Electrodacus SMBS0 I/O Summary

This is a collection of information about the I/O pins and other information about the SBMS0. This information comes from a combination of the SBMS0 manual, Forum Member Inputs and emails with Dacian. (Dacian is aware of this paper but it is not an official document from Dacian)

This document should be used as a supplement to the SMBS0 Manual found here: https://electrodacus.com/SBMS0/SBMS0v03d.pdf **If there are discrepancies between this document and the manual, use the information in the manual.**

NOTE: As I learn more, I will be updating this paper.

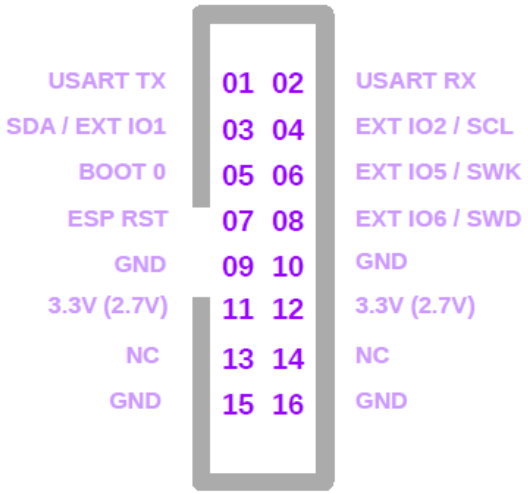
ElectroDacus SBMS0 16 Pin Green Connector

#	Name	Function	Settings	Comments
1	PVn	Solar array shunt[1,5]	PV Shunt Resistance[1]	The shunt(s) must be directly connected to the + on the battery bank. **Do not put a fuse between the battery bank and the shunt(s).** (It can damage the SBMS voltage detectors if the fuse blows.)
2	PVp			
3	ADC1n	Main Battery Shunt[1,4]	Battery Shunt Resistance[1]	
4	ADC1p			
5	ADC2	Voltage Sensor[2] (0-60V)		Voltage is displayed on screen 1 monitoring and recorded in logs[2]
6	ADC3	Voltage Sensor[2] (0-60V)		Voltage is displayed on screen 1 monitoring and recorded in logs[2]
7	EXTIO6-	Load or Charge Control	Type 1, through Type 6	Can be used to control additional Loads or Chargers
8	EXTIO6+			
9	EXTIO5-	Load or Charge Control	Type 1, through Type 6	Can be used to control additional Loads or Chargers
10	EXTIO5+			
11	EXTIO4-	Load or Charge Control	Type 1, through Type 6 (Factory default = Type 1)	Recommended to leave as Charge Control (Type 1)
12	EXTIO4+			
13	EXTIO3-	Load or Charge Control	Type 1, through Type 6 (Factory default = Type 2)	Recommended to leave as Load Control (Type 2)
14	EXTIO3+			
15	XT1-	Battery Temp Sensor	Temp Control Parameters	
16	Xt1+			

Note 1:	The shunt should be sized at ~1.6 to 2 times the max expected current. SBMS0 supports any shunt between 0.0400mOhm and 9.9999mOhm. The Shunt resistance can be calculated from Voltage/Current. (A 75mv-300A shunt would be .075/300 = .00025 ohms or .25 mOhm)
Note 2:	ADC2 and ADC3 have no specific functionality. They are just voltmeters and will measure any voltage up to 60V DC and display on page 1 monitoring and will also be stored together with other values. They are there if you want to measure and log something.
Note 3:	The EXT IOx are Toshiba opto-isolators TLP172GM (Older versions of the SBMS0 uses Toshiba TLP187 opto isolators) They are capable of max 50mA.
Note 4:	Pin 4 (ADC1p) is connected to the battery side of the shunt.
Note 5:	Pin 5 (PVp) is connected to the side of the shunt closer to the solar panels (Away from the battery)

