



DPC: 16 / 30317775 DC

BSI Group Headquarters

389 Chiswick High Road London W4 4AL

Tel: +44 (0)20 8996 9000

Fax: +44 (0)20 8996 7400

www.bsigroup.com

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Part 90-10: IEC 61850 objects for scheduling

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Responsible Committee Secretary: **Mr Tom Digby-Rogers (BSI)**
Direct tel: **020 8996 7170**
E-mail: **tom.digby-rogers@bsigroup.com**

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Introduction

This draft standard is based on international discussions in which the UK has taken an active part. Your comments on this draft are welcome and will assist in the preparation of the consequent standard. There is a high probability that this text could be adopted by CENELEC as a reference document for harmonization or as a European Standard. Recipients of this draft are requested to comment on the text bearing in mind this possibility.

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Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	(7)
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/ Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	

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	Also of interest to the following committees Intéresse également les comités suivants		Supersedes document Remplace le document 57/1510/DC – 57/1759/INF
Proposed horizontal standard Norme horizontale suggérée ☐ Other TC/SCs are requested to indicate their interest, if any, in this CDV to the TC/SC secretary Les autres CE/SC sont requis d'indiquer leur intérêt, si nécessaire, dans ce CDV à l'intention du secrétaire du CE/SC			
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Titre :

Title : IEC/TR 61850-90-10 Ed. 1

Communication networks and systems for power utility automation - Part 90-10: IEC 61850 objects for scheduling

Note d'introduction

Introductory note

This voting document is circulated in English only. The French NC stated that it will generally not prepare French versions for DTS or DTR documents.

This document has been developed by TC 57 WG 10 / WG 17; it is based on documents 57/1510/DC and 57/1759/INF.

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IEC 61850 COMMUNICATION NETWORK AND SYSTEMS IN POWER UTILITY AUTOMATION

Part 90-10: IEC 61850 objects for scheduling

Document history

Any person intervening in the present document is invited to complete the table below before sending the document elsewhere. The purpose is to allow all actors to see all changes introduced and the intervening persons.

Any important message to IEC editors should also be included in the table below.

Name of intervening person	Document received		Brief description of the changes introduced	Document sent	
	From	Date		To	Date
Christoph Brunner			Core development		
Laurent Guise		May 2016	Editorial modifications and some technical comments and questions	WG17	2016-05-27
Frances Cleveland		May 2016	Editorial modifications and some technical comments and questions		
Karlheinz Schwarz and Jacob Dall		June 2016	Editorial modifications, technical clarifications and added a possibility to differentiate between processible, non-processible and forecast schedules.	WG10/WG17	2016-06-10
Frances Cleveland		June 9 2016	Minor editorial updates		
Laurent Guise		June 2016	Result from WG17 decisions made in Beijing + needed clarifications on ramping, start time update in case of periodic schedule, schedule controller behavior in case of same priority schedules	WG17	2016-17-21
Margareta Noeth	Ch. Brunner	2016-08-03	DTR document	CO	2016-08-04

This table will be removed by IEC editors before FDIS circulation (in case of IS) or before final publication (in case of TS or TR).

Note: "As agreed at the recent CAG we introduce a table providing document history into all documents of our current and future standard projects.

This table is intended to give information on the document exchange between

- project leader (chief editor)
- secretary
- IEC central office
- translating National Committee

Further history on changes during editing in working groups are not in the scope of this table.

I kindly ask you to distribute this document to the respective project leaders / chief editors with the request to integrate the table in the first page of the working documents,"

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IEC 61850 COMMUNICATION NETWORK AND SYSTEMS IN POWER UTILITY AUTOMATION

Part 90-10: IEC 61850 objects for scheduling

1 Scope

This Technical Report describes scheduling for devices using IEC 61850.

The parameters which are identifying this new namespace are:

- Namespace Version : 2015
- Namespace Revision : A
- UML model file from which this namespace has been extracted : wg17uml02v17b90-10
- Namespace release date : 2015-11-19
- Namespace name : "(Tr)IEC61850-90-10:2015A"

The namespace "(Tr)IEC61850-90-10:2015A" is considered as "transitional" since the models are expected to be included in next editions of IEC 61850-7-4xx and IEC 61850-7-3 International Standards (IS). Potential extensions/modifications may happen if/when the models are moved to the International Standard status. Only the new data objects and CDCs which are not said inherited from existing LNs will be tagged with this namespace name. The others should still refer to the namespace where they are primarily defined."

