HEDS-9930PRGEVB

Evaluation Board & Programming Kit

User Guide

Version 1.0

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1.0 HEDS-9930EVB Evaluation Board

1.1 Top and Bottom Views

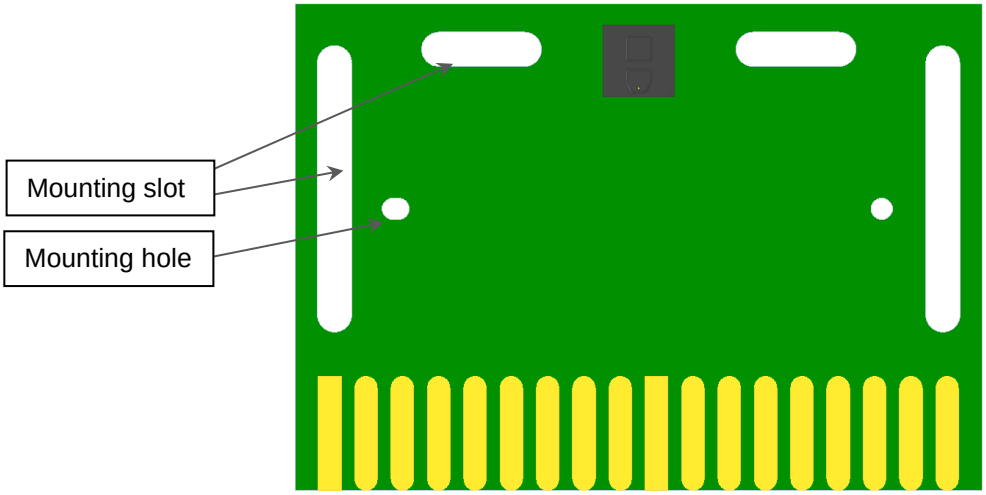


Figure 1 Bottom Side of the PCB

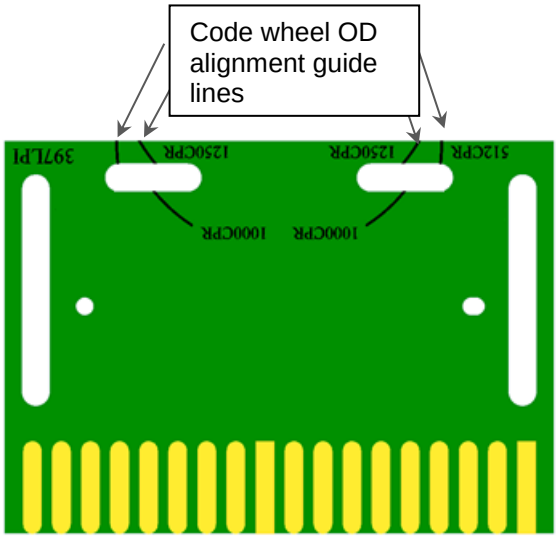


Figure 2 Top Side of the PCB 397 LPI

NOTE Please remove the protective kapton tape covering the encoder ASIC before use.

The silk screen printed guide line on the PCB is to help in providing visual alignment of the code wheel edge (outer diameter) for each of the different Rop (CPR) tracks. A sample diagram showing the position when encoder is aligned to 625 CPR track is shown in Figure 3 below.

