Cable sizing and over current protection

Array size:

10 12V, 51Watt modules

ISC = 3.25A

VOC = 20.7V

Batteries:

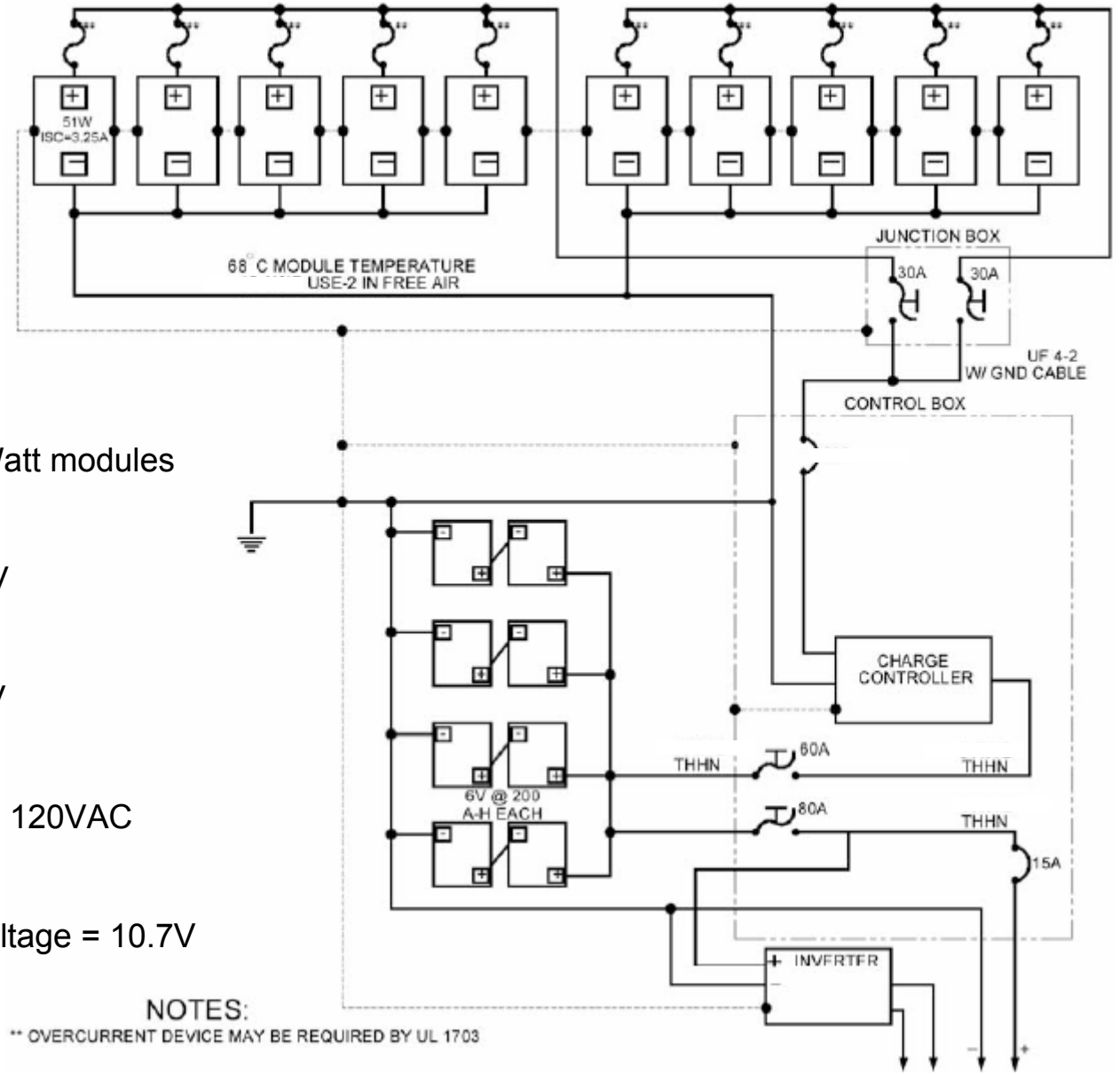
800 Ahr, 12V

Inverter:

