



BSI Standards Publication

Communication networks and systems in power utility automations

Part 90-16: Requirements of system management for Smart Energy Automation

National foreword

This Published Document is the UK implementation of IEC TR 61850-90-16:2021.

The UK participation in its preparation was entrusted to Technical Committee PEL/57, Power systems management and associated information exchange.

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 2021
Published by BSI Standards Limited 2021

ISBN 978 0 539 16068 0

ICS 33.200

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 31 July 2021.

Amendments/corrigenda issued since publication

Date	Text affected
------	---------------



IEC TR 61850-90-16

Edition 1.0 2021-06

TECHNICAL REPORT



**Communication networks and systems in power utility automations –
Part 90-16: Requirements of system management for Smart Energy Automation**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 33.200

ISBN 978-2-8322-9713-1

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

CONTENTS

FOREWORD..... 4

INTRODUCTION..... 6

1 Scope..... 7

2 Normative references 8

3 Terms and definitions 9

4 Smart Grid System life cycle..... 10

 4.1 Overview..... 10

 4.2 IED life-cycle 11

 4.2.1 Software 11

 4.2.2 Hardware..... 11

 4.2.3 Main life-cycle stages 11

 4.2.4 Cybersecurity lifecycle for system management..... 12

 4.3 System management roles identified..... 14

 4.3.1 Business roles 14

 4.3.2 System roles..... 15

 4.4 System management architecture 17

5 System management Business Use Cases 19

 5.1 General..... 19

 5.2 BUC: Enable Automation System to perform operational functions in best conditions 19

 5.2.1 Description of the use case 19

 5.2.2 Diagrams of use case 20

 5.2.3 Technical details..... 21

6 System management system Use Cases 21

 6.1 General..... 21

 6.2 Configuration and administration system Use Cases 22

 6.2.1 System Use Cases identified 22

 6.2.2 SUC: Deploy a Power System Function 22

 6.2.3 SUC: Synchronize multiple automation-system-devices updates..... 35

 6.3 Asset management, supervision and maintenance system Use Cases 40

 6.3.1 System Use Cases identified 40

 6.3.2 SUC: Replace an IED of an automation-system with an identical one 41

 6.3.3 SUC: Store and provide electrical network asset information during its lifecycle 46

 6.4 Cybersecurity system Use Cases for system management..... 50

 6.4.1 System Use Cases identified 50

 6.4.2 Cybersecurity SUC diagrams descriptions 59

Annex A (informative) Short description of complementary Use Cases..... 65

Bibliography..... 66

Figure 1 – Scope of the functions and objects covered by the Smart Grid Device Management..... 7

Figure 2 – Smart Grid Systems and system management 11

Figure 3 – Different Use Cases through the lifecycle of a smart grid system 12

Figure 4 – Illustration of system management architecture on SGAM..... 17

Figure 5 – Interactions between Information System and IEDs..... 18

Figure 6 – General architecture of key roles involved in system management	18
Figure 7 – Overview of BUC Enable Automation System to perform operational functions in best conditions	21
Figure 8 – Scenario diagram of SUC Deploy a Power System function.....	27
Figure 9 – Deploy firmware state machine	31
Figure 10 – Update and activate power system configuration state machine	33
Figure 11 – Overview of SUC: Synchronize multiple automation-system-devices updates.....	38
Figure 12 – Overview of SUC: scenario flow chart of "Synchronizing multiple IED updates"	39
Figure 13 – Overview of SUC: Replace an IED of an automation-system with an identical one	43
Figure 14 – Scenario diagram of SUC: Replace an IED of an automation-system with an identical one	44
Figure 15 – Overview of SUC: Store and provide electrical network asset information during its lifecycle	48
Figure 16 – Scenario diagram of SUC: Store and provide electrical network asset information during its lifecycle.....	49
Figure 17 – Asset information business objects	49
Figure 18 – Key cybersecurity roles	59
Figure 19 – Manufacturer manufacturers a new IED use case actors	60
Figure 20 – Manufacturer manufacturers a new IED activity diagram	61
Figure 21 – New owner purchases new IED use case actors.....	62
Figure 22 – New owner purchases new IED activity diagram.....	63
Table 1 – Differences between Business and System Use Cases.....	10
Table 2 – System management business roles.....	14
Table 3 – System management system roles	15
Table 4 – Identified configuration and administration system Use Cases.....	22
Table 5 – Deploy firmware state machine transitions.....	31
Table 6 – Update and activate power system configuration state machine transitions	33
Table 7 – Identified asset management, supervision and maintenance System Use Cases	41
Table 8 – List of cyber security Use Cases	51

INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMUNICATION NETWORKS AND SYSTEMS IN POWER UTILITY AUTOMATIONS –

Part 90-16: Requirements of system management for Smart Energy Automation

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.

IEC 61850-90-16 has been prepared by IEC technical committee TC57: Power systems management and associated information exchange. It is a Technical Report.

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

Draft	Report on voting
57/2315/DTR	57/2352/RVDTR

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

A list of all the parts in the IEC 61850 series, published under the general title *Communication networks and systems in power utility automations*, can be found on the IEC website.

