International Core Journal of Engineering Volume 5 Issue 10, 2019
ISSN: 2414-1895 DOI: 10.6919/ICJE.201909_5(10).0045

Design of Thyristor Performance Test System Based on LabVIEW

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Abstract

Under the condition of higher and higher precision requirements for thyristor, a new, convenient and fast thyristor performance testing system is needed more and more, in order to solve the problem that the pin information and performance of thyristors are difficult to judge due to the appearance, the performance test of thyristor is carried out.

Keywords

LabVIEW; thyristor; test system.

1. Introduction

In the thyristor test, we can use PC-based graphics programming software LabVIEW to test the thyristor performance, control the voltage output of the data acquisition card to the thyristor through software, and collect the output current information of the thyristor by the data acquisition card, finally, finally, through LabVIEW, this information is processed, integrated, and displayed to obtain performance information of thyristor..

It can be seen from the test results of this paper that the performance test results of thyristor through LabVIEW have high reliability, high accuracy, and fast display, these are the conditions that must be have for testing precision instruments such as thyristor.

2. System Overview

The measured object is a single thyristor, under the premise of knowing the thyristor model, the polarity of the pin is changed by changing the access mode of the pin, and continuously changing the voltage applied to the thyristor to obtain a continuous current of the thyristor at successive different voltages, thus obtaining a set of precise thyristor parameter.

The block diagram of the thyristor performance test system with LabVIEW is shown in Fig.1:

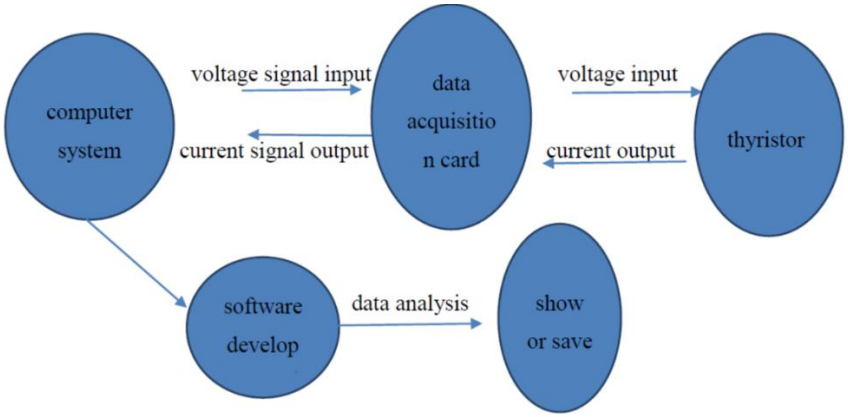

Fig.1 LabVIEW is applied to build the thyristor test system

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This test system utilizes the technical resources of the PC, and uses a computer as centre, output, collect, and test all the parameters generated by the acquisition card card with LabVIEW software, and display the results. First, LabVIEW is used to generate a separate test model to determine the pin information, and then output the changed voltage signal, load it on the thyristor through the data acquisition card, collect the output voltage generated by the thyristor through the data acquisition card, and return to the computer, then then show or save the voltage and calculated current through the thyristor test software on LabVIEW, thereby achieving the purpose of testing performance of the thyristor.

3. Channel Allocation of Data Acquisition Card

Data acquisition card: it generates analog or digital signals from sensors or other devices under test, autonomously collect non-electrical signals or power signals, and finally sent to the PC for processing, analysis or display.

The data acquisition system is a measurement system that can be convenient and easily modified by measuring the performance data of the hardware and software products with a computer or other special test system.

In a complete system of PC-based data acquisition systems, sensor partitions, signal conditioning partitions, signal acquisition card partitions, PC and software partitions must be included.

In order to achieve the acquisition function of target data, a computer hardware expansion card is needed: the data acquisition card, if we want to get a complete data acquisition card function, then it will at least have an analog input and output part, a digital output I/O port, the counter/timer section these parts as the basic functions.

When the data acquisition card is selected, it is necessary to seriously consider the selection of appropriate bus form, sampling speed, and input/output and even the use time, the purpose is to achieve the required requirements and save costs.

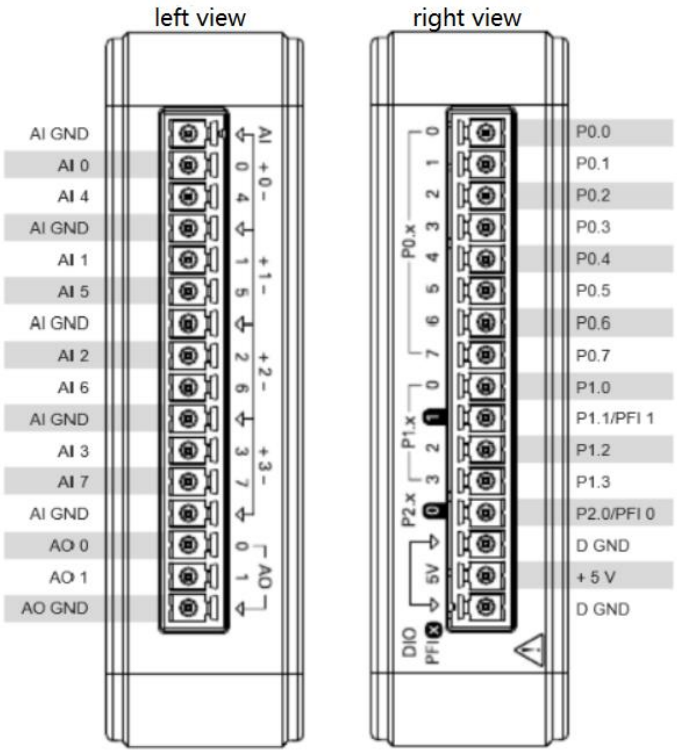

Fig.2 pin image of data acquisition card

There are several principles that need to be proposed: data resolution, data accuracy, and maximum sampling speed, number of channels, bus standard, whether isolation or not, support for software

