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:

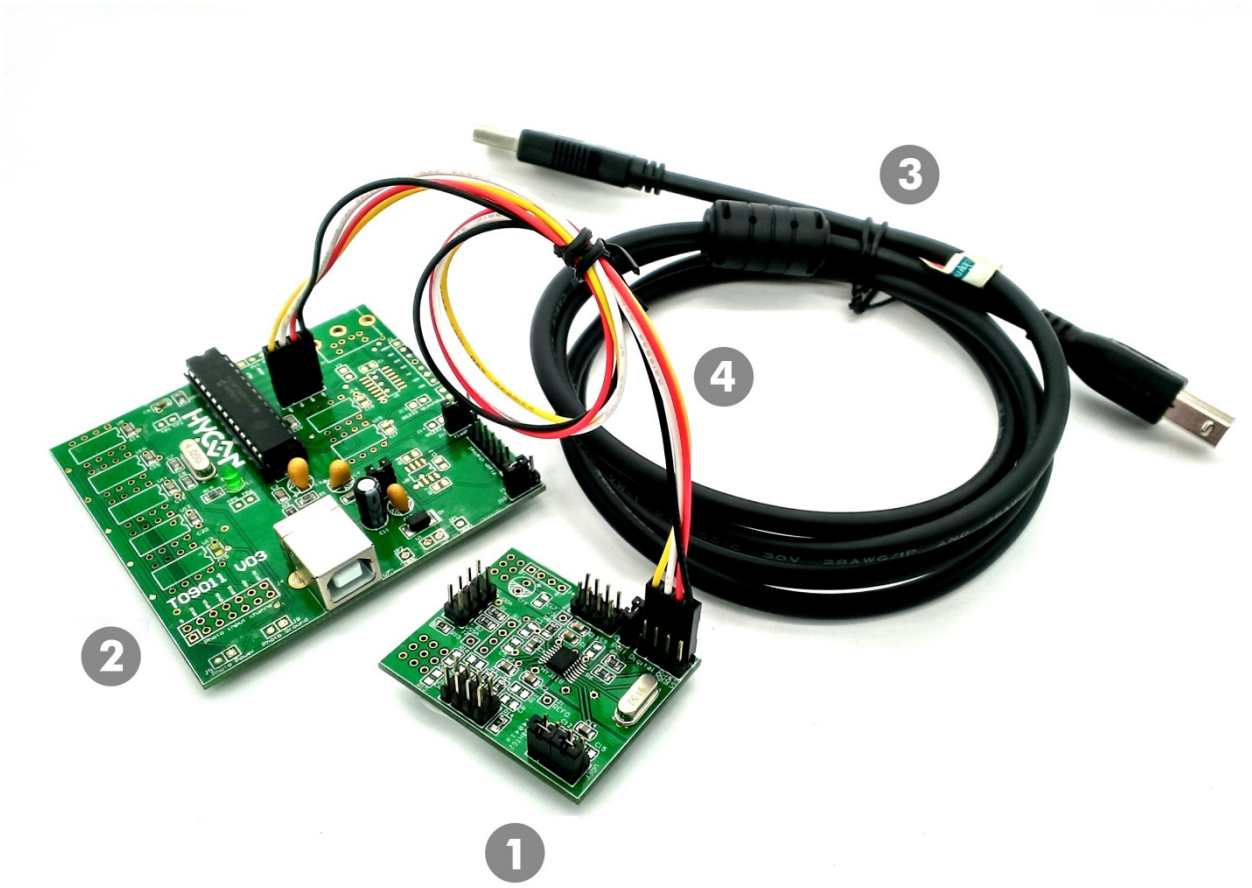


Figure 1- 1

No.	Model No.	Description	Quantity
HY3118-AK01	1. HY3118-AK01	HY3118 Communication Board	1
	2. HY31000-CM01	HY3118 ENOB Control Board	1
	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:

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

$$\text{RMS Noise} = \frac{V_{RFE} \times \sqrt{\frac{\sum_{k=1}^{n} \left(\text{ADC}[k] - \text{Average}\right)^2}{n}}}{2^{\text{Scale}}} \quad (2)$$

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:

$$\text{ENOB} = Log_2\left(\frac{\text{FSR}}{\text{RMS Noise}}\right) = \frac{ln\left(\frac{\text{FSR}}{\text{RMS Noise}}\right)}{ln(2)} \quad (3)$$

