The Computer Stand-alone Test Reference Scheme of the Version of TFmini Plus_I^2 C v1.0

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1. Introduction

This scheme can realize a simple method of testing TFmini_Plus's I²C interface by connecting a USB-I²C converter available on the market to a computer.

The USB-to-I²C converter used in the scheme is not the product of Benewake (Beijing) Co. Ltd. If you need it, please buy it by yourself. Reference: （https://item.taobao.com/item.htm?id=530719835121

This scheme is applicable to TFmini_Plus firmware version v1.9.0 and above.

2. Tools

（1）USB-I²C converter： Yousheng Electronics USBCOM2I2C

This converter can be used directly in accordance with TFmini_IC protocol. Converters of other brands may not be used directly.

Fig.1 USBCOM2I2C

（2）TFmini_Plus

Fig.2 TFmini-Plus

（3）PC： windows operating system

（4）USB-TTL converter

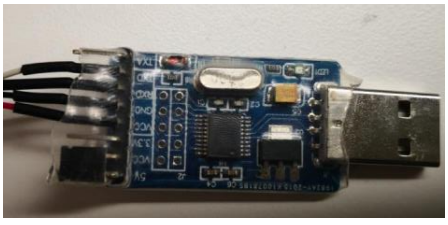

Fig.3 USB-TTL Converter

（5）Dupont wires:

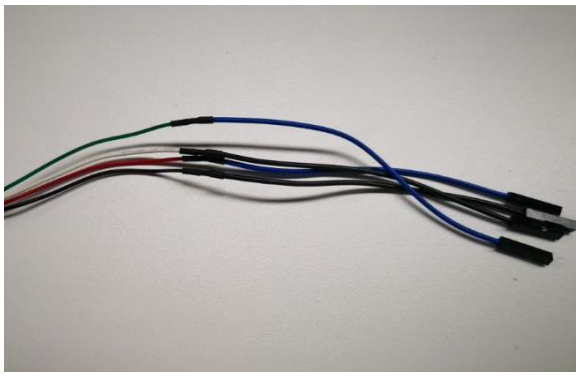

Fig.4 Wires

（6）Software：Serial Port Assistant（sscom5）

3. Set to I²C Communication Mode

TFmini-Plus defaults to TTL serial communication mode, which can be set to I²C communication mode by serial command. See Chapter 7.4 of the product manual for details.

Output mode	5A 05 05 01 65	5A 05 05 01 65	Standard 9 bytes（cm）	√
	5A 05 05 02 66	5A 05 05 02 66	String format（m）	/
	5A 05 05 06 6A	5A 05 05 06 6A	Standard 9 bytes（mm）	/
baud rate	5A 08 06 H1 H2 H3 H4 SU	5A 08 06 H1 H2 H3 H4 SU	set baud rate	115200
Output switch	5A 05 07 00 66	5A 05 07 00 66	Turn off data output	/
	5A 05 07 01 67	5A 05 07 01 67	data output	√
Communication Interface Settings	5A 05 0A MODE SU	/	0（UART）	UART
			1（I²C）	

Fig.5 Settings Command

The I²C communication mode command set to standard 9-byte (cm) format is:： **5A 05 0A 01 6A**

After successful setup, the radar will be changed into I²C communication mode, which is master-slave mode. Radar serves as slave, waiting for the host to send commands before uploading data, will not actively upload.

