DS1103 PPC Controller Board

- Single-board system with comprehensive I/O
- PowerPC 750GX running at 1 GHz for rapid control prototyping
- Application memory 32 MB

dSPACE

DS1103 PPC Controller Board

Powerful controller board for rapid control prototyping

Key Features

- **Single-board system with comprehensive I/O**
- **CAN interface and serial interfaces**
- **Interfaces for connecting incremental encoders**
- **High I/O speed and accuracy**
- **PWM-synchronous or externally triggered I/O strobe**
- **32 MB application memory**
- **PLL-driven UART for accurate baud rate selection**

Description

Application Areas

The controller board is designed to meet the requirements of modern rapid control prototyping and is highly suitable for applications such as:

- Induction motor control
- Robotics
- Positioning systems and stepper motors
- Active vibration control
- Rapid control prototyping for automotive controllers

Key Benefits

The DS1103 is an all-rounder in rapid control prototyping. You can mount the board in a PC or a dSPACE Expansion Box to test your control functions in a laboratory or directly in the vehicle. Its processing power and fast I/O are vital for applications that involve numerous actuators and sensors. Used with Real-Time Interface (RTI), the controller board is fully programmable from the Simulink® block diagram environment. You can configure all I/O graphically by dragging RTI blocks. This is a quick and easy way to implement your control functions on the board.

Comprehensive Interfaces

The unparalleled number of I/O interfaces makes the DS1103 a versatile controller board for numerous applications. It provides a great selection of interfaces, including 50 bit-I/O channels, 36 A/D channels, and 8 D/A channels. For additional I/O tasks, a DSP controller unit built around Texas Instruments' TM320F240 DSP is used as a subsystem.

Recording and Output of I/O Values

The control of electrical drives requires accurate recording and output of I/O values. It is possible to synchronize the A/D channels and D/A channels, and the position of the incremental encoder interface, with an internal PWM signal or an external trigger signal. Also, the serial interface (UART) is driven by a phase-locked loop to achieve absolutely accurate baud rate selection.

Technical Details

Parameter		Specification
Processor	PowerPC Type	■ PPC 750GX
	CPU clock	■ 1 GHz
	Cache	■ 32 KB level 1 (L1) instruction cache ■ 32 KB level 1 (L1) data cache ■ 1 MB level 2 (L2)
	Bus frequency	■ 133 MHz
	Temperature sensor	■ Reads actual temperature at the PPC
Memory	Local memory	■ 32 MB application SDRAM as program memory, cached
	Global memory	■ 96 MB communication SDRAM for data storage and data exchange with host
Timer	2 general-purpose timers	■ One 32-bit down counter ■ Reload by software ■ 15-ns resolution
		■ One 32-bit up counter with compare register ■ Reload by software ■ 30-ns resolution
	1 sampling rate timer (decrementer)	■ 32-bit down counter ■ Reload by software ■ 30-ns resolution
	1 time base counter	■ 64-bit up counter ■ 30-ns resolution
Interrupt controller		■ 3 timer interrupts ■ 7 incremental encoder index line interrupts ■ 1 UART (universal asynchronous receiver and transmitter) interrupt ■ 1 CAN interrupt ■ 1 slave DSP interrupt ■ 2 slave DSP PWM interrupts ■ 1 host interrupt ■ 4 external interrupts (user interrupts)
A/D converter	Channels	■ 16 multiplexed channels equipped with 4 sample & hold A/D converters (4 channels belong to one A/D converter. 4 consecutive samplings are necessary to sample all channels belonging to one A/D converter.) ■ 4 parallel channels each equipped with one sample & hold A/D converter ■ Note: 8 A/D converter channels (4 multiplexed and 4 parallel) can be sampled simultaneously.
	Resolution	■ 16-bit
	Input voltage range	■ ±10 V
	Overvoltage protection	■ ±15 V
	Conversion time	■ Multiplexed channels: 1 µs[1)] ■ Parallel channels: 800 ns[1)]
	Offset error	■ ±5 mV
	Gain error	■ ±0.25%
	Offset drift	■ 40 µV/K
	Gain drift	■ 50 ppm/K
	Signal-to-noise ratio	■ >83 dB
D/A converter	Channels	■ 8 channels
	Resolution	■ 16-bit
	Output range	■ ±10 V
	Settling time	■ 5 µs (14-bit)
	Offset error	■ ±1 mV
	Gain error	■ ±0.5%
	Offset drift	■ 30 µV/K
	Gain drift	■ 25 ppm/K

