

**NOTES:**

- 1) IF MOTOR EXHIBITS POSITIVE FEEDBACK, SWITCH MOTOR POWER LEADS. OR SWITCH ENCODER A, B LINES
- 2) KEEP ENCODER / INPUTS AWAY FROM NOISEY MOTOR POWER WIRES.

**DO NOT UNPLUG LOADS WHILE POWER IS ON. BREAKING OF CURRENT IN THE INDUCTANCE OF THE MOTOR GENERATES A HIGH VOLTAGE ARC, WHICH DAMAGES THE DRIVE.**

**SEE PAGE 4 FOR MANUFACTURER SPECIFIC BLDC MOTOR WIRING EXAMPLES**

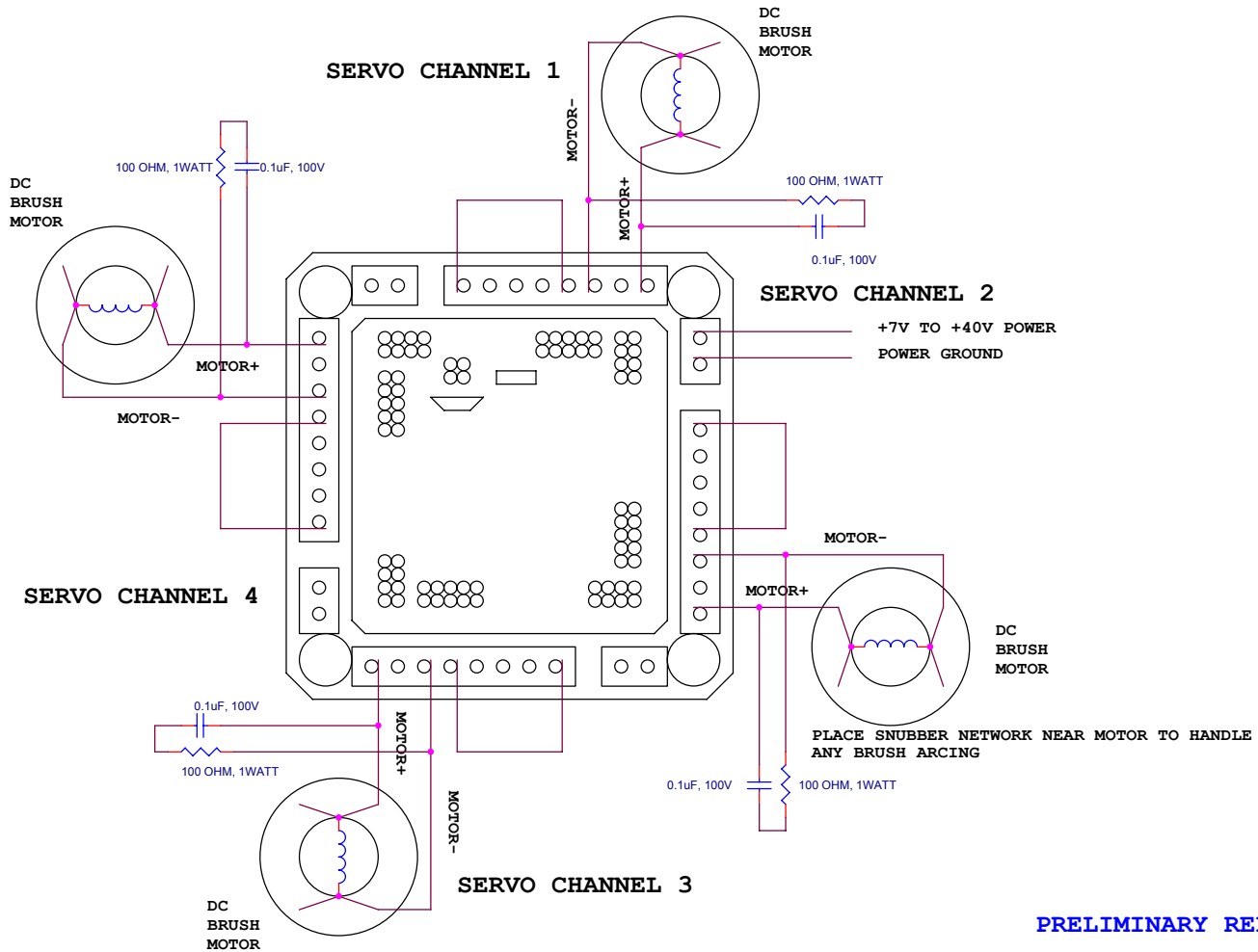
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**PRELIMINARY RELEASE**

