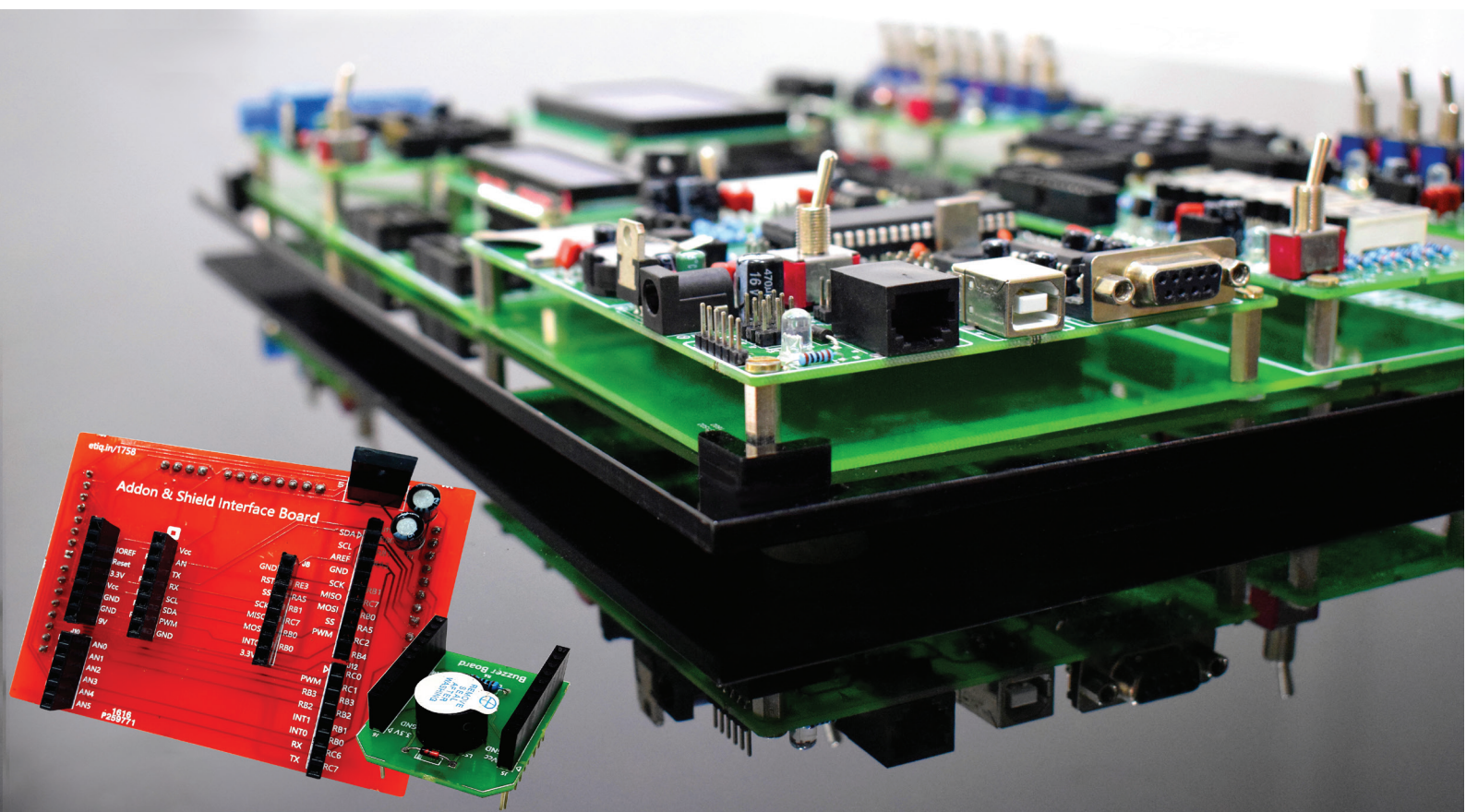- **OpenLab** ARM/ PIC/ 8051/ AVR embedded design platforms
- Features external bus for stackable addon **QuickInsert** boards
- Swappable peripheral boards with advanced features
- Highly customizable hardware structure depending on the user application
- Online Learning Centre

Bluetooth® WiFi® GSM GPS LoRa™

OpenLab^{pro} Design platforms

OpenLab design platforms

- Excellent online resource centre support, helping self learning from basics to advanced level.
- Supports all communication standards USB, USART, I2C, SPI, I2S & CAN as available in ARM/ PIC/ 8051/ AVR
- The well-designed and easy to learn modular hardware structure.
- Flexibility for selcting different ports & interfacing modules/ sections.
- High power driver section for DC motors, Servo motors, 230V devices.

