Product Manual

Communications Device

AL205E

ALERT2 Encoder

07/2020

RELIABLE SINCE 1974 MONITORING

CAMPBELL SCIENTIFIC

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1. Overview

The AL205E is a low-power ALERT2 encoder and radio modem that has one radio port for connecting the UHF or VHF radio used for over air ALERT2 and/or ALERT concentration transmissions and services. Two serial ports support multiple data collection platforms. Campbell Scientific data loggers use these serial ports to transmit hydrometeorological and other measurements. The AL205E also includes a USB port for local AL205E administration and LEDs that indicate status and activity.

The AL205E meets the ALERT2 standards maintained by the National Hydrologic Warning Council (NHWC) and the ALERT2 Protocol Technical Working Group (TWG), formally the ALERT Users Group (AUG). The ALERT2 protocol was released by the TWG in September 2010. It is a low bandwidth, reliable protocol for transmitting real-time data over a radio telemetry network. Compared to its predecessor, the ALERT2 protocol provides faster, more reliable data transfer, forward error correction (FEC), and Time Division Multiple Access (TDMA) architecture. These features increase the accuracy and performance of flood warning and other data acquisition systems. For more information about the ALERT2 protocol, refer to: www.hydrologicwarning.org/content.aspx?page_id=22&club_id=617218&module_id=83216.

The AL205E includes GPS functionality that provides time-synchronization required for TDMA radio transmissions. The configurable FEC supports 250 millisecond, TDMA time slotting that allows more ALERT2 nodes on a radio network. Users can update the AL205E operating system in the field to incorporate ALERT2 protocol enhancements.

1.1 Power

The AL205E requires an external DC power source. The AL205E can accept inputs ranging from 9 to 17 VDC, and includes reverse-polarity protection. Typical installations will provide power using 12 VDC lead-acid batteries.

Once deployed in the field, the current drawn by the AL205E depends on the frequency of GPS clock synchronization cycles and the number of message transmissions. Typical applications have an average current draw of less than 4 mA at 12 VDC, making the AL205E suitable for use with a small (5 W or 10 W) solar panel.

1.2 Port descriptions

Table 1-1 (p. 2) describes the functions of the AL205E ports.

Table 1-1: Port descriptions	
Port label	**Function**
Console	Micro USB port acts as a serial port and is primarily intended for configuration. Serial port settings are fixed at 115200 8,N,1. When the device is booting, some diagnostic information may be displayed.
GPS	GPS antenna must be connected for proper time sync.
Serial 1	Serial port 1
TX Radio	5-pin connection for transmit radio
Serial 2	Serial port 2

1.3 Status LEDs

The following table describes the LED functions.

Table 1-2: Status LEDs	
LED label	**Description**
Tx Radio On	Lights up to indicate power is being supplied to the TX radio.
Transmit	Lights up while the AL205E is transmitting
Clock Sync	A solid light indicates that the AL205E has a reliable clock source, and will transmit in TDMA mode. The clock can maintain synchronization for up to 4 hours without the GPS being on.
GPS On	Lights up to indicate the GPS is currently powered up. The GPS may require several minutes to initially get a fix, but after that will only require turning on for a brief time to maintain accurate time.
Serial 1	Flashes to indicate input or output serial data is on serial port 1.
Serial 2	Flashes to indicate input or output serial data is on serial port 2.

2. Specifications

Temperature range: –40 to 80 °C

Power supply: 9 to 17 VDC, reverse polarity protected

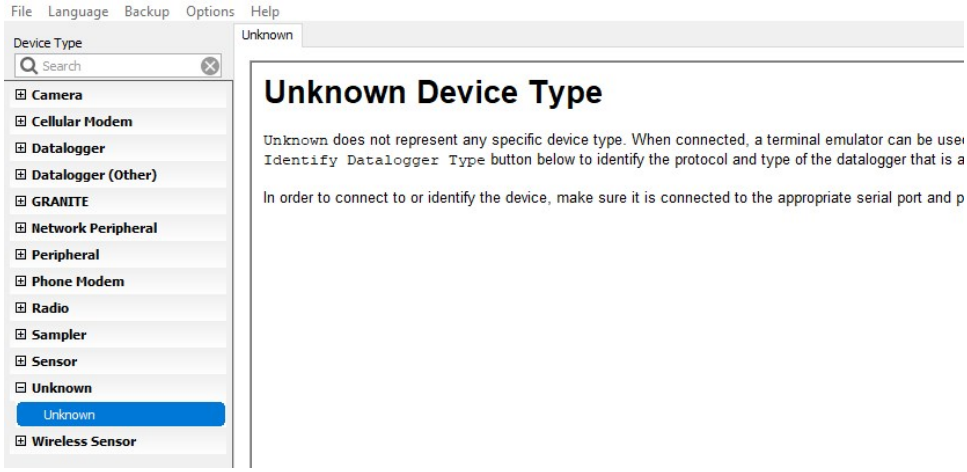
Current drain at 12 VDC:	1.4 mA (normal operation, no LEDs, no external connections) ~34 mA (GPS searching) ~29 mA (GPS locked) ~1 mA (each LED; disabled via jumper) ~1.5 mA (each connected serial port) 17 mA (during message transmission)
TX radio modulation voltage:	Two preconfigured values, selected using jumper, for use with Ritron or Maxon radios, plus a user-adjustable level via potentiometer
Clock Synchronization:	GPS
Clock drift:	2 ppm (0 to 40 °C); 3.5 ppm (-40 to +80 °C)
Interfaces	
Power:	2 pin, spring clip, polarity protected
RS-232:	2 ports, line-level, custom 3-pin cable, 1200 to 57600 bps
LEDs:	Serial 2, Serial 1, GPS On, Clock Sync, Transmit, Tx Radio On
Configuration:	Micro USB console and configuration port
USB:	Software upgrade and data export via thumb drive
Active GPS antenna:	SMA female
TX radio:	5-pin spring clip (power, ground, PTT, data, channel select)
ALERT2:	Compatible with NHWC ALERT2 AirLink v1.1, MANT v1.1, API v1.0 Supports ALERT2 API input and ALERT2 API and ASCII output Implements ALERT data concentration and ALERT2 IND interface Implements proposed protocol extension for *Configurable Forward Error Correction* Flexible addressing support: assign an address to the whole device or customize a specific serial port with a unique address
Dimensions:	19.0 x 10.2 x 3.2 cm (7.5 x 4 x 1.25 in)
Weight:	600 g (1.3 lb)

3. Configuration

The AL205E can be configured using the configuration menu at power up, or using the ALERT2 API at any time. In most installations, the AL205E is used with an ALERT2 Application Protocol Device (APD) that will manage the AL205E configuration. Refer to Settings explanations (p. 6) for more information.