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drivers and software platforms, and voltage range, gain, and non-linear error of input signals and other factors. When building a test system, it is necessary to have an indicator of the measurement accuracy. This indicator need consider the degree of the entire system, not only limited to A/D, D/A conversion, but also consider the sensor, signal modulation circuit and computer data processing and many other problems. Moreover, we should also consider the accuracy requirements of the acquisition card. The highest acquisition rate of the acquisition card is usually expressed in the highest sampling frequency; its single channel sampling can use the highest sampling frequency, which limits the maximum frequency of the acquisition signal. The number of channels is the selected channel that needs to meet the test task, and the number of input and output channels with a comparable data channel and a sufficient number of digits is selected. The bus standard of the data acquisition card determines different law of data transmission and the speed of transmission. Whether the isolation is due to the data acquisition system with strong electromagnetic interference, the acquisition card with isolated configuration is selected; it will guarantee the reliability of data collection. The software for selecting the data acquisition card, in addition to test compatibility with existing test systems, should also take into account the wider applicability and convenience for use, so facilitate use in other operating systems and work tasks.

The NI data acquisition card used is the NI USB 6001, it is a multi-function DAQ device which consists of 8 AI (14-bit, 20ks/s), 2-way AO (5kS/s/ch), 13-channel DIO, and USB multi-function I/O devices. It provides analog I/O, digital I/O, and a 32-bit counter. It can do some simple data storage records, portable simple measurement, and the laboratory test, and provide basic data collection for other application place.

4. Block Diagram of Program

This program consists of signal generation partition, signal acquisition partition, signal processing partition, and final signal display partition. The signal generation partition is composed of two large partitions, which are the output pulse voltage partition and the output signal voltage partition; the signal acquisition partition is composed of the acquisition end and the connected acquisition storage area; the signal processing is signal processing is the center of analysis and processing of data, it consists of a series of programs with array and operations; the final signal display partition is composed of the output voltage and the calculated result and form image. This should be a large output of the voltage and a smaller index value to collect, in order to obtain a more detailed output current value, thus forming a more accurate voltage and current signal graphics, but limited by hardware software, it have not been realized, and a detailed explanation will be provided in the text.

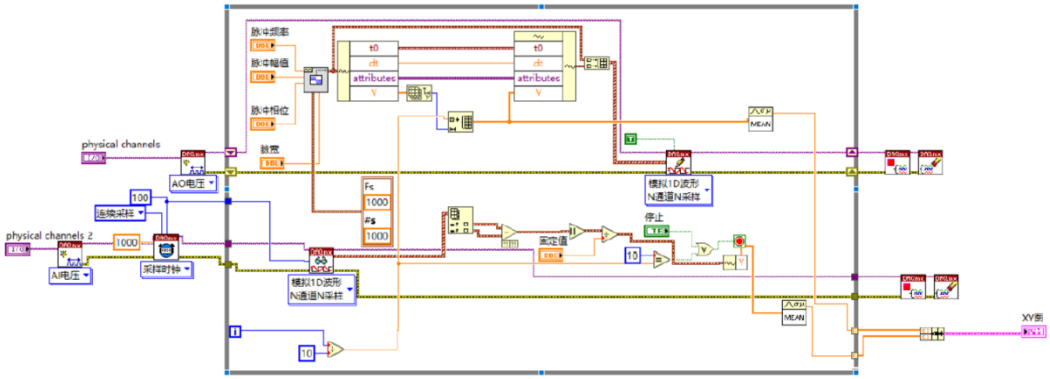

Fig.3 block diagram of total program of software

5. Performance Test of Thyristor

We are measuring under the condition of knowing pins in thinking. First of all, the parameter we want to determine is the gate drive voltage, the pulse voltage is continuously amplified and adjusted until it has the same or similar output voltage as the input voltage, thus obtaining the pulse voltage value

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and pulse time of the thyristor. In application, a fluctuating positive voltage in the anode and cathode, such as sinusoidal wave signal, moreover, and the pulse voltage added to the gate increases continuously, and then the output voltage changes of output end are collected by the data acquisition card until the same or similar voltage can be observed clearly at the output end, thus the pulse voltage of the thyristor is obtained. After the pulse voltage is obtained, we can use the fixed pulse voltage value, then gradually increase the input port voltage, collect the output voltage through the acquisition card; the current is calculated by the formula:

$$\mathrm{I} = \mathrm{U}/R$$

operation in LabVIEW software, thereby the relationship between the input voltage and the output current is obtained.

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