Unique features of OpenLab

Modularity in structure

Each peripheral boards and modules of OpenLab design platforms are independently placed one from other, to isolate different sections in OpenLab design platforms. This structure is helpful to identify each hardware sections from others during prototyping.

Flexibility in selection of different ports

OpenLab design platforms introduce flexibility in selection of different ports for interfacing. In addition to the default ports available for LCD, GLCD, TFT LCD, Motor Relay Board, IO Boards, Seven Segment Board & Keypad, there are 4 different additional ports are also available on the middle of Base board.
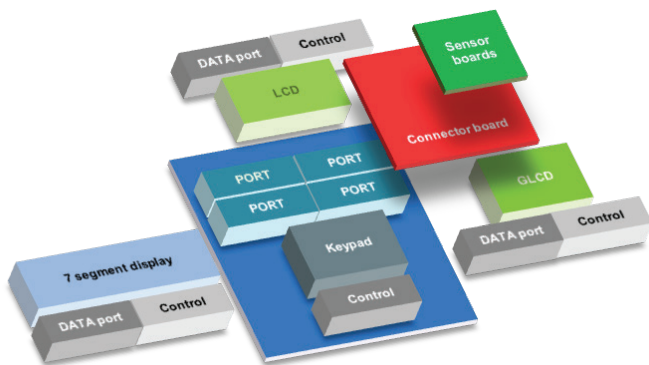
Extended and unlimited addon functionalities

OpenLab design platforms features an extension of additional functionalities beyond the platform using an Addon & shield interface board and an external bus interface. This added feature Facilitates the development of a complex embedded project with unlimited readily available QuickInsert boards in sensor boards & wireless boards category. Extended functionality ensures that, unlimited possibilities of application design by exploring in a wide concept.

Replaceability of peripheral boards

Apart from the default peripheral boards which are available with OpenLab design platforms, the user can purchase other swappable boards compatible with OpenLab from web portal,
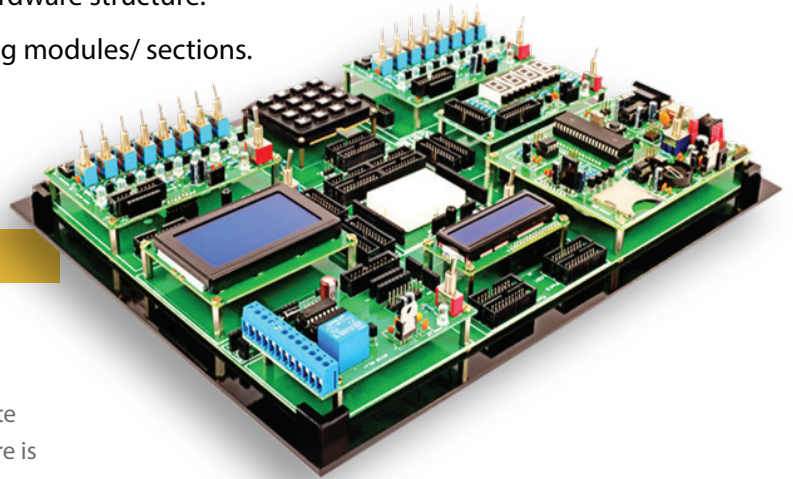
www.openlabpro.com with advanced features and functionalities. These boards are similar in form factor with the default peripheral boards which are supposed to be replaced.

Embedded experiments to prototyping

OpenLab is a self-learning embedded application development platform on which students and techno enthusiasts can experiment circuits & codes of their choice and there by acquire related skills and expertise. For those highly skilled professionals also, OpenLab is best recommended for industrial prototype design of complex control systems.

Unlimited resources supporting self learning

Apart from the user manuals and other leaf lets and palmlets, OpenLab has a well-prepared website for learner's help. There is a dedicated section named Learning center where all the necessary tutorials on OpenLab are available with detail description and graphics. Besides, there are pages and sections on the website dealingwith various other information regarding OpenLab and embedded system in general. For enhancing the effectiveness of learning, tutorials are embedded with enough number of examples in each case.
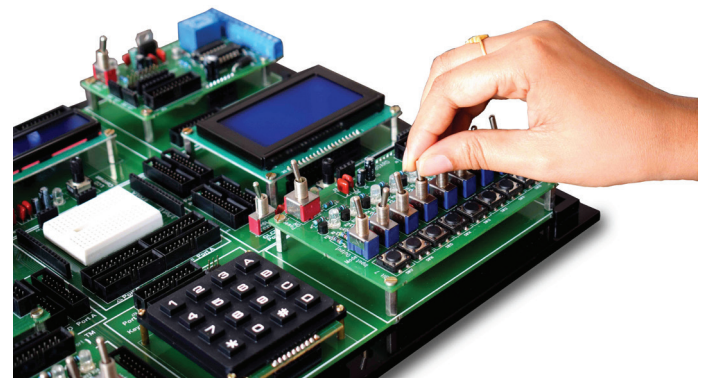
OpenLab ARM design platform

OpenLab ARM features embedded design with high speed 32bit processors and supports ARM coretex M3, cortex M0 and LPC 2148 (ARM7 TDMI) families. The product comes with NXP LPC1768 (ARM cortex M3) by default. OpenLab ARM mainly focusing on applications requires high level of integration and low power consumption at clock frequency of 12MHz.

