



BSI Standards Publication

Communication networks and systems for power utility automation

Part 90-6: Use of IEC 61850 for Distribution Automation Systems

National foreword

This Published Document is the UK implementation of IEC TR 61850-90-6:2018.

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 secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

© The British Standards Institution 2018
Published by BSI Standards Limited 2018

ISBN 978 0 580 51803 4

ICS 33.200

Compliance with a British Standard cannot confer immunity from legal obligations.

This Published Document was published under the authority of the Standards Policy and Strategy Committee on 30 September 2018.

Amendments/corrigenda issued since publication

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



IEC TR 61850-90-6

Edition 1.0 2018-09

TECHNICAL REPORT



**Communication networks and systems for power utility automation –
Part 90-6: Use of IEC 61850 for Distribution Automation Systems**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 33.200

ISBN 978-2-8322-6039-5

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

CONTENTS

| | |
|---|-----|
| FOREWORD..... | 9 |
| INTRODUCTION..... | 11 |
| 1 Scope..... | 13 |
| 1.1 General..... | 13 |
| 1.2 Namespace information | 13 |
| 1.3 Code components..... | 13 |
| 2 Normative references | 14 |
| 3 Terms, definitions, abbreviated terms and definitions of fault types | 15 |
| 3.1 Terms and definitions..... | 15 |
| 3.2 Abbreviated terms..... | 16 |
| 3.2.1 Proposed specifically for the data model part of the report..... | 16 |
| 3.2.2 Existing abbreviations used in the original IEC 61850 data object names model | 17 |
| 3.3 Definitions of fault types..... | 29 |
| 4 Common actors | 29 |
| 5 Requirements and use cases..... | 38 |
| 5.1 General..... | 38 |
| 5.2 Use case 1: Fault indication and report..... | 39 |
| 5.2.1 General | 39 |
| 5.2.2 Use case 1a: Generic use case – Not fault type specific..... | 39 |
| 5.2.3 Use case 1b: Overcurrent non directional Fault Localization and Indication (F1C/NC)..... | 58 |
| 5.2.4 Use case 1c: Phase to earth faults, non directional fault detection (F2) | 59 |
| 5.2.5 Use case 1d: Overcurrent and Phase to earth faults detection non directional (F3) | 59 |
| 5.2.6 Use case 1e: Overcurrent, directional and non directional, fault detection (F4)..... | 60 |
| 5.2.7 Use case 1f: Overcurrent, non directional, phase to earth faults, directional and non directional fault detection (F5)..... | 60 |
| 5.2.8 Use case 1g: Overcurrent and phase to earth faults, directional and non directional fault detection (F6) | 60 |
| 5.3 Use case 2: FLISR based on local control..... | 60 |
| 5.3.1 General | 60 |
| 5.3.2 Use case 2a: FLISR using sectionalizers detecting fault current | 60 |
| 5.3.3 Use case 2b: FLISR using sectionalizers detecting feeder voltage (PDFV) | 72 |
| 5.4 Use case 3: FLISR based on centralized control | 89 |
| 5.4.1 General | 89 |
| 5.4.2 Use case 3a: FLISR in a radial feeder based on centralized control | 89 |
| 5.4.3 Use case 3b: FLISR in an open loop feeder based on centralized control | 98 |
| 5.5 Use case 4: FLISR based on distributed control..... | 104 |
| 5.5.1 General | 104 |
| 5.5.2 Use case 4a: FLISR in an open loop network based on distributed control – Type A | 105 |
| 5.5.3 Use case 4b: FLISR based on distributed control – Type B..... | 129 |
| 5.6 Use case 5: Centralized Voltage and Var Control..... | 146 |
| 5.6.1 Description of the use case | 146 |

