TECHNICAL NOTE

Overview of 1per10 Time Protocol

Summary

1per10 is a precision time protocol used to synchronize Sepam™ digital protection relays in time-critical applications.

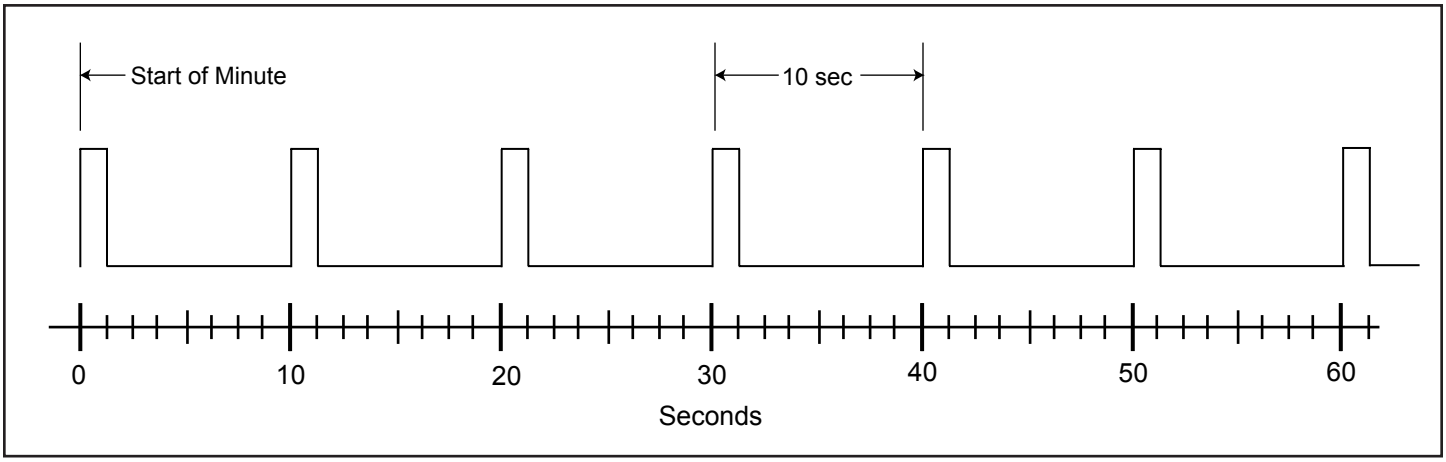
This document describes the protocol, gives examples of how 1per10 is used by Cyber Sciences products, and provides references for further study.

PROTOCOL DESCRIPTION

Introduction to 1per10

1per10 (one-pulse-per-ten-seconds) is a simple time protocol that uses one synchronizing pulse every 10 seconds to provide an accurate time reference for power system devices. This protocol is used by Sepam™ digital protection relays from Schneider Electric. The relays can accept any synchronization pulse period from 10 to 60 s, by 10 second steps. The shorter the synchronization period, the more accurate time-tagging of status changes; therefore, 1per10 is preferred.

The rising edge of the first 1per10 pulse occurs at the exact start of a minute, and subsequent pulses follow at 10 second intervals. Since only the rising edge is used for synchronization, the width (duration) of the pulse is not important. The figure below shows a typical 1per10 signal.



One pulse per ten seconds (1per10)

Example

1per10 can be used to set a device's clock with high precision, once the device's own clock has been set initially and its accuracy is known to be within +/- 4 seconds. As an example, consider a device whose clock has been set through some other means and now reads 08:15:59. If it detects a 1per10 sync pulse at this instant, it can safely assume this is the start-of-minute pulse and adjust its clock to 08:16:00. The only way it could be an intermediate pulse (say, the 10 second pulse) would be if the correct time were 08:16:10, but this would exceed the error specification of 4 seconds.

APPLICATION OF 1PER10 IN CSI PRODUCTS

STR-100 Satellite Time Reference

STR-100

The Cyber Sciences STR-100 Satellite Time Reference accepts a GPS smart antenna input or a modulated IRIG-B signal to provide a precision time reference. The STR then outputs a DCF77 or 1per10 signal (24Vdc nominal). By connecting devices in a daisy-chain configuration, the STR can provide an accurate time reference for up to 32 power system devices. Typical accuracy is on the order of 100 microseconds, making it suitable for Sequence of Events Recording (SER) applications requiring one (1) millisecond resolution.

Note: to support 1per10 protocol, the STR's channel 2 output must be configured for 1per10 instead of DCF77 (default). Refer to the STR instruction bulletin for more details.

APPLICATION OF 1PER10 IN OTHER PRODUCTS

Schneider Electric Sepam Relays (series 20 shown)

Sepam Relays

Sepam relays from Schneider Electric have an internal clock that can be set via software and synchronized via an external 1per10 pulse to achieve precise time-tagging of events. Logic input I21 (I103 for Series 80) may be designated for this purpose using Sepam setup software. The following are excerpts from the Sepam instruction manual.

In the initialization phase, the resetting process (switching of Sepam into "synchronous" mode) is based on the difference between Sepam's current time and the nearest ten second period. Resetting is allowed if the difference is less than or equal to 4 seconds, in which case Sepam switches to "synchronous" mode and when the next synchronization pulse is received, the clock is reset to the nearest ten second period.

The synchronization pulse period (one pulse per 10 seconds) is determined automatically by Sepam when it is energized. It is based on the first two pulses received. The synchronization pulse must therefore be operational before Sepam is energized.

If Sepam is in "correct time and synchronous" status, and the difference between the nearest ten second period and the receipt of the synchronization pulse is greater than 4 seconds for two consecutive synchronization pulses, it switches into non-synchronous status and generates a "not synchronous" event. Likewise, if Sepam is in "correct time and synchronous" status, and does not receive a synchronization pulse for 200 seconds, it generates a "not synchronous" event.

REFERENCES

For More Information (CSI)

STR Instruction Bulletin (IB-STR-01)

Tech Note: SER System Architectures (TN-101)

References

Sepam Series 20 instruction bulletin (typical of other models). Document number PCRED301005.

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