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EMPIR JRP 18RPT03 MetForTC

WORKSHOP – Development of novel measurement facilities for verification of thermocouple performance

Inhomogeneity testing device

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Justervesenet

MetForTC

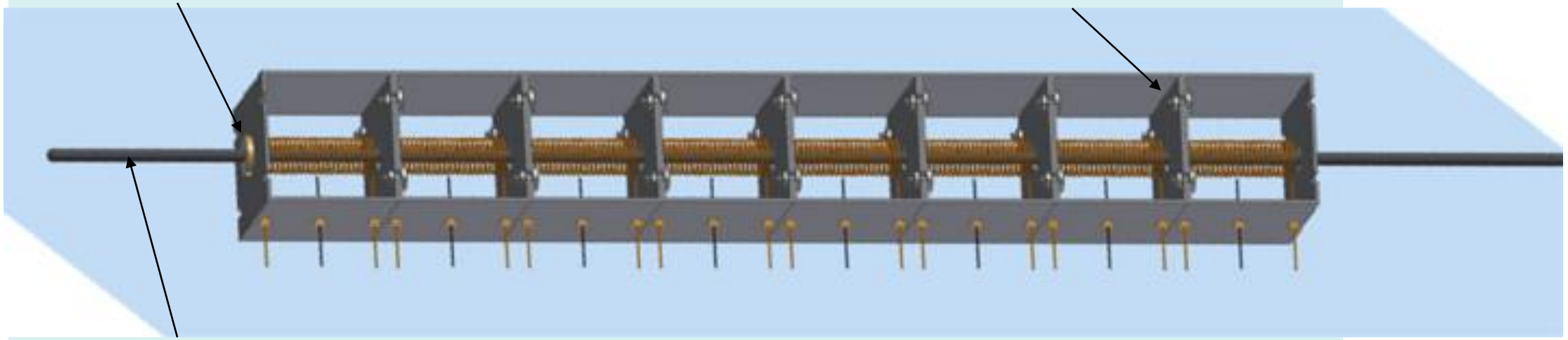
New inhomogeneity testing device

- Thermocouple inhomogeneity is commonly tested in temperature laboratories, either by withdrawing the thermocouples from the zones of controlled temperature or by moving the heater along the thermocouple probes.
- Manual withdrawal of thermocouples from the oil bath, in relatively small steps, is time-consuming since users need to be continuously engaged in the process.
- Automatized methods utilize mechanisms with moving parts that are relatively expensive and there is some risk of mechanical failure that could lead to damage to the thermocouple under test.
- For the mentioned reasons new device was developed within WP3 of the MetForTC project that does not have moving parts. The thermocouple under the test is placed into the device and the testing procedure can be performed automatically.
- The device consists of several electrical heaters, where each heater can heat one portion of the thermocouple probe.
- In relation to the common methods, this device allows simultaneous heating of different portions of the thermocouple probes, even at different temperatures and with different heating/cooling rates for each separate heater module.

Connected heater modules

Ceramic insert for thermocouple centering

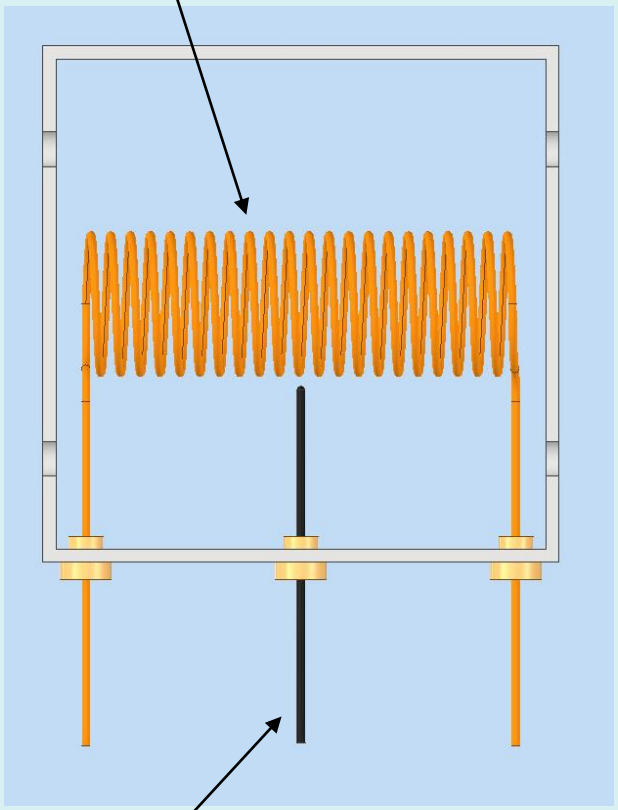
Bolts and nuts for connecting separate heater housing modules



