1 Secondary development guide

ComXim Programmable Series Electric Turntables series of turntable support and platform independent Secondary development interface, neither requires the library function and does not need static or dynamic link library. So there is no need for DLL and related code files. So as to ensure that any platform, any development language as long as the control side to support the WIFI network will be able to achieve the control of the turntable. Users that need Secondary development can use the CT command control and operation of the turntable, and according to their own needs, to develop their own needs of the turntable control software.

CT command : Controlling the ComXim programmable electric turntable is very straightforward. ComXim provides a complete set of control commands for the turntable, including:

- Angle Control: Adjust the rotation angle of the turntable.
- Speed Control: Set the speed at which the turntable rotates.
- Action Control: Specify and manage various rotational actions.
- Combined Behavior Control: Create complex sequences of actions and behaviors.

After completing the specified control actions, the turntable sends feedback messages back to the controlling device.

Whether you are using a USB interface (which, after installing the driver, appears as a COM port in the operating system), Bluetooth, or WiFi to connect to the turntable, the control commands remain the same. The difference between COM (USB), Bluetooth, and WiFi is primarily in the connection process. Once successfully connected, the programming and control commands are identical across all connection methods.

1.1 CT command for the secondary development (WIFI)

Only need a simple 2 step can be achieved on the turntable control, following the form of pseudo code examples how to carry out the two development.

The first step developer in their own programming environment to create a socket instance, and connect the turntable.

Pseudo code examples:

```
Socket *mysocket ;
mysocket = new Socket();
mysocket->connectHost(192.168.181.181,8181);
```

The second step is to control the rotation of the turntable, Next call the Socket class to send the function to send the CT command string.

Pseudo code examples:

/ / Note: send commands let a single turntable rotates 10 degrees clockwise inverse method.

```
mysocket->send("CT+TRUNSINGLE(1, 10);");
```

Note: in the above example, "CT+TRUNSINGLE (1,10);" . "Send ()" is string transfer function of Socket class. CT command begins with CT, with ";" at the end. (all text is the English characters). Return command from turntable begins with "CR", with ";" at the end. (all text is the English characters).

You can also use the third party telnet tool to send these CT commands to control the turntable, such as secure*CRT*, putty, etc..

Details of the CT command to download hyperlinks :

https://www.comxim.com/development-kit/

1.2 Secondary development of command detailed

Secondary development commands include:

- CT command: the terminal is sent to the terminal equipment, and equipment orders (with respect to the terminal is sent, T or Transmit).
- Cr report: equipment - > terminal, equipment receives the terminal command to equipment to the terminal sends back to report information (with respect to the terminal is received, i.e. r receive). This feature can be turned on or off by "CT+ACK (onOff);" command.
- Event: equipment - > terminal equipment to complete a certain action, sent to the terminal event information. This feature can be turned on or off by "CT+EVENT (onOff);" command.
- Heartbeat mechanism: terminal equipment for the < - > communication link between the terminal equipment and detection. Through the device and the terminal mutual communication link detection (heartbeat) bytes, to inform the other side of the connection status. This feature can be turned on or off by "CT+HEARTBEAT (onOff);" command.
- Error code: terminal equipment - > when the device receives an error command, to inform the terminal error code form.

Below through a few examples of the Secondary development of the command usage:
Example 1: terminal to send a legitimate command to the device, the terminal receives the command and execution.
//This case involves the CT command, CR report, EVENT event.

- To send "CT+TRUNSINGLE - terminal equipment (0,30); command;
- The equipment after receipt of order to report back to the "CR+OK;" to the terminal, and execute the command, which left (clockwise) 30.
- L equipment executed action turn left (30 degrees), to the terminal sends event event "CR+EVENT=TB_END end;" and inform the terminal device performs an action completed.

Example 2: terminal to send an illegal command to the device, the terminal receives the command to return the error code.
// This case involves the CT command error code.

- To send "CT+TRUNSINGLE - terminal equipment (ABC, 30);" command, the first parameter (ABC number) illegal;
- The equipment after receiving the command, the feedback error code "CR+ERR=71;", namely first CT commands

(=71-70) parameters of non numeric error.

Example 3: device and terminal heartbeat mechanism test.

/ / this case involves the heartbeat mechanism.

