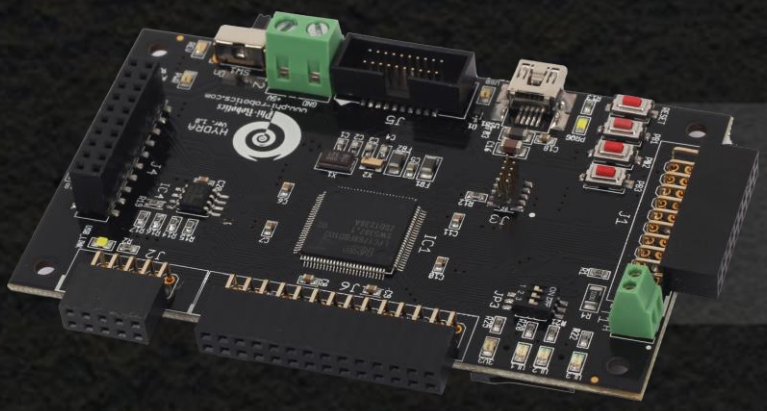
Phi Robotics

Product Manual



Hydra

Version 1.0

Phi Robotics Research Pvt. Ltd.

www.phi-robotics.com

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1 Introduction

Hydra is a feature rich development board powered by ARM Cortex-M3 based LPC1768 microcontroller. The modular design makes it suitable for any embedded and robotics application. It is suitable for beginner, intermediate and advanced embedded developers. Hydra may be powered by 5V external power supply or using USB. Hydra is compatible with Phi Robotics DP83848Eth-BB Ethernet breakout board. Hydra can be enhanced to connect to external USB devices/hosts by connecting external USB socket to its USB interface header. For portable data storage, a standard micro SD card socket is included. The micro SD Card is interfaced with the microcontroller using SPI bus. Hydra also has a battery socket for on-chip RTC.

A unique feature of Hydra is Phi Robotics Expansion Bus. Phi Robotics Expansion Bus is a cross-platform stackable connector which allows user to build modular systems. Multiple expansion boards can be stacked on top of a base board to expand the system functionality. All the signals on the expansion bus are standardised to 3.3V. Base board expansion bus have 3.3.V and 5V supply lines to power expansion boards. All Phi Robotics base boards and expansion boards comply with this expansion bus design.

Phi Robotics Expansion Bus is a 10x2 pin connector having the following peripherals: UART, SPI, I2C, CAN, GPIO and external interrupts. All expansion bus peripherals are enabled on base boards, however on expansion boards only peripherals that are required are enabled.

2 Board Features

- LPC1768 ARM Cortex-M3 microcontroller
- Compatible with Phi Robotics DP838 Ethernet breakout board
- Direct USB Interface header for future expansion
- Micro SD slot for file storage
- Separate CAN channels available on expansion header and separate terminal
- USB to UART convertor for ISP programming and powering the board
- JTAG for debugging and programming
- Expansion port having I2C, CAN, SPI, UART, GPIO and external interrupt pins
- Reverse protection circuit
- On-board 3.3V regulator
- 10 pin auxiliary IO connector for sensor interface and PWM based application
- Multiple power supply options: USB or external power supply
- User LEDs and switches

3 Specifications

- LPC1768 package: LQFP100
- Supply voltage: 5V
- Power supply options: USB powered or external power supply
- On-board crystal frequency: 12 MHz
- RTC crystal frequency: 32.768 KHz
- RTC battery voltage: 3V

3.1 PCB Details

- PCB size: 95.25 mm x 57.15 mm
- PCB material: FR4
- Number of layers: 2
- Board thickness: 1.6 mm
- Solder mask: Black
- Surface finish: Immersion gold