[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
D/A converter	Signal-to-noise ratio	■ >83 dB
	I_{max}	■ ±5 mA
	CI_{max}	■ 10 nF
Digital I/O	Channels	■ 32-bit parallel I/O ■ Organized in four 8-bit groups ■ Each 8-bit group can be set to input or output (programmable by software)
	Voltage range	■ TTL input/output levels
	$I_{out, max}$	■ ±10 mA
Digital incremental encoder interface	Channels	■ 6 independent channels ■ 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
	Encoder supply voltage	■ 5 V/1.5 A ■ Shared with analog incremental encoder interface
Analog incremental encoder interface	Channels	■ 1 channel ■ Sinusoidal signals: 1 Vpp differential or 11 µApp differential (software programmable)
	Position counters	■ < 5° resolution ■ 32-bit loadable position counter ■ Max. 0.6 MHz input frequency, i.e., fourfold pulse count up to 2.4 MHz
	A/D converter performance	■ 6-bit resolution ■ 10 MSPS
	Encoder supply voltage	■ 5 V/1.5 A ■ Shared with digital incremental encoder interface
CAN interface	Configuration	■ 1 channel based on SAB 80C164 microcontroller ■ ISO DIS 11898-2 CAN high-speed standard
	Baud rate	■ Max. 1 Mbit/s
Serial interface	Configuration	■ TL6C550C single UART with FIFO ■ PLL-driven UART for accurate baud rate selection ■ RS232/RS422 compatibility
	Baud rate	■ Up to 115.2 kBd (RS232) ■ Up to 1 Mbd (RS422)
Slave DSP	Type	■ Texas Instruments TMS320F240 DSP
	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	■ 16 A/D converter inputs ■ 10 PWM outputs ■ 4 capture inputs ■ 2 serial ports
	Input voltage range	■ TTL input/output level ■ A/D converter inputs: 0 … 5 V
	Output current	■ Max. ±13 mA
Host interface		■ Plug & Play support ■ Requires a full-size 16-bit ISA slot
Physical characteristics	Physical size	■ 340 x 125 x 45 mm (13.4 x 4.9 x 1.77 in)
	Ambient temperature	■ 0 … 50 °C (32 … 122 °F)
	Cooling	■ Passive cooling
	Power supply	■ +5 V ±5%, 4 A ■ +12 V ±5%, 0.75A ■ -12 V ±5%, 0.25A

