

## >>Microprocessor

### Modular Integrated Training System Microcontroller

#### HBE-MCU-Multi



- Supports multiform MCU of independent module structure
- Supports CPLD module for digital circuit experiment
- Functional modularity of application
- Provides analysis and measurement module for improving the efficiency of MCU learning
- Supports various interfaces for signal connections between MCU and module
- Offers measurement point for signal analysis
- Provides multiform program experiments for the basis and project experiments

#### Introduction

MCU products based on 8-bits is the basic training theme that is being used on education sites for a long time. However, when it is a product manufactured to fit into traditional training method, a cramming one, it is impossible to configure its capabilities in the way users want, This product is a micro embedded training system designed to support variety of MCUs and, based on that, realize independent modularity of each function for the purpose of quickly applying the multiform program lessons including the basic training and meeting user's requirements to effectively apply the creativity engineering training recently emerging from universities and high schools to education.

#### Features

- Devices of ATmega128, 89C51, PIC18F6722 designed to be modules of connector structure which are mountable and removable, allowing multiform microcontroller training.
- CPLD module installed to perform the digital circuit design education at the same time.
- Provides a configuration that multiform connects MCU module and functional module.
- Each functional module can be installed and removed so users can use application design type they want by utilizing functional modules separated from the base board user wants.
- Provides the signal and power analysis modules that can improve the efficiency of MCU lesson and design. (interrupt, frequency analysis)
- Provides the dedicated measurement point for easy analysis of MCU and application signals.
- Provides multiform input switches and output display devices.
- Multiform sensor modules are mountable.
- Provides application modules for USN and sensor training.
- Provides various experiment programs necessary for application experiment.
- Supports multiform design environment ranging from the basic processor education level to the application design level.
- Provides multiform option modules such as stack module and actuator module for maximizing use of the product.

## Specifications

### • MCU

Classification	Product	Manufacturer	Model	Compiler	Specification
MCU	AVR	ATMEL	ATmega 128A	AVR Studio WinAVR	Up to 8MIPS Throughput at 8MHz JTAG Interface, ISP Program 128k Bytes FLASH, 4k Bytes Internal SRAM 4K Byte EEPROM 8-channel PWM, 8-channel 10-bit ADC I <sup>2</sup> C, Dual UART
	PIC (Option)	MICROCHIP	PIC18F 6722	MPLAB IDE MPLAB C18	Up to 10MIPS Throughput at 40MHz ISP Program 128K Bytes FLASH, 3936Bytes Internal SRAM 1024Byte EEPROM 2-channel PWM, 12-channel 10-bit ADC I <sup>2</sup> C, SPI, UART
	8051 (Option)	ATMEL	AT89C 51ED2	IAR EW8051	Up to 40MHz Operating ISP Program 64k Bytes FLASH, 1792Bytes Internal SRAM, Full Duplex UART 6-channel Interrupt

### • Application

Classification	Product	Specification
PLD	CPLD, EPM570	15k Logic Gate CPLD Built in Clock Manage Block
	LED	16Digit RED LED
Display	FND	2Digit 7-Segment
	FND	4Digit Array 7-Segment
	Text LCD	2Line 16char Text LCD Back Light
Motor	OLED	128 * 128 Dot, 262k Color
	Step Motor	5V Stepping Motor
Relay	Relay	Dual Channel Relay 2EA
	SRAM	512k bits (65,536 * 8bit)
Memory	EEPROM	16k bits (2k * 8bit), I <sup>2</sup> C Interface
	FLASH	512k bits (65,536 * 8bit, SPI Interface
Audio	Piezo	Piezo 1EA
	Sound	Stereo Codec (Up to 96k), MIC Input 1 Port, Stereo Speaker Output 1 Port
DAC	Parallel DAC	800k SPS, 8bit Interface
	Serial DAC	300k SPS, SPI Interface
Sensor	Temperature	-40 ~ 124°C Range, I <sup>2</sup> C I/F
	Humidity	0 ~ 100% Range, I <sup>2</sup> C I/F
	Photo Diode	Visible Light Sensor
	CdS	Infrared Light Sensor
Interface	RS232	Up to 460kbps Data rate
	USB	Up to 1Mbps Data rate, RS232 to USB Interface
Measure Analysis	Frequency	Up to 100kHz Freq Measure Frequency & Duty Display
	Interrupt	8-Interrupt Input analysis Rising, Falling State Display
Input	Key Pad	3 x 4 Key Pad
	Switch	Push Button 8EA, 16 Step Rotary Switch, 8 Pole DIP Switch
Power	Power	5V/6A, 3.3V/5A

