

OKOS

AL8xGTe
8 bit 1-3 GHz 2 Channel A/D Card



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Document

AL8xGTe Manual
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Section 1: General Information

General Information

General Description

The AL8xGTe is a two channel A/D board for the PCI Express x1 bus. It is optimized for high-speed transient capture at a sampling rate of 1, 1.5, 2 or 3 GSamples/sec at very high repetition rates. A large dual-ported onboard buffer memory allows simultaneous transient recording and readout of captured data. A post-processing section can be used to extract peak information on multiple gates while the captured data is transferred over the PCI Express bus into the PC's main memory.

The analog inputs are DC-coupled and terminated with 50 Ohms impedance for high signal fidelity over the entire analog bandwidth of over 1 GHz. Input voltage ranges are programmable from 125mVp-p to 2Vp-p.

One or two A/D converters with 8 bits resolution sample the input signal at 1.0 or 1.5 Gsamples/sec. Board versions with two A/D converters can either sample both input channels simultaneously at 1.0 or 1.5 Gsamples/sec or use both A/D converters on the same channel in an interleaved fashion to achieve 2.0 or 3.0 Gsamples/sec effective sampling rates.

The sampled data is stored in an onboard memory buffer of up to 4 Gsamples. The size of this buffer memory determines the maximum length of an acquisition. The board will be ready to accept a trigger about 2 microseconds after the end of the previous acquisition, which allows for repetition rates well beyond 100 kHz for short acquisitions.

The sampling clock is generated on the board and not available externally. Lower sampling rates of 750, 500, 375, 333, 250 Msamples/sec down to 244 kSamples/sec are created by decimating the sampled data while reading it from the buffer memory. Reading data from the buffer memory occurs simultaneously with acquisition and does not affect repetition rate.

The sampled data is transferred over the PCI Express bus using DMA, thus requiring no CPU intervention to achieve high transfer rates. During this data transfer, a set of peak detectors can be used to monitor the sample stream and extract peak position and threshold crossing data over selected pieces of the sampled data.

A large selection of flexible triggering modes allows the user to tailor the behavior of the board to many applications. In addition to the standard software-generated trigger, the board can be triggered by a threshold crossing of the analog input signal on any channel or a signal fed to the BNC Trigger connector, a digital TTL signal on the internal trigger connector or a position-derived trigger from an encoder or motor of a scanning system.

The BNC Trigger and internal trigger connectors can also drive a trigger signal as an output; for instance, to fire an ultrasonic pulser/receiver. This driver supports special modes that can be used to trigger multiple boards simultaneously from any of the connected boards, simply by tying the BNC Trigger or internal trigger connectors together.

A simple oscilloscope program is included with the board. It allows evaluation of the various configurations and triggering modes of this board. Drivers and a DLL implementing OKOS Solutions' software provide easy access to the functionality of the board from a user application.

Section 2: Specifications

Analog Section

- 1 or 2 channels analog input
- AC/DC coupling, software selectable
- 50 Ohm /50 K Ohm input impedance – software selectable
- Input ranges: 125 mV, 250 mV, 500 mV, 1 V, 2V peak-to-peak
- Bandwidth: DC to 1.0 GHz -3dB, AC from 100KHz – 1000 MHz
- Individual gain and attenuation for both channels
- Calibration data for all input ranges stored on board

A/D Converters

- Up to 2 Channels
- 1.0 or 1.5 GSamples/sec sampling rate, 8 bits resolution, one or two channels
- Interleave mode for doubled sampling rate on one channel
- Min Sample rate: 250 KS/sec single shot for internal clocking

Sampling Rates

- Sampling rates: 3.0 GHz, 2.0 GHz, 1.5 GHz, 1.0 GHz (depending on configuration), 750 MHz, ... to 244 kHz

Clock

- Internal, can be locked to an external frequency reference (typ. 5.00 or 10.00 MHz)

Connectors

- 2 BNC connectors for analog signal input
- BNC connector for frequency reference input/output
- BNC connector for trigger input/output
- 16 bit digital I/O
- 10 pin encoder trigger input
- Internal trigger I/O connector (3 pin header)
- PCI-E interface card-edge connector

Memory

- Up to 4 GSamples, dual-ported
- Fast offload while acquiring

Trigger Sources

- Software trigger
- Encoder trigger from up to 4 encoders
- Internal trigger connector, TTL (3 pin header)
- External trigger input, programmable threshold (BNC)
- Signal trigger on either channel, programmable threshold and slope