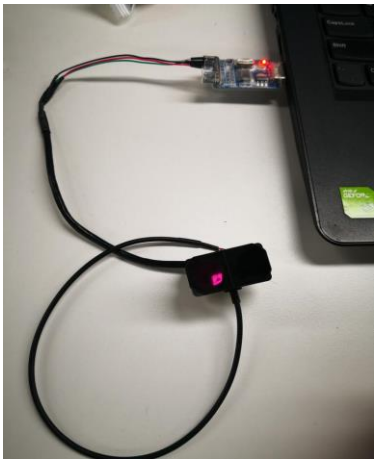

Fig.6 Connecting Radar and Computer with USB-TTL

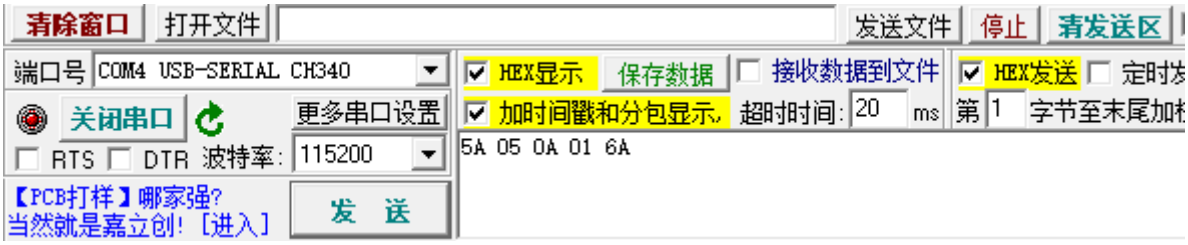

Fig.7 Example of serial assistant sending commands

4. I² C Connection

USB-I²C converter interface manual: (see product manual for details)

Signal	Type	Explain
SCL	Output	Bus-Clock
SDA	Input/output	Bus-Data
GND	Power Supply	Power ground
VCC	Power Supply	3.3V Voltage Output, Supporting Maximum Current 200MA
5V	Power Supply	5V voltage output depends on the power supply capability of USB interface

TFmini_Plus interface manual: (see product manual for details)

No.	Color	Corresponding PIN	Function	Comment
①	Red	PIN-1	+5V	Power supply
②	White	PIN-2	RXD/SDA	TTL Receiving/I² C data
③	Blue/Green	PIN-3	TXD/SCL/IO	TTL Transmitting/I² C Clock/IO
④	Black	PIN-4	GND	Ground

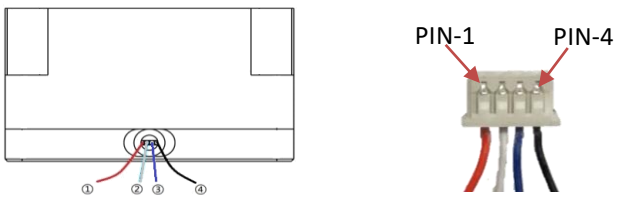

Fig.8 Definition of TFmini-Plus Pin

Connection：

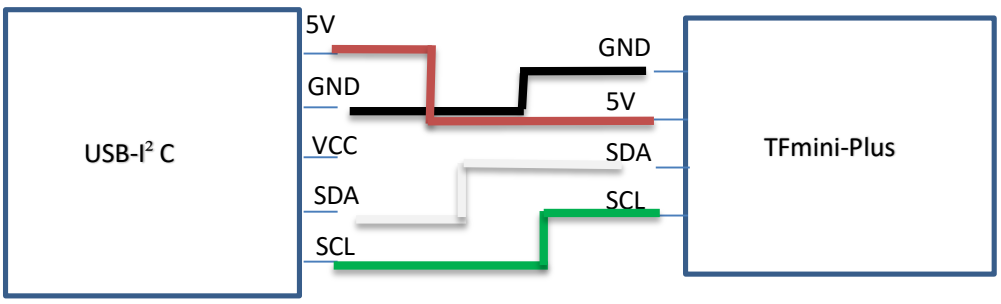

Fig.9 Connection Diagram of USB-I^{2}C and TFmini-Plus

5. I^{2}C Operating

（1）Connection

After connecting in the correct sequence, insert it into the computer USB interface. After the correct connection, a weak red light can be seen from the radar lens.

