



**Class: 4th Stage**  
**Subject: Control Lab**  
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# (Control laboratory)

## Experiment No. 00(3)

(Comprehensive Training on the assembling of heat pump Air conditioning system)

Prepared by  
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## **Exp.NO.(3):-Comprehensive Training on Heat Pump Air-conditioning System.**

### **Training Object:-**

- 1- To understand the control method on the electrical system of heat pump air conditioner.
- 2- The measurement, judging and working principles of the main components in the electric system of heat pump air conditioner.
- 3- Analysis on the control principle of the electrical system of heat pump air – conditioner.
- 4- Research on the circuit compositions and functions of electrical system in common heat pump air-conditioner.
- 5- How to connect to the peripheral circuit of the main electric components of heat pump air conditioner.

### **Training Equipment :-**

NO.	Name	Quantity
1	Training Evaluation Equipment for Air conditioner and Refrigerator Assembly and Commissioning	1
2	Power and instrument modules	1
3	Electric control module of air conditioner	1
4	Multimeter	1
5	Leads	10 or more

### **Training content:-**

The system uses double sensor air conditioning microcomputer remote control system. The whole electrical system is composed of power circuit, single chip master controller circuit, infrared receiving circuit, forced



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operation circuit, temperature detection circuit, indication circuit, driving circuit and so on.

1. Power circuit is composed of AC power supply and DC power supply. AC power supply is mainly supplied for actuating elements like transformer, compressor, and indoor / outdoor blowers and so on. DC power mainly includes +5V and +12V, +5V mainly supplied for infrared receiving circuit, single chip master control circuit, and temperature detection circuit, while +12V mainly supplied for driving circuit, step motor and relay.
2. Single chip master control circuit : the model of single chip used is S3F9495B
3. Infrared receiving circuit is functioned to transmit the information from user's remote controller through infrared tube, and carry out corresponding actions through process analysis, as indicated in fig. 8-1
4. Forced operation circuit is mainly composed of a button switch, current limiting resistor, etc. when pressing the button switch, single chip will be given a +5V flip-flop signal. The button switch (SB) here, also known as 'emergency switch', is functioned to start air conditioning system when there is no remote controller or remote controller is out of work, as indicated in SW1 in fig 8-1.

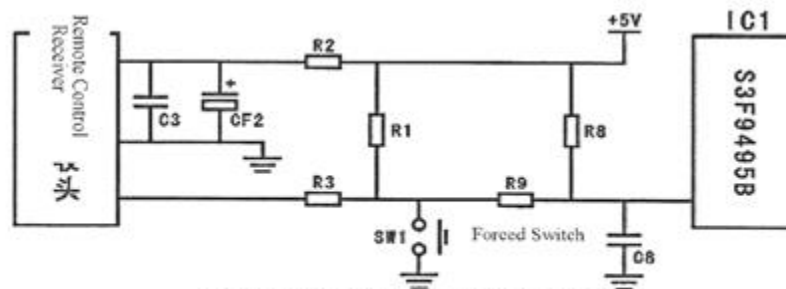


Fig. 8-1: Remote Control Receiving Circuit



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5. Temperature detection circuit along with the change of temperature, the resistance of the thermistor in temperature detection circuit system is also given the characteristic to change linearly with it. In the circuit, thermistor is often used in series with resistor. It adopts series bleeder circuit, and utilizes resistor drop to transmit voltage signal to the input terminal of single chip. The master controller of single chip will process the single chip collected and executed the state of running as indicated in fig. 8-2.
6. Driving circuit, mainly in DARLINGTONTON ULN2003, is functioned to carry out reverse drive on the control signal outputted by single chip, thus to ensure the weak signal outputted by single chip master controller able to drive its actuating components (such as relay, buzzer, step motor and other low power actuating components). The maximum driving capability of ULN2003 is 500mA, and every circuit inside is provided with fly wheel diode.
7. Measure and judge the quality of compressor, the winding of indoor/outdoor motor, sensor, etc.
8. According to the results of judging, use training leads to connect the output terminals HI, MED, LOW, 4F, and COMP on the panel of hanging tank to the corresponding components on control panel, thus to master the connection of peripheral circuit of electrical control system in heat pump air conditioner.

