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Revision History

<table>
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<th>Date</th>
<th>Version</th>
<th>Description</th>
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<tr>
<td>December 2008</td>
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1 Introduction

The Starter Kit is the core of the nRFgo evaluation and development platform for our ultra low power radios and is the ideal platform for each stage of the development process. The Starter Kit is used in conjunction with our development kits (sold separately). The nRF modules that are included with the nRFgo development kits are designed to fit onto the nRFgo Motherboard included in this Starter kit.

1.1 Prerequisites

To fully understand this User Guide a background in software development and/or electronic engineering is required. The nRFgo Starter Kit getting started guide must also be read.

1.2 Writing Conventions

This user guide follows a set of typographic rules that makes the document consistent and easy to read. The following writing conventions are used:

- Commands are written in Courier.
- File names and User Interface components are written in **bold**.
- Cross references are **underlined and highlighted in blue**.
1.3 Kit content

Figure 1. nRFgo Starter Kit content

1. 2 nRFgo Motherboards (nRF6310)
2. 2 USB cables
3. 4 10-ribbon flat cables
4. 8 2-lead patch cables
5. 1 CD:
   - Getting Started Guide
   - User Guide
   - nRFgo Studio
6. 1 Display Module (nRF6350)
7. Printed Getting Started Guide
2 Hardware description

The core of the nRFgo Starter Kit are the two Motherboards (nRF6310) which contain all the necessary I/O port headers, buttons, LEDs and power supply to support our nRFgo compatible Development Kits (sold separately).

The nRFgo Starter Kit also contains a nRF6350 display module which is an extension port compatible module that offers additional IO options for the nRF development kit modules. The display module consists of a joystick for user input and a display for user output.
2.1 nRFgo Motherboard (nRF6310)

1. nRF module target supply LED
2. The Motherboard (nRF6310) main supply LED
3. nRF module current measurement header
4. Status display
5. nRF module reset button
6. nRF module controlled LEDs
7. nRF module input buttons (0 - 7)
8. Ground connection point
9. RS232 serial port connector
10. External ISP interface
11. PC USB connector
12. ON/OFF switch
• On the underside of the Motherboard is a battery holder that takes three AAA batteries.

### 2.1.1 nRF module connectors

To utilize the features of the nRFgo Starter Kit a nRFgo compatible development kit module (sold separately) must be inserted into the nRF module socket (5 in Figure 2).

**Note:** When inserting your nRF development kit module do not apply too much downward pressure at the antenna/SMA connector side as this may distort the nRF module connector pins.
The nRF module connectors, MOD A (P3) and MOD B (P4), have all the I/Os required for communicating with nRFgo compatible modules.

![Image of nRF module connectors - MOD B and MOD A]

**Figure 4. nRF module connectors - MOD B and MOD A**

<table>
<thead>
<tr>
<th>Pin numbers</th>
<th>MOD B</th>
<th>MOD A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Function</td>
<td>Name</td>
</tr>
<tr>
<td>1, 3</td>
<td>Vext</td>
<td>VCC</td>
</tr>
<tr>
<td></td>
<td>Power supply output for circuitry on nRFgo Motherboard</td>
<td></td>
</tr>
<tr>
<td>2, 4</td>
<td>VTG</td>
<td>VTG_nRF</td>
</tr>
<tr>
<td></td>
<td>Target Power supply for non nRF device(s) on the development kit module.</td>
<td></td>
</tr>
<tr>
<td>7 - 14</td>
<td>P3.x</td>
<td>P0.x</td>
</tr>
<tr>
<td></td>
<td>nRF device port 3</td>
<td></td>
</tr>
<tr>
<td>15 - 16</td>
<td>GND</td>
<td>GND</td>
</tr>
<tr>
<td></td>
<td>Ground</td>
<td></td>
</tr>
<tr>
<td>17 - 20</td>
<td>TCK, TDI, TDO, TMS</td>
<td>MOSI, MISO, CSN SCK</td>
</tr>
<tr>
<td></td>
<td>nRFprobed HW debugger JTAG interface</td>
<td></td>
</tr>
<tr>
<td>21 - 22</td>
<td>GND</td>
<td>GND</td>
</tr>
<tr>
<td></td>
<td>Ground</td>
<td></td>
</tr>
</tbody>
</table>
Table 1. Description of the nRF module connectors pins

The pin out of each of the generic ports will change depending on which device is present on the nRF module. Please refer to the nRF device’s development kit user guides for pinout details on the nRF device ports (pins 7 - 14 or 29 - 36).

