# Research on Cigarette Shape Detection based on Dual Channel Acquisition

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**Abstract.** The cigarette shape detection system of cigarette machine is to online detect the unqualified cigarettes with warping, paper sticking, flattening and mouth burst in the high-speed flow cigarettes on the production line, and eliminate them in real time to ensure the product quality of finished cigarettes. At present, the photoelectric technology is adopted for the cigarette shape detection sensor, and the output signal range is analog quantity within 0-15Vdc. According to the field installation error, sensor difference and attenuation in use, the front and rear signal ranges are inconsistent. Corresponding modules are required to adjust the reference voltage and magnification of the front and rear channels and output standard 0-10vdc analog quantity. The current module is installed under the max detection wheel and adjusted through the general potentiometer of the internal circuit board. It is independent of the quality detection system and is far away from the MLP man-machine interface of the quality data display. Therefore, the adjustment process is very inconvenient, the device improves the calibration intelligent level of this part, forms a closed loop with the quality detection system, improves the adjustment accuracy, prolongs the service life, improves the staff work efficiency and facilitates the staff operation.

**Keywords:** Cigarette Shape Detection; Dual Channel Acquisition; Analog Quantity.

## 1. Introduction

In order to solve the above technical problems, the purpose of this paper is to study the calibration of cigarette shape detection signal of cigarette machine. This research can improve the intelligent level of cigarette shape detection, form a closed loop with the quality detection system, improve the adjustment accuracy, prolong the service life of equipment, improve personnel work efficiency and facilitate personnel operation.

## 2. Calibration Device Design

In order to achieve the above purpose, the following technical scheme is adopted in this paper:

The utility model relates to a cigarette shape detection signal calibration device for a double pass coiler. The device mainly comprises a gear selection switch, a quality detection system, an MLP man-machine system and a shape signal processing module. The gear selection switch is used for function selection, the shape signal processing module is used to obtain the Otis signals of the front and rear channels, and the quality detection system is used to obtain the machine signals; The shape signal processing module includes filter, operational amplification circuit, gear selection switch, coarse tuning amplifier, single chip microcomputer 1, fine tuning amplifier, liquid crystal digital display voltmeter, pcf8591 A/D converter and single chip microcomputer 2. The filter is connected to obtain the front and rear Otis signals, the filter is connected with the operational amplification circuit, and the operational amplification circuit is connected with the coarse tuning amplifier through the gear selection switch Fine tuning amplifier and liquid crystal digital display voltmeter, coarse tuning amplifier and fine tuning amplifier are connected with single chip microcomputer 1, the operation amplification circuit outputs the above front and rear Otis output signals through gear selection switch, which is connected with quality detection system and pcf8591 A/D converter, the quality detection system is connected with MLP man-machine system through CAN bus, and pcf8591 A/D converter

is connected with single chip microcomputer 2 to output alarm and reset; The device includes the following steps: display two cigarette shape detection waveforms according to the shape quality detection interface of MLP man-machine system, send them to MCU 2 for processing and storage through CAN bus communication, judge whether the front and rear shape detection quality exceeds the expected value, give corresponding warnings if it exceeds the expected value, take corresponding measures for manual calibration or automatic calibration, and select the required calibration gear, Gear 1 (front channel) or gear 3 (rear channel), and then control the proportional coefficient of the corresponding coarse tuning amplifier and fine tuning amplifier. Through data transmission, it is sent to the single chip microcomputer 1 for processing and storage. The reference voltage or proportional coefficient is changed through the operation amplification circuit. The calibration results are monitored when the LCD digital display voltage is used, and the standard signal suitable for the requirements of the quality detection system is output, Through the sampling processing of the quality detection system, the corresponding waveform is sent to the man-machine interface to judge whether the cigarette quality meets the process requirements and form an effective closed-loop control with the quality detection system.

## 3. Beneficial Effects

Due to the difference of the sensor's adjustment range and the use level of the sensor in this paper, the adjustment accuracy of the two channels is improved, and the service life of the sensor is consistent with that of the on-site installation personnel. Due to the difference of the sensor's adjustment range and the use level of the two channels, this paper improves the sensor's performance, improves the sensor's calibration level, and improves the service life, Convenient for personnel operation.

## 4. Experimental Method

An analog signal is simulated by the signal generator and input into two corresponding channels of dual card acquisition at the same time, and then the sampling rate of the two data acquisition cards is changed to study the average value of delay time and relative error.

