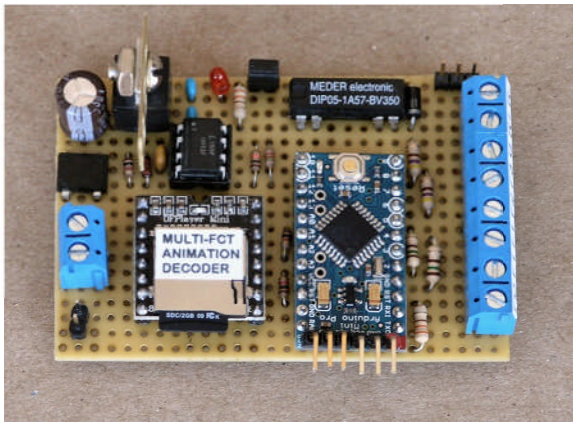
MULTI-FUNCTION ANIMATION DECODER

By Fred Miller, MMR

For almost a dozen years I have been promoting, in various clinics and presentations, the topic of "Light, Sound and Motion" animation for model railroads. Of course over those years more modelers have been venturing into this wonderful aspect of model railroading with a variety of custom implementations. The commercial world now also offers a number of devices and fixtures to bring animation to the layout.

Recently the availability of inexpensive and easy-to-use microcontrollers has opened the animation door even further. The Arduino line of microcontrollers now is a wonderful tool for developing all kinds of custom animation projects.

A new implementation: I have been using the various Arduino microcontrollers and their little brothers, ATTiny 84s and 85s for various DCC and Loconet interfaced projects for my model railroad. But I recently decided to put my earlier thoughts of "light, Sound and Motion" animation into a single custom built DCC decoder. I call my developed project the "Multi-function Animation Decoder" or MFAD. This decoder responds to DCC commands for Functions 0-8 to perform a variety of tasks including control of lights, sounds and servo motions. My initial intent was to make it easy to animate the activities in several of the buildings on my layout.



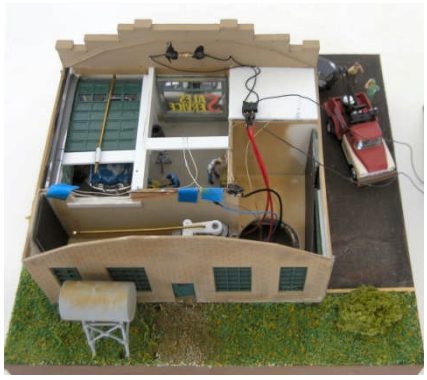
My MFAD has the ability to control several LEDs with simple ON-OFF controls and two LEDs with blinking capability and another with random flickering. Several different sound tracks can be played and a servo motor can operate some motion animation.

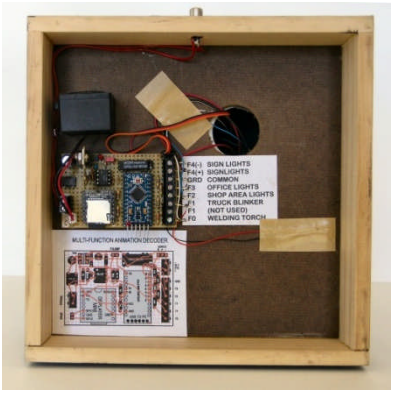
As one demonstration example, I have used my MFAD to operate tasks associated with a Motor Sales and Service building. The various assigned Function keys: (1) turn on lights in the sales office and in the shop area; (2) blink an emergency light on a tow truck; (3) flicker an LED to simulate a welding operation; (4) operate the shop garage door; (5) play different shop sounds as well as match sounds to the operating door and welding torch.

