

# >>Digital Signal Processing

## Standard Digital Signal Processing Trainer

### HBE-DSPLAB II



- Mounted TI's TMS320F28335
- Code Composer Studio program Development Environment
- Various Signal Processing Experiments of Voice and Bio signal
- Built-in Function generator
- Built-in 2 Channel PC Based Oscilloscope for signal measurement
- Provide Sample program sources for experiments
- Available DSP application programming through Matlab simulink
- Provide Emulator

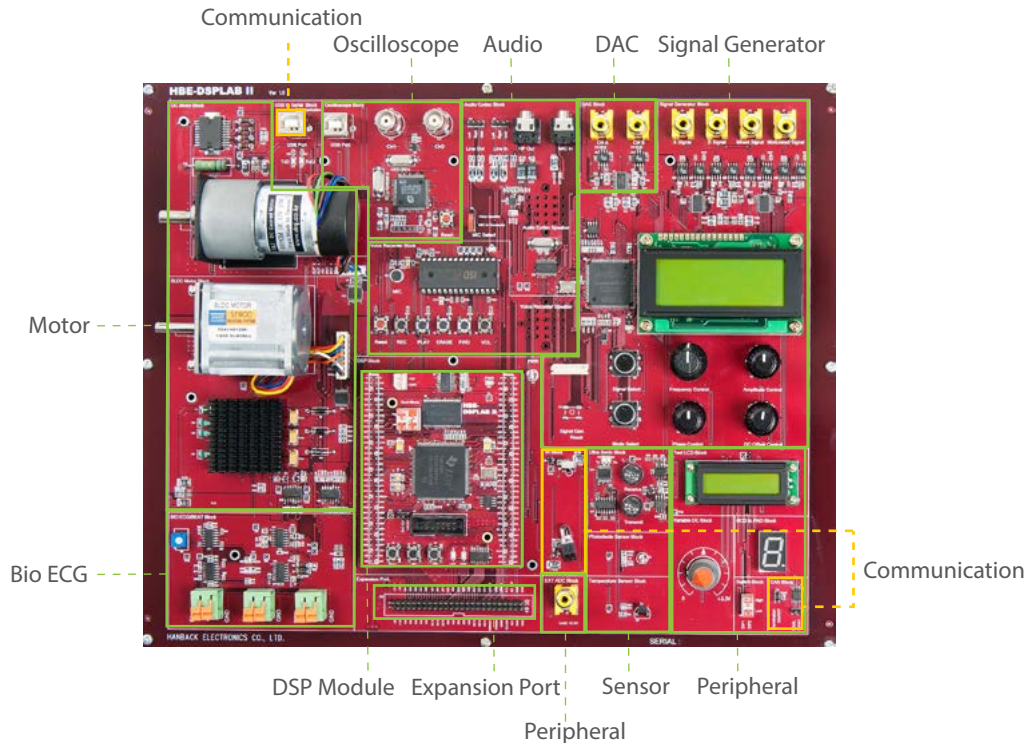
### Features

- Using TMS320F28335 - 32bit Floating-point Operation type device of TI.
- For beginners, Peripheral block is designed to control a simple signal.
- Various control experiments using several type sensors of Photo Diode, Temperature and Ultra Sonic etc.
- Check ECG signal and Beat signal of body through Bio ECG Block.
- Provide internal Waveform Generator(1Hz ~ 100kHz) which outputs Sinusoidal/Triangle/Square wave. User can practice without the additional equipment.
- Provided Audio Codec Block to process external voice signal.
- Provided Mixer Block to output the signal by Mixing Audio signal with Waveform Generator signal.
- Provided Modulation Block to output the signal by Modulation of Waveform Generator signal with the set frequency.
- For Motor control study, Provided DC Motor Block and BLDC Motor Block.

