

Booklet

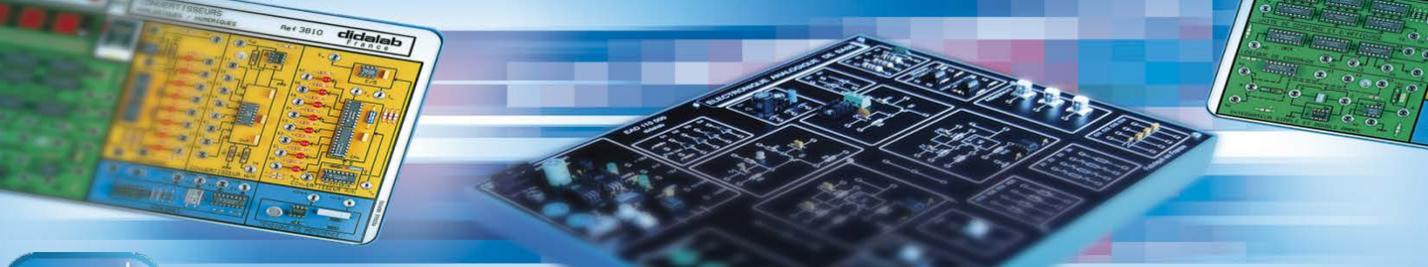
# Electrical engineering Telecommunications

2018 edition

**Pedagogical  
Equipments & solutions**

STEM

TVET



# Analogical electronics

## EAD 110 : BASIC ANALOG FUNCTIONS STUDY BOARD



•It enables the study of:

- Basic circuits for the carrying out of stabilized Power Supply (half-wave, single phase rectifier bridge, full-wave, single phase rectifier bridge, single phase Graetz bridge, capacitor filtering, voltage control by follower transistor device and Zener voltage reference)
- Transistor amplifier,
- Transistor multivibrator,
- Basic circuits with Operational Amplifiers (follower, amplifier, integrator, derivator circuits),
- Filters (low-pass filter, high-pass filter, band-pass filter).

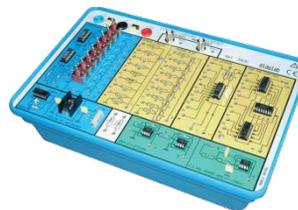
## EDD3810B : A/D Conversion



**Analogical Digital Conversion :**

- Sample & Hold Unit
- Single and double ramp converter
- Conversion by counting
- Built-in D/A convertor

## EDD3806B: D/A Conversion



**Digital Analogical Conversion :**

- D/A conversion with weighted resistors
- D/A conversion with R/2R networks
- D/A conversion by counting
- Built-in D/A convertor

## PED3746B Core Transformer



Typical Experiments :

- Recording of variable frequency hysteresis cycles,
- Recording of the first magnetization curve,
- Display of integrated multiplier instantaneous power,
- Measurement of the average power by low-pass filter.

## PED3767B Nodal Breakdown supplies

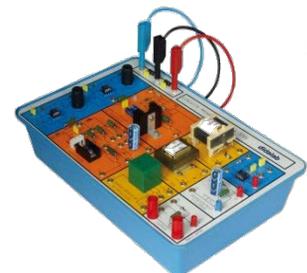


Switching Power Supplies

module, enabling the study of the following functions:

- Flyback Power Supply,
- Forward Power Supply,
- Push Pull Power Supply,
- Inductive & capacitive storage choppers.

## PED3765B Magnetic Circuits



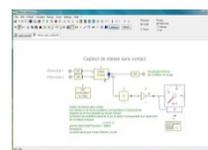
Study of several magnetic circuits :

- Iron core transformer,
- Ferrite core transformer,
- Pulse transformer.

Typical experiments :

- Inductance measurement of ferrite core circuit,
- Hysteresis cycle,
- Flyback Power Supply.

## Sensors



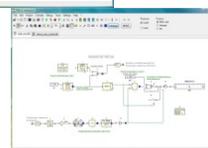
For the study of:

- Displacement measurement

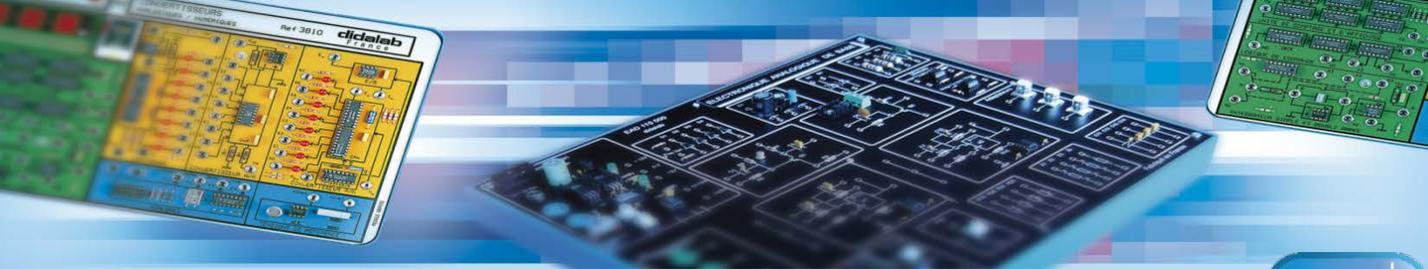
- Angular, Linear
- Position, speed, acceleration

