



BSI Standards Publication

## Representation of communication in power utility automation

---

## National foreword

This Published Document is the UK implementation of IEC TS 63266:2023.

The UK participation in its preparation was entrusted to Technical Committee GEL/3, Documentation and graphical symbols.

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 55 19627 6

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 October 2023.

### Amendments/corrigenda issued since publication

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

---



# IEC TS 63266

Edition 1.0 2023-09

# TECHNICAL SPECIFICATION

---

Representation of communication in power utility automation

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

---

ICS 33.200

ISBN 978-2-8322-7501-6

**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, definitions and abbreviated terms ..... 9

    3.1 Terms and definitions..... 9

    3.2 Abbreviated terms..... 9

4 General description of physical resource documentation..... 10

    4.1 Secondary system documentation description..... 10

    4.2 Target users of the documentation..... 10

    4.3 Use cases..... 11

5 Documentation requirement..... 11

6 Physical source of communication description in tabular format..... 11

    6.1 Sampled value presentation..... 11

        6.1.1 General..... 11

        6.1.2 Creation of sampled values, LPIT..... 12

        6.1.3 Sample values publisher to subscriber..... 13

        6.1.4 Creation of sampled values by a SAMU..... 15

    6.2 GOOSE communication presentation..... 17

        6.2.1 General..... 17

        6.2.2 Publisher to subscriber..... 17

    6.3 Client-to-server control presentation..... 19

    6.4 Reporting..... 21

    6.5 Time synchronization..... 23

        6.5.1 General..... 23

        6.5.2 SNTP time synchronization..... 23

        6.5.3 PTP IEC/IEEE 61850-9-3 time synchronization..... 24

    6.6 Disturbance recorder..... 26

    6.7 Digital communication protocol gateways..... 28

    6.8 Protection and control devices with only proprietary communication protocol..... 28

Annex A (informative) Representation of information concept for power utility automation..... 30

Bibliography..... 31

Figure 1 – Example of an optical instrument transformer with digital output (LPIT)..... 12

Figure 2 – Sample values publisher (IED 1) to subscriber (IED 2)..... 14

Figure 3 – Analogue transformer connected to a SAMU..... 15

Figure 4 – Communication scheme of publisher (IED 1) to subscriber (IED 2)..... 18

Figure 5 – Communication scheme of client to server..... 19

Figure 6 – Communication scheme of server to client..... 21

Figure 7 – Communication scheme of SNTP time synchronization..... 23

Figure 8 – Communication scheme of PTP IEC/IEEE 61850-9-3..... 25

Figure 9 – Communication scheme of disturbance recorder..... 27

Figure 10 – Communication scheme of digital communication protocol gateways..... 28

Figure 11 – Communication scheme of protection and control devices with only proprietary communication protocol .....	29
Figure A.1 – Positioning of the RCCA within the documentation system for an IEC 61850 substation.....	30
Table 1 – Abbreviations .....	9
Table 2 – Data presentation for use in SV communication.....	12
Table 3 – Information about all MUs connected to the instrument transformer for data stream $n$ .....	13
Table 4 – Communication between the publishing MU and the subscribing IEDs.....	14
Table 5 – Presentation of subscriber $n$ to an SV stream .....	15
Table 6 – Data presentation for use in SV communication.....	16
Table 7 – Presentation of a SAMU connected to a conventional transformer .....	17
Table 8 – Presentation of a publisher of a GOOSE .....	18
Table 9 – Presentation of Subscriber to a GOOSE.....	19
Table 10 – Presentation of MMS client.....	20
Table 11 – Presentation of MMS server .....	21
Table 12 – Presentation of an MMS report server .....	22
Table 13 – Presentation of an MMS report client.....	23
Table 14 – Presentation of a SNTP server .....	24
Table 15 – Presentation of a client.....	24
Table 16 – Presentation of PTP GMC .....	25
Table 17 – Presentation of a PTP slave clock .....	26
Table 18 – Presentation of disturbance recorder, server .....	27
Table 19 – Presentation of disturbance recorder, client.....	27
Table 20 – Presentation of communication conversion .....	28
Table 21 – Presentation of protection and control device with proprietary communication protocol .....	29

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## REPRESENTATION OF COMMUNICATION IN POWER UTILITY 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 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 TS 63266 has been prepared by IEC technical committee 3: Documentation, graphical symbols and representations of technical information. It is a Technical Specification.

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

Draft	Report on voting
3/1611/DTS	3/1623/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](http://www.iec.ch/members_experts/refdocs). The main document types developed by IEC are described in greater detail at [www.iec.ch/publications](http://www.iec.ch/publications).

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](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.

Currently in preview, click buy full version

## INTRODUCTION

The data communication system is a critical point in the real time operation of a power utility automation system. Information from the system is retrieved and used for reliable operation, for supervision, and for efficient maintenance work in power utility automation systems, such as hydro power plant, thermal power plant, transmission station, distribution station, industrial site, etc.; hereby referred to as substations.

Power utility automation systems, including those for substations, have been increasingly modernized thanks to their benefits to power utilities. Digital data exchange, based on IEC 61850 (all parts), among the functions in the system, replaces the copper hardwired conventional communication.

