med associates inc

instrumentation and software for research

PIGEON KEY WITH MULTI-COLOR DISPLAY

ENV-126AM

USER'S MANUAL

DOC-307
Rev. 1.1

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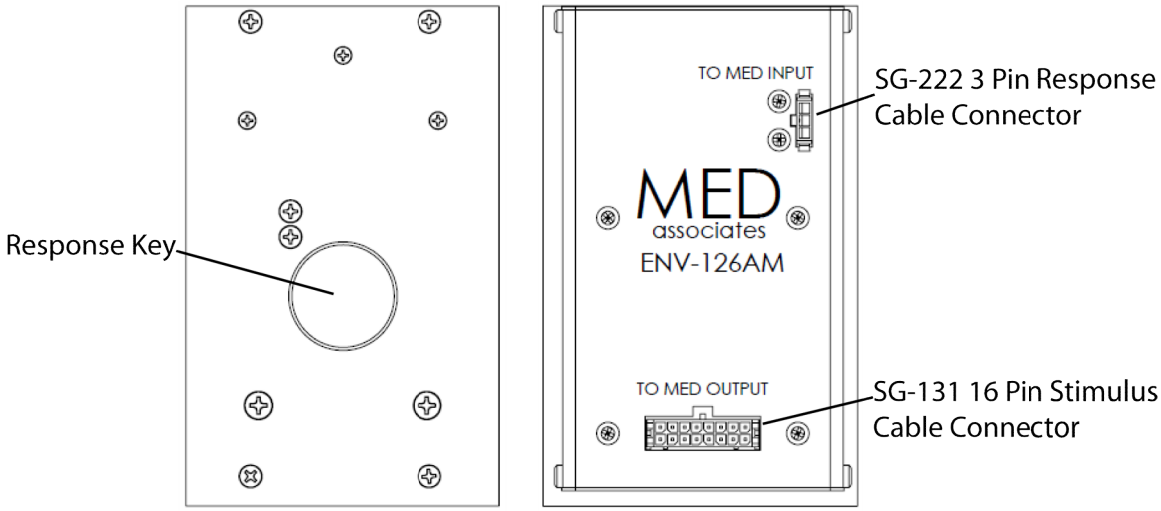
CHAPTER 1 | INTRODUCTION

The ENV-126AM Pigeon Key is a fast-response tap key designed for use in a modular operant conditioning chamber, and is capable of producing over 4,000 different colors in two different user selectable modes of operation. In legacy mode the ENV-126AM produces 12 different colors depending on which output is turned on. The legacy mode colors approximate the colors available on the Med Associates' ENV-123AM and ENV-124AM pigeon keys. The enhanced mode allows the user to generate up to 4,096 different colors by turning on multiple outputs.

CHAPTER 2 | HARDWARE

Hardware Overview

Figure 2-1 - ENV-126AM Front and Side View



Stimulus Cable

Use Table 2-1 as a guide when connecting the SG-131 (Figure 2-2) stimulus cable to the outputs and power port on the connection panel. Note, for legacy color mode operation, do not connect the white/yellow **Mode Select** cable.