- Environment measurement

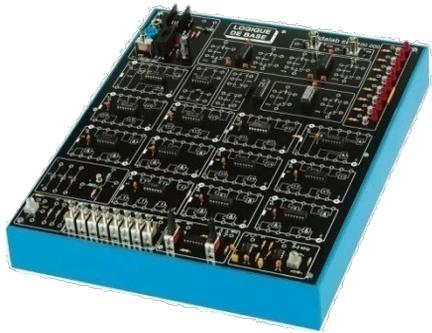
- Humidity
- Temperature
- Flow, pressure



- Actuators, displays



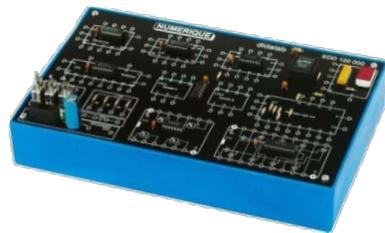
# Digital electronics



## EDD 100 : BASIC LOGIC TRAINER

- Study of the fundamental electronic circuits of the basic logic :
- **Logic functions** : ♦ 2 Resistors, 3 Diodes, 1 Transistor (Realisation of AND, OR, NOR, NAND in RTL & DTL technologies) ♦ 6 NOT ♦ 8 AND 2 inputs ♦ 8 NAND 2 inputs ♦ 3 NAND 3 inputs ♦ 8 OR 2 inputs ♦ 8 NOR 2 inputs ♦ 3 NOR 3 inputs ♦ 4 XOR 2 inputs.
- **Flip-Flops** : ♦ 2 RS ♦ 2 RSH ♦ 2 D ♦ 4 JK
- **Services Functions** : ♦ 1 Potentiometer ♦ 1 Bounce-free pushbutton ♦ 1 Pushbutton to be wired ♦ 1 Fixed clock : 1 KHz ♦ 1 Adjustable clock : 0 to 2 KHz ♦ 8 Switches for programming 0 or 1 levels ♦ 8 Logic state LED displays ♦ 2 adaptators (BNC/ 2 mm sockets) ♦ External plug-in security power supply (7-12 V AC or DC)

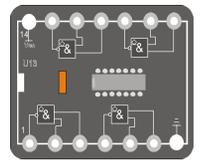
## EDD 120 : DIGITAL LOGIC TRAINER



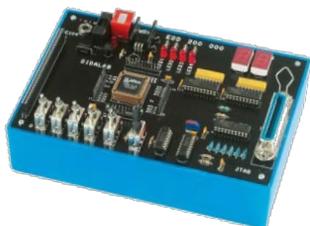
Linked to the **EDD - 100** Range, it enables the study of the basic digital circuits : Counters, comparators, registers, multiplexers et demultiplexers, Arithmetic and Logic Units,...

The Trainer front-panel is following as closely as possible the Manufacturer's technical Documents, in order to ensure a quick and efficient training. The connectors have the same plugging as given in the « DATA-SHEET ».

- *Example :*  
NAND
- *Open collector*  
ref. 7401



## EDD 200 : PROGRAMMABLE LOGIC TRAINER

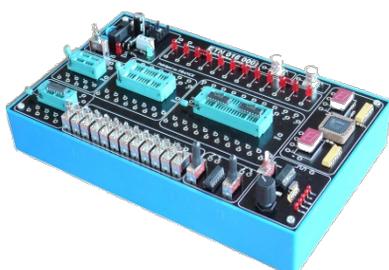


The **EDD 200** pack enables the study of EPLD- range programmable logic circuits, as well as learning and running VHDL language.

In the digital techniques training process, it ensures the link between the basic logic and the microprocessor systems.

The 8 bits PC 104 bus enables the student to carry out experiments very closely to the industrial reality.

## EDD 050: LOGIC TRAINER



The EDD050000 is designed for enabling the basic training on logic functions. It is equipped of 4 zero insertion sockets.

The student plugs the components to be studied into the socket, all connections are achieved by 2 mm patching leads & banana plugs



## Computer sciences

### **EID 110 : 8/16 BITS MICROCONTROLLER**

The **EID 110** enables the study of the architecture of a 8/16 bits 68 HC12 microprocessor/micro-controller based Microsystems, using: USB Port, RS232, PC104 bus, 24 bits // port, 6 Analog Inputs & 4 Outputs on 40pts HE10, 2x16 digits ASCII displays, joystick.

Delivered with: On /Off Input/Output Simulator  
PC editor, Cross assembler, Cross compiler, Debugger monitor



### **EID 210 : 16/32 BITS MICROCONTROLLER - CPU32**

The **EID 210 B** System enables the study of microprocessors and micro controllers of the 68000 range..

A complete range of actuators allows the student to be faced with an industrial development context (input/output simulator, traffic light simulator, stepping motor)

Delivered with: On/Off Input/Output Simulator  
PC editor, Cross assembler, Cross compiler, Debugger monitor



### **EID- 510 : ARM9 with OS (WIN CE, Linux)**

Study and implementation of a embedded OS (Win CE)

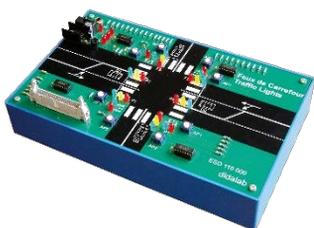
ARM9 processor, 210 MIPS  
Broadband analogue inputs/outputs  
JAVA processor embedded.  
Serial port: USB, Ethernet, CAN supplied with CAN OPEN cell control.



