



# PSI3541 2023

## SISTEMAS EMBARCADOS DISTRIBUIDOS

---

AULA 08 27/04/2023

ATIVIDADE 8.1 CONTROLE DE AQUECIMENTO: HOME I/O, CONNECT I/O, MODBUS, NODE-RED

PROF. SERGIO TAKEO KOFUJI - KOFUJI@USP.BR

# OBJETIVO

---

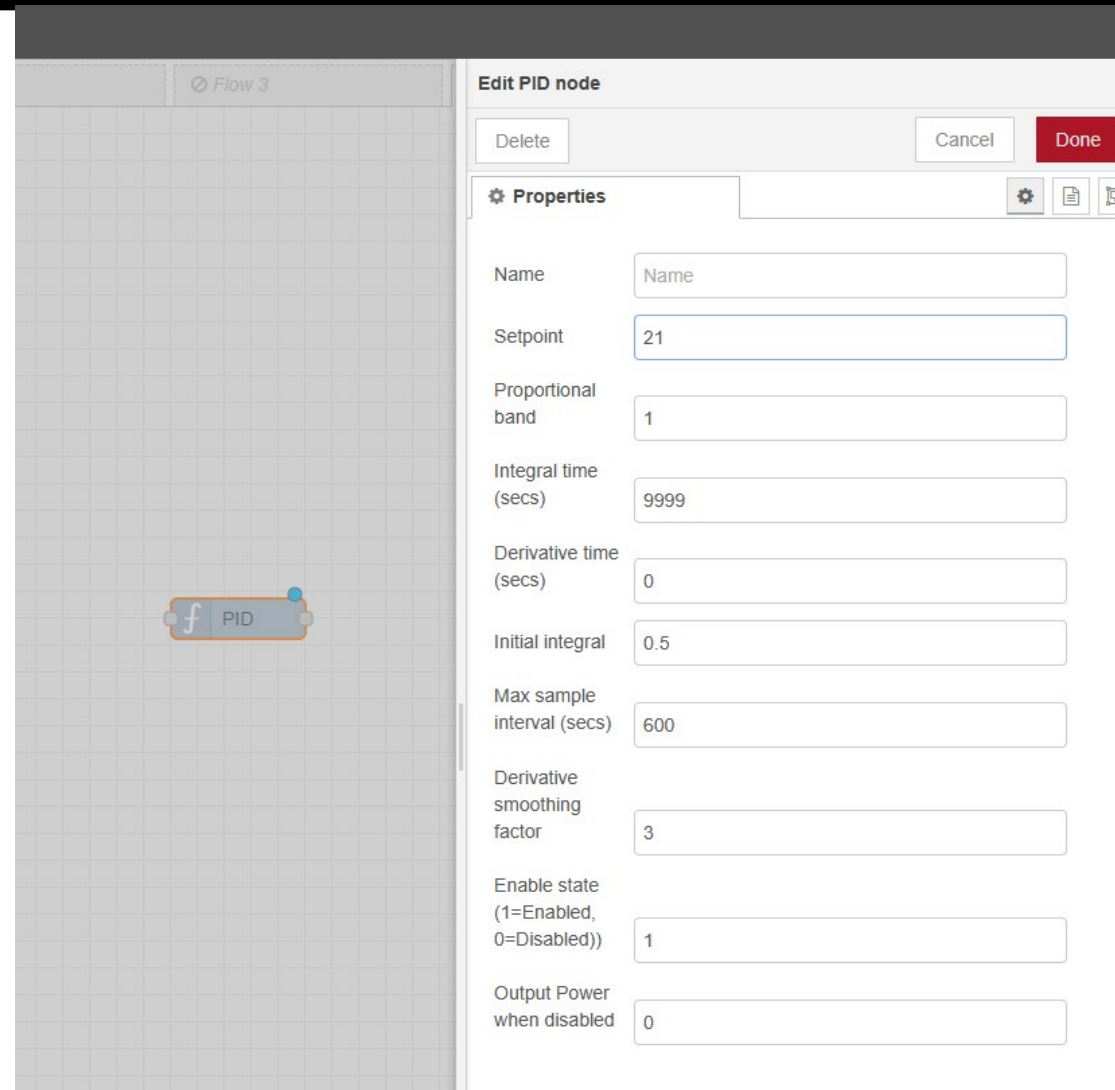
- Implementar um controle ON-OFF para o aquecedor

