



## MODULAR - BLOCK EDUCATIONAL UNITS FOR THEORETICAL AND EXPERIMENTAL ELECTRONICS TRAINING

The advantages of the theoretical-experimental method for the study of electronic circuits are well known. The aim of the "BLOCK-TRONIC" system is to make easier the teacher's and the student's experimental activity employing already assembled circuits, ready to operate and organised so as to assure the best safety and flexibility of use.

The main advantages of the "BLOCK-TRONIC" system are the following:

- ease of technical modernization
- ease of transport and storage
- ease of use (immediate accessibility)
- minimal wiring required to save lab time
- improved practical experimentation due to the small number of involved components
- absolute safety of use

Particularly, the "BLOCK-TRONIC" system has peculiar features that make it unique for reliability and functionality:

- compact modular blocks with synoptic panels
- magnetic fastening to the circuit former
- swift connection of the blocks to make more complex circuits by means of standard cables with terminal pins
- error-proof circuits operating at low voltage power supply
- remarkably strong blocks made of unbreakable materials

The "BLOCK-TRONIC" system includes the following main elements:

- modular blocks supplied in different number according to the model and to the particular area at which they are aimed to
- ledger-shaped circuit former, able to accommodate four blocks located on two ranks
- standard set of cables with 3 mm banana plug
- accessory kit
- instruction manual and courseware
- special unbreakable case container.

The "BLOCK-TRONIC" system is suitable for five training configurations, each one corresponding to a particular area of study:

- BT-1001/BE : BASIC ELECTRICITY
- BT-1002/GE : GENERAL ELECTRONICS
- BT-1003/RT : RADIOELECTRONICS-TELECOMMUNICATIONS (\*)
- BT-1004/IE : INDUSTRIAL ELECTRONICS
- BT-1005/DE : DIGITAL ELECTRONICS

The experimental blocks included in the supply allow the performance of a wide range of exercises listed below.

Upon request it is possible to purchase the BT-1000 units in a configuration to be inserted on a vertical bench frame. Each module of the BT-1000 series can be sold also singularly as perfectly configured for a stand alone working.

(\*) to be announced.

**BT-1001/BE BASIC ELECTRICITY****CONFIGURATION**

It is composed of:

- N. 9 MODULAR BLOCKS DEDICATED TO:
  - BE-01 Electric circuits
  - BE-02 Resistors
  - BE-03 Wheatstone bridge
  - BE-04 Variable resistors
  - BE-05 Capacitors, inductors and transformers
  - BE-06 Diodes and filters
  - BE-07 Motors and Generators
  - BE-08 Variable frequency and voltage power supply
  - BE-09 Dc power supply (batteries)
- N. 1 Ledger-shaped support suited to hold 4 blocks (on two ranks)
  - N. 1 Set of cables with multi-pins plugs
  - N. 1 multi range AC-DC millivoltmeter
  - N. 1 multi range AC-DC milliammeter
  - Accessories an multi coloured wires (banana plug)
  - Student manual with 48 proposed exercises
  - Case container
  - Volume: 55 x 55 x 20 h cm
  - Weight: 25 Kg

**FEATURES**

The common features of the modular blocks are the following:

- components mounted on printed circuit board (shielded)
- socket terminals for measurements and connections ( $\varnothing$  2 mm)
- silk-screened synoptical panel
- unbreakable plastic case
- magnetic fastening device to the circuit former

**TOPIC COVERAGE**

1. The electric circuit
2. Current magnitude and its measurement
3. Voltage and its measurement
4. Electric resistance
5. Series and parallel loads
6. Switching
7. Lamp control from several points
8. OHM's law - The characteristics  $I = f(V)$
9. Measurements of resistance (volt-ampometric method)
10. The Wheatstone Bridge
11. The resistance of a conductor - The resistivity
12. The variation of a conductor resistance with the temperature
13. N.T.C. and P.T.C. characteristics
14. Resistances in series
15. Resistances in parallel
16. Electrical network
17. Internal resistance of an ammeter
18. Determination of the internal resistance of a voltmeter
19. Variable resistors and potentiometers
20. Ohm's law for a generator
21. Voltage generator and current generator
22. Electric power and its measurement
23. Charge and discharge of a capacitor
24. Magnetic effect of the electric current
25. Magnetic field produced by the current passing in a coil
26. The induced E.M.F.
27. The alternating current