Trigger Outputs

- Internal trigger connector, TTL (3 pin header)
- External trigger connector (BNC)
- Any trigger source can be routed to the trigger connectors as an output signal, independent of the selected acquisition trigger source

Acquisition Control

- Pre-trigger and Post-trigger delay acquisition
- Auto re-arming
- Interrupt after programmable number of acquisitions
- 32 bit pre/post-trigger and length counters
- 4 Gsamples max. acquisition length

Bus Interface

- PCI-E x1 interface
- PCI master mode operation
- DMA transfers with scatter/gather support
- Programmable interrupts

General

- PCI-E board dimensions 4.25" x 9.375"

Installation

Initial Inspection

A complete A/D package consists of the following:

1. A/D Board: AL8xGTe
2. AL.NET Drivers with AL8xGTe Scope Software
3. User Guide
4. Software Development Kit (SDK)

Before installing the AL8xGTe, please inspect the board and make sure the board is not damaged. If any of the pins or connectors are bent, or if the board appears to be cracked, please contact OKOS Solutions as the board may have been damaged in transit. The board and software have been carefully inspected and tested prior to shipment. Please retain all packing slips and shipment information in case a claim needs to be submitted to the carrier.

Unpacking and Installation

The AL8xGTe is shipped in an anti-static bag. The board has sensitive electronic components that can be damaged due to static electricity discharge. Prior to touching the board, ground yourself by touching the back panel of the computer that is plugged into an electrical outlet. When handling the board, please always touch the board at the PCI bracket; never directly touch the board surface.

IMPORTANT NOTE: Boards should be installed with adequate ventilation to prevent overheating. OKOS requires the installation of the A/D board fan shipped with your order. This fan should be replaced yearly to prevent thermal damage to the board. The board should be kept free of dust and debris. Canned air can be used to regularly clean the board's surface.

After installing the AL.NET drivers, peel the yellow 'Static Warning' sticker off the antistatic bag and remove the board from its bag by holding the metal bracket at the end of the board. Install the board carefully into a free PCI Express slot in the computer and properly secure the board (usually by screwing down the bracket; securing it with a clip may not be sufficient). **Do not install the board in the computer before the AL.NET drivers have been installed.** The board will work in x1, x4 or x8 PCI Express slots.

IMPORTANT NOTE: Make sure the board is firmly inserted and that the bracket is screwed down before operation. Otherwise, the board may not be seated well and will be damaged or not function properly when the system is turned on.

When the system is powered on with the AL8xGTe installed, LED D2002 (located at the bottom front of the board next to the PLX chip) should be green. This indicates that the AL8xGTe is active and properly communicating with the PCI Express bus.

IMPORTANT NOTE: there is another LED (D2003) located at the bottom back of the board that will be red on startup. This is normal and should not be confused with LED D2002.

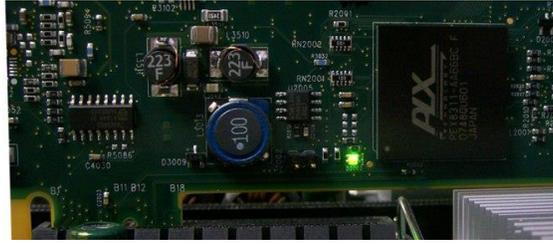


Figure 1: 8xGTe powered on and communicating (D2002 is green)

Some older BIOS may have trouble communicating with the AL8xGTe. If LED D2002 is red on startup, perform the following checks to make sure your system is correctly configured:

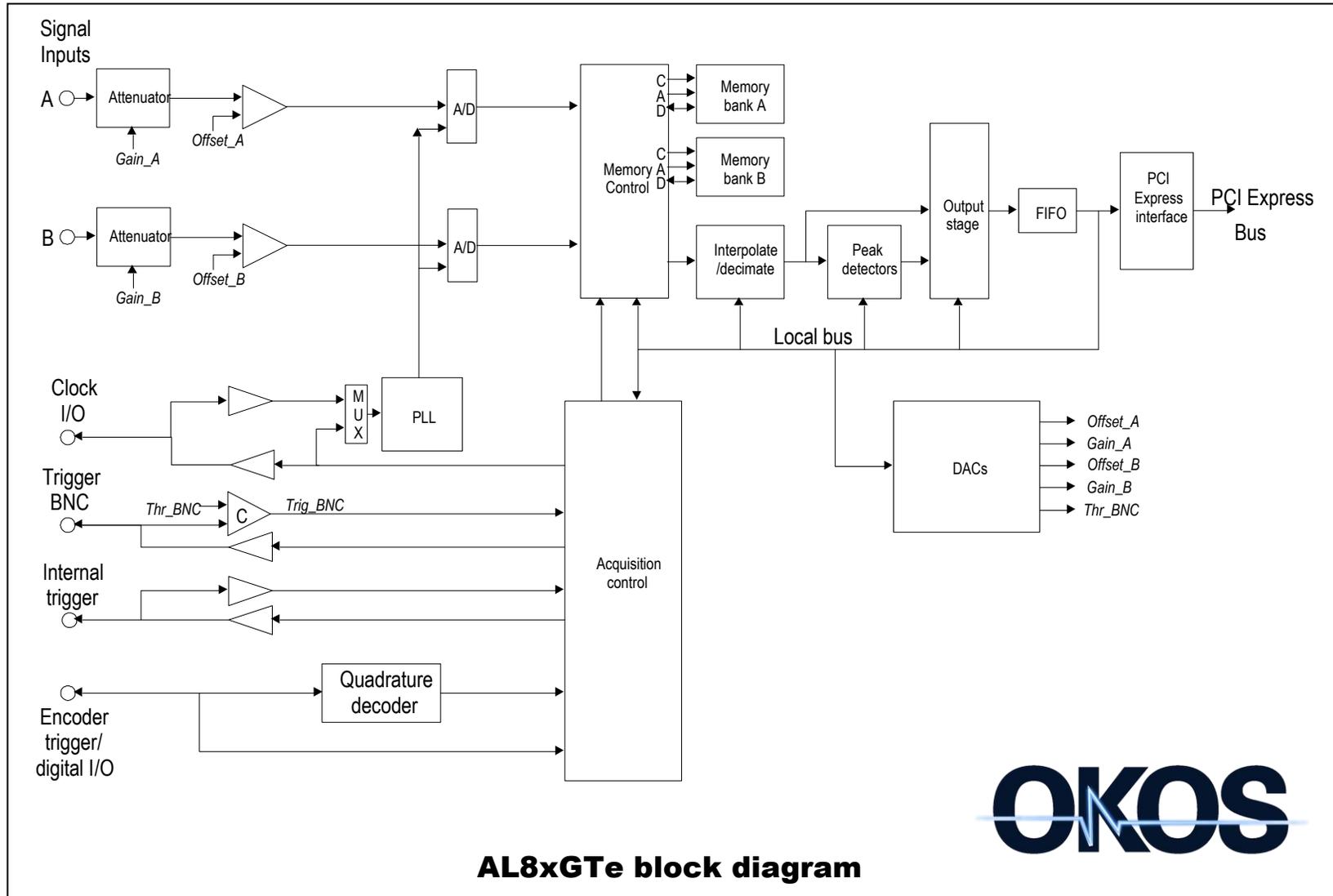
- 1) Make sure to install the latest BIOS updates for your system.
- 2) Try moving the board to a different PCI Express slot.

Software Updates

Use of the AL8xGTe requires version 2.3.16 of the AL.NET2 drivers (or later).

Please contact OKOS Solutions at info@okos.com for information on software updates.

AL8xGTe Block Diagram



Connector Assignments

Internal Trigger – J5 is used to trigger the A/D board by an external TTL trigger.

Pin	Signal
1	Ground
2	Trigger Input
3	Ground

The internal trigger connector is a single-row, three-pin header at the upper edge of the board (J5). Pins 1 and 3 are Ground, and pin 2 can be used as a trigger input with programmable polarity or as a trigger output under program control. In either case the signal is TTL compatible. An active trigger edge on this input will be accepted with a timing uncertainty of ± 10 ns.

Encoder Trigger – J6 is used to trigger the A/D based on the input from encoder signals or as general-purpose digital I/O

