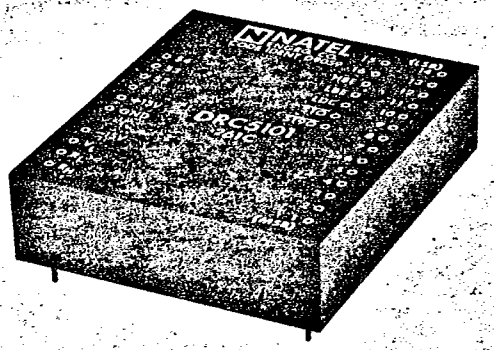
NATEL
DSC5101/DRC5101

1 arc-minute Accuracy Digital-to-Synchro (Resolver) Converter 16 bit, Microprocessor Compatible

Features

- **Fully protected 3 VA output**
  (current limiting)
  (short circuit proof)
  (thermal cut-off)
- **Low quadrature output**
  (±0.1%)
- **1 arc-minute accuracy**
- **Microprocessor compatible**
  (8 and 16-bit)
- **Double buffered inputs**
- **Very low scale factor variation**
  (0.03% maximum)
- **Excellent load regulation**
- **Reference and signal transformer isolated**
- **Pin-programmable set-up and test mode**
- **Does not require +5 V power supply**
- **TTL and CMOS compatible**
- **Priced at $545/USA price**
  (DSC5101-159S)



Applications

S/D and R/D testing
Driving control transformers
Flight instrumentation
Fire control systems
Positioning control systems
Simulators
Driving CRT displays

Description

Designed to test synchro(resolver)-to-digital converters, the Model 5101 offers accuracy of 1 arc-minute for loads of up to 1.2 VA and 1.33 arc-minutes for loads of up to 3 VA. Other features include low quadrature output of 0.1%, excellent voltage regulation and low scale factor variation. In addition the converter offers 8 and 16-bit microprocessor compatibility and two self-test functions. These outstanding features have been made possible by the use of a hybrid multiplying digital-to-sine/cosine converter (Natel Model HDSC2016) for the conversion process. The output stage employs a unique feedback technique to provide a ±0.5% voltage regulation from no-load to full-load.

Packaged in an industry-standard size (3.1 x 2.6 x 0.82 inch), the converter requires only ± 15-V power supplies. The digital inputs are double buffered and the converter is TTL, standard CMOS and high-level CMOS compatible. The digital input thresholds are 0.8 V-dc for logic low and 2.4 V-dc for logic high. For high-level CMOS, the switching thresholds can be increased by connecting the logic supply to the V_L pin.

All data bits (1 through 16) are actively pulled-down to ground. If the converter requires less than 16-bit resolution, the unused pins of data bits may be left open. Control signals LBE, HBE, LDC and self-test-functions $\overline{ST0}$ and $\overline{ST90}$ are actively pulled-up to the V_L supply voltage. When not required by your application, these pins may also be left open.

To make it possible to use this high performance converter in existing designs the Model 5102 is offered. Model 5102 is pin and size compatible with industry-standard digital-to-synchro (resolver) converters (e.g., Natel models 5012 and 5112) and offers superior performance . . . high accuracy, lower quadrature output, more drive capability, excellent load regulation and low scale-factor variation.

