

M703A
USER MANUAL
Laser Distance Module

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1. 模块简介 Introduction of Module

M703A 激光测距模块为我司研发的高精度测距模块，具有测量精度高，测量速度快，安装操作简单等特点。已广泛用于家装测量，工业控制等各领域。

模块安装和使用前请仔细阅读安装和操作相关章节，防止损坏模块。

M703A Laser Distance Module is designed for precise measurement, which has high accuracy, fast measuring speed, easy to install and operate. Our module has been widely used in daily measurement, industrial measurement, warehouse monitoring, traffic investigation, and robots etc.

2. 性能指标 PARAMETERS

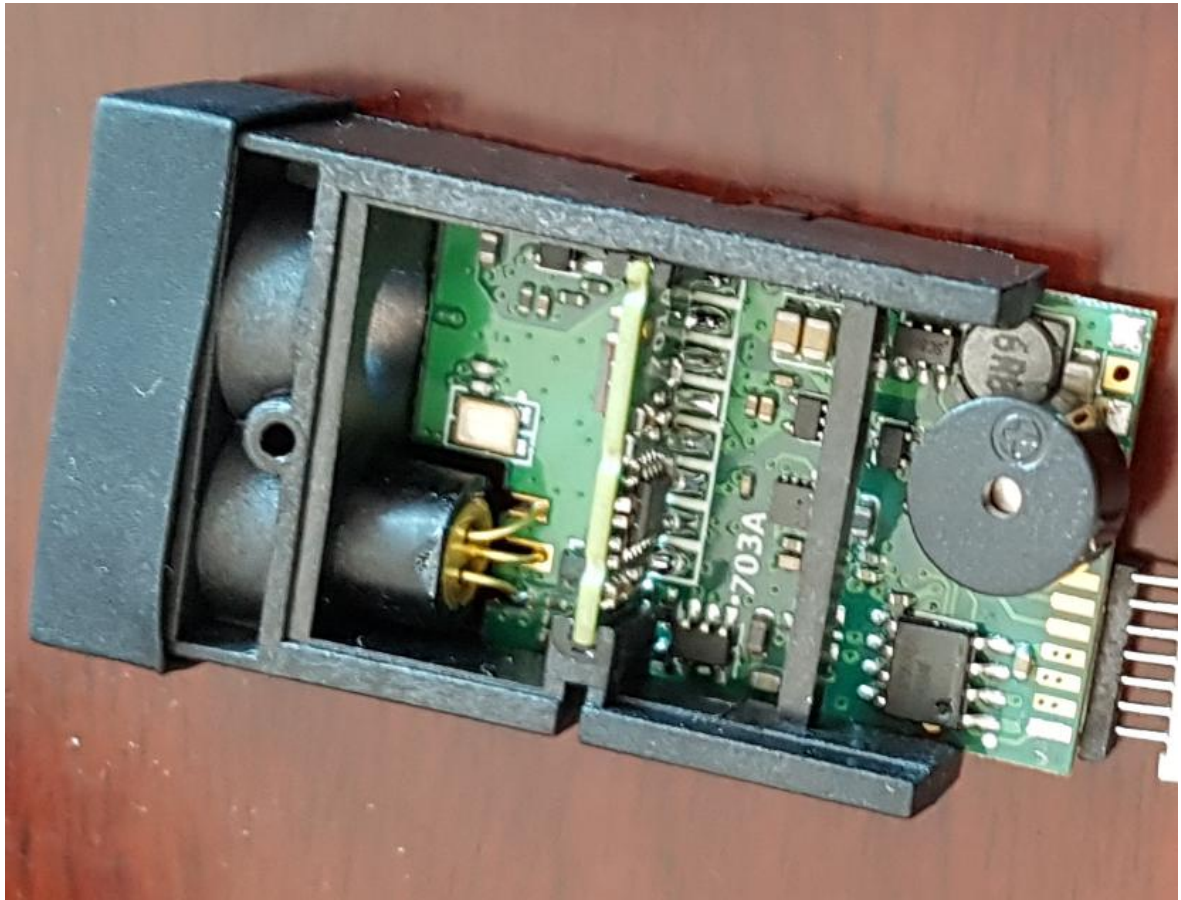
Accuracy	±1 mm (0.04 inch)
Measuring Unit	meter/inch/feet
Measuring Range (without Reflection)	0.03-40m
Measuring Time	0.1~3 seconds
Laser Class	Class II
Laser Type	635nm, <1mW
Size	45*25*12mm (±1 mm)
Weight	About 10g
Voltage	DC2.0~3.3V
Electrical Level	TTL/CMOS
Frequency	8Hz
Operating Temperature	0-40 °C (32-104 °F)
Storage Temperature	-25~60 °C (-13~140 °F)

