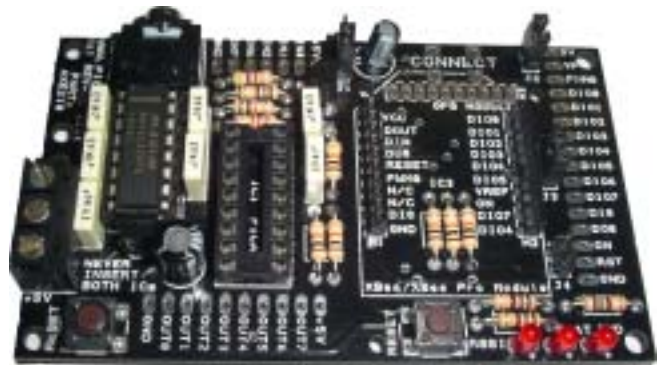# PICAXE CONNECT (AXE210)

Description:

The AXE210 Connect board has been designed as a experimental project board for users wishing to learn how to interface a PICAXE chip to the Maxstream XBee module or a low cost GPS module.

Use with XBee Wireless Modem

When considering a wireless PICAXE application most users will compare the 2.4GHz XBee modem units with the slightly lower-cost 433MHz RF modules.

Whilst the 433 modules are low cost and may be suitable for some very simple PICAXE applications, the XBee modules offer considerable advantages. The primary advantage is that the XBee modules are 'bi-directional'. Most budget 433 systems only transmit in one direction, so the transmitter has no idea whether the receiver is actually getting the data! The XBee modules transmit and receive in both directions, so you can easily test (at both ends) if the system is working correctly.

The second advantage is that of unique addressing. Each XBee unit has a unique serial number. This means two (or more) units can be set up to exclusively talk to each other, ignoring all signals from other modules. This is not easily achieved with 433 modules.

The third advantage is that the XBee module has in build 'data-packet' building and error-checking to ensure reliable data transmission.

Finally the XBee protocol allows for a number of 'channels'. By setting different units on different channels additional interference can be avoided.

Typical wireless networks could include
PC to remote PICAXE   e.g. remote control of robot/equipment
remote PICAXE to PC   e.g. data collection from a greenhouse
multiple remote PICAXEs to PC   e.g. a security system
remote PICAXE to remote PICAXE   e.g. different sensor modules of a weather
station

The Maxstream XBee module is available from
www.techsupplies.co.uk   XBE001

For the full version of this datasheet (including assembly instructions) please see
www.picaxe.com/docs/axe210.pdf

Use with a GPS module

The AXE210 Connect board can also be used to interface to a low cost GPS module, to provide a PICAXE to GPS project/experimentation board. It is not possible to use both XBee and GPS modules at the same time.

The low cost GPS module is available from
www.techsupplies.co.uk   part GPS001

An external active antenna for the module is also available (apply 3.3V to Ext Ant pin(DIO0))
www.techsupplies.co.uk   part GPS002

It is recommended that 3 nylon support posts are also purchased, part GPS003.

Principles of Operation

The PICAXE 'AXE210 Connect Board' has been designed to support:

two XBee modes of use:

- as a computer to XBee wireless modem interface (MAX3232 chip)
- as a PICAXE to XBee wireless modem interface (PICAXE chip inserted)

or two GPS modes of use:

- as a computer to GPS interface (MAX3232 chip inserted)
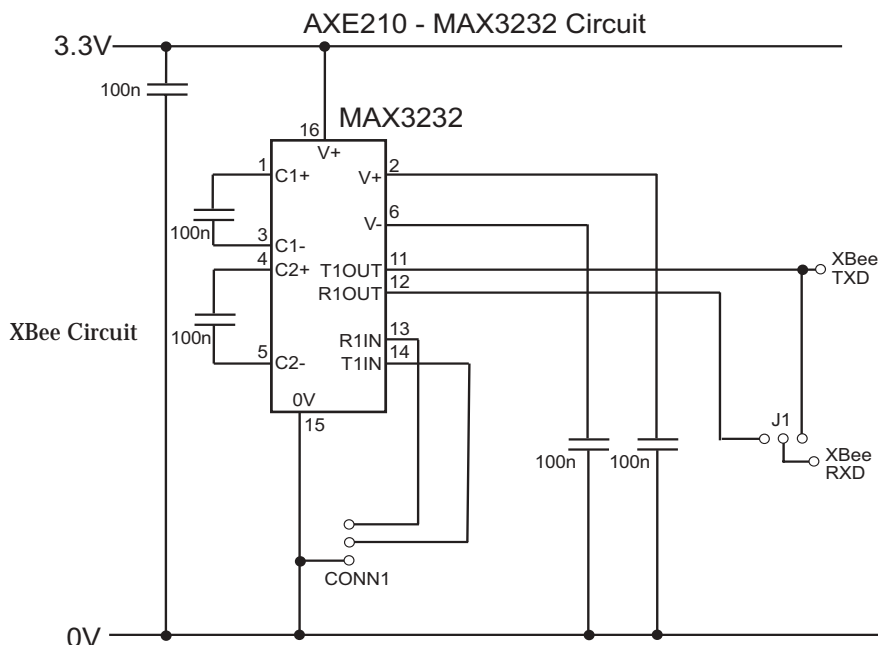- as a PICAXE to GPS interface (PICAXE chip inserted)

Important Note:

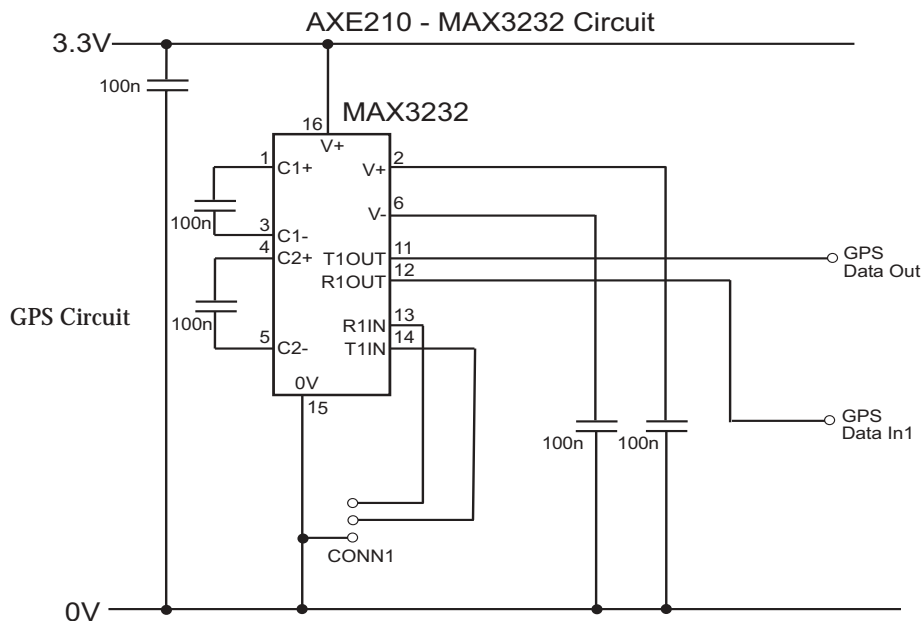When used as a PICAXE interface a PICAXE chip is inserted in the 18 pin socket.

When used as a computer interface a MAX3232CPE chip is inserted in the 16 pin socket.

Never insert both the PICAXE chip and MAX3232 chip at the same time!

Circuit Diagrams (MAX3232 chip inserted)

Please note that Sipex SP3232EUCP and Maxim MAX3232CPE are equivalent parts (from different manufacturers) and either may be supplied in the kit (depending on current availability).

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Circuit Diagrams (PICAXE chip inserted)