**EZ QUAD SERVO POWER SECTION WIRING DIAGRAM FOR BLDC MOTOR**

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DO NOT UNPLUG LOADS WHILE POWER IS ON. BREAKING OF CURRENT IN THE INDUCTANCE OF THE MOTOR GENERATES A HIGH VOLTAGE ARC, WHICH DAMAGES THE DRIVE.

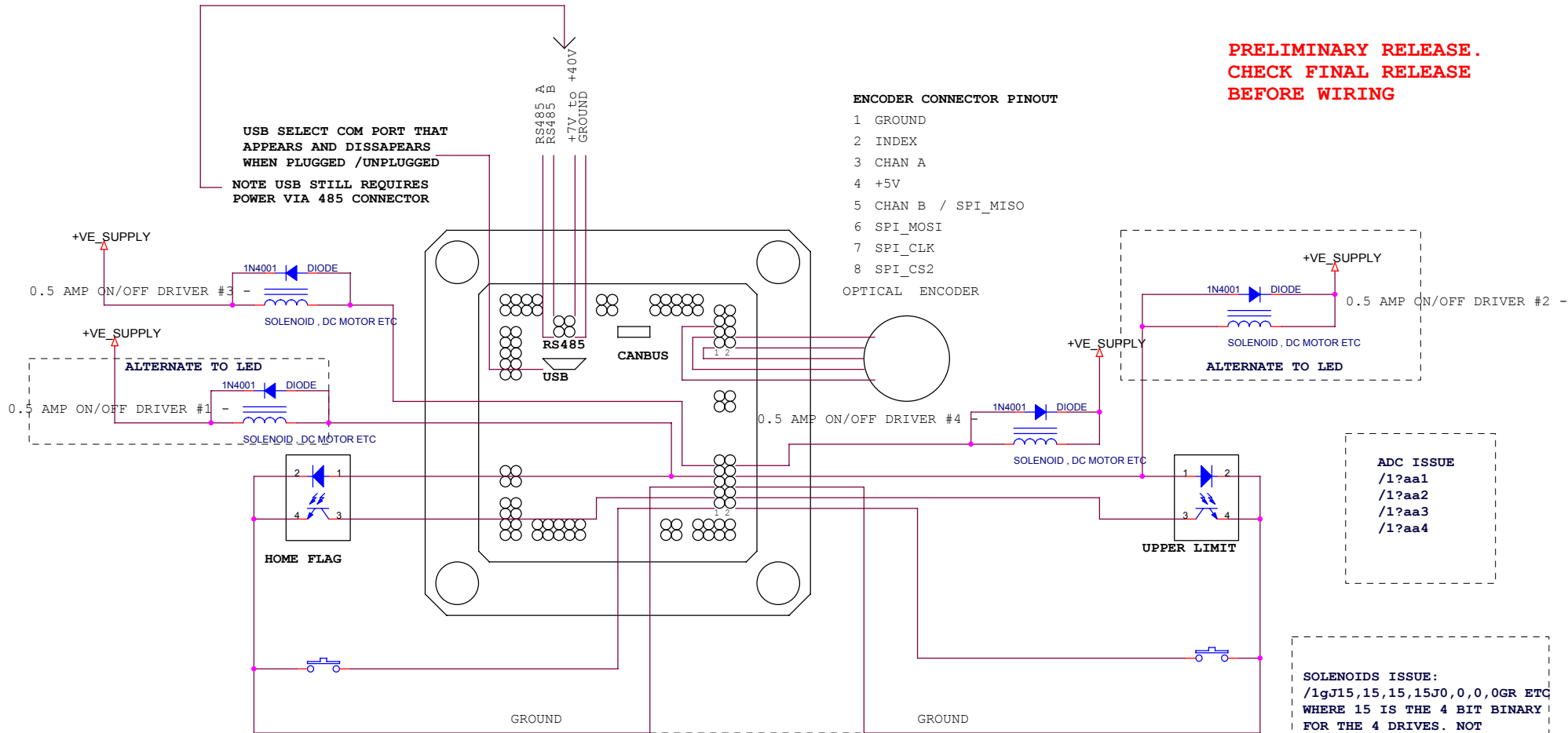
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EZ QUAD SERVO POWER SECTION WIRING DIAGRAM FOR BRUSH MOTOR