- OpenLab ARM platform hosts NXP LPC1768, 32-bit ARM Cortex-M3 core
- Low power and high speed data processing for your high performance prototypes
- Support add-on shield interface board & QuickInsert boards with compatibility to Arduino shields
- LPC176x ARM cortex M3/ LPC2148/ ARM7 TDMI/ Cortex M0 series of 16/ 32bit processors.
- Best Suitable for Hardware and software learning, fast prototyping, building high end projects & experiments
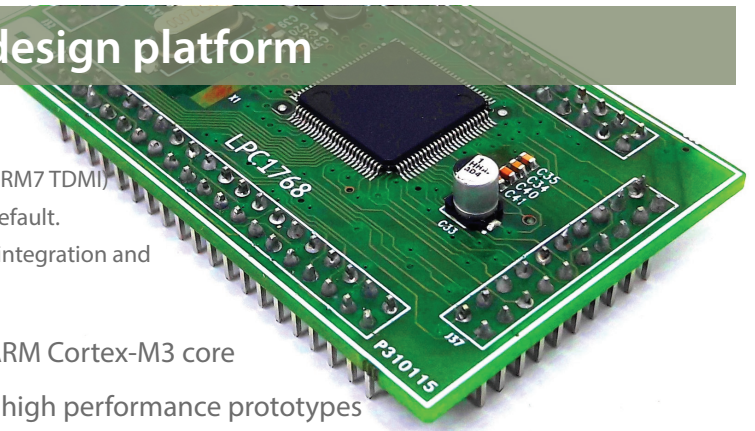
Technical specification of ARM board & IP board

IP board (Inter Processor board for LPC1768)
IP board is a 120 pin processor specific card which connects ARM board to ARM processor. Features of LPC1768 include 512 kB of flash memory, 64 kB of data memory resides in boot ROM block of the microprocessor memory.

LPC1768 (ARM cortex M3)
LPC2148 (ARM7TDMI)
Cortex M0 series & 16/ 32bit processors

Regulated DC supply 5V & 3.3V
5V & 3.3V regulated DC supply powers the whole platform

5V DC regulated supply
3.3V DC regulated supply

Onchip RTC
On chip low power Real Time Clock is available with LPC1768 and is supplied with clock frequency of 32.768KHz from external crystal oscillator on IP board.
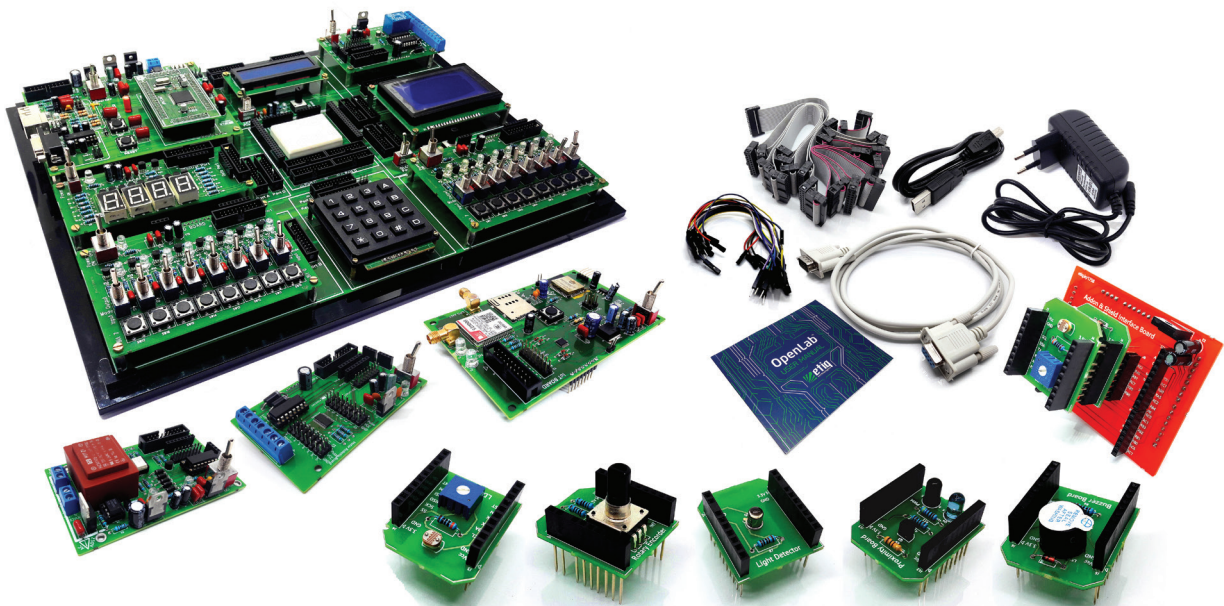
Onchip RTC
External clock frequency, 32.768KHz

