



**Available Models**

EM-38air

**Technical Specifications**

**Operation Mode**

Playback only

**Audio File Type**

WAV

- PCM (uncompressed) & IMA ADPCM
- Up to 44.1KHz/16-bit/stereo
- MP3
- ISO 11172-3, up to 44.1KHz/16-bit/stereo

**Max. Number of Sound Files**

Parallel / Direct Mode: 8  
 Parallel / Binary Mode: 128  
 Wi-Fi Mode: 999  
 Serial Mode: 999

**Memory Card Type/Capacity**

SD/SDHC up to 2GB/32GB

**Max. Recording Time**

16.5 hours/GB @ 128 kbps

**Supply Voltage**

12 ~ 30 VDC

**Typical Standby Current**

90 mA @ 24 VDC  
 115 mA @ 12 VDC

**Audio Output**

(30V supply, 8 Ohm load, 10% THD+N)  
 High efficiency class D  
 Stereo: 15W per channel  
 Mono: 55W bridge tied load (BTL)

**Serial Interface**

RS-232 / RS-485

**Parallel Interface**

8 inputs, contact closure or 3.3V/5V logic

**Wi-Fi Interface**

2.4 GHz (Station & AP)  
 File management  
 TCP control

**Physical Dimensions**

155 x 103 x 35 mm

**Versions**

Device Firmware: 4.20  
 File Uploader: 2.10  
 User's Manual: 1.0

**Inputs, Outputs & Controls**

**Power Light (PWR)**

The power light is turned on when power is applied.

**Parallel Interface Terminals: T1 - T8, GD**

The parallel interface is enabled by default. It provides 8 trigger inputs for connection with push buttons, motion sensors, PLCs and etc. The GD terminal is connected internally to the power ground.

**Reset Input Terminal: RS**

Pulse this input to the ground to reset the device. Min. duration is 50 ms. After reset, the device takes about 5 seconds to become ready to operate.

**Busy Output Terminal: BY**

This open collector output is automatically turned on while playing audio, with a maximum sink current of 200 mA. It can be used to activate an external relay for turning on devices such as a lamp or a motor.

**Power Input Terminals: V+, GD**

Use a well regulated DC power supply to obtain the best sound quality. Alternatively, power can also be supplied via the DC Adaptor Jack located on the rear side of the unit.

**Line Output (LINE)**

This 1/8" stereo phone jack provides single ended line output.

**Balance Knob (BAL)**

This knob adjusts the output balance between the two channels. It should be set at the middle (center detent) if the unit is configured for BTL (bridge tied load) mono out.

**Volume Knob (VOL)**

Turn this knob clockwise to increase the output volume. It affects both the speaker and the line out.

**Speaker Output Terminals: LF (left channel), GD, RT (right channel)**

See the Speaker Connections section.

**DC Adaptor Jack**

Device power can also be supplied via this 2.1mm center positive coaxial jack, but the Power Input Terminals are preferred for high power applications.

**SD Card Slot**

The SD card should be inserted with the device powered off, or the unit will not work.

**Serial Interface: RS-485, RS-232**

The serial interface is disabled by default. It can be enabled via the system configuration file as described in the Serial Interface section. The parallel interface is disabled automatically when the serial interface is enabled.

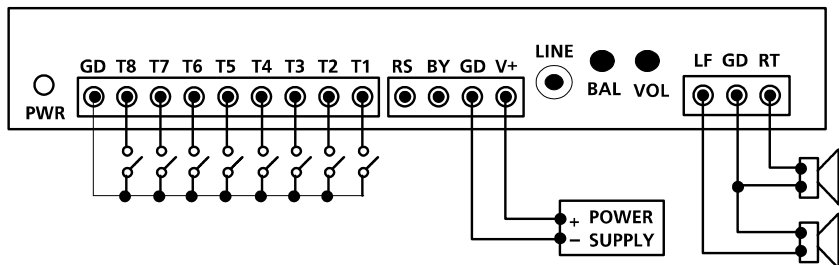
RS-232 (female DB9): set internal jumper JP1 to '232' (factory default setting)

RS-485 (terminals A+ / B-): set internal jumper JP1 to '485'

**Wi-Fi Interface: ANT**

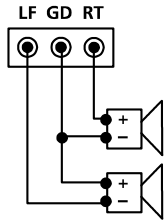
Antenna connection. Adding an external antenna greatly improves the Wi-Fi range.

