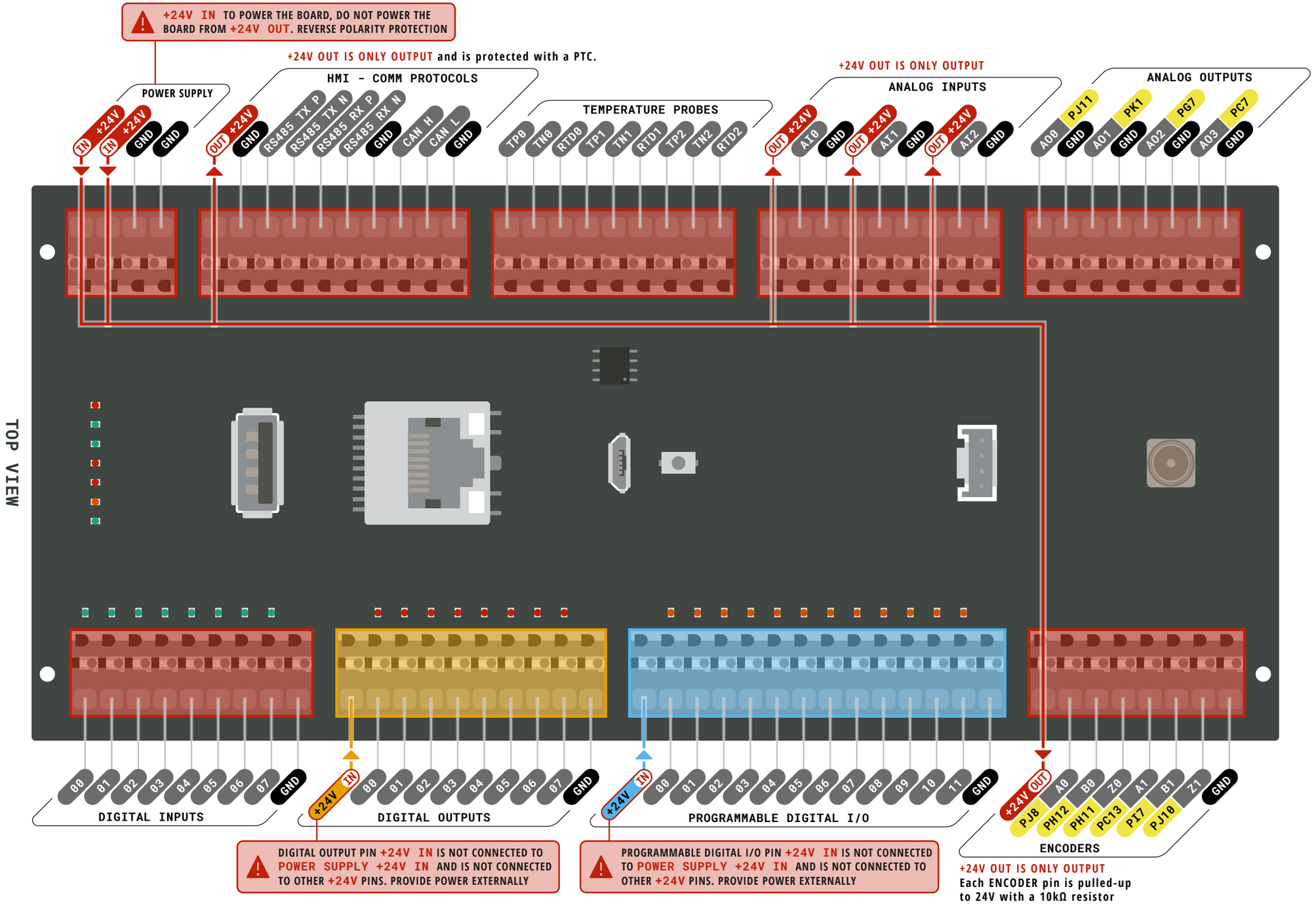

Legend:

- Power
- Ground
- +24V programmable outputs
- +24V digital outputs
- IN Power Input
- OUT Power Output
- GPIO Digital External
- Analog External
- Main Part
- Secondary Part
- Internal Component
- Other Pins (Reset, System Control, Debugging)
- LED
- RGB LED
- Other

GND is the same all over the board

ARDUINO **PORTENTA MACHINE CONTROL**

SKU code: AKX00032
Full Pinout - Page 1 of 11
Last update: 22 Nov, 2023

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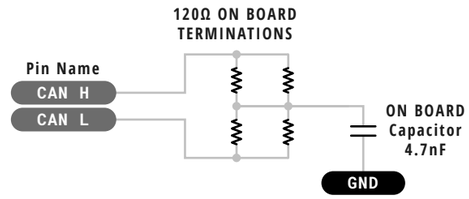
RS485, RS422, RS232