2 Normative references

The following referenced documents are indispensable for the application 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 61850-7-1 Ed 2, Communication networks and systems for Power Utility Automation – Part 7-1: Basic communication structure – Principles and models
- IEC 61850-7-2 Ed 2, Communication networks and systems for Power Utility Automation – Part 7-2: Basic communication structure – Abstract communication service interface (ACSI)
- IEC 61850-7-3 Ed 2, Communication networks and systems for Power Utility Automation – Part 7-3: Basic communication structure – Common data classes
- IEC 61850-7-4 Ed 2, Communication networks and systems for Power Utility Automation – Part 7-4: Basic communication structure – Compatible logical node classes and data object classes
- IEC 61850-7-410, Communication networks and systems for power utility automation – Part 7-410: Hydroelectric power plants – Communication for monitoring and control
- IEC 61850-7-420: Communication networks and systems for power utility automation – Part 7-420: Basic communication structure – Distributed energy resources logical nodes
- IEC 61850-90-7: Communication networks and systems for power utility automation – Part 90-7: IEC 61850 object models for photovoltaic, storage, and other DER inverters
- ISO 4217, Codes for the representation of currencies and funds

3 Terms and definitions

For the purposes of this International Standard, the terms and definitions given in IEC 61850-2 and 61850-7-2 apply.

4 Abbreviated terms

Clause 4 of IEC 61850-7-4 defines abbreviated terms for building concatenated data names.

For the purpose of the document, some new abbreviations have been introduced as presented in Table 1:

Table 1 New abbreviations for data object names

Term	Description
Dsa	Disable, disabled
Edt	Edit, edited
Entr	Entry, entries
Schd	Schedule
Req	Requested
Reuse	Reuse
Vld	Valid, validate, validated

NOTE Abbreviations used for the identification of the common data classes and as names of the attributes are specified in the specific Clauses of this document and are not repeated here.

5 Requirements for schedules

5.1 Schedules for establishing time-based behaviour

Schedules establish which behaviour (e.g., tariff 1 or 2, mode 1 or 3) or expectation (e.g., forecast) is applied during specified time periods. A schedule consists of a series of entries with a setting for the value of a setpoint, the selection of a particular mode or the value of a parameter for a mode.

There are different ways to operate a scheduled entity based on the following operation principles:

- The actual values of a scheduled entity (e.g. active and reactive power produced or consumed) are directly controlled using setpoints and controls. For example, the DER system reacts on changes of the setpoints or on controls (e.g. start or stop the DER system) in real time.
- The functional behavior of a scheduled entity is configured to operate in a mode in which it responds to locally sensed conditions (e.g. Volt-VAr Mode in case of DER) or externally provided information (e.g. prices). In that case, the DER system undertakes autonomous reactions to such locally sensed conditions or externally provided information.

One of the most common uses of schedules is for scheduling real power output. In that case, DER systems that directly manage their power output, such as reciprocating engines and energy storage systems, can use schedules to determine the time and level of power output.

However, many other controllable entities can also be scheduled. Larger inverter-based DER systems and large aggregations of small inverter-based DER systems have significant influence on the distribution system and have local Volt-VAr characteristics that may vary throughout the day. As a result, a single function or operational mode such as a specific Volt-VAr curve may not be suitable at all times. Yet sending many control commands every few hours to many different DER systems may impact bandwidth-limited communications systems or may not be received in a timely manner, leading to inadequate DER system responses. However, if schedules can be established that the DER systems can follow autonomously, then these communication impacts can be minimized.

Schedules can be used to allow even more autonomous control of the behaviour of DER equipment. They are usually sent ahead of time, and then activated at the appropriate time or by an external trigger event. There are different applications for schedules:

- schedules for direct values (e.g. setpoints for P/Q/cosphi)
- schedules for constraints (e.g. do not exceed the maximum value of P/Q/cosphi at a certain time)
- schedules for pricing information (act on constraints)
- schedules for modes (e.g. Volt-VAr curves)
- schedules for parameters of modes
- schedules used for predictions or forecasts

Therefore, two types of schedules can be differentiated:

- **Values** are direct settings, such as maximum power output. These are absolute values or a percentage and are primarily used where specific values are needed. Examples are setpoints for active or reactive power or pricing signals. Binary values (ON, OFF) can be used to block or unblock power consumption.
- References to **modes** that manage output through algorithmic calculations and their associate parameters. Examples are Volt-VAr mode, frequency-watt mode, temperature or pricing signals.