This publication is split into two parts:

- This document, providing an overview of the main content, and high-level diagrams
- This document has an associated machine-readable version of the use-cases in the form of a zipped HTML code component IEC_TR_61850-90-16_HTML_2020_FullDC2.zip. It uses Active X components and is compatible with Microsoft Internet Explorer

The same copyright and licensing conditions apply to the "paper" part (this document) and the complementary HTML part provided within the IEC_TR_61850-90-16_HTML_2020_FullDC2.zip file.

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/standardsdev/publications.

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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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

The distribution grid is facing a massive roll out and refurbishment of automation equipment to implement deeper monitoring and new smart grid applications. The new equipment to be deployed in order to solve today's issues (MV voltage and reactive power regulation for example) will necessarily have to be adjustable and updatable in order to face challenges of tomorrow (for example massive electric vehicles fleets, low voltage automation, etc.) which will arrive long before the end of its 20 years' service life. Furthermore, there is a necessity for the equipment to adapt to the evolving and growing cybersecurity threats.

The equipment will therefore need to be patched, updated and reconfigured, and this has to be done remotely due to the great number of equipment. This is a cornerstone of the System Management (SM), which refers to functionalities that are not directly linked to the operational role of the equipment but allow it to perform its operational functions in the best conditions possible. System Management or Smart Grid Devices Management also includes other functions such as asset management or supervision.

These functionalities need to be managed by the grid operator and address multiple devices from different vendors through independent Information Systems and thus the requirements and exchanges need to be standardized. As these are to be applied to IEC 61850 compliant equipment, these mechanisms need to be integrated in the standard.

COMMUNICATION NETWORKS AND SYSTEMS IN POWER UTILITY AUTOMATIONS –

Part 90-16: Requirements of system management for Smart Energy Automation

1 Scope

This part of IEC 61850, which is a technical report, specifies the mechanisms for the system management of Smart Grid Devices as IEC 61850 equipment in power utility automation as well as telecommunication and cybersecurity equipment.

System Management of Smart Grid Devices or Smart Grid Device Management refers to functionalities that are not directly linked to the operational role of the equipment (which for grid automation equipment would be to protect and allow remote supervision and control on the grid) but allow it to perform its operational functions in the best conditions possible.

The main functions of Smart Grid Device Management can be categorized as illustrated in Figure 1 and described below. These actions being available from remote information systems, they affect system automation functions, telecommunication functions and cybersecurity functions as these three categories are interacting in a Smart grid Device or system.

The Smart Grid domain has been chosen for these use cases, including distributed energy resources. This content is expected to be applicable to other domains, such as industrial automation domain and grid user domain.

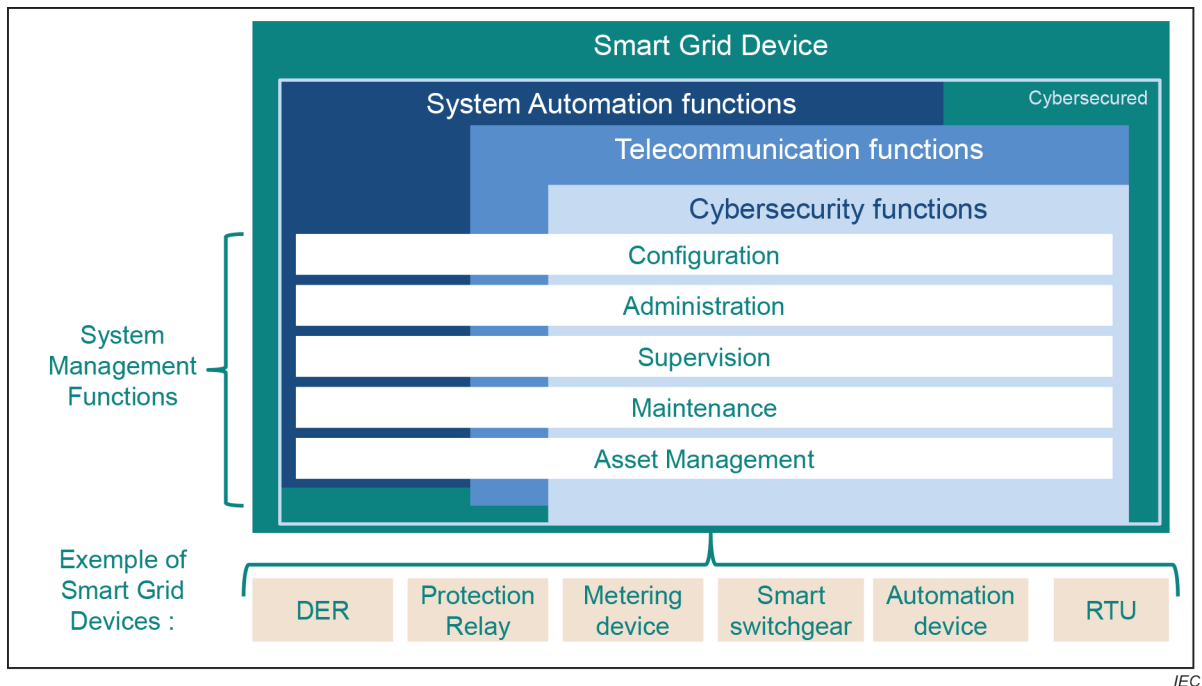


Figure 1 – Scope of the functions and objects covered by the Smart Grid Device Management