4 Hardware Connections

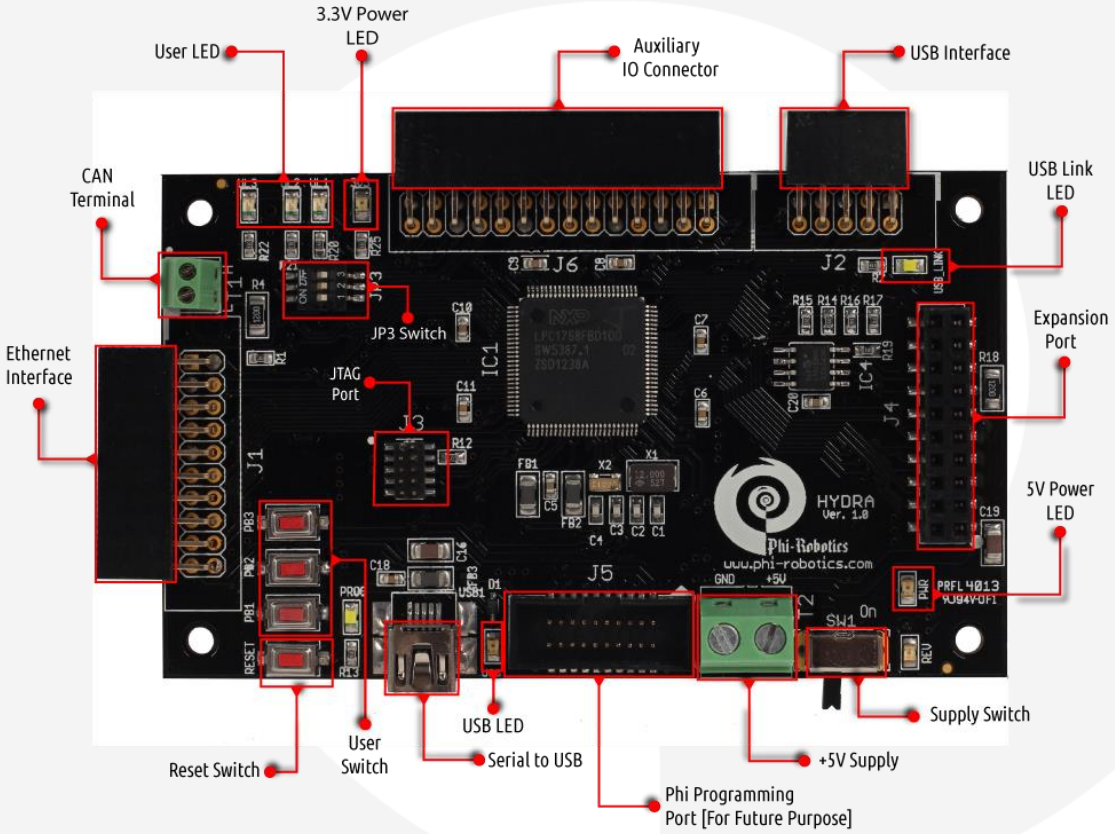

Figure 1 - Hydra top view

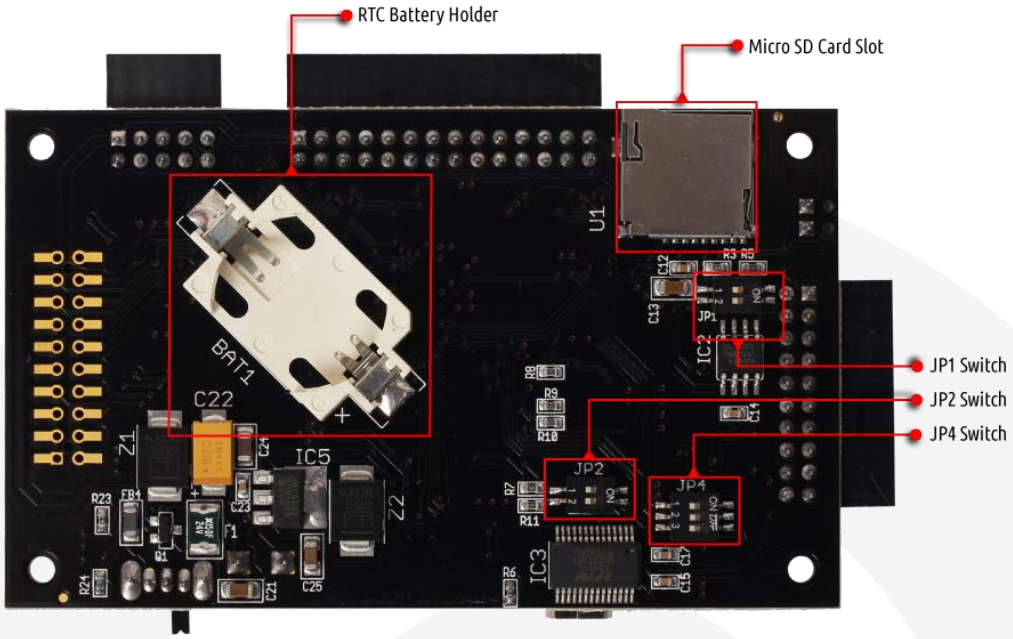

Figure 2 - Hydra bottom view

4.1 Power Supply

Hydra can be powered using standard 5V power supply or USB. It is recommended to use external power supply for high current (> 500mA) aplications.

