16 Differential/32 Single Ended 16-bit A/D Input Channels
2 Differential, 12 bit, isolated A/D Input Channels
Eight 16-Bit D/A Channels
Thirty-Two 14-Bit D/A Channels
48 Opto-Isolated Digital I/O Cells
- Each Digital I/O Cell can Factory Configured as Input or Output
- Output Sink up to 1A
- Factory Configurable Input Threshold Levels
16 Opto-Isolated Digital Input Channels Designed for Switch Activation
VME Slave Interface Implemented in a High Performance FPGA
All Digital & analog I/O signals are available at the VME P2 & P0 connectors
Low Power Consumption < 8 W
VxWorks, Linux, and INTEGRITY Drivers (Optional)
BIT (Optional)
On-Board A/D, D/A Loopbacks and High Precision Reference Voltage Sources for High Reliability Operation
On-Board Temperature Sensor
Conduction and Air Cooled Versions
Vibration and Shock Resistant
Overview

The innovative Aitech C431 is a VMEbus slave card that provides extensive I/O resources including analog-to-digital, digital-to-analog, and opto-isolated digital I/O capabilities for harsh environment applications.

Two ADC devices, a 16-bit and a 12-bit ADC, provide high precision analog-to-digital conversion. The 16-bit device input channels are software configurable, either to 32 single-ended input channels or 16 differential channels or a combination of both. The 12-bit ADC controls two completely isolated differential channels.

C431 Block Diagram

Two DAC devices, a 16-bit and a 14-bit DAC, provide 32 high reliability output levels.

All ADC and DAC devices are advanced high-speed devices enabling high sampling rates.

Digital I/O provides high current opto-isolated channels specifically designed for switch activation and high current switching applications. Each of these opto-isolated channels may be individually configured to operate as input or output.

The card integrates a sophisticated design totally separating the analog and digital domains allowing it to achieve high quality analog to digital and digital to analog conversions.

The VMEbus interface implemented in the C431 is incorporated in an FPGA logic device providing a simple and reliable interface. The VME interface provides slave functionality only and supports A32/D08/D16/D32 access modes.

The C431 is a low power card delivering high I/O capabilities with minimal power consumption.

The C431 is optionally delivered with a complete set of drivers and optionally Built-In Tests (BIT) for all of its on board resources. The drivers integrated into the VME host card environment provide full control and access to all of the C431 modules.

The on-board temperature sensor enables fixing of analog and digital conversion errors.
**Functional Description**

**Analog I/O Interface**
The C431 VME I/O board includes Analog to Digital (A/D) and Digital to Analog (D/A) channels as described below.

**Standard A/D Input Channels (ADC1)**
- Up to 32 Single Ended or up to 16 Differential Analog Input Channels (combinations of the two are available)
- 16-bit ADC device resolution (12-bit actual input voltage resolution)
- Input Channels are Software selected by MUX devices
- Software configuration of Differential/Single Ended inputs
- Input voltage range: +/-10 V (other input voltage ranges can be implemented upon request)
- Up to +/- 70 V over voltage/fault protection
- Includes two modes of operation:
  - “Single mode” – convert on command one selected channel.
  - “Single Scan mode” – convert all channels sequentially on demand.
- Support for VME interrupt or polling mode operation
- Analog data sampling rates:
  - Up to 100 kHz per channel for single mode
  - Up to 30 kHz per channel for single scan mode
- Offset and Gain Calibration support using a built-in voltage and ground references
- Active analog low pass filtering on ADC input. (Filter parameters can be customized upon request)
- ADC1 includes software programmable gain control.
- BIT support for the A/D path using internal loopback connections from DAC outputs to ADC1 inputs.

**Isolated A/D Input Channels (ADC2)**
- 2 Differential analog Input channels.
- 12-bit A/D device resolution
- Isolated supply and digital interfaces
- 0 to +10 V analog inputs voltage range (other input voltage ranges can be implemented upon request)
- Sampling Rate: Up to 9.6 kHz
- Up to +70 V over voltage/fault protection.
- BIT, Offset and Gain Calibration support using the built-in voltage and ground references

**D/A (DAC1) Output Channels**
- Up to eight Analog output channels
- 16-bit D/A device resolution
- 0 to +10 V analog output voltage range (Other output voltage ranges can be implemented upon request)
- Max Conversion time per channel (from VME to analog output): 3 µsec
- Buffer amplifier outputs delivers up to 2.5 mA at full-scale voltage on all outputs simultaneously.

**D/A (DAC2) Output Channels**
- Up to 32 Analog output channels
- 14-bit D/A device resolution
- 0 to +10 V analog output voltage range (Other output voltage ranges can be implemented upon request)
- Max Conversion time per channel (from VME to analog output): 3 µsec
- Buffer amplifier outputs delivers up to 2.5 mA at full-scale voltage on all outputs simultaneously.

