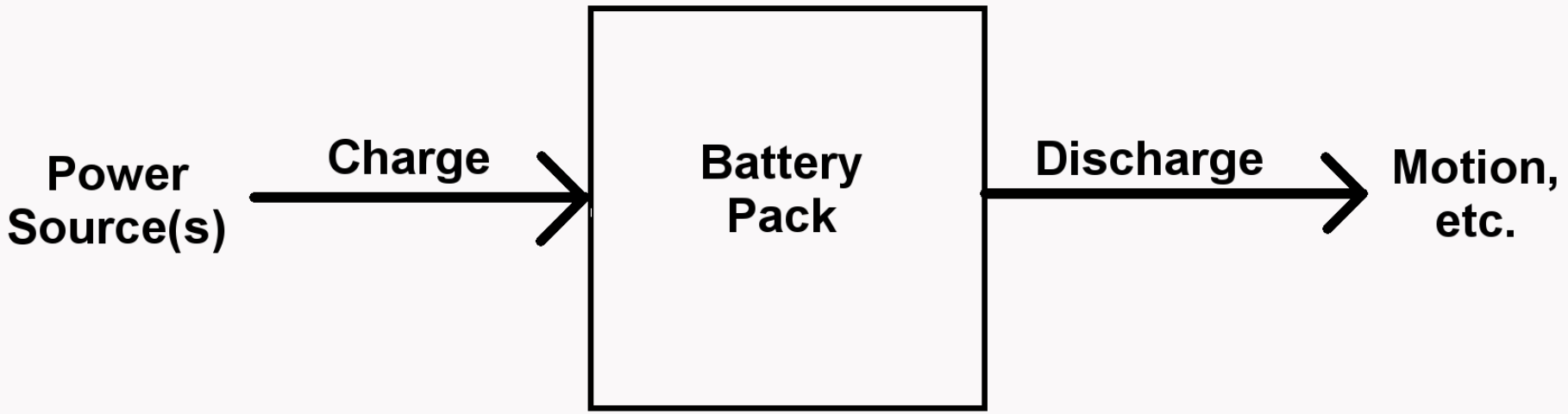
Dakota Charging System Plans

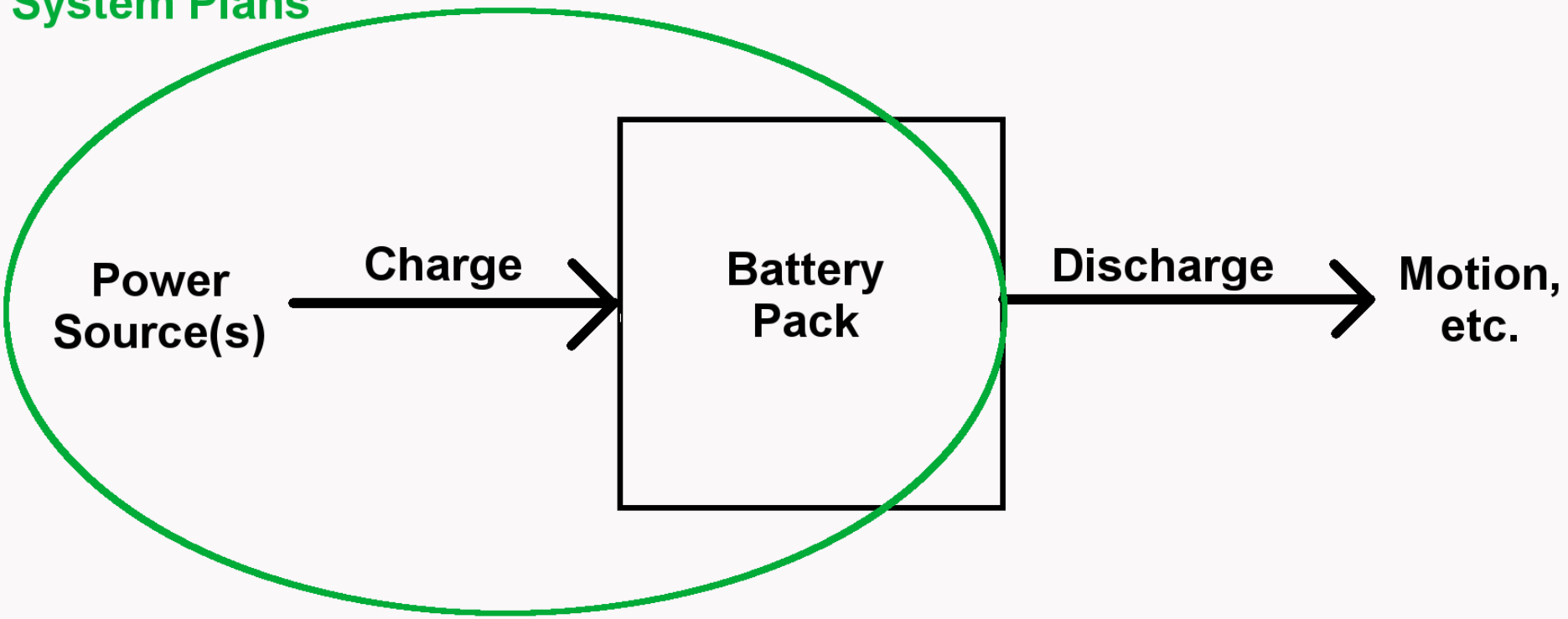
Ted Lowe – FVEAA Meeting - March 2015

Battery Electric Vehicles

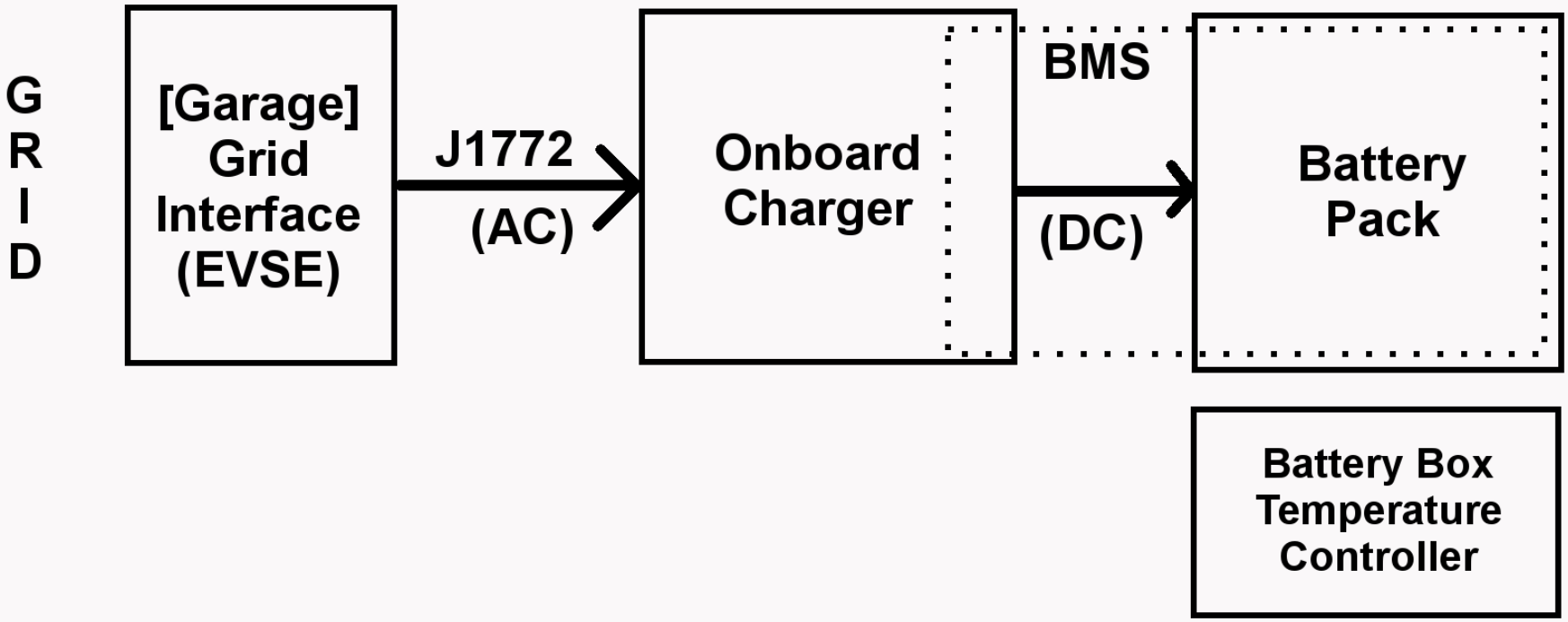


Battery Electric Vehicles

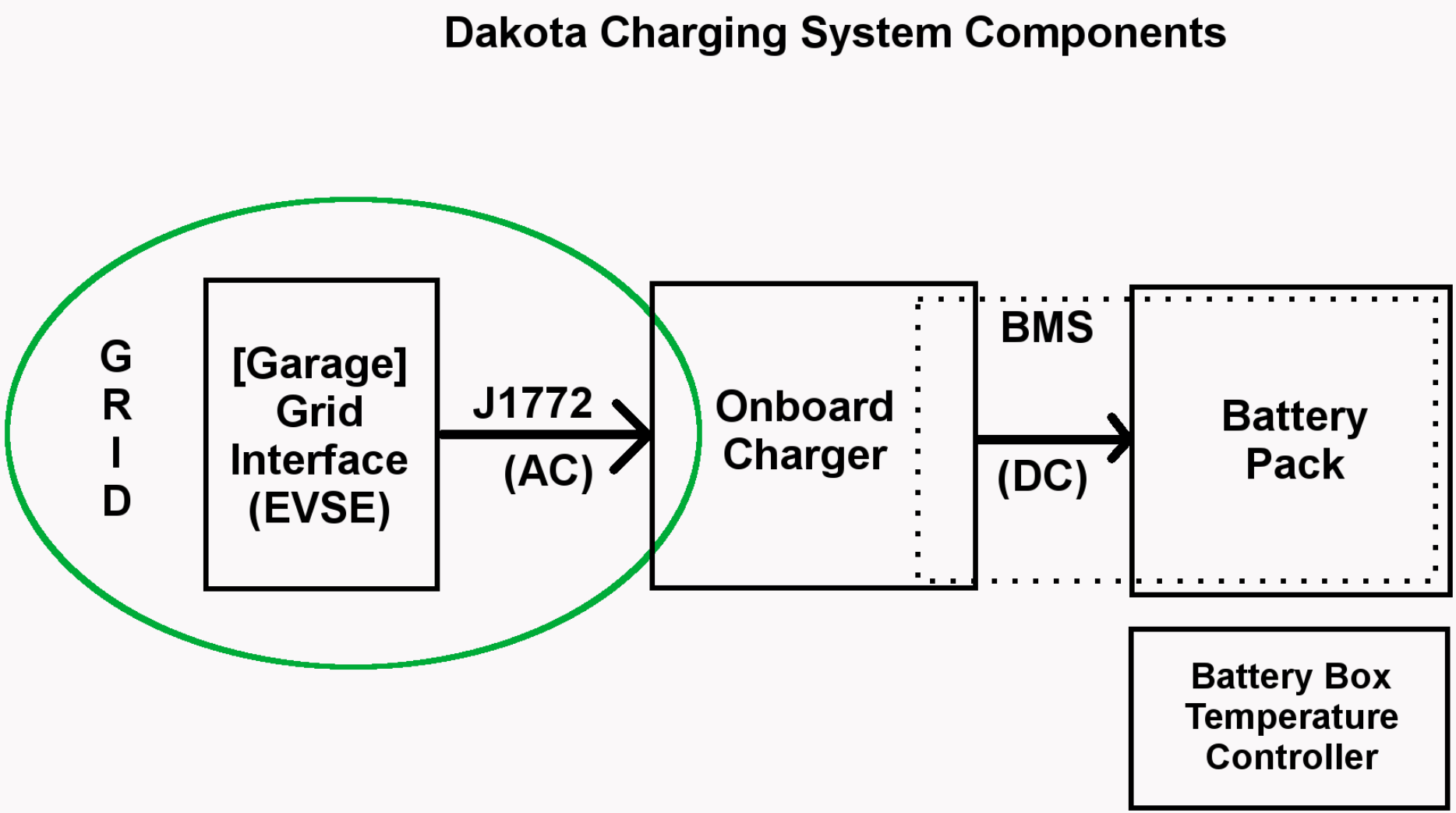
