EM-51A Prop Controller
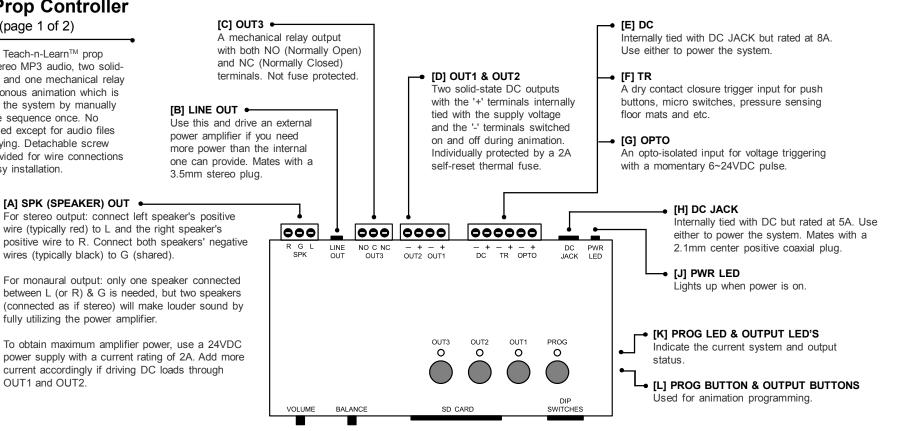
The EM-51A is a Teach-n-Learn™ prop controller with stereo MP3 audio, two solid-state DC outputs and one mechanical relay output for synchronous animation which is programmed into the system by manually going through the sequence once. No computer is needed except for audio files creation and copying. Detachable screw terminals are provided for wire connections for quick and easy installation.

[C] OUT3
A mechanical relay output with both NO (Normally Open) and NC (Normally Closed) terminals. Not fuse protected.

[D] OUT1 & OUT2
Two solid-state DC outputs with the '+' terminals internally tied with the supply voltage and the '-' terminals switched on and off during animation. Individually protected by a 2A self-reset thermal fuse.

[E] DC
Internally tied with DC JACK but rated at 8A. Use either to power the system.

[F] TR
A dry contact closure trigger input for push buttons, micro switches, pressure sensing floor mats and etc.

[G] OPTO
An opto-isolated input for voltage triggering with a momentary 6~24VDC pulse.

[B] LINE OUT
Use this and drive an external power amplifier if you need more power than the internal one can provide. Mates with a 3.5mm stereo plug.

[A] SPK (SPEAKER) OUT
For stereo output: connect left speaker's positive wire (typically red) to L and the right speaker's positive wire to R. Connect both speakers' negative wires (typically black) to G (shared).

For monaural output: only one speaker connected between L (or R) & G is needed, but two speakers (connected as if stereo) will make louder sound by fully utilizing the power amplifier.

To obtain maximum amplifier power, use a 24VDC power supply with a current rating of 2A. Add more current accordingly if driving DC loads through OUT1 and OUT2.

[H] DC JACK
Internally tied with DC but rated at 5A. Use either to power the system. Mates with a 2.1mm center positive coaxial plug.

[J] PWR LED
Lights up when power is on.

[K] PROG LED & OUTPUT LED'S
Indicate the current system and output status.

[L] PROG BUTTON & OUTPUT BUTTONS
Used for animation programming.

R G L SPK | LINE OUT | NO C NC OUT3 | − + − + OUT2 OUT1 | − + − + − + DC TR OPTO | DC JACK | PWR LED

OUT3 OUT2 OUT1 PROG

VOLUME · BALANCE · SD CARD · DIP SWITCHES

[M] VOLUME KNOB
Adjusts the level for both SPK OUT and LINE OUT.

[N] BALANCE KNOB
Adjusts the balance for SPK OUT only.

[P] SD CARD
Push on, push off. Turn power off before inserting.

[Q] DIP SWITCHES
#1 Animation Time (max.): OFF = 1 minute, ON = 2 minutes
#2 Trigger Polarity: OFF = normal, ON = reversed
#3 Program Lock: OFF = no, ON = yes

POWER UP & IDLE MODE

The system is in the Idle Mode when it's not in the Program Mode or the Animation Mode.

