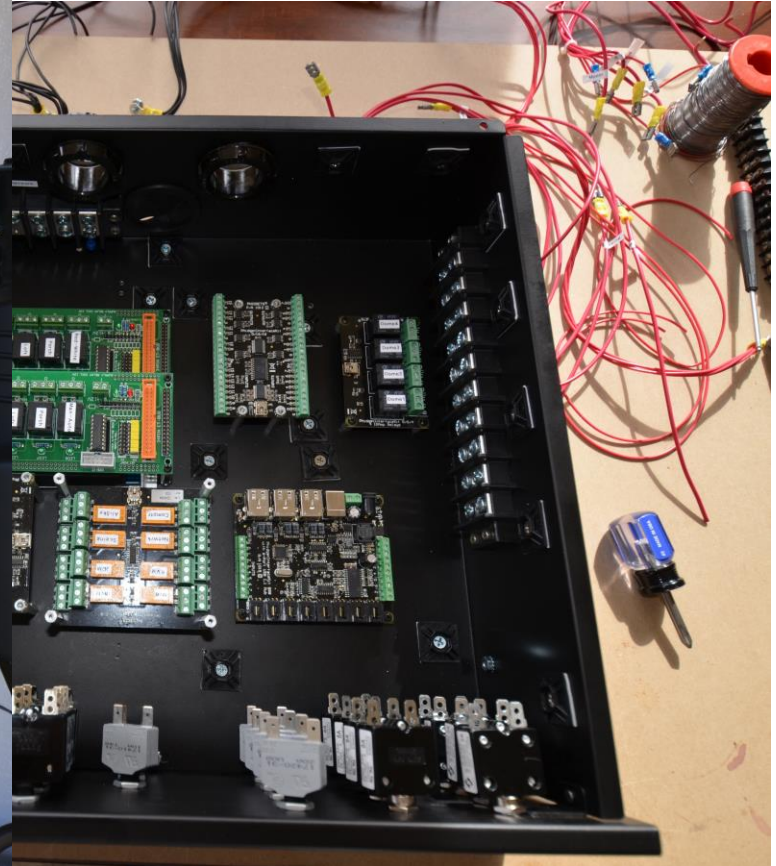


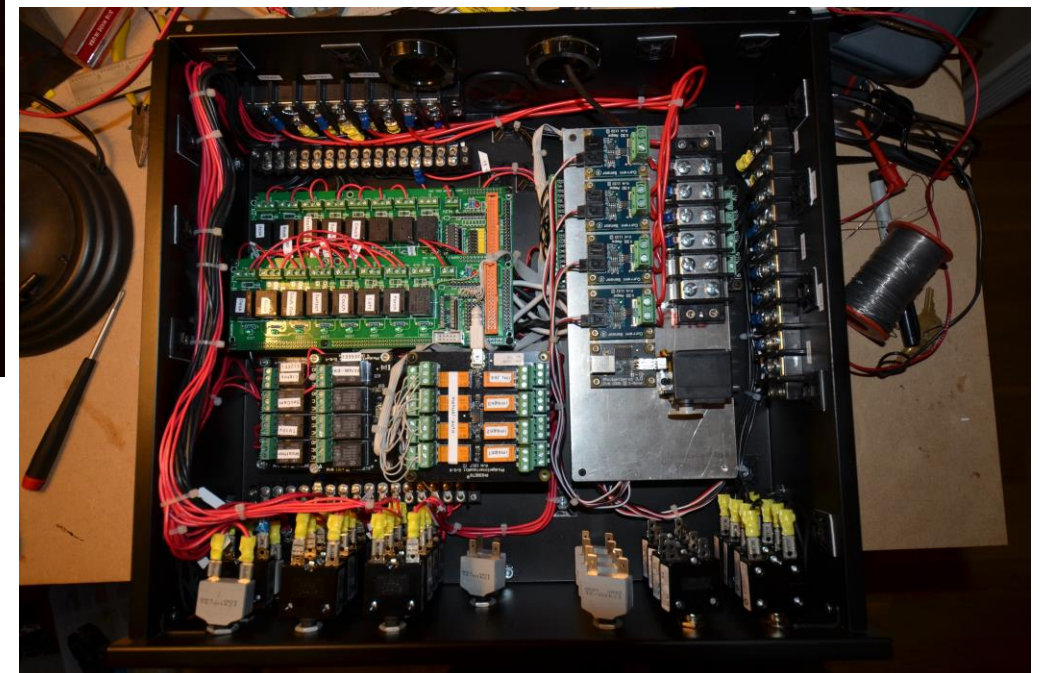
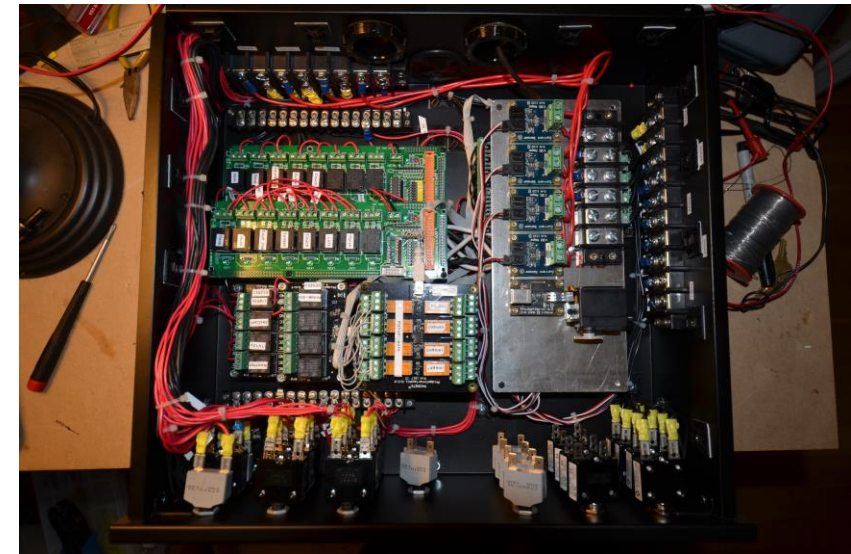
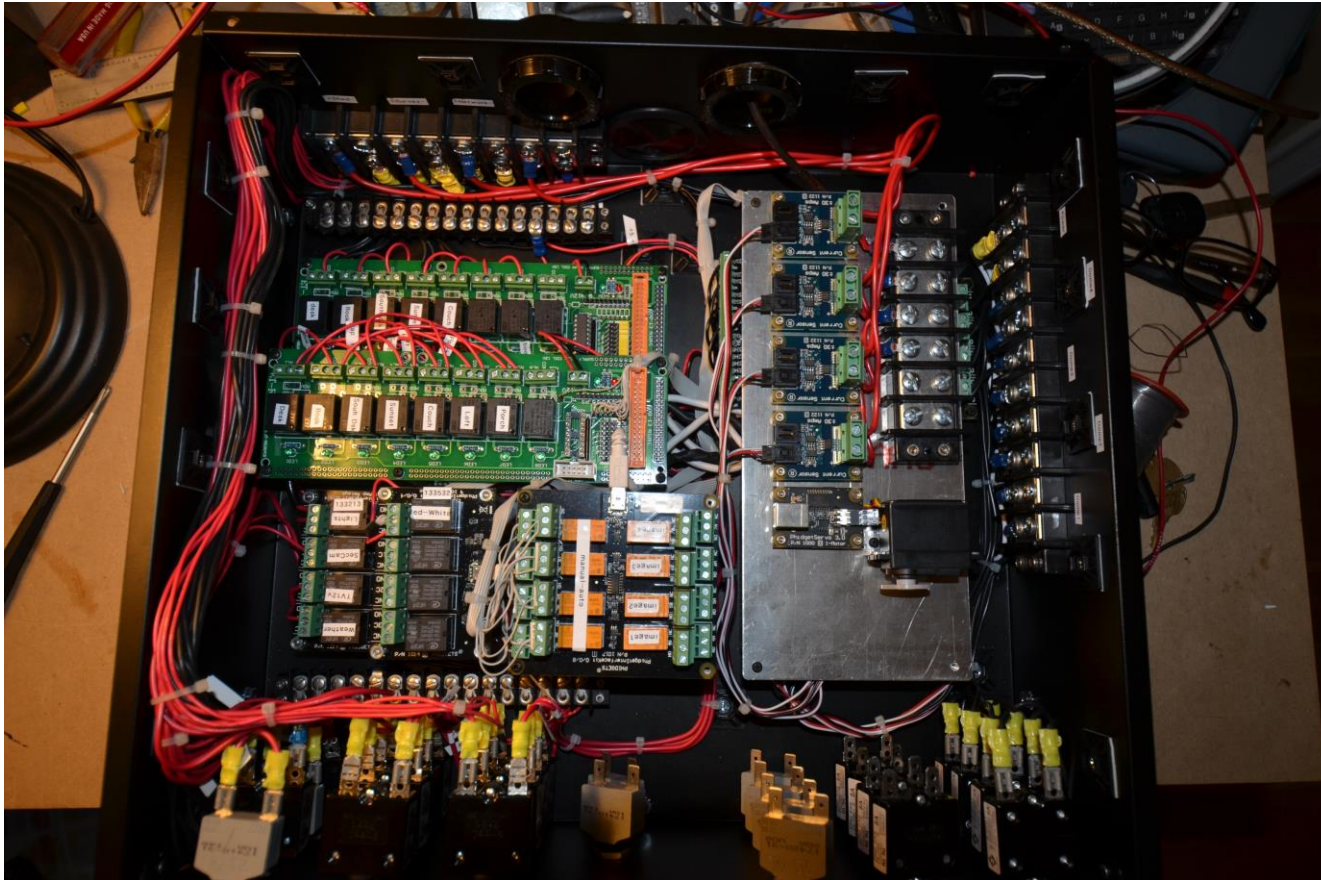
Site Remote Control