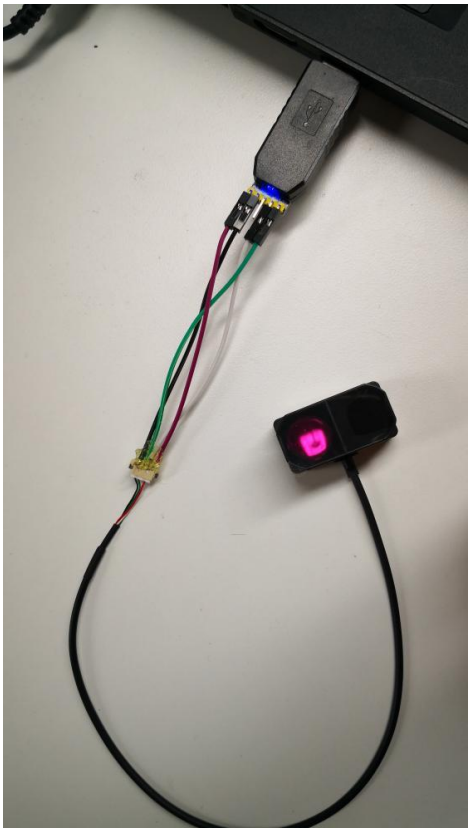

Fig.10 Correct Connection

（2）Acquiring radar value

Open the PC's serial assistant software, select the correct serial number (if there is no serial number, you may need to install the driver of this converter), the baud rate is 9600, and use hexadecimal to send and receive data.

Pay attention to canceling RTS selection.

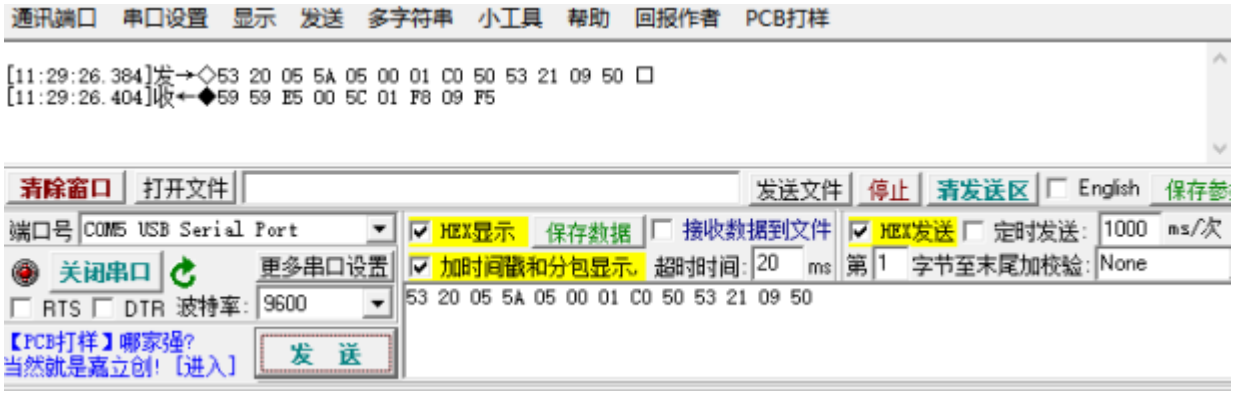

Fig.11 Serial Port Assistant Settings

Combining TFmini-Plus reading data sequence and USB-I²C adapter protocol, and using serial port to send corresponding reading commands.

Start	Addr	W	A	Byte0	A	---	ByteN	A	Stop	Wait 100ms	Start	Addr	R	A	Byte0	A	---	ByteN	A	Stop

Fig.12 the Data Sequence of TFmini-Plus I²C

Examples of reading commands: If the I²C slave address of TFmini-Plus is 0x10 (default factory), the computer reads the measuring distance of TFmini-Plus by serial port as follows:

53 20 05 5A 05 00 01 C0 50 53 21 09 50

Command explanation：

0x53： The S command of the USB-I²C adapter is used to initiate the start signal; (See the adapter manual for details)

0x20：slave address 0x10，write operation；（bits 7-1 represent address, bit 0 represent data read/write. for instannce, 0x10 in binary format is 00010000, bits 7-1 represent address, left shift one bit and bit 0 is set 0 , so it becomes 00100000, it's hexadecimal format is 0x20.）

0x05： Write 5 bytes of data；

0x5A： TFmini-Plus Data Protocol Frame Header；

0x05： This command frame contains 5 bytes of data；

0x00： Obtaining the ranging result;

0x01： Data format is 9 bytes hexadecimal， cm；

0xC0： Data checksum of this frame；

0x50： The P command of the USB-I²C adapter is used to initiate the stop signal;

0x53： The S command of the USB-I²C adapter is used to initiate the start signal;

