Assembly instructions

Content

TO PC

PMODUSBUART USB TO UART MODULE
410-212

1

UART_TX

RTS RXD TXD CTS GND SYS3V3

GND

GPS_UART_RX

GPS_UART_TX

UART_RX

JS202011CQN

GPS_RST#

GPS_UART_RX
GPS_UART_TX

Nucleo 64 PINs
Arduino PINs
X-Nucleo PINs
Alternate PINs — Not Connected

PB_8 PB_9 AVDD GND PA_5 PA_6 PA_7 PB_6 PC_7 PA_9 PA_8 PB_10 PB_5 PB_3 PA_10 PA_2 PA_3

D15 D14 D13 D12 D11 D10 D9 D8 D7 D6 D5 D4 D3 D2 D1 D0

SCL SDA WAKEUP PPS RESET RESET PPS WAKEUP USART1 TX USART1 RX USART1 RX USART1 TX

CN5

CN9

PPS

3.3V   3.3V

SDO SDA SCL CS

GND

ST
STEVAL-MKI164V1

3.3V

life.augmented

X-Nucleo GNSS1A1
Arduino Headers

CN6

CN8

NC

IOREF NRST +3V3 +5V GND GND VIN

3.3V

GND

A0 A1 A2 A3 A4 A5

PA_0 PA_4 PB_0 PC_1 PC_0

GPS
Antenna

Gravity

FR0605

Digital RGB
LED Module V1.0

GND

VCC

LED_DI

3G MODEM

USB OTG Cable

E3533I-1

GND

VCC

BOB-12700

UR050-06N

Raspberry Pi Zero W

HDMI

SanDisk
32 GB
32GB MicroSD

4

Connector / Header Pin Table:

Pin	Label		Pin	Label
39	GND		40	NC
37	NC		38	NC
35	NC		36	GND
33	NC		34	NC
31	NC		32	GND
29	NC		30	
27			28	
25	GND		26	NC
23	NC		24	NC
21	NC		22	NC
19	LED_DI		20	GND
17	3.3V		18	RELAY_RESET
15	NC		16	RELAY_SET
13	NC		14	BUZZER_IN
11	GPS_RST#		12	
9	GND		10	UART_RX
7	NC		8	UART_TX
5	SCL		6	GND
3	SDA		4	5.0V
1	3.3V		2	5.0V

Labels and components:

SCL_5V
SDA_5V
VCC
GND
VCC
GND
PCA9306
EN SCL2 SDA2 VREF2
LOW SCL1 SDA1 VREF1 GND
SCL
SDA
3.3V

LBAT_VOLTAGE
2kΩ
CF14JT2K00

BATTERY
354

16bit I2C ADC+PGA
ADS1115
VDD GND SCL SDA ADDR ALRT A0 A1 A2 A3
VCC
GND

SCL_5V
SDA_5V
LBAT_VOLTAGE

1MΩ
RC0805FR-071ML
18kΩ
RMCF0805FT18K0
GND
B32529C0153J189
CAP
0.015uF
63V

SYP-02T
SYP-02T-1
GND

HIGH VOLTAGE BATTERY CHARGER

MP2636 Power Booster & Charger Module
BATTERY
VOUT VIN
UR050-06N

VCC
GND
BOB-12035
VCC D- D+ ID GND

10uF
16V
CAP
ECA-1CM1001

CUI INC
AVO TRIM +VO +VIN
-VO GND -VIN R
PDQ15
PDQ15-Q48-S5-D

HIGH VOLTAGE BATTERY
XT30U-F
XT30U-M
69125661D002
UP52CR2MFD1TD
CAP
2.2uF
160V
GND
GND
UP52CR2MFD1TD
CAP
2.2uF
160V

HIGH_BAT_VOLTAGE
B32529C0153J189
CAP
0.015uF
63V
GND
1MΩ
RC0805FR-071ML
18kΩ
RMCF0805FT18K0
GND

GND

VCC
GND
BOB-12700
VCC D- D+ ID GND
UR050-06N

VCC
GND
BSS138P,215
ISD512A
1N5817-TP
1N5817-TP
VCC
VCC

2 COIL LATCH RELAY
ADZS22105

215kΩ
MFR-25FBF52-215K
GND
BUZZER_IN

CPE-767

215kΩ
MFR-25FBF52-215K
GND
RELAY_SET
DMN3404L-7

215kΩ
MFR-25FBF52-215K
GND
RELAY_RESET
DMN3404L-7

69125661D002
UCS2C221MHD1TN
CAP
220uF
160V
GND

MOTOR DRIVER
XT30U-M
XT30U-F
UCS2C221MHD1TN

Legend:
DIGITAL LINE
ANALOG LINE
POWER LINE +
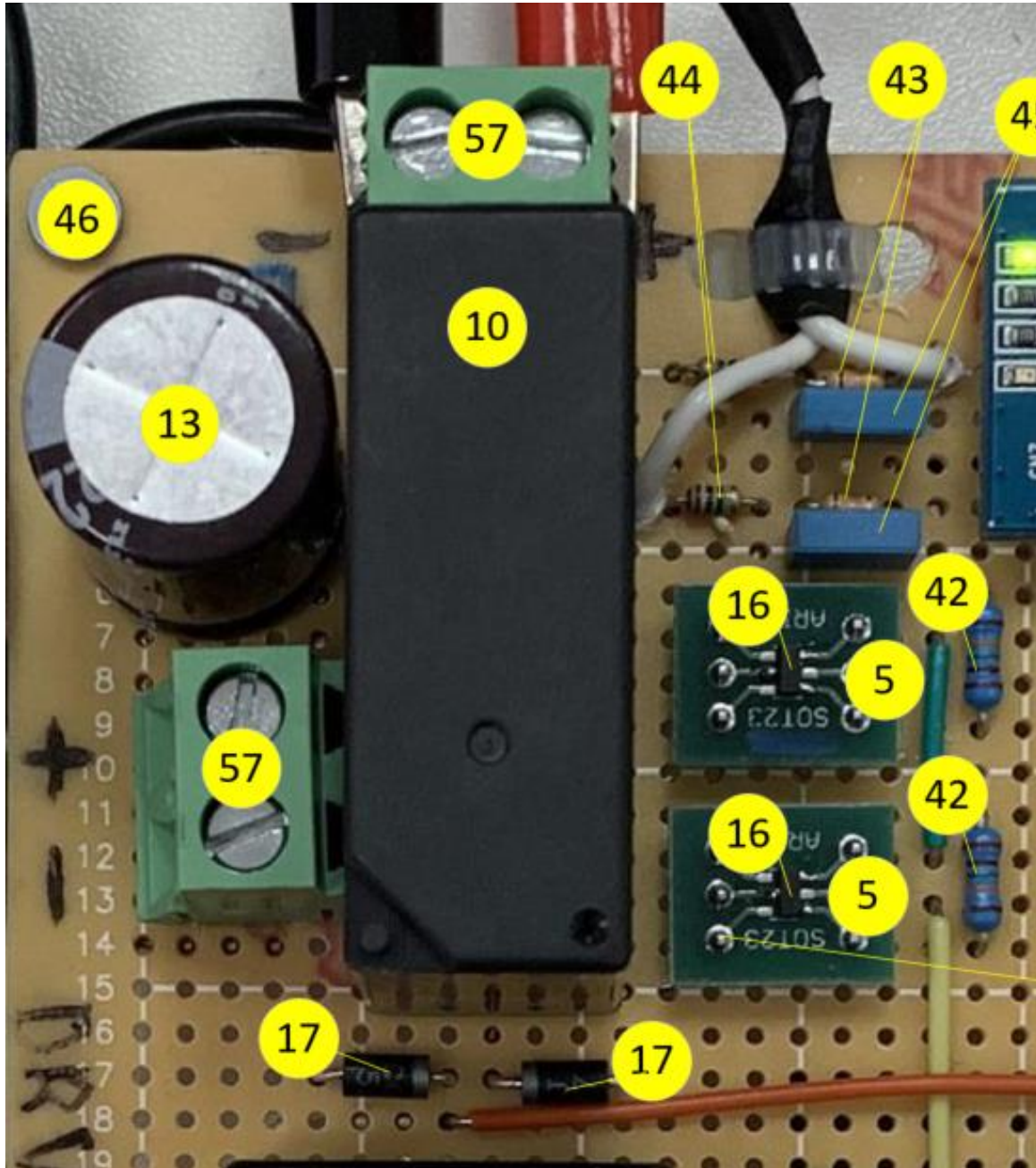POWER LINE -

5

1. High Power switch assembly

Figure.4 High power switch prototype view

All components in Table.1 mount and solder as showed on the Figure.4

Table.1 High power switch main components

Number	Description	Company	Part number	Quantity
5*	SOCKET ADAPTER SOT-23 TO 6DIP	Aries Electronics	LCQT-SOT23-6	2
10	RELAY GEN PURPOSE SPST 50A 5V	Panasonic	ADJH23005	1