| | | |
|--------|---|-----|
| 5.6.2 | Diagrams of use case | 148 |
| 5.6.3 | Technical details..... | 149 |
| 5.6.4 | Step by step analysis of use case | 150 |
| 5.6.5 | Information exchanged | 152 |
| 5.7 | Use case 6: Anti-islanding protection based on communications | 152 |
| 5.7.1 | Description of the use case | 152 |
| 5.7.2 | Diagrams of use case | 154 |
| 5.7.3 | Technical details..... | 157 |
| 5.7.4 | Step by step analysis of use case..... | 158 |
| 5.7.5 | Information exchanged | 161 |
| 5.8 | Use Case 7: Automatic transfer switch..... | 161 |
| 5.8.1 | Description of the use case | 161 |
| 5.8.2 | Diagrams of use case | 162 |
| 5.8.3 | Technical details..... | 164 |
| 5.8.4 | Step by step analysis of use case..... | 164 |
| 5.8.5 | Information exchanged | 166 |
| 5.9 | Use Case 8: Monitor energy flows (Energy flow related Use cases)..... | 166 |
| 5.9.1 | Use case breakdown | 166 |
| 5.9.2 | Monitor Energy flows | 168 |
| 5.9.3 | Elaborate the direction of the energy flow | 169 |
| 5.10 | Use Case 9: Environment situation awareness..... | 172 |
| 5.10.1 | Description of the use case | 172 |
| 5.11 | Use case 10: Configuration of IEDs participating in distributed control..... | 175 |
| 5.11.1 | Description of the use case | 175 |
| 6 | Information models | 190 |
| 6.1 | Mapping of requirements on LNs | 190 |
| 6.1.1 | Mapping of the requirements of Fault Identification and report..... | 190 |
| 6.1.2 | Mapping of the requirements of FLISR based on local control – Type 2..... | 192 |
| 6.1.3 | Mapping of the requirements of FLISR based on centralized control – Type 3 | 195 |
| 6.1.4 | Mapping of the requirements of FLISR based on distributed control – Type 4 | 196 |
| 6.1.5 | Mapping of the requirements of VVC use case – Type 5..... | 204 |
| 6.1.6 | Mapping of the requirements of anti-islanding protection use case – Type 6 | 206 |
| 6.1.7 | Mapping of the requirements of automatic transfer switch use case – Type 7 | 207 |
| 6.1.8 | Mapping of the requirements of Monitor energy flows related Use case – Type 8 | 209 |
| 6.1.9 | Mapping of Environment situation awareness use case – Type 9..... | 210 |
| 6.2 | Mapping summary of the set of UCs over the LNs (existing or new) | 213 |
| 7 | Logical node classes and data objects modelling..... | 214 |
| 7.1 | General..... | 214 |
| 7.2 | Logical node classes..... | 214 |
| 7.2.1 | General | 214 |
| 7.2.2 | Abstract LN of 90-6 namespace (Abstract90-6LNs)..... | 214 |
| 7.2.3 | LN of Group A (LNGroupA_90_6) | 219 |
| 7.2.4 | LN of Group D (LNGroupD_90_6)..... | 230 |
| 7.2.5 | LN of Group K (LNGroupK_90_6) | 232 |
| 7.2.6 | LN of Group M (LNGroupM_90_6) | 236 |

| | | |
|--------------|--|-----|
| 7.2.7 | LN from Group P (LNGroupP_90_6) | 249 |
| 7.2.8 | LN of Group R (LNGroupR_90_6) | 251 |
| 7.2.9 | LN of Group S (LNGroupS_90_6) | 253 |
| 7.3 | Data semantics | 265 |
| 7.4 | Enumerated data attribute types | 271 |
| 7.4.1 | General | 271 |
| 7.4.2 | Actual source (ActualSourceKind enumeration) | 272 |
| 7.4.3 | AffectedPhases90_6Kind enumeration | 273 |
| 7.4.4 | ATSAutoReturnModeKind enumeration | 273 |
| 7.4.5 | ATSSequenceResultKind enumeration | 274 |
| 7.4.6 | ATSSequenceStatusKind enumeration | 274 |
| 7.4.7 | FaultConfirmationModeKind enumeration | 275 |
| 7.4.8 | FaultPermanenceKind enumeration | 275 |
| 7.4.9 | FaultSourceTypeKind enumeration | 276 |
| 7.4.10 | GateStatusKind enumeration | 276 |
| 7.4.11 | IslandingStateKind enumeration | 277 |
| 7.4.12 | momentary close request in case of use of RFV automation (MomentaryCloseResultKind enumeration) | 277 |
| 7.4.13 | NormalSourceKind enumeration | 277 |
| 7.4.14 | RFVFuncTypeKind enumeration | 277 |
| 7.4.15 | Result of the latest restoration process (SequenceEndResultKind enumeration) | 278 |
| 7.4.16 | SequenceStatusKind enumeration | 278 |
| 7.5 | SCL enumerations (from DOEnums_90_6) | 279 |
| 8 | Communication and architectures | 281 |
| 8.1 | Types of communication architecture | 281 |
| 8.1.1 | General | 281 |
| 8.1.2 | Digital communication with remote monitoring | 281 |
| 8.1.3 | Digital communication with remote monitoring and control | 282 |
| 8.1.4 | Digital communication with distributed control | 282 |
| 8.2 | Architectures matching use cases | 283 |
| 8.3 | Cyber-security | 284 |
| 9 | Configuration | 284 |
| Annex A | (informative) Interpretation of logical node tables | 294 |
| A.1 | General interpretation of logical node tables | 294 |
| A.2 | Conditions for element presence | 294 |
| Annex B | (informative) Typical Grid topologies considered in this report | 297 |
| Bibliography | | 298 |
| Figure 1 | Actors top level hierarchy | 30 |
| Figure 2 | System Actors SGAM positioning (function) | 31 |
| Figure 3 | System Actors SGAM positioning (not function related) | 32 |
| Figure 4 | Fault indication – Main use case | 41 |
| Figure 5 | Fault indication for FPI – T1 | 42 |
| Figure 6 | Fault indication and report for FPI – T2 | 43 |
| Figure 7 | Fault indication for FPI – T3,T4 (with communication to HV/MV SS) in the context of FLISR as described in 5.4. | 44 |

