Uncle Magic's Liquid Turntable main board -- open a sheet below. Signals that continue on another sheet use global labels; supply rails use power symbols.

Power

Power input, protection and LED-ring supply (+3V3 comes from the ESP32-S3-ETH module)

File: power.kicad_sch

Controller

ESP32-S3-ETH module sockets and boot-strap resistors

File: controller.kicad_sch

Motor

TMC2209 StepStick sockets and NEMA17 connector

File: motor.kicad_sch

LED

LED ring data and clock buffers (driven by the ESP32-S3-ETH), ring signal and power connectors, fan header

File: led.kicad_sch

Panel IO

TCA9555 I2C expander, encoder and button headers

File: panel_io.kicad_sch

Test points

Probe pads for the rails and a few signals

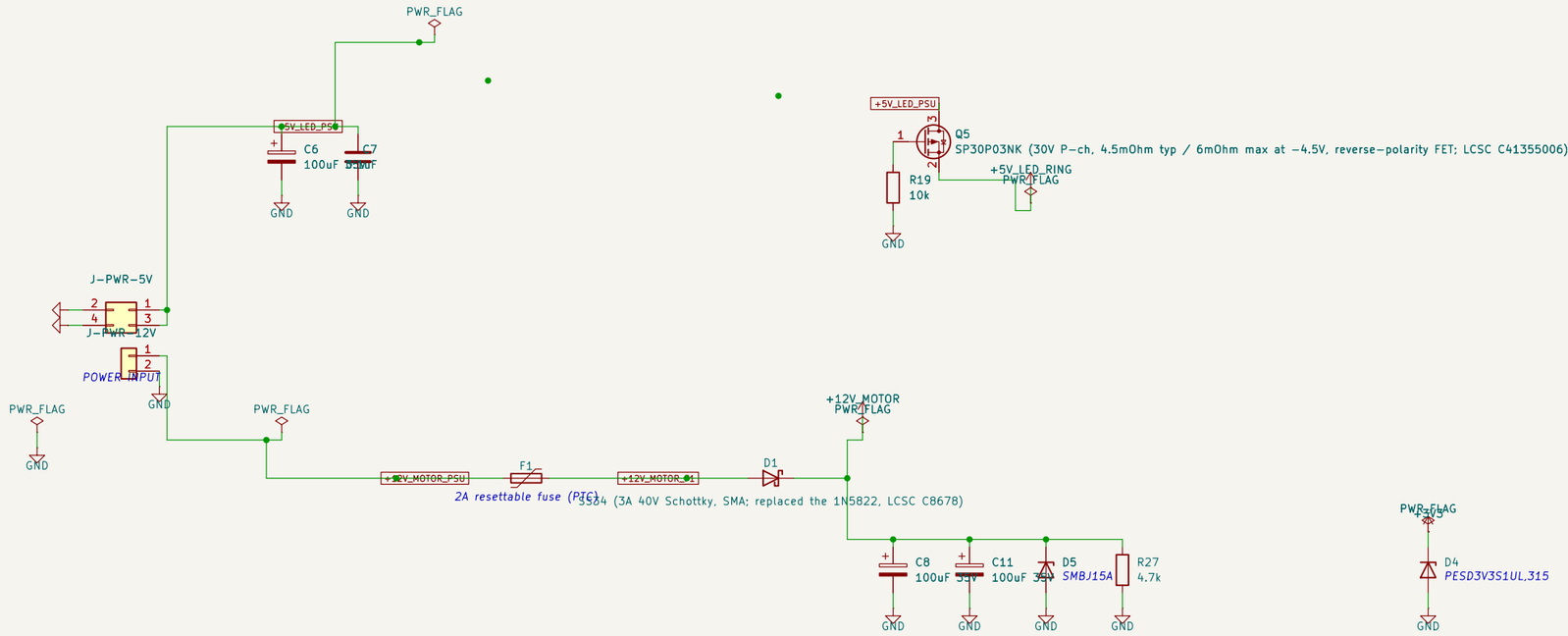
File: testpoints.kicad_sch

Sheet: /
File: Mainboard.kicad_sch

Title: Uncle Magic's Liquid Turntable -- main board

Size: A3	Date:	**Rev:**
KiCad E.D.A. 10.0.6		Id: 1/7

POWER -- Power input, protection and LED-ring supply



OFF-BOARD PSU (12V/5V only -- 3V3 is made by the ESP32-S3-ETH module's own JW5060 buck from +5V_LED_LOGIC on its VSYS pin) fed via two harness connectors: J-PWR-5V (Molex Mini-Fit Jr 2x2) and J-PWR-12V (JST XH 2-pin)

