Temperature Control Trainer (Air) KIT

MODELLING OF AIR TEMPERATURE CONTROL TRAINER

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WHAT IS A TEMPERATURE CONTROL TRAINER?

An air temperature control trainer is an educational tool used in the field of engineering and HVAC (Heating, Ventilation, and Air Conditioning) to teach students or professionals about the principles and practical aspects of air temperature control systems.

The trainer typically consists of a physical setup that mimics an HVAC system, allowing learners to observe and understand how various components work together to regulate and control air temperature in different environments. It provides a hands-on approach to learning, enabling users to interact with the equipment, conduct experiments, and troubleshoot potential issues.

In many process industries ON-OF control of temp is normally used. Thermostatic control of temp is commonly used method. In some process application PID mode is also used to achieve temp control.

In the temp cabinet or oven, temp is controlled by varying voltage applied across the heater coil thereby varying the current flowing through the coil i.e. $P=I^2R$ is

controlled. In PID control trainer, the main objective is to observe how PID controls the temperature inside the temp cabinet/oven across the desired set point.

A 1kW heater coil is used to heat the air inside the temp cabinet. Temp Sensor RTD is used to sense the temp, which is given to PID controller as measured variable. This input is compared to set value and error signal is generated. This error signal generated is fed to arithmetic PID block and output is computed. This controller output is given to Solid state relay, which is responsible for breaking and connecting the circuit. This output is fed to heater element of the oven and temp is controlled.

In our system, when the value exceed the set point, the relay breaks the connection with heater and the fan will be ON automatically, whenever the temp goes down to the set value, the fan will be OFF and heater will be ON.

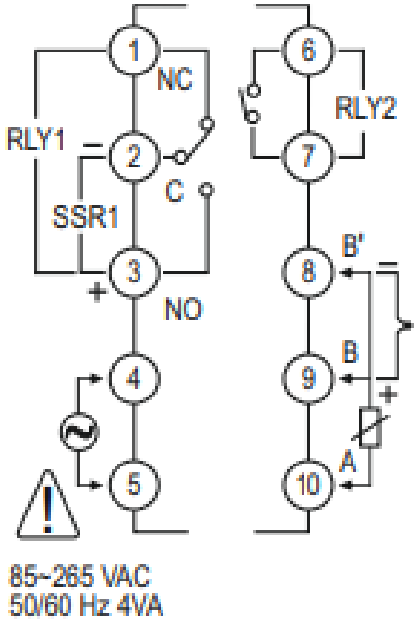
Hence, the temperature remains almost constant inside the cabinet/oven. And temperature is controlled.

MATERIALS REQUIRED

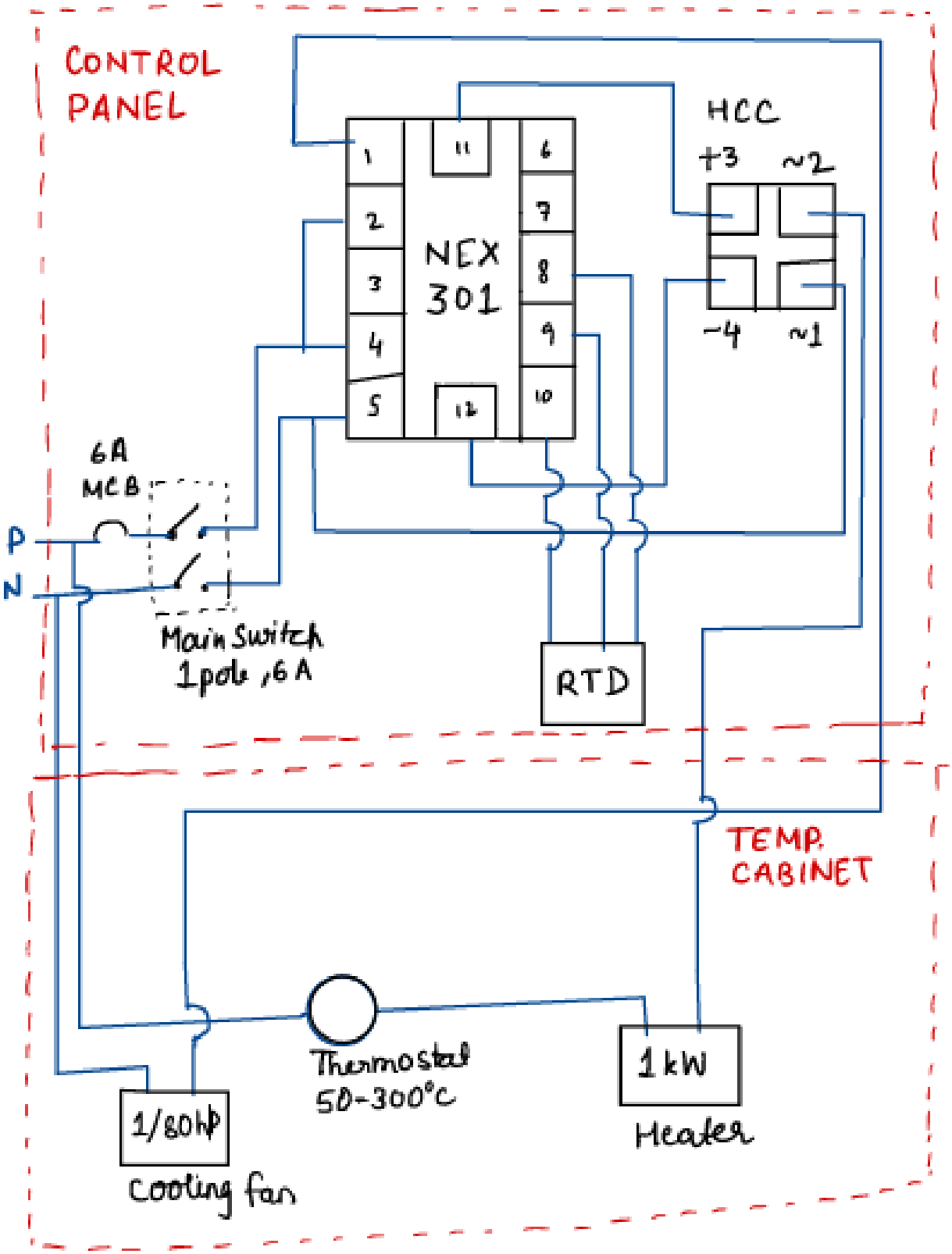
Sl.No.	Item Name	Specification	Qty
1	Temp. Sensor	Type: PT-100, Sheath dia=6mm, length=100mm,I/p- RTD PT-100 Range- 0-200 degrees 3 wire type	1
2	Thermostat	Adjustable 50-300 degree 15 Ams 230/250VAC	1
3	Heater Controller Card (SSR)	UNI 901 PHT i/p- 4-16mA, o/p- 24-480 V AC 25A max	1
4	PID Controller	Make: Fuji, Model- NEX 301	1
5	Switch	6A	7
6	MCB	1Pole, 6A	1
7	Heater Coil	1 kW	1