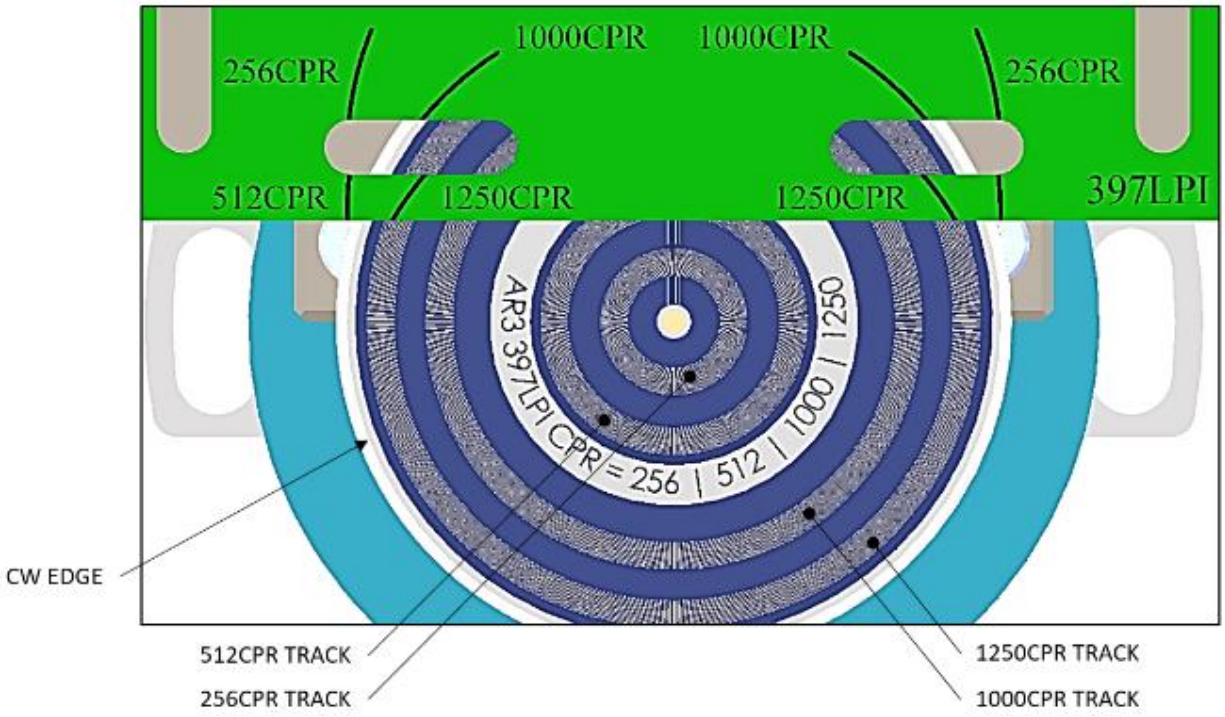


Figure 3 Bottom side of PCB

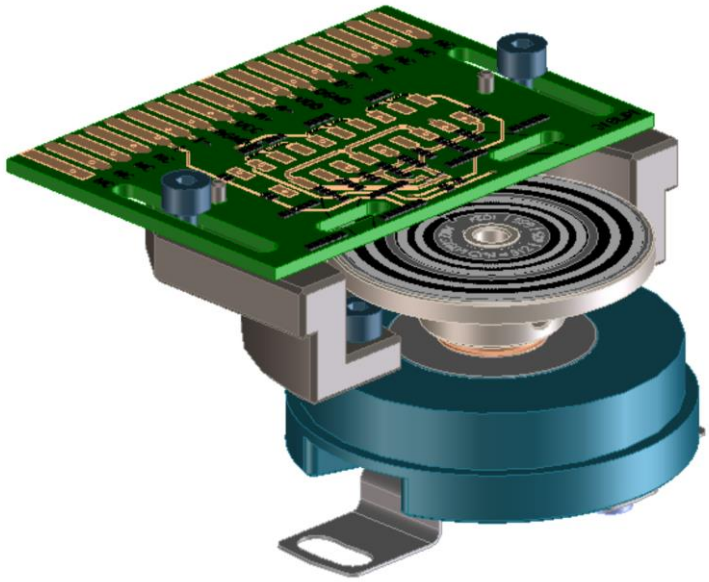


Figure 4 Sample Evaluation Board Mounting with reference to Code Wheel

2.0 Select Options

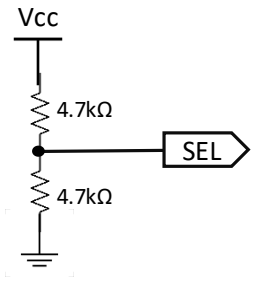
Table 1: Selection Table for AEDR-9930 397 LPI

No	SEL1	SEL2	SEL3	Interpolation Factor	IND SEL	Index
1	Low	Low	Low	1X	Low	Interpolation 1X - Index Gated 90 deg
					High	Interpolation 1X - Index Gated 180 deg
					Open	Interpolation 1X - Index Raw (Ungated)
2	High	Low	Low	2X	Low	Interpolation 2X - Index Gated 90 deg
					High	Interpolation 2X - Index Gated 180 deg
					Open	Interpolation 2X - Index Gated 360 deg
3	Open*	Low	Low	3X	Low	Interpolation 3X - Index Gated 90 deg
					High	Interpolation 3X - Index Gated 180 deg
					Open	Interpolation 3X - Index Gated 360 deg
4	Low	High	Low	4X	Low	Interpolation 4X - Index Gated 90 deg
					High	Interpolation 4X - Index Gated 180 deg
					Open	Interpolation 4X - Index Gated 360 deg
5	High	High	Low	5X	Low	Interpolation 5X - Index Gated 90 deg
					High	Interpolation 5X - Index Gated 180 deg
					Open	Interpolation 5X - Index Gated 360 deg
6	Open	High	Low	6X	Low	Interpolation 6X - Index Gated 90 deg
					High	Interpolation 6X - Index Gated 180 deg
					Open	Interpolation 6X - Index Gated 360 deg
7	Low	Open	Low	7X	Low	Interpolation 7X - Index Gated 90 deg
					High	Interpolation 7X - Index Gated 180 deg
					Open	Interpolation 7X - Index Gated 360 deg
8	High	Open	Low	8X	Low	Interpolation 8X - Index Gated 90 deg
					High	Interpolation 8X - Index Gated 180 deg
					Open	Interpolation 8X - Index Gated 360 deg
9	Open	Open	Low	9X	Low	Interpolation 9X - Index Gated 90 deg
					High	Interpolation 9X - Index Gated 180 deg
					Open	Interpolation 9X - Index Gated 360 deg
10	Low	Low	High	10X	Low	Interpolation 10X - Index Gated 90 deg
					High	Interpolation 10X - Index Gated 180 deg
					Open	Interpolation 10X - Index Gated 360 deg
11	High	Low	High	11X	Low	Interpolation 11X - Index Gated 90 deg
					High	Interpolation 11X - Index Gated 180 deg
					Open	Interpolation 11X - Index Gated 360 deg
12	Open	Low	High	12X	Low	Interpolation 12X - Index Gated 90 deg
					High	Interpolation 12X - Index Gated 180 deg
					Open	Interpolation 12X - Index Gated 360 deg
13	Low	High	High	13X	Low	Interpolation 13X - Index Gated 90 deg
					High	Interpolation 13X - Index Gated 180 deg
					Open	Interpolation 13X - Index Gated 360 deg