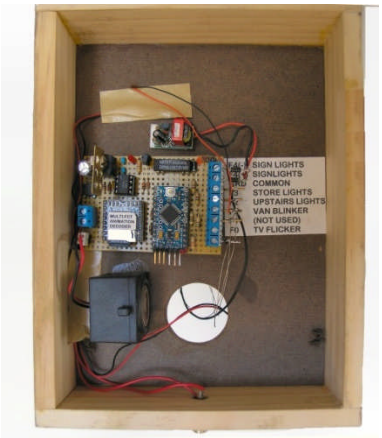
Another demonstration application for my MFAD is in a typical two-story building with a Café on the first floor and living quarters above. The DCC function keys operate: (1) both café and second floor lights; (2) blinking light on a milk delivery truck; (3) an external sign for the café; (4) a flickering TV set on the second floor; and (5) operating shades in the café; (6) play customer chatter sounds as well as matching TV and operating shade sounds.

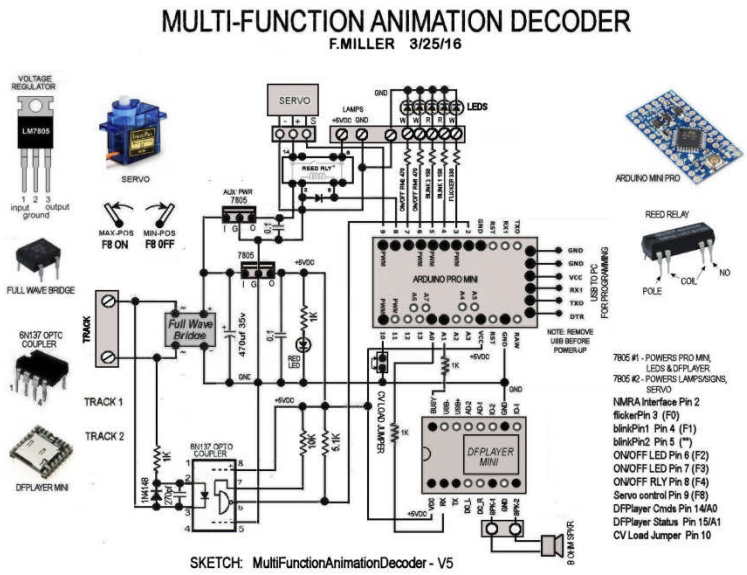
Operating the MFAD: The MFAD is controlled by DCC decoder function commands. Those commands can be issued from a number of different sources including DCC throttles and JMRI scripts or panels. For my Digitrax LocoNet layout, I have built an Arduino circuit with runs a "day schedule." A script is established which will issue LocoNet function ON-OFF commands at particular times of the simulated day. More details about this day scheduler is presented in a sidebar.

The MFAD circuit board is implemented with an Arduino MiniPro microcontroller which operates a DFPlayer sound board, playing selected MP3 or Wave file tracks, and a mico servo to provide motion. The LEDs are driven directly from the MiniPro but an additional output drives a relay for more current demanding components. One such use is providing power to a Miller Engineering Light Works sign. The Café example uses a custom built sign using the Electroluminescence Experimenter's kit.

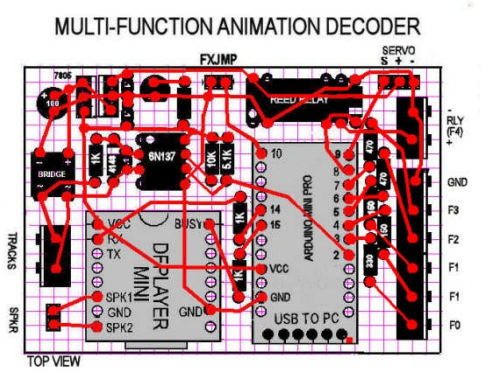


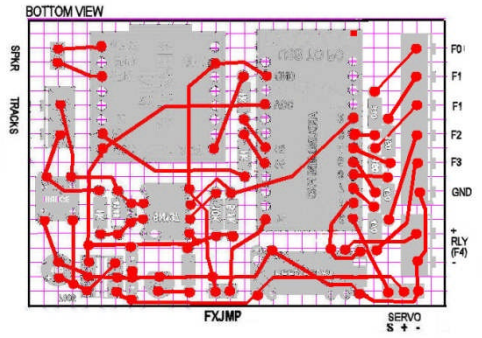






The MFAD circuit board accepts power and DCC function commands from the DCC track circuit. My implementations have used inexpensive parts mounted on a perf board. I use a graphic wiring aid to mount and wire the parts.