13	CAP ALUM 220UF 20% 160V RADIAL	Nichicon	493-13277-3-ND	1
16	MOSFET N-CH 30V 5.8A SOT-23	Diodes Incorporated	DMN3404L-7	2
17	DIODE SCHOTTKY 20V 1A DO41	Micro Commercial Co	1N5817-TP	2
42	RES 215K OHM ¼W 1% AXIAL	Yageo	MFR-25FBF52-215K	2
57	TERM BLK 2P SIDE ENT 10.16MM PCB	Wurth Electronics Inc.	691256610002	2
31	DC supply male plug	AMASS	AMASS XT30U-M	1
32	DC supply female plug	AMASS	AMASS XT30U-F	1
35	Black colored power 16AWG lead cable	STÄUBLI	60.7031-21	1
36	Red colored power 16AWG lead cable	STÄUBLI	60.7031-22	1

After components mounting, use the functional schematic on the Figure.5 for signal wires soldering
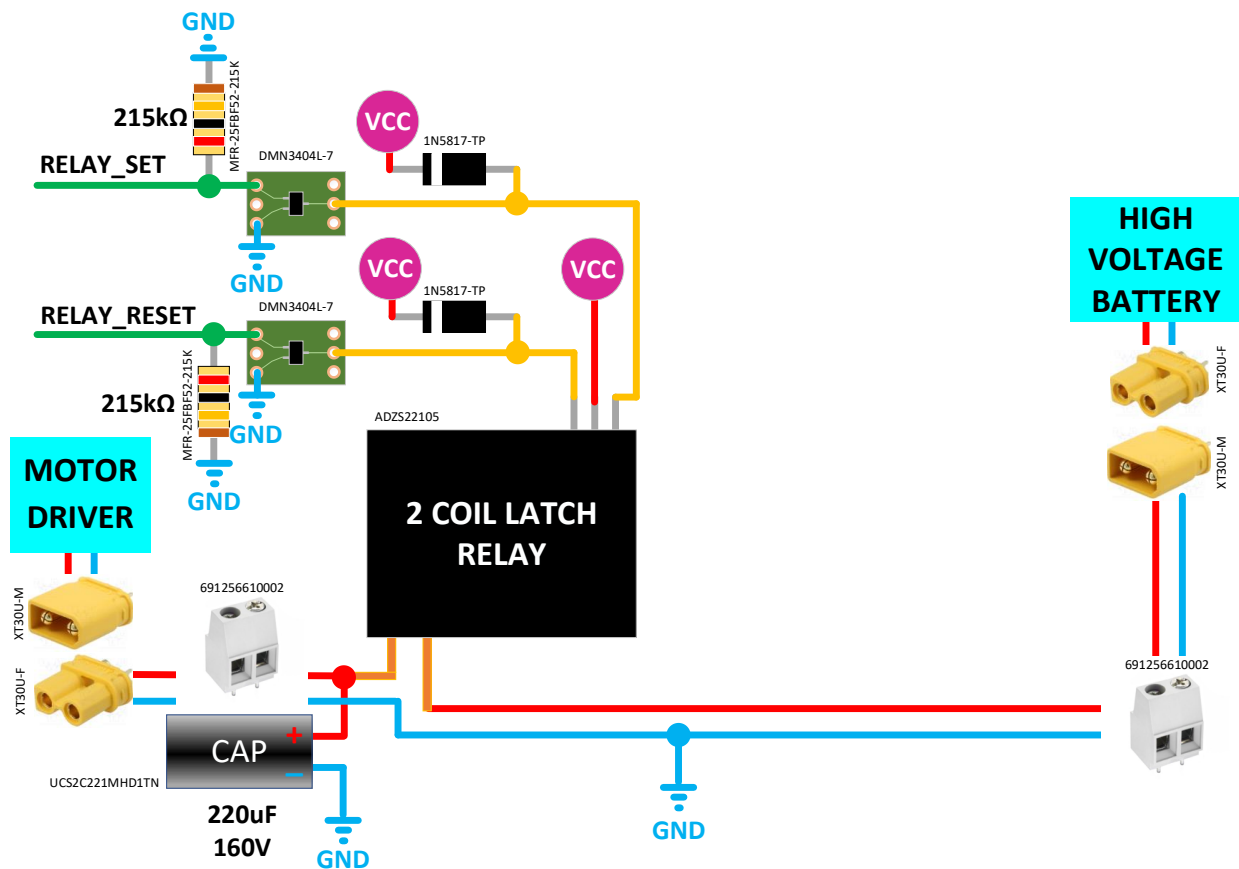
Figure.5 high power switch with connector and driver functional schematic part

2. Voltage sense assembly
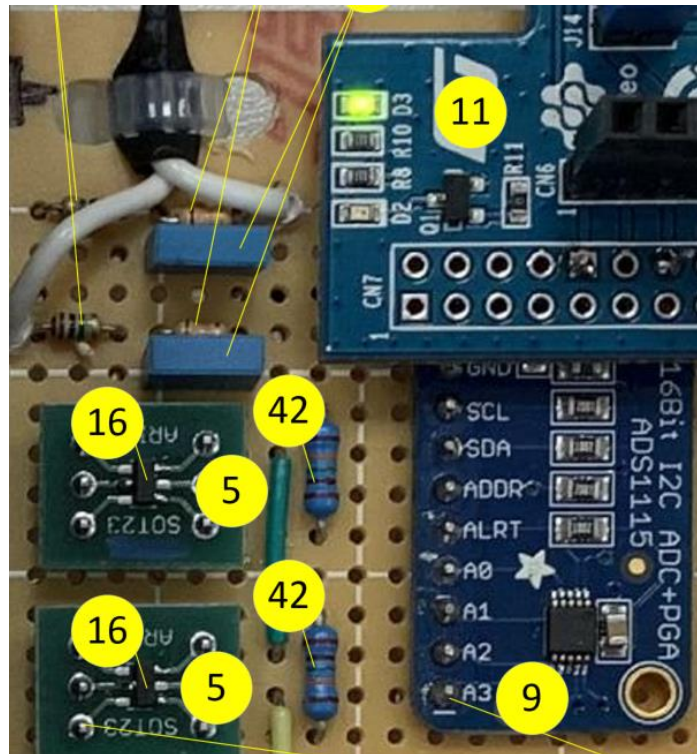
Figure.6 Voltage sense prototype view
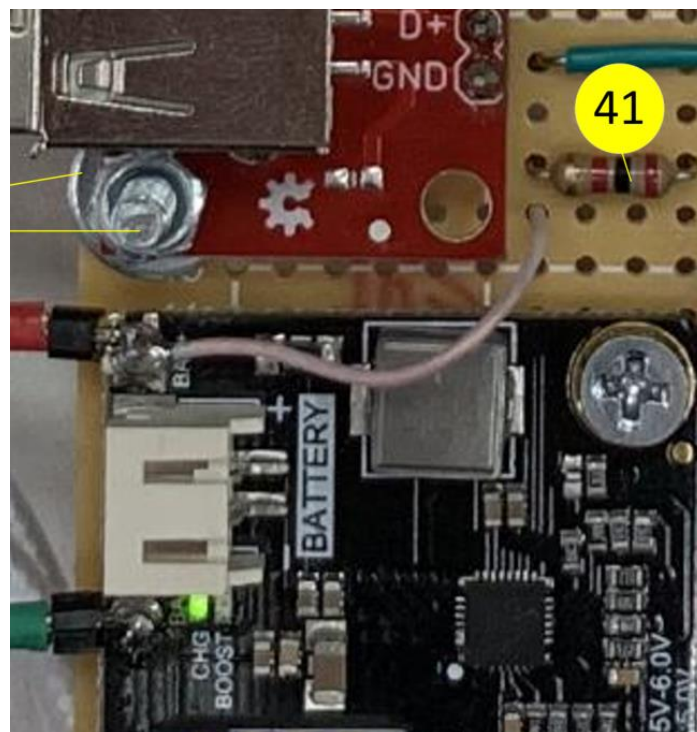
Figure.7 Voltage sense prototype view

All components in Table.2 mount and solder as showed on the Figure.6, Figure.7

Table.2 Voltage sense main components

Number	Description	Company	Part number	Quantity
43	RES 18K OHM 1/4W 1% AXIAL	Stackpole	RNMF14FTC18K0	2
44	RES 1M OHM 1/4W 1% AXIAL	Stackpole	RNF14FTD1M00	2
45	CAP FILM 0.015UF 5% 63VDC RADIAL	EPCOS (TDK)	B32529C0153J189	2
9	ADS1115 16BIT ADC 4CH PROG GAIN	Adafruit	1085	1
41	RES 2K OHM 1/4W 5% AXIAL	Stackpole	CF14JT2K00	1