| | |
|--|-----|
| Figure 8 – Fault indication for FPI – T3,T4 (without communication to HV/MV SS) in the context of FLISR as described in 5.4..... | 45 |
| Figure 9 – Voltage Presence/Absence | 59 |
| Figure 10 – FLISR use case breakdown..... | 63 |
| Figure 11 – Fault location sequence diagram..... | 64 |
| Figure 12 – Fault isolation sequence diagram..... | 65 |
| Figure 13 – Service restoration sequence diagram..... | 66 |
| Figure 14 – A distribution grid configuration in a multi-source network based on open loops | 73 |
| Figure 15 – The basic behavior of distribution feeder in FLISR using sectionalizers detecting feeder voltage | 75 |
| Figure 16 – FLISR-SDFV use case break down | 76 |
| Figure 17 – FLISR-SDFV Fault Location and Identification sequence diagram | 77 |
| Figure 18 – FLISR-SDFV Fault Location and Identification sequence diagram | 78 |
| Figure 19 – FLISR-SDFV Fault Location and Identification sequence diagram | 78 |
| Figure 20 – FLISR-SDFV Fault Location and Identification sequence diagram | 79 |
| Figure 21 – Auxiliary use cases for FLISR using SDFV | 79 |
| Figure 22 – FLISR-SDFV Set X specific time sequence diagram | 80 |
| Figure 23 – FLISR-SDFV Set Y specific time sequence diagram | 80 |
| Figure 24 – FLISR-SDFV Release blocking of closing sequence diagram | 80 |
| Figure 25 – FLISR-SDFV Set functional type sequence diagram..... | 81 |
| Figure 26 – FLISR-SDFV Set connection direction sequence diagram | 81 |
| Figure 27 – FLISR-SDFV Supervisory sequence diagram | 81 |
| Figure 28 – Common actors in a distribution system with FLISR using SDFV..... | 83 |
| Figure 29 – Centralized FLISR in a radial feeder – Use cases..... | 91 |
| Figure 30 – Centralized FLISR for radial feeder – Fault location sequence diagram | 92 |
| Figure 31 – Centralized FLISR for radial feeder – Fault isolation sequence diagram | 93 |
| Figure 32 – Centralized FLISR for radial feeder – Service restoration sequence diagram | 93 |
| Figure 33 – Centralized FLISR for open loop – Use case breakdown | 100 |
| Figure 34 – Centralized FLISR for open loop – Service restoration sequence diagram..... | 101 |
| Figure 35 – A distributed DAS for an open loop overhead feeder | 107 |
| Figure 36 – Distributed FLISR in an open loop network – Upstream use cases breakdown | 110 |
| Figure 37 – Distributed FLISR in an open loop network – Operation use cases breakdown | 111 |
| Figure 38 – Distributed FLISR in an open loop network – Topology discovery sequence diagram | 112 |
| Figure 39 – Distributed FLISR in an open loop network – FLISR operation sequence diagram | 114 |
| Figure 40 – Logical selectivity – FLI along the MV feeder | 131 |
| Figure 41 – Logical selectivity – FLI inside the EU plant | 132 |
| Figure 42 – Logical selectivity – FLI along the MV feeder and anti-islanding | 133 |
| Figure 43 – Distributed FLISR 4b – Use case breakdown..... | 134 |
| Figure 44 – Distributed FLISR 4b – For further analysis | 135 |
| Figure 45 – Volt-Var Control – Use case breakdown | 148 |