### **Operating parts**

### **EID 002 : TRAFFIC LIGHTS SIMULATOR**

The EID 002 card allows the study of :  
- Display device & keypad board,  
Alternate continuous operation on both roads (Red, Yellow, Green)  
Taking into account pedestrian call  
Car detection on the secondary road ...



### **EID 005 : DISPLAY & KEYPAD BOARD**

- 16 keys matrix keyboard,
- ASCII readout (7 to 20) x 16 characters and/or graphical 128 x 64 monochrome,
- 4 kHz Piezoelectric buzzer,
- Real time clock with alarm signal and saved 114 bits static RAM..

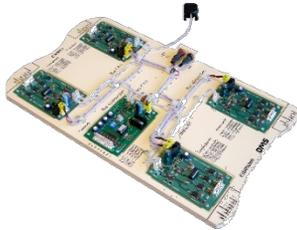




# Computer sciences

## Optional CAN Networks operative parts

### CAN01A: CAR LIGHTS CONTROL WITH CAN NETWORKS



The **CAN01A** allows:

- simulation of the lights lever device
- simulation of the optical blocks filament state
- display of the optical blocks filament state

### CAN01B: WINDSCREEN WIPER MOTOR CONTROL WITH CAN NETWORKS



The **CAN01B** allows :

- control of the wiper motor
- activation the windscreen wiper
- regulation of the windscreen wiper speed
- ...

### VMD01C: DIDACTIC MULTIPLEXED VEHICLE WITH CAN NETWORKS



The **VMD** has been conceived for the study of a Local Industrial Network : CAN (Controller Area Networks). The model is based on the controls at the steering wheel in a car : light signalisation and windscreen wiper.

There are 2 versions :

- VMD01B : multiplexed car with the study of lights signalisation
- VMD01C : multiplexed car with the study of lights signalisation, windscreen wiper (with speed control), embedded web server, real time kernel

## ETHERNET WEB & CAN EXTENSIONS



#### **EID 003 000 10 Mbits/s Ethernet Network board**

10 Mbits/s Ethernet Network,  
TCP/IP stack supplied,  
I2C bus, SPI Sockets, Web server,,,  
10 base T Ethernet RJ 45 Connector,  
Integrated ping's function  
TELNET et WEB server port



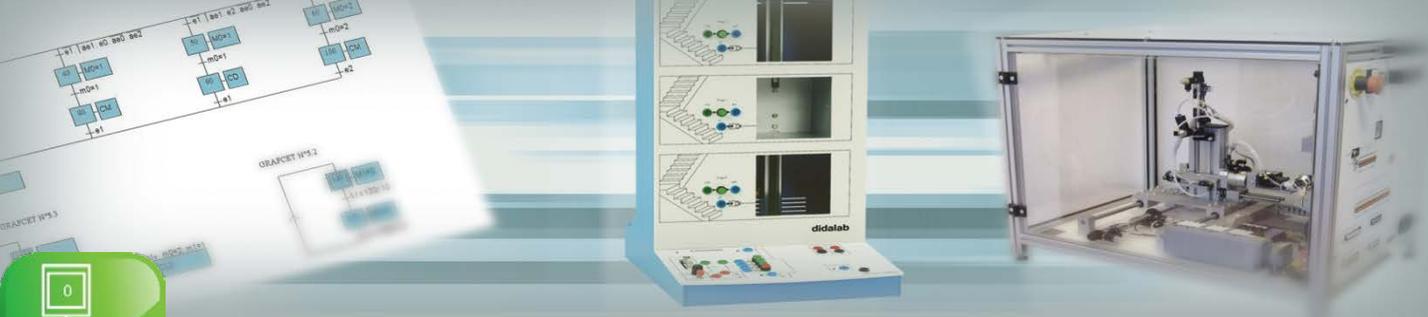
- **A complete set of CAN Input Output boards** allows bulding car'signaling system off a car (headlihgt, stops, klaxon, trafficator...):
- EID 004 000 : PC104 bus CAN controller Board
- EID 050 000 : 1 Analogic Input and 8 TOR input board
- EID 051 000 : 4 TOR Outputs
- EID 052 000 : Model of Windscreen wiper board

### MTR - 86 : REAL TIME KERNEL

MTR86 is a real time multitask monitor specifically designed for INTEL and MOTOROLA microprocessors. The version implemented into EID 210 controls the board own resources: RS232 port control and USB control.

One part of the kernel code is in flash EPROM, which allows to minimise the code size to be downloaded

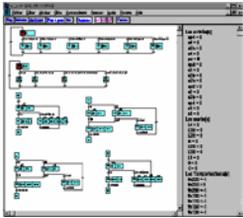




# Automatic control

## Software

### MENTORGRAF

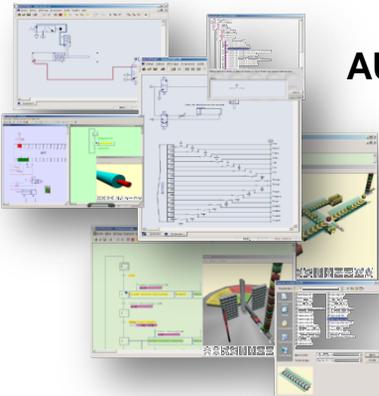


**Mentorgraf** : Editor, enabling to draw the Grafcet with the basic tools, step, transition, AND / OR divergence/convergence, macro steps...  
 Generator, converting the GRAFCET into execute code, check the syntax & coherence between the target & used variables...  
 Simulator, executing the GRAFCET in simulation, one "click" on the input variable enables to activate the corresponding transition, the whole graph can be tested before operating the actuated part.

