QuickStart Guide

**LPC2468 Industrial Reference Design Platform
System Development Kit Version 1.2**

August 2008

1.0 System Overview

The LPC2468 Industrial Reference Design (IRD) is a platform targeted at RTOS based embedded systems. Designed around a flexible "Core" and "Base" Printed Circuit Board (PCB) concept, it features many of the system functions and wired communications protocols found in today's embedded applications. The flexible design allows for changing of core and base boards, displays and keypads as needed by the targeted application. The platform is powered from an external 5VDC power supply, or from a Power-Over-Ethernet (POE) Device application board. Circuitry to measure current consumption of 3.3VDC while operating the platform in different modes is designed into the base board. Software development and debug are accomplished with the use of a JTAG connection and Micrium's system monitor feature. Hardware circuitry is incorporated to facilitate In-System-Programming (ISP), allowing different software packages to be easily loaded and demonstrated on the platform.

The version 1.2 kit features:
- The Embedded Artists (red PCB), or NXP (black PCB) designed LPC2468 core board.
- The NXP-designed base (green PCB) board
- A phone style keypad board
- A 20 X 4 Character LCD module.

The platform is built around Micrium µC/OS-II Real Time Operating System (RTOS), and provides software support for 10/100Base Ethernet, USB Host/Device, CAN, RS-232, and I^2C wired communication protocols. Additionally, the platform provides flexible interfaces for:
- Vacuum Fluorescent Displays (VFD) or Liquid Crystal Displays (LCD)
- UART expansion
- I^2C expansion
- Application specific hardware through connection headers on the baseboard.

The platform is powered from an external 5VDC power supply, or from a Power-Over-Ethernet (POE) Device application board (optional). Circuitry is provided to monitor system current consumption of 3.3VDC while operating the platform in different modes.

2.0 Assembling the Hardware

2.1. Packing List

Verify the contents of IRD kit:

1. LPC2468 "Processor Core Board"
2. NXP Industrial Reference Design (IRD) "Baseboard", version 1.3
3. LCD Display Lumex model# LCM-S02004DSR
4. Display ribbon cable (assembled on the LCD/VFD Display)
5. NXP I^{2}C keypad, version 1.0
6. External temperature sensor (2N3906-type red/white cabled temperature sensor)
7. Condor, 5VDC 2.5A power supply
8. Ethernet Cable
9. USB A/B cable
10. RS232 cable
11. IAR J-Link JTAG Debugger and cables
12. IAR CD containing the Embedded Workbench Integrated Development Environment
13. NXP CD containing the documentation, software and HTML Files
14. Quick Start Guide (this document)

Contact your supplier if components are missing.

The kit may also include other components as NXP bundles this kit with other connective device reference platforms (e.g. CAN Board, DALI Solid State Lighting Board, etc). If other components are included, see the guide associated with that platform. The guide can be found on the included CD.

2.2. Kit Assembly

Please read carefully the following assembly instructions. Failure to follow these instructions may cause the platform not to function properly. The following instructions apply to the IRD platform only.

1. The IRD demonstration code programmed into the LPC2468 MCU uses HTML pages that are on the NXP CD. A USB Flash drive (not provided) is needed for the PC GUI application to work. The USB Flash drive must be formatted as "FAT" or "FAT16", and the whole folder \HTTPRoot should be copied from the CD to the Flash drive. All the web page files MUST be stored on the USB Flash drive in the folder: \HTTPRoot (e.g. E:\ HTTPRoot).
   See instructions in section 3 (Page 6) for more details.

2. Connect the following boards as shown in Figure 1 (next page):
   - LCD display: Connected to J_VFD
   - I^{2}C Keypad: Connected to J_KEYPAD
   - External temperature sensor: Connected to J_TEMP (Red wire to D+, White to D-)
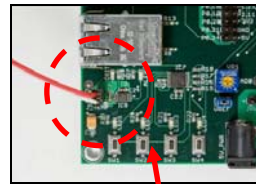   - USB Flash Drive: Connected to USB_HOST connector

Figure 1
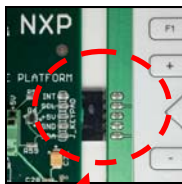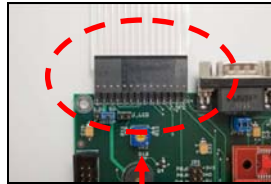
Keypad Connection   VFD/LCD Connection   Temp Sensor Connection   USB Drive Connection