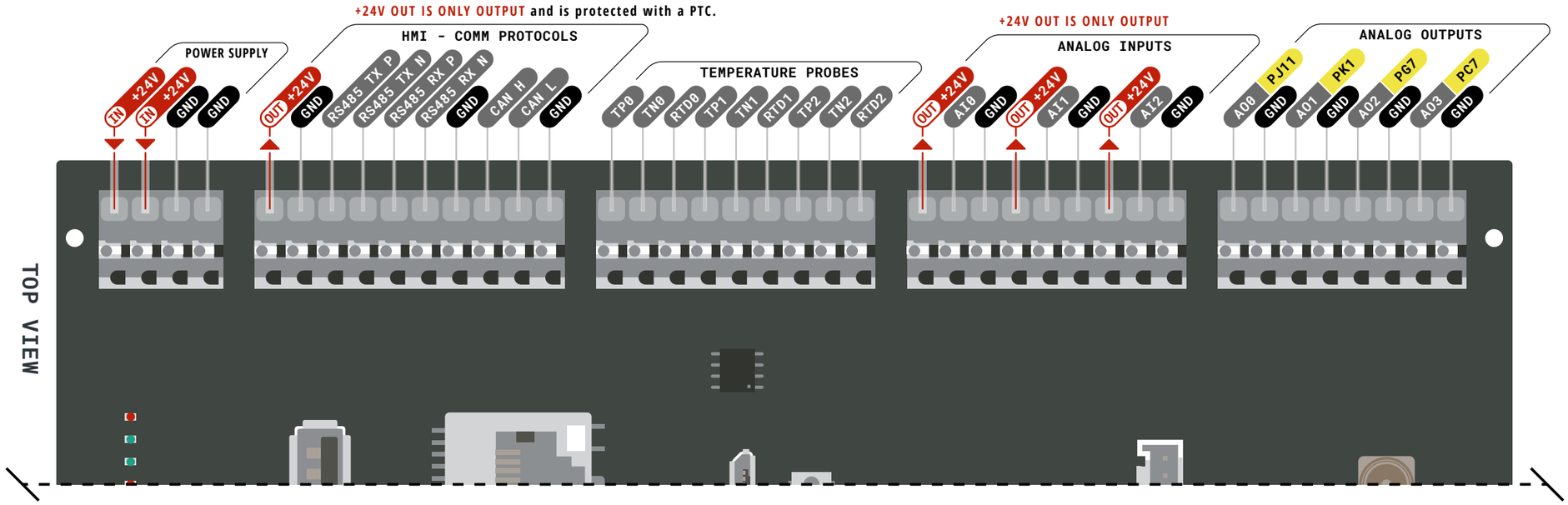
Pin Name	Functionality: RS485 / RS422 full duplex	Functionality: RS485 half duplex	Functionality: RS232
RS485 TX P	TX+	Data+	NOT CONNECTED
RS485 TX N	TX-	Data-	TXD
RS485 RX P	RX+	NOT CONNECTED	RXD
RS485 RX N	RX-	NOT CONNECTED	NOT CONNECTED

ⓘ 120Ω termination resistors are integrated and can be connected/disconnected via FW configuration

CAN

Pin Name	Functionality: CAN
CAN H	CAN_H
CAN L	CAN_L





Legend:

- Power
- Ground
- +24V programmable outputs
- +24V digital outputs
- IN Power Input
- OUT Power Output
- GPIO Digital External
- Analog External
- Main Part
- Secondary Part
- Internal Component
- Other Pins (Reset, System Control, Debugging)
- LED
- RGB LED
- Other

GND is the same all over the board

PORTENTA MACHINE CONTROL

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TEMPERATURE PROBES

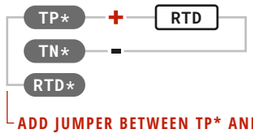
TERMOCOUPLE SUPPORTED [J] [K]

Connection diagram:

CONNECT THE THERMOCOUPLE NEGATIVE TO TN, NOT TO GND

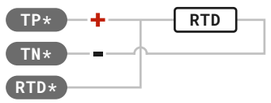
RTD SUPPORTED [PT100]

Connection diagram, with 2 wires RTD:



ADD JUMPER BETWEEN TP* AND RTD* PINS

Connection diagram, with 3 wires RTD:



TEMPERATURE PROBES PINS CAN BE CONNECTED ONLY WITH COMPATIBLES THERMOCOUPLES OR RTDs, NO DIRECT VIN SHOULD BE CONNECTED TO THE PINS

ANALOG INPUTS

THE 3 ANALOG INPUT PINS CAN MEASURE VOLTAGE IN 3 WAYS:

0-10V function (DEFAULT):

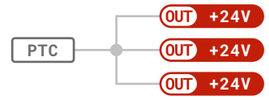
MAXIMUM INPUT VOLTAGE IS 10V

4-20mA function:

MAXIMUM CURRENT IS 20mA
MAXIMUM VOLTAGE IS 3V3

NTC function:

All +24V OUT ANALOG INPUT pins are connected and protected by a single PTC.



PTC MAXIMUM CURRENT IS 500mA

DO NOT CONNECT DIRECTLY +24V IN OR +24V OUT TO AI*

BE CAREFUL BEFORE CHANGING THE FUNCTION THAT THE WIRING IS CORRECTLY DONE, HIGH RISK OF BOARD DAMAGE!