Can control all our actuating parts

## AUTOSIM – Simulation of Electrical, Hydraulic and Pneumatic Automatism

### AUTOMGEN – Programme Designing for PLC



- Package (AUTOMGEN/AUTOSIM), easy and quick ownership.
- Very big library, dynamic modification of diagrams during simulation.
- Most usual software in France.
- Used in the Industry.
- Standard programming languages (GEMMA, Grafcet, ladder...).
- Very realistic simulation of operating parts.

## Pedagogical PLC



### M340 Schneider



- 16 On/Off Inputs, 16 On/Off Outputs with relays, connections with Ø 4-mm sockets,
- 4 analogue Inputs and 2 analogue Outputs, connections with Ø 4-mm sockets
- 31 On/Off Inputs, 21 On/Off Outputs, 16 mini-switches for test, connection with DB37 socket
- 1 CAN OPEN communication module, embedded in the Unit, Ethernet connection.
- Supplied with software for computer languages : LD, FBD, SFC, ST, IL



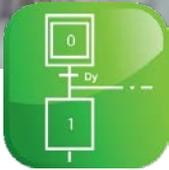
### S7 1200 Siemens



- 14 Inputs 10 Outputs, 24 VDC,
  - 1 analogue Input 1 analogue Output,
  - Inputs and Outputs simulator
  - Supplied with STEP 7 programme with SFC extension..
- Optional extra :
- 4 ports mini-switch
  - 8 Inputs extension.



# Automatic control

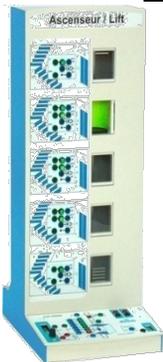


## ESD100: ELECTRO-PNEUMATIC TRAINER



- Study of the components and their technology.
- Study of basic electric logic functions.
- Study of pneumatic logic functions.

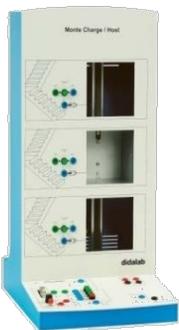
## ESD 350 : 5-LEVELS LIFT - 50 INPUTS/OUTPUTS



The ESD 350 lift model is suitable for a progressive training of Students to the sequential systems. The lift model can be controlled either through wired logic, PLCs, PC Computers, 68000 Microprocessors, 68HC11 Microcontrollers, etc...).

The mimic layout displayed on the front panel indicates all the available functions. All I/O (23 Inputs and 27 Outputs) are available in multiplex TTL standard, either on 34 pins connector, or on 2 mm sockets (TTL standard or DC 24/48V PLC).

## ESD 250 : 3-LEVELS HOIST - 21 INPUTS/OUTPUTS



The control front-panel displays 21 Inputs/Outputs. The control is carried out by using patching leads (Ø 2 mm) or EPP standard connector.

- 3 tray calls and 3 level calls,
- 3 tray presence detections,
- 3 tray absence detections,
- 3 level presence displays,
- 1 emergency stop,
- 1 up control, 1 down control.

## ESD 030 : ELECTROPNEUMATIC ROBOT WITH GRAFCET CONTROL



The ESD030B robot unit was developed in collaboration the Schneider Company. It represents a model of pieces plugging flexible cell.

The Unit includes :

- One electro-pneumatic robot moving on 5 axis (translation, forward/backward, up/down, rotation & gripper opening/closing, which totalizes 10 different controls (4 bi-stable & 2 mono-stable devices) & 11 sensors,
- One plugging station having 1 bi-stable control & 3 sensors (piece presence , up & down positions of the jack),

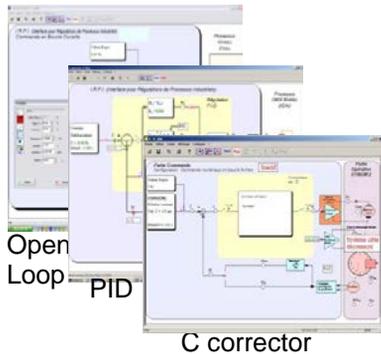




# Servo systems and process control

**D\_CCA: Didalab Contrôle Commande Asservissement (Didalab, servo systems control)**

**Software with control and capture for servo-systems and process control ; ergonomic graphic interface which allows to configure the system, to analyze and to compare the various tests**

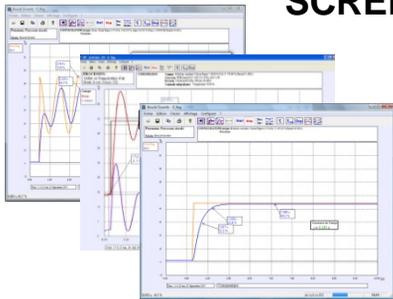


## PARAMETERS WINDOW

It enables the User, through an ergonomic graphic interface to configure the System :

- Selection of the System structure : open loop / closed loop,
- Selection between Current control or Voltage control
- Selection of the control type and characteristic values : constant step, ramp, sine, trapezoid,
- Selection of the P, PI, PD, PID corrector and adjustments of the corrector parameters

## SCREENS WITH CURVES OF TEST IN PROGRESS



It enables to get /do:

Time response display of one (or several) characteristic value(s) : position, speed, acceleration, motor current, motor voltage, control signal, error, corrector output etc.

