HV Power Distribution

Main Battery

MainBatteryPack
Pack_HV+
Pack_HV−
add e-stops
Pack_HV+
rating?
F1
600A?
Pack_HV−
value?
how does this connect to amperes?
R1
????
−Shunt_3
+Shunt_2

HV+ Contactor
Drive_HV+ D2
S2
S1
D1 GND_HV+
L2
L1
HV+
+Sens_HV+
−Sens_HV+

HV− Contactor
Drive_HV− D2
D1 GND_HV−
HV−
+Shunt_1
−Shunt_4

Array Precharge Contactor
Drive_APCHG D2
D1 GND_APCHG
ArrayPreRes−
ArrayPreRes+
????
R2
+Sens_APCHG
−Sens_APCHG

Array Main Contactor
Drive_ARR D2
D1 GND_ARR
ARR_HV+
+Sens_ARR
−Sens_ARR

Motor Precharge Contactor
Drive_MPCHG D2
D1 GND_MPCHG
MotorPreRes−
MotorPreRes+
????
R3

Motor Main Contactor
Drive_MTR D2
D1 GND_MTR
MTR_HV+
motor fuse?
+Sens_MTR
−Sens_MTR

BPS

PeripheralSOM3
+12V_PCAN
+PCAN
−PCAN
GND_PCAN
PCAN_BPS
+Shunt
−Shunt
Amperes_Daughter_Shunt

LeaderSOM1
12V_Out1
GND_Out1
+12V
GND
+12V_CarCAN
+CarCAN
−CarCAN
GND_CarCAN
CarCAN
+12V_PCAN
+PCAN
−PCAN
GND_PCAN
PCAN_BPS

Strobe Light
this strobe is over CAN now?
+12V_Strobe
GND_Strobe
Array Precharge Contactor
HV+ Contactor
HV− Contactor
Array Contactor
VentFan1
VentFan2
Ventilation Fans
+Sens_APCHG
−Sens_APCHG
Drive_APCHG
GND_APCHG
+Sens_HV+
−Sens_HV+
Drive_HV+
GND_HV+
+Sens_HV−
−Sens_HV−
Drive_HV−
GND_HV−
+Sens_ARR
−Sens_ARR
Drive_ARR
GND_ARR

ActivePrechargeBoard_Array
ArrayPreRes+
ArrayPreRes−
Resistor+
Resistor−
ADC_SPI
ArrayPreSPI
ReadyC
ArrayPreReady
BPS_Daughter

8 VoltTemp boards — one per battery segment (?? modules, ?? cells).
PeripheralSOM1
+12V_PCAN
+PCAN
−PCAN
GND_PCAN
PCAN_BPS
Volt[1..5]
VoltageTaps
Temp[1..8]
TemperatureTaps
Volt1
Volt2
Volt3
Volt4
Volt5
Temp1
Temp2
Temp3
Temp4
Temp5
Temp6
Temp7
Temp8
VoltTemp_Daughter (8x)

LeaderSOM3
12V_Out3
GND_Out3
+12V
GND
+12V_CarCAN
+CarCAN
−CarCAN
GND_CarCAN
CarCAN
+12V_PCAN
+PCAN
−PCAN
GND_PCAN
PCAN_Motor
Motor Precharge Contactor
Motor Contactor
+Sens_MPCHG
−Sens_MPCHG
Drive_MPCHG
GND_MPCHG
+Sens_MTR
−Sens_MTR
Drive_MTR
GND_MTR
VehicleControlUnit

ActivePrechargeBoard_Motor
MotorPreReady
MotorPreSPI
Ready
ADC_SPI
Resistor+
Resistor−
MotorPreRes+
MotorPreRes−

Prohelion WaveSculptor 22 Motor Controller
MTR_HV+
HV−
DC+
DC−
+12V_ICAN
+ICAN
−ICAN
GND_ICAN
PCAN_Motor
PhaseA
PhaseB
PhaseC
A
B
C
Mitsuba M2096-III Motor

MotorControllerInterface
+12V_ICAN
+ICAN
−ICAN
GND_ICAN
PCAN_Motor
Fan1
Fan2

Cooling

PeripheralSOM9
+12V_PCAN
+PCAN
−PCAN
GND_PCAN
CarCAN
Pump
RadFan1
RadFan2
Radiator Fans
Flow1
Temp1
Temp2
Temp3
Pump_Control_Board

