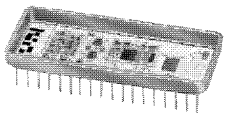
ILC DATA DEVICE CORPORATION®

DSC-11520



16-BIT PIN PROGRAMMABLE D/S OR D/R CONVERTER

DESCRIPTION

The DSC-11520 is a versatile multiplying digital-to-analog converter. The digital input represents an angle and the output is pin programmable for either resolver type sin/cos or for three-line synchro output. The reference input will accept any waveform, even a sawtooth for CRT drive. Because the reference is DC-coupled to the output, the DSC-11520 can be used in many configurations:

With a synchro or resolver reference input, the DSC-11520 is a digital-to-synchro or digital-to-resolver converter.

With a DC reference input, the unit can be used as a hybrid digital-to-sin/cos DC converter.

With the reference input proportional to the radius vector, the DSC-11520 converts polar to rectangular coordinates.

With a sawtooth reference input and a rotating digital input, the module can generate a cartwheel rotating sweep for PPI displays.

Packaged in a 36 pin double DIP, the DSC-11520 is a complete D/S and D/R converter in one hybrid module.

The DSC-11520 features low weight, low power consumption, very high reliability, and a wide operating temperature range. The circuit design results in high accuracy and reduces the output scale factor so that the output can drive displays directly. The output line-to-line voltage can be scaled by external resistors. The reference input provides high AC and DC common mode rejection.

APPLICATIONS

Because of its high reliability, small size and low power consumption, the hybrid DSC-11520 is ideal for the most stringent and severe industrial and military ground or avionics applications. All units are available with MIL-PRF-38534 processing as a standard option.

Among the many possible applications are computer based systems in which digital information is processed, such as simulators, flight trainers, flight instrumentation, fire control systems, radar and navigation systems, and PPI displays including moving target indicators.

FEATURES

- ***Complete D/S or D/R Converter***
- ***Accuracy: to ±1 Minute***
- ***0.05% Scale Factor Variation With Angle***
- ***DC-Coupled Reference Accepts Any Waveform***
- ***Generates SIN/COS DC or Rotating PPI Sweep***
- ***High-Rel CMOS D/R Chip***
- ***8-Bit/2-Byte Double Buffered Transparent Latches***

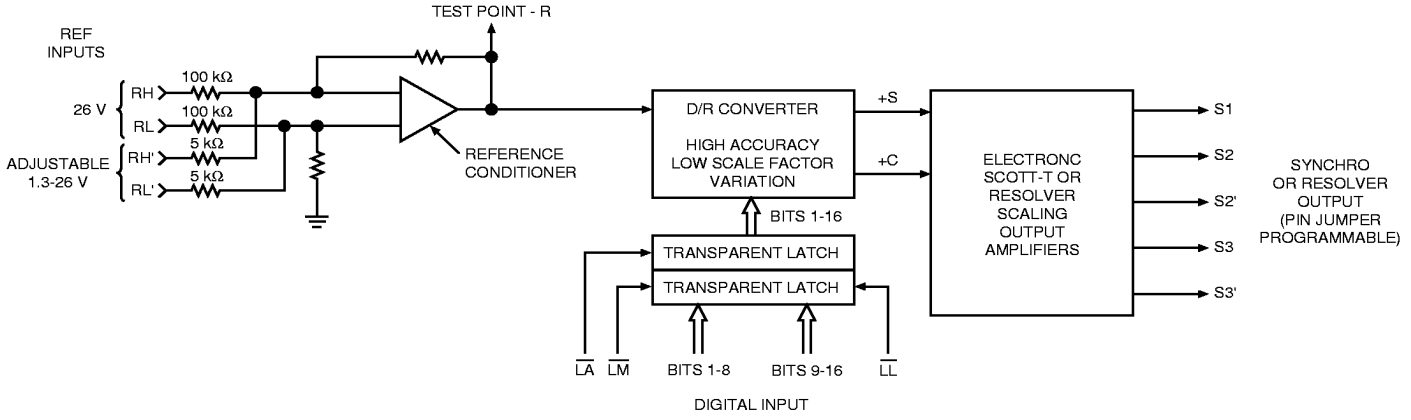


FIGURE 1. DSC-11520 BLOCK DIAGRAM

TABLE 1. DSC-11520 SPECIFICATIONS
Apply over temperature range, power supply ranges, reference voltage and frequency range and 10% harmonic distortion in the reference.

