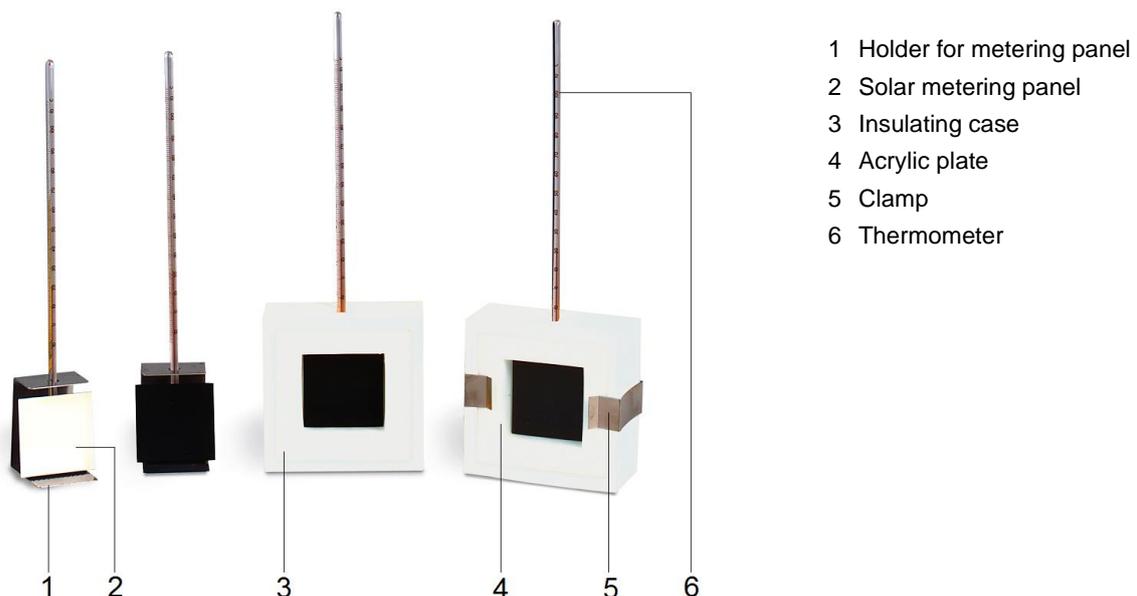


Set "Principles of the Solar Thermal Collector" 1000839

Instruction sheet

10/16 ALF



1. Safety instructions

The metering panels and halogen lights get hot during the experiments so that there is a risk of burns.

- Let the sample panels and halogen lights cool down when the experiment is finished.

The thermometers are sensitive instruments, made from glass. Caution, they are fragile!

- Do not expose to mechanical stress.

2. Description

The set "Principles of the Solar Thermal Collector" is an equipment set for experiments on utilization of solar energy.

The equipment set consists of four sample solar metering panels, with which it is possible to make four simultaneous measurements during an experiment lasting about 25 minutes. Comparing the four sets of measurements allows conclusions to be drawn about the change in

temperature and the maximum temperature that can be reached by the sample panels, which all differ in terms of surface coating, heat insulation and covering.

3. Contents / Technical data

4 Solar metering panels

Material:	Copper
Dimensions:	60 x 60 mm ²
Colour:	1 white, 3 black
Weight:	50 g approx.

2 Insulating cases

Material:	Foam
Dimensions:	120 x 120 x 50 mm ³

1 Acrylic plate:	100 x 100 mm ²
4 Thermometers:	-10° C – +100° C

2 Holders for metering panels

2 Clamps

1 Storage box

4. Experimental set-up

If the experiment cannot be conducted in direct sunlight, a 500 W halogen lamp has to be used as a substitute.

Recommended accessories:

1 Halogen lamp, 500 W @230 V, 50/60 Hz	1000894
or	
@115 V, 50/60 Hz	1000893
1 Tripod stand	1002835

- Position one black and one white sample panel in each of the holders and place the other two black panels in an insulating case. The smooth, coloured side should point towards the light source.
- Put the thermometer through the drill hole in the holder or the insulating case, respectively, and into the bottom hole at the rear of the metering panel.
- Mount the acrylic plate with the clamps to one of the insulating cases.
- Position the metering panels at the same distance and angle to the light source.



Fig. 1 Experimental set-up with halogen lamp

5. Experimental procedure

- Position the halogen lamp at a distance of approximately 30 to 40 cm from the metering panels.
- Read thermometer before the experiment, and take a note of the reading.
- Switch on lamp.
- Read the temperature every minute, enter it into a table and plot a graph of the results.

The various metering panels reach their maximum temperature within different periods of time.

The covered metering panel reaches its maximum temperature after approximately 25 min.

The experiment can be halted once the maximum temperature has been reached.

It can easily be seen (Fig. 2) that black surfaces lead to a much higher rate of temperature increase than white ones.

The thermal insulation of the insulating case prevents energy losses from the rear of the metering panel. Adding the acrylic plate improves utilisation of the radiant power, since the “greenhouse effect” prevents cooling of the meter panel by atmospheric convection and by long-wave heat dissipation from the front. This “greenhouse effect” even compensates for the losses due to absorption by the acrylic plate, which are reflected in the slightly shallower initial slope of the measured curve. The black metering panel, furnished with thermal insulation and a cover, has all the physical attributes of a solar collector panel for a hot water heater.

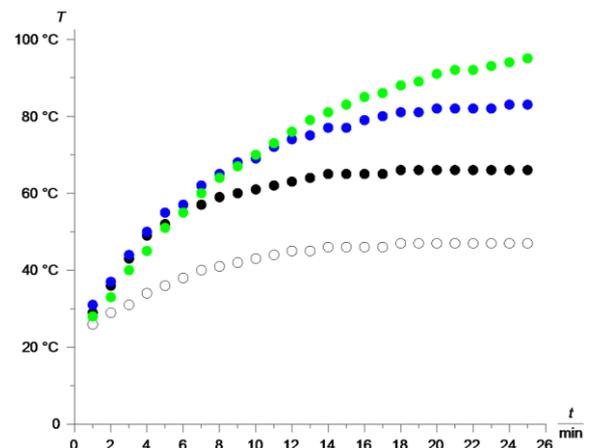


Fig. 2 Temperature increase in the solar meter panels White (○), black (●), black, insulated (●), black, insulated, with acrylic plate (●)