3. Ensure that the following jumpers are in place.

Jumper	Default Connection	Description
JP2	Jumper connected	Used for I_{CC} measurement on IRD platform when disconnected
JP18	Pins 1&2 connected	Enables 3.3VDC from onboard regulator
JP19	Pins 1&2 connected	Enables 5.0VDC from external Condor power supply.
J_VDISP	Pin 2&3 connected	Provides 5.0VDC to LCD Display
VREF	Jumper connected	Provides ADC/ DAC VREF connection to the microcontroller
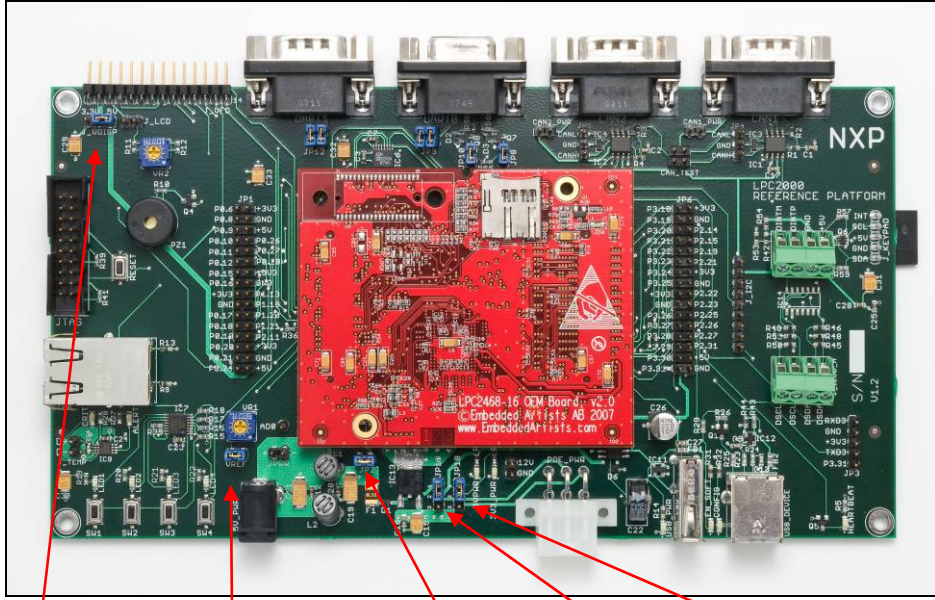
| J VDISP | VREF | JP2 | JP18 | JP19 |

<table>
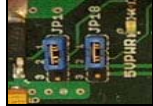<tr><td>🛑 STOP</td><td>Before moving to Step 4, make sure that ALL the instructions described in Step 1 (USB drive), Step 2 (hardware connections) and Step 3 (jumper configuration) have been properly followed. If this kit contains an application board (DALI board, Motor Controller board, etc …), please also read carefully the Quick Start Guide that comes with it. Failure to follow these instructions may cause the platform not to function properly</td></tr>
</table>

4. Connect the external Condor 5VDC power supply to JPWR (2.5mm plug)

5. Wait a few seconds for the system to power-up and examine the LCD display
   for the following text:
   1st line: **NXP SEMICONDUCTORS**,
   2nd line: **03/25/2008**
                      (date of source code release), followed by
                      TEMPERATURE: XX º C
                      (measured ambient temperature, in degrees Celsius)
   3rd line: **INDUSTRIAL PLATFORM**
   4th line: contains the firmware release date and version

```
N X P   S E M I C O N D U C T O R S
0 3 - 2 5 - 2 0 0 8       + 2 4 . 3 ° C
I N D U S T R I A L   P L A T F O R M
0 5 / 2 9   I R D   v 1 . 0
```

The Heartbeat LED (bottom right corner of base PCB) should be blinking at a 1Hz rate.

The following LEDs should be ON:

1.   5VPWR   (Red LED located bottom middle of Base Board)
2.   3V3_PWR   (Red LED located bottom middle of Base Board)
3.   USB_PWR   (Green LED located bottom right of Base Board)

A pressed key on the keypad will display its label on the forth line of the LCD display.
Note if the heartbeat LED is flashing, but the LCD is blank, try adjusting the LCD contrast
potentiometer, VR2.