AXE210 - PICAXE Circuit

XBee Circuit

AXE210 - PICAXE Circuit

GPS Circuit
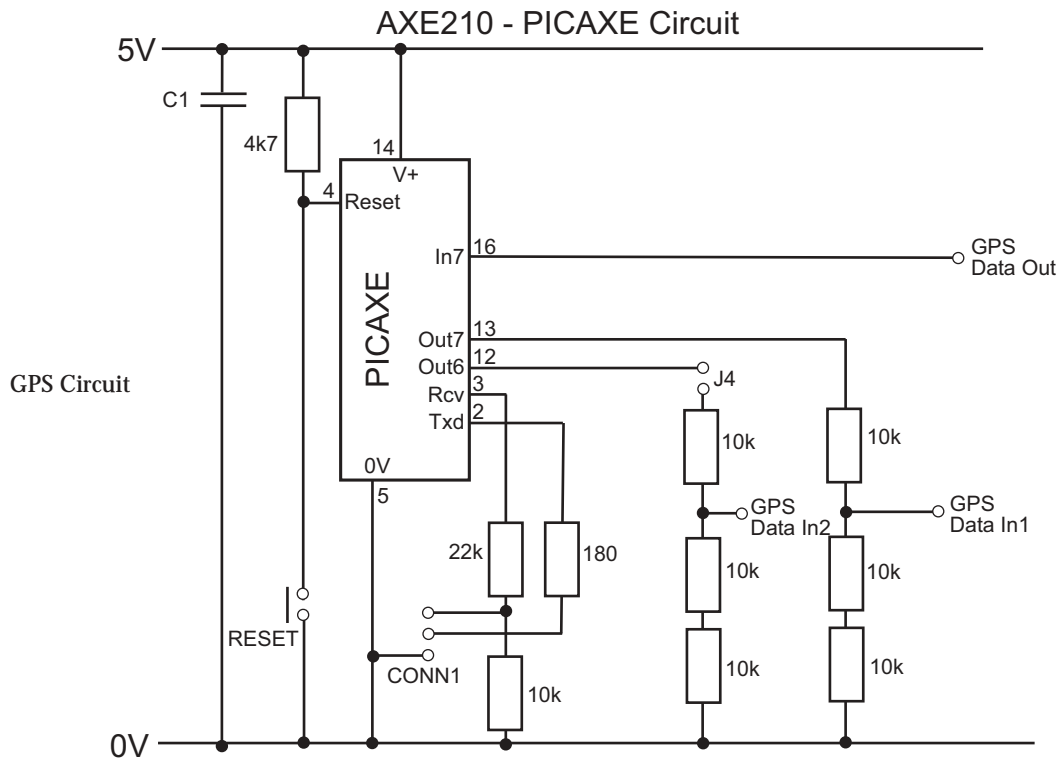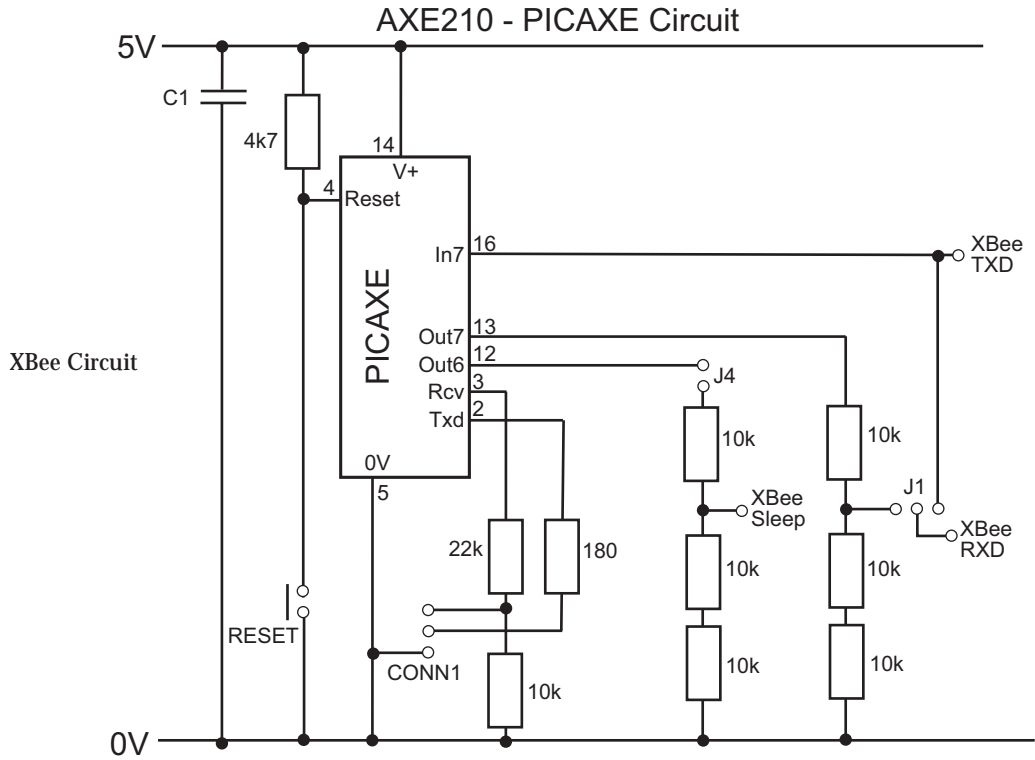
Serial/USB Cable Connection

The Connect board has a 'stereo' type socket for connection of the PICAXE serial cable, part AXE026. This cable is used for PICAXE downloads when a PICAXE chip is connected, or direct computer communication with the XBee/GPS module when the MAX323 chip is fitted.