Note:

1. Under bad measure condition, like environment with strong light or the diffuse reflectance of measuring point over-high or low, the accuracy would have bigger amount of error: ±1 mm+40PPM.
2. Under strong light or bad diffuse reflectance of target, please use a reflector.
3. Operating temperature -10 °C~50 °C can be customized.
4. 如果需要增加电压，可以用电源转接模块。Voltage can be changed by power converter LDO

3. 外形尺寸 DEMENSION

3.1 模块实物图 PICTURE



4. 模块使用 HOW TO USE

4.1 模块安装 INSTALLATION

TBD...

4.2 模块防护 PROTECTION

4.2.1 电气防护 ELECTRICAL PROTECTION

TBD...

4.2.2 环境防护 ENVIRONMENTAL PROTECTION

TBD...

4.3 电气连接 ELECTRICAL CONNECTION

正确的接入电源和通信链路，是保证模块正常工作的前提条件，错误的接入操作可能会导致模块工作异常，甚至损坏。

Proper connection to power and communication links is a prerequisite for the module working properly. Incorrect access operations may cause the module working abnormally, even damaged.

4.3.1 供电 POWER SUPPLY

M703A 工作电压范围为直流 2.0V~3.3V，推荐使用 3.3V 或 3.0V 直流电源供电，正常测量时电流在 100mA@3.3V，为了保证模块的稳定工作，电源输电流能力需要 300mA 及以上。供电连接示意如图 4-2 所示，其中 P3.VIN 为电源输入引脚，P1.GND 为电源地。

The working voltage for our M703A is 2.0V~3.3V, recommended DC 3.3V or 3.0V. While normal measurement, the current is 100mA@3.3V. In order to ensure the stability of the module, the current capacity of power supply needs 300mA and above.

Power supply connection is as shown in Figure 4-2, where P3.VIN is power input pins, P1.GND is power ground.