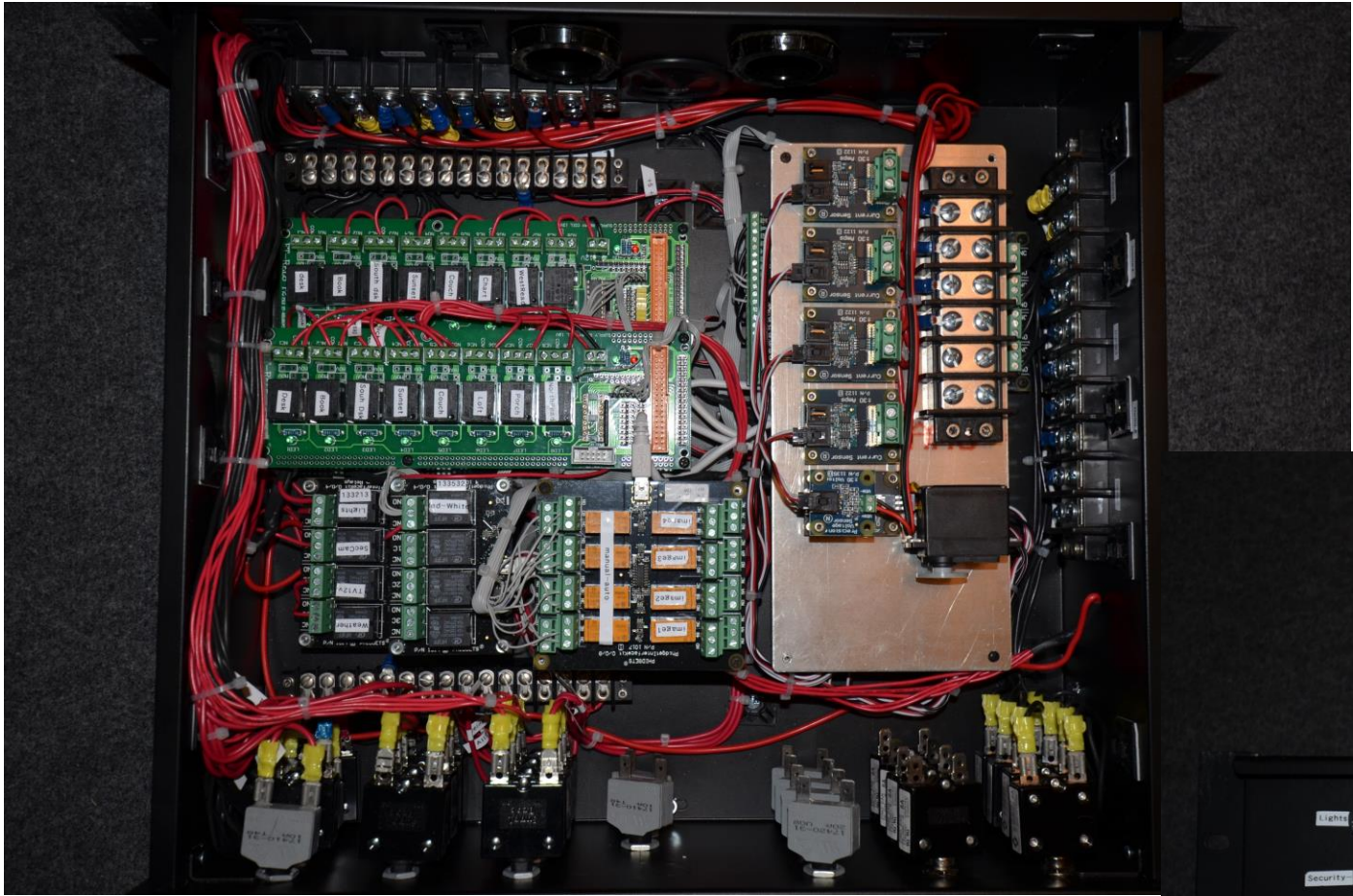
2012 to 2025

Jan 2012

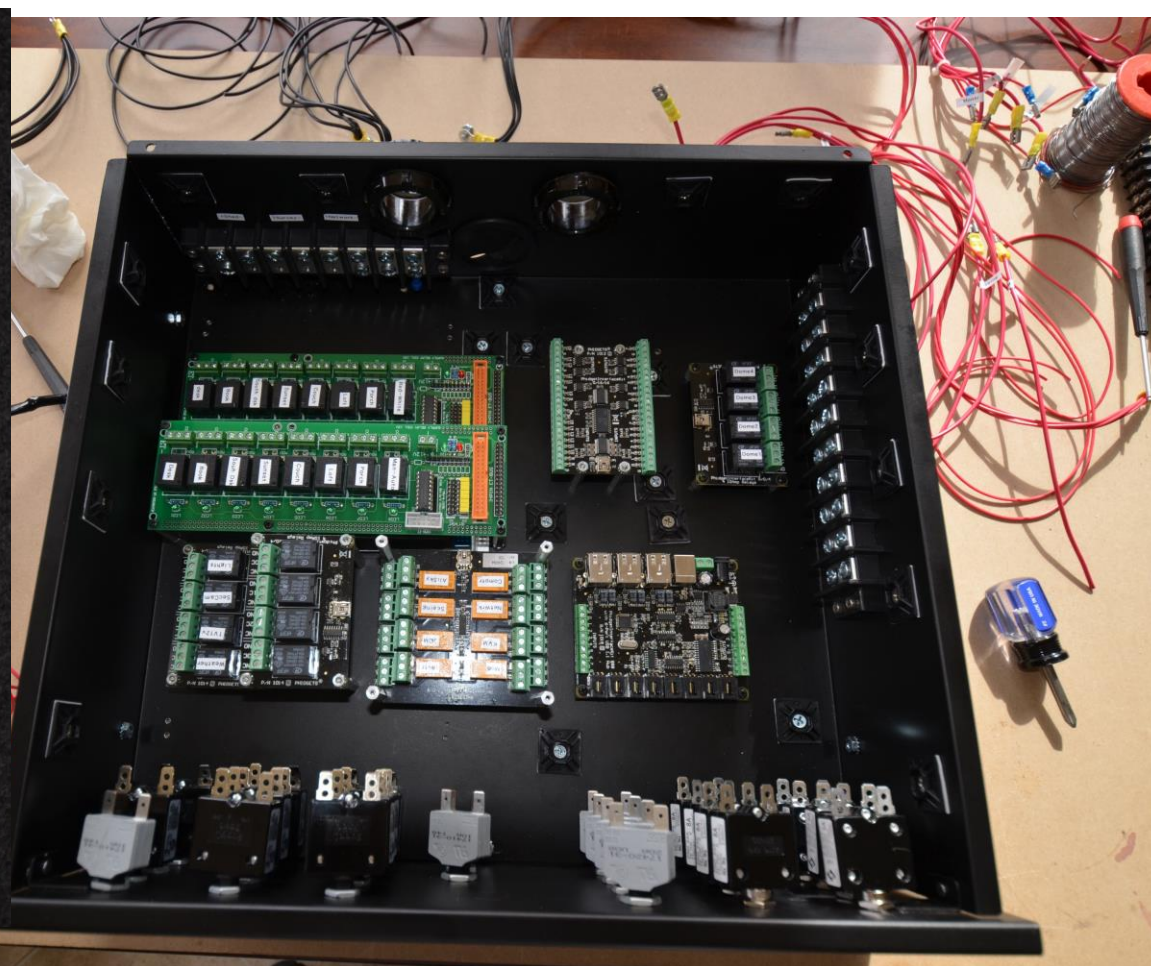
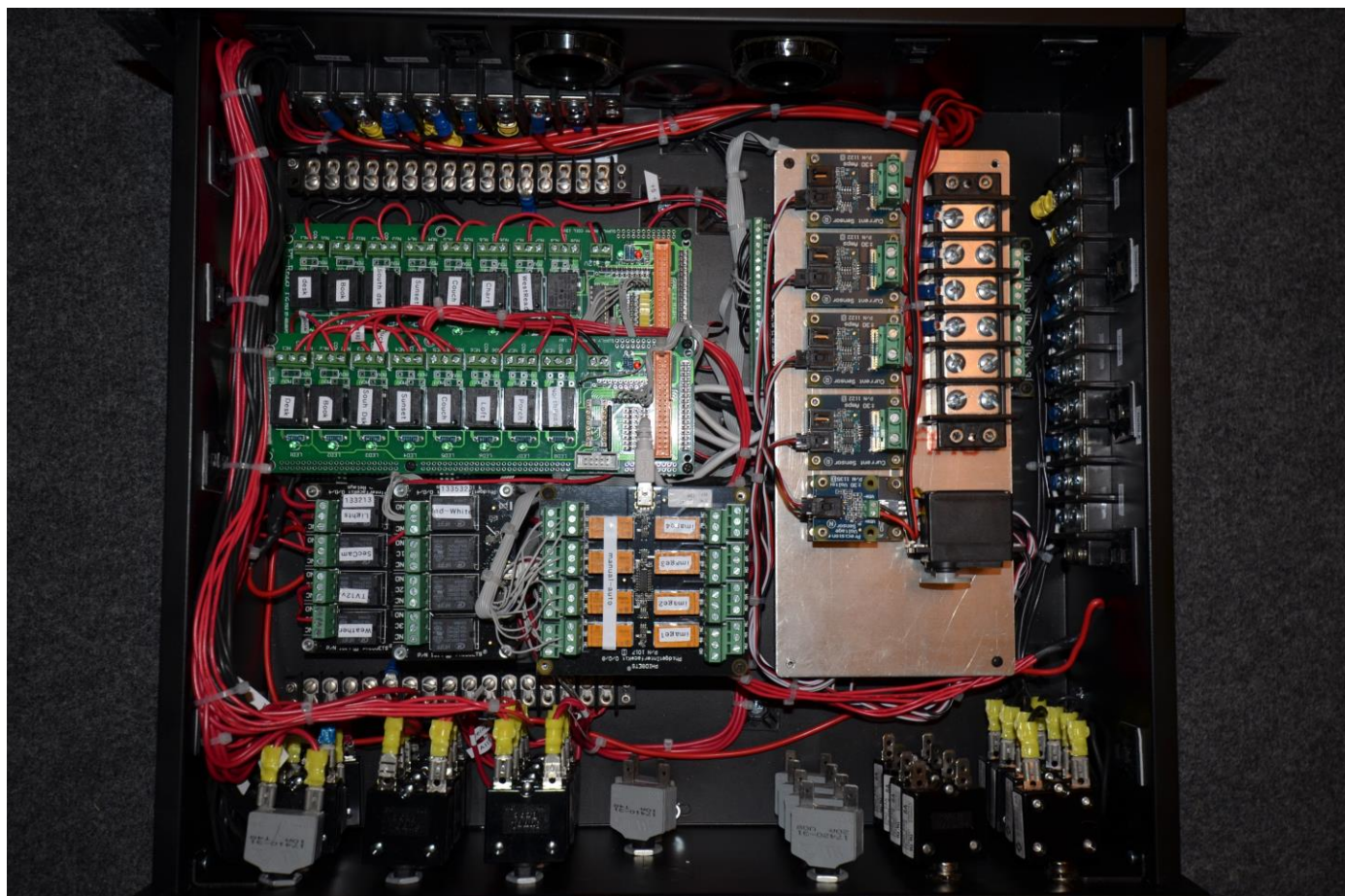


