

HY311x ENOB Test

User Manual



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1. Package Contents

ENOB Test Board is a tool for customers to evaluate chip's ADC performance, as shown in figure 1-1, with HYCON software, can be manipulated in the visual interface control, the following description of the packaging contents:



Figure 1-1

No.		Model No.	Description	Quantity
	1.	HY3118-AK01	HY3118 Communication Board	1
	2.	HY31000-CM01	HY3118 ENOB Control Board	1
HT3116-ANU1	3.	Cable line	USB Type A to Type B Cable	1
	4.	Connection line	4Pin/2.54 (2.54mm pitch)	1



2. Safety Precautions

- Do not place heavy objects on the display panel, in order to avoid damage caused by stress.
- Place the application display boards at steady place, so as to avoid falling damage.
- Do not use this product with the input voltage which is not meeting the electrical specifications, in order to avoid working abnormally or damage
- Avoid application display boards being touched by liquid, dirt and avoid being exposed to moisture during operation. This application should be kept in a dry environment, so as not to affect the function and performance
- Remove the power supply when not using it.
- When following status occurred, please remove the power supply immediately, and contact our engineer.
- Power Supply line is worn or damaged.
- Power source (battery) connected but no any light on while operating.
- Component off.



3. ENOB and Noise Free Description

RMS Noise that generated from Sigma Delta ADC is the minimum voltage value of distinguishable sampling signal. Therefore, 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 ratio of Peak-to-Peak Noise with Full Scale Range.

RMS Noise Equation:

Average Count
$$\rightarrow$$
 Average $=\frac{\sum_{k=1}^{n} ADC[k]}{n}$ (1)

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

$$ENOB = Log_2\left(\frac{FSR}{RMSNoise}\right) = \frac{ln\left(\frac{FSR}{RMSNoise}\right)}{ln(2)}$$
(3)

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

Equation of Peak-to-Peak Noise :

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

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4. Software Installation

4.1. Minimum System Requirements

Hardware Requirements
 PC compatible with (PENTIUM®) system
 256MB Memory (recommend 512MB)
 500MB Hard disk

Operation System
 Windows XP
 Windows Vista
 Windows 7
 Windows 8
 Windows 10

 Apply the following interface modes USB Port

4.2. Installation and Uninstallation

4.2.1. Software Installation

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

Execute the Setup.exe execution file, step by step through the screen installation steps. As shown in below dialog window.



🗞 Setup - HY311x ENOB
Welcome to the HY311x ENOB Setup Wizard
This will install HY311x ENOB version 1.4 on your computer.
It is recommended that you close all other applications before
Click Next to continue, or Cancel to exit Setup.
F →
Next > Cancel
Setup - HY311x ENOB
Please read the following important information before continuing.
Please read the following License Agreement. You must accept the terms of this agreement before continuing with the installation.
HY311x ENOB程式最終用戶使用條款
用戶使用條款(以下簡稱本使用條款)於HYCON網站
(<u>nttp://www.nycontek.com/</u> ,以下簡稱「本店」)提供「HY311X ENOB」(以 下間稱「軟體」)之下載服務。
 I do not accept the agreement
HYCON Technology Corporation
< Back Next > Cancel
Setup - HY311x ENOB
Information Please read the following important information before continuing.
When you are ready to continue with Setup, dick Next.
Note:
Before installing the executive program, proposed closing anti-virus
antivirus software will delete or forbid the materials installed, make
The installation fall or cut off.
Version Revision Record
V1.40 (2017.10.25) *. Hardware support model:
-HY3118-AK01 * Support model:
-HY3116, HY3118
IN Minimum Autom requirements for UVIDE program -
< Back Next > Cancel
*

HY311x ENOB Test User Manual



stub - HISTIX ENOR							
elect Destination Location							
Where should HY311x ENOB be installe	ed?						
<u> </u>							
Setup will install HY311x ENO	B into the following folder.						
To continue, click Next. If you would like to select a different folder, click Browse.							
C: VHYCON VHY311x ENOB	Browse						
At least 11.1 MB of free disk space is n ON Technology Corporation	equired.						
	< Back Next > Cancel						
	↓						
etup - HY311x ENOB							
elect Components	-						
Which components should be installed?							
Select the components you want to ins install. Click Next when you are ready	stall; dear the components you do not want to to continue.						
Full installation							
	•						
Main procedure	▼ 10.3 MB						
Main procedure Documents	10.3 MB 2.4 MB						
☑ Main procedure ☑ Documents	10.3 MB 2.4 MB						
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Main procedure Main procedure Documents Current selection requires at least 13.4 Current selection requires at least 13.4 ON Technology Corporation etup - HY311x ENOB elect Start Menu Folder Where should Setup place the program Setup will create the program To continue, click Next. If you would lik MCON-HY311x ENOB IVCON-HY311x ENOB Don't create a Start Menu folder ON Technology Corporation	10.3 MB 2.4 MB 2.4 MB 4 MB of disk space. A MB of disk space. Cancel a shortcuts? a shortcuts? a shortcuts in the following Start Menu folder. a to select a different folder, dick Browse. Browse						