4.3.2 引脚布局 PIN LAYOUT

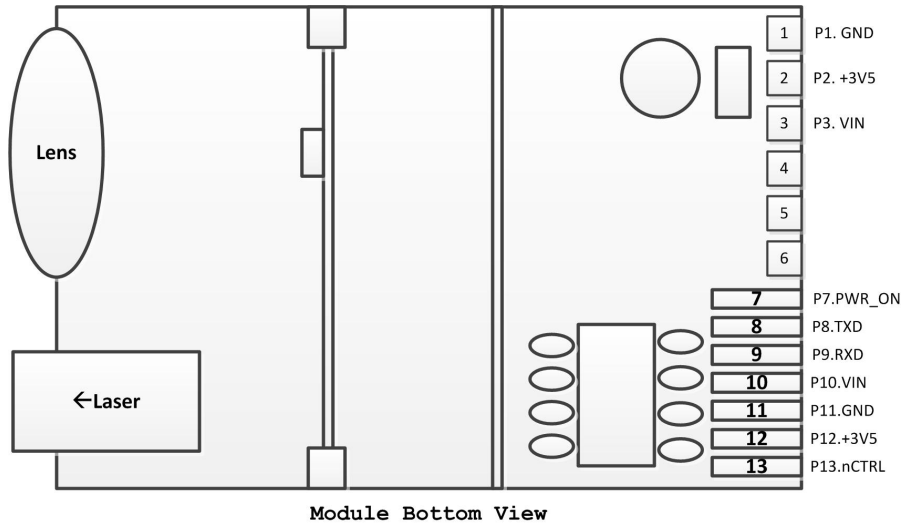


图 4-1 模块引脚布局 Pin Layout of the Module

4.3.3 引脚功能 PIN FUNCTION

表 4-1 引脚定义 Pin Definition

序号 No.	名称 Name	性质 Description	功能描述 Function
1	GND	电源地 Power Ground	输入、输入电源地，通信地 Input, Input Power Ground, Communication ground
2	+3V5	电源输出 Power Output	内部输出电压 3.5V，测试使用 Module Output Voltage 3.5V, test use
3	VIN	电源输入 Power Input	输入电源，DC +2.0V~+3.3V，300mA+ Input power, DC2.0V~3.3.V, 300mA+
4			保留
5			保留
6			保留
7	PWR_ON	控制 Control	模块开机控制，高电平开机，低电平关机 On/Off control, high level to switch on, low level to switch off
8	TXD	通信输出 Transmit	串口通信，模块端发送引脚，接控制器端接收引脚 Serial port communication, module transmit pin, connected to receive pin on the controller.
9	RXD	通信输入 Receive	串口通信，模块端接收引脚，接控制器端发送引脚 Serial port communication, module receive pin, connected to transmit pin on the controller.

10	VIN	电源输入 Power Input	输入电源, DC +2.0V~+3.3V, 300mA+ Input power, DC2.0V~3.3.V, 300mA+
11	GND	电源地 Power Ground	输入、输入电源地, 通信地 Input, Input Power Ground, Communication ground
12	+3V5	电源输出 Power Output	内部输出电压 3.5V, 测试使用 Module Output Voltage 3.5V, test use
13	nCTRL	控制 Control	连续测量控制引脚, 低电平进入连续测量模式 Continuous measurement control pin, continuous measure mode activated by low level