Pin #	Direction	Function
1	-	GND
2	I/O	Digital I/O port, bit 0; Encoder 0 Step/CW
3	I	Encoder 0 Differential Z-
4	I/O	Digital I/O port, bit 1; Encoder 0 Direction/CCW/Z+
5	I	Encoder 0 Quadrature Differential A-
6	I/O	Digital I/O port, bit 2; Encoder 0 Quadrature A+
7	I	Encoder 0 Quadrature Differential B-
8	I/O	Digital I/O port, bit 3; Encoder 0 Quadrature B+
9	-	GND
10	I/O	Digital I/O port, bit 4; Encoder 1 Step/CW
11	I	Encoder 1 Differential Z-
12	I/O	Digital I/O port, bit 5; Encoder 1 Direction/CCW/Z+
13	I	Encoder 1 Quadrature Differential A-
14	I/O	Digital I/O port, bit 6; Encoder 1 Quadrature A+
15	I	Encoder 1 Quadrature Differential B-
16	I/O	Digital I/O port, bit 7; Encoder 1 Quadrature B+
17	-	GND
18	I/O	Digital I/O port, bit 8; Encoder 2 Step/CW
19	-	GND
20	I/O	Digital I/O port, bit 9; Encoder 2 Direction/CCW
21	-	GND
22	I/O	Digital I/O port, bit 10; Encoder 2 Quadrature A
23	-	GND
24	I/O	Digital I/O port, bit 11; Encoder 2 Quadrature B
25	-	GND
26	I/O	Digital I/O port, bit 12; Encoder 3 Step/CW
27	-	GND
28	I/O	Digital I/O port, bit 13; Encoder 3 Direction/CCW
29	-	GND
30	I/O	Digital I/O port, bit 14; Encoder 3 Quadrature A
31	-	GND
32	I/O	Digital I/O port, bit 15; Encoder 3 Quadrature B
33	-	+5V, switched and overload protected
34	-	+5V, switched and overload protected

Alternate Encoder Trigger – J8 is used as alternate encoder trigger input

Pin#	Function
1	Encoder Z-
2	Encoder A-
3	Encoder B-
4	switched +5V power supply, 0.5A max., overcurrent-limited
5	Ground
6	Encoder A+ or STEP input
7	Z+, ZERO or SCAN DIRECTION CONTROL input
8	Encoder B+ or DIRECTION input
9	Digital output (3.3V)
10	unused, not connected

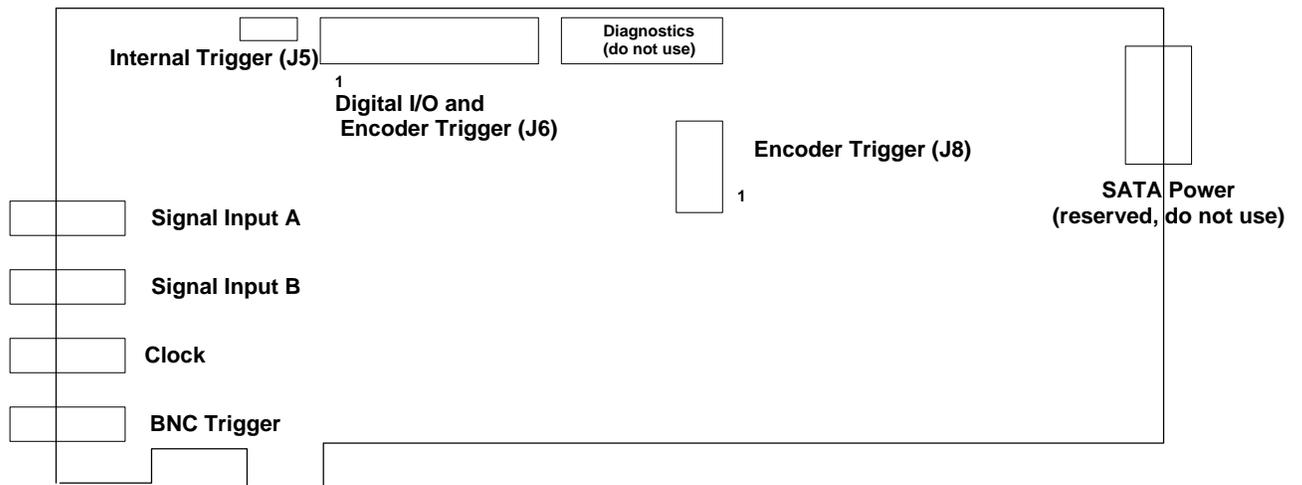
Differential Encoder Configuration – SW 4001 DIP switch block on the back of the board enables and configures differential encoder input. All switches are off by default.