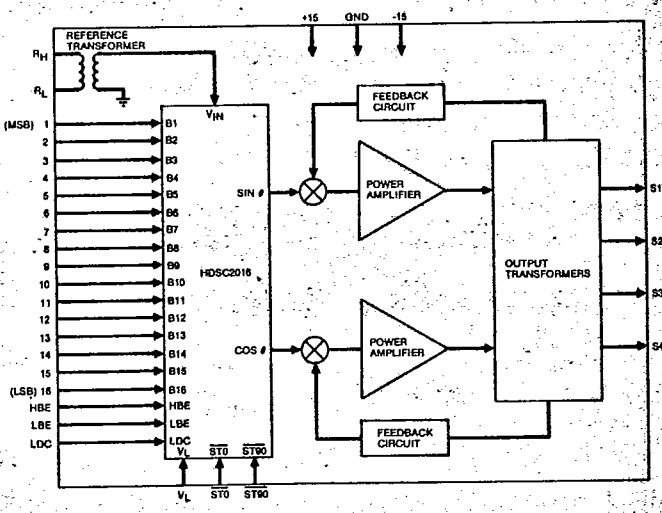


FIGURE 1 Block Diagram Model 5101

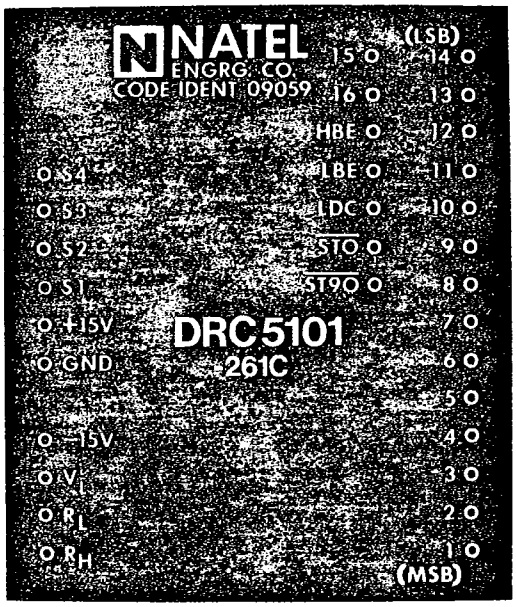
Output stage and Load Regulation

The sine and cosine output of the internal HDSC2016 is applied to two power amplifiers. The power amplifier design incorporates a safe operating area protection circuit similar to those used in voltage regulators. Besides short-circuit protection and current limiting, the power amplifiers are designed to provide thermal shut down when the amplifier case temperature reaches 125° C, thereby making them virtually indestructible. The outputs of the amplifiers go to either a scott-tee (for synchro output) or resolver isolation transformers.

Output transformers are designed with feedback windings. Normally for constant reference input, the line-to-line output voltage varies depending on the load. This variation is due to output resistance of the transformer winding. For small transformers this variation can be as high as 10% from no-load to full-load. To eliminate this large change in output voltage, model 5101 converter uses a feedback circuit. The output voltage is continuously monitored by a transformer winding. When the output voltage drops, due to heavy load, the gain of the power amplifier is increased to compensate for the voltage drop, thereby keeping the output relatively constant. Using this technique the output load regulation is improved by a factor of 10 over existing designs while providing higher drive capability and lower quadrature output.

Pin Designations

V_L	Logic Supply Voltage (may be left open for 5 V-dc logic)
GND	Power Supply Ground Digital Ground
1-16	Parallel Data Input Bits 1 is MSB = 180 degrees 16 is LSB = 0.0055 degree
Note:	For Model 5102, bit 14 is LSB = 0.022 degree Pins for bits 15 and 16 are not brought out.
±15 V	Supply Voltages
RH, RL	Reference Voltage Input
S1,S2,S3,S4	Output Analog Signals (Synchro or Resolver Output) Pin S4 is not present for the synchro output
$\overline{LBE}$	*Low Byte Enable
HBE	*High Byte Enable
LDC	*Load Converter
$\overline{ST0}$, $\overline{ST90}$	*Self Test functions
*Notes:	1. These pins are not brought out for the Model 5102 2. See data sheet HDSC2016 for a detailed description and application notes for these functions.

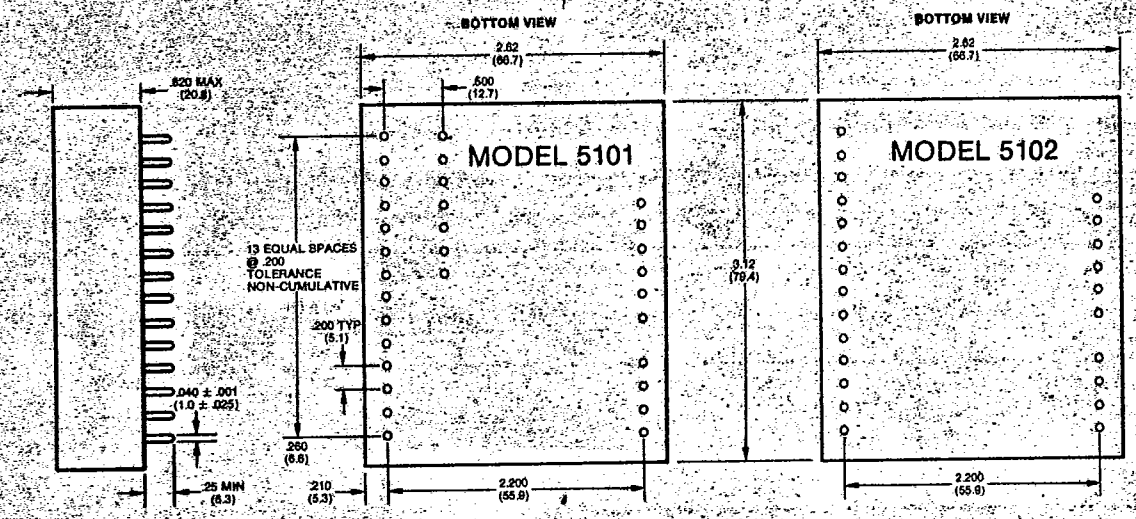


Absolute Maximum Ratings

Reference Input	150% of Normal Voltage
Power Supply Voltages (±15 V)	±18 V-dc
Logic Voltage (VL)	4.5 V-dc to +15 V supply
Digital Inputs	-0.3 V-dc to +15 V supply
Storage Temperature	-55° C to 125° C