**Typical Wiring Diagram for Push Button Activation**

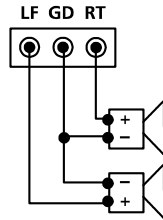


## Speaker Connections

### Regular Stereo

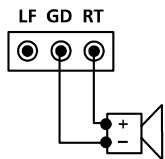


### Virtual Surround Stereo

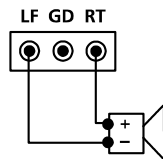


The left channel is internally inverted therefore the left speaker must be connected backwards for regular stereo output.

### Regular Mono



### BTL Mono (4X Output Booster)



BTL mono is used to boost output power with low supply voltage. Do not use speakers of impedance lower than 8 Ohms to avoid overloading the internal power amplifier.

## File Number Assignment

Every audio file needs to be assigned a unique file number for identification purpose. The file number must be 3 digits long and within the following range:

- For Direct Trigger: 001 ~ 008
- For Binary Trigger: 001 ~ 128
- For Serial Mode: 001 ~ 999
- For Wi-Fi Mode: 001 ~ 999

The assignment is as simple as adding the file number to the beginning of the original filename, e.g. "001mysound.mp3".

## Background Music

There is an easy ways to play background music (BGM) automatically when the device is idle. Just copy the BGM file(s) to the memory card and name them A01.mp3, A02.mp3 ... up to A99.mp3. The files will automatically play and cycle through the list. However, file numbering must start from A01 and be consecutive.

When the background music resumes to play after interruption, it will pick up from where it left off.

High bitrate audio files should be used for background music or a popping noise may occur when the playback advances from one file to the next.

## Device Configuration File

By default, the device works in the following modes if no configuration file is found:

- Control Interface: Parallel*
- Trigger Mode: Direct*
- Playback Mode: Non-Interruptible*

To operate the device in any other modes, create a plain text file called "MODE.TXT" and enter the following letters.

### To Enable The Parallel Interface

First Letter: Parallel Trigger Mode

- D = Direct
- B = Binary

Second Letter: Parallel Playback Mode

- N = Non-interruptible
- I = Interruptible

### To Enable The Serial Interface

00 = RS-232 Mode (internal jumper JP1 set to '232')

01 ~ 98 = RS-485 Mode (internal jumper JP1 set to '485')

- \* This 2-digit number becomes the device's RS-485 serial ID. Make sure it's unique.

The default baud rate (9600) can be changed by adding the desired baud rate after the serial ID. Supported baud rates are: 9600, 19200, 28800, 38400, 57600, and 115200.

### To Enable The Wi-Fi Interface

The Wi-Fi interface is always enabled for file management. To enable its TCP control, enter a single letter T.

## Configuration Examples

DI = Parallel Interface, Direct, Interruptible

BN = Parallel Interface, Binary, Non-interruptible

00 = Serial Interface, RS-232 Mode, 9600 Baud

68,19200 = Serial Interface, RS-485 Mode, ID 68, 19200 Baud

T = Wi-Fi Interface, TCP Control

## The Parallel Interface

The parallel interface allows the device to be triggered by a variety of mechanisms such as push buttons, motion sensors, PLCs and etc. The following operation modes can be enabled via the device configuration file MODE.TXT - see the **Device Configuration File** section for details.

### Parallel Trigger Modes

Parallel trigger modes define how the inputs are to be triggered.