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C-I		
Sei	ect Additional Tasks Which additional tasks should be pe	rformed?
	Select the additional tasks you woul	d like Setup to perform while installing HY311x
	anob, then dick next.	
	Additional icons:	
	Create a desktop icon	
	Create a Quick Launch Icon	
IYCON	I Technology Corporation	< Back Next > Cancel
		•
Setu	up - HY311x ENOB	
Rea	ady to Install Setup is now ready to begin installin	Ig HY311x ENOB on your computer.
(Click Install to continue with the inst change any settings.	allation, or dick Back if you want to review or
	Destination location: C:\HYCON\HY311x ENOB	*
	Setup type:	
	Full installation	=
	Selected components: Main procedure Documents	
	Start Menu folder: HYCON-HY311x\HY311x ENOB	
	4	•
IYCON	I Technology Corporation —	
		< <u>B</u> ack Install Cancel
Setu	up - HY311x ENOB	
Ins	talling Please wait while Setup installs HY3	11x ENOB on your computer.
E	Extracting files C:\\HY311x ENOB\Documents\AE	C Performance Test Tool User's Manual_EN.pdf
1		
IYCON	I Technology Corporation	





Figure 4-1

4.2.2. Software Uninstallation

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

1. Control panel (Start->setup -> control panel), clicking" Program and Function".



Figure 4-2

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





Figure 4-3

5. Software Menu Description



5.1. Option



Figure 5-2

5.1.1. Setup





When test tool and HY311X series chip are connected, the device number and communication mode are fixed, User needs not to make other selection.





5.1.2. RAM Panel

	11.1111111111111111111111111111111111																				
	-	0	1	2	3	4	5	6	7	8	9	À	В	С	D	E	F				
	000	00	00	00	00	00	00	-	-	-	-	-	-	-	-	-	-				
	010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Г	_			
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	090	00	00	00	00	00	00	00	00	00	00	00	ŝ	et Ma	urkín	ew co	olor)	Mark (define now color)		
	OAO	00	00	00	00	00	00	00	00	00	00	00	F	eset	Mark			_	Wark (denne new color)		
	ОВО	00	00	00	00	00	00	00	Se	ot tin	s	00	F	eset All Mark Cancel marks			Cancel marks				
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	ODO	00	00	00	00	00	00	Са	ance	el tip	s	00	ы Т	et <u>H</u> 1	nt m				Cancel all marks		
	OEO	00	00	00	00	00	04				-00	00		leset.	Hint All U						
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							Ī	oad I	RAM	Data	ι 4	-	Save as RAM file								
	Bank0 Switch to RAM BANK0								5	Sa <u>v</u> e RAM Data 🛛 👞 Save To excel				-	Load RAM file						
									ب ا	A <u>M</u> I	BANI	X0			Save RAM contents in Excel format						



- Open RAM window, memory content of the chip will be displayed.
- If the address is inexistent, it will display "-".
- If the address shows that the number has a underline, it means Hint has been configured.
- The data in the address can be directly modified by clicking the left button on the address.
- By double-clicking the left button on the address, the window of modified data will show up.
- For details, please refer to HY-IDE software manual, RAM window operation.

5.1.3. REG Panel

XXX 3118	Register								×
INDO: M[000]=00 Program Counter: 0									
INDI: M	000]= 00	Work		ycle: BZA4	10000				
PAGE	1								_
REG0	-	OSM	IRQEN	ADCEN	ENLDO	ENREFO	ENOP	Registers	
REG1	-	-	INN2	INN1	INN0	INP2	INP1	INPO	1
REG2	VRP\$1	VRPS0	VRN\$1	VRNS0	DCSET3	DCSET2	DCSET1	DCSET0	
REG3	OSCS1	OSCS0	FSRB	PAG2	PGA1	PGA0	ADGN1	ADGN0	
REG4	LDO1	LDO0	REFO	HS	OSR2	OSR1	OSR0	-	



Please refer to HY-IDE software manual, register window operation.