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CHECK FINAL RELEASE  
BEFORE WIRING**



**ENCODER CONNECTOR PINOUT**

- 1 GROUND
- 2 INDEX
- 3 CHAN A
- 4 +5V
- 5 CHAN B / SPI\_MISO
- 6 SPI\_MOSI
- 7 SPI\_CLK
- 8 SPI\_CS2

OPTICAL ENCODER

USB SELECT COM PORT THAT APPEARS AND DISSAPERS WHEN PLUGGED /UNPLUGGED  
NOTE USB STILL REQUIRES POWER VIA 485 CONNECTOR

ADC ISSUE  
/?aa1  
/?aa2  
/?aa3  
/?aa4

SOLENOIDS ISSUE:  
/1gJ15,15,15,15J0,0,0,0GR ETC  
WHERE 15 IS THE 4 BIT BINARY  
FOR THE 4 DRIVES. NOT  
IMPLEMENTED IN PRELIMINARY  
RELEASE FIRMWARE

**WIRING FOR REV D+, (PRODUCTION)**

**I/O CONNECTOR PINOUT**

- 9 DRIVER 3 (OPEN DRAIN)
- 7 OPTO 1 LED DRIVE/ DRIVE 1 (OPEN DRAIN)
- 5 GND
- 3 OPTO 1/HOME/LOWER LIMIT/DIGITAL IN 2^2
- 1 SWITCH 1 IN/DIGITAL 2^0/ ANALOG CH1
- 10 DRIVER 4 (OPEN DRAIN)
- 8 OPTO 2 LED DRIVE/ DRIVE 2 (OPEN DRAIN)
- 6 GND
- 4 OPTO 2/UPPER LIMIT/DIGITAL IN 2^3
- 2 SWITCH 2 IN/DIGITAL 2^1/ ANALOG CH2

