Spatial OEM Development Kit Manual
# Table of Contents

1  Revision History.................................................................................................................2

2  Introduction..........................................................................................................................3

   2.1  Kit Contents..................................................................................................................3

3  Quick Start................................................................................................................................4

   3.1  Troubleshooting..............................................................................................................4

4  OEM Development Board Overview..........................................................................................5

   4.1  Spatial OEM Module.........................................................................................................6

   4.2  Serial UART to USB Converter..........................................................................................6

   4.3  Dual RS232 Transceiver....................................................................................................6

   4.4  GPIO Header and Status LEDs.........................................................................................7

   4.5  RF Connection..................................................................................................................8

5  Configuration and Operation......................................................................................................9

   5.1  Configuration Switches.....................................................................................................9

      5.1.1  Primary Serial Port to USB.......................................................................................10

      5.1.2  Primary Serial Port to RS232 1 and GPIO 3 & 4 to RS232 2......................................10

      5.1.3  Primary Serial Port and GPIO 3 & 4 to GPIO Header at TTL levels.........................10

   5.2  Power source....................................................................................................................11

6  Electrical..................................................................................................................................12

   6.1  Schematics.......................................................................................................................12

   6.2  Bill of Materials...............................................................................................................15

7  Mechanical...............................................................................................................................17

   7.1  Mechanical Drawing.........................................................................................................17

   7.2  Optional Enclosure............................................................................................................17
# Revision History

<table>
<thead>
<tr>
<th>Version</th>
<th>Date</th>
<th>Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.0</td>
<td>29/04/2015</td>
<td>Updated for hardware v1.2</td>
</tr>
<tr>
<td>2.0</td>
<td>22/04/2013</td>
<td>Updated for hardware v1.1</td>
</tr>
<tr>
<td>1.0</td>
<td>28/08/2012</td>
<td>Initial Release</td>
</tr>
</tbody>
</table>
2 Introduction
The Spatial OEM development kit allows developers to quickly test and integrate Spatial OEM into prototypes and low quantity products. It provides the user with access to all of Spatial OEM's interfaces with a number of convenient connection options.

2.1 Kit Contents
The Spatial OEM Development Kit includes:
1. 1x Spatial OEM Module (pre installed)
2. 1x OEM Development Board
3. 1x GNSS Antenna
4. 1x Mini USB to USB A cable
5. 1x U.FL to U.FL cable (pre installed)

Attention
The OEM development board is an electrostatic sensitive device and must be handled with care. Precautions must be taken when operating the OEM development board.
3 Quick Start

The Spatial OEM development kit is ready to function straight out of the box using the USB interface. It is recommended that users familiarise themselves with Spatial OEM through the Spatial Manager software prior to starting their own integration.

1. If you are using Windows, install Java from [http://www.java.com](http://www.java.com).
2. Download Spatial Manager from the Advanced Navigation website.
3. Open Spatial Manager by double clicking on it. If this does not work, right click and choose open with → Java
4. Screw the GNSS antenna onto the board connector finger tight and place the antenna in an area with a view of the sky.
5. Plug one end of the USB cable into the development board and the other end into your computer.
6. Click connect in Spatial Manager. If the connection indicator does not turn green, disconnect and try selecting another serial port.

3.1 Troubleshooting

If the serial port does not show up when the OEM development board is plugged in, the system may require drivers. These are available from [http://www.ftdichip.com/Drivers/VCP.htm](http://www.ftdichip.com/Drivers/VCP.htm).
4 OEM Development Board Overview

The OEM development board is a configurable PCB that provides developers with easy access to all of the features of the Spatial OEM module through a number of different interfaces. Illustration 1 shows an image of the OEM development board.

Illustration 1: Labelled OEM development board
4.1  Spatial OEM Module

The Spatial OEM module connects to the development board through a micro 20 pin board to board connector. Four M1.6 stainless steel screws bolt into precision stand-offs and ensure rigid mechanical mounting to the development board. All development boards are shipped with a Spatial OEM already mounted to allow immediate use out of the box. If you wish to remove the Spatial OEM from the development board please refer to the Spatial OEM Reference Manual for mounting and removal instructions. Please note that the board to board connector is fragile and the module should be removed with care.