After components mounting, use the functional schematic on the Figure.8 for signal wires soldering
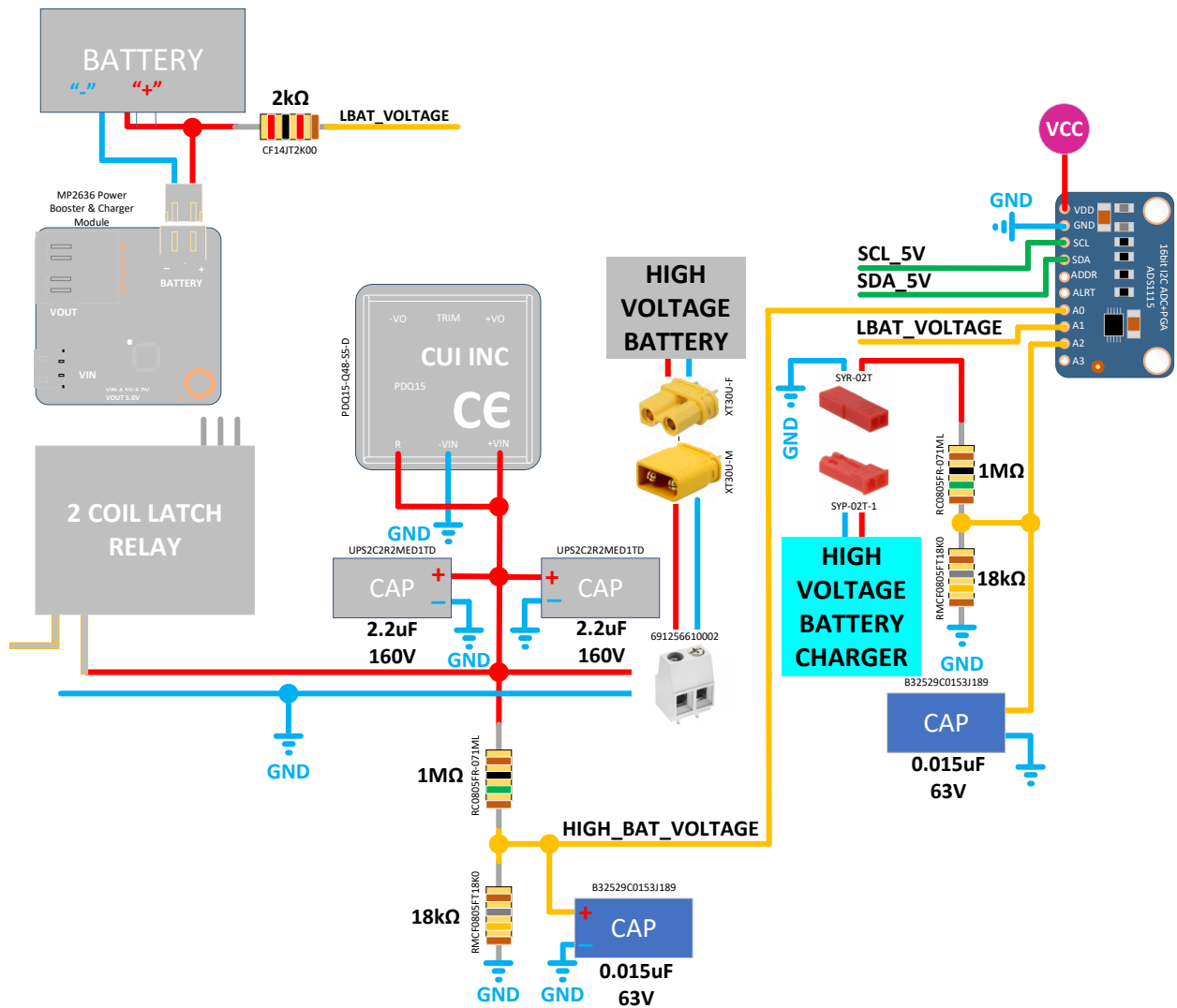
Figure.8 voltage sense functional schematic part

3. High Voltage DCDC assembly
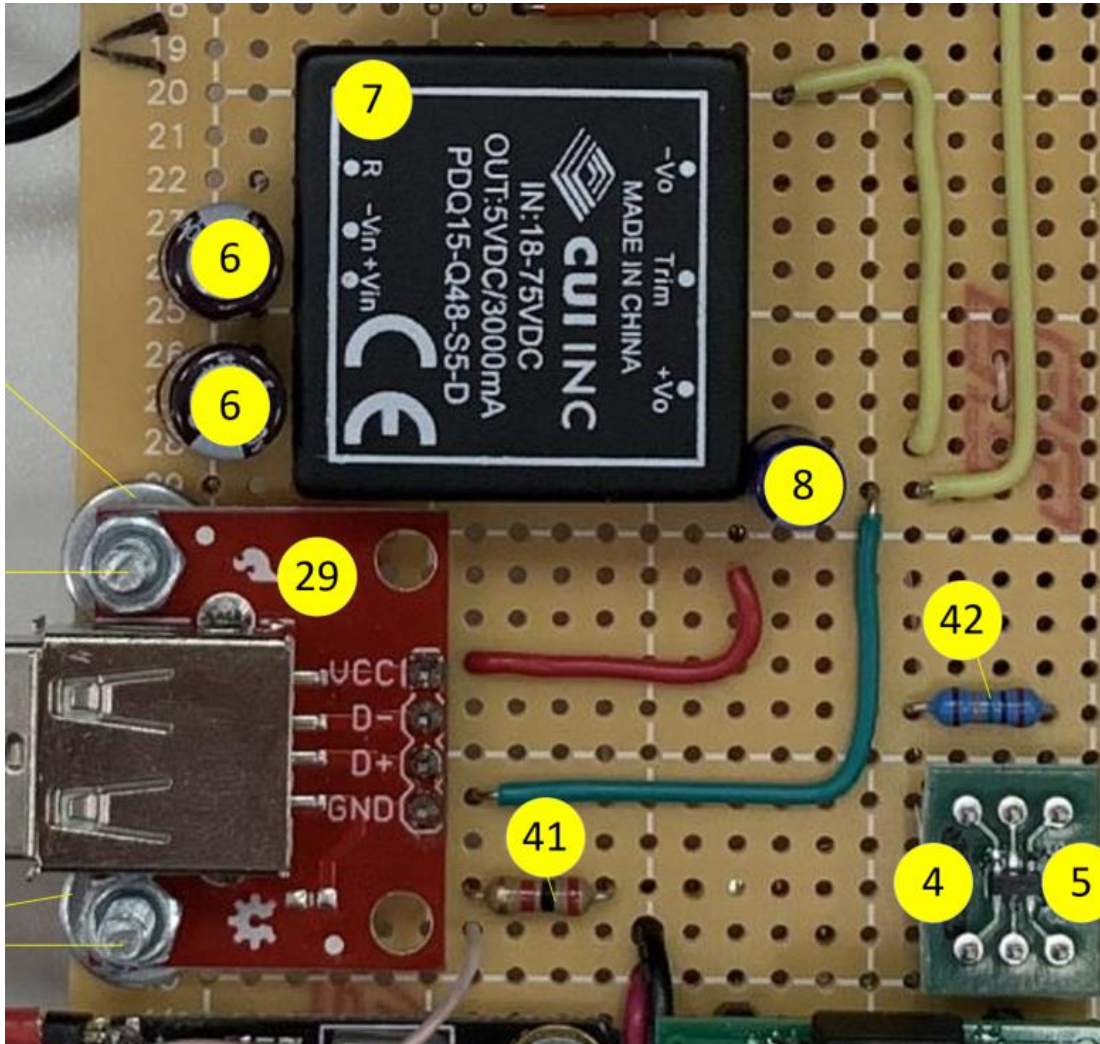
Figure.9 High voltage DCDC prototype view

All components in Table.3 mount and solder as showed on the Figure.9

Table.3 High voltage DCDC main components

Number	Description	Company	Part number	Quantity
7	Isolated Module DC DC Converter 5V 3A 18V - 75V Input	CUI Inc.	PDQ15-Q48-S5-D	1
6	CAP ALUM 2.2UF 20% 160V RADIAL	Nichicon	UPS2C2R2MED1TD	2
8	CAP ALUM 10UF 20% 16V RADIAL	Panasonic	ECA-1CM100I	1
15	CONN HEADER VERT 40POS 2.54MM	Sullins	PREC040SABN-RC	1
29	SparkFun USB Type A Female Breakout	sparkfun	BOB-12700	1
47	M3 Pan Head Machine Screw Phillips Drive Nylon	Essentra Components	NMS-310	2

48	M3 Flat, Retaining Washer 0.055" (1.40mm) Thick Plastic	Essentra Components	015003000503	4
49	M3 Hex Nut 0.217" (5.50mm) Nylon	Wurth Electronics Inc.	709940300	2
14	USB 2.0 Cable A Male to Micro B Male 0.50'	Tripp Lite	UR050-06N	1