3.0 IRD Ethernet User Interface

3.1. User Supplied Equipment and Components

To operate the IRD Ethernet User Interface, the following items are needed:
1. PC with *Internet Explorer* (version 6.0 or later)
2. USB Flash Drive (not provided)
3. Ethernet cable (provided)
4. DB9 RS-232 Serial Cable (optional, not required for basic operation)

3.2. USB Flash Drive Preparation

1. Copy the web pages (.html) from the supplied NXP CD to a user supplied USB flash drive. The whole folder \HTTPRoot can be copied from the CD to the flash drive. All the web page files must be stored on the USB Flash Drive in the folder: \HTTPRoot (e.g. **E:\ HTTPRoot**)
2. Power down the IRD platform
3. Plug the USB Flash Drive into the IRD board USB Host Port
4. Plug the Ethernet cable into the IRD board and the PC. Ensure the PC is turned on and the Ethernet connection is enabled
5. IRD Board is now ready to be powered
6. Plug in the power connector
7. After the board boots up and displays "NXP Semiconductors" on the first line of the LCD, the HTTP Server is ready to be invoked

3.3. PC Ethernet Configuration

The PC's IP address must first be configured to a static address within the range of the IRD's fixed IP address, by executing the following steps:

1) On the PC, open up the Windows Control Panel (START → Control Panel)
2) Double-click on the **Network Connections** icon
3) Find the Wired 10/100 connection (usually called: "Local Area Connection") icon, right-click on it and select '*Properties'* to open up that connection configuration
4) Click on the **Internet Protocol(TCP/IP)** selection and then click on 'Properties' (see image)
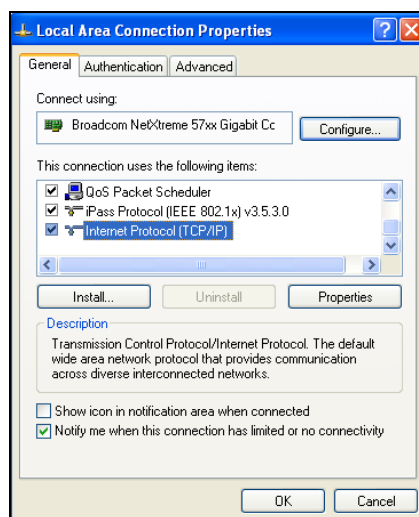
5) Write down the current setting (typically, the "Obtain an IP address automatically" is the default setting & DNS servers are blank).
6) Select: '**Use the following IP Address'**

7) Type in an IP Address of: **192.168.2.70**
8) In the subnet mask type in: **255.255.255.0**
9) Click on '**OK'** to close this window.
10) Click on '**OK'** again to close the network properties
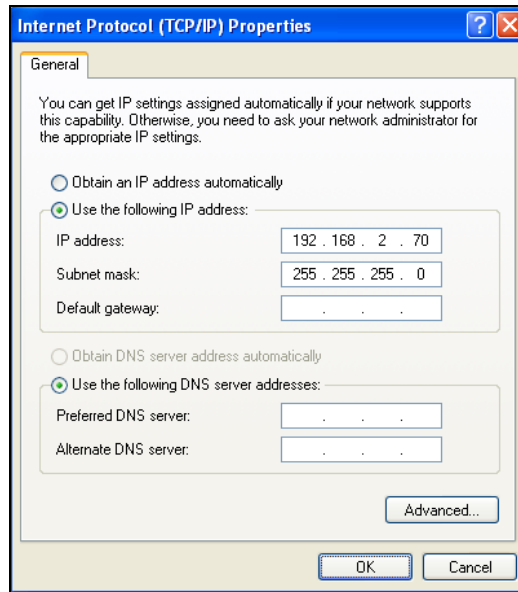
3.4. Launching the IRD HTML User Interface

1. On the PC, start up **Internet Explorer** or compatible browser
2. In the URL line, type in: **192.168.2.80/index.html**
3. The IRD Main web page will now be displayed in the browser
4. Follow the menu system to set IRD functions and to run demos and applications
5. Before attempting to connect the PC back to a network or the internet, reconfigure the Ethernet configuration back to the original settings

