Equipment for Occultation Timing Observations

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There are a lot of technics to mark time moments during occultation observations using "eye-key" method. Everybody from you does this best. Unfortunately, in our country there are not ordinary cheap devices for clock comparing and timings with necessary accuracy. The equipment in our method consists of universal devices which are used in couple with the simple self-made equipment to complete its possibilities. We think, that timings hardware have to replay for the next demands:

1. Accuracy of UTC moments preservation up to 1 ms of time.
2. Possibility of observer's training.
3. Comfort of use.
4. Small size and weight.

Of course, we know that the such kind of microprocessor devices exist, but we hadn't the resources for constructing or buying up such devices. Morever, in many cases we couldn't use the universal devices because they were contradictable to our demands. For our field observations we use some modification of method, which was recommended by Danlop (S. T. Danlop, "A step by step quide to the night sky", 1985, Gamlin Publisher Group Ltd.), where second signals from simple quartz generator and signal from push-button are registered on the taperecoder. But decoding the record with the wanted accuracy is the serious task, and observer's training becomes difficult. We've made up the equipment for observations in field conditions, when the main demands are not only the accuracy and the transportability of equipments, but and their power independence. Our devices we'll describe a little below.

The profits of using in the normal observatory conditions the universal professional equipment are obvious. When there aren't problems with the AC power supply, the using of thermostabilized quartz clock becames possible. More, the using of clock synchronization with the radio signals throw oscilloscope becomes possible too. And industrial calibrated frequency meter allows for us quickly to define short time intervals. Such equipment set we used in obtaing the main part of our results. In addition, simple measuring of observers delays (personal equations) and the permanent observer's training become possible, what we think is neccesary for all observations.

The field set of devices was made up at first. The recording device was the compact tape recorder with the battery supply source. The mixed signals from quartz second's and key-controlled generators were recorded by it. We have constructed the special device attached to tape recorder which generated the following signals:

– the signal of internal quartz generator for the second's marking;
– press button signal.

Simultaneously, this device permits mixing the radio timings from the radio receiver with the previous ones. All the signals had the various sound frequencies and amplitudes. Hence, it is possible to distinguish them both in audio experience and visually at the oscilloscope screen. This device had the small

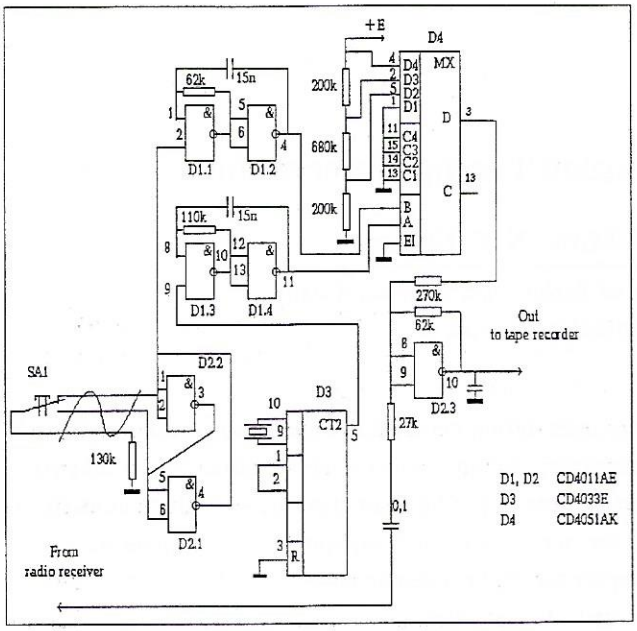


Figure 1.

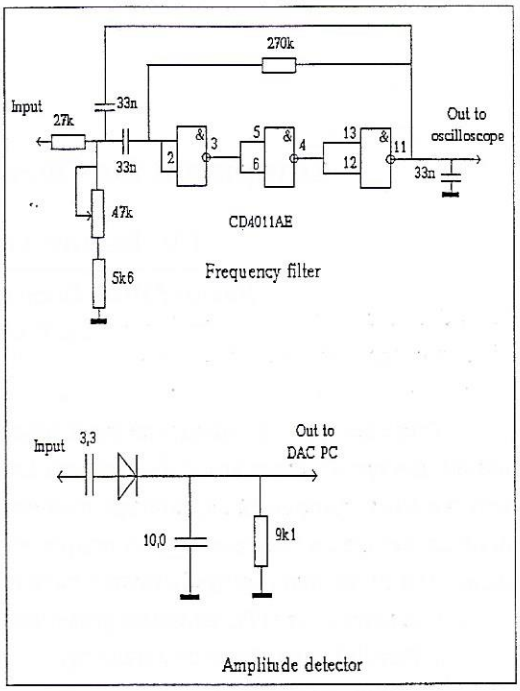


Figure 2.