Driver Controls

LeaderSOM2
12V_Out2
GND_Out2
+12V
GND
+12V_CarCAN
+CarCAN
−CarCAN
GND_CarCAN
CarCAN
+12V_PCAN
+PCAN
−PCAN
GND_PCAN
PCAN_Controls
Controls_Daughter (Dashboard)
Determine what dashboard LEDs and buttons will be connected

PeripheralSOM7
+12V_PCAN
+PCAN
−PCAN
GND_PCAN
PCAN_Controls
Accel_Pot
Brake_Fluid
Brake_Pot
Pedal_Board

Backup_Camera
Left_Side_Camera
Right_Side_Camera
USBC
USB1
USB2
USB3
USB4
Driver_Display
Determine how many USB/whether using USB hub on canopy

Display_Screen
HDMI
12V_Out2
GND_Out2
+12V_PCAN
+PCAN
−PCAN
GND_PCAN
PCAN_Controls

Lighting

PeripheralSOM4
+12V_PCAN
+PCAN
−PCAN
GND_PCAN
PCAN_Controls
DFTLT_Headlight
DFTLT_Turn
DSDLT_Turn
SDRT_TurnD
FTRT_TurnD
FTRT_HeadlightD
Lighting_Daughter_Front

PeripheralSOM5
+12V_PCAN
+PCAN
−PCAN
GND_PCAN
PCAN_Controls
RRRLT_BRK_Turn
RRRT_BRK_TurnD
Lighting_Daughter_Back

PeripheralSOM8
+12V_PCAN
+PCAN
−PCAN
GND_PCAN
PCAN_Controls
BRK_Canopy
BPS_StrobeD
Lighting_Daughter_Canopy

Steering_Board
File: Steering_Board.kicad_sch

Telemetry

add dynamics + lingot (4x), environment (6x??), TPMS transceiver (4x), broker?

LeaderSOM4
12V_Out4
GND_Out4
+12V
GND
+12V_CarCAN
+CarCAN
−CarCAN
GND_CarCAN
CarCAN
+12V_PCAN
+PCAN
−PCAN
GND_PCAN
PCAN_Telemetry
GPS
LTE
RF
XBee_LTE
XBee_RF
Telemetry Daughter (Wireless Transceiver)

Array

add blackbody A/C (temp/irradiance sensors)

Each MPPT internally fused to 8A
do we need more inline fuses?

MPPT_A
MPPT_B
MPPT_C
+12V_CarCAN
+CarCAN
−CarCAN
GND_CarCAN
CarCAN
BATT+
BATT−
PV+
PV−
ARR_HV+
HV−
Rear_SubArray
FrontRight_SubArray
FrontLeft_SubArray

LV Power Distribution

PeripheralSOM10
+12V_PCAN
+PCAN
−PCAN
GND_PCAN
CarCAN
+12V_In
GND_In
+12V_OutBus
GND_OutBus
PowerDistributionBoard
12V_Out[1..12]
GND_Out[1..12]
12V_Out1
12V_Out2
12V_Out3
12V_Out4
12V_Out5
12V_Out6
12V_Out7
12V_Out8
12V_Out9
12V_Out10
12V_Out11
12V_Out12
GND_Out1
GND_Out2
GND_Out3
GND_Out4
GND_Out5
GND_Out6
GND_Out7
GND_Out8
GND_Out9
GND_Out10
GND_Out11
GND_Out12

PowerBoard
+12V_Supp
GND_Supp
+12V_Out
GND_Out
+12V_DCDC
GND_DCDC
PDU and PowerBoard may be combined — TBD

DC-DC_Converter
+12V_DCDC
GND_DCDC
HV+
HV−
rating?
Y2
3A?

Supp Enable switch on dashboard
Supp_Enable
SupplementalBattery
+12V_Supp
GND_Supp

PeripheralSOM11
+12V_PCAN
+PCAN
−PCAN
GND_PCAN
CarCAN
+12V_Supp
GND_Supp
SuppMonitoringBoard
add shunt?

TODO:
- Controls Daughter Board
- Steering board
- Battery boards (internal HV?)
- Telemetry sensors/reader
- Array (MPPTs, Blackbody sensors)
- Explain purpose of each CAN
- Diagram CAN loop topology

define what we mean by HV, HC,...

Wire Legend:
- Custom Bus Bar (cross-section?)
- High-Voltage High-Current (6 AWG)
- High-Voltage Low-Current (14 AWG)
- Low-Voltage High-Current (14 AWG)
- Low-Voltage Low-Current (20 AWG)
- Wireless

Notes

CAN Topology

The main CAN bus is CarCAN, which is utilized for system-wide communication (EX.,..). There are four peripheral CAN (PCAN) buses: BPS (Battery Protection System), Controls, Telemetry, and Motor (between VCU and motor controller).