4.2  Serial UART to USB Converter

An FTDI FT232R USB to serial UART converter chip is included on board to allow the Spatial OEM to interface directly to a computer through USB. Two status LEDs indicate the flow of data to and from the USB port.

USB drivers for all operating systems can be downloaded directly from FTDI's website at http://www.ftdichip.com/Products/ICs/FT232R.htm.

All development boards are shipped with this interface enabled as standard.

4.3  Dual RS232 Transceiver

A Linear Technology LTC2804 dual channel serial UART to RS232 transceiver is included on the development board to allow developers to communicate with the Spatial OEM module via RS232. The LTC2804 allows baud rates of up to 1000000 baud.

Channel 1 of the LTC2804 is for use with the primary serial port on the Spatial OEM Module and Channel 2 of the LTC2804 is for use with GPIO 3 (RS232 TX 2) and GPIO 4 (RS232 RX 2).

Connection to the RS232 level signals is through a 3x2 2.54mm header, see Illustration 2. This header is on the left of the board and allows developers to attach wires or headers as needed.

Please note that by default the LTC2804 is disabled. Switch 1 turns it on, please see section 5.1.

Illustration 2: RS232 header with functions labelled
4.4 GPIO Header and Status LEDs

Users have access to 6 multi-purpose GPIO pins from Spatial OEM. These are available on the 7x2 2.54mm header, see Illustration 3. Four of these pins (GPIO 1-4) are also connected to LEDs on the development board. When using a GPIO in certain input functions, the LED can cause interference with the signal. In this situation, the LED’s resistor should be removed. When using the GPIO lines for off board functions it is important to note that these signals are not protected against static charges, over-voltage or over-current events. Failure to protect the signals may result in damage to Spatial OEM. Other pins on the GPIO header include a regulated 3.3V supply from Spatial that can supply up to 50mA, Spatial’s reset line and the external voltage input (VEXT).

![Image of GPIO header with functions labelled]

Illustration 3: GPIO header with functions labelled

4.5 RF Connection

Spatial OEM connects to a GNSS antenna through a miniature onboard U.FL connector. Due to the fragile nature of this connector, a U.FL to SMA adapter is supplied on the development board. It is recommended to use this adapter during development to prevent damage to the Spatial OEM U.FL connector.

For applications where the development board is placed inside an enclosure it is recommended
that developers use a U.FL to SMA cable assembly. These assemblies are available from most of the large electronics distributors.
5 Configuration and Operation

5.1 Configuration Switches

The OEM development board contains a DIP switch array that allows the user to route signals between the USB to serial converter, RS232 converter and GPIO header. The configuration switches are shown below in Illustration 4 in their default positions. The default position routes Spatial's primary serial port to the USB to serial converter and has GPIO 3 and GPIO 4 connected only to the GPIO header. Please see Table 1 for the configuration switch functions.

![Configuration switches in their default position](Illustration 4)

<table>
<thead>
<tr>
<th>Switch</th>
<th>Default</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Off</td>
<td>Power on RS232 transceiver. When the RS232 transceiver is powered on GPIO 3 and 4 will be connected to RS232 TX 2 and RS232 RX2 respectively. It will no longer be possible to use GPIO 4 in a TTL level mode. The primary serial port TX will also be connected to RS232 TX 1 but the primary serial port RX will only be connected to RS232 RX 1 if switch 2 is turned on.</td>
</tr>
<tr>
<td>2</td>
<td>Off</td>
<td>Connect primary serial port RX to RS232 transceiver (RS232 RX 1). Please note that only one of the switches 2,3 or 4 should be turned on at once to prevent short circuit.</td>
</tr>
<tr>
<td>3</td>
<td>Off</td>
<td>Connect primary serial port RX to USB serial converter. Please note that only one of the switches 2,3 or 4 should be turned on at once to prevent short circuit.</td>
</tr>
<tr>
<td>4</td>
<td>Off</td>
<td>Connect primary serial port RX to GPIO header (UART RX). Please note that only one of the switches 2,3 or 4 should be turned on at once to prevent short circuit.</td>
</tr>
</tbody>
</table>

