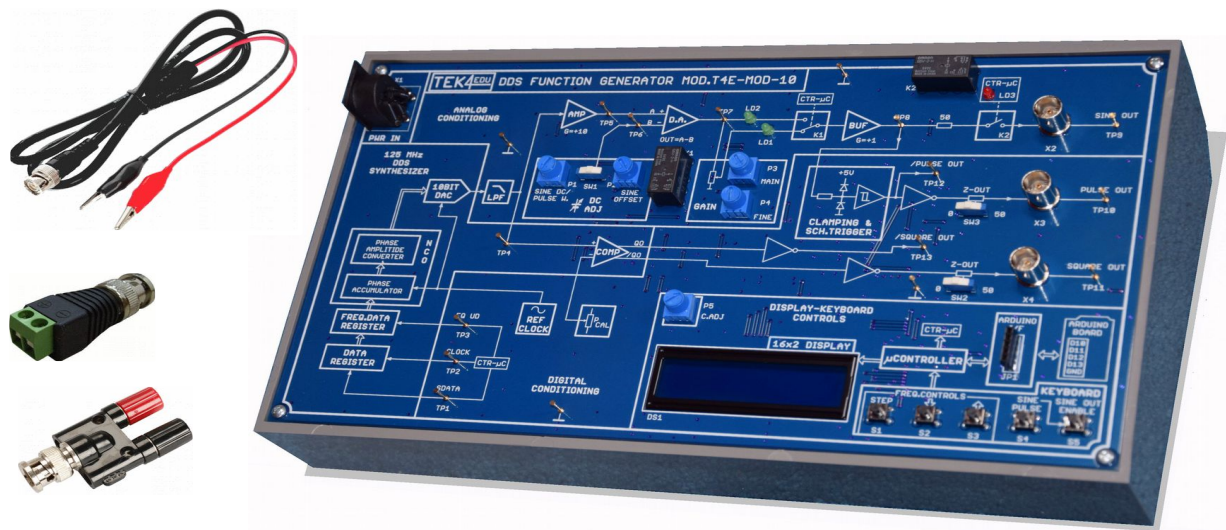


DDS FUNCTION GENERATOR MOD. T4E-MOD-10



COURSE PROGRAM (cont.1)

The module **DDS Function Generator mod.T4E-MOD-10** is a complete waveform generator that can be used:

- to study the DDS technology (Direct Digital Synthesis) that is used to digitally synthesize a periodic waveform
- as a function generator of laboratory to provide the necessary signals to the experimental circuits. 3 useful accessories are included.

The module can generate SINE / SQUARE / PULSE signals:

- Minimum frequency 0.1 Hz
- direct and inverted logic
- Control of the DC offset and the output impedance

The display, the keyboard and the microcontroller allow the setting and display the desired frequency and the management of different operating modes, such as in professional generators.

The **Arduino interface** allows easy connection to an external board **Arduino UNO (not included)**. This configuration allows the use of an Arduino UNO board and Arduino Software (IDE) for:

- Study the code provided in the module
- Change the code and to evaluate the effects
- Update the module code
- Re-program the microcontroller.

COURSE PROGRAM

Characteristics of function generators:

- SINE/SQUARE/PULSE signals and polarity
- output impedance
- control of duty-cycle, frequency and step

DDS synthesizer:

- data and frequency registers
- NCO (numerically controlled oscillator): Phase accumulator and phase/amplitude converter
- DAC (Digital to Analog Converter)

Reference frequency generator

Reconstruction Filter

Signal characteristics generated by the DDS

Techniques of analog signal processing to convert the fixed signal generated by the DDS in the signal with amplitude and mean value desired:

- analog signal amplification and gain control
- DC offset control
- buffering

Techniques of digital signal processing to convert an analog signal into a digital signal with an adjustable duty-cycle:

- clamping and Schmitt trigger

Enabling / disabling SINE output:

- Enables setting and measurement the desired signal (amplitude and DC offset) without having to disconnect the circuit: it avoids to provide an unwanted amplitude signal to the connected circuit
- You can enable / disable the output using the keyboard

Design and dimensioning:

- electronic components in the generator
- DDS chip used: Analog Devices AD9850

Measures:

- signal generated by DDS
- signals processed in the different functional blocks of the module
- sine/square/pulse output signals, direct and inverted logic
- Data/Clock/Freq.Update signals provided by the microcontroller to DDS

TECHNICAL SPECIFICATIONS

Waveform generated by the DDS:

- sinusoidal
- amplitude: 1Vpp
- mean value: 0.5V

Sinusoidal waveform (**SINE out**):

- amplitude: 10Vpp (max, HiZ load), continuously adjustable with double-potentiometer (Main and Fine)
- current: +/- 100mA (max, 50 Ohm load)
- frequency: 0.1Hz to 10MHz (-6dB) / 18MHz (2Vpp), HiZ load
- DC Offset: > +/-5V (max), continuously adjustable with double-potentiometer (DC and offset)
- output impedance: 50 Ohm

relay to control the output: managed by keyboard

Square waveform (**SQUARE out**):

