BIPOLAR	I8.0	Start conversion mode
SP_INT	MD200	Initial given value
PV_IN	MD102	Feedback input
GAIN	DB1.DBD14	Proportional value
TI	MD160	Integral time
LMN	MD150	PID regulated output
FC106_IN	MD150	Digital input
FC106_OUT	MW250	Digital output
PQW276	MW250	Given value of inverter
PQW278	27648	Given value of electric valve

2.4 HW Configuration

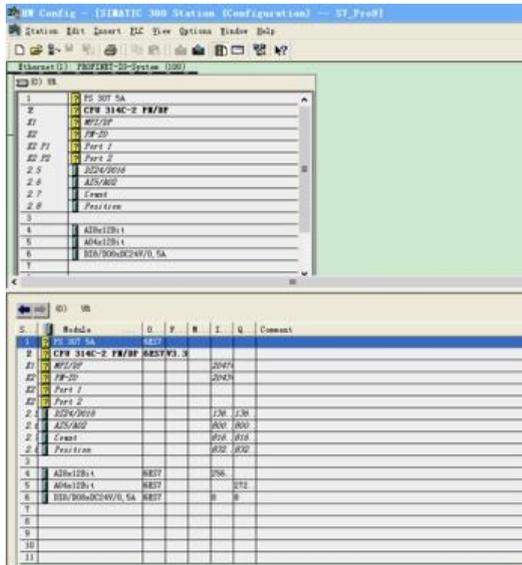The hardware configuration is shown in the figure 3.

Figure 3: Hardware Configuration

3. SYSTEM SOFTWARE DESIGN

The software design part contains two parts, which are the design of control interface configuration software and the design of PLC program based on STEP7.

3.1 WINCC Configuration software design

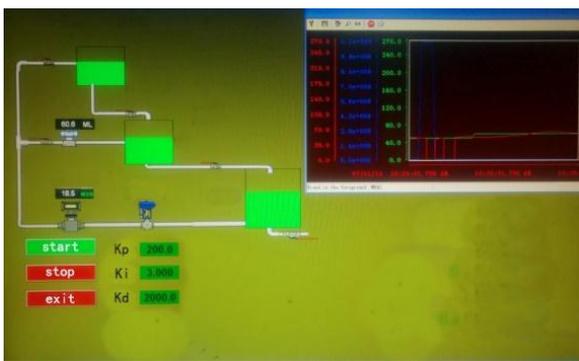Create a WINCC project, the design of the human computer interaction interface is shown in the figure 4.

Figure 4: WINCC Design of Human Computer Interaction Interface

3.2 PLC Program design

The PLC program design mainly includes analog-to-digital conversion, digital- to -analog conversion, PID adjustment module. The flow chart is shown in figure 5.
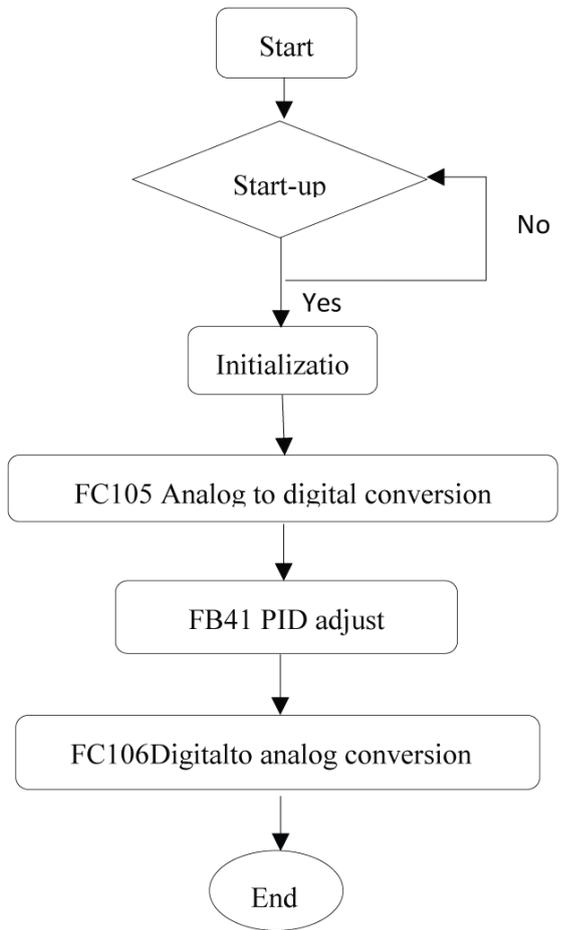
Figure 5: Flow chart of program design

3.2.1 The Analog to Digital Conversion Module FC105

The Ladder diagram of the analog to digital conversion module FC105 is shown in figure6. The analog input value is the current value measured by the current level meter. The corresponding address of PIW262 is the Current value of Liquid level meter I. Then, the input value is converted to a real shape value by FC105, and is transmitted to MD102.

3.2.2 The PID Adjustment Module FB41

The design uses continuous control mode, so we use FB41 to implement.

Figure 6: Ladder diagram of FC105 module

Figure 7: Ladder diagram of FB41 module

3.2.3   The Digital Mode Conversion Module Fc106

The core of this design digital mode conversion module is FC106. The output value of the PID is used as its input value. Then converter is sent to the converter. The address of the converter is PQW276.And then we can Control the liquid level by control the input voltage of the converter.

Figure 8: Ladder diagram of FC106 module

4.   DEBUGGING AND RESULT

4.1   Debugging

The debugging process includes hardware debugging and software debugging, hardware debugging through current meter observation of current value data and collected the corresponding, the premise is already set for inverter control mode, each p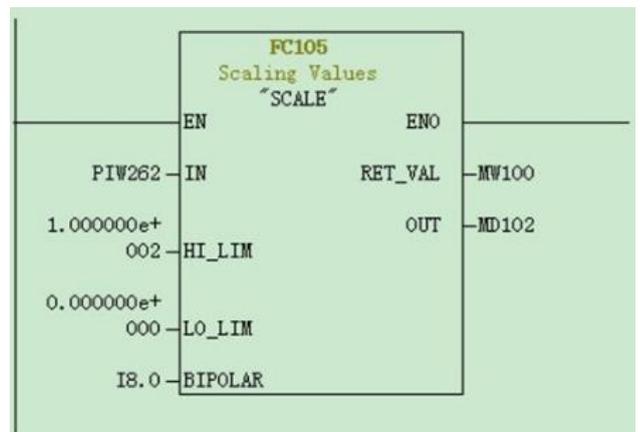art of the line is connected [3]. The liquid level meter and the analog input module short circuit, solenoid valve and the corresponding analog output corresponding to the inverter interface converter input and analog output connection excuse. By changing the input current value of the corresponding device, debug the observation line whether there is a problem.

Software debugging includes the PC configuration software debugging and STEP7 debugging, debugging configuration software is mainly test run state variable window is abnormal, and the column chart and graph variables are set correctly. PLC programming debugging in two steps [2]. First, on-line debugging between hardware and equipment directly, to observe whether the analog to digital and analog to digital conversion is correct, and whether the PID adjustment is effective or not. Second, through the host computer and the hardware debug through the PC settings window, set the PID parameters, PID parameters obtained after the ideal observation of PID adjustment curve.

4.2   Result

The ladder diagram program is debugged with the upper computer and the hardware equipment. The change of the output response curve is observed, and the stability of the system is judged. Finally, a stable PID parameter value is determined. The final result is shown in the following picture.

Figure 9: The simulation curve when the setting value is 60

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