After components mounting, use the functional schematic on the Figure.10 for signal wires soldering
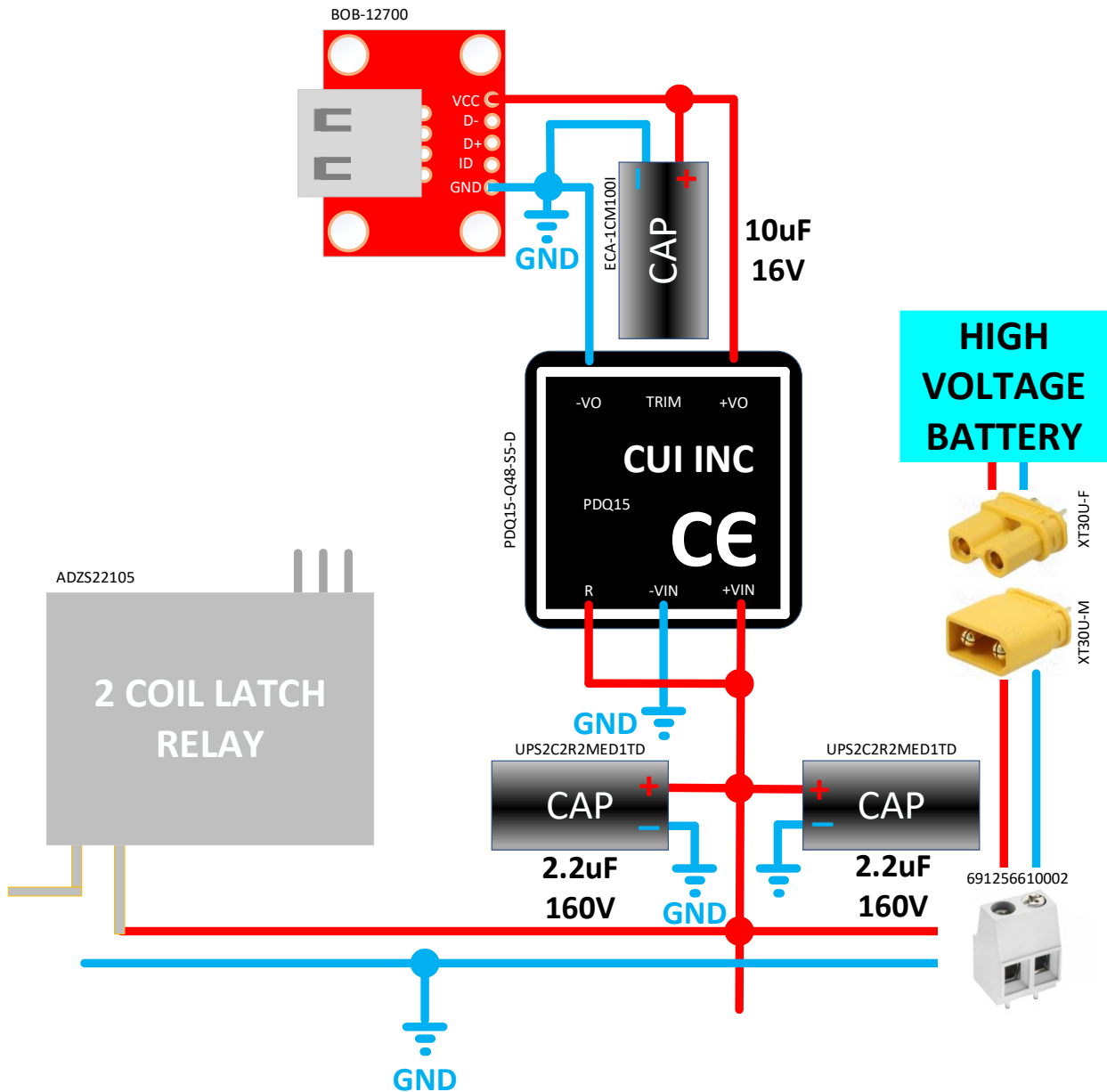
Figure.10 High voltage DCDC functional schematic part

4. Buzzer driver assembly
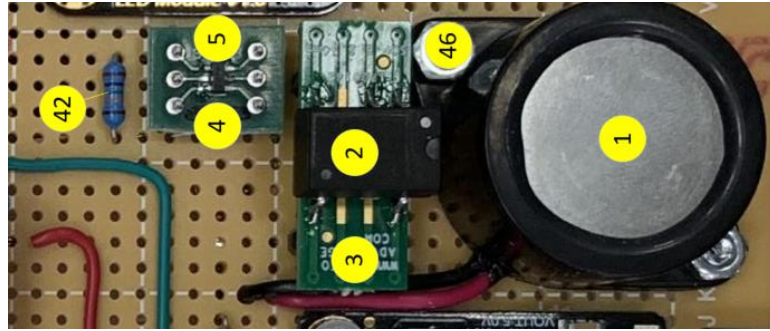
Figure.11 Buzzer driver

All components in Table.4 mount and solder as showed on the Figure.11

Table.4 Buzzer driver main components

Number	Description	Company	Part number	Quantity
1	AUDIO PIEZO INDICATOR 6-14V CHAS	CUI Inc.	CPE-267	1
2	DC DC CONVERTER 12V 1W	XP Power	ISE0512A	1
3	SOP-8 TO DIP-8 SMT ADAPTER	Chip Quik	IPC0142	1
4	MOSFET N-CH 60V 360MA TO-236AB	Nexperia USA Inc.	BSS138P,215	1
5	SOCKET ADAPTER SOT-23 TO 6DIP	Aries Electronics	LCQT-SOT23-6	1
46	M3 Pan Head Machine Screw Phillips Drive Nylon	Wurth Electronics Inc.	97790603111	2
49	M3 Hex Nut 0.217" (5.50mm) Nylon	Wurth Electronics Inc.	709940300	2

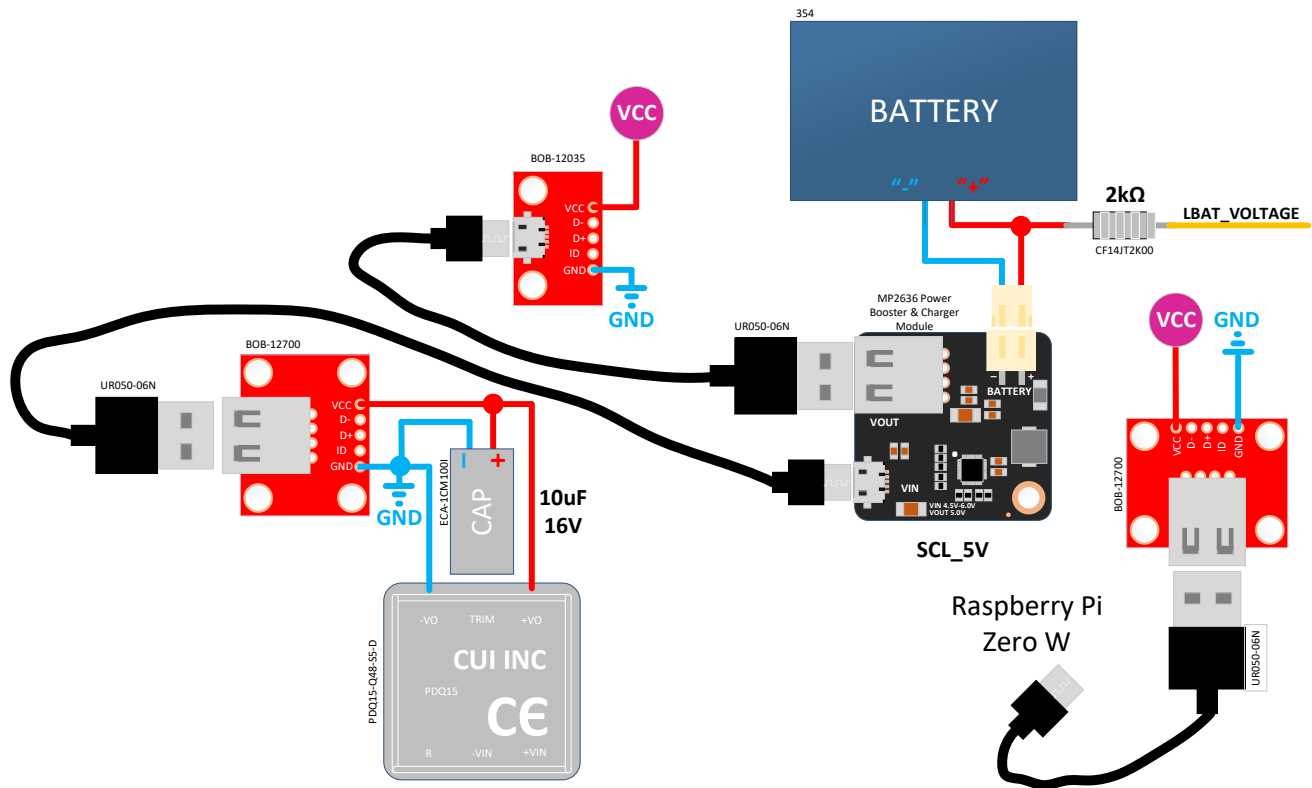After components mounting use the functional schematic on the Figure.12 for signal wires soldering
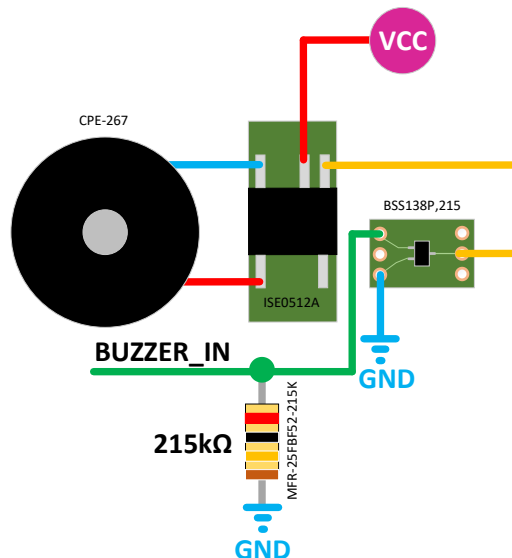
Figure. 12 Voltage sense main components

