

C670
A689
695
A1618

Revised April 1987

SOLID STATE COMPUTING MODULES

FEATURES:

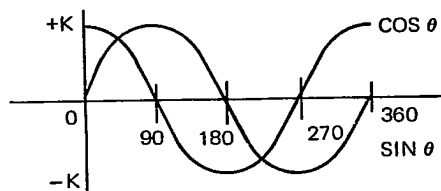
- No calibration, adjustments or warmup.
- Ultra reliable:
- Infinite resolution.
- Factory repairable, hermetically sealed for total protection.
- Designed for P.C. board mounting.
- All models are short circuit proof.
- Meets MIL-STD-202D. Methods 101C, 105B, 106C, 107C, 202D, 204D and 205D.



Coordinate rotation, polar to rectangular or rectangular to polar conversion, sine-cosine generation and similar trigonometric computing functions that in the past were implemented with mechanical resolver servo-systems, can now be performed with our small, highly reliable, solid state modules.

LINEAR DC TO SINE-COSINE, MODEL C670

Converts a D.C. voltage, representing an angle, into two output voltages that are proportional to the sine and cosine of the desired angle.



Input: -10VDC to +10VDC
(See Input Variations)

Input Z: 95K minimum.

Output:

Two D.C. voltages: one proportional to $K \sin \theta$, the other to $K \cos \theta$. K is 10 volts $\pm 1\%$ over specified operating temperature range.

Output Impedance: 1 Ω maximum.

***Accuracy:**

	Code "C" 0° to +70°C	Code "M" -55°C to +85°C
at 25°C	$\pm 10'$	$\pm 1.2'$

*Angular accuracy is determined by ratio of $\frac{\text{sine out}}{\text{cosine out}}$

Input Variations:

On special order, the input angle may be offset from 0° to 360°; the scale factor (volts per degree) may be changed from 0.5 volt/180° to 100 volts/180°; the angular limits of rotation may be as low as a 90° span, and the output may be reversed.
Dynamic Response: For a 180° step input, 5 ms maximum for output to reach rated accuracy.

Load Resistance: 2000 ohms minimum for rated accuracy.

Output Drive Capability: 5 mA for rated accuracy. Output is short circuit proof.

Output Ripple: 10 mv RMS max.

DC Power Requirements: $\pm 15\text{VDC} \pm 3\%$ at 40 mA maximum
+ 5VDC $\pm 3\%$ at 30 mA maximum

Operating Temperature: Model C: 0°C to +70°C
Model M: -55°C to +85°C

Storage Temperature: -65°C to +125°C.

Weight: Approx. 10 oz.

Potting: For high shock or vibration applications, units should be potted. Add "P" after part number.

Part Number Designation:

C670-XXXX(X)X XX X X

└─ Add "P" if potting required
└─ Operating Temp. (C or M)
└─ Indicates magnitude of K for full scale angle. Disregard polarity
S: +voltage for + angle
R: +voltage for - angle.
Offset, if any including polarity
180: +180° to -180°
090: + 90° to - 90°
Add "A" suffix for 0° to θ format. Ex:

θ	R	S
180°	-10	+10
90°	-5	+5
270°	+5	-5

180A: 0° to 180°
360A: 0° to 360°

COORDINATE ROTATOR MODEL A689

Accepts rectangular inputs (X and Y) and rotates these coordinates through an angle that is proportional to a linear DC input.

Input:

Rectangular Input θ :

$X = R \cos \theta$, (-10 to +10VDC).

$Y = R \sin \theta$, (-10 to +10VDC).

R may vary from ± 20 mV to ± 10 volts.

Angular Input β : +10 to -10VDC

Representing angles from 0 to 360°.

Input Z: 100K minimum.

Output: $R \sin (\theta + \beta)$

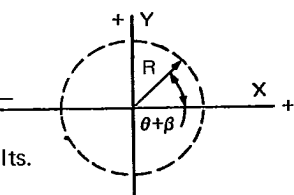
$R \cos (\theta + \beta)$

***Accuracy:**

	Code "C" 0° to +70°C	Code "M" -55°C to +85°C
at 25°C	$\pm 10'$	$\pm 1.2'$

*Angular accuracy is determined by ratio of $\frac{\text{sine out}}{\text{cosine out}}$

Dynamic Response: For a 180° step input, 5 ms maximum



Output Impedance: 1 Ω maximum

Load Resistance: 2000 ohms minimum for rated accuracy.

Load Resistance: 2000 ohms minimum for rated accuracy.

Output Drive Capability: 5 mA for rated accuracy. Output is short circuit proof.

Output Ripple: 10 mV RMS maximum

DC Power Requirements: $\pm 15\text{VDC} \pm 3\%$ at 75 mA maximum
+ 5VDC $\pm 3\%$ at 50 mA maximum

Operating Temperature: Model C: 0°C to +70°C
Model M: -55°C to +85°C

Storage Temperature: -65°C to +125°C.