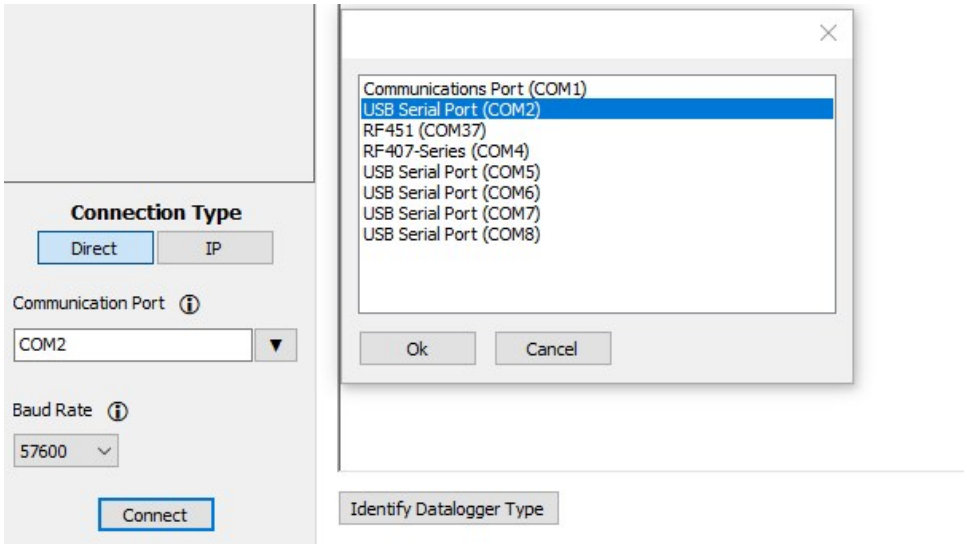
The following procedure uses the configuration menu:

1. Connect the AL205E to the computer using a USB cable.
2. Start the Device Configuration Utility.
3. Click the **Unknown** from the **Device Type** list.



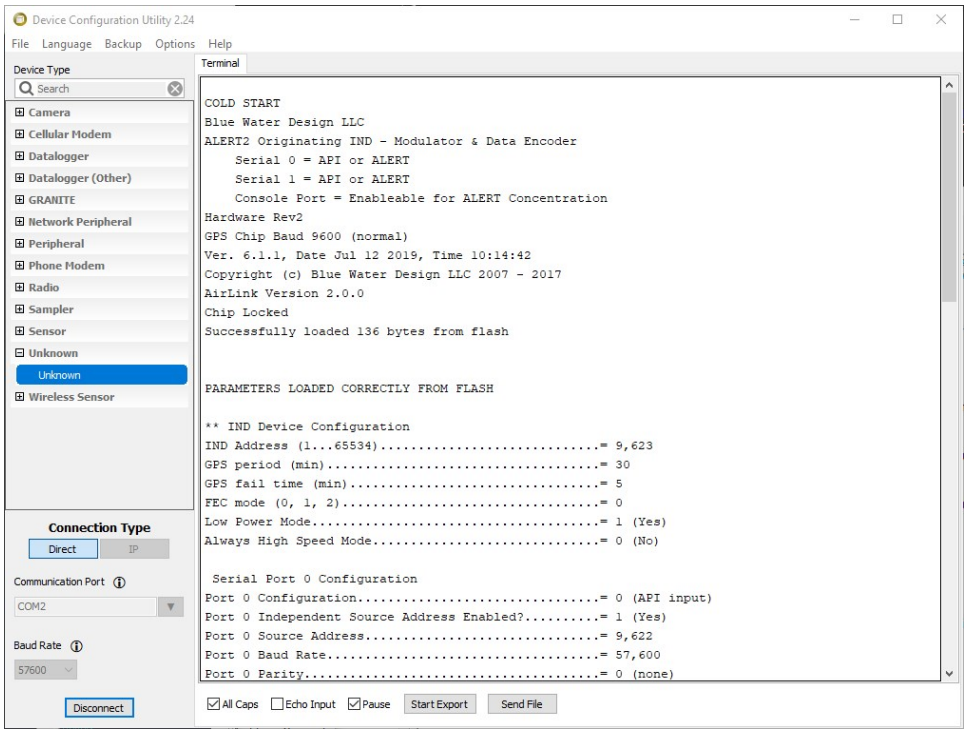
4. Click **Direct**.
5. Select the appropriate **Communications Port**.

6. Select **57600** from the **Baud Rate** drop down list.



7. Click **Connect** .

8. Supply power to the AL205E. The AL205E will display the current operating system, settings, and configuration parameters. After each parameter is displayed, the screen waits 3 seconds for a new value to be entered.



9. Type a new value or leave the field blank to skip to the next parameter. After all parameters are displayed, the new configuration is stored in the AL205E and displayed again.

10. If revisions are needed, press **Enter** twice within 5 seconds. This will re-enter the process and allow the user to make changes. After 5 seconds without pressing **Enter**, the AL205E stores the new settings and then starts to operate.

3.1 Settings explanations

The following tables show the AL205E settings (numbered 0 through 55) and their default values. Press **Enter** or wait about three seconds to move to the next setting. More detailed explanations of these settings can be found in Chapter 2 of the ALERT2 API Specification 1.0 document found at https://s.campbellsci.com/documents/us/miscellaneous/alert2-intelligent-network-device.pdf.