#### Direct Trigger (default)

In this mode each input directly triggers a corresponding file: T1 for File 001, T2 for File 002, ....., T8 for File 008.

A trigger is valid if the input is shorted to the ground for at least 50 ms. The inputs are prioritized from T1 (the highest) to T8 (the lowest). However, it does not mean a higher priority input can interrupt a lower one. It only means that if multiple triggers are applied at the same time, the highest priority wins.

#### Binary Trigger

In this mode inputs T7 (MSB) to T1 (LSB) are used to form a binary code ranging from 0000000, 0000001, 0000010, ... to 1111111. An input is considered to be '0' if it's driven to 0V, and '1' if it's either undriven or driven to 3V or higher (do not exceed 40V).

After the binary code is formed on T7 to T1, pulse T8 to 0V for at least 50 ms to complete the trigger. Code 0000000 triggers file 128, 0000001 triggers file 001, 0000010 triggers file 002, ... and 1111111 triggers file 127.

### Parallel Playback Modes

Parallel playback modes define how the playback is to proceed.

#### Non-interruptible Playback (default)

The file is played once per trigger, and not interruptible except by the hardware reset. Looping is possible by applying a constant trigger on the input.

#### Interruptible Playback

The file is played once per trigger, and interruptible by a later trigger on any input but itself. Looping is possible by applying a constant trigger on the input.

### Testing the Parallel Interface

- Rename a WAV/MP3 file to 001 and copy it onto an SD card.
- Insert the SD card into the device with the power turned off.
- Connect a momentary push button between T1 and GD.
- Turn on the device.
- Press the button and, if file 001 starts to play, the test is good.

### Trouble Shooting Checklist

- Power light is on.
- Audio files are of supported types and numbered correctly.
- The SD card is inserted with the device powered off.
- Operation mode is configured properly in MODE.TXT.
- The triggering mechanisms are known good.
- Speaker volume is turned up.
- Speakers are known good and connected correctly.

## The Serial Interface

The serial interface consists of a female DB9 connector for RS-232, and a 2-position screw terminal for RS-485. To use RS-485, the internal jumper JP1 must be moved from the default '232' setting to the '485' setting.

See the **Device Configuration File** section on how to enable the serial interface. When the serial interface is enabled, the parallel interface is automatically disabled.

On the RS-232 connector, only three pins are used:

- Pin 2 = RX
- Pin 3 = TX
- Pin 5 = Ground

On the RS-485 connector:

- A+ = A Terminal
- B- = B Terminal

For RS-232 applications, the unit (a DCE device) is connected to a DTE device (such as a PC) with a regular serial cable (not null modem). For RS-485 applications, up to 32 units, each assigned with a unique device ID, can be daisy chained together with a 2-wire cable.

The **Default Hardware Communication Parameters** are:

- Baud Rate = 9600 (changeable)*
- Data Bits = 8*
- Parity = None*
- Stop Bits = 1*
- Flow Control = None*

The software protocol is the same for both RS-232 and RS-485 except that the addressing step is omitted for RS-232.

For RS-485, each command is preceded with a header consisting of a letter A followed by a binary byte equal to the device ID. For RS-232 this header is omitted.

### Testing the Serial Interface

Create a plain text file called "MODE.TXT" on the flash card. Enter only two characters in the file: 00 for RS-232 test, 66 for RS-485 test (66 becomes the device ID).

Rename a WAV/MP3 file to 001 and copy it onto the SD card.

Connect the device with the DTE (PC) and power it up. Run the serial communication program of your choice on the DTE. Create a new connection with the default hardware communication parameters described above, and send the following command.

For	DTE Sends	Player Responds
RS-232	F001	f001
RS-485	ABF001	f001

The test is good if file 001 starts to play.

Note that we sent B as the device ID since the ASCII code of letter B is 66 - the number we entered in the MODE.TXT file.