14	High	High	High	14X	Low	Interpolation 14X - Index Gated 90 deg
					High	Interpolation 14X - Index Gated 180 deg
					Open	Interpolation 14X - Index Gated 360 deg
15	Open	High	High	15X	Low	Interpolation 15X - Index Gated 90 deg
					High	Interpolation 15X - Index Gated 180 deg
					Open	Interpolation 15X - Index Gated 360 deg
16	Low	Open	High	16X	Low	Interpolation 16X - Index Gated 90 deg
					High	Interpolation 16X - Index Gated 180 deg
					Open	Interpolation 16X - Index Gated 360 deg
17	High	Open	High	17X	Low	Interpolation 17X - Index Gated 90 deg
					High	Interpolation 17X - Index Gated 180 deg
					Open	Interpolation 17X - Index Gated 360 deg
18	Open	Open	High	18X	Low	Interpolation 18X - Index Gated 90 deg
					High	Interpolation 18X - Index Gated 180 deg
					Open	Interpolation 18X - Index Gated 360 deg
19	Low	Low	Open	19X	Low	Interpolation 19X - Index Gated 90 deg
					High	Interpolation 19X - Index Gated 180 deg
					Open	Interpolation 19X - Index Gated 360 deg
20	High	Low	Open	20X	Low	Interpolation 20X - Index Gated 90 deg
					High	Interpolation 20X - Index Gated 180 deg
					Open	Interpolation 20X - Index Gated 360 deg
21	Open	Low	Open	25X	Low	Interpolation 25X - Index Gated 90 deg
					High	Interpolation 25X - Index Gated 180 deg
					Open	Interpolation 25X - Index Gated 360 deg
22	Low	High	Open	32X	Low	Interpolation 32X - Index Gated 90 deg
					High	Interpolation 32X - Index Gated 180 deg
					Open	Interpolation 32X - Index Gated 360 deg
23	High	High	Open	64X	Low	Interpolation 64X - Index Gated 90 deg
					High	Interpolation 64X - Index Gated 180 deg
					Open	Interpolation 64X - Index Gated 360 deg
24	Open	High	Open	128X	Low	Interpolation 128X - Index Gated 90 deg
					High	Interpolation 128X - Index Gated 180 deg
					Open	Interpolation 128X - Index Gated 360 deg
25	Low	Open	Open	256X	Low	Interpolation 256X - Index Gated 90 deg
					High	Interpolation 256X - Index Gated 180 deg
					Open	Interpolation 256X - Index Gated 360 deg
26	High	Open	Open	512X	Low	Interpolation 512X - Index Gated 90 deg
					High	Interpolation 512X - Index Gated 180 deg
					Open	Interpolation 512X - Index Gated 360 deg
27	Open	Open	Open	SPI Mode	Low	SPI Mode: Program Selection
					High	SPI Mode: Output Enabled

NOTE Open selection must be connected to middle of a voltage divider circuit.

Recommended to use 2 x 4.7kΩ resistors (Vcc-GND)



The digital interpolation factor above may be used in conjunction with the equations below to cater to various rotational speed (RPM) and count per revolution (CPR).

RPM = (Count Frequency x 60) / CPR

The CPR (@ 1X interpolation) is based on the following equation that is dependent on radius of operation (ROP).

CPR = LPI x 2π x ROP (inch) or CPR = LP mm x 2π x ROP (mm)

Note: LPmm (lines per mm) = LPI / 25.4

2.1 Programmable Select Options

SPI programmable with interpolator factor from 1x to 1024x.

1. Configure external selection to SPI Mode: Program Selection.
2. For signals output after configuration, set external selection to SPI Mode: Output Enabled