- terminal and the device is connected properly and equipment intervals 1s to terminal sends a byte of #, terminal also intervals 1s sent to the device a a # bytes.
- The terminal stop sending "#" bytes.
- equipment for some time (3S) did not receive "#" a byte, and did not receive the order a CT, then enter the heart lost state, then every interval 1s send string ### inform terminal heartbeat lost.
- Every 1s to re - terminal equipment sends a "#" byte.
- equipment received "#" byte, or received a CT command and exit heartbeat lost state and subsequent device every interval 1s to terminal sends a # bytes.

Be careful：

- equipment received CT command equivalent to receive heartbeat byte "#", namely equipment for some time (3S) not received "#" bytes, and did not receive the order a CT, then enter the heart lost; equipment received "#" a byte, or received a CT command, out of the heart lost state.
- terminal can also through similar mechanisms, such as a period of time (3S) did not receive "#" bytes of event or report back, then enter the heart lost state, then every interval 1s send string ### inform equipment heartbeat lost.

1.2.1 CT command（Terminal->Eequipment）

1.2.1.1 Base command

Format	Parameters number	Meaning
CT();	0	CT Startup Test
CT+ACK(onOff);	1	Return switch (default) ● OnOff: 0: close 1: open (default)
CT+EVENT(onOff);	1	Event switch (by default) ● OnOff: 0: close 1: open (default)
CT+HEARTBEAT(onOff);	1	Heartbeat switch (default) for link detection ● OnOff: 0: close 1: open (default)
CT+IRDISABLE(onOff);	1	Infrared remote controller to enable switch ● OnOff: 0: no (not to enable) 1: is (to enable)
CT+SPKMUTE(onOff);	1	Turntable mute switch ● OnOff: 0: not mute (default) 1: Mute

CT+SAVECONF(); 	0	Save device configuration, keep content as follows: Turntable parameters: 1 rotation direction: 0: turn left (clockwise), 1: turn right (counter clockwise) 2 rotation mode: 0: continuous, 1: intermittent, 3: swing (temporarily not supported) 3 automatic shutter: 0: non automatic, 1: automatic 4 rotation angle: rotation angle (positive floating point number, unit degree) 5 pause time: positive integer, unit second 6 repeat number: positive integer, unit time 7 rate level: positive integer (over the maximum rate of the turntable support is the maximum rate of the turntable to take maximum rate)
CT+GETCONF(); 	0	Retrieve the saved device configuration. Refer to the return values listed in the CT+SAVE command.
CT+GETDEVICEINFO(); 	0	Return values are as follows: +DID: Device ID +DNAME: Device Name +HVER: Hardware Version +FVER: Firmware Version +CTVER: CT Command Version +INTER: International Identifier

1.1.1.1 Control command

Format	Parameters number	Meaning
CT+SETSTOP(); 	0	Set the turntable to stop.
CT+SETSPEED(speedGrade); 	Set the turntable speed grade:	Set the turntable speed grade: ● **speedGrade**: A positive integer ranging from 0 to 127. If the value is out of this range, an error will be reported. However, if the value is within the 0 to 127 range but exceeds the maximum speed grade supported by the turntable, the turntable will use the maximum supported speed. For example, if the device's current speed grade is 5, after executing the CT+SETSPEED(3) command, the turntable's speed grade will be set to 3.
CT+CHANGESPEED(speedUpOrDown); 	1	Change the current turntable speed grade: ● speedUpOrDown:

		0: Decrease speed (reduce speed grade by 1 level) 1: Increase speed (increase speed grade by 1 level)
CT+SETZERO();	0	Set the current position of the turntable to 0.
CT+TOZERO();	0	Reset the turntable to the previously set 0 position.
CT+SETDIR(direction);	1	Set the turntable rotation direction (only sets the direction of rotation): ● **direction**: 0: Left turn (clockwise) (default) 1: Right turn (counterclockwise)
CT+SETMODE(turnMode);	1	Set the turntable rotation mode: ● **turnMode:** 0: Continuous rotation mode (default) 1: Intermittent rotation mode (rotates and pauses at intervals) 2: Swing rotation mode
CT+SETAUTOSHUTTER(onOff);	1	Set automatic shutter ● On**Off:** 0: not automatic 1: automatic (default)
CT+SETANGLE(angle);	1	Set the turntable's single rotation angle (used for non-continuous rotation modes): ● **angle**: Rotation angle (positive floating-point number or fraction, in degrees) For example: CT+SETANGLE(22.5); sets the angle to 22.5 degrees, which is equivalent to 360/16. CT+SETANGLE(360/16); sets the angle to 360/16 degrees, which is equivalent to 22.5 degrees. 360.0/16.0, 360.0/16, and 360/16.0 are also valid. Both methods of setting are equivalent, with the latter being convenient for configuring how many times the turntable stops per rotation.
CT+SETPAUSETIME(seconds);	1	Set the turntable pause duration (used for non-continuous rotation modes): ● **seconds**: Pause duration (positive integer, in seconds)
CT+SETREPEATTIMES(times);	1	Set the turntable repeat count (used for non-continuous rotation modes): ● **times**: Number of repeats (positive integer, in counts)