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

Equation of Peak-to-Peak Noise：

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

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

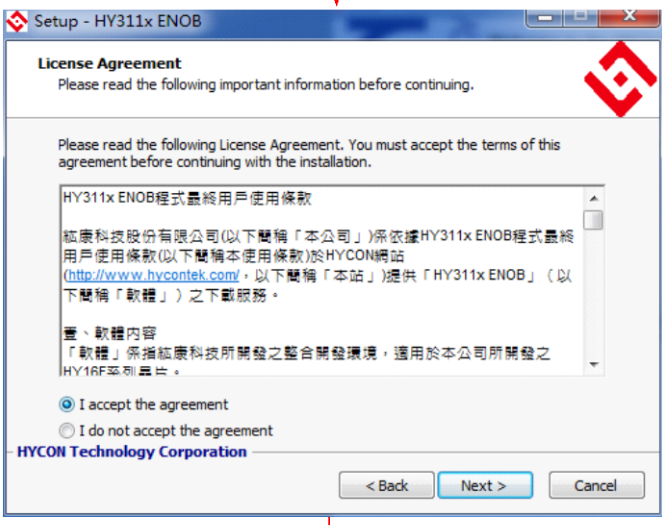
  USB Port

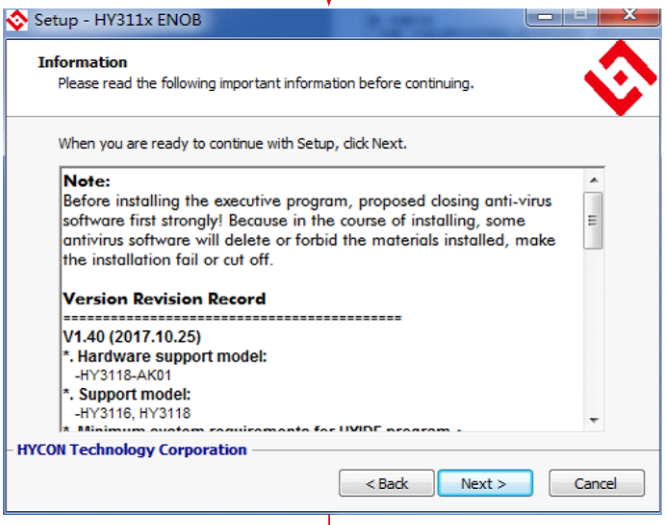
4.2. Installation and Uninstallation

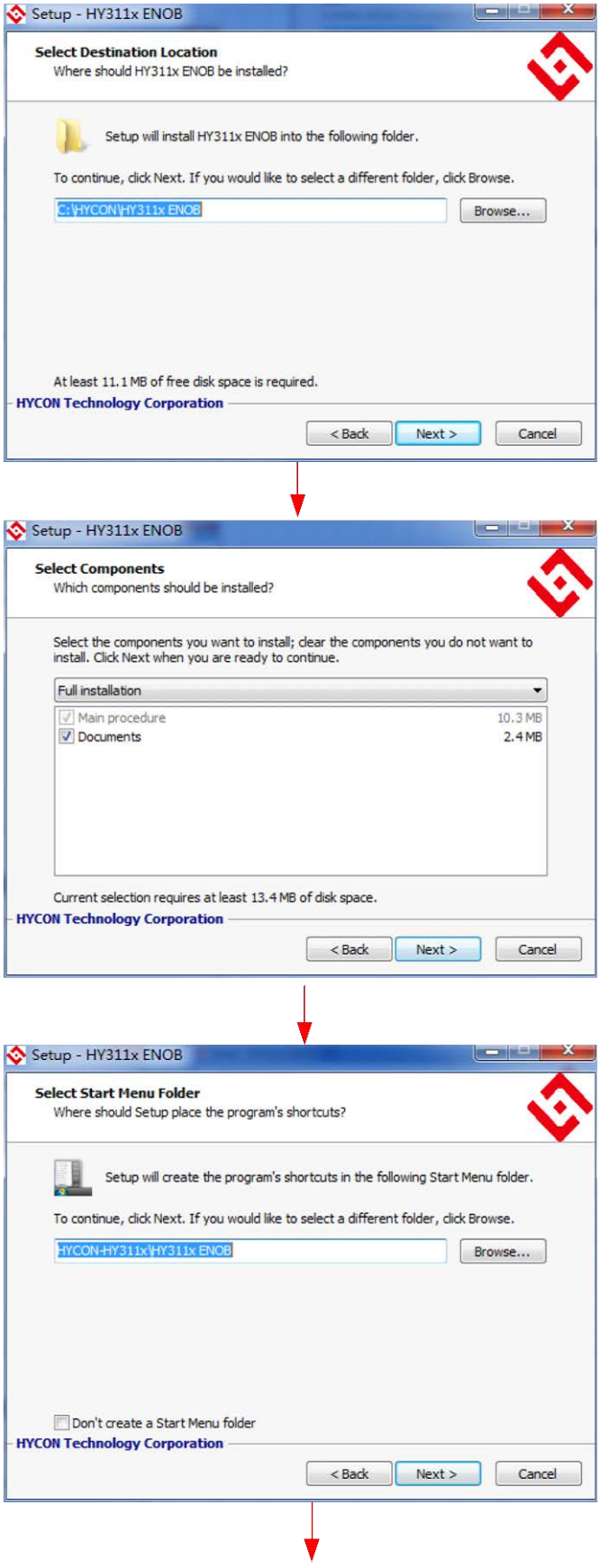
4.2.1. Software Installation

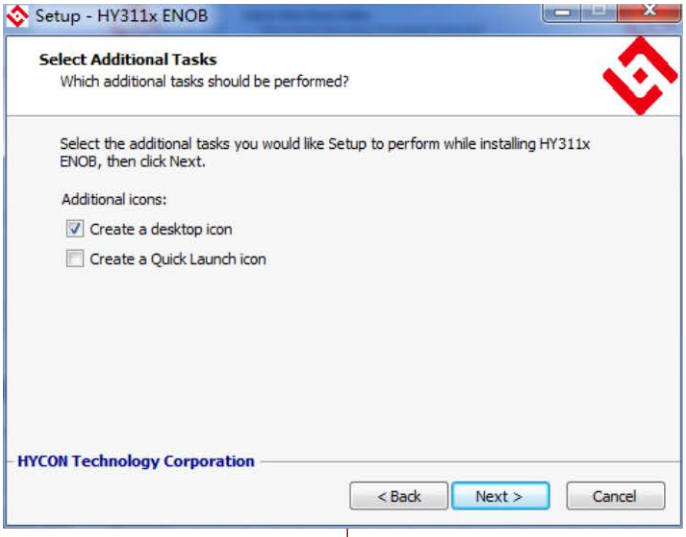
For certain operation system, it requires Administrator identity to install software to the computer.

