T-73-41

6125A

DATA AND SPECIFICATIONS
DESCRIPTION AND INSTRUCTIONS

Optical Electronics Incorporated

ANALOG IMAGE ROTATOR

FEATURES

- 360° ROTATION
- FREQUENCY RESPONSE 500KHz
- REAL TIME ANALOG
- OUTPUT : ± 10V, ± 10mA

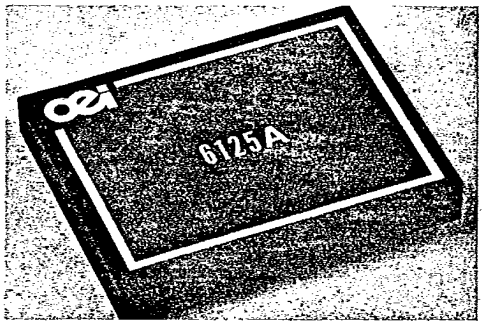
APPLICATIONS

- IMAGE ROTATION
- COMPOSITE - ISOMETRIC VIDEO
- INFRARED IMAGERY
- ULTRASONIC IMAGERY
- AUDIO - COMMUNICATIONS
- SONAR
- RADAR

DESCRIPTION

The 6125A Image Rotator is an analog device that enables the user to rotate the image of an object about any of its axes. In a stand-alone configuration, the 6125A may be used as a two-dimensional image rotator. Rotation is continuous over a full 360° and the rotation angle is linearly related to the rotation input voltage. In operation, two voltages representing the X and Y coordinates of a vector V are applied to the A and B inputs of the device. If now a DC voltage is applied to the phase input of the device, a phase difference will be introduced between the old X and Y vectors. In other words, an angular displacement takes place about the origin of the two vectors in either a positive or negative direction, depending on the sign of the applied phase voltage. A full 0° to 180° rotation is accomplished between 0 and +10V. Another 0° to 180° rotation happens when the voltage is varied from 0 to −10 volts. This DC voltage can come from any source, including, of course, a digital to analog (D/A) converter. However, the user can take advantage of the ±10V reference voltages provided on the +10VR and −10VR pins of the device. A linear potentiometer can be connected to these pins with the wiper going to the θ (phase) pin to serve as an input.

The information on the A and B axes is limited to ±10 volts and the frequency limitations are DC to



500KHz or 30V/μs. For continuous rotation, the input voltage can be a triangle, or a ramp with a fast flyback. Voltages must be linear, else the rotation will not be linear. Two 6125A's, connected as shown in the application section, will provide rotation about either of two axes. If rotation of 3 axes is required, three 6125A's are necessary for the application.

When the vector length is measured by the square root of the sum of the squares, i.e. measuring both outputs at a +7.07 volts DC input voltage and sweeping the θ (phase) input over the full ±10V range, the vector length error is ±3% max. guaranteed. Input resistance is 1M ohm minimum and the input voltage can vary from 0 to ±10 Volts.

SPECIFICATIONS

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ELECTRICAL

Specifications at T_A = +25°C, V_{CC} = ±15VDC unless otherwise noted.