5.2 Relation between schedules and directly set values and parameters of the DER system

As it has been mentioned before, schedules are an alternate way to determine the behaviour compared to direct control possibilities (i.e. using setpoints or activate and configure a selected mode of operation). Therefore, it is important to describe how schedules and direct control possibilities interact.

Schedules are configured to overwrite currently applied values without sending an operate message (direct control) to the data object representing the “controllable entity”.

Example: A high priority schedule (triggered by a client) with an analogue setting value of “30 per cent” would “overwrite” the current value of “100 per cent”. Another schedule for “60 per cent” would overwrite the “30 per cent”.

NOTE: The above example shows that any controllable entities (see below in subclause 7.1) may be configured as scheduled. There is no need to directly operate on “controllable entities”.

6 Principles for modelling schedules

6.1 Schedule controllers and their schedules

Within an electrical system, multiple entities can be scheduled in parallel, e.g. it is possible to schedule active power and reactive power. For each of the scheduled entities (see subclause 7.1), there will be at most one schedule controller and potentially several schedules referenced (used) by the schedule controller. One given schedule may be referenced by multiple schedule controllers.

An entity may be one setpoint or one setting or one activation of a particular mode (more details provided in subclause 7.1). For instance, a schedule controller could be associated with WMax (setting of the maximum real power output of a DER – namespace “(Tr) IEC 61850-90-7:2012”). Another schedule controller could be associated with OpModVVar which enables/disables the volt/var mode (namespace “(Tr) IEC 61850-90-7:2012”). The reference to these data objects uses the ORS CDC (see subclause 7.2.1).

The description in this subclause applies to one scheduled entity (i.e. one schedule controller and multiple schedules).

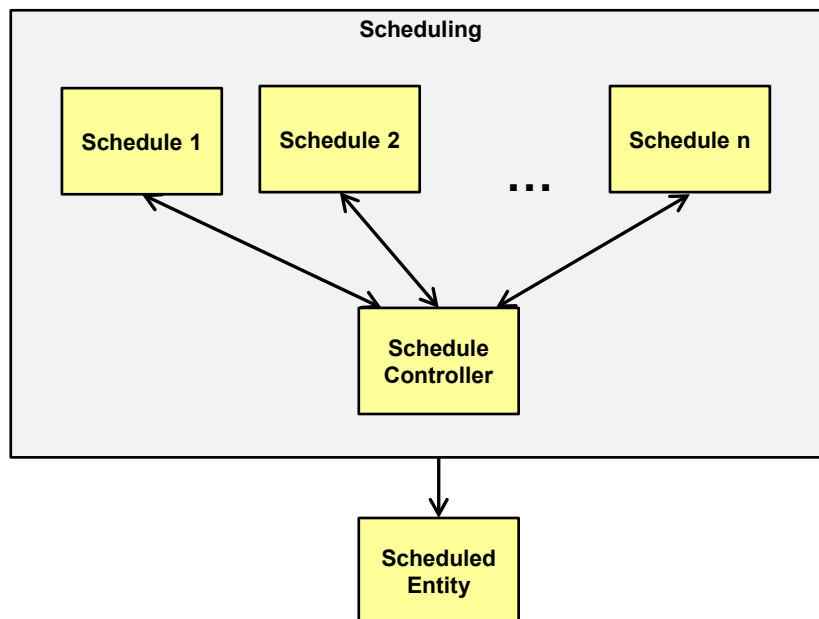


Figure 1: Scheduling principle

6.2 Schedule structure

The following is an overview on the principle information available in the schedules. The detailed modelling as IEC 61850 logical nodes and data objects is described later.

A schedule consists of an indication of the (fixed) duration of the schedule interval and a series of entries, representing the “absolute” expected output of the schedule at each consecutive schedule interval time, the first value being attached to the first time interval.

Each schedule has an identity (provided as the object reference in an ORG CDC) that is used by a schedule controller for managing the scheduled entity.

Schedules may have a priority. The default priority is priority 0. Schedules with higher priority take precedence over schedules with lower priority.

Schedules can be started by one or multiple time stamps (2016-06-10 06:00), one or multiple calendar times (e.g., every Monday at 08:00 h), or by an external trigger.

Table 2 contains the key information provided within a schedule.

- The first six entries provide the Information that is required to control the execution of the schedule, including its configuration and status,
- The last three entries (framed) are the contents of the schedule while the last entry is repeated for each interval time.

NOTE : if the number of instances of typed values exceeds the defined number of schedule entries, the remaining last entries are ignored.