# MAE 171A: Heat Transfer Experimental Procedure

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Objectives

- Week 1
    1. To calibrate the heat flux meter
    2. To measure the velocity profile across the duct
- Week 2
    1. Measure the heat flux in forced convection, and free convection
    2. Determine the heat transfer coefficient (h), Nusselt number (Nu).Plot Nusselt numbers (Nu) against Reynolds number (Re) for forced convection, and against Raleigh Number (Ra) for free convection.
- Week 3
    1. Complete any unfinished experiments from the flat plate heat transfer experiment from previous weeks
    2. Determine the heat transfer coefficients for the fins
    3. Plot Nusselt numbers (Nu) against Reynolds Number (Re), or Rayleigh Number (Ra)
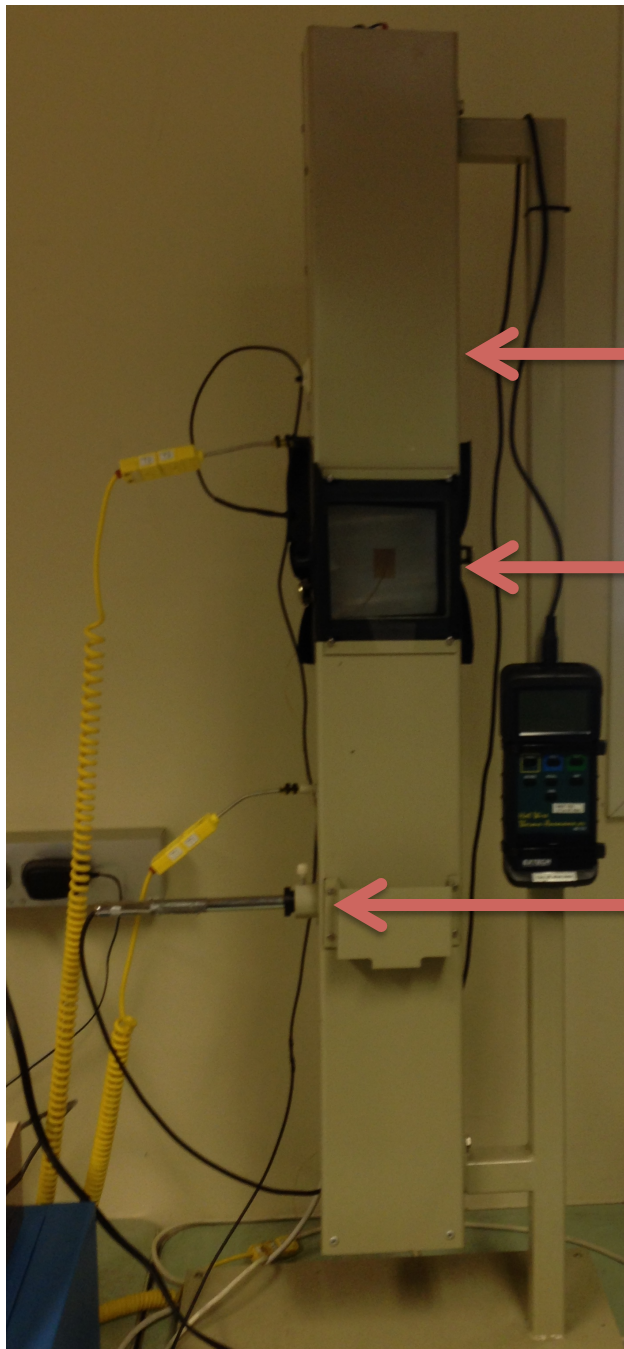
Experimental Setup
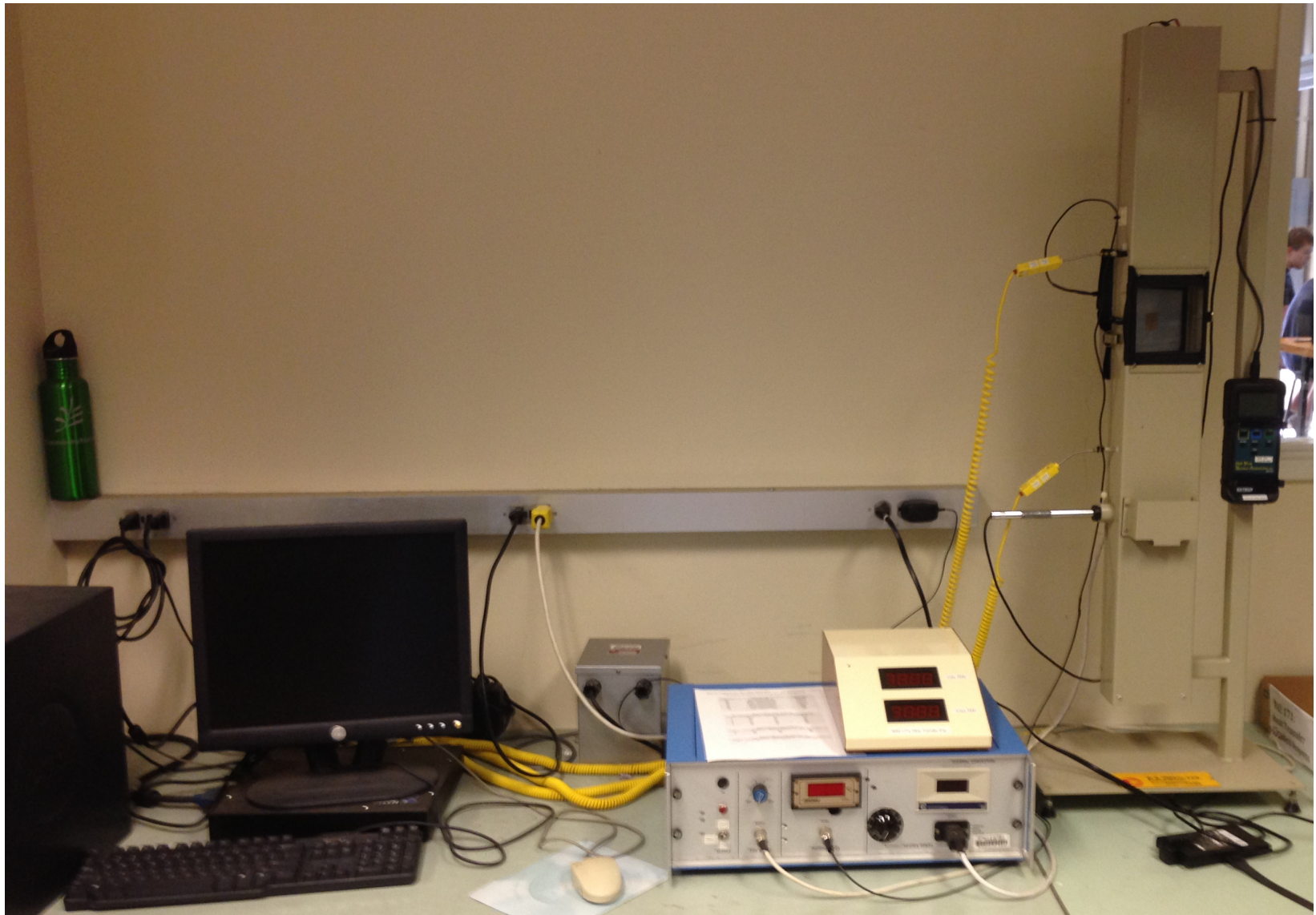
Control & Measurement of Power
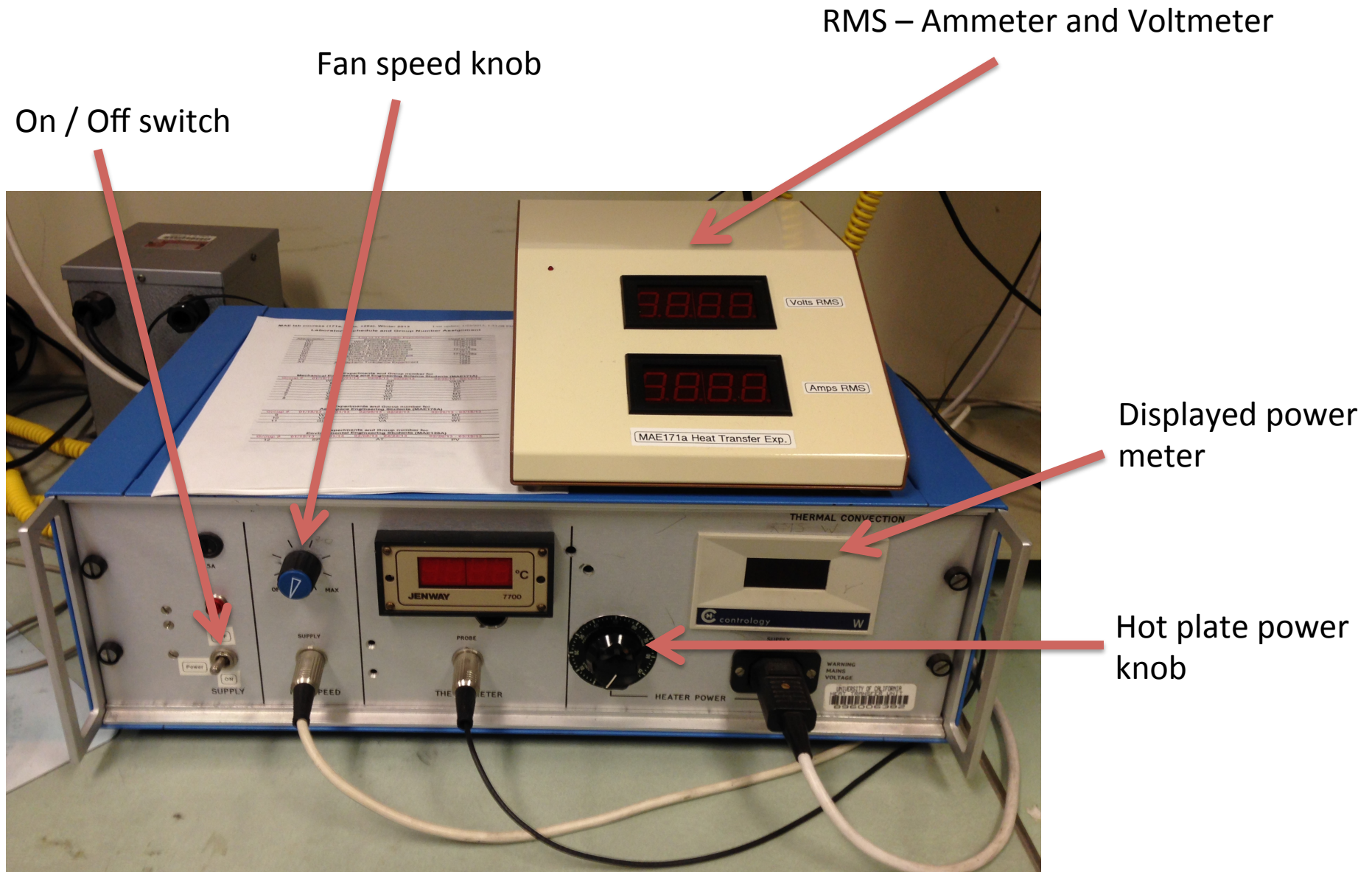
Chanel with Flat Hot Plate