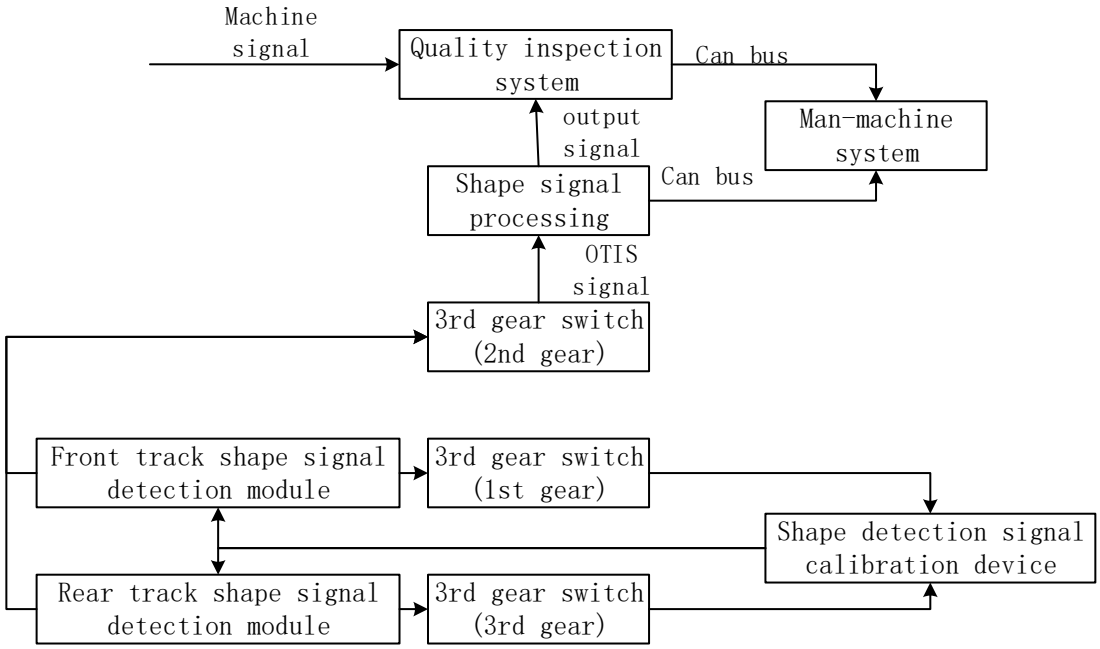



**Figure 1.** composition diagram of cigarette appearance quality inspection of cigarette machine

Firstly, we set the frequency of the connected signal source as 1MHz, and both acquisition cards collect at their highest sampling frequency rate. However, in the actual program, the dual channel acquisition program cannot meet the conditions; After many experimental operations and debugging, the maximum sampling rate can only be set at 1GS/s.

As shown in Figure 1, it is a signal processing method for cigarette shape detection of cigarette machine. The device mainly includes gear selection switch, quality detection system, MLP man-machine system and shape signal processing module.

(1) In the process of keeping the acquisition rate of the nipci-5122 acquisition card unchanged and gradually reducing the acquisition rate of the nipci-5122 acquisition card, when reading the output data file, it can be found that the precision bits of the time axis cannot meet the reading of absolute time, so the time identification is ignored when reading the output data, Data processing is only conducted on the relative time axis. D through observation, it can also be clearly observed that there is a certain relationship between the unit time t and the sampling rate f(t=1/F).

(2) For the data processing of delay time, due to the large amount of experimental data, it cannot be compared one by one, so the time delay of double channel acquisition is calculated only by reading the time delay of the rising edge of any ten-time cycles. At the same time, there are different methods to solve the delay time of the rising edge of F. In this experiment, the acquisition processing is carried out by reading out the zero-point method, that is, the delay time of the two waveforms is obtained by determining the lowest point of the whole rising edge.

As shown in Figure 2, the shape signal processing module realizes the processing function of the front and rear Otis signals. The hardware composition includes filter, operational amplification circuit, gear selection switch, coarse adjustment amplifier, single chip microcomputer 1, fine adjustment amplifier, liquid crystal digital display voltmeter, pcf8591 A/D converter and single chip microcomputer 2.

