The Research on Minimum System Construction Management Based on Water Temperature Detector

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Abstract. The operation of the system greatly affects our work efficiency. We need to improve our system construction management. Therefore, we will use the eight-way detection method to study how to manage the minimum system with the water temperature detector. The research results show that the design and construction of the minimum system has passed the temperature detection of DS18B20 in eight, the system is stable, and the effect of the minimum system of process management is achieved.

1. Introduction
Design scheme for construction and management of water temperature detector system.

1.1. Technical indicators
(1) Temperature measurement range: 0 to 100°C, accuracy ± 0.1°C.
(2) 4-digit digital tube display.
(3) Over limit alarm (upper limit 90°C, lower limit 30°C).
(4) 8 way detections.

1.2. System Structure and Working Principle

![Water temperature detector system frame diagram.](image)

Figure 1. Water temperature detector system frame diagram.
As shown in Figure 1, the water temperature detector system consists of a minimum system, a temperature detection circuit, an independent keyboard circuit, an alarm circuit, and a display circuit. The minimum system includes a power supply circuit, a clock circuit, a reset circuit, and a BKGD circuit; the temperature detection circuit uses eight DS18B20s to perform an eight-way temperature detection function; the display control is composed of four independent keys in an independent keyboard circuit; The buzzer and LED are completed; the temperature display function is completed using a 4-digit digital display circuit.

1.2.1. Selection of temperature sensor. This system uses the DS18B20 temperature sensor. The DS18B20 is the world's first temperature sensor to support the "first-line bus" interface, which was launched by DALLS Semiconductor. Its advantages are miniaturization, easy to configure microprocessor, low power consumption, strong anti-interference ability, high performance, etc., which can directly convert temperature into serial data signal for processor processing [1].

1.2.2. Pin Introduction. The DS18B20 is available in two packages: a three-pin TO-92 in-line (most common package) and an eight-pin SOIC chip. The package leads are shown in Figure 2 and the pin definitions are shown in Figure 3. This system uses the DS18B20 in a three-legged TO-92 in-line package [2].

Figure 2. DS18B20 pin package diagram.

![DS18B20 Pin Package Diagram](image)

Figure 3. DS18B20 pin definition.

| PIN DESCRIPTION | Description             |
|-----------------|-------------------------|
| GND             | Ground                  |
| DQ              | Data In/Out             |
| VDD             | Power Supply Voltage    |
| NC              | No Connect              |

1.2.3. System Working Principle. The MC9S12XS128 chip obtains the temperature data of each point by reading the temperature data of the temperature detecting circuit, and displays the temperature value of each sampling point in real time by the display circuit. Through the independent button circuit, the temperature values of different sampling points can be displayed cyclically, and the current over-limit alarm value can also be modified. When the temperature exceeds the limit, the alarm circuit realizes the sound and light alarm to remind the system to use the current water temperature limit.
2. Principles of Minimum System Management

2.1. Minimum system frame

2.1.1. Power Circuit. As shown in Figure 4, the system is powered by a dry battery. The power switch S11 is used to control the power on and off. The 750mA fuse F11 is used for over-current protection. The LED indicator D11 is used to identify whether the system is powered or not. The low dropout three-terminal regulator LM2940 (U11) provides a stable 5V voltage output. Filter capacitors are used to suppress high-frequency noise, improve electromagnetic compatibility of the system, reduce the impact of power supply fluctuations on the system, and enhance the stability of the circuit.

![Figure 4. Power circuit.](image)

2.1.2. Minimum System Management Framework.

![Figure 5. Minimum System Management Framework.](image)
As shown in Figure 5, the minimum system consists of the MC9S12XS128 chip, power supply and filter circuit, clock circuit, reset circuit, and BKGD circuit.

2.1.3. Minimum System Management Framework.

![Clock circuit diagram](image)

**Figure 6.** Clock circuit diagram.

![Reset circuit diagram](image)

**Figure 7.** Reset circuit diagram.

2.1.4. Reset circuit. In the Figure 7, during normal operation, the reset input pin \( \text{RESET} \) is connected to the positive terminal of the power supply through a 10KΩ resistor, which is high. If the reset button is pressed, the \( \text{RESET} \) pin is grounded to a low level, causing the chip to reset.

2.2. Temperature detection circuit

![Temperature detection circuit](image)

**Figure 8.** Temperature detection circuit.
As shown in Figure 8, the A port of the MC9S12XS128 chip is connected to eight DS18B20s to read the temperature sampling data of eight points to achieve eight-channel temperature detection.

2.3. Display circuit design

As shown in Figure 9, the 4-digit 8-segment digital tube display circuit, D41 is a 4-bit 8-segment digital tube module, and four tri-polar tube positions are selected by four bits. Since the segment selection segments are connected together, different displays are required. The number needs to be implemented by dynamic scanning. The Q1-QH segment is connected to the P port of the MC9S12XS128 chip, and the bit selection terminal is connected to the PK0-PK3 of the MC9S12XS128 chip [3].

2.4. Independent keyboard circuit design

As shown in Figure 9, the 4-digit 8-segment digital tube display circuit, D41 is a 4-bit 8-segment digital tube module, and four tri-polar tube positions are selected by four bits. Since the segment selection segments are connected together, different displays are required. The number needs to be implemented by dynamic scanning. The Q1-QH segment is connected to the P port of the MC9S12XS128 chip, and the bit selection terminal is connected to the PK0-PK3 of the MC9S12XS128 chip [3].
As shown in Figure 10, KEY1 KEY4 is directly connected to the lower four bits of the H port of the MC9S12XS128 chip. The functions are cyclic display without sampling point temperature value and mode modification (mode 0 is the self-test program, mode 1 is the temperature detection mode, Mode 2 is the temperature upper limit modification mode, mode 3 is the temperature lower limit modification mode), plus temperature upper/lower limit, minus temperature upper/lower limit.

2.5. Temperature detection circuit

As shown in Figure 11, the B port of the MC9S12XS128 chip is directly connected to 8 LEDs, and the buzzer is controlled by PK4. When the water temperature exceeds the upper limit or lower than the lower limit, the corresponding LED flashes and the buzzer sounds an alarm [4].

3. Organization of the Text

The first part of the article first sets the technical indicators in the design scheme of the system construction management, then introduces the structure and working principle of the system, selects the DS18B20 temperature sensor; the second part explains the minimum system management principle, including the minimum system overview and application. DS18B20 performs 8-channel temperature detection, display circuit design, independent keyboard circuit design and alarm circuit design for the circuit. The third part summarizes: We have completed the design and construction of the minimum system, and passed the eight-way temperature detection of the DS18B20 sensor, which will be applied in the design and practice of the minimum system in the future to achieve enhanced circuit system stability and achieve the goal of process management.

4. Conclusion

Through the above design, we have completed the design and construction of the minimum system, and realized eight-way temperature detection with eight DS18B20s, which will be applied in the design and practice of the minimum system in the future to achieve enhanced circuit system stability and achieve the goal of process management.

References

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