Jan 2012

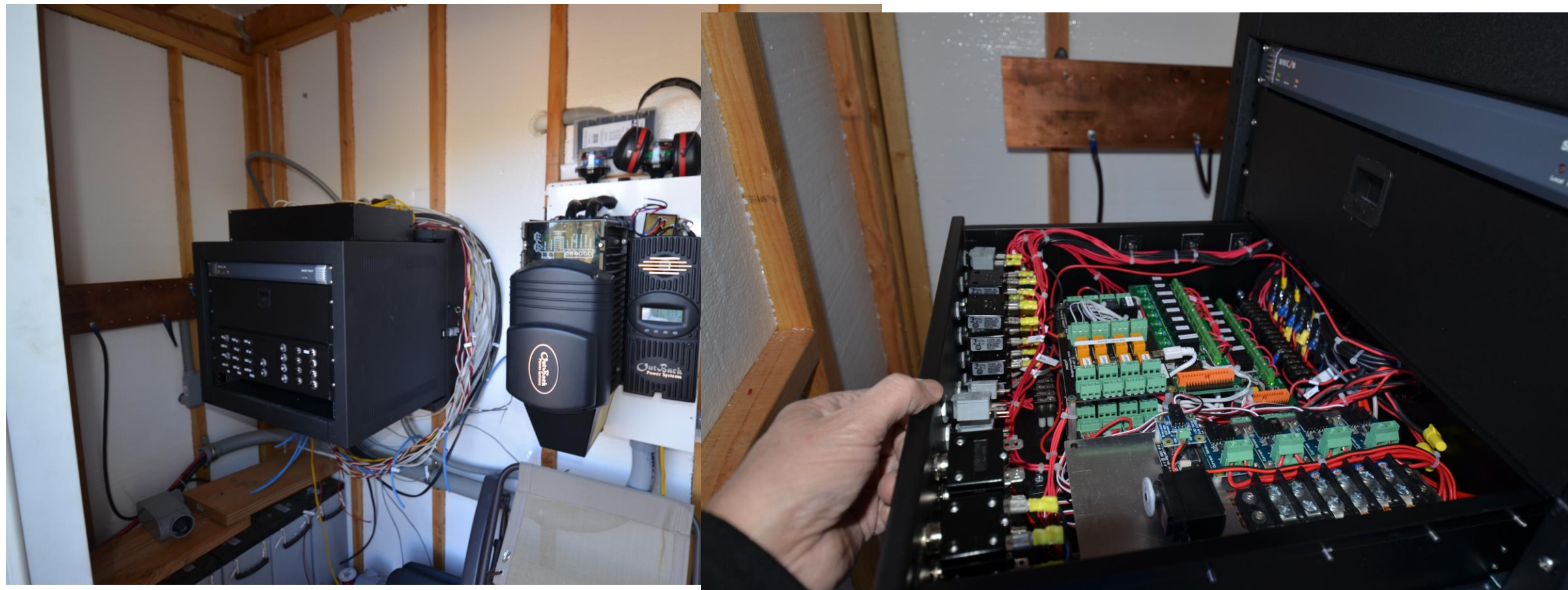




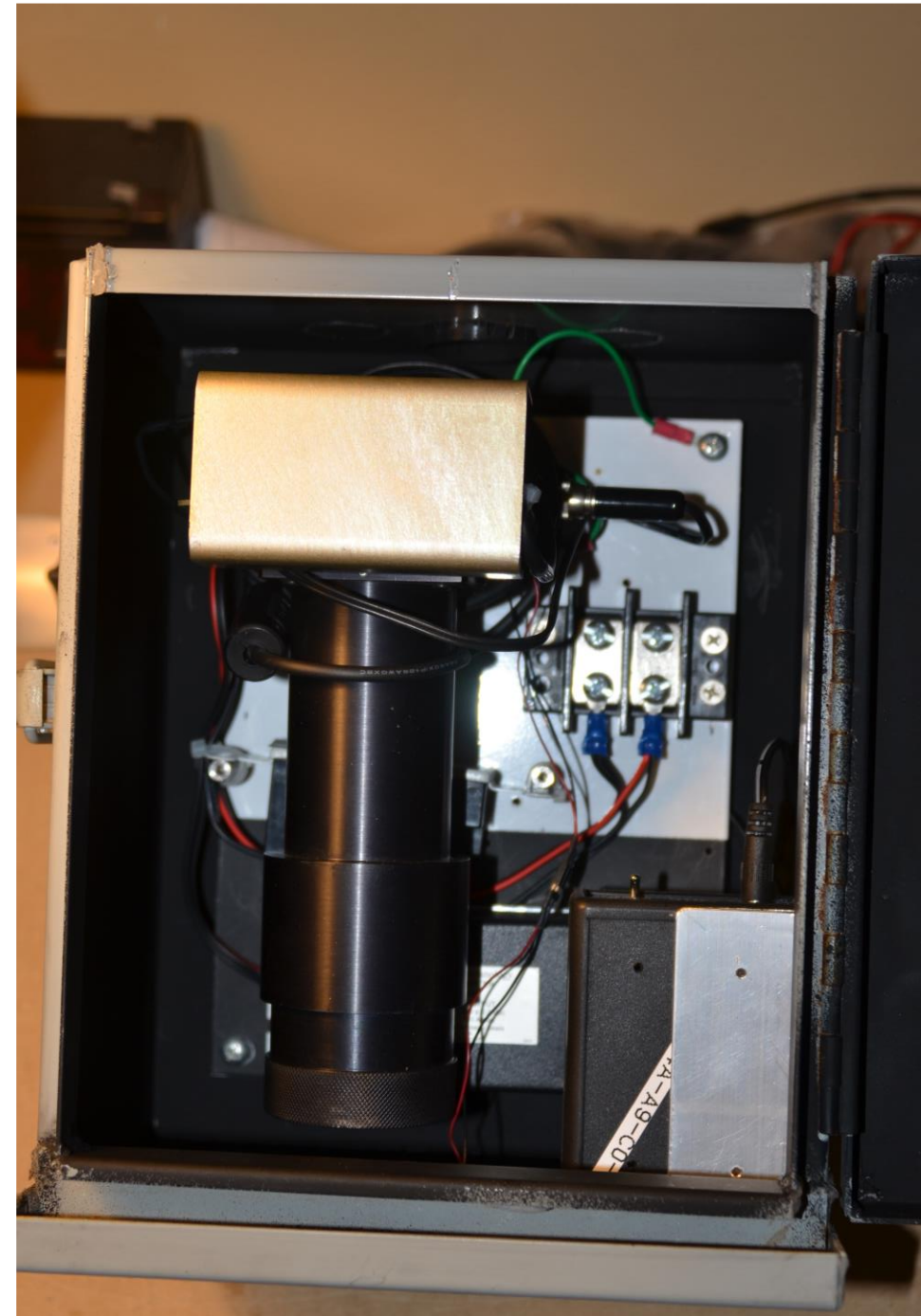
Jan 2012



Jan 2012



Feb 2012

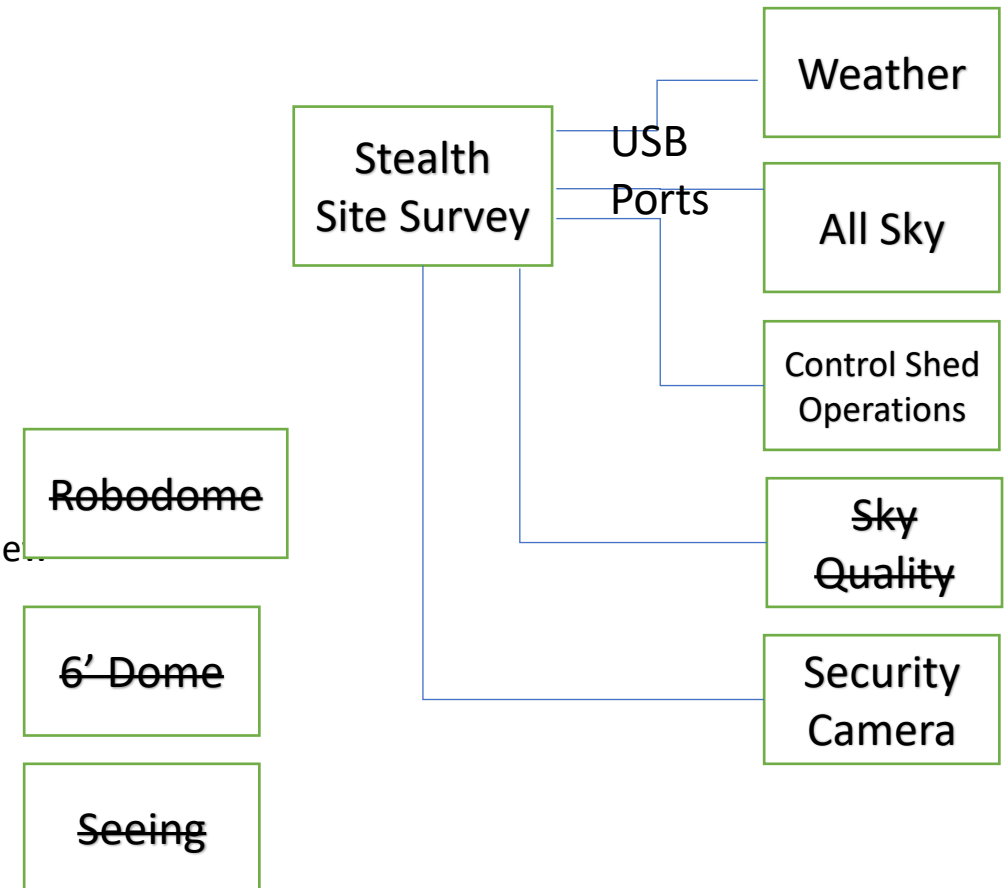




Existing Instruments 2024 and Additional Instruments

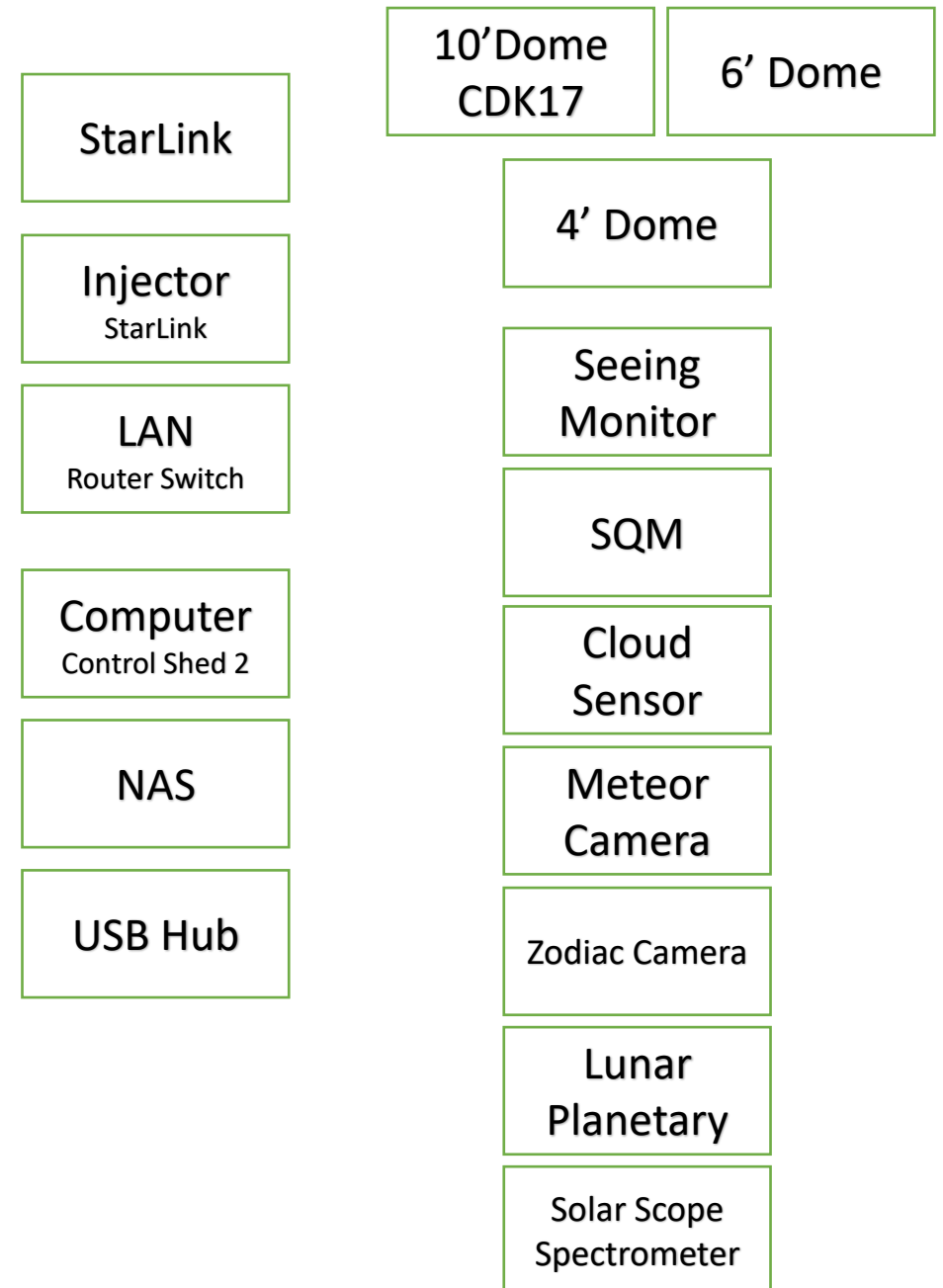
24hr Day-Night Operations Control Shed 1

- Weather Station
- All Sky Camera
- Control Shed operations
- ~~Sky Quality Meter~~ Leave here and augment with new
- Security Cameras
- ~~Robodome System~~ Leave here and augment with new
- ~~6' dome system~~ Leave here and augment with new
- ~~Seeing Camera~~ Leave here and augment with new
- ~~110Volt at instrument charger/ batteries~~ Leave here and augment with new
- Control Shed 2 on-off
- 110 volt Control Shed 1 on-off and switching for charging
- Infrasound Sensor: purchased 201912
- Seismograph: purchased 201912
- Lightning sensor



Additional Instruments

- Small Instrument Pad
 - Seeing monitor
 - SQM
 - Cloud Sensor
 - Meteor Camera
 - Zoom lens camera
 - Lunar-Planetary scope 6"-8" Mac with high speed camera
- Solar Scope 80mm aperture
 - Spectrometer??
- CDK17 Telescope and 10' dome
- StarLink system for control and data download; 110volt version is 50 watts
 - Injector 12 volt backup to 48 volts, use direct battery relay
- Computer 12 volt backup to 19 volts, use direct battery relay
- Router 12 volts, use 12v power supplied relay
- Switch 12 volts, use 12v power supplied relay
- NAS 10TB 12v, use direct battery relay



ControlShed 2 Functionality

Astronomical and Intermittent Instruments

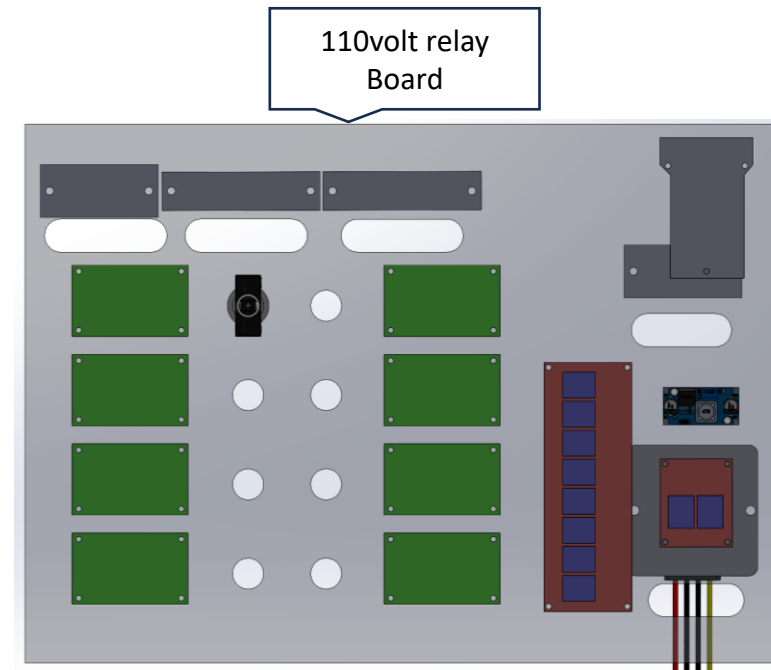
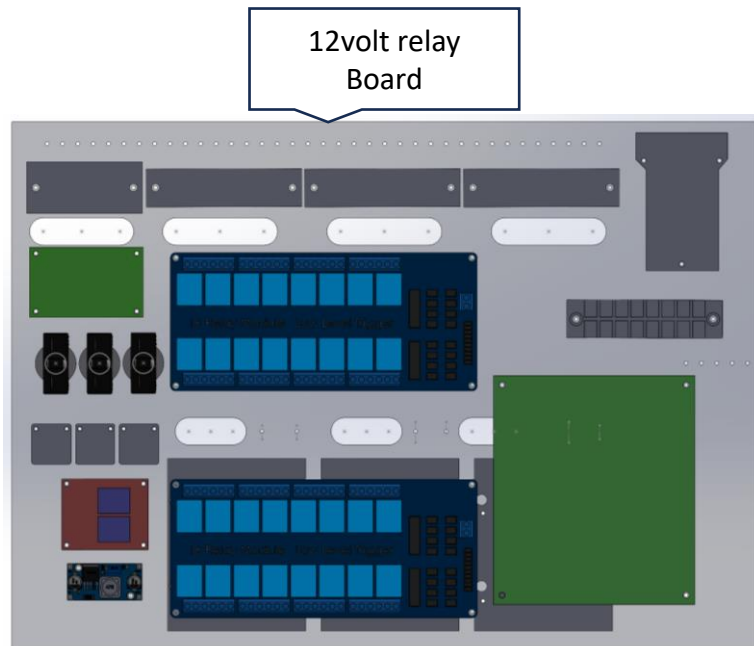
- Astro-Conditions
 - Weather... draw data from weather station
 - SQM
 - Seeing Monitor
 - Cloud Sensor