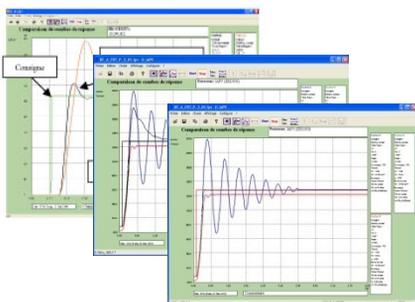
Modification of the time diagram scales (zoom in X, in Y)

- Determination of Automatic characteristic values (time constant, response time at 5%, overflow amplitude etc.)
- Assistance to the measurement of typical values in automatic control: time constant, overshoot, stabilization at 5%, harmonic calculation, sinusoidal

## TESTS COMPARISON

- Several successive tests with reminder of the parameters
- Comparison with the preceding tests. (4 tests max in the comparison).

**D\_CCA enables to control all our operating parts**







## Servo systems and Process control

### ERD 050 : SPEED AND POSITION SERVO SYSTEM



**ERD 050** carries out a speed and position servosystem of a rotating mechanical load driven by DC motor.

A power electronic board enables the power interface for the motor supply, as well as the interface for the generator, simulating mechanical load

A graduated disk enables the display and location of angular motions

### ERD 100 : SPEED AND POSITION SERVO SYSTEM (SYNUN)



**ERD100** is a complete training system especially designed for the detailed study of digital and analogue servo-systems . It shows the speed and position control by DC motor of a rotating machine load.

Selection of the adjustable driven mechanical load : Fluid friction by Eddy current, Dry friction by shaft brake block, Inertia by graduated disk & additional weight.

Optional : D\_Scil, module for the creation of real time correctors, with SCILAB/XCOS

### ERD 150 : SPEED AND POSITION SERVO SYSTEM (DIGITAL AXIS)



•Digital Axis are used in many industrial systems : , NC engines, ... « AXNUM » is made with industrial elements, and through a PC or a PLC, students can perform speed and position digital servo control experimentations.

•Optional : D\_Scil, module for the creation of real time correctors, with SCILAB/XCOS

### ERD 800 : ROBOT AUTONOME MOBILE INTELLIGENT (RAMI)



- 1 self-supporting frame integrating a very powerful motherboard (ARM9 200 MIPS with Windows CE and 1 FPGA with 400 000 gates), power interfaces for the motors' control (AC or DC)...

- 2 wheels driven by a reducer converter encoder, 1 colour TFT screen with 320 x 240 points, batteries, WIFI

- 1 inertial unit (accelerometer, 3 axis-orientation)

- Webcam, sound card (micro/speakers), ultrasonic sensors, infrared sensors (Track following)

- RAMI Robot is operating with Microsoft Robotics.



# Servo systems and Process control



## ERD 540 : AIR FLOW AND AIR TEMPERATURE CONTROL



This process control enables a very progressive study of the control principles :  
Study of current loop - Experiment in current loop of air flow control or air temperature control.

Flow control with : P, P I, PID and Z transform correctors - Temperature control with : P, P I, PID, Z transform, flow negative action, cascade dual loop correctors.

Automatic computing of : time constant, overlap and time response at 5%.

Optional : new corrector with C program writing

Optional : D\_Scil, module for the creation of real time correctors, with SCILAB/XCOS

## ERD 550 : WATER LEVEL AND FLOW CONTROL



The ERD 550 water level/flow process control, industrial-type, is compatible with all 4/20 mA Inputs/Outputs Controllers.

Its time constants : 90 s for level, 8 s for pure delay and 500 ms for flow enable to carry out many experiments in the same Practical Works session.

Open Loop, P, P I, PID, Z transform correctors, cascade dual loop,

Optional : new corrector with C program writing

Optional : D\_Scil, module for the creation of real time correctors, with SCILAB/XCOS

## ERD 560 : AIR PRESSURE CONTROL



Air pressure process control, industrial-type,

Air tank 1000 cm<sup>3</sup>, time constant (1st order) 14,5 s.

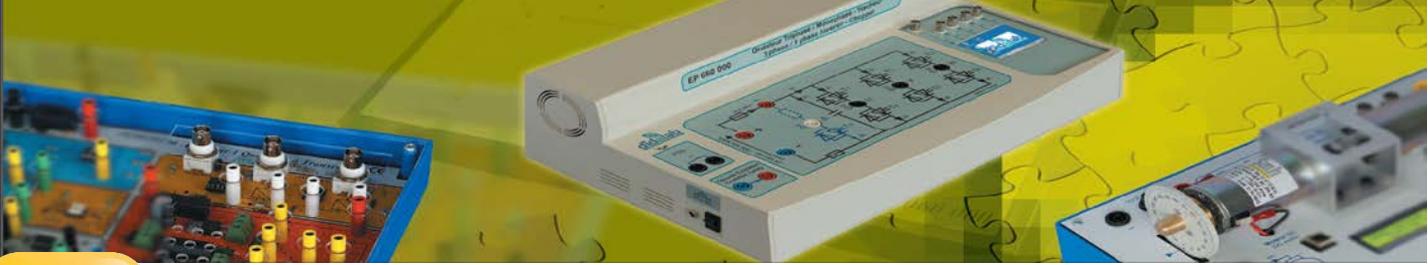
Proportional valve for filling, On/Off valve for leak disturbance, power disturbance

Pressure sensor : 4/20 mA, 3 manometers

Open Loop, P, P I, PID, Z transform correctors, cascade dual loop,

Optional : D\_Scil, module for the creation of real time correctors, with SCILAB/XCOS

Optional : silent compressor



# Power electronics

**4 Ranges: 30 W – 300 W (SELV & LV) – 1500 W**

In order to answer our clients' needs, DIDALAB offers four ranges of power: 30W, 300 W (SELV and LV), 1.5kW.



