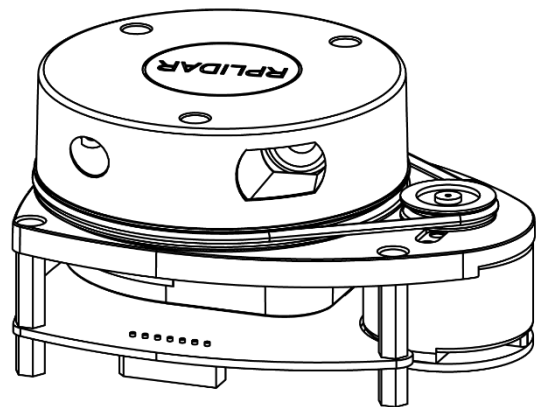


RPLIDAR A1

Low Cost 360 Degree Laser Range Scanner

Development Kit User Manual

Model: A1M8



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RPLIDAR A1 development kit includes the matched tools used for evaluating RPLIDAR A1's performance and initial development. After connecting the RPLIDAR A1 with PC via USB cable and adapter, Users can observe the cloud map of the environment scanning point collected by the RPLIDAR A1 and start development based on the SDK.

Items in the Development Kit

RPLIDAR A1 Development Kit contains:

- RPLIDAR A1 (PWM motor driver embedded)
- USB Adapter
- RPLIDAR A1 communication cable

Note: The Micro-USB cable needs to be prepared by users.



Figure 1-1 Items in the RPLIDAR A1 Development Kit

RPLIDAR A1



Figure 1-2 The RPLIDAR A1

The RPLIDAR A1 development kit contains standard RPLIDAR A1 unit (A1M8-R1). The RPLIDAR A1 is embedded with logic IO drivable(3.3v) 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 A1 usage and interface definition will be introduced in the coming sections.

USB Adapter

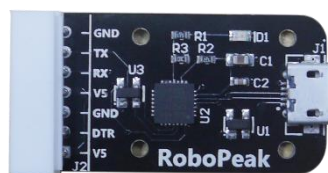


Figure 1-3 RPLIDAR A1 Adapter

RPLIDAR A1 development kit contains a USB adapter to provide power supply for RPLIDAR A1 and convert RPLIDAR A1 internal UART serial interface to USB interface.

Connection

RPLIDAR A1 can be easily connected to PC according to the following steps.

- 1) Connect RPLIDAR A1 with the USB adapter using provided communication cable. The socket is in the bottom of RPLIDAR A1.

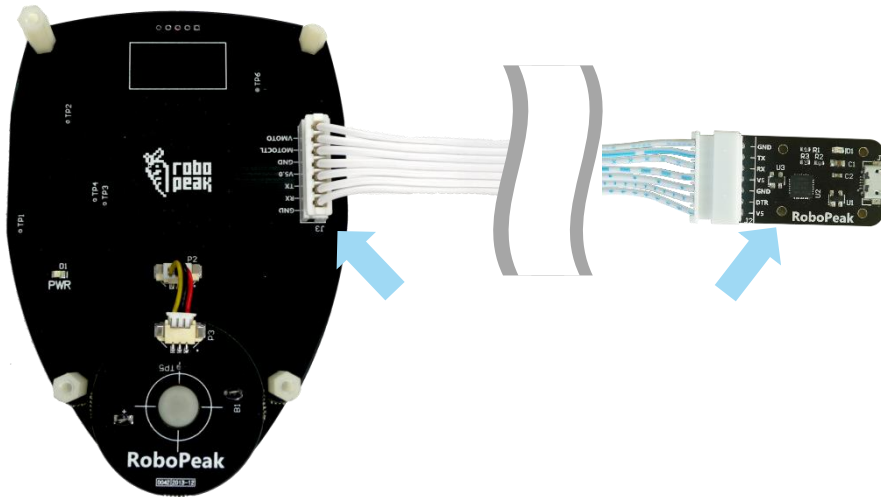


Figure 2-1 Connect RPLIDAR A1 and USB Adapter

- 2) Connect the USB adapter to your PC using the Micro-USB cable. After connecting RPLIDAR A1 to your PC through the USB cable, the LED in the bottom of the RPLIDAR A1 will light up and RPLIDAR A1 start scanning.

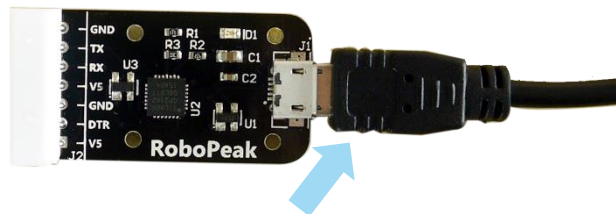


Figure 2-2 Connect the USB Adapter to PC via Micro-USB Cable

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/usb-bridges/Pages/usb-bridges.aspx>

Here's the installation steps in Windows:

After connecting the RPLIDAR A1 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.

