



micro-module
series



FEATURES

- 2" X 2" Module outline
- 12-Bit position output
- Fast tracking to 100 RPS
- Excitation frequencies 50 Hz to 2600 Hz
- Velocity output
- Inter-LSB output
- Direction output
- Ripple Clock output

APPLICATIONS

Ordinance Control — Radar Tracking
Systems — Navigation Systems —
Collision Avoidance Systems — Process
Control

1-13

GENERAL DATA

The Series 268A300 is a third generation, synchro/resolver-to-digital converter packaged in a 2.0" x 2.0" x 0.395" module, weighing only 1.25 ounces. This new, small size rivals that of hybrid converters, yet still maintains the flexibility and fast deliveries of modular converters.

The converter is a continuously tracking type and can follow synchro or resolver shaft speeds of up to 100 RPS without additional error. Operation can be specified over a frequency range of 50 Hz to 2.6 KHz and an input signal range of 2.5 to 115 volts rms. The converter uses a ratiometric conversion technique which insures high noise immunity and tolerance of lead length when

located at a distance from the synchro or resolver source.

The output is a 12-bit parallel, natural binary angle, positive logic. An INHIBIT input and CONVERTER BUSY output insures easy data transfer. The DIRECTION and RIPPLE CLOCK outputs allow simple extension of the counters for multi-turn applications.

CONNECTING THE CONVERTER

The power lines, which must not be reversed, should be connected to the +15V, -15V, and +5V pins with the common connection to the GND pin.

ELECTRICAL SPECIFICATIONS

Parameter	Value
Resolutions	12 bits
Accuracy⁽¹⁾	±8.5 minutes
Input Rates	60 Hz 400 Hz 2600 Hz
Tracking Rate	20 RPS 50 RPS 100 RPS
Acceleration	
Constant	2000 Sec ⁻² 12,000 Sec ⁻² 500,000 Sec ⁻²
Settling Time	500 ms 150 ms 40 ms
(179° step)	
Frequency	
Response	15 Hz 34 Hz 240 Hz
Power Supplies⁽²⁾	
+15V	30 mA max. (20 mA typ.)
-15V	30 mA max. (20 mA typ.)
+5V	100 mA max. (80 mA typ.) LSTTL
	15 mA max. (5 mA typ.) HCMOS
Reference Input	
Voltage	2.5 to 115 Vrms
Frequency	50 Hz to 2.6 kHz
Signal Input⁽³⁾	
Voltage	2.5 V rms 11.8 V rms 90V rms
Impedance	26 Kohms 100 Kohms 800 Kohms
Inhibit Input(INH)	Logic '0' inhibits
Load	0.5 LSTTL
Parallel Angle(1-12)	Natural binary angle positive logic
Max. load(LSTTL)	20 LSTTL
(HCMOS)	6 LSTTL
Converter Busy (CB)	Logic '1' when busy
Maximum load	6 LSTTL
Pulse width	1 microsecond
Direction Output (DIR)	Logic '0' when counting up
Maximum load	1 LSTTL
Ripple Clock(RC)	Low-level output pulse when an overflow or underflow condition exists
Maximum load	20 LSTTL
Velocity Voltage (VEL)⁽⁴⁾	
Full Scale Voltage	±10 Vdc
Full Scale Accuracy	±20% max.
Polarity	Positive for increasing angle
Reversal Error	±10% max. (included in Full Scale Accuracy)
Linearity	2% for 0-20% of max. velocity 6% for 0-50% of max. velocity 15% for 0-100% of max. velocity
Zero Offset	±8 mV max.
Ripple	5 mVrms
Inter LSB Voltage (E)⁽⁴⁾	
Polarity	Negative for increasing angle
Output Voltage	±4.5 V/LSB
DC Error Voltage (D)⁽⁴⁾	
Polarity	Negative for increasing angle
Output Voltage	±15 mV/LSB
Dimensions	2.0" X 2.0" X 0.395"
Weight	1.25 oz
Temperature Ranges	
Operating	0° to 70° C
Storage	-55° to 125° C

NOTES:

- Accuracy applies for:
 - ±10% specified signal amplitude variation
 - over entire reference voltage range
 - 25% signal and reference harmonic distortion
 - over power supply range
 - over operating temperature range
- Although specified at ±15V all units can operate on voltages between ±12V to ±16.5V with no degradation in performance. The tolerance on the +5V supply is ±5%.
- Other signal voltages available on special order, consult factory.
- These outputs should be connected via buffers to prevent the possibility of oscillation.