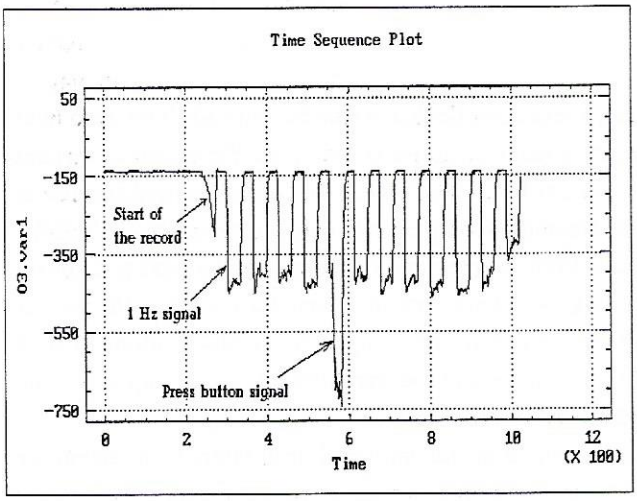


Figure 3.

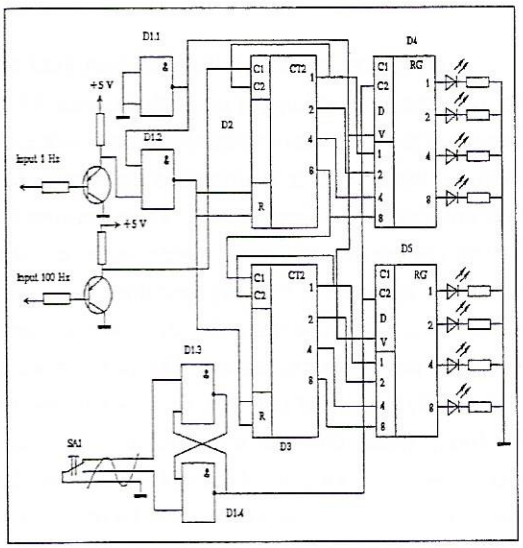


Figure 4.

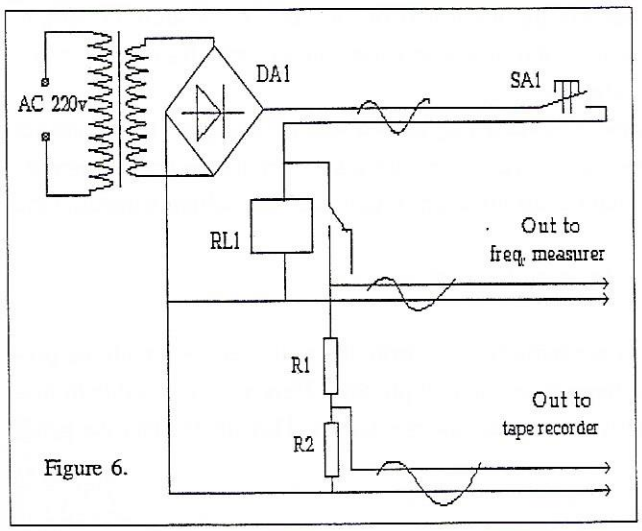
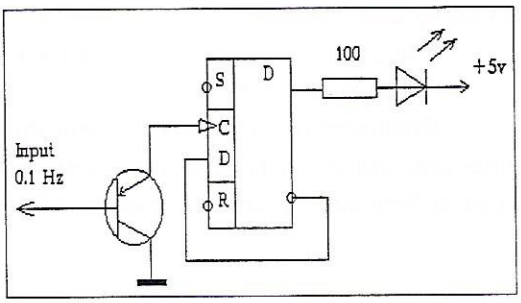


Figure 6.

Figure 5.



size, battery supply and small current of supply. Therefore, the difference between the device's internal scale and UTC one may conserve during some days. The scheme of this device is shown in Fig.1.

The CMOS chips are used. D2.1-D2.2 trigger is performing the front steepness. The second impulses are produced by the D3 generator. D1.1-D1.2 generator is controlled by the button press. D1.3-D1.4 generator is controlled by the D3 impulses. All of them are completely undependent. D4 multiplexer performs the amplitude and frequency modulations of output signal. And D2.3 is the mixer for the radio time signals.

But the tape decoding in this case is the difficult task. It was possible, for example, to observe the record on the oscilloscope screen. The resulting accuracy was 0.1 sec or worse. The using of the frequency filter and the amplitude detector which are shown in Fig. 2 in complex with the digitazing equipment permits to get records similar to that shown in Fig. 3 and insignificant to increase the accuracy.

For the purposes of the observer's training we used the other device which is shown in Fig. 4 in complex with so named "artifitial star" which is shown in Fig. 5. The main constructive feature of the first one is the binary code LED indication. It looks possible to use this device and as registrating one in the occultation observing process.

There are not the small-size and low-current demands at the our stationary observatory where we can use the fair 20-cm visual refractor and some standart electronic devices – oscilloscope, radio receiver, frequency measurers and universal quartz clock with the delicate time delay adjust. In such conditions observations are simple and pleasant. The main cycle of observations is described in other our article. The only self-made device is the button, which have to stop the time interval measuring of the frequency measurer. According scheme which is shown in Fig. 6 all the signals can be also written on the magnetic tape, in the case of grazing observations for example. Power AC 220 V supply is using. When the button pressed, the 100 Hz signal stops the frequency meter counting, started ordinary by the minute signal from quartz clock. So we obtain the precision time of the event after taking into account the observer's delay.

Methodology of observations and obtained results are discribed in the other our article. Accuracy of the most part of our results due to both methodics and hardware possibilities is about 0.05 second.

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