Tested thermocouple

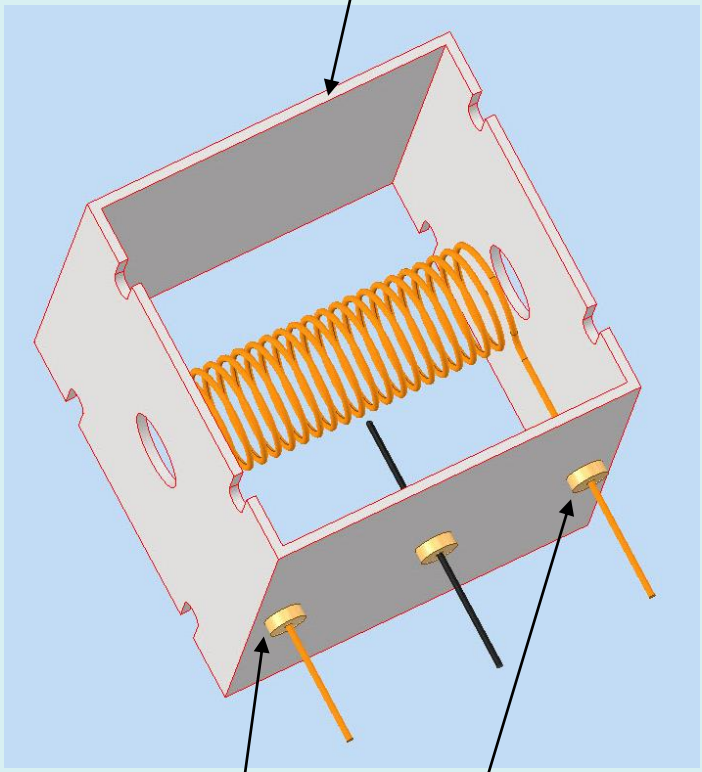
Separate heater modules

Heater, Kanthal A1, 1.77 Ω/m
$\phi_K = 1\ mm$
Coil diameter ϕ16 mm
Pitch cca. 2.3 mm
U=24 V, *P*≈300 W