28. The instantaneous values of the alternating current
29. The effective (R.M.S.) values
30. The resistive bipole
31. The resistive-inductive bipole
32. The impedance variation according to the frequency variat.
33. Determination of "R" and "L" in a resistive inductive bipole
34. The capacitive bipole
35. The capacitive reactance variation
36. The resonance curve for a RLC series circuit
37. The capacitor in parallel to a RL bipole
38. The transformer
39. The characteristics of a diode
40. The zener diode
41. The controlled diode
42. Half-wave rectification
43. The Graetz bridge
44. Capacitive smoothing filter –
45. The direct-current electric motor (no load operation)
46. The direct-current electric motor (load operation)
47. D.C. generator no load operation
48. D.C. generator load - operation

**BT-1002/GE GENERAL ELECTRONICS****CONFIGURATION**

It is composed of::

- N° 6 MODULAR BLOCKS DEDICATED TO:
  - GE-01 Passive Networks
  - GE-02 AC/DC fundamentals
  - GE-03 Semiconductor devices
  - GE-04 Transistor applications
  - GE-05 Control circuits
  - GE-06 Operational amplifier
- N. 1 Ledger-shaped support suited to hold 4 blocks (on two ranks)
  - N. 1 Set of cables banana - plug with pins for supply and multi-coloured interconnections
- Accessories
  - Technical manual with electric diagrams
  - Student manual with 86 proposed exercises
  - Case container
  - Volume: 55 x 55 x 20 h cm
  - Weight: 22 Kg

**TOPIC COVERAGE****GE-01 PASSIVE NETWORKS**

1. Ohm's circuits
2. Generator's output impedance
3. Phase relationship
4. Capacitive Circuit

5. Inductive Circuit
6. Series and parallel inductors
7. Series and parallel capacitors
8. Capacitive divider
9. Balanced divider
10. RC Circuit
11. CR Circuit
12. LR Circuit
13. RL Circuit
14. Series Resonance
15. Parallel Resonance
16. Time constants
17. RC and CR Circuits on square-wave operation
18. RL and LR Circuits on square-wave operation

#### GE-02 AC/DC FUNDAMENTALS

1. Diode: unidirectional behaviour
2. Forward and reverse biasing
3. Dynamic relief of the characteristic curve
4. Limiter circuits
5. Two independent levels Limiter
6. Clamper circuit
7. Transformer: no-load test
8. Power and efficiency transfer
9. Reflex resistance of a transformer
10. Half-wave rectifier
11. Full-wave rectifier
12. Bridge rectifier
13. Ripple filtering
14. Voltage doubler

#### GE-03 SEMICONDUCTOR DEVICES

1. The Zener Diode
2. Input voltage regulation
3. Load regulation
4. Synchronizing signals
5. Power regulator
6. Regulator with variable output voltage
7. Regulator with current output
8. Efficiency test of bi-junction transistors
9. Base-emitter characteristic relief
10. Base-collector characteristic relief
11. Transistor circuit currents
12. Transistor circuit voltages
13. Output characteristic and load line

#### GE-04 TRANSISTOR APPLICATIONS

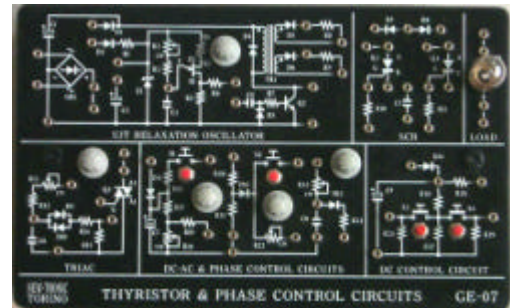
1. Transistor switching application
2. Switching time
3. Transistor bias
4. Resistive Divider Bias
5. Automatic bias networks
6. BJT linear operation
7. Wide signals amplification
8. Dynamic load line
9. Amplifiers frequency response
10. Square-wave signal response
11. Input resistance of the amplifier stage

#### GE-05 CONTROL CIRCUITS

1. Transistor astable multivibrator
2. Astable multivibrator improvement
3. Control pulse
4. Transistor monostable Multivibrator
5. Timer astable operation
6. Timer monostable operation
7. Frequency divider
8. Pulse width modulator (PWM)
9. Pulse Position modulator (PPM)

