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(Revision of
IEEE Std C37.118™-2005)

IEEE Standard for Synchrophasor Data Transfer for Power Systems

Sponsor

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Abstract: A method for real-time exchange of synchronized phasor measurement data between power system equipment is defined. This standard specifies messaging that can be used with any suitable communication protocol for real-time communication between phasor measurement units (PMU), phasor data concentrators (PDC), and other applications. It defines message types, contents, and use. Data types and formats are specified. A typical measurement system is described. Communication options and requirements are described in annexes.
Keywords: data concentrator, DC, IEEE C37.118.2, PDC, phasor, phasor data concentrator, phasor measurement unit, PMU, synchronized phasor, synchrophasor

The Institute of Electrical and Electronics Engineers, Inc.
3 Park Avenue, New York, NY 10016-5997, USA

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Introduction

This introduction is not part of IEEE Std C37.118.2-2011, IEEE Standard for Synchrophasor Data Transfer for Power Systems.

Digital computer based measurement, protection, and control systems have become common features of electric power systems. These measurement, protection, and control systems use sampled data to compute various quantities such as voltage and current phasors. Phasors are used in many protection and data acquisition functions, and their utility is increased further by referencing them to a common time base. This can be accomplished by synchronizing the phasor estimate to a precise time source that is common to the various measuring sites. Phasor estimates synchronized to a common time source and referenced to a common nominal frequency are defined as *synchrophasors*. Simultaneous measurement sets derived from synchronized phasors provide a vastly improved method for tracking power system dynamic phenomena for improved power system monitoring, protection, operation, and control.

The original standard for synchrophasors was IEEE Std 1344™-1995 [B3], which was reaffirmed in 2001.[a] This standard was replaced in 2005 by IEEE Std C37.118™-2005 [B6]. IEEE Std C37.118-2005 provided additional clarification for the phasor and synchronized phasor definitions. The concepts of total vector error and compliance tests were introduced. The message formats were updated from the original standard to improve information exchange with other systems such as a master station. Specifically, the sync, frame size, and station identification fields were added to the data frame, configuration frame, header frame, and command frame. Analog data was added to the data frame, the fraction-of-second (FRACSEC) field replaced the sample count field, and the status field was significantly modified to include time quality.

The 2005 version of IEEE Std C37.118 included both measurement requirements and real-time data transfer requirements. To simplify widespread adoption and facilitate the use of other communication protocols for phasor data transfer, IEEE Std C37.118-2005 [B6] was split into two standards: IEEE Std C37.118.1™ for synchrophasor measurement requirements including dynamic performance, and IEEE Std C37.118.2-2011 (this standard) with synchrophasor data transfer requirements.[b] The previous requirements for data transfer are retained, and one new configuration frame has been added.

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[a] The numbers in brackets correspond to those of the bibliography in Annex A.
[b] Information on references can be found in Clause 2.

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Lisa Perry
IEEE Standards Program Manager, Document Development

Soo H. Kim
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IEEE Standard for Synchrophasor Data Transfer for Power Systems

1. Overview

1.1 Scope

This standard defines a method for exchange of synchronized phasor measurement data between power system equipment. It specifies messaging including types, use, contents, and data formats for real-time communication between *phasor measurement units* (PMU), *phasor data concentrators* (PDC), and other applications.

1.2 Purpose

The purpose for this standard is to facilitate data exchange among measurement, data collection, and application equipment. It provides a defined, open access method for all vendors to use to facilitate development and use of synchrophasors. It is a simple and direct method of data transmission and accretion within a phasor measurement system, which may be used directly or with other communication protocols. This method was initially established by IEEE Std C37.118™-2005 [B6].[1]

[1] The numbers in brackets correspond to those of the bibliography in Annex A.

1.3 General overview

This standard defines data transmission formats for real-time data reporting for synchronized phasor measurements used in electric power systems.

- Clause 1 provides the scope and need for the standard.
- Clause 2 references other standards that are related or may be useful in the study and application of this standard.
- Clause 3 defines terms, acronyms, and abbreviations found in this standard.
- Clause 4 provides background for synchrophasor measurement.
- Clause 5 describes synchrophasor measurement system.
- Clause 6 defines the real-time communication protocol and message formats.

Six informative annexes are provided to clarify the standard and give supporting information:

- Annex A is a bibliography.
- Annex B gives information about cyclic redundancy codes and the cyclic redundancy check (CRC) required by this standard.
- Annex C provides background in communication bandwidth.
- Annex D illustrates the message formats defined in Clause 6 with complete message examples.
- Annex E defines message mapping into standard communication protocols.
- Annex F discusses synchrophasor communications methods for Internet Protocol (IP).

1.4 Need for this standard

The 2005 version of IEEE Std C37.118 includes both measurement requirements and real-time data transfer requirements. To simplify widespread adoption of synchrophasor measurement technology and facilitate the use of other communication protocols for phasor data transmission, IEEE Std C37.118-2005 [B6] was split into two standards, one with measurement requirements and the other with the data transfer requirements. This allows other communication protocols and systems to be used with phasor measurement systems supporting the original purpose of the standard. This split facilitates harmonization of IEEE Std C37.118-2005 with IEC 61850. This standard includes only the data transfer portion of IEEE Std C37.118-2005, adding some corrections and improvements yet retaining the current messaging for backward compatibility. This approach supports the widely used method for current and developing deployments, and allows for a smooth transition of synchrophasor systems to new protocols as needed.