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UM11081

User Manual for LPCXpresso802 Board

Rev. 1.01 — 6 December 2017 User Manual

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1.0	20171128	First draft
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1.02	20171206	Corrected board part number references.

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1. Introduction

The LPCXpresso family of boards provides a powerful and flexible development system for NXP's Cortex-M MCUs. They can be used with a range of development tools, including the MCUXpresso IDE toolchain. The LPCXpresso802 board is developed by NXP to enable evaluation of and prototyping with the LPC802 MCU. Figure 1 shows the LPCXpresso802 Board.

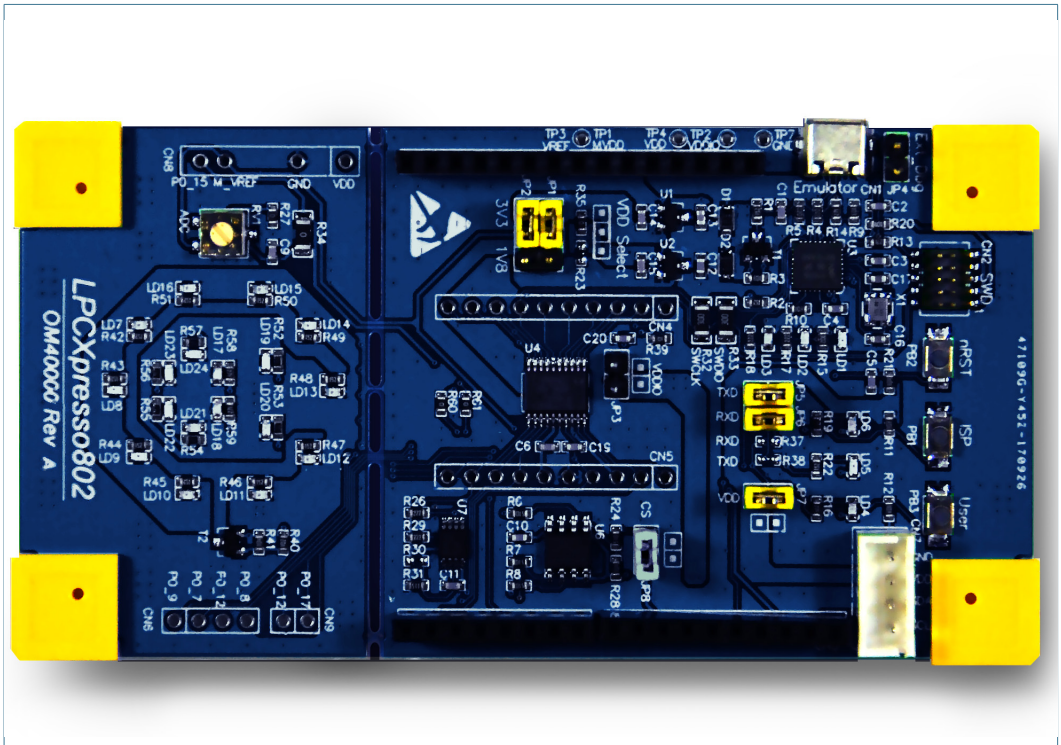


Fig 1. LPCXpresso802 Board

The LPCXpresso802 board includes the following features:

- Compatible with MCUXpresso IDE and other popular toolchains (incl. IAR and Keil)
- LPC802 Arm Cortex-M0+ MCU running at up to 15MHz
- On-board CMSIS-DAP (debug probe) with VCOM port, based on LPC11U35 MCU
- Debug connector to allow debug of target LPC802 MCU using an external probe
- LPC802 ISP and User/Wake buttons
- LPC802 Reset button
- 1Mb Winbond SPI flash
- NXP LM75BDP temperature sensor
- Detachable board section with LEDs and potentiometer for prototyping and demo development
- I^2C Grove connector for easy connection of sensors, or to use the LPCXpresso802 as an I/O expander peripheral

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2. Board Layout

Figure 2 below shows the layout of the LPCXpresso802 board, indicating location of jumpers, buttons and connectors/expansion options.