If you only have access to a USB port you will require the PICAXE USB cable, part AXE027.
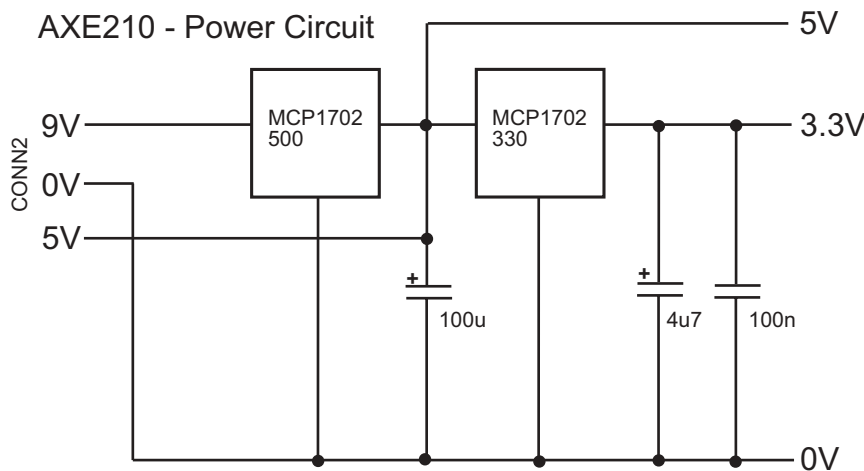
Power Supply

For experimentation work the AXE210 is designed to work from a regulated 9V or 5V DC supply. It can also be used with batteries (4.5V from 3xAA cell).

The ground (0V) connection is via the centre terminal of connector CONN2. A 9V regulated DC supply can be connected to the top terminal. Alternately a regulated 5V DC supply (or 4.5V battery pack) can be connected to the bottom terminal.

For ease of use whilst experimenting, the AXE210 contains both a 5V and 3.3V regulator. The PICAXE chip (and therefore also its output pins) operate at 5V. The XBee/GPS module operates at 3.3V. Therefore when connecting a PICAXE output pin to the module it is necessary to use a voltage divider circuit to step down the 5V PICAXE output to 3.3V (see circuit diagrams). Connecting 5V directly to the module will cause damage to the module.

The regulators are convenient for experimentation. However when powered by batteries, the 5V and 3.3V regulators are fairly inefficient and so will draw a few mA of standby current. This is not ideal for long term battery powered installations and so in this situtaion it is recommended that the end user considers using a permanent 3.3V supply and modifying the board to remove these regulators.

AXE210 - Power Circuit

```
                                              5V

CONN2
  9V ──── MCP1702  ──── MCP1702 ──────────── 3.3V
          500           330
  0V ────
  5V ────
              +          +        
            100u        4u7      100n

                                              0V
```

Connection of a higher voltage (e.g. a 9V PP3 battery) to the 5V input, or accidentally reversing the power supply connections, will damage the ICs and modules. These will then require replacing.

Note that the voltage regulators are rated to 200mA. This is suitable for the XBee or GPS modules. The MaxStream 'XBee Pro' module can draw currents greater than 200mA and so the regulator will need upgrading for use with this unit.

LED indicators

The AXE210 board has three LED indicators.

XBEE Module

RSSI	connects to the XBee RSSI (pin 6)
STATUS	connects to the XBee ON/Sleep pin (pin 13)
IND	connects via Jumper 3 to either XBee
	Associate (pin 15) or Transmit (pin 11)

RSSI	indicates the XBee received signal strength
STATUS	indicates whether the XBee module is active/sleeping
IND	indicates whether the XBee module has associated with another module (Associate) or is transmitting data (Transmit).