Figure 2-2 - SG-131 Stimulus Cable

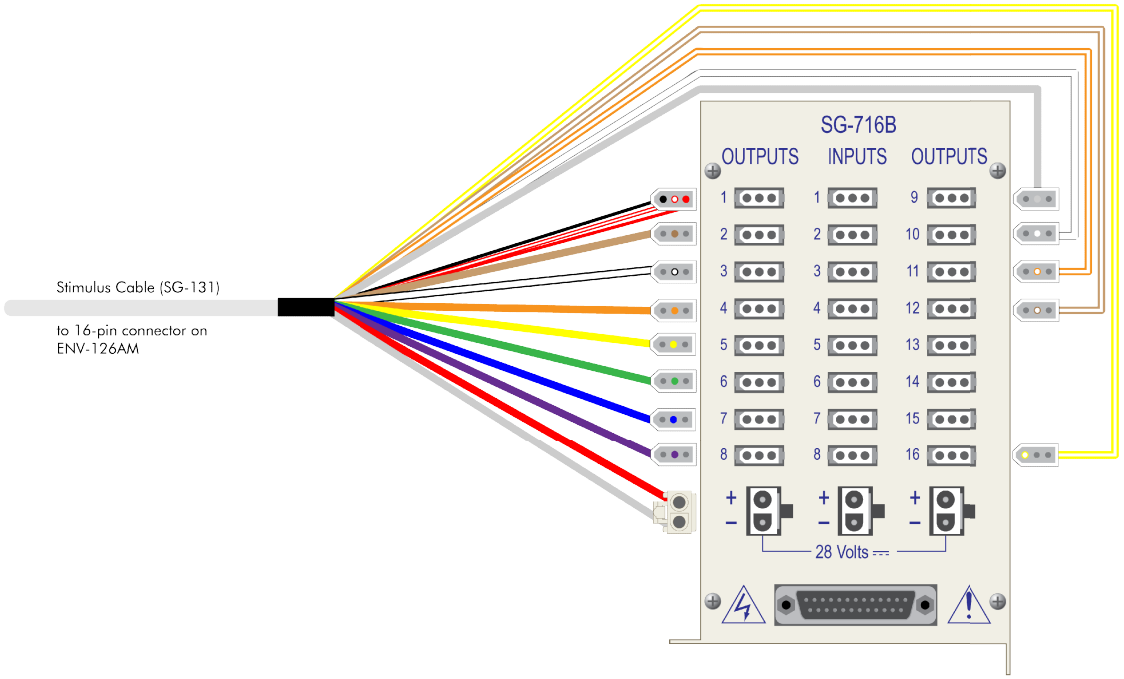


Table 2-1 – SG-131 Stimulus Cable Color Guide

Connector#/ Output #	Molex Pin #			Display Color / Function (Legacy)	Display Color / Function (Enhanced)
	1	2	3		
	Wire Color	Wire Color	Wire Color		
1	Black	Red/White	Red	Tan	Red 1
2	N/A	Brown	N/A	Red 1	Red 2
3	N/A	White/Black	N/A	Red 2	Red 3
4	N/A	Orange	N/A	Red 3	Red 4
5	N/A	Yellow	N/A	Amber	Green 1
6	N/A	Green	N/A	Yellow	Green 2
7	N/A	Blue	N/A	Green 1	Green 3
8	N/A	Purple	N/A	Green 2	Green 4
9	N/A	Grey	N/A	Blue 1	Blue 1
10	N/A	White	N/A	Blue 2	Blue 2
11	N/A	White/Orange	N/A	Blue 3	Blue 3
12	N/A	White/Brown	N/A	Blue 4	Blue 4
Power	Two pin connector with a black wire and a red wire**			28V Power	
Mode Select *	White/Yellow	N/A	N/A	Enable Enhanced Mode	

* Connect to any available output to enable Enhanced Mode.

** Not required if output 1 is connected.

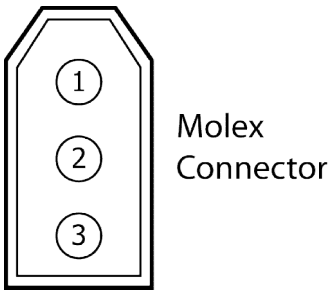
Response Cable

Plug the SG-222 response cable (Figure 2-3) into any available input on the connection panel.

Figure 2-3 - SG-222 Response Cable

Table 2-2 – SG-222 Response Cable Pinout

Molex Pin #	Wire Color	Function
1	Black	28VDC Ground
2	White	Key Response
3	Red	28V Power



CHAPTER 3 | OPERATING MODES

Legacy Mode

When the **Mode Select** cable is disconnected from the connection panel, the ENV-126AM operates in legacy mode. This mode enables the user to produce 12 different colors depending on which individual output is turned on. Legacy mode colors approximate the colors available on the Med Associates' ENV-123AM and ENV-124AM pigeon keys. A sample of available legacy mode colors is illustrated in Table 3-1.