Upon power-up the system goes through a self test and turns on the following LEDs one by one as the test progresses:

OUT3 - self test started
OUT2 - SD card found
OUT1 - SD card file system checked
PROG - system good to go

The system then turns all LEDs off and enters the Idle Mode where it will be either silent or, if a file named BGM.mp3 is found on the SD card, looping the background audio which shares the same volume knob as the animation audio.

PROGRAM MODE

To enter the Program Mode, make sure DIP switch #3 is turned off. Then press and hold the PROG BUTTON till the PROG LED lights up. Release the button and the animation audio will start to play. Press the output button(s) at desired moments for desired duration. Programming can continue even after the audio is over. Programming ends when either the PROG BUTTON is pressed again or the maximum animation length is reached, whichever happens first.

The animation is saved in nonvolatile memory and can be reprogrammed for thousands of times.

After programming, DIP switch #3 can be turned on to 'lock' the program so that it cannot be erased by accidentally pressing the PROG BUTTON.

ANIMATION MODE

When triggered, the system immediately enters the Animation Mode. The trigger polarity can be reversed with a DIP switch setting, which means the system can be triggered with the trigger signal being present or absent.

The animation audio file must be named ANM.mp3 and copied to the SD card. If you want to delay animation after triggering, add a 2-digit delay time (00 ~ 99) to the filename, such as ANM05.mp3 (delay 5 seconds). Otherwise animation starts without any delay.

In the Animation Mode the PROG LED will be flashing, and the OUT1/OUT2/OUT3 LEDs will indicate the output status at the moment. The animation can be stopped prematurely by pressing the PROG BUTTON.

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[A] SPK (SPEAKER) OUT

The internal class D power amp is highly efficient and generates little heat. Maximum output power per channel is 5W @ 12VDC (4 Ohm load), 10W @ 24VDC (8 Ohm load). These are continuous (RMS) power, and peak power is even higher. The power supply must provide enough power or the system will become unstable when the volume is turned up. If you need more power than the internal power amplifier can provide, use LINE OUT and drive an external power amplifier.

[B] LINE OUT

This stereo line level output can be used to drive an external power amplifier if you need more power than the internal one can provide. The output level is adjustable with the VOLUME KNOB. Internally each channel has a 15 Ohm resistor for AC short protection and a 10uF capacitor for DC blocking.

[C] OUT3

This is a mechanical relay output with both NO (Normally Open) and NC (Normally Closed) terminals. It can be used to control AC or DC loads. Although the relay's contact rating is 12A @ 120VAC, 10A @ 240VAC/28VDC, the screw terminals are rated at 8A only. Therefore the load current should be kept below 8A. This output is not fuse protected.

> *CAUTION: High voltage can cause sever harm or even death. Be extra careful when handling high voltage wires & devices.*

[D] OUT1 & OUT2

Solid-state outputs for controlling DC loads. The output voltage is the same as the supply voltage, and is always present on the '+' terminal. The '-' terminal is switched on/off during animation. Internal flyback diodes protect outputs against inductive loads.

Since the output voltage is the same as the supply voltage, these outputs cannot be used to control 12VDC loads if the supply voltage is 24VDC, and vice versa. If you need to control different-voltage loads, either use OUT3, or use OUT1/OUT2 to control an external relay which then controls the load.

These outputs are individually protected by a 2A self-reset thermal fuse, so keep the load under 2A for each output. Also, the output current is drawn from the power supply and goes through the power connector. If the total current (system + OUT1 + OUT2) exceeds the power connector specs, you can do one or both of the following:

- Use OUT3 for one of the loads. The OUT3 current flows from the power supply to the load via the relay terminals without going through the system's power connector.

- Use an external power amplifier instead of the internal one. This can take up to 2A of current off the power connector.

[E] DC

Rated at 8A this power connector is more suitable for high power applications than the DC JACK which is rated at 5A. This input is diode protected so that a wiring mistake of the wrong polarity will not damage the system.