\* Specifications can be changed without notice

## Microprocessor

3D PRINTER

SMART NUCLEO

HBE-Arduino-Sensor

### HBE-MCU-Multi

HBE-MCU-Multi-SENSOR

HBE-MCU-Multi II - ST

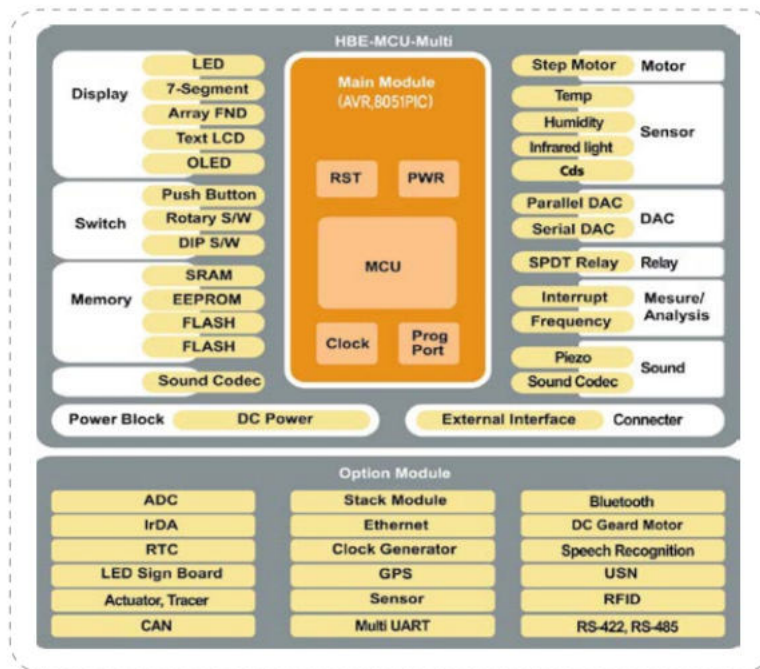
HBE-MCU-Multi Mini(AVR)

HBE-CAN

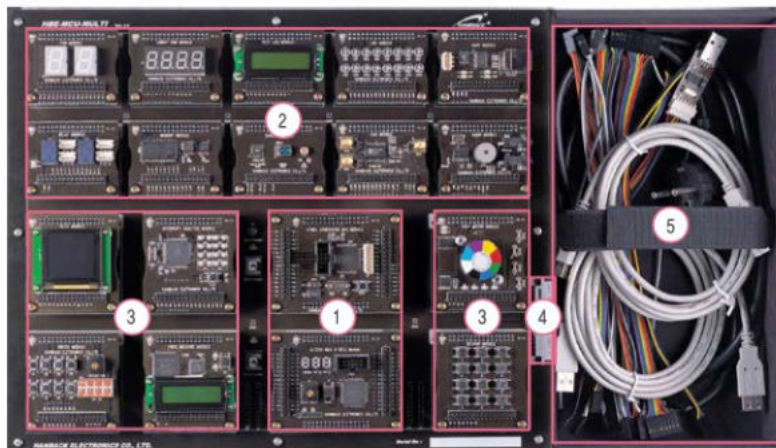
# Microprocessor

## >>HBE-MCU-Multi

### Block diagram

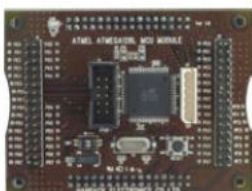


### Main configuration



1. MCU Module Zone : MCU and CPLD Module
2. 56mm \* 45mm Module Zone : LED, FND, Array FND, Text LCD, Sensor, Memory, Relay, DAC, Audio, UART Module
3. 56mm \* 60mm Module Zone : OLED, Step Motor, Switch, Key Pad, Freq Measure, Interrupt Analysis Module Installation
4. Option Module Interface : Interface for connecting option modules additionally provided
5. Cable box : Contains various cables used for the product