Table 3-1 - Legacy Mode Colors

Output #	Color	Name	Hex Value	Red Value	Green Value	Blue Value
1		Tan	#CDB09D	205	189	157
2		Red 1	#F28172	242	129	114
3		Red 2	#604344	96	67	68
4		Red 3	#A05D5C	160	93	92
5		Amber	#FDA475	254	161	117
6		Yellow	#CE9F6F	206	159	111
7		Green 1	#557D64	85	125	100
8		Green 2	#1F4C3A	31	76	58
9		Blue 1	#202D39	32	45	57
10		Blue 2	#363F45	54	63	69
11		Blue 3	#484E4D	72	78	77
12		Blue 4	#254C4A	37	76	74

Any combination of outputs may be turned on to create various colors in legacy mode.

Enhanced Mode

Enhanced mode allows the user to generate up to 4,096 different colors that are brighter and more vibrant than the colors produced in legacy mode. Enable enhanced mode by plugging the **Mode Select** cable into any available input on the connection panel.

Enhanced mode may be operated in a manner similar to legacy mode by simply turning on a single output (or multiple outputs for white). The available colors using this approach are illustrated in Table 3-2.

Table 3-2 - Enhanced Mode Basic Colors

Output #	Color	Name
1		Red 1
2		Red 2
3		Red 3
4		Red 4
5		Green 1
6		Green 2
7		Green 3
8		Green 4
9		Blue 1
10		Blue 2
11		Blue 3
12		Blue 4
1 + 5 + 8		White*
1 + 5		Yellow
1 + 8		Pink

* Actual white color generated may vary.

Enhanced Mode Advanced Operation

Colors are produced by mixing different values of the primary colors red, green and blue. Each primary color is allocated 4 outputs, 1-4 for reds, 5-8 for greens and 9-12 for blues. Multiple outputs may be turned on to produce up to 4,096 different colors. A sample of available colors is presented in Table 3-3.

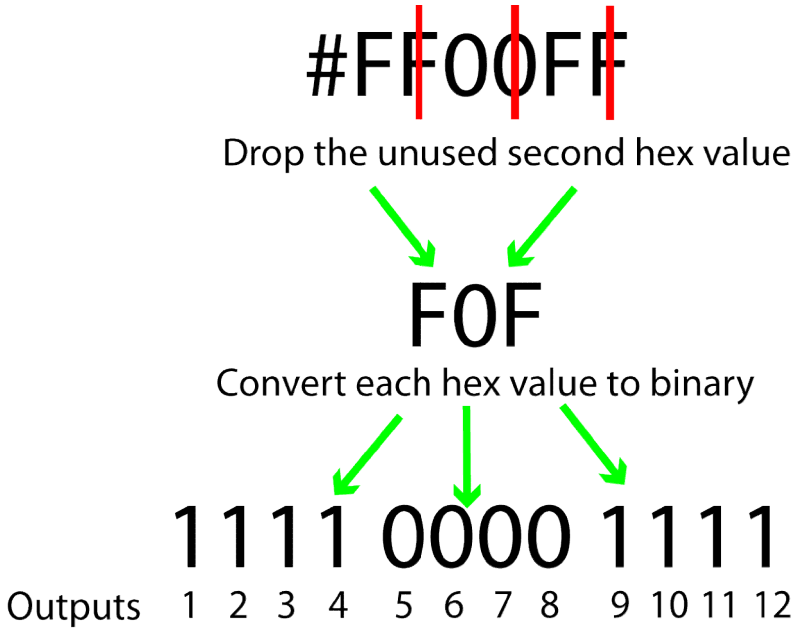
Table 3-3 - Sample Enhanced Mode Colors

Color	Name	Hex Value	Red Value	Green Value	Blue Value
	Light Blue	#99CCFF	153	204	255
	Yellow	#FFFF00	255	255	0
	Gold	#FFD700	255	215	0
	Lime Green	#66FF33	102	255	51
	Orange	#FF6600	255	102	0
	Cornflower Blue	#6495ED	100	149	234

Enhanced mode colors are generated using the “Additive” color system. Starting with the color black, different values of red, green and blue are added to the black to obtain the desired color. The different values of red, green and blue are added to the mix by turning on different numbers of outputs. Determining which outputs to turn on starts with the hex value of the desired color. The hex value is then converted to a binary number, and each 1 in the binary number will indicate which output to turn on.