| | |
|---|-----|
| Figure 46 – Volt-Var Control – Sequence diagram | 149 |
| Figure 47 – Possible fault location on the feeder..... | 153 |
| Figure 48 – Anti-islanding protection – Use case breakdown..... | 154 |
| Figure 49 – Anti-islanding protection – Role diagram | 155 |
| Figure 50 – Anti-islanding protection – Sequence diagram..... | 156 |
| Figure 51 – Automatic transfer switch – Scenario flowchart..... | 163 |
| Figure 52 – Automatic transfer switch – Use cases breakdown | 163 |
| Figure 53 – Automatic transfer switch – Activity flowchart..... | 165 |
| Figure 54 – Monitor energy flows – use case breakdown | 167 |
| Figure 55 – Sequence diagram for the “Monitor energy flows” use case..... | 168 |
| Figure 56 – Environment situation awareness – Use cases breakdown | 173 |
| Figure 57 – Environment situation awareness – Sequence diagram | 174 |
| Figure 58 – The schematic diagram of remote configuration process | 178 |
| Figure 59 – Configuration of IEDs participating in distributed control – Use case diagram | 179 |
| Figure 60 – Configuration of IEDs participating in distributed control – Sequence diagram | 180 |
| Figure 61 – Possible arrangement of LNs to support fault passage indication | 192 |
| Figure 62 – Typical Arrangement of LNs to support FLISR using sectionalizers detecting fault current | 193 |
| Figure 63 – Typical Arrangement of LNs to support FLISR using SDFV | 194 |
| Figure 64 – Logical arrangement of LNs to support FLISR using SDFV..... | 194 |
| Figure 65 – Typical Arrangement of LNs to FLISR based on centralized control..... | 196 |
| Figure 66 – Typical arrangement of LNs to support distributed fault location (case 4a) | 197 |
| Figure 67 – Typical arrangement of LNs (between FeCtl) to support distributed fault location (case 4a) | 198 |
| Figure 68 – Typical arrangement of LNs to support distributed fault isolation (case 4a) | 199 |
| Figure 69 – Typical arrangement of LNs (between FeCtl) to support distributed fault isolation (case 4a) | 199 |
| Figure 70 – Possible arrangement to support distributed service restoration | 200 |
| Figure 71 – Break down of LNs and relationships to support distributed service restoration | 201 |
| Figure 72 – Possible LN arrangement of breakers related functions, contributing to distributed FLISR (case 4b) | 203 |
| Figure 73 – Possible LN arrangement of disconnectors related functions, contributing to distributed FLISR (case 4b) | 204 |
| Figure 74 – Possible LN arrangement for the mapping for tap changer control..... | 205 |
| Figure 75 – Possible LN arrangement for the mapping for capacitor bank control | 206 |
| Figure 76 – Breakdown of LNs and relationships to support unintentional islanding protection | 207 |
| Figure 77 – Possible arrangement of LNs to perform automatic transfer switch..... | 209 |
| Figure 78 – Possible arrangement of LNs to Monitor energy flows related Use cases | 210 |
| Figure 79 – Possible arrangement of LNs to support Environment situation awareness use cases | 212 |
| Figure 80 – Class diagram LogicalNodes_90_6::LogicalNodes_90_6..... | 214 |
| Figure 81 – Class diagram Abstract90-6LNs::LN AbstractLN 90_6..... | 215 |