Micro SD card slot
On-board SD card (secure digital card) slot is an advanced memory extension feature to add additional memory in addition to the microprocessor internal memory.

High quality micro SD card connector
SPI communication protocol

CAN (Controller Area Network) interface

Controller Area Network (CAN) is a high performance communication protocol for serial data communication. The CAN Controller in ARM processorLPC1768 is designed to provide a full implementation of the CAN-Protocol according to the CAN Specification version 2.0B.
CAN communication protocol version 2.0B
MCP2551, high speed CAN transceiver

Bootloader

OpenLab ARM supports bootloader programming. Bootloader makes the microprocessor a self programmable device. This is a machine code resides in boot ROM block of the microprocessor memory and is executed on power up and reset.

EEPROM

Electrically erasable programmable read-only memory (EEPROM) can retain the stored data even after the power is turned off.
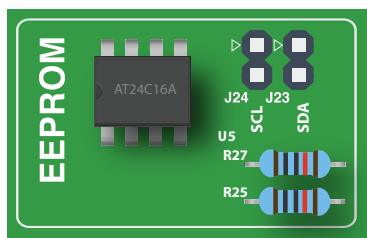
I2C communication protocol
AT24C16A has 16KB memory, 128 pages of 16 bytes
Supports AT24C16A, AT24C32 & AT24C64 from Atmel

## JTAG programmer/Debugger interface

20-pin JTAG connector interface for JTAG programmers/debuggers. JTAG debugger allows burning the code into the flash memory, debugging & analyzing programs running on the target processor.

TTL to RS232 Level shifter

UART to RS232 converter is a level shifter which interfaces a device communicating in TTL-5V or 3.3V voltage level to other device in RS232 voltage level
TTL to RS232 level shifter
Serial communication interface
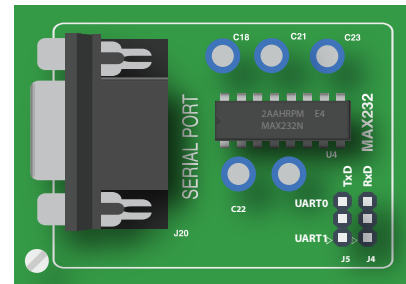
USB to Serial converter

single chip USB to asynchronous serial data transfer interface features a hub between serial and USB interface. USB to Serial converter transfers Serial data from UART module of the microprocessor into USB data and incomming USB data is converted back to serial data.
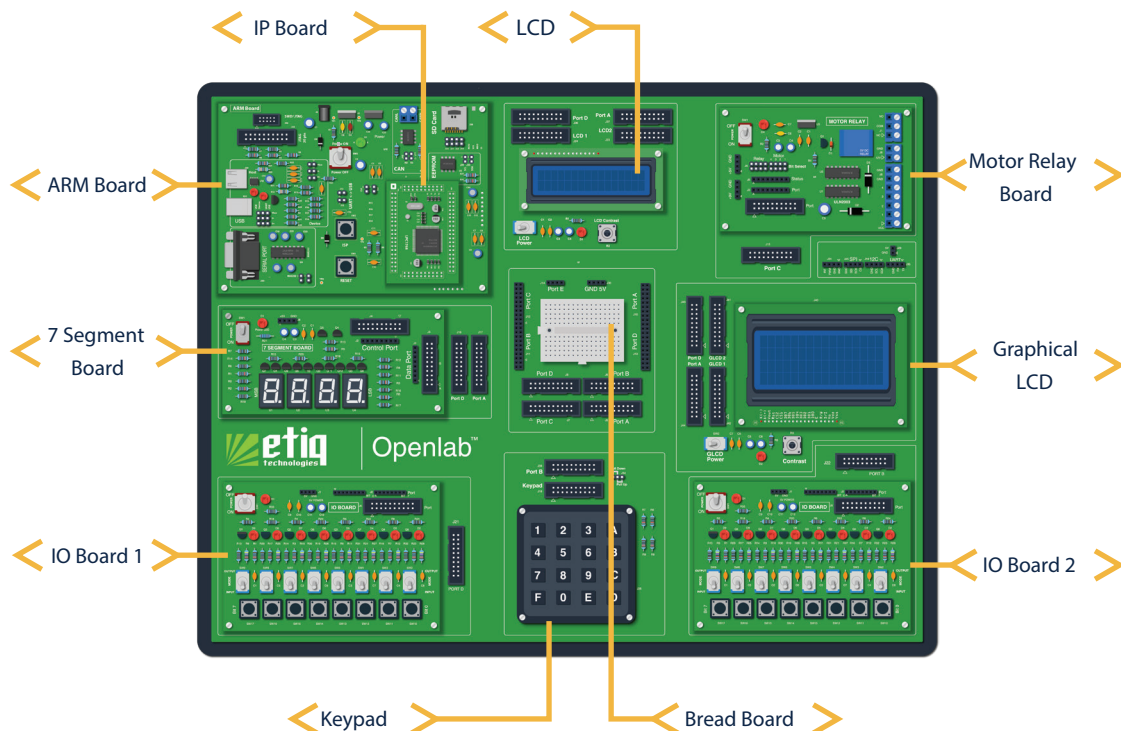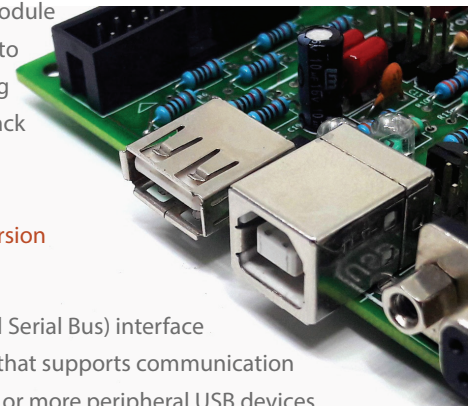FT232R chip from FTDI
UART to USB data conversion