#### GE-06 OPERATIONAL AMPLIFIER

1. Max variation of the output voltage
2. Output impedance measurement
3. Slew rate
4. Current and power drain
5. Inverting voltage amplifier
6. Noninverting voltage amplifier
7. Summing amplifier
8. Buffer, emitter follower
9. Offset voltage measurement and calculation
10. Band width relief and calculation
11. Max width of the undistorted output signal
12. Integrator circuit
13. Differential circuit
14. Low-pass active filter
15. High-pass active filter
16. Band-pass active filter
17. Half-wave rectifier circuit
18. Comparator applications
19. Schmitt Trigger
20. Noninverting comparator
21. Inverting comparator



## BT-1004/IE INDUSTRIAL ELECTRONICS

### CONFIGURATION

It is composed of:

- N° 9 MODULAR BLOCKS DEDICATED TO:
  - IE-01 Industrial Semiconductor Devices
  - IE-02 Thyristor & Phase Control Circuits
  - IE-03 Linear Circuits & Analog Converters
  - IE-04 Oscillators & Non-linear Circuit Controls
  - IE-05 Direct Current Relais
  - IE-06 Alternate Current Relais
  - IE-07 DC Motor Controls
  - IE-08 Stepper Motor Controls (To Be Announced)
  - IE-09 DC/DC & DC/AC Converters (To Be Announced)
- N. 1 Ledger-shaped support suited to hold 4 blocks (on two ranks)
- N. 1 Set of conductors with terminals
- Accessories
- Instruction Manual with presently developed 86 Exercises
- Unbreakable Case container
- Volume: 55 x 55 x 20 h cm
- Weight: 25 Kg

**TOPIC COVERAGE (Units Titles)****IE-01 INDUSTRIAL SEMICONDUCTOR DEVICES**

1. Diac
2. GTO Thyristor
3. Darlington Pair Configuration
4. JFET
5. Power Mosfet
6. Ultra-Fast IGBT

(Total exercises: 18)

**IE-02 THYRISTOR & PHASE CONTROL CIRCUITS**

1. Silicon Controlled Diode (SCR)
2. SCR Conduction switch-on with a DC powered Gate
3. SCR Conduction switch-on with AC powered gate
4. Uni-Junction Transistor (UJT)
5. SCR conduction switch-on through pulse oscillator with UJT
6. Use of SCR in DC power circuits supplied with AC
7. Use of SCR power circuits supplied with AC
8. Use of SCR in power circuits supplied with DC
9. TRIAC
10. Use of Triac in low and medium power circuits

(Total exercises: 16)

**IE-03 LINEAR CIRCUIT & ANALOG CONVERTERS**

1. Reference Voltage Generator
2. Voltage-to-current converter (V/I)
3. Current-to-voltage converter (I/V)
4. Instrumentation Amplifier
5. Signal Conditioner
6. Voltage-to-frequency (V/F) & Frequency-to-voltage (F/V) converter

(Total exercises: 12)

**IE-04 OSCILLATOR & NON-LINEAR CIRCUIT CONTROLS**

1. Relaxation Oscillator
2. Function Generator
3. Precision Rectifier
4. Voltage Limiter
5. Window Comparator
6. Peak Detector

(Total exercises: 10)

**IE-05 DIRECT CURRENT RELAIS**

1. High-speed relay
2. Time-delay relay
3. High-speed relay with photoresistor control
4. High-speed relay with optical insulation
5. Delayed relay with bipolar transistors
6. Delayed relay with operational amplifiers

(Total exercises: 9)

**IE-06 ALTERNATE CURRENT RELAIS**

1. High-speed relay
2. Time-delay relay
3. Relay with photoresistor control
4. AC operation of static relay with triac and optical insulation
5. AC operation of time-delay relay with triac
6. AC operation of delayed relay with triac and I.C. timer

(Total exercises: 9)

**IE-07 DC MOTOR CONTROL**

1. DC Unidirectional Control Circuit
2. PWM Unidirectional Control Circuit
3. DC Bi-directional Control Circuit
4. PWM Bi-directional Control Circuit

5. DC Bi-directional control with Speed loop
6. PWM Bi-directional Control with Speed loop
7. DC Bi-directional Control with Speed & Current loop
8. PWM Bi-directional control with speed & Current loop

