RUBY-MM-1616AP 4/8/16 channel 16-bit Analog Output PC/104 Module with Digital I/O

16-Channel Model with 48 DIO

FEATURES

- 4, 8, or 16 analog outputs
- 16-bit D/A resolution
- Unipolar and bipolar operation
- Simultaneous updating of all outputs
- ±10V, ±5V, 0-10V, 0-5V voltage output ranges
- 0-20mA, 4-20mA, 0-24mA current output ranges
- Independent output range for each channel
- D/A digital calibration
- Waveform generator up to 16 channels
- 48 digital I/O lines, bit and byte-wide
- External trigger capability
- 2 32-bit programmable counter/timers
- 4 24-bit pulse width modulators
- Requires only +5V power supply
- Fully calibrated for highest accuracy
- PC/104-Plus form factor (3.55" x 3.775")
- Automatic host bus select with PCI preference
- Operating temperature -40°C to +85°C

Description

The Ruby-MM-1616AP/816AP/416AP series provide up to 16 channels of 16-bit resolution analog voltage or current output in the PC/104-Plus form factor. The output range for each channel can be individually selected for 0-5V, 0-10V, ±5V, ±10V, 0-20mA, 4-20mA, or 0-24mA. All outputs are updated simultaneously, either with a software command or in response to an external signal. A waveform generator is available on up to 16 channels with simultaneous updating of all channels.

The board also includes 48 lines of digital I/O, 40 lines of byte-wide and 8 lines of bit-wide, two 32-bit counter/timers, and four 24-bit pulse width modulators. Other features include +5V only operation, individual DC/DC converters with filtered outputs for each DAC to supply ±15V for operation, and a six layer circuit board to bury and shield the analog signals.

Rugged Design for the Real World

Extended temperature capability of -40°C to +85°C enables the board to operate in environments with extreme temperature swings, such as vehicles or outdoor installations. In addition, the board may be custom-configured with 0-ohm resistors in place of jumpers for increased ruggedness in high-vibration environments. As with all of Diamond's analog I/O boards, Ruby-MM-1616 utilizes a 6-layer PCB with split analog and digital power and ground planes to keep the analog outputs quiet. All analog and digital lines reset to a known state on power up or system reset to guarantee predictable behavior. Factory calibration ensures the highest possible accuracy over the lifetime of the product. The board requires only +5V from the system power supply. These features make Ruby-MM-1616's quality and performance a leader in the market.

Automatic host bus select with PCI preference

The AP series includes both PCI and ISA bus connectors connected to the FPGA controller. If the PCI bus is present (the board is installed in a system with PCI bus present) it will be selected for the host interface. The board can also be installed in an ISA-based PC/104 system and will automatically switch over to the ISA bus. The ISA bus interface can also be forced with a jumper on the board in case there are no remaining PCI slots available in the system.

Analog Output Ranges

A wide selection of output ranges is selectable on Ruby-MM-1616A. Each output can have its own output range. The table below lists the available output ranges and the associated resolution.

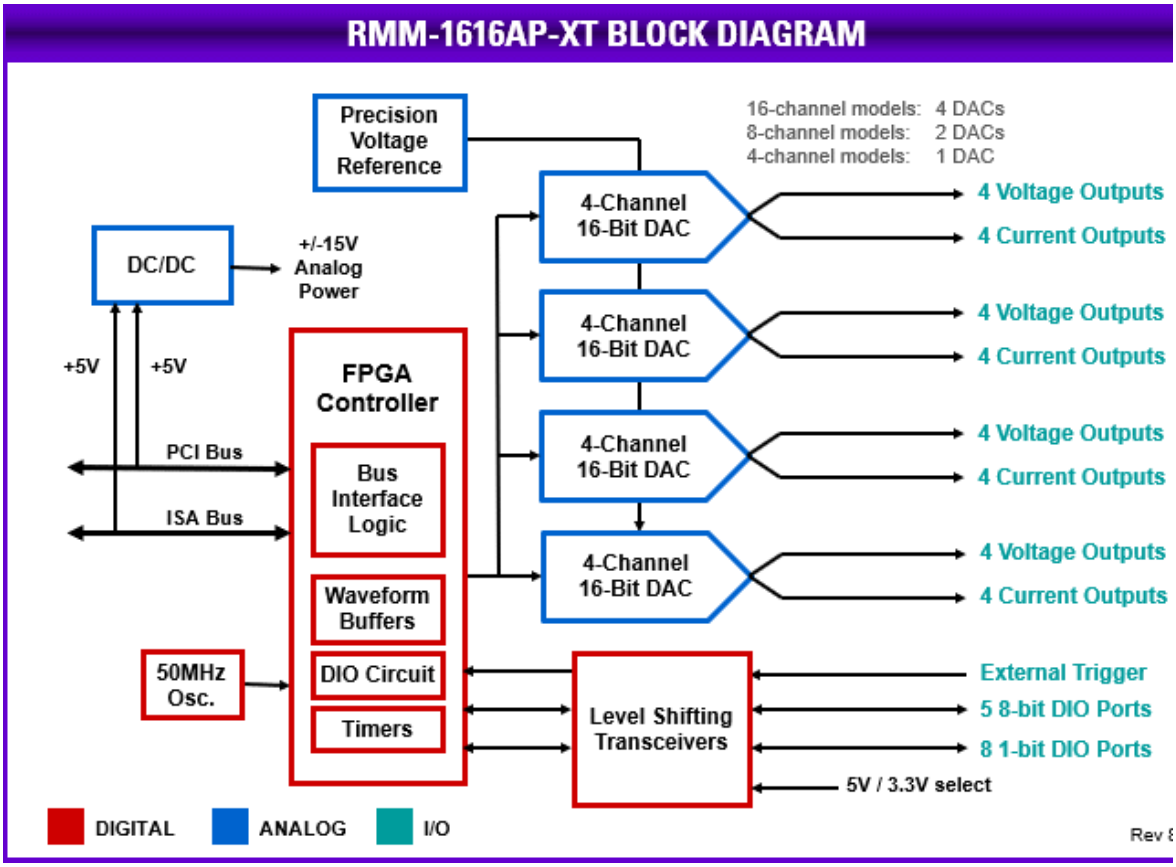
Output Range	Resolution (1 LSB)
±5V	153µV
±10V	310µV
0 - 10V	153µV
0 - 5V	76µV
0 - 20mA	1 LSB

