A2M User Manual

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About the A2M

The A2M from Blue Water Design is a low-power ALERT2 encoder and transmitter designed for unattended use in remote and rugged environments.

ALERT2 Information

ALERT2 is a low-bandwidth, high-reliability protocol designed for the transport of real-time data over radio telemetry networks.

A Description of the ALERT2 Protocol[1], a white paper summarizing the protocol, opens with the following description:

> ALERT2 is a new protocol optimized for the transport of real-time data over radio telemetry networks. It is the intended successor to the ALERT (Automated Local Evaluation in Real Time) protocol introduced in the 1970s. It offers a 7- to 10-fold increase in net data rate (or channel capacity), detects all errors introduced in transmission and corrects the great majority of them. The new protocol comprises multiple sub-protocols, with the flexibility to add new ones as needs emerge. It provides greater "data space" that expands the range of sensor identifiers and data resolution. It can be used in either ALOHA or TDMA environments, the latter providing the opportunity to eliminate data contention altogether.

The protocol specification documents are linked from Blue Water Design's support page, here.

Power

An external DC power source is required. The A2M can accept inputs ranging from 9 to 17 volts, and includes reverse-polarity protection. Typical installations will provide power using 12V lead-acid batteries.

Once deployed in the field, the device current draw will vary depending the frequency of GPS clock synchronization cycles and the frequency of message transmission. Typical applications should achieve an average current draw of less than 4ma at 12v, making the A2M suitable for use with a small (5W or 10W) solar panel.

Console Port

The A2M has a microUSB serial console port on the front of the device. To use the console, you will need a terminal emulator program such as Tera Term or Minicom.

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[1] *A Descirption of the ALERT2 Protocol*, Don Van Wie, October, 2011, http://bluewaterdesign.us/docs/ALERT2_Description_102511.pdf

To connect to the serial console:
- ● Connect the microUSB cable from your computer to the A2M
- ● Configure your terminal emulator to talk to the console (57600 baud, N, 8, 1)
- ● Set up appropriate CR/LF handling:
  - ○ In Tera Term: Terminal Setup -> RX: LF Only TX: CR
  - ○ In Minicom: Add Carriage Return: True
- ● Power on the A2M
- ● Firmware information should be displayed, followed by configuration information
- ● To enter configuration mode, press [Enter] twice *within 5 seconds of the display of the configuration information*.
- ● After 5 seconds, the device will enter normal operating mode. After this point, all configuration will need to be done via the ALERT2 API.
- ● It is possible to return to the configuration menu by power cycling the A2M.

Status LEDs

LEDs are visible on the front of the device or may be brought to other locations via headers on the board.

Name	Functional Description
Serial 1-2	These LED will toggle when an API command or ALERT concentration message is successfully received on the corresponding serial port.
GPS On	This LED is illuminated if the GPS is currently powered on. The GPS may require up to 15 minutes to get an initial fix, but subsequently, it should only turn on for a brief time to maintain an accurate clock.
Clock Sync	This light indicates that the A2M has a reliable clock source, and will transmit in TDMA mode. The clock is able to maintain synchronization for up to 210 minutes without the GPS being on. By default, the device will attempt to sync the clock every 30 minutes.
Transmit	This light indicates that the A2M is transmitting an ALERT2 message.
TX Radio On	This light indicates that power has been applied to the TX radio.

Port Descriptions

Name	Functional Description
Console	micro USB port, which acts as a serial port. Primarily intended for configuration.

GPS	A GPS antenna must be connected for proper time sync.
Serial 1	First serial port
TX Radio	5 pin connection for transmit radio
Serial 2	Second serial port

Configuring the A2M

The A2M can be configured via the configuration menu at power up, or via the ALERT2 API at any time.

In most installations, the A2M is will be used with an ALERT2 Application Protocol Device (APD) that will manage the A2M's configuration.

The easiest approach for manual configuration is to use the configuration menu:
- Connect to the console, as described in the *Console* section, above.
- Restart the A2M by removing power, and reconnecting it.
- At power-up the A2M displays its firmware version and current configuration values (loaded from flash).
- After display of the configuration, the system *waits 5 seconds for serial input on the console port*. If no input is received, the system begins normal operation.
- To change any of the configuration data, enter two sequential "carriage return" characters before the 5 seconds expires. (Be sure that only <CR> is sent when the "return key" is entered; some terminal programs send <CR><LF> which will not work.)
- The A2M will begin displaying configuration parameters sequentially. After each parameter is displayed, the UI waits 3 seconds for a new value to be entered.
- Enter a new value, or leave the field blank to skip to the next parameter.
- After all the parameters are displayed, the new configuration is stored in flash and displayed again.
- If revisions again are needed, the UI process can immediately be entered by again entering two sequential "carriage return" characters before the 5 seconds expires.