0x21：slave address 0x10，read operation；（bits 7-1 represent address, bit 0 represent data read/write. for instannce, 0x10 in binary format is 00010000, bits 7-1 represent address, left shift one bit and bit 0 is set 1 , so it becomes 00100001, it's hexadecimal format is 0x21.）

0x09： Read 9 bytes of data；

0x50： The P command of the USB-I²C adapter is used to initiate the stop signal;

TFmini-Plus should return 9 bytes of data

For example, return 59 59 E9 00 5D 01 00 0A 03 :

0x59： Frame Header；

0x59： Frame Header；

0xE9：Dist_L: Distance value lower by 8 bits
0x00：Dist_H: Distance value higher by 8 bits
0x5D：Strength_L low 8 bits
0x01：Strength_H high 8 bits；
0x00：Temp_L low 8 bits
0x0A：Temp_H high 8 bits
0x03：Checksum is the lower 8 bits of the cumulative sum of the numbers of the first 8 bytes.

（3）Setting Radar Slave Address

Combining TFmini-Plus reading data sequence and USB-I^{2}C adapter protocol, and using serial port to send corresponding reading commands.

The current configurable parameter list of TFmini-Plus is detailed in Chapter 7.4 of the TFmini-Plus manual.

Example of setting radar address command: If you want to change radar address 0x10 to 0x11, the command of setting TFmini-Plus slave address through serial port is as follows:

53 20 05 5A 05 0B 11 7B 50

Command Interpretation：
0x53：The S command of the USB-I^{2}C adapter is used to initiate the start signal; (See the adapter manual for details)
0x20：slave address 0x10，write operation；（bits 7-1 represent address, bit 0 represent data read/write.
0x05：Write 5 bytes of data；
0x5A：TFmini-Plus Data Protocol Frame Header；
0x05：This command frame contains 5 bytes of data；
0x0B：Change the slave address command field;
0x11：the new slave address；
0x7B：Data checksum of this frame；
0x50：The P command of the USB-I^{2}C adapter is used to initiate the stop signal;

Tip: After changing the LiDAR address, the LiDAR needs to be powered back on to take effect. The new address should be marked to avoid inconvenience.

（4）Switching from I^{2}C mode to TTL serial mode

Examples of commands for switching radar address 0x10 from I^{2}C to TTL serial mode:

53 20 05 5A 05 0A 00 69 50

After switching over, the radar is re-energized, and TTL serial communication can be tested by using TTL serial port adapter board.

6. Compatible commands with TFmini-I^{2}C

TFmini-Plus I^{2}C data reading can also be compatible with TFmini-I^{2}C data reading format.

Examples of reading commands: If the I^{2}C address of TFmini-Plus is 0x10, then the command for computer to read the measuring distance of I^{2}C of TFmini-Plus through serial port is as follows

53 20 03 01 02 07 53 21 07 50

Command Interpretation：

0x53：The S command of the USB-I²C adapter initiates the start signal; (Watch the adapter manual for details)

0x20：Slave address is 0x10, WRITE operation; (The upper 7 bits represent the address, the lowest bit represents the read/write)

0x03：Write 3 bytes of data;

0x01：The upper 8 bits of the slave register address;

0x02：The lower 8 bits of the slave register address;(Read the data of LiDAR, the register address is 0x0102, watch the TFmini-I²C instruction manual for details)

0x07：The bytes of range information, etc;

0x53：The S command of the USB-I²C adapter initiates the start signal;

0x21：Slave address is 0x10, READ operation; (The upper 7 bits represent the address, the lowest bit represents the read/write)

0x07：Read 7 bytes of data;

0x50：The P command of the USB-I² C adapter initiates the stop signal;

TFmini-I²C should return 7 bytes of data, namely Trigger_Done, 0x00, Dist_L, Dist_H, Strength_L, Strength_H and Modes.

For example, return 01 00 D6 00 6C 00, data interpretation as follows:

0x01：Current frame measurement results;

0x00：Fixed value;

0xD6： Dist_L: Distance value lower by 8 bits

0x00：Dist_H: Distance value higher by 8 bits

0x6C：Strength_L low 8 bits；

0x00：Strength_H high 8 bits；

0x00：NC。