4.2 Programming the Board

Hydra can be programmed using USB in ISP mode and JTAG (J3). Table 1 explains the jumper settings required.

Table 1 - Programming mode jumper setting

Programming mode	JP2
ISP	All jumper on
JTAG	NA

4.3 Expansion Port

Expansion port is used for enhancing the feature of the board. The port has different communication pins SPI, CAN, I2C and GPIO. All Phi Robotics base boards and expansion boards comply with this expansion port design to provide direct stacking ability between expansion boards and base boards. The expansion port also has 5V and 3.3V supply connections to power up expansion boards or external sensor boards. Figure 3 below shows the pin layout for expansion port.

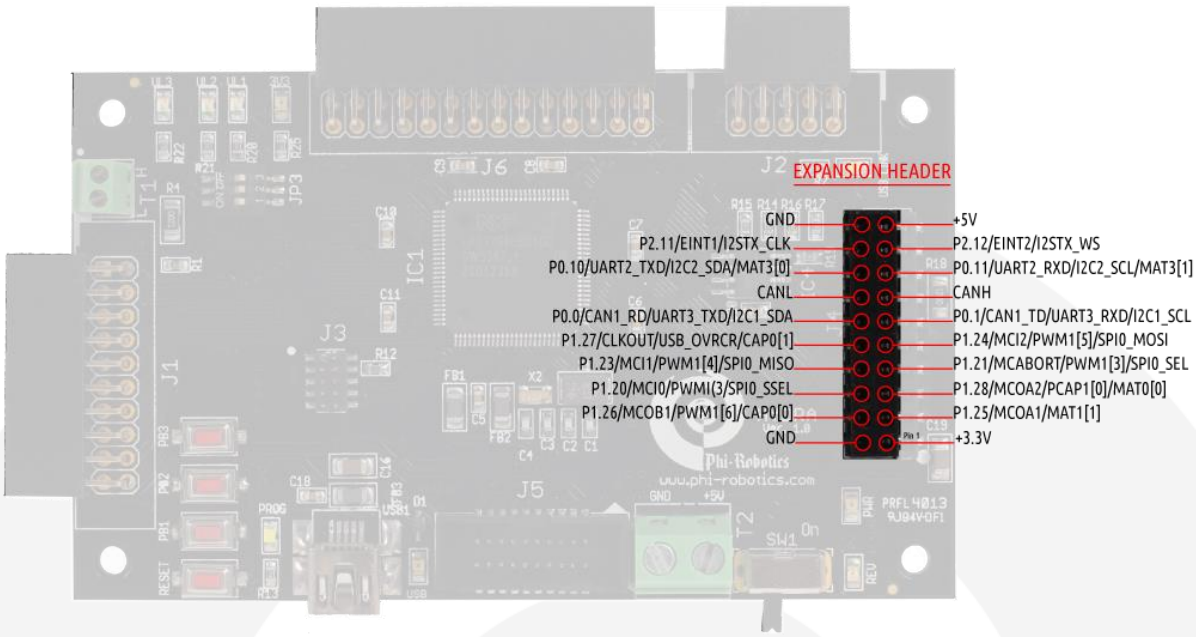

Figure 3 - Expansion header pin layout

4.4 Auxiliary IO Ports

Hydra provides a header (J2) for interfacing USB breakout boards. If not used for USB interfacing the pins can be used as general purpose IO. Figure 4 below shows the pin layout for J2.

