

HY313X EVA Test Tool

User Manual



Table of Contents

1.	DES	SCRIPTION OF ENOB AND NOISE FREE	3
2.	HAI	RDWARE/SOFTWARE INSTALLATION	4
	2.1	MINIMUM SYSTEM REQUIREMENTS	4
	2.2	INSTALLATION AND REMOVAL	4
3.	SOF	TWARE MENU DESCRIPTION	
	3.1	Option	
	3.1.	1 Setup	
	3.1.2	2 RAM Panel	
	3.1.3	3 REG Panel	
	3.1.4	4 CLK, ProCounter, MAP, ADS, ADF, OP and POWER Panel	
	3.2	USB SCAN	15
	3.3	READ RAM	15
4	ENG	OB TEST	
5	SET	ЪММ	
6	HAI	RDWARE DESCRIPTION	21
	6.1	USB ENOB TEST BOARD DESCRIPTION	21
	6.2	HY313x DEMO BOARD DESCRIPTION	
7	QUI	ESTION OBVIATION	23
8	REV	VISION RECORD	24



1. Description of ENOB and Noise Free

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 RMS Noise and Full Scale Range ratio. 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 RMS Noise 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 = $\frac{V_{RFE} \times \sqrt{\frac{\sum_{k=1}^{n} (ADC[k] - Average)^{2}}{\frac{n}{2}Scale}}$ (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:

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

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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.







🙀 HY3131EYA_Y1.10 - InstallShield Wizard	
Readme Information Please read the following readme information carefully.	4
HYDMM EVA Test Tool程式最終用戶使用條款 紘康科技股份有限公司(以下簡稱「本公司」)係依據HYDMM EVA Test Tool程式最終用 戶使用條款(以下簡稱本使用條款)於HYCON網站(http://www.hycontek.com/,以下簡稱 「本站」)提供「HYDMM EVA Test Tool」(以下簡稱「軟體」)之下獻服務。 蚕、軟體內容 「軟體」係指紘康科技所開發之整合開發環境,適用於本公司所開發之HY11P系列晶 片。	
貳、同意条款 一、於使用本軟體前,請您詳細閱讀本使用条款。當您按下「同意」鍵,而下載並使 用軟體時, 即表示您已閱讀、廢解並同意本使用条款之所有內容; 若您不同意本使用 條款,請您按下「取消」鍵離開或請不要再使用本軟體。 InstallShield	

🖥 HY3131EYA_Y1.10 - InstallShield Wizard	
Customer Information Please enter your information.	
Venhon	
Organization:	
HYCON	
Install this application for:	
 Anyone who uses this computer (all users) 	
Only for <u>m</u> e (Yenhon)	
Instalibrield	ext > Cancel

HY313X EVA Test Tool User Manual



🔂 НУЗІЗІ	🖁 HY3131EYA_Y1.10 - InstallShield Wizard											
Destination Folder Click Next to install to this folder, or click Change to install to a different folder.												
<u></u>	Install HY3131EVA_V1.10 to: C:\Program Files\HYDMM\HY3131\hange											
InstallShield –	< <u>Back</u> <u>Next</u> Cancel											

Select installation path

🛃 HY3131EVA_V1.10 - InstallShield Wizard	
Custom Setup Select the program features you want installed.	
Click on an icon in the list below to change how a feature is ins	Feature Description
InstallShieldSpace	hange Next > Cancel





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".



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

新增或卷	除程式
2	您確定要從電腦移除 HY3131E∀A_∀1.10 嗎?

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 browse and assign driving program menu, the default location is "C:\Program Files\HYDMM\HY3131\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 ^{従磁片安装}	2. Press Yes
▲ 請插入製造廠商的安裝磁片,然後確定 揮正確的磁碟。	定在下面選
製造廠商檔案複製來源(C): C:\Program Fibs\HyEnobTest\HY3106En → DF5X.ml11 Kanewna + N ↔ 平田 + 文	nobTest/Dri · 瀏覽(B))
<上一步	(B) 下一步(D) > 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者	経式	
→ 諸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]。如果您想從礙	片安裝其他驅
模型 Hycon-USB Temperature Reader Device	1. Select Hycon-USB Temperature Reader Devic	e
▲ 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	2. Pres	ビ安雄(m) ss Next
	<上一步(B) 下一步(A)>	取消



• Install complete





3. Software Menu Description

КЖ НУЗ	3131-DMM											
<u>O</u> ption	<u>U</u> SB Scan	<u>R</u> ead RAM	SETDMM	<u>E</u> NOB Test	IN TF-Wait							
				E '	4							

Figure 3-1

OPTION: Setup and graphical block diagram

USB Scan: USB controller scan

Read RAM: Reload registers status

SETDMM: Load and calibration setup of DMM ranges

ENOB Test: RMS noise and noise free test

INTF-Wait/INTF-reading: When ADC under read status, it must be configured in INTFreading status. ADC will reload data after INTF flag event occurs.