- Astrolmaging Instruments
 - RoboDome
 - 6' Dome
 - 10' Dome
 - Meteor Camera
 - Zodiacal light- night environment
- Network and Communications
 - NAS
 - Network
 - StarLink 50 watts normal 90 watts with heater

Additional Accoutrements

- Generator 2KW propane, gas
 - Sound proofed
 - Remote controlled
 - Isolated
 - Power to
 - Battery shed
 - Trailer
- Storage units (2) 10X12
- Septic System 1000 gallon
- Additional Solar 4 panels now 12 more later

Additional Power and Control

- (24) 12volt relays for low power instruments
- (8) 110volt AC relays for inverter power distribution
- (8) control relays for switching states of instruments and inverter



Pin Function Mega2560Pro

- Pin (6)D2 - D7 Digital Inputs
 - D2==Local Use Pin
 - D3== computer Fan Control
 - D4== Control2 Temp
- Pin D09 Enable 12 volt board
- Pin (2)D10 - D11, (6)D14 - D19, (8)D22 - D29... (16)Relays , set HIGH ==OFF, set LOW == ON
- Pin 30 – Pin 53... (24)Relays , set HIGH ==OFF, set LOW == ON
- Pin 20... Data INA260 Power Module
- Pin 21... Clock INA260 Power Module

Breaker and Power Supply Mapping

- Breaker 1
 - INA260 (nill, nill address)
 - Relay Board A power
 - Power Supply 1
 - Relays A1-A4
 - Battery Relays it is expected that each of these will have its own power monitoring
 - A13- A16
- Breaker 2
 - INA260 (A0, nill address)
 - Mega 2560 Board power
 - Power Supply 2
 - Relays A5-A8
 - Battery Relays it is expected that each of these will have its own power monitoring
 - B1- B4
- Breaker 3
 - INA260 (nill, A1 address)
 - Relay Board B power
 - Power Supply 3
 - Relays A9- A12
 - Battery Relays it is expected that each of these will have its own power monitoring
 - B5- B8
- 5volt always on Power Supply hooked to 12 volt Battery Mains