2.1.2 Power supply

The Motherboard can be powered from three sources:

- From USB while connected to a PC
- External power supply with the following:
  - AC or DC
  - 8-20v, min 500mA.
  - 2.1mm center pin, with any polarity
- Batteries, 3 x AAA 1.5v. Do not use rechargeable batteries.

![Figure 5. Power supply connection and S8 setting for A:USB and B: External](image-url)
The S9 switch (20 in Figure 2.) is the main power switch. You can turn on and off the power for the nRFgo Motherboard using this switch. Using switch S8 (21 in Figure 2.) you can select if the power supply is sourced from VBUS in the USB connector (19 in Figure 2.) or if it should supply the external power supply connector J3 (22 in Figure 2.).

The 3xAAA battery pack supplies the board if neither external power supply options are present. When using batteries the S9 switch is still the main power switch, but setting the S8 switch is no longer relevant.

The regulated supplies on the nRFgo Motherboard can supply a total of 500 mA. When external application circuitry is connected, ensure that the current drain does not exceed this limit. If USB is used as the power supply to the system, ensure that the USB port is capable of delivering 500mA or use an externally powered USB hub.

2.1.2.1 Regulated supplies

The nRFgo Motherboard has three separate power nets: VTG, VCC and VEXT.

**VTG:** Vtarget is the power supply for the nRF development kit module. This is a variable power supply, controlled from nRFgo Studio PC software following the Starter Kit. The VTG is split into two branches VTG and VTG_nRF. VTG_nRF is split from VTG and routed through the nRF current measurement header P7 (3 in Figure 2.). On the nRF development kit modules VTG_nRF supplies only the nRF devices. Any non Nordic Semiconductor circuitry is supplied from VTG. This arrangement enables ‘nRF device(s) only’ current consumption measurements on P7.

**VCC:** VCC is a fixed 3.8v supply mainly for the nRFgo Motherboard control circuitry. It is available in the nRF module connectors and more importantly in the extension board connectors for development flexibility.

**VEXT:** VEXT supplies the signal level shifters and circuitry/headers directly interfacing the nRF module. VEXT on the nRFgo Motherboard is sourced from the nRF development kit module to ensure correct signal levels interfacing it. In most cases the connector pins VTG and VEXT are shorted on the nRF Module resulting in VEXT=VTG. Please refer to the nRF development kit user guides for details.

2.1.2.2 Status LEDs

The nRFgo Motherboard has two LEDs indicating power supply status:

- D9 (2 in Figure 2.) is lit if VCC is present.
- D8 (1 in Figure 2.) is green if VTG is present.

2.1.3 Status display

The LED status display (4 in Figure 2.) shows the ID number assigned to the nRFgo Motherboard, while it is connected to a PC, by nRFgo Studio. The same ID will be shown in the nRFgo Studio user interfaces. If two or more nRFgo Motherboards are connected to one PC, make sure the ID number in the user interface matches the ID on the nRFgo Motherboard you want to control.
If you unplug the USB cable linking the Motherboard to the PC, and the board is fitted with batteries, the number assigned to the Motherboard will begin to flash intermittently with a dot (.), this signals that the Motherboard’s ID may change in nRFgo Studio when the Motherboard is reconnected to the PC.

2.1.4  nRF reset button

The nRF RESET button (9 in Figure 2.) is the reset button for the nRFgo development kit module connected to MODA/MODB. Pressing this button causes a full reset of the development kit module, but it does not affect the nRFgo Motherboard’s main MCU.

2.1.5  Ground connection

Apart from the GND found in various headers on the nRFgo Motherboard a separate GND connection (12 in Figure 2.) is available for test instruments.

2.1.6  I/O port headers

The I/O ports of a nRF development kit module are routed directly to the I/O headers (P8-P11, 6 in Figure 2.) on the nRFgo Motherboard.

![Figure 6. General pinout of the I/O port headers](image)

All IO header pinouts are identical and shown in Figure 6. The number of headers and pins used and the pinout will vary depending on which nRFgo development module is fitted. Please refer to each nRF Development Kit User Guide for details.

2.1.7  Buttons

Eight buttons (11 in Figure 2.) are provided on the Motherboard to offer you a simple way to give device feedback during development. The buttons are connected to the Button header (P1, 8 in Figure 2.). One of the 10-way ribbon or patch cables supplied in the nRFgo Starter Kit is used to connect the Button header (P1) to the wanted device port or pin found in the IO headers (P8-P11), illustrated in Figure 7.
Pressing a button provides a 0V input for the nRF device, pull up resistors gives VEXT level when the buttons are released. See Figure 7 for the button circuitry schematic and the button header (P1) pinout.