Weight: Approx. 10 oz.

Potting: For high shock or vibration applications, units should be potted. Add "P" after part number.

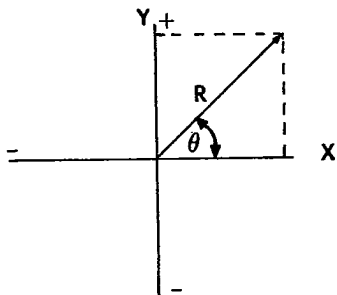
Part Number Designation:

A689 **

└─ Add "P" if potting required
└─ Operating Temp. (C or M)

RECTANGULAR TO POLAR, MODEL 695

Converts rectangular coordinates (X, Y) into polar coordinates (R, θ)



Input: $X = R \cos \theta$
 $Y = R \sin \theta$

R may vary from 20mV to 10 V DC

Input Z: 100 K Ω minimum

Output:

a) $R = \sqrt{X^2 + Y^2}$. Varies from +50 mV minimum to +10 V DC maximum. (200:1 minimum Dynamic Range)

b) $\theta = \tan^{-1} \frac{Y}{X}$. Varies from -10V DC to +10V DC representing 0 - 360°.

Cross Over Point is Non-ambiguous

Accuracy: ± 15 minutes at $R = 10$ V DC at 25°C
 Accuracy varies inversely with R. Typical values are 25 minutes at $R = 1$ V DC and 3° at $R = 0.050$ V DC

Stability: $\theta \pm 0.015^\circ/\text{C}$ at $R = 10\text{VDC}$
 $R \pm 0.01\%$ FS/°C

Dynamic Response:

For a 180° step input, 2 ms maximum for output to reach rated accuracy.

Load Resistance: 3000 ohms minimum for rated accuracy.

Capacity Loading: 100 pF maximum

Output Drive Capability: 5 mA for rated accuracy. Output is short circuit proof.

Output Ripple: 10 mV rms maximum excluding switching transients

DC Power Requirements: ± 15 V DC $\pm 3\%$ at 75 mA maximum

Operating Temperature: Model C: 0°C to +70°C
 Model M: -55°C to +85°C

Storage Temperature: -65°C to +125°C.

Weight: Approx. 11 oz.

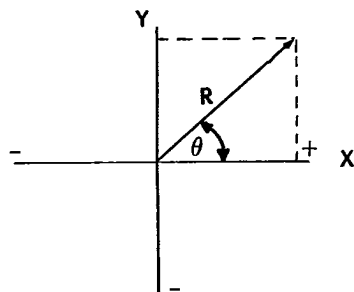
Potting: For high shock or vibration applications, units should be potted. Add "P" after part number.

Part Number Designation:

695**
 Add "P" if potting required
 Operating Temp. (C or M)

POLAR TO RECTANGULAR, MODEL A1618

Converts polar coordinates (R, θ) into rectangular (X, Y)



Input:

R: $\pm 20\text{mV}$ to $\pm 10\text{VDC}$

θ -10VDC to +10VDC representing 0-360°

Input Z: 100K minimum

Output:

$X = R \cos \theta$ (-10 to +10VDC)

$Y = R \sin \theta$ (-10 to +10VDC)

Accuracy:

	At 25°C	Code C 0° to +70°C	Code M -55°C to +85°C
$\theta =$	$\pm 10'$	$\pm 30'$	$\pm 1.2^\circ$

$\theta = \tan^{-1} Y/X$. θ varies inversely with R. Typical values are 10 minutes at $R = 10\text{VDC}$, 30 minutes at $R = 1\text{VDC}$ and 3° at $R = 0.05\text{VDC}$.

Dynamic Response: For a 180° step input, 5 ms maximum for output to reach rated accuracy.

Output Z: 1 Ω maximum

Load Resistance: 2000 ohms minimum for rated accuracy.

Output Drive Capability: 5 mA for rated accuracy. Output is short circuit proof.

Output Ripple: 10 mV RMS maximum

DC Power Requirements: $\pm 15\text{VDC} \pm 3\%$ at 75 mA maximum
 $+ 5\text{VDC} \pm 3\%$ at 50 mA maximum