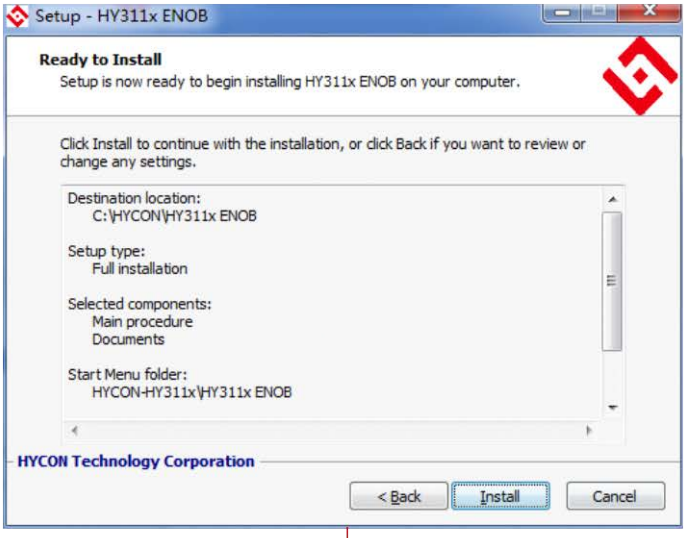
Execute the Setup.exe execution file, step by step through the screen installation steps. As shown in below dialog window.

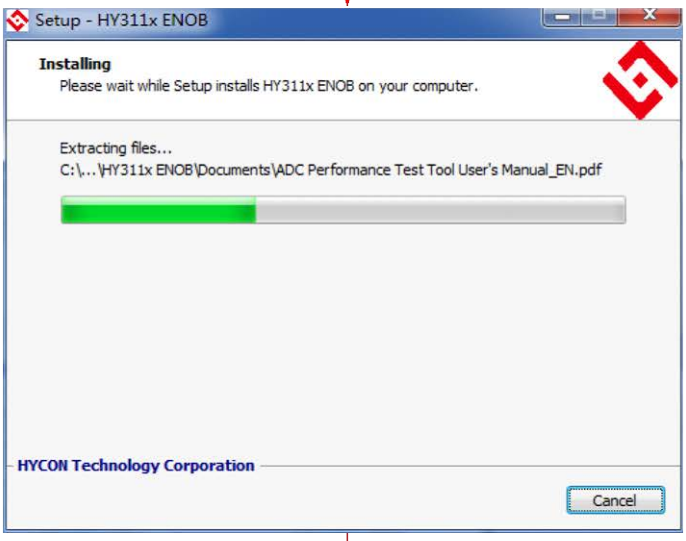







Setup - HY311x ENOB
Select Additional Tasks
Which additional tasks should be performed?
Select the additional tasks you would like Setup to perform while installing HY311x ENOB, then click Next.
Additional icons:
Create a desktop icon
Create a Quick Launch icon
HYCON Technology Corporation
< Back
Next >
Cancel


Setup - HY311x ENOB
Ready to Install
Setup is now ready to begin installing HY311x ENOB on your computer.
Click Install to continue with the installation, or click Back if you want to review or change any settings.
Destination location:
C:\HYCON\HY311x ENOB
Setup type:
Full installation
Selected components:
Main procedure
Documents
Start Menu folder:
HYCON-HY311x\HY311x ENOB
HYCON Technology Corporation
< Back
Install
Cancel


Setup - HY311x ENOB
Installing
Please wait while Setup installs HY311x ENOB on your computer.
Extracting files...
C:\...\HY311x ENOB\Documents\ADC Performance Test Tool User's Manual_EN.pdf
HYCON Technology Corporation
Cancel

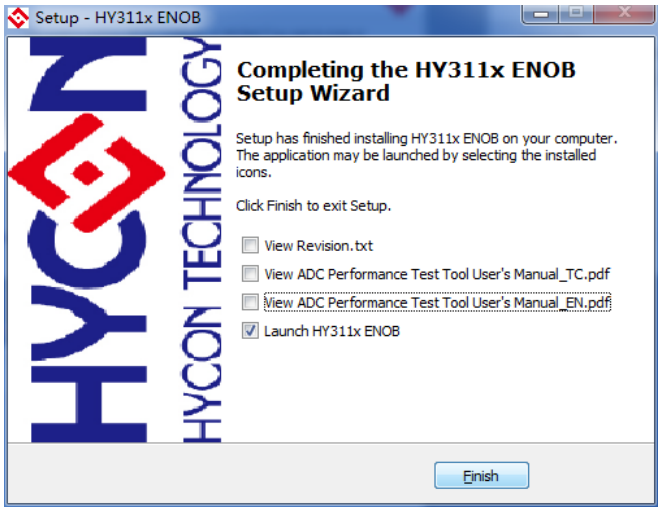


Figure 4- 1

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".