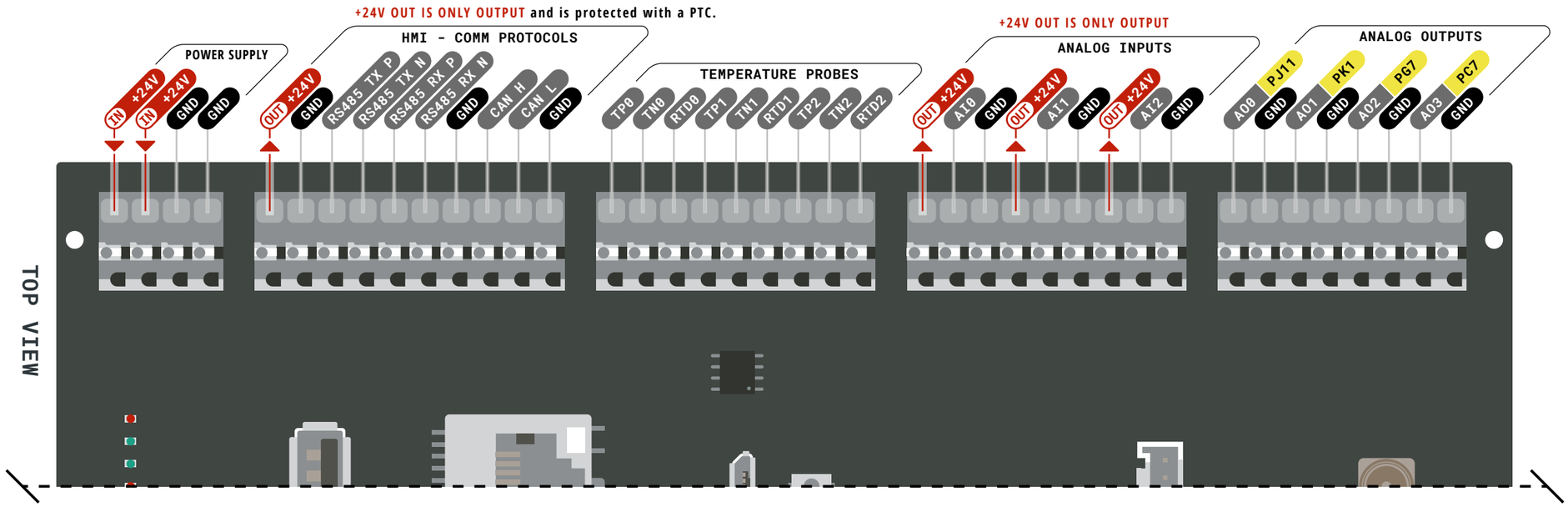
ANALOG OUTPUTS

Each pin can be independently set up to 10V and can source up to 20mA.

HMI - COMM PROTOCOLS

+24V OUT is protected with a PTC.

PTC MAXIMUM CURRENT IS 500mA



Legend:

- Power
- Ground
- +24V programmable outputs
- +24V digital outputs
- Power Input (IN)
- Power Output (OUT)
- GPIO Digital External
- Analog External
- Main Part
- Secondary Part
- Internal Component
- Other Pins (Reset, System Control, Debugging)
- LED
- RGB LED
- Other

GND is the same all over the board

PORTENTA MACHINE CONTROL

SKU code: AKX00032
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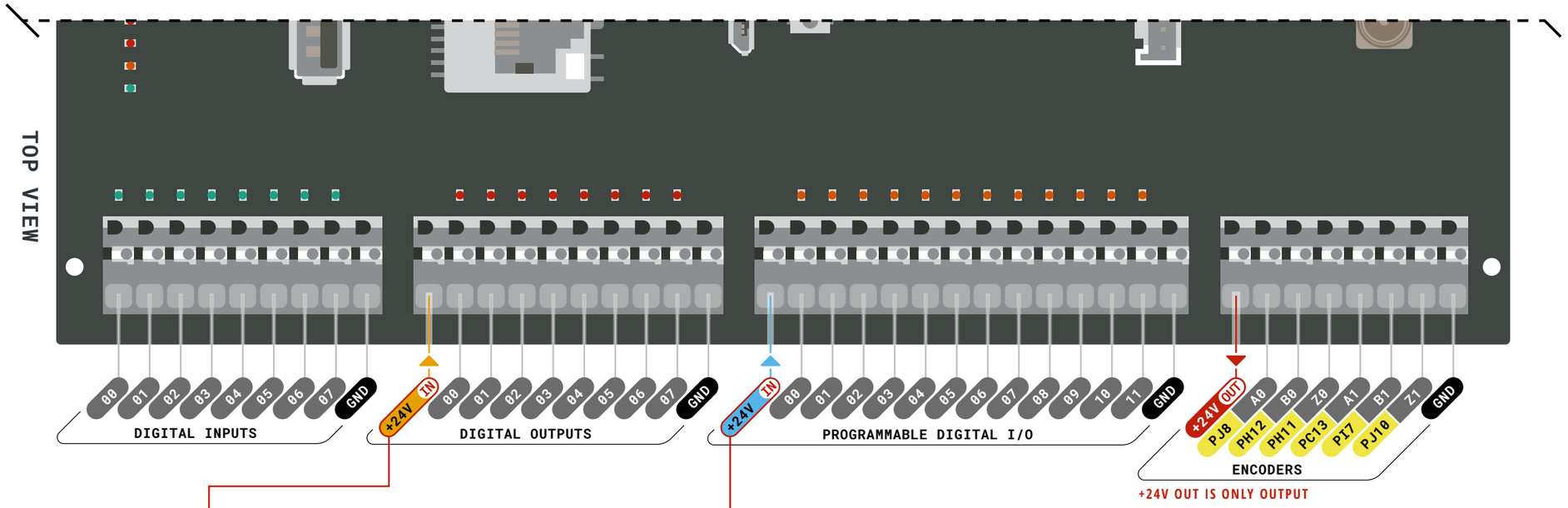
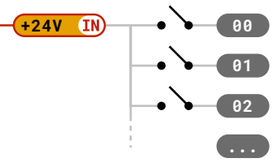


DIGITAL OUTPUT PIN +24V IN IS NOT CONNECTED TO POWER SUPPLY +24V IN AND IS NOT CONNECTED TO OTHER +24V PINS. PROVIDE POWER EXTERNALLY

PROGRAMMABLE DIGITAL I/O PIN +24V IN IS NOT CONNECTED TO POWER SUPPLY +24V IN AND IS NOT CONNECTED TO OTHER +24V PINS. PROVIDE POWER EXTERNALLY

DIGITAL OUTPUTS

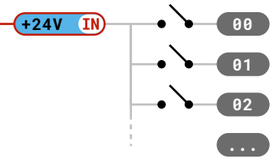
- The pins are connected with the +24V IN with high side switches:



MAXIMUM CURRENT IS 500mA FOR EACH PIN

PROGRAMMABLE DIGITAL I/O

- The output voltage can be readed, if HIGH or LOW.
- The pins are connected with the +24V IN with high side switches:



MAXIMUM CURRENT IS 500mA FOR EACH PIN

ENCODERS

+24V OUT is protected with a PTC.

PTC MAXIMUM CURRENT IS 500mA

Each pin is pulled-up to 24V with a 10kΩ resistor.