## **SELV : Safety Extra Low Voltage**

**30 W**

This range presents little or no electro-technical phenomena (characteristics of motors); nevertheless it allows a first approach on converters and their structure (technology, control, insulation, power).

This range addresses mainly:

- The unspecialized trainings, in electro technical eng. (to have notions in power electronics of power)
- The first years in electro technical studies to be able to visualize and connect directly the components of the power part and the control part.

This range of power already presents electro-technical phenomena (characteristics of motors) but allows to apprehend the electro-technical phenomena in an electronic environment.

It allows to work in complete safety (50 V); the students can thus be in direct contact with the various materials (converters, engines, load).

It allows to work with "standard" tables (with 1-phase 230 V / 16 plugs).

This range addresses mainly:

- Colleges, which must teach the power converters et motors but don't have electro-technical laboratories (with 3-phase power supplies ...) Several training in electro-technical engineering....

**300 W**



## **LV : Low Voltage**

This range of power already presents electro-technical phenomena (characteristics of motors). However, by having a relatively low power, the cost of equipment remains moderate.

This range addresses mainly:

- All the trainings which propose practical class of power electronics and electro-technics with a dedicated room (electro-technical environment compulsory with 3-phase power supply and tables of measure (with fixed 3 phase AC, adjustable 3 phase AC, adjustable continuous DC ...).

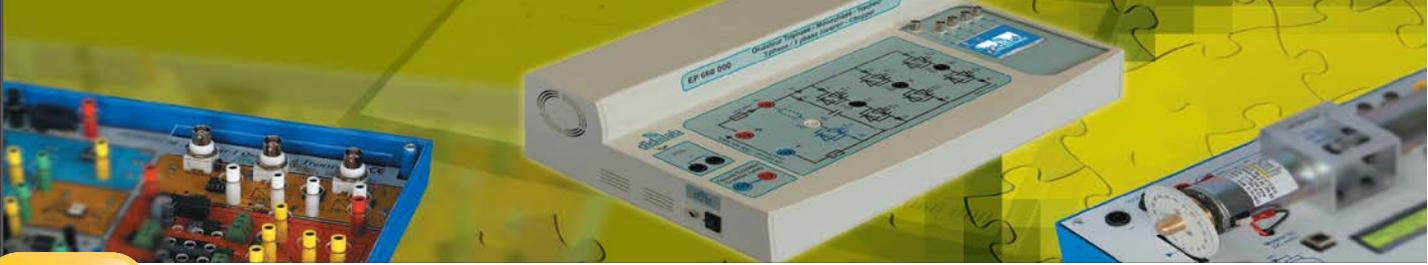
**300 W**

**1500 W**

This range of power presents all the electro-technical phenomena (characteristics of motors). it is the most present in the electro-technical workshops.

This range addresses mainly:

- All the trainings which propose practical class of power electronics and electro-technics with a dedicated room (electro-technical environment compulsory with 3-phase power supply and tables of measure (with fixed 3 phase AC, adjustable 3 phase AC, adjustable continuous DC ...).



# Power Electronics

## 30-W range

### PED 020 100 : 1-quadrant transistor chopper

**For the study of:**

- Sub-voltage chopper (serial chopper)
- Sub-voltage chopper with current control
- Overvoltage chopper (parallel chopper)
- Overvoltage chopper with current control



### PED 020 700 : 1-quadrant thyristor chopper

**For the study of:**

- Thyristor serial chopper device,
- Built-in differential voltage measurement probe,
- Built-in current measurement probe,



### PED 020 420: 4-quadrant chopper

**For the study of:**

- 4 quadrant chopper
- Inverter with Simple control
- Inverter with Constant U/f control
- Inverter with Offset control
- Inverter with Pulse Width Modulation



### PED 020 500 : 1-phase rectifier

**For the study of:**

- Single wave or double wave, all thyristors bridge,
- Double wave, thyristors bridge & free wheel diode,
- Double wave, with dual bridge,
- Double wave, dual bridge & free wheel diode



### PED 020 600: 3-phase rectifier

**For the study of:**

- 3-phase rectifier
- All diodes, all thyristors,
- Single wave, dual wave



### PED 020 300: PID corrector

**For the study of:**

- Speed regulation on the 30-W range power bridge



### EPD 037 820: AC synchronous motor

This motor is perfectly matched to the 4 quadrants chopper module 30 W.



### EPD 037 580: DC motors bench

This bench can be connected to any « Chopper & Rectifiers » units of the 30 W set.