### Trouble Shooting Checklist

- Power light is on.
- Audio files are of supported types and numbered correctly.
- The SD card is inserted with the device powered off.
- Operation mode/ baud rate are configured properly in MODE.TXT.
- Internal jumper JP1 set to the proper setting (RS-232/RS-485).

## **The Wi-Fi Interface**

The device operates in two different Wi-Fi modes simultaneously:

### **AP Mode**

The AP Mode allows the device to be configured wirelessly (**Wi-Fi Configuration Method #1**). Alternatively Wi-Fi configuration can also be done on the SD card directly (**Wi-Fi Configuration Method #2 and #3**).

### **Station Mode**

The Station Mode allows the device to connect with a LAN (and the Internet if applicable) via a Wi-Fi router for remote file management and/or TCP control.

The file management function is always enabled, which means one can remotely list/delete/upload files even if the device is operating in the parallel or the serial mode.

The TCP control supports the same command set as the serial mode. It needs to be enabled in MODE.TXT and cannot operate along with the parallel or the serial mode.

### **Enabling TCP Control**

Enter one of the following in MODE.TXT:

**T**

No acknowledgement sent upon connection.

**T,Hello**

Acknowledgement Hello and the system status will be sent upon connection. 'Hello' may be replaced with any other word.

**T:9000**

Use 9000 as the transfer port instead of the one in the device configuration. 9000 may be replaced with any other port as long as it's unused by other apps.

### **Testing TCP Control**

- Enable TCP control with acknowledgement as described above.
  - Open a session with a third party TCP tester such as NetAssist.
  - Select the "TCP Client" protocol.
  - Set the "Host Address" and the "Host Port" to that of the device.
  - Make the connection - click [Connect].
  - The device will respond with one of the following messages to acknowledge the connection:
    - Hello: (s)
    - Hello: (b)
    - Hello: (p)
- Where s/b/p indicates the device status: idle/playing/pausing. Wait till this message is received before sending commands.
- Send the play command "F001" in the ASCII format.
  - The test is good if the audio file starts to play.

### **Trouble Shooting Checklist**

- Power light is on.
- Audio files are of supported types and numbered properly.
- The SD card is inserted with the device powered off.
- The device is configured correctly.
- TCP control is properly enabled in MODE.TXT.
- Add an external antenna for longer Wi-Fi range.

## **Serial & Wi-Fi TCP Commands**

The serial mode and the Wi-Fi TCP control support the same set of commands.

### **Play File**

DTE Sends: F### (### is the three-digit file number)

Device Returns: f### (the file number)

If the file exists, it will be played once.

The command is ignored if the file does not exist.

The Error Code is returned if the device is playing/pausing.

### **Loop File**

DTE Sends: L### (### is the three-digit file number)

Device Returns: l### (the file number)

If the file exists, it will be played repeatedly.

The command is ignored if the file does not exist.

The Error Code is returned if the device is playing/pausing.

### **Stop Playback**

DTE Sends: S

Device Returns: s

The system will stop the current playback (playing/pausing).

The command is ignored if the device is not playing/pausing.

### **Pause Playback**

DTE Sends: P

Device Returns: p

The command is ignored if the device is not playing.

When the device is pausing, its Busy output is still active.

### **Resume Playback**

DTE Sends: R

Device Returns: r

The command is ignored if the device is not pausing.

### **Busy?**

DTE Sends: B

Device Returns: b (if playing/pausing), s (otherwise)

### **Command Timeout**

The device will time out if a complete command is not received within 3 seconds of initial transmission. In this case an error code to be returned as described below.

### **Error Code**

The device will return an 'e' if an invalid/incomplete command is received, or if a valid command is received at the wrong time, e.g. a Play File command received when the device is playing/pausing.

### **Command Broadcast**

Address code 99 can be used to broadcast commands to all units on the RS-485 bus. In this case no device will return anything in order to avoid bus conflict. Therefore one will not be able to know if any device actually received and executed the command.

Command broadcast is usually used to make multiple units start playing at the same time for synchronization purposes. However, due to clock variation in each unit, the playback may still gradually go out of sync over time when playing a lengthy file.