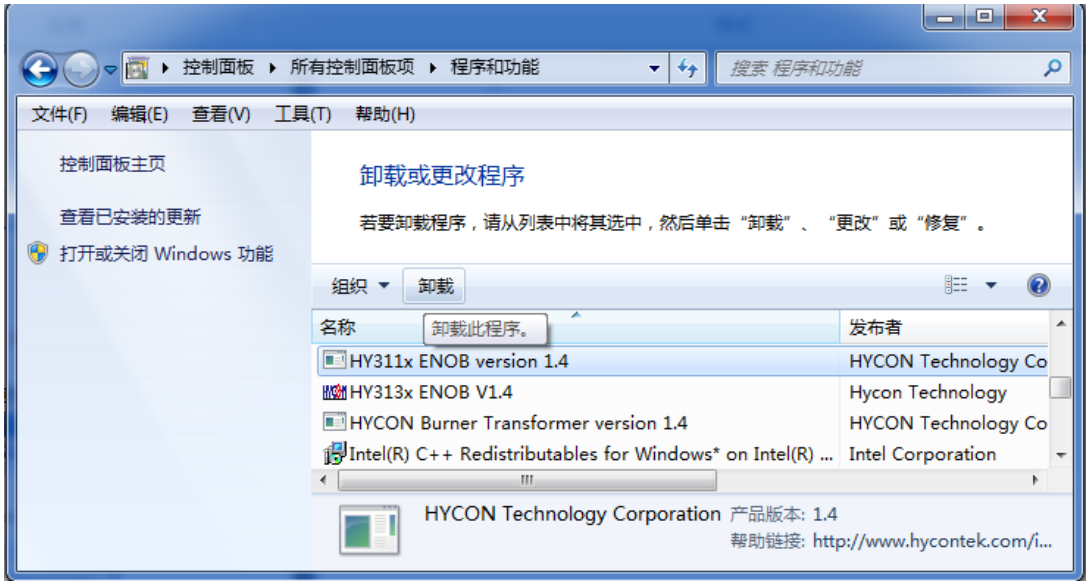


Figure 4- 2

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

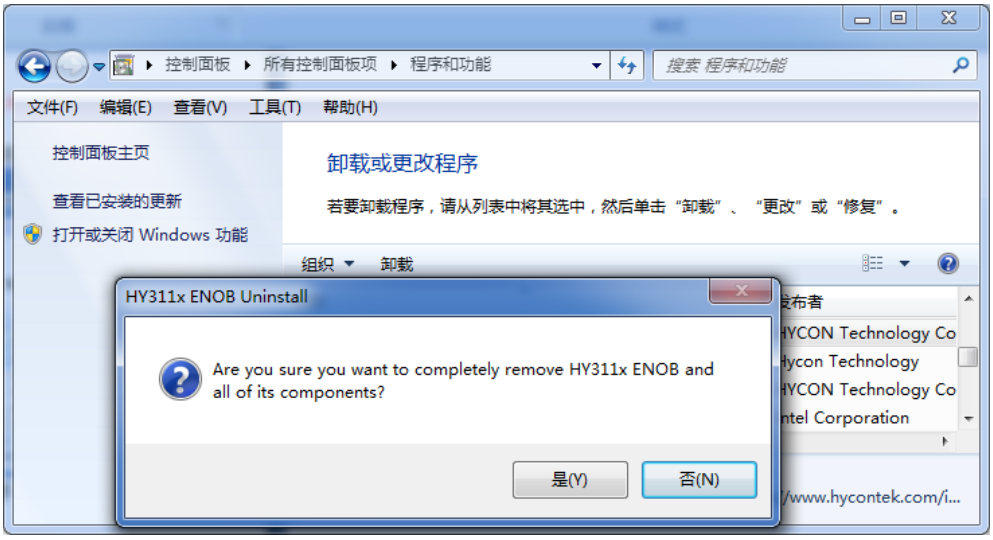

控制面板 ▸ 所有控制面板项 ▸ 程序和功能
搜索 程序和功能
文件(F) 编辑(E) 查看(V) 工具(T) 帮助(H)
控制面板主页
查看已安装的更新
打开或关闭 Windows 功能
卸载或更改程序
若要卸载程序，请从列表中将其选中，然后单击“卸载”、“更改”或“修复”。
组织 卸载
HY311x ENOB Uninstall
Are you sure you want to completely remove HY311x ENOB and all of its components?
是(Y)
否(N)
HYCON Technology Co
ycon Technology
HYCON Technology Co
ntel Corporation
/www.hycontek.com/i...

