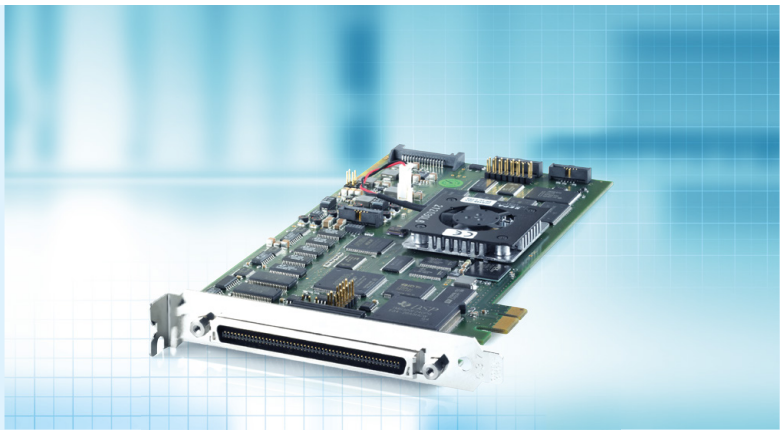
DS1104 R&D Controller Board

Cost-effective system for controller development

Highlights

- Single-board system with real-time hardware and comprehensive I/O
- Cost-effective
- PCI/PCIe (PCI Express) hardware for use in PCs



Application Areas

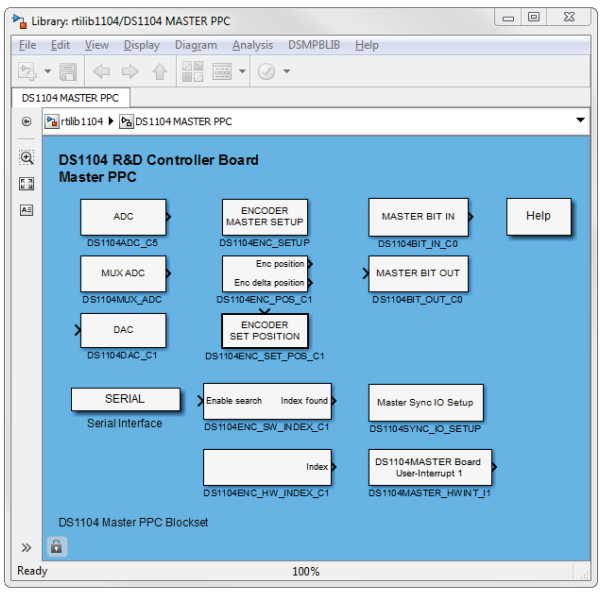
The real-time hardware based on PowerPC technology and its set of I/O interfaces make the controller board an ideal solution for developing controllers in various fields, such as drives, robotics, and aerospace. The board is used in many university laboratories.

Key Benefits

The DS1104 R&D Controller Board is a cost-effective entry-level system with I/O interfaces and a real-time processor on a single board that can be plugged directly into a PC. It upgrades your PC to a development tool for rapid control prototyping and is ideal for developing smaller control applications or for education purposes. Real-Time Interface (RTI, p. 62) provides Simulink® blocks for graphical I/O configuration. The board can be installed in virtually any PC with a free PCI or PCIe slot.

Using Real-Time Interface

With Real-Time Interface (RTI), you can easily run your function models on the DS1104 R&D Controller Board. You can configure all I/O graphically, insert the blocks into a Simulink block diagram, and generate the model code via Simulink® Coder™. The real-time model is compiled, downloaded, and started automatically. This reduces the implementation time to a minimum.



