



Solving UTC and Local Time Time-Stamp Challenges Using ACSELERATOR TEAM[®] SEL-5045 Software

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INTRODUCTION

As intelligent electronic devices (IEDs) that allow historical data recording and trending (such as protective relays and revenue meters) are integrated into power systems, it becomes apparent that correlating time between devices at multiple locations can be a complex issue. It is good practice to connect high-accuracy clocks to all IEDs to allow for event analysis. When comparing events, it is usually easy to determine if one event record is applicable or not because of time zone differences or daylight-saving time (DST) discrepancies. However, when comparing continuous trending data, such as load profile data, it becomes much more important to record accurate time zone and DST information. Without this information, the data profile might not provide enough detail to determine what local time the data were recorded in. This application note describes the challenges associated with time zones and DST, and it presents two ACSELERATOR TEAM[®] SEL-5045 Software configurations for solving time-stamp ambiguity issues.

PROBLEM

The two major challenges associated with data time stamps are time zones and DST application. Most users prefer that IEDs in the field be programmed with local time to make their jobs easier, but this causes complications with older devices that do not understand time zones or DST.

Time Zones

Local times were first determined by apparent solar time using devices such as sundials. Because apparent solar time fluctuates based on where the measurement is taken (roughly four minutes for every degree of longitude), time zones were created to maintain a standard time between multiple regions. Time zones solved a host of time-related issues. One example of where the use of time zones is preferred over apparent solar time is railway management. Using apparent solar time to maintain railway schedules would be problematic because apparent solar time measurements taken simultaneously at different stops would each present a different time. A train conductor would need to adopt a time schedule referenced to a single location to maintain accuracy and familiarity.

When communicating with electronic devices, the user needs to know what the device time is in relation to. Older devices may not know what time zone they are in, so this local time needs to be converted to Coordinated Universal Time (UTC) so that it can be compared with data from another time zone with no ambiguity.

Daylight-Saving Time

In the United States (as of 2007), DST begins at 2 a.m. local time on the second Sunday in March and ends at 2 a.m. local time on the first Sunday in November. When DST is entered in March, clocks are set one hour forward. When DST ends in November, clocks are set one hour backward. Note that this information is presently accurate but may change in the future. DST is a complex issue due to the volatility of the start and end dates as well as the difficulty of determining what regions observe DST. For example, in 2006, Indiana became the forty-eighth state in which all counties observe DST. Previously, different parts of the state observed different DST applications, making it difficult to determine local time and compare times between two locations. While software can be configured to handle the multitude of regional time modifications, one problem that is encountered is that when the clocks are set back one hour in the fall (referred to as DST fall back), duplicate local time stamps occur at 2 a.m. when DST ends. Determining which time stamp occurred first during this gray area can be a difficult task.

SEL SOLUTIONS

The following TEAM configurations can help solve time-stamp issues (note that this is not an all-inclusive list of the ways to configure time with TEAM):

- IEDs set to UTC.
- IEDs set to local time with DST application.

When setting up metering points in TEAM, a metering point should always be set to the same time configuration as the relay. If the relay is set to local time, set the metering point to the local time zone as well. If the relay is set to UTC, set the metering point to UTC. Failure to do so will result in erroneous time-stamp corrections.

The TEAM instruction manual specifies that all metering data time stamps are converted to UTC before data are recorded in the ACSELERATOR Database. This conversion allows all data to be mapped to the same time stamps regardless of what region the data were recorded in. The result is that when the data are queried from the database, the user can remap the time stamps to any region or with any DST options that are required. To ensure that time stamps are all normalized to UTC, data presented with local time stamps must include time zone and DST information. If time zone or DST information is not available, time correlation may fail if the database contains data from multiple time zones or with DST applied.

UTC Configuration

SEL recommends that users set all of their devices to UTC time. This is the easiest method to ensure that all devices are producing the same kind of time stamps. The major drawback to this method is that all of the historical data are not presented in local time. For example, a technician who is tasked with downloading event data from a fault that occurred on June 30 at 11 p.m. local time might be confused about which data to obtain because the UTC time stamp for this event is in the early morning hours of July 1. Likewise, if the operations center for a utility is creating an interruption report and uses a printout of the Sequential Events Recorder (SER) report, an incorrect record could be created if the operator does not realize that the time stamp is not in local time. However, the major benefit to UTC configuration is that when local clocks are set back one hour in the fall for DST, duplicate time stamps do not show up.

When devices are set up in TEAM, a metering point that includes time zone information is required for each device. When communicating with older devices, TEAM assumes that the time stamp is in local time and uses the preconfigured time zone information from the metering point

to convert the time stamp to UTC. Newer devices are aware of local time and the difference from UTC, which makes conversion to UTC an easier task. For example, the following screen capture shows time information from an SEL-411L Advanced Line Differential Protection, Automation, and Control System that is aware of time zone and DST application as well as UTC.

```
=>time dst
local: 15:26:50    UTC: 19:26:50    UTC Offset: -04.0 hrs

Daylight Savings Time Begin Rule: 2nd Sunday of March at 02:00
Daylight Savings Time End Rule: 1st Sunday of November at 02:00

Daylight Savings Time Presently Active

Next Daylight Savings Time Beginning: 03/10/2013 02:00
Next Daylight Savings Time Ending: 11/04/2012 02:00
```

Local Time With DST Application Configuration

When IEDs are set to local time with DST application, direct human interaction with the devices (e.g., engineering access or relay testing) becomes easier but comes at the expense of more complex data management. Most issues can be resolved during the setup of the archiving systems, but DST fall back and duplicate time stamps will continue to cause problems. If your system is configured in this manner, contact an SEL representative to discuss how to work around these issues and to discuss the use of TEAM with your system. Note that TEAM is best suited for applications where IEDs understand the difference between UTC and local time.

Some newer IEDs have the ability to display local time as well as UTC. Eventually, this ability will enable automated data collection in UTC, while engineering access interrogation of the IED will be reported in local time. Presently, however, a real-world application is likely to have a mix of both old and new IEDs, which can be challenging when comparing time stamps.

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