

The Electrical Control System PLC Transformation of The T68 Boring

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Abstract: T68 boring machine electric control system circuit is complex ,its reliability and flexibility is poor with high failure rate. The mitsubishi FX2N-40MR Programmable controller for the technical innovation of electric control system improves the work performance of the whole electric control system and the work efficiency. This paper introduces the mitsubishi FX2N-40MR PLC in T68 boring machine electric control system ,the application of the elaborated system’s hardware and PLC program design can provide work for technical reform of similar equipment.

Key words: mitsubishi FX2N-48MR PLC; T68 boring machine electrical control system transformation

1 Introduction

T68 boring machine is mainly used for machining high precision of the distance between the holes for accurate parts. The T68 boring machine recursion in dozens of years ,generally uses the relay contactor control circuit , for troubleshooting exclusion , machine tool maintenance

workload is to be reckoned. The mitsubishi FX2N-40MR Programmable controller of T68 boring machine electric control system of relay contact technical renovation ,the technical transformation of hardware and software design are discussed. The schematic diagram of the electrical control system of T68 boring machine is shown in Fig. 1^[1-3].

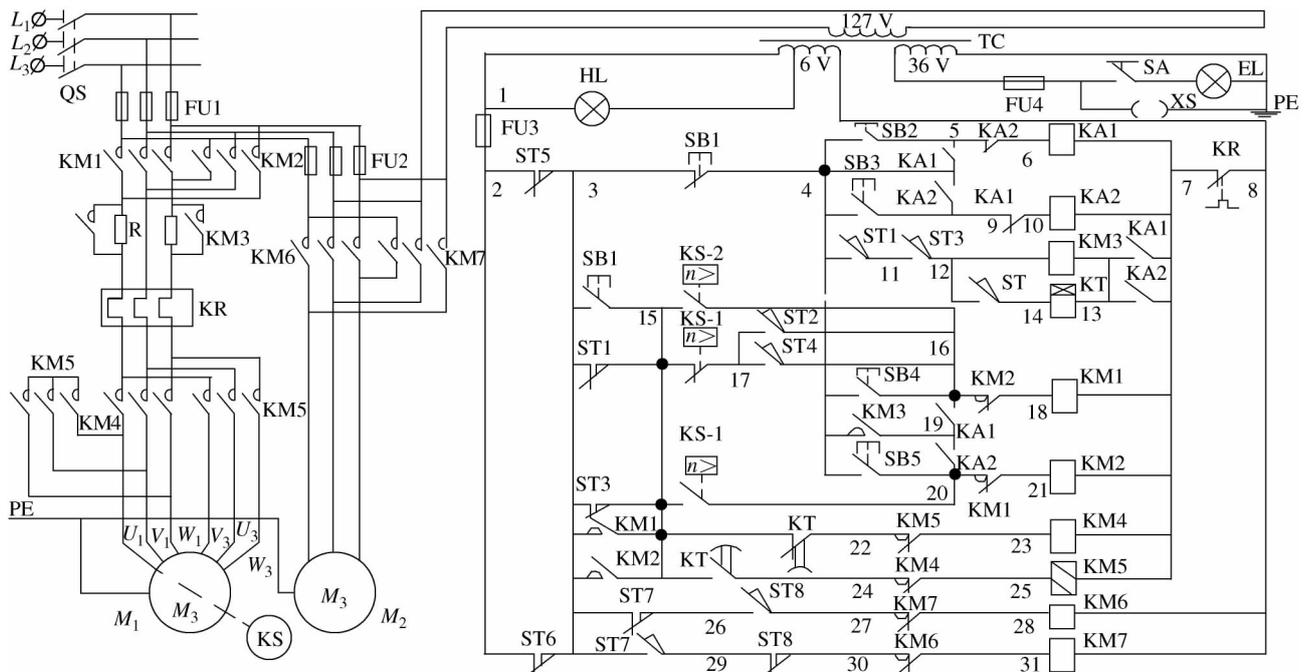


Figure 1 T68 boring machine electrical control schematics

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2 The requirement of the electrical control system of T68 boring machine

T68 boring machine electrical control circuit consists of main circuit , control circuit and auxiliary circuit and protection link.