4.0 Troubleshooting

A few common problems that can occur when operating the IRD are:

1. Hardware related issues:
   - The keypad and the LCD need to be correctly connected to the "Baseboard". Refer to section 2.2 of this manual for more information
   - All jumpers must be configured as per section 2.2 of this manual
   - The keypad will not respond if the user unplugs and plugs it back in while the IRD is still powered. When this happens, power down the board and power it up again

2. Ethernet related issues:
   - The Ethernet and USB Drive must be connected before powering the IRD
   - If the web pages cannot be displayed, try a different USB drive.. If the USB drive is not the one provided in the kit, be sure it is formatted as FAT16 (under properties, displays as "FAT") not FAT32
   - If the above does not bring the HTML pages up, reboot the computer.

This completes the IRD demonstration code Quick Start.

5.0 Flash Magic QuickStart

If you have downloaded a new program into the IRD using the supplied J-Link, but wish to reload the original demo program (a .hex file), the LPC2468 MCU can be reprogrammed in-system using UART0 and a free program called Flash Magic. The following describes how to reprogram the LPC2468 with the demo program.

1) Download the latest version of Flash Magic from http://www.flashmagictool.com/
2) Connect a user supplied DB9 cable to the UART0 connector of the IRD board and the other end to the PC.
3) Ensure the jumpers are installed at JP9 (default), JP10, and JP8 (jumpers from JP12 can be used).
4) Run Flash Magic and configure as shown below.
5) The demo hex file is located in the \Binaries folder on the CD. Click on the browse icon and locate the .hex file for the demo program.

PC's Com Port connected to the IRD

MCU on the board is the LPC2468

You may want to adjust the baud rate for max error-free communications.

Using passive serial port cable

Erase before programming

The MCU uses the internal oscillator for ISP so no need to set this value

Demo binary (.HEX) file

Verify download

6) When ready, click on the "start" icon.

6.0 Information and Documents on CD's

6.1. Documentation – NXP CD

The NXP CD includes a copy of this Quick Start Guide, Schematics, Bill of Material, Gerber files for the Baseboard, IRD User Interface html web pages, and training modules for the major functions of the IRD platform.

6.2. NXP Software

The NXP CD includes two versions of the demo program. The demo program preprogrammed into the IRD includes proprietary software from Micrium and therefore the

source is not included. The binary file for the demo program is on the CD. Source code for a feature-limited version of the demo is also available on the CD.

To obtain the source code of the full version of the demo code, contact Micrium for licensing details.

The NXP CD also includes a simple IRD project (that blinks the heartbeat LED) that will compile using IAR's eval version of the compiler or the 32K kickstart version.

6.3. Software – IAR CD

The IRD software was developed using IAR Embedded Workbench version 5.11. The IAR CD contains various ARM MCU development tools including a free 60-day evaluation version of the compiler that is required to edit and compile the IRD demonstration code.
To install the IAR Embedded Workbench:
1. Insert the IAR CD into your PC
2. Follow the instructions in the Auto-Installer window.
3. During the installation process, it is required to register the product with IAR to receive the license key for the IDE. This is done via email. Once registered, an IAR representative will contact you (usually via email) to follow up on your IDE requirements. Be sure to keep in contact with IAR, as they may be able to extend your trial period License with an additional 30 days if required.

6.4. Software – JLink Debugger

The JLink Debugger that is included in the IRD kit allows code debugging and programming of the LPC2468 ARM7 microcontroller.
1. Connect the JLink to a PC USB port
2. Follow the instructions to install the driver. Driver is included in the IAR CD
3. Once the driver is installed, connect the JTAG connector to the JTAG port in the IRD Base Board
4. For information on debugging, refer to section 4 of the "Arm Embedded Workbench Users Guide" available through the Embedded Workbench "Help" menu.

