nRF24LE1 Development Kit

User Guide v1.1

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Revision History

Date	Version	Description
August 2008	1.0	
May 2011	1.1	Updated photographs and section 1.4 on page 5. Added chapters 2 on page 6 and 3 on page 7.

Contents

1 Introduction

This Development Kit is designed for use with the nRFgo Starter Kit (sold separately). Once you connect the modules contained in this kit to the nRFgo Motherboard from the nRFgo Starter Kit, you can begin testing, developing and debugging your nRF modules.

This User Guide covers the nRF24LE1 Development Kits:

- nRF24LE1 24pin 4x4mm (nRF24LE1-F16Q24-DK)
- nRF24LE1 32pin 5x5mm (nRF24LE1-F16Q32-DK)
- nRF24LE1 48pin 7x7mm (nRF24LE1-F16Q48-DK)

1.1 Who should read this user guide?

To fully understand this User Guide a background in software development and/or electronic engineering is required. The nRFgo Starter Kit User Guide must be read before reading this document.

1.2 Minimum requirements

Minimum requirements for using the nRF24LE1 Development Kit are:

- nRFgo Starter Kit
- Computer with 2 USB ports
- Windows XP, Windows 7

1.3 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 New bold.`**
- File names and User Interface components are written in regular **bold**.
- Cross references are underlined and highlighted in blue.

1.4 Kit content

The nRF24LE1 Development Kit contains the following hardware, software and documentation components.

Figure 1. Kit content

nRF24LE1 Development Kit content:

- 2 nRF24LE1 modules with PCB antenna
- 1 nRF24LE1 module with SMA connector
- 5 nRF24LE1 samples
- 1 printed Getting Started Guide
- Software and documentation downloaded from www.nordicsemi.com, including:
  - This user guide
  - nRFgo Studio
  - nRFprobe HW debugger
  - Software Development Kit (SDK)
  - Development Kit hardware schematics and PCB layout files

2 Programming an nRF24LE1 module

The nRF24LE1 device features a microcontroller that is used for the application firmware. To test your own applications or examples from the SDK, you need to program an nRF24LE1 module. It is assumed that you have downloaded the latest version of tools and documentation before proceeding with this. Please refer to the nRF24LE1 Development Kit Getting Started Guide.

To program an nRF24LE1 module from the software application nRFgo Studio:

1. Make sure the ON/OFF switch (**S9**) on the nRFgo Motherboard is turned **OFF**.
2. Plug an nRF24LE1 module onto the module connectors (MOD A and MOD B) on the nRFgo Motherboard.
3. Connect the nRFgo Motherboard to your computer using a USB cable.
4. Turn **S9** to **ON**.
5. Start the nRFgo Studio from the Windows **Start** menu - **All Programs** - **Nordic Semiconductor** - **nRFgo Studio**.
6. In nRFgo Studio, select **Motherboards** in the **Device Manager** pane and then select **Module** - <nRF24LE1xx>.
7. If a new version of nRFgo Studio is used, you may need to upgrade the firmware on the nRFgo Motherboard. Please follow the instructions in nRFgo Studio.
8. Select the file you want to download to nRF24LE1 for programming.
9. Click the **Program** button.

3 Create an RF link between a host and a device

This chapter describes how you can set up two nRFgo Motherboards to function respectively as a host and a device, and how you can create an RF link between them.

3.1 Set up the host

1. Select one of the nRFgo Motherboards as the host, and mount an nRF24LE1 module with a PCB antenna (or with an SMA connector and external antenna) onto the nRFgo Motherboard.
2. Turn **S9** to **ON**.
3. Open nRFgo Studio.
4. In nRFgo Studio, browse for the precompiled .hex file **enhanced_shockburst_prx_nrf24le1.hex** which is by default located at **Nordic Semiconductor\nRFgo <version number>\precompiled_ hex\nRFgo SDK\precompiled_hex**.
5. Select the .hex file by clicking the **Open** button.
6. Click the **Program** button.
7. Use a flat cable (included in the nRFgo Starter Kit) to connect port 0 on header P8 to the LEDs on header P2.