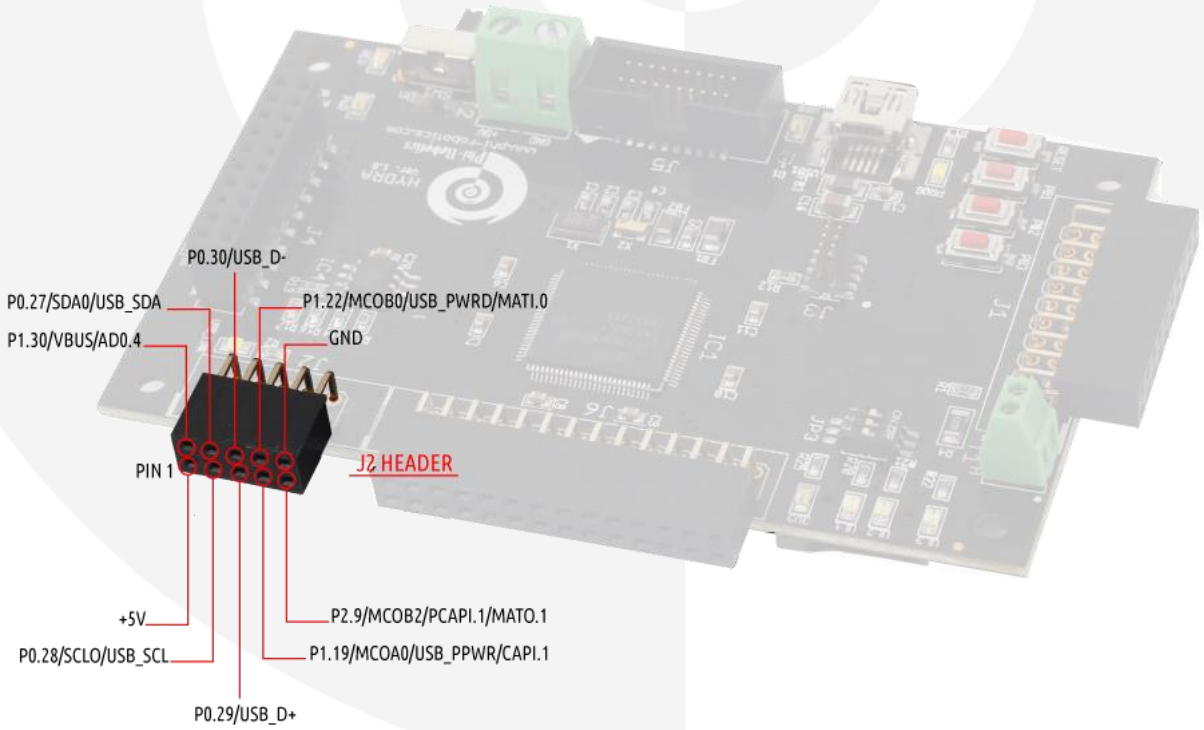

Figure 4 - J2 pin layout

The J6 header on Hydra provides peripherals like PWM, ADC, DAC, UART, external interrupt which can be used for interfacing with sensors and other devices. Figure 5 below shows pin layout for J6 header.

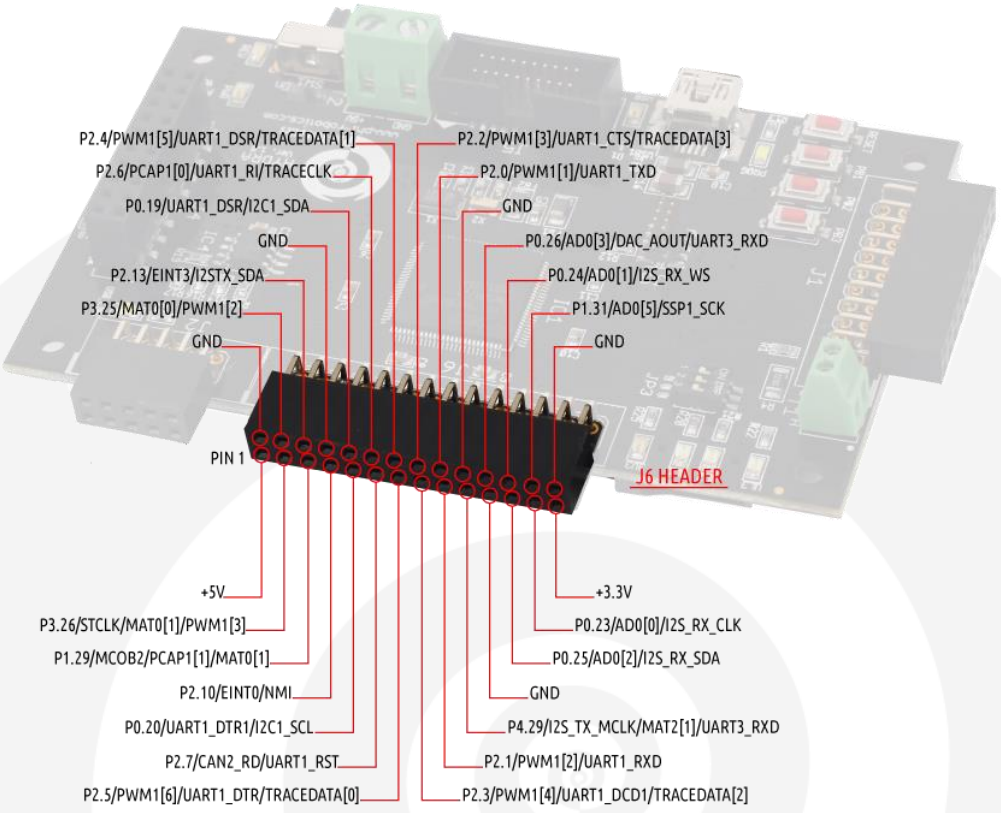

Figure 5 - Auxiliary port pin description

Hydra can be interfaced with Ethernet breakout board. J1 header designed to interface with the Phi Robotics DP83848Eth-BB Ethernet breakout board. Alternative the header can be used for general purpose IO. Figure 6 below shows the pin layout for J1 header.