Table 3-1: Settings

Setting number	Setting	Description
[00/55]	**Start serial boot loader to load new program?**	To load a new operating system into the AL205E, type **1** then press **Enter** to put the AL205E into boot loader mode (see Operating system update (p. 19)).
[01/55]	**Load default configuration parameters & save in non-volatile memory?**	Type **1** then press **Enter** to reset the device to factory defaults and load the default settings in the flash memory.
[02/55]	**Enable test ransmissions?**	Type **1** or **2** to put the AL205E in the test mode, which causes the AL205E and radio to generate a tone. Type **3** to force the AL205E to send an ALERT2 transmission. See Test transmission procedure (p. 17) for more information. 1 = continuous 1 KHz audio tone 2 = continuous 1.2 KHz audio tone 3 = ALERT2 transmission

Table 3-2: IND device configuration settings

Setting number	Setting	Description
[03/55]	IND address	Type a unique ALERT2 network IND address used for all transmissions by this AL205E. This station ID number must be unique within the network, and must be an integer between **0** and **65534**. Default is 9000.
[04/55]	GPS (override) period (min)	This setting controls when the AL205E will sync its clock with the GPS constellation system. This determines the number of minutes the GPS receiver will be powered and attempt to get a GPS fix. Range is **5** to **1440** minutes and default is **30**.
[05/55]	GPS maximum on time (min)	Sets the maximum time (minutes) the GPS will be online when the AL205E is syncing with GPS without a GPS fix being obtained. Minimum is **1** minute; maximum is period minus 1 minute.
[06/55]	FEC, AirLink Encoding Mode	**0** (default) = highest error correction; lowest throughput (traditional ALERT2 transmission mode) **1** = medium error correction; medium throughput **2** = lowest error correction; highest throughput
[07/55]	Low Power Mode	**1** (default) = the AL205E does not turn on the radio if messages are not transmitted in this frame. In this setting, the APD must complete the message handoff to the AL205E before the radio turn-on time for the message to be sent to this frame. This is the recommended mode. **0** = the AL205E turns on the radio every frame; any message received between the radio turn-on time and slot time is sent in the current frame.
[08/55]	Always High Speed Mode	This compatibility mode is retained from the R2011 architecture to prevent the AL205E from switching to a slower clock speed, in case the AL205E is used in an AC powered, high-throughput transmitter.

Table 3-3: Serial 1 settings[1]

Setting number	Setting	Description
[09/55]	Port 0 Type	Sets the type of information that is received on this serial port. **0** (default) = ALERT API commands **1** = ALERT (ALERT1) data that converts the data to a ALERT concentration packet
[10/55]	Port 0 Independent SA Enabled?	When enabled, an independent source address is assigned to this port. **0** (default) = disable **1** = enable
[11/55]	Port 0 source address	Port 0 (serial port 1) is not configured for an independent source address (SA). Therefore, an SA entry is not allowed. The AL205E uses this port to send the IND address assigned to the data. Range is **1** to **65534**; default is **9000**.
[12/55]	Port 0 baud	Baud rate setting for port 0 (serial port 1). Valid entries are **57600** (default), **38400**, **19200**, **9600**, **4800**, or **1200**.
[13/55]	Port 0 parity	**0** (default) = none **1** = odd **2** = even
[14/55]	Port 0 stop bits	Valid entries are **1** (default) or **2**.

[1]Serial port 0 is labeled Serial 1 on the AL205E case.

Table 3-4: Serial 2 settings[1]		
Setting number	Setting	Description
[15/55]	Port 1 type	Sets the type of information that is received on this serial port. **0** (default) = ALERT API commands **1**= ALERT (ALERT1) data that converts the data to a ALERT concentration packet
[16/55]	Port 1 Independent SA enabled?	When enabled, an independent source address is assigned to this port. **0** (default) = disable **1** = enable
[17/55]	Port 1 source address	Port 1 (serial port 2) is not configured for an independent source address (SA). Therefore, an SA entry is not allowed. The AL205E uses this port to send the IND address assigned to the data. Range is **1** to **65534**; default is **9001**.
[18/55]	Port 1 baud	Baud rate setting for port 1 (Serial port 2). Valid entries are **57600** (default), **38400**, **19200**, **9600**, **4800**, or **1200**.
[19/55]	Port 1 parity	**0** (default) = none **1** = odd **2** = even
[20/55]	Port 1 stop bits	Valid entries are **1** (default) or **2**.
[1]Serial port 1 is labeled Serial 2 on the AL205E case.		

Table 3-5: Console port settings		
Setting number	Setting	Description
[21/55]	Console port debug output	When enabled, allows debug information to be sent to the console. 0 = disable 1 (default) = enable
[22/55]	Console port enabled for ALERT type input?	When enabled, allows ALERT data to be sent through this port. 0 = disable 1 (default) = enable

Table 3-6: Originating IND MANT header settings		
Setting number	Setting	Description
[28/55]	Default destination address	Set the destination IND address of packet information and inserts the destination address in the MANT header. This address must be an integer between 1 and 65534. Default is 9999.
[29/55]	Add time service request	When enabled, the ALERT2 network adds time service request information to the packet. 1 (default) = enable 0 = disable
[30/55]	Add path service request	When enabled, each IND adds its source address to the PDU as it gets repeated. This can be used to determine the path a packet took to get from the remote to the base. 1 (default) = enable 0 =disable
[31/55]	Hop limit	Sets the hop limit (number of hops) allowed on the ALERT2 network (through repeaters). This setting controls the number of times a packet from this station can be repeated. Each time the packet is repeated, the hop count decrements. When the hop count reaches 0, the packet is not repeated. Default is 1.

Table 3-6: Originating IND MANT header settings		
Setting number	Setting	Description
[32/55]	Add destination address	When enabled, the AL205E adds the destination address to the ALERT2 packet. This value is only used if the default destination address is enabled. **0** (default) = disable **1** = enable
[35/55]	Encrypt outgoing packets	When enabled, the AL205E to encrypt the ALERT2 packet. **0** (default) = disable **1** = enable
[36/55]	Encrypt key	Sets the encryption key used to encrypt the packet. 16 byte key is required.
[37/55]	Pending encrypt key	Sets the encryption key used to encrypt the packet. This setting is used in conjunction with the next setting to allow the entire network to move to a new key all at the same time.
[38/55]	Pending encrypt key effective date	Sets the effective data of the new encryption key. Pending encryption key update time is set as a unix timestamp (seconds since Jan 1, 1970, UTC). For example, Jan 1, 2021 at midnight UTC is **1609459200**.
[39/55]	EMID	When enabled, the AL205E send an *Ever-increasing Message ID* number as part of the encrypted ALERT2 packet. **0** (default) = disable **1** = enable

