TECHNICAL NOTE

Overview of DCF77 Time Protocol

Summary

DCF77 is a precision time protocol used to synchronize power system devices in time-critical applications.

This document describes the protocol, gives examples of how DCF77 is used by Cyber Sciences products, and provides references for further study.

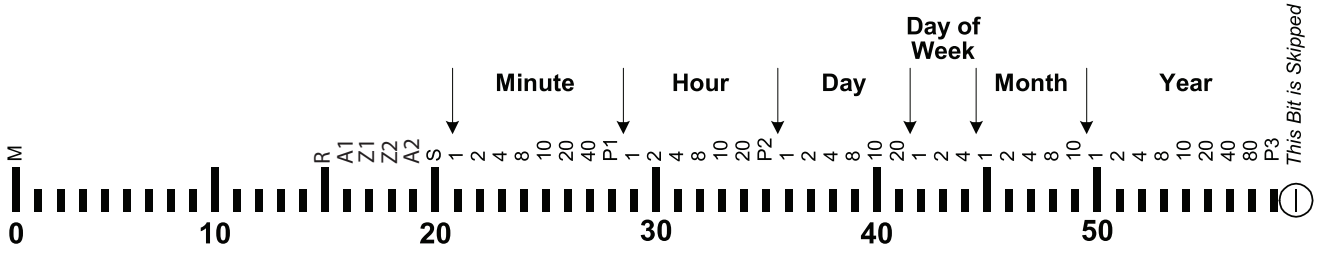
DCF77 STANDARD

Introduction

DCF77 is a time synchronization protocol used widely in central Europe. DCF77 was developed by the Physikalisch-Technische Bundesanstalt (PTB) in Braunschweig, Germany, the national institute for science and technology. DCF77 is both a longwave time signal and a radio station used by the PTB to transmit a precision time signal. The radio station has been in operation since 1959.

DCF77 is similar to WWVB (USA) and MSF (UK). The DCF77 time synchronization output is a 24Vdc pulse-width modulated signal that provides a complete date/time string once every minute. The signal contains a one-pulse-per-second component that is accurate to 100 microseconds in reference to UTC (Coordinated Universal Time). Each minute, a pulse-string contains a BCD (Binary Coded Decimal) value for minute, hour, day, day of week, month, and year as well as other control parameters such as leap second and Daylight Saving Time (Summer Time).

Note: DCF77 stands for D=Deutschland, C=long wave signal, F=Frankfurt, and 77= 77.5kHz.



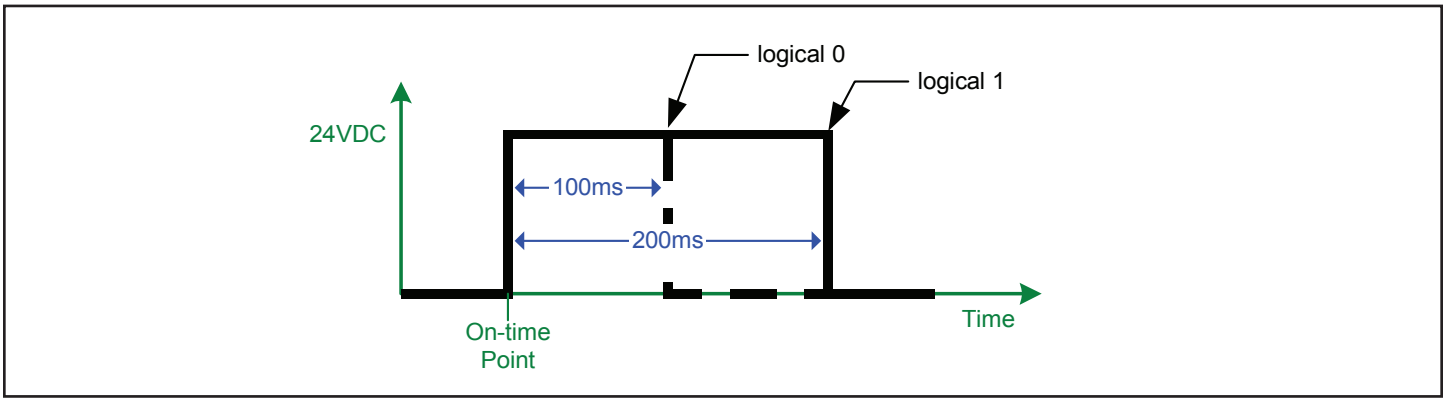
M	Start of Minute (always 0)
R	Antenna Bit (always 0)
A1	Announce Bit for Daylight Saving Time (DST) Switching
Z1	If this bit is set, Daylight Saving Time (DST) is Active
Z2	If this bit is set, Standard Time is Active
A2	Announce Bit for Leap Second
S	Start Bit of Time Information (always 1)
Px	Parity Bit (Even Parity)

DCF77 time signal coding

DCF77 STANDARD (cont.)

DCF77 Time Code Pulse

Each DCF77 pulse has a logical value of either 0 or 1 based on its width (duration). The figure below provides a description of the pulse-width modulation (at 24 Vdc nominal) utilized in the DCF77 protocol.



DCF77 pulse-width modulation

DCF77 IMPLEMENTATION

DCF77 in Power System Devices

DCF77 uses 24 Vdc nominal voltage; therefore, it can be distributed to multiple devices over long distances, making it well-suited to power and automation applications. Thanks to its relatively low bit-rate of 1 pulse-per-second and time frame of 1 minute (compared to 100 pps and 1 second for IRIG-B), DCF77 requires less processor overhead, yet can achieve equivalent accuracies.

APPLICATION OF DCF77 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 signal. 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.

REFERENCES

For More Information (CSI)

STR Instruction Bulletin (IB-STR-01)

Tech Note: SER System Architectures (TN-101)

References

The Physikalisch-Technische Bundesanstalt (PTB) web site. *(http://www.ptb.de/index_en.html)*

"DCF77 time code" — from the PTB web site. *(http://www.ptb.de/en/org/4/44/442/dcf77_kode_e.htm)*

"DCF77 longwave time signal" — from Meinberg GmbH. web site. *(http://www.meinberg.de/english/info/dcf77.htm)*

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Cyber Sciences, Inc. USA