HYC I 紘康科技

HY310X ENOB Test

User Manual



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1. ENOB and Noise Free Description

RMS Noise that generated from Sigma Delta ADC is the minimum voltage value of distinguishable sampling signal. Hence, ENOB (Effective Number of Bits) is calculated by the ratio of RMS Noise and Full Scale Range. However, RMS Noise must be calculated by many average times. Insufficient sampling times can only represent RMS Noise for a specific period of time instead of the entire ADC operation. Therefore, RMS Noise operation times cannot be less than 1024 times.

However, Noise Free Bit represents that ADC output value count is not rolling. Noise Free Bits are stable ADC output performance. Bit operation is defined as Peak-to-Peak Noise and Full Scale Range ratio.

RMS Noise Equation:

平均Count → Average =
$$\frac{\sum_{k=1}^{n} ADC[k]}{n}$$
 (1)
RMSNoise = $\frac{V_{RFE} \times \sqrt{\frac{\sum_{k=1}^{n} (ADC[k] - Average)^{2}}{\frac{1}{2}Scale}}}{2^{Scale}}$ (2)

In the above equation, n represents total sampling number of ADC and Scale represents ADC total output bits. ENOB and Noise Free Bits can be gained by taking Equation 1 and Equation 2 to the following equation:

$$ENOB = Log_{2}\left(\frac{FSR}{RMSNoise}\right) = \frac{In\left(\frac{FSR}{RMSNoise}\right)}{In(2)}$$
(3)

Noise Free Bits =
$$Log_2\left(\frac{FSR}{Peak - to - Peak Noise}\right) = \frac{In\left(\frac{FSR}{Peak - to - Peak Noise}\right)}{In(2)}$$
 (4)

Equation of Peak-to-Peak Noise:

Peak - to - Peak Noise =
$$\frac{V_{REF} \times \left(ADC_{Max} - ADC_{Min}\right)}{2^{Scale}}$$
(5)



2. Hardware/Software Installation

2.1 Minimum System Requirements

1. Hardware Requirements:

IBM AT/ATX PC PENTIUM[®] or any above compatible type Memory size > 32MB (>256MB is recommended) Resolution > VGA 1024×768, 256-color display Hard discs space > 10MB USB port

2. Operation System

Windows™ 98SE Windows™ 2000 Windows™ XP Windows™ Vista

Windows™ 7

Not supportive for 64 bit window, *nix and OSX operation system. Menu could be unreadable code when operating in non-traditional Chinese operation system.

2.2 Installation and Removal

1. Software Installation

For certain operation system, it requires Administrator identity to install software to the computer.

• Look for Setup.exe and execute it from CD-ROM menu or unzip file. Proceeding the installation procedures as frame indicates. As shown in below dialog window.



HY310X ENOB Test User Manual





Customer Information		
Please enter your information.		
User Name:		
PAMERS		
Ourse list kines	1. 輸入使用者名稱和	
	公可名柟	
,		
Install this application for:		
Install this application for:		
Install this application for:	computer (all users)	
Install this application for:	computer (all users)	
Install this application for:	computer (all users) 2. 按下一步(Next)	1
Install this application for:	computer (all users) 2. 按下一步(Next)]
Install this application for: (<u>Anyone who uses this</u> (Only for <u>m</u> e () InstallShield	computer (all users) 2. 按下一步(Next)	Cancel



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HY310X ENOB Test User Manual



Custom Setup Select the program features you want installed.	
Click on an icon in the list below to change how a feature is installed.	
Feature	Description
Install to:	
Install to: InstallShield按下一步(N	lext)



2. Software Removal

To certain operation systems, it requires Administrator identity to remove software.

• Control panel (Start \rightarrow setup \rightarrow control panel), clicking "install/remove program".

梦 控制台						_	
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				() .	2		-
48 個物件							11.



• After pressing "Yes", the program will be removed but no relative window will pop up.



3. Software Installation

For certain operation systems, it requires Administrator identity to install hardware driving program.

• When connecting PC and USB ENOB Test Board via USB wire, PC will find a new hardware. Please select "Install from a list or specific location (Advance)" and proceeds next step.





Select "Don't search. I will choose the driver to install" and press next.



Click "Have Disk".

硬體更新精靈	
選取您要爲這個硬體安裝的裝置驅動程式	
→ 諸選擇您的硬體裝置製造商和機型,然後按[下一步]。如果/ 動程式,請按[從磁片安裝]。	您想從磁片安裝其他驅
□ 顯示相容硬體(C)	
機型 Finan IISP IDE Davies	
	Have Disk
▲ 驅動程式尚未數位签章! 告訴我爲什麼驅動程式簽章很重要	從磁片安裝(田)
<上─步® 下一步	·(<u>M</u>) > 取消

 Click browse and assign driving program menu, the default location is ""C:\ProgramFiles\HyEnobTest\HY3106EnobTest\Driver\"" and press yes.