For details on the meaning of the configuration parameters, review the ALERT2 IND API document, linked from Blue Water Design's support page: http://bluewaterdesign.us/support/

Firmware Upgrades

Files Required
- A2MFirmwareV[X]_[Y].exe

Upgrade Steps

1. Connect a serial cable to the console port of the device to be upgraded
2. Check if the COM port has a number less than 10 (i.e., COM1 - COM9). If so, skip to step 3.
   - If not, you will need to change the COM port assignment.
   - Open the Device Manager
   - Expand the Ports (COM & LPT) section
   - Right-click the COM port and select Properties
   - Click the Port Settings tab and click Advanced
   - Change the COM port number to an available COM port number less than 10
   - Restart your computer if prompted to do so
3. Put the A2M in "Firmware Update" mode
   - The easiest way to do this is via the serial console:
     - launch Tera Term (57600, N, 8, 1) and power cycle the encoder.
     - Press [enter] within 5 seconds of powering up the encoder to bring up the menu
     - When prompted with "Start Bootloader....", press"1" then [enter]
   - Once the boot loader is ready to accept firmware, it will print "SNDM", on the console
4. Launch the firmware loading command line line application
   - **Note that the encoder will leave the firmware update mode if the firmware update is not started shortly after switching into that mode. If that happens, repeat step 3 above**.
   - Open a command prompt window (Windows + R, then "cmd") and change to the directory that contains the firmware to load and the executable
   - Ensure that TeraTerm is closed and that nothing else is using the COM port that the device is attached to
   - Launch the firmware update application. The command should be: A2MFirmwareV[X]_[Y].exe <PORT>. For example:

     `A2MFirmwareV6.0.exe COM3`

   - The program will prompt you to confirm the update. Type "YES" then [enter] to continue. The updater should then show progress by displaying number of records sent, then quit.
   - Confirm that the firmware correctly loaded by rebooting the A2M and looking at the version string using a serial console program such as TeraTerm.

Sending Data

The A2M supports two modes for sending data: the ALERT2 Self-Reporting Protocol (SRP) and ALERT concentration (CCN). Each serial port may be configured to operate in either of these modes.

Sending Example

In order to send data via the ALERT2 SRP, we will use the ALERT2 IND API (documented in full in the API specification document).

All commands in using the ALERT2 IND API follow a similar format: a prefix ("ALERT2") followed by a extensible length value[2] of the message, followed by the message itself. The message consists of one or more API commands.

An API command, in turn, contains of three-components:
1. an extensible type value (the API command);
2. an extensible length value (the length of the value);
3. and, the value.

Thus, to send an ALERT2 message we use:

	Prefix	Length	API Command (Type)	Length	Value
ASCII / Decimal	ALERT2	10	Self-Reporting Protocol	8	Payload
Encoded Hex	41 4C 45 52 54 32	0A	00	08	0C 33 F6 01 03 05 11 0F

Please see the ALERT2 Application Layer document, linked from BWD's support page, for more details on how to form the "Payload" portion of the message.

If a port is configured for ALERT concentration, it will not respond to API commands. Instead, it is expecting binary ALERT-data in the 4-byte format defined in the ALERT2 Application Layer specification.

Connectors, Cabling, and Pinouts

Serial ports

Two serial ports are available for use, and their function is configurable. The serial ports operate at RS232 line levels.

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[2] The ALERT2 IND API makes frequent use of extensible values, where the first bit indicates if this value is a 1-byte or 2-byte value. So, values 0 - 127 are represented in one byte form (e.g., 114 = 0x72 hex). Values greater than 127 must be represented in two bytes, because the first bit will be high (e.g., 128 = 0x8080 and 3421 = 0x8d5d).

Serial port Pinout (from left, facing the A2M):

Pin Number	Pin Function
1	TX (data output from A2M)
2	RX (data input to A2M)
3	Ground

The serial port connector is made by Harting Elektronik, part number 14310410301000.

The default serial port settings for all ports are:

Setting Name	Setting Value
Input Mode	API
Output Mode	API
Baud Rate	9600
Parity	None
Stop Bits	1
Flow Control	None
Independent Addressing	False/Off
Address	9000 (see above, not enabled by default)

Serial port settings can be configured using the ALERT2 IND API or via the A2M's configuration menu.

The A2M implements version 1.0 of the ALERT2 IND API. The specification document is linked from the Blue Water Design website, here: http://bluewaterdesign.us/support/

Radio port

TX Pinout (from left, facing the A2M):

Pin Number	Pin Function
1	RF Data (output from A2M)
2	Ground
3	Push to Talk

4	12V power (provided by A2M)
5	Channel Select

The TX radio connector is made by Harting Elektronik, part number 14310513101000.

Radio output level

On the circuit board, the A2M has two sets jumpers which enable user customization of the audio level sent to the TX radio. Different radios have different audio voltage level requirements.

Fixed settings are provided for the commonly used Ritron and Maxon radios, while a third setting allows user customization with an adjustable potentiometer. Please refer to your radio vendor's datasheet for the proper input voltage level. If specified when ordering the A2M, Blue Water Design will configure a custom output level.

Radio	Jumper 1	Jumper 2
Ritron	LEFT	LEFT
Maxon	MIDDLE	MIDDLE
Custom	RIGHT	RIGHT

Please Note: In order to complete the circuit, **the same jumper position must be selected on BOTH sets of jumpers!** If you ordered an A2M with a radio, your A2M was already configured with the proper jumper settings for that radio. A misconfigured output level can cause poor signal quality and messages may not be received.