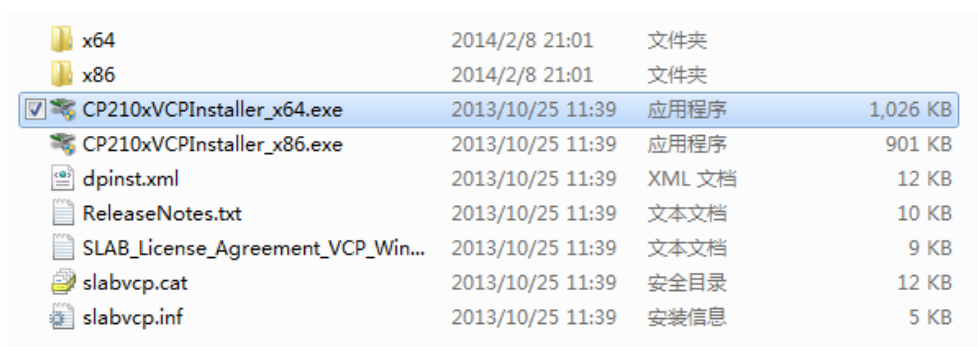


Figure 2-3 Choose USB Adapter Driver for Installation



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 A1 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.

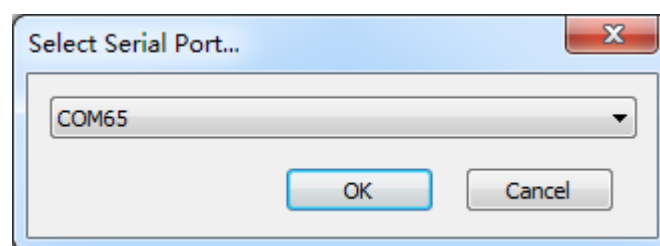


Figure 2-6 Choose Serial Port Name Matched with the USB Adapter

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

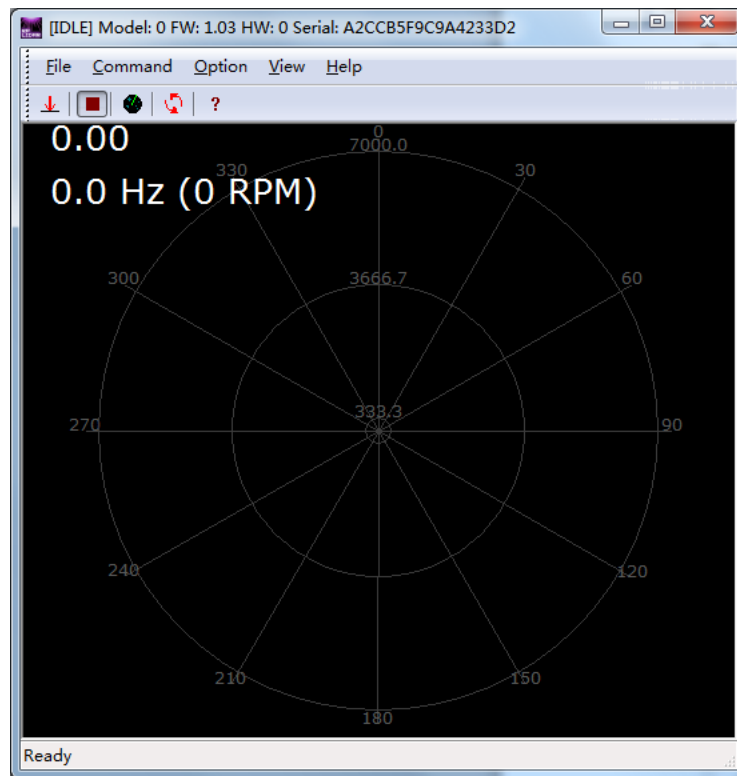


Figure 2-7 The Start of Demo Application

The firmware/hardware version and serial number of the RPLIDAR A1 will show in the title line of the GUI. The supported commands of RPLIDAR A1 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 A1	Restart scan core to clear internal errors

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 :