Table 1: Configuration switch functions

5.1.1 Primary Serial Port to USB
5.1.2 Primary Serial Port to RS232 1 and GPIO 3 & 4 to RS232 2

Illustration 6: Switch positions for primary serial port to RS232 1 and GPIO 3 & 4 to RS232 2

5.1.3 Primary Serial Port and GPIO 3 & 4 to GPIO Header at TTL levels

Illustration 7: Switch positions for primary serial port and GPIO 3 & 4 to GPIO header at TTL levels
5.2 Power source

The development board has two power source options; USB power (5V nominal) or an external power source. By default, the development board is configured to use USB power. The external power source can be fed into the board through VEXT on either the GPIO header or RS232 header and can be any voltage between 4V and 36V. Please refer to the Spatial OEM Reference Manual for full power supply requirements. The power source is selected by a three way switch, please see Illustration 8 and Illustration 9.
6 Electrical

6.1 Schematics

See the following pages for the development board schematics.
### 6.2 Bill of Materials

<table>
<thead>
<tr>
<th>Item #</th>
<th>Designator</th>
<th>Quantity</th>
<th>Mfg Part #</th>
<th>Comment</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ANT1</td>
<td>1</td>
<td>U.FL-R-SMT(10)</td>
<td>Surface Mount U.FL Connector</td>
<td>Hirose</td>
</tr>
<tr>
<td>2</td>
<td>ANT2</td>
<td>1</td>
<td>CONSMA001-SMD</td>
<td>Surface Mount SMA Connector</td>
<td>Linx Technologies Inc</td>
</tr>
<tr>
<td>3</td>
<td>B1</td>
<td>1</td>
<td>DF40C(2.0)-20DS-0.4V(51)</td>
<td>Spatial Connector (20pin 0.4mm pitch board-board)</td>
<td>Hirose</td>
</tr>
<tr>
<td>4</td>
<td>C1, C2</td>
<td>2</td>
<td>GRM155R71C104K A88D</td>
<td>0.1uF 0402 Ceramic Capacitor</td>
<td>Murata</td>
</tr>
<tr>
<td>5</td>
<td>C3</td>
<td>1</td>
<td>C1608X5R1A475K/0.50</td>
<td>4.7uF 0603 Ceramic Capacitor</td>
<td>TDK Coporation</td>
</tr>
<tr>
<td>6</td>
<td>C4, C5, C6</td>
<td>3</td>
<td>GRM155R61A105K E15D</td>
<td>1.0uF 0402 Ceramic Capacitor</td>
<td>Murata</td>
</tr>
<tr>
<td>7</td>
<td>C7</td>
<td>1</td>
<td>C1005X5R1E224K</td>
<td>0.22uF 0402 Ceramic Capacitor</td>
<td>TDK Corporation</td>
</tr>
<tr>
<td>8</td>
<td>D1</td>
<td>1</td>
<td>LTST-C190KSKT</td>
<td>Yellow LED</td>
<td>Lite-On Inc</td>
</tr>
<tr>
<td>9</td>
<td>D2</td>
<td>1</td>
<td>LTST-C191KGKT</td>
<td>Green LED</td>
<td>Lite-On Inc</td>
</tr>
<tr>
<td>10</td>
<td>D3, D5</td>
<td>2</td>
<td>LTST-C191KRKT</td>
<td>Red LED</td>
<td>Lite-On Inc</td>
</tr>
<tr>
<td>11</td>
<td>D4, D6</td>
<td>2</td>
<td>LTST-C191KFKT</td>
<td>Orange LED</td>
<td>Lite-On Inc</td>
</tr>
<tr>
<td>12</td>
<td>FB1</td>
<td>1</td>
<td>BLM15AX221SN1D</td>
<td>0402 Ferrite Bead</td>
<td>Murata</td>
</tr>
<tr>
<td>13</td>
<td>H2</td>
<td>1</td>
<td>15-91-2140</td>
<td>2x7 2.54mm pitch header</td>
<td>Molex</td>
</tr>
<tr>
<td>14</td>
<td>H3</td>
<td>1</td>
<td>UX60-MB-5ST</td>
<td>Mini USB Connector</td>
<td>Hirose</td>
</tr>
<tr>
<td>15</td>
<td>H4</td>
<td>1</td>
<td>15912060</td>
<td>3x2 2.54mm pitch header</td>
<td>Molex</td>
</tr>
<tr>
<td>16</td>
<td>L1</td>
<td>1</td>
<td>VLS201612ET-100M</td>
<td>10uH 2x1.6mm Inductor</td>
<td>TDK Corporation</td>
</tr>
<tr>
<td>17</td>
<td>R1, R2, R4, R5, R6, R7</td>
<td>6</td>
<td>ERJ-2GEJ331X</td>
<td>330R 0402 Resistor</td>
<td>Panasonic</td>
</tr>
<tr>
<td>18</td>
<td>R3</td>
<td>1</td>
<td>RMCF0402ZT0R00</td>
<td>OR 0402 Resistor</td>
<td>Stackpole Electronics Inc</td>
</tr>
<tr>
<td>19</td>
<td>R8, R9, R10, R11, R12, R13</td>
<td>6</td>
<td>PRG18BB470MB1R B</td>
<td>PTC 0603</td>
<td>Murata</td>
</tr>
<tr>
<td>20</td>
<td>R14</td>
<td>1</td>
<td>RMCF0402JT100K</td>
<td>100k 0402 Resistor</td>
<td>Stackpole Electronics Inc</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Sw1</td>
<td>1</td>
<td>218-10LPST</td>
<td>10 Pole Single Throw DIP Switch Array</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Sw2</td>
<td>1</td>
<td>EG1381A</td>
<td>1 Pole 3 Throw DIP Switch</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>U1</td>
<td>1</td>
<td>FT232RL</td>
<td>USB to Serial UART Converter IC</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>U2</td>
<td>1</td>
<td>LTC2804CGN-1#PBF</td>
<td>Dual Serial UART to RS232 Transceiver</td>
<td></td>
</tr>
</tbody>
</table>