Table 3-7: Application layer header control byte creation		
Setting number	Setting	Description
[40/55]	Control byte test payload flag	Sets the control test flag byte **0** (default) = disable **1** = enable
[41/55]	Control byte increment PDU ID flag	When enabled, sets the PDU ID Flag. **1** (default) = enable **0** =disable
[42/55]	Control byte extra header flag	When enabled, sets the control byte extra header flag. **0** (default) = disable **1** = enable

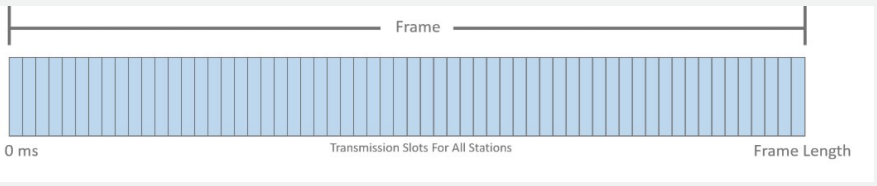
Table 3-8: AirLink media access configuration settings		
Setting number	Setting	Description
[43/55]	Enable TDMA media access	**1** (default) = enable **0** = disable
[44/55]	TDMA frame length	Sets the TDMA frame length (in milliseconds) for the ALERT2 network. The frame needs to be long enough to accommodate all remote stations, repeaters, and possible future stations transmitting on the same frequency. Range is **5000** to **3600000** in milliseconds. Default is **15000**. Typically, this value is set to 60000 or 120000 (1 or 2 minutes), and the maximum value is 3600000 (1 hour). 

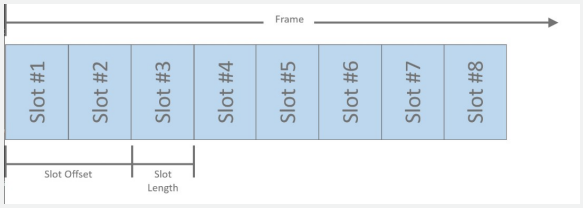
Table 3-8: AirLink media access configuration settings		
Setting number	Setting	Description
[45/55]	TX slot length	Sets the slot length (in milliseconds) that the station can transmit data during a self report or event. The slot length must be able to accommodate all the values included in a transmission. Shorter slot lengths allow more slots in a given frame. However, short slots contain fewer values. The range is **250** to **10000**, but the value needs to be an integral multiple of the INDS minimum slot size. Typically, this value is set to 500 or 1000; default is **1000**.
[46/55]	TX slot time offset into frame	Sets the amount of time (in milliseconds) into the TDMA frame that the station-transmission slot will begin. Each station in the network must have a unique slot offset to prevent multiple stations from transmitting at the same time. Range is **0** to length of the frame minus the slot length. Default is **0**. 
[47/55]	TX centered in slot	If enabled, the message is centered in the TDMA slot. **0** (default) = disable **1** = enable
[48/55]	TX minimum buffer in slot	Units are milliseconds. Default is **25**.

Table 3-9: AirLink protocol configuration settings

Setting number	Setting	Description
[49/55]	Transmitter always powered up	1 (default) = radio always powered up 0 = radio powered down when not in use
[51/55]	Transmitter audio preload time	Sets the amount of time (in milliseconds) that power will be applied to the radio before a transmission begins. Default is 100 ms.
[52/55]	Carrier only preamble time	Sets amount of tone-modulated carrier time (no data) used in Airlink preamble. Units are milliseconds. Range is 5 to 1000 ms. Default is 10 ms.
[53/55]	AGC preamble time	Units are milliseconds. Range is 5 to 1000 ms. Default is 55 ms.
[54/55]	Transmission postamble tail time	Sets the amount of unmodulated carrier time, in milliseconds, that follows the transmitted frame. Range is 0 to 100 ms. Default is 5 ms.
[55/55]	Modulation inverted	Sets the modulation polarity of the modulated signal fed to the radio. 0 (default) = no 1 = yes

4. Controlling and sending data using the API interface

Advanced Programming Interface (API) commands can drive the AL205E through its serial ports (if configured). The AL205E conforms to the ALERT2 IND API Specification Version 1.0 standard available at www.campbellsci.com/al205e. The API is a series of hexadecimal commands used to manage the AL205E and send ALERT2 and ALERT data through the modem.

The following are examples of the API commands.

All commands using the ALERT2 IND API have the following format:

- Prefix (ALERT2)
- Extensible length value[1] (value length)
- Message consisting of one or more API commands. Each API command has the following components:
  - Extensible type value (API command)
  - Extensible length value (value length)
  - Value

Example 1: Return GPS time valid flag

This example uses ALERT2 IND API to check the status of the AL205E GPS. Table 4-1 (p. 15) provides the display parameters and Table 4-2 (p. 15) provides the AL205E response.

Table 4-1: Display parameter – return GPS time valid flag

	Prefix	Length	API command (type)	Length	Value
ASCII/ Decimal	ALERT2	3	Display parameter (124)	1	Return GPS time valid flag (127)
Encoded Hex	41 4C 45 52 54 32	03	7C	01	7F

Table 4-2: Display parameter response – return GPS time valid flag

	Prefix	Length	API command (type)	Length	Value
ASCII/ Decimal	ALERT2	3	Return GPS time valid flag (127)	1	03 (GPS clock, not synced)
Encoded Hex	41 4C 45 52 54 32	03	7F	01	03

[1]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. Therefore, values 0 to 127 are represented in one byte form (for example, 114 = 0x72 hex). Values greater than 127 must be represented in two bytes, because the first bit will be high (for example., 128 = 0x8080 and 3421 = 0x8d5d).

Example 2: Return GPS time, in seconds, since 2010

This example uses ALERT2 IND API to get the AL205E GPS current time, in seconds, since 2010. Table 4-3 (p. 16) provides the display parameters and Table 4-4 (p. 16) provides the AL205E response.

