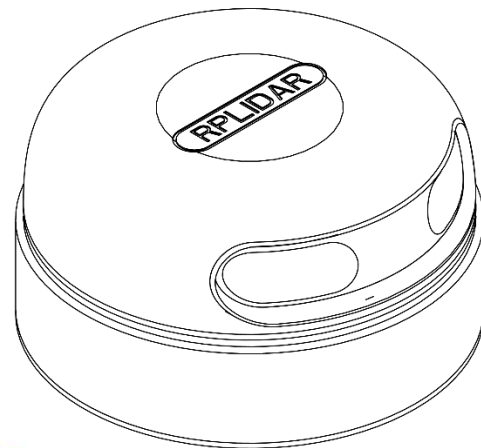


# RPLIDAR A2

Low Cost 360 Degree Laser Range Scanner

Development Kit User Manual

Model: A2M4



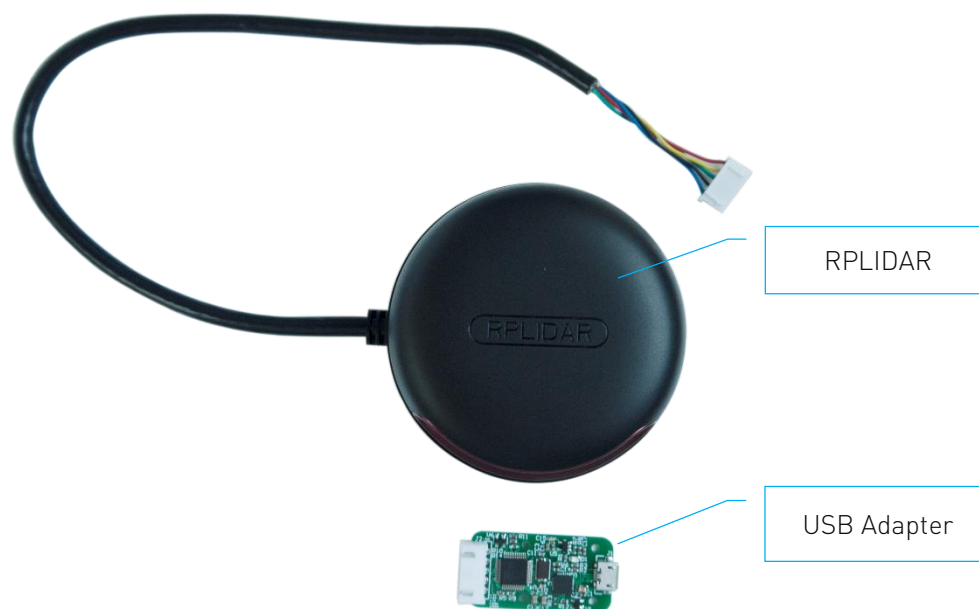
<b>CONTENTS</b> .....	<b>1</b>
<b>1. OVERVIEW</b> .....	<b>3</b>
ITEMS IN THE DEVELOPMENT KIT .....	3
RPLIDAR A2 .....	4
USB ADAPTER .....	4
<b>2. CONNECTION AND USAGE</b> .....	<b>5</b>
CONNECTION .....	5
INSTALL DRIVER FOR THE USB ADAPTER .....	6
RUN DEMO APPLICATION .....	7
TROUBLESHOOTING .....	10
MOTOR SPEED ADJUSTMENT .....	10
<b>3. SDK INTRODUCTION AND USAGE</b> .....	<b>11</b>
RPLIDAR A2 PIN DEFINITION AND SPECIFICATION .....	11
PIN DEFINITION FOR THE USB ADAPTER .....	12
CONFIGURE RPLIDAR A2 SCAN FREQUENCY .....	12
SDK USAGE .....	12
<b>4. OPERATION RECOMMENDATION</b> .....	<b>13</b>
PRE-HEATING FOR BEST PERFORMANCE .....	13
AMBIENT TEMPERATURE .....	13
AMBIENT LIGHT .....	13
<b>5. REVISION HISTORY</b> .....	<b>14</b>
<b>APPENDIX</b> .....	<b>15</b>
IMAGE AND TABLE INDEX .....	15

RPLIDAR A2 development kit includes the matched tools used for evaluating RPLIDAR's performance and initial development. After connecting the RPLIDAR A2 with PC via USB cable and adapter, Users can observe the cloud map of the environment scanning point collected by the RPLIDAR and start development based on the SDK.