Air flow channel

Flat Hot Plate

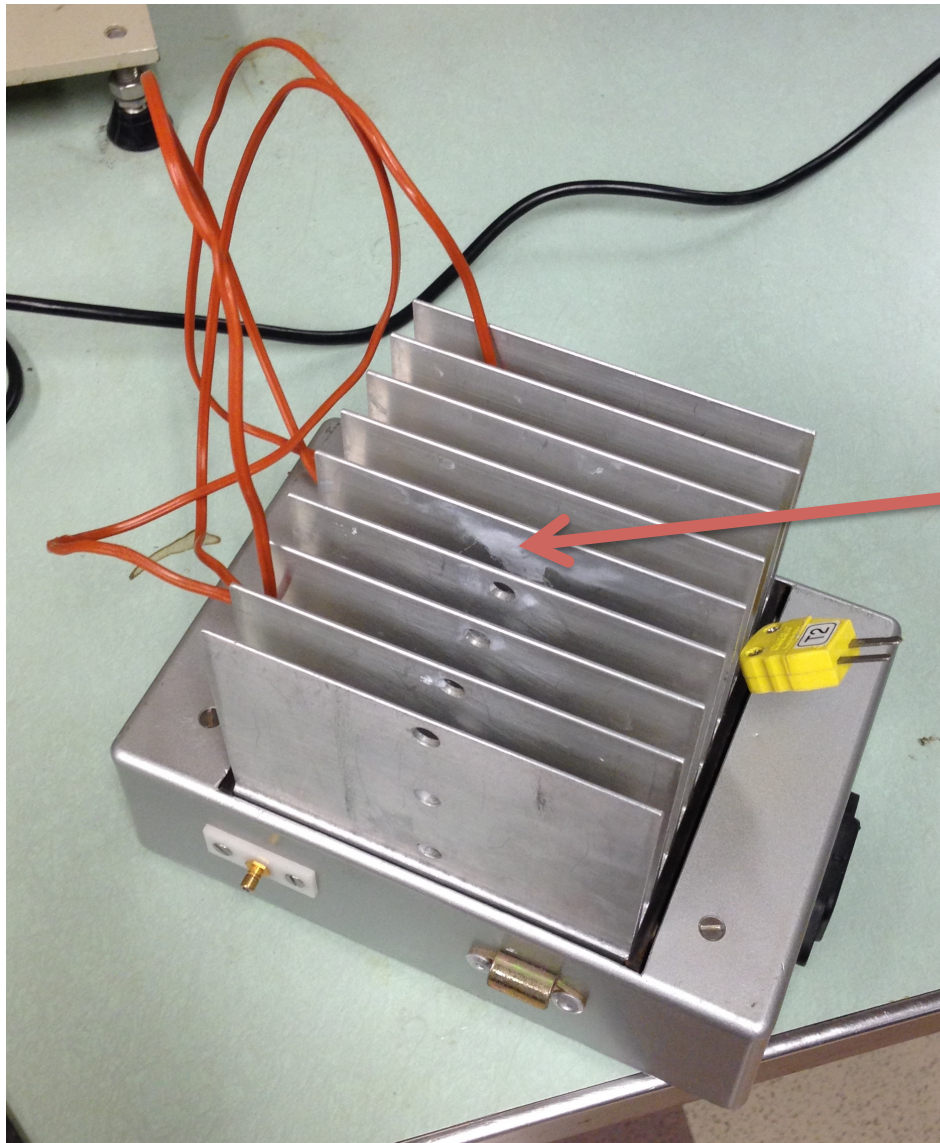Air velocity measurement – Hot wire anemometer

