

# SC Electronics Architecture

## 1. MCU

Looks like the **ESP32-WROOM-32** will work swimmingly. Pinout:

Peripheral	Pin Assignment	GPIO Number	Notes/Functions
Analog Input 1	SENSOR_VP	36	ADC1_CH0, input-only
Analog Input 2	SENSOR_CAPP	37	ADC1_CH1, input-only
Analog Input 3	SENSOR_CAPN	38	ADC1_CH2, input-only
Analog Input 4	SENSOR_VN	39	ADC1_CH3, input-only
Digital Output 1	IO25	25	General I/O, output-capable
Digital Output 2	IO26	26	General I/O, output-capable
Digital Output 3	IO27	27	General I/O, output-capable
Digital Output 4	MTCK/IO13	13	General I/O, output-capable
Digital Output 5	MTMS/IO14	14	General I/O, output-capable
Digital Output 6	MTDO/IO15	15	General I/O, output-capable
Digital Input 1	VDET_1	34	General input, input-only
Digital Input 2	VDET_2	35	General input, input-only
I2C SDA	IO21	21	I2C data, configurable
I2C SCL	IO22	22	I2C clock, configurable
CAN TX	IO4	4	TWAI TX, connects to transceiver TXD
CAN RX	IO5	5	TWAI RX, connects to transceiver RXD
RTC Crystal XP	32K_XP	32	32.768 kHz crystal for RTC
RTC Crystal XN	32K_XN	33	32.768 kHz crystal for RTC

GPIO0, 2, 12, 16, 17, 18, 19, 23 are available for future expansion.

## 2. CAN Bus

1. Just need a 3.3V CAN Transceiver - **SN65HVD231DR**
2. Connector - M12 bulkhead? BoardLock bulkhead?
3. Voltage Regulator
  1. Most of the time will be spent sleeping. A low quiescent current, then, is actually more important than live current, perhaps?
  2. **TLV1117-33IDCYR** would work but emits 4.35W at 500mA - thermals need looked into for this.
  3. **TPS629206DRLR** is also good. Just need 2 resistors and an inductor as well. Good cost. Probably better.
4. RTC (use builtin to MCU)
  1. Need ext. osc: **CM315D32768DZFT**
5. Jack Motor - 1 AI, 2 DO
  1. Motor: **RP-785615**
  2. Motor connector: **AT06-2S**
  3. Motor to cable connector: **AT04-2P**
  4. Cable: **16/2 PVC jacket cable**
  5. Cable to Control Box: **PG9 Cord Grip + Faston Tabs**
  6. Relays (2): **A161CS12VDC.64** (25A current, 53.3 mA coil)
  7. Relay driver: **2N7002AK-Q** (240 mA max)
  8. Fuse: **20A ATO fuse**
  9. Current sensor: **ACS37042KLHBLT-030B3** (30A max, -030B5 exists which is a 5v variant)
6. Fluffer (Accessory) Motor - 1 AI, 2 DO
  1. Motor: **TBD**
  2. Motor connector: **AT06-2S**
  3. Motor to cable connector: **AT04-2P**
  4. Cable: **16/2 PVC jacket cable**
  5. Cable to Control Box: **PG9 Cord Grip + Faston Tabs**
  6. Relays (2): **A161CS12VDC.64** (25A current, 53.3 mA coil)
  7. Relay driver: **2N7002AK-Q** (240 mA max)
  8. Fuse: **20A ATO fuse**
  9. Current sensor: **ACS37042KLHBLT-030B3** (30A max, -030B5 exists which is a 5v variant)
7. Drive Motor - 1 AI, 2 DO
  1. Motor: **80ZYT-12/JW-7** -OR- **80ZYT-12/JW-3B** (50A)
  2. Motor connector: **6mm Ring Terminals with Boots**
  3. Cable: **12/2 PVC jacket cable**
  4. Cable to Control Box: **PG9 Cord Grip + Faston Tabs**
  5. Relays (2): **A31CSP12VDC2R** (70A current, 150 mA coil)
  6. Relay driver: **2N7002AK-Q** (240 mA max)

7. Fuse: **60A fuse**
8. Current sensor: **ACS37220LEZATR-100B3** (100A max, -100B5 exists which is a 5v variant)
8. Jack Limit Switch - 1 DI
  1. Sensor: **PBM6-AN-1H** (-1A exists also which is a 2m pigtail. -1H is a M12 connector)
9. Odometry Geartooth Sensor - 1 DI
  1. Sensor: **PBM6-AN-1H** (-1A exists also which is a 2m pigtail. -1H is a M12 connector)
10. Solar Charging Circuit
  1. **BQ24650 charge controller**
  2. N-channel MOSFETs (Q1 high-side, Q2 low-side): 40V-rated, low RDS(on) (e.g., 20mΩ), such as **AO3400** or equivalent, for synchronous rectification.
  3. Inductor (L): 10μH, rated for at least 5A saturation current (e.g., Würth **7447788220**) to support switching at 400kHz.
  4. Current sense resistor (R\_SR): 10mΩ, 1% tolerance, 5W rating (e.g., **WSMS5515L1000FEK**) for ~4A maximum charge current (differential voltage of 40mV).
  5. Input capacitors: 10μF ceramic (X7R, 35V) × 3, placed near MOSFETs.
  6. Output capacitors: 4.7μF ceramic (X7R, 25V) × 2, near the battery connection.
  7. Schottky diodes: For reverse protection (e.g., **1N5819**) and status indication.
  8. Resistors for voltage setting: Precision 1% types (e.g., R1 = 100kΩ, R2 = 576kΩ for 14.4V regulation).
  9. Optional: LEDs and resistors for charge status (e.g., bulk/absorption indication).
11. Battery - 1 AI
  1. Battery: **TL1212**
  2. Battery to cable conn: **Female Fastons**
  3. Cable: **12/2 PVC jacket cable**
  4. Cable to control box: **PG9 Cord Grip + Faston Tabs**
  5. Voltage divider to sense battery voltage (goes to ESP32) - **1M + 150k resistors**
12. Display
  1. Focus LCDs **C162A-FTW-DS23** (-30 to +80C operating range)
  2. This will be driven by an I/O Expander. It could be shared with the buttons.
    1. 8 bit: **PCF8574**
    2. 16 bit: **MCP23017**
13. Settings Adjust Buttons (4 buttons)
  1. Option (SMD): **TL3305BF260QG**
  2. Option (THT): **TS02-66-43-BK-260-SCR-D**
14. Manual Override Buttons (4 buttons)
  1. Option A: Hardwired, with an enclosed PCB
  2. Option B: Hardwired, with simple waterproof switches
  3. Option C: Remote

Pros of Remote	Pros of Hardwire
Can operate from all around the coop	Can't lose it
Easiest cable management	Easy to repair
	No pairing required
	Easy interrupt (wake from sleep)
	If you need to make it custom, it's easier
	No batteries to die