## Wi-Fi Configuration

The Wi-Fi configuration is stored in a file named DEVICE.INI on the SD card, not to be confused with the MODE.TXT file which stores the non-Wi-Fi configuration.

### Wi-Fi Configuration Method #1

The device will stop normal operation during the configuration.

Use a Wi-Fi equipped PC to find and connect with em38air-ap (AP SSID). The default password is 12345678. Ignore any message saying the Internet connection is unavailable.

Open a web browser and go to http://192.168.1.99. Log in with User Name: em38air, Password: 1234.

### EM - 38Air Parameters

Field Name	Value
Device IP	192.168.1.101
NetMask	255.255.255.0
Gateway	192.168.1.1
DNS	8.8.8.8
Web UserName	em38air
Web Password	****
Update UserName	em38air
Update Password	****
WiFi SSID	ELETECH-Zyxel
WiFi Password	*****
AP SSID	em38air_AP
AP Password	*****
AP IP	192.168.1.99
AP NetMask	255.255.255.0
AP Gateway	192.168.1.99
GMT Offset	480
Day Light Saving	0
TCP Command Port	55555
TCP Transfer Port	55556
NTP Server	asia.pool.ntp.org

#### Device IP / NetMask / Gateway / DNS

For the Station Mode. Be sure the Device IP is available on the target LAN.

#### Web UserName / Web Password (default: 1234)

For all web login other than the EM38Air File Uploader app.

Default Web UserName: em38air

Default Web Password: 1234

#### Update UserName / Update Password

For the EM38Air File Uploader app login only.

Default Update UserName: em38air

Default Update Password: 1234

#### WiFi SSID / WiFi Password

For the Station Mode Wi-Fi router connection.

#### AP SSID / Password / IP / NetMask / Gateway

For the AP Mode.

Default AP SSID: em38air\_AP

Default AP Password: 12345678

#### GMT Offset / Day Light Saving / NTP Server

These settings are unused for now.

#### TCP Command Port / TCP Transfer Port

These settings are usually left unchanged.

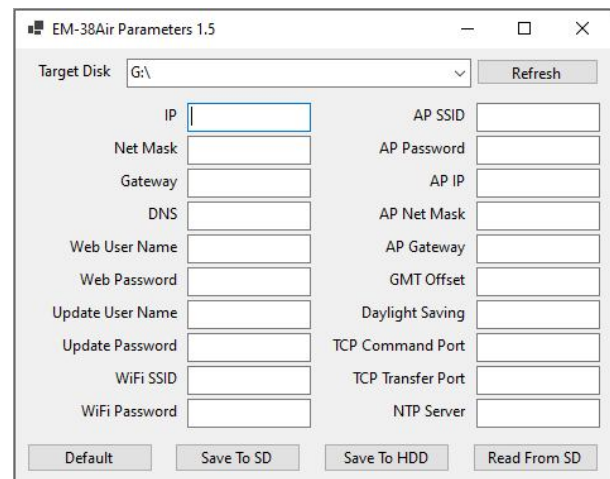
Make necessary changes and click **[Save]**. The device will automatically reset itself and make the new settings effective.

Click **[Quit]** to abort the operation. The device will automatically reset itself and the old settings will be unchanged.

### Wi-Fi Configuration Method #2

This method is done on the SD card directly, providing a way to configure multiple units quickly.

Install and run the "EM38Air Parameters" app on a Windows 7 (or higher) PC.



Click **[Default]** to load factory default settings, or **[Read From SD]** to load existing settings on the SD card.

Make necessary changes.

Select the target removable disk (click **[ReNew]** to refresh the list if necessary). Click **[Save To SD]** to save to the SD card, or **[Save to HDD]** to save to a hard drive.

