

TECHNICAL SPECIFICATION



**Wind energy generation systems –
Part 25-71: Communications for monitoring and control of wind power plants –
Configuration description language**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 27.180

ISBN 978-2-8322-7392-0

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

CONTENTS

| | |
|--|----|
| FOREWORD..... | 4 |
| 1 Scope..... | 6 |
| 2 Normative references | 6 |
| 3 Terms and definitions | 7 |
| 4 Abbreviated terms | 8 |
| 5 SCL introduction..... | 9 |
| 5.1 General..... | 9 |
| 5.2 SCL sections | 10 |
| 5.3 SCL file types | 12 |
| 5.4 SCL tools..... | 13 |
| 6 SCL use cases in the wind power domain..... | 14 |
| 6.1 General..... | 14 |
| 6.2 IED level interface server configuration..... | 15 |
| 6.2.1 General | 15 |
| 6.2.2 Configuration process..... | 16 |
| 6.3 WPPS level interface server configuration | 16 |
| 6.3.1 General | 16 |
| 6.3.2 Configuration process..... | 18 |
| 6.4 Client data flow definition..... | 18 |
| 6.4.1 General | 18 |
| 6.4.2 Configuration process..... | 19 |
| 6.5 Topology definition..... | 21 |
| 6.5.1 General | 21 |
| 6.5.2 SCL components used to define the topology | 21 |
| 6.5.3 Configuration process..... | 24 |
| 7 Mapping specific configuration..... | 24 |
| 7.1 General..... | 24 |
| 7.2 Web Services mapping configuration parameters – WS communication parameters | 24 |
| 7.3 MMS mapping configuration parameters | 25 |
| 7.3.1 MMS communication configuration parameters | 25 |
| 7.3.2 MMS extension data types configuration..... | 25 |
| 7.4 IEC 60870-5-101/104 mapping configuration parameters | 26 |
| 7.4.1 IEC 60870-5-101/104 communication parameters..... | 26 |
| 7.4.2 IEC 60870-5-101/104 addressing..... | 28 |
| 7.5 DNP3 specific mapping configuration parameters | 29 |
| 7.5.1 DNP3 communication parameters..... | 29 |
| 7.5.2 DNP3 addressing..... | 31 |
| 7.6 OPC UA mapping configuration parameters – OPC UA communication parameters | 32 |
| Annex A (informative) SCL schema extensions for its use within IEC 61400-25 projects..... | 33 |
| A.1 General..... | 33 |
| A.2 Extensions in the DataTypeTemplates section | 33 |
| A.2.1 tCdcEnum..... | 33 |
| A.2.2 tBasicTypeEnum..... | 33 |

| | | |
|-----------------------|---|----|
| A.3 | Extensions in the Process section..... | 33 |
| A.3.1 | tProcess | 33 |
| A.3.2 | ref2SubstationFromTerminal..... | 33 |
| A.4 | Extensions in the Communication section – tPTypeEnum..... | 33 |
| Annex B (normative) | SCL schema for IEC 61400-25 | 34 |
| Annex C (informative) | Configuration examples..... | 82 |
| C.1 | General..... | 82 |
| C.2 | Wind power plant configuration with IEC 61400-25 interface at wind turbine level..... | 83 |
| C.3 | Wind power plant configuration with IEC 61400-25 interface at WPPS | 84 |
| Bibliography..... | | 86 |
| Figure 1 | – Example with several IEDs..... | 15 |
| Figure 2 | – Configuration diagram..... | 16 |
| Figure 3 | – Example with only one IED as WPPS | 17 |
| Figure 4 | – WPPS logical node allocation..... | 17 |
| Figure 5 | – Report data flow configuration..... | 18 |
| Figure 6 | – Data flow configuration using several ICD/CID/IID files as input | 19 |
| Figure 7 | – Data flow configuration using a SCD file as input | 20 |
| Figure 8 | – Electrical connection using Line and Segments..... | 22 |
| Figure 9 | – Example of substation connectivity..... | 23 |
| Figure C.1 | – WPP topology..... | 82 |
| Figure C.2 | – WPP Server interface | 84 |
| Table 1 | – WS specific communication configuration parameters | 24 |
| Table 2 | – MMS specific communication configuration parameters..... | 25 |
| Table 3 | – IEC 60870-5-101 specific communication configuration parameters | 26 |
| Table 4 | – IEC 60870-5-104 specific communication configuration parameters | 27 |
| Table 5 | – IEC 60870-5-104 redundancy group configuration parameters..... | 27 |
| Table 6 | – IEC 60870-5-101/104 point mapping attributes | 29 |
| Table 7 | – DNP3 configuration parameters..... | 29 |
| Table 8 | – DNP3 networking communication configuration parameters..... | 30 |
| Table 9 | – DNP3 serial communication configuration parameters | 30 |
| Table 10 | – DNP3 point mapping attributes | 32 |
| Table 11 | – OPC UA specific communication configuration parameters..... | 32 |

