PSU

+12V +5V +3V3

12VD
5VD
3V3D
GNDD

GND

USB

USB_VBUSD — for sensing USB-serial connection
USB_P
USB_M

R101 5.1k
UCPD_CC1
R102 5.1k
UCPD_CC2 — no USB-PD

GND

MECHANICAL

FID101 Fiducial   FID102 Fiducial   FID103 Fiducial

H101 M3   H103 M3   H105 M3   H107 M3
H102 M3   H104 M3   H106 M3   H108 M3

GND

ESP32

USB_VBUS
USB_P
USB_M

SPI_SCKD
SPI_COPID
SPI_CIPO
SPI_CSD

UART_RX
UART_TX

I2C_SDA
I2C_SCL

EOL_LEFT
EOL_RIGHT

ENCODER LEVEL SHIFT

+3V3   +5V

C101 0.1u   R104 5.1k R106 5.1k R108 5.1k R109 5.1k R111 5.1k   C102 0.1u

GND   GND

U101 SN74LVC4245

- 23 3V3
- 24 3V3
- 22 OE
- 1 5V
- 2 DIR

ENC_A — 21 B1 — A1 3 — ENC_V1
ENC_B — 20 B2 — A2 4 — ENC_V2
ENC_C — 19 B3 — A3 5 — ENC_BELTPHASE
EOL_R_N — 18 B4 — A4 6 — EOL_R_N
EOL_R_S — 17 B5 — A5 7 — EOL_R_S
16 B6 — A6 8
15 B7 — A7 9
14 B8 — A8 10

13 GND
12 GND
11 GND

R103 5.1k R105 5.1k R107 5.1k R110 5.1k R112 5.1k

GND

SOLENOID DRIVERS

{MCU_SOL}D — {MCU_SOL}   {SOL}D — {SOL}

CONNECTORS

{SOL}

SPI_SCK
SPI_COPI
SPI_CIPO
SPI_CS

UART_RX
UART_TX

I2C_SDA
I2C_SCL

EOL_L
EOL_R

ENC_V1
ENC_V2
ENC_BELTPHASE
EOL_R_N
EOL_R_S

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Sheet: /
File: ayab-esp32.kicad_sch

Title: AYAB-ESP32 overview

Size: A4 | Date: 2023-07-17 | Rev: 0.1
KiCad E.D.A. kicad 7.0.5-0 | Id: 1/6

ESP32-S3-MINI-1

RESET

SW301 RESET
R301 10k
C301 0.1u
GND

+3V3

U301
ESP32-S3-MINI-1

+3V3
C302 0.1u
C303 1u
C304 22u
GND

+5V

D301 WS2812B
DIN VDD
VSS DOUT
RGB
C305 0.1u
GND

Pin	Signal
45	EN / nRST
19	GPIO15/U0RTS/ADC2_CH4/XTAL_32K_P / MCU_SOL_4
20	GPIO16/U0CTS/ADC2_CH5/XTAL_32K_N / MCU_SOL_5
35	MTCK/GPIO39/CLK_OUT3/SUBSPICS1 / SPI_SCK
36	MTDO/GPIO40/CLK_OUT2 / SPI_COPI
37	MTDI/GPIO41/CLK_OUT1 / SPI_CIPOD
38	MTMS/GPIO42 / SPI_CS

{MCU_SOL}

3V3

U0TXD/GPIO43/CLK_OUT1 39 UART_TX
U0RXD/GPIO44/CLK_OUT2 40 UART_RX
GPIO20/U1CTS/ADC2_CH9/CLK_OUT1/USB_D+ 24 USB_P
GPIO19/U1RTS/ADC2_CH8/CLK_OUT2/USB_D− 23 USB_M
GPIO0/BOOT 4 BOOT0
GPIO1/TOUCH1/ADC1_CH0 5 EOL_LEFT
GPIO2/TOUCH2/ADC1_CH1 6 EOL_RIGHT
GPIO3/TOUCH3/ADC1_CH2 7 JTAG_SEL
GPIO4/TOUCH4/ADC1_CH3 8 MCU_SOL_0
GPIO5/TOUCH5/ADC1_CH4 9 MCU_SOL_1
GPIO6/TOUCH6/ADC1_CH5 10 MCU_SOL_2
GPIO7/TOUCH7/ADC1_CH6 11 MCU_SOL_3
GPIO8/TOUCH8/ADC1_CH7/SUBSPICS1 12 MCU_SOL_8
GPIO9/TOUCH9/ADC1_CH8/FSPIHD/SUBSPIHD 13 MCU_SOL_9
GPIO10/TOUCH10/ADC1_CH9/FSPICS0/FSPIIO4/SUBSPICS0 14 MCU_SOL_A
GPIO11/TOUCH11/ADC2_CH0/FSPID/FSPIIO5/SUBSPID 15 MCU_SOL_B
GPIO12/TOUCH12/ADC2_CH1/FSPICLK/FSPIIO6/SUBSPICLK 16 MCU_SOL_C
GPIO13/TOUCH13/ADC2_CH2/FSPIQ/FSPIIO7/SUBSPIQ 17 MCU_SOL_D
GPIO14/TOUCH14/ADC2_CH3/FSPIWP/FSPIQS/SUBSPIWP 18 MCU_SOL_E
GPIO17/U1TXD/ADC2_CH6 21 MCU_SOL_6
GPIO18/U1RXD/ADC2_CH7/CLK_OUT3 22 MCU_SOL_7
GPIO21 25 MCU_SOL_F
GPIO38/FSPIWP/SUBSPIWP 34 BUZZER
GPIO45 41 VCC_SPI
GPIO46 44 BOOT1
GPIO47/SPICLK_P/SUBSPICLK_P_DIFF 27 EOL_R_N
GPIO48/SPICLK_N/SUBSPICLK_N_DIFF 30 I2C_SCL