5.1.4. ADC Panel



- Please refer to HY-IDE software user manual, ADC window operation.
- Setup parameters; please refer to HY311x Series datasheet.
- 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 23 Bit.
 - (3) Press ADCRead, ADC output value will be display immediately; the format can be configured by users.
 - (4) Press continually of reading data, the ADC output data will be displayed in Dec format.

5.2. USB Scan

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





5.3. Read RAM

After "USB Scan" completed and "USB on Line" confirmed, please run the "Read RAM" function. 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.



6. ENOB Test

ADC Sample point	Manalyse ADC		Instant capture /	ADC value	Numerical / chart switch display		
`	Scale 23	ENOB Noise Free	Average Vp-pl	Noise RMS Noise Catch /	ADC Save to CSV	Chang to Chart	Ref Volt Avr. Times 2.4 V 1 •
ADC Output bit	00 01 0000 Display 0002 Display 0003 0004 0005 0005	ENOB	Average of ADC sampling (Count)	06 07 08 Peak-to-Peal Noise (nV) Noise (nV)	k Save as CSV file		DE OF The average number of times after capturing the value
ADC obtain data	0007 0008 0009 000A 0008 0008 0000C				En	ter the reference voltage value	

Figure 6-1

1. Sample Point

ADC sample point of "Catch ADC" function. Minimum sample of ADC output is 64 records and maximum is 65536 records.

2. Scale

ADC output bit. Minimum ADC output bit is 8-bit and maximum is 23-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. Save to CSV

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

10. Change To Chart

Switch chart and value in value display zone.

11. Ref Volt

Input Reference Voltage (unit: V).

12. 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.

7. Hardware Description



PC transmits Command to USB ENOB Test Board; USB ENOB Test Board configures and reads ADC value via I²C from HYCON HY311x Demo Board.

7.1. USB ENOB Test Board Description



Figure 7-2

1. J15 : I²C Port

J15 description

 $\mathsf{PIN}\:1\to\mathsf{VDD}$, $\mathsf{Power}\:\circ$

PIN 2 $\rightarrow\,$ SCL , I^2C SCK signal wire $\circ\,$

- PIN 3 \rightarrow SDA , I²C SDA signal wire \circ
- PIN 4 \rightarrow VSS , Ground \circ

2. JP1 \smallsetminus JP2 \smallsetminus J6 \smallsetminus U3 \colon Power Supply Circuit

The power supply loop supplies power to U3 to generate 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:

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

3. U7 : USB Port

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

7.2. HY311x Demo Board Description



Figure 7-3





Figure 7-4









Figure 7-6

1. JP3 : I²C Port

PIN 1 \rightarrow VDD powered by 3.3V voltage via USB ENOB Test Board

- PIN 2 \rightarrow SCL , SCK signal wire
- PIN 3 \rightarrow SDA , SDA signal wire
- $\mathsf{PIN}\:4\to\mathsf{VSS}$, Ground.

2. JP1 \ JP2 : ADC Signal Input End

- PIN 1 \rightarrow VDDA , VDDA power supply
- $\text{PIN}\ 2 \rightarrow \text{AIN1}\ / \text{AI3}$, signal input end
- PIN 3 \rightarrow AIN2 / AI4 , signal input end
- PIN 4 \rightarrow VSSA , Ground.

3. JP4 : ADC Signal Reference End

- PIN 1 \rightarrow VDDA , VDDA power supply
- PIN 2 \rightarrow REFP(VRP), voltage input reference end.
- PIN 3 \rightarrow REFN(VRN) , voltage input reference end.
- $\mathsf{PIN}\:4\:\rightarrow\:\mathsf{VSSA}$, Ground.

4. U1 : Main Chip

HY3118 IC, SSOP16 package type.



8. Troubleshooting

1. Registers cannot be configured under ADC window?

USB Scan and Read RAM must be executed first. After that, 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 then 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 that 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.



9. Revision History

Major differences are stated thereinafter

Date	Version	Page	Summary of Changes
2011/04/12	V01	ALL	First version release
2017/11/06	V02	ALL	1. Added Chapter 1 and Chapter 2
			2. Due to software and PCB are upgraded, so update the file in
			the illustrations