3.0 Board Schematic & Pin Assignment

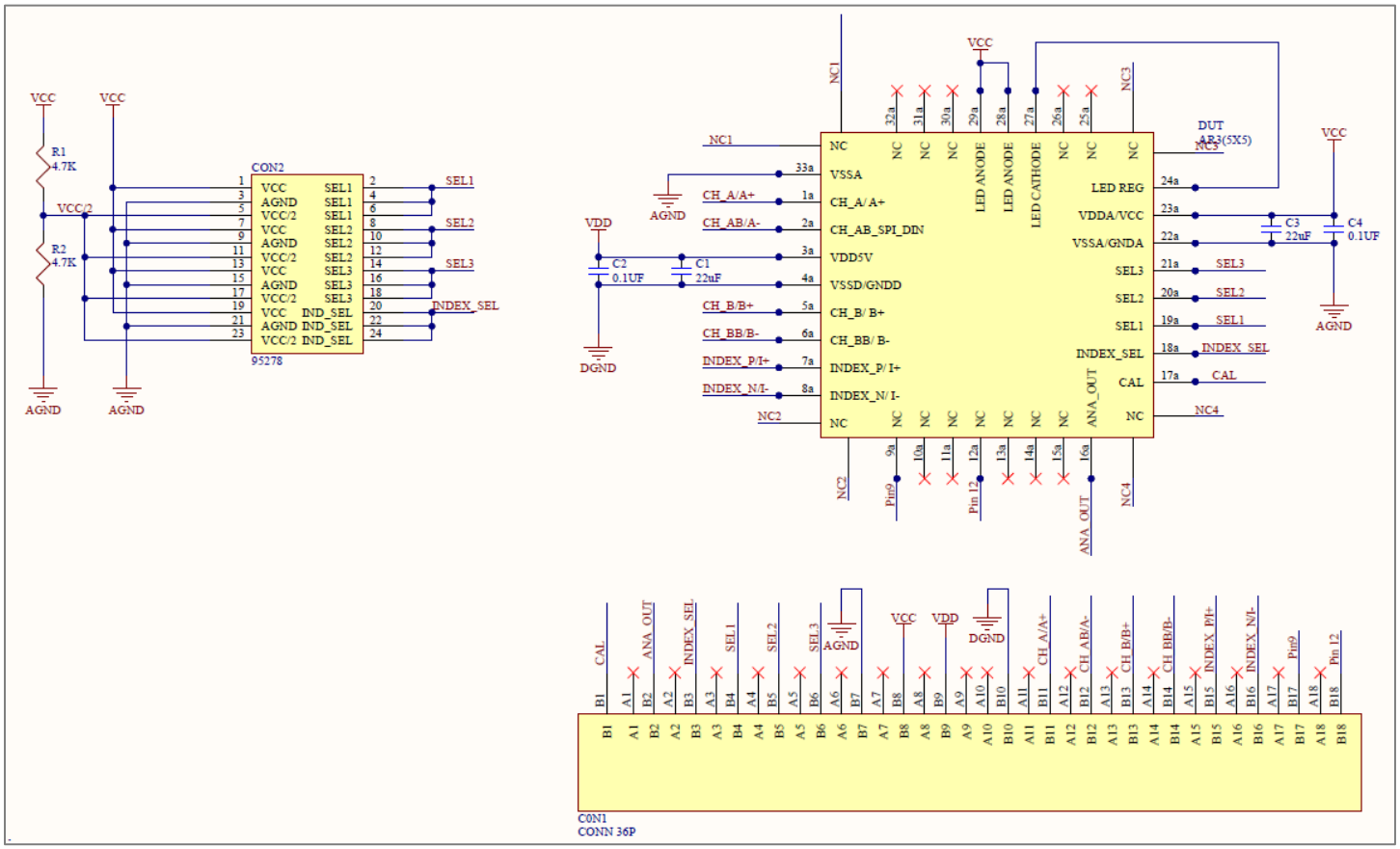


Figure 1: HEDS-9930EVB Evaluation Board Schematic

3.1 Connector Assignment

Table 2: Connector 1 Pin Assignment

Connector 1 (Top Side)	Label
1	CAL
2	ANA OUT
3	INDEX_SEL
4	SEL1
5	SEL2
6	SEL3
7	AGND/VSSA
8	VCC
9	VDD
10	DGND/VSSD
11	CH_A/A+
12	CH_A/A- (SPI_DIN)
13	CH_B/B+
14	CH_BB/B- (SPI_CLK)
15	CH_I/I+(SPI_DOUT)
16	CH_I/I- (CLK_100KHz)
17	NC
18	NC

The finger design of Connector 1 is match to either of the following card edge connector:

1. EDAC, CONN EDGE DUAL FMALE 36POS 0.100, P/N# 395-036-520-202 or,
2. SULLINS, CONN EDGE DUAL FMALE 36POS 0.100, P/N# EBC18DREH

The use of the above mentioned card edge connector is not needed if necessary connections can be made via manual soldering to the relevant card edge fingers.

Table 3: Connector 2 Pin Assignment

Connector 1 (Top Side)	Label	State
1	SEL1	VCC
2		AGND
3		OPEN
4	SEL2	VCC
5		AGND
6		OPEN
7	SEL3	VCC
8		AGND
9		OPEN
10	INDEX_SEL	VCC
11		AGND
12		OPEN

NOTE Please refer to Table 1 AEDR-9930 397 LPI for the various interpolation selection options available by changing the SEL1, SEL2 & SEL3 jumper positions.

4.0 Code Wheel Drawing

For AEDR-9930 evaluation board sample, the matching code wheel sample drawing is as shown in Figure 6 below.

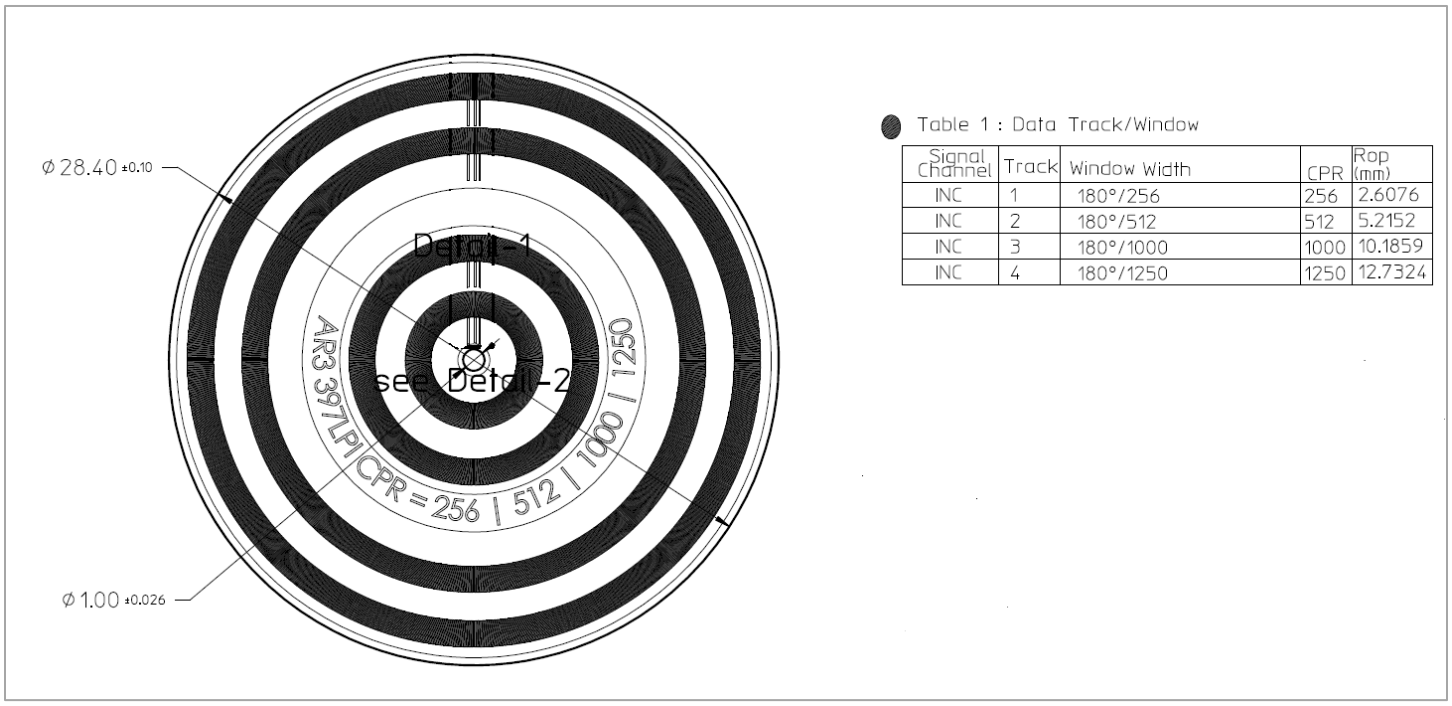


Figure 2: AEDR-9930 397 LPI 4-track (CPR) sample code wheel drawing

For the detailed drawing of the sample code wheel, please do request from regional FAE.