500W rating, 120VAC

90% eff

Min input voltage = 10.7V



Cable sizing and over current protection

Homework answers:

- Size source circuit conductors for the two sub-arrays
  (USE-2 rated in free air, 68C ambient)

  10AWG: 55A * 0.58 = 31.9 A

- Size the combined circuit conductors from junction box
  (UF conductor directly buried, 40C ambient)

  3AWG : 85A * 0.82 = 69.7 A

- Size the inverter output conductor
  (THWN in conduit with 4 current carrying conductors, 40C ambient)

  14AWG: 20A * 0.88 * 0.8 = 9.85 A

- Size the battery to inverter to conductors
  (THHN in free air, 40C ambient temperature)

  8AWG: 80A * 0.91 = 72.8 A

ESS34 - Homework 3 Answers:

- Size source circuit conductors for the two sub-arrays
  (USE-2 rated in free air, 68C ambient)

  1. Continuous current = 3.25 A x 1.25 = 4.06A x 5 modules = 20.31 A

  2. Over current device rating = 20.31 A x 1.25 = 25.39 A Fuse 30 A

  3. Cable ampacity = 20.31 A x 1.25 = 25.39 14 AWG 35 A

  4. Derated ampacity = 35 A x .58 = 20.30 A
     20.30 < 20.31 No 12 AWG 40 A
     40 A x .58 = 23.20 A
     23.20 A > 20.31 A OK

  5. Ampacity vs over current rating? 23.2 A < 25.39 A No
     10 AWG 55 A

  6. Over current device compatibility? 10 AWG at 90 C = 55 A > 25.39 A OK

  7. Over current device adjustment required? No

  10AWG: 55A * 0.58 = 31.9 A

- Size the combined circuit conductors from junction box
  (UF conductor directly buried, 40C ambient)

  1. Continuous current = 30 A x 2 = 60 A x 1.25 = 75 A

  2. Over current device rating = 75 A x 1.25 = 93.75 A Fuse 100 A

  3. Cable ampacity = 75 A x 1.25 = 93.75 2 AWG 95 A

  4. Derated ampacity = 95 A x .82 = 77.9 A
     77.9 A > 75 A OK

  5. Ampacity vs over current rating? 77.9 A < 93.75 A No
     3 AWG 110A

  6. Over current device compatibility? Yes 110 A > 100 A

  7. Over current device adjustment required? No

  3AWG : 85A * 0.82 = 69.7 A

- Size the inverter output conductor
  (THWN in conduit with 4 current carrying conductors, 40C ambient)

  AC: Not DC Rules
  500 W / 120 VAC = 4.17 A x 1.25 = 5.21 A AWG 14 20 A

  14AWG: 20A * 0.88 * 0.8 = 9.85 A
  Conductor Temp Rating * # of conductors in conduit correction factor

- Size the battery to inverter to conductors
  (THHN in free air, 40C ambient temperature)

  500 W / Batt. 12 V x Inverter Eff. .90 = 46.3 A (Text Pg. 290)

  1. Continuous current = 46.3 A x 1.25 = 57.88 A

  2. Over current device rating = 57.88 A x 1.25 = 72.35 A Fuse 80 A

  3. Cable ampacity = 57.88 A x 1.25 = 72.35 A 8 AWG 80 A

  4. Derated ampacity = 80 A x .91 = 72.8 A
  72.8 > 57.88 OK

  5. Ampacity vs over current rating? 72.8 A > 72.35 A OK

  6. Over current device compatibility? 8 AWG at 90 C = 80 A > 57.88 A OK

  7. Over current device adjustment required? No

  8AWG: 80A * 0.91 = 72.8 A