



June 19, 2013

Performance and Standards Task Team Announcement

Regarding IEEE Standard C37.118.1-2011

This announcement provides guidance to the users and developers of phasor measurement unit (PMU) technology. The existing IEEE Synchrophasor standard C37.118.1 is in the process of being amended.

The Performance Standards Task Team (PSTT) of the NASPI (North American Synchrophasor Initiative) in collaboration with its members and the industry is issuing this information letter regarding some aspects of the 2011 IEEE Std. C 37.118.1 having requirements that are difficult to meet or further clarifications and interpretation may be needed. The users may want to meet with their respective product manufacturing and determine whether any of the changes under consideration will have adverse effects on the user applications.

The IEEE Std. C 37.118.1 presents a set of performance requirements, for PMU devices, to ensure that compliant PMUs will perform similarly under typical operating conditions. Unlike an IEEE Guide, where user applications are described with product specifications, the product manufactures are expected to fully meet all requirements defined in the IEEE standard. Since the users refer to the IEEE Guides and Standards as part of project requirements, this PSTT letter is intended to inform the end users with a brief listing of the findings and status updates.

The synchrophasor standard C37.118.1-2011 covers the measurement aspects of synchrophasors. It provides a substantial update to the coverage of measurement aspects in its predecessor standard (C37.118-2005). For example, the phasor and synchronized phasor definitions to include dynamic operating conditions. The concepts of total vector error (TVE) and compliance tests are expanded, tests over temperature variations are added, and the dynamic performance tests are introduced. In addition, limits and characteristics of frequency and rate of change of frequency measurements are developed. A reference model is also included, with the intention of verifying the ability to implement the required performance measures.

Members of the industry including practitioners, test facilities and manufacturing have identified some issues after the standard was completed, described below.

1. The published model (annex C of the standard) has been found to yield the following results
 - a. P class PMUs can pass all the requirements.
 - b. M class PMUs can pass most of the requirements except
 - i. Frequency test at 30 fps for $f = 60$ Hz
 - ii. Most Frequency Error (FE) and rate of change of frequency error (RFE) requirements under out of band (OOB) interference conditions
 - iii. TVE requirements under frequency ramp at some reporting rates

2. Commercial PMUs have difficulty in meeting the Rate-of-Change-of-Frequency (ROCOF) requirements.
3. There is a need for clarification of the definition of latency. There are two kinds of latencies defined within the standard. The standard will clarify which version intended in section 5.5.9.
4. Some inconsistencies have been found, such as:
 - a. Performance requirements are generally higher for M class than for P class, but frequency and ROCOF go both ways.
 - b. The ROCOF error limit is 0.01Hz/s for several requirements. The integer value resolution is the same, which leaves no margin for errors.
5. Some obvious typographical errors have been noticed
 - a. Section 4.3 lists the error in the MHz region which is not correct.
 - b. In table 11, the response time of 0.199 s for $F_s = 50\text{Hz}$ is not consistent with the entries around it.

The issues are being addressed and resolved. After the issues surfaced, the IEEE Working Group (WG) submitted a new Project Authorization Request (PAR) in January 2013 to clarify and to address them. A task force put in the modeling and testing efforts to determine the root cause. After exploring several alternatives, the WG has proposed to make several changes based on the following overall guidelines:

1. The basic purpose of the standard is to assure interoperability is unchanged as the guiding principle.
2. ROCOF is susceptible to error in high noise environment, so the requirements are relaxed to prevent this derivation from driving PMU design.
3. The M class reference model is improved to achieve a good frequency measurement, a parameter that is widely used.
4. Typographic errors are fixed and clarification added where needed.
5. Any other technical errors are corrected.

To achieve these goals, the following changes are planned:

1. 1. The M class reference model described in Annex C is updated with longer filters that improve the ability to achieve TVE requirement with a larger margin and provide good frequency measurements. The penalty is a little longer latency for the measurement reporting, from 5 to 7 reporting periods. The frequency and ROCOF computation models are improved with an unbiased estimate.
2. Associated text and illustrations in annex c will be updated.
3. The minimum ROCOF requirements to be raised to 0.1 from 0.01 Hz/s for integer reporting and increasing margin.
4. Suspending the ROCOF requirements for the out of band, harmonic, and step tests.
5. The combined AM-PM and separate PM modulation tests will be just one AM and one PM test to simplify setting requirements and making evaluation.

6. Step test requirements in Table 11 will be recomputed for the changed model / filter.
7. Some of the wording used in the description of latency is being revised to make it clearer, and the requirement for M class PMUs is being adjusted upwards, to make it consistent with other proposed changes.

The updates listed for the most part are to help products conform to the standards. The PSTT believes that users may want to meet with their respective product manufacturing and determine whether any of the above identified changes under consideration will have adverse effects on their applications.

One of the roles of NASPI's PSTT is to support industry with developing documents supporting PMU deployment. As it will take some time for the Standard working group to fully address and complete the updates through the established IEEE review and publication process, the NASPI PSTT has provided the above explanation to help with PMU deployment and development and clarify progress status of the IEEE Std. C 37.118.1.

For further detail regarding this PSTT information letter, please contact Vahid Madani (VxM6@pge.com) or Damir Novosel (DNovosel@Quanta-Technology.com).