3RD RAIL: +3V3 logic (ESP32-S3-ETH, TMC2209 VIO, TCA9555, and the encoder headers' pull-up supply). +5V_LED feeds the LED ring, via +5V_LED_PSU, Q5 (reverse polarity) and +5V_LED_RING (held to about 4.5A by the LED engine), and, through D33, +5V_LED_LOGIC: the two LED buffers and the module's VSYS pin. The 5V side is fused off the board: a 7.5A blade fuse in the harness at the supply. +3V3 source (since 2026-11-10): the module's own JW5060 buck (4-18V in, 3A), fed from VSYS, out on its 3V3 pin (J1-H1 pin 5) to the board. U2 (K7803-2000R3 from +12V_MOTOR) and C12/C13/C14 were removed. So the logic needs the 5V supply; the module's USB-C also powers it (the module's 1N4148 keeps our 5V off USB).

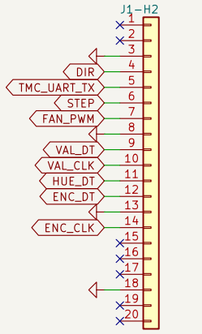
Power input, protection and LED-ring supply (+3V3 comes from the ESP32-S3-ETH module)

Sheet: /Power/
File: power.kicad_sch

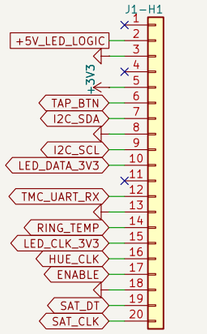
Title: Power

Size: A3	Date:	Rev:
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CONTROLLER -- ESP32-S3-ETH module sockets and boot-strap pull-up







J1-H1 pin 1 (VBUS) -- NC. Pin 2 (VSYS) <- +5V_LED_LOGIC: the module makes +3V3 itself with its JW5060 buck and puts it out on pin 5 for the whole board. Pin 4 (3V3_EN) open: R67 on the module pulls it up to VSYS. (Until 2026-11-10 3V3_EN was grounded and U2 supplied +3V3 from 12V.)

Ethernet SPI pins (9-14) internal to module, not wired externally

Boot straps: GPIO0 carries ENABLE: R23 (1k to +3V3) holds it high at reset (normal boot) and keeps the TMC2209 disabled through boot, whatever pulls the driver carrier has. GPIO45 (fan PWM, through R57 and the Q6 gate pull-down R58) and GPIO46 (STEP) are low at reset. GPIO21 drives the module's onboard RGB LED, so it carries only the rarely used TAP button. GPIO43/44 are the boot-log UART: panel inputs only. Pin map revised 2026-10-07 for routing: R24, R25 and R28 were removed.

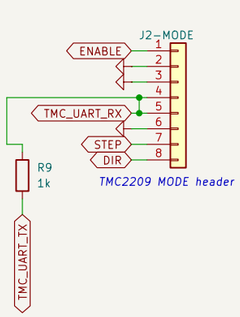
ESP32-S3-ETH module sockets and boot-strap resistors

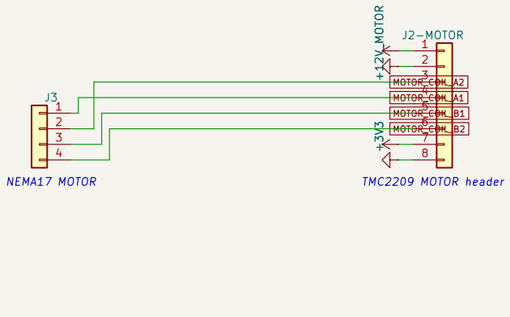
Sheet: /Controller/
File: controller.kicad_sch

Title: Controller

Size: A3	Date:	**Rev:**
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MOTOR –– TMC2209 StepStick sockets and NEMA17 connector





J2–MODE pin4/5 (PDN_UART, single–wire half–duplex) both tied to TMC_UART_RX –– factory–default resistor routes the internal UART signal to pin4; pin5 is the alternate access point for the same net, harmless to also wire

MS1/MS2/CLK tied direct to GND (UART addr 0, StealthChop set by firmware, internal oscillator)

DIAG/VREF/INDEX are separate solder points on the module, not part of either 8–pin header row –– not brought to this board at all

J3 uses the standard stepper pin order: 1 A+ (black), 2 A– (green), 3 B+ (red), 4 B– (blue), as on StepperOnline's 17HS08–1004S. Pins 1+2 are one coil, 3+4 the other.