4 - 20mA	1 LSB
0 - 24mA	1 LSB

Simultaneous Update

All analog outputs are updated simultaneously with a single read command. This feature minimizes time skew effects when multiple channels are being used to control a single device (for example, when two channels are controlling the X-Y position on a laser). When an update command occurs, only channels with new data written to them will change; the remaining channels will maintain their current output voltage level without interruptions or glitches.

Block Diagram



Software Support

The Ruby-MM-1616 ships with Diamond's free **Universal Driver software** for C language programming under Windows 7, Windows Embedded 7, Windows XP, Linux and DOS. All major functions of the board are supported by the driver and example programs are also included. Some examples of the supported board operations are:

- Analog output on single channel
- Analog output on multiple channels with simultaneous update
- Interrupt-driven analog outputs with internal or external trigger
- Digital input, bit, byte, and word

- Digital output, bit, byte, and word

Analog I/O Header Pinout

Vout 0	**1**	**2**	Iout 0
Agnd	**3**	**4**	Vout 1
Iout 1	**5**	**6**	Agnd
Vout 2	**7**	**8**	Iout 2
Agnd	**9**	**10**	Vout 3
Iout 3	**11**	**12**	Agnd
Vout 4	**13**	**14**	Iout 4
Agnd	**15**	**16**	Vout 5
Iout 5	**17**	**18**	Agnd
Vout 6	**19**	**20**	Iout 6
Agnd	**21**	**22**	Vout 7
Iout 7	**23**	**24**	Agnd
Vout 8	**25**	**26**	Iout 8
Agnd	**27**	**28**	Vout 9
Iout 9	**29**	**30**	Agnd
Vout 10	**31**	**32**	Iout 10
Agnd	**33**	**34**	Vout 11
Iout 11	**35**	**36**	Agnd
Vout 12	**37**	**38**	Iout 12
Agnd	**39**	**40**	Vout 13
Iout 13	**41**	**42**	Agnd
Vout 14	**43**	**44**	Iout 14
Agnd	**45**	**46**	Vout 15
Iout 15	**47**	**48**	Agnd
Ext Trig	**49**	**50**	Dgnd

Analog Outputs	
Number of outputs	4, 8, or 16
Resolution	16-bits
Output ranges	0-5V, 0-10V unipolar, ±5V, ±10V bipolar 0-20mA, 4-20mA, 0-24mA
Settline time	10us maximum to ±.003%
Linearity error	±2 LSB maximum
Differential nonlinearity	±2 LSB maximum
Monotonicity	15 bits minimum
Maximum output current	±5mA/2KΩ minimum load
Reset	All DACs reset to 0V
Calibration	Digital with internal scale and offset registers for each channel
Waveform generator	Up to 16 channels
Digital I/O	
Number of lines	40 byte-wide, 8 bit-wide, programmable direction CMOS/TTL compatible (82C55)
Input voltage	Logic 0: -0.5V min, 0.8V max Logic 1: 2.0V min, 5.5V max
Output voltage	Logic 0: 0.0V min, 0.4V max Logic 1: 3.0V min, 4.6V max
Output current	±2.5mA maximum per line
Pull-up resistor	10KΩ on each I/O lines
External trigger	TTL/CMOS compatible, 10KΩ pull-up resistor, active high edge
Reset	All digital I/O lines are set to input and all data registers are set to 0
Counter/timers	2 32-bit programmable; 40MHz clock
Pulse width modulators	4 24-bit
General	
Input Power	+5VDC ±10%
Operating temperature	-40°C to +85°C Extended
Dimensions	90mm x 96mm (3.55" x 3.775")

Form Factor	PC/104 compliant
Weight	3.0oz (85g)
MTBF	100,000 hours
RoHS	Compliant

Models and Accessories

Ruby-MM-1616AP		
available models:		
RMM-1616AP-XT	16 Channel 16-bit Analog Output PC/104-Plus Module with 48 Digital I/O, extended temperature	Available
RMM-816AP-XT	8 Channel 16-bit Analog Output PC/104-Plus Module with 48 Digital I/O, extended temperature	Min Order Quantity
RMM-416AP-XT	4 Channel 16-bit Analog Output PC/104-Plus Module with 48 Digital I/O, extended temperature {minimum order quantities apply}	Min Order Quantity

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