## Items in the Development Kit

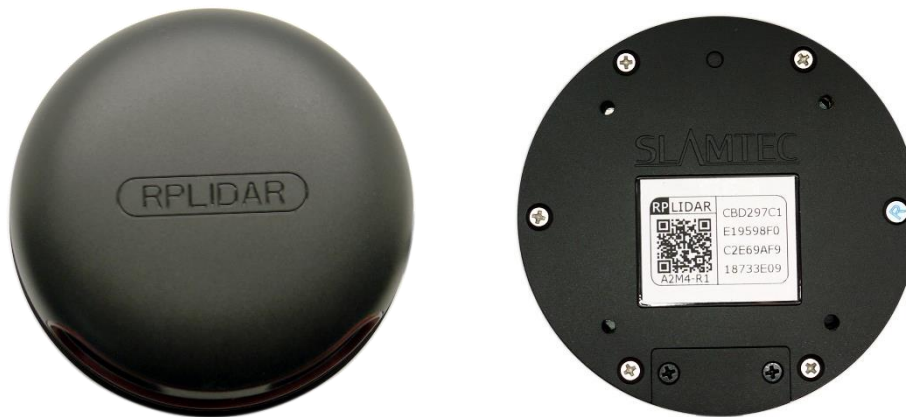
RPLIDAR Development Kit contains:

- RPLIDAR ( PWM motor driver embedded )
- USB Adapter



*Figure 1-1 Items in the RPLIDAR Development Kit*

## RPLIDAR A2

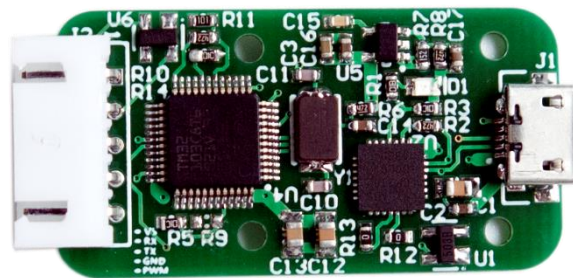


*Figure 1-2 The RPLIDAR*

The RPLIDAR A2 development kit contains standard RPLIDAR A2 unit (A2M4-R1). The RPLIDAR is embedded with logic IO drivable motor controller which can be used to configure the scan frequency by tuning motor speed. Developers can also choose to turn off the motor for power saving purpose.

RPLIDAR usage and interface definition will be introduced in the coming sections.

## USB Adapter

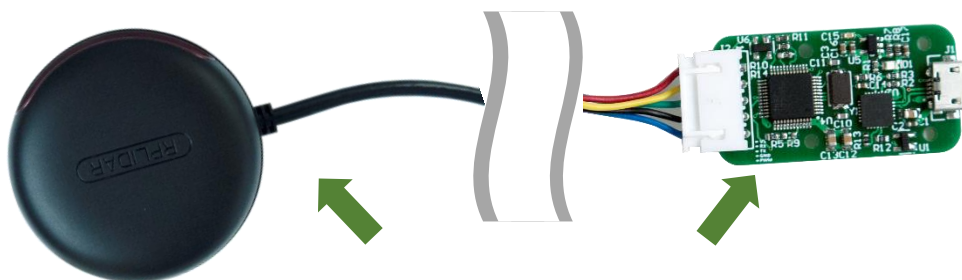


*Figure 1-3 RPLIDAR Adapter*

### Connection

RPLIDAR A2 can be easily connected to PC according to the following steps.

- 1) Connect RPLIDAR A2 with the USB adapter.



*Figure 2-1 Connect RPLIDAR A2 and USB Adapter*

- 2) Connect the USB adapter to your PC via the Micro-USB cable. If the PC is on, after connecting the USB cable to your PC, the indicator light of the USB will light up but the RPLIDAR will not start scanning.



*Figure 2-2 Connect the USB Adapter to PC via Micro-USB Cable*

## Install Driver for the USB Adapter

The USB adapter converts UART to USB by using CP2102 chip. You need to install the device driver for the chip. The driver can be found in the provided SDK package or downloaded from Silicon Labs' official website:

<http://www.silabs.com/products/interface/usbtouart/Pages/usb-to-uart-bridge.aspx>

Here's the installation steps in Windows:

After connecting the RPLIDAR with PC, please find the driver file "CP210x VCP Windows" and choose correct operating system version accordingly: x86 for 32-bit OS and x64 for 64-bit OS.

