The Measure and Control System in Parameters

Testing Device of the Spindle Wings of Fly Frames

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Abstract

The programmable logic controller, touch panel and printer are applied in the parameters testing device of the spindle wings of fly frames, which realizes a new intelligentized control system. And then the hardware and software designs are introduced. The system has been used successfully in the parameters testing device of the spindle wings of fly frames, whose performance is reliable while the operation is very easy.

Keywords: PLC, Touch panel, The parameters testing device of the spindle wings of fly frames

1. Overview

Roving working procedure is one of the important procedures. The spindle wing is a crucial component which decides the roving machine' performance. During producing process, the cotton bar produced by the collateral bar procedure will be extended by the roving machine and twisted by the spindle wing and then winded on the canister pipe. To use the spindle wing press palm is to make the roving directing pipe coiled and to give pressure to the pipe cop so that they can be winded closely. The press palm of the spindle wing will produce centrifugal force to the roving pipe in high speed rotation so that it makes the roving wind asymmetry or too many breakers. It often arises quarrel between manufacture and the user. While the questions are main aroused by the unbalanced press palm strength. The distortion value arisen by the high revolving wing influences the roving machine's rotate speed and design structure. So press palm strength and distortion are two important parameters of the roving spindle wing. There aren't tests about it but only about the rigidity. For example, using the micrometer to measure the extended value and the corresponding speed. The disadvantage of above is: low measure precision, bad automatic testing method, and restrictive testing scope. It is of importance to develop high precision and high efficiency dynamic testing equipment in order to test whether the parameter is ok. The measure and control system in testing parameter's device of the spindle wings of fly frames will play an important role in measuring the dynamic press palm strength and distortion, investigating the structure of the spindle wing as well as improving the spindle wing quality. The characteristic of the device is: continuous measure of the dynamic press palm strength and distortion value, high precision, self-loading measure results, routine data statistic. It is a new design and has high technology content. The device can be used not only by the corporation and cotton factory that produce the spindle wing but the school referring to the textile and mechanism specialty.

2. System structure

The control system adopts Taida PLC: DVP-12SA.It supplies abundant instruction settings and has a 8K program memory including digital input/output (the max input/output points can reach 112)and analog module(A/D,D/A).It can communicate with PC through special cable. The program software is WPL soft. And the touch panel is HITCH PWS6600-S.With the touch panel we can set the parameters, choose the mode, regulate the rotate speed and direction, display the cause of the faults and the production's No., data, current speed, press palm strength, distortion value, radius display the press palm strength curve .The measured data can be recorded in graph. All data can be printed by the printer.

The system input is composed of several sensors and switches including two high pulse input photoelectricity sensor, two displacement sensor, one press sensor and two button switches and so on. The displacement sensor which tests the distortion value of the roving spindle wing's solid and hollow arm of force and the pressure sensor which tests the dynamic press palm strength both use the analog value .So DVP-04AD analog module of TaiDa is adopted .The system output is AC motor. The rotate speed and direction are written in the PLC register from the touch panel. The PLC can