- amplitude: 5V TTL
- current: +/- 24mA (max)
- frequency: 0.1Hz to 5MHz (Zout= 0Ohm), HiZ load, Risetime/ FallTime <20ns

output impedance: selectable 0/50 Ohm

No. 2 outputs: direct and inverted logic

Pulse waveform (**PULSE out**):

- amplitude: 5V TTL
- current: +/- 24mA (max)
- frequency: 0.1Hz to 4MHz (Zout= 0Ohm), HiZ load, Risetime/ FallTime <20ns

duty cycle: continuously adjustable

output impedance: selectable 0/50 Ohm

No. 2 outputs: direct and inverted logic

TECHNICAL SPECIFICATIONS (cont.1)

ATmega328P microcontroller:

- The code manages the display, keyboard and DDS programming
- 10bit A/D converter used to read the push-buttons of the keyboard

Display:

- 16 characters x 2 lines
- Blue LCD with white LED backlight
- Contrast adjustment
- Displays the voltage and current measurements

Measurements on the display:

- values of frequency and frequency step

Keyboard:

- Select the frequency Step: 0.1/1/10/100/1k/10k/100k/1M (Hz)
- Select the generated frequency from 0.1 Hz to 40 MHz
- Selects the signal path for the waveforms SINE/PULSE
- Enable the SINE output

Arduino interface:

- No.1 connector type Female Header, 5 Contacts (No.4 for RESET / MISO / MOSI / SCK signals and No.1 on ground)
- Used to connect the module to an Arduino UNO board
- It allows the study of the code provided, or edit it and evaluate its effect on the module operation
- Allows updating / re-programming of the microcontroller code in the module

Quality:

- Test point: brass alloy, surface gold
- Electronic components: RoHS
- PCB: 35µm copper, UL mark, IPC2

TECHNICAL SPECIFICATIONS (cont.2)

Ergonomics:

- Synoptic panel: blue with white silkscreen to ensure contrast and readability, 15° inclination to optimize use and readability
- Controls: mini-slide switches and buttons
- Test points and BNC connectors: for use with measuring instruments
- Header female: standards for connection to Arduino UNO board

Safety:

- External power supply: protection for power and temperature overload, and short circuit
- Electronic circuits: sturdy box in ABS that protects the internal circuits making them inaccessible

Accessories included:

- Student manual: contains exercises that describe how to use the module, the circuit design concepts, the description of the code used in the module
 - Power unit: 90-264VAC / 47-63Hz input, with cable and connector
 - Mains AC power cable: IEC60320
 - No.1 Crocodile clips/BNC cable
 - No.1 2-pin terminal block/BNC adapter
 - No.1 4 mm banana Plug/BNC adapter
- Dimensions and weight:
- Packaging: 350x230x120 mm
 - Front panel: 300x160 mm
 - Total weight: 1kg

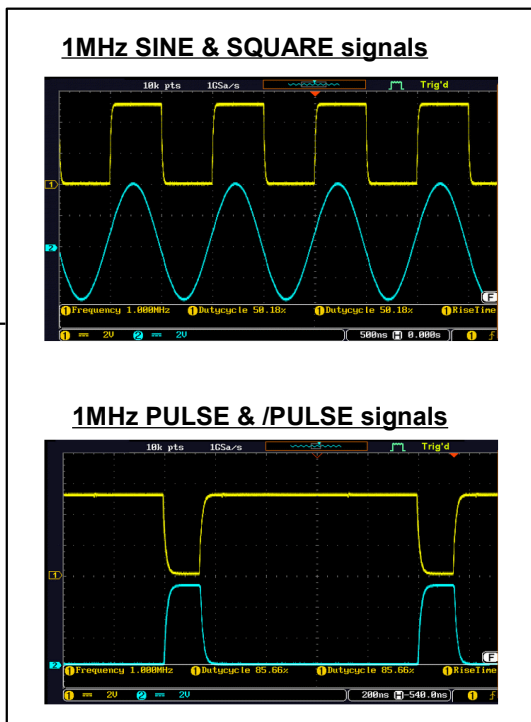
Accessories included:

- Student manual
- Power supply unit
- Power cable
- No.1 Crocodile clips/BNC cable
- No.1 terminal block/BNC adapter
- No.1 banana Plug/BNC adapter



Accessories not included:

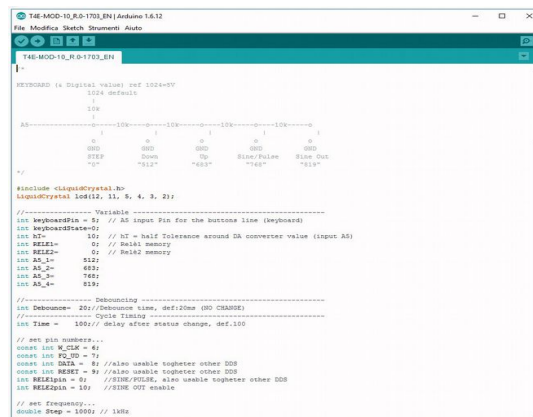
- Arduino UNO board
- Computer
- Breadboard



Example of installation and use



Arduino UNO I/F



Arduino Software (IDE) w/ code



Arduino UNO board

USB