Legend:

- Power
- Ground
- +24V programmable outputs
- +24V digital outputs
- IN Power Input
- OUT Power Output
- GPIO Digital External
- Analog External
- Main Part
- Secondary Part
- Internal Component
- Other Pins (Reset, System Control, Debugging)
- LED
- RGB LED
- Other

GND is the same all over the board

ARDUINO PORTENTA MACHINE CONTROL

SKU code: AKX00032
Full Pinout - Page 4 of 11
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Micro USB connector used to program Portenta

Micro USB
+5V OUT
J1-27 USB D-
J1-25 USB D+
PJ6 USB ID
GND

Current limited to 1A

USB A
+5V IN
J1-28 PA11 USB D-
J1-26 PA12 USB D+
GND

Portenta reset button

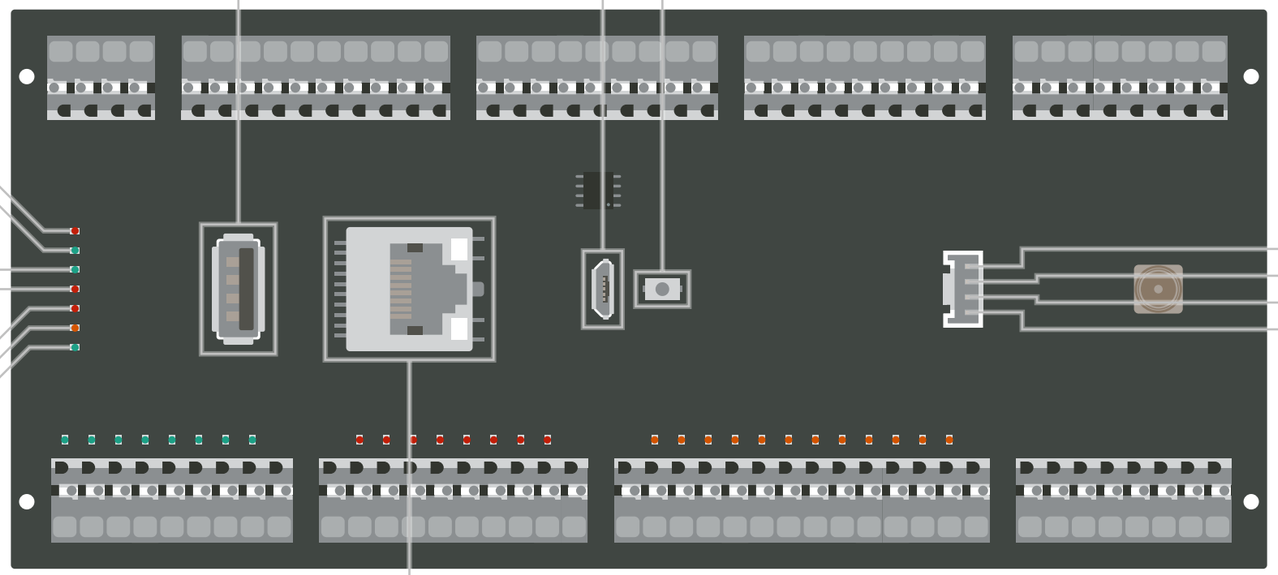
U19 SP335ECR1
T1IN-DI PA0 RS485 TX
R2OUT-DO PI9 RS485 RX

U15 TJA1049T/3J
TX PH13 CAN TX
RX PB8 CAN RX

+3V3
+12V
+24V

GROVE CONNECTOR
I2C SCL PH7
I2C SDA PH8
+3V3
GND

Grove I2C pins have 10kΩ pull-up resistors



TOP VIEW

ETHERNET
ETH_A_N A_N
ETH_A_P A_P
ETH_B_N B_N
ETH_B_P B_P
ETH_C_N C_N
ETH_C_P C_P
ETH_D_N D_N
ETH_D_P D_P
ETH_L1 LED1
ETH_L2 LED2

Legend:

- Power
- Power Input
- Power Output
- Ground
- +24V programmable outputs
- +24V digital outputs
- GPIO Digital External
- Analog External
- Main Part
- Secondary Part
- Internal Component
- Other Pins (Reset, System Control, Debugging)
- I2C — Default
- SPI — Default
- UART/USART — Default
- Other SERIAL Communication
- Analog — Default
- PWM/Timer
- LED
- RGB LED
- Other