Order Information

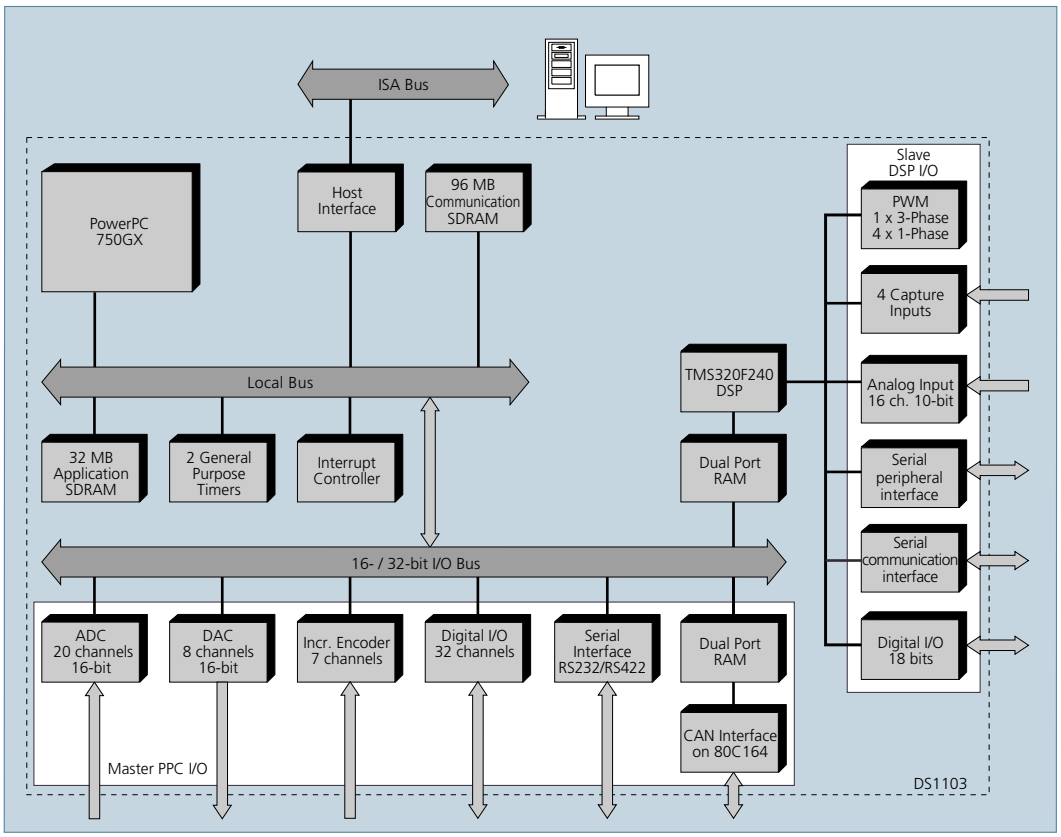
Product	Order Number
DS1103 PPC Controller Board	■ DS1103

Relevant Software and Hardware

Software		Order Number
Included	■ DS1103 Real-Time Library	–
	■ Experiment and Platform Manager for hardware management	–
Required	■ Real-Time Interface (RTI)	■ RTI
	■ Microtec C Compiler for PowerPC	■ CCPPPC
Optional	■ Real-Time Interface CAN Blockset	■ RTICAN_BS
	■ ControlDesk Standard – Developer Version	■ CS_D
	■ ControlDesk Standard – Operator Version	■ CS_O
	■ MLIB/MTRACE	■ MLIB/MTRACE
	■ CLIB	■ CLIB
	■ MotionDesk	■ MotionDesk

Hardware		Order Number
Optional	■ Connector Panel	■ CP1103
	■ Connector/LED Combi Panel	■ CLP1103

Block Diagram

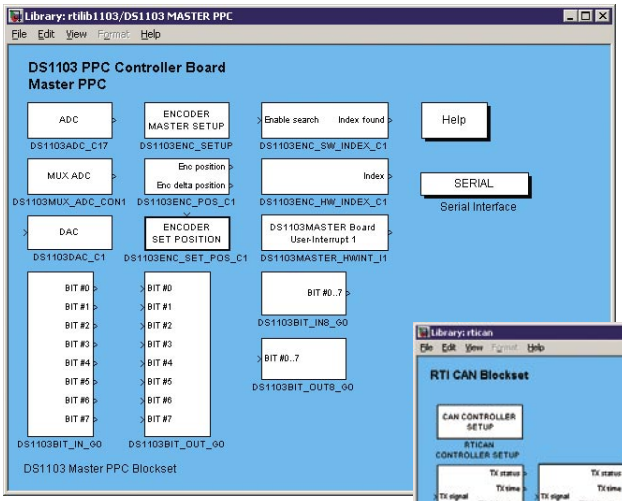


Graphical Configuration of the Controller Board

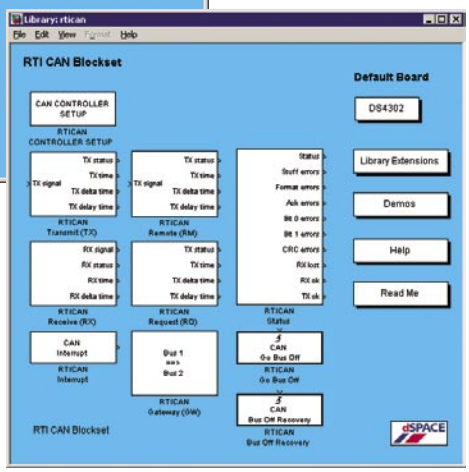
Real-Time Interface

Using RTI

With Real-Time Interface (RTI), you can easily run your Simulink® models on the controller board. You can configure all I/O graphically by dragging RTI blocks. The implementation time is reduced to a minimum. With the RTI CAN Blockset, CAN configurations can be completely carried out in a Simulink block diagram, with very little effort.