| | |
|--|-----|
| Figure 82 – Statechart diagram LNGroupA_90_6::AATS Generic state-machine | 219 |
| Figure 83 – Statechart diagram LNGroupA_90_6::AATS Normal-Back-up | 220 |
| Figure 84 – Class diagram LNGroupA_90_6::LN GroupA 90_6 | 221 |
| Figure 85 – Class diagram LNGroupD_90_6::LN GroupD 90_6 | 231 |
| Figure 86 – Class diagram LNGroupK_90_6::LN GroupK 90_6 | 233 |
| Figure 87 – Class diagram LNGroupM_90_6::LN GroupM (1) 90_6 | 236 |
| Figure 88 – Class diagram LNGroupM_90_6::LN GroupM (2) 90_6 | 237 |
| Figure 89 – Class diagram LNGroupP_90_6::LN GroupP 90_6 | 249 |
| Figure 90 – Class diagram LNGroupR_90_6::LN GroupR 90_6 | 251 |
| Figure 91 – Class diagram LNGroupS_90_6::LN GroupS (1) 90_6 | 253 |
| Figure 92 – Class diagram LNGroupS_90_6::LN GroupS (2) 90_6 | 254 |
| Figure 93 – Class diagram DOEnums_90_6::DO Enumerations 90_6 | 272 |
| Figure 94 – Centralised distribution automation architecture with monitoring | 281 |
| Figure 95 – Centralised distribution automation architecture with monitoring and control | 282 |
| Figure 96 – Distributed control architecture | 282 |
| Figure 97 – Mixed distribution automation architecture combining distributed and centralised monitoring and control | 283 |
| Figure 98 – Distributed feeder automation system for an open loop overhead feeder | 285 |
| Figure 99 – Configuration process for the information exchange between substation automation and grid automation systems | 286 |
| Figure B.1 – Typical grid topologies | 297 |
| Table 1 – Normative abbreviations for data object names | 17 |
| Table 2 – Normative abbreviations for data object names | 17 |
| Table 3 – Time based Fault types | 29 |
| Table 4 – List of common actors | 33 |
| Table 5 – Mapping of Fault Identification and report use case 1 requirements onto LNs | 190 |
| Table 6 – Mapping of FLISR using sectionalizers detecting fault current use case 2a requirements onto LNs | 193 |
| Table 7 – Mapping of FLISR using SDFV use case 2b requirements onto LNs | 195 |
| Table 8 – Mapping of Distributed FLISR (fault location) use case 4a onto LNs | 196 |
| Table 9 – Mapping of Distributed FLISR (fault isolation) use case 4a onto LNs | 198 |
| Table 10 – Mapping of Distributed FLISR (service restoration) use case 4a onto LNs | 200 |
| Table 11 – Mapping of Distributed FLISR use case 4b requirements onto LNs | 202 |
| Table 12 – Mapping of anti-islanding use case requirements onto LNs | 206 |
| Table 13 – Mapping of automatic transfer switch use case requirements onto LNs | 208 |
| Table 14 – Energy flow related use case requirement mapping over LNs | 210 |
| Table 15 – Mapping of Environment situation awareness use cases to existing or new LNs | 211 |
| Table 16 – Data objects of AutomatedSequenceLN | 216 |
| Table 17 – Data objects of AutomaticSwitchingLN | 217 |
| Table 18 – Data objects of ASWI | 222 |
| Table 19 – Data objects of AATS | 224 |
| Table 20 – Data objects of AFSI | 226 |

