

CCD DETECTOR IN TV STANDARD WITH SMALL EXPOSURE TIME

O.S. Shahrukhanov¹, A.V. Yushchenko¹, O. Techuk²

¹ Astronomical Observatory, Odessa National University, Ukraine
Shevchenko Park, Odessa, 65014, Ukraine, *root@lens.tenet.odessa.ua*

² Odessa National Polytechnical University, Ukraine

ABSTRACT. We constructed CCD-device working in TV standard. The exposure time can be changed from 1 to 16 TV frames. We report the results of test observations with new CCD-device and discuss the possible types of observations with this device.

Key words: instrumentation: detectors;

1. Introduction

Now it is usual to use high-precision CCD-devices for photometry, spectroscopy, astrometry and other branches of astronomy. These CCD devices are of different types - from big and expensive professional CCDs with sizes up to 50-200 mm to small PC cameras, which can be used only for observations of very bright objects by amateurs.

In this work we report the results of our attempt of construction a relatively cheap device which can be used in professional astronomy for a precise measurements (guiding, search of objects, etc.). This device is working in TV standard. We show the structural scheme of this CCD and present the results of test observations.

2. The structural scheme

We constructed the device for work in TV standard. Exposition time can be selected in discrete mode (1,2,4,8,16 TV frames). The output in TV standard permit us to see images on TV-monitor, to use computer with TV-tuner for registration and digitization of images, to write images on videotapes or computer hard disk.

The device was made without cooling. It permit us to made very compact and light receiver. Our detector can be used instead of eyepiece, guide, etc. The size of CCD chip in this device is near 4.5x6 mm.

On Fig. 1 we show the structural scheme of the device. *Digital distributor* produce impulses, which are necessary for reading information from CCD in the units of amplitudes of digital electronic schemes.

Timer can block the receiving of control information. The time of the blocking can be varied by *external device*. *Voltage transformer* transform the levels of voltage of digital electronic schemes to levels, which are necessary to control CCD. After reading from CCD, the signal is amplified by an *amplifier* and transformed to TV standard by *TV pattern generator*. The next operation is output of the signal in TV standard to *external device*.

As an external device we can use TV videomonitor or computer. In the first case the exposition time can be varied with the help of digital switch. In the second case the connection with computer can be made with the help of TV-tuner. The parallel port can be used for control the exposure time. In all cases the unit of the time of exposition is one TV frame - 0.02 seconds.

2. Observations

We made test observations with photographic objective and small 15-cm refractor to find the limiting magnitude of our device with these optics. Observations were made in the center of Odessa city. The quality of the sky was quit good in both cases.

In the first case we used photographic objective with a focal length 85 mm and diameter 49 mm. We used no filters. With exposition time 16 TV frames (each frame - 0.02 sec) we detected star of 8.0 magnitude (spectral class F4). With exposition time 8 TV images we detected star of 7.5 magnitude (spectral class B9).

In the second case we used 15-cm refractor with focal length 2.8 meters. For increasing of the field of view we used simple focal reducer. The equivalent focal length of the telescope was reduced nearly twice. We observed photometric standards in Pliades. The faintest stars, that we were able to observe was 10.2 magnitude star (spectral class G0). The used exposition time was 16 TV frames.

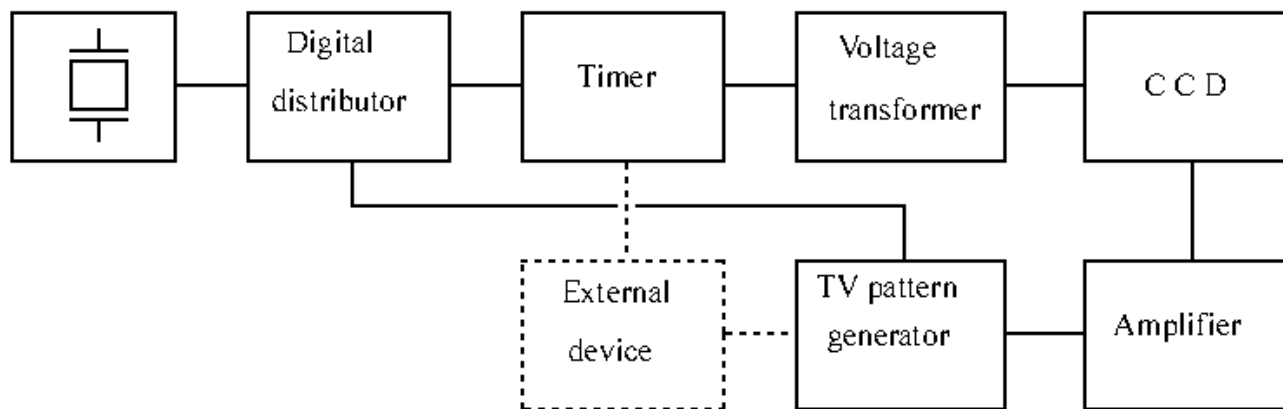


Figure 1: The structural scheme of CCD receiver in TV standard

5. Conclusion

We hope that described device will be useful for observation of artificial satellites, for guiding, for astrometry, etc. When using with the telescope with large focal length it is necessary to use focal reducer if we want to reach faint stars.

The main feature of observations in TV standard is high time resolution. This feature can be useful

in different type of observations. The digitization of image in TV standard can be made with 8-bit transformer. In many cases this precision is sufficient.

We hope that this device will be the first in the series of CCD detectors. We will use cooling in the next devices of this series. It will permit to increase limiting magnitude and exposure time.