3.2 Set up the device

1. Select the other nRFgo Motherboard as the device, and mount an nRF24LE1 module with a PCB antenna (or with an SMA connector and external antenna) onto the nRFgo Motherboard.
2. Turn **S9** to **ON**.
3. In nRFgo Studio, browse for the precompiled .hex file **enhanced_shockburst_ptx_nrf24le1.hex** which is by default located at **Nordic Semiconductor\nRFgo <version number>\precompiled_ hex\nRFgo SDK\precompiled_hex**.
4. Select the .hex file by clicking the **Open** button.
5. Click the **Program** button.
6. Use a flat cable (included in the nRFgo Starter Kit) to connect port 0 on header P8 to the buttons on header P1.

3.3 Test the RF link between the host and the device

1. Press the buttons on the device Motherboard to see if the LEDs light up on the host Motherboard. If they light up, then you have successfully created a link between the host and the device.

4 Hardware description

The nRF24LE1 modules with a PCB antenna and the nRF24LE1 modules with an SMA connector are identical except for the RF interface. The core circuitry of the nRF24LE1 is outlined by a frame in Figure 2. Gerber files for the core circuitry PCB layout are available for download from www.nordicsemi.com.

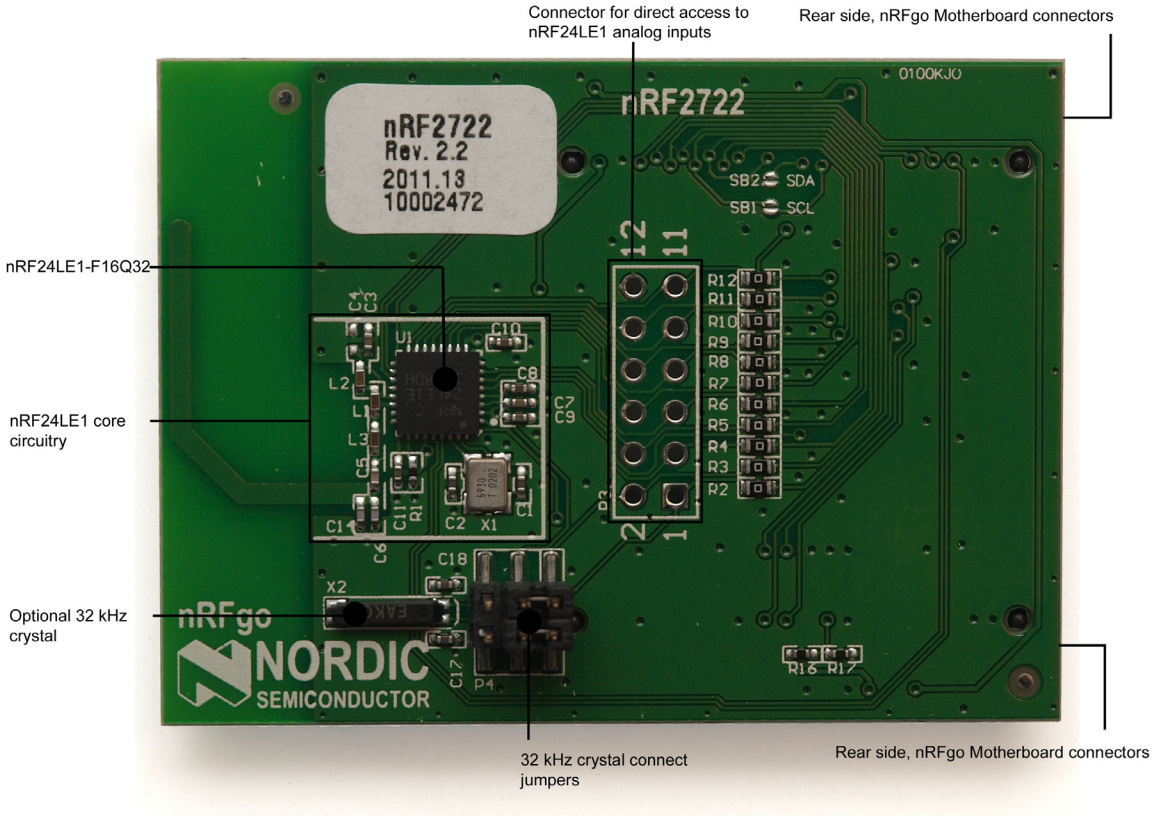

Figure 2. nRF24LE1 module with PCB antenna, using the nRF24LE1-F16Q32 device

4.1 nRF24LE1 module connectors

The nRF24LE1 module connects to the nRFgo Starter Kit Motherboard by inserting its connectors P1 and P2 into MOD A and MOD B on the nRFgo Motherboard. Once you have inserted your nRF24LE1 module you can begin testing and developing.

Note: When inserting the module into the nRFgo Motherboard do not apply too much pressure on the antenna end of the module as this may distort the pins in the nRFgo Motherboard connectors. Always remove the module by pulling it straight up.

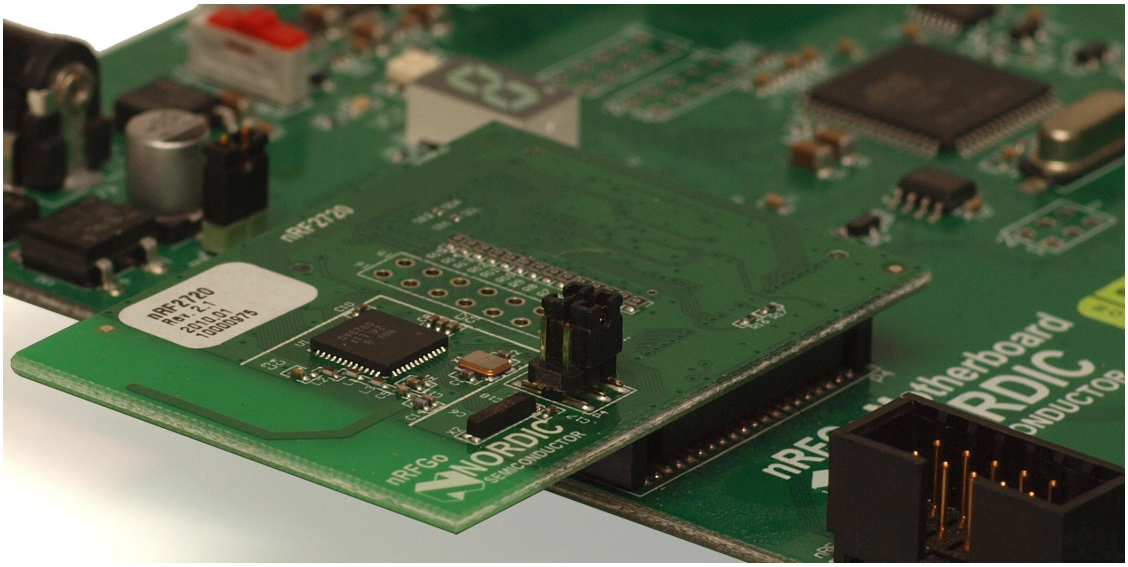

Figure 3. Plugging in an nRF24LE1 module

The nRF24LE1 module connectors, P1 and P2, are located on the underside of the nRF24LE1 module and have all the I/Os required for communicating with the nRFgo Motherboard.