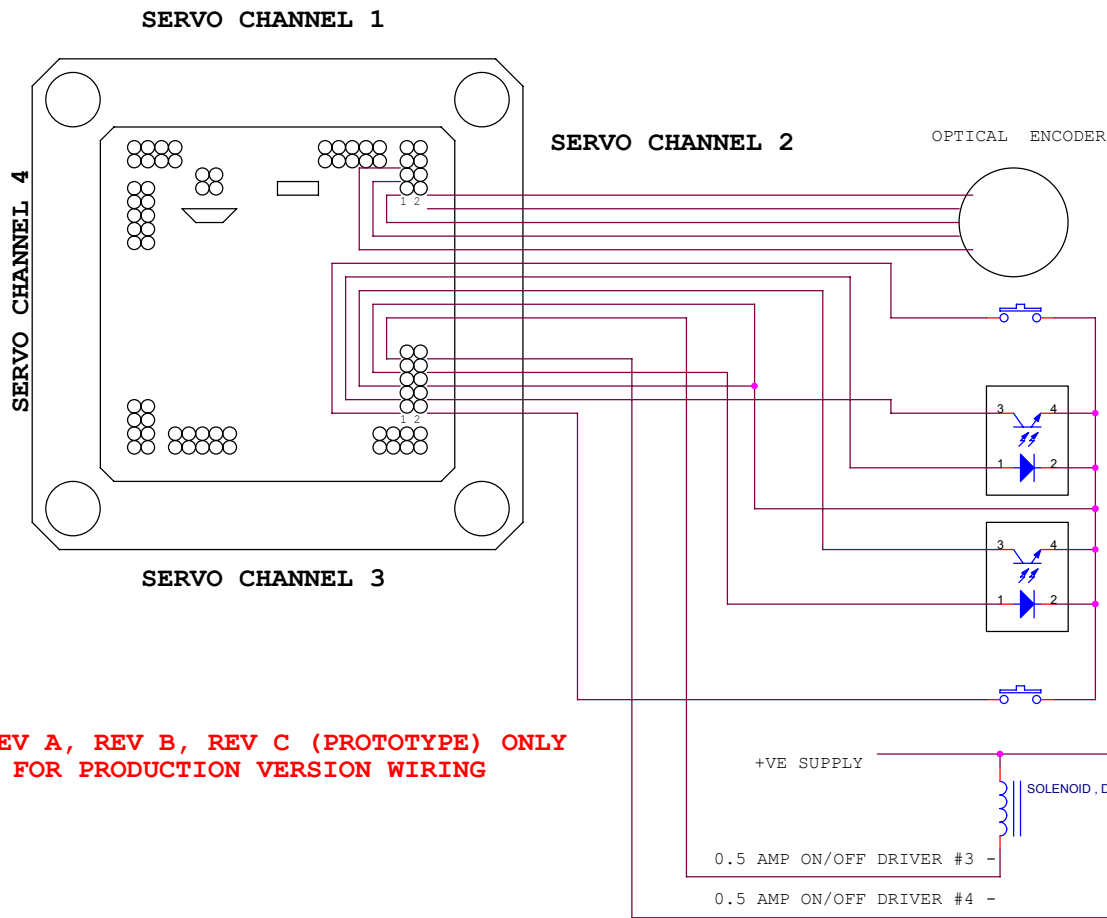
NOTE JOYSTICK INPUTS ARE CHANNEL 1, PIN 1

ADC INPUTS ARE PIN 1,2

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EZ QUAD SERVO  
I/O SECTION WIRING DIAGRAM**

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**ENCODER CONNECTOR PINOUT**

- 1 GROUND
- 2 INDEX
- 3 CHAN A
- 4 +5V
- 5 CHAN B / SPI\_MISO
- 6 SPI\_MOSI
- 7 SPI\_CLK
- 8 SPI\_CS2

**I/O CONNECTOR PINOUT**

- 1 SWITCH 2 IN/DIGITAL 2^0/ ANALOG CH2
- 2 SWITCH 2 IN/DIGITAL 2^1/ ANALOG CH2
- 3 OPTO 1 LED DRIVE/ DRIVE 1 (TTL)
- 4 OPTO 1/HOME/LOWER LIMIT/DIGITAL IN 2^2/ ANALOG CH3
- 5 OPTO 2/UPPER LIMIT/DIGITAL IN 2^3/ ANALOG CH4
- 6 GND
- 7 GND
- 8 OPTO 2 LED DRIVE/ DRIVE 2 (TTL)
- 9 DRIVER 3 (OPEN DRAIN)
- 10 DRIVER 4 (OPEN DRAIN)

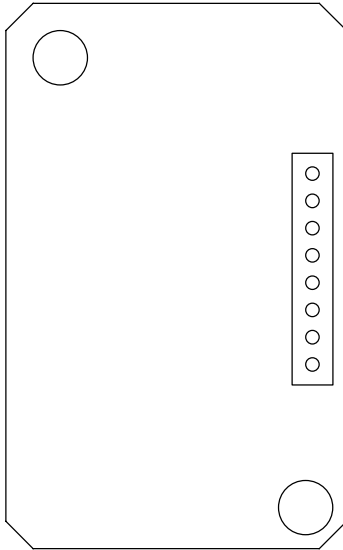
**NOTE**  
**WIRING FOR REV A, REV B, REV C (PROTOTYPE) ONLY**  
**SEE SHEET 3A FOR PRODUCTION VERSION WIRING**