4.3.4 通信链路 COMMUNICATION LINKS

模块和主控直连。Module Connected with Master Board

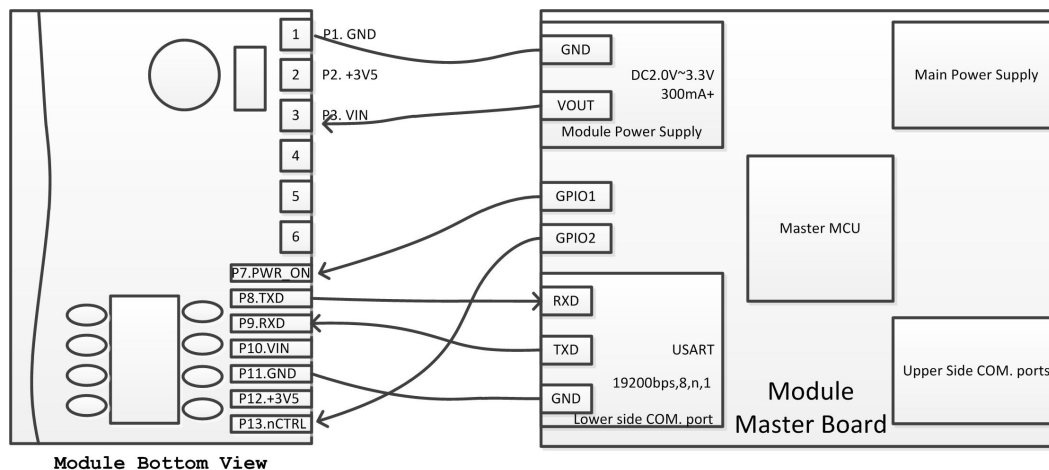


图 4-2 模块和主控连接示意 diagram

模块通过 USB 转串口模块和 PC 机进行连接 Module Connected with PC through a TTL-USB adapter

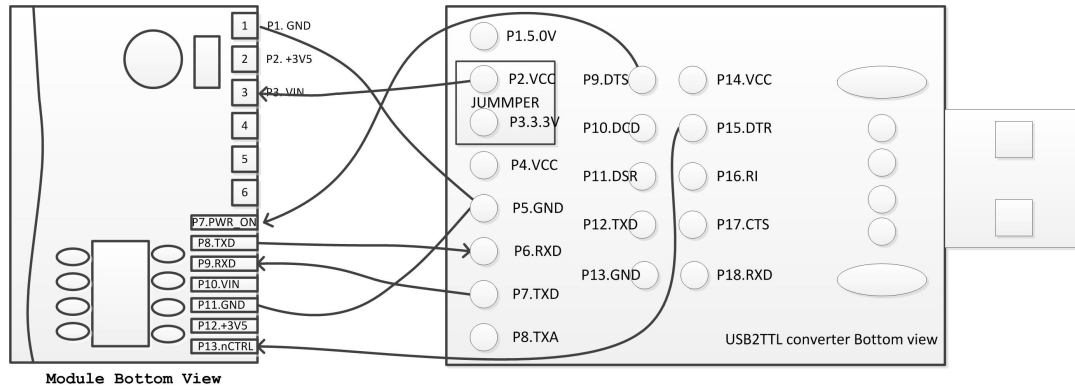


图 4-3 模块和 USB2TTL 转接板连接

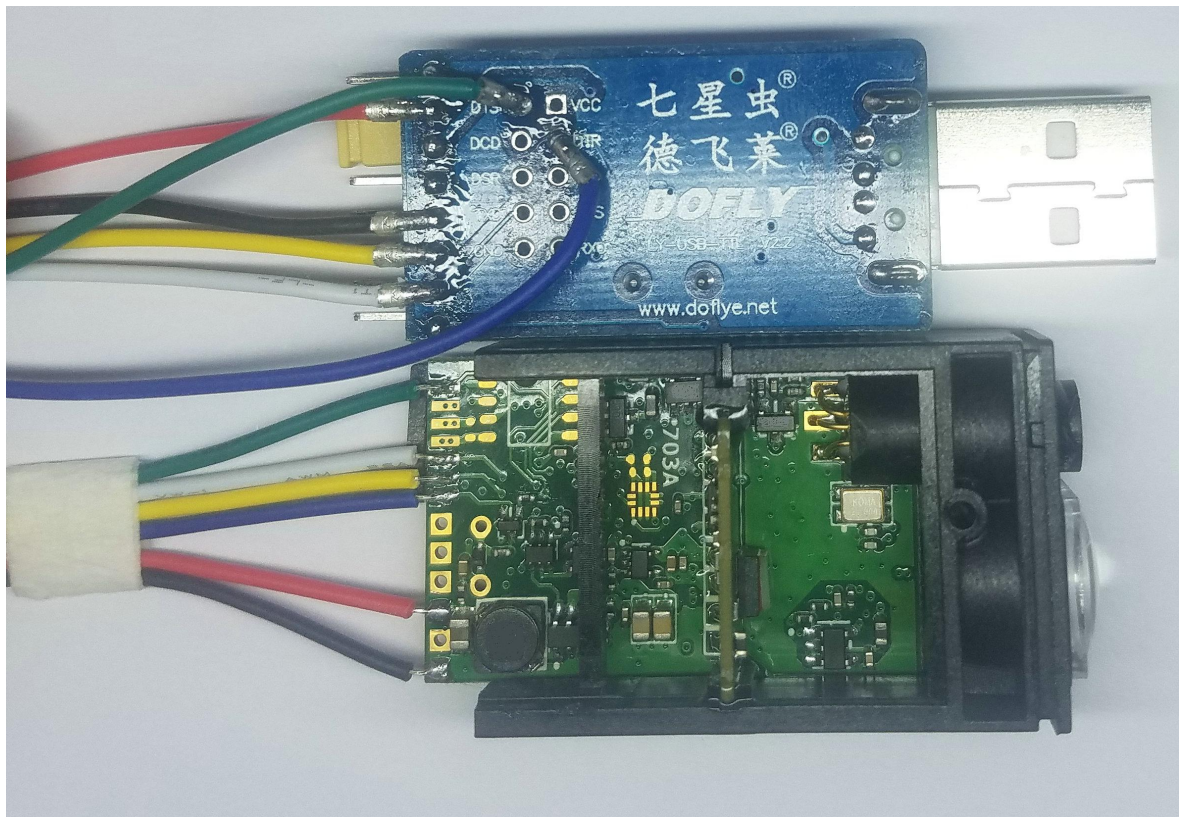


图 4-4 实物连接图

4.4 通信操作 COMMUNICATION OPERATIONS

4.4.1 端口配置 PORT CONFIGURATION

控制端串口基本配置: Basic Port Configuration:

- 波特率: 19200bps Baud Rate: 19200bps
- 起始位: 1 位 Start Bit: 1
- 数据位: 8 位 Data Bits: 8
- 停止位: 1 位 Stop Bit: 1
- 校验位: 无 Parity Bit: None