## Module Specifications



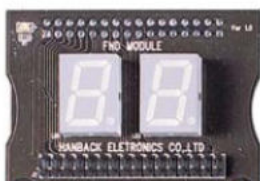
**AVR Module**

- ATmega128
- Up to 8MIPS
- JTAG, ISP Interface
- 128k Byte Flash, 4k Byte Internal SRAM
- 4k Byte Internal EEPROM
- 32.768k Crystal on board
- Size : 80mm x 60mm
- 49 Test Point



**CPLD Module**

- EPM570
- 15K Logic Gates
- JTAG Programmer Interface
- 1Hz ~ 10MHz 16 Step Clock Manager
- 56 User I/O
- Size : 80mm x 60mm
- 56 Test Point



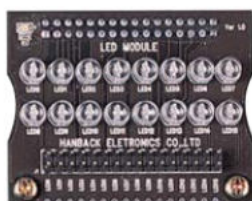
**FND Module**

- Common Cathode 2EA
- Red Color
- Size : 56mm x 45mm
- 16 Test Point



**Array FND Module**

- 4 Digit Dynamic Array FND
- Red Color
- Size : 56mm x 45mm
- 12 Test Point



**LED Module**

- High Brightness 16EA
- Red Color
- Size : 56mm x 45mm
- 16 Test Point



**Text LCD Module**

- 16Char \* 2Line Text LCD
- Small Size, Back Light
- Size : 56mm x 45mm
- 11 Test Point

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**OLED Module**

- 128 \* 128 Dot
- 262k Full Color
- Date Display Interface
- Easy Display Interface (Text LCD Interface Compatible)
- Size : 56mm x 60mm
- 13 Test Point



**Step Motor Module**

- 2 Full Step Control
- Interface Display LED 4EA
- Magnetic Sensor (Round Monitor)
- Round Monitor LED 2EA
- Size : 56mm x 60mm
- 5 Test Point



**Memory Module**

- SRAM (256k bits SRAM)
  - External Memory Interface
- Serial EEPROM (16k bits EEPROM)
  - I<sup>2</sup>C Interface
- Serial Flash (512k bits Flash)
  - SPI Interface
- Size : 56mm x 45mm
- 25 Test Point



**Audio Module**

- Stereo Sound Codec (Up to 96k)
- MIC Input 1Port
- Stereo Head Phone Output 1Port
- Serial(SPI) Interface
- Piezo Out 1Port
- Size : 56mm x 45mm
- 9 Test Point



**UART Module**

- USB Interface
  - RS232 to USB Interface
  - Throughput Speed : Max 1M bps
- RS232 Interface
  - Throughput Speed : Max 115,200 bps
- Size : 56mm x 45mm
- 4 Test Point



**Sensor Module**

- Temperature
  - -40 ~ 124°C Range, I<sup>2</sup>C Interface
- Humidity
  - 0 ~ 100% Range, I<sup>2</sup>C Interface
- Photo Diode, CdS
  - Visible Light, Infrared Light Sensor
- Size : 56mm x 45mm
- 5 Test Point

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**DAC Module**

- Parallel DAC
  - 800k SPS, 8bit Interface
  - 2 DAC Channel
- Serial DAC
  - 800k SPS, SPI Interface
- High Quality Interface (SMA Interface)
- Size : 56mm x 45mm
- 15 Test Point



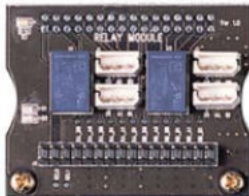
**Interrupt Analysis Module**

- 8 Port Interrupt Monitor
- Interrupt Status Display (Rising, Falling)
- Size : 56mm x 60mm
- 16 Test Point



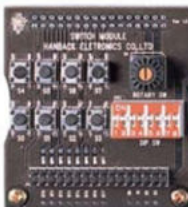
**Frequency Measure Module**

- Clock Signal Analysis Module
- Frequency & Duty Analysis
- Frequency & Duty display included
- 2 Channel Input
- 500 ~ 500k Input Range
- Size : 56mm x 60mm
- 2 Test Point