![Diagram of button connections]

Figure 7. Connection of nRFgo Motherboard buttons to an IO header

2.1.8 LEDs

Eight LEDs (in Figure 2) are provided on the Motherboard to supply you with a simple way to read device output during development. These are fitted with drivers and connected to the LED header (P2, in Figure 2). The 10-way ribbon or patch cables supplied are used to connect the LED header (P2) to the wanted I/O port or pin headers, see Figure 9.

![Diagram of LED pinout]

Figure 8. General pinout of the button headers
Logic high output from a nRF device lights the LEDs. See Figure 10, for the LEDs circuitry schematic and header P2 pinout.

Figure 9. Connection of nRFgo Motherboard LEDs to an IO header

2.1.9 RS232 serial port interface

The RS232 header (P15, in Figure 2, ) is connected to the RS232 serial port interface (J2, in Figure 2, ) through a RS232 converter. See Figure 11, for the schematic. Normally, only TXD (Transmit Data) and
RXD (Receive Data) are used, but CTS (Clear to Send) and RTS (Request to Send) can be used for hardware flow control.

The UART data pins, TXD and RXD, will be present on different IO port pins depending on the nRF development kit, please see each Development Kit User Guide for details. Connect a double or two single cables between P15 and the correct pins in P8 to P11 to use the RS232 converter. shows a connection example for a nRF24LE1-F16Q48. You must also switch on the RS232 converter with the RS232 serial port switch (S11, in Figure 2.).

Figure 11. RS232 converter schematic

Figure 12. RS232 header P15 connected to IO header
### 2.1.10 ISP interface

A nRF ISP interface (P16, in Figure 2) is available on the nRFgo Motherboard to enable in-circuit programming (ISP) of nRF devices. This interface enables ISP on your application boards. Figure 13, shows the pinout of the ISP connector. Please refer to nRF device product specifications for details on the program interface pinout on each nRF device.

**Note:** You must manually enable the nRF ISP interface in nRFgo Studio before you can use it for ISP on an application board external to the nRFgo Motherboard.

<table>
<thead>
<tr>
<th>Pin number</th>
<th>Signal name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RXD</td>
<td>UART receive data</td>
</tr>
<tr>
<td>2</td>
<td>TXD</td>
<td>UART transmit data</td>
</tr>
<tr>
<td>3</td>
<td>RTS</td>
<td>Request to send</td>
</tr>
<tr>
<td>4</td>
<td>CTS</td>
<td>Clear to send</td>
</tr>
</tbody>
</table>

*Table 2. UART header P15 pin description*

**Figure 13. nRF ISP interface pin out**

<table>
<thead>
<tr>
<th>Pin number</th>
<th>Signal name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RF_VDD</td>
<td>Supply voltage from the connected application board</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Not used</td>
</tr>
<tr>
<td>3</td>
<td>PROG</td>
<td>Program enable</td>
</tr>
<tr>
<td>4</td>
<td>CSN</td>
<td>SPI chip select</td>
</tr>
<tr>
<td>5</td>
<td>MOSI</td>
<td>SPI Master Out Slave In</td>
</tr>
<tr>
<td>6</td>
<td>RESET</td>
<td>Reset signal to the device to be programmed</td>
</tr>
<tr>
<td>7</td>
<td>MISO</td>
<td>SPI Master In Slave Out</td>
</tr>
<tr>
<td>8</td>
<td>SCK</td>
<td>SPI clock</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>Not used</td>
</tr>
<tr>
<td>10</td>
<td>GND</td>
<td>Common ground</td>
</tr>
</tbody>
</table>

*Table 3. nRF ISP interface pin description*

**Note:** RF_VDD is used for signal level shifters on the nRFgo Motherboard. Therefore, the power supply of the nRFgo Motherboard does not have to match the connected application board. The application board must, however, be powered from its own power supply.
2.1.11 nRF debug interface

A JTAG debug interface (P12, \( \text{in Figure 2.} \)) is available on the nRFgo Motherboard to enable the nRF-probe HW debugger to access nRF devices not found on a nRFgo development kit module. This interface enables HW debugging on your own application boards.

