

DMT Monitor - IRIG-B

Purpose:

Verifies LIGO data time stamps based on IRIG-B signals provided by the GPS receivers.

IRIG-B Time Code

The time codes, originally developed by the Inter-Range Instrumentation Group (IRIG), now used in government, military and commercial fields. There are many formats and several modulation schemes, but they are typically amplitude modulated on an audio sine wave carrier. The most common version is probably IRIG-B, which sends day of year, hour, minute, and second data on a 1 kHz carrier frequency, with an update rate of once per second. More information about the IRIG-B code is available at <http://www.phys.washington.edu/~berns/SUPERK/GPS/irigcode.html>. The pulse sequence structure of the IRIG-B signal is shown on Figure 1, while the pulse width encoding of the bits and position marker is illustrated on Figure 2.

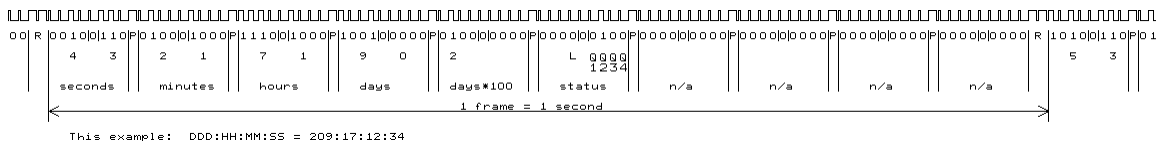


Figure 1. Pulse structure of an IRIG-B signal. (The 1KHz carrier is not displayed.)

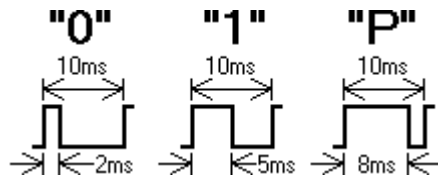


Figure 2. The "0", "1" and "P" symbols encoded in the pulse width ratio of the IRIG-B unit elements. (The 1KHz carrier is not displayed.) Two consecutive "P" elements serve as the reference ("R") marker. The GPS second "tic" coincides with the rising edge of the second "P" of the "R" marker.

IRIG-B DMT monitor

In several cases, serious DAQ problems manifested as large, multiple second time shifts in data labels relative to the correct time. While the TimeMon DMT monitor is able to detect timing problems from the sub second to sub microsecond levels, it is not necessarily able to register shifts of multiple seconds. The IRIG-B DMT monitor is capable to detect larger than a second inconsistencies between the GPS time and the time stamps on the data. In principle IRIG-B can achieve sub millisecond accuracy by detecting the phase of the 1KHz carrier, but it is not implemented yet since this region is well covered by TimeMon.)

At the present GPS clocks provide the IRIG-B signals but the monitor can also handle other sources as long as they conform to IRIG-B standards (like radio stations or atomic clocks). The IRIG-B signals are propagated through the LIGO DAQ along with all the other signals. At the end, the IRIG-B monitor program decodes the start time of the IRIG-B sequence and compares it to the time stamp on the data.

Output and alarms

The program provides a real time HTML display showing the detected delay, the error history and a well visible error condition indicator. Alarms are also provided. On multiple alarms not associated with reboots, the responsible CDS expert should be notified to resolve the problem.