GPS Module

RSSI	connects to the GPS 1PPS pin (pin 6)
STATUS	connects to the GPS PIO pin (pin 5)
IND	not used

RSSI	indicates the GPS status
STATUS	indicates the UTC second (see GPS datasheet)

Jumper Function (when using XBee Module only)

The AXE210 board has 4 jumpers, labelled J1 to J4.
These jumpers should not be fitted or used with the GPS module.

The operation of each jumper when used with the XBee module is shown below.
The default position of each jumper is shown in **bold** *.

J1
Open	- (not used)
Top *	- **Normal use**
Bottom	- Loopback test (XBee DOUT connected to DIN)

J2
Open	- XBee Vref not connected
Fitted *	- **XBee Vref connected to 3.3V**

J3
Open	- IND. LED not connected
Top	- IND. LED connected to XBee Transmit (DIO4)
Bottom *	- **IND. LED connected to XBee Associate (DIO5)**

J4
Open *	- **PICAXE output B.6 not connected**
Fitted	- PICAXE output B.6 connected to XBee sleep pin (DI8)

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Assembly instructions:

The AXE210 Connect board is a high quality plated through PCB and is therefore relatively straight forward to assemble. However a number of the electronic components are polarised, so please ensure these components are fitted the correct way around before soldering (see table below). Soldering experience is assumed.

Tools required (not supplied):
- Soldering iron and solder
- Side Cutters
- Small pair of pliers

Contents:

- PCB   1   AXE210 Connect PCB
- IC1   1   18 pin IC socket
- IC2   1   16 pin IC socket
- R1   1   4k7 resistor (yellow violet red gold)
- R2-5   4   180 resistor (brown grey brown gold)
- R6-12   7   10k resistor (brown black orange gold)
- R13   1   22k resistor (red red orange gold)
- C7-8   7   100nF (104) polyester capacitor
- C1   1   100uF electrolytic capacitor   *** + marked on PCB
- C9   1   4.7uF electrolytic capacitor   *** + marked on PCB
- LED1-3   3   3mm LED   *** flat marked on PCB
- RG1   1   MCP1702-500
- RG2   1   MCP1702-330
- S1-2   2   miniature push switch
- CONN1   1   3.5mm stereo socket
- CONN2   1   3 pin screw terminal block
- J1-4   1   10 pin header (snap into 2x3 and 2x2)
- J1-4   4   jumper links
- H1,2   2   10 pin connector

- BAT1   1   battery clip
- BAT1   1   4.5V (3xAA) battery box
- IC2   1   MAX3232CPE   (or equivalent SP3232EUCP)   *** pin 1 faces up

(*** denotes components which must be soldered the correct way around. See notes above).

Important Information for GPS Use:

The following extra information about assembly is important for GPS module users:

- Resistors R10, R11, R12 are not fitted.
- Headers J1, J2, J3, J4 are not fitted.
- Sockets H1 and H2 are not used. Instead solder one socket in the H3 position.
- The reset switch SW2 is soldered in the top position (over the word 'CONNECT') - if placed in the normal lower position it will be under the GPS module and so not accessible.
- The LEDs must be soldered at right angles to the PCB (see photo overleaf) to avoid contact with the GPS module.
- Wire links must be made to connect pins DIO0 and DIO1 to 3V (see notes on page 10).
- It is recommended that the GPS module is supported by three plastic support posts (available separately as part GPS003). The PCB holes may need slight enlargement to fit the posts.

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Assembly Instructions (PCB Part Version AXE210v2):

1. Solder the resistors in position
   (do not insert resistors R10, R11, R12 if using the GPS module).
2. Solder the two IC sockets and push switch S1 in position.
3. XBee   - solder switch S2 in position.
   GPS   - solder switch over the word CONNECT (not in position S2)
4. Solder the capacitors and LEDs in position.
   If using the GPS module the LEDs should be inserted at right angles to the
   PCB.
4. Solder the RG1 (MCP1702-500) and RG2 (MCP1702-330) regulators in
   position.
5. Solder the CONN1 and CONN2 connectors in place. Ensure the stereo socket
   'clicks' into position flat on the PCB prior to soldering.
6. XBee   - Solder the headers H1, H2 and jumpers J1-4 in position.
   GPS   - Solder the header H3 in position

Assembled board (XBee):

Assembled board (GPS):

XBee / PICAXE Connections

The PICAXE portC pins are connected to solder pads at the top of the board.
The PICAXE portB pins are connected to solder pads at the bottom of the board.
The XBee pins are connected to solder pads on the right hand side of the board.