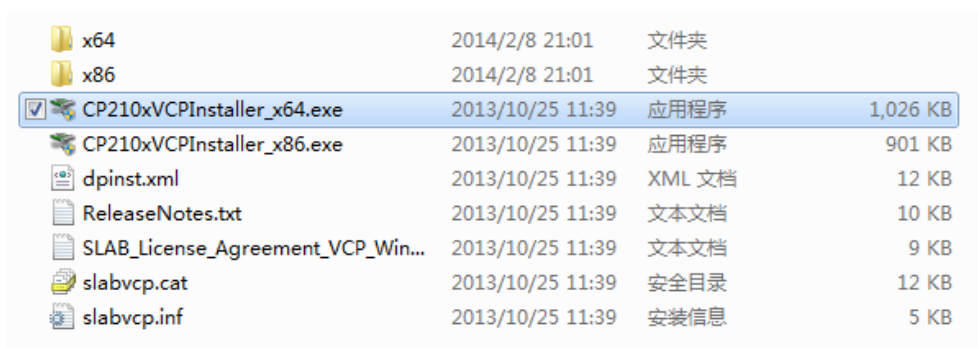


Figure 2-3 Choose USB Adapter Driver for Installation

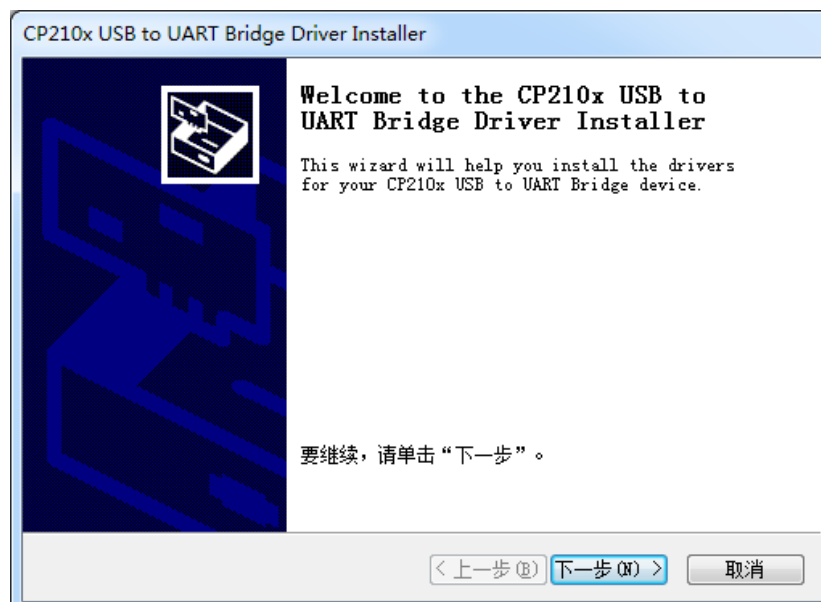


Figure 2-4 Start Page of USB Adapter Driver Installation

After Installing the driver according to the above installation steps, you will see corresponding serial port name in the [Control Panel] -> [Device and Printers]. Please refer to the below figure.



Figure 2-5 Recognized Serial Port Name Matched with the USB Adapter

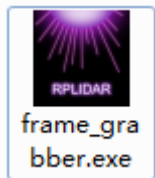
## Run Demo Application

Frame\_grabber is a GUI demo application provided by SLAMTEC. You can view the scan result directly in the UI and save the scan result to files for further processing. The source code of this demo application is also provided in matched SDK for reference.

This GUI demo can only run under Windows. For Linux and MacOS users, please refer to the other simple demo provided in the SDK.

Please make sure you have connected RPLIDAR to PC by using USB adapter and installed the device driver correctly before running the demo application.

Starting demo application framgrabber.exe and choose serial port name identified in the previous step.