### EMD 030 340: 1-phase and DC power supply, reversible current

**Strong points:**

- Current limitation
- Reversible
- Main reference

**Characteristics:**

- DC supply: +15V - 500mA
- Power: 0/30V DC adjustable -2,5 A reversible
- AC supply : 2 x 24V - 2,5 A



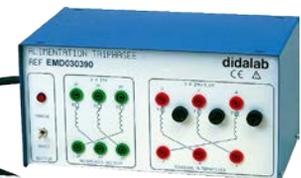
### EMD 030 390 : 3-phase power supply

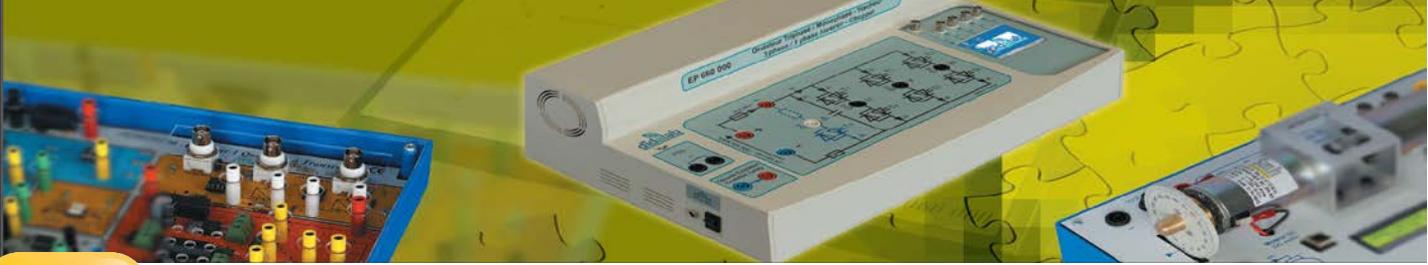
**Strong points:**

- Mains reference
- Star or delta

**Characteristics:**

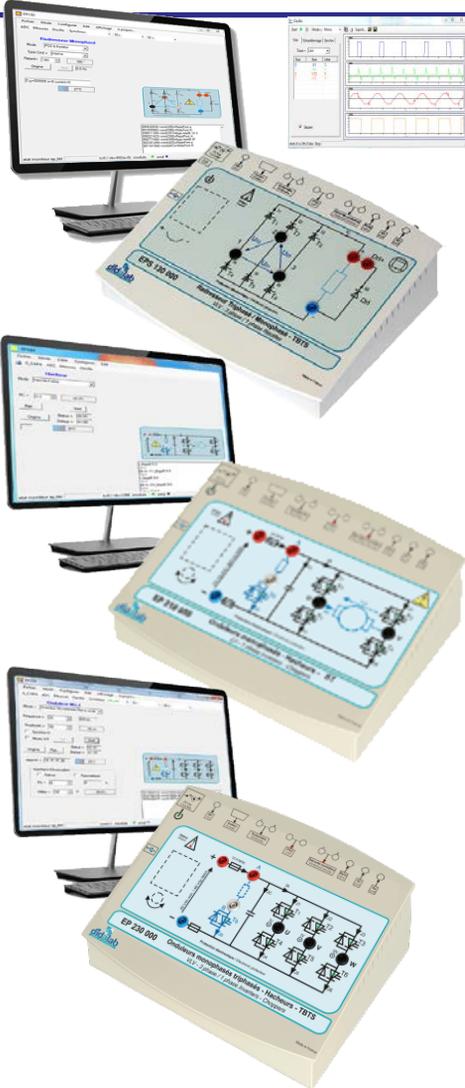
- 3 x 24 V - 2,5 A (output on 6 Ø 4-mm sockets), star or delta
- 3 x 24 V - 0,2 A A (output on 6 Ø 4-mm sockets), star or delta
- Power supply : 3-phase 380 V





# Power electronics

## 300-W range (SELV or LV)



### EP(S) 130: 1-phase / 3-phase rectifier

**For the study of:**

- 1-phase rectification
- 3-phase rectification
- all diodes, all thyristors, mixed symmetrical, mixed asymmetrical
- Assisted inverter

- Optional extra : speed regulation, prototyping

### EP(S) 210: 4-quadrant chopper/ 1-phase inverter

**For the study of:**

- Serial chopper, voltage reversible, current reversible, four quadrants, over-fitting double serial
- 1-ph inverter, shift control full wave, PWM +E/-E, PWM +E/0/-E, constant U/f ratio

- Optional extra : speed and position regulation, prototyping

### EP(S) 230: 4-quadrant chopper/ 3-phase inverter

**For the study of:**

- Serial chopper, voltage reversible, current reversible, four quadrants, over-fitting double serial
- 1-ph inverter, shift control full wave, PWM +E/-E, PWM +E/0/-E, constant U/f ratio
- 3-ph inverter, shift control full wave, PWM +E/-E, PWM +E/0/-E, constant U/f ratio

- Optional extra : speed and position regulation, prototyping

### EMS 300: Electro-technical power supply, SELV

- Power supply on mains 1-ph 240 VAC 16 A,
- Outputs: alternative current, 3 phases + neutral 24 VAC 11 A
- Or direct current 48 VDC 9A,
- And direct (for excitation) 48 VDC 2 A
- Permanent power: 450 VA,
- Intergrated measures: voltages, currents, active power, reactive power, phase shift...



### EM 300: Electro-technical power supply, LV



- Power supply on mains 1-ph 240 VAC 16 A,
- Outputs: alternative current, 3 phases + neutral 220 VAC 2 A
- Or direct current 340 VDC 1.5A,
- And direct (for excitation) 340 VDC 0.6 A
- Permanent power: 450 VA,
- Intergrated measures: voltages, currents, active power, reactive power, phase shift...