Table 4-3: Display parameter – return GPS time, since 2010, valid flag

	Prefix	Length	API command (type)	Length	Value
ASCII/ Decimal	ALERT2	3	Display parameter (124)	1	Return GPS time valid flag (127)
Encoded Hex	41 4C 45 52 54 32	03	7C	01	7E

Table 4-4: Display parameter – return GPS time, since 2010, valid flag

	Prefix	Length	API command (type)	Length	Value
ASCII/ Decimal	ALERT2	3	Return GPS time, in seconds, since 2010 (126)	4	03 (GPS clock, not synced)
Encoded Hex	41 4C 45 52 54 32	03	7E	04	13 AA CE 18[1]

[1] 13 AA CE 18 in HEX is 329960983 seconds since 2010. The date the GPS is reporting is 06/15/2020 23:49:44.

Example 3, Sending ALERT2 self-reporting data

This example sends an ALERT2 message using a general sensor report (GSR) for three sensors. Table 4-5 (p. 17) provides the message components. The reported values, when decoded, are Sensor ID 9 with a value of 0, Sensor ID 20 with a value of 13.780, and Sensor ID 12 with a value of 86.431. Data commands are not acknowledged and reported as successful or not.

Table 4-5: Example message components					
	Prefix	Length	API command (type)	Length	Value
ASCII/ Decimal	ALERT2	10	Self-reporting protocol	20	Payload
Encoded Hex	41 4C 45 52 54 32	0A	00	14	12 2C 07 01 0F 09 11 00 14 34 41 5C 7C 11 0C 34 42 AC DC BA

If a serial 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 as shown in the following table.

Table 4-6: ALERT concentration example		
	Prefix	Value
ASCII/ Decimal	3067	1022
Encoded Hex	7B 6F	FC DF

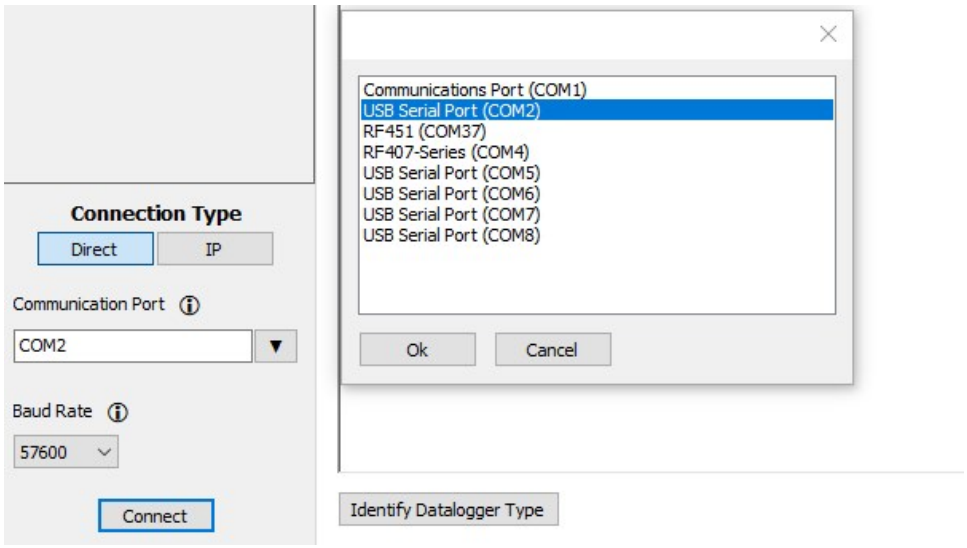
5. Test transmission procedure

The AL205E can generate test tones for radio and antenna testing. Use the following procedure to generate test tones.

1. Connect the AL205E to the computer using a USB cable.
2. Start the Device Configuration Utility.

3. Click the **Unknown** from the **Device Type** list.

4. Click **Direct**.
5. Select the appropriate **Communications Port**.
6. Select **57600** from the **Baud Rate** drop down list.



7. Click **Connect** .
8. Supply power to the AL205E. The AL205E will display the current operating system, settings, and configuration parameters.
9. Press **Enter** after the initial information is displayed.
10. Repeatedly press **Enter** until the cursor reaches the following text:

```
[02/55] Enable Test Transmissions?
1 = continuous 1 KHz audio tone, 2 = continuous 1.2 KHz audio tone, 3 =
ALERT2 transmission :
```

11. Type the tone option. For options 1 and 2, the AL205E transmits the tone for 10 seconds then waits for 10 seconds.
12. Repeatedly press **Enter** until the end of the settings menu is reached.

The AL205E is now in the test mode, and will stay in this mode until power is cycled. Testing output power and antenna and antenna cabling SWR testing can now be accomplished.

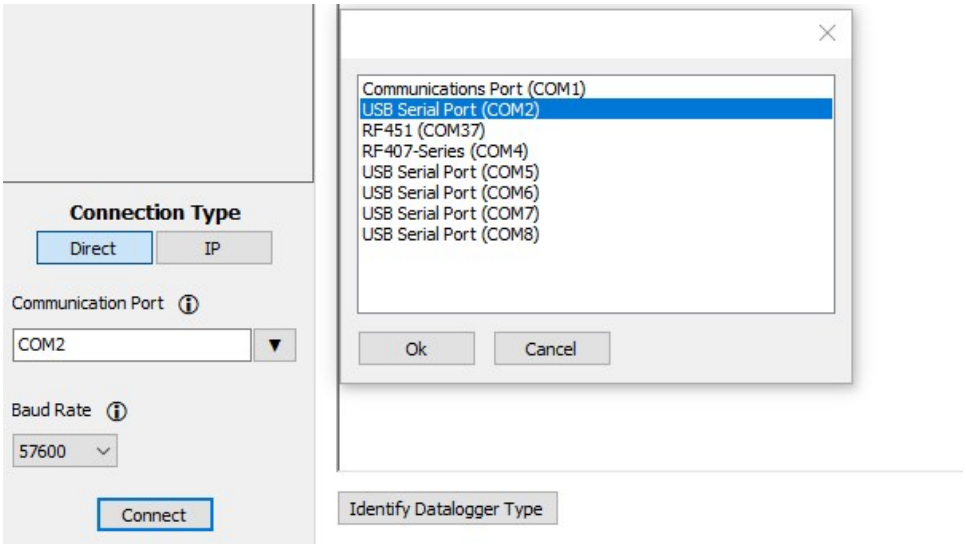
6. Operating system update

The user can update the AL205E operating system (OS) to get new features or bug fixes. Use the following procedure to update the OS:

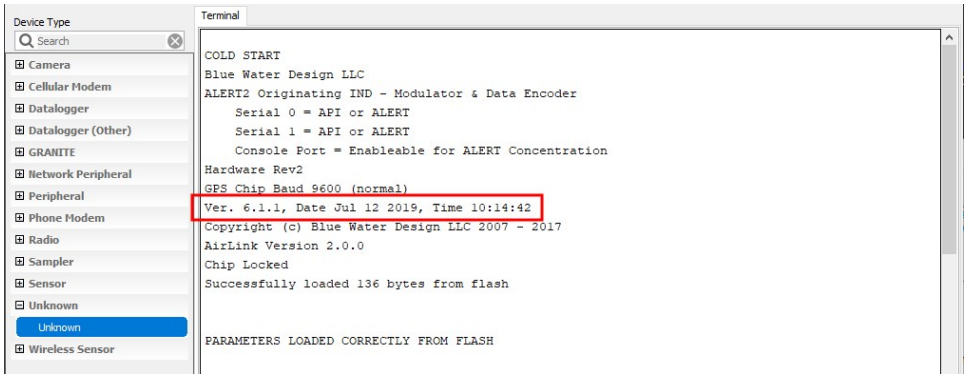
1. Download the operating system from: www.campbellsci.com/al205e.
2. Copy the downloaded file to c:\temp directory.
3. Connect the AL205E to the computer using a USB cable.
4. Start the Device Configuration Utility.

5. Click the **Unknown** from the **Device Type** list.
6. Click **Direct**.
7. Select the appropriate **Communications Port**.

8. Select **57600** from the **Baud Rate** drop down list.

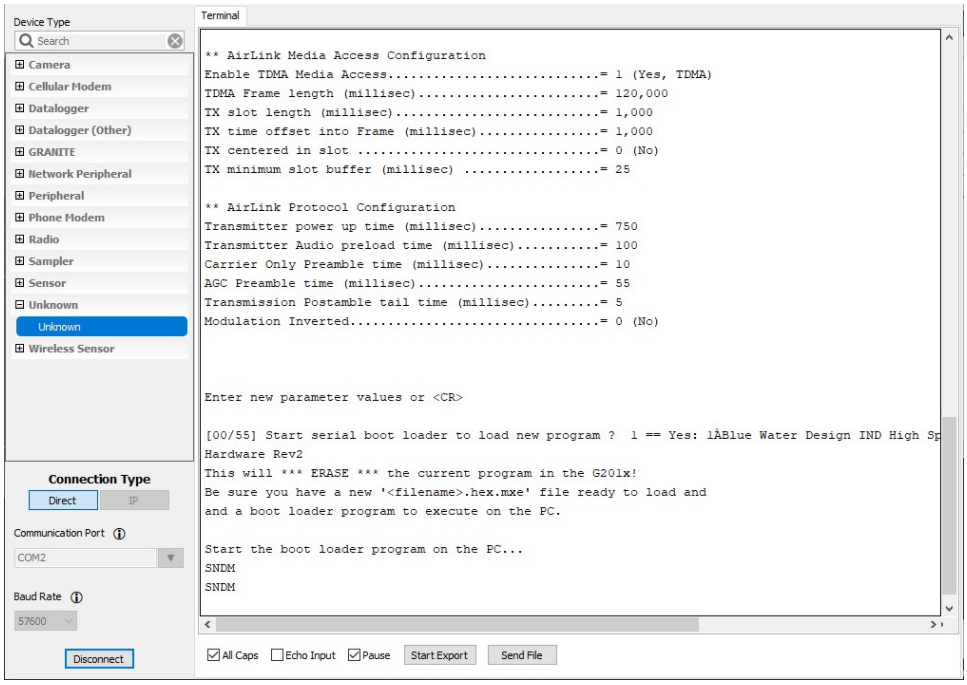


9. Click **Connect** .
10. Supply power to the AL205E. The AL205E will display the current operating system, settings, and configuration parameters.



11. Press **Enter** after the initial information is displayed.

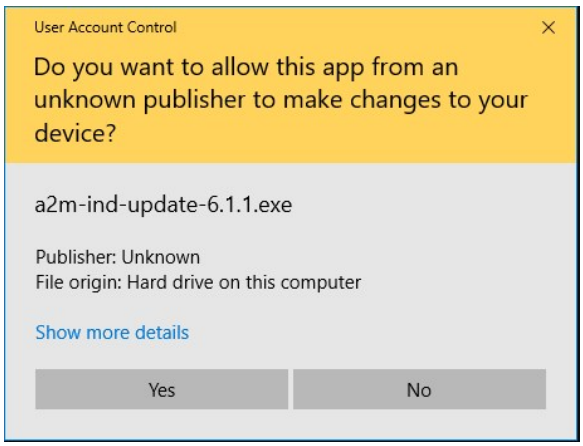
12. Type **1** then press **Enter** to put the AL205E into boot-loader mode.



13. Click **Disconnect**.
14. Open a Windows **Command Prompt** window.

15. Go to the C:\temp directory where you stored the firmware download.

16. Run the operating system update program that was downloaded (you might have to allow the app to run in Windows).



17. When prompted, type the serial port then press **Enter**. The software will confirm that the user wants to update the firmware.
18. Type **YES** and press **Enter**. While loading the new operation system, the program displays a counter. Once the firmware update is complete, the program automatically exits.

> **CAUTION:**
> Do not cycle power while loading the new operating system to avoid corrupting the AL205E operating system.

To confirm a successful update, redo steps 3 through 9 then cycle power to the AL205E and check the window for the new operating system version number.

7. Port descriptions

The AL205E has two serial ports with configurable functionality. The serial ports operate at RS-232 line levels.

Table 7-1: Serial port pinout (from left, facing the AL205E)

Pin number	Pin function
1	TX (data output from the AL205E)
2	RX (data input from the AL205E)
3	Ground

Serial port settings can be configured using the ALERT2 IND API or by using the AL205E configuration menu. The AL205E implements version 1.0 of the ALERT2 IND API. Default serial port settings are the following:

Table 7-2: Default serial port settings

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 (not enabled by default)

Table 7-3 (p. 23) provides the pinout for the TX port.