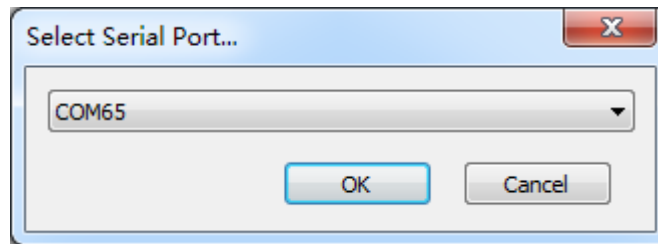


Figure 2-6 Choose Serial Port Name Matched with the USB Adapter

If the connection is ok, you shall see the UI like this:

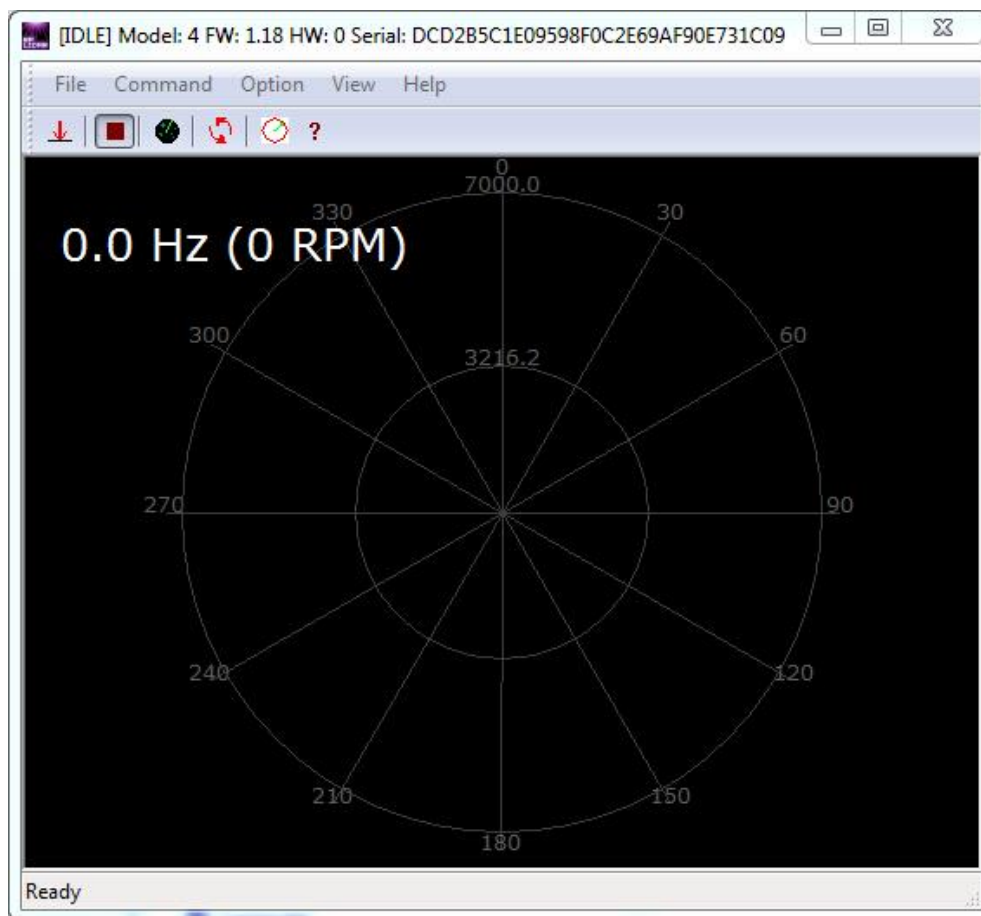


Figure 2-7 The Start of Demo Application

The firmware/hardware version and serial number of the RPLIDAR will show in the title line of the GUI. The supported commands of RPLIDAR are showed in the tool bar. The descriptions are listed in the bellow table.









Button	Function	Description
	Start Scan	Scan data will be displayed after scan core starting work
	Stop Scan	Scan core enter power save mode
	Save Scan Data	Save current scan data to the local file
	Restart RPLIDAR	Restart scan core to clear internal errors
	Adjust Motor Speed	Adjust the motor speed as required

Figure 2-8 The Supported Commands in Demo Application

Press the Start Scan button  , the scan data will be displayed in the UI as below :