CarCAN

PCAN_BPS
PCAN_Controls
PCAN_Telemetry

PCAN_Motor

Longhorn Racing Solar
Sheet: /
File: ElectricalSystem.kicad_sch
Title: 2026 High-Level Electrical Schematic
Size: User | Date: 2025-04-05 | Rev: Rev A
KiCad E.D.A. 9.0.0 | Id: 1/44

Resistor+

Resistor−

Ready

ADC_SPI

Sheet: /ActivePrechargeBoard_Array/
File: ActivePrechargeBoard.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.0		Id: 2/44

Resistor+

Resistor−

Ready

ADC_SPI

Sheet: /ActivePrechargeBoard_Motor/
File: ActivePrechargeBoard.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.0		Id: 3/44

+12V_PCAN

GND_PCAN

+PCAN

−PCAN

Sheet: /PeripheralSOM3/
File: PeripheralSOM.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.0		Id: 4/44

Sheet: /Amperes_Daughter_Shunt/		
File: Amperes_Daughter_Shunt.kicad_sch		
Title:		
Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.0		Id: 5/44

+12V_PCAN

GND_PCAN

+PCAN

−PCAN

USB1

USB2

USB3

USB4

HDMI

Sheet: /Driver_Display/
File: Driver_Display.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.0		Id: 6/44

Sheet: /Left_Side_Camera/
File: Backup_Camera.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.0		Id: 7/44

Sheet: /Controls_Daughter (Dashboard)/
File: Controls_Daugther.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.0		Id: 8/44

+Sens_APCHG

Drive_APCHG

−Sens_APCHG

GND_APCHG

+Sens_HV+

Drive_HV+

−Sens_HV+

GND_HV+

+Sens_HV−

Drive_HV−

−Sens_HV−

GND_HV−

+12V_Strobe

GND_Strobe

+Sens_ARR

Drive_ARR

−Sens_ARR

GND_ARR

Fan1

Fan2

ArrayPreSPI

ArrayPreReady

Sheet: /BPS_Daughter/
File: BPS_Daughter.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.0		Id: 9/44

+12V_PCAN

GND_PCAN

+PCAN

−PCAN

Sheet: /PeripheralSOM1/
File: PeripheralSOM.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.0		Id: 10/44

VoltageTaps

TemperatureTaps

Sheet: /VoltTemp_Daughter (8x)/
File: VoltTemp_Daughter.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.0		Id: 11/44

+12V

GND

+12V_CarCAN

GND_CarCAN

+CarCAN

−CarCAN

+12V_PCAN

GND_PCAN

+PCAN

−PCAN

Sheet: /LeaderSOM2/
File: LeaderSOM.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.0		Id: 12/44

FTLT_Turn

FTRT_Turn

FTLT_Headlight

FTRT_Headlight

SDLT_Turn

SDRT_Turn

Sheet: /Lighting_Daughter_Front/
File: Lighting_Daughter_Front.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.0		Id: 13/44

+12V_PCAN

GND_PCAN

+PCAN

−PCAN

Sheet: /PeripheralSOM4/
File: PeripheralSOM.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.0		Id: 14/44

RRLT_BRK_Turn

RRRT_BRK_Turn

Sheet: /Lighting_Daughter_Back/
File: Lighting_Daughter_Back.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.0		Id: 15/44

+12V_PCAN

GND_PCAN

+PCAN

−PCAN

Sheet: /PeripheralSOM5/
File: PeripheralSOM.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.0		Id: 17/44

+Sens_MTR

Drive_MTR

−Sens_MTR

GND_MTR

+Sens_MPCHG

Drive_MPCHG

−Sens_MPCHG

GND_MPCHG

MotorPreSPI

MotorPreReady

Sheet: /VehicleControlUnit/
File: VehicleControlUnit.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.0		Id: 18/44

+12V

GND

+12V_CarCAN

GND_CarCAN

+CarCAN

−CarCAN

+12V_PCAN

GND_PCAN

+PCAN

−PCAN

Sheet: /LeaderSOM3/
File: LeaderSOM.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.0		Id: 19/44

Accel_Pot

Brake_Pot

Brake_Fluid

Sheet: /Pedal_Board/
File: Pedal_Board.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.0		Id: 20/44

+12V_PCAN

GND_PCAN

+PCAN

−PCAN

Sheet: /PeripheralSOM7/
File: PeripheralSOM.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.0		Id: 21/44

HV+

HV−

Temp_+5V[0..61]

Temp_Sense[0..61]

Temp_GND[0..61]