[F] TR

This trigger input is for dry contact closure from push buttons, micro-switches, pressure sensitive floor mats and etc. Although the terminals are marked with '+' and '-', the wiring polarity is not important. For voltage triggering use the OPTO input.

[G] OPTO

This trigger input is for voltage triggering with a 6~24 VDC pulse of 0.1 second or longer. The trigger signal is opto-isolated. For dry contact closure triggering use the TR input.

Either of the two trigger inputs (TR and OPTO) can be used but they both trigger the same animation.

[H] DC JACK

This 2.1mm center positive coaxial power jack is rated at 5A. For high power applications the DC IN terminals should be used instead. This input is diode protected so that a plug of the wrong polarity will not damage the system.

[J] PWR LED

This green LED lights up when power is on.

[K] PROG LED & OUTPUT LED'S

The red PROG LED is off in the Idle Mode, blinking in the Program Mode, solid on in the Animation Mode.

The OUT LED's are green and indicate the current status of the corresponding output.

[L] PROG BUTTON & OUTPUT BUTTONS

The PROG button is used to enter the Program Mode as described in the PROGRAM MODE section.

The OUT buttons are used to activate the corresponding output in the Program Mode. Press and hold the button(s) at the desire moment for the desired duration.

[M] VOLUME KNOB

Adjusts output level for both LINE OUT and SPEAKER OUT.

[N] BALANCE KNOB

Adjusts balance for SPEAKER OUT only.

[P] SD CARD

The SD card is used to store the background audio file (BGM.mp3) and the animation audio file (ANM.mp3). Always turn the power off before inserting the card, or the system may not work properly.

[Q] DIP SWITCHES

#1: Max. Animation Time
OFF = 1 minute (standard), ON = 2 minutes (extended)

The timing resolution is 1/16 second (16 fps) for the standard length, 1/8 second (8 fps) for the extended length. Must power cycle the system for the new setting to take effect.

#2: Trigger Polarity
OFF = normal, ON = reversed

Under reversed trigger polarity the system is triggered when the contact is open on TR, or the trigger voltage is absent on OPTO. Since TR and OPTO are internally tied together, you must disable the unused one. For example, tie the TR terminals together when using OPTO in reversed polarity, otherwise the system will be constantly triggered by TR which is also in reversed polarity.

#3: Program Lock
OFF = no, ON = yes (system cannot be reprogrammed)

SPECIFICATIONS

Supply Voltage: 12VDC ~ 24VDC
Current Consumption: ~ 0.1A excluding power amp
                                  ~ 2A including power amp
Power Amp Output (max): 5W @ 12VDC (4 Ohm load)
                                  10W @ 24VDC (8 Ohm load)
OUT1/OUT2 Current (max): 2A (fused)
OUT3 Current (max): 8A @ 120VAC/240VAC/28VDC
Audio File Format: MP3 up to 320kbps, CBR or VBR
Memory Card: SD (2GB max.) or SDHC (32GB max.)
Max. Animation Time: 1 minute @ 16 fps (standard)
                                  2 minutes @ 8 fps (extended)
Physical Dimensions: 5.7" x 3.5" x 1.5" (footprint)

QUESTIONS & ANSWERS

[Q] System would not enter the Program Mode by pressing the PROG BUTTON.
[A] The program is probably locked. Unlock the program by turning DIP switch #3 off.

[Q] In the middle of programming, why did the system exit the Program Mode by itself?
[A] The maximum animation length had been reached. Switch to the extended animation length if necessary.

[Q] I can't get any audio to play.
[A] Make sure the file is MP3 and named correctly - BGM.mp3 for the background audio, A??.mp3 for the animation audio (where ?? are two digits from 00 to 99 specifying the delay). Also, try adjusting the VOLUME KNOB.

[Q] Can animation be programmed without audio?
[A] Yes, just don't put any animation audio file on the SD card.

[Q] Can I toggle outputs before animation audio starts?
[A] Technically no, but there is a work-around. Simply edit the animation audio file and add a few seconds (according to your needs) of silence at the beginning.