Ext I/O types

Type 1	(HVD - High voltage disconnect) used to control any charger that can be DSSR20, an MPPT solar charger with remote ON/OFF, a grid charger or a battery-to-battery charger.
Type 2	Type 2 (LVD - Low voltage disconnect) used to control any load like in most case an inverter or something like a Victron BP-65 for small DC loads.
Type 3&4	Type 3 and 4 are the same as 1 and 2 but based on SOC instead of voltage and should only be used as alarms not to control devices that is what the SOC setting is for in the EXT IO just for this type 3 and 4
Type 5	Type 5 is for fault conditions when something went wrong and you get to secondary high or low voltage limits named under voltage or over voltage lock. This is not necessary but can be used as backup in case one of the chargers or loads fail to respond to remote ON/OFF control (very unlikely that will ever happen) and the you can have something like a remote triggered circuit breaker than can be tripped by this type 5 signal and manual intervention will be needed to check the fault, repair and then reset the breaker or breakers.
Type 6	Type 6 is for dual PV setup where you install two PV arrays ideally one 2x larger than the other and that 2x larger PV array will be set as type 6



Left Side Connector (This connector is not available if you are using the USB/WiFi extension)			
#	**Name**	**Function**	**Comments**
1	USART TX	WIFI Connector	UART TX and RX pins are used for the WiFi module so if you want to use the USART for something else then WiFi will be disabled (voltage levels 0 to 3.3V).
2	USART RX		
3	SDA/EXT IO1	I2C port	These two pins are reserved as I2C port for communicating with Digital MPPT heat controller. Firmware version 3.0g or higher has support for DMPPT450 but only for monitoring and settings with SBMS0 not charging.
4	SCL/EXT IO2		
5	Boot 0	Programming Mode Jumper	Boot 0 connected to pin 12 will put the STM32F373 microcontroller in programming mode.
6	EXT IO5/SWK	IO 5 or STM32F373. programming SWK	This pin has dual function as programmable EXT IO5 (0 to 3.3V 20mA max) and as SWK programming interface for the STM32F373 (IO 5 is the same signal as on the green connector but before the opto Isolator)
7	ESP RST	WIFI PROGRAMMING Jumper	ESP Flash connected to GND will put the ESP32 WiFi module in programming mode.
8	EXT IO6/SWD	IO 6 or STM32F373. programming SWD	This pin has dual function as programmable EXT IO6 (0 to 3.3V 20mA max) and as SWD programming interface for the STM32F373 (IO 6 is the same signal as on the green connector but before the opto Isolator)
9	GND	Ground	
10	GND	Ground	
11	3.3V (2.7V)	Power	
12	3.3V (2.7V)	Power	
13	NC	No Connection	
14	NC	No Connection	
15	GND	Ground	
16	GND	Ground	

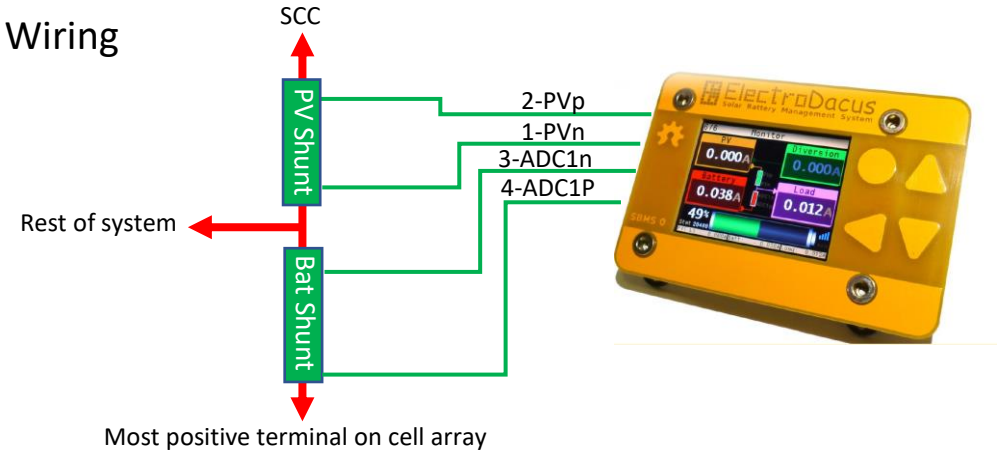
Green Connector on USB/WiFi Extension board. Note: These pins are isolated from the rest of the SMBS0 through a high-speed digital isolator			
#	**Name**	**Function**	**Comments**
1	GND	Ground	
2	3.3V DV	Power IN	If you are using the USB then this side of the isolator is powered from USB else if you say want to use this with UART directly connected to Raspberry Pi or similar boards then you need to provide also 3.3V on the 3V labeled pin.
3	USART TX	Serial port if not using WiFi.	UART TX and RX pins are used for the WiFi module so if you want to use the USART for something else then WiFi will be disabled (voltage levels 0 to 3.3V).
4	USART RX		
5	SCL/EXT IO2	Reserved for I2C	
6	SDA/EXT IO1		