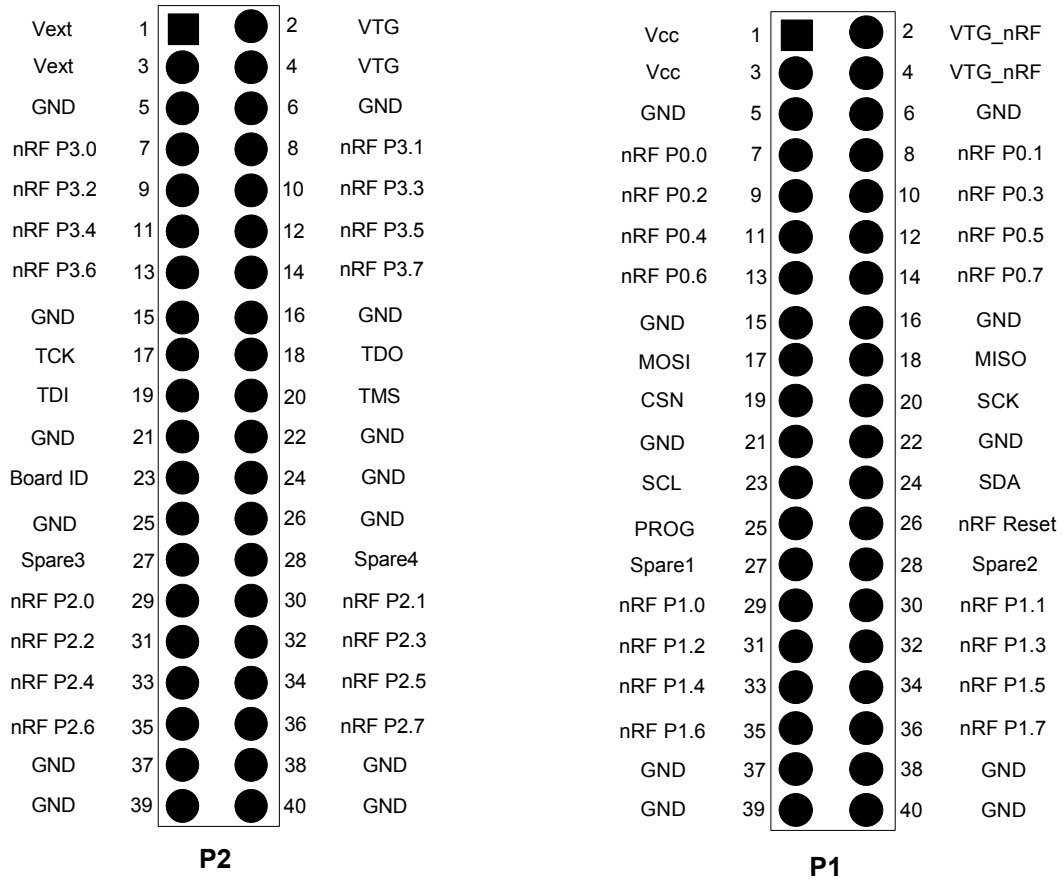

Figure 4. nRF24LE1 module connectors - P2 and P1

Pin numbers	P2		P1	
	Name	Function	Name	Function
1, 3	VEXT	Power supply output for circuitry on nRFgo Motherboard	VCC	nRFgo Motherboard main power supply.
2, 4	VTG	Target Power supply for non nRF device(s) on the development kit module.	VTG_nRF	Target Power supply for nRF devices on the development kit module.
7 - 14	P3.x	nRF device port 3	P0.x	nRF device port 0
15 - 16	GND	Ground	GND	Ground
17 - 20	TCK,TDI, TDO, TMS	nRFprobe HW debugger JTAG interface	MOSI, MISO, CSN SCK[1]	nRFgo Motherboard main MCU SPI control interface
21 - 22	GND	Ground	GND	Ground
23	Board ID[2]	Development kit ID	SCL[1]	2 wire clock from nRFgo Motherboard main MCU
24	GND	Ground	SDA[1]	2 wire data from nRFgo Motherboard main MCU
25-26	GND	Ground	PROG[2] nRF Reset[2]	nRFgo Motherboard main MCU program enable and reset control of nRFgo Development Kit module
27 -28	Spare x	Reserved	Spare x	Reserved
29 - 36	P2.x	nRF device Port 2	P1.x	nRF device port 1
37 - 40	GND	Ground	GND	Ground

1. nRFgo Motherboard main MCU control interfaces only. nRF device SPI and 2-wire interfaces (if present) are available in the nRF device ports (pins 7 - 14 or 29 - 36).
2. Used by nRFgo Motherboard only

Table 1. Description of the nRF24LE1 module P2 and P1 connectors pins

Note: Pins 17 to 20 in P2 are connected to the flash SPI or slave SPI depending on the state of the PROG.

