Available Models

EM-38AM: no internal relays.
EM-38AMR: 8 relays for simple control.
EM-38AMX: 8 relays for complex control.

Technical Specifications

Firmware Version
9.1

Control Interface
Modbus

Operation Mode
Audio playback with optional relay outputs

Sound File Format
MP3 (ISO 11172-3 up to 44.1KHz)

Max. Number of Sound Files
1000

Memory Card Type/Capacity
SD/SDHC up to 2GB/32GB

Max. Total Audio Time
16.5 hours/GB @ 128 kbps

Supply Voltage
12 ~ 30 VDC

Typical Standby Current
60 mA

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

Relay Rating (EM-38AMR & EM-38AMX)
15A @ 125 VAC
10A @ 250 VAC
6A @ 28 VDC

Physical Dimensions
EM-38AM: 5.3" x 4" x 1.35"
EM-38AMR & EM-38AMX: 5.3" x 6.7" x 1.35"

Inputs, Outputs & Controls

Power Light (PWR)
The power light is turned on when power is applied.

Trigger Inputs Terminals: T1 - T8, GD
Unused.

Reset Input Terminal: RS
Pull this input down to the ground momentarily to reset the unit. Min. duration is 100 ms.

Busy Output Terminal: BY
This open collector output is automatically turned on while playing audio, with a maximum sink current of 200 mA.

Power Input Terminals: V+, GD
Use a well regulated DC power supply to obtain the best sound quality. Power can also be supplied via the 2.1mm center positive coaxial jack.

Line Output (LINE): 1/8" Stereo Phone Jack
This 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)
This is the hardware volume control. Turn this knob clockwise to increase the audio volume. It affects both the speaker and the line out.

The Modbus protocol also provides software based volume control. The audio level goes through the software control first, then the hardware control.
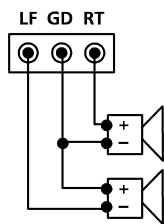
Serial Port (DB9 Female)
The serial port supports both RS232-MODBUS (default) and 2W-MODBUS interfaces. To select 2W-MODBUS, the internal jumper JP1 must be moved to the "485" setting.

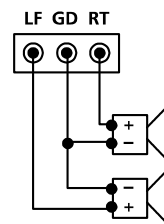**Relay Output Terminals (EM-38AMR & EM-38AMX only)**
Three terminals are provided for each relay output: NC (Normally Closed), NO (Normally Open) and Common. The contact is rated at 12A/120VAC or 10A/24VDC.

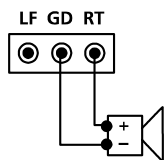## Speaker Connections

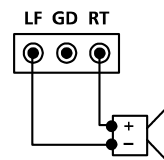**Regular Stereo**   **Virtual Surround Stereo**

The left channel is internally inverted therefore the left speaker must be connected backwards for regular stereo output. The inversion can be disabled if needed - see System Configuration File.

Regular Mono   **BTL Mono (4X Output Booster)**

BTL mono is used to boost output at low supply voltage - don't use speakers lower than 8 Ohms to avoid overloading the power amp.

Modbus Interface

EM-38AM is a Modbus slave and supports both RS232-MODBUS (default) and 2W-MODBUS interfaces. To select 2W-MODBUS, the internal jumper JP1 must be moved to the "485" setting.

The pin assignment on the female DB9 connector is:

RS232-MODBUS Pin Assignment
Pin 2 = RX
Pin 3 = TX
Pin 5 = Ground

2W-MODBUS Pin Assignment
Pin 1 = D1
Pin 9 = D0
Pin 5 = Ground

Note that the 2W-MODBUS pin assignment is not Modbus compliant. This can be remedied, if necessary, by using the optional *DB9 Breakout Board* that converts DB9 to screw terminals.

Communication Protocol & Parameters
Protocol = RTU, TCP (if equipped with Ethernet converter)
Baud Rate = 19200
Data Bit = 8
Parity = None
Stop Bit = 1
Flow Control = None

Supported Commands
Read Holding Registers (0x03)
* Only single register read is supported.
Write Single Register (0x06)

Device Address Assignment
Each device must be assigned with a unique adress ranging from 1 to 247. To make the assignment, simply create a text file named MODE on the SD card and put in it the 3-digit decimal address such as 007 or 168. The device reads this information every time it powers up. If MODE is missing or contains invalid data, the default address (1) will be used.

Sound Files & Playlist

For identification purposes, each sound file must be assigned with a unique 3-digit decimal number ranging from 000 to 999. To make the assignment, simply add the file number at the beginning of the filename such as "001 original_filename".