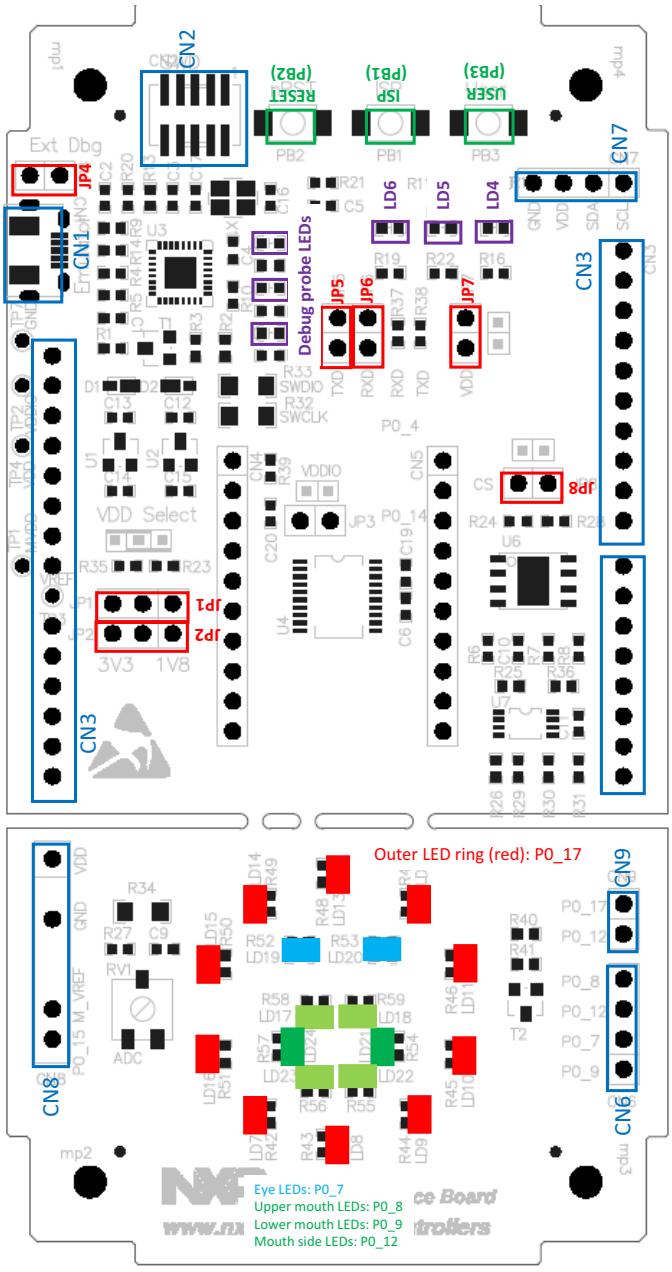


Fig 2. Board layout (top silkscreen)

Table 1 below shows the layout of the LPCXpresso802 board, indicating location of jumpers, buttons, connectors/expansion options and MCU devices.

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Table 1. Jumpers and connectors

Circuit reference	Description	Reference section
JP1	Power rail selection and/or ammeter connection for LPC802 supply. Insert a jumper either between the center and left pin for 3.3V or between center and right pin for 1.8V operation. Note that a jumper must always be installed for the LPC802 to operate.	See schematic.
JP2	Voltage selection for LPC802 ADC reference. Insert a jumper either between the center and left pin for 3.3V or between center and right pin for 1.8V operation.When a 3.3V reference is used the LPC802 supply must also be set to 3.3V (see JP1 above)	See schematic.
JP4	Inserting a jumper on JP4 holds the LPC11U35 debug probe in reset. Install JP4 when using an external debug probe.	[4.1]
JP5, JP6	PIO0_4 (TXD) and PIO0_0 (RXD) are connected to a LPC11U35 debug probe UART port via these two jumpers. The same LPC802 UART is shared with the Arduino connectors, so JP5 and JP6 may be removed to prevent contention between the debug probe and devices connected to the LPC802 via this peripheral.	[4]
JP7	JP7 is connected in-line between with the anodes of the User LEDs and the 3.3V VDD supply. This jumper may be removed to prevent unwanted current draw and when the snap-off section of the board is being used (since the same ports (PIO0_8, PIO0_9 and PIO0_12) are used to drive LEDs on that circuitry.)	See schematic.
JP8	JP8 is connected in-line with the SPI chip select to the SPI flash memory device (U6). This jumper may be removed to disable U6 when PIO0_11 is being used be a device connected to the Arduino expansion connectors.	See schematic.
CN1	USB connector for debug probe / board power.	[4]
CN2	External debug probe connector.	[4]
CN3	Arduino expansion connectors.	[5.1]
CN6, CN8, CN9	Expansion connectors for snap off board. If the snap-off section of the board is detached, installing these connectors will enable the snap-off section to be reconnected via the Arduino connectors.	[7.6]