PARAMETER	VALUE		
RESOLUTION	16 bits		
ACCURACY AND DYNAMICS			
Output Accuracy	±8 minutes to ±1 min. (See Ordering Info.)		
Differential Linearity	±1 LSB max		
Output Settling Time	Less than 20 µsec for any digital step change.		
DIGITAL INPUT			
Logic Type	Natural binary angle parallel positive logic CMOS and TTL compatible. Inputs are CMOS transient protected. Each input has a 20 µA max pull down to GND.		
Logic Voltage Level V_L	V = +4.5 V to +15 V supply Logic 0 = 0 to +0.25 V_L Logic 1 = 0.4 V_L to V_L		
Load Current	20 µA max to GND (bit 1-16) 20 µA to V_L ($\overline{LL}$, $\overline{LM}$, $\overline{LA}$) See Timing Diagram (FIGURE 2)		
REFERENCE INPUT			
Type	Two differential solid-state inputs, one for standard 26 V input and one programmable. DC to 1000 Hz		
Frequency Range			
	Standard Input	Programmable input	
Voltage	26 V ±10%	1.3 V min for full output; higher voltages are scaled by adding two series resistors	
Input Impedance			
Single Ended	100 kΩ ± 0.5%	5 kΩ ± 0.5%	
Differential	200 kΩ ± 0.5%	10 kΩ ± 0.5%	
ANALOG OUTPUT			
Type	Pin programmable for synchro or resolver mode.		
Output current	2 mA rms max.		
Max Output Voltage (Tracks Reference Input Voltage)	11.8 V rms L-L ±0.25%nominal in synchro mode 6.81 V rms L-L ±0.25%nominal resolver mode		
Transformation Ratio Tol.	±0.2% max		
Scale Factor Variation	±0.05% max		
DC Offset Each Line to GND	±15 mV standard, varies with input angle ±5 mV available- Consult Factory		
POWER SUPPLIES			
Voltage	+15 V	-15 V	Logic Voltage V_L
Voltage Limits	±5%	±5%	+4.5 V TO +15 V
Max Voltage Without Damage	+18 V	-18 V	+18 V
Current or impedance	20 mA max	20 mAmax	±100 µA
	V_L may be left unconnected where +5 V logic levels are used.		
TEMPERATURE RANGES (CASE)			
Operating			
-1 Option	-55°C to +125°C		
-3 Option	0°C to +70°C		
Storage	-55°C to 135°C		
PHYSICAL CHARACTERISTICS			
Type	36 pin double DIP		
Size	0.78 X 1.9 X 0.21inch (2.0 X 4.8 X 0.53 cm)		
Weight	0.85 oz (24g)		

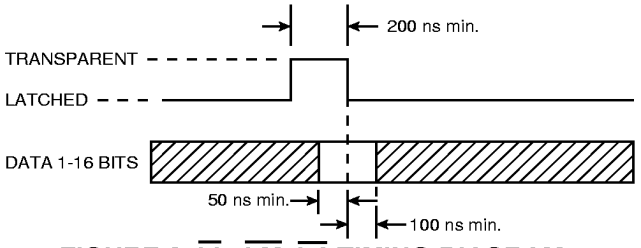


FIGURE 2. $\overline{LL}$, $\overline{LM}$, $\overline{LA}$ TIMING DIAGRAM

INTRODUCTION

As shown in the block diagram, the signal conversion in the DSC-11520 is performed by a high accuracy digital-to-resolver converter whose sin and cos outputs have a low scale factor variation as a function of the digital input angle. This resolver output is either amplified by scaling amplifiers for resolver output, or is both amplified and converted to a synchro output by an electronic Scott-T. In both cases, the output line currents are limited to 2 mA rms max, which is sufficient for driving S/D converters, solid-state control transformers, and displays. Output power amplifiers will be required, however, for driving electro-mechanical devices such as synchros and resolvers.

The reference conditioner has a differential input with high AC and DC common mode rejection, so that a reference isolation transformer will seldom be required. There are two sets of reference inputs. The RH, RL input provides the maximum synchro or resolver output voltage for a standard 26 V rms reference input. The RH', RL' input is used to scale the output for other reference voltage levels. Series resistors can be added to the reference input as described below either to accommodate lower reference levels for full output, or to reduce the output level.

The reference conditioner output -R is intended for test purposes. A signal between 6 V and 7.5 V at -R indicates that a reference input signal is present.

OUTPUT SCALING AND REF. LEVEL ADJUSTMENT

The DSC-11520 operates like a multiplying D/A converter in that the voltage of each output line is directly proportional to the reference voltage.