INTERNATIONAL ELECTROTECHNICAL COMMISSION

WIND ENERGY GENERATION SYSTEMS –

Part 25-71: Communications for monitoring and control of wind power plants – Configuration description language

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.

Technical Specification IEC 61400-25-71 has been prepared by IEC technical committees TC 88: Wind energy generation systems and TC 57: Power systems management and associated information exchange.

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

| | |
|------------|------------------|
| Draft TS | Report on voting |
| 88/706/DTS | 88/715A/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 61400 series, published under the general title *Wind energy generation systems*, 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 "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document 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.

WIND ENERGY GENERATION SYSTEMS –

Part 25-71: Communications for monitoring and control of wind power plants – Configuration description language

1 Scope

The focus of the IEC 61400-25 series is on the communications between wind power plant components such as wind turbines and actors such as SCADA systems. Non-IEC 61850/IEC 61400-25 internal communication within wind power plant components is outside the normative scope of the IEC 61400-25 series.

This document describes how to extend the IEC 61400-25 series with the IEC 61850-6 Substation Configuration description Language (SCL) file format for describing communication-related Intelligent Electronic Device (IED) configurations of a wind turbine, wind power plant controller, meteorological mast, etc. The extension of SCL to the wind domain is intended to simplify integration of wind power plant equipment for clients, as well as their integration to the electrical system. The adoption of SCL allows formalised tool-based exchange of IED parameters, communication system configurations, switch yard (function) structures, as well as description of the relations between them.

The purpose of this format is to formally and efficiently exchange wind turbine and wind power plant IED capability descriptions, and system descriptions between IED engineering tools and the system engineering tool(s) of different manufacturers in a compatible way. The file format is also intended to provide report configuration and alarms as well as HMI interface information from a wind power plant. This information can be used to engineer overlying SCADA systems for the site, for connected DSO, or TSO, or for fleet operators' maintenance and surveillance systems. Finally, the SCL is intended as a documentation of the configuration and topology of the delivered system.

The System Configuration description Language (SCL) is defined in IEC 61850-6, which in turn is based on Extensible Markup Language (XML) version 1.0. Extensions to the IED and communication system model in SCL to cover IEC 61400-25-2 are included in this document. Also Specific Communication Service Mapping (SCSM) extensions or usage rules to cover all mappings defined in IEC 61400-25-4 and IEC 61400-25-41¹ are included in this document.

This document does not specify individual implementations or products using the SCL language, nor does it constrain the implementation of entities and interfaces within a computer system. Further this document does not intend to specify the download format of configuration data to an IED, although the SCL format could be used as part of the configuration data.

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 consideration.

IEC 61400-25-1, *Wind energy generation systems – Part 25-1: Communications for monitoring and control of wind power plants – Overall description of principles and models*

IEC 61400-25-2, *Wind turbines – Part 25-2: Communications for monitoring and control of wind power plants – Information models*

IEC 61400-25-3, *Wind turbines – Part 25-3: Communications for monitoring and control of wind power plants – Information exchange models*

IEC 61400-25-4:2016, *Wind energy generation systems – Part 25-4: Communications for monitoring and control of wind power plants – Mapping to communication profile*

IEC 61400-25-6, *Wind energy generation systems – Part 25-6: Communications for monitoring and control of wind power plants – Logical node classes and data classes for condition monitoring*

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

IEC 61850-6:2018, *Communication networks and systems for power utility automation – Part 6: Configuration description language for communication in electrical substation related to IEDs*

IEC 61850-7-1, *Communication networks and systems for power utility automation – Part 7-1: Basic communication structure – Principles and models*

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 61850-7-3, *Communication networks and systems for power utility automation – Part 7-3: Basic communication structure – Common data classes*

IEC 61850-7-4, *Communication networks and systems for power utility automation – Part 7-4: Basic communication structure – Compatible logical node classes and data object classes*

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*