# MÓDULO CONTROLADOR PID NODE-RED

---

- Node-Red-Contrib-Pid 1.1.7: PID loop controller for Node-RED
  - <https://flows.nodered.org/node/node-red-contrib-pid>
  - Descrição: Um nó Node-RED que opera como um nó controlador de loop PID destinado ao controle de processos do mundo real
- Entradas:
  - mensagens contendo:
    - valores de processo (no intervalo 0-1)
    - parâmetros de configuração
- Saídas:
  - mensagens contendo valores de controle de processo (intervalo 0-1)

# Nó Controlador PID



Flow 3

Delete Cancel Done

**Properties**

Name

Setpoint

Proportional band

Integral time (secs)

Derivative time (secs)

Initial integral

Max sample interval (secs)

Derivative smoothing factor

Enable state (1=Enabled, 0=Disabled))

Output Power when disabled

# Controle Simples ON-OFF

---

- Vamos implementar um controle simples ON-OFF
  - Se a variável de processo estiver acima de (SETPOINT +V1), então ativar o atuador
  - Se a variável de processo estiver abaixo de SETPOINT-V2), então desativar o atuador
- Controle do aquecedor
  - Entrada: temperatura do ambiente
  - Saída: controle do aquecedor

# HOME I/O

---

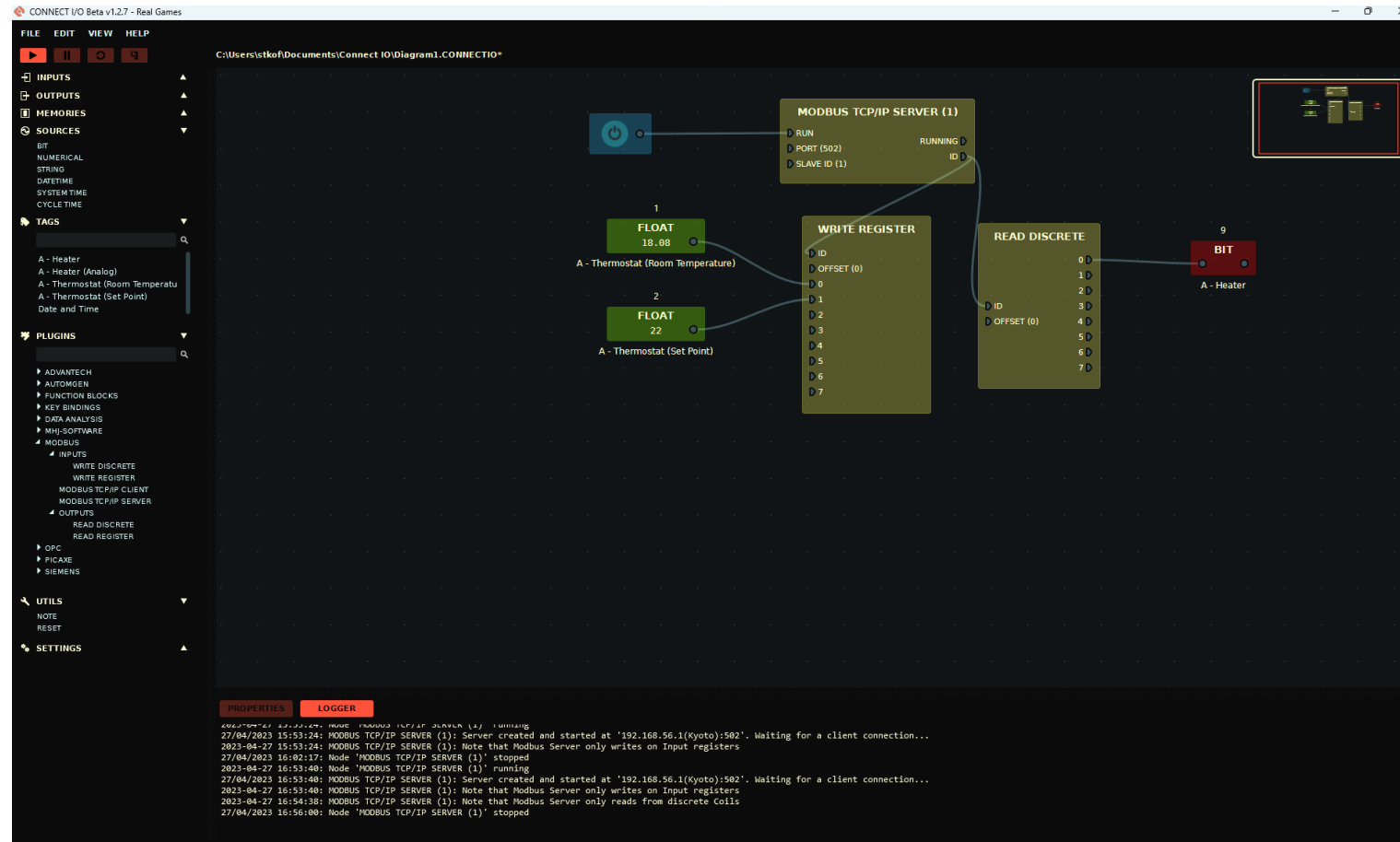


# CONNECT I/O

---

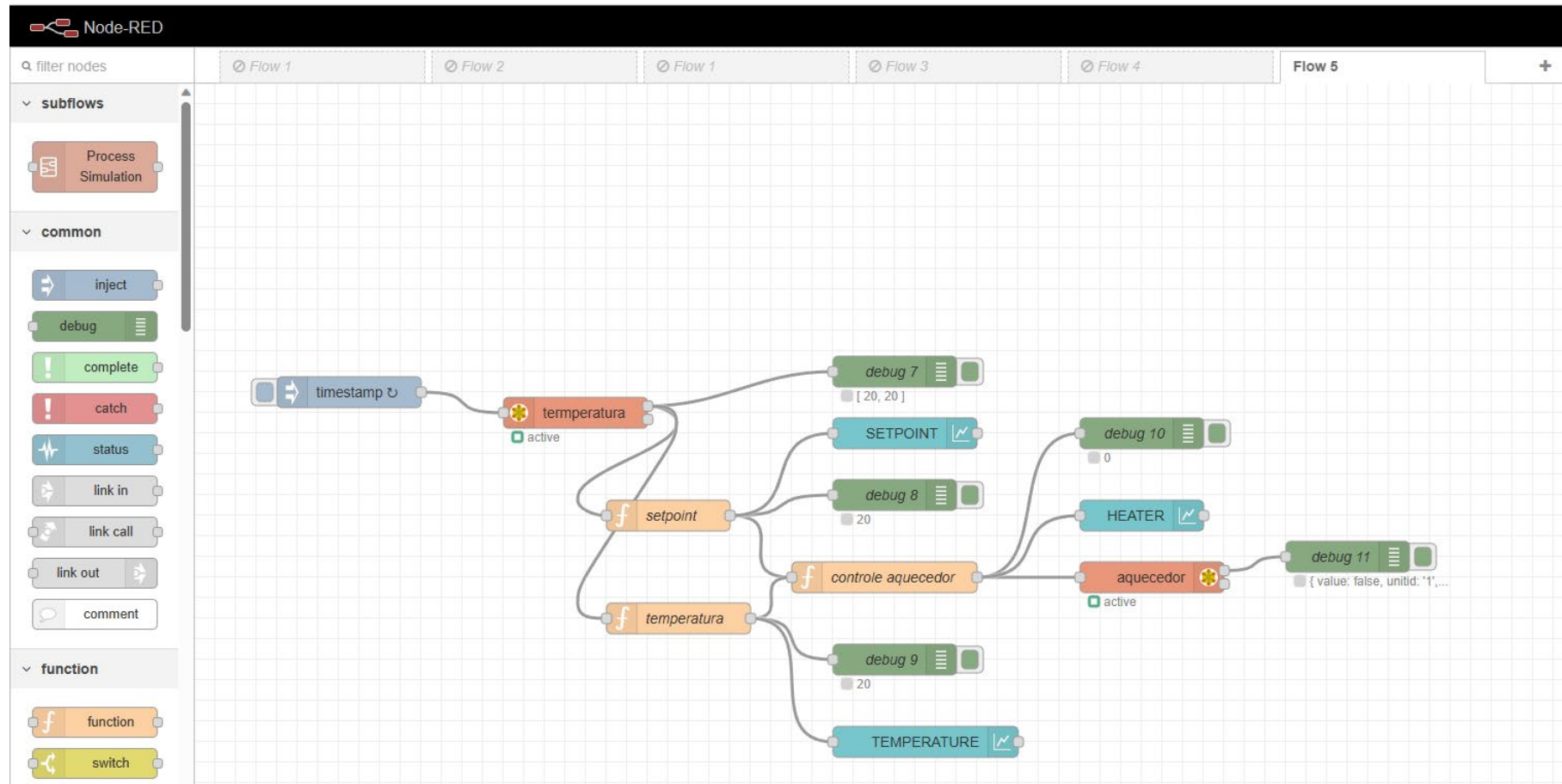
The screenshot displays the CONNECT I/O software interface. The top menu bar includes FILE, EDIT, VIEW, and HELP. Below the menu are playback controls: a red play button, a pause button, a refresh button, and a search button. The left sidebar contains a tree view with categories: INPUTS, OUTPUTS, MEMORIES, SOURCES, TAGS, PLUGINS, UTILS, and SETTINGS. The TAGS section is expanded, showing a search bar and a list of tags: A - Heater, A - Heater (Analog), A - Thermostat (Room Temperatu, A - Thermostat (Set Point), and Date and Time. The main workspace shows a control panel with three indicators: 9 BIT A - Heater, 1 FLOAT 19.99 A - Thermostat (Room Temperature), and 2 FLOAT 0 A - Thermostat (Set Point). The file path at the top right is C:\Users\stkof\Documents\Connect IO\Diagram1.CONNECTION\*.