Normally each red, green and blue color value is represented by 2 hexadecimal values, or 8 bits each. The ENV-126AM is a 4-bit system so the second hex value for each color is not used. To illustrate, the hex value for Fuchsia is #FF00FF, dropping the second hex value for each color leaves F0F, which converted to binary is 1111 0000 1111. To generate the fuchsia color we will turn on each output that has a 1 in the binary number, so outputs 1-4 and 9-12 are turned on. See for Figure 3-1 for an example.

Figure 3-1 – Fuchsia Hex to Binary to Output Number Example



Converting hexadecimal color values and converting them to binary values is easily accomplished by using any of the many available online resources. This Hexadecimal Colors[1] page has a great color mixer/selector and contains helpful information about hexadecimal color values. And Binary to Decimal to Hexadecimal Converter[2] has a value converter for obtaining the binary vale from the hex value.

As additional examples, assume we select the following colors using a hexadecimal color table:

Color Sample	8-bit Hex Value
	4D1B7B
	00FF00
	FFBF00
	FE0000

1: https://www.mathsisfun.com/hexadecimal-decimal-colors.html

2: https://www.mathsisfun.com/binary-decimal-hexadecimal-converter.html

Now convert the 8-bit hex color value to the 4-bit equivalent by dropping every other bit (highlighted in grey):

Color Sample	8-bit Hex Value	4-bit Hex Value
	4D1B7B	417
	00FF00	0F0
	FFBF00	FB0
	FE0000	F00

Using a hexadecimal to binary conversion tool, such as linked to above, convert the 4-bit hex values to binary numbers:

Color Sample	8-bit Hex Value	4-bit Hex Value	Binary Value
	4D1B7B	417	0100 0001 0111
	00FF00	0F0	0000 1111 0000
	FFBF00	FB0	1111 1011 0000
	FE0000	F00	1111 0000 0000

Remember, each color value, red, green and blue, is allocated 4 output values. Outputs 1-4 are assigned to red, 5-8 are assigned to green and 9-12 are assigned to blue. Each set of 4 digits in the binary number is allocated the same way, the first set of 4 digits correspond to outputs 1-4 for red, the second set of 4 binary digits corresponds to outputs 5-8 for green and the last set of digits is for outputs 9-12 for blue. To generate a color, turn on the outputs that have a 1 in the binary pattem:

Color Sample	8-bit Hex Value	4-bit Hex Value	Binary Value	Outputs to Turn On
	4D1B7B	417	0100 0001 0111	2, 8, 10, 11, 12
	00FF00	0F0	0000 1111 0000	5, 6, 7, 8
	FFBF00	FB0	1111 1011 0000	1, 2, 3, 4, 5, 7, 8
	FE0000	F00	1111 0000 0000	1, 2, 3, 4

Alternative Wiring Connections

While 13 output connections are required to provide full functionality of the ENV-126AM Pigeon Key, the ENV-126AM may be operated using fewer output connections to provide limited color outputs. For example, if only 4 outputs are available on the connection panel, output lines 1, 5, 9 and the mode select line could be used to produce the enhanced mode red, green and blue colors. These lines could also be used to mix red and green, red and blue, or blue and green.

CHAPTER 4 | CONTACT INFORMATION

Please contact Med Associates, Inc. for information regarding any of our products.

For Technical questions, email support@med-associates.com.

For Sales questions, email sales@med-associates.com.

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