This Talk:
Dakota Charging
System Plans



Dakota Charging System Components



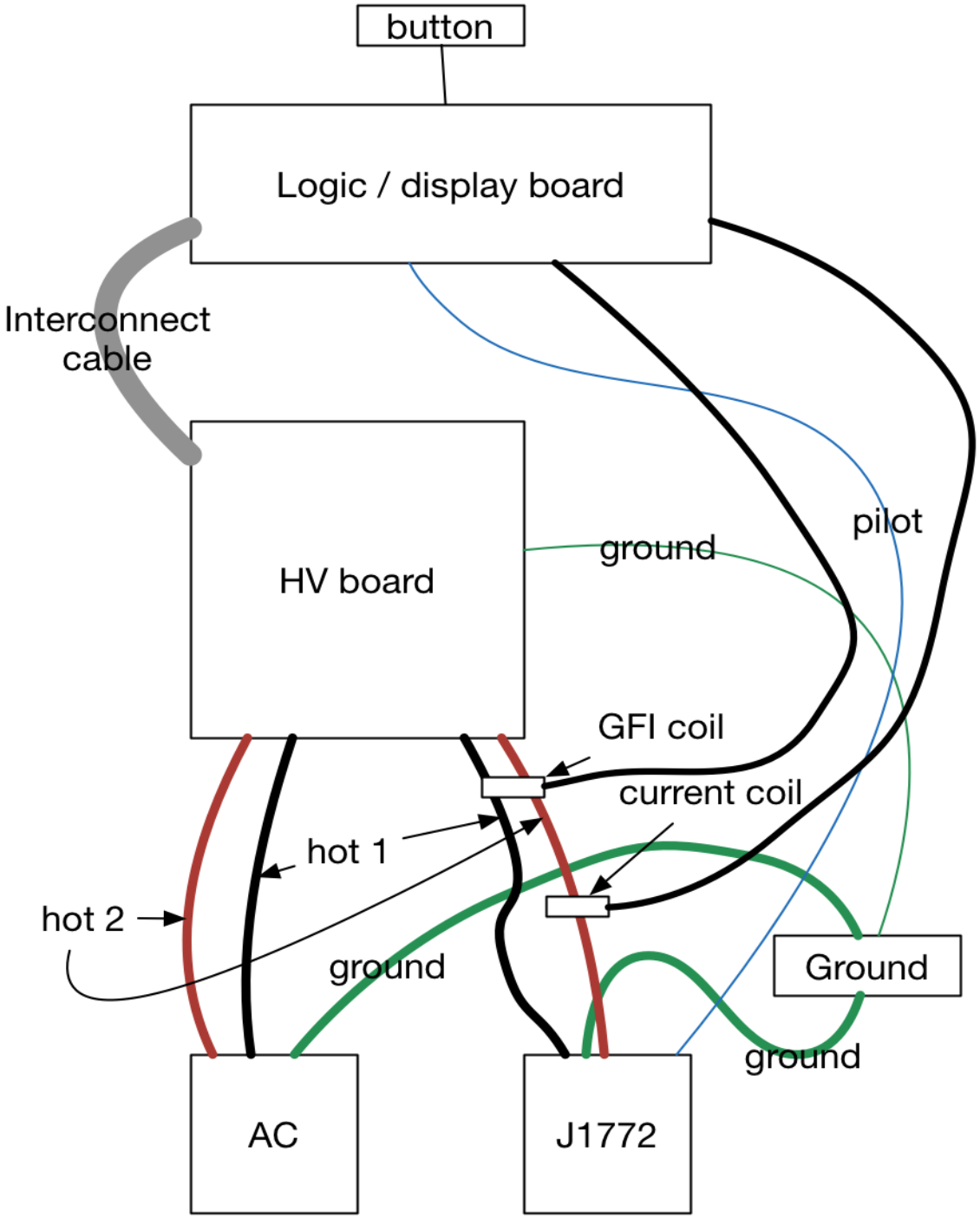
First Topic! EVSE

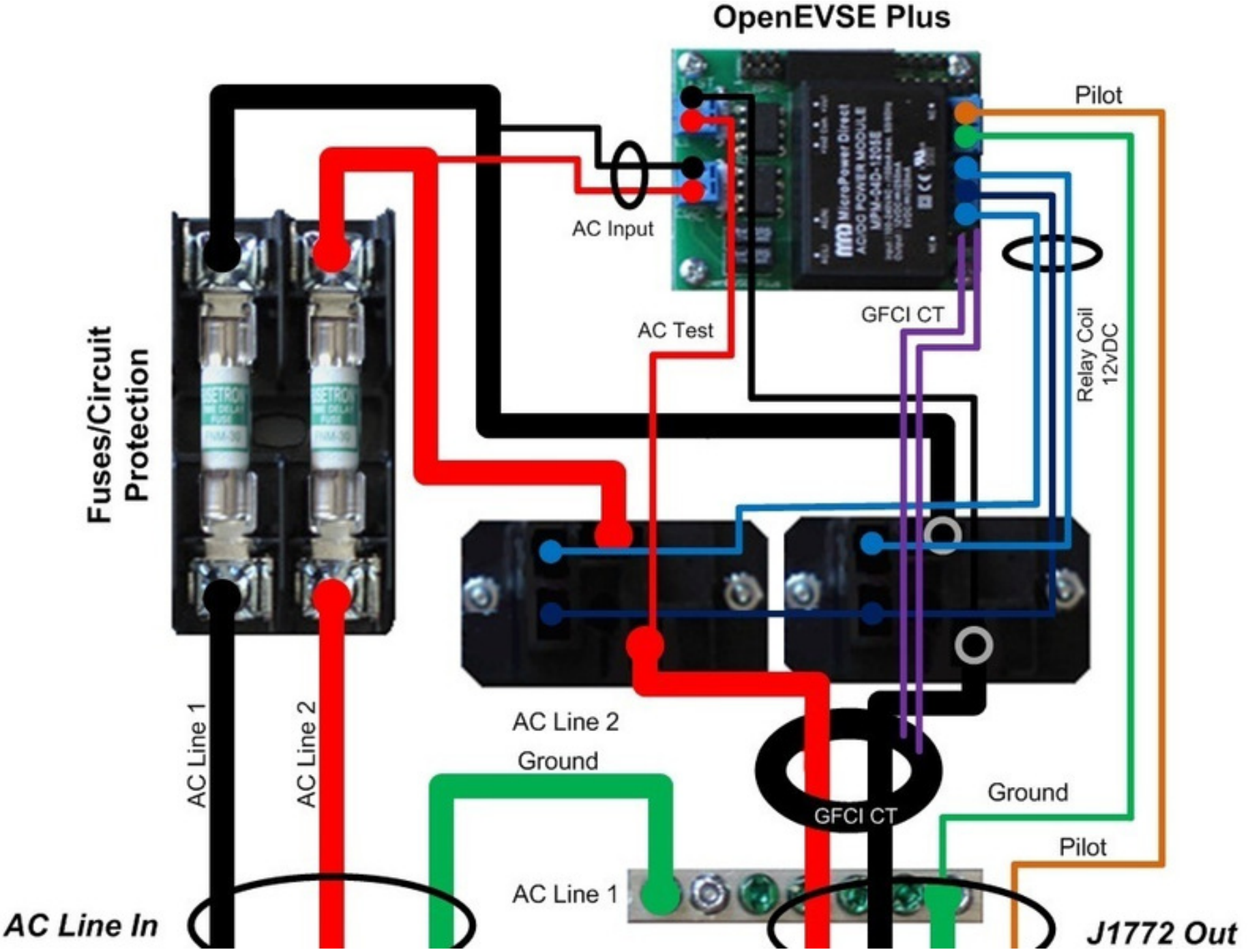


open-evse - $219

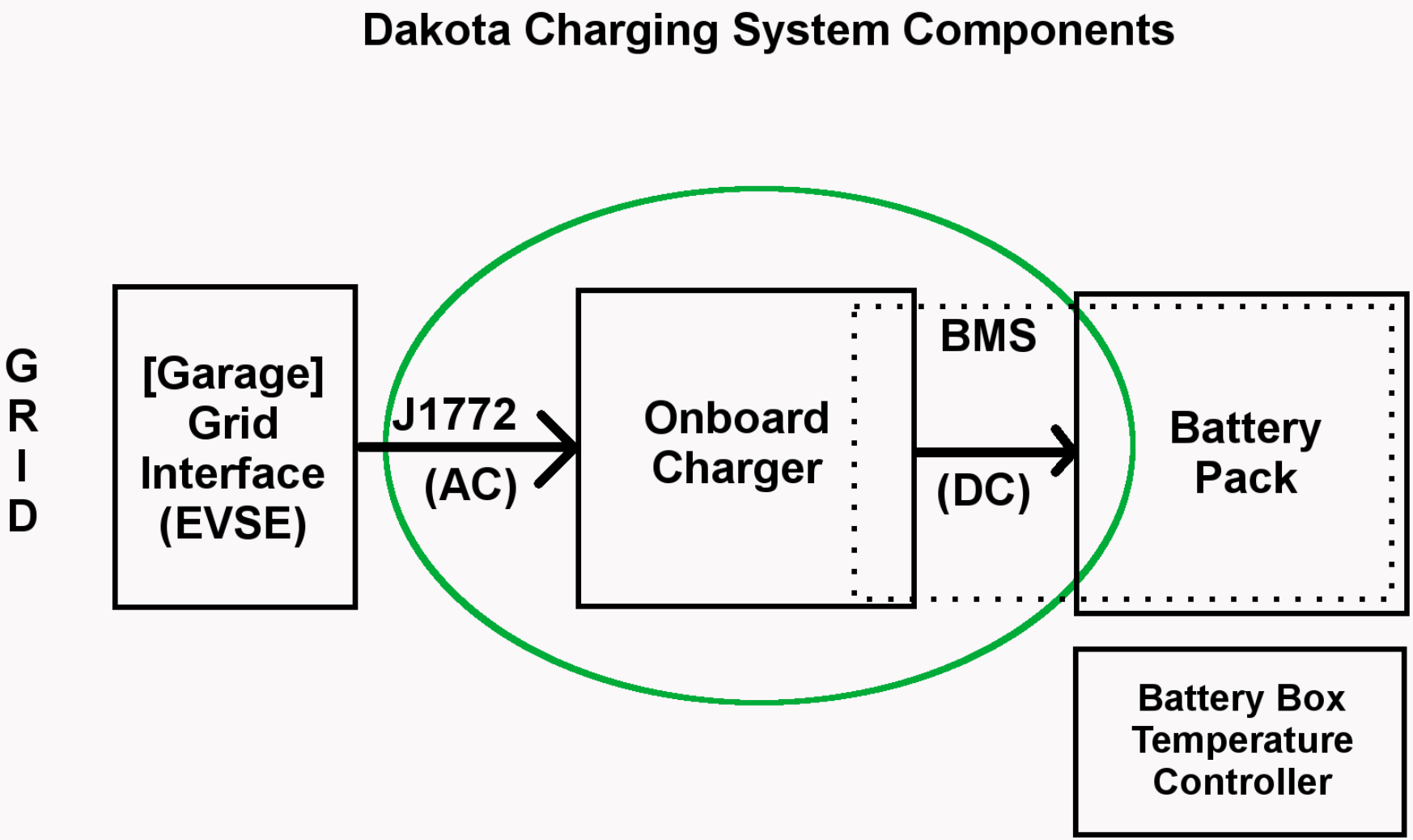
Open Source EVSE