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5. Internal Battery controller
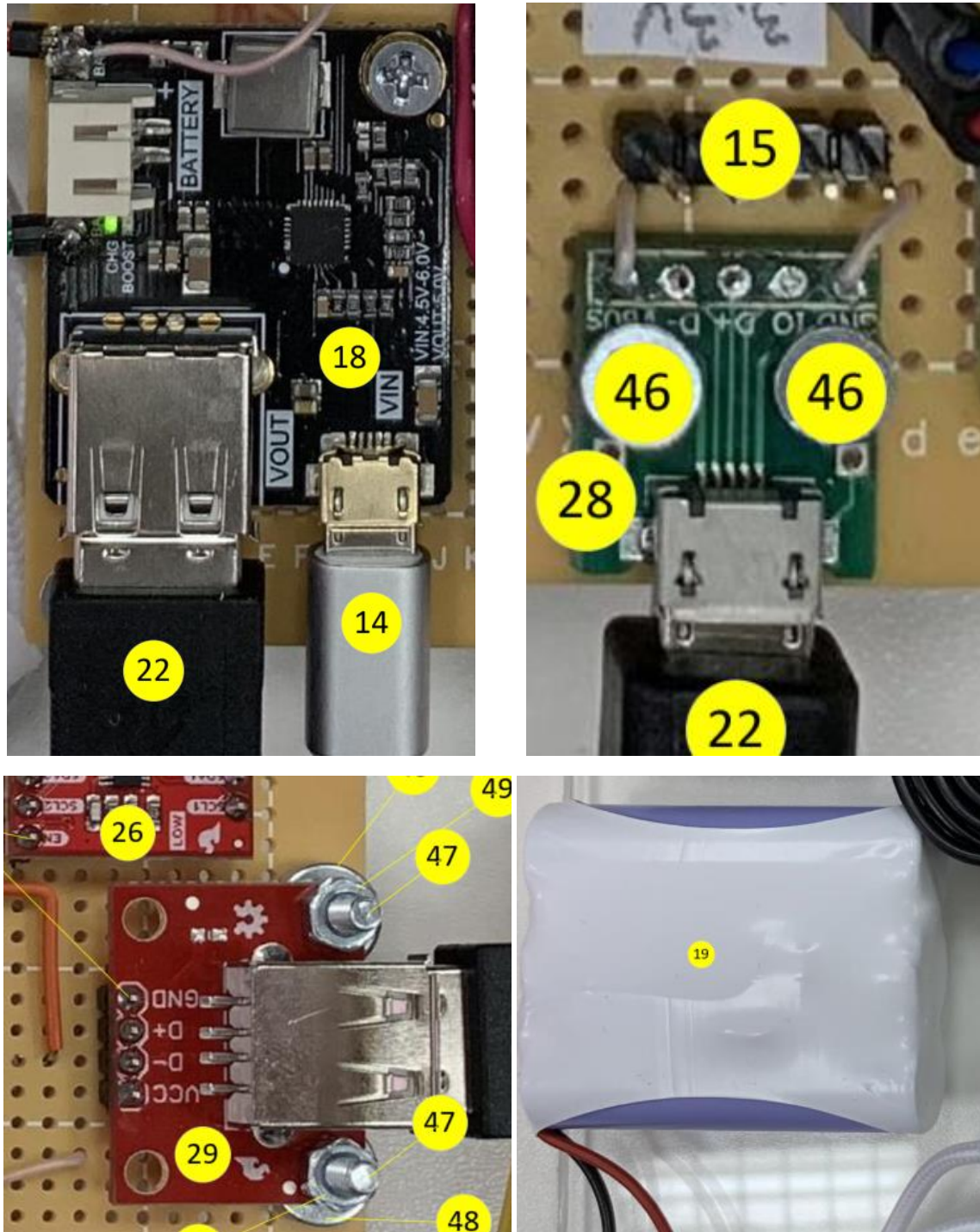
Figure. 13 Internal battery controller with power connectors prototype view

All components in Table.5 mount and solder as showed on the Figure.13

Table.5 Internal battery controller components

Number	Description	Company	Part number	Quantity
18	MP2636 Power Booster & Charger Module	DFRobot	DFR0446	DFRobot
28	SparkFun microB USB Breakout	sparkfun	BOB-12035	sparkfun
29	SparkFun USB Type A Female Breakout	sparkfun	BOB-12700	sparkfun
15	CONN HEADER VERT 40POS 2.54MM	Sullins	PREC040SABN-RC	Digikey
47	M3 Pan Head Machine Screw Phillips Drive Nylon	Essentra Components	NMS-310	4
48	M3 Flat, Retaining Washer 0.055" (1.40mm) Thick Plastic	Essentra Components	015003000503	9
49	M3 Hex Nut 0.217" (5.50mm) Nylon	Wurth Electronics Inc.	709940300	5
49	M3 Hex Nut 0.217" (5.50mm) Nylon	Wurth Electronics Inc.	709940300	1

After components mounting, use the functional schematic on the Figure.14 for signal wires soldering

Figure. 14 Internal battery controller with connectors functional schematic part
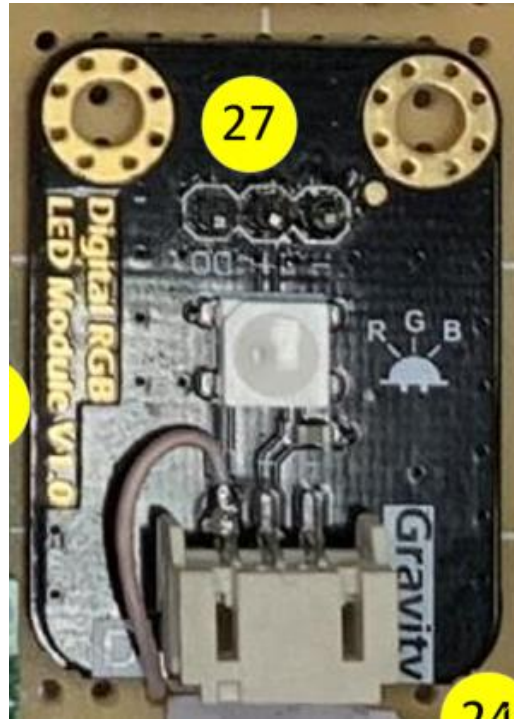
6. LED indication assembly

Figure. 15 LED indication module ptototype view

All components in Table.6 mount and solder as showed on the Figure.15

Table.6 LED indication components

Number	Description	Company	Part number	Quantity
27	Gravity: Digital RGB LED Module	dfrobot	FR0605	1
15	CONN HEADER VERT 40POS 2.54MM	Sullins	PREC040SABN-RC	1

After components mounting, use the functional schematic on the Figure.16 for signal wires soldering
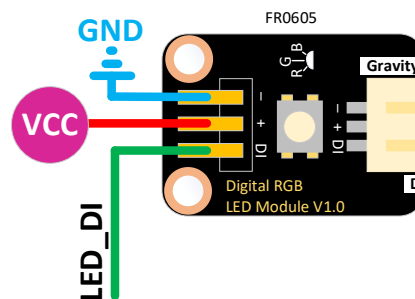
Figure. 16 LED indication module functional schematic part

7. Accelerometer assembly

Figure. 17 Accelerometer module ptototype view

All components in Table.7 mount and solder as showed on the Figure.17

Table.7 Accelerometer components

Number	Description	Company	Part number	Quantity
12	ADAPTER BOARD LIS2HH12 DIL24	STMicroelectronics	STEVAL-MKI164V1	Digikey