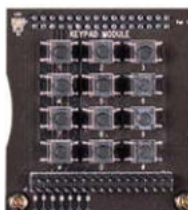
**Relay Module**

- Dual Channel Relay 2EA
- Up to 1A 30V DC
- Size : 56mm x 45mm
- 14 Test Point



**Switch Module**

- Push Button Switch 8EA
- 8 Pole DIP Switch
- 16 Position Rotary Switch
- Size : 56mm x 60mm
- 20 Test Point



**Key Pad Module**

- 3 Colum \* 4 Row Key Pad
- Size : 56mm x 60mm
- 7 Test Point

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### Option Module Specifications



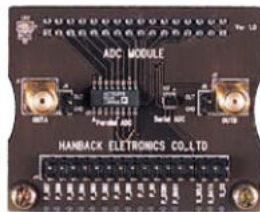
**8051 Module**

- AT89C51ED2
- Up to 40MHz Operating
- ISP Program
- 64k Byte Flash, 1792Bytes Internal SRAM
- Full UART, 6-channel Interrupt
- Size : 80mm x 60mm
- 34 Test Point



**PIC Module**

- PIC18F6722
- Up to 10MIPS Throughput at 40MHz
- ISP Interface
- 128k Byte Flash, 3936Bytes Internal SRAM
- 1024Byte Internal EEPROM
- 2channel PWM, 12channel 10bit ADC
- Size : 80mm x 60mm
- 51 Test Point



**ADC Module**

- Parallel ADC : AD7819 (8bit, 200kSPS)
- Serial ADC : AD7478 (8bit, 1MSPS, SPI)
- Size : 56mm x 45mm
- 15 Test Point



**Bluetooth Module**

- FB155BC, Up to 30mFR Range
- Size : 56mm x 45mm
- 6 Test Point



**Clock Management Module**

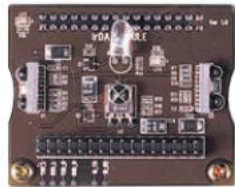
- RTC (RTC4513)
- Clock Generator  
(Programmable OSC, 200Hz ~ 270MHz)
- Size : 56mm x 45mm
- 9 Test Point



**GPS Module**

- GGM-600S, SiRFstar III support
- Size : 56mm x 60mm
- 2 Test Point

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**IrDA Module**

- IrDA
- IR Transceiver & Receiver
- Size : 56mm x 45mm
- 6 Test Point



**Voltage Meter Module**

- 0 ~ 5V Voltage Meter
- 10 Level LED Display
- Size : 56mm x 45mm
- 1 Test Point



**Multi UART Module**

- I<sup>2</sup>C to UART, RS232 4Port support
- Size : 56mm x 45mm
- 19 Test Point



**RS422 / RS485 Module**

- RS422/RS485 Full & Half Duplex support
- Size : 56mm x 60mm
- 4 Test Point
- must use a pair of modules.  
(need one more AVR module)  
(support just RS422/RS485 interface function)



**Tilt Sensor Module**

- - 60 ~ + 60, Dual axis Slope Detecting Sensor
- Twinaxis Slope Detecting Support
- Size : 56mm x 45mm
- 4 Test Point



**DC Geared Motor Module**

- Interface Display LED 2EA
- Magnetic Sensor (Round Monitor)
- Round Monitor LED 2EA
- Size : 56mm x 60mm
- 5 Test Point

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**HBE-MCU-Multi**

HBE-MCU-Multi-SENSOR

HBE-MCU-Multi II - ST

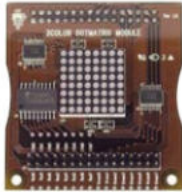
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## >>HBE-MCU-Multi



**3 Color Dot-Matrix Module**

- 8 \* 8 Red, Green Color
- Size : 56mm x 60mm
- 24 Test Point



**Ethernet Module**

- W5100 Ethernet Controller
- Include TCP/IP Stack
- Size : 56mm x 60mm
- 5 Test Point



**RFID Interface Module**

- Need a RFID Reader
- 125k RFID Reader (Option)
- 13.56MHz RFID Reader (Option)
- 900MHz RFID Reader (Option)