USB 2.0

features a USB (Universal Serial Bus) interface which is a four-wire bus that supports communication between a host and one or more peripheral USB devices
USB host/ device configuration
LPC176x devices enables USB full-speed (12 Mb/s) data exchange


Structe of OpenLab

OpenLab PIC

- OpenLab PIC hosts PIC18F4550 MCU by default.
- Most popular 8-bit embedded design platform among OpenLab.
- OpenLab PIC supports over 70 PIC18 family of microcontrollers.
- Compatible with Swappable boards & QuickInsert boards.
- Suitable for fast prototyping, building projects & experiments.
- Addon shield interface board connection port (External bus interface) and supports interface to Arduino shields.

OpenLab 8051

- Hosts Atmel AT89S8253 8-bit MCU by default.
- Featured Design platform with Atmel AT89S series of MCUs.
- Suitable for building projects & experiments.
- Compatible with Swappable boards & QuickInsert boards.
- Addon shield interface board connection port (External bus interface) and supports interface to Arduino shields.

OpenLab AVR

- OpenLab AVR comes with Atmel ATMEGA32 MCU by default.
- Supports a wide range of 40pin Atmel AVR Microcontrollers.
- Compatible with Swappable boards & QuickInsert boards.
- Suitable for building projects & experiments.
- Addon shield interface board connection port (External bus interface) and supports interface to Arduino shields.
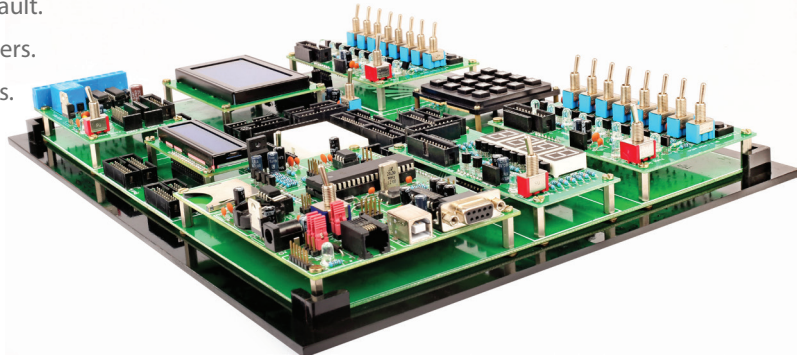
Technical specification of main board (PIC/ 8051/ AVR)

Regulated DC supply 5V

OpenLab PIC/ 8051/ AVR platforms feature 5V regulated DC supply which powers the whole platform.

5V DC regulated supply

SD card slot

On-board SD card (secure digital card) slot is an advanced memory extension feature to add additional memory in addition to the microprocessor internal memory.

High quality micro SD card connector

SPI communication protocol

RTC (Real Time Clock)

Real Time Clock module with connected Dual In Line package DS1307 chip. DS1307 is a low power, fully binary coded decimal(BCD) clock/calendar

56 bytes of NV SRAM

I2C communication protocol

EEPROM

Electrically erasable programmable read-only memory (EEPROM) can retain the stored data even after the power is turned off.