**EZ QUAD SERVO  
I/O SECTION WIRING DIAGRAM**

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NOTE: MOTORS WITHOUT ENCODERS CAN BE RUN IN THE "N0" VELOCITY MODE, OR FOR FINER CONTROL THEY CAN BE RUN IN "N1" MODE WITH TWO OF THE HALL SENSOR LINES WIRED TO THE ENCODER CHANNELS A AND B TO ACT AS A ROUGH POSITION ENCODER. THIS WILL ALLOW FINE ACCELERATION CONTROL, OR ROUGH POSITION CONTROL. THE VELOCITY WILL NEED TO BE SET LOW. TRY /1L1V1000R, ENSURE THAT THE ENCODER IS HOOKED UP TO COUNT UP WHEN THE MOTOR MOVES IN THE POSITIVE DIRECTION.



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	POPULAR MANUFACTURER WIRE COLORS									
	PITTMAN	MAXON	MAXON	ELECTROCRRAFT OPTICAL HALL	ELCTROCRRAFT MAGNETIC HALL	FAULHARBER	ANAHEIM AUTOMATION	HARMONIC DRIVES RSF8B	PORTESCAP NUVODISC 32BF	MAXON EC-max
HALL A	WHITE	BLUE	RED/GREY	BROWN	YELLOW	GREEN	WHITE	YELLOW	SENSOR1	GREY
HALL B	GREY	GREY	WHITE/GREY	WHITE	GREEN	BLUE	BLUE	BROWN	SENSOR3	BROWN
HALL C	BLUE	VIOLET	BLACK/GREY	GREEN	GREY	GREY	GREEN	RED	SENSOR2	YELLOW
+5V HALL SENSOR POWER	PURPLE	YELLOW	GREEN	NC	ORANGE	RED	RED	WHITE (PINK)	VDD	GREEN
HALL SENSOR GROUND	BLACK	GREEN	BLUE	NC	BLACK	BLACK	BLACK	BLACK	GROUND	BLUE
PHASE A POWER DRIVER	BROWN	ORANGE	WHITE	BROWN	BROWN	BROWN	BLACK (M)	BLACK (M)	PHASE 3	BLACK
PHASE B POWER DRIVER	RED	RED	BLACK	WHITE	WHITE	ORANGE	YELLOW (M)	RED (M)	PHASE 2	RED
PHASE C POWER DRIVER	ORANGE	BROWN	RED	BLUE	BLUE	YELLOW	RED (M)	WHITE (M)	PHASE 1	WHITE

FROM OPTICAL ENCODER + HALL

GROUND BLACK  
 INDEX ORANGE  
 CHAN A YELLOW  
 +5V RED  
 CHAN B BLUE

DO NOT CONNECT ORANGE BLUE GREEN

NOTE: ENCODER SIGNALS MUST BE >4.5V HIGH LEVEL. THIS MAY REQUIRE EXTERNAL PULLUPS.

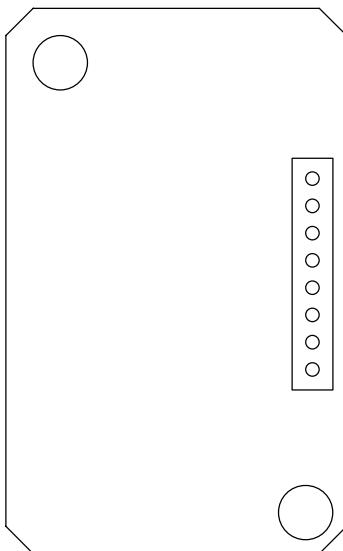
PLEASE NOTE: FOR OTHER MOTORS, ALLMOTION WILL BE PLEASED TO WORK OUT THE WIRING FOR NO CHARGE.