Specifications

Parameter	Value	Remarks
Digital Angular Resolution	16 bits (0.33 arc-minute)	MSB = 180°, LSB = 0.0055°
Output Accuracy		
Angular Accuracy	±1.0 arc-minutes (up to 1.2 VA Load) ±1.33 arc-minutes (up to 3 VA Load)	Accuracy of the converter is maintained over specified frequency and operating temperature ranges.
Radius Accuracy	± 0.03%	
Reference Input		Transformer Isolated
Voltages	26 V-rms ±10% 115 V-rms ±10%	
Frequency	360 to 440 Hz	
Input Impedance	50 KΩ minimum 200 KΩ minimum	26 V-rms models 115 V-rms models
Breakdown Voltage	500 V minimum to ground	
Harmonic Distortion	10% maximum	Without degradation in accuracy
Digital Inputs **Logic Voltage Levels**		CMOS transient protected
Logic "0" Logic "1"	-0.3 V-dc to 0.8 V-dc +2.4 V-dc to $+V_S$	Does not need external logic voltage (Pin V_L not connected), 0.1 TTL load
Logic "0" Logic "1"	-0.3 V-dc to 0.2 V_L 0.8 V_L to V_L	Using External V_L $6 \leq V_L \leq +V_S$ @ 1 mA
Input Currents		
Data Bits (1-16)	15 μA typical, "active" pull down to Ground (GND)	For less than 16-bits input, unused pins can be left unconnected
HBE, LBE, LDC, $\overline{ST0}$, $\overline{ST90}$	-15 μA typical, "active" pull up to Logic Supply (V_L)	When not used pins can be left unconnected
Register Controls		
HBE	Logic "1" Logic "0"	8 MSBs enter high byte input register High byte register remains unaffected
LBE	Logic "1" Logic "0"	8 LSBs enter low byte input register Low byte register remains unaffected
LDC	Logic "1" Logic "0"	Data from input registers transferred to holding register Data in holding register remains unaffected
Pulse Width	600 nsec minimum	For guaranteed data transfer
Data Set-up time	200 nsec minimum	Before data transfer
Data Hold time	200 nsec minimum	Before input data changes
Synchro (Resolver) Outputs		Transformer Isolated
Voltages (Line-to-Line)	11.8 V-rms ±1% 26 V-rms ±1% 90 V-rms ±1%	For nominal reference voltages. The output varies directly in proportion to the variations in reference voltage.
Quadrature Output	0.1% maximum	
Load Regulation	±0.2% Typical ±0.5% Typical	For 1.2 VA load. For 3 VA load.
Output Settling Time	50 μsec maximum	For any digital step change
Short Circuit Protection	Continuous, indefinite time	Without damaging or degrading the converter
Thermal Cut-Off	@125° C internal temperature	Output is automatically restored when temperature drops below 125° C.
Power Supplies		
Supply Voltages (±15 V)	±15 V-dc ±5%	Reverse Voltage Protected
Supply Currents No-load Currents Full-load Currents Mean Peak Currents	± 100 mA maximum ± 250 mA maximum for 1.2VA Load ± 400 mA maximum for 3 VA Load ± 450 mA maximum for 1.2 VA Load ± 1 A maximum for 3 VA Load	
Physical Characteristics		
Size	3.12 x 2.62 x .82 inch (79.4 x 66.7 x 20.8 mm)	
Weight	8 oz (230 grams) maximum	



NOTES:
1. DIMENSIONS SHOWN IN INCHES AND (mm)
2. PINS ARE GOLD PLATED (50μINCH MIN)
3. CASE MATERIAL IS GLASS FILLED DIALLYL PHTHALATE

TOLERANCES:
.XX = ±.020 (±.51)
.XXX = ±.010 (±.25)

MECHANICAL OUTLINE

Ordering Information

DSC5101 - T R O M

Temperature Range
1 = 0°C to +70°C
2 = -55°C to +85°C

MIL Specification
S = Standard
B = MIL-STD-883B
C = MIL-STD-883C

Reference Voltage
5 = 115 V-rms
6 = 26 V-rms

Output Voltages
1 = 11.8 V-rms L-L
2 = 26 V-rms L-L
9 = 90 V-rms L-L

Specify DRC5101 for Resolver Output

Specify Model 5102 for 14-bit industry standard pin out.

Other products available from NATEL

- Low profile (0.42"), 1.3 VA Output Drive, 16-bit microprocessor compatible Digital-to-Synchro (Resolver) Converter (Model 5001)
- Hybrid (36-pin DDIP size) Synchro (Resolver)-to-Digital converters with 10 to 16-bit resolutions (1000 series)
- Hybrid (36-pin DDIP size) Digital-to-Synchro (Resolver) converter with 14 and 16-bit resolutions (2000 series)
- Two-speed Synchro (Resolver)-to-Digital converters with 16 and 20-bit resolutions in a single package. (Models 2SD402 and 2SD412).
- Multiplexed Synchro (Resolver)-to-Digital converters.
- Solid State control transformers (SSCT) and differential transmitters (SCDX).
- Angle position indicators and synchro instrumentation for one-speed and multi-speed applications.

A wide range of applications assistance is available from Natel. Application Notes can be requested when available . . . and Natel's applications engineers are at your disposal for specific problems.

NATEL Engineering Co., Inc.

4550 Runway Street, Simi Valley, CA 93063 (USA)
Phone: (805) 581-3950 TWX: 910-494-1959