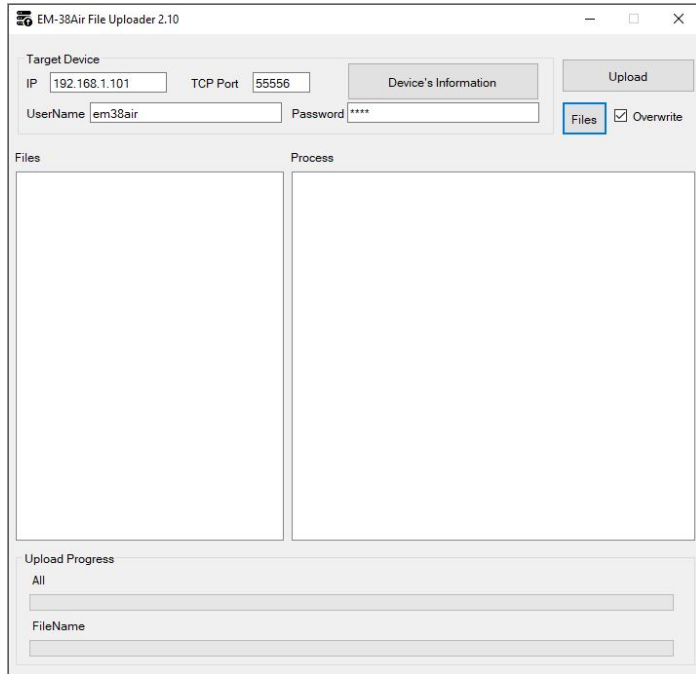
### Wi-Fi Configuration Method #3

If a DEVICE.INI file created previously contains the desired configuration data, simply copy it to the SD card.

## EM38Air File Uploader

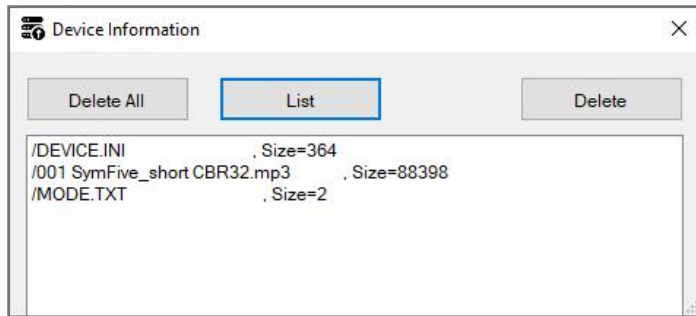
Install and run the "EM38Air File Uploader" app on a Windows 7 (or higher) PC. The device will stop normal operation when the app is open, and automatically reset itself and resume normal operation when the app is closed.

Make sure IP, TCP Port, UserName and Password are entered correctly in the main window.



### List & Delete Files

Click **[Device Information]**.



The screen shot above shows the SD card having 3 files only.

#### **[Delete All]**

Delete all files.

#### **[List]**

Refresh the file list.

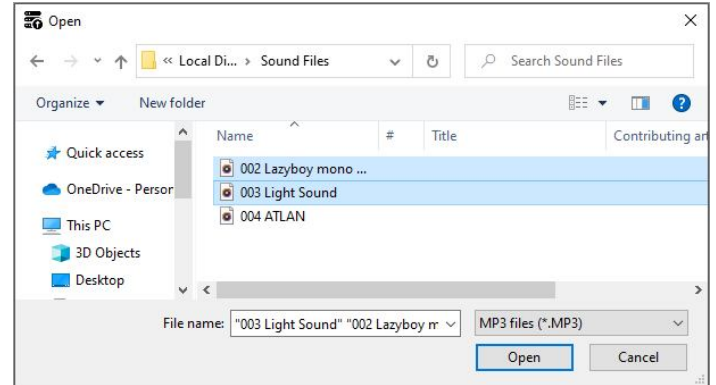
#### **[Delete]**

Delete the selected (highlighted) files.