GND is the same all over the board

ARDUINO PORTENTA MACHINE CONTROL

SKU code: AKX00032
Full Pinout - Page 5 of 11
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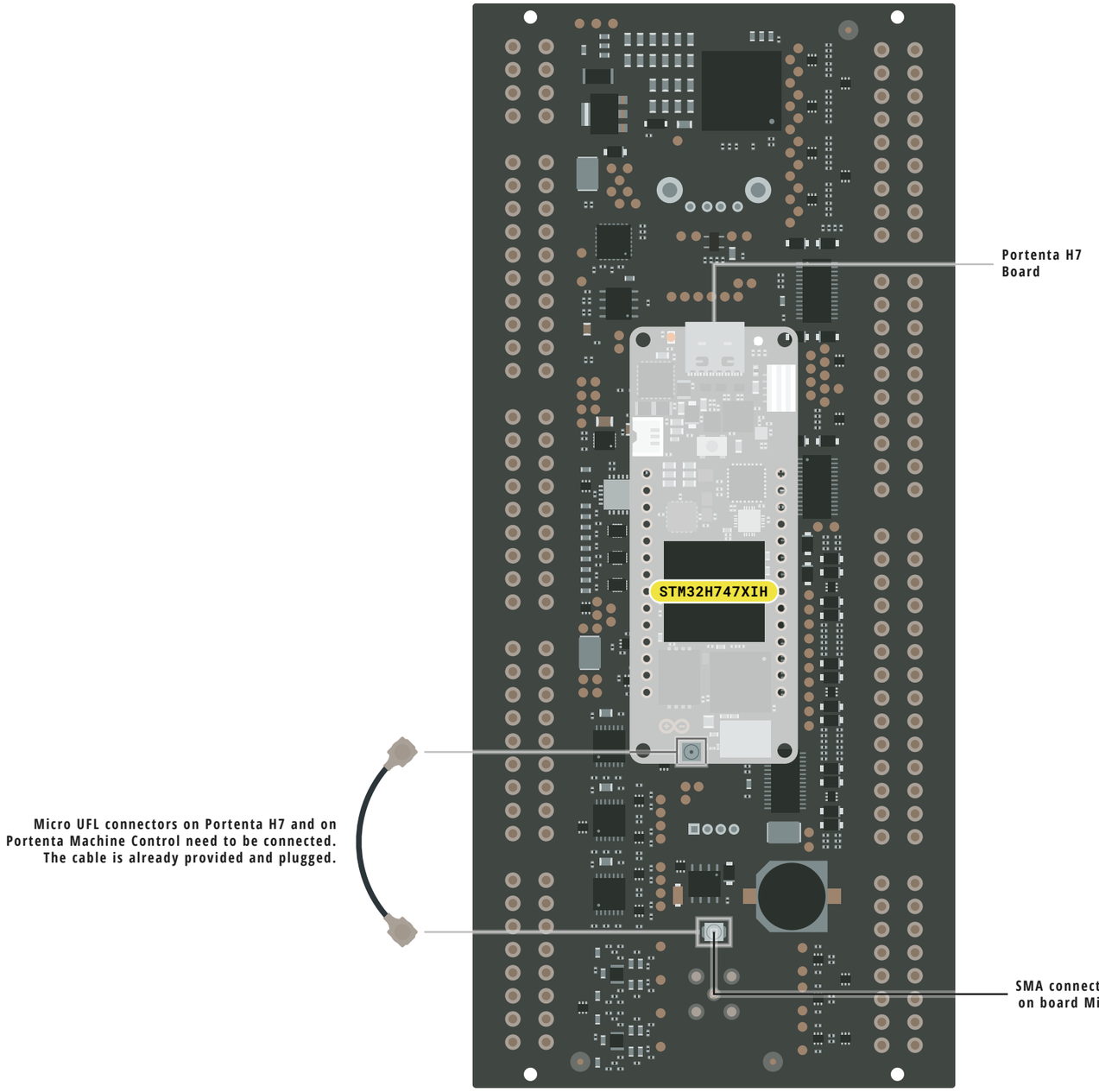
BOTTOM VIEW



Legend:

- Power
- Power Input
- Power Output
- Ground
- +24V programmable outputs
- +24V digital outputs
- GPIO Digital External
- Analog External
- Main Part
- Secondary Part
- Internal Component
- Other Pins (Reset, System Control, Debugging)
- LED
- RGB LED
- Other

GND is the same all over the board

ARDUINO PORTENTA MACHINE CONTROL

SKU code: AKX00032
Full Pinout - Page 6 of 11
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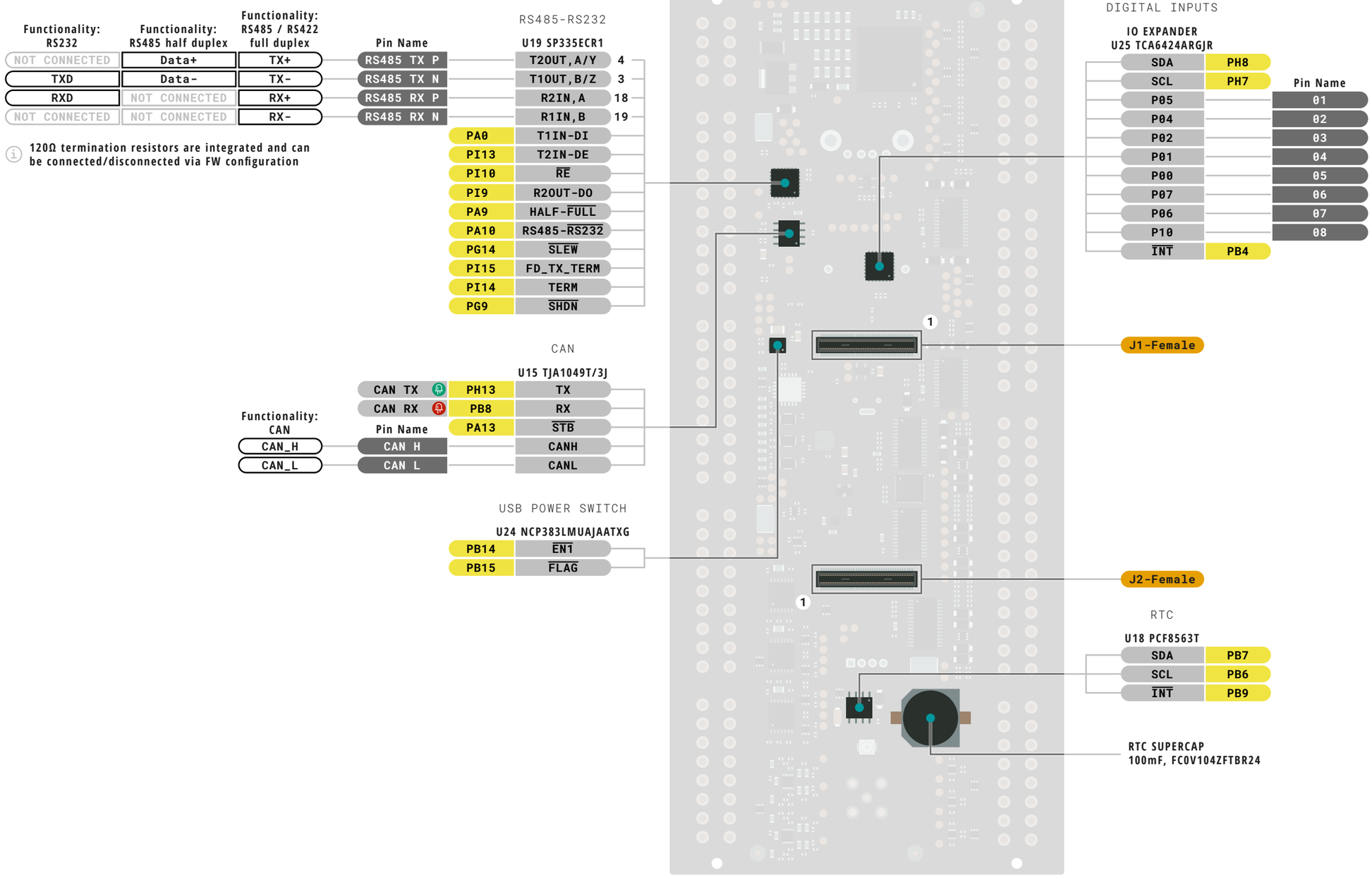
WARNING!