Finned Hot Plate

Plate temperature
measurement thermocouple

Hot Wire Anemometer

Anemometer Probe

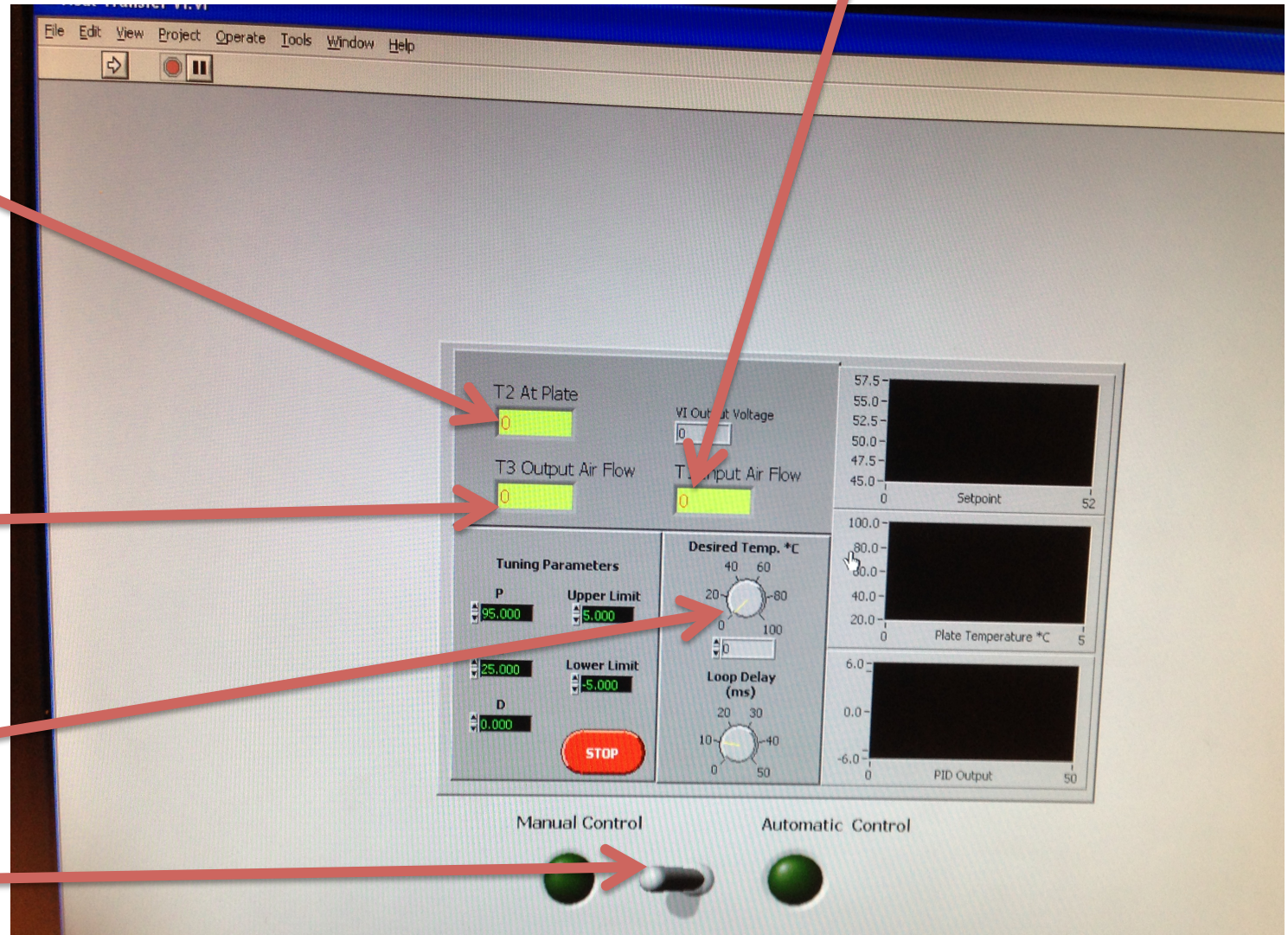Anemometer Display unit

LabView

TC1 – Measure pre plate / input Air temperature

TC2 – Plate surface temperature

TC3 – Measure post plate / output Air temperature

Temperature control knob
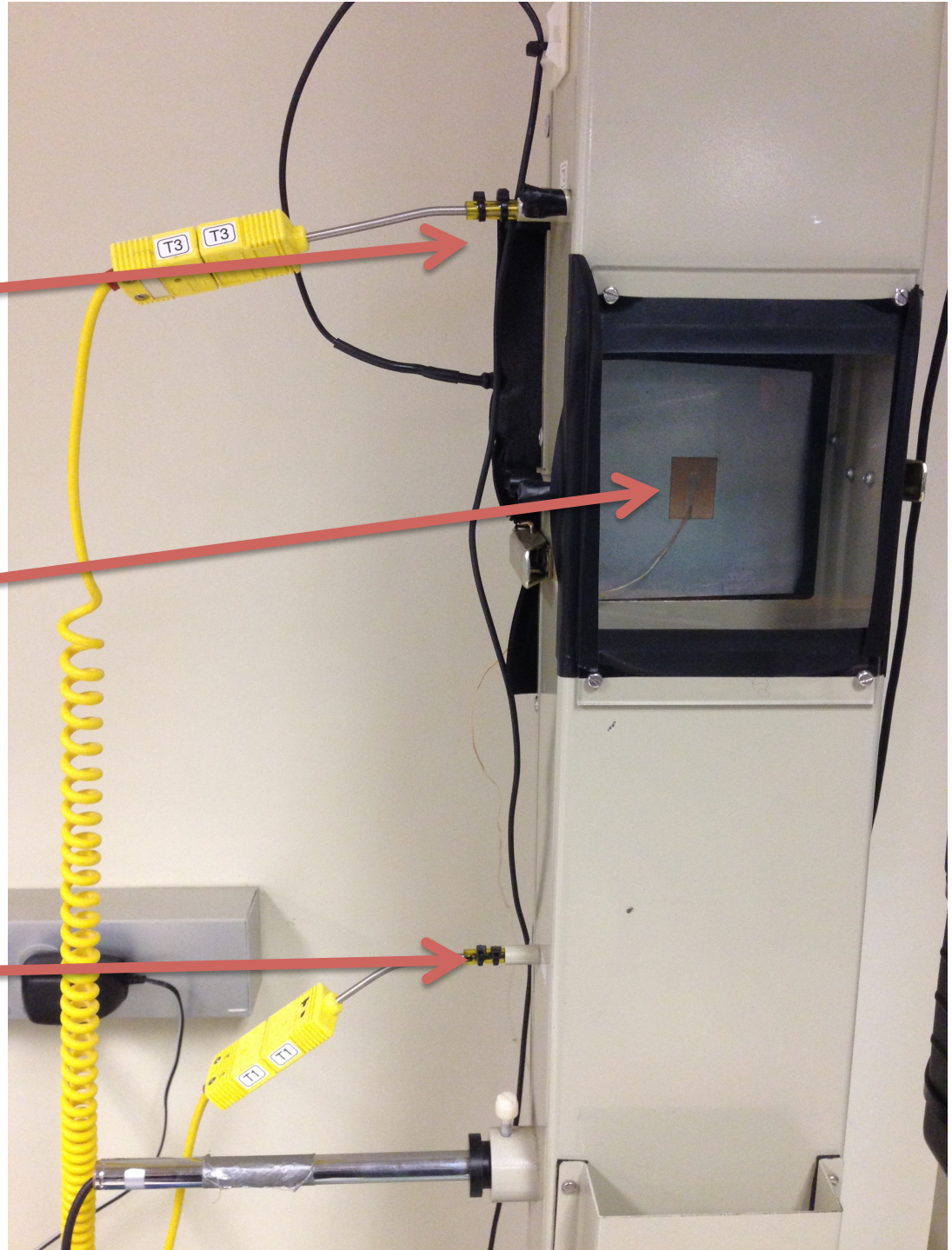
Manual / Auto control knob

Thermocouples

TC3 – Measure post plate / output Air temperature

TC2 – Plate surface temperature

TC1 – Measure pre plate / input Air temperature

Experimental Procedure – Week 1

- Calibration of Heater Power
  - Measure / Record displayed power vs actual power (P = V * I)
- Measurement of Velocity Profiles
  - Using Anemometer, measure air velocity at three different locations across the cross-section for 3 different center line velocities (0.6, 1.0, 2.0 m/s)

Experimental Procedure – Week 2: Flat Plate

- Use LabView Auto mode to ramp up plate temperature to within 1-2 °C of desired T, switch to manual and control power to reach desired temperature

- At each temperature, measure actual heater power & air temperatures

Exp #	1	2	3	4	5	6	7	8	9	10	11
Plate Temp (°C)	40	50	60	70	80	60	60	60	60	80	80
Flow speed (m/s)	0	0	0	0	0	0.5	1.0	1.5	2.0	1.0	2.0

Experimental Procedure – Week 3: Finned Plate

- Change flat plate to Finned plate, and follow same procedure from week 2.

- At each temperature, measure actual heater power & air temperatures

Exp #	1	2	3	4	5	6	7	8	9
Plate Temp (°C)	40	50	60	70	80	40	40	40	40
Flow speed (m/s)	0	0	0	0	0	0.5	1.0	1.5	2.0

Lab Logistics with respect to MAE 170

- No continuous TA / Lab manager supervision
- TA / Lab Manager will discuss at beginning of section, procedure to be performed by students
- When in doubt ask TA / Lab Manager
- If you finish recording data early, try to perform analysis in lab
- Results Analysis more important / time consuming than actual data recording