3.1 Option

III HY3131-DMM ¥1.10													
<u>O</u> ption	<u>U</u> SB Scan	<u>R</u> ea	d RAM	SETDMM	<u>E</u> NOB Test	INTF-Reading							
<u>S</u> etup)		1										
<u>r</u> am	[Panel												
R <u>E</u> G	Panel												
<u>C</u> LK	Panel												
<u>P</u> roC	ounter Panel												
<u>M</u> AP													
<u>a</u> ds													
A <u>D</u> F													
<u>O</u> P හ	nd Power												
OPR ON	Line		1										

Figure 3-2

Introduce in sequence:

3.1.1 Setup

1288 選項									
Select Chip DMM Communication Interfafce DMM	LPT Address								
COM JUUM1 Baud 300 Parity None	 ✓ ✓ ✓ 								
開閉									
	Figure 3-3								

When test tool and HY313X series are connected, the device number and communication mode is set. User needs not to make other selection.

3.1.2 RAM Panel

	11111111111111111111111111111111111111																		
	-	0	1	2	3	4	5	6	7	8	9	A	В	С	D	E	F	Г	
	000	00	00	00	00	00	00	-	-	-	-	-	-	-	-	-	-		
	010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Me	emory	/	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Co	onten	t	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Fu	nct	ion list shows up
	050	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	afte	r cl	icking right button
	060	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-L	/		
	070	-	-	-	-	-	-	-	-	-	-		-	-	-	7	-		
	080	00	00	00	00	00	00	00	00	00	00	00	S	et M	ark	100	100		
	090	00	00	00	00	00	00	00	00	00	00	00	s	et M	ark(n	ew c	olor)		
	OAO	00	00	00	00	00	00	00	00	00	00	00	F	– <u>L</u> eset	Mark		·		
	ОВО	00	00	00	00	00	00	00	00	00	00	00	F	leset	All M	fark			
	oco	00	00	00	00	00	00	00	00	00	00	00		-+ II:					-
	ODO	00	00	00	00	00	00	00	00	00	00	00	ы Ц	et <u>n</u> 1	III Hint				
	OEO	00	00	00	00	00	00	00	00	00	00	00	л Л	leset	11011 A 11 H	lint			
	OFO	00	00	00	00	00	00	00	00	00	00	00		.0001	<u></u>				-
													Ī	oad :	RAM	[Dat	8.		
	Bank0								Save RAM Data										
-													2	ave :	l <u>o</u> ex	cel VO			
													F	(A <u>M</u>)	SAN.	KU			