6.5. Training Modules

The CD includes training modules for the various features of the IRD board. The topics are:
- Industrial Reference Platform Overview
- LPC2468 Microcontroller Functionality
- Micrium OS-II RTOS
- CAN, Ethernet, and I^{2}S Communications
- I^{2}C Devices and Keypad
- USB Host and Device
- Serial Communications
- VFD and LCD Display
- Power Sourcing, Power-Over-Ethernet (POE), and Current Monitoring

7.0 Software and Document Updates

Software and documentation updates are available from:
http://www.standardics.nxp.com/support/boards/ird/

8.0 Connection Headers Reference Table

The following list is a description of all the jumpers and connection headers on the IRD Baseboard (version 1.2). Additional information can be found in the IRD schematic and User Manual documents.

JP4 & JP5 – CAN Analyzer Connectors

Pin	Label	Function
1	CANH	Connects CAN Analyzer to CANH signal of TJA1040
2	GND	Ground connection.
3	CANL	Connects CAN Analyzer to CANL signal of TJA1040

CAN_Test – CAN Loopback Interface

Pin	Label	Function
1	CAN2-L	CAN2 Channel CANL Signal
2	CAN1-L	CAN1 Channel CANL Signal
3	CAN2-H	CAN2 Channel CANH Signal
4	CAN1-L	CAN1 Channel CANH Signal

CAN1_PWR & CAN2_PWR – CAN Slave Port Power Connectors

Pin	Label	Function
1	+5VDC	+5VDC Power Supply From External Supply or POE Module
2	CAN-PWR	Connects +5VDC to CAN Slave Unit via pin 9 of DB9 Connector

JP8 & JP10 – ISP Mode Selection

JP8	P2_10	The microcontroller is placed in ISP mode when this jumper is connected, enabling Flash Magic to program the LPC2468.
JP10	RESET	The microcontroller is held in reset for ISP programming when this jumper is connected, enabling Flash Magic to program the LPC2468

JP9 – UART0 DCE/DTE Selection

Pin	Label	Function
1	T1OUT	RS-232 Serial Data Output from UART0
2	UART0 Pin2	Pin 2 of the UART0 DB9 Connector
3	UART0 Pin3	Pin 3 of the UART0 DB9 Connector
4	R1IN	RS-232 Serial Data Input to UART0

JP12 – UART1 DCE/DTE Selection

Pin	Label	Function
1	T2OUT	RS-232 Serial Data Output from UART1
2	UART1 Pin3	Pin 2 of the UART0 DB9 Connector
3	UART1 Pin2	Pin 3 of the UART0 DB9 Connector
4	R2IN	RS-232 Serial Data Input to UART1

J_TEMP – External Temperature Sensor Connector

Pin	Label	Function
1	D-	External Temperature Sensor negative (White Wire) connection
2	D+	External Temperature Sensor positive (Red Wire) connection

JP18 – 3.3VDC Source Selection

Pin	Label	Function
1	+3.3VDC	IC13 (Onboard 3.3VDC Regulator) Output
2	IRD +3.3V Supply	IRD +3.3VDC Supply
3	POE_3.3V	POE Connector 3.3VDC Supply

JP19 – 5.0VDC Source Selection

Pin	Label	Function
1	+5.0VDC	JPWR +5VDC Source (from Condor External Power Supply)
2	IRD +5.0VDC Supply	IRD +5VDC Supply
3	POE_5V	POE Connector 5.0VDC Supply

12V – POE 12VDC Output Connection

Pin	Label	Function
1	POE_12V	POE Connector 12VDC supply connection
2	GND	Ground connection

JP2 – IRD Current Monitor Connection

Pin	Label	Function
1	IRD +3.3V Supply	IRD 3.3VDC Source Power
2	+3V3	3.3V IRD Supply Line

J_VDISP – IRD Display Power Source Selection

Pin	Label	Function
1	IRD +3V3	3.3V IRD Supply Line
2	VFD/LCD VCC	VFD &LCD Display Supply Source
3	IRD +5.0VDC	IRD +5VDC Supply

J_LCD – LCD Contrast Control Selection

Pin	Label	Function
1	V_Contrast	Contrast voltage from VR2
2	LCD_Contrast	LCD Contrast Voltage V0

VREF – Microcontroller VREF Selection

Pin	Label	Function
1	VREF	ADC/DAC reference voltage signal to MCU
2	V3A	Filtered 3.3v source for VREF

9.0 Support

Online technical support is available at http://www.nxp.com/support
Manuals and Datasheets: http://www.standardics.nxp.com/support/boards/ird/