Table 7-3: TX pinout (from left, facing the AL205E)

Pin number	Label	Pin function
1	AO	RF data (output from the AL205E)
2	G	Ground
3	PTT	Push to talk
4	12V	12 V power (provided by the AL205E)
5	CS	Channel select

7.1 Radio output level

On the circuit board, the AL205E has two jumpers that 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. Refer to your radio specifications for the proper input voltage level.

Table 7-4: Jumper settings

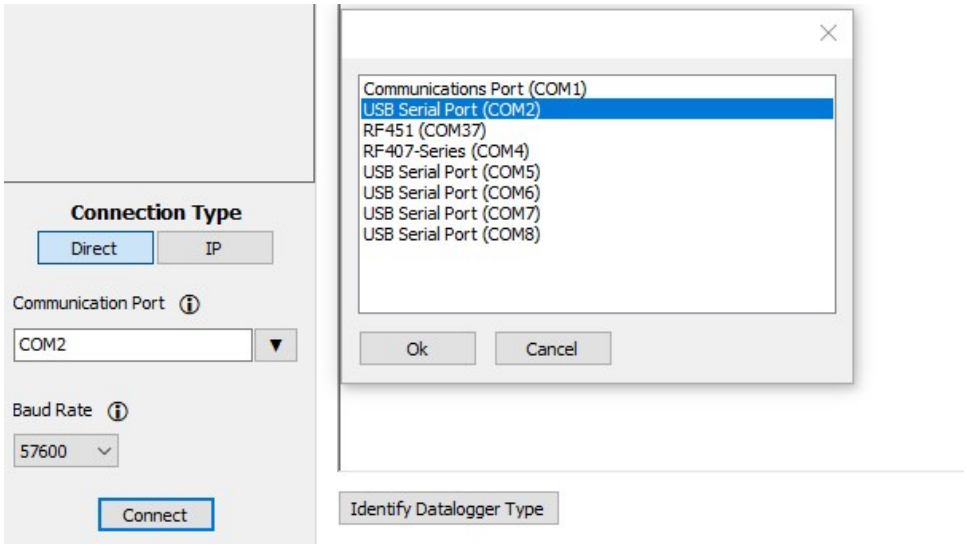
Radio	Jumper 6	Jumper 7
Ritron	Left	Left
Maxon	Middle	Middle
Custom	Right	Right

CAUTION:
To complete the circuit, both jumpers must be in the same jumper position. If the AL205E is ordered with a radio, the AL205E comes configured with the proper jumper settings for that radio. A misconfigured output level can cause poor signal quality and missed messages.

Appendix A. Terminal information and troubleshooting

Use Campbell Scientific Device Configuration Utility to view useful diagnostic information.

1. Connect the AL205E to the computer using a USB cable.
2. Start the Device Configuration Utility.
3. Click the **Unknown** from the **Device Type** list.
4. Click **Direct**.
5. Select the appropriate **Communications Port**.
6. Select **57600** from the **Baud Rate** drop down list.
7. Click **Connect** .



8. Apply power to the AL205E and the AL205E will display the current settings.

After the AL205E powers up, the Device Configuration screen will display the AL205E operating system and stored settings, and indicate whether the settings were retrieved from flash memory.

```
COLD START
Blue Water Design LLC
```

```
ALERT2 Originating IND - Modulator & Data Encoder
  Serial 0 = API or ALERT
  Serial 1 = API or ALERT
  Console Port = Enableable for ALERT Concentration
Hardware Rev2
GPS Chip Baud 9600 (normal)
Ver. 6.1.1, Date Jul 12 2019, Time 10:14:42
Copyright (c) Blue Water Design LLC 2007 - 2017
AirLink Version 2.0.0
Chip Locked
Successfully loaded 136 bytes from flash

PARAMETERS LOADED CORRECTLY FROM FLASH

** IND Device Configuration
IND Address (1...65534).............................= 9,000
GPS period (min)....................................= 30
GPS fail time (min).................................= 5
FEC mode (0, 1, 2)..................................= 0
Low Power Mode......................................= 1 (Yes)
Always High Speed Mode..............................= 0 (No)

Serial Port 0 Configuration
Port 0 Configuration................................= 0 (API input)
Port 0 Independent Source Address Enabled?..........= 0 (No)
Port 0 Source Address...............................= 9,000
Port 0 Baud Rate....................................= 57,600
Port 0 Parity.......................................= 0 (none)
Port 0 Stop bits....................................= 1

Serial Port 1 Configuration
Port 1 Configuration................................= 0 (API input)
Port 1 Independent Source Address Enabled?..........= 0 (No)
Port 1 Source Address...............................= 9,001
Port 1 Baud Rate....................................= 57,600
Port 1 Parity.......................................= 0 (none)
Port 1 Stop bits....................................= 1

Serial Console Port Configuration
Console Port Debug Output...........................= 1 (Yes)
Console Port Data Input Enabled?....................= 0 (No)

**Originating IND MANT Header Configuration
Originating IND Dflt Destination Address (1...65534)= 9,999
Originating IND Add Time Service Request............= 1 (Yes)
Originating IND Add Path Service Request............= 1 (Yes)
Originating IND Hop Limit...........................= 1
Originating IND Add Destination Address ............= 0 (No)
Encrypt Outgoing Packets............................= 0 (No)
Encryption Key......................................= XXXXXXXXXXXXXXXX
Pending Encryption Key..............................= XXXXXXXXXXXXXXXX
```

```
Pending Encryption Key Effective Date..............= 0
EMID ..............................................= 0

** Application Layer Header Control Byte Creation
Concentration App Time tags are seconds before next TX
Control Byte Test Payload Flag.....................= 0 (No)
Control Byte Increment PDU ID Flag ................= 1 (Yes)
Control Byte Extra Header Flag.....................= 0 (No)

** AirLink Media Access Configuration
Enable TDMA Media Access...........................= 1 (Yes, TDMA)
TDMA Frame length (millisec).......................= 15,000
TX slot length (millisec)..........................= 1,000
TX time offset into Frame (millisec)...............= 1,000
TX centered in slot ...............................= 0 (No)
TX minimum slot buffer (millisec) .................= 25

** AirLink Protocol Configuration
Transmitter power up time (millisec)...............= 750
Transmitter Audio preload time (millisec)..........= 100
Carrier Only Preamble time (millisec)..............= 10
AGC Preamble time (millisec).......................= 55
Transmission Postamble tail time (millisec).........= 5
Modulation Inverted................................= 0 (No)
```