I2C communication protocol

AT24C16A has 16KB memory, 128 pages of 16 bytes

ICSP/ ISP/ RJ11 programmer/Debugger interface

OpenLab PIC features microchip ICD debugger and ICSP (Incircuit

Serial programming) interfaces, while OpenLab 8051 and AVR provides programming interface of ISP (In system programming).

ICD/ ICSP/ ISP programming interface

TTL to RS232 Level shifter

UART to RS232 converter is a level shifter which interfaces a device communicating in TTL-5V or 3.3V voltage level to other device in RS232 voltage level.

TTL to RS232 level shifter

Serial communication interface

USB to Serial converter

single chip USB to asynchronous serial data transfer interface features a hub between serial and USB interface. USB to Serial converter transfers Serial data from UART module of the microprocessor into USB data and incomming USB data is converted back to serial data.

FT232R chip from FTDI

UART to USB data conversion

(*USB to Serial converter is not available in OpenLab PIC)

USB 2.0

features a USB (Universal Serial Bus) interface which is a four-wire bus that supports communication between a host and one or more peripheral USB devices.

USB host/ device configuration

LPC176x devices enables USB full-speed (12 Mb/s) data exchange

(*USB module is not available in OpenLab 8051 & OpenLab AVR)

Character LCD 16×2

16x2 LCD module is one of the output devices capable of displaying 2 lines with each containing 16 characters (16 bytes). Default data and control ports are available near the LCD module. LCD contrast control is provided for adjusting the intensity.

16x2 character LCD
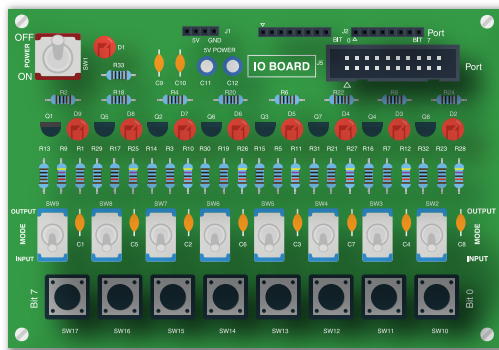
Default control port & data port

LCD contrast control

Input Output board (IO board)

IO board is a basic learning board and is used for practicing basic experiments with PORT registers of microprocessor or checking intermediate outputs in a specific stage of a project. In input mode, IO board can be interfaced with microprocessor for fetching bitwise inputs.

Input and Output modes of operation

Features bitwise inputs to the controller

Motor Relay board & Motor driver 230V, 7A

Motor Relay Board consists of 230V, 7A relay driver & 4 channel DC motor driver. Motor driver board features 4 channels having current sinking capability up to 1A each from the load.

230V, 7A relay driver

4 terminal Darlington array

1A current sinking capability

Seven Segment Display board

Four seven segment display modules for displaying 4 digit numerical values (0000-9999) using port multiplex method.

Four 7 segment display modules

Port multiplexing method
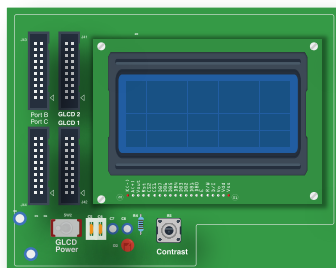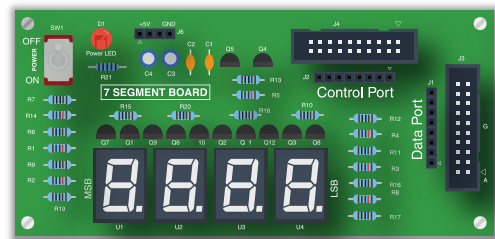
Default ports for Seven segment modules

128x64 Graphical LCD

128x64 pixels graphical LCD with nearby default control port and data port to easily interface with the host controller.

128 x 64 pixels graphic LCD.

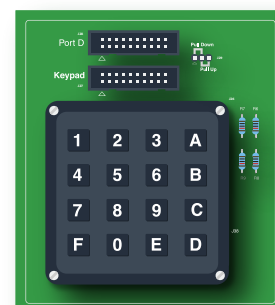Default control & data ports

GLCD contrast control

Keypad (4x4 matrix)

Keypad 4X4 matrix Matrix keypad features 16 inputs to the host processor using 8bit I/O port.

High quality 4X4 matrix keypad

16inputs through 8bit port

PULL UP and PULL DOWN modes

Mini Bread board

A mini bread board is fixed at middle of base board for assembling small test circuits in connection with the processor ports.