Switch#	Function
1	Encoder 1 Single/Diff Select (off = single, on = diff)
2	Encoder 1 Diff Invert (only works in diff mode, off=Inv, on=Normal)
3	Encoder 2 Single/Diff Select
4	Encoder 2 Diff Invert (only works in diff mode, off=Inv, on=Normal)

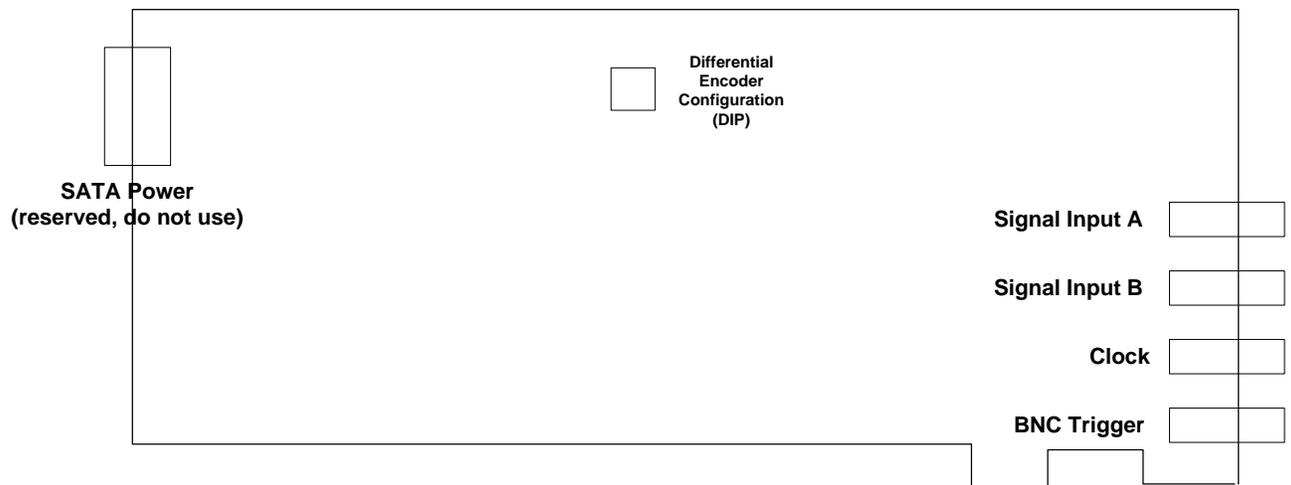
Location of Connectors

The AL8xGTe is a plug and play device. The PCI Express BIOS assigns the system resources automatically at system startup. All functions are software configurable. No jumpers are used on this card. The input analog signal to be digitized is fed through **Signal Input** connectors. The **Trigger** BNC connector is used for receiving an external trigger or generating a trigger to be used by an external device.

The SATA Power connector is reserved for technician use, and should never be connected under normal circumstances.

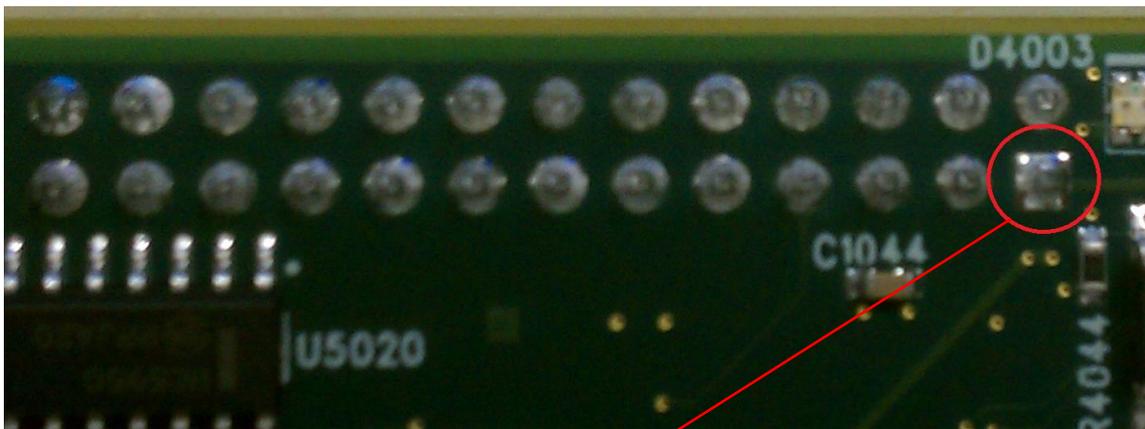
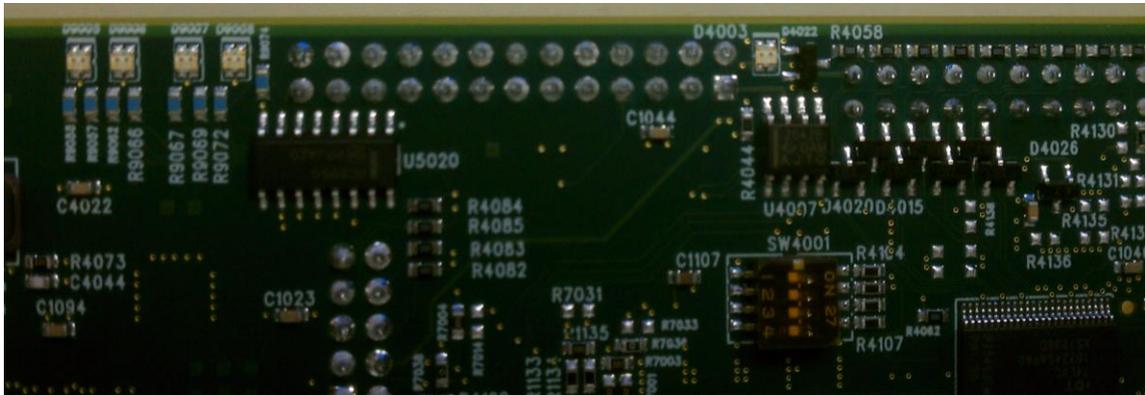