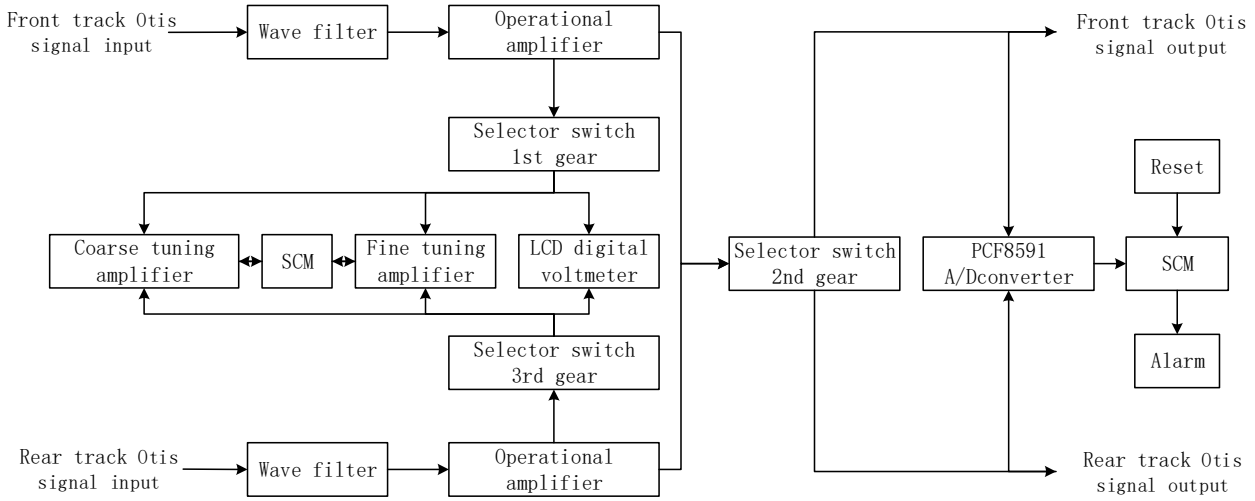



**Figure 2.** Composition block diagram of outline signal processing module

In this paper, the gear selection switch is used for function selection, the shape signal processing module is used to obtain the front and rear Otis signals, and the quality detection system is used to obtain the machine signals; The shape signal processing module includes filter, operational amplification circuit, gear selection switch, coarse tuning amplifier, single chip microcomputer 1, fine tuning amplifier, liquid crystal digital display voltmeter, pcf8591 A/D converter and single chip microcomputer 2. The filter is connected with the front and rear Otis signals obtained, the filter is connected with the operational amplification circuit, and the operational amplification circuit is connected with the coarse tuning amplifier through the gear selection switch Fine tuning amplifier and liquid crystal digital display voltmeter, coarse tuning amplifier and fine-tuning amplifier are connected with single chip microcomputer 1. The operation amplification circuit outputs the above front and rear Otis output signals through gear selection switch, which is connected with quality

detection system and pcf8591 A/D converter. The quality detection system is connected with MLP man-machine system through CAN bus, and pcf8591 A/D converter is connected with single chip microcomputer 2 to output alarm and reset.

The device includes the following steps: display two cigarette shape detection waveforms according to the shape quality detection interface of MLP man-machine system, send them to MCU 2 for processing and storage through CAN bus communication, judge whether the front and rear shape detection quality exceeds the expected value, give corresponding warnings if it exceeds the expected value, take corresponding measures for manual calibration or automatic calibration, and select the required calibration gear, Gear 1 (front channel) or gear 3 (rear channel), and then control the proportional coefficient of the corresponding coarse tuning amplifier and fine tuning amplifier. Through data transmission, it is sent to the single chip microcomputer 1 for processing and storage. The reference voltage or proportional coefficient is changed through the operation amplification circuit. The calibration results are monitored when the LCD digital display voltage is used, and the standard signal suitable for the requirements of the quality detection system is output, Through the sampling processing of the quality detection system, the corresponding waveform is sent to the man-machine interface to judge whether the cigarette quality meets the process requirements and form an effective closed-loop control with the quality detection system.

## 5. Conclusion

Through the analysis of the above data, the following conclusions can be drawn:

The proposed optimal sampling rate scheme. When the access signal source frequency is 2MHz and 400kHz, the acquisition rate of nipci-5122 is set as 200ms/s, and the acquisition rate of nipci-5122 is set as 100ms/s, the waveform distortion is small, which basically meets the acquisition of amplitude data, and its time synchronization is the best. At the same sampling rate, there are more precision bits from nipci-5122, so the effect of data acquisition is better. When the frequency of the receiving signal source changes, it can be re measured and studied according to the above research methods to obtain the best sampling rate scheme.

In the process of this design and research, due to the limitation of experimental conditions, only the experiments on the frequency connection of two fixed signal sources are carried out, and the general situation is not discussed. Therefore, the next step is to connect the nuclear radiation data for research. At the same time, through the study of nuclear radiation data, the change of delay time at different acquisition rates can be obtained, and then the quantitative relationship between them can be obtained, which provides an experimental platform for determining the delay time correction coefficient of dual channel data acquisition system, so as to obtain nuclear information more accurately.

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