The pinout of each of the generic nRF ports (Px.x) will change depending on which nRFgo Development Kit is used. The following pinouts apply for the different nRF24LE1 Development Kits:

	Development Kit Port				
	P0.x	P1.x	P2.x	P3.x	Comment
nRF24LE1-F16Q24-DK	P0.x	Not Used[1]	Not Used[1]	Not Used[1]	P0.7 not used[1]
nRF24LE1-F16Q32-DK	P0.x	P1.x	Not Used[1]	Not Used[1]	P1.7 not used[1]
nRF24LE1-F16Q48-DK	P0.x	P1.x	P2.X	P3.x	P3.7 not used[1]
nRFgo Motherboard I/O header	P8	P10	P9	P11	

1. Unused pins and ports are left open on the nRF24LE1 module

Table 2. nRF24LE1 Development Kit pinouts

4.2 32 kHz crystal

The nRF24LE1 can use an optional 32 kHz crystal (Figure 2.) for high accuracy and low power timing. On the nRF24LE1 module, P0.0 and P0.1 are disconnected from the nRFgo Motherboard and connected to the two jumpers at the position closest to the 32kHz crystal, see Figure 5.

Note: Jumper P4 only facilitates the physical connection of the 32 kHz crystal. In order for the crystal oscillator to be used by the nRF24LE1 the device must also be configured correctly, please refer to the nRF24LE1 product specification for details.

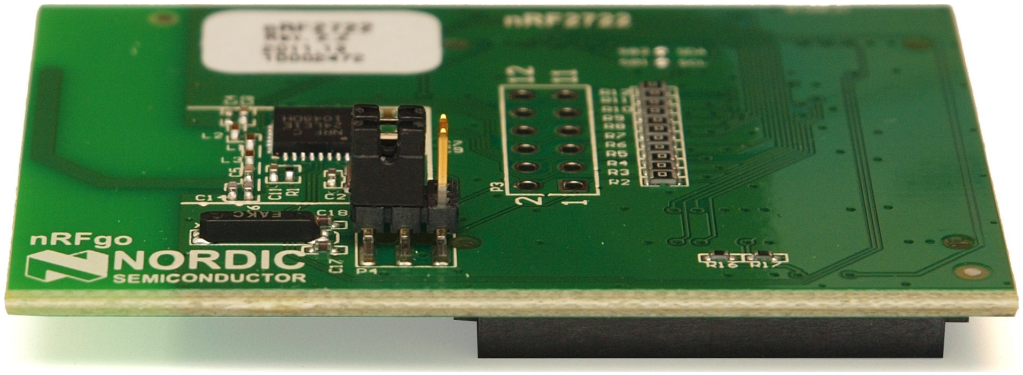

Figure 5. Jumpers in position for connecting the crystal

If the jumpers are placed in the position furthest from the crystal (this is the default position of the jumpers when shipped) P0.0 and P0.1 are connected to the nRFgo Motherboard and can be used for normal I/O. See Figure 6.

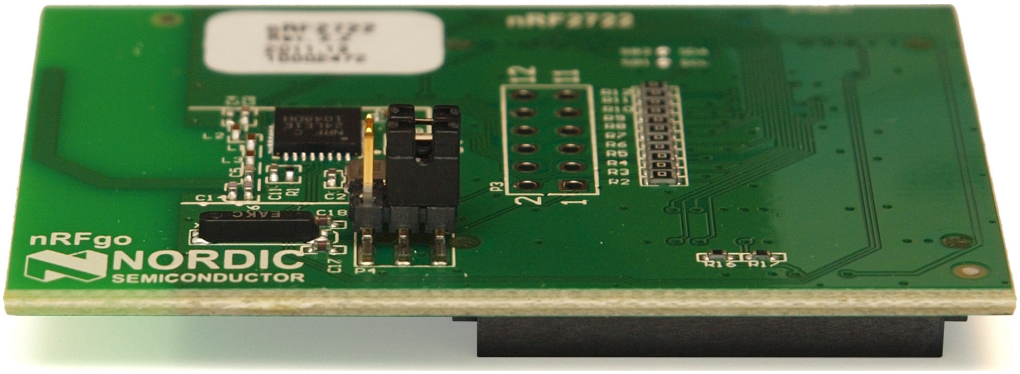

Figure 6. Jumper in normal position

4.3 Analog inputs

The analog inputs of the nRF24LE1 device are by default accessible on the Port I/O headers P8-P11 on the nRFgo Motherboard together with other digital I/Os. However, due to the routing length and possible system noise introduced by application circuitry, the quality of high resolution sampling of analog input signals may suffer.