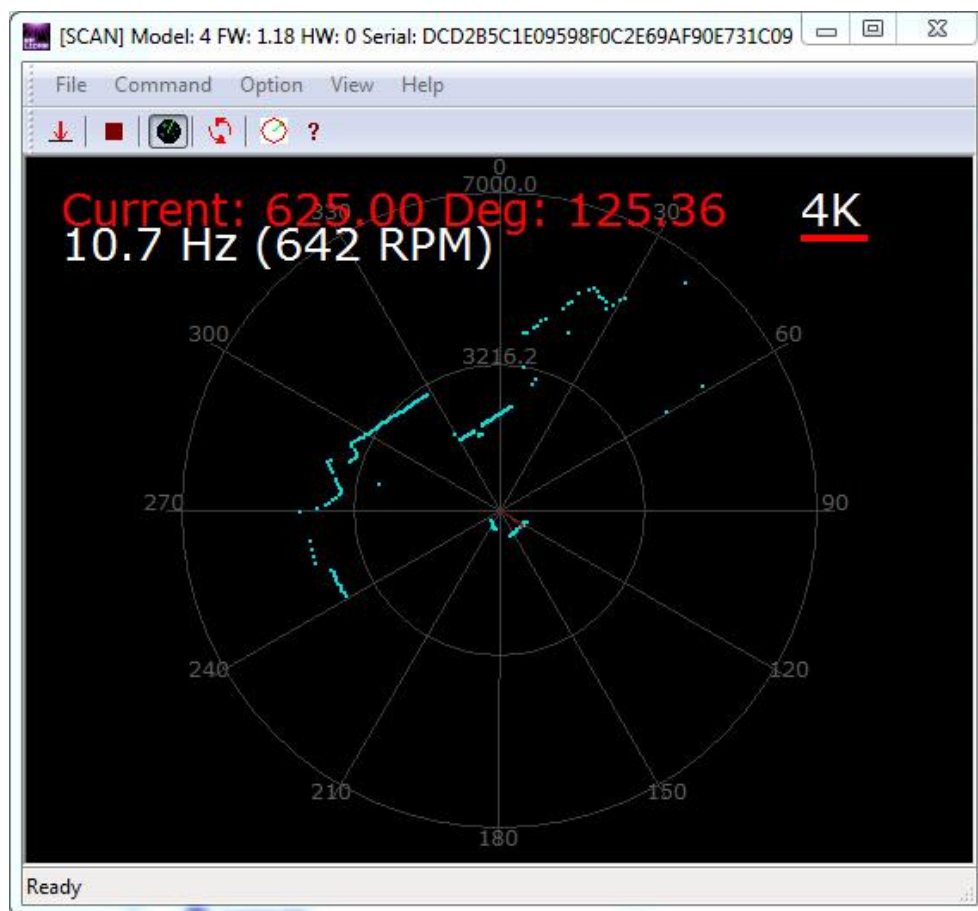



Figure 2-9 The Scan Outline in RPLIDAR Demo Application


Use the mouse wheel to zoom in and out. Move the cursor to any sample point, the distance and degree value to the RPLIDAR will be showed in the screen with red font.

The scan frequency is also showed in the UI.

## Troubleshooting

When the scan core or the laser power works abnormally, the scan core will enter protection mode. This state can be retrieved by using SDK API. If such scenario happened, please send restart command  to reset the scan core.

## Motor Speed Adjustment

During the running process, different motor rotating speed can be achieved by pressing the  button. There will be a speed adjustment dialog box popped up for users to enter required speed. After clicking set, the motor will work as the settled rotating speed automatically. User can also drag the progress bar to the required rotating speed.

The current rotating speed will show in real time in the Framegrabber main dialogue box.