The exchange of digital information, in the form of data objects and data attributes, between intelligent electronic devices (IEDs), has become very common in utility automation and these data are essential for control and protection of the power grid, and the amount of such data exchanges is increasing.

The engineering tools available for configuration of the communication systems are typically focusing on the data exchange between tools and less on readability for human perception. Documents prepared by these tools are often comprehensive and well-structured files, for example, in XML-format, but are difficult to read and to understand and could therefore be inappropriate in some steps of the product/system life cycle. With the increasing amount of data exchanges and the increasing level of complexity, the inconsistencies and errors in the complex documentation cannot be efficiently perceived by human users. Proper visualization of data exchanges from different entities makes the maintenance and design more reliable.

This document aims to provide a structure for documentation of exchanged information that is used for testing and maintenance of devices in the substation. This standardized documentation is called "representation of communication configuration and application", abbreviated as RCCA. This reference documentation is intended to be part of the delivery documentation for an IEC 61850 substation.

As a consequence of using IEDs and digital communication in substations, the need arises for readily available, clearly presented, human-readable representation of data for reliable and convenient use by persons in the field.

The IEC 61850 series has provided the comprehensive range of International Standards covering functional, communication and engineering aspects, but not covering the presentation and visualization of these functions.

## REPRESENTATION OF COMMUNICATION IN POWER UTILITY AUTOMATION

### 1 Scope

This document specifies a structure for representation of exchanged information that is essential for testing and maintenance of the devices in power utility automation systems. It is mainly intended to be applied to communication equipment that communicate information in accordance with IEC 61850 (all parts) in at least one part of their communication flow.

The following communication equipment is included within the scope:

- optical instrument transformer;
- conventional instrument transformers related to IEC 61850 traffic;
- merging unit;
- stand-alone merging unit;
- protection, control and measuring devices with at least one IEC 61850 interface;
- switchgear control unit (breaker IED);
- switchgear providing IEC 61850 interface;
- IEC 61850 time synchronization device;
- IEC 61850 gateway (RTU) and station HMI;
- digital disturbance recorder / digital fault recorder;
- digital communication protocol gateways with at least one IEC 61850 interface;
- protection, control and measuring devices that utilise a proprietary protocol for communication with devices that have at least one IEC 61850 interface.

The following communication equipment, scheme and protocols are excluded from the scope:

- IEC 61850 Ethernet switches and network topology;
- PMU phasor measurement unit with at least one IEC 61850 interface;
- the full path of substation-to-substation communication;

EXAMPLE 1: The description of R-GOOSE Publisher in substation A does not include the description of R-GOOSE Subscriber in substation B.

- functions with only hardwired communication, e.g. direct analogue copper wired connection;

EXAMPLE 2: A current transformer connected to a protection relay with hardwired tripping of a circuit breaker.

- functions using only proprietary communication protocol systems;

EXAMPLE 3: A dedicated system for collecting disturbance recorder files with courier protocol or path from IEC 60870-5-103 to IEC 60870-5-101 will not be presented in this document.

protocol mappings to XMPP (IEC 61850-8-2).

This document forms a supplement to other documentation standards in power utility automation.

It also harmonizes the representation of the logical data flow structures based on IEC 61850 communication among different devices in order to provide a reference document that can be created for any IEC 61850 substation.

This document focuses in principle on the visualization of the digital information exchanged between IEDs and control or measurement devices in a power utility automation system. The information visualization does not refer to any graphical modelling but to a tabular format of presentation. The data in tabular format can be used as a basis for other kinds of visual presentation outside the scope of this document.

For representing all kinds of substation information, a single suitable tabular form is not possible to find. This document instead presents a limited number of high visual performance representation formats.

Presentation formats described in this document provide interactive visualization that assists users in analysing data and identifying some important and essential information in a more efficient way.

## 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 61082-1, *Preparation of documents used in electrotechnology – Part 1: Rules*

IEC 61850-5, *Communication networks and systems for power utility automation – Part 5: Communication requirements for functions and device models*

IEC 61850-6, *Communication networks and systems for power utility automation – Part 6: Configuration description language for communication in power utility automation systems related to IEDs*

IEC 61850-7-2, *Communication networks and systems for power utility automation – Part 7-2: Basic information and communication structure – Abstract communication service interface (ACSI)*

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 61869-9, *Instrument transformers – Part 9: Digital interface for instrument transformers*

IEC 62439-3, *Industrial communication networks – High availability automation networks – Part 3: Parallel Redundancy Protocol (PRP) and High-availability Seamless Redundancy (HSR)*

IEC 81346-1, *Industrial systems, installations and equipment and industrial products – Structuring principles and reference designations – Part 1: Basic rules*

IEC 81346-2, *Industrial systems, installations and equipment and industrial products – Structuring principles and reference designations – Part 2: Classification of objects and codes for classes*

ISO 81346-10, *Industrial systems, installations and equipment and industrial products – Structuring principles and reference designations – Part 10: Power supply systems*

IEC 82045-1, *Document management – Part 1: Principles and methods*