- 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

IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII							
INDO: Mf000 1=00 Program Counter: 0							
IND1: M[000 1-00] Week: 00] Center 1 BD 40000							
INDI. M[000]			D40000				
				Byte			
AD1<7:0>	AD1<15:8>	AD1<23:16>	AD2<7:0>	AD2<15:8>	AD2<23:16>	LPF<7:0>	LPF<15:8>
00	00	00	00	00	00	00	00
RMS<7:0>	RMS<15:8>	RMS<23:16>	RMS<31:24>	RMS<39:32>	PKHMN<7:0>	PKHMN<15:8>	PKHMN<23:16≻
00	00	00	00	00	00	00	00
PKHMX<15:8>	PKHMX<23:16>	CTC<7:0≻	CTC<15:8>	CTC<23:16>	CTB<7:0>	CTB<15:8>	CTB<23:16>
00	00	00	00	00	00	00	00
CTA<15:8>	CTA<23:16>						
00	00						
PAGE1							
CTSTA<0x14>	PCNTI	ACPO	CMPHO	CMPLO	-	-	-
INTF<0x1E>	BORF	-	-	RMSF	LPFF	AD1F	AD2F
INTE<0x1F>	-	-	-	RMSIE	LPFIE	ADHE	AD2IE
R20<0x20>	SCMP12	SCMPI1	SCMPIO	ENCMP	ENCNTI	ENCMPO	ENCTR
R21<0x21>	SCMPRH3	SCMPRH2	SCMPRH1	SCMPRHO	SCMPRL3	SCMPRL2	SCMPRL1
R22<0x22>	AD1052	AD10S1	AD10S0	AD1CHOP1	AD1CHOP0	AD10SR2	AD10SR1
R23<0x23>	ENADI	-	-	AD1RG	ADIRHBUF	ADIRLBUF	AD11PBUF
R24<0x24>	SAD1FP3	SAD1FP2	SAD1FP1	SAD1FP0	SDIO	SAD1FN3	SAD1FN2
R25<0x25>	AD2IG1	AD2IG0	ADHGI	AD11G0	SACM1	SACMO	OPS2
R26<0x26>	ENAD2	-	ENCHOPAD2	AD2RG	SAD2CLK	AD2OSR2	AD2OSR1
R27<0x27>	SAD2IP1	SAD2IP0	SAD2IN1	SAD2IN0	SAD2RH1	SAD2RH0	SAD2RL1
R28<0x28>	-	AD1RH2	AD1RH1	AD1RH0	-	AD1RL2	AD1RL1
R29<0x29>	ENRMS	ENLPF	LPFBW2	LPFBW1	LPFBW0	ENPKH	PKHSEL1
R2A<0x2A>	PS1	DS1	FS1	SS1	PSO	DS0	FSO
R2B<0x2B>	PS3	D\$3	FS3	SS3	PS2	DS2	FS2
R2C<0x2C>	PSS	DSS	FSS	SS 5	PS4	DS4	FS4
R2D<0x2D>	PS7	DS7	FS7	SS7	PS6	DS6	FS6
R2E<0x2E>	PS9	DS9	FS9	SS9	PS8	DS8	FS8
R2F<0x2F>	ENVS	SMODE6	SMODES	SMODE4	SMODE3	SMODE2	SMODE1
R30<0x30>	SREFO	ACC6	ACCS	ACC4	ACC3	ACC2	ACC1
R31<0x31>	ENREFO	ENBIAS	SAGND1	SAGNDO	SFU VR3	SFUVR2	SFUVR1
R32<0x32>	ENOP2	SOP2P2	SOP2P1	SOP2P0	ENOP1	SOP1P2	SOP1P1
R33<0x33>	OP1CHOP1	OP1CHOP0	ENOSC	ENXI	SFT1	SFTO	SAD111
<							>

Figure 3-5

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





3.1.4 CLK You Procounter MAP ADS ADF OP and POWER Panel

- Every Panel will display relative configuration parameters, please refer to HY3131datasheet.
- ADC will update data when READ ADC and "INTF-READING" displayed.
- ADS ADC output is 24bit, after setup via ADS output bits, desirable bits will display on the window.

3.2USB Scan

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



3.3 Read RAM

After "USB Scan" completed and "USB on Line" was 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

III Analyse	ADC - DM	IM														
Sample Point Scale	256	ENOB	Noise Free	Average	Vp-p Noise	RMS Noise	ADCS	ADCF	Save to CSV	Chang to Chart	Ref Volt	Avr. Time:				
Juaie	24	4					AVG	RMS		Change FFT	1.2	-	menup			
	00	01	02	03	04	05	06	07	08	09	0A.	OB	0C	0D	OE	OF
0000								1				ĵ.				
0001																
0002																
0003																
0004																
0005								_								
0006						_										
0007																
0008																
0009															_	
000A																
000B																
000C																
000D																
000E																
000F																



1. Sample Point

ADC sample point of "Catch ADC" and "ADC-Temp" function. Minimum sample of OTP ADC output is 256 record 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. ADCS ${\scriptstyle \ensuremath{\cdot}}$ ADCF ${\scriptstyle \ensuremath{\cdot}}$ AVG ${\scriptstyle \ensuremath{\cdot}}$ RMS

Real time capture and sequence display ADC value in value display zone.

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.



5 SETDMM

User can store register setup file through SETDMM dialog and test every range's efficiency under calibration status.