CT+START(direction,turnMode,shutter,angle,seconds,times);	6	Set the turntable to rotate multiple times. This is a combined action command. You must master this command as it is very useful and simplifies your control. The Direction determines the rotation direction, turnMode determines the rotation mode, and shutter determines whether to output the shutter during the pause in intermittent mode. Angle determines the degree of rotation for each cycle in intermittent mode, seconds determines the pause time after completing the angle rotation, and times determines how many times to repeat the rotation of the specified angle. ● **direction** (Rotation Direction): 0: Left turn (clockwise) 1: Right turn (counterclockwise) ● **turnMode** (Rotation Mode): 0: Continuous rotation mode (default) 1: Intermittent rotation mode (rotates and pauses at intervals) 2: Swing rotation mode ● **shutter** (Automatic Shutter): 0: Do not automatically output the shutter 1: Automatically output the shutter ● **angle** (Rotation Angle): The angle of rotation (positive float, in degrees) ● **seconds** (Pause Time): Positive integer, in seconds ● **times** (Repeat Times): Positive integer, in times For example, CT+START(1,1,1,90,3,4); sets the turntable to rotate to the right (direction=1) in an intermittent mode (turnMode=1), rotating 90 degrees each time (angle=90). After each 90-degree rotation, it pauses for 3 seconds (seconds=3), and this 90-degree rotation is repeated 4 times (times=4). During each pause after the 90-degree rotation, it triggers the shutter to take a photo (shutter=1).
CT+TRUNSINGLE(direction,angle);	3	Set the turntable to rotate in the direction specified by direction for a single rotation with an angle of angle. ● **direction** (rotation direction): 0: Rotate left (clockwise) 1: Rotate right (counterclockwise) ● **angle** (rotation angle): The angle of rotation (positive floating-point number, in degrees)

1.1.1.2 Extended command

Format	Paramete	Meaning

	rs number	
CT+CAMERACTRL(focusOnOff,captureOnOff);	1	Camera control FocusOnOff: 0: focus stop 1: focus start CapturesOnOff: 0: photo stop 1: take photos to start

1.1.2 CR return information（Eequipment -> Terminal）

This feature can be turned on or off by "CT+ACK (onOff);" command.

Format	Meaning
CR+OK;	Indicates that the turntable receives commands correctly.
CR+ERR=param;	Param for the error code, see the error code definition.

1.1.3 Event（Eequipment -> Terminal）

This feature can be turned on or off by "CT+EVENT (onOff);" command.

Format	Meaning
● CR+EVENT=param; The turntable returns the message “CR+EVENT=param;”. This function can be enabled or disabled using the command “CT+EVENT(onOff);”.	● param is an event parameter: CR+EVENT=TB_PAUSE;: Indicates that the turntable is paused. In intermittent rotation mode, this message is sent when the turntable has rotated a specified angle and then pauses. CR+EVENT=TB_END;: Indicates that the action is complete. This message is sent when the turntable has finished all the actions, such as completing the ″times rotations″ specified in the CT+START(direction, turnMode, shutter, angle, seconds, times); command and completing all the actions specified by the command.

1.1.4 Heartbeat mechanism（Eequipment < -> Terminal）

Communication link detection between a device and a terminal. Through the device and the terminal mutual communication link detection (heartbeat) bytes, to inform the other side of the connection status.
This feature can be turned on or off by "CT+HEARTBEAT (onOff);" command.

Format	Meaning
″#″or″###″	The equipment and equipment send heartbeat byte #″. Under normal circumstances, each interval of 1s to the terminal equipment sends a ″#″ byte. If the equipment for a period of time (3S) did not receive ″#″ a byte, and did not receive the order a CT, then enter the heart lost state, then every interval 1s send string″###″inform terminal heartbeat lost, until the equipment received ″#″ byte exit heartbeat lost state.

1.1.5 Error code

The error code is the parameter of the CR return (CR+ERR=param).
This feature can be turned on or off by "CT+ACK (onOff);" command.