MODEL		6125A			
PARAMETER	**CONDITION**	**MIN**	**TYP**	**MAX**	**UNITS**
TRANSFER FUNCTION					
A-0 B-0		Ain cos θ − Bin sin θ Bin cos θ + Ain sin θ			
RATED OUTPUT					
Voltage Current A_O, B_O Resistance	Io = ±10mA, R_L = 1KΩ Vo = ±10V, R_L = 1KΩ	±10 ±10		 1	V mA Ω
DYANMIC RESPONSE					
Trignometric Functions Small Signal Bandwidth Multiplier Small Signal Bandwidth Trignometric Functions Large Signal Bandwidth Multiplier Large Signal Bandwidth Output Slewing Rate		300 1 30 500	 30	 	KHz MHz KHz KHz V/μsec
REFERENCE VOLTAGE					
	Io = ±10mA		±10.0		V
INPUT OFFSET VOLTAGE					
Input Offset Voltage-R Input Input Offset Voltage Drift Output Offset Voltage Output Offset Temperature Coefficient Power Supply Sensitivity				±20 ±1 ±20 ±2 ±25	mV mV/°C mV mV/°C mV/V
ERROR					
Sine Error Cosine Error Multiplication Error Total Error			 0.3	0.3 0.3 0.5 0.5	% % % %
INPUT					
Angle Θ Resistance Angle Θ Voltage Range Ain, Bin Resistance Ain, Bin Voltage Range[2] Maximum Voltage Without Damage		100 ±10 1 ±7.0 $\pm V_S$			MΩ V MΩ V V
POWER SUPPLY					
Rated Voltage Current, Quiescent		±12	±15	±18 ±120	V mA
TEMPERATURE RANGE					
Operating Range Storage Range Thermal Resistance of Module Quiescent Temperature Rise		-55 -65		+85 +100 10 13	°C °C °C/W °C Above Ambient

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TYPICAL PERFORMANCE CURVES

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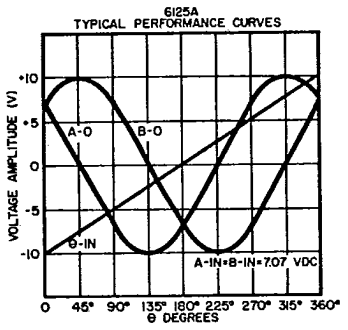
(T_A = +25°C, V_{CC} = ±15VDC unless otherwise noted)



The reference voltage sources provide +10 Volts or −10 Volts, and are capable of delivering ±10 milliamp maximum. These reference voltages can be used for other applications in the same system, and are not limited for use as the angular input only. The power supply leads are internally compensated and no external bypass capacitors are needed.

GENERAL DESCRIPTION AND APPLICATIONS

The 6125A is best known for its transfer function of an image rotator. In this application, image rotation in one, two, or three axes can be performed with a minimum of parts and effort. However, the device can also be used as a function generator, as will be discussed later in this section.

The 6125A utilizes active monolithic circuitry in combination with passive discrete components in a modular construction. As noted before, continual vector rotation of 360° about one axis of a three dimensional image is possible. Also, vector additions of the form Ain cos θ − Bin sin θ and, simultaneously, Bin cos θ+Ain sin θ can be performed. Additionally, +10 Volt and −10 Volt reference voltages are furnished. These references can be used with the 6125A or for any other purpose in the same system.

Normally, the 6114 channel amplifier is connected in front of the 6125A, but, of course, it can be used in a stand-alone configuration as well.

The functional block diagram shown in Figure 1 explains the operation. Three inputs are used for proper operation. The inputs labeled A and B are the vector values for the two axes. Additionally, the phase angle θ is input at its front end. The voltage representing the phase angle is split and fed to two function generators which provide sin θ and cos θ at their output. This information, together with the input vector information, is fed to two independent multipliers. This combination provides the functions mentioned earlier.

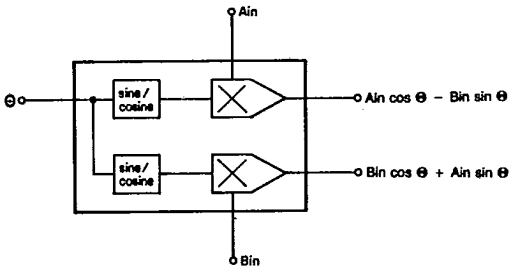


FIGURE 1. FUNCTIONAL BLOCK DIAGRAM

BASIC CONNECTIONS

Figure 2 shows the basic connections of the 6125A. The A and B inputs could, for instance, represent the vertical and horizontal axes of a display. Naturally, the same, but processed, information is then taken off from the A-0 and B-0 pins to be fed to the appropriate display. The phase information θ can be sourced in any way as long as the positive and negative voltages do not

