A note on time code transfer via a hardwire line

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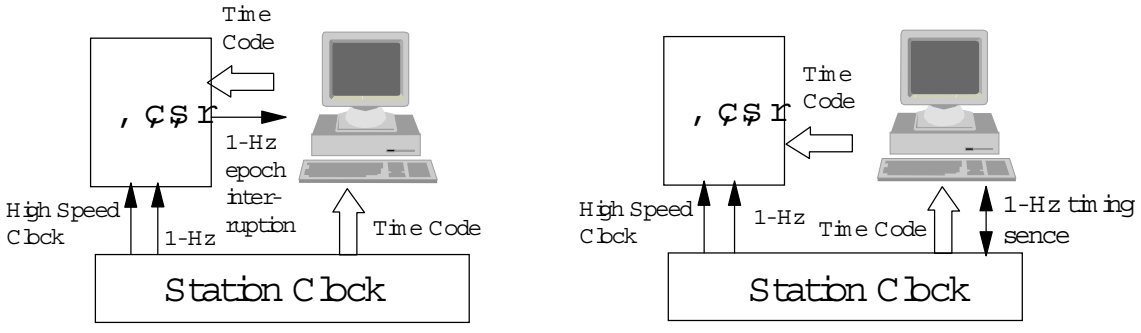
Introduction

In a Japanese proposal on the VLBI standard interface, time code transfer via a hardwire line is presented. The time code transfer is one of important technical issues by which reliable reconstruction of observed data on a correlator can be made, that is essential to the offline processings of data on a tape in VLBI.

Conventional way of time code transfer

A data acquisition system currently working in VLBI observatories controls the critical time electrically by an 1-Hz pulse, and a time code is labeled on data under a control of a computer software as illustrated in Figure 1. In the case of Figure 1(a), the control software recognizes the arrival of the 1-Hz tick to the DTS through an interruption line then supply the time code to the DTS. A service request function of a standard IEEE-488 bus is now used for the interruption in the Japanese data acquisition terminal. The time setting program temporarily works at a time only when it is interrupted by a service request from the DTS. The procedure has an advantage in lightening burdens of the control software. In considering a standard interface, however, the software time code setting is difficult to standardize because of the necessity of communications accompanied with an interruption line such as the IEEE-488 bus (GP-IB bus). Now a simple communication line such as RS-232 or Ethernet is proposed for the VSI.

The VLBA recording system do the time code setting in a different manner as shown in Figure 1(b). The control software watches the arrival of the 1-Hz signal then set a time code to a clock in the DTS. No interruptions from the DTS are received. In case of the VLBA recording system in Usuda station, the control software watches a time server at every 100 milliseconds then recognizes the 1-Hz epoch then start a time setting work. Almost same procedures are taken for the S2 terminal in Usuda.



(a) Time code transfer with an interruption line (b) Time code transfer without an interruption line

Figure 1 Software time code transfer

Problems in the software time code transfer

In case that the software time code setting is employed, we have to be careful an error on the clock caused by

(1) An electric circuit noise may cause an extra count in the DTS clock.,

(2) A momentary electricity failure may cause a loss of some counts in the DTS clock,

those can not be detected by time code verification. Once the counter error detected, we have to reset the counter by referencing the time to an external 1-Hz signal, and also we have to do the time code transfer again.

For the software time code setting we need to define the following communication protocol on the VSI.

(1) counter error sense

(2) counter reset command.

In addition to that we have to consider how to cope with a communication blockade caused by frequent occurrence of the counter error, if we perform the counter error monitoring at every 1 second for the safety with the highest priority. For example, if some troubles happen on the external 1-Hz, the counter error happens at every 1 second. The control software becomes very busy to repeat the time code transfer at every 1 second and can not find a time to inquire the cause of the external 1-Hz failure probably happened on a station clock. This trouble is actually experienced in Japan especially at the development stage of the DAT. Now the function of monitoring the counter error at every second is abandoned by paying the penalty for the safety operation of the clock.

Advantage of the hardwire time code transfer

In the hardwire time code transfer system shown in Figure 2, no software communications are requested. The clock reset and time code setting are automatically done inside the DTS. If we hope, we can do the clock status sense and time code verification with an arbitrary time cycle by our choice. If something happens on the hardwire time transfer system, we can still keep the additional chance to do the time code transfer with a conventional way. This makes the reliability of the time code transfer much higher than a conventional system. The definition on the communication protocol for the time code transfer is unnecessary for the time being. Any type of time code, a conventional "yyyydddhhmmss" or the MJD or others, are permissible to write on a tape if once we can get an agreement on the hardwire time code

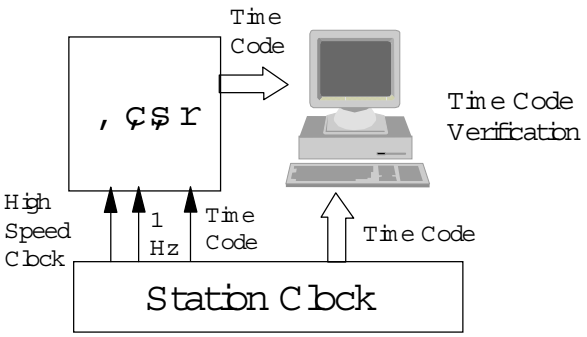


Figure 2 Hardware time code transfer

transfer.

The IRIG-B time transfer system (any other types of a time transfer system permissible) is one of candidates of the hardwire time code transfer system. It is well defined and widely used in the world. It is easy to add the IRIG-B time code transmitter to a station clock with a reasonable cost. A simple single line connection is possible and can be included in an I/O connector of 50 pins as is shown in the Japanese proposal. Any other type of a hardwire time code transfer system are welcome to be proposed.

Conclusion

The hardwire time code transfer is highly desirable to make the DTS more reliable. It also makes the software standard much more simple. We can enjoy much better interchangeability between different types of DTS by simply changing the hardwire connection. Even in the case where the software time code transfer is agreed as a VSI, I would like to propose the hardwire connection in the VSI as an option.