

IEC 61850 기반의 OCR IED에 대한 적합성 시험방안

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Conformance Testing for IEC 61850 based OCR IED

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Abstract - IEC 61850 is a new approach international standard which is applicable to Substation Automation System (SAS) and defines the communication between intelligent electric devices (IEDs) in the substation and the related system requirements. It already has a significant impact on the development of different devices or systems used in substation. Conformance claims and the establishment of their validity are important parts of the acceptance of systems and equipment. This paper introduces the conformance testing, mapping of IEC 61850 services and MMS services, and in case study part it gives the example of testing OCR IED.

1. Introduction

IEC 61850 is a new international standard for communication networks and systems in substations that has a significant impact on the developments in power system protection. It has many benefits such as it supports the implementation of high-speed peer-to-peer communications based applications and distributed protection solutions using sampled analog values. All major substation protection and control equipment manufacturers have products that implement different forms of IEC 61850 communications to simplify integration in substation automation systems and improve the functionality of the system, while at the same time reduce the overall system cost.

As the IEC 61850 standards are very complex, so after the products which made by manufactures or the devices made by some research department are finished, the strictly testing should be done. Testing of high-speed peer-to-peer based protection and control systems presents new challenges to protection engineers.

As we know, there are a few company can provide the conformance testing services and the testing will cost a lot of money, in order to minimize the test cost, we can do our best to do the testing by ourselves.

This paper describes the conformance testing for IEC 61850 based OCR IED made by SIEMENS company. The performance testing is still under way, so this paper only focus on the device related conformance test.

2. Conformance Testing

2.1 Introduction of conformance testing

A conformance testing is the type test for communication and the system related test of the incorporated IEDs. In general, conformance testing of the communication behavior of an IED should address the functional requirements and performance requirements of typical applications supported by these devices in a Substation Automation System (SAS). The test demonstrates the capability of the DUT to operate with other IEDs in a specified way according to the IEC 61850 series.

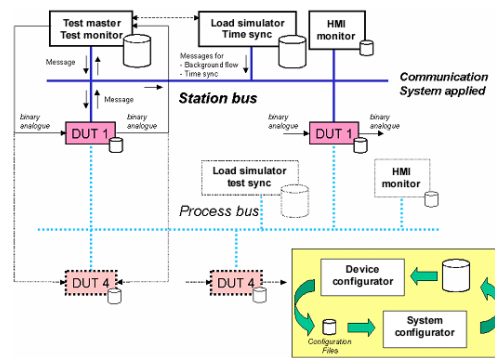
Conformance testing requires consideration of the following issues: The problem of all testing is the completeness of the test. It is impossible to test all system configurations using IEDs from different world-wide suppliers, which means the needing of a standardizing test architecture.

A communication standard does not standardize the functions of the communicating equipment.

Some properties of the device, which are out of the scope of standard, may be proven by information and documents provided with the Device Under Test (DUT).

2.2 Device related conformance testing

The test system architecture is given by IEC 61850-10 shown as in Fig.1. This architecture contains the minimum test set-up for station bus, the process bus, and an optional DUT4.



<Fig.1> Test system architecture

As it mentioned in IEC 61850-10, it is said that verification of functional applications (use of GOOSE messages) is not part of a conformance test, so this paper also ignores the GOOSE communication part.

The comprehensive interoperability testing of communication among devices for all possible products is not feasible. Therefore, the test concept shall include test devices, test configurations and test scenarios. The dynamic behavior should be tested properly by using well-defined test cases.

Conformance testing contains the positive test, which means while verification of normal conditions, typically resulting in response +, and negative test, which means while verification of abnormal conditions, typically resulting in response -. Some probable test cases are summarized in IEC 61850-10. According to the summarized information, the test procedure can be made as the format given by the standards. Take test case Srv2 as an example, which is described as Issue a GetLogicalDeviceDirectory request and check response. The test procedure is shown in Table 1:

<Table 1> Test case procedure of Srv2

Test reference	Test purpose	<input type="checkbox"/> Passed
Srv2	Issue a GetLogicalDeviceDirectory request and check response	<input type="checkbox"/> Failed
		<input type="checkbox"/> Inconclusive
Ref. Part, Clause and Subclause of IEC 61850		
IEC 61850-7-2 Subclause 8.2.1		
IEC 61850-8 Subclause 11		
MMS-EASE Reference Manual, GetNameList Service		
Expected result		
Server response + "LNReference"(The GetNameList object class has a value of NamedVariable within the scope of a particular domain)		
Test description		
Client request a GetLogicalDeviceDirectory service (GetNameList)		
Comment		

The right-top part of Table 1 is the test result, when the observed test outcome gives evidence of conformance to the conformance requirement on which the test purpose of the test case is focused