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3. Getting Started

The firmware for the on-board debug probe and Windows 7/8 driver for the virtual com (VCOM) port are available from http://nxp.com/demoboard/OM40000 under the Software and Tools tab (look under “Software” download types). If using Window 7 or 8, you will need to install the VCOM driver by running the installer program before attempting to use the board. After downloading and unzipping the package, run the installer program provided to install the driver (see installation notes included in the package for further information.)

The LPCXpresso802 board is pre-programmed with a simple demo program (“the Demo”) to illustrate some features of the board. Connect a micro USB cable from connector J4 to a host computer or power supply to power up the board and run this program. The Demo uses the LEDs on the detachable section of the board; the outer ring of the LED “face” (red LEDs) vary in brightness depending on board temperature (from the LM75 sensor), and the expression on the LED “mouth” varies with the position of the potentiometer.

The rest of this section describes how to set up your board for use with MCUXpresso IDE and/or third party tools.

3.1 Using the board with MCUXpresso IDE

Once the board debugger firmware has been installed (as described in Section 3.1), to use the board during a debug session in MCUXpresso IDE, connect to the host computer then follow the steps below.

Note that MCUXpresso IDE has built-in knowledge of the LPC802 part family, so does not require any SDK installation steps. Follow the steps below to build and run a simple example from the LPC802 Code Bundles provided by NXP.

1. Code Bundles for the LPC8xx family are included in the MCUXpresso IDE installation. These can also be downloaded from nxp.com (in case of any updates between IDE releases): http://www.nxp.com/products/software-and-tools/software-development-tools/software-tools/lpc800-code-bundles:LPC800-Code-Bundles.
2. Open a new workspace in the IDE.
3. In the Quickstart panel of the IDE, click in “Import a new project from the file system”
4. In the “Import project(s) from file system...” dialog box that opens, click “Browse...” in the Project Archive (from zip) section, and select the LPC802 Code Bundle zip file from the Code Bundles directory in the MCUXpresso IDE installation (or select a version downloaded from nxp.com, as described in Step 1 above.) Click “Next >” on the “Import project(s) from file system...” dialog to continue.
5. You will see several projects listed in the Code Bundle; click “Finish” to import them all.
6. The dialog box will close, and you will see the imported projects in the Project tab at the upper left window of the IDE. Click on Example_Multi_Timer_Blinky to select it, then select Build from the Quickstart panel. You will see the build processing in the Console window to the right of the Quickstart panel. The projects are set up to include dependency checking, so the build process will automatically build the utility and peripheral libraries as well as the example program.

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7. Ensuring the LPCXpresso802 is connected to the host computer, click Debug in the Quickstart panel. The IDE will search for available debug probes. Select the debug probe that appears for your board, then click OK. Note that the IDE will remember your selection for the next time you debug this project, so will not prompt for this again, unless it cannot find the board.
8. The code will execute to main. Press F8 to resume and run the program. You will now see the User LEDs light, each color in turn.

3.2 Using LPCXpresso802 with 3rd Party IDEs

Once the board debugger firmware has been installed (as described in Section 3.1), to use the board during a debug session in MCUXpresso IDE, it can be used with 3rd party development tools. Set up will vary between Development Tools, but the board debug probe should supported as a CMSIS-DAP probe in all cases).

Code Bundles, including sample projects for Keil MDK and IAR EWARM, are available from NXP's website at http://www.nxp.com/products/software-and-tools/software-development-tools/software-tools/lpc800-code-bundles:LPC800-Code-Bundles. Refer to the readme files provided with each code bundle in order to build/debug.