- **CTS Electrocomponen ts**
- **E-Switch**
- **FTDI**
- **Linear**
7 Mechanical

7.1 Mechanical Drawing

Illustration 10: OEM development board mechanical drawing

7.2 Optional Enclosure

The OEM Development Board can be installed into an optional off the shelf enclosure for more rugged testing if required. The development board will fit inside a Hammond 1550Z106BK or 1550Z111BK heavy duty, watertight enclosure. These enclosures can be purchased from Digikey, Mouser, Element 14 and many other electronics distributors.

Please take care to ensure that all signals from the OEM development board that are routed out of any enclosure design are protected against ESD and other potential electrical hazards that may damage Spatial OEM.
Information in this document is provided solely in connection with Advanced Navigation products. Advanced Navigation reserves the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All Advanced Navigation products are sold pursuant to Advanced Navigation’s terms and conditions of sale. Purchasers are solely responsible for the choice, selection and use of the Advanced Navigation products and services described herein, and Advanced Navigation assumes no liability whatsoever relating to the choice, selection or use of the Advanced Navigation products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by Advanced Navigation for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

UNLESS OTHERWISE SET FORTH IN ADVANCED NAVIGATION’S TERMS AND CONDITIONS OF SALE ADVANCED NAVIGATION DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ADVANCED NAVIGATION PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

UNLESS EXPRESSLY APPROVED IN WRITING BY TWO AUTHORIZED ADVANCED NAVIGATION REPRESENTATIVES, ADVANCED NAVIGATION PRODUCTS ARE NOT RECOMMENDED, AUTHORIZED OR WARRANTED FOR USE IN MILITARY, AIR CRAFT, SPACE, LIFE SAVING, OR LIFE SUSTAINING APPLICATIONS, NOR IN PRODUCTS OR SYSTEMS WHERE FAILURE OR MALFUNCTION MAY RESULT IN PERSONAL INJURY, DEATH, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE.

ADVANCED NAVIGATION PRODUCTS WHICH ARE NOT SPECIFIED AS “AUTOMOTIVE GRADE” MAY ONLY BE USED IN AUTOMOTIVE APPLICATIONS AT USER’S OWN RISK.

Resale of Advanced Navigation products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by Advanced Navigation for the Advanced Navigation product or service described herein and shall not create or extend in any manner whatsoever, any liability of Advanced Navigation.

Information in this document supersedes and replaces all information previously supplied.

© 2015 Advanced Navigation Pty Ltd - All rights reserved