Relay-Mega2560 Mapping

Control Shed 2 Relay Mapping											
Relay Function	Relay Board	Relay Number Data Offset		Mega 2560							
				Mega Pin	Command Mapping On Off						
				4							
				5							
				6							
				7							
				8							
				9							
-		-					-	-			Digital Input Digital Input Digital Input Digital Input Digital Input
12 Volt Switching Power Supply1	A1	1		30	34	33		1a			SQM
12 Volt Switching Power Supply1	A2	2		31	36	35		2a			Seeing Monitor
12 Volt Switching Power Supply1	A3	3		32	38	37		3a			Cloud Sensor
12 Volt Switching Power Supply1	A4	4		33	40	39		4a			Zodiacal Light Camera
12 Volt Switching Power Supply2	A5	5		34	42	41		5a			Seismograph
12 Volt Switching Power Supply2	A6	6		35	44	43		6a			Infrasound
12 Volt Switching Power Supply2	A7	7		36	46	45		7a			Lightning Sensor
12 Volt Switching Power Supply2	A8	8		37	48	47		8a			Meteor Camera
-		-		20				-	yellow	-Data- INA260 Power Module	
-		-		21				-	blue	-Clock- INA260 Power Module	
12Volt Switching Power Supply3	A9	9		38	50	51		1b			LAN
12Volt Switching Power Supply3	A10	10		39	52	53		2b			NAS
12Volt Switching Power Supply3	A11	11		40	54	55		3b			Starlink may need 110v
12Volt Switching Power Supply3	A12	12		41	56	57		4b			
Battery	A13	13		42	58	59		5b			
Battery	A14	14		43	60	61		6b			
Battery	A15	15		44	62	63		7b			
Battery	A16	16		45	64	65		8b			
Battery	B1	17		29	32	31		1c			
Battery	B2	18		28	30	29		2c			
Battery	B3	19		27	28	27		3c			
Battery	B4	20		26	26	25		4c			
Battery	B5	21		25	24	23		5c			
Battery	B6	22		24	22	21		6c			
Battery	B7	23		23	20	19		7c			
Battery	B8	24		22	18	17		8c			
	B9										
Control Switching Relays		25		19	16	15		-	1d, 2d	Enable 12 volt board	Enable 12 volt board
	B10										
Control Switching Relays		26		18	14	13		-	3d, 4d		RoboDome Computer Enable
	B11										
Control Switching Relays		27		17	12	11		-	5d, 6d		RoboDome Dome Enable
	B12										
Control Switching Relays		28		16	10	9		-	7d, 8d		SixDome Computer Enable
	B13										
Control Switching Relays		29		15	8	7	on 110V board	18, 19	1e, 2e	Enable 110Volt Board	Enable 110Volt Board
	B14										
Control Switching Relays		30		14	6	5	on 110V board	20, 21	3e, 4e		SixDome Dome Enable
	B15										
Control Switching Relays		31		11	4	3	on 110V board	22, 23	5e, 6e		10'Dome System Enable
	B16										
Control Switching Relays		32		10	2	1	on 110V board	24, 25	7e, 8e	Enable Inverter	Enable Inverter
110 volt Board	C1	33		46	66	65	on 110V board	1			RoboDome Charging Enable
110 volt Board	C2	34		47	68	67	on 110V board	2			SixDome Charging Enable
110 volt Board	C3	35		48	70	69	on 110V board	3			10'Dome ChargingEnable
110 volt Board	C4	36		49	72	71	on 110V board	4			StarLink
110 volt Board	C5	37		50	74	73	on 110V board	5			Meteor Charge Enable
110 volt Board	C6	38		51	76	75	on 110V board	6			
110 volt Board	C7	39		52	78	77	on 110V board	7			
110 volt Board	C8	40		53	80	79	on 110V board	8			
								Ground			

Serial Commands for Mega2560Pro

- :RON# Sets relays ALL ON
- :ROF# Sets relays ALL OFF
- :RRR# Get Relay state reports relay on-off state for all 40 relays
- :RAD# Relay state and INA260 A-C reports
- :RPW# Reports the INA260's amps, volts, watts data

- :xxx# turn on selected relay xxx == the three digit "even" number between 2 and 80 mapped to relays
- :xxx# turn off selected relay xxx == the three digit "odd" number between 1 and 79 mapped to relays
- :EHV# Enables the 110volt board
- :DHV# Disables the 110volt board

Data Arrays

- bufGRS... get relay state 41 element array
 - (40) relay values 0== off 1== on followed by a comma “,”
- bufARC... (3)INA260 values 73 element array
 - Current string 8.2
 - Voltage string 8.2
 - Power string 8.2
- bufDHT22... (2) DHT22 Sensors 25 element array
 - Humidity string 4.1
 - Temperature string 4.1
- :RAD# 121 characters read...

DB25-Mega Pin Mapping Summary

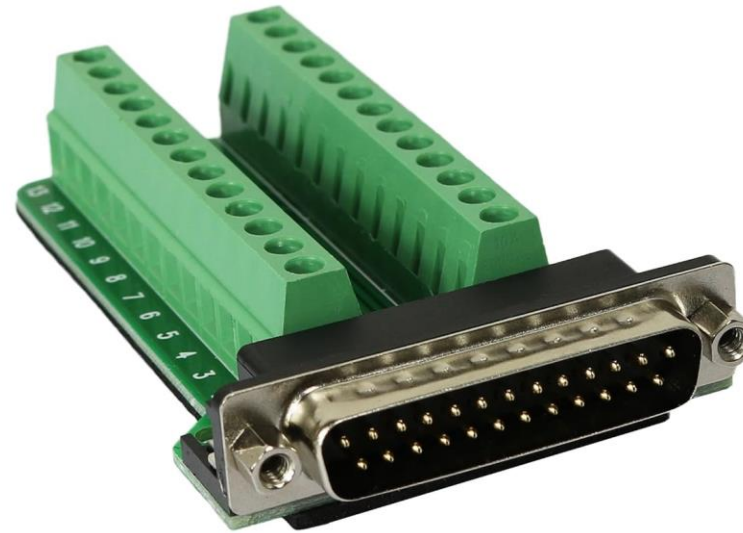
- Pins 1-8 110volt relays 1-8
- Pins 18-25 Control Switching Relays 5, 6, 7, 8

Mega Control at Start

• Computer ON	Computer comes up with power “NO RELAY”	
• Router ON	offset 10	Mega Pin 39
• Switch ON	offset 11	Mega Pin 40
• USB Hub ON	offset 15	Mega Pin 44

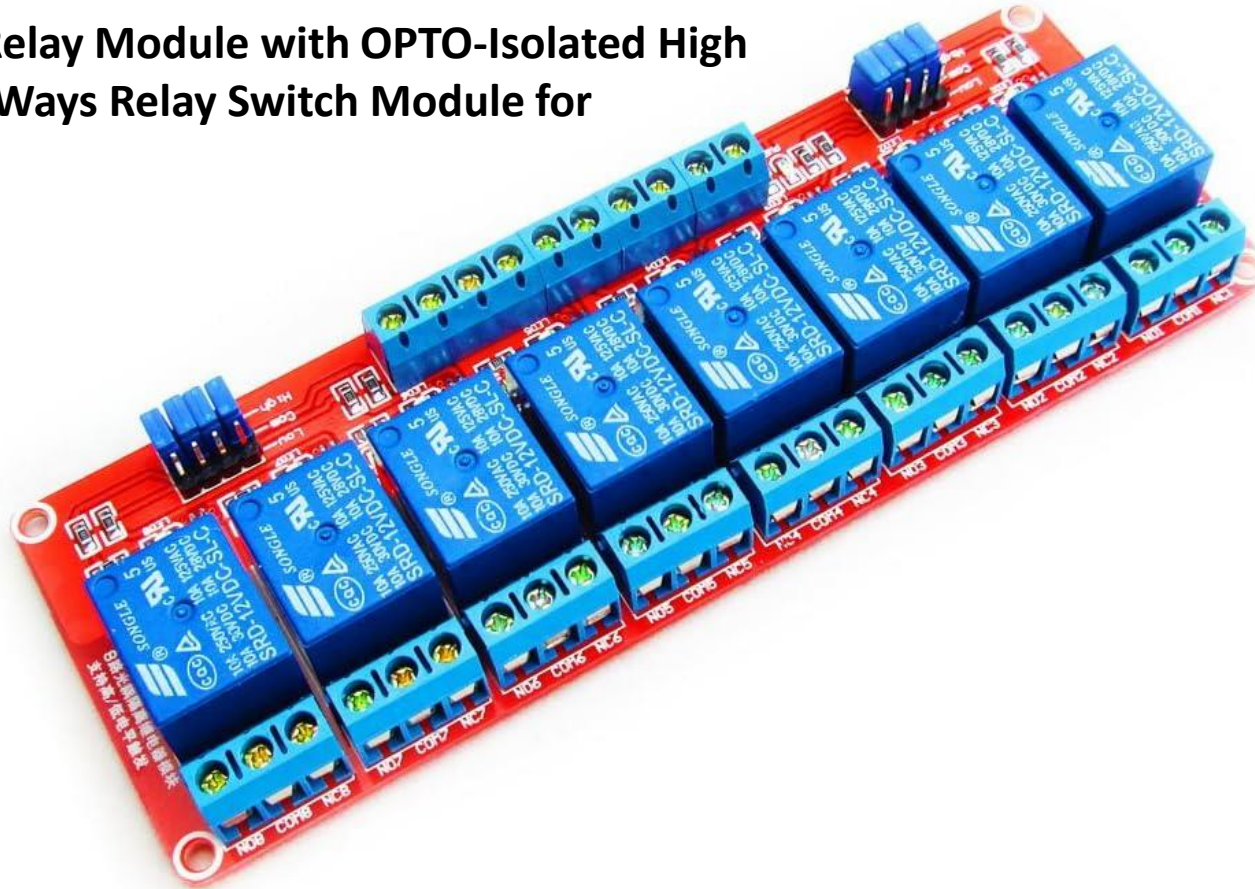
DB25 Breakout Connectors

Twinklebay Connector Db25 D-sub

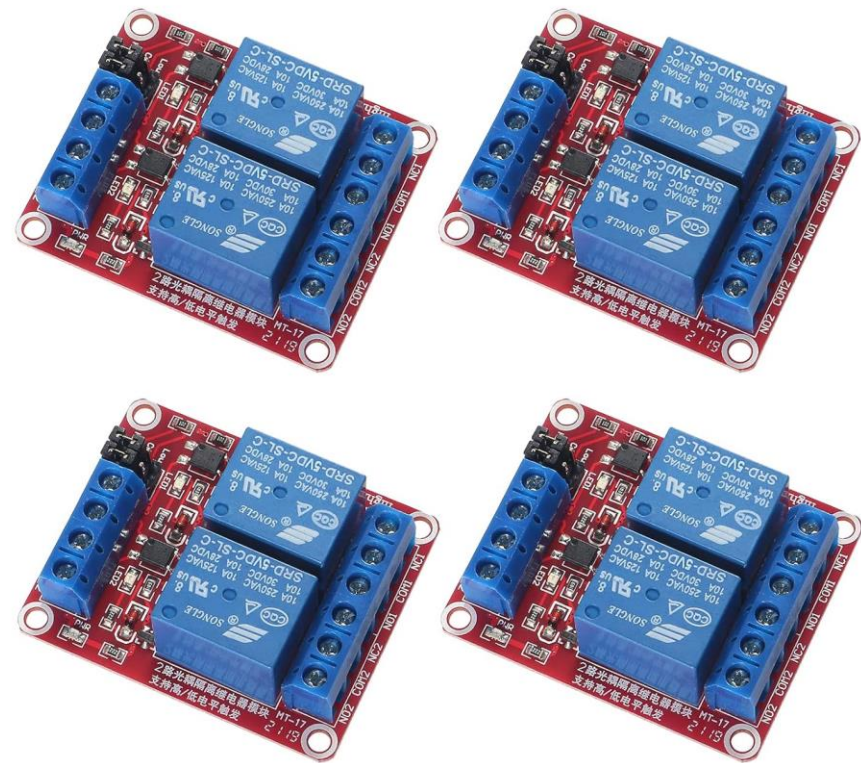


8-Relay Module

HiLetgo 12V 8 Channel Relay Module with OPTO-Isolated High and Low Level Trigger 8 Ways Relay Switch Module for Arduino