错误码定义	设备返回命令	含义
31	CR+ERR=31;	Command receive timeout error
40	CR+ERR=40;	The device does not support the command, or the command input is incorrect.
41	CR+ERR=41;	CT command ultra short, less than 5 characters (such as shorter than the shortest command "CT ();")
42	CR+ERR=42;	CT command header error (if not for "CT"), pay attention to Chinese and English input
43	CR+ERR=43;	CT command connection error (if not "+"), pay attention to Chinese and English input
45	CR+ERR=45;	CT command parameters start with errors (if not "("), pay attention to Chinese and English input
46	CR+ERR=46;	CT command parameter end error (if not), pay attention to the input in English
48	CR+ERR=48;	CT command tail error (if not ";"), pay attention to Chinese and English input
51	CR+ERR=51;	CT command name character long
52	CR+ERR=52;	CT command name illegal
61	CR+ERR=61;	CT command parameter for null character
62	CR+ERR=62;	CT command parameter character
63	CR+ERR=63;	CT command number of parameters out limit
64	CR+ERR=64;	CT command number of parameters does not match
70	CR+ERR=70;	CT command parameters non numeric (71~79 corresponding to the 1~9 parameters of the error)
80	CR+ERR=80;	The CT command parameter is a numeric value that goes beyond the valid range (the 81~89 corresponding to the error of the first 1~9 parameter)

2 Using COM Port to Control the Turntable: Example with C# and Visual Studio

Here's a step-by-step guide for controlling a turntable using COM port commands, with C# as the programming language in Visual Studio:

2.1 Create a Project in Visual Studio

2.1.1 Open Visual Studio.

2.1.2 Create a new project:

2.1.2.1 Go to **File > New > Project**.

2.1.2.2 Choose a **Windows Forms App (.NET Framework)** or **Console App (.NET Framework)**, depending on your preference.

2.1.2.3 Name your project and click **Create**.

2.1.3 Establish a Serial Port Connection

2.1.3.1 In the Solution Explorer, right-click on your project and select **Add > New Item**.

2.1.3.2 Choose **SerialPort** from the available options. This will add a SerialPort component to your project, named serialPort1 by default.

2.2 Configure the Serial Port

1. Double-click on the serialPort1 component in the Designer view to open its properties.
2. Set the following properties:
   - **BaudRate**: 115200
   - **Parity**: None
   - **DataBits**: 8 (default, unless otherwise specified)
   - **StopBits**: One (default, unless otherwise specified)
   - **HandShake**: None

2.3. Write Commands to Control the Turntable

1. To open the serial port connection, add the following code in your form's or application's initialization routine:

   ```
   serialPort1.Open();
   ```

2. To send a command to the turntable, use the Write method of the SerialPort class. For example, if you want to use the command CT+START(1,1,1,90,3,4);, your code would look like this:

   ```
   serialPort1.Write("CT+START(1,1,1,90,3,4);");
   ```

   Command String Examples

Example 1:

Command: CT+START(1,1,1,90,3,4);
Description:
Direction: 1 (Right/Counterclockwise)
Turn Mode: 1 (Intermittent Rotation)
Angle: 90 degrees
Pause Time: 3 seconds after each 90-degree rotation
Times: 4 rotations
Shutter Control: 1 (Trigger the shutter to take a photo after each pause)

Example 2:

Command: CT+START(0,1,1,90,3,4);
Description:
Direction: 0 (Left/Clockwise)
Turn Mode: 1 (Intermittent Rotation)
Angle: 90 degrees
Pause Time: 3 seconds after each 90-degree rotation
Times: 4 rotations
Shutter Control: 1 (Trigger the shutter to take a photo after each pause)

Complete Example Code

Here's a simple example of a C# application to send a command to the turntable:

csharp

```
using System;
using System.IO.Ports;
using System.Windows.Forms;

public partial class Form1 : Form
{
    public Form1()
    {
        InitializeComponent();

        // Set up the serial port
        serialPort1.BaudRate = 115200;
        serialPort1.Parity = Parity.None;
        serialPort1.DataBits = 8;
        serialPort1.StopBits = StopBits.One;
        serialPort1.Handshake = Handshake.None;

        // Open the serial port
        try
```

```
            {
                serialPort1.Open();
                MessageBox.Show("Serial port opened successfully.");
            }
            catch (Exception ex)
            {
                MessageBox.Show("Error opening serial port: " + ex.Message);
            }
        }

        private void SendCommand(string command)
        {
            if (serialPort1.IsOpen)
            {
                try
                {
                    serialPort1.Write(command);
                    MessageBox.Show("Command sent: " + command);
                }
                catch (Exception ex)
                {
                    MessageBox.Show("Error sending command: " + ex.Message);
                }
            }
            else
            {
                MessageBox.Show("Serial port is not open.");
            }
        }

        private void buttonSendCommand_Click(object sender, EventArgs e)
        {
            SendCommand("CT+START(1,1,1,90,3,4);");
        }
}
```

