# Temperature Control Circuit (RTD-PT100)

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Topic: Design of a Temperature Control Circuit for 37°C in a Dental Unit

In this circuit, we focus on controlling the heater and the fan.

The board uses an RTD PT100 temperature sensor along with a MAX31865 digital converter module and an Arduino Uno board. Two SSR relay modules are also used to control the heater and the fan.

## Arduino Uno (ATmega328P)

Function: Acts as the central controller of the system. It reads temperature data from the sensor and, based on it, issues ON/OFF commands to the relays.

- Supply voltage: 5V+ (via port or onboard regulator)

- Typical current consumption: 50–70 mA in normal operation

- Important pins in this circuit: IO10, IO11, IO12, IO13

## RTD-to-Digital Converter Module: MAX31865

Function: An analog-to-digital converter designed specifically for the PT100 RTD sensor. This IC reads the sensor resistance and converts it into digital data. It consumes very little power since it only reads and sends signals.

- Reference resistor: 430Ω (for precise measurement)

- Current consumption: about 1–2 mA

- Supply voltage: 3.3V

- Power pins: VDD – DVDD

## Temperature Sensor: RTD PT100

Function: High-accuracy temperature measurement. This is a resistive sensor (its resistance changes with temperature).

- Connection type: 4-wire (for greater accuracy)

- Pins: E / S- / S+ / E+

- Does not receive voltage directly.

- Excitation current source: 1 mA from MAX31865 module.

## SSR Relay Module (G3MB-203P)

Two relays:

- RL HEATER → controls ON/OFF of the heater

- RL FAN → controls the cooling fan

Pins:

- LD1/LD2 LEDs → indicate ON/OFF status of heater and fan

- IN– / IN+ → command input from Arduino board

Electrical characteristics:

- Input trigger voltage: 5V DC

- Input trigger current: about 7–12 mA per relay

- Relays have 5V inputs and connect directly to Arduino digital pins.

- Output switching voltage: 100V AC – 240V AC

- Total current consumption for both relays: ~25 mA

## Relay Status LEDs

- D2 (RED LED): indicates heater relay active (2V)

- D3 (BLUE LED): indicates fan relay active (3V)

Each LED is connected to the relay module output.

- Voltage range: 2V – 3.2V

- Current requirement: 5 – 20 mA

- A series resistor must be used to limit current (may not appear in schematic, but required).

## Manual Reset Circuit for Arduino

Includes a push button and an LED for manually resetting the Arduino board and displaying the reset action.

## UART Module (Grove Terminal)

Function: Allows the system to connect to external UART modules or display data on serial monitors.

- Supply voltage: usually 3.3V or 5V depending on module type

- Power source: 5V

- Pins:

- RXD / TXD → for serial data receive/transmit

- RTS / CTS → for flow control (if used)