- 流控制: 无 Flow Control: None

4.4.2 控制命令 COMMAND

序号 No.	命令 Command		功能 Function
	ASCII 码 (大写) ASCII Code (Capital)	ASCII 码对应的 十六进制(HEX) HEX ASCII corresponding Hexadecimal	
1	O	0x4F	开启激光, 激光开启后模块返回字符串:",OK!" Turn ON laser, and module returns string: ",OK!"
2	C	0x43	关闭激光, 激光关闭后模块返回字符串",OK!" Turn OFF laser, and module returns string: ",OK!"
3	S	0x53	读取模块状态, 模块返回状态字符串: "18.0'C, 2.7V", 分别代表模块当前温度和输入电压 Read module status, and module returns strings including current temperature and input voltage, e.g.: "18.0'C, 2.7V", means current temperature is 18.0°C, and input voltage is 2.7V.
4	D	0x44	启动自动测量过程, 模块返回包含测量距离和测量信号质量的字符串, 如: "12.345m,0079", 表示测量距离为 12.345 米, 信号质量为 79。 注意: 1. 测量距离如果不足 10 米, 那么 10 米位置由空格字符占位, 保证返回的距离字符串长度不变; 2. 信号质量值越小表示信号质量越好, 这个值越大表示反射信号越差; 3. 自动测量会根据反射面情况, 在保证测量精度的前提下, 自动旋转不同的测量速度; 4. 当测距不成功, 该命令会返回错误报告字符串":Er.XX!", 其中 XX 表示不同的错误号, 具体错误号请查看错误号列表。 Turn on auto measurement mode, module returns strings including measurement result and signal quality, e.g.: "12.345m,0079", means measuring distance is 12.345M, and SQ is 79. NOTICE: 1. If the distance is less than 10 metres, then ten's digit would be replaced by a space character, in order to remain strings length; 2. The smaller signal quality value, the higher signal quality,

			<p>and vice versa;</p> <p>3. In prerequisite of ensuring measurement accuracy, auto measurement would change the measuring speed automatically according to the reflection condition;</p> <p>4. When measurement is failed, the command will return error report string ": Er.XX!", where XX stands for different error codes, please check the error codes chapter for details.</p>
5	M	0x4D	<p>启动慢速测量过程，返回字符串和 D 命令一样。该命令的测量速度最慢，但是测量精度最高。</p> <p>Turn on slow measurement, module returns strings like Command D. The measuring speed is the lowest but with the highest accuracy under this command.</p>
6	F	0x46	<p>启动快速测量过程，返回字符串和 D 命令一样。该命令的测量速度最快，但是测量精度最低，在反射面差的情况下，可能会出现错误的测量结果。通常该命令用于反射良好的测量情况下。</p> <p>Turn on fast measurement, returns strings like command D. The measuring speed is the highest, but the accuracy is the lowest of this command. In poor reflection conditions, it may return wrong measuring results. This command usually uses in good reflection situations.</p>
7	V	0x56	<p>查询模块版本信息，返回字符串如："1702250029,29456"。其中 1702250029 为模块序列号，29456 为软件版本信息。</p> <p>Check module version, returns strings like: "1702250029,29456". 1702250029 is the model serial number, and 29456 is software version.</p>
8	X	0x58	<p>关闭模块，关闭模块的同时需要将 PWR_ON 引脚拉低</p> <p>Turn off the module, and lower the PWR_ON pin at the same time.</p>

4.4.3 连续测量模式 Continuous Measurement

连续测量模式适用于所有测量过程，如自动测量过程、慢速测量过程和快速测量过程。

- 进入连续测量：将模块的连续测量控制引脚拉 P13.nCTRL 低后，再输入 D/M/F 三个命令中的一个后，那么模块就会开始连续测量，测量的速度根据 D/M/F 三个命令进行。
- 退出连续测量：测量过程中将模块的连续测量控制引脚 P13.nCTRL 再次拉高，连续测量立即停止。

Continuous measurement can be used on all measurement modes: auto measurement, slow

measurement and fast measurement.

- Enter continuous measurement: after pulling the control pin P13.nCTRL lower, enter D or M or F, the module will start measuring, the measuring speed is according to the command you just entered.
- Exit continuous module: Pull the control pin P13.nCTRL higher when the module is continuous measuring, the continuous measurement mode stop immediately.