The maximum line-to line levels are determined by the output amplifiers and are nominally 11.8 V for synchro output and 6.81 V for resolver output.The RH, RL reference input is designed to provide this nominal output for the standard 26 V reference level. The scaling adjustment is made by two internal 100 kΩ resistors in series with the reference conditioner input (see DSC-11520 Block Diagram). The maximum output levels without distortion are 10% greater than the nominal 11.8 V and 6.81 V levels.

The RH', RL' reference input has only 5 kΩ internal resistors in series with the reference conditioner input, so that nominal line-to-line output is obtained for a reference input of 1.3 V. For higher reference voltages, two resistors R' must be inserted in series with the inputs as shown in FIGURE 3. These resistors scale the

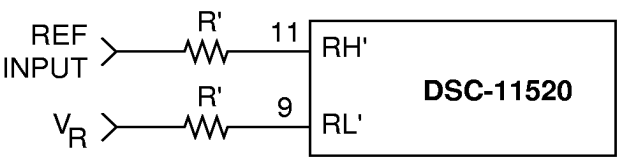


FIGURE 3. REFERENCE LEVEL ADJUSTMENT

DSC-11520 outputs down to the nominal 11.8 V and 6.81 V levels stated above, or to lower voltages if desired. The magnitude of the resistors R' in ohms is calculated as follows:

$$R' = \frac{5000}{1.3}(V_R - 1.3)\left(\frac{\text{NOMINAL L-L VOLTAGE LEVEL}}{\text{DESIRED L-L VOLTAGE LEVEL}}\right)$$

OUTPUT PHASING AND OUTPUT SCALE FACTOR

The analog output signals have the following phasing:

Synchro output

S1 — S3 = (RH-RL) A_O (1 + A(θ)) sin θ

S3 — S2 = (RH-RL) A_O (1 + A(θ)) sin (θ + 120°)

S2 — S1 = (RH-RL) A_O (1 + A(θ)) sin (θ + 240°)

Resolver output

S1 — S3 = (RH-RL) A_O (1 + A(θ)) sin θ

S2 — S4 = (RH-RL) A_O (1 + A(θ)) cos θ

The output amplitudes simultaneously track reference voltage fluctuations because they are proportional to (RH-RL). The transformation ratio A_O is 11.8/26 for 11.8 V rms L-L output. The maximum variation in A_O from all causes is ±0.2%. The term A (θ) represents the variation of the amplitude with the digital input angle. A (θ), which is called the scale factor variation, is a smooth function of θ without discontinuities and is less than ±0.05% for all values of θ. The total maximum variation in A_O (1 + A(θ)) is therefore ±0.25%.

Because the amplitude factor (RH-RL) A_O (1 + A(θ)) varies simultaneously on all output lines, it will not be a source of error when the DSC-11520 is to drive a ratiometric system such as a synchro or resolver. However, if the outputs are used independently, as in X-Y plotters, the amplitude variations must be taken into account.