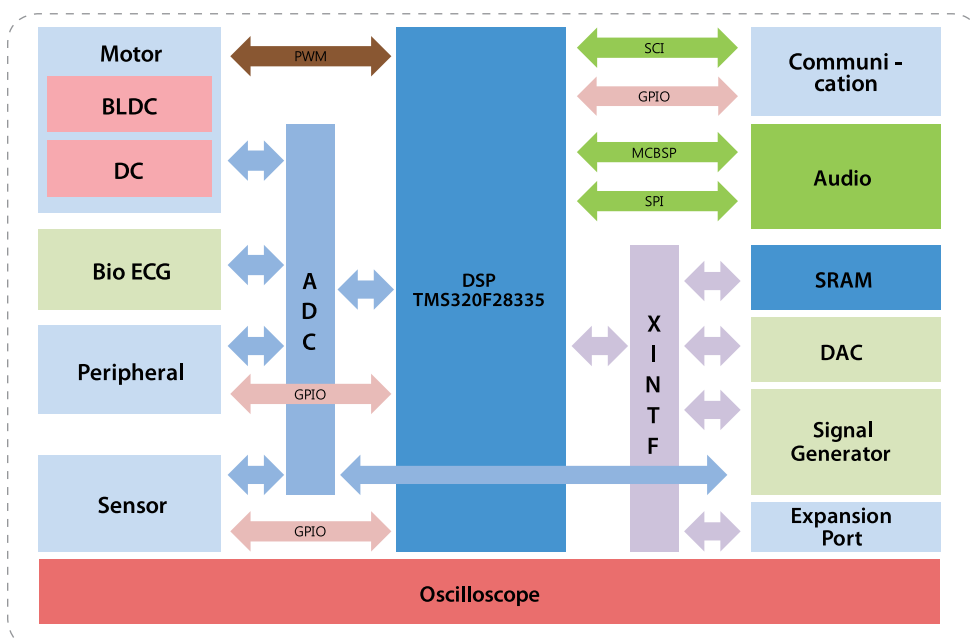
### Basic Experiment List

1. Program Development Experiment using Code Composer Studio IDE
2. Digital measurement and control Experiment with GPIO
3. Interrupt Experiment
4. ADC measurement control Experiment
5. Communication Experiment : SCI, CAN, I<sup>2</sup>C, McBSP, SPI
6. Standalone Flash programming
7. Measuring Analog and Digital signal
8. DC motor measurement control
9. BLDC motor measurement control
10. Bio ECG bio signal measurement control
11. FIR and IIR filter Design
12. Composite Signal Filtering
13. Noise Filtering
14. Frequency analysis by FFT
15. Voice Signal Measuring and Signal Processing

### Configuration and Names



### Block Diagram



# Digital Signal Processing

## >>HBE-DSPLAB II

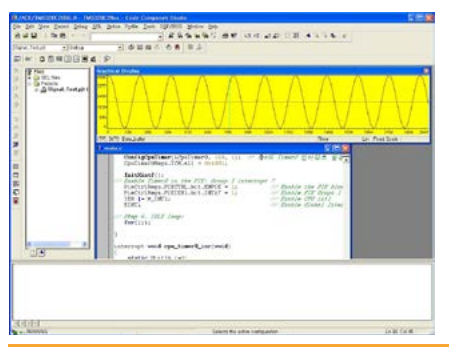
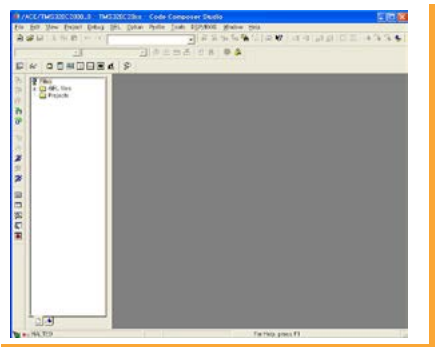
### Hardware Specifications