Figure 4- 3

5. Software Menu Description

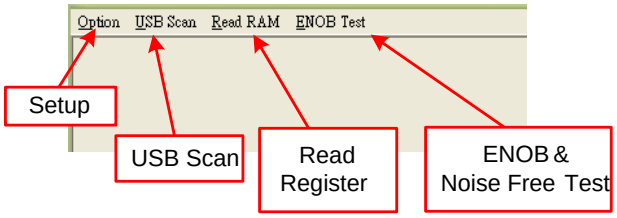


Figure 5- 1

5.1. Option

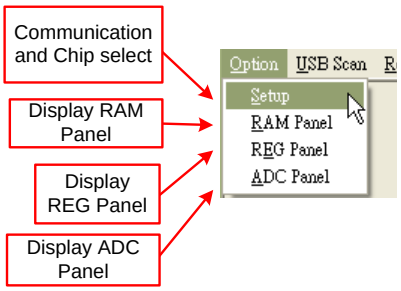


Figure 5- 2

5.1.1. Setup

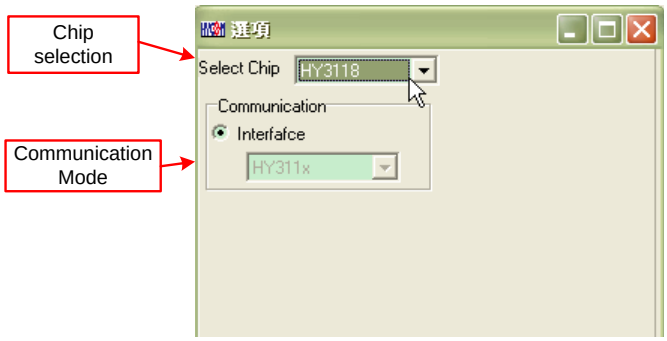


Figure 5-3

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

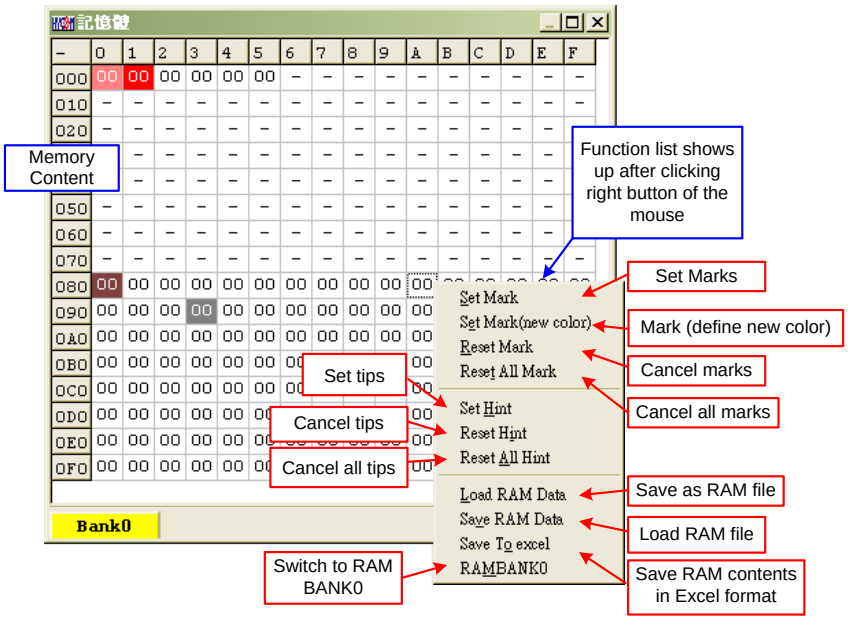


Figure 5-4

- 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

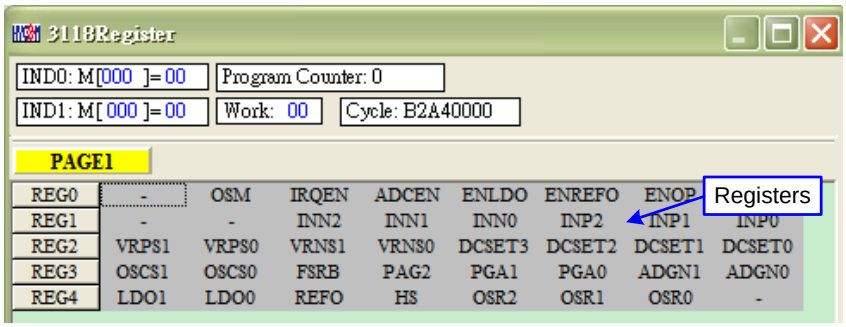


Figure 5-5

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