control the converter to change the motor's rotate speed and direction. The system has two main working modes: testing the press palm strength mode and testing distortion value mode. The MCW-L (high prevision differential transforming DC displacement sensor) can test the pressure on the spindle wing. The PLC records the pressure when the radius increases and the velocity changes and the detailed data will be disposed and stored and then displayed on the touch panel in chart format. If needed, the history data will be printed. During the last mode, the MCW-L/D displacement sensor is chosen, which is a differential replacement transformer sensor and it changes the line moving mechanical variable into electricity one. Its nonlinearity is lower than 0.05(%F.S), the non-repetition rate is less than 0.05(%F.S), precision and high lag <0.05(%F.S).It can work reliably. Synchronously the instrument can test the shape variable of the sincere and hollow arm of force and dispose and store the detailed data. According to the data, the craftwork rules and equipment can be modified so that it can guarantee the reliability of the instrument. Among each part there are necessary mutual lock relations. When there is a fault all of the actions can be stopped immediately. During normal status, the rational reset can be required. When the reset button is pressed the hollow arm will stop at mechanism zero position.
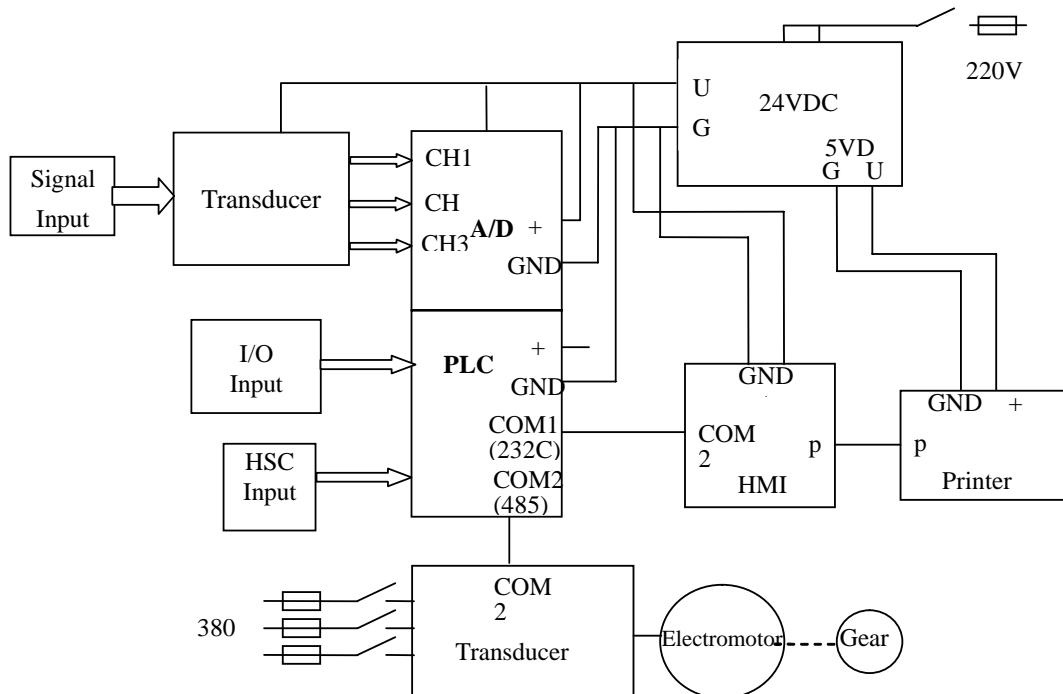