The digital output is taken from pins 1 thru 12 where pin 1 is the MSB, which equals 180°.

Connecting the converter to a synchro is as follows:

SYNCHRO		CONVERTER	
R1	TO	RH	
R2	TO	RL	
S1	TO	S1	
S2	TO	S2	
S3	TO	S3	

There are two conventions when connecting resolvers, depending on which rotor windings are excited. The converter/resolver connectors for the two conventions are as follows:

R2-R4 EXCITED			R1-R3 EXCITED		
RESOLVER	TO	CONVERTER	RESOLVER	TO	CONVERTER
R2	TO	RH	R1	TO	RH
R4	TO	RL	R3	TO	RL
S1	TO	S1	S1	TO	S4
S2	TO	S2	S2	TO	S1
S3	TO	S3	S3	TO	S2
S4	TO	S4	S4	TO	S3

OPERATION OF THE CONVERTER

The 268A300 series is a tracking converter, therefore the output follows the input for speeds up to the specified tracking rate. No convert command is necessary — a conversion is initiated by each LSB increment of the input. Each increment generates a 1-microsecond CB pulse which in turn causes the digital output to increment one LSB.

The direction of rotation of the synchro or resolver is indicated by the DIR output. This direction data is always valid in advance of a CB pulse.

The RC output indicates when the synchro or resolver crosses electrical zero. Its relationship to CB and DIR can be seen in the timing diagram.

The CB output or INH input can be used to interface to a computer. The converter will ignore an inhibit command applied during an increment command. There are two methods of interfacing with a computer: (1) Synchronous and (2) asynchronous. A simple method of synchronous loading is to: (a) set INH to logic

'0', (b) wait 1 microsecond, (c) transfer the digital angle, and (d) reset INH to logic '1'. Asynchronous loading is accomplished by transferring data on the negative going edge of the CB pulse.

VELOCITY VOLTAGE

The Velocity output (VEL) is a dc voltage proportional to the angular velocity of the synchro or resolver shaft. Voltage polarity is positive for an increasing angle. This output can be used in many applications to provide loop stabilization and velocity feed back data. Refer to the electrical specifications for performance characteristics.

INTER LSB VOLTAGE

The Inter LSB (E) voltage is a dc analog voltage representing the synchro or resolver shaft position within the least significant bit of the digital angle output.

DC ERROR VOLTAGE

The DC Error Voltage (D) is the signal at the output of the phase sensitive demodulator and is proportional to the error between the analog input angle and digital output angle. This is an unfiltered output and will increase if the output angle fails to track the input for any reason.

DYNAMIC PERFORMANCE

The 268A300 series employs a type II servo loop ($K_v = \infty$) with very high acceleration constants. The loop dynamics are completely independent of power supply variations within their specified ranges. As long as the maximum tracking rate is not exceeded there will be no velocity lag and only minor acceleration lag in the converter output. Acceleration lag (in degrees) can be computed from the following equation:

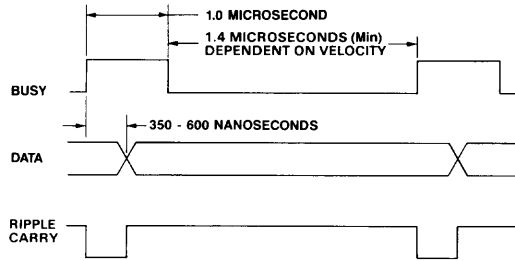
$$E_a = \frac{\text{Acceleration } (^{\circ}/\text{sec}^2)}{K_a}$$

The nominal open loop transfer functions are given by:

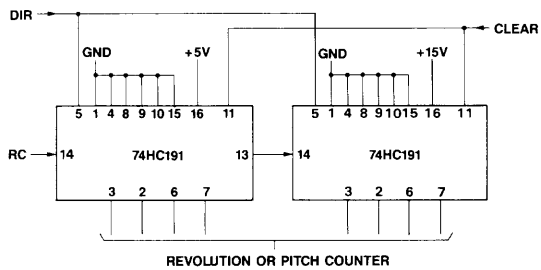
$$G_{60\text{HZ}} = \frac{45^2 \left(\frac{S}{35} + 1 \right)}{S^2 \left(\frac{S}{139} + 1 \right)} \quad G_{400\text{HZ}} = \frac{100^2 \left(\frac{S}{75} + 1 \right)}{S^2 \left(\frac{S}{295} + 1 \right)}$$

$$G_{2600\text{HZ}} = \frac{707^2 \left(\frac{S}{500} + 1 \right)}{S^2 \left(\frac{S}{2000} + 1 \right)}$$

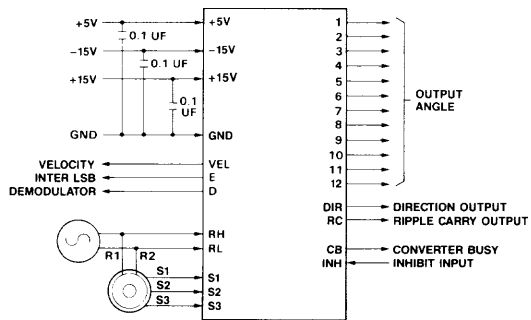
TIMING DIAGRAM



HCMOS EXTERNAL COUNTER



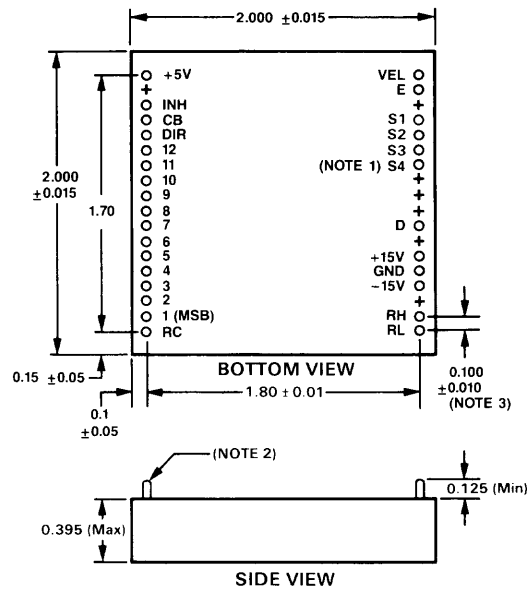
CONNECTION DIAGRAM (SYNCHRO)



ORDERING INFORMATION

268A SUFFIX	INPUT TYPE	L-L VOLTAGE	REF FREQ	LOGIC TYPE
300	SYNC	11.8V	50-2600HZ	LSTTL
301	SYNC	90V		LSTTL
302	SYNC	11.8V		HCMOS
303	SYNC	90V		HCMOS
304	RSVR	11.8V		LSTTL
305	RSVR	90V		LSTTL
306	RSVR	11.8V		HCMOS
307	RSVR	90V	50-2600HZ	HCMOS
308	SYNC	11.8V	360-2600HZ	LSTTL
309	SYNC	90V		LSTTL
310	SYNC	11.8V		HCMOS
311	SYNC	90V		HCMOS
312	RSVR	2.5V		LSTTL
313	RSVR	2.5V		HCMOS
314	RSVR	11.8V		LSTTL
315	RSVR	90V		LSTTL
316	RSVR	11.8V		HCMOS
317	RSVR	90V	360-2600HZ	HCMOS
318	SYNC	11.8V	2600HZ	LSTTL
319	SYNC	11.8V		HCMOS
320	RSVR	2.5V		LSTTL
321	RSVR	11.8V		LSTTL
322	RSVR	2.5V		HCMOS
323	RSVR	11.8V	2600HZ	HCMOS

MECHANICAL OUTLINE



NOTES

1. S4 pin appears on multiple input and resolver models only.
2. Rigid .025 diameter pins suitable for solder-in or plug-in applications.
3. Non-cumulative.
4. Dimensions are in inches.