Important Notes:

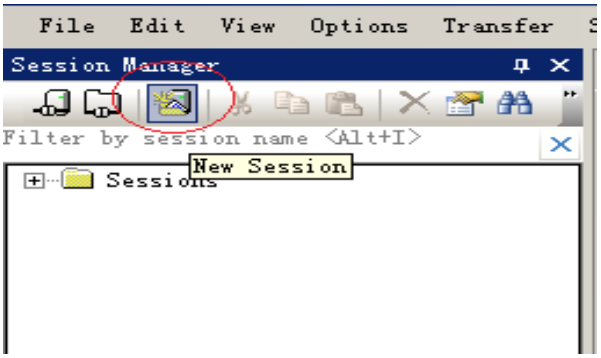
- Ensure the turntable is properly connected and powered on before sending commands.
- Always handle exceptions and errors in communication to prevent crashes and handle connection issues gracefully.
- Customize the commands as needed based on the turntable's specifications and required actions.

3 CT command common debugging tools

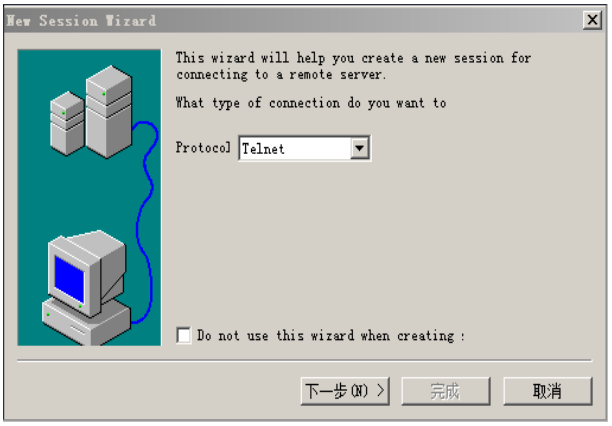
Users for the first time using the CT command, it is recommended to use the following sections of the introduction of the third party Telnet tools, this chapter, respectively, SecureCRT, Windows super terminal as an example.
Note: SecureCRT, Windows this product with non super terminal software, please users from legitimate channels.

3.1 SecureCRT

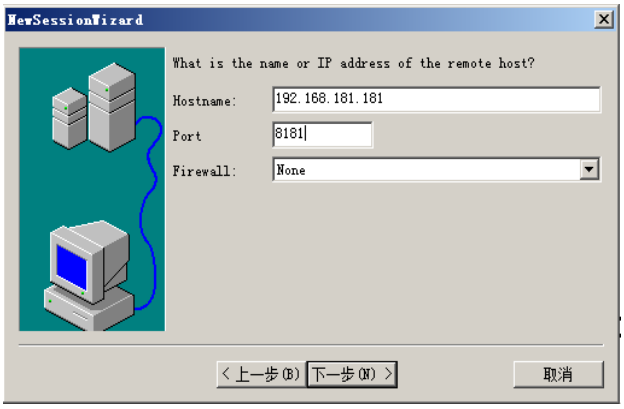
Step1: create a session, as shown in the figure below and click the button to create a session.



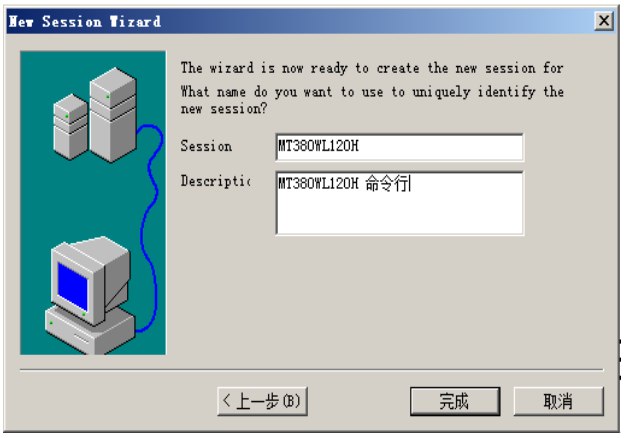
Step2: protocol type selection Telnet.