After components mounting, use the functional schematic on the Figure.18 for signal wires soldering
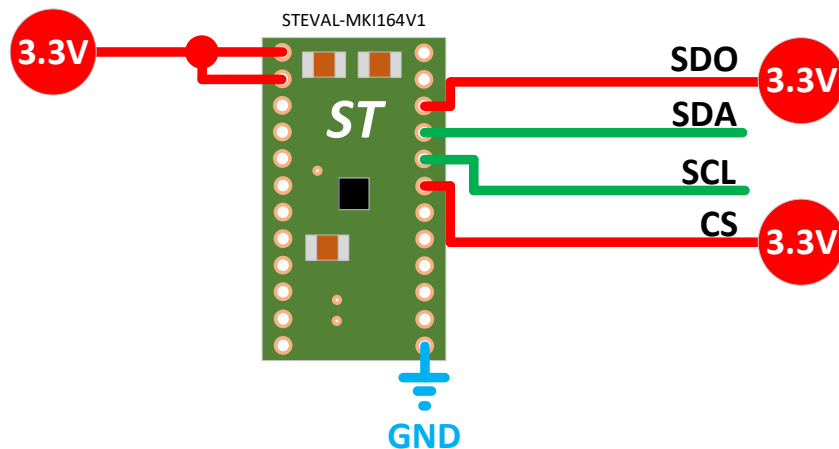
Figure. 18 LED indication module functional schematic part

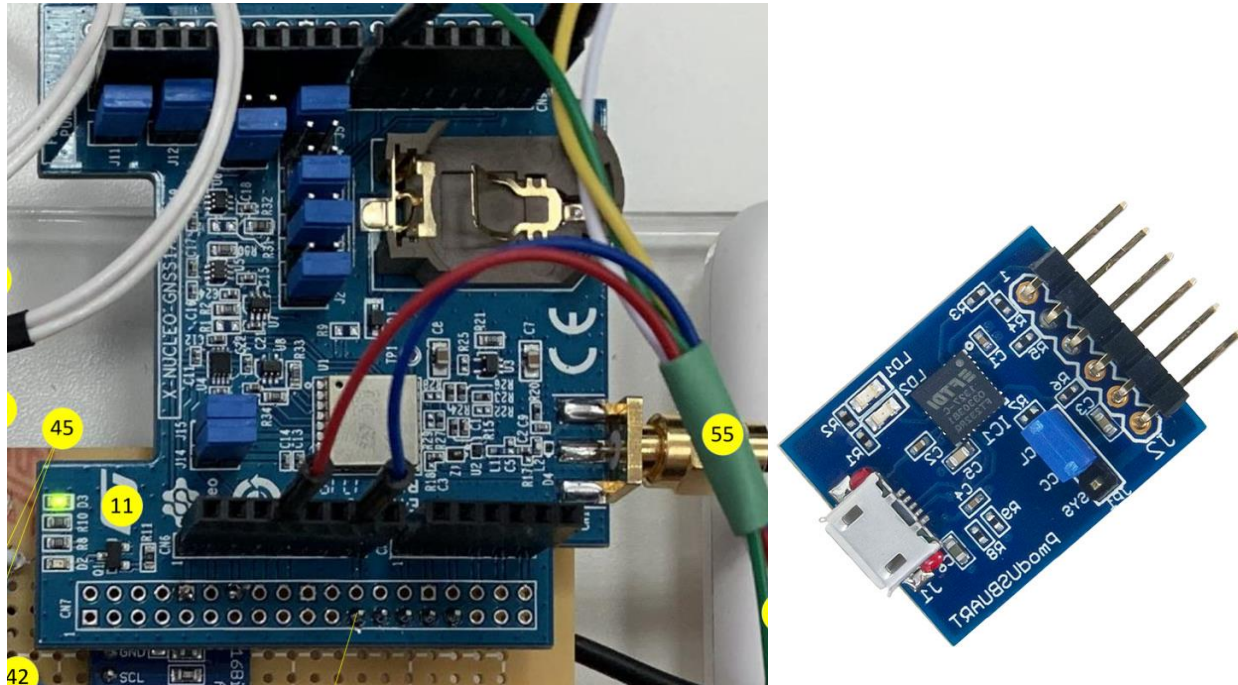## 8. GPS Module and USB UART bridge assembly

Figure. 19 GPS module and USB to UART bridge ptototype view

All components in Table.7 mount and solder as showed on the Figure.19

Table.8 GPS module connection components

Number	Description	Company	Part number	Quantity
11	X-NUCLEO-GNSS1A1	STMicroelectronics	X-NUCLEO-GNSS1A1	1
52	Jumper Wires Standard 7" M/M - 30 AWG (30 Pack)	sparkfun	Jumper Wires	1
14	USB 2.0 Cable A Male to Micro B Male 0.50'	Tripp Lite	UR050-06N	1
30	Slide Switch DPDT Through Hole	C&K	JS202011CQN	1
33	PMODUSBUART USB TO UART MODULE	Digilent, Inc.	410-212	1

After components mounting, use the functional schematic on the Figure.20 for signal wires soldering
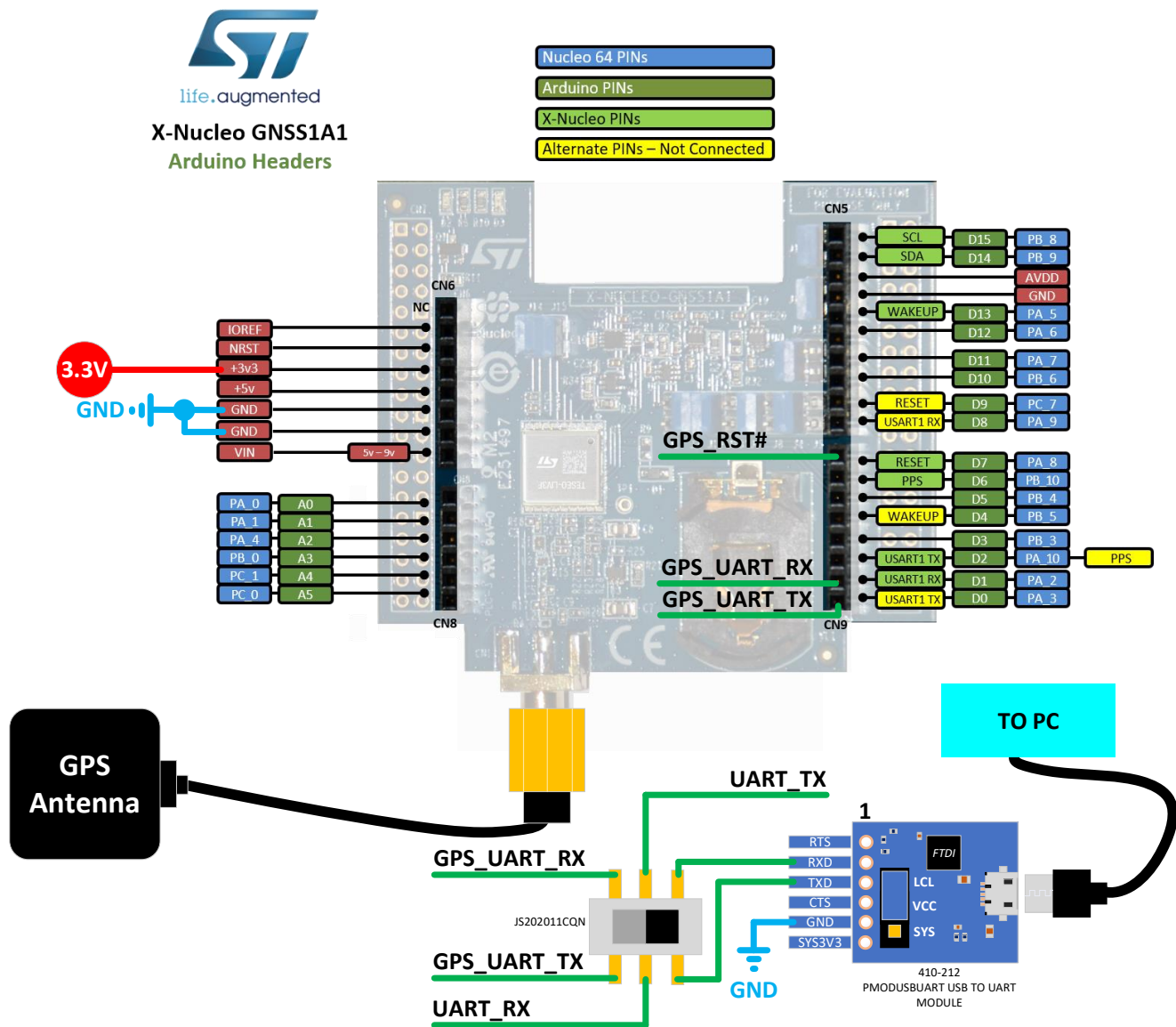
Figure. 20 GPS module functional schematic connection
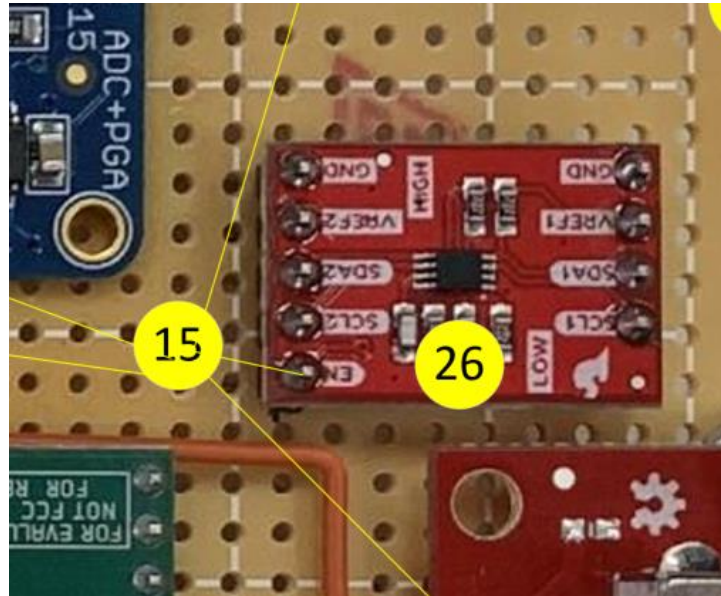
9. Logic level translator assembly