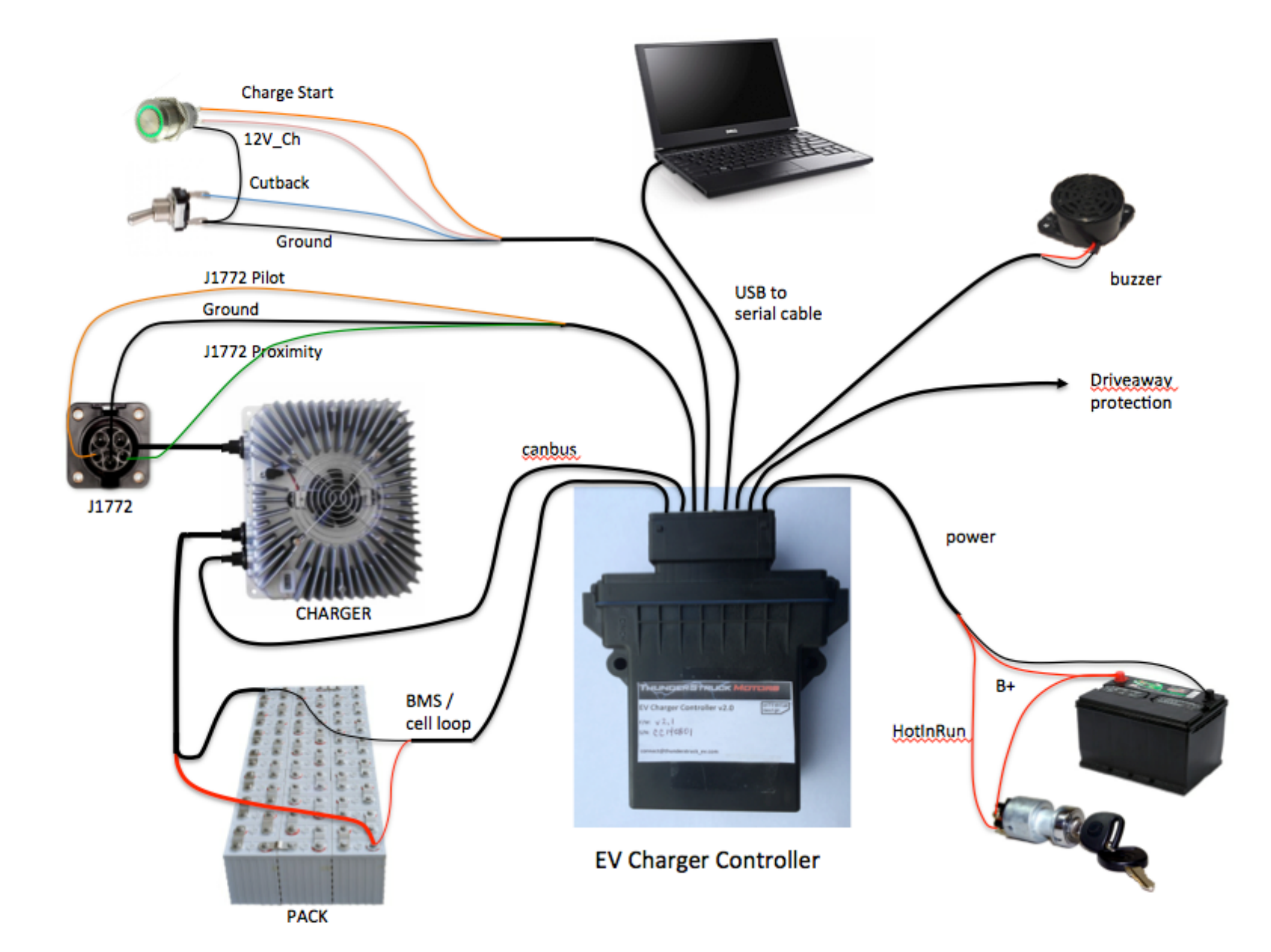
- open-evse: https://code.google.com/p/open-evse/
- Connects GRID to onboard charger via J1772
- MODIFIABLE! We get to extend it with new features!
- Arduino-based
- Garage use
- Cheaper than some other solutions


button
Logic / display board
Interconnect cable
HV board
pilot
ground
GFI coil
current coil
hot 1
hot 2
ground
Ground
ground
AC
J1772


OpenEVSE Plus
Pilot
AC Input
AC Test
GFCI CT
Relay Coil
12vDC
Fuses/Circuit
Protection
AC Line 1
AC Line 2
AC Line 2
Ground
GFCI CT
Ground
Pilot
AC Line 1
AC Line In
J1772 Out