5.1.4. ADC Panel

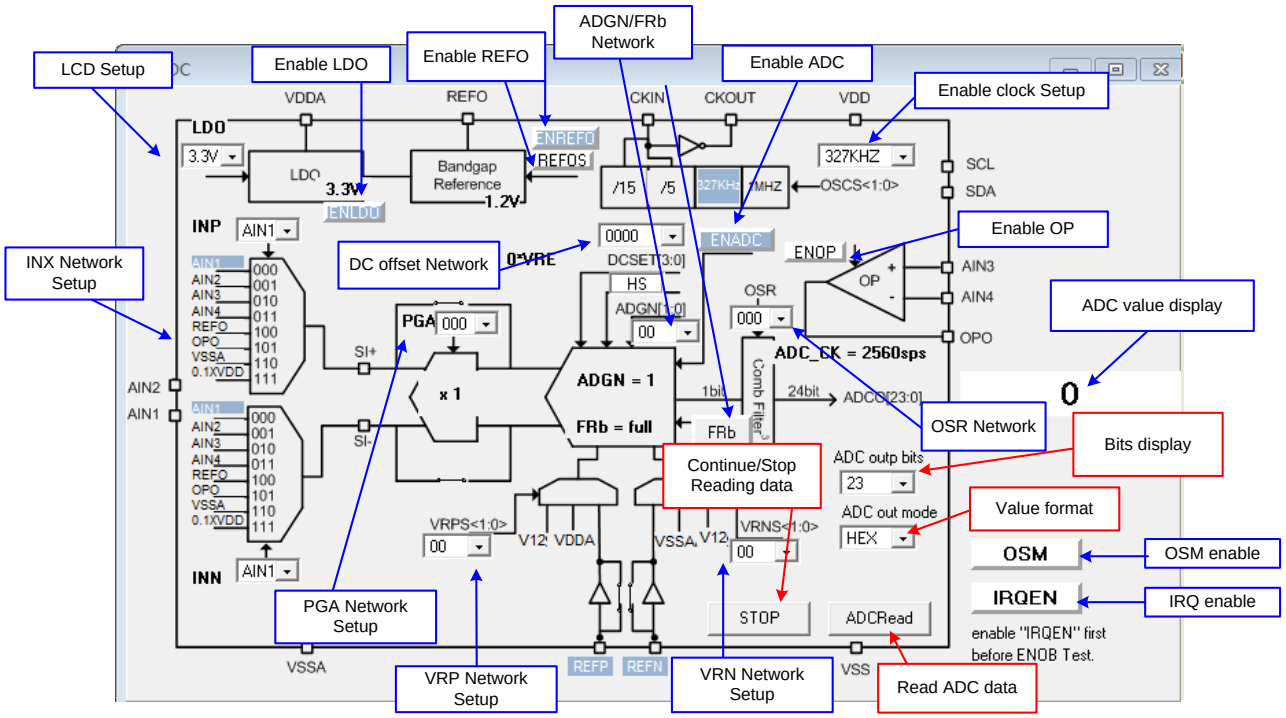


Figure 5-6

- 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

Figure 5-7

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

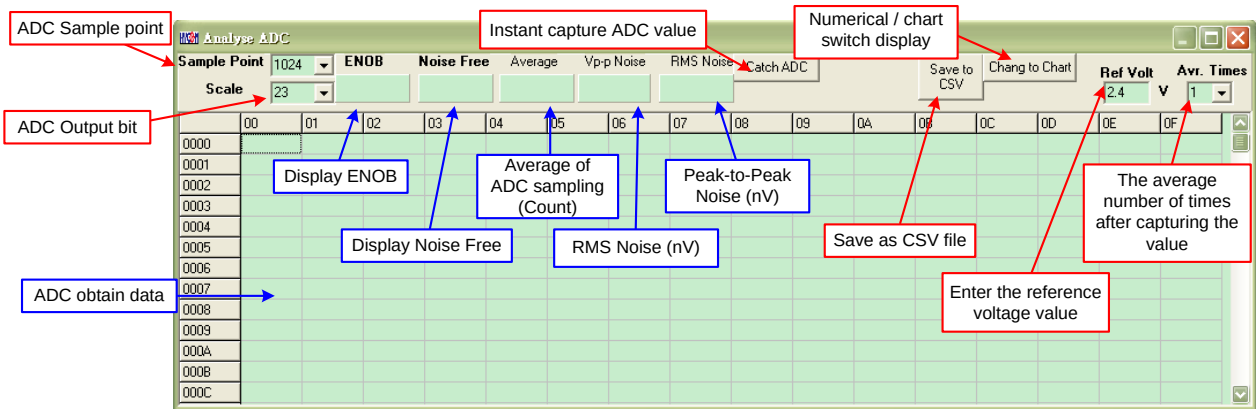


Figure 6-1

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

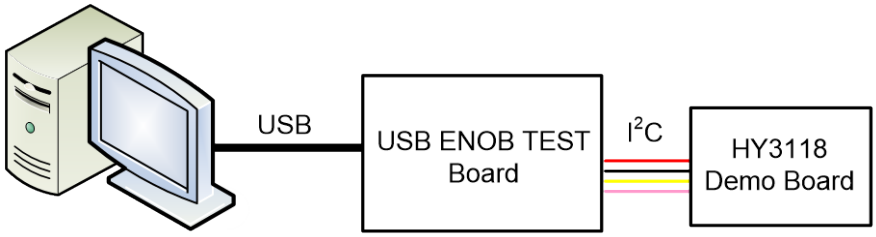


Figure 7-1

PC transmits Command to USB ENOB Test Board; USB ENOB Test Board configures and reads ADC value via I^{2}C from HYCON HY311x Demo Board.