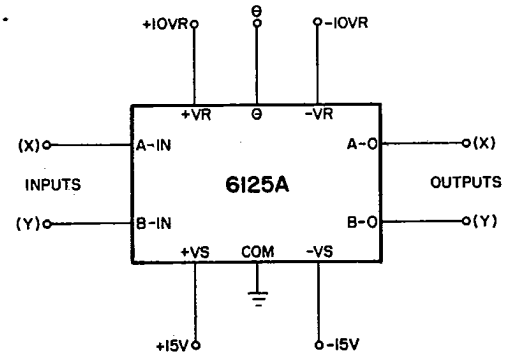


FIGURE 2. BASIC CONNECTIONS

exceed the ±10V maximum signal levels. The 1M ohm minimum input resistance will load any signal source only minimally. The outputs are capable of ±10V full scale into a 1000 ohm minimum load resistance. The device is capable of operation from DC to 500kHz.

Also provided are two reference voltages, a +10V and −10V, both of which are capable of delivering ±10mA.

The final connections are the three power supply inputs of nominally ±15V, and the device will operate from ±12V to ±18V. When designing with the 6125A, it should be remembered that the quiescent supply current is ±120mA maximum.

FUNCTION GENERATOR

As has been mentioned earlier, the 6125A is capable to operate as a function generator. The A and B inputs together with the phase input θ are converted to the two functions Ain cos θ − Bin sin θ and Bin cos θ + Ain sin θ. Figure 3 shows the device when it is connected for this use.

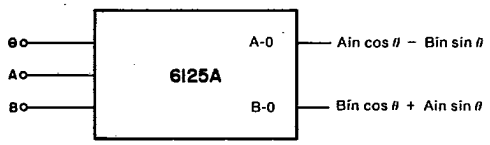


FIGURE 3. WAVEFORM GENERATION

VECTOR MANIPULATION

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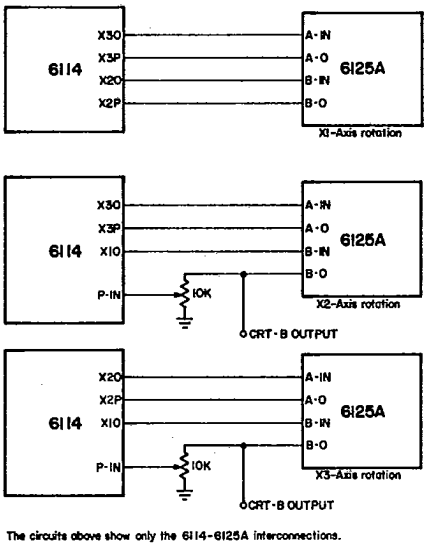
Figure 4 shows the connections for the 6125A when it is used together with 6114 channel amplifier. Three different connection schemes for single rotation of each axis are shown.



The circuits above show only the 6114-6125A interconnections.

FIGURE 4: 6114-6125A INTERCONNECTIONS

Rotation is accomplished by holding one of the axes and rotating the others about this reference. In a three-dimensional application, this would look as shown in Figure 5.

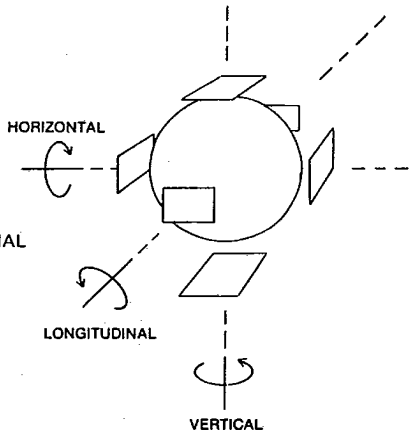


FIGURE 5: THREE DIMENSIONAL ROTATION

Figure 6 shows the connections for applications needing more than one axis rotated simultaneously. Four different connection schemes for two and three axes rotation are shown.