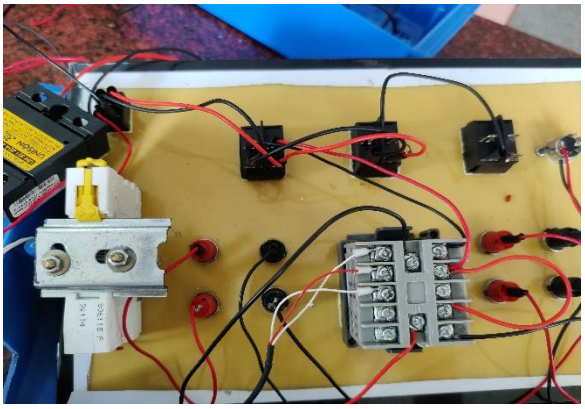
8	Cooling Fan	Motor- 1/80 hp	1
9	Electrical Panel	Panel with 4 switches, MCB , 8 test points, PID controller in front	1
10	Temperature Cabinet	With heater, cooling fan & Thermostat with 3 mains switches	1

BLOCK DIAGRAM



NEX301 PINOUT DIAGRAM

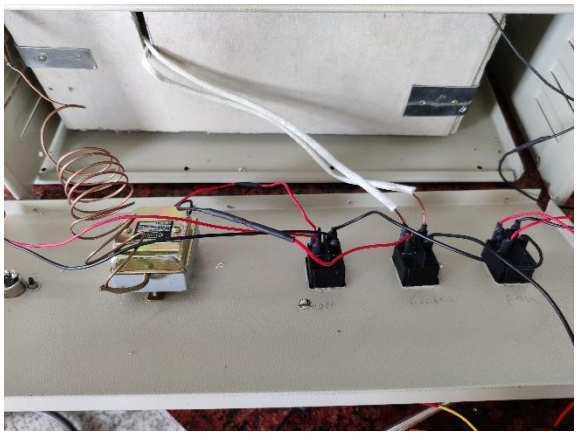

CONTROL PANEL
NEX 301
1
2
3
4
5
11
12
6
7
8
9
10
HCC
+3
~2
-4
~1
6A MCB
P
N
Main Switch 1pole, 6A
RTD
TEMP. CABINET
Thermostat 50-300°C
1 kW Heater
1/80HP Cooling fan



INTERNAL CIRCUIT OF CONTROL PANEL

FRONT FACE OF THE CONTROL PANEL

FRONT FACE OF TEMPERATURE CABINET



INTERNAL CIRCUIT OF TEMPERATURE CABINET

INSIDE OF THE TEMP CABINET

ANALYSIS AND DISCUSSION

The air temperature controller trainer with a PID controller is an essential educational tool offering a realistic simulation of temperature regulation. It enables users to understand PID control principles through interactive demonstrations and response visualization. The trainer's versatility allows experimentation with PID tuning parameters and disturbance rejection capabilities. Advanced features like auto-tuning and safety mechanisms enhance the learning experience. Comprehensive educational materials accompany the trainer, empowering users to apply PID control in various fields. Overall, this trainer provides a safe, informative, and interactive platform for mastering temperature regulation and its applications.

CONCLUSION

In conclusion, the air temperature controller trainer equipped with a PID controller has proven to be an invaluable educational tool for understanding and mastering temperature regulation principles. Through realistic simulations and interactive demonstrations, users have gained comprehensive insights into PID control and its application in maintaining desired temperature setpoints. Experimentation with various PID tuning parameters and disturbance rejection capabilities has enabled users to grasp the significance of proper control tuning for system stability and accuracy. The inclusion of advanced features like auto-tuning and safety mechanisms has further enriched the learning experience, ensuring a secure and efficient training environment. The accompanying educational materials have provided a solid theoretical

foundation, empowering users to apply PID control principles confidently in real-world scenarios, ranging from HVAC systems to industrial automation and process control.