# CONNECT I/O





# NODE-RED



# CLIENTE MODBUS DE LEITURA DA TEMPERATURA (ATUAL E O SP)

The image shows a Node-RED workflow for reading temperature data via Modbus. The main workspace contains a flow starting with a 'timestamp' node, followed by a 'temperatura' node (with an 'active' indicator). This node is connected to three function nodes: 'setpoint', 'temperatura', and 'controle aquec'. The 'setpoint' node is connected to a 'SETPOINT' node. The 'temperatura' node is connected to a 'debug 9' node. The 'controle aquec' node is connected to a 'TEMPER' node. There are also 'debug 7' and 'debug 8' nodes connected to the 'temperatura' node.

The right-hand panel shows the configuration for the 'Modbus-Getter' node:

- Name:** temperatura
- Unit-Id:** 1
- FC:** FC 4: Read Input Registers
- Address:** 0
- Quantity:** 2
- Delay to activate input:**
- Server:** connectio

# NÓ DE CONTROLE ON-OFF

The image shows the Node-RED web interface. On the left, the 'function' category is selected in the node palette. The main workspace contains a flow starting with a 'timestamp' node, followed by a 'temperatura' node (with an 'active' indicator). This node connects to three function nodes: 'setpoint', 'controle aquecedor', and another 'temperatura' node. The 'setpoint' node connects to a 'debug 7' node. The 'controle aquecedor' node connects to a 'debug 8' node and a 'TEMPE' node. The second 'temperatura' node connects to a 'debug 9' node. On the right, the 'Edit function node' panel is open for the 'controle aquecedor' node, showing the following JavaScript code:

```
1 var sp, temp;
2 var hplus=2;
3 var hminus=2;
4 var sp = context.get('setpoint') || 0;
5 var heater = context.get('heater') || 0;
6
7 if(msg.topic=="SETPOINT"){
8     sp=msg.payload;
9     context.set("setpoint", sp);
10    return null;
11 }
12
13 temp=msg.payload;
14
15 if(temp>=(sp+hplus)) {
16     heater=0;
17     context.set('heater', heater);
18 }
19 else
20     if(temp<=(sp-hminus)) {
21         heater =1;
22         context.set('heater', heater);
23     }
24
25 msg.payload=heater;
26 return msg;
```

# CLIENTE MODBUS DE ESCRITA (AQUECEDOR)

The image shows the Node-RED web interface. On the left, a sidebar contains various node categories: subflows, common, and function. The main workspace displays a flow with a 'timestamp' node connected to a 'temperatura' node. The 'temperatura' node is connected to a 'setpoint' node, which is then connected to a 'temperatura' node. The 'temperatura' node is also connected to several 'debug' nodes and a 'SETPOINT' node. The 'temperatura' node is marked as 'active'.

On the right, the 'Edit Modbus-Write node' configuration panel is open. It includes a 'Delete' button, 'Cancel', and 'Done' buttons. The 'Properties' section is expanded, showing the 'Settings' tab. The configuration details are as follows:

- Name: aquecedor
- Unit-Id: 1
- FC: FC 5: Force Single Coil
- Address: 0
- Delay to activate input:
- Server: connectio

# NODE-RED DASHBOARD

---

**SETPOINT**



**TEMPERATURE**



**HEATER**



# DÚVIDAS?

---

KOFUJI@USP.BR