Advanced Section

The following information is for advanced use only and may not be officially supported by Arduino software

BOTTOM VIEW



Legend:

- Power
- Power Input
- Power Output
- Ground
- +24V programmable outputs
- +24V digital outputs
- GPIO Digital External
- Analog External
- Main Part
- Secondary Part
- Internal Component
- Other Pins (Reset, System Control, Debugging)
- LED
- RGB LED
- Other

GND is the same all over the board

PORTENTA MACHINE CONTROL

SKU code: AKX00032
Full Pinout - Page 8 of 11
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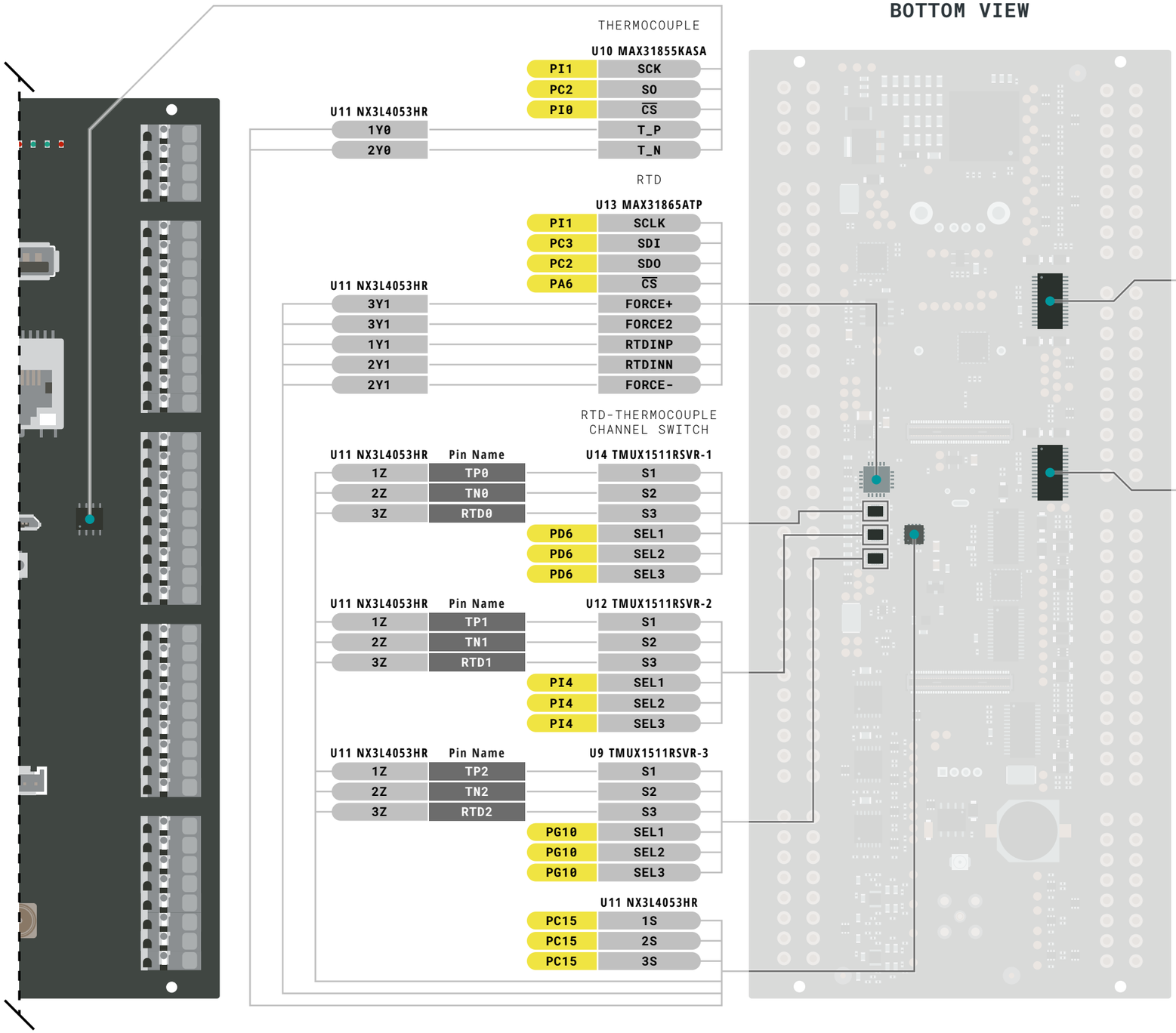
BOTTOM VIEW



ⓘ Digital Outputs THER pins are controlled by PB2

Legend:

- Power
- Power Input (IN)
- Power Output (OUT)
- Ground
- +24V programmable outputs
- +24V digital outputs
- GPIO Digital External
- Analog External
- Main Part
- Secondary Part
- Internal Component
- Other Pins (Reset, System Control, Debugging)
- LED
- RGB LED
- Other

