operation*

IEC TS 62898-3-1, *Microgrids – Technical requirements – Part 3-1: Protection and dynamic control*

IEC TS 62898-3-4:2023, *Microgrids – Technical requirements – Part 3-4: Microgrid monitoring and control systems*

IEEE Std 1815-2012, *IEEE Standard for Electric Power Systems Communications-Distributed Network Protocol (DNP3)*

MODBUS Application Protocol Specification:
https://www.modbus.org/docs/Modbus_Application_Protocol_V1_1b.pdf [viewed 2023-12-12]

3 Terms, definitions and abbreviated terms

For the purposes of this document, the following terms and definitions 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 Terms and definitions

3.1.1
energy management system
EMS
system monitoring, operating, controlling, and managing DER and loads

[SOURCE: IEC 60364-8-1:2019, 3.2.1 – modified: "Electrical" has been deleted from the term, "energy resources and loads of the installations" has been replaced by "DER and loads".]

3.1.2
distributed energy resources
DER
generators (with their auxiliaries, protection and connection equipment), including loads having a generating mode (such as electrical energy storage systems), connected to a low-voltage or a medium-voltage network

[SOURCE: IEC 60050-617:2017, 617-04-20]

3.1.3
microgrid energy management system
MEMS
system operating and controlling energy resources and loads of the microgrid

[SOURCE: IEC 60050-617:2018, 617-04-25]

3.1.4
microgrid controller
physical device/system which includes MMCS functions and can include MEMS as well, for example, in small size microgrid

3.1.5
microgrid monitoring and control systems
MMCS
computer or PLC based system performing real time monitoring and control of microgrid

3.1.6
point of common coupling
PCC
point in an electric power system, electrically nearest to a particular load, at which other loads are, or could be, connected

[SOURCE: IEC 60050-614:2016, 614-01-12]

3.1.7
point of connection
POC
reference point on the electric power system where the user's electrical facility is connected

[SOURCE: IEC 60050-617:2009, 617-04-01]

3.1.8
state of charge
SOC
available capacity in a battery pack or system expressed as a percentage of rated capacity

[SOURCE: ISO 12405-4:2018, 3.20]

3.1.9
state of health
SOH
general condition of a battery and its ability to deliver the specified performance compared with a new battery (0 % to 100 %)

3.2 Abbreviated terms

EES electric energy storage

ESS energy storage system

4 General

4.1 System architecture and functional mapping

Generally, microgrids can be integrated into the electric power system (see Figure 1), and MEMS is one of the key components or functions of microgrid. Figure 1 is based on a general view and the displayed blocks have other possibilities depending on the size of the microgrids and the type of applications.