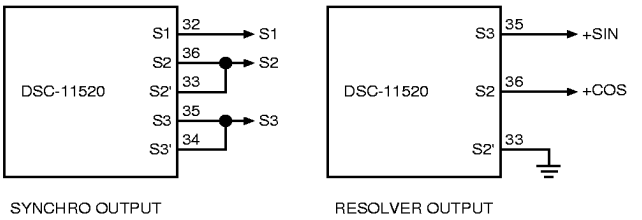


FIGURE 4. OUTPUT PIN PROGRAMMING

TABLE 2. PIN CONNECTIONS

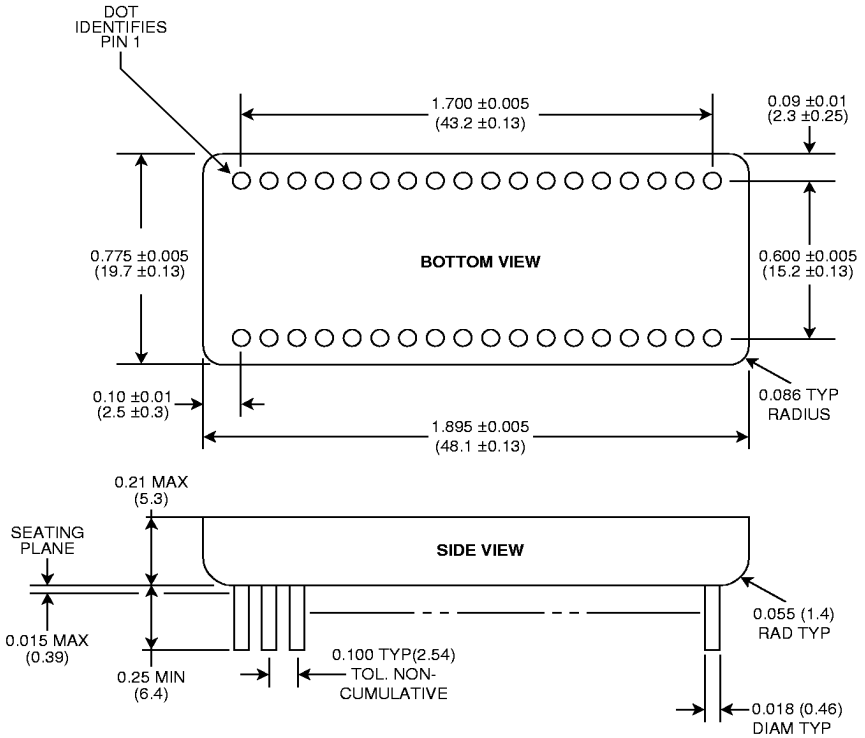
PIN	FUNCTION	PIN	FUNCTION	PIN	FUNCTION
1	NC	13	BIT 13	25	BIT 1 (MSB)
2	+15 V	14	BIT 12	26	BIT 15
3	GND	15	BIT 11	27	BIT 16 (LSB)
4	-15 V	16	BIT 10	28	$\overline{LM}$
5	NC	17	BIT 9	29	$\overline{LL}$
6	VL	18	BIT 8	30	$\overline{LA}$
7	-R	19	BIT 7	31	NC
8	RL	20	BIT 6	32	S1
9	RL'	21	BIT 5	33	S2'
10	RH	22	BIT 4	34	S3'
11	RH'	23	BIT 3	35	S3 (+SIN)
12	BIT 14	24	BIT 2	36	S2 (+COS)

Notes:

1.-R (PIN 7) can be used for test purposes to detect whether a reference signal is present. See block diagram.

2. Functions $\overline{LL}$, $\overline{LA}$ and $\overline{LM}$ may be left unconnected when not used.

3. V_L (PIN 6) may be left unconnected where 5 V logic levels are used.



NOTES

1. Dimensions shown are in inches (millimeters)
2. Lead identification numbers are for reference only.
3. Lead cluster shall be Centered within ±0.10 of outline dimensions. Lead spacing dimensions apply only at seating plane.
4. Pin material meets solderability requirements of MIL-STD-202E, Method 208C.
5. Package is Kovar with electroless nickel plating.
6. Case is electrically floating.

FIGURE 5. MECHANICAL OUTLINE 36 PIN DOUBLE DIP

ORDERING INFORMATION

DSC-11520-X X X

Accuracy:
- 2 = ±8 minutes
- 3 = ±4 minutes
- 4 = ±2 minutes
- 5 = ±1 minutes

Reliability Grade:
- 0 = Standard DDC procedures
- 1 = Fully Compliant with MIL-PRF-38534*
- 2 = Screened to MIL-PRF-38534 but without QCI testing*
- 3 = Fully Compliant with MIL-PRF-38534 + PIND Testing*
- 4 = Fully Compliant with MIL-PRF-38534 + Solder Dip*
- 5 = Fully Compliant with MIL-PRF-38534 + PIND Testing + Solder Dip*
- 6 = Screened to MIL-PRF-38534 + PIND Testing but without QCI Testing*
- 7 = Screened to MIL-PRF-38534 + Solder Dip but without QCI Testing*
- 8 = Screened to MIL-PRF-38534 + PIND Testing + Solder Dip but without QCI testing*

Operating Temperature Range:
- 1 = -55°C to +125°C (case)
- 3 = 0°C to +125°C (case)
- 4 = -55°C to +125°C +Variables Data
- 8 = 0°C to +70°C +Variables Data

*Available in -55°C to +125°C temperature range only.

DDC
ILC DATA DEVICE CORPORATION®
105 Wilbur Place, Bohemia, New York 11716-2482

For technical support: 1-800-DDC-1772, ext. 7389 or 7413 (outside N.Y.)
1-800-245-3413, ext. 7389 or 7413 (in Canada)
Headquarters - Tel: (516) 567-5600, ext. 7389 or 7413,
Fax: (516) 567-7358
West Coast - Tel: (714) 895-9777, Fax: (714) 895-4988
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