Calibration Segme	nt - 0				
ADC1 Scale	Name				
66000	AC 40mA(n	AC 4V		
Calibration Ref.	Calibration U	Įnit	AC 40V		
40000	0.11uA		AC 400V		
Select ADC	RMS	-	AC 1000V		
		1	NO FILE		
Cal. Gain	Cal. Offset		NO FILE		
Average Times	8		NO FILE		
ADC1 Offset	RMS Offset		NO FILE		
0	2042		NO FILE		
Soup Dogistor	Cancel Of	fset	NO FILE		
Save Register		winynl			
ADC1		enhon			
		面			
		1Y3131 Confia			
		ACV			
Close					
Destination Folders : C:\Do	cuments and Settings\!	Yenhon\桌面	1\HY3131\Config\ACV	11.	

First, configure the path to install menu. HYCON offers different range configuration.

🔄 Config		
檔案(E) 編輯(E) 檢視(Y) 我的最愛(A) 工具(I)	說明(<u>H</u>) 連結	
🕞 上一頁 🔹 🕥 🔹 🏂 🔎 搜尋 陵 資料	夾	
網址 (D) 🛅 C.\Program Files\HYDMM\HY3131\Config		🖌 🄁 移至
資料夾 × □ □ Program Files □ □ 3Com □ 3Com Corp □ 0.7-Zip □ Acro Software □ Acronis	LCY Current&mV	CAP DCV
Adobe Apple Software Update Apple Active	онм	Sel_Cal



Take DC 400mV as an example:

Calibration Segmen	nt - 0			
ADC1 Scale	Name			
66000	DC 400mA(DC 400mA(mV)		
Calibration Ref.	Calibration Unit	DC 40mA(40mV)		
40000	0.001uA	AC 400mA(mV)		
Select ADC	ADC1 -	AC 40mA(mV)		
		NO FILE		
Cal. Gain	Cal. Offset	NO FILE		
Average Times	16	NO FILE		
ADC1 Offset	RMS Offset	NO FILE		
5000	40000	NO FILE		
	Cancel Offset	NO FILE		
Save Register		1		
ADC1]		
וחחר	□□□ □□□ □□□ □□□ □□□ □□□ □		<u> </u>	
333,	🛉 📄 HY313	1		
Current&mV				
Close				
Destination File : C:\Docum	nents and Settings\Yenhon\点ī	₩Y3131\Config\Current&mV\	HYCONFIG-0.txt	

After click, it will be highlighted and displayed in blue color.

To enhance identification, NAME and calibration unit can be marked by users in word form

ADC1 scale: Maximum value after calibration.

Calibration Ref: ADC output will be calibrated as ref. value.

Select ADC: select ADC1 or RMS output as output

Cal. Gain: ADC data of the current network status will be configured as "Calibration Ref" setup after pressing this button.

Cal. Offset: Record the current ADC1 or RMS output value as offset. When "cancel offset" is ticked, ADC1 will deduct offset value and multiply calibration GAIN; RMS will deduct offset first, then perform root and multiply GAIN of RMS.

Save Register: Save all registers status in the setup file that is highlighted in blue color. If NO FILE is selected and then save is pressed, one setup file will be added in this menu; however, maximum setup file within a menu is ten.



Configure Jump on HY3131 Target Board based on different measurement functions:

Function	J2	J6	J17	J8	
ACV	Short	Onen	Onen	Open	
DCV	Short	Open	Open	Open	
AC mV					
DC mV	Open	Short	Open	Open	
Thermocouple					
AC Current				A(Open)	
DC Current	Open	Open	Open	mA(1-2) uA(2-3)	
Resistor				••••(=•)	
Continuity	Onon	Chart	Onan	Open	
Diode	Open	SHOIL	Open		
Capacitor					
Frequency(CNT Input)	Open	Short	Short	Open	



6 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.

6.1 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.

 $\text{PIN 2} \rightarrow \text{SPIDI}_Q$, 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.
- $\text{PIN 5} \rightarrow \text{SPICS}_\text{Q},$ optical coupler CS signal wire.
- PIN 6 \rightarrow VSSP, optical coupler Ground.

2. JP1, JP2, J6, 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:

HY313X EVA Test Tool User Manual



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

3. U9, U10, U11, U12 :

Optical coupler IC components

4. U7 : USB Port

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

6.2HY313x Demo Board Description





7 **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.



8 Revision Record

Major differences are stated thereinafter:

Version	Page	Revision Summary
V01	ALL	First edition
V02	20	Add in the Table of Target Board Jump of different measurement functions.
	22	Add in circuit diagram