In the main circuit , M_1 is used for the spindle motor to achieve the main movement of the machine tool and feeds movement of the spindle motor for double speed motor. M_2 is used for the fast moving motor , spindle box , workbench moving fast. T68 boring machine specific control requirements are as follows:

- 1) The spindle rotation and feeding has a wide speed range.
- 2) A variety of feed movement has positive and negative running in different directions , the main motor requirements can forward and reverse.
- 3) To meet the needs of the adjustment , the main motor should be able to realize the dynamic control of forward and inversion point.
- 4) In order to ensure the spindle stop quickly and accurately , the main motor should be parking brake.
- 5) The spindle speed and feed speed when parking or running in the main motor can take , to facilitate with speed gear meshing , variable speed impulse process at low speed.
- 6) To reduce the auxiliary time , each feeding direction can move quickly with fast – moving motor drive , using fast motor , reverse jog control.
- 7) The main motor is two – speed motor , a high and low speeds to choose from , first by low – speed opera-

tion should start.

- 8) As the moving parts and more , should be equipped with the necessary interlocks and protection link.

3 Electrical control system PLC hardware transformation

3.1 PLC hardware task analysis

When T68 boring PLC electrical control circuit transformation is the transformation of the main control circuit and power supply circuit , main circuit remains unchanged. TC transformer output section removed , using PLC control. In order to ensure that the various interlocking function , you need to position switch ST1 ~ ST8 , speed shift lever ST , push button switches SB1 ~ SB5 are access inputs of the PLC; positive and reverse speed relay contacts are inputs of the PLC access thermal relay normally closed contact KR have access to the input terminals of the PLC. Output devices using 127V AC voltage contactors , lighting circuits and calls indicate that no output from the PLC.

3.2 Hardware transformation

T68 boring machine control system has input points 17 points and output points 7: 00 , according to the number of input and output ports , and to consider extending functionality of the system , select Mitsubishi FX2N-48MR (24 inputs / 24 outputs) relay output type PLC. All electrical components or the use of transformation of the former model , the installation location is also unchanged. T68 boring each input / output points PLC address allocation shown in Table

1. T68 Boring PLCI / O wiring diagram shown in Figure 2^[4-6]. T68 boring machine control system with input points ,17 points ,output points 7 points , according to the number of I/O port , and considering the expansion of the system function , selection of mitsubishi FX2N-48 Mr Input/output by 24 (24 points) re-

lay output type PLC. All the electrical components or using models before modification , and its installation position is the same. T68 boring machine all input/output points of PLC address assignment as shown in Table 1. T68 boring machine PLCI/O wiring diagram is shown in Figure 2^[4-6].

Table 1 I/O allocation table

Input point is assigned	Output points is assigned
Enter contact input the name of the switch	Output contacts driven equipment
X_0 SB1 spindle stop and brake	Y_0 KM1 M_1 motor is transferred contactor
X_1 SB2 spindle rotates button	Y_1 KM2 M_1 motor reversing contactor
X_2 SB3 spindle reverse button	Y_2 KM3 limiting resistor contactor
X_3 SB4 spindle rotates to move the button	Y_3 KM4 M_1 motor contactor low Δ
X_4 SB5 spindle reverse jog buttons	Y_4 KM5 M_1 contactor connection speed YY
X_5 ST1 spindle speed travel switch	Y_5 KM6 M_2 motor contactor Forward
X_6 ST2 spindle speed travel switch	Y_6 KM7 M_2 motor reversing contactor
X_7 ST3 feed speed travel switch	
X_{10} ST4 feed speed travel switch	
X_{11} ST5 table , boring headstock feed limit switch	
X_{12} ST6 spindle , flat rotating disk infeed trip switch	
X_{13} ST7 M_2 motor fast forward stroke limit switches	
X_{14} ST8 M_2 motor trip switch quickly reversing Limit	
X_{15} ST high and low conversion limit switch	
X_{16} KR thermal protection contact	
X_{17} KS-1 forward speed relay contacts	
X_{20} KS-2 reverse speed relay contacts	