Topic Change! Onboard Charger

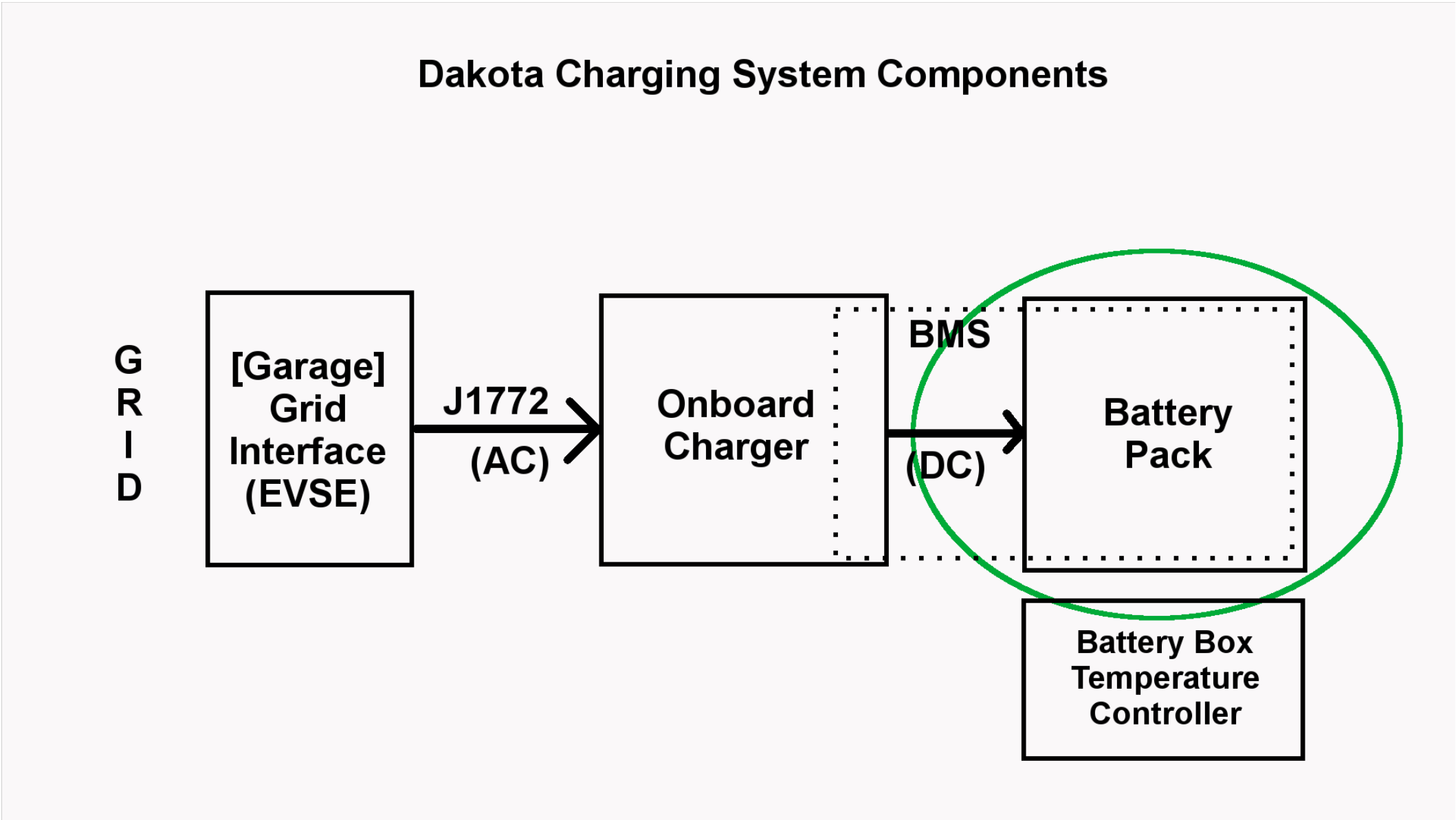



Charge Start
12V_Ch
Cutback
Ground
J1772 Pilot
Ground
J1772 Proximity
J1772
CHARGER
canbus
USB to
serial cable
buzzer
Driveaway
protection
power
B+
HotInRun
BMS /
cell loop
PACK
EV Charger Controller

ThunderStruck
PFC-II 2500 and Charge Controller

- J1772 Interface
- Dual Input Voltage: 120V and 240V AC
- User Programmable Voltage & Current
- CANBUS Interface
- BMS Master Interface (off/cutback/buzzer)
- Power stages can be paralleled for faster charging
- $750 for 2.5kW, $1275 for 5kW
- $300 EVCC only for use with CANBUS equipped Elcon chargers
- http://www.thunderstruck-ev.com/pfc-ii-2500-a

Topic Change! Battery Pack



45 * CALB CA 180AH Cells
45 * 3.2V = 144V system
144V * 180AH = 26kWH pack
26kWH@500WH/mi=52mile range

Lithium Battery Pack in Dodge Dakota EV - 45 LiFePo cells in series

2015-01-29

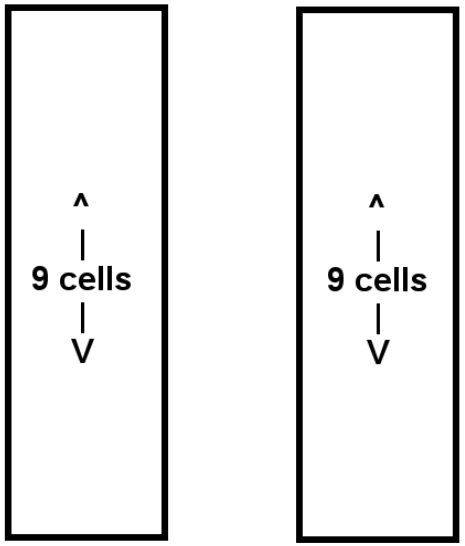
Charge cell maximum to: 3.65 v
Maximum pack voltage: 3.65 * 45 = 164.25v

Nominal cell operating voltage: 3.2v
Nominal pack voltage: 3.2 * 45 = 144v

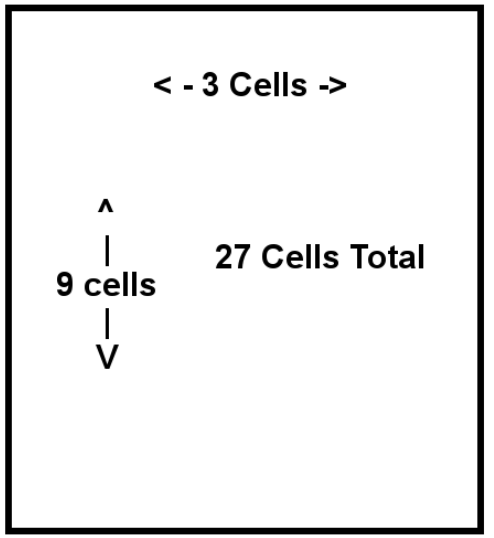
Discharge cell minimum to: 2.5v
Minimal pack voltage: 2.5 * 45 = 112.5v

