# ANALOG DEVICES

T-73-27

AC Vector Controllers
AD2S100/AD2S110

FEATURES
Complete Clarke and Park Transformations
Real-Time Computation
Homopolar Output
8- to 12-Bit Digital Interface

APPLICATIONS
AC Vector Control
AC Induction and DC Permanent Magnet Motors
HVAC, Pump, Fan Control
  Material Handling
  Robotics
  Spindle Drives
  Gyroscopes
Stabilization Platforms
Three Phase Power Measurement

FUNCTIONAL BLOCK DIAGRAMS
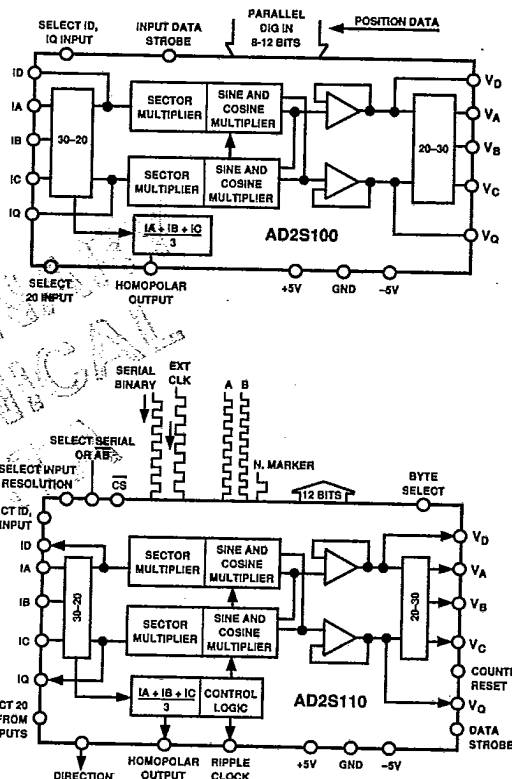
GENERAL DESCRIPTION
The AD2S100 performs the vector rotation of two 90 degree orthogonal ac signals and rotates them into a reference frame related to the update frequency of the digital input port.

Two transforms are included in this single silicon system. The first is the Clarke transform which converts three phase 120 degree signals into their two phase 90 degree equivalents. These signals represent real and imaginary currents which can be computed to give the vector current magnitude.

The Park transform rotates these currents at the update speed of the applied digital input. This digital input is normally provided from a resolver-to-digital converter, or in the case of the AD2S110 an optical encoder position sensor.

If the input current signals are represented by I_{DS} and I_{QS}, respectively, the transformation can be mathematically described as follows:

$$I_{DS}' = I_{DS} \, Cos \, \theta - I_{QS} \, Sin \, \theta$$

$$I_{QS}' = I_{DS} \, Sin \, \theta + I_{QS} \, Cos \, \theta$$

Where I_{DS}' and I_{QS}' are the output of the Park transform and Sin θ and Cos θ the trigonometric values of the input rotor position.

The input section of the device can be configured to accept either three phase inputs, two phase inputs of a three phase system, or two 90 degree separated input signals. A three phase input selection is the only input type which will record the correct homopolar output. This output identifies the situation where an imbalance between the three phase currents exists. In normal conditions this output will normally be zero.

The digital input section will accept a variable resolution from 8 to 12 bits (AD2S100). An input data strobe signal is required to freeze the position data and load this information into the device counters.

Two analog output formats are available. A two phase rotated output facilitates concatenation where a derotation is required. The other output provides three phase signals which can be used as an input to a dc, or, ac motor controller.

The AD2S100 optical encoder version provides the functions above with the addition of a parallel digital port which can be used to extract real-time absolute position data. The AD2S100/AD2S110 are fabricated on LC²MOS and operate on ±5 volt power supplies.

REV. 0

AD2S100/AD2S110—SPECIFICATIONS (typical at +25°C unless otherwise stated)

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Parameter	Min	Typ	Max	Units	Conditions
ANALOG INPUTS					
Voltage Level	0		±5	V dc	
ANALOG OUTPUTS					
Output Voltage Offset			3	mV dc	
ANGULAR ERROR	0		±30	arc min	
Radius Error			0.2	%	
BANDWIDTH			150	Hz	
Settling Time			2	μs	0°C–180°C Step
POWER SUPPLIES					
+V$_{DD}$	+4.75	+5.0	+5.25	V dc	
−V$_{SS}$	−4.75	−5.0	−5.25	V dc	
I$_{DD}$			8	mA	
DIGITAL DATA INPUT FORMAT					
AD2S100 (Only)					10- or 12-Bit Absolute Parallel Binary
AD2S110 (Only)					12-Bit Absolute Serial or 1000 Line A Quad B
DIGITAL DATA OUTPUT FORMAT					12-Bit Absolute Parallel Binary

Specifications subject to change without notice.

PRODUCT HIGHLIGHTS

Hardware Peripheral for Standard Microcontrollers and DSP Systems. The AD2S100/AD2S110 remove the time consuming cartesian transformations from digital processors and benchmarks a speed improvement of 30:1 on standard 20 MHz processors.

Field Orientated Control of AC and DC Brushless Motors. The AD2S100/AD2S110 accommodate all the necessary functions to provide a hardware solution for ac vector control of induction motors and dc brushless motors.

Three Phase Peak Current Measurement. The AD2S100/AD2S110 calculates the peak time current and can be used to sense overcurrent situations, or, imbalances in a three phase system via the homopolar output.

Resolver or Optical Encoder Interface. The AD2S100/AD2S110 provide these general purpose interfaces which will allow direct application of these circuits without changing the rotor position sensor.