In order to maximize the number of files that can be stored on the SD card, the filename should contain:
- 8 characters or less (including the file number)
- only numbers and capital letters

The audio playback is playlist-based instead of file-based. A playlist, containing one or more consecutively numbered files, is defined by the first file number and the last file number. The first file number should always be equal to or smaller than the last file number. These two file numbers should be the same if there is only one file in the playlist.

Holding Registers

Register R1 - Command (R/W)
Write to issue the command. This register reads 0 after the command has been executed by the device.

High Byte: Unused
Low Byte / High Nibble: Play Count (for Start Play only)
    0 = Forever
    1 = 1 time
    ....
    15 = 15 times
Low Byte / Low Nibble: Command
    0 = None
    1 = Start Play
    2 = Stop Play
    3 = Pause Play
    4 = Resume Play
    5 = Set Volume
    6 = Set Relay
    7 ~ 15 = unused

Register R2 - First File Number (R/W)
Read/write to get/set the playlist's first file number.

16-bit Word = file number in binary form (0 ~ 999)

Register R3 - Last File Number (R/W)
Read/write to get/set the playlist's last file number.

16-bit Word = file number in binary form (0 ~ 999)

Register R4 - Volume (R/W)
Read/write to get/set the software volume.

High Byte: Right Channel, 0 (silent) ~ 255 (loudest)
Low Byte: Left Channel, 0 (silent) ~ 255 (loudest)

In addition to the software volume there is also a physical knob that sets the hardware volume. The actual output volume is a multiplication of both volumes.

Register R5 - Relay (R/W)
Read/write to get/set relay states.

High Byte: Unused
Low Byte: Relay
    Bit 0 = relay #1 (0: OFF, 1: ON)
    ....
    Bit 7 = relay #8 (0: OFF, 1: ON)

Register R6 - Playback Status (R/O)
Read to get the playback status.

High Byte: Unused
Low Byte: Playback Status
    0 = idle
    1 = playing
    2 = paused

Register R7 - Current File Number (R/O)
Read to get the file number of the file currently playing or pausing.

16-bit Word = file number in binary form (0 ~ 999)

Modbus Command Examples

* Numbers preceded with 0x are in hex format.
* Always write R1 the last.

Play file 020.mp3 one time
R2 Write = 0x0014
R3 Write = 0x0014
R1 Write = 0x0011

Loop file 020.mp3 ~ 026.mp3 forever
R2 Write = 0x0014
R3 Write = 0x001A
R1 Write = 0x0001

Stop playback
R1 Write = 0x0002

Pause playback
R1 Write = 0x0003

Resume playback
R1 Write = 0x0004

Set volume to 0xD2 (left) and 0xE3 (right)
R4 Write = 0xE3D2
R1 Write = 0x0005

This sets the software volume only. There is also a physical knob that sets the hardware volume. The actual output volume is a multiplication of both volumes.

Set relay #1 & #3 on, others off
R5 Write = 0x0005
R1 Write = 0x0006

Relay Controls

EM-38AMR & EM-38AMX are equipped with internal relays that can be used to control electrical devices such as solenoids, lamps, and motors. Note the relays do not output power for the devices, they switch power instead. Therefore one relay can be used for switching a 110V AC lamp while another for switching a 24V DC solenoid. Power being switched must be provided externally.

Each relay has three terminals for connection: NO (normally open), NC (normally closed), and COM (common).

When the relay is OFF:
NC and COM are connected via the relay.
NO is open.

When the relay is ON:
NO and COM are connected via the relay.
NC is open.

EM-38AMR (basic control)
The basic control allows internal relays to be set/reset at any time, although it is very hard to precisely synchronize the relay states to the audio.

EM-38AMX (advanced control)
The advanced control allows internal relays to synchronize to the audio precisely. Instead of being controlled via Modbus in real time, the relay cues are pre-programmed into the audio file by using the Windows based QSAplay software. When the pre-programmed audio file plays back, the relays will toggle automatically without any Modbus control.

Trouble Shooting Guide

1. Communications error.
a. Device address is not assigned properly in MODE.TXT.
b. Device address conflicts with another device on the same bus.
c. Incorrect communications parameters such as baud rate.
d. Incorrect and/or loose wiring.
e. The system would not work if the SD card is inserted when the power is on. Re-insert the SD card with the power off.

2. No communications error but cannot play any file.
a. File numbers are not assigned properly.
b. Playlist is not set up properly.
c. The software and/or hardware volume may be too low.

3. Noisy playback.
The speed of the flash card is too slow. Use a faster flash card or convert the file to a lower bit rate.