

This is a preview - click here to buy the full publication



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.....	16
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 (SDFV)	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 communications 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 MMTRExt.....	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 LogicalNodes_90_6 package	265
Table 43 – Literals of ActualSourceKind	273
Table 44 – Literals of AffectedPhases90_6Kind	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.

In this document, code components are contained in the tables and XML code lines located within Clause 7.

A separate file contains the electronic version of these code components.

The Code Components included in this IEC document are also available in a light version (without the description textual elements) as electronic machine readable file at:

http://www.iec.ch/tc57/supportdocuments/IEC_61850-90-6.NSD.2018A.light.zip

The Code Component(s) included in this IEC standard are potentially subject to maintenance works and the user shall select the latest release in the repository located at: <http://www.iec.ch/tc57/supportdocuments>.

The latest version/release of the document will be found by selecting the file of name: IEC_61850-90-6.NSD.{VersionStateInfo}.light.zip with the filed VersionStateInfo of the highest value.

In case of any differences between the code components available at the address given above and the IEC pdf published content, the code component(s) published on the IEC web site (see above) is(are) valid; they may be subject to updates. See history files of these code components.

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 61850-2, *Communication networks and systems in substations – Part 2: Glossary*

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

IEC 61850-6:2009, *Communication networks and systems for power utility automation – Part 6: Configuration description language for communication in electrical substations related to IEDs*

IEC 61850-6:2009/AMD1:2018

IEC 61850-7-2:2010, *Communication networks and systems for power utility automation – Part 7-2: Basic information and communication structure – Abstract communication service interface (ACSI)*

IEC 61850-7-2:2010/AMD1:2018²

IEC 61850-7-3:2010, *Communication networks and systems for power utility automation – Part 7-3: Basic communication structure – Common data classes*

IEC 61850-7-3:2010/AMD1:2018³

IEC 61850-7-4:2010, *Communication networks and systems for power utility automation – Part 7-4: Basic communication structure – Compatible logical node classes and data object classes*

IEC 61850-7-4:2010/AMD1:2018⁴

IEC 61850-8-1:2011, *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*

² Under preparation. Stage at the time of publication: IEC/AFDIS 61850-7-2/AMD1:2018.

³ Under preparation. Stage at the time of publication: IEC/AFDIS 61850-7-3/AMD1:2018.

⁴ Under preparation. Stage at the time of publication: IEC/AFDIS 61850-7-3/AMD1:2018.

IEC 61850-8-2⁵, *Communication networks and systems for power utility automation – Part 8-2: Specific Communication Service Mapping (SCSM) – Mapping to Extensible Messaging Presence Protocol (XMPP)*

IEC TS 61850-80-1, *Communication networks and systems for power utility automation – Part 80-1: Guideline to exchanging information from a CDC-based data model using IEC 60870-5-101 or IEC 60870-5-104*

IEC TR 61850-90-2, *Communication networks and systems for power utility automation – Part 90-2: Using IEC 61850 for communication between substations and control centres*

IEC 62689-1:2016, *Current and voltage sensors or detectors, to be used for fault passage indication purposes – Part 1: General principles and requirements*

IEC 62689-2, *Current and voltage sensors or detectors, to be used for fault passage indication purposes – Part 2: System aspects*

IEC 62559-2, *Use case methodology – Part 2: Definition of the templates for use cases, actor list and requirements list*

⁵ Under preparation. Stage at the time of publication: IEC/CFDIS 61850-8-2:2017.