Mini bread board with170 holes

Dimension : 4.5cm × 3.5cm × 1cm

Swappable peripheral boards

Swappable boards replace the default peripheral boards that are available with OpenLab design platforms.These boards are compatible with any of OpenLab PIC/ AVR/ 8051/ ARM design platforms and have the same form factor as default peripheral boards. Swappable boards have advanced features like different wireless interfaces, DC drives, high power control etc. comparing to peripheral boards default boards.

Robotic ARM board

Robotic ARM board is a replaceable additional board with same form factor of Motor Relay Board which comes by default with all OpenLab design platforms.Robotic ARM board features a quadruple high-current half-H driver with bidirectional current drives. 16-channel, 12-bit PWM output for servo motor control of Robotic ARM & other applications. I2C interface for PWM controller, to communicate with host processor.
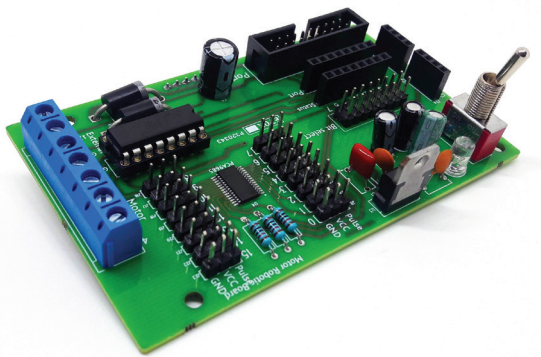
TFT LCD board

2.8-inch TFT LCD screen replaces the default GLCD comes with OpenLab PIC/ AVR/ 8051/ ARM platforms.

Touch Keypad
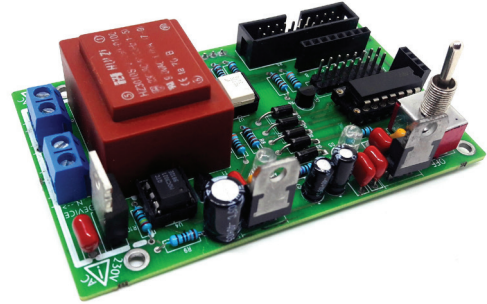
16 keys input capacitive touch keypad replaces the default Keypad matrix available OpenLab PIC/ AVR/ 8051/ ARM platforms.

TRIAC board

TRIAC control board for 230V devices. Low power to high power device interface.

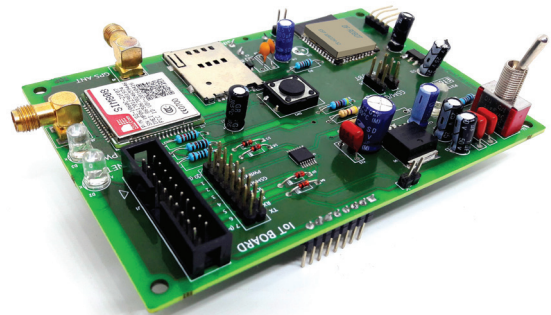50-60Hz sync square wave generator

High power control

IoT board

IoT board is swappable with default peripheral IO board on any OpenLab PIC/ AVR/ 8051/ ARM platforms. GSM, GPS, Wi-Fi & Bluetooth modules are available in this single board.

GSM/ GPS/ GPRS, Quad-band 850/900/1800/1900MHz

Wi-Fi 2.4GHz

Bluetooth LE

UART interface

Addon QuickInsert boards & shield connector board

QuickInsert boards

Addon QuickInsert boards are proprietary boards designed for OpenLab and SensIt platforms by Etiq Technologies. These boards are plugin type boards and can be inserted directly into your applications. This category includes a wide range of sensors, transducers and communications technologies. Addon shield connector board is used for connecting QuickInsert sensor boards and Arduino shields easily to OpenLab design platform. Addon & shield interface board is different for OpenLab ARM, and OpenLab PIC, but same board is used for OpenLab AVR and OpenLab 8051. Our design engineers are constantly updating the inventory with latest sensors and technologies.

Addon shield interface board

Addon shield connector board is used for connecting QuickInsert sensor boards and Arduino shields easily to OpenLab design platform.

Addon & shield interface board is different for OpenLab ARM, and OpenLab PIC, but same board is used for OpenLab AVR and OpenLab 8051.