**Voltage Reference Output**
High precision 2.5V voltage reference buffered output routed to P0 I/O connector

**Digital I/O Interface**
The C431 VME I/O board provides digital isolated input and output channels

**I/O Channels**
48 optically isolated I/O channels can be factory configured as inputs or outputs.

**When Configured as Outputs:**
- Each channel provides two lines (+ & -) at two operation state modes:
  - Output logic “0” - Lines are open
  - Output logic “1” - Lines are shorted
- Max output voltage range: 0 to +40 VDC or AC peak
- Max output current sink: 1A per output channel
- Each output channel includes on board feedback status circuit used for testing during real-time operation.
- Each channel has a 400 W Transients over voltage protection
- During power-up and initialization, all outputs are set to logic “0” (lines open).

**When Configured as Inputs:**
- Each channel can be factory configured with a various voltage level threshold
- Internal power supply is used for testing the input channels during non operation
- Each channel has a 400 W Transients over voltage protection
- The board reads logic “0” at any unconnected (open) input channel
- Max current draw for each channel is up to 5 mA
**Input Channels**
16 optically isolated input channels

- The input terminal needs to be connected to a switch, which closes circuit to the common supply GND.
- Each input channel can be factory configured with a various voltage level threshold.
- Max current draw for each channel is up to 5 mA.
- The board reads logic “0” at any unconnected (open) input channel.
- 8 channels have a 200 W Transient over voltage protection and 8 channels have a 400 W Transient over voltage protection.

**VMEbus Interface**
The C431 VME Bridge is implemented in an FPGA logic device. The VME Bridge provides slave VME capabilities and supports A32/D08/D16/D32 data transfers from/to any standard VME host board.
The C431 supports VMEbus interrupts generation on any of the seven VME interrupt levels.

**Geographical Addressing**
The C431 VME Base address can be set in one of three methods:

- Using the on board jumpers.
- Using VME64x geographical address signals.

Factory programming is available upon request.

**General Purpose TTL Input**
A TTL level input for optional triggering of A/D or D/A devices.

**Mechanical Features**
The C431 is available in two mechanical formats:
- Air-cooled per ANSI/VITA 1-1994
- Conduction cooled per IEEE 1101.2

Both mechanical formats are single-slot 6U modules.

Custom metal frame provides excellent rigidity and shock resistance. In addition custom metal frame provides an array of stiffeners to support rugged PMC boards.

**Dimensions**
- Air-cooled: per ANSI/VITA 1-1994
- Conduction cooled: per IEEE 1101.2

**Weight**
- Air-cooled: < 410 g (0.9 lbs)
- Conduction cooled: < 550 g (1.21 lbs)

**Thermal Management**
A careful mechanical design including custom Heatsink modules combined with a metal frame allow for optimal heat dissipation.

**Power Requirements**
The C431 may be configured to receive all its power from the VME backplane’s +5.0 V supply only. It also has the capability to utilize the +3.3 V power supply from the backplane supply as defined in the VME64x specification.

Total power consumption of the C431 depends on its configuration and assembly options.

Fully featured and configured to take all its supply from the +5.0 V power supply, its power consumption is 7.85 W (Typ.) and 13.6 W (Max) as follows:

- +3.3 V (± 5%) 0 A (typ) 0 A (max)
- +5.0 V (± 5%) 1.45 A (typ) 2 A (max)
- +12 V (± 10%) 0.05 A (typ) 0.3 A (max)
- −12 V (± 10%) 0 A (typ) 0 A (max)

**Software Support**
The C431 slave VME board can optionally be supplied with drivers for the VxWorks, Linux, and INTEGRITY operating systems, which are loaded and run on the VME host board (master). These drivers allow operation and control of the C431 from the host board via the VMEbus.

The C431 drivers also optionally include a set of BIT functions, which are used to test the A/D, D/A, and the Digital I/O functions.

Drivers for other popular real-time operating systems can be supplied upon request.

**Environmental Features**
Refer to the Aitech Ruggedization datasheet.
C431
A/D, D/A, and Digital I/O VME Board

Ordering Information

Digital I/O (Up to 64)
1 = 16 in, 48 out
2 = 32 in, 32 out
3 = 48 in, 16 out
4 = 64 in only
9 = Custom

Configuration No.
To be assigned by Aitech

Ruggedization
1 = Commercial
2 = Rugged
4 = Military

Cooling
A = Air
R = Conduction

DAC and ADC
00 = No DAC and no ADC
22 = DAC: 24 channels @ 14-bit (0 - 10V),
8 channels @ 16-bit (0 - 10V)
ADC: 32 SE/16 DIFF @ 16-bit (+/-10V),
2 Isolated DIFF @ 12-bit (0 - 10V)
99 = Custom

Example: 4C431-R322-00

Note: Configuration options have been simplified relative to previous releases of this datasheet.
Orders using legacy part numbers will be honored, but are not recommended for new designs.

For alternative configurations or more information about the C431 or any Aitech product, please contact Aitech Defense Systems sales department at (888) Aitech-8 (248-3248).