TMC2209 StepStick sockets and NEMA17 connector

Sheet: /Motor/
File: motor.kicad_sch

Title: Motor

Size: A3	Date:	**Rev:**
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LED -- ring data and clock buffers (driven by the ESP32-S3-ETH: GPIO18 data, GPIO2 clock), LED-ring connectors, fan

+5V_LED_LOGIC
D33
+5V_LED_PSU
SS54 (5A 40V Schottky: feeds +5V_LED_LOGIC, the LED buffers' supply, from +5V_LED_PSU; blocks a reversed supply; LCSC C8678)
PWR_FLAG
+5V_LED_LOGIC
LED_DATA_3V3
33R58
LED_DATA
R26
10k
GND
LED_DATA
2
U3
74AHCT1G125
VCC
GND
+5V_LED_LOGIC
GND
3
1
5
4
LED_DATA_5V
C10
0.1uF
LED_DATA_5V
33R63
LED_DATA_OUT
LED_CLK_3V3
33R61
LED_CLK
R62
10k
GND
LED_CLK
2
U5
74AHCT1G125
VCC
GND
+5V_LED_LOGIC
GND
3
1
5
4
LED_CLK_5V
C15
0.1uF
LED_CLK_5V
33R64
LED_CLK_OUT
LED_DATA_OUT
GND
LED_CLK_OUT
GND
NTC_RING_J
1
2
3
4
5
J-LED-SIG
LED RING SIGNAL (JST XH 5-pin B5B-XH-A: 1 DATA, 2 GND, 3 CLK, 4 GND, 5 NTC_RING; LCSC C157991)
ESD protection on the ring NTC line, LCSC C70371)
PESD3V3S1UL,315
GND
NTC_RING_J
+3V3
R65
10k 1%
R66
1k
NTC_RING_J
RING_TEMP
RING_TEMP
C16
0.1uF
GND
+5V_LED_RING
1
2
3
4
J5
LED RING POWER (JST VH 4-pin B4P-VH, vertical: 1-2 +5V_LED_RING, 3-4 GND; pairs with JST VH 4-pin)
Ring temperature: TH1 on the ring (10k NTC, B3434) to GND through J-LED-SIG pin 5; R65 pulls NTC_RING_J up to +3V3 (10k 1%), D34 clamps ESD at the connector, R66 (1k) and C16 filter it into GPIO3 (ADC1_CH2, RING_TEMP)
Fan header (12 V fan): powered straight from +12V_MOTOR. GPIO
J-FAN
FAN, 4-wire 12V: 1 GND, 2 +12
GND
+12V_MOTOR
FAN_TACH_J
FAN_PWM_OUT
1
2
3
4
+5V_LED_RING
D32
FAN_PWM_OUT
FAN_GATE
1
Q6
2N7002 (fan PWM transistor; LCSC C460717)
FAN_PWM
R57
10k
FAN_GATE
R58
10k
FAN_TACH_J
R59
4.7k
GND

Ring signal: the ESP32-S3-ETH drives the SK9822 (APA102-type) ring itself (in-firmware LED engine): GPIO18 = data, GPIO2 = clock (SPI). U3/U5 (74AHCT1G125, TTL-level inputs) lift both to 5 V; R26/R62 hold them low while the ESP32 boots so the ring stays dark; R63/R64 (33R) damp the cable; the ring has 470R at its end. D33 feeds the buffers from +5V_LED_PSU and blocks a reversed supply. J-LED-SIG (JST XH) carries data and clock in their own cable, each beside a ground; J5 (JST VH 4-pin) carries only power.

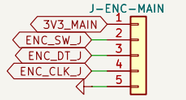
LED ring data/clock buffers (GPIO18, GPIO2), ring signal and power connectors, fan header

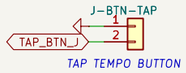
Sheet: /LED/
File: led.kicad_sch

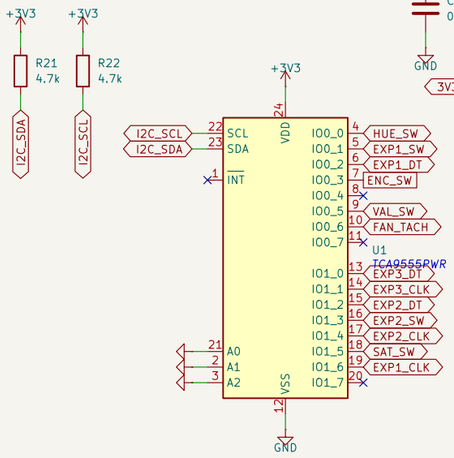
Title: LED

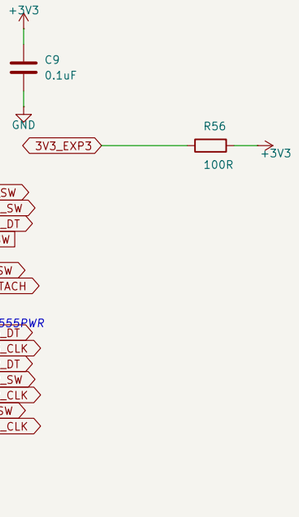
Size: A3	Date:	**Rev:**
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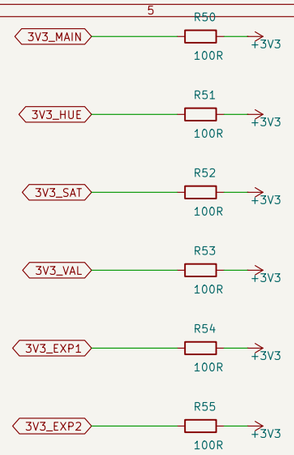
PANEL IO -- TCA9555 I2C expander, encoder and button headers