4.4.4 测试软件操作 TESTING

1. 配置串口参数 SERIAL PORT CONFIGURATION PARAMETERS

将演示用的 USB 转串口插入计算机 USB 口，点击打开串口，并对串口的参数做如图 4-4 调整。

Insert the USB adapter for testing to computer, click open serial port, and set parameters as picture 4-4

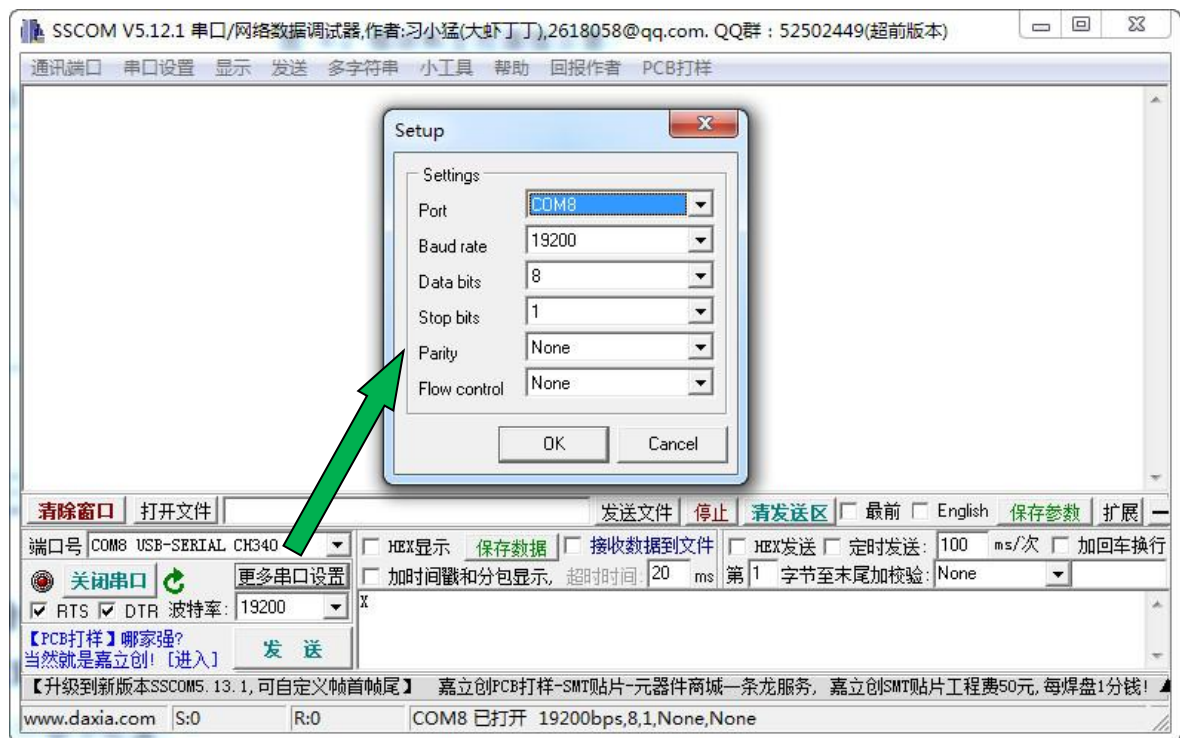


图 4-5 串口参数设置 parameters setting

2. 给模块上电 Power on

为了演示模块的基本功能，我们将测距模块的电源控制引脚 P7.PWR_ON 连接到了 USB 转串口模块的 DTR 引脚上，SSCOM 软件的 DTR 复选框选中的情况下，DTR 引脚输出低电平。同理，我们将测距模块的连续测量控制引脚 P13.nCTRL 连接到了 USB 转串口模块的 RTS 引脚上，当 SSCOM 软件的 RTS 复选框被选中，RTS 引脚输出低电平。

初次插入模块时，由于串口 RTS 和 DTR 初始电平问题会导致，测距模块已经上电。为了演示模块的上电功能，我们需要在初次插入 USB 转串口模块后，可以先发送关机"X"命令让模块关机，注意在发送"X"命令前，请先将 SSCOM 软件中的 RTS 和 DTR 复选框都选中，让

DTS 和 DTR 引脚均输出低电平，避免 USB 转串口模块通过这 2 条引脚给模块上电。具体过程可以查看 SSCOM 软件输出框中的第 1 行和第 2 行。

In order to demonstrate the basic functions of the module, if we connect power supply control pin of distance module P7.PWR_ON to DTR pin of the USB to serial port module, when the DTR check box of the SSCOM software is selected, the DTR pin output is low level. Similarly, if we connect the continuous measurement control pin P13.nCTRL of the distance measuring module to the DTS pin of the USB to serial port module, when the RTS check box of the SSCOM software is selected, the DTS pin output is low level.