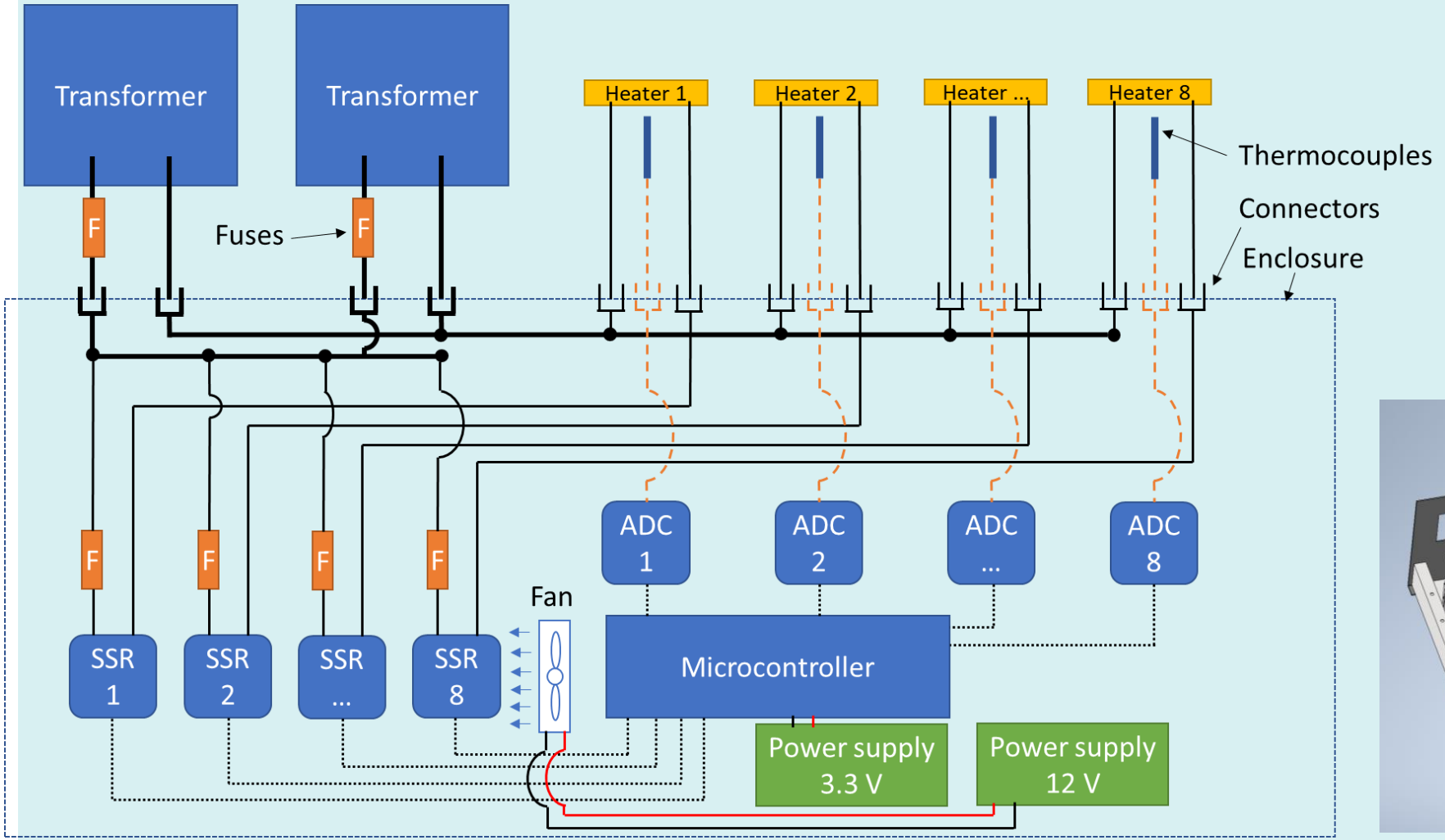
Thermocouple sensor for heater temperature control

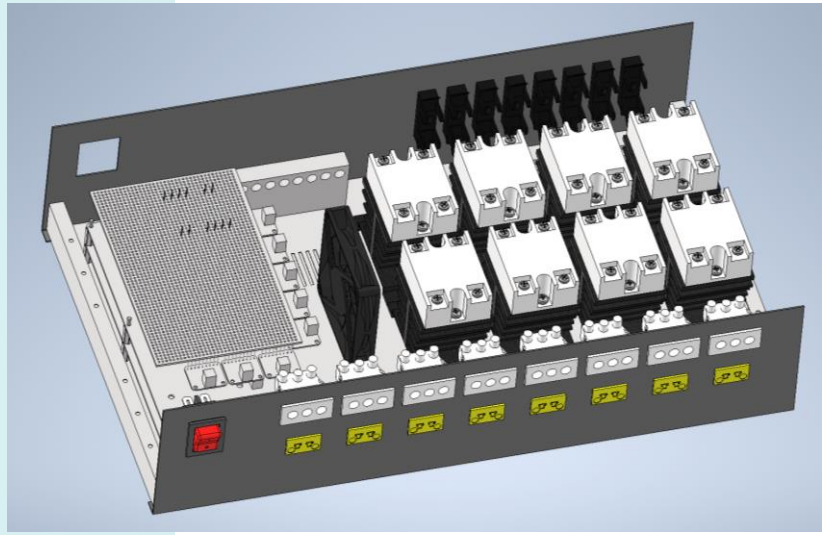
Heater housing, quadratic metal tube 60x60x1.5 mm