Ribbon Cable Wire Function Info		
Wire #	**12V/4S Configuration**	**24V/8S configuration**
1	SBMS0 Power Negative[1]	SBMS0 Power Negative[2]
2	Neg Voltage Sense	Neg Voltage Sense
3	Cell 1 Voltage Sense	Cell 1 Voltage Sense
4	Cell 2 Voltage Sense	Cell 2 Voltage Sense
5	Cell 2 Voltage Sense	Cell 3 Voltage Sense
6	Cell 2 Voltage Sense	Cell 4 Voltage Sense
7	Cell 2 Voltage Sense	Cell 5 Voltage Sense
8	Cell 2 Voltage Sense	Cell 6 Voltage Sense
9	Cell 3 Voltage Sense	Cell 7 Voltage Sense
10	Cell 4 Voltage Sense	Cell 8 Voltage Sense
11	SBMS0 Power Positive[1]	SBMS0 Power Positive[2]
12	SBMS0 Power Positive[1]	SBMS0 Power Positive[2]

Note 1: With a 12V battery SBMS0 self consumption will be around 70mA
Note 2: With a 24V battery SBMS0 self consumption will be around 35mA(?)

Other interesting tidbits I have learned:

1. Shunt Wiring



1. Do not put a fuse or breaker (or anything else) between the battery + and the Shunt(s). If the fuse/breaker were to blow, the resulting voltages on the input to the SBMS0 could damage it.

2. The new SBMS0 uses the Toshiba TLP172GM instead of the TLP187 used in the earlier SBMS0 version. They have similar characteristics so still 50mA max. The difference is that there is no longer an internal diode as it uses two back to back mosfets on the output so polarity is no longer relevant though it is a good idea to respect the polarity as on the old SBMS0 just to be sure someone is not confusing the two versions.

ExtIO output wiring

The external IO pins (ExtIOn) are driven by the output of Toshiba TLP172GM opto-isolators (Older versions of the SBMS0 uses Toshiba TLP187 opto isolators). As such they do not produce a voltage or current. (It is like the output of a small relay.) The max current the pins can handle is 50ma

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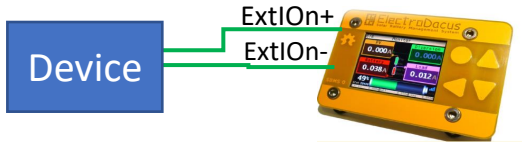
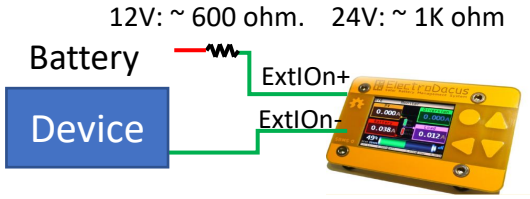
Devices that have control inputs that can use a switch and require very low current (<50mA) can use the ExtIOn+ and ExtIOn- directly.

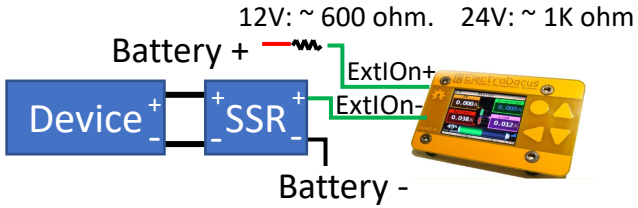


Devices that have control inputs that requires a low current (<50mA) voltage to turn on/off can **not** use the ExtIOn+ and ExtIOn- directly. Instead, they should be wired as shown to the right. The resister is there as a safety device to limit current in case of a short. It will not only protect the wires but also protect the opto-isolator in the SBMS0



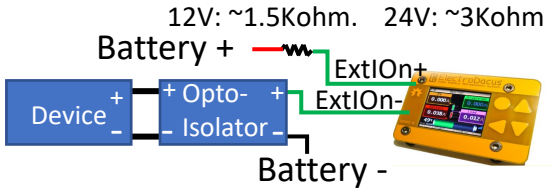
If the device to control requires more than 50mA to control, an **SSR** can be used.