(Total exercises: 12)

**IE-08 STEPPER MOTOR CONTROLS (TO BE ANNOUNCED)****IE-09 DC/DC & DC/AC CONVERTERS (TO BE ANNOUNCED)****BT-1005/DE DIGITAL ELECTRONICS****CONFIGURATION**

It is composed of:

- N. 6 MODULAR BLOCKS DEVOTED TO:
  - DE-01 Logic gates (NOT, AND, OR, BUFFERS)
  - DE-02 Logic gates (NAND, NOR, EXOR, EXNOR, AOI)
  - DE-03 Combinational logic
  - DE-04 Memory elements
  - DE-05 Counters
  - DE-06 Input-Output
- N. 1 Ledger-shaped support suited to hold 4 blocks (on two ranks)
- N. 1 Set of cables banana - plug with pins for supply and multi-coloured rigid wires for interconnections
- Accessories
- Technical manual with electric diagrams
- Student manual with 43 proposed exercises
- Case container
- Volume: 55 x 55 x 20 h cm
- Weight: 22 Kg

**FEATURES**

Common features for all the modular blocks are as follows:

- Components set on printed circuit board
- SSI and MSI TTL integrated circuits
- Miniature wire lead sockets for circuit connection
- Interconnected sockets for multiconnections
- Distributed power supply input to the various circuits foreseen
- High-reliable pins for rigid wire circuit connection (AWG)
- Knots for signal multiplication
- Short circuit and overvoltage protection
- Protection against polarity inversion
- 5V to 15 V.D.C. power supply required (no regulation needed)
- LED for visualisation of logic state of digital circuit outputs
- Silk-screened synoptic panel
- Unbreakable plastic case
- Magnetic fastening device mounted at the rear of the blocks

**TOPIC COVERAGE****1. COMBINATIONAL CIRCUITS:**

1. OR Logic gate (OR GATE)
2. AND Logic gate (AND GATE)
3. Inverter (NOT)
4. Reciprocal conversion of OR and AND gates
5. Inhibition operation (ENABLE)



6. The exclusive OR (EXCLUSIVE OR GATE)
7. EX-NOR Logic gate (EXCLUSIVE NOR GATE)
8. The NOR and NAND Logic gates (NOR and NAND GATE)
9. The AND-OR-INVERTER function (AOI)
10. Elementary binary adder (Half adder)
11. Full adder
12. BCD - 7 segments decoder
13. 4-bits parallel adder
14. 4-bit binary full adders
15. Binary subtracter
16. 4-bit adder – subtracter
17. Digital comparator
18. 4-bit Magnitude comparator
19. 3 to 8 Decoder
20. Digital multiplexer
21. Priority encoder
22. Buffer Open collector
23. Buffer Three-State
24. ALU: Arithmetic-Logic Unit

## 2. SEQUENTIAL CIRCUITS:

### a) 1 bit Memory

25. SET-RESET Flip-Flop (SRFF)
26. The clocked SRFF
27. JK Flip-Flop
28. JK Master Slave Flip-Flop
29. D type Flip-Flop and T- type Flip-Flop

### b) N bit Memory

30. Serial IN Parallel -OUT Shift-Register
31. Serial IN - Serial OUT Shift Register
32. Parallel – IN Serial OUT Shift Register
33. Parallel IN-Parallel OUT Shift Register

### c) Asynchronous counters

34. Asynchronous Binary Up-Counter
35. Asynchronous Binary Down-Counter
36. Fixed Module Counter
37. Decade Counter
38. Variable Module Counter
39. Presetable Binary Down-Counter
40. Decade Counter as frequency divider

### d) Synchronous counters

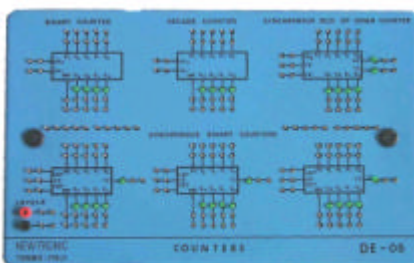
41. Series carry Synchronous Binary Counter
42. Parallel Carry Synchronous Binary Counter
43. Synchronous decade Counter



BT-1000 modules on the vertical version



Use of the BT-1000 modules for collective lessons



Standard version of BT-1000 in its case