The nRF debug interface is wired in parallel with the nRF Module, so to use the nRF debug interface remove the nRF Module from the nRFgo Motherboard. Figure 14, shows the pinout of the nRF debug interface. Please refer to relevant nRF device product specification for debug interface pin out details.

```
TCK  1  TCK
TDO  3  TDO
TMS  5  TMS
Not used 7  Not used
TDI  9  TDI
```

Figure 14. nRF HW debug interface pinout

<table>
<thead>
<tr>
<th>Pin number</th>
<th>Signal name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TCK</td>
<td>JTAG clock</td>
</tr>
<tr>
<td>2</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>3</td>
<td>TDO</td>
<td>JTAG data out</td>
</tr>
<tr>
<td>4</td>
<td>VEXT</td>
<td>Application board supply voltage. Used by signal level shifters on the nRFgo Motherboard to ensure correct signal levels between nRFgo Motherboard and target application board.</td>
</tr>
<tr>
<td>5</td>
<td>TMS</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>VEXT</td>
<td>Not used</td>
</tr>
<tr>
<td>7</td>
<td>RESET</td>
<td>nRF device reset</td>
</tr>
<tr>
<td>8</td>
<td>TDI</td>
<td>JTAG data in</td>
</tr>
<tr>
<td>9</td>
<td>Not used</td>
<td></td>
</tr>
</tbody>
</table>

Table 4. nRF HW debug interface pin description

2.1.12 Extension board connectors

The extension board connectors (\( \text{in Figure 2.} \), EXT A (P5) and EXT B (P6), have the same pinout as the nRF module connectors, offering full access to all the IO’s of the nRFgo development kit used.
The only exception is pin 23 on EXT B. This pin is used to identify the extension module. Please refer to Table 1. on page 10 for the pin description.

These connectors give you full access to all the nRF module I/O pins and the nRFgo Motherboard power supply for application development, see Figure 16, for the mechanical dimensions of the extension board connectors.
Figure 16. Mechanical dimensions of the extension board connectors
2.1.13 Block schematic

Figure 17. The nRFgo Motherboard (nRF6310) block schematic
2.2 Display module (nRF6350)

The 2x16 alphanumerical display (1 in Figure 18.) uses 2 wire serial communication and is connected to the extension board socket 2-wire bus. This enables the display to be used by both the Motherboard main MCU or by any nRF development kit module that has a 2-wire master.

The display uses the slave address 0x3E. This is set in hardware and can not be changed. The display controller is the ST7032i from Sitronix. It uses standard HD44780 commands over a serial interface.

2.2.1 Display

The 2x16 alphanumerical display (1 in Figure 18.) uses 2 wire serial communication and is connected to the extension board socket 2-wire bus. This enables the display to be used by both the Motherboard main MCU or by any nRF development kit module that has a 2-wire master.

The display uses the slave address 0x3E. This is set in hardware and can not be changed. The display controller is the ST7032i from Sitronix. It uses standard HD44780 commands over a serial interface.

2.2.2 Joystick

The joystick (2 in Figure 18.) is connected to a 2-wire port extension IC (4 in Figure 18.), MAX7329 from Maxim. The 2-wire port extension IC uses the slave address 0x3F on the 2-wire bus and it also has an interrupt line that signals use of the joystick. This uses the spare1 line on the Extension Board connector (3 in Figure 18.).

Please refer to the Software Development Kit (SDK) of your nRFgo compatible development kit for examples on how to use the display and joystick.
3 Troubleshooting

I have connected the nRFgo Motherboard to the PC with the USB cable, but the LEDs on the nRFgo Motherboard don't light up

- Verify that the nRFgo Motherboard is turned ON (S9)
- Verify that the power selection button (S8) is set to “VBUS”
- Remove all third party hardware connected to the nRFgo Motherboard in order to remove possible short circuits
- Change USB port on the PC
- Try a different USB cable

I have connected the nRFgo Motherboard to an external power supply but the power indicator LED’s don’t light up

- Verify that the nRFgo Motherboard is turned ON (S9)
- Verify that the power selection button (S8) is set to “SUPPLY”
- Remove all third party hardware connected to the nRFgo Motherboard in order to remove possible short circuits
- Make sure external power supply level are within 8 - 20V

I can’t see my nRFgo Motherboard in the nRFgo Studio user interface

- Verify that the USB connection is correct
- Verify that the nRFgo Motherboard is switched ON, VCC and VTG LED is lit
- Make sure no other software is using the nRFgo Motherboard. For example nRFprobe.
- Try a different USB port
- Replace USB cable
- Restart nRFgo Studio
- Remove and Re-install USB drivers (or entire nRFgo Studio)