**Sensor Interface Module**

- HBE-Sensor-Multi Sensor Module Interface
- Support 34 Sensor Module



**USN Interface Module**

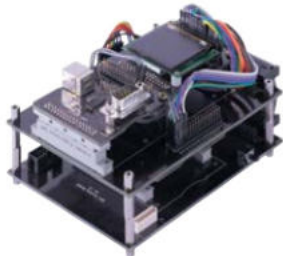
- TinyOS, Nano QPlus support
- RF (CC2420, IEEE802.15.4 Ready)
- CPU : ATmega128, MSP430
- Size : 56mm x 45mm
- 28 Test Point
- ZigbeX-mote is Option  
(need to use with ZigbeX-mote)



**Ext Interface Module**

- HBE-MCU-Multi Option Module Interface
- Equipment on the body by attaching an optional module is configured to practice
- Support 15 Option Module 56mm x 45mm, 56mm x 60mm Module Support

## Application Example



**HBE-MCU-Stack Module**

- HBE-MCU-Stack-Module option modules help students easily integrate several functional modules.
- Multifunctional MCUs, sensors, mobile power pack and functional modules can be integrated using stack interface option modules.



**Handheld Digital Thermometer Device Example**

Handheld Digital Thermometer Device can be made using MCU, Sensor and Array FND display through HBE-MCU-Stack-Module.



**Handheld Digital Digital Picture Frame Example**

- Handheld Digital Picture Frame can be made using MCU, UART and OLED display through HBE-MCU-Stack-Module.
- Image application software with USB interface to PC.
- With OLED control experiments, full color and high contrast image design, display, download and operation can be learned easily by students.



**HBE-RoboCAR**

- Designed as flexible robot actuator.
- Many universal interfaces for various embedded systems, sensors and communications.
- Default microcontroller and ultrasonic, distance, ultra red and accelerometer sensors implemented.
- Wireless control & data communication with wireless sensor network.

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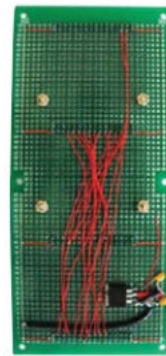
### Application Example

All kinds of modules of HBE-MCU-Multi can be used for the application of universal breadboard.



Digital Temperature Application Example

- MCU, Sensors and Text LCD display integrated handheld digital temperature device project experiments on universal breadboard.
- Easy soldering universal pin connector and cabling general copper wire on back side breadboard can make students flexible experiments.



### Contents

#### Contents of Education

#### HBE-MCU-Multi(AVR)

- INTRODUCTION TO MICROCONTROLLER
1. AVR Micro Controller
  2. AVR Micro Controller Development Environment
- FUNCTIONS OF MICROCONTROLLER
3. GPIO I/O Control
  4. Internal Memory
  5. Interrupt
  6. Timer and Counter
  7. Timer and PWM
  8. UART
  9. A/D Converter
  10. External Memory Interface
  11. Serial Interface
- APPLICATIONS OF MICROCONTROLLER
12. Rotating Step Motor
  13. Pin Pad using KeyPAD
  14. LED brightness control using DAC function
  15. Digital frame using OLED

## Contents of Education

### HBE-MCU-Multi(PIC)

1. PREPARING TEST AND USING MPLAB
2. TURNING ON LED
3. RECEIVING PORT INPUT
4. STATIC FND
5. DYNAMIC FND
6. INPUTTING SEVERAL SWITCHES(KEYPAD)
7. DISPLAYING CHARACTERS ON TEXT LCD
8. RECEIVING EXTERNAL INPUT OF TIMER/COUNTER
9. INTERRUPT
10. STEPPING MOTOR
11. PWM
12. UART COMMUNICATION
13. ADC
14. EEPROM

### HBE-MCU-Multi(8051)

- MICROCONTROLLER
1. 8051 Micro Controller
  2. 8051 Micro Controller Developing Environment
- FUNCTIONS OF MICROCONTROLLER
3. GPIO I/O Control
  4. Internal Memory
  5. Timer and Counter
  6. Interrupt
  7. PCA and PWM
  8. UART
  9. External Memory Interface
  10. Serial Interface
- USING MICROCONTROLLER
11. Rotating Step Motor
  12. Pin Pad using KeyPAD
  13. Controlling LED brightness with DAC
  14. Make Paint with OLED

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## Package contents



HBE-MCU-Multi



User's manual and product CD



HBE-AVR-ISP Programmer



USB Cable (A to B Type)



AC Power Cable



Jumper Cable



Byteblaster for CPLD



Parallel Cable for CPLD