Note:
a) Ignore 256CPR codewheel track, is not valid to use with auto calibration.
b) All other codewheel tracks with base resolution 512, 1000 and 1250CPR required Auto Calibration

5.0 HEDS-9930PRGEVB Programming USB-SPI Kit

In order to program interpolation value other than the ones offered in Table 1 via the SEL1, SEL2 & SEL3 option pins, user may connect to the AEDS-9930 encoder ASIC via SPI interface.

Broadcom offers a simple USB to SPI programming kit, together with a PC-based custom program for end user to program in the desired interpolation value.

Figure 3: The HEDS-9930PRGEVB USB to SPI Programmer Kit

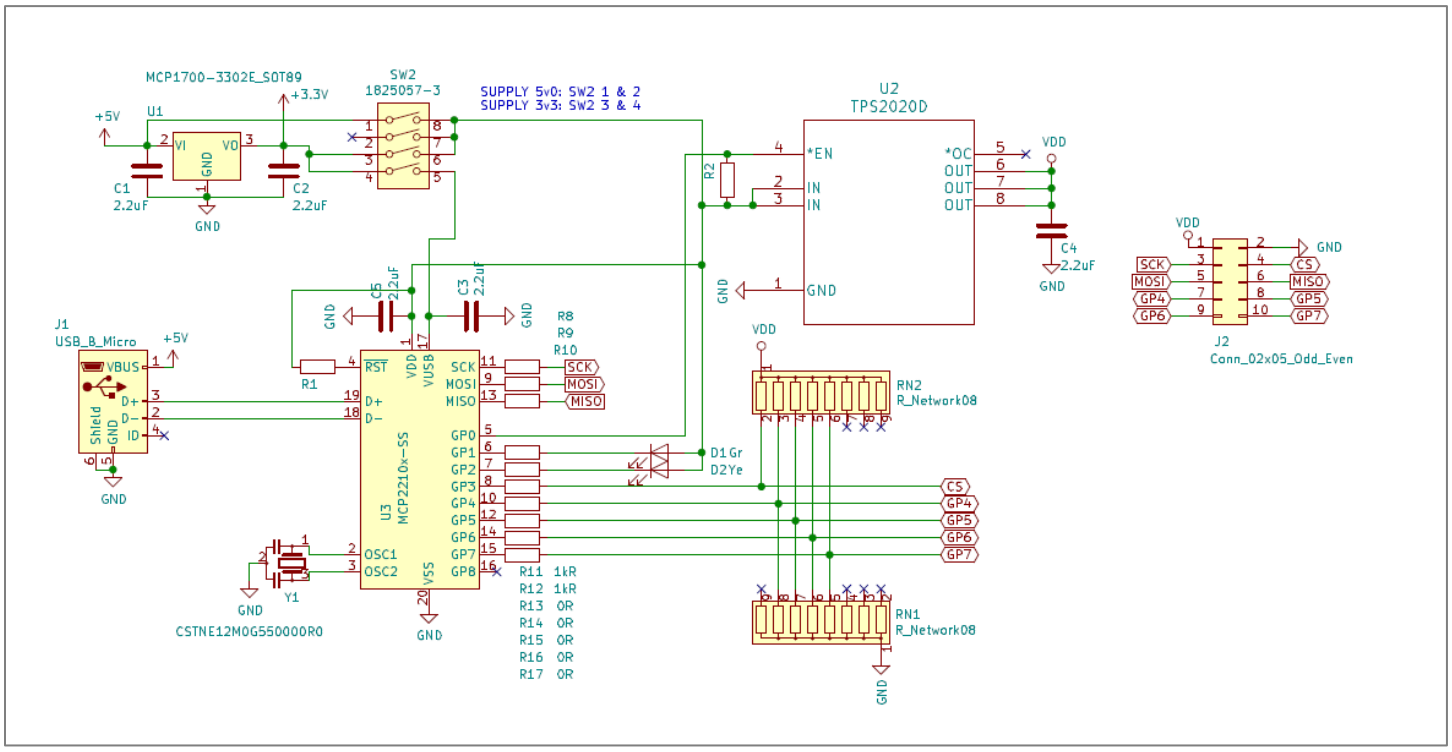


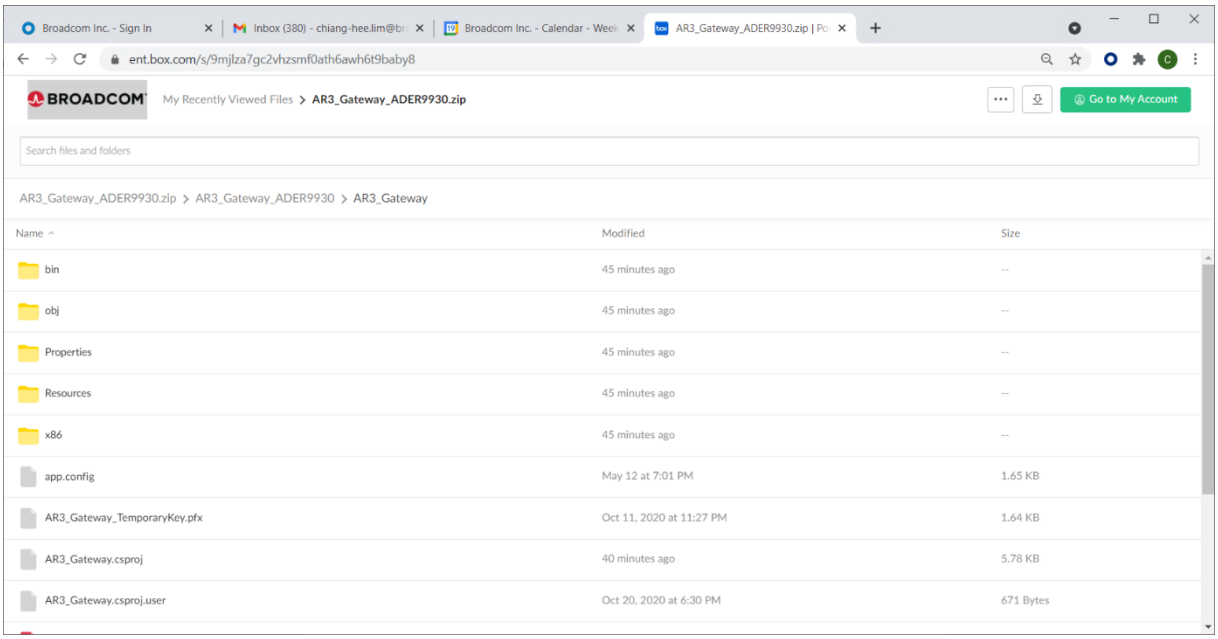
Figure 4: The HEDS-9930PRGEVB USB to SPI Programmer Kit Schematic

6.0 AEDR-9930 Gateway Programming GUI

The HEDS-9930PRGEVB kit is to be used together with the AEDR-9930 Gateway.exe to program in the desired interpolation factor into the encoder ASIC.

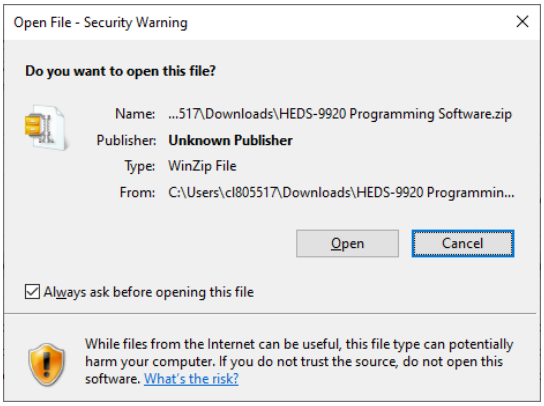
a. Download the zip file from:

https://broadcom.ent.box.com/v/HEDS-9930-Programming-Software

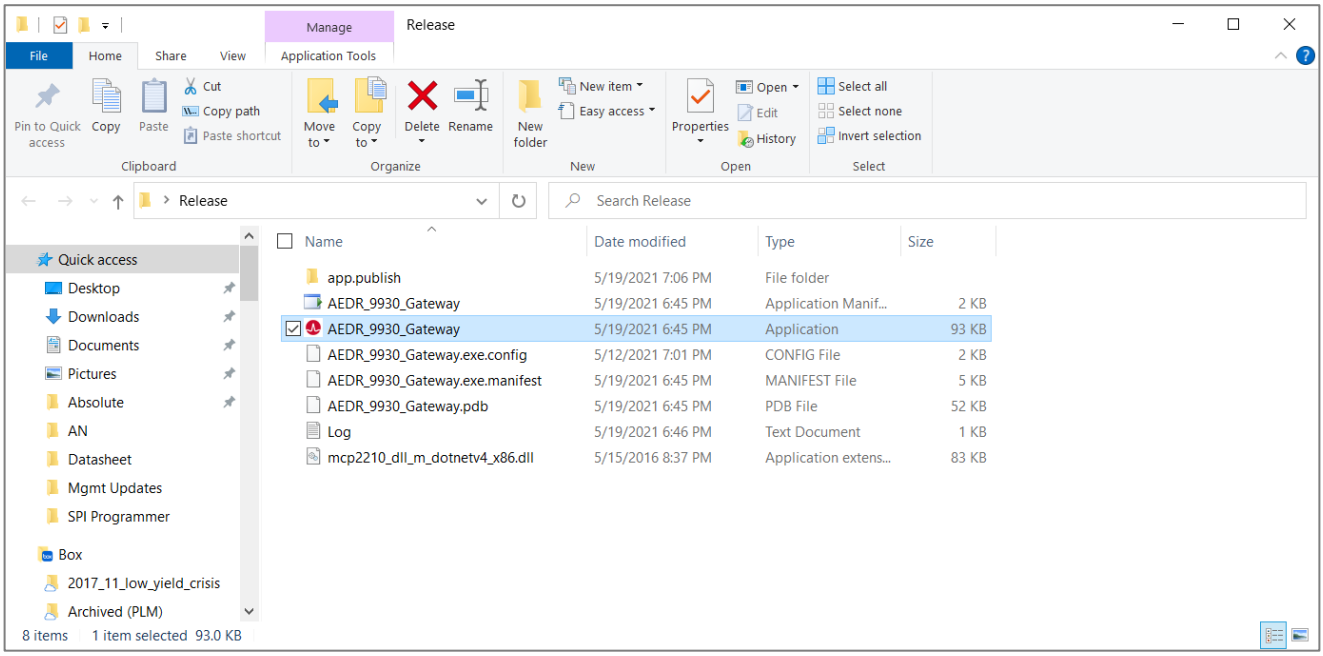


b. Saved the zip file into a PC local drive.