GND is the same all over the board

ARDUINO PORTENTA MACHINE CONTROL

SKU code: AKX00032
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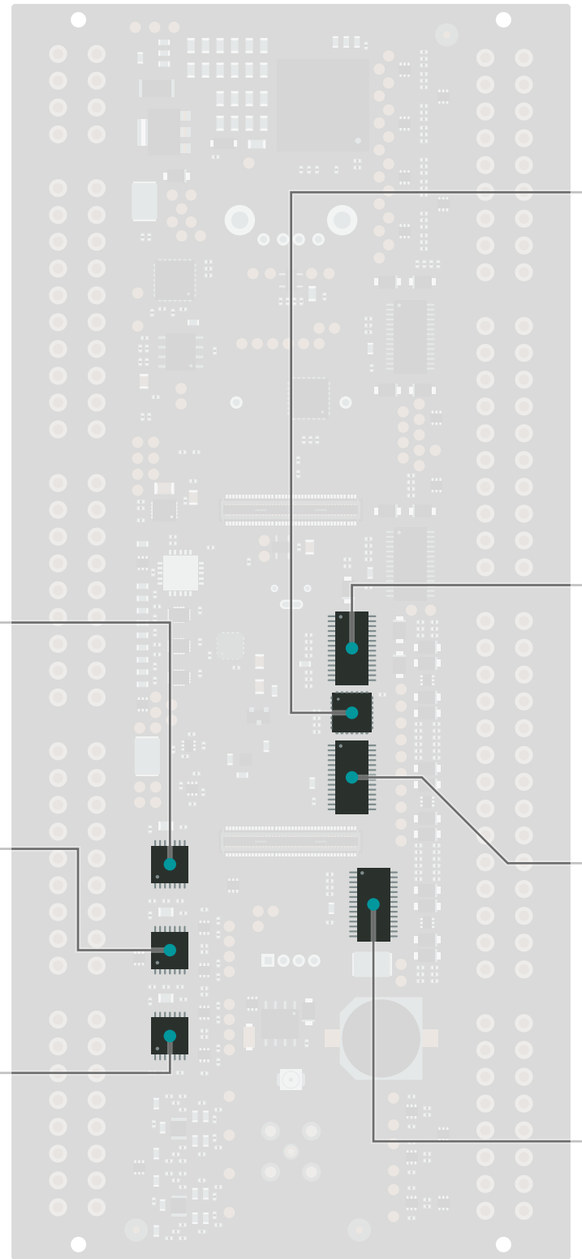
BOTTOM VIEW



PROGRAMMABLE DIGITAL I/O

IO EXPANDER
U21 TCA6424ARGJR

			Pin Name
	SDA	PH8	
	SCL	PH7	
P27	READ_CH00		00
P26	READ_CH01		01
P25	READ_CH02		02
P24	READ_CH03		03
P23	READ_CH04		04
P22	READ_CH05		05
P21	READ_CH06		06
P20	READ_CH07		07
P17	READ_CH08		08
P16	READ_CH09		09
P15	READ_CH10		10
P14	READ_CH11		11
	INT	PI5	

ANALOG INPUTS
CHANNEL SWITCH

U4 TS12A44514PWR-1

Pin Name		
	+3V3	COM1/NTC REF
	PC3_C	COM2
AI0		NO1
	PD4	IN1
	PD5	IN2
	PE3	IN3
	PG3	IN4

U5 TS12A44514PWR-2

Pin Name		
	+3V3	COM1/NTC REF
	PC2_C	COM2
AI1		NO1
	PD7	IN1
	PH6	IN2
	PJ7	IN3
	PH15	IN4

U6 TS12A44514PWR-3

Pin Name		
	+3V3	COM1/NTC REF
	PA1_C	COM2
AI2		NO1
	PH10	IN1
	PA4	IN2
	PA8	IN3
	PC6	IN4

⚠ EACH PORTENTA PIN CONNECTED TO AN ANALOG INPUT IN* PIN IS INVERTED BY A TRANSISTOR

U20 TPS4H160AQPWPRQ1-1

			Pin Name
	OUT1		00
	OUT2		01
	OUT3		02
	OUT4		03
	THER	PH14	U21 TCA6424ARGJR
	IN1		P00/EN_CH0
	IN2		P01/EN_CH1
	IN3		P02/EN_CH2
	IN4		P03/EN_CH3

U22 TPS4H160AQPWPRQ1-2

			Pin Name
	OUT1		04
	OUT2		05
	OUT3		06
	OUT4		07
	THER	PH14	U21 TCA6424ARGJR
	IN1		P04/EN_CH7
	IN2		P05/EN_CH6
	IN3		P06/EN_CH5
	IN4		P07/EN_CH4

U23 TPS4H160AQPWPRQ1-3

			Pin Name
	OUT1		08
	OUT2		09
	OUT3		10
	OUT4		11
	THER	PH14	U21 TCA6424ARGJR
	IN1		P10/EN_CH8
	IN2		P11/EN_CH9
	IN3		P12/EN_CH10
	IN4		P13/EN_CH11

ⓘ Digital Programmable THER pins are controlled by PH14

Legend:

- Power
- Power Input (IN)
- Power Output (OUT)
- Ground
- +24V programmable outputs
- +24V digital outputs
- GPIO Digital External
- Analog External
- Main Part
- Secondary Part
- Internal Component
- Other Pins (Reset, System Control, Debugging)
- LED
- RGB LED
- Other