The AL205E then retrieves the three dimensional GPS position and time fix. The AL205E shuts off the GPS and displays the current date and time after getting the GPS fix. While the AL205E is getting the GPS fix, the screen will be similar to the following:

```
** system started **
clk slow
GPS UPDATE START
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-13 00:00:01 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-13 00:00:07 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-17 20:51:22 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-17 20:51:28 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-17 20:51:34 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: True GPS Time: 20-06-11 20:51:40 Leap
Seconds: 18 Leap Source: Saved
Fix type: No Fix # SVs: 0 GPS time valid: True GPS Time: 20-06-11 20:51:46 Leap
Seconds: 18 Leap Source: Saved
Fix type: No Fix # SVs: 8 GPS time valid: True GPS Time: 20-06-11 20:51:52 Leap
Seconds: 18 Leap Source: Saved
3D FIX
*** Waiting 10 seconds for GPS time clock to settle ***
Fix type: 3D (4+ SV) # SVs: 8 GPS time valid: True GPS Time: 20-06-11 20:51:58
Leap Seconds: 18 Leap Source: Saved
```

```
Fix type: 3D (4+ SV) # SVs: 8 GPS time valid: True GPS Time: 20-06-11 20:52:04
Leap Seconds: 18 Leap Source: Saved
WAIT COMPLETE. Leap Source: Saved; Leap Value: 18
SETTING PPS COUNTER
WAITING FOR PPS
GOOD PPS SET
GPS SHUTDOWN
20-06-11 20:51:50
```

The AL205E tries to get a GPS fix for 5 minutes. If it does not get a valid GPS fix in that 5 minutes, the AL205Ewill shut off the GPS, wait 5 minutes, then retry to get a GPS fix. This process continues until the AL205E gets a valid GPS fix. The following is an example of the AL205E not getting a GPS fix after the first 5 minutes

```
GPS UPDATE START
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-13 00:00:01 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-13 00:00:07 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-13 00:00:13 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-13 00:00:19 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-13 00:00:25 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-13 00:00:31 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-13 00:00:37 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-13 00:00:43 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-13 00:00:49 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-13 00:00:55 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-13 00:01:01 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-13 00:01:07 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-13 00:01:13 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-13 00:01:19 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-13 00:01:25 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-13 00:01:31 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-13 00:01:37 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-13 00:01:43 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-13 00:01:49 Leap
Source: Unknown
```

```
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-13 00:01:55 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-13 00:02:01 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-13 00:02:07 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-13 00:02:13 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-13 00:02:19 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-13 00:02:25 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-13 00:02:31 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-13 00:02:37 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-13 00:02:43 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-13 00:02:49 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-13 00:02:55 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-13 00:03:01 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-13 00:03:07 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-13 00:03:13 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-17 00:32:52 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-17 00:32:58 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-17 00:33:04 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-17 00:33:10 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-17 00:33:16 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-17 00:33:22 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-17 00:33:28 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-17 00:33:34 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-17 00:33:40 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-17 00:33:46 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-17 00:33:52 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-17 00:33:58 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-17 00:34:04 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-17 00:34:10 Leap
Source: Unknown
```

```
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-17 00:34:16 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-17 00:34:22 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-17 00:34:28 Leap
Source: Unknown
Fix type: No Fix # SVs: 0 GPS time valid: False GPS Time: 11-11-17 00:34:34 Leap
Source: Unknown
MAX TIME WAITING FOR 3D FIX, SHUTDOWN
GPS UPDATE TIMEOUT - GPS SHUTDOWN
Consecutive Failed: 1
clk slow
```

After getting the GPS fix, the screen will display the Alert2 data (A2) on the S0 (Serial 1) port.

```
A2 on S0 at: 34677
```

The next line shows the transmission of that received data and the number of bytes in the packet.

```
Create Frame, Mant len: 27
```

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General

- Protect from over-voltage.
- Protect electrical equipment from water.
- Protect from electrostatic discharge (ESD).
- Protect from lightning.
- Prior to performing site or installation work, obtain required approvals and permits. Comply with all governing structure-height regulations.
- Use only qualified personnel for installation, use, and maintenance of tripods and towers, and any attachments to tripods and towers. The use of licensed and qualified contractors is highly recommended.
- Read all applicable instructions carefully and understand procedures thoroughly before beginning work.
- Wear a **hardhat** and **eye protection**, and take **other appropriate safety precautions** while working on or around tripods and towers.
- **Do not climb** tripods or towers at any time, and prohibit climbing by other persons. Take reasonable precautions to secure tripod and tower sites from trespassers.
- Use only manufacturer recommended parts, materials, and tools.

Utility and Electrical

- **You can be killed** or sustain serious bodily injury if the tripod, tower, or attachments you are installing, constructing, using, or maintaining, or a tool, stake, or anchor, come in **contact with overhead or underground utility lines**.
- Maintain a distance of at least one-and-one-half times structure height, 6 meters (20 feet), or the distance required by applicable law, **whichever is greater**, between overhead utility lines and the structure (tripod, tower, attachments, or tools).
- Prior to performing site or installation work, inform all utility companies and have all underground utilities marked.
- Comply with all electrical codes. Electrical equipment and related grounding devices should be installed by a licensed and qualified electrician.
- Only use power sources approved for use in the country of installation to power Campbell Scientific devices.

Elevated Work and Weather

- Exercise extreme caution when performing elevated work.
- Use appropriate equipment and safety practices.
- During installation and maintenance, keep tower and tripod sites clear of un-trained or non-essential personnel. Take precautions to prevent elevated tools and objects from dropping.
- Do not perform any work in inclement weather, including wind, rain, snow, lightning, etc.

Maintenance

- Periodically (at least yearly) check for wear and damage, including corrosion, stress cracks, frayed cables, loose cable clamps, cable tightness, etc. and take necessary corrective actions.
- Periodically (at least yearly) check electrical ground connections.

Internal Battery

- Be aware of fire, explosion, and severe-burn hazards.
- Misuse or improper installation of the internal lithium battery can cause severe injury.
- Do not recharge, disassemble, heat above 100 °C (212 °F), solder directly to the cell, incinerate, or expose contents to water. Dispose of spent batteries properly.

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