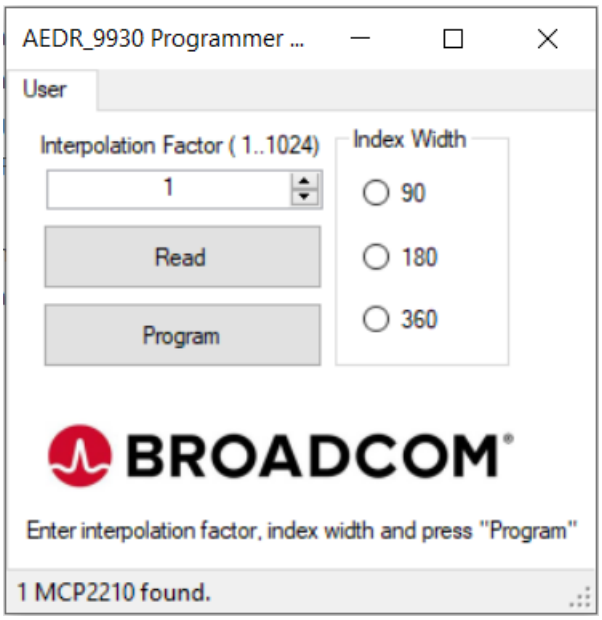
c. Unzip the AR3_AEDR-9930_Gateway programming software.zip to a local folder of choice.



d. Select & double click on AEDR-9930 Gateway.exe file.



e. Once the AEDR-9930 Gateway.exe program is running, the board should be detected.



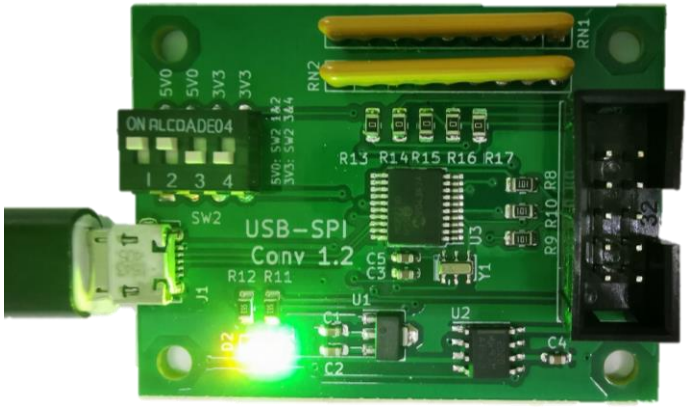
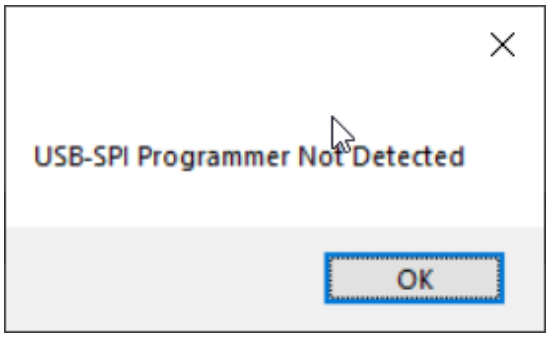


Figure 5: Both amber & green LEDs detected by the AR3_AEDR-9930_Gateway program

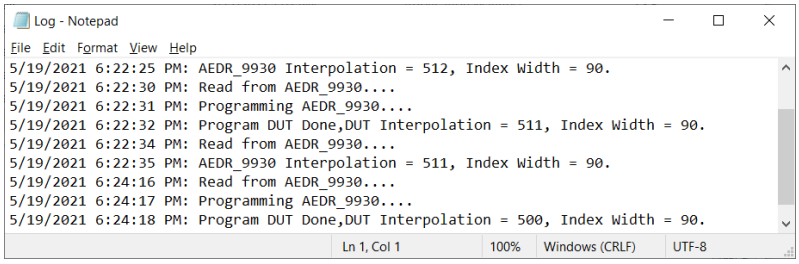
f. If the following message appears, please do check on board connections & try again.

