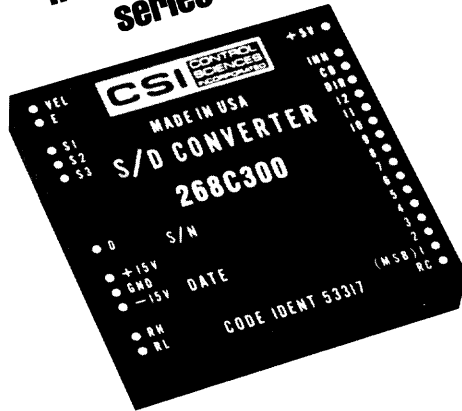


low power  
micro-module  
series



#### FEATURES

- 2" X 2" Module outline
- 12-Bit position output
- Fast tracking to 50 RPS
- Excitation frequencies 50 Hz to 1200 Hz
- Velocity output
- Inter-LSB output
- Direction output
- Ripple Clock output
- 150 MW power dissipation @  $\pm 12V$

#### APPLICATIONS

Ordinance Control — Radar Tracking  
Systems — Navigation Systems —  
Collision Avoidance Systems — Process  
Control — Battery Operated Equipment

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#### GENERAL DATA

The Series 268C300 is a low power 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 50 RPS without additional error. Operation can be specified over a frequency range of 50 Hz to 1.2 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
<b>Resolutions</b>	12 bits
<b>Accuracy</b> <sup>(1)</sup>	± 8.5 minutes
<b>Input Rates</b>	60 Hz      400Hz
Tracking Rate	20 RPS    50 RPS
Acceleration	
Constant	2000 Sec <sup>-2</sup> 12,000 Sec <sup>-2</sup>
Settling Time	500 ms    150 ms
(179° step)	
Frequency	
Response	15 Hz    34 Hz
<b>Power Supplies</b> <sup>(2)</sup>	
+ 15V	6mA max. (5mA typ.)
- 15V	8mA max. (7mA typ.)
+ 5V	3mA max. (2mA typ.)
<b>Reference Input</b>	
Voltage	2.5 to 115 Vrms
Frequency	50 Hz to 1.2 kHz
<b>Signal Input</b> <sup>(3)</sup>	
Voltage	2.5 V rms    11.8 V rms    90V rms
Impedance	26 Kohms    100 Kohms    800 Kohms
<b>Inhibit Input (INH)</b>	Logic '0' inhibits
Load	0.5 LSTTL
<b>Parallel Angle (1-12)</b>	Natural binary angle positive logic
Max. load	2 TTL
<b>Converter Busy (CB)</b>	Logic '1' when busy
Maximum load	2 TTL
Pulse width	1-2 microseconds
<b>Direction Output (DIR)</b>	Logic '0' when counting up
Maximum load	1 LSTTL
<b>Ripple Clock (RC)</b>	Low-level output pulse when an overflow or underflow condition exists
Maximum load	2 TTL
<b>Velocity Voltage (VEL)</b> <sup>(4)</sup>	
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
<b>Inter LSB Voltage (E)</b> <sup>(4)</sup>	
Polarity	Negative for increasing angle
Output Voltage	± 4.5 V/LSB
<b>DC Error Voltage (D)</b> <sup>(4)</sup>	
Polarity	Negative for increasing angle
Output Voltage	± 15 mV/LSB
<b>Dimensions</b>	2.0" X 2.0" X 0.395"
<b>Weight</b>	1.25 oz
<b>Temperature Ranges</b>	
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 connections for the two conventions are as follows:

R2-R4 EXCITED			R1-R3 EXCITED		
RESOLVER	CONVERTER		RESOLVER	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 268C300 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 inter-

facing with a computer: (1) Synchronous and (2) asynchronous. A simple method of synchronous loading is to: (a) set INH to logic '0', (b) wait 2 microseconds, (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 in the input for any reason.

### DYNAMIC PERFORMANCE

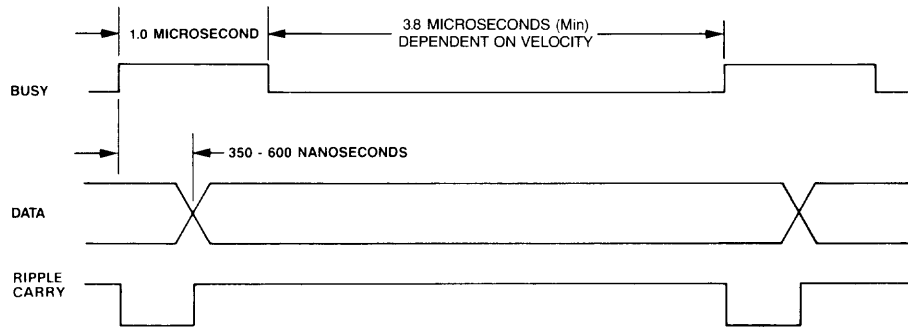
The 268C300 series employs a type II servo loop ( $K_v = \infty$ ) with very high acceleration constants. The loop dynamics are completely independent of power supply variations within their specific ranges. As long as the maximum tracking rate is not exceeded there will be no velocity lag and only minor acceleration lag in the converter output. Acceleration lag (in degrees) can be computed from the following equation:

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

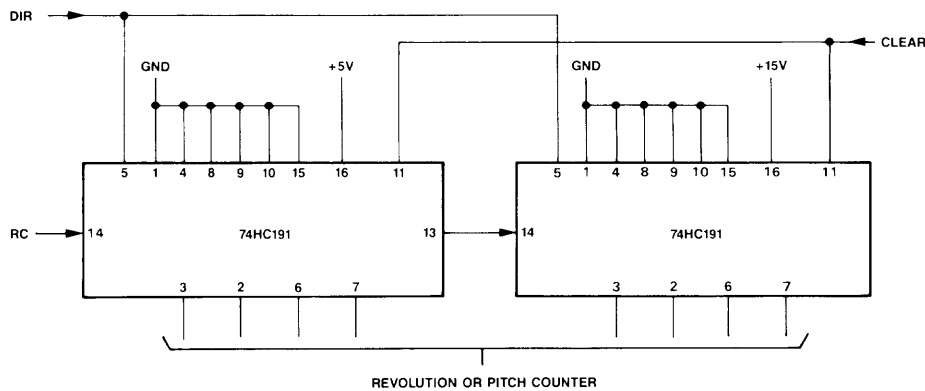
The nominal open loop transfer functions are given by:

$$G_{60\text{HZ}} = \frac{45^2 \left( \frac{S}{35} + 1 \right)}{S^2 \left( \frac{S}{139} + 1 \right)} \quad G_{400\text{HZ}} = \frac{100^2 \left( \frac{S}{75} + 1 \right)}{S^2 \left( \frac{S}{296} + 1 \right)}$$

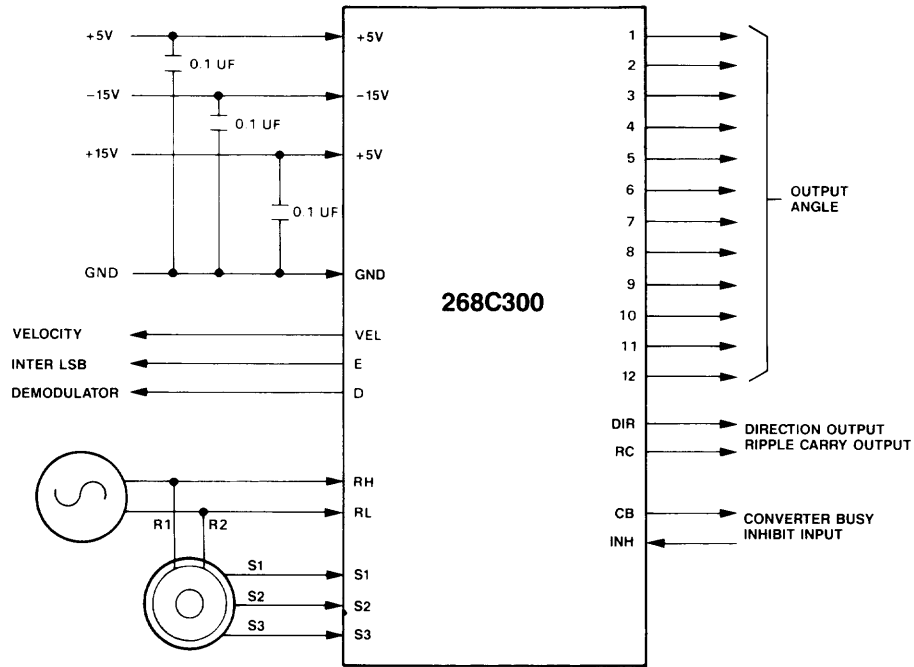
### TIMING DIAGRAM



### HCMOS EXTERNAL COUNTER



# CONNECTION DIAGRAM (SYNCHRO)



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## ORDERING INFORMATION

268C SUFFIX	INPUT TYPE	L-L VOLTAGE	REF FREQ
300	SYNC	11.8V	50-1200Hz
301	SYNC	90V	50-1200Hz
302	RSVR	11.8V	50-1200Hz
303	RSVR	90V	50-1200Hz
304	SYNC	11.8V	360-1200Hz
305	SYNC	90V	360-1200Hz
306	RSVR	11.8V	360-1200Hz
307	RSVR	90V	360-1200Hz

## NOTES

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

## MECHANICAL OUTLINE

