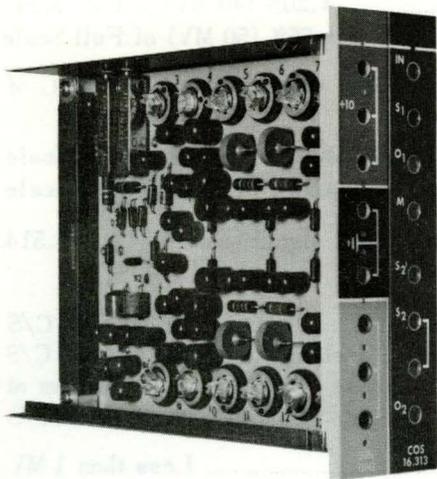


an accessory for PACE[®] TR-10/TR-20/TR-48 Analog Computers

SINE-COSINE GENERATOR

Type 16.313 - - single unit for TR-10 and TR-20 analog computers

Type 16.314 - - dual (two independent) unit for TR-48 analog computer



FEATURES

- * High reliability
- * Unlimited resolution
- * Extensive flexibility
- * Wide bandwidth response
- * Function set-up time minimized
- * Low drift and noise
- * Patch panel terminations for simplified programming
- * Low power drain

Type 16.313/16.314 Sine-Cosine Generators are used in EAI TR-10, TR-20 and TR-48 Desk-Top Analog Computers to supply a fixed function of a variable. Used in conjunction with two operational amplifiers, they accept inputs ranging from $-10V$ to $+10V$ and provide outputs in all four quadrants ($\pm 180^\circ$) for Sine and Cosine. They replace the usual feedback resistors, and included networks assure correct magnitudes of scaling and input impedance. The use of these Sine-Cosine Generators simplifies the setting up of fixed functions while providing greater reliability, flexibility and accuracy than has been previously possible.

Selected silicon diodes and precision wirewound resistors are used throughout the Sine-Cosine generators to assure long-life reliability, and high resolution with low drift and noise. Thermistor circuits minimize drift due to temperature changes. Setting-up time is merely that required for an initial check-out of the module -- the only other procedure being the patching of the function into the problem. All connections necessary are available on the patching panel, and are clearly marked for ease of programming.

Versatility of function formation and visual presentation is extended with the availability of up to 20 segments for Sine functions, 10 segments for Cosine. When patched for Sine the input scaling is 18° per volt, with a typical error of 0.4% full-scale over the 20 kc frequency range.

(EAI reserves the right to revise its product specifications in accordance with its continuing program of product development.)

EAI

ELECTRONIC ASSOCIATES, INC., Long Branch, New Jersey

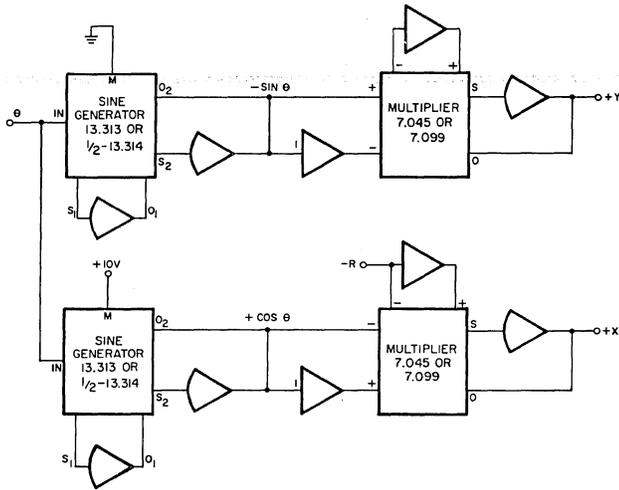
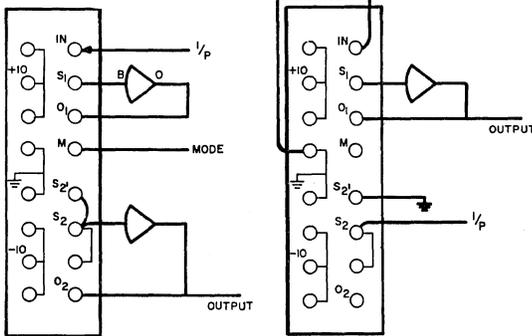


Figure 1. Polar to Rectangular Conversion

Problems requiring the solution of a vector quantity into its rectangular coordinates can be solved by combining the Sin/Cos Generator with any of the EAI Quarter-Square Electronic Multipliers. Electronic coordinant resolution, utilizing such combinations, offer many advantages over servo-resolvers. The most significant is in dynamic accuracy, where the combination of the Model 13.313 or 13.314 Sin/Cos Generator with a Quarter-Square Multiplier is capable of performing coordinant resolutions 100 times faster than with servo-resolvers. The unsurpassed dynamic accuracy of the combination makes it ideally suited for repetitive operation computers and for other computations where high-speed operations is desirable. Other advantages resulting from the all-solid-state circuitry are unlimited resolution, low-noise level, and increased reliability.

Polar to rectangular transformations, Figure 1, are performed by resolving a known vector R and angle θ into vector quantities along the X and Y coordinate axis, according to the equations $X = R \cos \theta$, and $Y = R \sin \theta$.



Patching 180° Function

Patching 90° Function

M GROUNDED FOR SINE $\pm 180^\circ$
 M AT $\pm 10V$ FOR $\pm \text{COSINE } \pm 180^\circ$
 M AT $-10V$ FOR $-\text{COSINE } \pm 180^\circ$

SPECIFICATIONS

Input Scaling ($\pm 10V$ Maximum = 180°)

Sine Mode $18^\circ/V$ (0.555 V/Degree)
 Cosine Mode $18^\circ/V$ (0.555 V/Degree)

Output Scaling ($\pm 10V$ Maximum)

Sine Mode $\pm 10 \sin \theta$
 Cosine Mode $\pm 10 \cos \theta$

ACCURACY

Static Error -- any point within $\pm 180^\circ$ (any of the three modes)

Ambient Temperature varying between $12^\circ C$ and $50^\circ C$:

Typical $\pm 0.20\%$ (40 MV) of Full Scale
 Maximum $\pm 0.25\%$ (50 MV) of Full Scale

Ambient Temperature varying between $\pm 5^\circ C$ of set up temperature:

Typical $\pm 0.10\%$ (20 MV) of Full Scale
 Maximum $\pm 0.15\%$ (30 MV) of Full Scale

Dynamic Error -- small signal (with 6.712 or 6.514 Dual DC Amplifier)

Phase Shift 5° at 1000 C/S
 Peaking Within Passbands 5% at 4000 C/S
 Frequency Response (Typical) 3 dbdown at $>12KC/S$

Zero Error Less than 1 MV

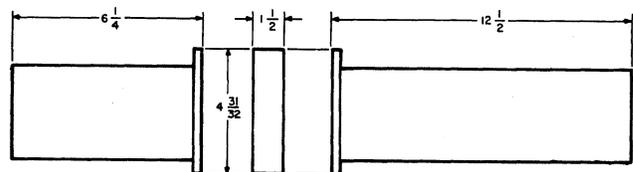
Noise (any of the three modes)

Typical 5 MV Peak-to-peak
 Maximum 10 MV Peak-to-peak

POWER SUPPLY REQUIREMENTS PER CARD

+15V 4.5 MA
 +10V 2.2 MA
 -10V 2.2 MA
 -15V 4.5 MA

DIMENSIONS



Type 13.313

Type 13.313-4
(Identical)

Type 13.314