

OPEN MICROPROCESSOR TRAINER



DL ARM32BIT-HP/ DL ARM32BIT-UL/ DL ARM32BIT-MS

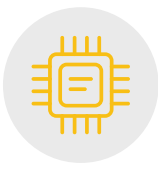
INTRODUCTION

The Open Microprocessor Trainer is designed to teach the basics of working with a 32-bit industrial microprocessor based on the flexible architecture of a Dual Arm® Cortex®-A7 core and/or Cortex®-M4. It is ideal for learning software and hardware development for industrial control systems. It helps students understanding ARM Cortex microprocessors and becoming familiar with their programming and components.

The trainer consists of a main module with power supply, with the possibility of choosing one of the three proposed systems:

- **DL ARM32BIT-HP** (with Cortex-A7 operating at 650 MHz and Cortex-M4 operating at 209 MHz)
- **DL ARM32BIT-UL** (with Cortex-M4 operating at 80 MHz)
- **DL ARM32BIT-MS** (with Cortex-M4 operating at 168 MHz)

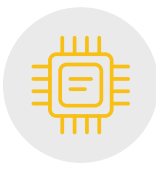
according to the end user's needs, with different interfaces and a set of software application each.



The Cortex family is divided into the A-series (Application), the R-series (Realtime), the M-series (Microcontroller), and the SecureCore series.

- The A series is aimed at computers, advanced mobile phones and more generally applications that require computing power and flexibility.
- The R series is developed for real-time applications.
- The M series is the smallest series, developed for use in microcontrollers.
- The SecureCore series is derived from the M series and used for security applications, such as Smart cards.

This trainer is robust and suitable for both beginners and advanced learners.



DL ARM32BIT-HP

This processor helps deepen the understanding of **STM32MP1** peripherals and the Linux operating system, while enhancing the programming ability of microprocessors and the Linux environment.

- Development software:
 - Ubuntu, FileZilla, Visual Studio Code, CH340 driver.
- Windows support:
 - Windows 10 64bit Professional,
 - Windows 11 64bit.

TECHNICAL FEATURES

The **STM32MP1** series is a general purpose and multimarket microprocessor (MPU) class of products, targeting a wide range of applications in industrial, in Smart city, in Smart home, in Medical and health care, and in IoT.

The **STM32MP157** is a high-performance heterogeneous multi-core processor, integrating a dual-core Cortex-A7 application processor with a main frequency of 650 MHz and a Cortex-M4 single-core real-time controller with a main frequency of 209 MHz, and supporting the complex Linux operating system.

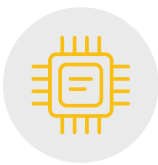
PERIPHERAL INTERFACES RESOURCES ON THE BOARD

- Onboard 1GB DDR3L memory and 8GB EMMC.
- General inputs and outputs with at least 44 ports.
- Keyboard with hexadecimal keys.
- Interfaces: CAN BUS, RS232 BUS, 485 BUS, TCP/IP, SD Card, JTAG, IIS, LCD and screen, USB.
- Peripheral: Light environment sensor, 6-axis motion tracking sensor.
- Expansion bus for connecting external applications.

TRAINING OBJECTIVES

With this board it is possible to perform experiments on the following subjects:

- Linux C Programming experiment,
- TF-A transplantation experiment,
- Uboot transplantation experiment,
- Linux Kernel transplantation experiment,
- Root file system construction experiment,
- Linux LED Driver experiment,
- Linux Key Input experiment,
- Linux Kernel Timer experiment,



ELECTRONICS



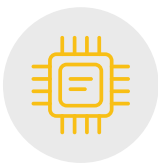
- Linux Interrupt experiment,
- Linux LCD Driver experiment,
- Linux IIC Driver experiment,
- Linux RTC Driver experiment,
- Linux SPI Driver experiment,
- Linux RS232/485 Driver experiment,
- Linux USB Driver experiment,
- Linux Audio Driver experiment,
- Linux Network Device Driver experiment,
- Linux ADC Driver experiment,
- Linux DAC Driver experiment.

ACCESSORIES

The trainer is supplied with the following elements:

- DC12V/2A power adapter,
- SD Card,
- Ethernet cable,
- USB Type A-B cable,
- RS232/RS485 cable.

And complete with technical documentation, practical manual and software.



DL ARM32BIT-UL

This processor helps deepen the understanding of **STM32L4** peripherals and low-power implementation, while strengthening programming skills for microprocessors and their components.

- Development software:
 - Keil MDK-ARM V5.15 with STM32L4 device package.
 - STM32CubeMX.
 - JLink V7.82.
- Windows support:
 - Windows 10 64bit Professional,
 - Windows 11 64bit.