Volt_RowA[0..7]

Volt_RowA_GND

Volt_RowB[0..7]

Volt_RowB_GND

Volt_RowC[0..7]

Volt_RowC_GND

Volt_RowD[0..6]

Volt_RowD_GND

Sheet: /MainBatteryPack/
File: PrimaryBatteryPack.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.0		Id: 22/44

HV+

HV−

+12V_DCDC

GND_DCDC

Sheet: /DC−DC−Converter/
File: DC−DC−Converter.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.0		Id: 23/44

Sheet: /SupplementalBattery/
File: SupplementalBattery.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.0		Id: 24/44

+12V_LV

GND_LV

+12V_DCDC

GND_DCDC

+12V_Supp

GND_Supp

Sheet: /PowerBoard/
File: PowerBoard.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.0		Id: 25/44

+12V_In

+12V_OutBus

GND_In

GND_OutBus

Sheet: /PowerDistributionBoard/
File: PowerDistributionBoard.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.0		Id: 26/44

+12V_ICAN

+ICAN

−ICAN

GND_ICAN

DC+

DC−

PhaseA

PhaseB

PhaseC

Sheet: /Prohelion WaveSculptor 22 Motor Controller/
File: MotorController.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.0		Id: 27/44

+12V_Supp

GND_Supp

Sheet: /SuppMonitoringBoard/
File: SuppMonitoringBoard.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.0		Id: 27/44

+12V

GND

+12V_CarCAN

GND_CarCAN

+CarCAN

−CarCAN

+12V_PCAN

GND_PCAN

+PCAN

−PCAN

Sheet: /LeaderSOM1/
File: LeaderSOM.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.0		Id: 28/44

Sheet: /Backup_Camera/
File: Backup_Camera.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.0		Id: 29/44

Sheet: /Right_Side_Camera/
File: Backup_Camera.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.0		Id: 30/44

BRK_Canopy

BPS_Strobe

Sheet: /Lighting_Daughter_Canopy/
File: Lighting_Daughter_Canopy.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.0		Id: 31/44

HDMI

+12V

GND

Sheet: /Display_Screen/
File: Display_Screen.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.0		Id: 32/44

+12V_PCAN

GND_PCAN

+PCAN

−PCAN

Sheet: /PeripheralSOM8/
File: PeripheralSOM.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.0		Id: 33/44

Pump
Fan1
Fan2
Temp1
Temp2
Temp3
Flow1

Sheet: /Pump_Control_Board/
File: Pump_Control_Board.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.0		Id: 34/44

+12V_PCAN

GND_PCAN

+PCAN

−PCAN

Sheet: /PeripheralSOM9/
File: PeripheralSOM.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.0		Id: 35/44

+12V_PCAN

GND_PCAN

+PCAN

−PCAN

Sheet: /PeripheralSOM10/
File: PeripheralSOM.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.0		Id: 36/44

+12V_ICAN

+ICAN

−ICAN

GND_ICAN

Fan1

Fan2

Sheet: /MotorControllerInterface/
File: MotorControllerInterface.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.0		Id: 37/44

+12V_PCAN

GND_PCAN

+PCAN

−PCAN

Sheet: /PeripheralSOM11/
File: PeripheralSOM.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.0		Id: 37/44

Sheet: /Steering_Board/	
File: Steering_Board.kicad_sch	
Title:	
Size: A4	Date:
KiCad E.D.A. 9.0.0	Id: 38/44

Rev:

+12V_CarCAN

GND_CarCAN

+CarCAN

−CarCAN

PV+

PV−

BATT+

BATT−

Sheet: /MPPT_B/
File: MPPT.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.0		Id: 39/44

+12V_CarCAN

GND_CarCAN

+CarCAN

−CarCAN

PV+

PV−

BATT+

BATT−

Sheet: /MPPT_C/
File: MPPT.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.0		Id: 40/44

+12V_CarCAN

GND_CarCAN

+CarCAN

−CarCAN

PV+

PV−

BATT+

BATT−

Sheet: /MPPT_A/
File: MPPT.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.0		Id: 41/44

◇XBee_LTE

◇XBee_RF

◁GPS

Sheet: /Telemetry Daughter (Wireless Transceiver)/
File: Telemetry_Daughter.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.0		Id: 42/44

+12V

GND

+12V_CarCAN

GND_CarCAN

+CarCAN

−CarCAN

+12V_PCAN

GND_PCAN

+PCAN

−PCAN

Sheet: /LeaderSOM4/
File: LeaderSOM.kicad_sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. 9.0.0		Id: 43/44