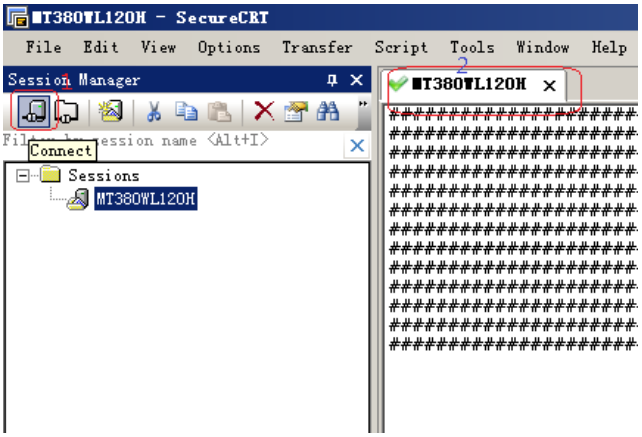
Step3: fill in the MT380/600WL series turntable IP address and port number, IP address: 192.168.181.181, port number: 8181.



Step4: fill in your favorite session name, this example is named MT380WSL120H, click Finish button.

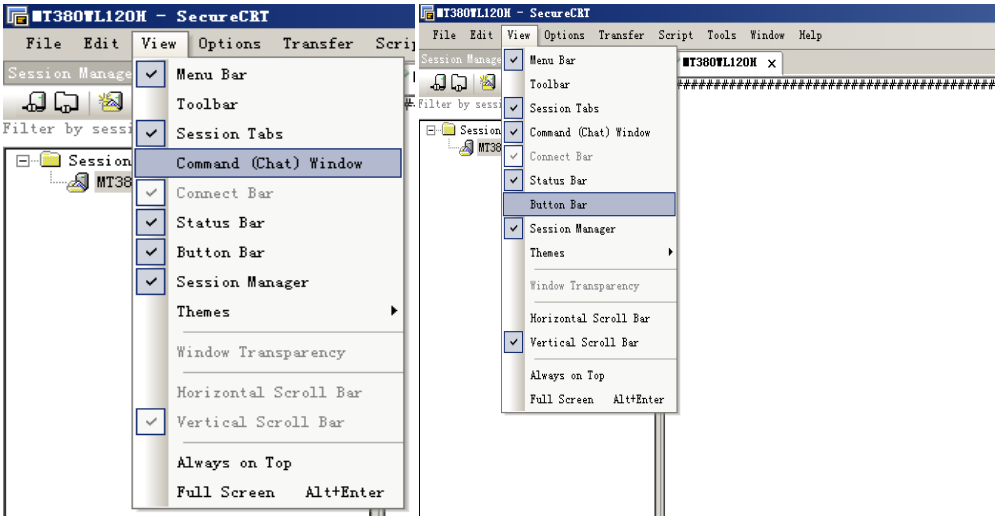


Step5: click the connect button connected devices, the form on the right side of the software will continue to receive communication link detection character (character of the heartbeat) "#" that equipment, software and the connection is successful.



Step6: this device is connected to complete. The following tips for SecureCRT, familiar with the user to skip.

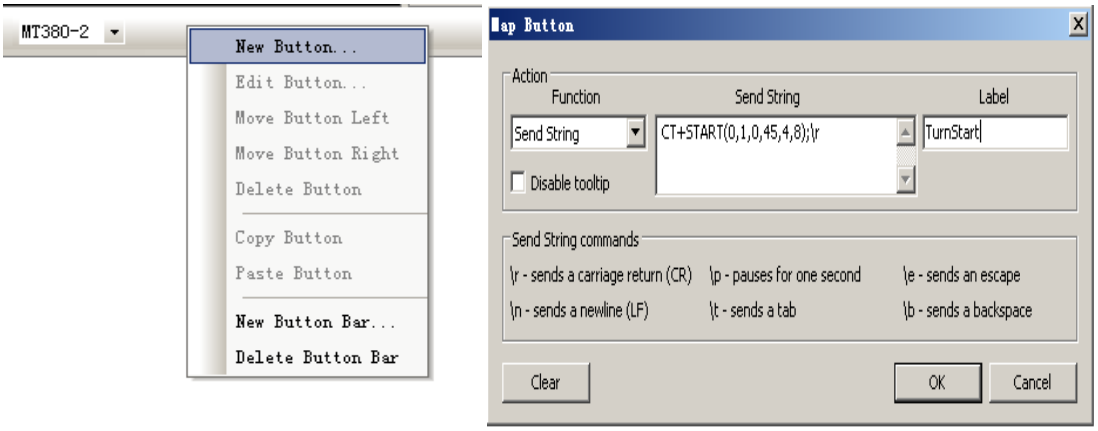
a) SecureCRT to open the command window and custom button toolbar.