As has been mentioned, any of the axes can be taken as the reference, if the image is displayed with an XY monitor.

OEI has a device (6280), a composite video to analog converter, which provides horizontal and vertical ramps, and, of course, video less sync pulses. Horizontal and vertical sync pulses are isolated and output independently.

This kind of display is used in a number of sophisticated computer/map overlays. In one instance, the camera's video signal is zoomed in at a 10:1 ratio, then, again, zooming the "projector" at the same ratio for a total zoom ratio of 100:1. An airfield can be displayed in this manner as an overlay of a map, and then rotated, depending on the aircraft aspect angle. The real time performance of the 6125A is much appreciated in such a case. Of course, the device does find applications in other areas, including the entertainment industry.

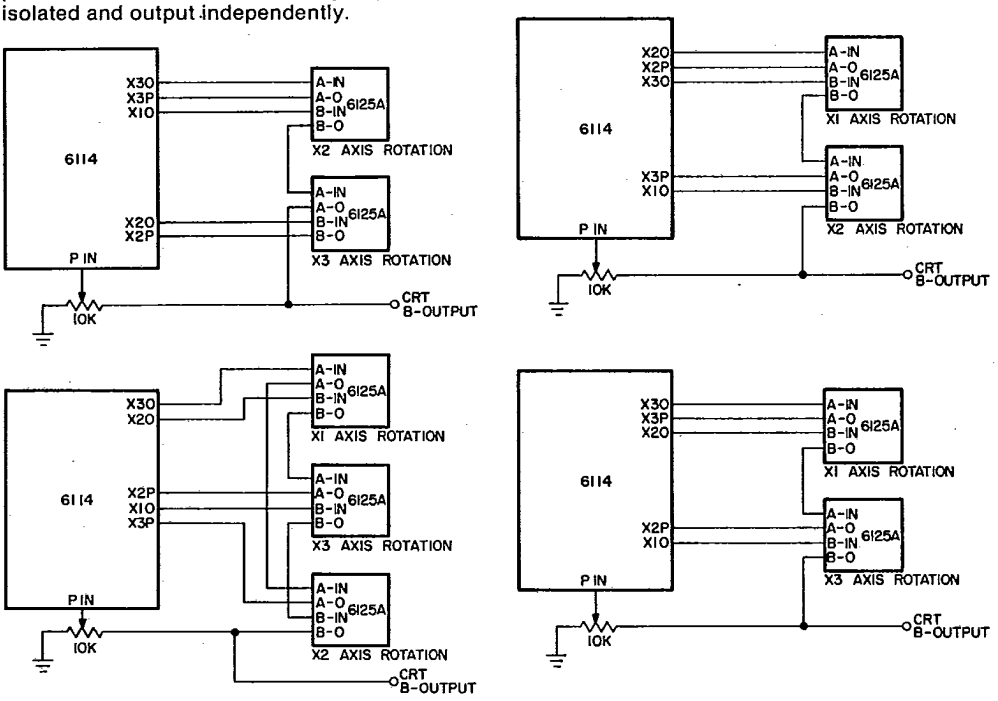


FIGURE 6: 1 & 2 — CONNECTIONS FOR SIMULTANEOUS AXIS ROTATION

CLOCK IMAGE MULTIPLEXER

The 6125A rotator finds an interesting application in a rather unexpected place. Figure 7 shows the basic connections for this expandable application, where the wide frequency range capability of the device can be taken advantage of. The objective is to display the hour and minute hands of a clock. An example of the display is shown in figures 8a and 8b.

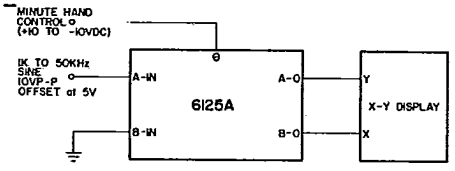


FIGURE 7: CLOCK IMAGE BASIC CONNECTIONS

FIGURE 8A & B: CLOCK IMAGE MULTIPLEXING

Figure 8a has a minute hand control voltage of zero volts, 8b is at +5V. Naturally, this display could be expanded to show more than one vector, if the images were multiplexed. Further, if

appropriately done, one could rotate each vector differently. This is depicted in Figure 9a and 9b.

