sapphire optic-fiber, which can be made into a compact-structure, high-temperature and stable-function sensor head. After both ends of the sapphire optic-fiber with Cr^{3+} are optically polished, one end of the $Cr^{3+}:Al_2O_3$ optic-fiber with Cr^{3+} is used as the temperature sensor head; the other is connected with a Y-type quartz optic-fiber (Wade *et al.*, 1999). A pulse-driven diode emits very bright green light, which is used as a stimulating light source with its luminescence center wave-length being 575 nm and spectrum bandwidth being 40 nm, and focused by a lens onto one end of a Y-type quartz optic-fiber to stimulate the crystal emitting fluorescence. The stimulated fluorescence is transmitted from the other end of the Y-type quartz optic-fiber to an interference filter. After filtering the stimulated light mixed, fluorescence signals arrive at the PIN Si photoelectric detector. After the photoelectric conversion and amplification the fluorescence signals are sent to a signal processing circuit to measure the fluorescence lifespan (Sholes and Small, 1980). The fluorescence signals, which are stimulated from the optic-fiber temperature sensors that are based on the fluorescence effect, are generally very weak, and the electric signals, which are usually immersed in noise, are also very weak after the photoelectric conversion. In order to extract out the signals from the noise, we must adopt a homologous weak signal measuring circuit (Grattan *et al.*, 1991).

This is the key technique of the optic-fiber fluorescence temperature sensors. In the optic-fiber fluorescence temperature measuring system, for simplifying the optical system design, we usually make some periodic marks to the light source, therefore a phase-lock amplifier commonly adopted as the measurement device of the analogue signals from the photodetector, as follow in Figure 2 The phase-lock amplifier has the following characteristics: It has a very narrow bandwidth (B<1 Hz) and it can overcome the system temperature-drifting factor and effectively suppress the noise. It is a kind of amplifier with phase-sensitive detection to alternating signals. It makes use of the reference signals with the same frequency and phase position as those of the signals measured, and only responds to the measured signals and those voice components that have the same frequency and phase position to the reference signals. So it can obviously suppress useless noise, improving the measurement of signal-to-noise ratio. In addition, phase-lock amplifier of its weak signal has very high discernibility, and is an effective method to probe weak signals (Zhang *et a*l., 1991). The basic unit of the phase-lock amplifier has three main parts: signal passage, reference passage and phase-sensitive detection (Zhang *et al.*, 1991). The signal passage selects a frequency from beginning signals with the noise and amplifies to the selected signal, and preliminarily carries out the narrowband filtering of noise. Reference passage provides a reference voltage with the same frequency and phase position as those of the signals measured through phase-lock and phase-shift (Wang *et al.*, 1993). The device of phase-sensitive detection constitutes the low-pass filter and mixing multiplicator.

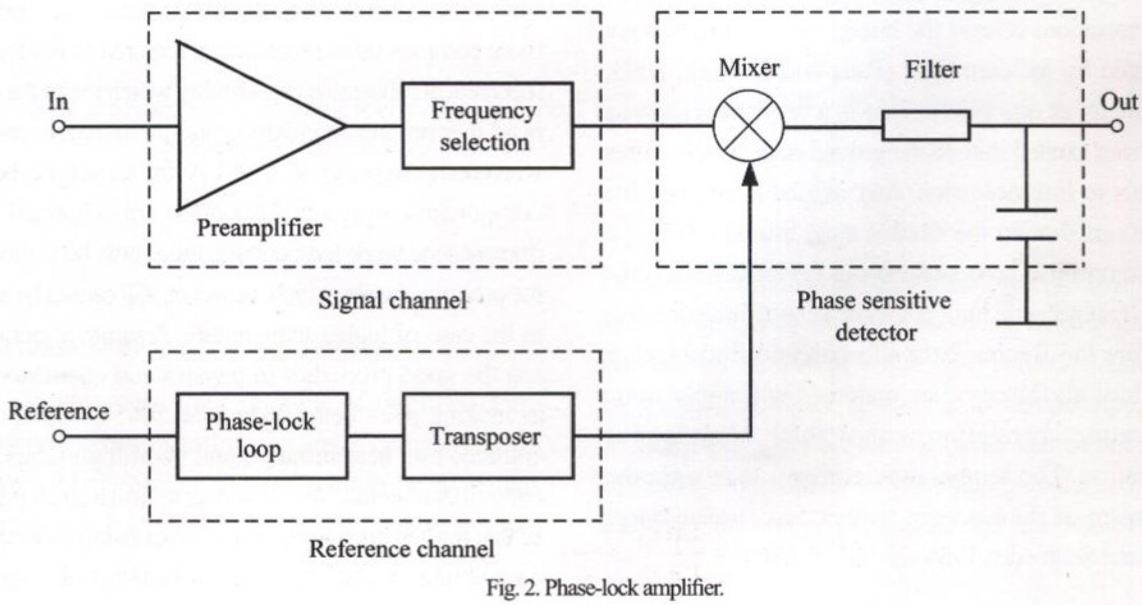

Fig. 2. Phase-lock amplifier.