4pcs DC 5V Relay Module 2 Channel Relay Board with Optocoupler Support High or Low Level Trigger

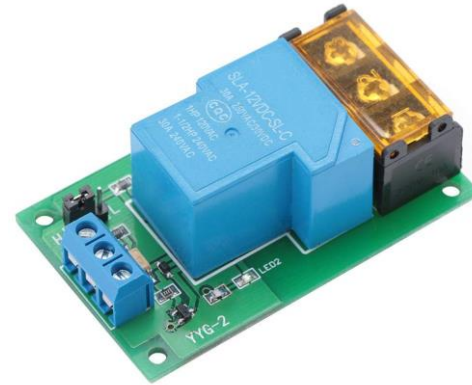
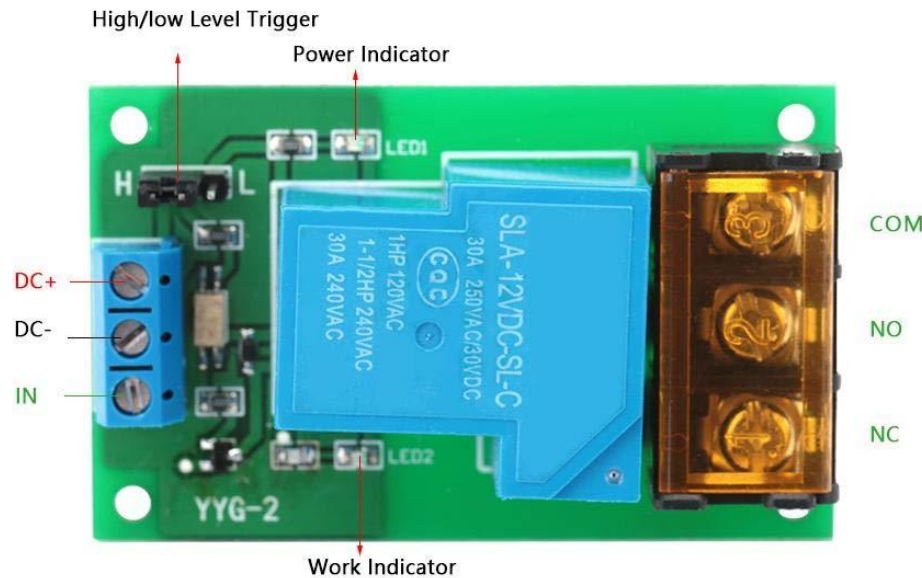


Power Supply for Lighting 20Amps

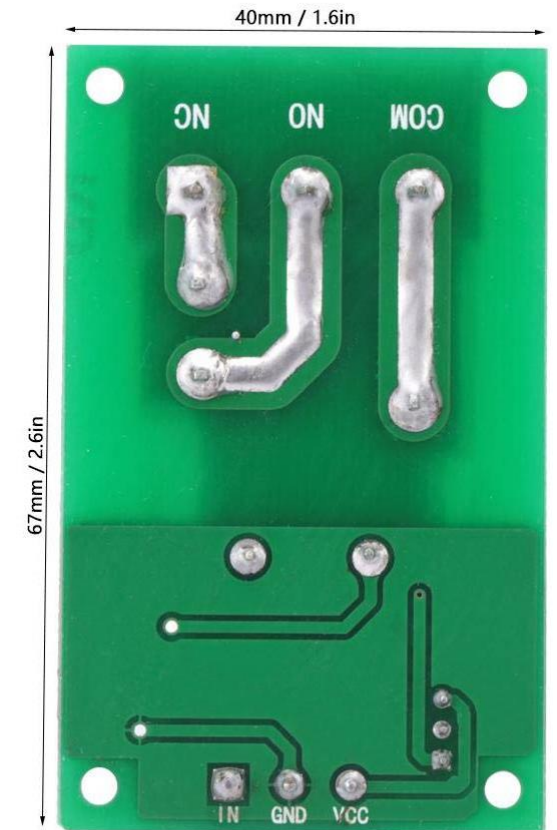
**DROK Boost Buck Converter 9V-36V to 12V 20A 240W
Aluminium Shell Waterproof Auto Step Up Down Voltage
Regulator 12V Volt**



Relay Module One Way 30A Optocoupler Isolation Relay



1.3125" x 2.3125" hole pattern



Current Rating	30 Amps
Brand	YWBL-WH
Coil Voltage	12 Volts
Contact Current Rating	30 Amps
Maximum Switching Current	30 Amps

1. DC+: the positive pole of the external DC power supply
2. DC-: the negative pole of the external DC power supply
3. IN: Signal input terminal
4. NO: the relay often opens the interface, the relay suspends before pulling in, and then shortens the connection with the COM.
5. COM: common interface of relay
6. NC: the relay is normally closed, the relay is short to the COM before it is pulled in.

Overload Protection 20Amps

**Thermal Circuit Breaker 20 Amps, Thermal Overload Protector
L1 Series 125-250V AC 50V DC Push Button Manual Reset
Circuit Breaker 20A 2 Pcs**

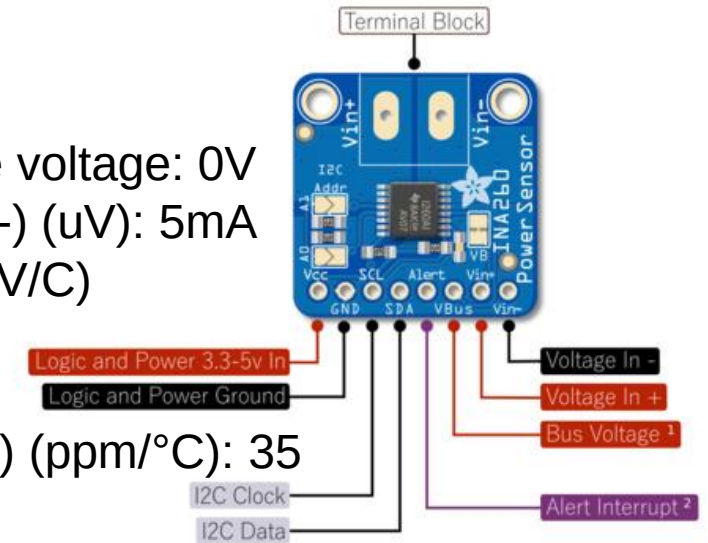


1NA260 I2C Power Monitor

1NA260 Pinout

- Bi-directional
- Integrated Shunt
- Low-side Capable
- Precision Integrated Shunt Resistor: Current Sense Resistance: 2 m Ω
- Tolerance Equivalent to 0.1%
- 15-A Continuous From -40°C to $+85^{\circ}\text{C}$
- 10 ppm/ $^{\circ}\text{C}$ Temperature Coefficient (0°C to $+125^{\circ}\text{C}$)
- Senses Bus Voltages From 0 V to 36 V
- High-Side or Low-Side Sensing
- Reports Current, Voltage, and Power
- High Accuracy: 0.15% System Gain Error (Maximum)
- 5-mA Offset (Maximum)
- Configurable Averaging Options
- 16 Programmable Addresses

- Minimum Common mode voltage: 0V
- Maximum Input offset (+/-) (μV): 5mA
- Input offset drift (+/-): 1($\mu\text{V}/\text{C}$)
- Gain: 1 Gain
- Error: 0.15%
- Gain error drift (+/-) (Max) (ppm/ $^{\circ}\text{C}$): 35
- Minimum CMRR: 126db
- Bandwidth: 3.5KHz
- Maximum Supply voltage: 5.5V
- Minimum Supply voltage: $>2.7\text{V}$
- Maximum Iq: 0.42mA
- Digital interface: I2C, SMS bus
- Resolution: 16bits
- Rating: Catalog
- Operating temperature range (C): -40 to 125



www.Circuits-DIY.com

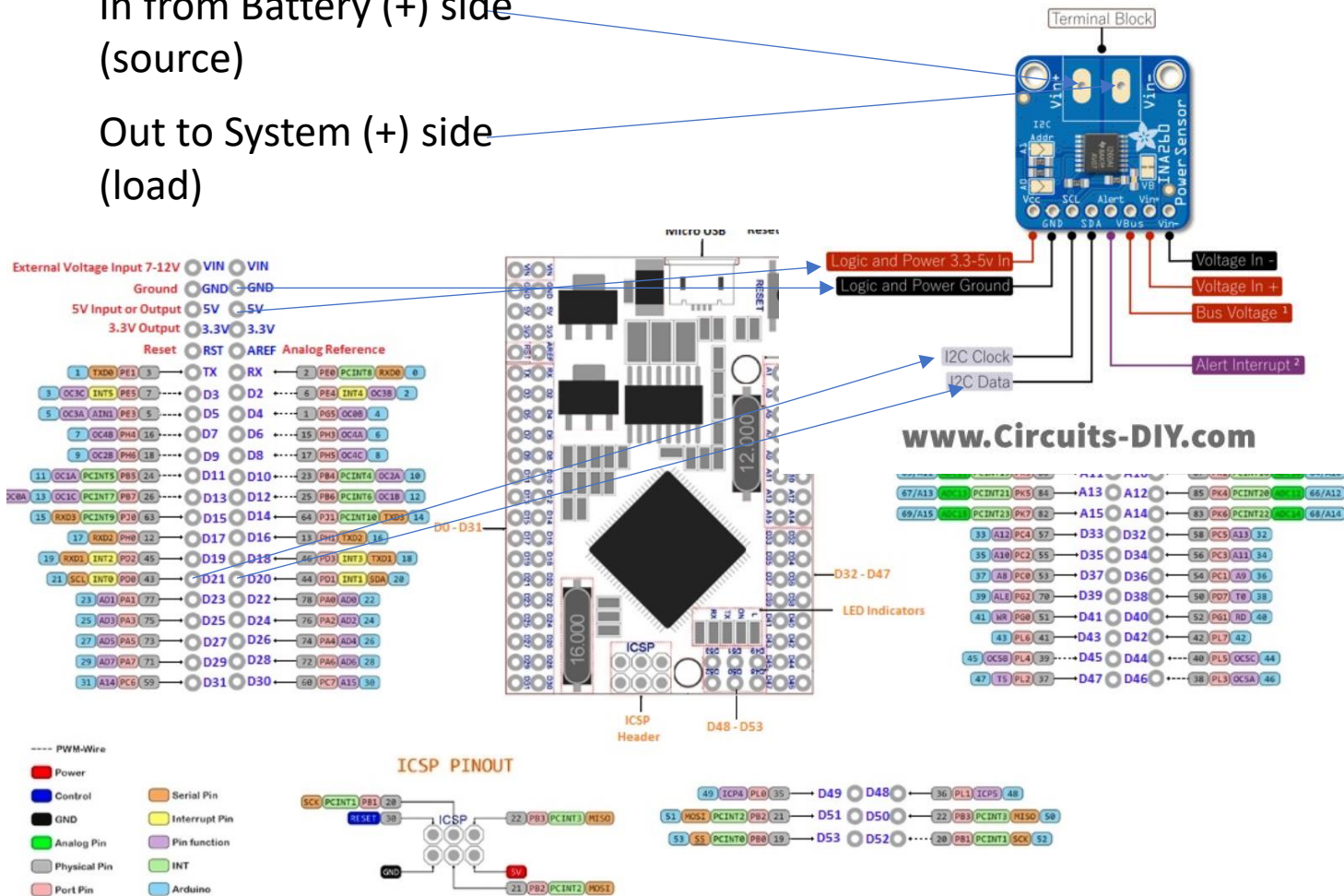
1NA260 I2C Power Monitor

Hook-up and test sketch

1NA260 Pinout

In from Battery (+) side
(source)