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 EZQUAD SERVO WIRING DIAGRAM

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NOTE: MOTORS WITHOUT ENCODERS CAN BE RUN IN THE "N0" VELOCITY MODE, OR FOR FINER CONTROL THEY CAN BE RUN IN "N1" MODE WITH TWO OF THE HALL SENSOR LINES WIRED TO THE ENCODER CHANNELS A AND B TO ACT AS A ROUGH POSITION ENCODER. THIS WILL ALLOW FINE ACCELERATION CONTROL, OR ROUGH POSITION CONTROL. THE VELOCITY WILL NEED TO BE SET LOW. TRY /1L1V10000R, ENSURE THAT THE ENCODER IS HOOKED UP TO COUNT UP WHEN THE MOTOR MOVES IN THE POSITIVE DIRECTION.



ADDITIONAL POPULAR MANUFACTURER WIRE COLORS									
				KOLLMORGEN AKM11E- BNMN2-00					
HALL A				BROWN					
HALL B				GREY					
HALL C				WHITE					
+5V HALL SENSOR POWER				NC					
HALL SENSOR GROUND				NC / SHIELD					
PHASE A POWER DRIVER				BLUE					
PHASE B POWER DRIVER				BROWN					
PHASE C POWER DRIVER				VIOLET					

TO ENCODER  
 GROUND BLACK  
 INDEX VIOLET  
 CHAN A GREEN  
 +5V RED  
 CHAN B BLUE

NOTE: ENCODER SIGNALS MUST BE >4.5V HIGH LEVEL. THIS MAY REQUIRE EXTERNAL PULLUPS.

PLEASE NOTE: FOR OTHER MOTORS, ALLMOTION WILL BE PLEASED TO WORK OUT THE WIRING FOR NO CHARGE.

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 EZ-QUAD-SERVO  
 WIRING DIAGRAM

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## EZSV23 ACCESSORIES AND OTHER ELECTRICAL NOTES

### MATING CONNECTORS:

POWER CONNECTIONS AMP MTA 100 SERIES  
 8PIN 22 GA DIGIKEY P/N A31111 (NEMA23 MOTOR)  
 8PIN 24 GA DIGIKEY P/N A31023 (NEMA17 MOTOR)  
 8PIN 26 GA DIGIKEY P/N A31030  
 T HANDLE CRIMP TOOL DIGIKEY P/N A9982  
 PISTOL GRIP TOOL DIGIKEY P/N A1998 + A2031

### SIGNAL CONNECTIONS HIROSE DF11 SERIES

4PIN DF11-4DS-2C  
 8PIN DF11-8DS-2C  
 10PIN DF11-10DS-2C

USB: USB MICRO

### OPTO HOME SWITCH:

- "Z" OR HOME COMMAND RUNS MOTOR UNTIL OPTO #1 IS ON FLAG EDGE.
- AN OPTO SWITCH PROVIDED WITH EACH STARTER KIT
- USE TRANSISTOR OPTO THAT HAS  $I_c > 1\text{mA}$  @  $I_F = 20\text{mA}$ .
- EXAMPLES OF ACCEPTABLE OPTOS ARE:  
 DIGIKEY P/N QVA11134  
 DIGIKEY P/N H21A1  
 HONEYWELL HOA1887-012 (IS PREWIRED)  
 HONEYWELL HOA1870-33 (IS PREWIRED)  
 OPTEK OPB830W11 (IS PREWIRED)
- THE OPTO COUPLER LED PIN HAS 200 OHM TO 5V IN SERIES ON THE BOARD. THE 200 OHM CAN BE REMOVED IF DESIRED FOR RUNNING SENSORS THAT REQUIRE DIRECT ACCESS TO 5V. (OR USE ENCODER 5V POWER) THE COLLECTOR OF THE TRANSISTOR HAS A 10K PULLUP TO 5V. THE TOTAL CURRENT DRAWN FROM THE 5V SUPPLY (INCLUDING OPTOS) MUST BE LESS THAN 200mA.

6) ALL INPUTS ARE 0-3.3V ADC INPUTS, THE ONE/ZERO THRESHOLD IS FACTORY SET TO 1.23V, TO BE TTL COMPATIBLE, AND CAN BE CHANGED BY SOFTWARE COMMAND.