Figure. 21 Logic level translator module prototype view

All components in Table.9 mount and solder as showed on the Figure.21

Table.9 Logic level translator module components

Number	Description	Company	Part number	Quantity
26	SPARKFUN LEVEL TRANSLATOR BREAKOUT - PCA9306	sparkfun	PCA9306	1
15	CONN HEADER VERT 40POS 2.54MM	Sullins	PREC040SABN-RC	1

After components mounting, use the functional schematic on the Figure.22 for signal wires soldering
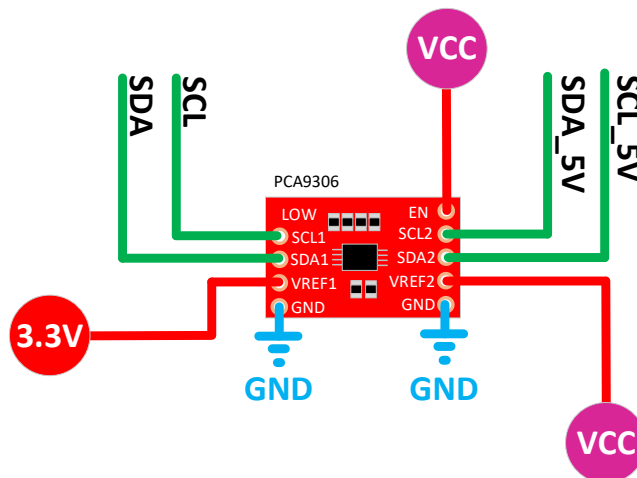

Figure. 22 Logic level translator module functional schematic connection
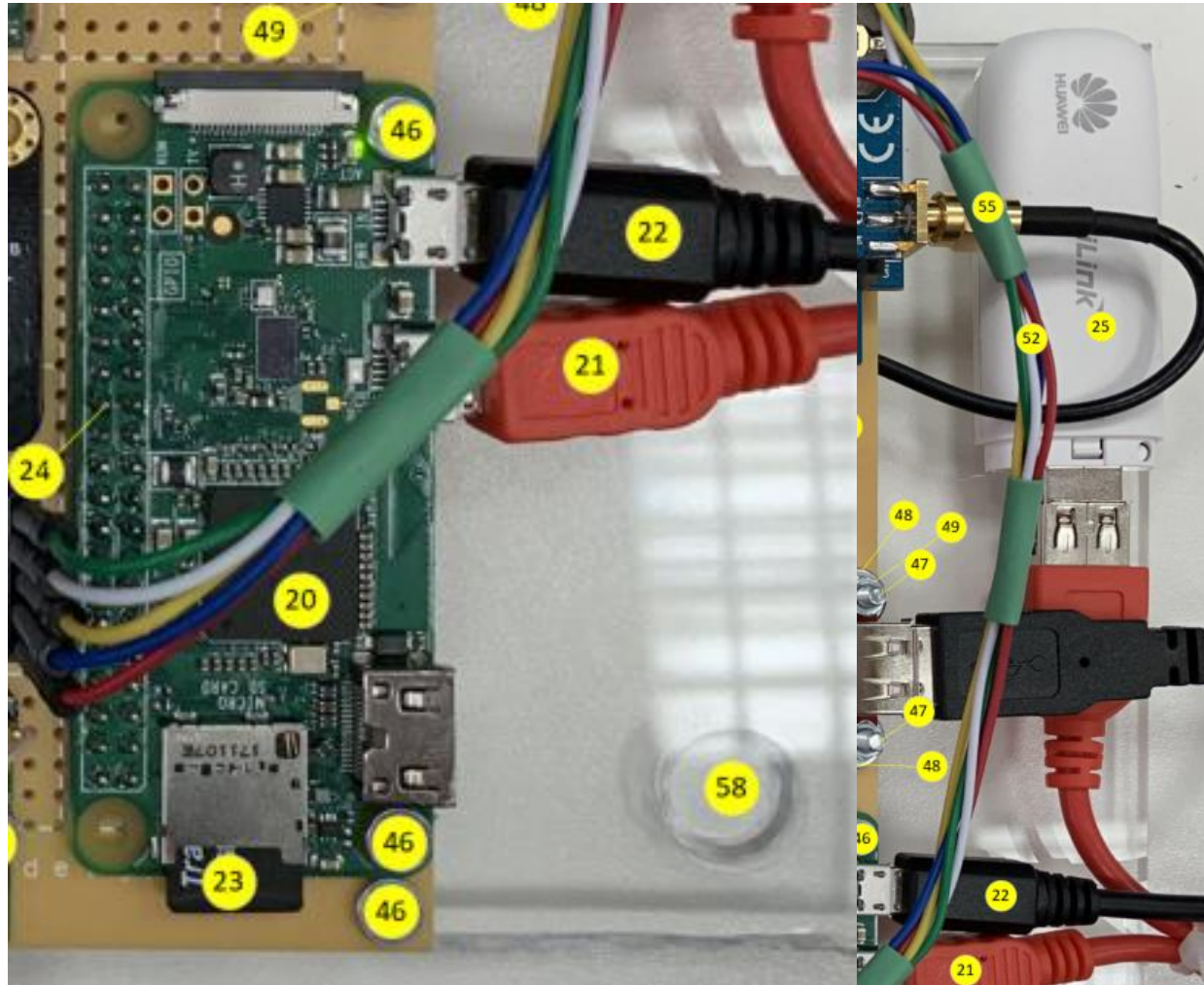
10. Raspberry Pi and 3G Modem

Figure. 23 Raspberry Pi and 3G modem ptototype view

All components in Table.7 mount and solder as showed on the Figure.23

Table.11 Raspberry Pi and 3G modem connection components

Number	Description	Company	Part number	Quantity
23	microSD Card with Adapter - 32GB (Class 10)	sparkfun	32GB MicroSD	1
24	CONN HEADER VERT 40POS 2.54MM	Amphenol ICC (FCI)	67997-240HLF	1
25	3G GSM modem Huawei E3531i-1	Huawei	E3531i-1	1
21	USB OTG Cable - Female A to Micro B - 5in	sparkfun	USB OTG Cable	1
22	Raspberry Pi micro-USB power cable	reichelt	AK67421-0.5	1
20	Raspberry Pi Zero W	sparkfun	Raspberry Pi Zero W	1

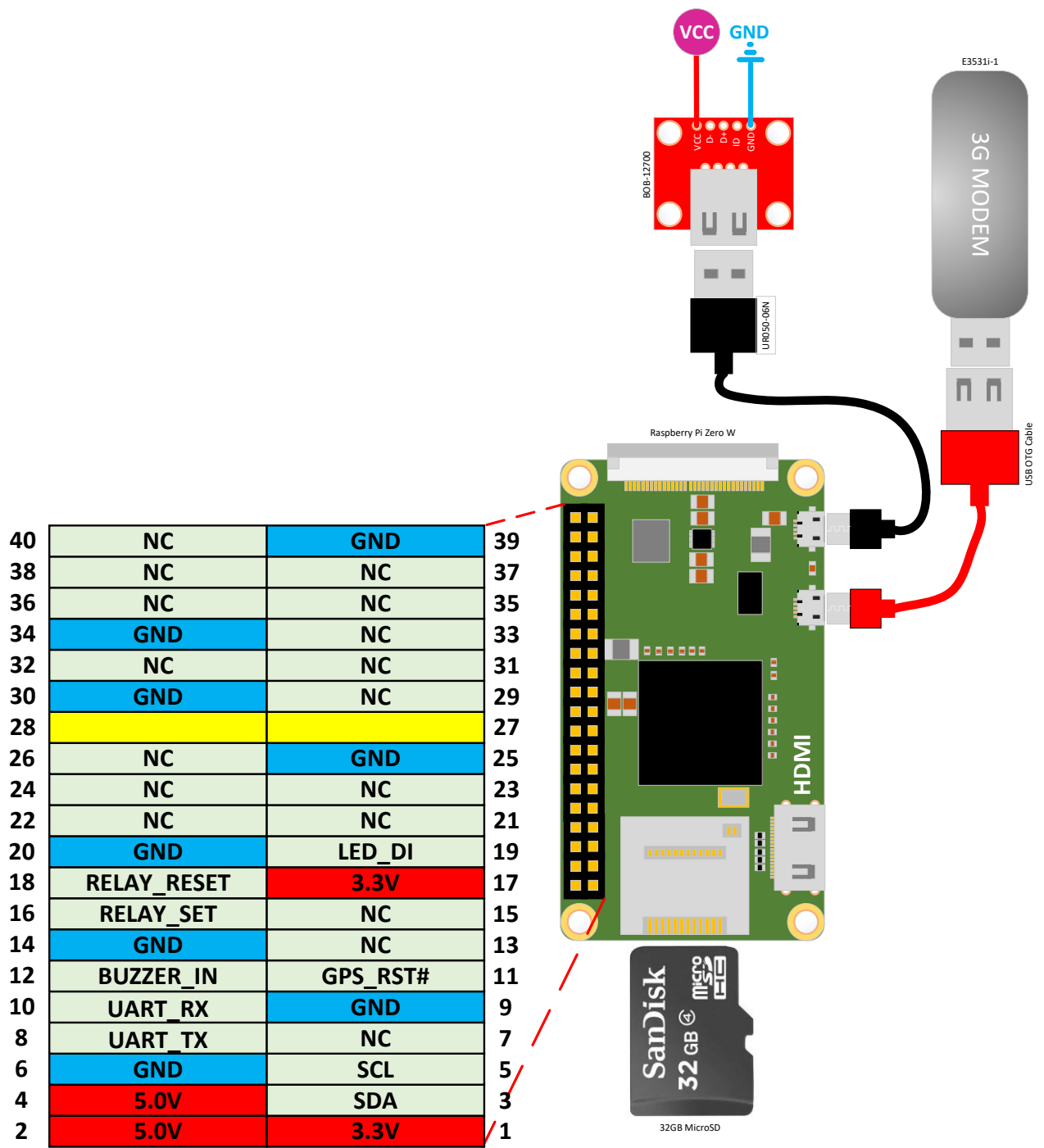After components mounting, use the functional schematic on the Figure.24 for signal wires soldering