Real-Time Interface provides Simulink blocks for convenient configuration of items such as A/D, D/A, digital I/O lines, incremental encoder interface and PWM generation.



RTI CAN Blockset for graphical configuration of CAN interfaces.

Robotics

Use Case

Rapid Prototyping in Robotics

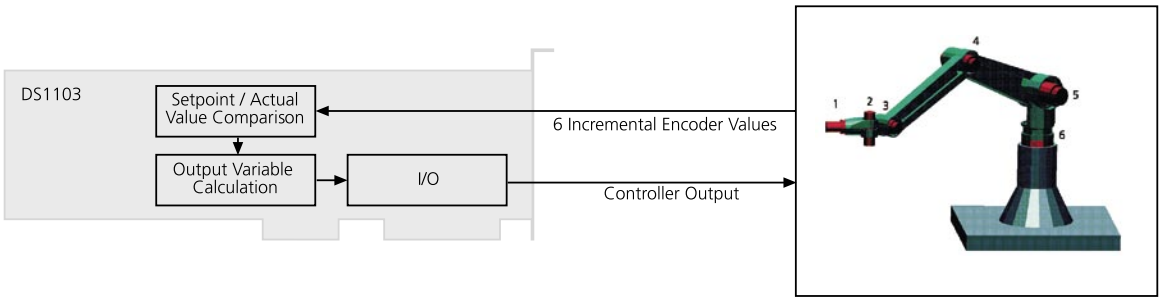
The DS1103 provides six digital incremental encoder interfaces. This is sufficient to pick up all the movements of a six-joint robot. Thus, this cost-effective single-board hardware makes it possible to perform rapid control prototyping in robotics.

Easy Handling

In this example, the controller board replaces the position controller. The easy programmability of the DS1103 enables you to implement and test different control algorithms very quickly, which reduces design iteration times to a minimum. The prototyping hardware allows easy parameter changing and modification, without any hardware setup changes.

Calculating Values

The real-time system picks up the robot's six incremental encoder signals to determine the current robot position. Then this data is compared with the reference values. Afterwards, the DS1103 calculates the control algorithm and sends the controller output – for example, data on positions and velocities – back to the robot.



Calculating a control algorithm for robotics on a DS1103 PPC Controller Board.

Further Processing Potential

All reference values are calculated in real-time, even for inverse kinematics with highly nonlinear functions. External sensors such as axis-force momentum sensors can be included. Performing trajectory planning and advanced algorithms for collision avoidance is also very convenient with the DS1103 PPC Controller Board.

Benefits for Various Applications

With its versatile features, the DS1103 covers many fields of applications. An integrated Infineon CAN microcontroller makes the board an attractive tool for automotive and automation applications.

Headquarters in Germany

dSPACE GmbH
Technologiepark 25
33100 Paderborn
Tel.: +49 5251 1638-0
Fax: +49 5251 66529
info@dspace.de

United Kingdom

dSPACE Ltd.
Unit B7 · Beech House
Melbourn Science Park
Melbourn
Hertfordshire · SG8 6HB
Tel.: +44 1763 269 020
Fax: +44 1763 269 021
info@dspace.ltd.uk

France

dSPACE Sarl
Parc Burospace
Bâtiment 20
Route de la Plaine de Gisy
91573 Bièvres Cedex
Tel.: +33 1 6935 5060
Fax: +33 1 6935 5061
info@dspace.fr

Japan

dSPACE Japan K.K.
10F Gotenyama Trust Tower
4-7-35 Kitashinagawa
Shinagawa-ku
Tokyo 140-0001
Tel: +81 3 5798 5460
Fax: +81 3 5798 5464
info@dspace.jp

USA and Canada

dSPACE Inc.
50131 Pontiac Trail
Wixom · MI · USA 48393-2020
Tel.: +1 248 295 4700
Fax: +1 248 295 2950
info@dspaceinc.com

www.dspace.com

01/2008