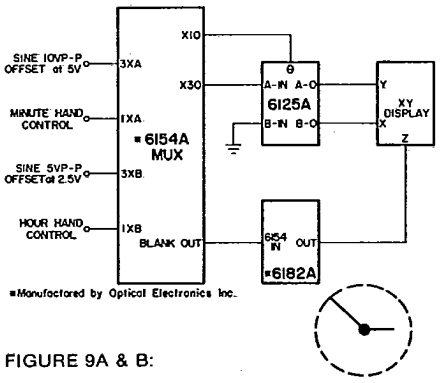


FIGURE 9A & B:

Figure 9b has a minute hand control of −2.5V and the hour hand control is at +5V.

Figure 10a shows a block diagram for the multiplexing of three separate clock images on one display. Each clock has independently rotating hands, and an illustration of the display is shown in Figure 10b. The OEI 6182A blanking module in

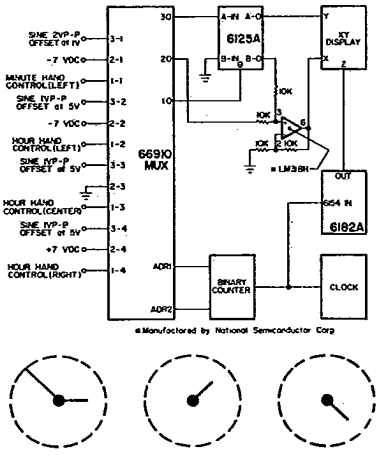


FIGURE 10A & B:

the circuit eliminates all retrace lines between the images being multiplexed. Note: The 6182A output is positive blanking.

Alpha numerics could be generated by an X-Y keyboard and could also be multiplexed with the display. Alpha numerics could also be silk screened on a film and placed directly on the CRT screen.

This application is not limited to clock time, any needle reading gauge can be displayed in this fashion, including air speed indicators, speedometer, and other measurement devices.

VISUAL EFFECTS

Still another rotation application is shown in Figure 11. This system gives the user the ability to multiplex two images together. Image one could be used as a reference background plain(s) and image two as the main image. Image two will have the ability of rotation about any of three axes, zooming accomplished with the OEI 6134, perspective views, shading cues, and horizontal or vertical translation, or both. Image one can be used as an unprocessed reference image to enhance the depth of image two. R1 controls the relative intensity between multiplexed images. R2 controls the amount of perspective induced in image two and R3 controls the shading intensity of image two. Perspective, horizontal, and vertical translation are produced by the 6114 circuitry. Shading and the inherent hidden line interposition is generated through the rotators in three-dimensional applications (blanking input on X-Y display necessary).

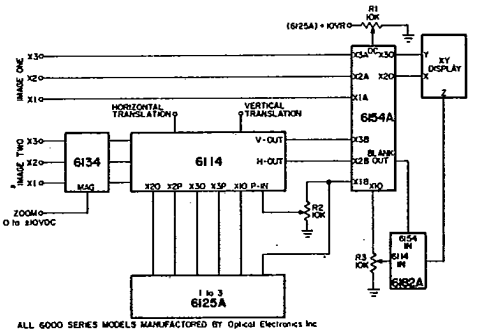


FIGURE 11:

Stereo viewing can also be incorporated with the 6125A. Binocular effects and studies on how people see can be performed with the OEI 6170 module.

For ease of connections of a system, OEI offers 44-pin cards to mount the modules and hold any external circuitry needed. The 6125A rotator mounts on a 66025 card. All other OEI modules mentioned also have a 66000 series card to mate with. Please contact OEI for more details on these products.

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