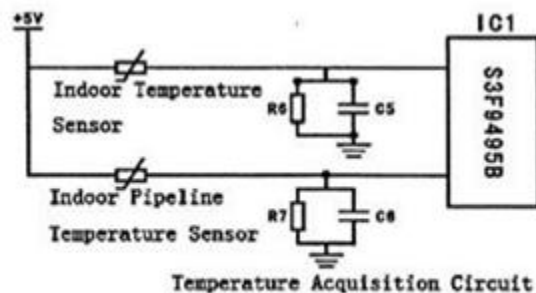


Fig. 8-2: Temperature Acquisition Circuit



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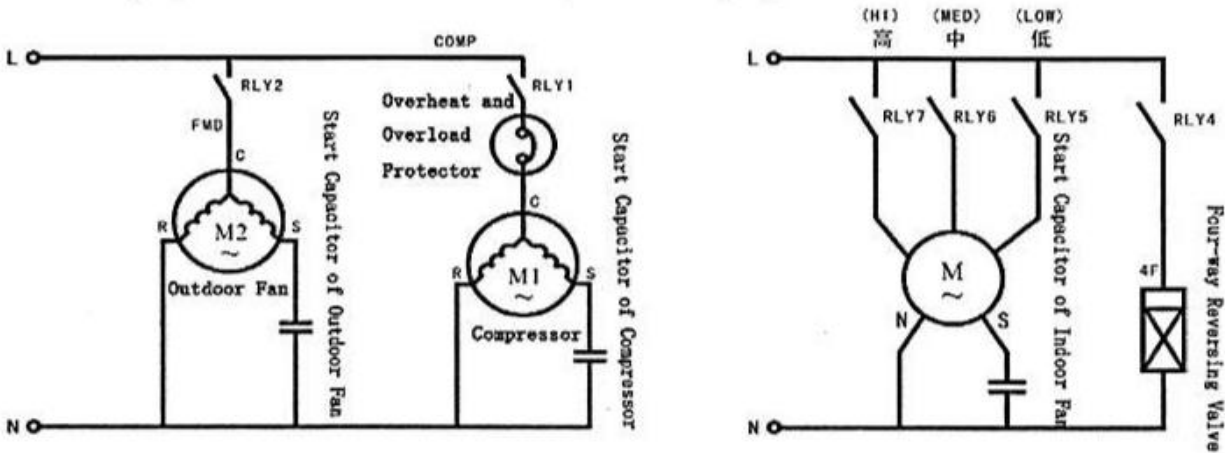


Fig. 8-3: Connection of Peripheral Circuit of Heat Pump Air-conditioner

### Procedure:

1. Connect the leads of indoor ambient temperature sensor and indoor pipe line temp. Sensor to the terminal block at the wiring area on training table through wire casing. (find the one to the corresponding relation according to the pipes of responding numbers).
2. Connect the leads of outdoor ambient temperature sensor and outdoor pipe line temp. Sensor to the terminal block at the wiring area on training table through wire casing. (Find the one to the corresponding relation according to the pipes of responding numbers).
3. Connect the leads of compressor, indoor fan, outdoor fan, and four way reversing valve at the area of air conditioning system to the terminal block at



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the wiring area of training table through wire case. (find the one to the corresponding relation according to the pipes of responding numbers).

4. According to Fig.6-1 use training leads to connect the compressor capacitor, indoor fan capacitor, outdoor fan capacitor HI, and MED, LOW, 4F and COMP output terminals on the panel of the hanging tank to the corresponding numbers on the terminal block at the wiring area of training table.
5. Connect the power L and N terminals on the panel of hanging tank M280 to the L and N terminals of hanging tank, the input AC220V power grid voltage for the power L1 and N1 terminals of hanging tank.
6. Turn on the power switch on the panel of hanging tank M280, the power indicator light on panel will light, hanging tank will be powered, and there should be a sound of a ring.
7. Press force button 'SW1' to start forcedly or use remote controller to carry out operating control on different running modes of the system. The 'power' indicator light on panel will be light. Every time when the system carry out a step of operation, single chip port will have a high level impulse outputted, and the buzzer will ring once.
8. Use remote controller to carry out commissioning under different modes.
9. Turn off power supply, have the training leads sorted.



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### Discussion:-

1. In forced operation circuit, which one is effective, low level or high level?  
What is the voltage?
2. What phenomena will happen when there is open cct or short cct? In the pipe line temperature or ambient temperature sensor? What are the main functions of them?
3. Explain the functions and working process of four way valve in heat pump air conditioning system?
4. Brief the working principle of electric circuit and the whole working process of refrigerating and heating.