Ceramic insulators

Control unit schematics





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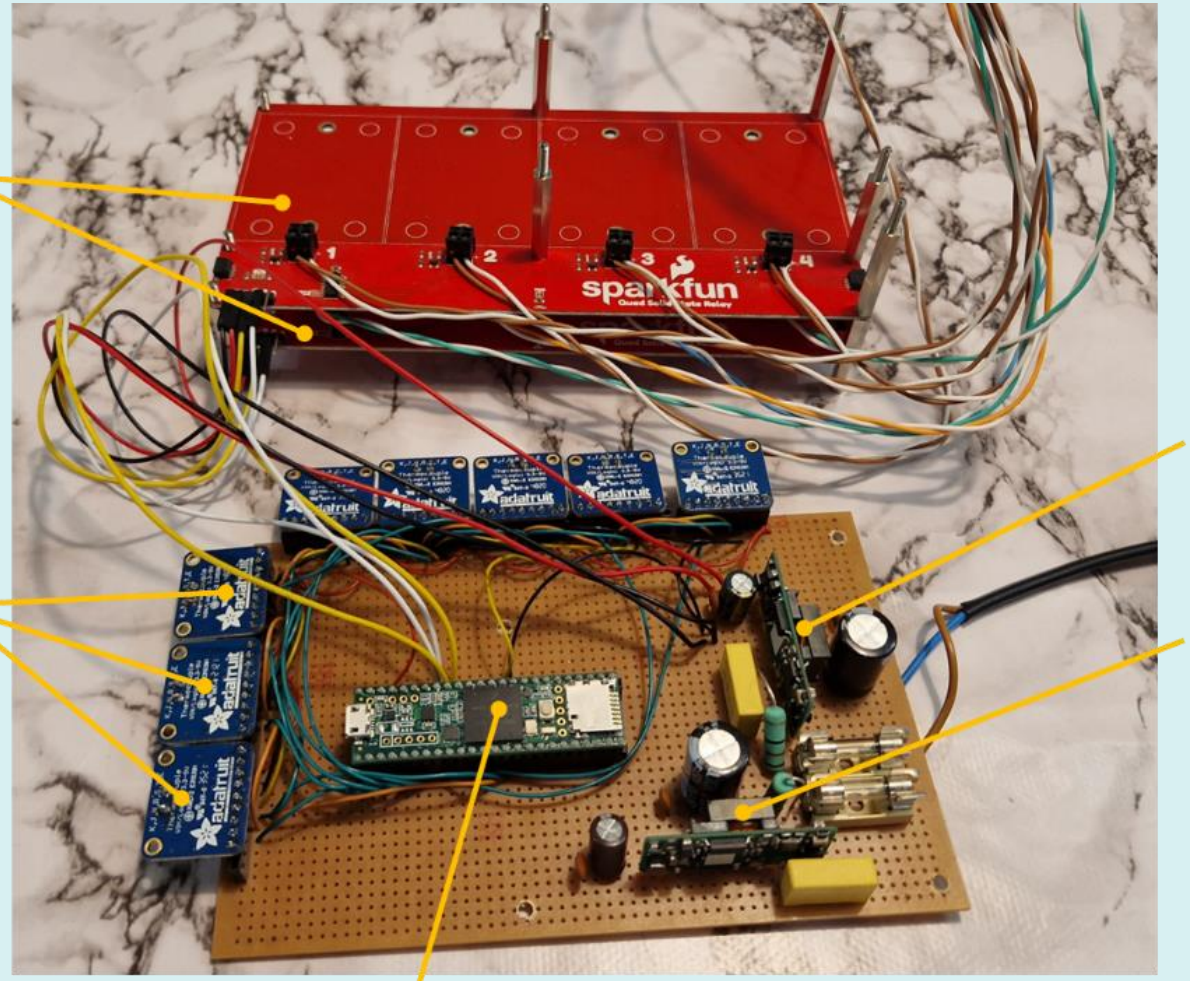
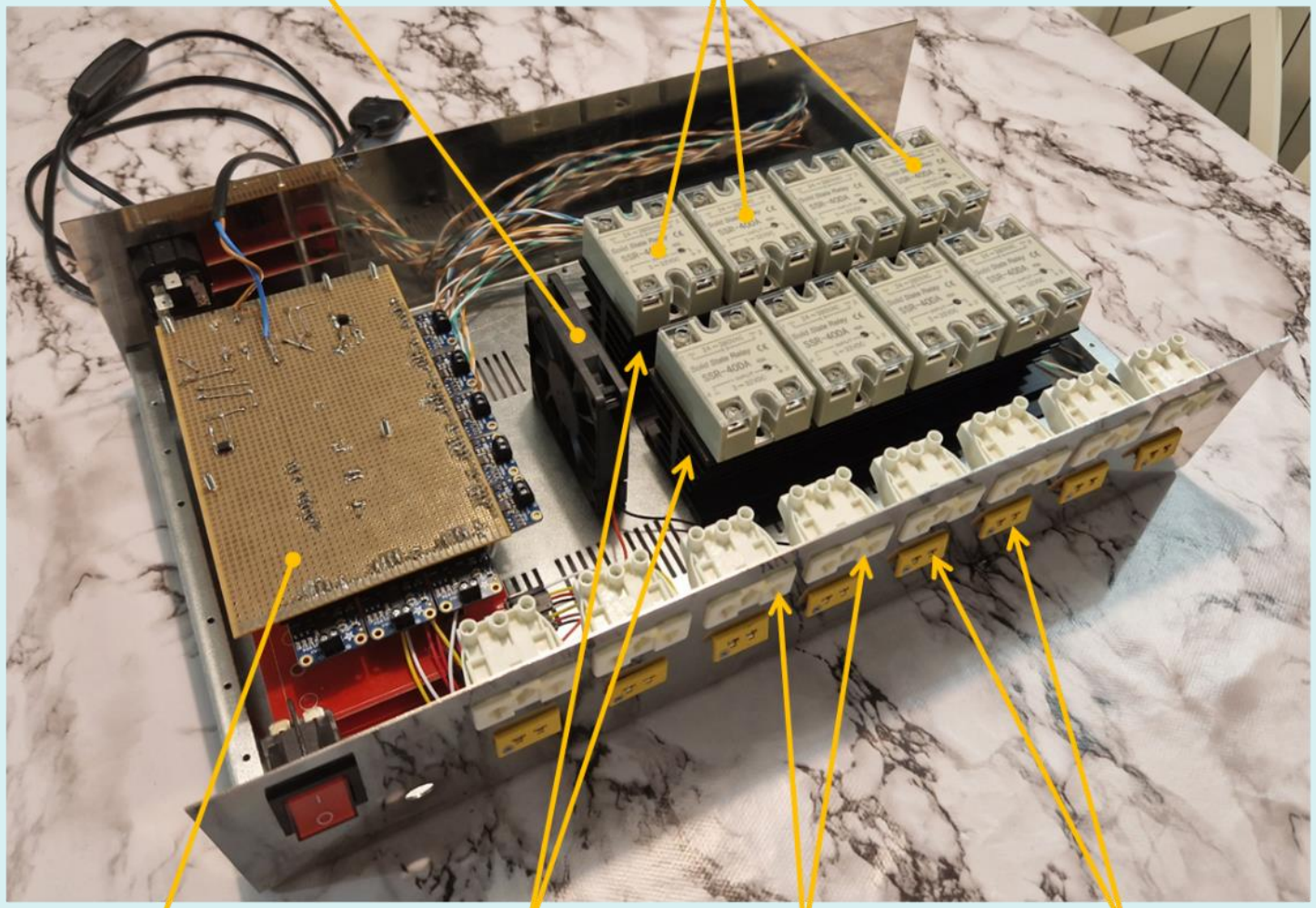
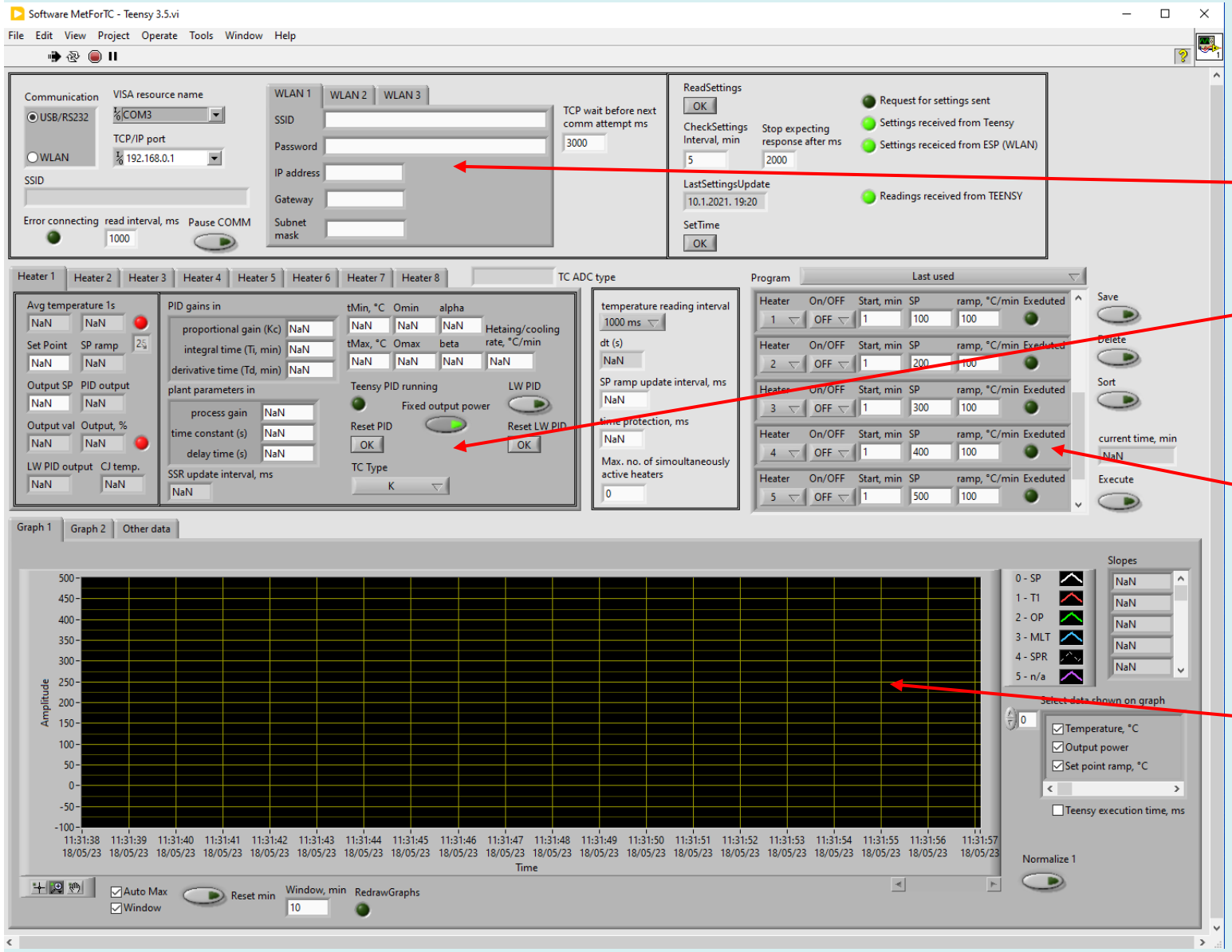
Microcontroller and other electronic components



Device assembly



PC software



Program enables

- Setting of desired communication method (USB or WLAN)

- Setting of PID controlling parameters, output power limits, temperature limits, and heating/cooling rate for each heater

- Making the program that will heat or cool each heater to the desired temperature during the desired time interval

- Graphical representation of the thermocouple readings, temperature set points and output powers

Acknowledgement

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Thank you for your attention!