Solutions to Chapter 8

Exercise 8.1: Radiation Sensors

a) Secondary Standard; accuracy: ± 2 %

b) 1) Pyranometer with shade ball
2) Pyranometer with shade ring

c) No, the pyranometer is too slowly for this. Instead solar cells of photo diodes are used in this case.

Exercise 8.2: Peak Power Measurement at Site

See Figure 8.8

Exercise 8.3: Thermographic Measuring Technology

a) Bright thermography: Detection of bad cells, cabling errors
Dark thermography: Control of contact resistances, detection of inactive cells or cell parts

b) $P = \sigma \cdot \varepsilon_{\text{Correct}} \cdot T_{\text{Correct}}^4 = \sigma \cdot \varepsilon_{\text{Device\_adjusted}} \cdot T_{\text{Device\_shown}}^4 \Rightarrow \varepsilon_{\text{Correct}} \cdot T_{\text{Correct}}^4 = \varepsilon_{\text{Device\_adjusted}} \cdot T_{\text{Device\_shown}}^4$

$$\Rightarrow T_{\text{Correct}} = T_{\text{Device\_shown}}^4 \cdot \sqrt[4]{\frac{\varepsilon_{\text{Device\_adjusted}}}{\varepsilon_{\text{Correct}}}} = 314.74\ \text{K} \Rightarrow \vartheta_{\text{Correct}} = \underline{41.6\ °\text{C}}$$

Exercise 8.4: Electroluminescence Measuring Technology

a) Silicon emits light just above its bandgap wavelength of 1107 nm. As CCD sensors also consist of silicon this light is at the absorption limit and therefore only weakly detectable. Furthermore, in many CCD contain a filter against infrared radiation.

b) Micro cracks, screen printing errors, local shunts.