Physical Cell Layout

Truck Front



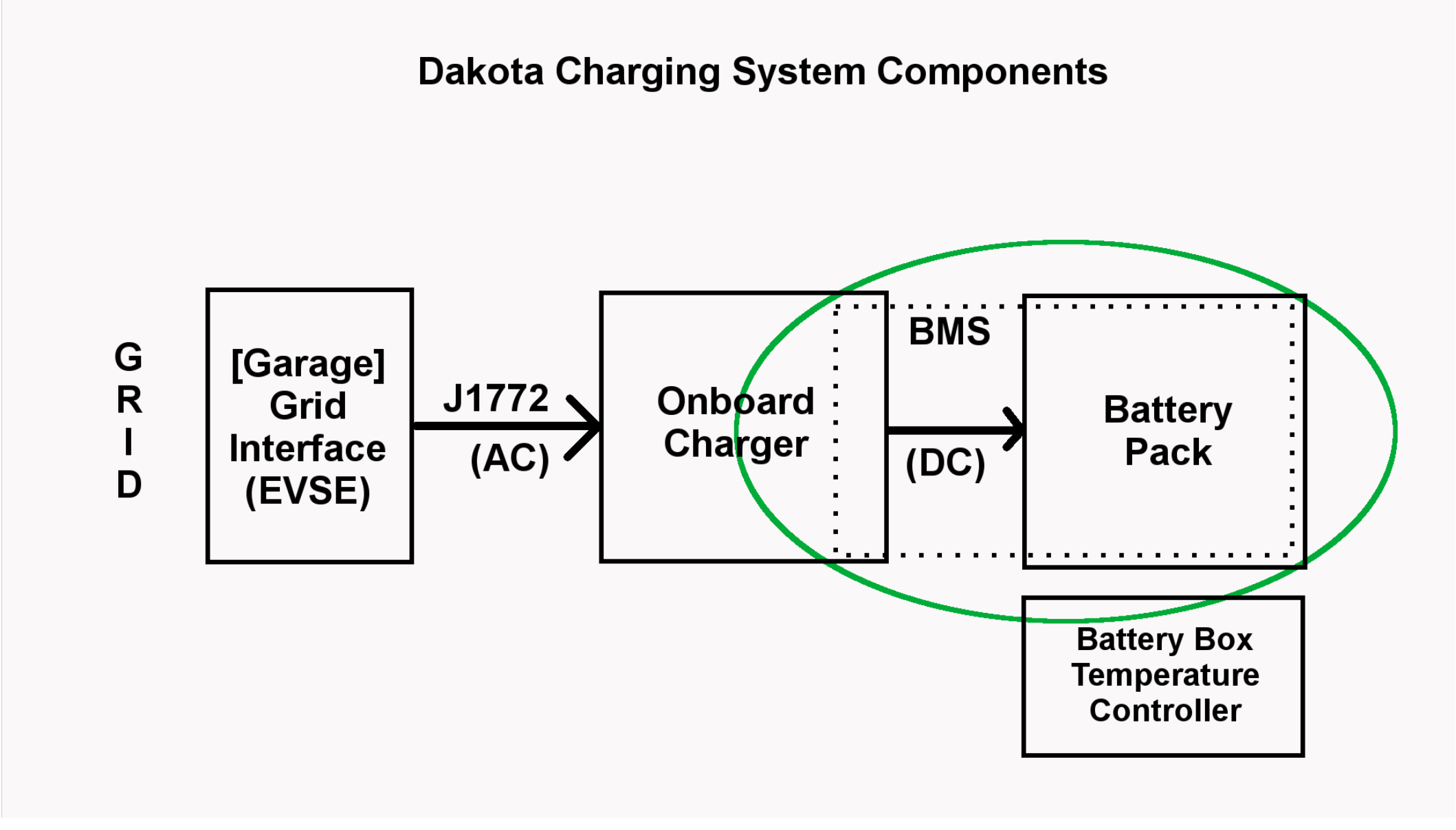
Battery boxes under hood



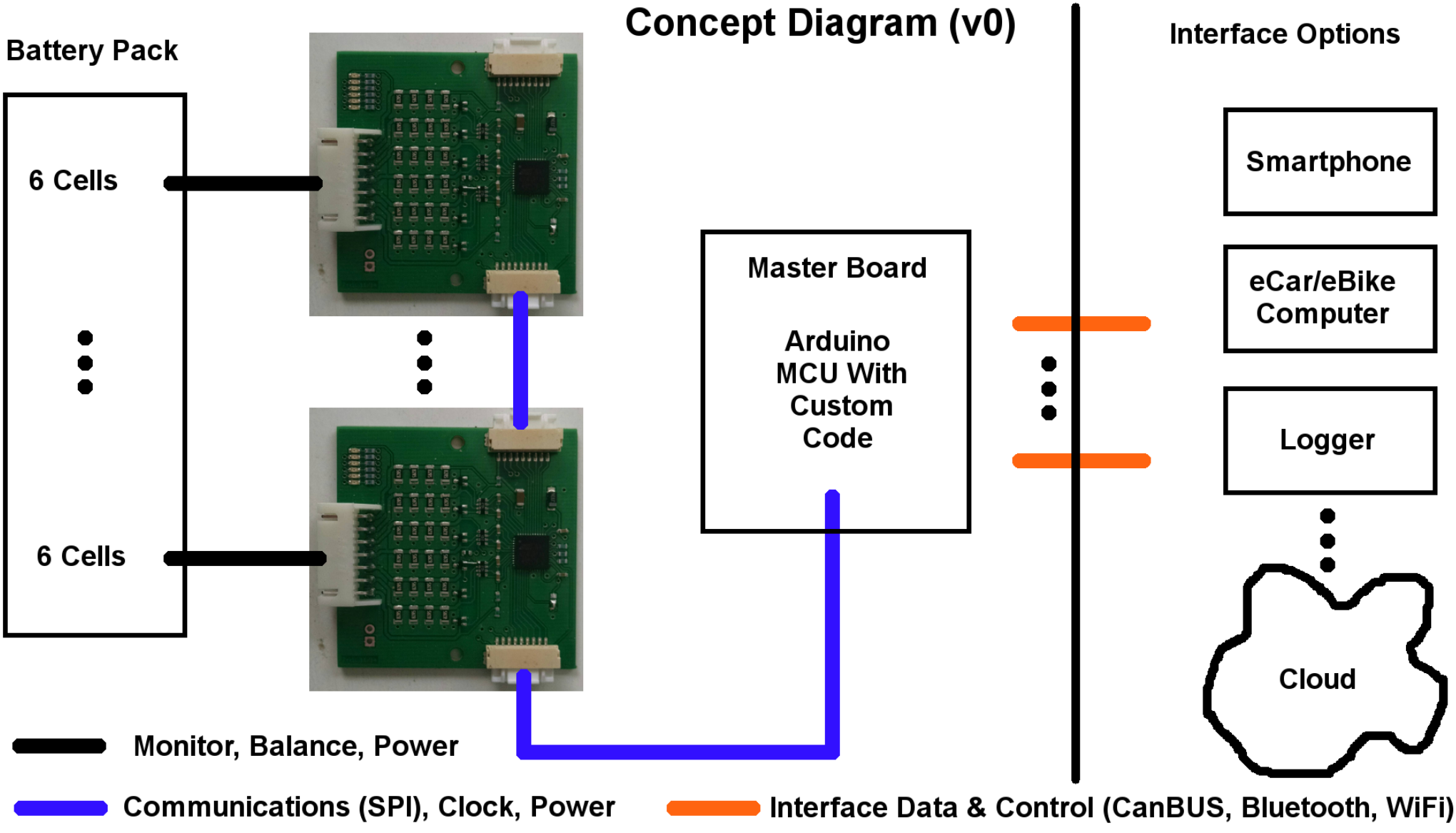
Battery box under truck bed

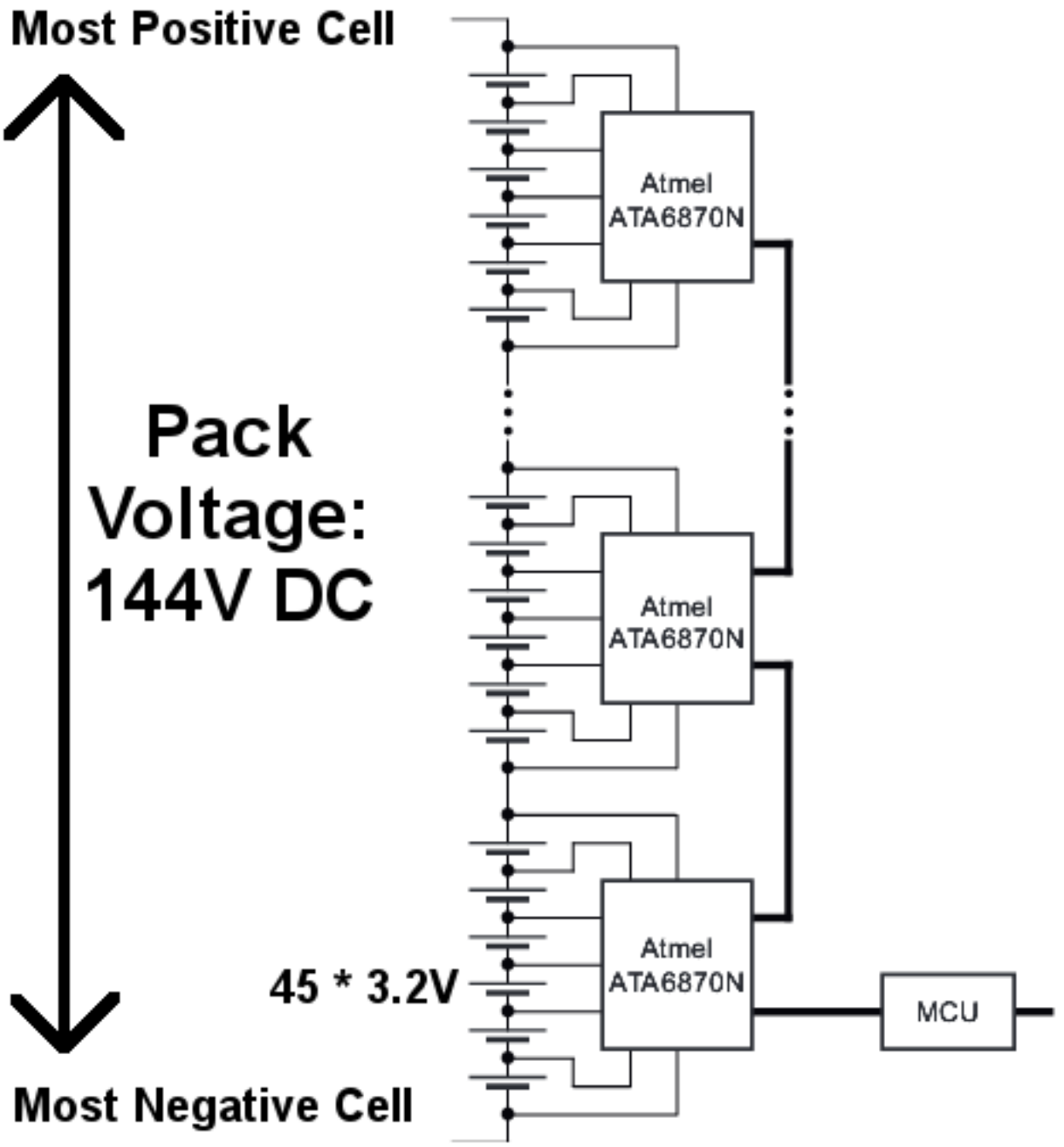
Truck Rear

Topic Change!
Battery Management System (BMS)