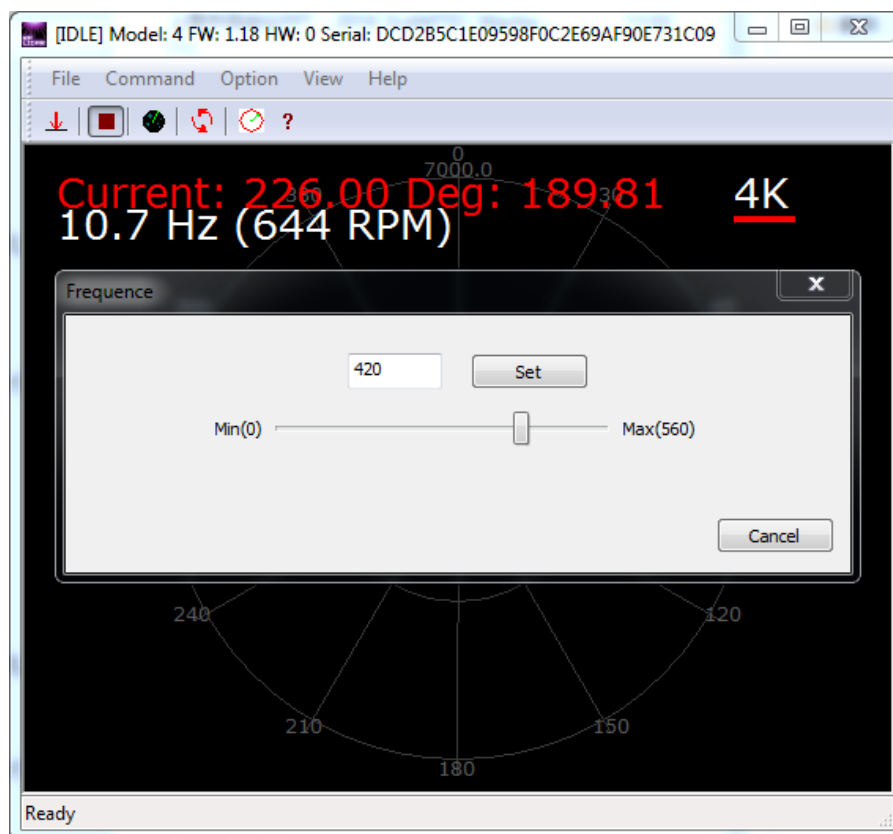


Figure 2-10 The Motor Speed Adjustment Dialogue

## RPLIDAR A2 Pin Definition and Specification

RPLIDAR A2 is using XH2.54-5P specification plug. Please use it with socket that meet the specification of XH2.54-5P. The detailed pin definition is shown as below:

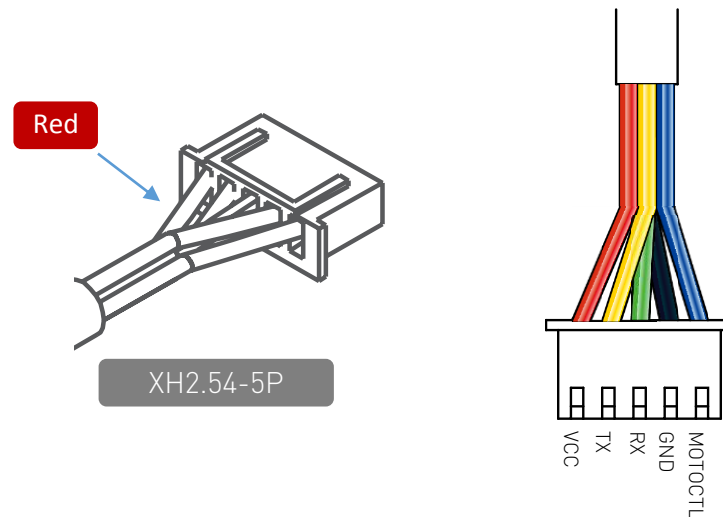


Figure 3-1 RPLIDAR A2 Pins

Color	Signal name	Type	Description	Minimum	Typical	Maximum
Red	VCC	Power	Power supply for the whole RPLIDAR	4.9V	5V	5.5V
Yellow	TX	Output	Serial output for RPLIDAR scan core	0V	3.3V	3.5V
Green	RX	Input	Serial input for RPLIDAR scan core	0V	3.3V	3.5V
Black	GND	Power	GND	0V	0V	0V
Blue	MOTOCTL	Input (pull down)	Enable pin for RPLIDAR scan motor/PWM control signal (active high)	0V	3.3V	5V

Figure 3-2 RPLIDAR Pin Definition and Specification

RPLIDAR A2 uses the one 5V DC power supply for powering the scan motor and the scan core at the same time. No extra power is required.

With build-in and speed-adjustable motor driver, RPLIDAR A2 can control the start, the stop and the rotating speed of the motor via the MOTOCTL signal.