Technical Details

Parameter		Specification
Processor		■ MPC8240 processor with PPC 603e core and on-chip peripherals ■ 64-bit floating-point processor ■ CPU clock: 250 MHz ■ 2 x 16 KB cache, on-chip
Memory	Global memory	■ 32 MB SDRAM
	Flash memory	■ 8 MB
Timer	4 general-purpose timers	■ 32-bit down counter ■ Reload by hardware ■ 80-ns resolution
	1 sampling rate timer (decrementer)	■ 32-bit down counter ■ Reload by software ■ 40-ns resolution
	1 time base counter	■ 64-bit up counter ■ 40-ns resolution
Interrupt controller		■ 5 timer interrupts ■ 2 incremental encoder index line interrupts ■ 1 UART interrupt ■ 1 slave DSP interrupt ■ 1 slave DSP PWM interrupt ■ 5 A/D converter (end of conversion) interrupts ■ 1 host interrupt ■ 4 external interrupts (user interrupts)
A/D converter	Channels	■ 4 multiplexed channels equipped with one sample & hold A/D converter (1x16-bit) ■ 4 parallel channels each equipped with one sample & hold A/D converter (4x12-bit) ■ Note: 5 A/D converter channels (1x16-bit and 4x12-bit) can be sampled simultaneously
	Resolution	■ Multiplexed channels: 16 bit ■ Parallel channels: 12 bit
	Input voltage range	■ ±10 V
	Conversion time	■ Multiplexed channels: 2 µs[1)] ■ Parallel channels: 800 ns[1)]
	Offset error	■ ±5 mV
	Gain error	■ Multiplexed channels: ±0.25% ■ Parallel channels: ±0.5%
	Offset drift	■ 40 µV/K
	Gain drift	■ 25 ppm/K
	Signal-to-noise ratio	■ Multiplexed channels: >80 dB ■ Parallel channels: >65 dB
D/A converter	Channels	■ 8 channels
	Resolution	■ 16-bit
	Output range	■ ±10 V
	Settling time	■ Max. 10 µs (full-scale, accuracy ½ LSB)
	Offset error	■ ±1 mV
	Gain error	■ ±0.1%
	Offset drift	■ 130 µV/K
	Gain drift	■ 25 ppm/K
	Signal-to-noise ratio	■ >80 dB
	I_{max}	■ ±5 mA
Digital I/O	Channels	■ 20-bit parallel I/O ■ Single bit selectable for input or output
	Voltage range	■ TTL input/output levels
	$I_{out, max}$	■ ±5 mA

[1)] *Speed and timing specifications describe the capabilities of the hardware components and circuits of our products. Depending on the software complexity, the attainable overall performance figures can deviate significantly from the hardware specifications.*

Parameter		Specification	
Digital incremental encoder interface	Channels	■ 2 independent channels ■ Selectable single-ended (TTL) or differential (RS422) input (software programmable for each channel)	
	Position counters	■ 24-bit resolution ■ Max. 1.65 MHz input frequency, i.e., fourfold pulse count up to 6.6 MHz ■ Counter reset or reload via software	
	Sensor supply voltage	■ 5 V/0.5 A	
Serial interface	Configuration	■ Single UART (universal asynchronous receiver and transmitter) with FIFO ■ PLL-driven UART for accurate baud rate selection ■ RS232/RS422/RS485 compatibility	
	Baud rate	■ Up to 115.2 kBd (RS232) ■ Up to 1 MBd (RS422/RS485)	
Slave DSP	Type	■ Texas Instruments TMS320F240 DSP ■ 16-bit fixed-point processor	
	Clock rate	■ 20 MHz	
	Memory	■ 64Kx16 external code memory ■ 28Kx16 external data memory ■ 4Kx16 dual-port memory for communication ■ 32 KB flash memory	
	I/O channels[1)]	■ 10 PWM outputs ■ 4 capture inputs ■ 1 serial peripheral interface	
	Input voltage range	■ TTL input/output level ■ A/D converter inputs: 0 … 5 V	
	Output current	■ Max. ±13 mA	
Host interface (requires one PCI or one PCIe x 1 slot)		PCI	PCIe
Physical characteristics	Physical size	■ 185 x 107 mm (7.28 x 4.2 in)	■ 220 x 111 mm (8.66 x 4.3 in)
	Ambient temperature	■ 0 … 55 °C (32 … 131 °F)	■ 0 … 55 °C (32 … 131 °F)
	Cooling	■ Active cooling by fan	■ Active cooling by fan
	Power consumption	■ 18.5 W	Please inquire
	Power supply	■ +5 V ±5%, 2.5 A ■ +12 V ±5%, 0.3 A ■ -12 V ±5%, 0.2 A	Please inquire

[1)] *The exact number of I/O channels depends on your configuration and is described in the user documentation.*

Connector Panels

All I/O signals of the DS1104 R&D Controller Board can usually be accessed via adapter cables. A more convenient solution is I/O access via connector panels, which make the signals available in either a 19" rack or a 19" desktop box. The panels are tailored to a specific controller board, so that you have all the signals for easy connection to the real world at your disposal.