https://www.amazon.com/Kyoto-Electric-KF0602D-Solid-State/dp/B00B888WVC Or
https://www.amazon.com/SSR-25DD-3-32VDC-Output-5-240VDC-Plastic/dp/B08GNSPCND

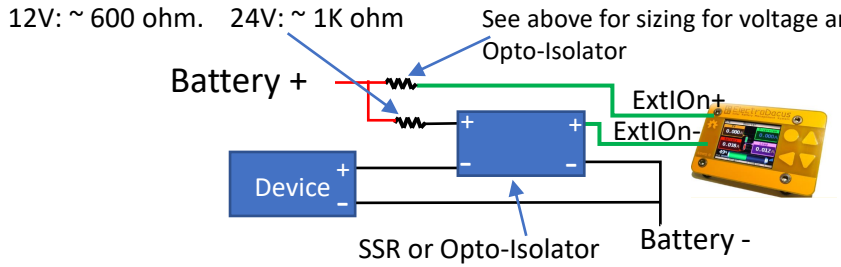


If the device to control requires more than 50mA to control, an **opto-isolator** can be used size the resistor to limit the current through the input LED of the opto-isolator

https://www.mouser.com/ProductDetail/IXYS-Integrated-Circuits/CPC1706Y/?qs=8uBHJDVwVqzre5rFfw2ftA%3D%3D



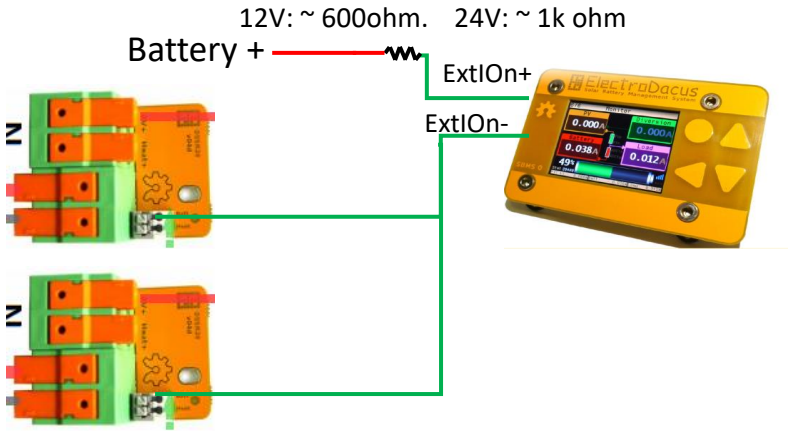
If the SSR or Opto Isolator is driving another voltage signal, it is a good idea to put a protective resister on the output circuit near the connection to the battery.

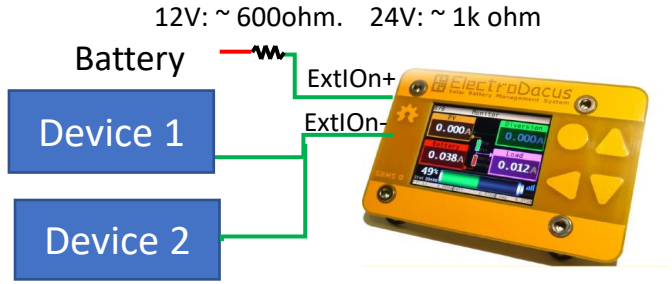


Sharing an ExtIO

The external IO pins (ExtIOn) are driven by the output of Toshiba TLP172GM opto-isolators (Older versions of the SBMS0 uses Toshiba TLP187 opto isolators). As such the do not produce a voltage or current. (It is like the output of a small relay.) The max current the pins can handle is 50ma

If multiple devices use a voltage as the on/off signal, it is possible to use a single ExtIO output to drive multiple devices. <u>However, you must ensure the devices do not draw more than 50mA total on their control pins.</u> (This is how multiple DSSR20s are wired)





Currents shown are for max continuous load

Sample System Design - 1

From Alternator
(Fuse at battery)

295W
38.9Voc

12AWG

Connect to Chassis or
Neg bus bar

Victron Orion
TR Smart
12/24 15
Non-isolated

Victron
Smartsolar
100/30

Victron Orion
24/12 40
(non isolated)

40A 8AWG

Shore Power
10/3
30
Plug

10AWG
10AWG

20A
12AWG

14/3

AC out 2

AC in

AC OUT 1
10/3

15A 14 AWG

15A 14 AWG

30A 10AWG

On/off cable

Non-inv.