硬體更新精靈		
選取您要爲這個硬體安裝的裝置驅動程式		
€ 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	2. Press Yes	≥ 他驅
● 請插入製造廠商的安裝磁片,然後確 擇正確的磁碟。 ● 操	定在下面選 確定 取消	
製造廠商檔案複製來源(C): C:\Program Files\HyEnobTest\HY3106E	inobTest\Dri <mark>▼</mark> 瀏覽(B	
▲ □副初始日1267世期月14月現 辛 [15] 年度 □副初始日1267世界月14日現 辛 [15] 年度	1. Click Brov assign m	wse and henu
<u> <上一步</u>	●圆 下一步圆>	取消

 Select "Hycon-USB Temperature Reader Device" and press next. After compatibility warning shows up, please press "continue installation".

硬體更新精靈	
選取您要爲這個硬體安裝的裝置驅動程	EX EX
● 請選擇您的硬體裝置製造商和機型 動程式,請按[從磁片安裝]。 □ 顯示相容硬體(C)	,然後按 [下一步]。如果您想從磁片安裝其他驅
機型 Hycon-USE Temperature Reader Device	1. 選擇Hycon-USB Temperature Reader Device
▲ 驅動程式尚未數位登章! 告訴我爲什麼驅動程式簽章很重要	2. 按下一步
	<上一步® 下一步® 取消

Install complete

硬體更新精靈								
	正在完成硬體更新精霊							
	這個精靈安裝了軟體於:							
	Hycon-USB Temperature Read	er Device						
	按 [完成] 關閉精靈。	Installation complete						
	<上一步(B) 完	成] 取消						



3. Software Menu Description





3.1 Option





3.1.1 Setup



When test tool and HY310X series are connected, the device number and communication mode is set. User needs not to make other selection



3.1.2 RAM Panel

	Image: Strate Strate Set Mark - 0 1 2 3 4 5 6 7 8 9 A B C D E 000 00 00 00 00 00 00 -											×							
	-	0	1	2	3	4	5	6	7	8	9	A	В	С	D	E	F	Γ	
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	010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Me	emory	/	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Co	onten	t	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Fu	nc	tion list shows up
	050	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	afte	rc	licking right button
	060	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-L	/		
	070	-	-	-	-	-	-	-	-	-	-	_	-	-	-	7	-		
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- Open RAM window, memory content of the chip will be displayed.
- If the address is inexistent, it will display -.
- If the address underlined number, it means Hint has been configured.
- The data in the address can be directly amended by clicking the left button on the address.
- By double-clicking the left button on the address, the window of amending data will show up.
- For detailed operation description, please refer to Chapter 3.2 of HY-IDE software user manual.



3.1.3 REG Panel



Figure 3-5

Please refer to Chapter 3.3 Register window operation of HY-IDE software user manual.



3.1.4 ADC Panel



- Please refer to Chapter 3.6 of HY-IDE Software User Manual, ADC window operation.
- Setup parameters; please refer to HY310x Series datasheets.
- Please do not change setup value when ADC reads data, this may lead to unpredictable consequences.
- ADC value display:
 - (1) Select ADC value output format, Hex or Dec format output.



- (2) Select Bit of ADC value, output from 8 to 24 Bit.
- (3) Press read ADC or temperature sensor data. ADC output value will be display immediately; the format can be configured by users.
- (4) Press continue reading data, the ADC output data will be displayed in Dec format.

3.2USB Scan

When USB port is connected to ENOB control board, "USD On Line" will display as like the following

USB On Line Figure 3-7

3.3 Read RAM

After "USB Scan" completed and "USB on Line" confirmed, please implement Read RAM. The RAM and Registers of chip will be read to the buffer zone of PC. It will affect RMS Noise and Peak-to-Peak Noise operation of ENOB Test.



4. ENOB Test

Analys	e ADC	- HY:	3102															×
Sample Po	oint 10	24 💌	ENOB	Noise Free	Average	Vp-p N	Noise	RMS No	ise Cati	ch ADC		Save to	Chang to C	hart Bef	Volt Avi	. Times 🗖	Temperature	,
Scale	24	•]						AD	C-Temp		CSV		1.2	V 1	• •	Contunuous	
	00	01	02	03	04	05		06	07	08	09	0A	OB	OC	0D	0E	OF	^
0000 0001	/		Average	e of ADC samp	ling (Count	t) [Peak-	-to-Peak N	loise (n\	/)								
ADC ou	tput bit]			DMC		(n) ()	1										
0004					RIVIST	voise ((117)]										
0005																		
0006																		
0007 0008		ADC	Obtained I	Data														
0009																		~
				1				Fi	gure	3-8				1				

1. Sample Point

ADC sample point of "Catch ADC" and "ADC-Temp" function. Minimum sample of OTP ADC output is 256 records and maximum is 65536 records.

2. Scale

ADC output bit. Minimum ADC output bit is 8-bit and maximum is 24-bit.

3. ENOB

Display ENOB, the calculation is shown as Equation 3, the unit is bit.