Figure 1. System circuit diagram

3. Software design

The program flow is shown as diagram2. When the machine starts to run, it will enter self check mode and the touch panel program will be executed and the work mode will be chosen. Firstly the equipment will enter self-test screen. The operator needs to input password before entering into the control screen and then chooses work mode, rotate speed, rotate direction and the production's batch number and spindle wing hatch width. If the width does not accord with the test requirements, the alarm will be brought and the equipment action will not be executed so that the reliability can be guaranteed. There are nine modules in the program design. I.initialized module: that is mainly to set the communication protocol, exceeding time, send requirement and read the data equipment's address and length. II. HMI design module. III. start-up and mode chosen module. IVtest and regulate rotate speed module: when the equipment is running, the program will test the wing's rotate speed and show on he HMI in real time. If the speed can not reach the requirement value, push the button to rectify the speed. V return to the initiative module: when the equipment shuts down, the hollow arm should be on the zero position (positioned by the photoelectricity sensor).VI. Abnormal status, urgency stop module: when the equipment goes wrong, all actions will be stopped, the program will jump END. VIItest the palm pressure module: firstly read the chosen rotate speed, direction and batch number on the HMI, test and store the palm pressure of the motor into D0 in low speed. Then calculate the spindle's max radium according to the import width so that the max displacement of the sensor can be known .The sensor can be protected by touching the arm wing. When the max displacement arrives, the motor will stop. As the palm pressure is monotonously changed with the increasing of roving pipe's radium .In order to make the test curve keep consistent with the real one, the program will set the pipe's radium. When it increases 2 mm, the press palm and the radium will be stored and recorded in the buffer. That can supply data for the palm pressure curve and can calculate the average palm pressure.
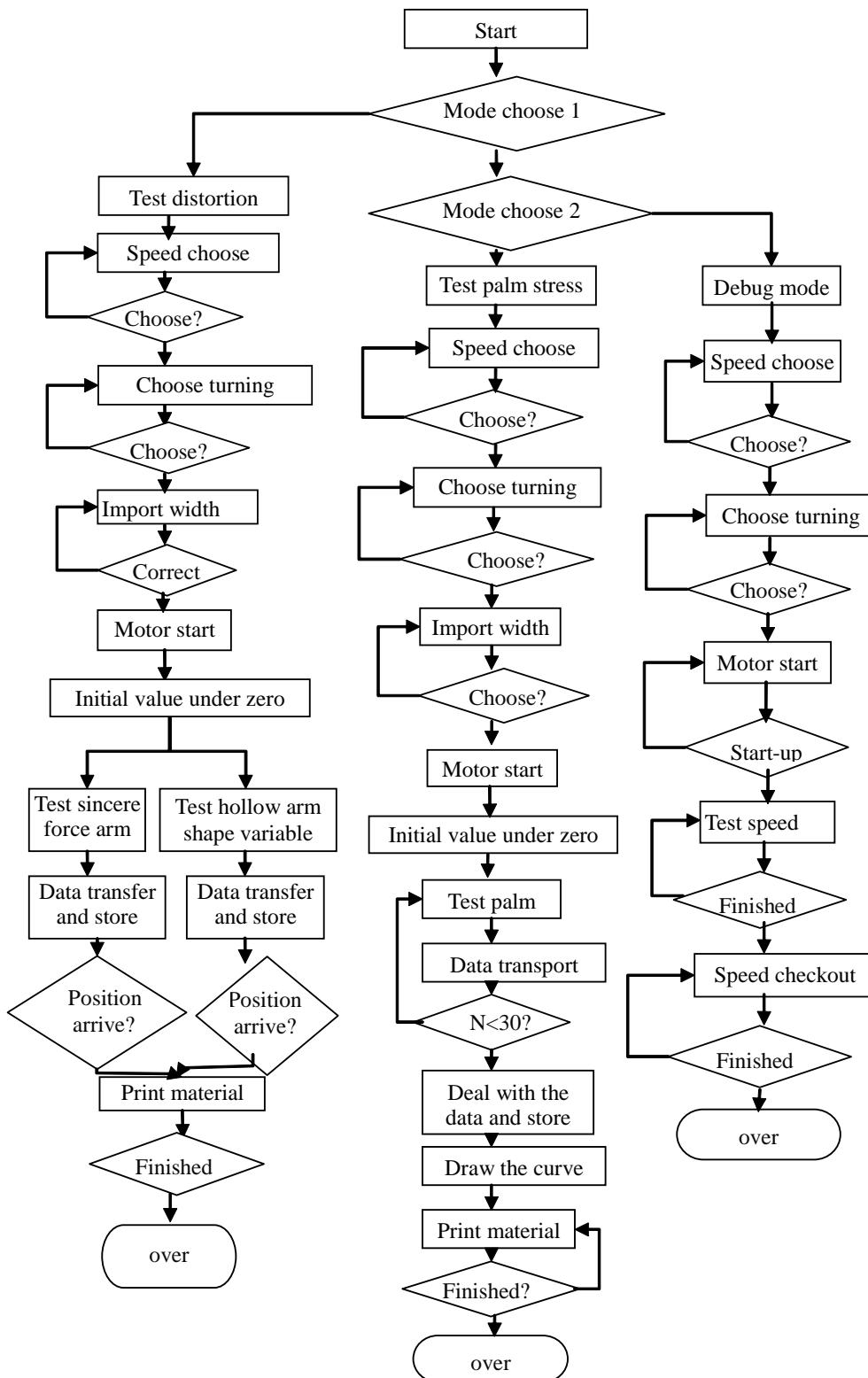
Figure 2. System flow

VIII.test the distortion module: firstly read the chosen rotate speed, direction and batch number on the HMI, test and store the initial value of the spindle wing's solid and hollow arm force and then store in D1, D2.In order to enhance the work efficiency, when the chosen speed of the motor arrives, 30 seconds will be countered. And then we think the distortion is steady and the value will be stored in D23, D24 and the buffer in order to supply data for the operators. IX.data store module: when the batch number is the same, 150 spindles' palm pressure values and 100 distortion values can be recorded while the batch number is changed, 200 batches palm pressure value and distortion can be recorded.