TECHNICAL FEATURES

The **STM32L496** device is ultra-low-power microcontrollers based on the high-performance Arm® Cortex®-M4 32-bit RISC core operating at a frequency of up to 80 MHz. The low power consumption feature enables dynamic voltage scaling (range 1 & 2) in stop mode current (~1µA with SRAM retention) and standby mode current (~0.4µA with RTC).

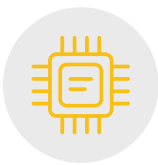
PERIPHERAL INTERFACES RESOURCES ON THE BOARD

- General inputs and outputs with at least 18 ports.
- Keyboard with hexadecimal keys.
- Interfaces: RS232, JTAG, IIS, TFTLCD, 7-segment LCD.
- Peripheral: Light environment sensor, Infrared receiver, Infrared receiving and transmitting peripheral, 6-axis sensor, Temperature and humidity sensor.
- Expansion bus for connecting external applications.

TRAINING OBJECTIVES

With this board it is possible to perform experiments on the following subjects:

- LED Running Light experiment,
- Button Input experiment,
- External Interrupt experiment,
- Serial Communication experiment,
- Timer interrupt experiment,
- TFT LCD Display experiment,
- RTC (Real-Time Clock) experiment,
- Ambient Light Sensor experiment,
- IMU (Inertial Measurement Unit) test experiment,



ELECTRONICS



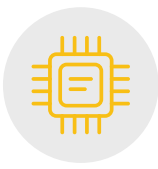
- Infrared (IR) Transmitter & Receiver experiment,
- Music Player experiment,
- Temperature & Humidity Sensor experiment,
- Low-power voltage and current detection experiment,
- 7-segment LCD Display experiment,
- Ultra-low power consumption experiment.

ACCESSORIES

The trainer is supplied with the following elements:

- DC5V/2A power adapter,
- USB – RS232 cable,
- JLink Debugger,
- Wires.

And complete with technical documentation, practical manual and software.



DL ARM32BIT-MS

This processor helps deepen the understanding of **STM32F4** peripherals, as well as the FreeRTOS operating systems, while enhancing the programming skills of microprocessors and their components.

- Development software:
 - Keil MDK-ARM V5.15 with STM32F4 device package.
 - STM32CubeMX.
 - JLink V7.82.
 - ST-Link debug.
- Windows support:
 - Windows 10 64bit Professional,
 - Windows 11 64bit.

TECHNICAL FEATURES

The **STM32F407** is a high-performance Cortex-M4 MCU with FPU and DSP instructions, operating at 168 MHz, supporting operating systems such as FreeRTOS.

The **STM32F407** is designed for medical, industrial and consumer applications where the high level of integration and performance is required, embedded memories and rich peripheral set are required.

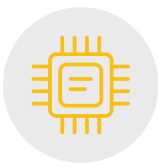
PERIPHERAL INTERFACES RESOURCES ON THE BOARD

- Onboard 1MB SRAM.
- General inputs and outputs with at least 24 ports.
- Keyboard with hexadecimal keys.
- Interfaces: CAN, RS232, 485 BUS, TCP/IP, SD Card, JTAG, IIS, LCD and touch screen.
- Peripheral: Photosensitive sensor, Infrared receiver, Three-axis magnetometer, Temperature and humidity sensor.
- Expansion bus for connecting external applications.

TRAINING OBJECTIVES

With this board it is possible to perform experiments on the following subjects:

- LED Running Light experiment,
- Button Input experiment,
- External Interrupt experiment,
- IWDG (Independent Watchdog) experiment,
- Serial Communication experiment,



ELECTRONICS



- Timer interrupt experiment,
- TFT LCD Display experiment,
- RTC (Real-Time Clock) experiment,
- SD Card & SRAM experiment,
- 485 & CAN communication experiment,
- Light Sensor experiment,
- PFU/DSP experiment,
- Infrared Remote-control experiment,
- ADC & DAC experiment,
- Music & Video Player experiment,
- Temperature & Humidity Sensor experiment,
- Audio Recorder experiment,
- Magnetometer experiment,
- Network communication experiment,
- FreeRTOS Task Scheduling experiment,
- FreeRTOS queue operation experiment,
- FreeRTOS semaphore experiment

ACCESSORIES

The trainer is supplied with the following elements:

- DC12V/2A power adapter,
- SD Card,
- Ethernet cable,
- USB Type A-B cable,
- RS232/RS485 cable,
- Touch pen.

And complete with technical documentation, practical manual and software.