7.1. USB ENOB Test Board Description

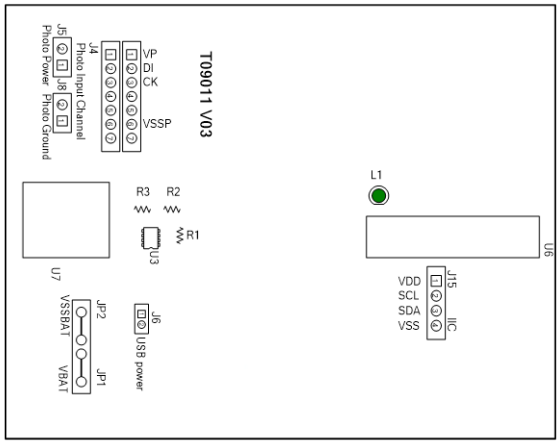


Figure 7-2

1. J15：I^{2}C Port

J15 description

PIN 1 → VDD，Power。

PIN 2 → SCL，I^{2}C SCK signal wire。

PIN 3 → SDA，I^{2}C SDA signal wire。

PIN 4 → VSS，Ground。

2. JP1、JP2、J6、U3：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:

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

3. U7：USB Port

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

7.2. HY311x Demo Board Description

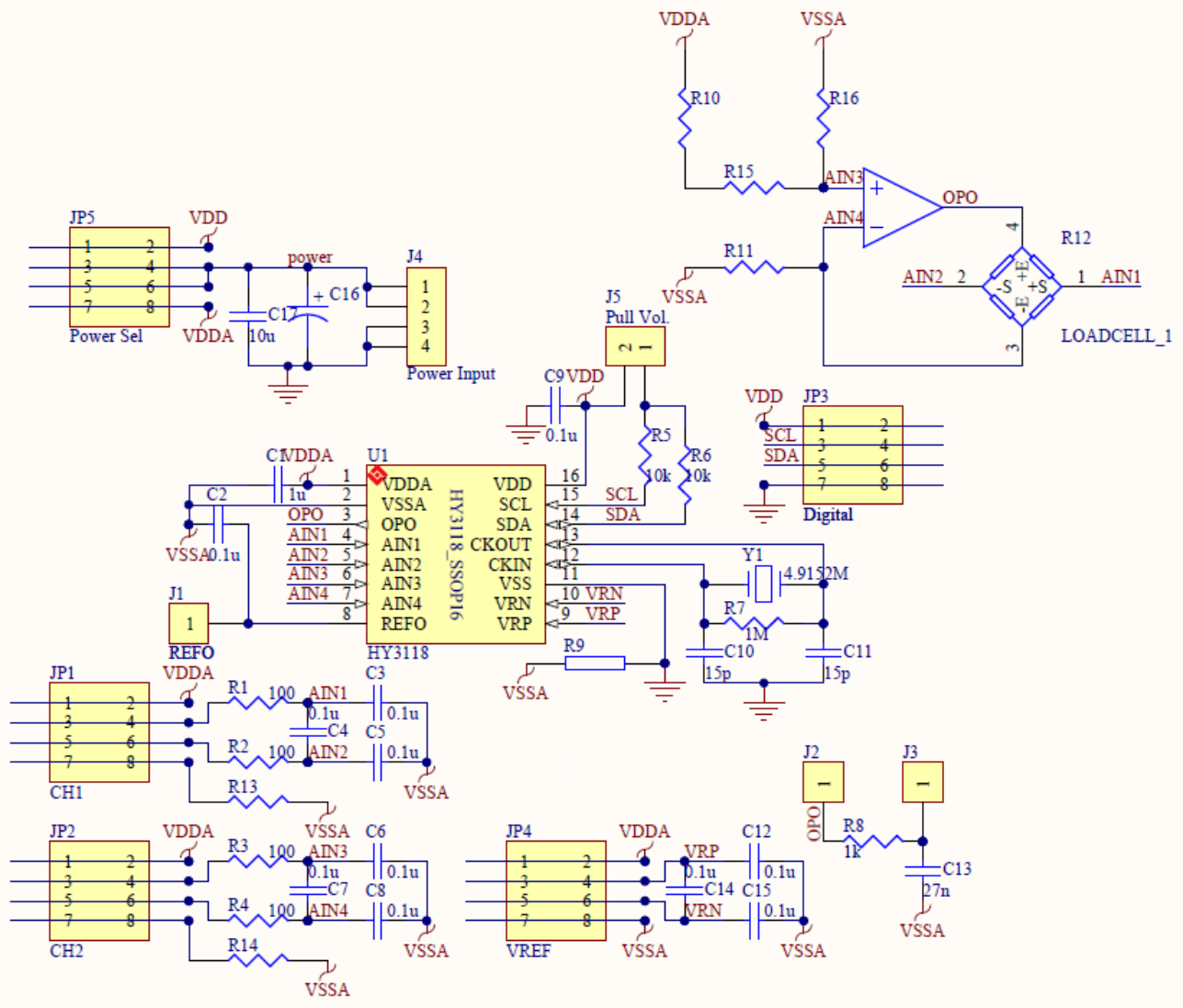


Figure 7-3

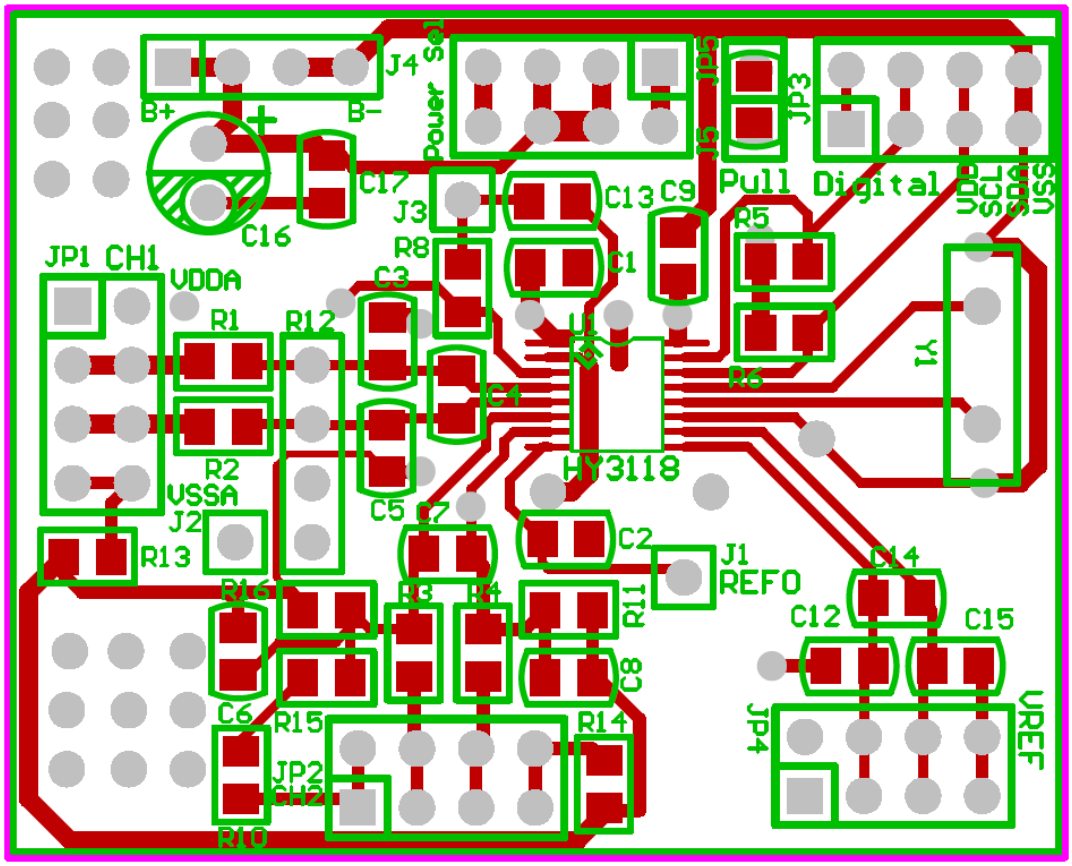


Figure 7-4

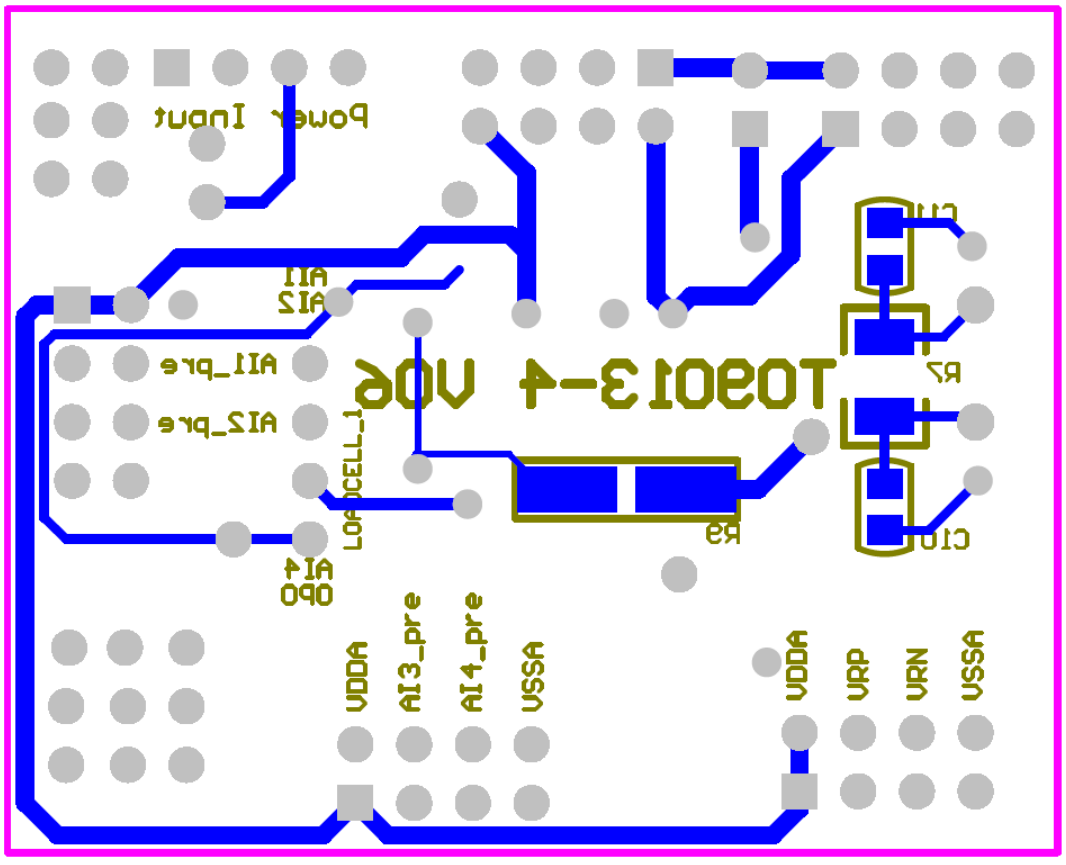