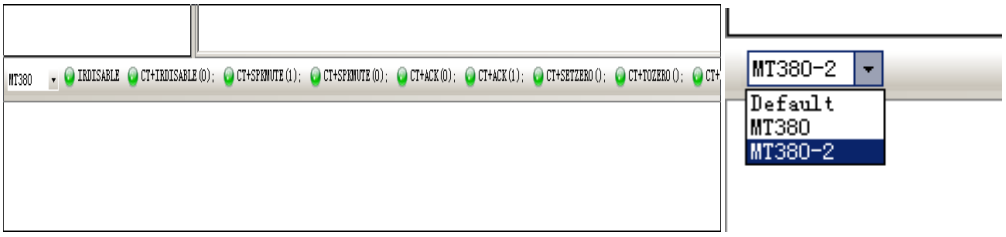
b) Create a new button toolbar and add a button to the toolbar named MT380-2.



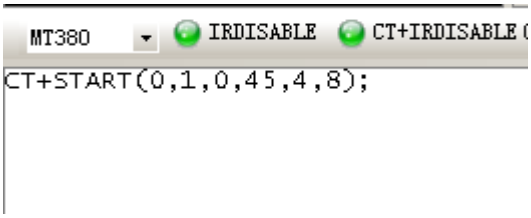
c) New shortcut button and add a button to press the time to send the string, SecureCRT needs to be added at the end of the command "\r", CT+START (0,1,0,45,4,8); \r.



d) In accordance with their own needs to add a number of buttons and common control buttons.



e) Or directly in the command input text box, enter the command, enter the next issue.

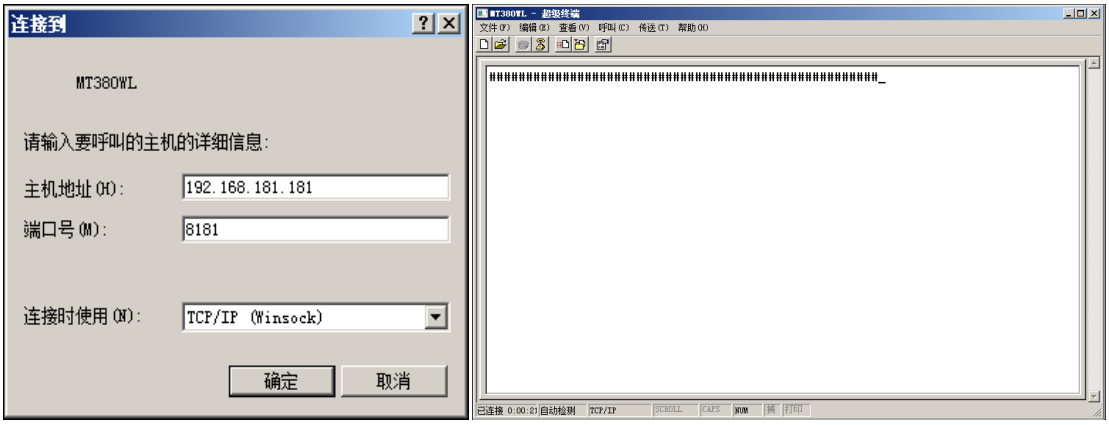


3.2 Windows super terminal

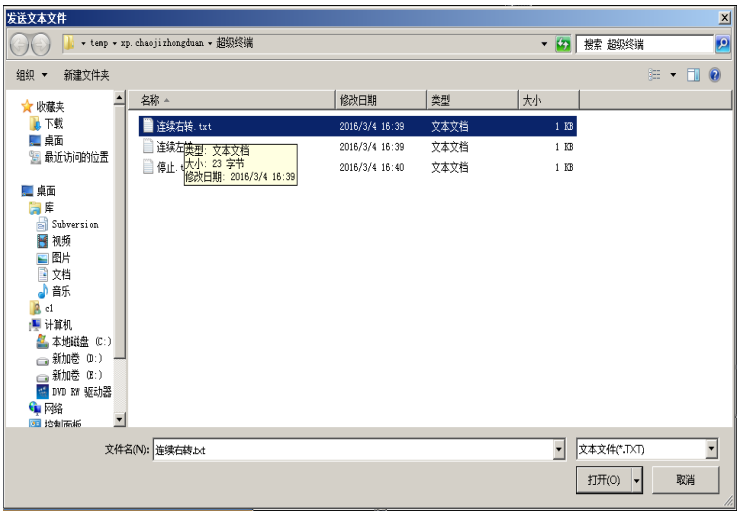
Step1: Open the super terminal, type the name of the user's favorite.