| | |
|---|-----|
| Table 21 – Data objects of AFSL..... | 227 |
| Table 22 – Data objects of ASRC..... | 229 |
| Table 23 – Data objects of DISL..... | 232 |
| Table 24 – Data objects of KFIM..... | 234 |
| Table 25 – Data objects of KILL..... | 235 |
| Table 26 – Data objects of MENVExt..... | 238 |
| Table 27 – Data objects of MMETExt..... | 240 |
| Table 28 – Data objects of MMTNExt..... | 242 |
| Table 29 – Data objects of MMTREExt..... | 244 |
| Table 30 – Data objects of MMXNExt..... | 246 |
| Table 31 – Data objects of MMXUExt..... | 247 |
| Table 32 – Data objects of PTRCExt..... | 249 |
| Table 33 – Data objects of RRFV..... | 251 |
| Table 34 – Data objects of SCPI..... | 255 |
| Table 35 – Data objects of SFOD..... | 256 |
| Table 36 – Data objects of SFPI..... | 257 |
| Table 37 – Data objects of SFST..... | 259 |
| Table 38 – Data objects of SGPD..... | 260 |
| Table 39 – Data objects of SSMK..... | 262 |
| Table 40 – Data objects of SPSE..... | 263 |
| Table 41 – Data objects of SVPI..... | 264 |
| Table 42 – Attributes defined on classes of Logical Nodes_90_6 package..... | 265 |
| Table 43 – Literals of ActualSourceKind..... | 273 |
| Table 44 – Literals of AffectedPhases90_6.msc..... | 273 |
| Table 45 – Literals of ATSAutoReturnModeKind..... | 274 |
| Table 46 – Literals of ATSSequenceResultKind..... | 274 |
| Table 47 – Literals of ATSSequenceStatusKind..... | 275 |
| Table 48 – Literals of FaultConfirmationModeKind..... | 275 |
| Table 49 – Literals of FaultPermanenceKind..... | 276 |
| Table 50 – Literals of FaultSourceTypeKind..... | 276 |
| Table 51 – Literals of GateStatusKind..... | 276 |
| Table 52 – Literals of IslandingStateKind..... | 277 |
| Table 53 – Literals of MomentaryCloseResultKind..... | 277 |
| Table 54 – Literals of NormalSourceKind..... | 277 |
| Table 55 – Literals of RFVFuncTypeKind..... | 278 |
| Table 56 – Literals of SequenceEndResultKind..... | 278 |
| Table 57 – Literals of SequenceStatusKind..... | 278 |
| Table 58 – Distribution automation architecture matching the use cases..... | 283 |
| Table 59 – Mapping information models onto the protocol..... | 284 |
| Table A.1 – Interpretation of logical node tables..... | 294 |
| Table A.2 – Conditions for presence of elements within a context..... | 294 |

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**COMMUNICATION NETWORKS AND SYSTEMS
FOR POWER UTILITY AUTOMATION –****Part 90-6: Use of IEC 61850 for Distribution Automation Systems**

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. However, a technical committee may propose the publication of a technical report when it has collected data of a different kind from that which is normally published as an International Standard, for example "state of the art".

IEC 61850-90-6, which is a technical report, has been prepared by IEC technical committee 57: Power systems management and associated information exchange.

The text of this technical report is based on the following documents:

| | |
|---------------|------------------|
| Enquiry draft | Report on voting |
| 57/1929/DTR | 57/2008/RVDTR |

Full information on the voting for the approval of this technical report 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.

As a reminder a Joint Ad Hoc Group (JAHWG 51) had been set up between IEC Technical Committee 38 and IEC TC 57 in order to capture the requirements elaborated by the experts of the Fault Passage Indicators domain, which resulted in the publication of IEC TR 62689-100 in October 2016.

As agreed in the term of reference of this JAHWG 51, IEC TC 57 merged the conclusions of the above work within this document.

In return, it was agreed that IEC 62689-3, dealing with *Current and Voltage sensors or detectors, to be used for fault passage indication purposes – Part 3: Communication*, should be based on the content of IEC TR 61850-90-6.

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

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- 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.

INTRODUCTION

IEC 61850 consists of the following parts, under the general title *Communication networks and systems for power utility automation* (all parts may have not been published yet).

- Part 1: Introduction and overview
- Part 2: Glossary
- Part 3: General requirements
- Part 4: System and project management
- Part 5: Communication requirements for functions and device models
- Part 6: Configuration description language for communication in electrical substations related to IEDs
- Part 7-1: Basic communication structure – Principles and models
- Part 7-2: Basic communication structure – Abstract communication service interface (ACSI)
- Part 7-3: Basic communication structure – Common data classes
- Part 7-4: Basic communication structure – Compatible logical node classes and data classes
- Part 7-410: Hydroelectric power plants – Communication for monitoring and control
- Part 7-420: Basic communication structure – Distributed energy resources logical nodes
- Part 8-1: Specific communication service mapping (SCSM) – Mappings to MMS (ISO 9506-1 and ISO 9506-2) and to ISO/IEC 8802-3
- Part 80-1: Guideline to exchange information from a CDC based data model using IEC 60870-5-101/104
- Part 9-2: Specific communication service mapping (SCSM) – Sampled values over ISO/IEC 8802-3
- Part 90-1: Use of IEC 61850 for the communication between substations
- Part 90-2: Using IEC 61850 for the communication between substations and control centres¹
- Part 90-3: Using IEC 61850 for condition monitoring
- Part 90-4: Network Engineering Guidelines – Technical report
- Part 90-5: Using IEC 61850 to transmit synchrophasor information according to IEEE C37.118
- Part 90-7: Object models for power converters in distributed energy resources (DER) systems
- Part 90-8: Object model for E-mobility
- Part 10: Conformance testing

In addition to the above, the IEC 61850 basic communication structure for Wind Turbines has been published as IEC 61400-25, *Wind turbines – Communications for monitoring and control of wind power plants*.