### ENCODERLESS OPERATION:

- THE EZSERVO CAN PERFORM VELOCITY MODE CONTROL OF A MOTOR THAT DOES NOT HAVE AN ENCODER BY USING THE HALL SENSORS AS A GAGE OF SPEED. (N=0 MODE)
- IT IS POSSIBLE TO USE THE N=1 POSITION CONTROL MODE BY WIRING TWO OF THE HALL SENSOR LINES TO THE ENCODER A AND B INPUTS IN ADDITION. THIS ALLOWS A CRUDE POSITION CONTROL MODE. IN THIS MODE THE VELOCITY CONTROL IS SUPERIOR TO THE N=0 MODE. USE SMALL ACCELERATIONS AND VELOCITIES IN THIS MODE. Eg TRY /1L1V10000P0R
- THE RESPONSE CAN ALSO BE "STIFFENED" BY INCREASING THE PID GAIN CONSTANTS eg /1L10w3000y3000V10000P0R
- IF WIRING HALL SENSORS AS ENCODERS, USE THE ENCODER 5 V TO POWER THE HALL SENSORS.

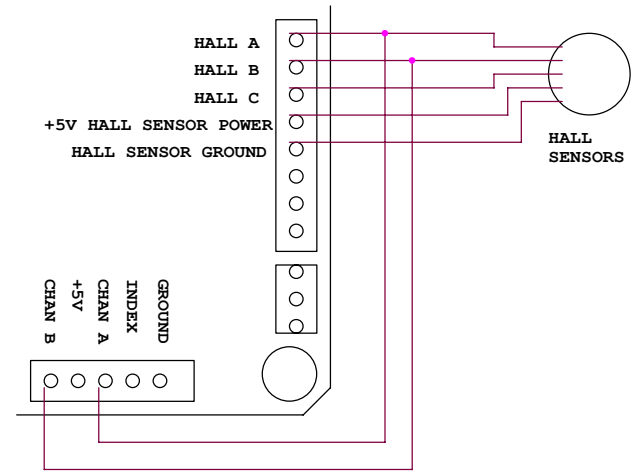
### MOTORS:

- THE EZ SERVO WILL DRIVE MOST SERVO MOTORS
- FOR BEST PERFORMANCE SELECT A MOTOR THAT HAS A BACK EMF OF ABOUT 1/2 OF THE SUPPLY VOLTAGE, AT THE MAX SPEED DESIRED TO RUN AT. (Eg USE A 12V MOTOR WITH A 24V SUPPLY).
- TYPICALLY A MOTOR THAT HAS AN INDUCTANCE OF AROUND 1mH AND A RESISTANCE OF AROUND 1 OHM WORKS WELL. BUT OTHER VALUES ARE ALSO OK. (0.1mH MINIMUM)

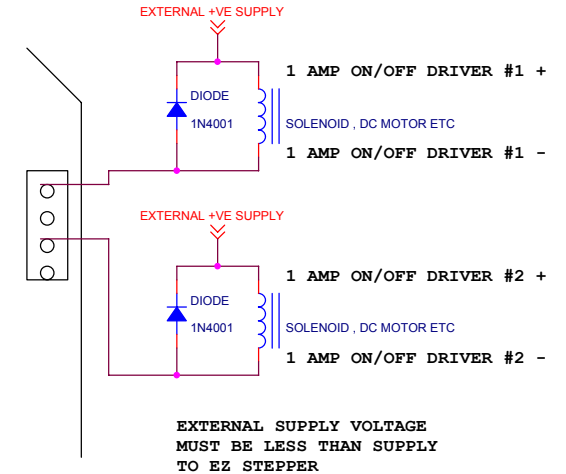
### ON/OFF DRIVERS ALTERNATE WIRING DIAGRAM