Pin	Signal
26	GPIO26
28	SPIIO4/GPIO33/FSPIHD/SUBSPIHD / EOL_R_SD
29	SPIIO5/GPIO34/FSPICS0/SUBSPICS0 / I2C_SDA
31	SPIIO6/GPIO35/FSPID/SUBSPID / ENC_AD
32	SPIIO7/GPIO36/FSPICLK/SUBSPICLK / ENC_BD
33	SPIDQS/GPIO37/FSPIQ/SUBSPIQ / ENC_CD

GND

{MCU_SOL}

R202 20k
USB_VBUS
R201 30k
GND

+5V
BZ301 Buzzer
R307 0R
Q301 AO3400A
R306 10k
GND

ESP32 CONFIGURATION

JTAG_SEL

+3V3
R303 10k
SW302 BOOTSEL
BOOT0
BOOT1
R304 10k
GND

VCC_SPI
R305 10k
GND

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Sheet: /ESP32/
File: mcu.kicad_sch
Title: ESP32
Size: A4   Date: 2023−07−17   **Rev: 0.1**
KiCad E.D.A. kicad 7.0.5−0   Id: 2/6

SOLENOID DRIVERS

{MCU_SOL}

+3V3

U403
ULN2003A

R410 R414 R418 R422 R426 R430 R434
10k 10k 10k 10k 10k 10k 10k

MCU_SOL_3 — I1 O1 — SOL_3
MCU_SOL_2 — I2 O2 — SOL_2
MCU_SOL_1 — I3 O3 — SOL_1
MCU_SOL_0 — I4 O4 — SOL_0
I5 O5
I6 O6
I7 O7
GND

R408 R412 R416 R420 R424 R428 R432
10k 10k 10k 10k 10k 10k 10k

GND

+12V

C306
10u

GND

{MCU_SOL}

+3V3

U405
ULN2003A

R438 R442 R446 R450 R454 R458 R462
10k 10k 10k 10k 10k 10k 10k

MCU_SOL_B — I1 O1 — SOL_7
MCU_SOL_A — I2 O2 — SOL_6
MCU_SOL_9 — I3 O3 — SOL_5
MCU_SOL_8 — I4 O4 — SOL_4
I5 O5
I6 O6
I7 O7
GND

R436 R440 R444 R448 R452 R456 R460
10k 10k 10k 10k 10k 10k 10k

GND

+12V

C308
10u

GND

+3V3

U404
ULN2003A

R411 R415 R419 R423 R427 R431 R435
10k 10k 10k 10k 10k 10k 10k

MCU_SOL_7 — I1 O1 — SOL_7
MCU_SOL_6 — I2 O2 — SOL_6
MCU_SOL_5 — I3 O3 — SOL_5
MCU_SOL_4 — I4 O4 — SOL_4
I5 O5
I6 O6
I7 O7
GND

R409 R413 R417 R421 R425 R429 R433
10k 10k 10k 10k 10k 10k 10k

GND

+12V

C307
10u

GND

+3V3

U406
ULN2003A

R439 R443 R447 R451 R455 R459 R463
10k 10k 10k 10k 10k 10k 10k

MCU_SOL_F — I1 O1 — SOL_7
MCU_SOL_E — I2 O2 — SOL_6
MCU_SOL_D — I3 O3 — SOL_5
MCU_SOL_C — I4 O4 — SOL_4
I5 O5
I6 O6
I7 O7
GND

R437 R441 R445 R449 R453 R457 R461
10k 10k 10k 10k 10k 10k 10k

GND

+12V

C309
10u

GND

unmodified machine is 26W
assuming all power is
used by solenoids ~ 130mA each

ULN2003A max current 500mA each

{SOL}

{SOL}

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Sheet: /SOLENOID DRIVERS/
File: solenoids.kicad_sch

Title: SOLENOID DRIVERS

Size: A4   Date: 2023-07-17   Rev: 0.1
KiCad E.D.A. kicad 7.0.5-0   Id: 3/6

KH-900

+12V

{SOL}

10	
9	
SOL_0	8
SOL_1	7
SOL_2	6
SOL_3	5
SOL_4	4
SOL_5	3
SOL_6	2
SOL_7	1

J602
900_SOLENOIDS_A

SOL_8	8
SOL_9	7
SOL_A	6
SOL_B	5
SOL_C	4
SOL_D	3
SOL_E	2
SOL_F	1

J603
900_SOLENOIDS_B

shared with which machine?