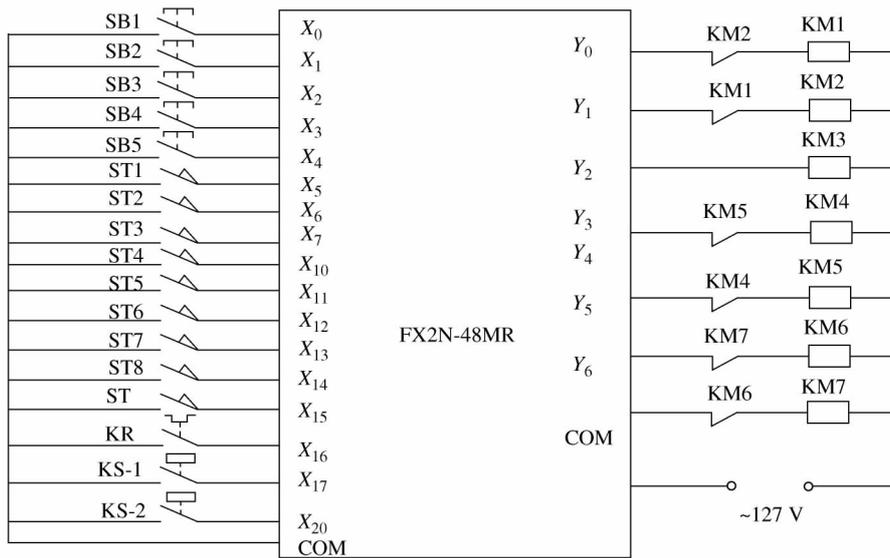


Figure 2 T68 Boring PLC I/O wiring diagram

4 PLC software design

PLC address control circuit T68 boring machine and the various input / output points are allocated based

on the design of the electrical control system PLC ladder diagram , shown in Figure 3^[7-9].