- ON/OFF DRIVERS RATED AT 2 AMPS PEAK, 1 AMP CONTINUOUS.
- THE NEGATIVE PIN OF THESE DRIVERS IS ACTUALLY AN OPEN COLLECTOR TYPE OUTPUT THAT PULLS DOWN TO GROUND. IT IS POSSIBLE TO DRIVE LOADS THAT ARE OF A DIFFERENT VOLTAGE THAN THE SUPPLY VOLTAGE, BY CONNECTING THE POSITIVE SIDE OF THE LOAD TO AN EXTERNAL SUPPLY, AND THE NEGATIVE SIDE TO THE -VE OUTPUT PIN. HOWEVER, IN CASE THIS IS DONE IT IS NECESSARY TO PLACE AN EXTERNAL "FREE WHEELING" DIODE ACROSS ANY INDUCTIVE LOADS. EXTERNAL SUPPLY VOLTAGE MUST BE LESS THAN SUPPLY VOLTAGE TO EZ STEPPER
- EXTERNAL DIODE IS NOT NECESSARY IF BOTH SIDES OF LOAD ARE WIRED BACK TO THE EZ STEPPER.

### USE OF HALL SENSORS AS ENCODERS



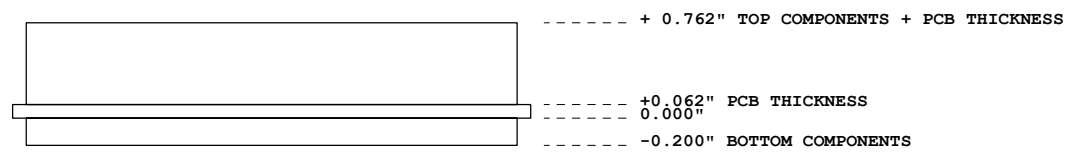
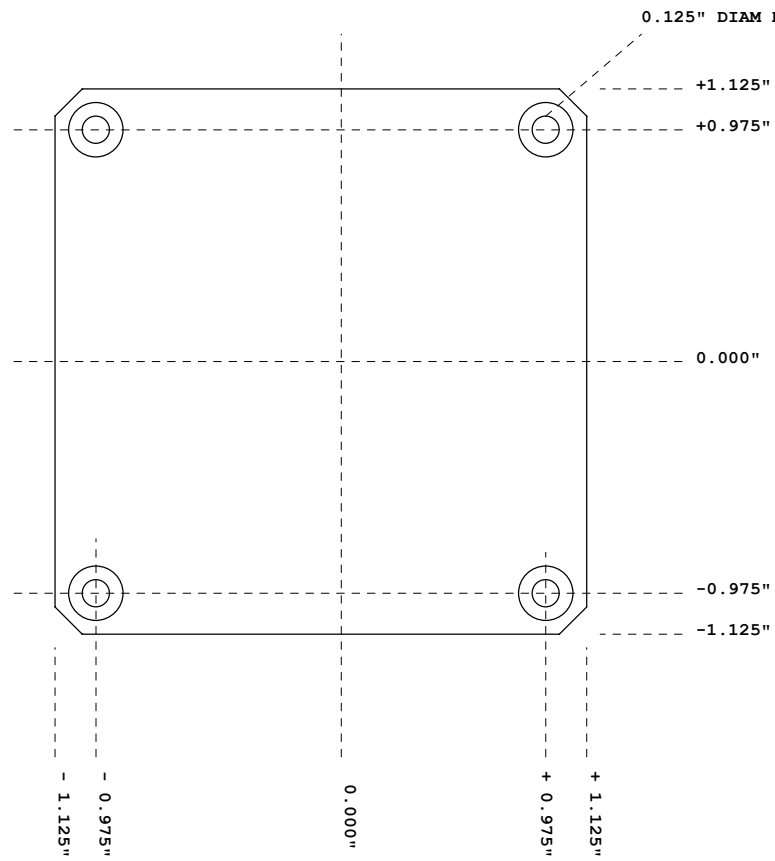
### ON/OFF DRIVERS ALTERNATE WIRING DIAGRAM



SEE NEXT PAGE FOR DIMENSIONAL INFO

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**EZ-QUAD-SERVO DIMENSIONAL INFORMATION**

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