When using Keil MDK, install the Device Pack for the LPC802 (version 1.6 or later) before attempting to use the board.

When using IAR EWARM, ensure that you have version 8.20.1 or later in order to have LPC802 device family support.

3.3 Debugger firmware update (optional)

The MP board comes pre-programmed with a CMSIS-DAP firmware image; it is not normally necessary to update the debugger firmware image, but this can be done by following the steps below.

1. Hold down the reset button and keep it held down while applying power to the board. Release reset. Using File Explorer (or equivalent on Mac/Linux platforms), look at the available drives on your system. A device called CRP_DISABLED will appear.
2. Delete the firmware.bin file on the CRP_DISABLED drive.
3. Drag and drop the firmware.bin file you downloaded from nxp.com on to the CRP_DISABLED drive.
4. Repower the board.
5. The board should now enumerate on your system - allow 20-30 seconds for this to complete.

4. Debug Probe

Later production LPCXpresso802 boards have been programmed with an updated version of CMSIS-DAP, and a standard UART VCOM port. It is recommended that the LPC11U35 firmware be updated to the latest version available on the LPCXpresso845 board page, under the Software and Tools tab. See Section 3.3 for information on how to update the debug probe firmware.

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The CMSIS, DISK and COMM LEDs are connected to the LPC11U35 device. The behavior of the LEDs will vary depending on firmware used, typically the CMSIS LED will blink when debug communication is occurring, and the COMM LED will blink when data is being transferred over the VCOMM port.

4.1 Using an external debug probe

An external debug probe that supports ARM's SWD interface, such as a SEGGER J-Link or PE Micro probe, can be used with the LPCXpresso802 board. The external probe must be connected CN2. When an external debug probe is used, the on-board probe must be held in reset by placing a jumper on JP4. It is recommended that JP4 is fitted before powering the board.

5. Expansion connectors/headers

The LPCXpresso802 board provides an Arduino UNO R3 shield site and a Grove I2C connector to add additional peripherals, sensors or other circuitry, including off-the-shelf expansion boards; this section describes these options. All LPC802 signals are also available on breakout headers CN4 and

. For further details please refer to the board schematics.

5.1 Arduino UNO Rev 3 expansion connectors

The Arduino UNO Rev 3 compatible connectors provided on the LPCXpresso802 board provide I2C, SPI, UART, PWM and analog function connections to shield boards that are available from various 3rd part suppliers, or for customer use. The pin mappings are shown in the tables below. Some connections are shared with other board features, as shown (in addition to being available on breakout headers CN4 and CN5.)

Table 2. Arduino expansion connector pin mappings (CN3)

CN3 pin	Arduino signal	LPC802 pin	Shared with
9	A0	PIO0_15	Potentiometer
15	I2C SCL	PIO0_16	Temperature sensor Grove connector (CN7)
16	I2C SDA	PIO0_10	Temperature sensor Grove connector (CN7)
17	AREF	n/a (3.3V)	
18	GND	n/a (GND)	
19	SPI SCK	PIO0_14	SPI flash
20	SPI MISO	PIO0_1	SPI flash
21	SPI MOSI	PIO1_13	SPI flash
22	SPI SSEL	PIO1_11	SPI flash
23	PWM	PIO1_17	
24	GPIO	PIO0_12	User LED3
25		PIO0_8	User LED1
26	PWM	PIO0_12	User LED3
27	PWM	PIO0_7	

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Table 2. Arduino expansion connector pin mappings (CN3)

CN3 pin	Arduino signal	LPC802 pin	Shared with
28	GPIO	PIO0_9	User LED2
31	TX	PIO0_0	Debug UART
32	RX	PIO0_4	Debug UART

Note that the default ports for ISP UART boot are connected to CN3.

5.2 Grove connector

The LPCXpresso802 board includes a header for connection of Seeed Studio Grove I^2C sensors. This header supplies the I2C connections plus 3.3V and ground.

6. Power measurement

JP1 is provided to enable supply voltage selection for the LPC802, but may also be used as an insertion point for an ammeter to measure current flow to that MCU.