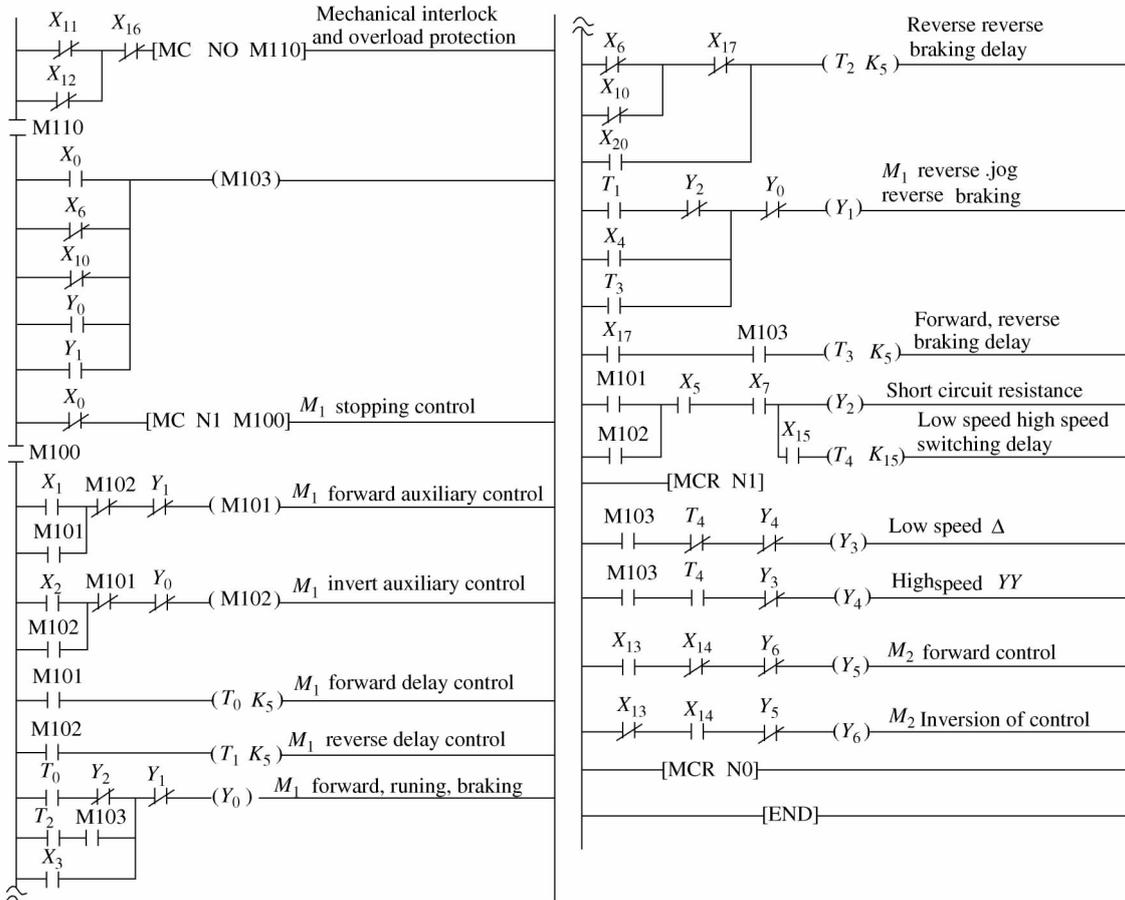


Figure 3 PLC Ladder

1) M_1 jog control

SB4 , SB5 is M_1 , reverse jog control button switch. Press SB4 or SB5 , X_3 or X_4 ON , Y_0 (or Y_1) and Y_5 coil is energized , KM1 (or KM2) and KM6 work , the motor M_1 phase winding connected into a triangle , in series resistance R low jog.

2) M_1 reversing control

PLC to complete the M_1 with positive and reverse control , you need to PLC internal relay M_{101} and M_{102} as a positive , reverse control auxiliary relay , in order to ensure reliable , reverse switch , use a timer to complete the T_1 and T_2 0.5 s conversion delay.

3) M_1 reverse brake control

KS speed relay has two pairs of normally open contacts separate KS-1 and KS-2 , KS-1 is closed when the motor M_1 is transferred , while reversing KS-2 is closed. KS-1 circuits connected in reverse , KS-2 circuit connected in forward , when the motor is transferred through the self-locking circuit is not energized so that inversion , when pressing the stop button SB1 , X_0 action , so circuit power forward , while inverting circuit is energized , be reverse braking , low speed when the speed relay contacts KS-2 off , reverse the circuit is powered down , the end of braking.

4) High speed switching control

ST is high , low speed selector switch , when the operating handle into the high – speed position , ST is depressed , X_{15} is turned on , after the delay timer T_3 , the normally closed contacts will contactor KM4 low power; its regular open contact will speed contactor is energized KM5 , then the motor windings M_1 YY connection to high-speed operation.

5) Spindle and the feed speed control

Spindle and feed speed can be carried out in the parking can also be carried out during operation. When shifting the shift lever pull , rotate speed disk , choose the right speed , then shift lever is pushed back. When pulling the shift lever , the corresponding speed limit switch is not under pressure; gear lever is pushed back , and the corresponding speed limit switch depressed. ST1 , ST2 spindle speed travel switch , ST3 , ST4 is feeding speed limit switch.

6) Rapid movement control

Fast moving headstock , table or spindle , handle and manipulate the rapid linkage ST7 , ST8 limit switch , control contactors KM6 or KM7 , then control the fast-moving motor M_2 reversing to achieve rapid movement. Will rapidly pull the handle in the middle position , ST7 , ST8 not be depressed , that X_{13} , X_{14} is not closed , Y_5 , Y_6 is not conducting coil , M_2 motor stopped; If quick pull handle in the forward position , ST7 is pressed Next , X_{13} closed , Y_5 coil conduction , M_2 motor is transferred , so that the corresponding parts quickly move forward; Conversely , if the quick pull handle in the reverse position , ST8 is depressed , X_{14} closed , Y_6 coil conduction , M_2 motor reverse , so that the corresponding reverse fast-moving parts.

7) Debugging

The 17 components in Figure 2 for each input to the input of the PLC , with seven LED lights instead of each output components , the PLC ladder program shown in Figure 3 inputs to be downloaded to the PLC FX2N-48MR , press T68 boring action sequence of operations connected to the PLC input command switch off the LED lights brighter observe the situation

(equivalent lights switched on ,the lamp is equivalent to disconnecting) ,paragraph by paragraph ,until it is completely in line with the debugger control system requirements , followed by the actual output of each device , continue debugging , to conform to expectations , connected to the main circuit to complete the transformation.

5 Conclusions

T68 boring machine control system uses PLC after the transformation of small size , easy to operate , less failure , anti-jamming capability , rapid response , improved equipment productivity. Logical relationships and work to ensure the safety of the whole of the original circuit , but also to adapt to frequent changes in process conditions , and achieved good economic results. Similar equipment for technological innovation has a job reference.

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Brief Biographies

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