■ Connector Panels (p. 326)

Order Information

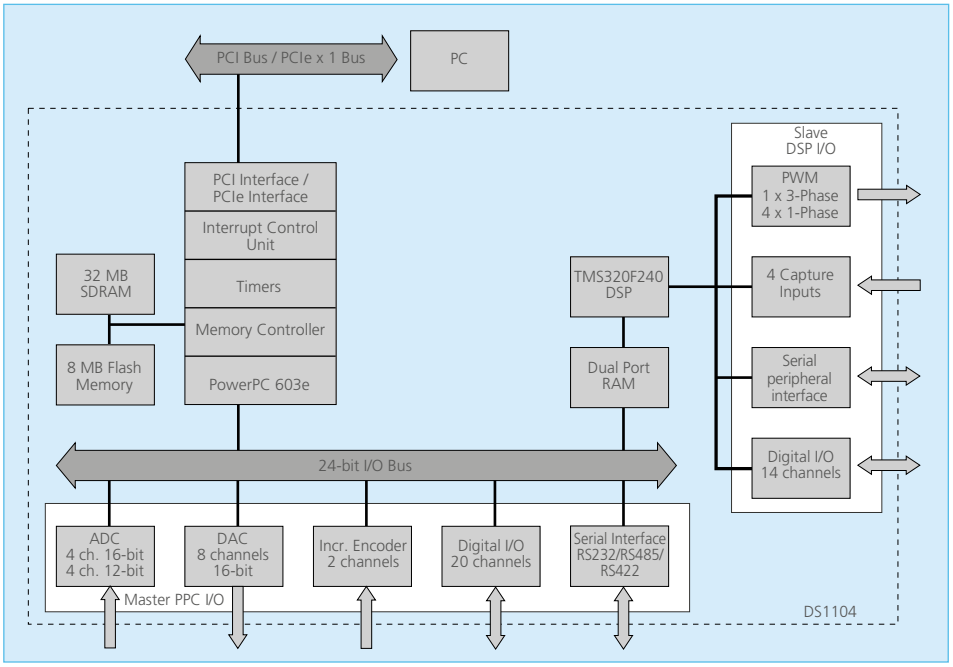
Product	Order Number
DS1104 R&D Controller Board (with PCI host interface)	■ DS1104
DS1104 R&D Controller Board (with PCI Express host interface)	■ DS1104PCIE

Relevant Software and Hardware

Software		Order Number
Included	■ Comprehensive C libraries (e.g., digital I/O support)	–
Required	■ Real-Time Interface (RTI) (p. 62)	■ RTI
	■ Microtec PowerPC C Compiler (p. 115)	■ CCPPPC
Optional	■ ControlDesk	See p. 122
	■ Platform API Package (p. 202)	■ PLATFORM_API

Hardware		Order Number
Optional	■ Connector Panel (p. 326)	■ CP1104
	■ Combined Connector/LED Panel (p. 326)	■ CLP1104
	■ Adapter cable for DS1104	■ ADP_CAB1104

Block Diagram



Induction Motor Control

Use Case

Drive Control

In this use case, an induction motor controller is developed with the DS1104. The DS1104 is well-suited for drive control: while in this use case the slave DSP system calculates the PWM signals, the PowerPC calculates the controller model. With the experiment software ControlDesk (p. 122), measuring and parameterization can be performed during run-time.

Determining Values

One of the board's incremental encoder interfaces picks up the encoder signal of the motor, while two A/D converters are required to analyze the motor currents. The controller board calculates the control algorithm on the basis of the measured values and determines the corresponding pulse width modulation (PWM). The three-phase PWM signals are generated on the board's DSP subsystem and determine the converter's output voltage and frequency.