KH-910

+12V

{SOL}

10	
9	
SOL_0	8
SOL_1	7
SOL_2	6
SOL_3	5
SOL_4	4
SOL_5	3
SOL_6	2
SOL_7	1

J606
910_SOLENOIDS_A

SOL_8	8
SOL_9	7
SOL_A	6
SOL_B	5
SOL_C	4
SOL_D	3
SOL_E	2
SOL_F	1

J607
910_SOLENOIDS_B

TP404 TP405
9   10

10	
9	
EOL_R_N	8
EOL_R_S	7
ENC_BELTPHASE	6
ENC_V2	5
ENC_V1	4
	3
	2
+5V	1

should reverse engineer
pins 9,10

pin 7:
see github
ayab-hardware #19

J608
910_ENCODERS_EOL_R

GND

KH-930

+12V

{SOL}

10	
9	
SOL_0	8
SOL_1	7
SOL_2	6
SOL_3	5
SOL_4	4
SOL_5	3
SOL_6	2
SOL_7	1

J610
930_SOLENOIDS_A

SOL_8	8
SOL_9	7
SOL_A	6
SOL_B	5
SOL_C	4
SOL_D	3
SOL_E	2
SOL_F	1

J611
930_SOLENOIDS_B

+5V

1	
2	
EOL_L	3

J612
930_910_EOL_L

1	
2	
EOL_R	3

J613
930_EOL_R

ENC_BELTPHASE	5
ENC_V1	4
ENC_V2	3
	2
	1

J614
930_ENCODERS

GND

KH-965

shared with which machine?

+5V

1	
2	
EOL_L	3

J615
965_EOL_L

1	
2	
EOL_R	3

J616
965_EOL_R

ENC_BELTPHASE	5
ENC_V1	4
ENC_V2	3
	2
	1

J617
965_ENCODERS

GND

USER EXPANSION

+3V3

R602   R603
5.1k   5.1k

I2C_SCLD	1
I2C_SDA	2
	3
	4

J604
USER_I2C

should we use qwiic connector?

GND

+3V3

R604
10k

SPI_CSD	1
	2
SPI_COPID	3
SPI_CIPOD	4
SPI_SCKD	5
	6

J401
Conn_01x06

GND

+3V3

UART_RXD	1
UART_TXD	2
	3
	4

J609
USER_UART

GND

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Sheet: /CONNECTORS/
File: connectors.kicad_sch

Title: CONNECTORS

Size: A4   Date: 2023-07-17   Rev: 0.1

KiCad E.D.A. kicad 7.0.5-0   Id: 4/6

J601
USB_C_Receptacle_USB2.0

VBUS A4
CC1 A5 UCPD_CC1
CC2 B5 UCPD_CC2
D− A7 USB_M
D− B7
D+ A6
D+ B6 USB_P
SBU1 A8
SBU2 B8
SHIELD S1
GND A1

USB_VBUS

PWR

+3V3
R601
1.5k

+5V

JP601
USB5V
1 2

U601
SRV05−4
VP 5
IO1 1   IO3 4
IO2 3   IO4 6
VN 2

C201 C202
47p   47p

GND

GND

Sheet: /USB/
File: usb.kicad_sch

Title: USB & ESD

Size: A4 | Date: 2023-07-17 | **Rev: 0.1**
KiCad E.D.A. kicad 7.0.5−0 | | Id: 5/6

INPUT, FILTERING
REVERSE POLARITY PROTECTION

J501 VIN
PWR
Q601 AO3401A
TP402 12V
PWR
PWR_FLAG
12V

D601 ZMM5V6-M
R605 100k
PWR_FLAG
GND

C506 10u
C508 10u
C510 10u
C512 10u
C513 10u
C515 220u
C517 220u
GND

is this current limit too high?
what's appropriate?

5V SUPPLY

not Z5U type
C418 3.3n
TP401 5V

+12V
U401 XL1509
GND
R404 1k
R406 3.3k
PWR_FLAG
PWR
5V

C414 220u
C416 10u
VIN
EN
FB
VOUT
L401 47uH
D405 SS54
C420 220u
C505 10u
C507 10u
C509 10u
GND GND GND GND
GND

$Vout = 1.23 * (R2/R1+1)$
due to BOM simplification this comes out 5.25V
but this is OK for parts used (SN74LVC4245)

INDICATORS

+12V
+5V
+3V3
R401 12k
R402 5k
R403 3.3k
D401 12VOK
D402 5VOK
D404 3V3OK
GND

3V3 SUPPLY

not Z5U type
C419 3.3n
TP403 3V3

+12V
U402 XL1509
GND
R405 1k
R407 1.8k
PWR_FLAG
PWR
3V3

C415 220uF
C417 10uF
VIN
EN
FB
VOUT
L402 47uH
D406 SS54
C421 220u
C514 10u
C516 10u
C518 10u
GND GND GND GND
GND

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Sheet: /PSU/
File: psu.kicad_sch
Title: POWER SUPPLY
Size: A4 | Date: 2023-07-17 | **Rev: 0.1**
KiCad E.D.A. kicad 7.0.5-0 | Id: 6/6