- Reference Design for RPLIDAR development

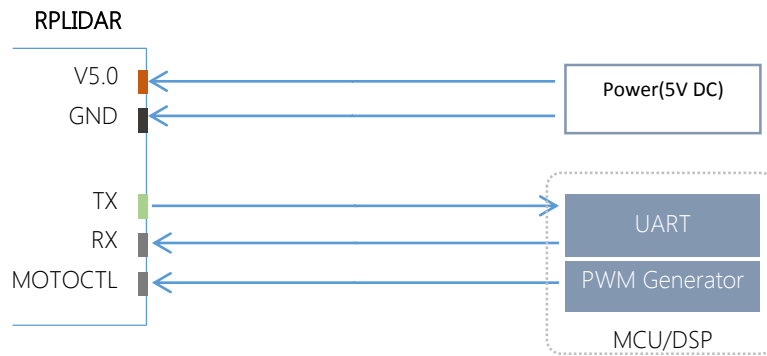


Figure 3-3 RPLIDAR A2 Pins Reference Design

## Pin Definition for the USB Adapter

The USB adapter is also using XH2.54-5P specification socket, and it can be connected with RPLIDAR A2 directly. The pin definition is the same as the RPLIDAR A2.

## Configure RPLIDAR A2 Scan Frequency

The motor speed control signal MOTOCTL can be configured directly via the USB adapter of RPLIDAR A2. Therefore, the RPLIDAR A2's scan frequency can be modified by invoking the related functions in the SDK to configure the motor speed.

Without the USB adapter, users can also control the speed by setting the PWM duty cycle of MOTOCTL. Please note that the PWM frequency is 20kHz. For more detailed parameter and index, please refer to the datasheet.

Please refer to the RPLIDAR protocol and application note for more information and the SDK for the sample code on RPLIDAR scan frequency.

## SDK Usage

SLAMTEC provides RPLIDAR SDK support on both Windows and Linux platform. And users can embed the SDK source code to other operational system or embedded system quickly. Please refer to the SDK document for more information.

## 4. Operation Recommendation **SLAMTEC**

### Pre-Heating for Best Performance

The scan core will be heating when start working. We recommend pre-heating RPLIDAR (Start the scan mode and the scan motor is rotating) for more than 2 minutes to get the best measurement accuracy.

### Ambient Temperature

RPLIDAR' s measurement resolution is sensitive to the ambient temperature. Improper use may even damage the sensor. Please avoid using RPLIDAR in extreme high temperature (>40 degree) and too low temperature (<-10 degree).

### Ambient Light

Although RPLIDAR is not sensitive to ambient light, improper use may still lead to errors. In indoor environment, please avoid lighting RPLIDAR with strong light source such as high-power laser.

In outdoor environment, please avoid facing RPLIDAR directly to sun light. This may lead to permanent damage to the image sensor of RPLIDAR and make the measurement invalid

The standard version of RPLIDAR may have less measurement range in the environment with strong sunlight.

## 5. Revision History

Date	Version	Description
2016-04-06	0.1 ( A2M4 )	Initial

## Image and Table Index

FIGURE 1-1 ITEMS IN THE RPLIDAR DEVELOPMENT KIT.....	3
FIGURE 1-2 THE RPLIDAR.....	4
FIGURE 1-3 RPLIDAR ADAPTER.....	4
FIGURE 2-1 CONNECT RPLIDAR A2 AND USB ADAPTER.....	5
FIGURE 2-2 CONNECT THE USB ADAPTER TO PC VIA MICRO-USB CABLE.....	5
FIGURE 2-3 CHOOSE USB ADAPTER DRIVER FOR INSTALLATION.....	6
FIGURE 2-4 START PAGE OF USB ADAPTER DRIVER INSTALLATION.....	6
FIGURE 2-5 RECOGNIZED SERIAL PORT NAME MATCHED WITH THE USB ADAPTER.....	7
FIGURE 2-6 CHOOSE SERIAL PORT NAME MATCHED WITH THE USB ADAPTER.....	8
FIGURE 2-7 THE START OF DEMO APPLICATION.....	8
FIGURE 2-8 THE SUPPORTED COMMANDS IN DEMO APPLICATION.....	9
FIGURE 2-9 THE SCAN OUTLINE IN RPLIDAR DEMO APPLICATION.....	9
FIGURE 2-10 THE MOTOR SPEED ADJUSTMENT DIALOGUE.....	10
FIGURE 3-1 RPLIDAR A2 PINS.....	11
FIGURE 3-2 RPLIDAR PIN DEFINITION AND SPECIFICATION.....	11
FIGURE 3-3 RPLIDAR A2 PINS REFERENCE DESIGN.....	12