3.1Protract the palm pressure curve

Because we should test the palm pressure and protract the curve in dynamic mode, we design that the sensor move along the silk bar to simulate the spindle radium .In high rotate speed, the sensor will be distorted by the palm, the centripetal force of itself and the silk bar. The sensor mode decides that the A/D mode will collect the data in self test. That is $F_t=F_p-F_s$, F_s is the composition force of sensor. The sensor contrail in the plane is near spire route and is very complex. During the testing, data is collected by equal space using the formula：$N_n(x) = f(x_0) + f[x_0,x_1](x-x_0) + \cdots + f[x_0,x_1,\ldots x_n](x-x_0)(x-x_1)\cdots(x-x_{n-1})$

For the test point (x_i, y_i), $x_i = x_0 + 2i$ (i=0,1,2,$\cdots$,n)

$F_s = y_0 + \frac{1}{2}\Delta y_0(x-x_0) + \frac{1}{8}\Delta^2 y_0(x-x_0)(x-x_1)$. With this method, we can calculate different F_s and then add the test F_t, we can get the actual value. The result is better in this way.

3.2Hitech hmi

The HMI we use is ADP6.0, which is a Chinese and visual interface. It has strong   real-time performance and good disposal capability and many rich, live multimedia screen so that it can deal with the real-time data. This ADP configuration soft has open structure and wide data adoption and data processing function. Meanwhile, it supplies good safety mechanism to provide different operating popedom. ADP supports much hardware equipment. It will not influence the whole system when there is a local change. The ADP configuration software is made up of two parts: ADP configuration environment and running environment which are isolated and related.
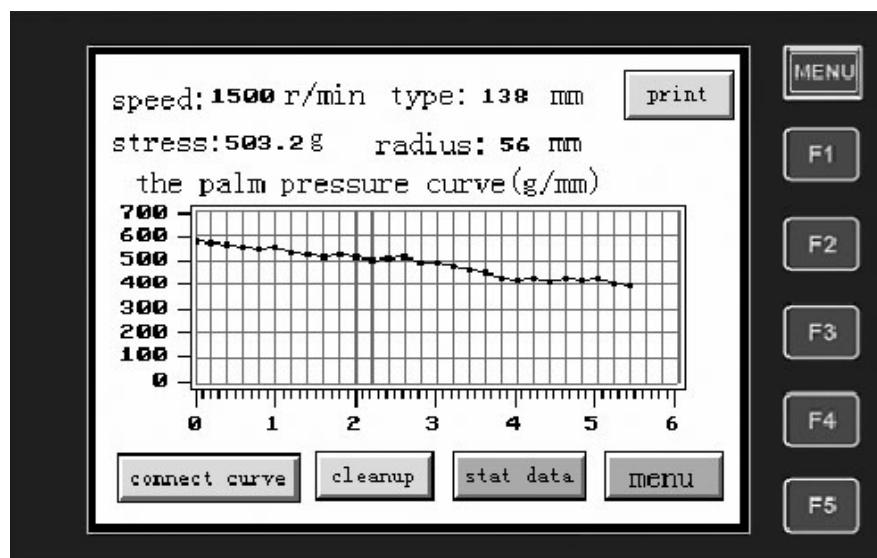

Figure 3. HMI drawing (curve of palm strength pressure)

According to the control process, the control interface of the roving spindle wing performance parameter testing instrument mainly has several parts: main screen, testing the distortion screen, testing press palm strength screen, regulating the speed screen and data screen and so on .The main screen helps the user operate the instrument correctly and give the responding clue with striking sign. Testing press palm strength screen and regulate the speed screen mainly help display the change trend of the press palm with the change of the radium, the parameter of the main working parts ,the history running trend picture and the printing message and so on.

4. The tag

Using the PLC and touch panel in the roving spindle system can improve the reliability and simplify the parameter setting and adjustment. It has intelligence so that the operators can work immediately without training. So the efficiency can be improved. The technique has been successfully used in spindle testing instrument in Tian jin textile factory.

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