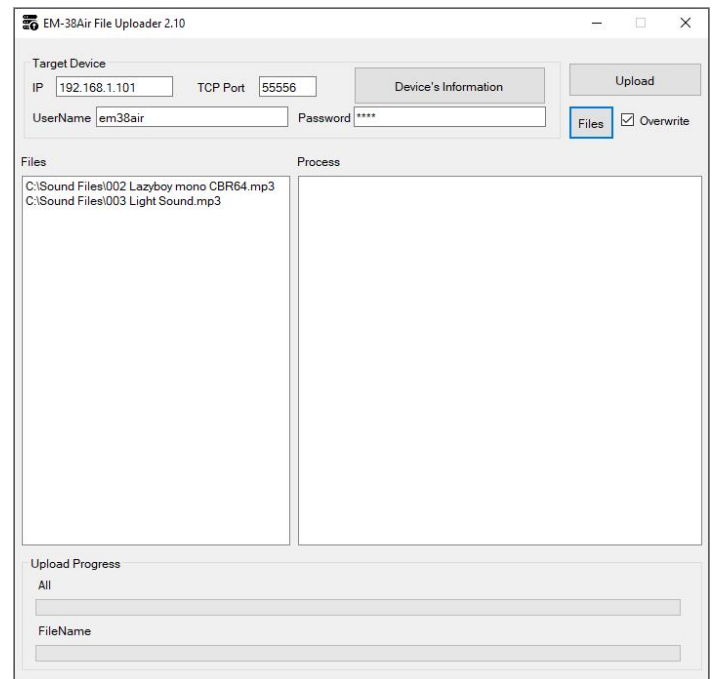
## Upload Files

The following file types can be uploaded: WAV, MP3, INI, TXT. Therefore it's possible to re-configure the device remotely by uploading a new DEVICE.INI and/or MODE.TXT.

Click **[Files]**.



Navigate to the file folder. Select the file(s) to upload. Click **[Open]**.



Selected files are now listed in the Files section.

To add more files to the list, uncheck the **Overwrite Box** and make more file selections.

To delete the list and start a new one, check the **Overwrite Box** and make new file selections.

Once the list is complete, click **[Upload]** to upload. Upload progress is displayed at the bottom of the window.

When the EM38Air File Uploader app is closed, the device will automatically reset itself. Normal operation will resume after the device comes out of reset in about 5 seconds.

## EM38air Demo Program

In order to communicate with the EM38air Demo Program, the target device must have its TCP control enabled by having the letter T in MODE.txt. Please refer to the Device Configuration File section in the user's manual for more information.

Download the installation file from the product webpage and unzip it into a folder of your choice. There will be 3 files:

### config.ini

Use a text editor and change the IP setting to that of the EM38air device. Leave the Port setting unchanged at 55555.

### ins.txt

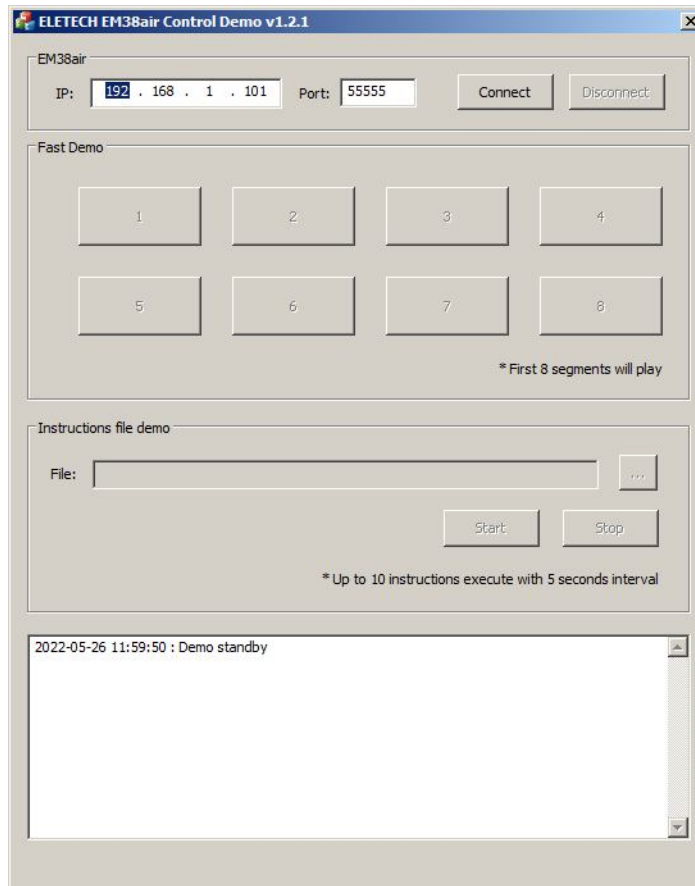
This simple text file, called the instruction file, contains a playlist. Each entry starts with an F followed by a 3-digit filename. Up to 10 entries are allowed. For example, if ins.txt contains:

```
F012
F003
F155
```