Out to System (+) side
(load)



```
#include <Adafruit_INA260.h>
```

```
Adafruit_INA260 ina260 = Adafruit_INA260();
```

```
void setup() {  
  Serial.begin(115200);  
  // Wait until serial port is opened  
  while (!Serial) { delay(10); }
```

```
Serial.println("Adafruit INA260 Test");
```

```
if (lina260.begin()) {
    Serial.println("Couldn't find INA260 chip");
    while (1);
}
Serial.println("Found INA260 chip");
}
```

```
void loop() {
  Serial.print("Current: ");
  Serial.print(ina260.readCurrent());
  Serial.println(" mA");
}
```

```
Serial.print("Bus Voltage: ");
Serial.print(ina260.readBusVoltage());
Serial.println(" mV");
```

```
Serial.print("Power: ");
Serial.print(ina260.readPower());
Serial.println(" mW");
```

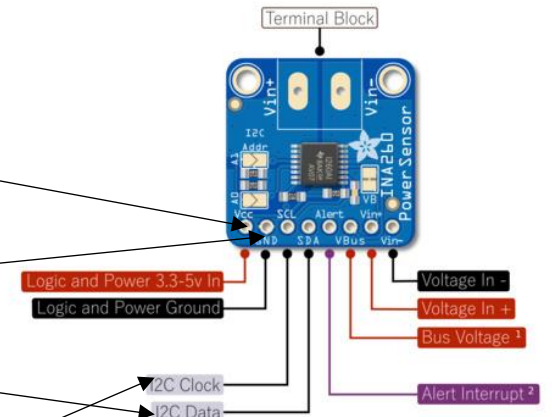
```
Serial.println();
delay(1000);
}
```


INA260 Power Monitor Wiring

- Red +5 Volts Vcc
- Black Ground
- Yellow Data Line
- Blue Clock

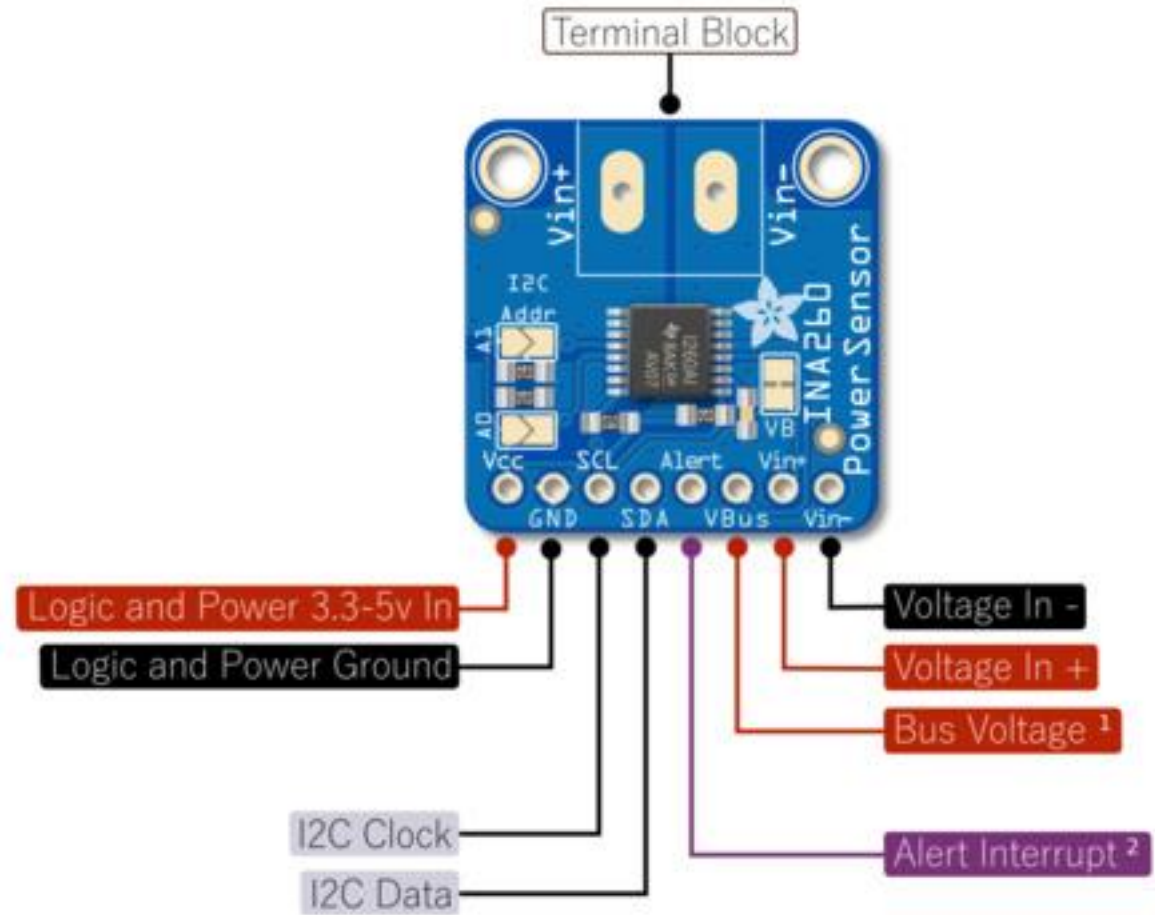
Mega2560 +5Volts
Mega2560 Ground
Mega2560 pin 20
Mega2560 pin 21

1NA260 Pinout



www.Circuits-DIY.com

1NA260 Pinout

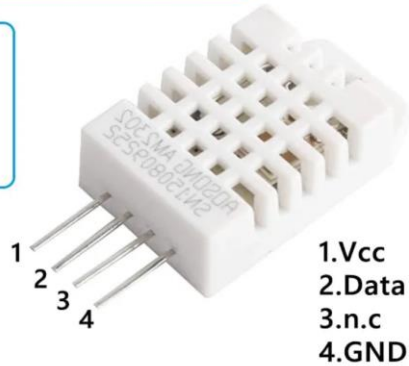


DHT22 Temperature Humidity Sensor Arduino

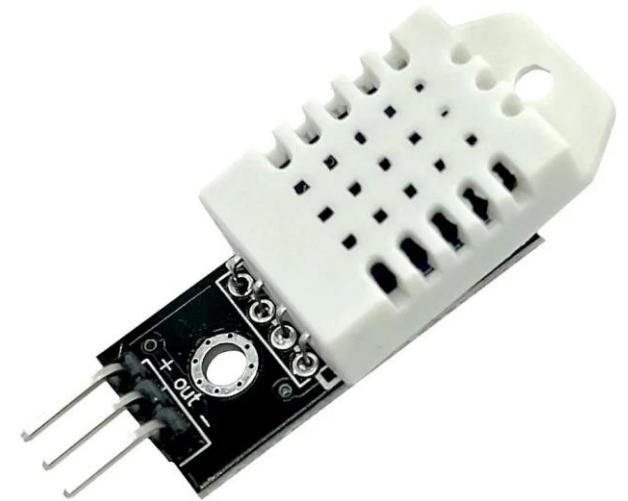
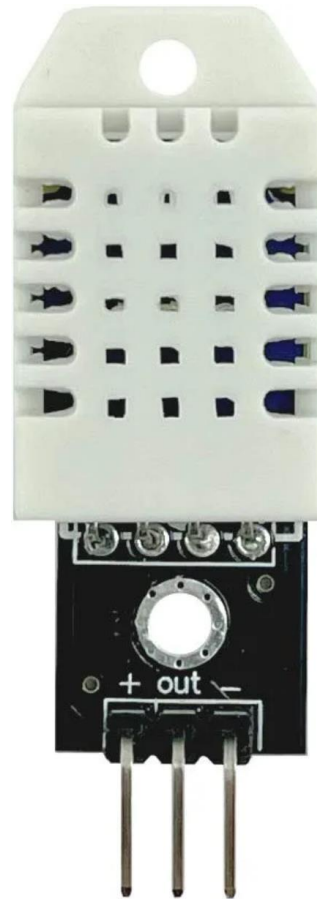
DHT22 Temperature-Humidity Sensor

- 3.3 to 6V power and I/O
- 1.5mA max current use during conversion
- 0-100% humidity reading with 2-5% accuracy
- 40 to 80°C temperature readings $\pm 0.5^{\circ}\text{C}$ accuracy
- Up to 0.5 Hz sampling rate(once every 2 seconds)
- 4 pins,0.1" spacing

- 1)VCC
- 2)DATA(digital I/O)
- 3)Not Connected (N.C)
- 4)GND



Note:Connect a 4.7K or 10K resistor between VCC and the DATA pin



DTH22 Library Header

```
DHT22.h - Notepad
File Edit Format View Help
/*
 * @file DHT22.h
 * @brief Arduino library for interface with DHT22 sensor
 * @n without use of pointers.
 * @author dvarrel
 * @version 1.0.0
 * @date 2022-11-09
 * @url https://github.com/dvarrel/DHT22.git
 */
#ifndef _DHT22_H
#define _DHT22_H
#include "Arduino.h"

class DHT22{
private:
    uint8_t _pinData;
    uint32_t _timer;
    uint64_t _rawData;
    uint16_t _h16bits;
    uint16_t _t16bits;
    uint8_t _crc8bits;
    uint8_t _timing800;
    uint8_t _timing800H;
    uint8_t _timing80;
    uint8_t _timing80S;
    uint8_t _timing80t;
    uint8_t _timing80t1;
    bool _firstStart=true;

    const uint8_t T=30;
    enum error{
        OK,
        ERR_TIMING_80,
        ERR_TIMING_50,
        ERR_TIMING_BITS,
        ERR_CRC
    };

public:
    DHT22(uint8_t pinData){
        _pinData = pinData;
    };
    /** @return 40bits of data sensor : h16 + t16 + crc8**/
    uint64_t getRawData();

    /** @return 40bits in a String ("0" left include)**/
    String getRawStrData();

    /** @return humidity %RH **/
    float getHumidity();

    /** @return temperature in °C **/
    float getTemperature();

    /** @return String with timings, 40bits, and calculate values**/
    String debug();

private:
    /** @brief measure timings of sensor*/
    void measureTimings();

    /**
     * @brief read the 40bits sensor data
     * @return 0 if no error, num of error instead
     */
    uint16_t readSensor();

    /** @brief compute checksum of h & t data
     * @return true if checksum=crc**/
    bool computeCRC();
};

#endif
```

humidity and temperature, 1-wire only

Author

[dvarrel](https://github.com/dvarrel)