10AWG

Charge Control -

Load Control +

Load Control -

Load Control + (Type 2)
Load Control - (Type 2)
Charge Control + (Type 1)
Charge Control – (Type 1)

Aux 2 +
Aux 2 -
Aux 1 +
Aux 1 -

115A 1/0AWG

Victron MultiPlus 3000 24-120

DC
Loads

AC
outlets

AC/DC
Fuse/Breaker
panel

15 ohm, 25W

ALL
1
2
OFF
COM

115A 1/0AWG

155A 1/0 AWG

8 AWG

40A 8AWG

Charge Control + (Type 1)
8–EXTIO6+

7–EXTIO6-
10 – EXTIO5+
9 – EXTIO5-
14 – EXTIO3+
13 – EXTIO3-
11 - EXTIO4+
12 - EXTIO4-

7	EXTIO6-	Type 1/Charger
8	EXTIO6+	
9	EXTIO5-	Type 2/Load
10	EXTIO5+	
11	EXTIO4-	Type 1/Charger
12	EXTIO4+	
13	EXTIO3-	Type 2/Load
14	EXTIO3+	

Fuses
30
40
30
200

1K ohm

Bus Bar

Fuse
200

3-ADC1n
4-ADC1p

Shunt
(300A 50mV)

10,11,12
1,2
3
9
4
6
7
5
8

155A
1/0 AWG

155A 1/0 AWG

40A 2AWG
From Alternator
Note that this carries the return current
for the Orion TR Smart. This is also the
bond from DC- to the chassis

24 Volt System

Sample System Design - 2

400W 400W 400W
400W 400W 400W
QCELL-400-72DUO Panels

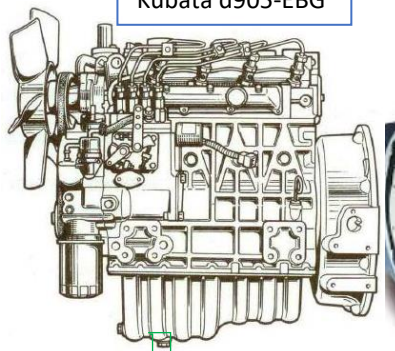
100’ 2AWG Cu

100’ 2AWG Cu

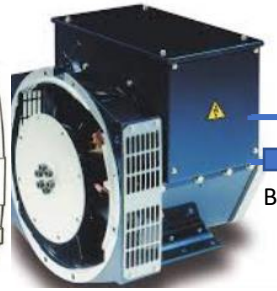
Victron Smartsolar 250/100

Pin	Signal	Configuration	Device controlled
7	EXTIO6-	Type 1/Charger	Solar Charge Controller
8	EXTIO6+		
11	EXTIO4-	Type 1/Charger	MultiPlus Charger Control
12	EXTIO4+		
13	EXTIO3-	Type 2/Load	MultiPlus Inverter Control
14	EXTIO3+		

Kubata d905-EBG



Newage Stamford Generator
BC I164D1L 12KVA



Breaker

150’ 4AWG Al

150’ 4AWG Al

Victron MultiPlus 3000 24-120

2-wire starter control

Charge Control +

Charge Control -

Fuse

Fuse

7 – EXTIO6-

8 – EXTIO6+

14 – EXTIO3+ Load Control + (Type 2)

13 – EXTIO3- Load Control - (Type 2)

Charge Control + (Type 1)

Charge Control – (Type 1)

Aux 2 +

Aux 2 -

Aux 1 -

Aux 1 +

2-PVp

1-PVn

3-ADC1n

4-ADC1P

11 - EXTIO4+

12 - EXTIO4-

1,2

3

4

5

6

7

8

9

10,11,12

Fuse

Fuse

PV Shunt

Bat Shunt

Bus Bar

Meter Shunt

Note: The 2-signal BMS helper is used in the MultiPlus configuration to set the Aux 1 and Aux2 functions.

