ANALOG IR–PHOTOMETER

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ABSTRACT. The circuit design is described of a photometer functioning in the analog regime with the signal accumulation and conversion and its input into the computer.

Key words: Photometers

Interest taken in investigations of cosmic object radiations in the IR–range has not faded away. That is why complicated IR–systems are produced (Kriksunova, 1980). However, at times for observing cosmic objects such photometers with removable IR–detectors can be used which are simple in maintenance and adjustment.

One of such systems has been produced in the Odessa Observatory and for a number of years it has been updated. Simultaneously with carrying out the works planned the system elements and units were being elaborated, refined and subsequently used in the IR–photometer. These are amplifiers of direct current, integrators, cooling systems, analog–digital converters, control units, optical–mechanical designs, interfaces with computers.

The functional scheme of photometer is given in the Figure.

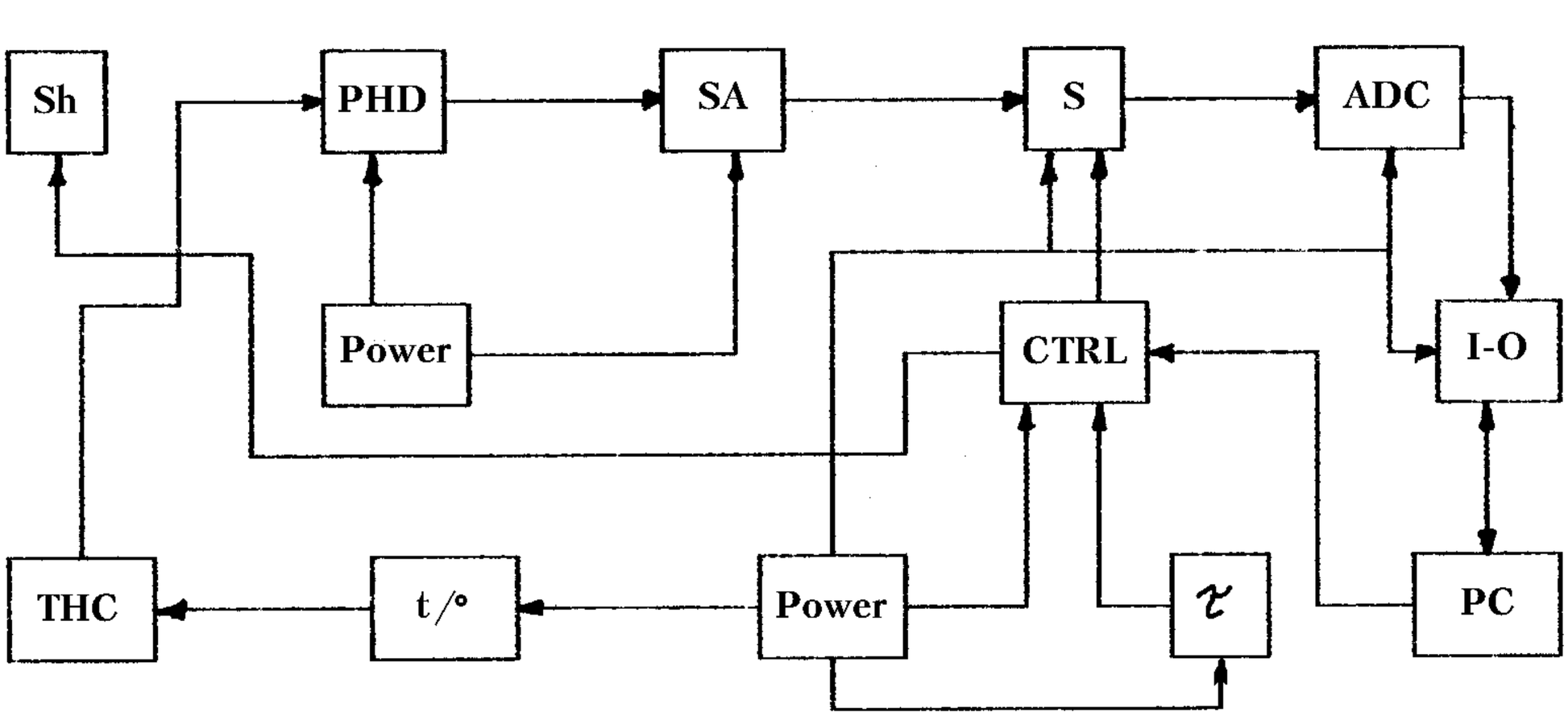
As photodetectors (PHD) both photodiodes of different types and photoresistors were used not larger than 10 mm in size. This is due to the fact that the cooled volume is limited by technical conditions of thermocoolers (THC).

To cool PHD standard semiresistor thermocoolers (one–cascade) TEB–04 and two–cascade coolers (TEB–023) are used which provide temperature difference in 25 – 30 K and 90 – 95 K respectively, and fit power. The cooler design makes it possible to cool the photodetector as low as –45 C (228 K) and stabilize the temperature t/ on this level.

This is a temperature of one of stability areas in the dark current determined from the work with oxygen photocopies which has not been explained yet. We have decided to stick to this temperature for PHD and stabilize it.

It is impossible to directly register a radiation flux emitted from stellar objects, and therefore the signal amplification (SA) is needed.

For amplifying the photocurrent, high sensitive IMS in the regime of direct current amplification (DCA) has been used. Based upon the experience of the work with DCA it has been found that the sensitivity 10 A is sufficient for a great number of stars and cosmic objects. The housing of IMS contains two amplifiers that permits to linearize the amplifier characteristic (Gutnikov, 1988).



The use of the integrator (S) designed in the same series of IMS incorporating polystyrene capacitors distinguished by small current losses enables to accumulate the signal in the analog form with a sufficient precision.

The quartz works for a timer that provides high time interval stability. The accumulation of time present by the timer ranges from 0.1 to 10 seconds.

The signal stored by the integrator (I) enters the analog–digital converter (ADC) (Fedorkov, Telets, 1990) where it is converted into a three–bit digital code. During the process of converting the PHD entry is closed by a shutter (SH) but as soon as at the circuit entry of the input–output (I–O) there appears a digital code, the hermetically sealed reed relay of the integrator zeroing is switched on and the shutter opens.

As the shutter is electromechanic, this link is the most sluggish in all the circuit and it determines the speed of response.

The circuit design of control gives signals and matches the work of the whole photometer as well as matches the information input and output to the computer and switches on the integrator following the computer command.

The photometer is designated to work at an off–line regime with an analog signal carried in the needle indicator when the photometer adjustment and PHD replacement are wanted.

References

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