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Microgrids -
Part 3-5: Technical requirements - Testing for microgrid monitoring, control, and energy management systems

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CONTENTS

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Microgrids - Part 3-5: Technical requirements - Testing for microgrid monitoring, control, and energy management systems

FOREWORD

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IEC TS 62898-3-5, which is a technical specification, has been prepared by subcommittee 8B: Decentralized electrical energy systems, of IEC technical committee 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/277/DTS	8B/292/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 [change language if necessary].

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– withdrawn, or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.

INTRODUCTION

Microgrid monitoring, control, and energy management systems (MMCS and MEMS) are essential components of microgrid infrastructure designed to monitor, control, and optimize the operation of a microgrid. These systems play a central role in managing distributed energy resources (DERs), ensuring grid stability, and improving the efficiency and reliability of energy supply within a microgrid.

The major functions of MMCS and MEMS include the control of device switching, islanding detection, operation modes switching, active/reactive power control, black-start, anti-maloperation locking, local power quality control, frequency/voltage regulation, tertiary control, etc.

Microgrid systems are often deployed in critical applications, such as hospitals, data centres, and remote communities. Providing a comprehensive testing for the MMCS and MEMS system is critical to ensure the microgrid system's stability, even during unexpected events or disturbances. A standardized set of testing procedures could facilitate the wide adoption of standard MMCS and MEMS functional and performance requirements by vendors and utilities while reducing the cost of design and construction.

The IEC 62898 series is intended to provide comprehensive guidelines and technical requirements for microgrid projects, however, there are some standardization gaps left in this series.

IEC TS 62898-3-1 mainly covers the requirements for microgrid protection, protection systems for microgrids and dynamic control for transient and dynamic disturbances in microgrids.

IEC TS 62898-3-2 covers the technical requirements for microgrid energy management systems (MEMS), but this document does not specify any testing procedures required for MEMS.

IEC TS 62898-3-3 covers the self-regulation of dispatchable loads of microgrids.

IEC TS 62898-3-4 covers the technical requirements for the monitoring and control of microgrids, however, it does not specify any testing items or procedures for MMCS.

The IEC TS 62898-3-5 aims to provide a standardized testing procedure for MMCS and MEMS' major functions.

This document covers the technical requirements for the hardware in the loop testing (HIL), commissioning testing, and periodic testing that allows the verification, and quantification of the performance of microgrid monitoring, control, and energy management systems.

The HIL test aims to verify the performance of MMCS and MEMS major functions and provide a set of metrics to quantify the minimum requirements of different functions. This test requires the interaction between both systems and the real-time simulation environment. HIL testing is recommended for MW level or larger microgrids.

The commissioning test provides the performance evaluation of both systems' major functions on-site. This test will be conducted after MMCS and MEMS are installed and ready for operation. Certain testing items will show actual performances of the MMCS and MEMS such as voltage deviation, harmonics, step power response, voltage/current evolution, power management efficiency, etc.

The periodic function test is set to verify certain functions' performance after a certain time of operation. The test interval is specified by the manufacturer, system integrator, or microgrid owner.

1 Scope

This part of IEC 62898, which is a Technical Specification, provides technical requirements for the hardware in the loop testing (HIL), commissioning testing, and periodic testing that allows the verification, and quantification of the performance of microgrid monitoring, control, and energy management systems (MMCS and MEMS). This document applies to MMCS and MEMS developed for grid-connected or isolated microgrids, or both.

This document includes the following aspects:

– general technical requirements;
– hardware in the loop testing;
– commissioning testing;
– periodic testing.

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 TS 62898-3-2, *Microgrids - Part 3-2: Technical requirements - Energy management systems*

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

3 Terms and definitions

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

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

– IEC Electropedia: available at https://www.electropedia.org/
– ISO Online browsing platform: available at https://www.iso.org/obp

3.1
microgrid
<in an electric power system> group of interconnected loads and distributed energy resources with defined electrical boundaries forming a local electric power system at distribution voltage levels, that acts as a single controllable entity and is able to operate in island mode, no matter if it is standalone or grid-connected

Note 1 to entry: This definition covers both (utility) distribution microgrids and (customer owned) facility microgrids.

[SOURCE: IEC 60050-617:2017 [30], 617-04-22, modified – "either grid-connected or island mode" has been changed to " in island mode, no matter if it is standalone or grid-connected"]

3.2
microgrid monitoring and control system
MMCS
computer or PLC based system performing real time monitoring and control of microgrid

Note 1 to entry: In a large grid or large microgrid, such a system is also designated by PMS (power monitoring system).

3.3
microgrid energy management system
MEMS
system operating and controlling energy resources and loads of the microgrid

[SOURCE: IEC 60050-617:2018 [30], 617-04-25]

3.4
distributed energy resources, pl.
DER, pl.
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 [30], 617-04-20]

3.5
renewable energy resource
RES
non-fossil energy resource such as wind, solar, hydropower, biomass, geothermal, etc

3.6
low voltage
LV
set of voltage levels used for the distribution of electricity and whose upper limit is generally accepted to be 1 000 V for alternating current

[SOURCE: IEC 60050-601:1985 [31], 601-01-26]

3.7
medium voltage
MV
any set of voltage levels lying between low and high voltage

Note 1 to entry: The boundaries between medium- and high-voltage levels overlap and depend on local circumstances and history or common usage. Nevertheless, the band 30 kV to 100 kV frequently contains the accepted boundary.

[SOURCE: IEC 60050-601:1985 [31], 601-01-28]

3.8
point of connection
POC
reference point on the electric power system where the user's electrical facility is connected

[SOURCE: IEC 60050-617:2009 [30], 617-04-01]

3.9
power conversion system
PCS
device that can control the charging and discharging process of a battery storage system, and carry out AC-DC conversion

3.10
state of charge
SOC
available capacity in a battery pack or system expressed as a percentage of rated capacity

[SOURCE: ISO 12405-4:2018 [32], 3.20]

3.11
hardware in the loop simulation
HIL
hardware in the loop testing provides real time simulation for MMCS and MEMS