7. Other board features

This section describes other board features not detailed elsewhere in this document.

7.1 ISP booting and the ISP button

The LPC802 can be forced into ISP boot mode by holding down the ISP button (PB1) and then holding and releasing reset. The ISP button is connected to LPC802 pin PIO0_12, which is also routed to the Arduino expansion connector and to the cathode of the green user LED3. LPC802 pin PIO0_12 can be reconfigured by software so that the button can be used by an application as a general purpose button (refer to the LPC802 User Manual).

7.2 User button

The Wake button (PB3) is for general purpose use by LPC802 applications. It is connected to a 10K ohm pullup to 3.3V, and to the LPC802 PIO0_8 pin. It is also shared with blue User LED1.

7.3 User LEDs

Three users LEDs are provided on the board, one blue, one green and one red. The anodes of the LEDs are connected together, then through jumper JP7 to the 3.3V regulator output. JP7 can be opened to prevent leakage from the LPC802 pins through the diodes if accurate power measurement measurements are being performed. All the LPC802 ports used to drive the User LEDs are also connected to LEDs on the detachable section of the board, and are shared with the Arduino expansion connector. The LEDs are connected to the LPC802 as shown in the table below.

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Table 3. User LED connections

LED	LPC802 pin
Blue (LED1)	PIO0_8
Red (LED2)	PIO0_9
Green (LED3)	PIO0_12

7.4 Temperature sensor (LM75)

An NXP temperature sensor is included on the LPCXpresso802. This device interfaces to the I2C peripheral of the LPC802, with an address of 0x1001100. Zero ohm resistors (R60 and R61) are provided in-line with the SDA and SCL signals so that this devices may be disconnected if not required.

7.5 SPI flash (Winbond W25X10CLSNIG)

A 1Mb SPI flash from Winbond is included on the LPCXpresso802. This device interfaces to the SPI peripheral of the LPC802. A jumper (JP8) is provided to this device can be disconnected (by disabling the SPI chip select PIO_11).

7.6 Detachable section

The LPCXpresso802 incorporates a detachable section, with LEDs and a potentiometer, intended for demonstration development. The LEDs are in the shape of an emoji face, driven by a combination of 5 GPIOs, with the LEDs lighting then the associated GPIO is driven low. The outer ring of the face (red LEDs) is controlled by PIO0_17, via a transistor. The eyes (blue LEDs) are driven by PIO0_8, the top lip (green LEDs) by PIO0_7, the bottom lip by PIO0_12 and the sides of the mouth (green LEDs) by PIO_9.

Potentiometer RV1 is connected to the voltage reference set by JP2 (either 1.8V or 3.3V, or a voltage injected via the center pin of this jumper). The wiper of the potentiometer is connected to PIO0_15 (which also connects to the A0 signal on the Arduino expansion connector).

The Detachable Section of the board can be separated from the rest of the board by applying pressure along the line shown in Figure 3, while gently bending the board. Once the sections of the board have been separated, the Detachable Section and still be used with the main board by soldering connectors into CN6, CN8 and CN9. The Detachable Section can then be plugged into the CN3 Arduino headers, aligning the gap between CN6 and CN9 with the gap in the right hand part of CN3 (assuming the board is oriented as shown in this Figure).

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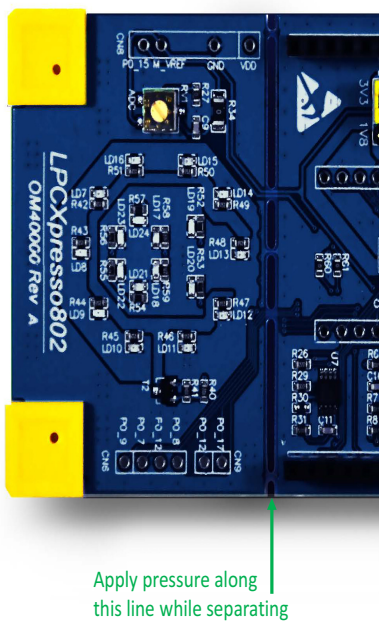


Fig 3. Separating Detachable Section of LPCXpresso802 Board

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