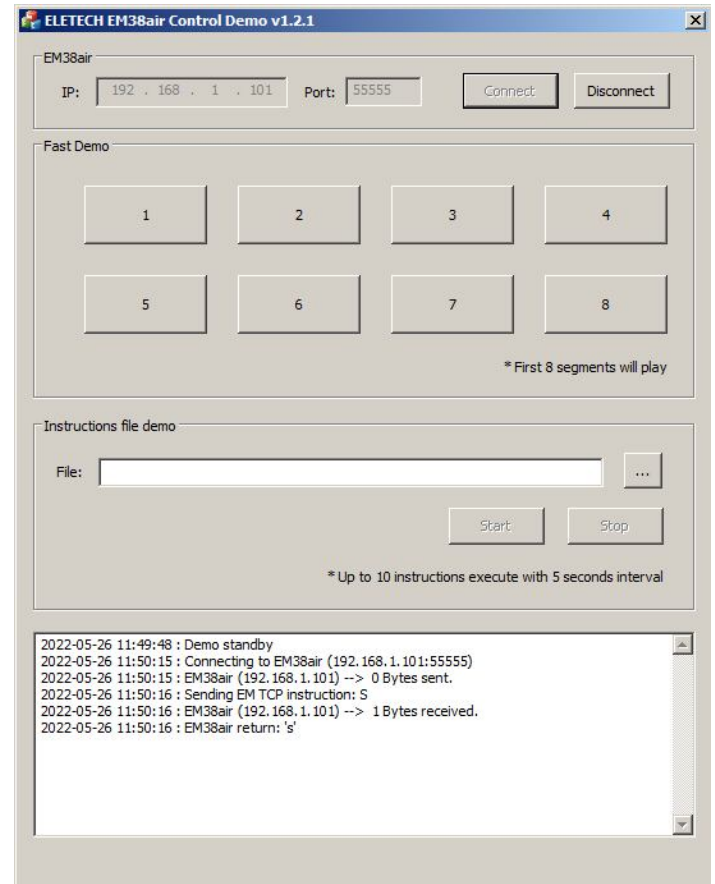
Then the device will play files F012, F003 and F155 sequentially with a 5-second pause in between.

### EM38airDemo.exe

No installation is needed, just double click the icon to run the app. The screen shot below shows the IP and Port settings prefilled with the value stored in the config.ini file.



Make sure the device has been powered up for at least 10 seconds before clicking the **[Connect]** button.



Once the device connection is successful, click on any one of the 8 buttons to play a corresponding file (001 ~ 008). For example, clicking the **[3]** button will cause the device to play file 003.

To run the instruction file demo, first click the **[...]** button and load the ins.txt file from the SD card. Then click the **[Start]** button. The **[Stop]** button can be used to stop the demo prematurely.

The **[Disconnect]** button is used to disconnect the device so that the app can be used to control another device.

The **[x]** button is used to exit the app.