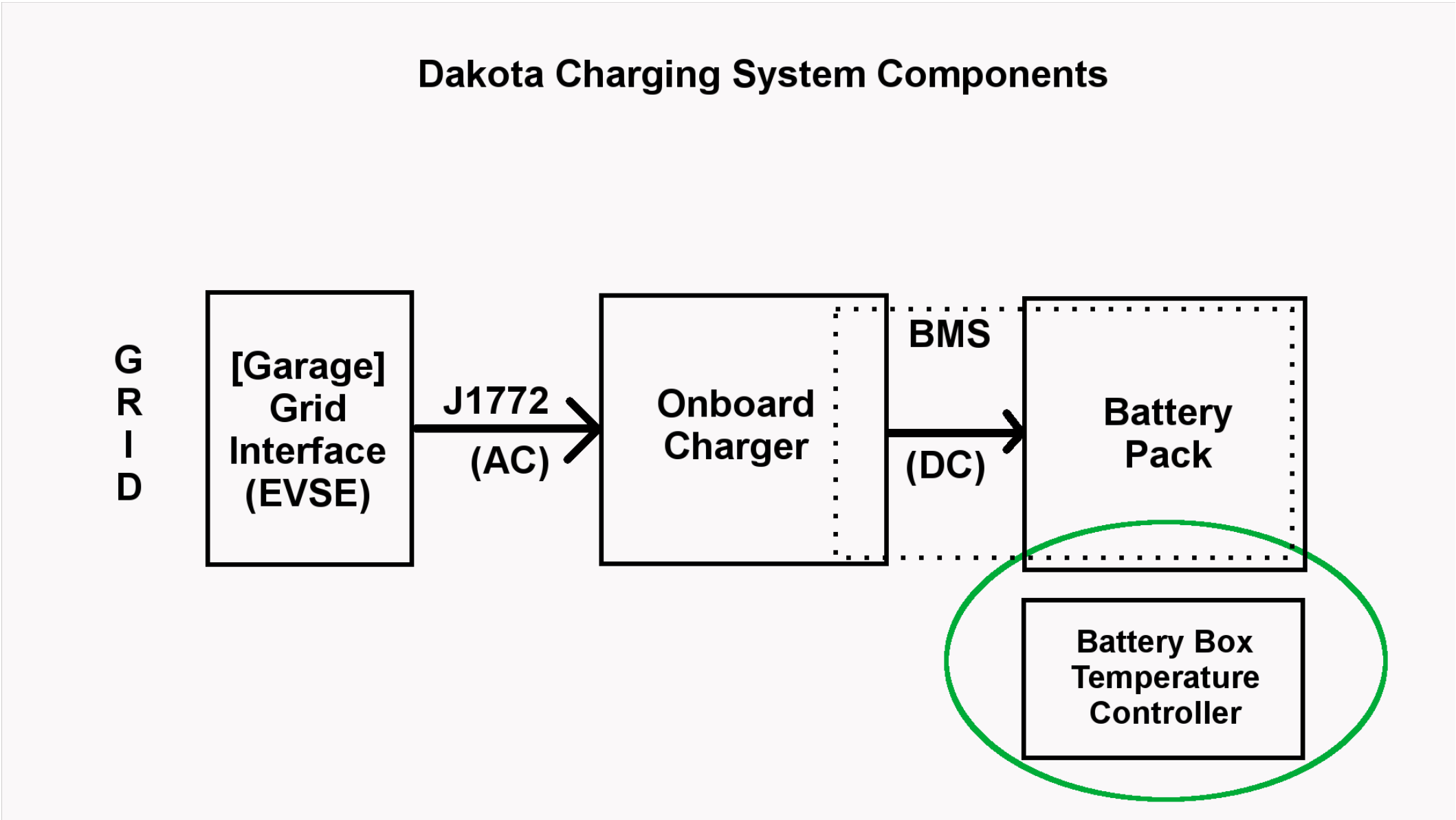


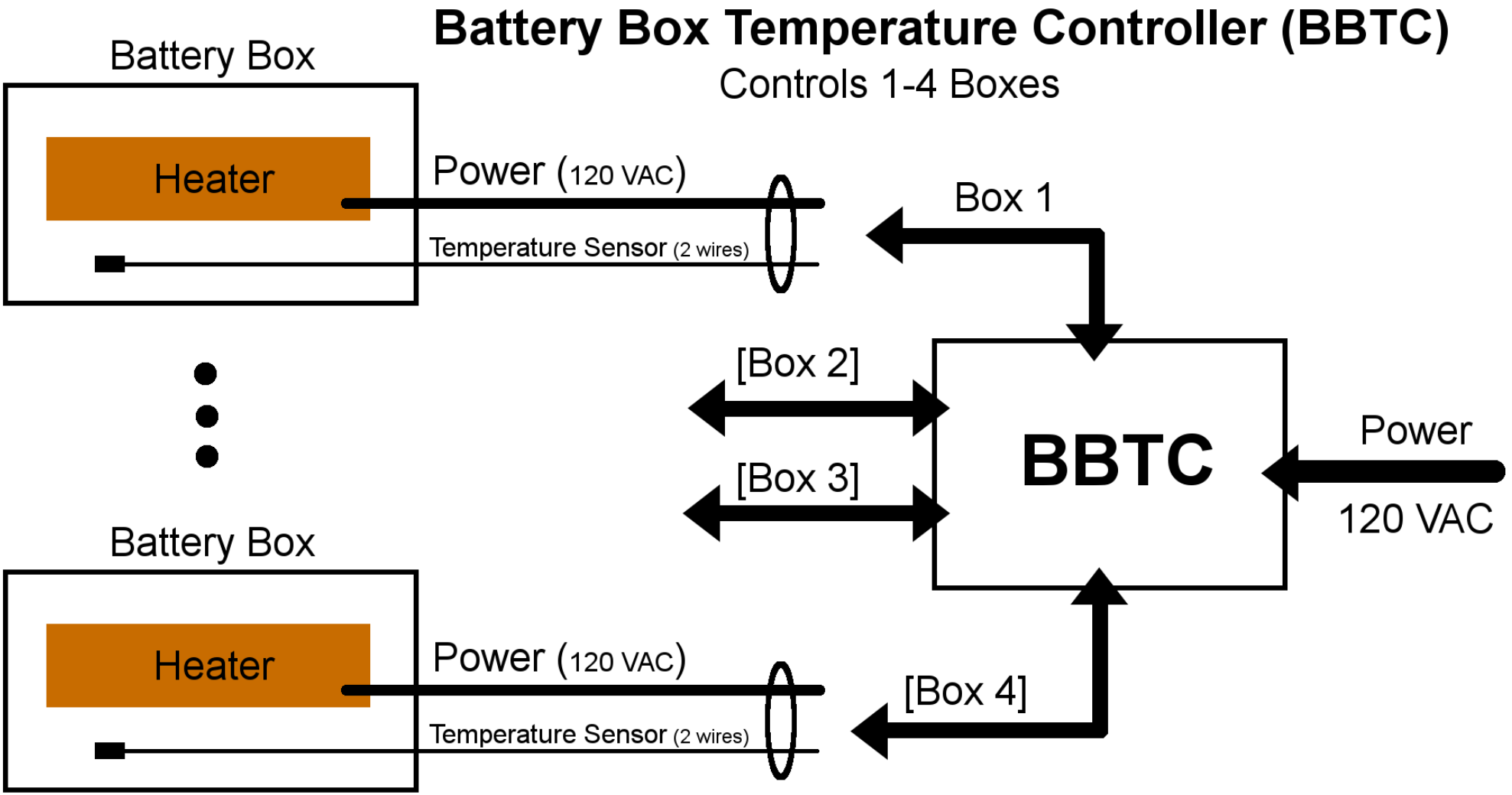
Concept Diagram (v0)




Most Positive Cell
Pack
Voltage:
144V DC
45 * 3.2V
Most Negative Cell
Atmel
ATA6870N
Atmel
ATA6870N
Atmel
ATA6870N
MCU

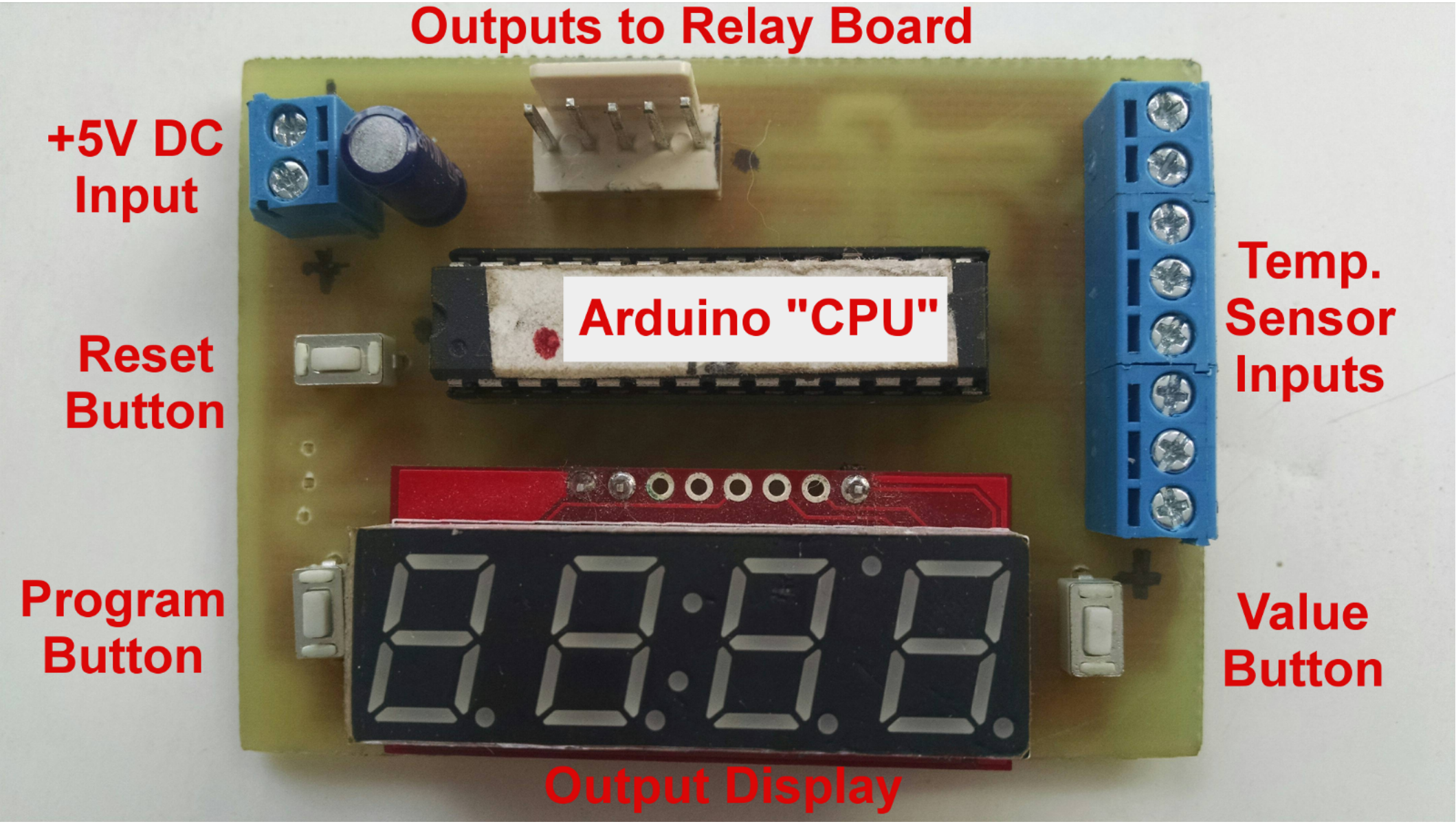
Topic Change!
BBTC




Battery Box Temperature Controller (BBTC)
Controls 1-4 Boxes
Battery Box
Heater
Power (120 VAC)
Temperature Sensor (2 wires)
Box 1
[Box 2]
[Box 3]
BBTC
Power
120 VAC
Battery Box
Heater
Power (120 VAC)
Temperature Sensor (2 wires)
[Box 4]

Battery Box Temperature Controller

- Batteries work best at 70 – 75 F (like humans)
- Without Winter heat, expect 50% range at best
- Can also be used to monitor battery heat in Summer (thanks Jeff Miller)
- Independently monitors and controls up to 4 battery boxes
- Arduino-based – customizable!
- Programmable settings
- Real time LED status display
- "Learns" number of attached temperature sensors
- Please stay tuned for videos soon...


Outputs to Relay Board
+5V DC Input
Reset Button
Program Button
Arduino "CPU"
Temp. Sensor Inputs
Value Button
Output Display

THANK YOU!

Questions?