4. Noise Free

Display Noise Free Bits, as Equation 4, the unit is Bit.

5. Average

Display sampling average value of ADC, as Equation 1, the unit is Counts.

6. Vp-p Noise

Display Peak-to-Peak Noise, as Equation 5 , the unit is nV.

7. RMS Noise

Display RMS Noise, as Equation 2, the unit is nV.

8. Catch ADC

Real-time catch and display ADC value in order. Please do not implement this function when ADC setup window displays data in continuous mode.

9. ADC-Temp

Real-time display ADC value and temperature sensor value in order.

10. Save to CSV

Save the display value to *.CSV file, including ENOB, Noise Free, Average, Vp-p Noise and RMS Noise.

11. Change To Chart



Switch chart and value in value display zone.

12. Ref Volt

Input Reference Voltage (unit: V).

13. Avr. Times

Select software average, the value is display zone will perform average again, according to the times of selection and then display in value display zone.

5. Hardware Description



PC transmits Command to USB ENOB Test Board; USB ENOB Test Board configures and reads ADC value via SPI from Hycon HY310x Demo Board.

5.1 USB ENOB Test Board Description



Figure 5-2

1. J4 : Optical Coupler SPI Port

J4 description

PIN 1 \rightarrow VP, powered by optical coupler IC (U8~U13), J5 and J8 must be opened to completely isolate power. J5 and J8 must be short to use common power supply.

PIN 2 \rightarrow SPIDI_Q, optical coupler DI signal wire.

 $\text{PIN 3} \rightarrow \text{SPICK}_\text{Q},$ optical coupler CK signal wire.

PIN 4 \rightarrow SPIDO_Q, optical coupler DO signal wire.

 $\mathsf{PIN}\ 5\to\mathsf{SPICS}_\mathsf{Q},$ optical coupler CS signal wire.

PIN 6 \rightarrow VSSP, optical coupler Ground.

2. JP1, JP2, J6 and U3 : Power Supply Circuit

JP1 and JP2 is external power input that supply power to U3 and generates VDD power. Using USB power, J6 is short circuit. Using external 5V power, JP1 and JP2 inputs, J6 is open circuit. Regulated circuit that composed by U3, R1, R2 and R3 generates VDD power. Amending R1, R2 and R3 can change output voltage, the relation is as follows:



$$VDD = 1.240V \times \left(1 + \frac{R1 + R2}{R3}\right) \tag{6}$$

3. U9, U10, U11 and U12 :

Optical coupler IC components

4. U7 : USB Port

Port connecting to PC, is the power source of entire system (5V), 500mA input.

5.2 HY310x Demo Board Description



Figure 5-3

1. JP3 : Optical Coupler SPI Port

JP description

PIN 1 \rightarrow VDD powered by 3.6V voltage via USB ENOB Test Board

- PIN 2 \rightarrow SPISDI, DI signal wire
- PIN 3 \rightarrow SPISCK, CK signal wire
- $\text{PIN} \ 4 \rightarrow \text{SPISDO}, \ \text{DO} \ \text{signal}$ wire
- PIN 5 \rightarrow SPICS, CS signal wire
- PIN 6 \rightarrow VSS, Ground.

2. JP1 and JP4 : Signal Input End

JP1 and JP4 description

- PIN 1 \rightarrow VDDA, supplies 3.3V power
- PIN 2 \rightarrow VINN1_1, signal input end
- PIN 3 \rightarrow SINP1_1, signal input end
- $\text{PIN 4} \rightarrow \text{VSSA}, \text{ Ground}.$

3. C9 and C10 : Filter Capacitor

0.1uF SMD capacitor

4. U3 : Main Chip

HY310x IC



6. Question Obviation

1. Registers cannot be configured under ADC window?

Communication way and IC selection must be configured first. After executing USB Scan and Read RAM, ADC register value can be configured. If USB is connected and confirmed, configuration still cannot be implemented, please close program and remove USB. After plug in the USB, execute the program again.

2. Configuration of ADC window is relatively slow?

Please do not change any setup when ADC reads data, this might bring about unpredictable results.

3. Can the data obtained include time?

Data obtained from the program includes file that be saved as CSV format but not including time. Users can detect the X axis represents time in graphical display mode, demonstrating in ms. Time recording function will be incorporated in next version of program update.

4. Program cannot be executed, file lack appears and program demands to reinstall.

Please print the error window and message and please contact the distributor who provided this DMM EVA Test Tool to you or directly contact HYCON Technology for further support. We are sorry for the inconvenience this has caused to you.

5. INF error shows up when USB drive program is under installation or is completed and a yellow exclamation mark appears in "device manager".

Please copy all programs of Driver file in the installation menu to c:\windows\system32\drivers. Reinstall driving program again. If error shows up again, please contact the distributor who provided this DMM EVA Test Tool to you or directly contact HYCON Technology for further support.



7. Revision History

Major differences are stated thereinafter:

VersionPageRevision SummaryV01AllFirst Edition