When the module is first inserted, it has been powered on due to the initial level of the serial port RTS and DTR. In order to demonstrate the power-on function of the module, we can send power-off command "X" to turn off the module after we first insert the USB to serial port module. Please pay attention that, to avoid the module be powered on by USB to serial module through RTS and DTR pins, before sending command "X", we need to select RTS and DTR Check box of SSCOM software first, so that DTS and DTR pins are output low level. Specific process please views the first and second lines in the SSCOM software output box.

3. 基本命令演示 Basic Commands Demonstration

基本命令演示，直接在发送串口输入对应的命令即可。不需要勾选 HEX 发送，直接输入字符即可。图中依次演示了"O"开激光命令，"C"关激光命令，"S"模块状态获取命令，"V"模块版本信息获取命令，"D"自动测量过程命令，"M"慢速测量过程命令，"F"快速测量过程命令。

Basic commands demonstration, just enter commands through the sending serial port. No need to check HEX sent, enter characters directly. These commands are shown in following figure:

- "O": switch on the laser;
- "C": switch off the laser command
- "S": get module status;
- "V": get module version information;
- "D": automatic measurement;
- "M": slow measurement;
- "F": quick measurement.



图 4-6 基本命令演示 Basic Commands Demonstration

4. 连续测量演示 Continuous Measurement Demonstration

进行连续测量前，先将 SSCOM 软件的 RTS 复选框选中，此时 USB 转串口模块的 DTS 引脚将变低，由于模块的连续测量控制引脚 P13.nCTRL 连接到了该 DTS 引脚上，那么 P13.nCTRL 跟着变低，此时模块进入了连续测量模式，此时还没有输入 "D"/"F"/"M" 启动测量命令，所以测量还没有正式开始。

Before proceeding with the continuous measurement, select RTS check box of the SSCOM software, then the DTS pin of the USB to serial port module will be low. Since the module's continuous measurement control pin P13.nCTRL is connected to the DTS pin, P13.nCTRL goes low, too. At this moment the module enters continuous measurement mode. Meanwhile, no "D" / "F" / "M" command has been entered to start measurement, so the measurement has not yet started.

当模块已经处于连续测量模式下，输入 "D" 命令，将使测距模块进入连续的自动测量过程，如图所示：

When the module is already in continuous measurement mode, enter "D" command, will make the module into a continuous automatic measurement process, as shown:

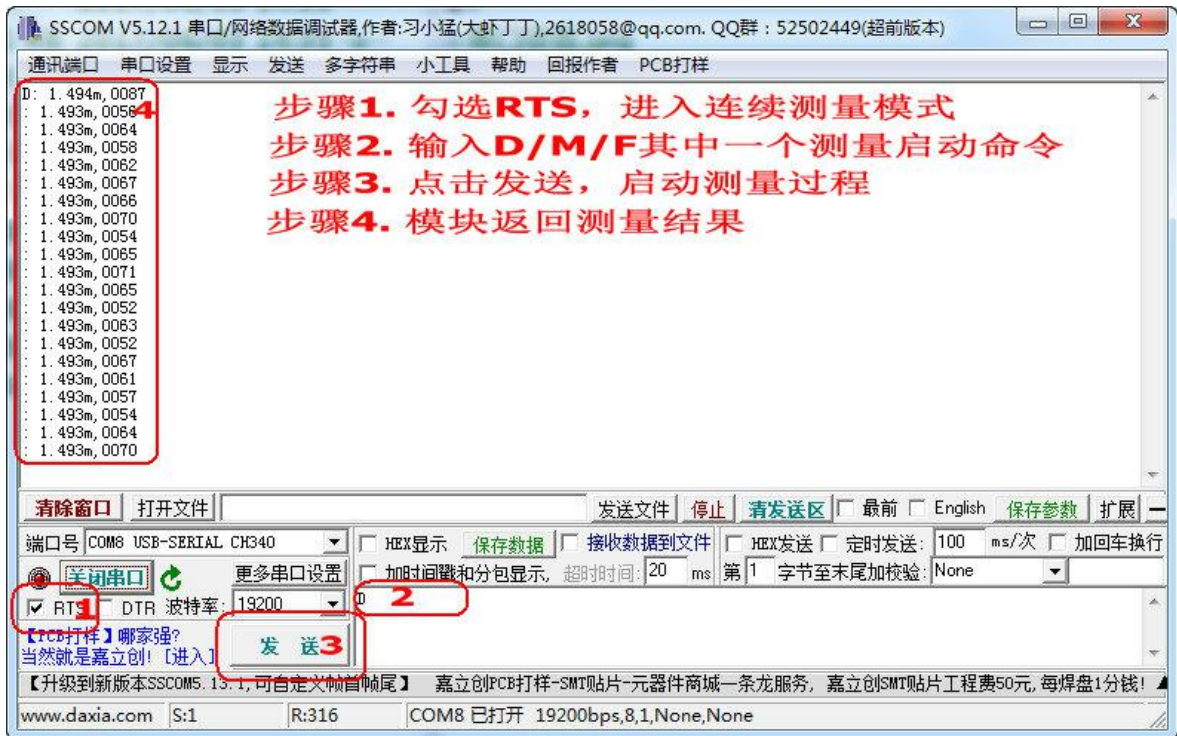


图 4-7 连续自动测量过程 Continuous Automatic Measurement Process

同理，其他两种模式，慢速测量过程和快速测量过程也可以在连续测量模式下进行，他们分别对应了连续慢速测量过程和连续快速测量过程。如所示：

Similarly, the other two modes, the slow measurement process and the fast measurement process can also be carried out in continuous measurement mode, which correspond to the continuous slow measurement process and the continuous fast measurement process. As shown:



图 4-8 连续慢速测量过程 Continuous Slow Measurement Process



图 4-9 连续快速测量过程 Continuous Fast Measurement Process

如果需要退出连续测量模式，那么只需要将 SSCOM 的 RTS 复选框关闭即可。

To exit the continuous measurement mode, uncheck RTS check box of SSCOM software.



图 4-10 退出连续测量 Exit the Continuous Measurement Mode

4.4.5 错误代码 Error Codes

表 4-2 系统错误码 Table 4-2 Error Codes

序号 No.	错误码 Error Codes	错误及应对措施 Errors and Solutions
1	:Er01!	输入电压太低, < 2.0V。检查输入电源是否正常 The input voltage is too low, <2.0V. Check the input power, make sure it is normal
2	:Er02!	内部错误, 重新开机无果后返修 Internal error, re-start the module, if it is still not working, contact your supplier.
3	:Er03!	环境温度太低(< -20℃) Temperature is too low (<-20 °C)
4	:Er04!	环境温度太高(> +40℃) Temperature is too high (> +40°C)
5	:Er05!	测量目标超过量程, 保证测量目标在量程内 The target is out of the measurement range, ensure that measurement target is within the range
6	:Er06!	错误的测量结果, 再次测量 Invalid results, measure again

7	:Er07!	环境光太强，遮光处理 Background light is too strong, shading
8	:Er08!	反射信号太弱，加强被测目标反光 Reflected signal is too weak, strengthen the measured target reflection
9	:Er09!	反射信号太强，降低被测目标反光 Reflected signal is too strong, reduce the measured target reflection
10	:Er10!	硬件错误 1，重新开机无果后返修 Hardware error 1, re-start the module, if it is still not working, contact your supplier.
11	:Er11!	硬件错误 2，重新开机无果后返修 Hardware error 2, re-start the module, if it is still not working, contact your supplier.
12	:Er12!	硬件错误 3，重新开机无果后返修 Hardware error 3, re-start the module, if it is still not working, contact your supplier.
13	:Er13!	硬件错误 4，重新开机无果后返修 Hardware error 4, re-start the module, if it is still not working, contact your supplier.
14	:Er14!	硬件错误 5，重新开机无果后返修 Hardware error 5, re-start the module, if it is still not working, contact your supplier.
15	:Er15!	模块抖动过大，稳定测距模块后重新测量 The jigger of module is too large, stable the module and measure again.
16	:Er16!	硬件错误 6，重新开机无果后返修 Hardware error 6, re-start the module, if it is still not working, contact your supplier.
17	:Er17!	硬件错误 7，重新开机无果后返修 Hardware error 7, re-start the module, if it is still not working, contact your supplier.

5. 结尾 END