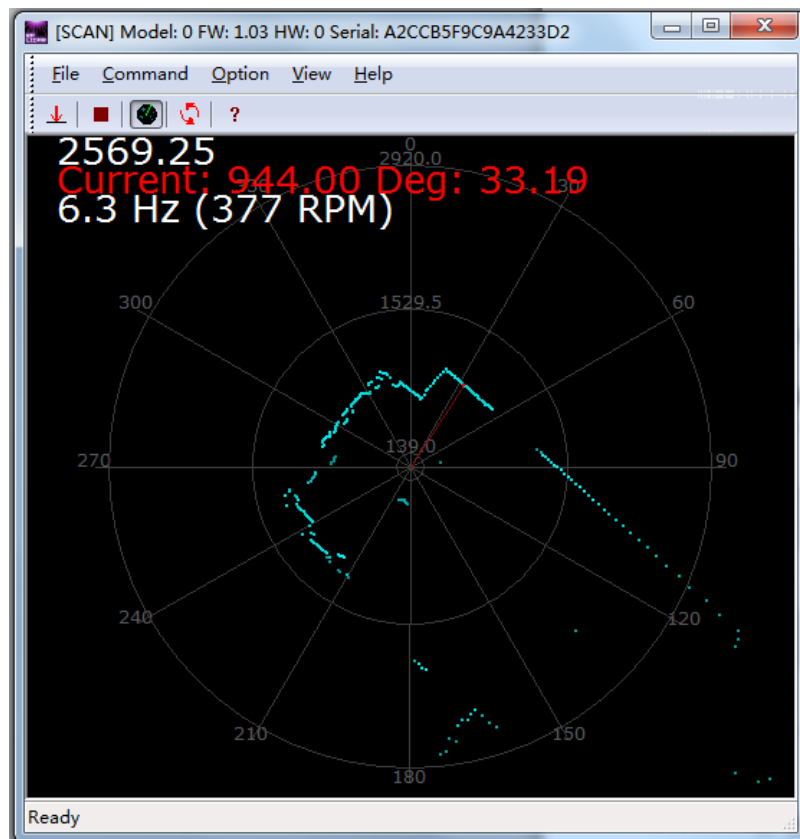



Figure 2-9 The Scan Outline in RPLIDAR A1 Demo Application

Use the mouse wheel to zoom in and out. Move the cursor to any sample point, the distance and degree value to the RPLIDAR A1 will be showed in the screen with red font.

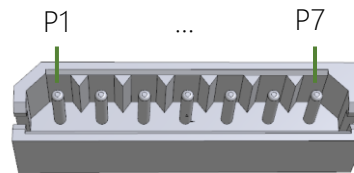
The scan frequency is also showed in the UI.

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.

RPLIDAR A1 Pin Definition and Specification

The socket in the bottom of RPLIDAR A1 is using 5267-7A specification: 2.5mm spacing 7 pin. Any communication cable has 5264-7 terminal block can be used to connect with RPLIDAR A1. Please find the detail pin definition in the bellow table:



5267-7A

Pin	Signal name	Type	Description	Minimum	Typical	Maximum
P1	VMOTO	Power	Power supply for the RPLIDAR A1 scan motor	-	5V	9V
P2	MOTOCTL	Input	Enable pin for RPLIDAR A1 scan motor/PWM control signal (active high)	0V	-	VMOTO
P3	GND	Power	GND signal for RPLIDAR A1 scan motor	-	0V	-
P4	V5.0	Power	Power supply for RPLIDAR A1 scan core	4.9V	5V	6V
P5	TX	Output	Serial output for RPLIDAR A1 scan core	0V	-	5V
P6	RX	Input	Serial input for RPLIDAR A1 scan core	0V	-	5V
P7	GND	Power	GND signal for RPLIDAR A1 scan core	-	0V	V5.0

Figure 3-1 RPLIDAR A1 Pin Definition and Specification

External system must provide required VMOTO and V5.0 power to make scan motor and scan core work correctly. In most of scenarios, VMOTO and V5.0 can share the same power supply.

MOTOCTL Pin used to control scan motor speed to adjust RPLIDAR A1's scan frequency, PWM signal also can be applied. The equivalent circuit showed as bellow:

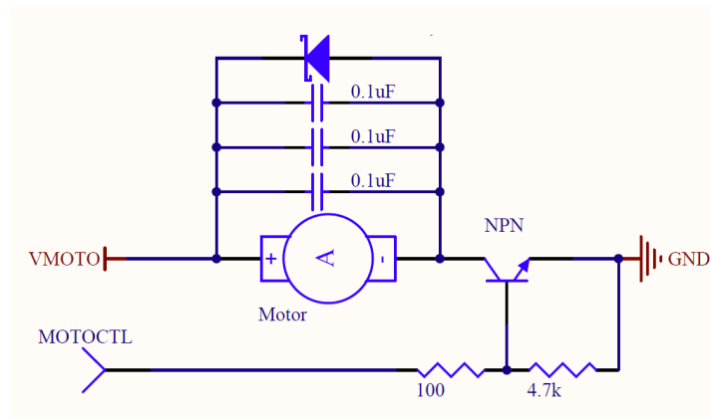


Figure 3-2 RPLIDAR A1 MOTOCTL Equivalent Circuit

- Reference Design for RPLIDAR A1 development

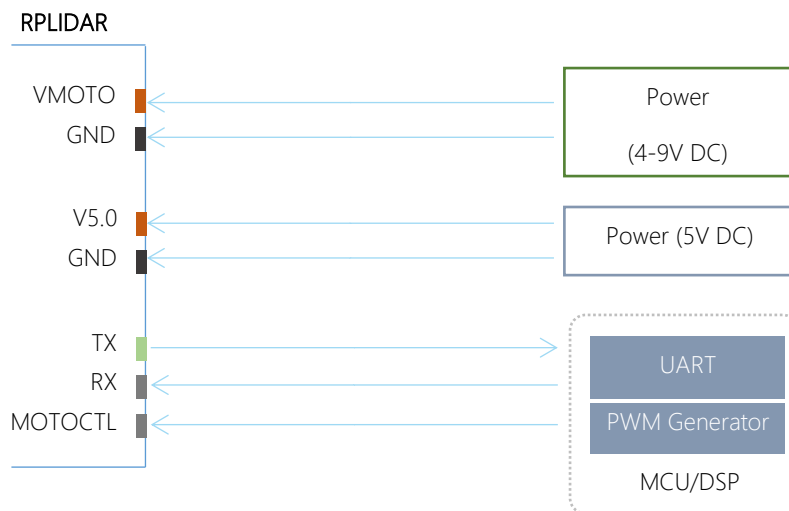
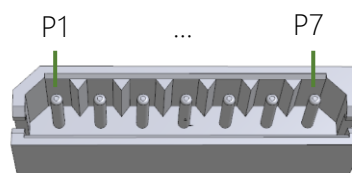


Figure 3-3 RPLIDAR A1 Pins Reference Design

Pin Definition for the USB Adapter

The USB adapter is also using 5267-7A specification socket: 2.5mm spacing 7 pin. Please find the detail pin definition in the bellow table:



5267-7A

Pin	Signal Name	Description
P1	V5.0	Power supply for RPLIDAR A1 scan core, USB 5V input
P2	HIGH	constant 5V high level output
P3	GND	GND for RPLIDAR A1 scan motor, USB GND
P4	V5.0	Power supply for RPLIDAR A1 scan core, USB 5V input
P5	RX	Input pin for USB serial adapter
P6	TX	Output pin for USB serial adapter
P7	GND	GND for RPLIDAR A1 scan core, USB GND

Figure 3-4 RPLIDAR A1 USB Adapter Pin Definition

Configure RPLIDAR A1 Scan Frequency

Since USB adapter's control signal MOTOCTL is fixed to high level, RPLIDAR A1's scan motor is always rotating at its highest speed which makes RPLIDAR A1 working on a relative high scan frequency. You can configure RPLIDAR A1's scan frequency by controlling motor speed.

By connecting MOTOCTL signal to the device has PWM output function such as MCU's PWM output I/O port, RPLIDAR A1's scan frequency can be locked in a proper value by adjust duty ratio of PWM using the scan frequency feedback provided by RPLIDAR A1 core.

Please refer to RPLIDAR A1 protocol and application note for more information. SDK also contains the sample code.

SDK Usage

SLAMTEC provides RPLIDAR A1 SDK support on both Windows and Linux platform. And users can embe the SDK source code to other operational system or embedded system quickly. Please refer to the SDK document for more information.

Pre-Heating for Best Performance

The scan core will be heating when start working. We recommend pre-heating RPLIDAR A1 (Start the scan mode and the scan motor is rotating) for more than 2 minutes to get the best measurement accuracy.

Ambient Temperature

RPLIDAR A1's measurement resolution is sensitive to the ambient temperature. Improper use may even damage the sensor. Please avoid using RPLIDAR A1 in extreme high temperature (>40 degree) and too low temperature (<-10 degree).

Ambient Light

Although RPLIDAR A1 is not sensitive to ambient light, improper use may still lead to errors. In indoor environment, please avoid lighting RPLIDAR A1 with strong light source such as high-power laser.

In outdoor environment, please avoid facing RPLIDAR A1 directly to sun light. This may lead to permanent damage to the image sensor of RPLIDAR A1 and make the measurement invalid

The standard version of RPLIDAR A1 may have less measurement range in the environment with strong sunlight.

Date	Content
2013-3-5	Initial draft
2014-2-11	Refine for final product
2016-05-19	Replaced obsolete images
2016-08-17	Updated USB adapter image

Image and Table Index

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