NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Time Error Correction

Prepared by

NERC Balancing Authority Controls Standard Drafting Team

1. Introduction

The NERC Time Error Correction standard is currently under review for modifications to bring the standard up to current minimum requirements. The standard drafting team has compiled information concerning the continued need for this standard. Included are a short history of Time Error Correction and a comparison of operations with and without the current Time Error Correction procedure. The team now seeks further industry input on this issue.

2. History of Time Error Correction

This short history of time error correction was compiled from information obtained from the Internet and other documents shared by members of the standard drafting team.

Invention of the Synchronous Motor Clock

In 1916, Henry E. Warren invented the self-starting synchronous motor used in the Telechron Clock in 1919. Because the accuracy of the Telechron Clock was dependent on the interconnection frequency, the Warren Clock Company gave clocks to electric system operators. These clocks would only provide the correct time if the power company maintained the correct average frequency over the long term. As a result, some power system operators began regulating system frequency to maintain the correct time on the clocks that they received.

Market Penetration

During the 1920s, other companies developed synchronous motor clocks and used the same marketing strategy, giving electric clocks to system operators. As the penetration of the synchronous electric clock increased, the electric revenue from the electric clock motors increased enough to justify the relatively small cost necessary to regulate system time by modifying system frequency. This additional revenue insured that Time Error Correction would be an ongoing service provided by the electric utility industry.

Time Error Correction Practice

As the industry interconnected, this service of providing time error correction was incorporated in general operating practice. The current form of Time Error Correction is a carryover of these practices. Documentation is available from as late as 1976 that synchronous electric clocks were still being used for important applications.

Improvements in Clock Accuracy

In 1969, marketing of the first mass-produced quartz watch began. This development provided for the first time a more reliable and less expensive alternative to the synchronous motor clock. In addition, in 1984, as a public service for the safety of all, the United States opened free use the Global Positioning System, based on time signals. As these alternatives have penetrated the market, they have displaced the synchronous electric clock as the preferred method of keeping accurate time.

Current Need for Time Error Correction

In 2004, the NERC Resources Subcommittee distributed a questionnaire to the National Electrical Manufactures Association (NEMA). Two NEMA groups returned that survey, Motor and Generator Section and Electricity Metering Section, indicating that they currently do not have a need for the corrections in time error provided by Time Error Correction. Consequently, the Resources Subcommittee has questioned the need to continue to provide a Time Error Correction Service.

Is Time Error Correction Detrimental to Reliability?

Observations of interconnection frequency deviations on the Eastern Interconnection have caused those observing the BAAL Field Trial to question whether current Time Error Correction practice is detrimental to reliability. The BAAL Field Trial demonstrated that large frequency deviations are much more likely to occur during those times when scheduled frequency is offset by a Time Error Correction than when Time Error Correction is not performed.

Balancing Authority Controls Standard Drafting Team

Based on the above history, the Balancing Authority Controls Standard Drafting Team has chosen to reach out to the industry for input on how to move forward on the issue of Time Error Correction. The following sections present two alternative paths for consideration.

3. Continue Time Error Correction

The following advantages and disadvantages of continuing Time Error Correction can be demonstrated technically.

Advantages

1. Synchronous motor electric clocks still in use will continue to maintain accurate time within the limits of the Time Error Correction procedures.

Disadvantages

1. There is no clear reliability reason to perform Time Error Correction. The SDT believes that synchronous motor electric clocks are no longer largely in use. However, there may be reasons to offset scheduled frequency to correct chronic frequency errors in a manner similar to Time Error Correction.
2. Time Error Correction has costs including maintenance of software, training and implementation of the TEC procedures.
3. The current Time Error Correction method of using a 20mHz offset of scheduled frequency increases the probability that frequency excursions below 59.95Hz or above 60.05Hz will occur on the interconnection be effectively and intentionally moving the target frequency closer to one of those limits. Therefore, Time Error Correction as currently performed is detrimental to reliability.

4. Discontinue Time Error Correction

The following advantages and disadvantages of discontinuing Time Error Correction can be demonstrated technically.

Advantages

1. There is no clear reliability reason to perform Time Error Correction.
2. Discontinuing Time Error Correction would reduce costs including maintenance of software, training and implementation of the TEC procedures.
3. The elimination of the current Time Error Correction procedure would improve reliability as measured by the variability of interconnection frequency. Based on study data from July 2005

through April 2008, approximately 43% of the Frequency Trigger Limit (FTL) Low exceedances occurred during Time Error Corrections where target frequency had been offset to 59.98Hz and the frequency error did not exceed -0.05Hz. Had the Time Error Correction not been in effect, and the target frequency set at 60Hz, it is likely that those same frequency errors would not have resulted in FTL Low exceedances. In other words, it is believed that FTL Low exceedances could be reduced by approximately 43% if Time Error Correction was discontinued. In another study, analysis of Eastern Interconnection data for calendar year 2006 shows that, assuming identical control, elimination of Time Error Corrections would have reduced the total number of frequency excursions from 2,535 to 1,797, or 29.11%. For low-time error corrections, 1,582 excursions reduced to 877 (44.56%); for high-time Error Corrections, 953 excursions reduced to 920 (3.46%).

Disadvantages

1. Synchronous motor electric clocks still in use will no longer maintain accurate time within the limits of the Time Error Correction procedures.

5. Conclusions and Recommendations

The SDT believes there is not a reliability reason to continue Time Error Corrections. The SDT also believes Time Error Corrections as currently implemented are detrimental to reliability. Given this, the SDT proposes to halt the use of Time Error Corrections in North America.

Time Error is the integral of Frequency Error. There are no other standards that require the industry to keep track of and evaluate average frequency error. BAL-001 only bounds the Standard Deviation of the Frequency Error; it does not directly address the average frequency error. The SDT believes it is still appropriate to measure Time Error as an indicator of system performance, and is not proposing to eliminate this measurement.

6. Questions

1.) Are there any technical reasons to continue Time Error Corrections? If so what are they?

2.) Do you agree there are technical reasons to discontinue Time Error Corrections? If not, why?

3.) Do you have any alternate proposals for Time Error Correction?

Time Error Correction Survey