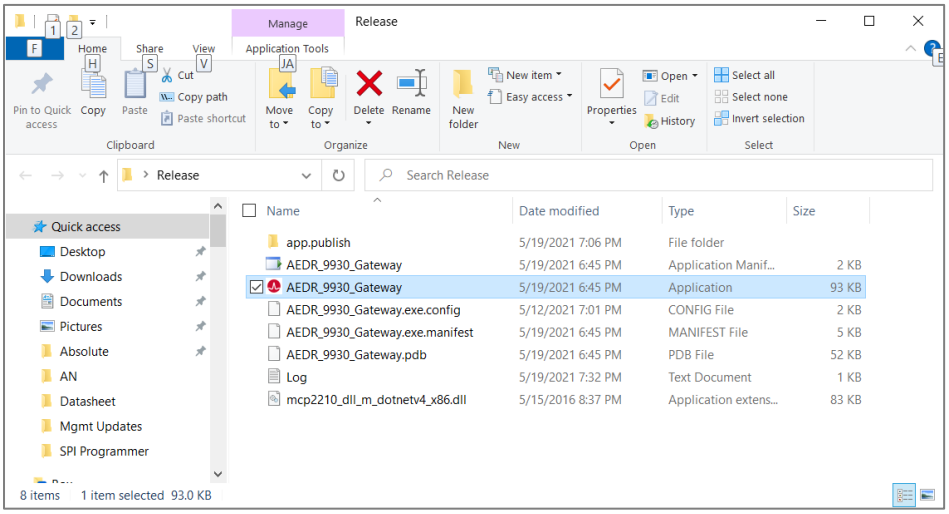


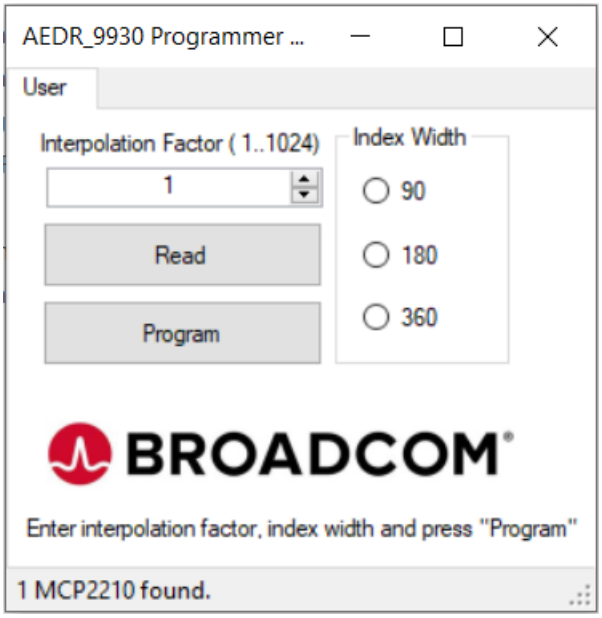
g. Click “Read” button to read back saved settings from AEDR-9930 encoder ASIC,

i. If existing settings is read out successfully, it will display Interpolation Factor & Index Width settings saved, as in the example below on the left.

ii. If AEDR-9930 is not connected or detected, the program will terminate. Please refer to “log.txt” in the same folder to check the failure status, refer to picture on the right.

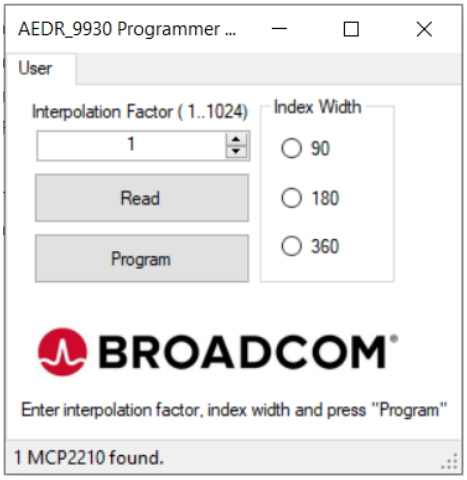




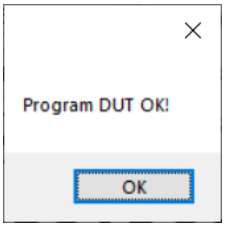


iii. If there is communication failure with AEDR-9930, the program will exit, please refer to log.txt file, same as step (g) to check on the error message

h. Enter the interpolation factor required (1 to 1024) and index width setting. Press “Program” to save the settings into AEDR-9930.



i. A message “Program DUT OK!” will appear when the settings is saved successfully into the AEDR-9930.



7.0 Using AEDR-9930 Gateway SPI Protocol to perform Calibration

Motor rotation with minimal speed ripple or smooth linear movement is required during calibration. This is to enable Index signals to be automatically adjusted to obtain a good crossover.

Steps to follow:

1. Turn the motor at a constant speed of 500rpm or linear stage reciprocal movement (stroke[50mm/s])
2. Click on “Auto Calibration” button.
3. Calibration in progress “Calibrating” will be shown in Status
4. Calibration status will indicate “Auto Cal Done” if calibration is successfully completed. Else it will indicate “Error”
   Note: Calibration error may be caused by wide spatial displacement, or failure to obtain index signals crossover.

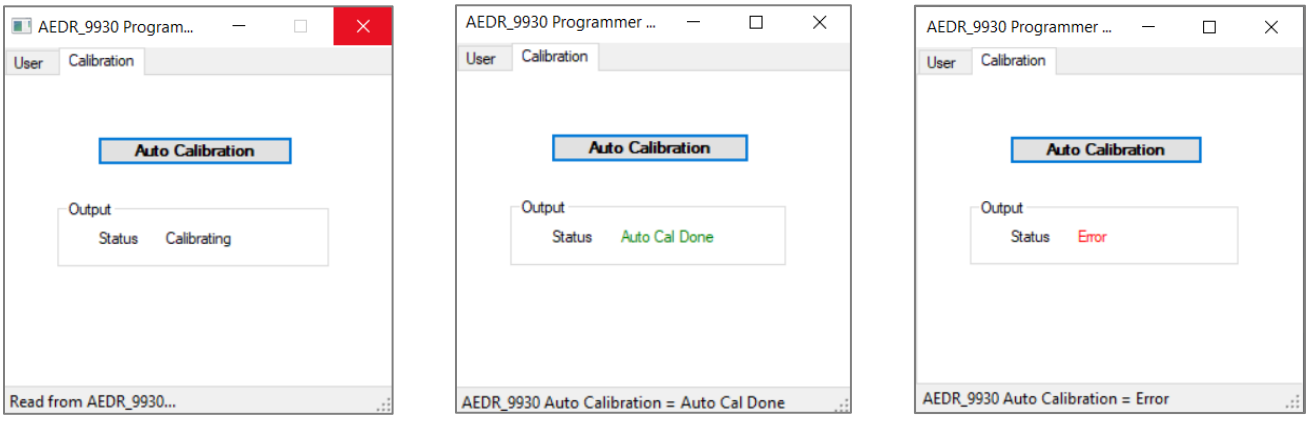


Figure 6: Samples of screen capture from AEDR-9930 Gateway program to perform calibration