The cost for the MFAD would be between $10 and $15 depending upon the use of optional

	PART PRICE AND SOURCE LISTING				
Q	DESCRIPTION	PRICE	SOURCE	SOURCE PART NO.	MIN QTY
1	FULL WAVE BRIDGE	$ 0.29	JAMECO.COM	10300	
1	1N4001 DIODE	$ 0.05	JAMECO.COM	35975	QTY 10
1	1N4148 HIGH SPEED DIODE	$ 0.05	JAMECO.COM	36038	QTY 10
1	100MFD 50V ELECTROLYTIC CAP	$ 0.15	JAMECO.COM	29962	QTY 10
2	0.1MFD 50V DISK CAP	$ 0.15	JAMECO.COM	2146302	QTY 10
1	270 pf CAPACITOR	$ 0.06	ALLELECTRONICS.COM	271D50	QTY 10
2	7805 5V REGULATOR	$ 0.29	JAMECO.COM	51262	
3	1K OHM 1/4 W RESISTOR	$ 0.21	ALLELECTRONICS.COM		QTY 10
1	10K OHM 1/4 W RESISTOR	$ 0.07	ALLELECTRONICS.COM		QTY 10
1	5.1K OHM 1/4 W RESISTOR	$ 0.07	ALLELECTRONICS.COM		QTY 10
2	470 OHM 1/4 W RESISTOR	$ 0.14	ALLELECTRONICS.COM		QTY 10
2	150 OHM 1/4 W RESISTOR	$ 0.14	ALLELECTRONICS.COM		QTY 10
1	330 OHM 1/4 W RESISTOR	$ 0.07	ALLELECTRONICS.COM		QTY 10
1	RED T1 LED	$ 0.12	JAMECO.COM		
1	6N137 OPTO ISSOLATOR	$ 0.75	JAMECO.COM	113911	
1	MINI-MICRO SERVO SG90	$ 1.24	ALIEXPRESSS.COM	SG90 SERVO	
1	5V REED RELAY	$ 0.60	ALLELECTRONICS.COM	RLY-495	
1	ARDUINO MINI-PRO	$ 1.32	ALIEXPRESSS.COM	-	
1	DFPLAYER MODULE	$ 2.56	ALIEXPRESSS.COM	-	
1	1" SPEAKER IN ENCLOSURE	$ 2.00	ALLELECTRONICS.COM	SK-61	
1	4GB MICRO SD MEM CARD	$ 2.19	BUYINCOINS.COM	P001330	
1	3-POSTION MALE HEADER	$ 0.35	JAMECO.COM	421489	
2	2-POSTION MALE HEADER	$ 0.35	JAMECO.COM	421489	
1	2-POS SHORTING JUMPER	$ 0.15	JAMECO.COM	112432	
	TOTAL	$ 13.37			
OPTIONAL					
1	8 PIN IC SOCKET	$ 0.12	JAMECO.COM	526299	
2	5-POSITION TERMINAL BLOCK	$ 1.40	ALLELECTRONICS.COM	TER-405	
1	3-POSTION MALE HEADER	$ 0.35	JAMECO.COM	421489	
2	2-POSTION MALE HEADER	$ 0.35	JAMECO.COM	421489	
1	2-POS SHORTING JUMPER	$ 0.15	JAMECO.COM	112432	
DEPENDING ON APPLICATION					
2	PIN-POINT RED LEDS				
3	WIRED WHITE LEDS				
1	PERF BOARD, MISC HARDWARE	-	RADIOSHACK.COM	-	
		$ 15.74			

See a short video showing the MFAD in action:
https://youtu.be/G675FPWuIGM