Items	Description
DSP Module	DSP : TMS320F28335 Device - High-Performance 32bit CPU - 6 Channel DMA Controller - On-Chip Memory : 256k x 16 Flash, 34k x 16 SARAM - Boot ROM (8k x 16) - 12 Bit ADC, 16 Channel SRAM : 1Mbit (64k x 16bit), Switch 2EA, LED 2EA, JTAG port
Peripheral	2pole DIP Switch 1EA BCD to FND 1EA : BCD value to 7-Segment display 16 x 2 Text LCD 1EA : E, RS, 4bit Data Variable DC : 0 ~ + 3.3V variable DC input Ext ADC RCA Port : External 0 ~ +3.3V range Signal input
DAC	2CH, 10MHz speed Digital to Analog Converter per a channel
Signal Generator	Sig A, Sig B, Mixer, Mod : Connected with each signal output RCA port and ADC block of DSP Text LCD : Set output signal value display Switch : Output signal set Switch and Initialization Switch Waveform Generator : Waveform output set to Sig A, Sig B port Waveform : Select of Sine, Triangle, Square waveform Frequency : Select of 1, 2, 5, 10, 20, 50, 100, 200, 500, 1k, 2k, 5k, 10k, 20k, 50k, 100k output frequency Amplitude : Select from 0Vp-p to 10Vp-p by 0.5Vp-p unit Phase : Select to 345° at intervals of 15° Bias : Select of -5V ~ +5V by 0.5V level unit
Sensor	Photo Diode 1EA, Temperature Sensor 1EA : LM35D, Ultrasonic Sensor 1set : Transmit /Receive Block
Bio ECG	ECG signal and Beat signal Measurement Block, Cable and Measuring Terminal included for Measurement
Communication	CAN Transfer Block, IR Transmit /Receive Block, USB to Serial Block : Serial Communication Block
Motor	DC Motor Block : +12V DC Geared/Encoder Motor, DC Motor Drive Block, PWM control, Encoder input BLDC Motor Block : +12V Brushless DC Motor, BLDC Motor Drive Block, 3 phase PWM control, Hall Sensor input, Sensorless control
Audio	Voice Recorder : SD1760P, 60 seconds recoding (8kHz Sampling), Reset, Record, Play, Erase, Forward, Volume Switch MIC. input speaker output (connected to MIC In of Audio Codec) Audio Codec : TLV320AIC23, MIC in, HP Out Connector, Line IN, Line Port, Can be used for input source
Oscilloscope	2 CH, ±16V measuring range, 500kHz Sampling Speed, PC monitor by USB communication
Expansion Port	Address, Data and Control signal of DSP module connected External expansion port
Power	+5V, +12V, -12V, +3.3V SMPS Power (50W)
Size	336 mm x 273 mm (except a bag)

\* Specifications can be changed without notice

## Software Specifications

### •Code Composer Studio 3.3 Program Test Environment



Programming Environment using Code Composer Studio

Real Time Data Check using Code Composer Studio

## Contents

### Contents of Education

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- [TMS320F28X System]
- 2. Structure of TMS320F28x
- 3. Development Environment of TMS320F28335
- [Control and Processing with TMS320F28335]
- 4. Digital I/O
- 5. Timer and Interrupt
- 6. Analog Digital Conversion
- 7. UART, CAN and IR Communication
- Infrared ray
- 8. Measuring Signal by Signal Generation
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- [Digital Signal Processing]
- 12. Convolution Operation
- 13. Digital Filter
- 14. Fast Fourier Transform
- 15. Autocorrelation Function
- 16. Cepstrum
- [Appendix A] Introduction of HBE-DSPLABII
- [Appendix B] Code Composer Studio download
- [Appendix C] HBE-DSPLABII

## Components



HBE-DSPLAB II



User's Manual and CD



ECG PAD



USB cable (A to B Type)



AC Power cable



RCA cable



DSP JTAG and Cable



ECG Probe Cable



Oscilloscope Probe Cable