⚠ **GND** is the same all over the board

ARDUINO PORTENTA MACHINE CONTROL

SKU code: AKX00032
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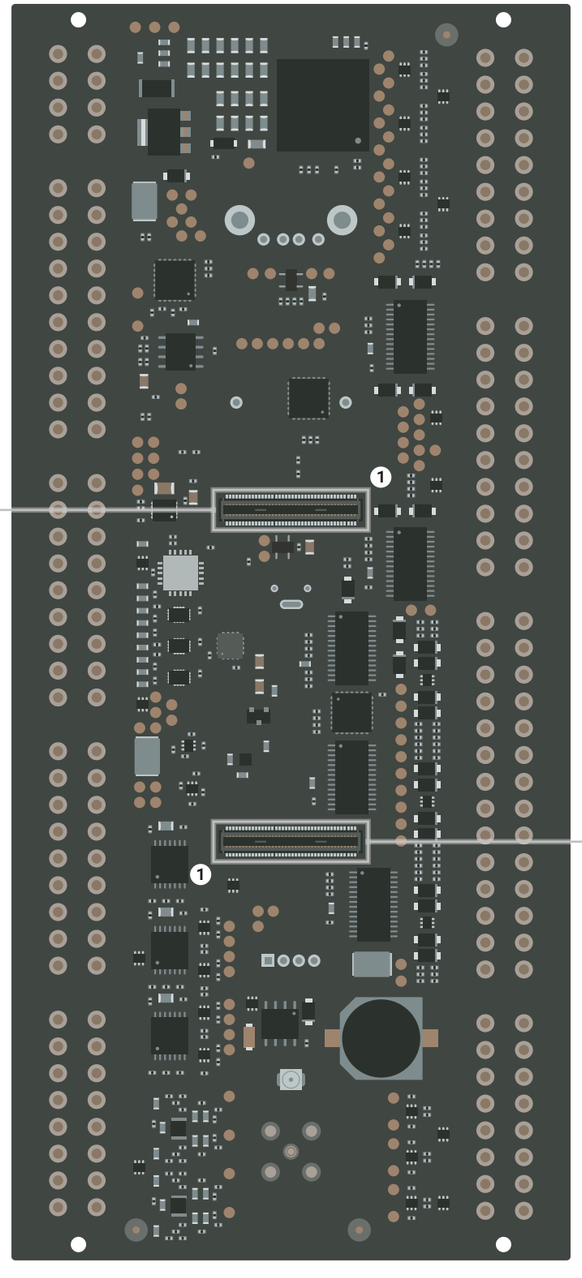
BOTTOM VIEW



J1-Female

ETH A+	1	2		
ETH A-	3	4		
ETH B+	5	6		
ETH B-	7	8		
	9	10	DSI D1+	
	11	12	DSI D1-	
	13	14	DSI D0+	
	15	16	DSI D0-	
ETH L1	17	18	DSI CK+	
ETH L2	19	20	DSI CK-	
VIN (IN)	21	22	GND	
USB1 VBUS (OUT)	23	24		
USB1 D+	25	26	USB0 D+	
USB1 D-	27	28	USB0 D-	
USB1 ID	29	30		
GND	31	32 (IN)	VIN	
UART1 TX	33	34	UART0 TX	
UART1 RX	35	36	UART0 RX	
UART1 RTS	37	38	UART0 RTS	
UART1 CTS	39	40	UART0 CTS	
VIN (IN)	41	42	GND	
I2C1 SDA	43	44	I2C0 SDA	
I2C1 SD6	45	46	I2C0 SCL	
GND	47	48 (IN)	VIN	
CAN1 TX	49	50		
CAN1 RX	51	52		
VSYS (OUT)	53	54	GND	
SDC CLK	55	56	I2S MCK	
SDC CMD	57	58	I2S WS	
SDC D0	59	60	I2S DI	
SDC D1	61	62	I2S DO	
SDC D2	63	64 (OUT)	VSYS	
SDC D3	65	66	DMIC CK	
	67	68	DMIC D0	
	69	70		
	71	72 (OUT)	V-SDCARD	
RESET	73	74		
SWDIO	75	76		
SWCK	77	78		
SWO	79	80		

J2-Female

ADC A7	80	79	ADC A3	
ADC A6	78	77	ADC A2	
ADC A5	76	75	ADC A1	
ADC A4	74	73	ADC A0	
ADC VREF- (OUT)	72	71 (OUT)	ADC VREF+	
GND	70	69 (OUT)	VCC/+3V3	
PWM 10	68	67	PWM 5	
PWM 9	66	65	PWM 4	
PWM 8	64	63	PWM 3	
PWM 7	62	61	PWM 2	
PWM 6	60	59	PWM 1	
GPIO 6	58	57	GND	
GPIO 5	56	55		
GPIO 4	54	53	SAI D0	
GPIO 3	52	51	SAI FS	
GPIO 2	50	49	SAI CK	
GPIO 1	48	47	I2C2 SCL	
GPIO 0	46	45	I2C2 SDA	
GND	44	43 (OUT)	VCC/+3V3	
SPI1 COPI	42	41		
SPI1 CIPO	40	39		
SPI1 CK	38	37		
SPI1 CS	36	35		
VCC (OUT)	34	33	GND	
	32	31		
	30	29		
UART2 RX	28	27	UART3 RX	
UART2 TX	26	25	UART3 TX	
GND	24	23 (OUT)	VCC/+3V3	
CAM HS	22	21		
CAM CLK	20	19		
CAM VS	18	17		
CAM D0	16	15		
CAM D1	14	13		
CAM D2	12	11		
CAM D3	10	9		
CAM D4	8	7	COINCELL	
CAM D5	6	5	POWER_ON_REQ	
CAM D6	4	3	BOOT_SOURCE	
CAM D7	2	1	FORCE_BOOTLOADER	

Legend:

- Power
- Ground
- +24V programmable outputs
- +24V digital outputs
- (IN) Power Input
- (OUT) Power Output
- GPIO Digital External
- Analog External
- Main Part
- Secondary Part
- Internal Component
- Other Pins (Reset, System Control, Debugging)
- LED
- RGB LED
- Other

GND is the same all over the board

PORTENTA MACHINE CONTROL

SKU code: AKX00032
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