Figure 7-5

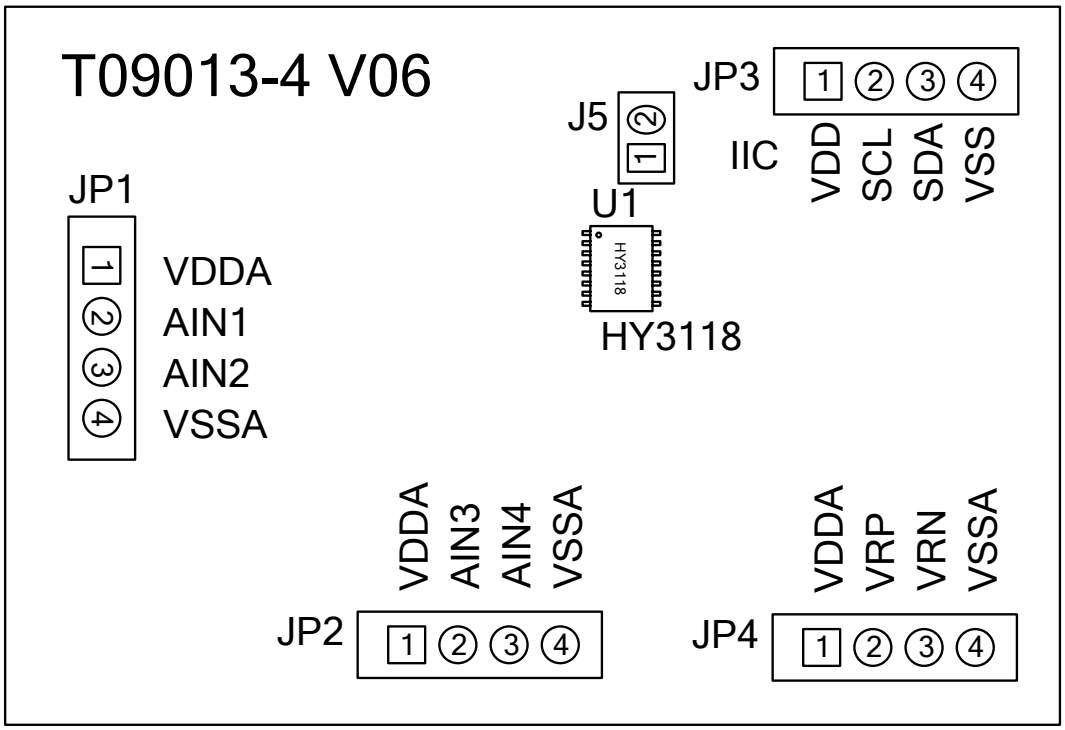


Figure 7-6

1. JP3：I²C Port

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

PIN 2 → SCL，SCK signal wire

PIN 3 → SDA，SDA signal wire

PIN 4 → VSS，Ground.

2. JP1、JP2：ADC Signal Input End

PIN 1 → VDDA，VDDA power supply

PIN 2 → AIN1 / AI3，signal input end

PIN 3 → AIN2 / AI4，signal input end

PIN 4 → VSSA，Ground.

3. JP4：ADC Signal Reference End

PIN 1 → VDDA，VDDA power supply

PIN 2 → REFP(VRP)，voltage input reference end.

PIN 3 → REFN(VRN)，voltage input reference end.

PIN 4 → 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