Website

<https://github.com/dvarrel/DHT22>

Category

[Sensors](#)

License

[CC0 1.0](#)

Library Type

Contributed

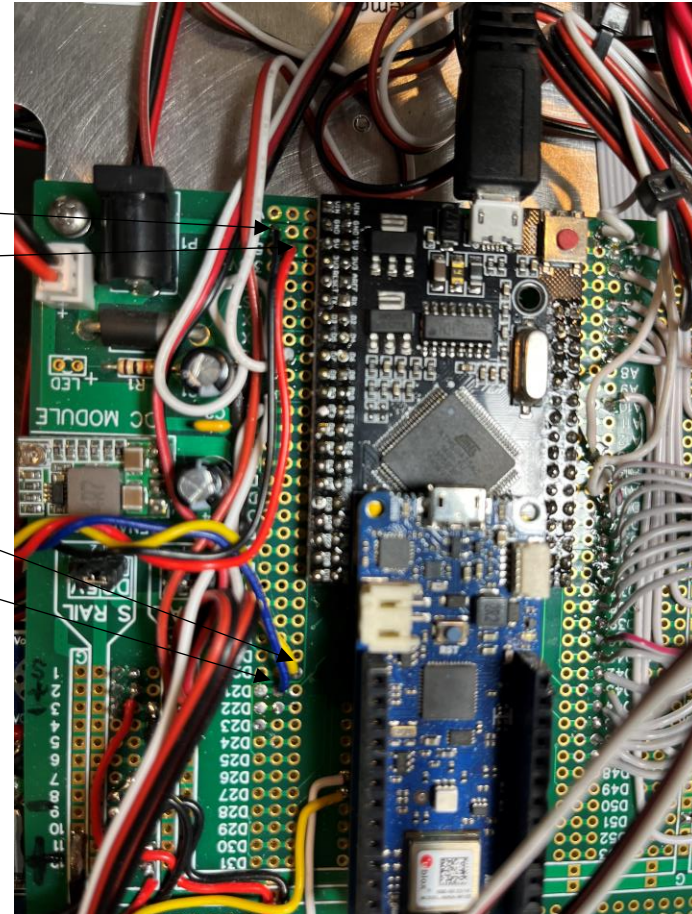
Architectures

Any

Control Shed 2 Board

Mega 2560 I2C INA260 Wiring

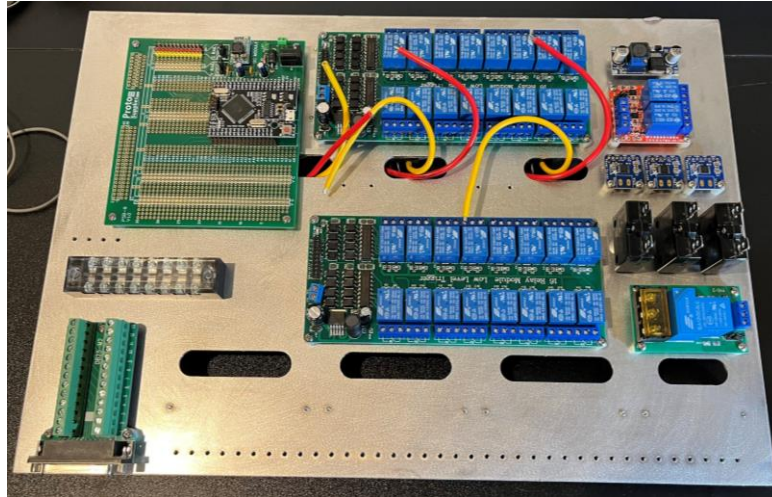
Ground Connection
+5Volt Connection
INA260 i2c Data Yellow D20
INA260 i2c Clock Blue D21



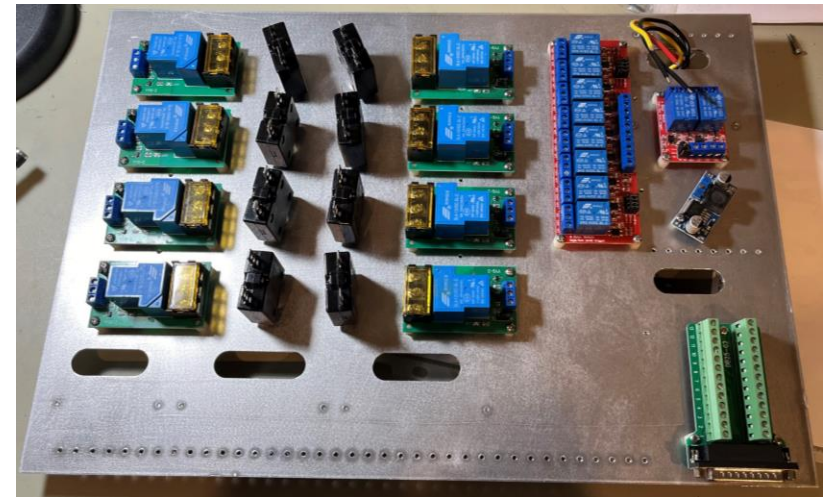
Control Shed 2 Board Construction



Drilling the Boards



Assembling the 12 volt Board



Assembling the 110 volt Board

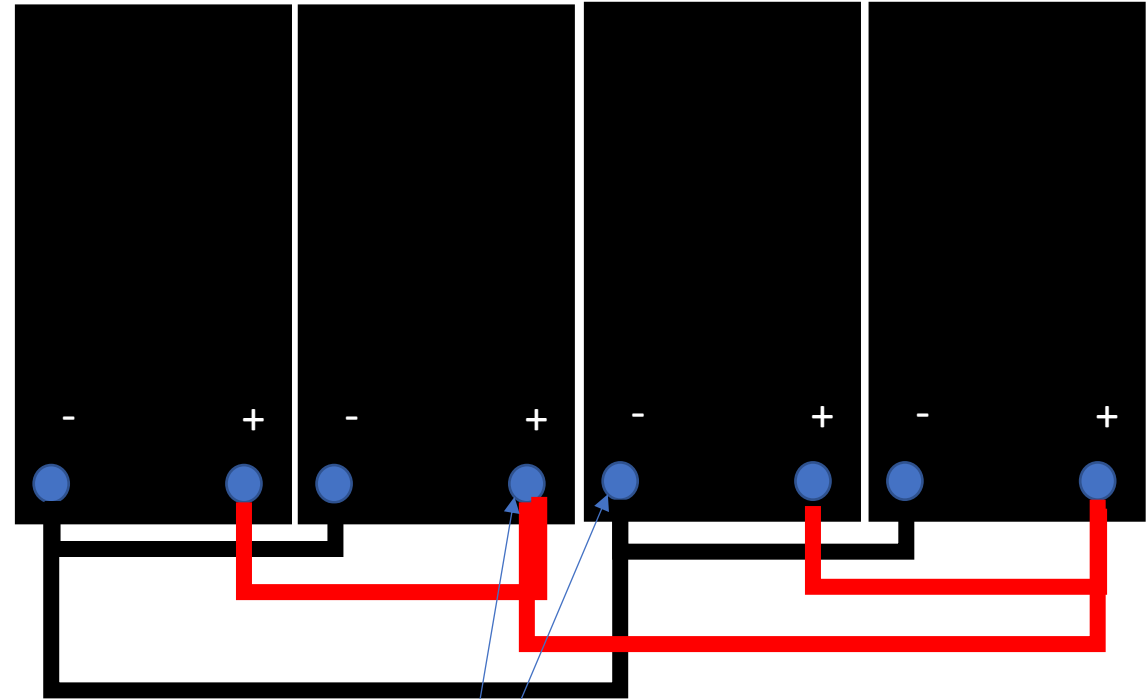
Boltwood Cloud Sensor

4-Battery “Parallel Balanced” Wiring: April 2025

300 Amp hour LiFePO4 batteries Replacements for The Control Shed



Short Runs 16"
(2) red
(2) Black
Long Runs 30"
(1) Red
(1) Black



Charge and Load Connections

Vatrer 12V 300Ah 200A BMS LiFePO4 Lithium Battery



Vatrer 12V 300Ah 200A BMS LiFePO4 Lithium Battery

Specification	Value
Nominal Voltage	12.8V
Charge Voltage	14.2V-14.6V
Charging Methods	4-String Charger (14.6V), Photovoltaic Solar Panels with MPPT, Inverter (Built-in AC to DC)
Weight	26.5KG / 58.42LB
Energy	3,840Wh
Max Continuous Charging Current	200A
Max Continuous Discharging Current	200A
Recommend Charge Current	60A (0.2C)
Max Load / Inverter Power	2,560W
Operating Temperature Range	Charge: 0°C~50°C (32°F~122°F) Discharge: -20°C~60°C (-4°F~140°F) Storage: -10°C~50°C (14°F~122°F)
Low Temp Cut Off Protection (Charge)	0°C±4°C (32°F±7.2°F)
Low Temp Cut Off Protection (Discharge)	-20°C±4°C (-4°F±7.2°F)
Waterproof Class	IP65
Terminal Type	M8
Dimension	520×269×220 mm (20.47*10.59*8.66 inch)
Cycle Life	≥5,000 Cycles

Vatrer 12V 300Ah 200A BMS LiFePO4 Lithium Battery

Vatrer 12V 300Ah 200A BMS LiFePO4 Lithium Battery

- Over 5,000 cycles and a 10+ year lifespan.
- Built-in 200A Smart BMS, Low-Temp charging protection and low 3% self-discharge.
- 3,840Wh energy, 2,560W output, lightweight at 58.42 lbs.
- 3 charging methods, 10X faster charging.
- 200A Max Continuous Discharge (500A 3s Peak Discharge).
- Series/parallel setup for up to 61.44kWh.
- Smaller than Group 8D size(L20.47*W10.59*H8.66 inches), ideal for RVs, solar, home storage.
- IP65 waterproof.
- Zero Maintenance, Environment Friendly.
- US ground fast delivery, 24/7 online service.
- Meets FCC, CE, RoHS, UN38.3 standards.
- Note: Best for energy storage, not engine starting.