PICAXE to XBee Connection

When a PICAXE chip is inserted in the 18pin socket the following connections are
made:

PICAXE B.7 is connected to the XBee transmit pin (via jumper J1).
PICAXE B.6 is connected to the XBee sleep pin (via jumper J4)
PICAXE C.7 is connected to the XBee receive pin.

Therefore data to be transmitted by the XBee module can be output via the
PICAXE command serout e.g.

```
serout B.7,T2400,("Data")
```

Data received by the XBee module can be processed by the PICAXE command serin
e.g.

```
serin C.7,T2400, b1
```

When configured for external pin activated sleep, the XBee module can be put to
sleep / woken from sleep by the PICAXE commands high and low e.g.

```
high B.6 / low B.6
```

Note that hardware controlled sleep needs to be configured by the XBee Wizard –
the default condition is no hardware sleep control. Jumper 4 must also be fitted.

Remember - never insert both the PICAXE chip and MAX3232 chip at the same
time.

Computer to XBee Connection

When a MAX3232 chip is inserted in the 16pin socket the XBee module is
connected (via the download cable) directly to the computer serial port. Therefore
data can be transmitted from/received by the computer. The XBee module can also
be configured via use of the XBee Wizard or configuration commands (see XBee
datasheet XBE001.pdf and tutorial AXE210_XBEE.pdf for more details).

If your laptop computer does not have a conventional 9 pin serial port you will
require the PICAXE USB download cable - part AXE027.

For further information about using the XBee module with the PICAXE chip please
see the separate XBee tutorial datasheet (datasheet AXE210_XBEE.pdf available from
the datasheets section at www.picaxe.co.uk)

Remember -
never insert both the PICAXE chip and MAX3232 chip
at the same time.

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GPS / PICAXE Connections

The PICAXE portC pins are connected to solder pads at the top of the board.
The PICAXE portB pins are connected to solder pads at the bottom of the board.
The GPS pins are connected to solder pads on the right hand side of the board.

Computer to GPS Connection

When a MAX3232 chip is inserted in the 16pin socket the GPS module is
connected (via the download cable) directly to the computer serial port. Therefore
data can be transmitted from/received by the computer at 9600 baud (e.g. via the
PICAXE Terminal at 9600). The GPS module can also be configured via use of the
configuration commands (see GPS datasheet GPS001.pdf for more details).

The board is designed to be used with AXE027 USB cable (or AXE026 serial
cable).

PICAXE to GPS Connection

When a PICAXE chip is inserted in the 18pin socket the following connections are
made:

GPS Pin		AXE210 Function	AXE210 Solder Pad
1	Data Out	PICAXE Input C.7	C.7
2	Data In	PICAXE Output B.7	B.7
3	Vcc	+3.3V	3V
4	GND	Ground	GND
5	PIO	Status LED	ON
6	1PPS	RSSI LED	PWM0
7	Reset	Reset Switch	RST
8	Data In 2	(optional)	-
9	VBAT	(link to 3V for VBAT)	DIO1 - MUST connect to 3V
10	Ant Pwr	(link to 3V for active ant.)	DIO0 - MUST connect to 3V

Please remember:

Never insert both the PICAXE chip and MAX3232 chip at the same time.

The GPS requires an antenna (eg GPS002) - and with an active antenna it is
essential to connect GPS 'Ant Pwr' to 3V (ie connect pads DIO0 & 3V together
with a wire link)

VBAT must be connected to 3V for the GPS to operate (ie connect pads DIO1 & 3V
together with a wire link).

The GPS antenna requires a clear view of the sky to operate (i.e. may not operate
correctly in a building). When initially testing always hang the active antenna out
a window!

The GPS module may require a few minutes after original power-up to locate the
satellite signal (see GPS datasheet www.picaxe.com/docs/gps001.pdf).

When the MAX3232 is fitted the NMEA data stream should be automatically
visible in the Serial Terminal at a baud rate of 9600. For multiple NMEA parsing
examples please search 'NMEA' in the www.picaxeforum.co.uk forum.

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