AL8xGTe Connector locations



**AL8xGTe Connector locations
(back)**

Pin order



PIN #1

2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32
13	5	7	9	11	13	15	17	19	21	23	25	27	29	31	

Pin order (32-pin connector)

10	9
8	7
6	5
4	3
2	1

Pin order (10-pin connector oriented vertically)

Section 3: Contact Information

Contact Information

Contact Information

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Section 4: Warranty

Warranty

1. Limited Warranty. OKOS Solutions warrants that the Boards delivered shall upon delivery substantially conform to the specifications; otherwise, OKOS Solutions at its election, will provide either a replacement Board or a refund of the price paid to OKOS Solutions for such Board. Buyer represents that it shall promptly test Boards for conformance upon delivery. This warranty shall apply only upon discovery of the non-conformance, but in any event within twelve months of the date OKOS Solutions delivers the Board to Buyer, Buyer provides OKOS Solutions with (i) written notice of the non-conforming Board; (ii) reasonable substantiation that the Board was non-conforming upon delivery and not due to damage from improper use or handling, including damage arising from any products it has been incorporated into; and (iii) the non-conforming Board. Original or replacement Boards may contain remanufactured or reconditioned components. Except for the replacement or refund provided herein, OKOS Solutions shall have no liability whatsoever to Buyer or any other person, and such refund or replacement, shall be the sole remedy relating to any claims pertaining to the Boards or including but not limited to any claims relating to their sale, operation, design, manufacture, or the work of OKOS Solutions in developing, designing, manufacturing and selling the Boards. No third party is an intended beneficiary nor shall any third party have any rights or remedies on account of a defective Board.

This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care. OKOS Solutions shall not be obligated to furnish service under this warranty a) to repair damage resulting from attempts by personnel other than OKOS Solutions representatives to install, repair or service the product; b) to repair damage resulting from improper use or connection to incompatible equipment, including, but not limited to, application of voltages higher than the specified amounts to the Product; or c) to service a Product which exhibits defects only under customer-written software

2. Limit of Liability. Regardless whether any remedy set forth herein fails of its essential purpose or otherwise, OKOS Solutions will not be liable for any lost profits or for any direct, indirect, incidental, consequential, punitive, statutory, multiple or other special damages suffered by OKOS Solutions, its customers or others arising out of or related to this agreement or any OKOS Solutions Boards or services, for all causes of action of any kind (including tort, contract, negligence, strict liability, breach of warranty, infringement, and statutory causes of action) even if OKOS Solutions has been advised of the possibility of such damages.

3. Limit of Damages. In no event will OKOS Solutions' total cumulative liability arising out of or in relation to this agreement or any or any OKOS Solutions Boards or services, for all causes of action of any kind (including tort, contract, negligence, strict liability, breach of warranty, infringement, and statutory causes of action) exceed the total amount paid by Buyer for the OKOS Solutions boards to which the dispute directly relates.

4. Legal Compliance. Buyer will comply with all applicable international, national, state, regional and local laws and regulations in its use, marketing, sale and distribution of Boards. Buyer acknowledges that all Boards including documentation and other technical data are subject to export controls imposed by the U.S. Export Administration Act of 1979, as amended (the "Act"), and related regulations. Buyer will not export or re-export (directly or indirectly) any Board or documentation or other technical data without complying with the Act and related regulations.