40	NC	GND	39
38	NC	NC	37
36	NC	NC	35
34	GND	NC	33
32	NC	NC	31
30	GND	NC	29
28			27
26	NC	GND	25
24	NC	NC	23
22	NC	NC	21
20	GND	LED_DI	19
18	RELAY_RESET	3.3V	17
16	RELAY_SET	NC	15
14	GND	NC	13
12	BUZZER_IN	GPS_RST#	11
10	UART_RX	GND	9
8	UART_TX	NC	7
6	GND	SCL	5
4	5.0V	SDA	3
2	5.0V	3.3V	1

Raspberry Pi Zero W

32GB MicroSD

Figure. 24 Raspberry Pi and 3G functional schematic connection

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Table. 12 Prototype components list

	Description	Manufacturer	Manufacturer PN	Link	Q-ty
1	AUDIO PIEZO INDICATOR 6-14V CHAS	CUI Inc.	CPE-267	Link	1
2	DC DC CONVERTER 12V 1W	XP Power	ISE0512A	Link	1
3	SOP-8 TO DIP-8 SMT ADAPTER	Chip Quik	IPC0142	Link	1
4	MOSFET N-CH 60V 360MA TO-236AB	Nexperia USA Inc.	BSS138P,215	Link	1
5	SOCKET ADAPTER SOT-23 TO 6DIP	Aries Electronics	LCQT-SOT23-6	Link	3
6	CAP ALUM 2.2UF 20% 160V RADIAL	Nichicon	UPS2C2R2MED1TD	Link	2
7	Isolated Module DC DC Converter 5V 3A 18V - 75V Input	CUI Inc.	PDQ15-Q48-S5-D	LInk	1
8	CAP ALUM 10UF 20% 16V RADIAL	Panasonic	ECA-1CM100I	Link	1
9	ADS1115 16BIT ADC 4CH PROG GAIN	Adafruit	1085	Link	1
10	RELAY GEN PURPOSE SPST 50A 5V	Panasonic	ADJH23005	Link	1
11	X-NUCLEO-GNSS1A1	STMicroelectronics	X-NUCLEO-GNSS1A1	Link	1
12	ADAPTER BOARD LIS2HH12 DIL24	STMicroelectronics	STEVAL-MKI164V1	Link	1
13	CAP ALUM 220UF 20% 160V RADIAL	Nichicon	493-13277-3-ND	Link	1
14	USB 2.0 Cable A Male to Micro B Male 0.50'	Tripp Lite	UR050-06N	Link	2
15	CONN HEADER VERT 40POS 2.54MM	Sullins	PREC040SABN-RC	Link	4
16	MOSFET N-CH 30V 5.8A SOT-23	Diodes Incorporated	DMN3404L-7	Link	2
17	DIODE SCHOTTKY 20V 1A DO41	Micro Commercial Co	1N5817-TP	Link	2
18	MP2636 Power Booster & Charger Module	DFRobot	DFR0446	Link	1
19	BATTERY LITHIUM 3.7V 4.4AH	Adafruit	354	Link	1
20	Raspberry Pi Zero W	sparkfun	Raspberry Pi Zero W	Link	1
21	USB OTG Cable - Female A to Micro B - 5in	sparkfun	USB OTG Cable	Link	1
22	Raspberry Pi micro-USB power cable	reichelt	AK67421-0.5	Link	2
23	microSD Card with Adapter - 32GB (Class 10)	sparkfun	32GB MicroSD	Link	1
24	CONN HEADER VERT 40POS 2.54MM	Amphenol ICC (FCI)	67997-240HLF	Link	1
25	3G GSM modem Huawei E3531i-1	Huawei	E3531i-1	Link	1
26	SPARKFUN LEVEL TRANSLATOR BREAKOUT - PCA9306	sparkfun	PCA9306	Link	1
27	Gravity: Digital RGB LED Module	dfrobot	FR0605	Link	1
28	SparkFun microB USB Breakout	sparkfun	BOB-12035	Link	1
29	SparkFun USB Type A Female Breakout	sparkfun	BOB-12700	Link	2
30	Slide Switch DPDT Through Hole	C&K	JS202011CQN	Link	1
31	DC supply male plug	AMASS	AMASS XT30U-M	Link	2
32	DC supply female plug	AMASS	AMASS XT30U-F	Link	2
33	PMODUSBUART USB TO UART MODULE	Digilent, Inc.	410-212	Link	1
34	BREADBOARD GENERAL PURPOSE PTH	SCI	PC-01LAM	Link	1
35	Black colored power 16AWG lead cable	STÄUBLI	60.7031-21	Link	1

36	Red colored power 16AWG lead cable	STÄUBLI	60.7031-22	Link	1
37	RCY receptacle housing (for pin contact)	JTS	SYR-02T	Link	1
38	RCY plug housing (for sokcet contact)	JTS	SYP-02T-1	Link	1
39	RCY pin contact	JTS	SYM-001T-P0.6(N)	Link	2
40	RCY socket contact	JTS	SYF-001T-P0.6(LF)(SN)	Link	2
41	RES 2K OHM 1/4W 5% AXIAL	Stackpole	CF14JT2K00	Link	1
42	RES 215K OHM 1/4W 1% AXIAL	Yageo	MFR-25FBF52-215K	Link	3
43	RES 18K OHM 1/4W 1% AXIAL	Stackpole	RNMF14FTC18K0	Link	2
44	RES 1M OHM 1/4W 1% AXIAL	Stackpole	RNF14FTD1M00	Link	2
45	CAP FILM 0.015UF 5% 63VDC RADIAL	EPCOS (TDK)	B32529C0153J189	Link	2
46	M3 Pan Head Machine Screw Phillips Drive Nylon	Wurth Electronics Inc.	97790603111	Link	16
47	M3 Pan Head Machine Screw Phillips Drive Nylon	Essentra Components	NMS-310	Link	6
48	M3 Flat, Retaining Washer 0.055" (1.40mm) Thick Plastic	Essentra Components	015003000503	Link	16
49	M3 Hex Nut 0.217" (5.50mm) Nylon	Wurth Electronics Inc.	709940300	Link	16
50	Hex Standoff Threaded M3 Nylon 0.394" (10.00mm) Natural	Keystone Electronics	'25510	Link	4
51	uxcell AWG30 1000.7FT Breadboard Wrapping Wire	uxcell	AWG30	Link	1
52	Jumper Wires Standard 7" M/M - 30 AWG (30 Pack)	sparkfun	Jumper Wires	Link	2
53	Heavy Duty Mounting Tape Clear	Amazon	VHB	Link	1
54	Multi-Purpose Cable Tie (100 Piece), 8", Black	TR	TR88302	Link	1
55	HEATSHRINK 3/16 IN X 4FT BLACK	Alpha Wire	F221B3/16 BK100	Link	1
56	HEATSHRINK 3/16" X 4' RED	Panduit Corp	HSTT19-48-Q2	Link	1
57	TERM BLK 2P SIDE ENT 10.16MM PCB	Wurth Electronics Inc.	691256610002	Link	2
58	BUMPER CYLINDRICAL 0.5" DIA CLR	Essentra Components	RBS-6	Link	4