Direct access to the nRF24LE1 analog inputs is therefore available on connector P3 (Figure 7.) on the nRF24LE1 module as well.

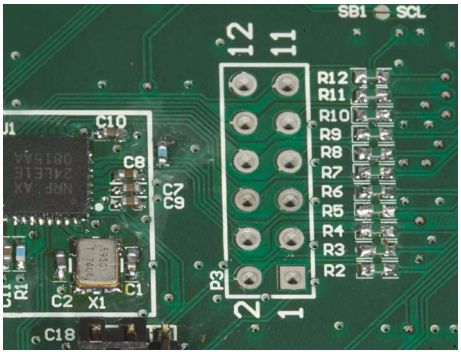

Figure 7. Connector for direct access to nRF24LE1 analog pins

The number of connection points on P3 follows the number of analog pins on each version of the nRF24LE1 device. The tracks to these nRF24LE1 pins are routed through an 0 ohm resistor (R2 - R12 in Figure 7.) to the nRF24LE1 module connectors P1 and P2. To avoid any noise from the nRFgo Motherboard, the 0 ohm resistors must be removed on the inputs that are connected directly to external analog circuitry.

Note: It is important that you only remove the 0 ohm resistors on the pins that you use for high-quality analog input. If the 0 ohm resistors on the pins used for nRF24LE1 programming and HW debugging are removed, you will not be able to program and debug the device.

4.4 Programming interface on the nRF24LE1-F16Q48 device

On the nRF24LE1-F16Q48 device the flash interface and the SPI slave interface are not located on the same pins. To interface both the flash interface and the SPI slave interface with the SPI master on the nRFgo Motherboard, the SPI bus must be switched while programming to the flash interface of the nRF24LE1-F16Q48 device. Two CMOS analog switches, placed on the underside of the nRF24LE1 module and controlled by the PROG signal, are used for this purpose. For normal use, the switches select the SPI slave interface of the nRF24LE1-F16Q48 device. These switches are only needed for use with the nRFgo Motherboard, not for any other applications.

4.5 Use of the 2-wire interface with nRFgo Display module

To be able to use an nRFgo Display module fitted in the extension port of the nRFgo Motherboard, the solder bridges named SB1 and SB2 on the nRF24LE1 module must be shorted. This will route the 2-wire interface of the nRF24LE1 device to the Display module.

4.6 Module schematics and PCB layouts

You can download nRF24LE1 Development Kit hardware schematics and PCB layout files from www.nordicsemi.com.

5 Troubleshooting

The nRF24LE1 module doesn't appear in the nRFgo Studio when it is plugged into the nRFgo Motherboard.

- Ensure that the nRFgo Motherboard is present in the nRFgo Studio. If not, refer to troubleshooting of the nRFgo Starter Kit User Guide.
- Verify that the nRF current measurement jumper (P7) on the nRFgo Motherboard is fitted.

I have connected an RS232 cable between the nRFgo Motherboard and my computer, but I can't communicate with the Development Kit.

- On the nRFgo Motherboard:
  - Verify that you have connected the signals in the UART header (P15) to the pins in I/O headers (P8-P11) actually carrying the UART signals from the nRF24LE1 module.
  - Verify that RS232 buffer is enabled by S11 set to **ON.**
- Verify that the UART module and I/O pins of the nRF24LE1 device are configured correctly, please refer to the device's product specification for details.

The 32kHz crystal oscillator on the nRF24LE1 device is not running.

- Verify that the 32kHz crystal jumper (P4) on the nRF24LE1 module is set correctly, see section 4.2 on page 12 of this document.
- Verify that the nRF24LE1 device CKLF configuration is correct, please refer to nRF24LE1 product specification for details.