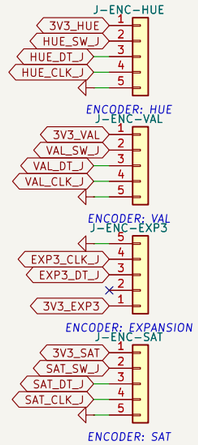


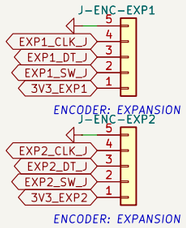






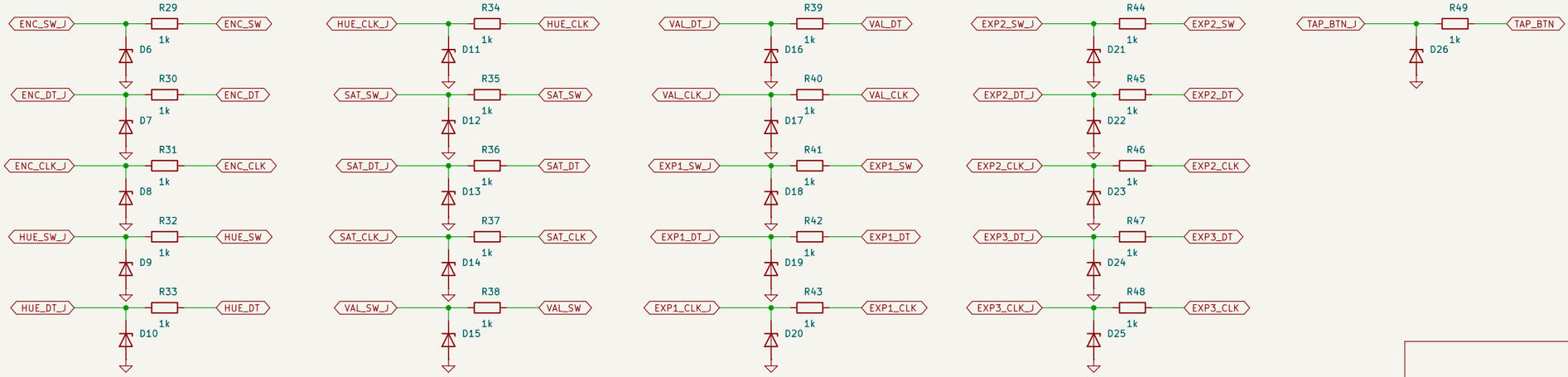






ESD / cable protection (added 2026-10-04). Each cable-facing signal line of the panel headers passes through a 1k series resistor (0402) into the board; a PESD3V3S1UL TVS to GND sits on the connector side of the resistor (net NAME_J), so a discharge on a knob, cable or button is clamped before it reaches the TCA9555 or the ESP32-S3 pin.

The 8 encoder headers' +3V3 pin is fed from +3V3 through its own 100R (net 3V3_<name>), in the column left of the headers.



TCA9555 I2C expander, encoder and button headers

Sheet: /Panel IO/
File: panel_io.kicad_sch

Title: Panel IO

Size: A3 | Date: | **Rev:**
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Test points. Each pad sits on its own net at the PCB position listed in tools/add_test_points.py.
STEP, DIR, TMC_UART and the ESP32 header signals run under the plugged-in modules: probe those on the module pins.

GND
TP1
GND

GND
TP2
GND

GND
TP3
GND

12V
TP4
+12V_MOTOR

12V F1
TP5
+12V_MOTOR_F1

3V3
TP6
+3V3

5V
TP7
+5V_LED_RING

DAT 3V3
TP8
LED_DATA_3V3

EN
TP9
ENABLE

SCL
TP10
I2C_SCL

SDA
TP11
I2C_SDA

DAT
TP12
LED_DATA

CLK
TP13
LED_CLK

Probe pads for the rails and a few signals; see tools/add_test_points.py

Sheet: /Test points/ File: testpoints.kicad_sch		
Title: Test points		
Size: A3	Date:	**Rev:**
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