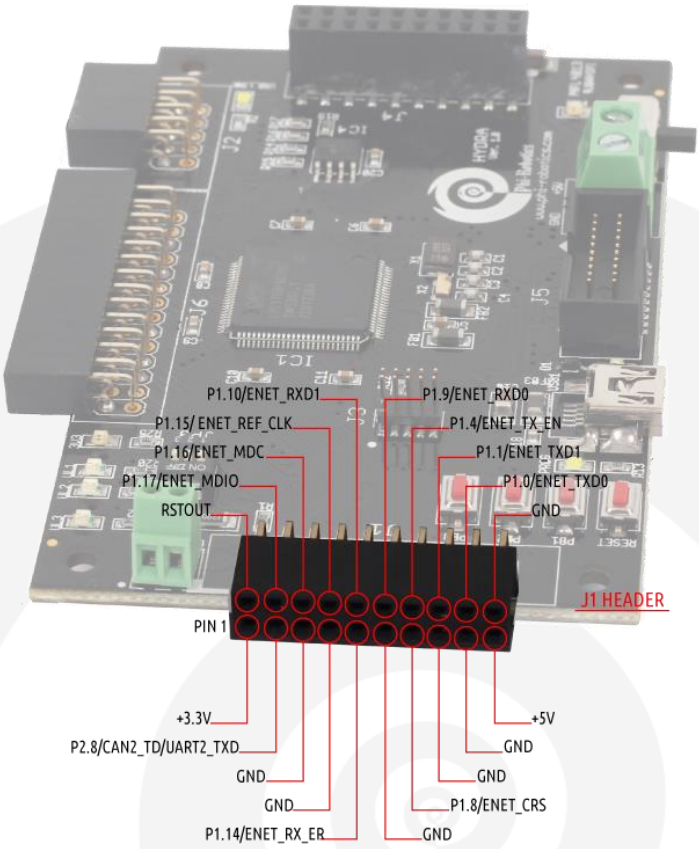

Figure 6 - Auxiliary port pin description

4.5 LEDs and Switches

The board have 3 user LEDS and 3 user switches. JP3 and JP4 are used for disabling and enabling user LEDs and switches respectively. Both, LEDs and switches are active low. User LEDs are connected to pin 4.29,0.26 and 0.25 and switches are connected to pin 0.24,0.23 and 1.31.

Along with user LEDs, following are indicator LEDs and switches available on Hydra.

- PWR LED: Power supply indicator
- REV: Reverse supply indicator
- 3.3V: 3.3V supply LED
- USB: USB power indicator
- Prog: Blinks when ISP programming using USB is in progress
- USB link: USB link indicator
- RESET: To reset the board
- SW1: Power ON/OFF switch

4.6 CAN Controller

LPC1768 chip has an on-chip 2 channel CAN controller. Hydra has a CAN transceiver (MCP2551). CAN channel 1 is provided on expansion port and CAN channel 2 is provided on a separate terminal T1. CAN transceiver can be disabled to save power. CAN needs terminating resistors for proper communication. Jumper switches are provided to enable/disable terminating resistors and CAN transceiver. Following are the guidelines for CAN jumper settings.

- The terminating resistor should be enabled only for 2 end nodes
- Terminating resistor for CAN channel 1 cannot be disabled
- CAN transceiver for channel 1 cannot be disabled
- To enable terminating resistor for CAN channel 2, switch 2 on jumper JP1 should be on
- To disable CAN transceiver for channel 2, switch 1 on jumper JP1 should be on
- When disabling the CAN transceiver, terminating resistor should also be disabled

5 Reference

LPC1768 Datasheet: http://www.nxp.com/documents/data_sheet/LPC1769_68_67_66_65_64_63.pdf

MCP2551 Datasheet: http://www.microchip.com/wwwproducts/Devices.aspx?dDocName=en010405

MCP1826S Datasheet: http://www.microchip.com/wwwproducts/Devices.aspx?dDocName=en531455

FT232RL Datasheet: http://www.ftdichip.com/Products/ICs/FT232R.htm

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