To AC panel

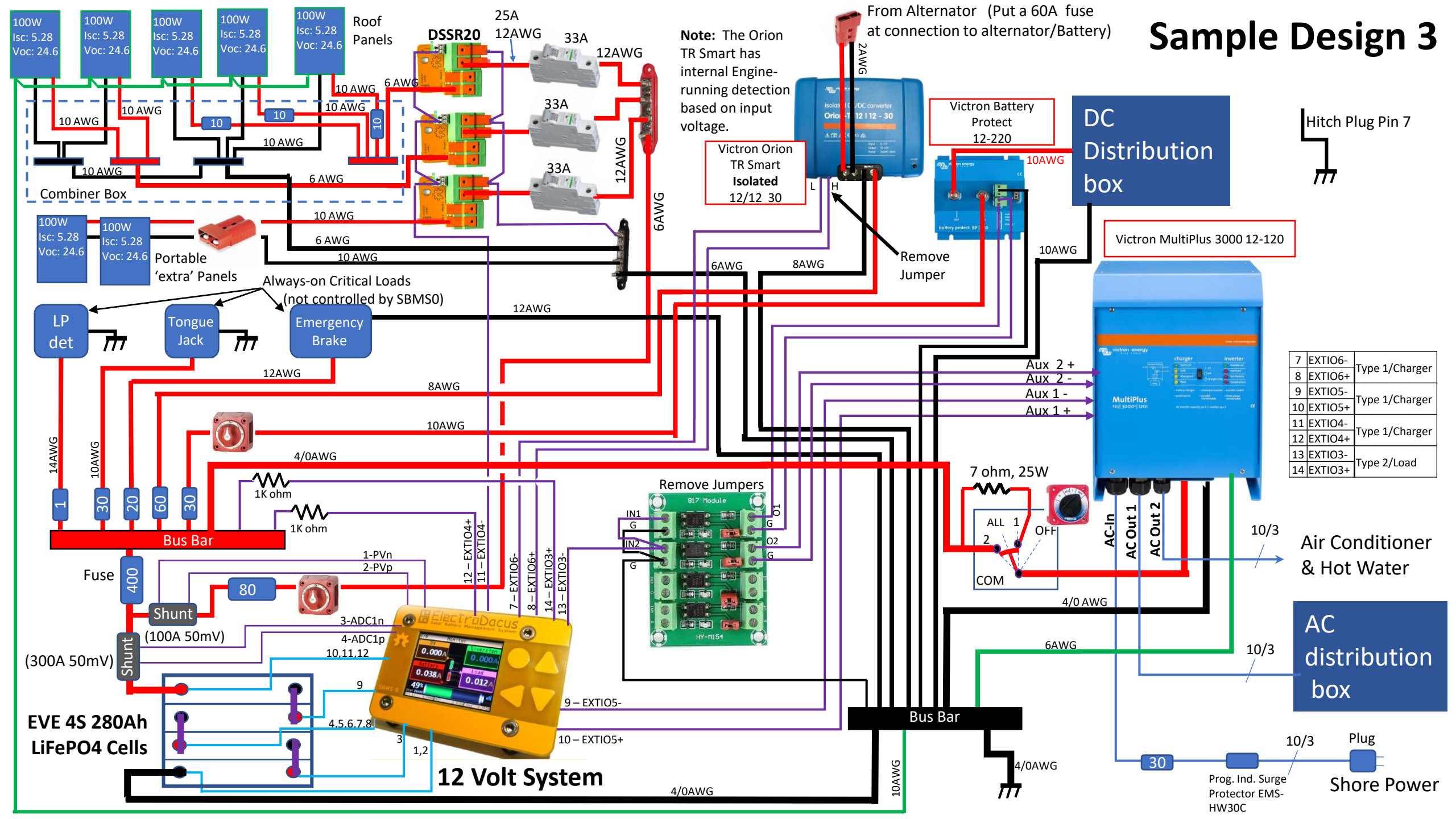
5P8S 280Ah Cells

Balance Harness

Control

24 Volt System

Sample Design 3



7	EXTIO6-	Type 1/Charger
8	EXTIO6+	
9	EXTIO5-	Type 1/Charger
10	EXTIO5+	
11	EXTIO4-	Type 1/Charger
12	EXTIO4+	
13	EXTIO3-	Type 2/Load
14	EXTIO3+	