OpenLab ARM | OpenLab PIC | OpenLab AVR | OpenLab 8051
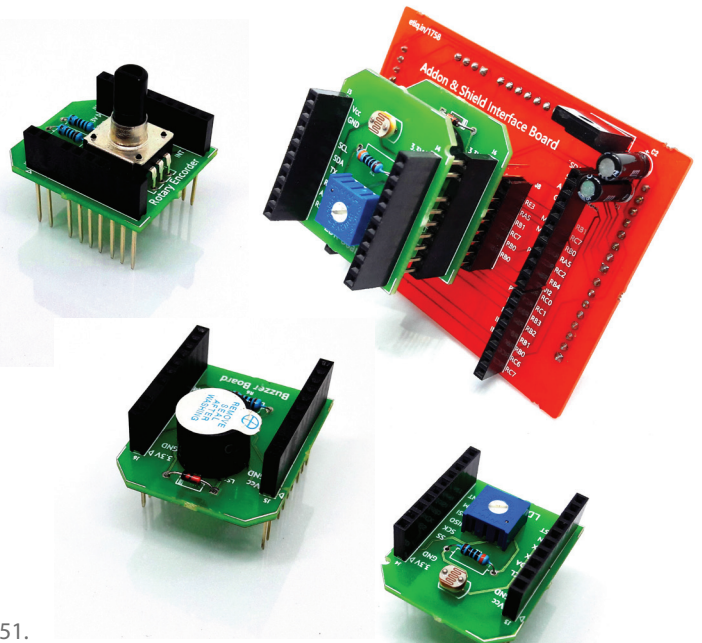
OpenLab design platforms, addons & Online learning center

OpenLab support official and third party development tools which enhance the compatibility of the platform for convenience of debugging and programming operations. QuickInsert boards as well as Swappable boards available with OpenLab, make it entirely different experience of practical learning. These add-on or replaceable boards can be used interchangeably with any OpenLab design platforms. Moreover, support of OpenLab for Arduino shields also bringing more additional functionality apart from default available modules. Notably, all these platforms are designed aiming at the convenience of operation and ease of learning even for the beginners to embedded systems. An excellent online Learning centre is available in website to support all platforms with a progressive self learning structure. The structure of hardware design makes it convenient to realize the interface & other interconnections easily along with supporting data. This makes fast prototyping for Engineers.
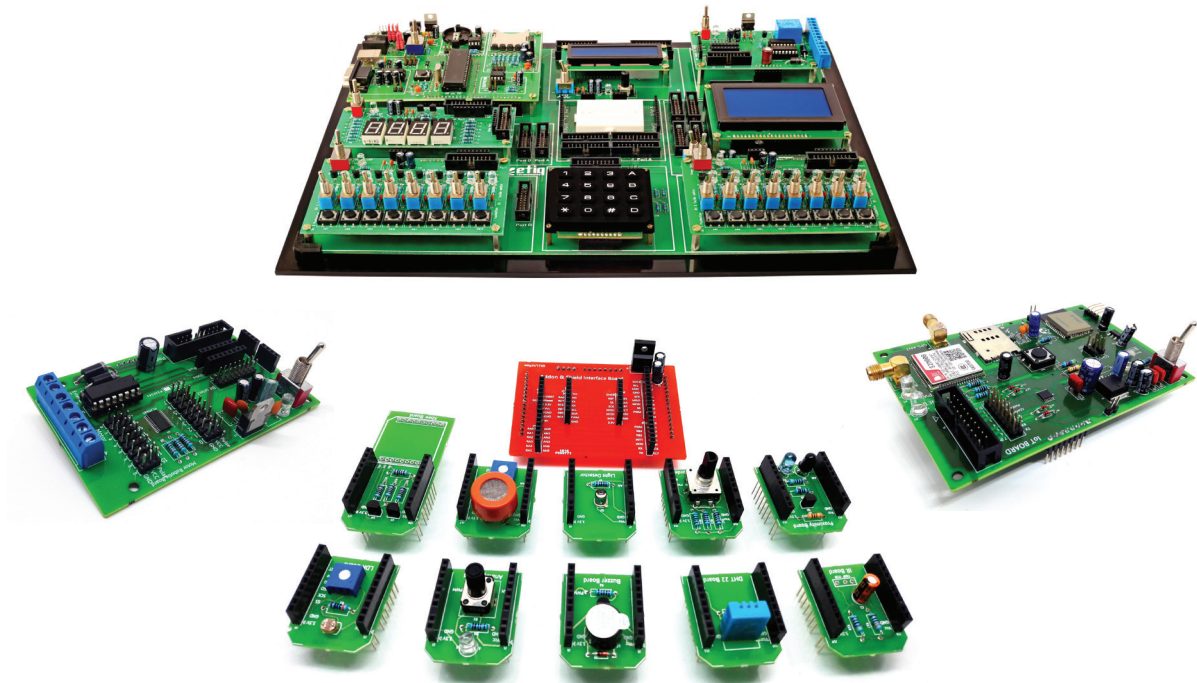
OpenLabpro and associated addon products:

OpenLabpro ARM/ PIC/ 8051/ AVR design platforms | DevLab ARM/ PIC/ 8051/ AVR development boards
Starter basic boards | QuickInsert boards | Swappable boards

For more details of products and features, please visit our cart on www.openlabpro.com

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