IEC 61850-1 is an introduction and overview of the IEC 61850 series. It describes the philosophy, work approach and contents of the other parts.

Distribution Automation (DA) is a concept which emerged in the 1970s to promote the application of computer and communication technologies for the betterment of distribution system operating performance. It is in general used as an umbrella term to capture the deployment of automation technologies for protection, control, monitoring, and operation of distribution systems. These technologies enable electric utilities to monitor, control, and

¹ Under preparation. Stage at the time of publication: IEC/PWI 61850-90-2:2018.

operate distribution components in a real-time or non-real-time mode. The industry is also pushing towards smart and active distribution networks which support the high penetration of Distributed Energy Resources (DERs) and have better supply reliability and operation efficiency. As a result, DA concepts are also being extended in the form of Advanced Distribution Automation (ADA), which includes automation of DERs and demand response programs.

A widely-recognized instance of a DA project involves utilization of communication and information technology to enable real-time monitoring and control of switching devices including circuit breakers, line reclosers, automatic sectionalizers as well as capacitor banks and line regulators in MV networks. This control can be achieved in local, distributed, and central means. Local control is implemented inside a device based on local measurements. Distributed control involves peer-to-peer communication among relevant field devices. Central control is SCADA-like and is implemented in a substation or control room. This category of DA is also referred to as Feeder Automation (FA). Before the deployment of FA, the switching operations have to be done by the field crew, requiring physical patrolling of the feeder route to locate faults and manual verification of every switching action. Evidently, this practice prolongs the switching time and gives rise to extended outage times and system inefficiencies. With the application of data collection and real-time control through FA, these switching tasks are accomplished in an automated fashion giving rise to accelerated restoration times which are much less than those offered by the legacy systems.

COMMUNICATION NETWORKS AND SYSTEMS FOR POWER UTILITY AUTOMATION –

Part 90-6: Use of IEC 61850 for Distribution Automation Systems

1 Scope

1.1 General

The contents of Distribution Automation (DA) vary between different countries, regions, even between different utilities in the same country. DA may cover HV/MV substations, MV networks, LV networks, distributed energy resources, as well as demand sides. This part of IEC 61850, which is a technical report, provides basic aspects that need to be considered when using IEC 61850 for information exchange between systems and components to support Distribution Automation applications, within MV network automation, as presented in Annex B.

In particular, this document:

- defines use cases for typical DA applications that require information exchange between two or more components/systems
- provides modelling of components commonly used in DA applications
- proposes new logical nodes and the extensions to the existing logical nodes that can be used in typical DA applications.
- provides guidelines for the communication architecture and services to be used in DA applications
- provides configuration methods for IEDs to be used in DA systems.

Its content also results from the merge of the preparatory work exposed in IEC TR 62689-100 – *Current and voltage sensors or detectors, to be used for fault passage indication purposes – Part 100: Requirements and proposals for the IEC 61850 series data model extensions to support fault passage indicators applications.*

1.2 Namespace information

The parameters which identify this new release of this namespace are:

- Namespace Version: 2018
- Namespace Revision: A
- UML model file which reflects this namespace edition: wg10uml02v20draft20-wg18uml02v11b-wg17uml02v22-jwg25uml02v04c-tc17umlv0-tc38umlv0.eap, UML model version WG10UML02v20draft20
- Namespace release date: 2018-05-20
- Namespace name: "(Tr)IEC61850-90-6:2018A"

The name space "(Tr)IEC61850-90-6:2018A" is considered as "transitional" since the models are expected to be included in IEC 61850-7-4xx Edition 2. Potential extensions/modifications may happen if/when the models are moved to the International Standard status.

1.3 Code components

This IEC standard includes Code Components i.e. components that are intended to be directly processed by a computer. Such content is any text found between the markers <CODE BEGINS> and <CODE ENDS>, or otherwise is clearly labelled in this standard as a Code Component.

The purchase of this IEC standard carries a copyright license for the purchaser to sell software containing Code Components from this standard to end users either directly or via distributors, subject to IEC software licensing conditions, which can be found at: www.iec.ch/CCv1.