Operating Temperature: Model C: 0°C to +70°C
 Model M: -55°C to +85°C

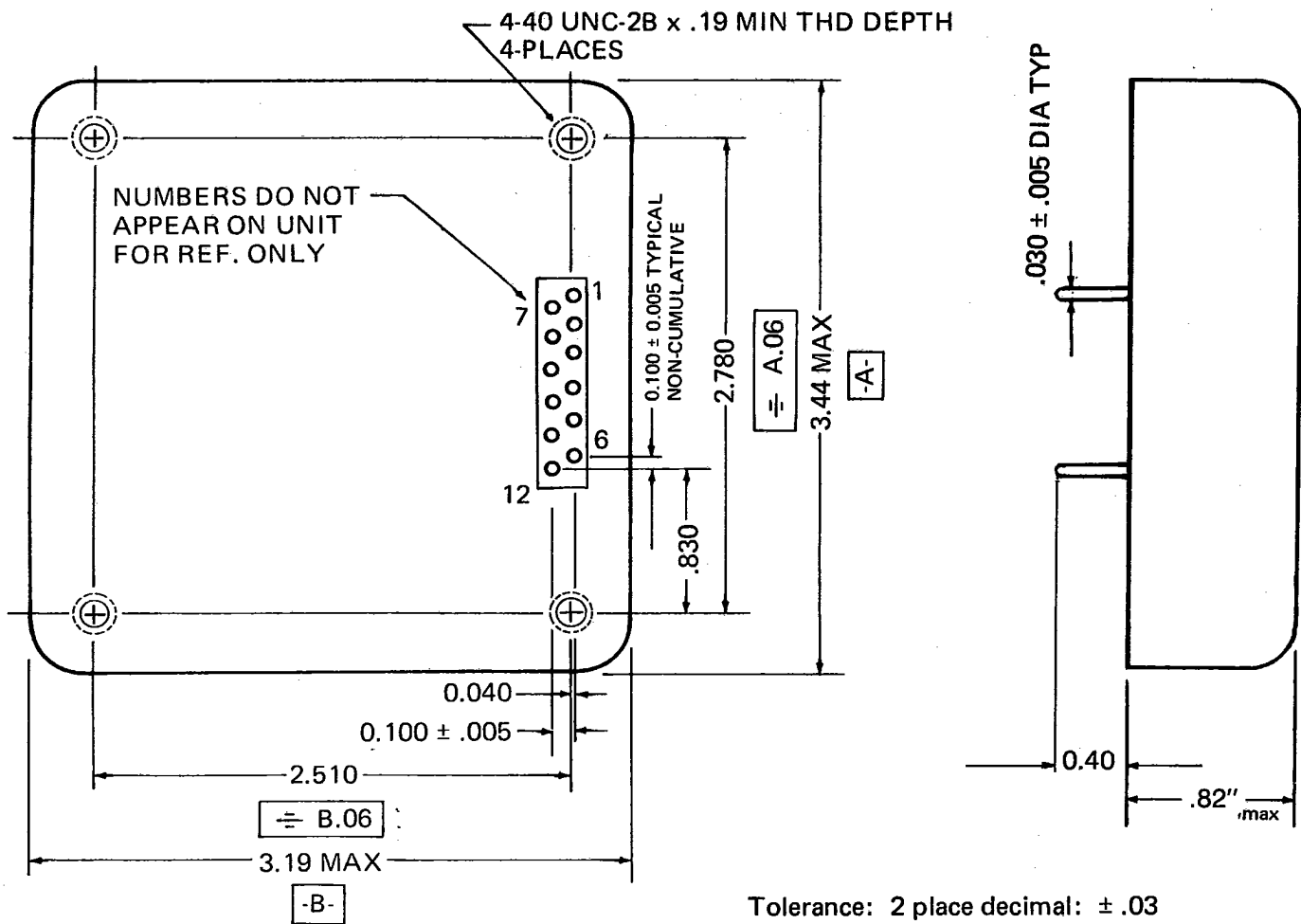
Storage Temperature: -65°C to +125°C.

Weight: Approx. 10 oz.

Potting: For high shock or vibration applications units should be potted. Add "P" after part number.

Part Number Designation:

A1618**
 Add "P" if potting required
 Operating Temp. (C or M)



All dimensions in inches

PIN CONNECTIONS

	<u>C670</u>	<u>A689 *</u>	<u>695</u>	<u>A1618</u>
1	+15VDC	+15VDC	Common	+15VDC
2	Common	Common	R Sin θ input	Common
3	NC	R Cos θ Input	NC	R Input
4	Cos θ Out	R Cos ($\theta + \beta$) Out	R Cos θ Input	R Cos θ
5	*+5VDC	*+5VDC	R Out	*+5VDC
6	-15VDC	-15VDC	+15 V DC	-15VDC
7	θ Input	β Input	NC	θ Input
8	NC	R Sin θ Input	NC	NC
9	*See note	*See note	NC	*See note
10	Sine θ Out	R Sin ($\theta + \beta$) Out	θ Out	R Sin θ
11	+15VDC	+15VDC	-15 V DC	+15VDC
12	Common	Common	Common	Common

*If external +5VDC is not available for pin 5, connect pin 9 to 11 to generate +5VDC internally.



TRANSMAGNETICS, INC.

210 ADAMS BOULEVARD, FARMINGDALE, NEW YORK 11735 U.S.A.
PHONE NO: 516 293-3100. TWX510-224-6420