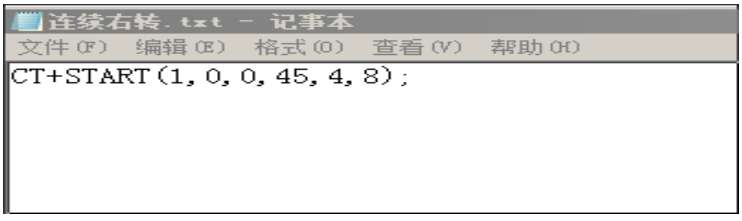


Step2: Input turntable IP address and port number. Connect to use: TCP/IP (WinSock), click ok. After the connection, automatically receive the communication link from the character "# test turntable".

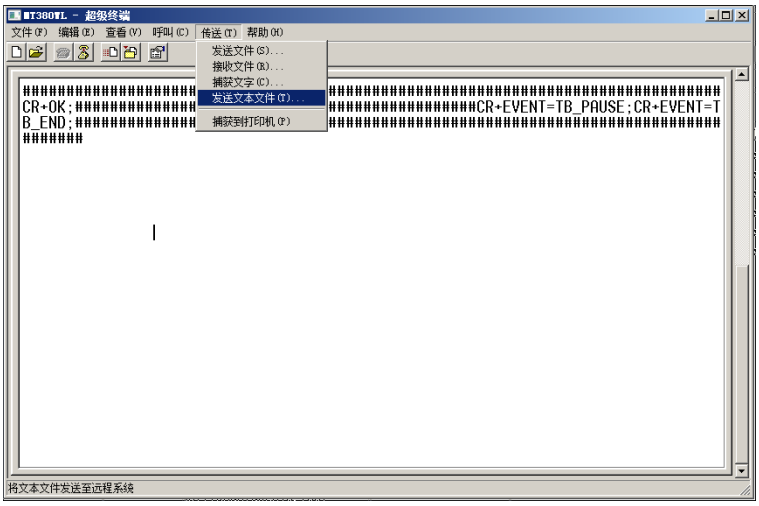


Step3: Send control commands to the turntable, the need to send the command to write in the text file, as follows:





Step4: Click on the send text file to send commands to the turntable.



4 Common problems self positioning

Number	Problem description	Possible causes and elimination measures
1	No response on the turntable (buzzer does not call, power / WIFI indicator is not bright).	● The external power supply module AC220V whether electricity sockets? Try to replace the power outlet. ● The power module is connected properly and dials?
2	The turntable is electrically normal, but does not rotate, or only rotates a very small angle is no longer rotation, is the turntable bad?	● May dial before the power to preserve the internal model into intermittent rotation and rotation angle is very small, pause time is very long, the number of repeat rarely (such as 0.5 degree rotation, pause 4S, repeat 1), power users is difficult to find the rotary table by a 0.5 degree. ● If the problem is, according to the continuous rotation controller button can normally rotate turntable.
3	The turntable electric buzzer ringing (normal sound 3 sound), intermittent or continuous.	● The power on self test abnormal, please re power if the problem persists, please contact customer service processing factory.
4	Infrared remote control is ineffective or the non response (normal turntable in response to remote control command, 1~2 buzzer sound).	● If the remote controller on the turntable and at the right distance (about 5M)? ● The remote control button is locked? Press Lock key to try. ● Whether Windows or Andriod - PC software App screen remote control function? ● The turntable is powered? ● Check the remote control batteries.
5	Windows PC software or Andriod App can not connect or can not normally control the turntable.	Taking Windows PC software as an example: ● The turntable is powered? ● The turntable is WIFI? (support WIFI requires MT380/600W or above disc version). ● - if the distance is too far (with no more than 3 meters is appropriate). ● The WIFI adapter is inserted into the PC USB

		interface? And try to replace the different USB interface or different USB PC interface. ● Magix PC correctly add WIFI device (disk), or a Windows PC software are correctly selected the equipment (turntable) corresponding to the COM port?