# Power electronics

## 300-W range (SELV or LV)

**EL(S)31x : BICMAC Instrumented load bench for DC and AC motors**



- 300-W test bench:
- The load is a magnetic break
  - A control board ensures the load generation and results acquisition (load : constant, function of the speed, of the square speed ..).
  - Various configurations for the tested motors (DC motors, 3-ph asynchronous motor, brushless...),

**EL(S)32x : BICSIN Instrumented load bench for DC and AC motors, active load**



- 300-W test bench:
- The load is based on a 750-W brushless motor controlled by a Siemens variator
  - A control board ensures the load generation and results acquisition (braking or driving load: constant, function of the speed, of the square speed ..).
  - Various configurations for the tested motors (DC motors, 3-ph asynchronous motor, brushless...),

On which you can study a 300-W motor. We offer 4 types of motors for each range (SELV or LV). For the motor characteristics, visit our website

**EL(S)3x1 : 300-W DC motor, with separate excitation**



**EL(S)3x2 : 300-W DC motor with permanent excitation**



**EL(S)3x3 : 300-W 3-phase asynchronous squirrel motor**



**EL(S)3x6 : 300-W Brushless motor**



*Example of configuration : EL323 : 300 W motor bench, LV, 3-ph asynchronous squirrel motor coupled to a active load with mechanical values acquisition*





# Power electronics



## 1.5 / 3-kW range

### EP 360 : 1-phase, 3-phase rectifier, AC controller, 0-3 kW



For the study of :

**-1-phase rectifier bridges :**

"All diodes", all thyristors, symmetrical dual, asymmetrical dual,

**- 3-phase rectifier bridges :**

"All diodes", dual, all thyristors

- Assisted-inverter,
- 1-phase AC controller
- 3-phase AC controller

### EP 560 : Chopper, 1-phase inverter, 0-3 kW



For the study of :

**- Choppers :**

Serial, Voltage reversible, Current reversible, Four quadrants, Serial dual mixed ( 0 +E 0 / 0 -E 0 ), Operating frequency: from 1,5625 Hz to 25,600 kHz

**- Inverters :**

Full wave, shifted control & fixed frequency,  
Full wave, shifted control & variable frequency, PWM +/-E, +/-E,

### EP 660 : Chopper, 1-phase & 3-phase inverter, 0-3 kW



For the study of :

**- Choppers:**

Serial, - Voltage reversible, Current reversible,  
Four quadrants, Serial, dual mixed ( 0 +E 0 / 0 -E 0 ),

**- 1-phase Inverters :**

Full wave, shifted control, fixed frequency, Full wave, shifted control, variable frequency, PWM +/-E, +/-E,

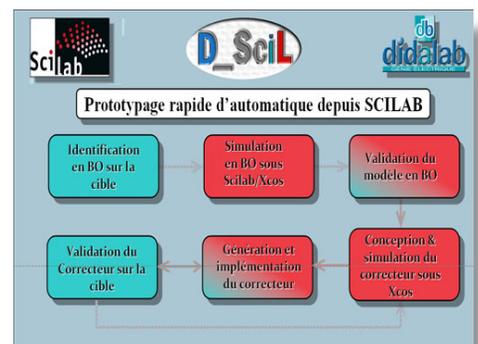
**- 3-phase Inverters :**

Full wave, shifted control, fixed frequency, Full wave, shifted control, variable frequency, PWM +/-E, +/-E,

### Option : Speed & position control and prototyping

For all the power bridges,

- Optional extra: Speed and/or Position control of the 1.5 kW motor
- Optional extra: D\_Scil for prototyping and simulation (motor and load modelizations, corrector creation...)



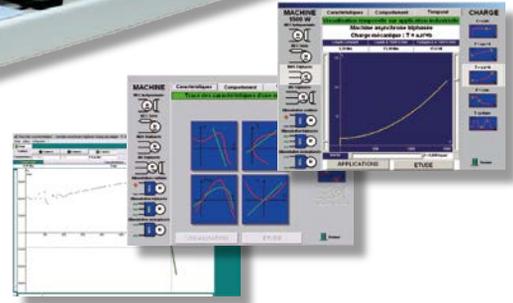
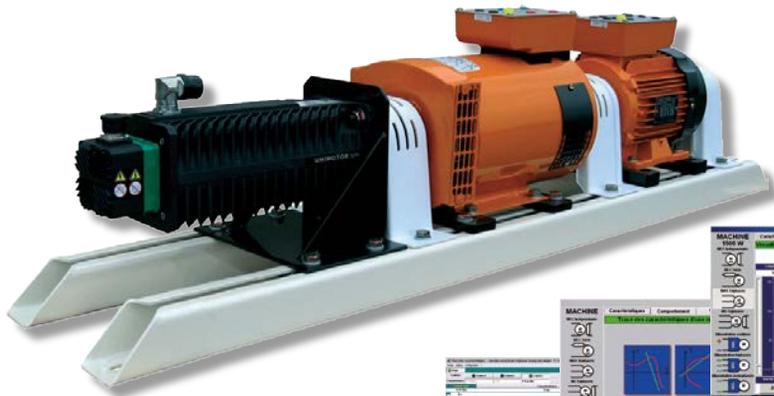


# Power electronics



## 1.5 ; 3-kW range

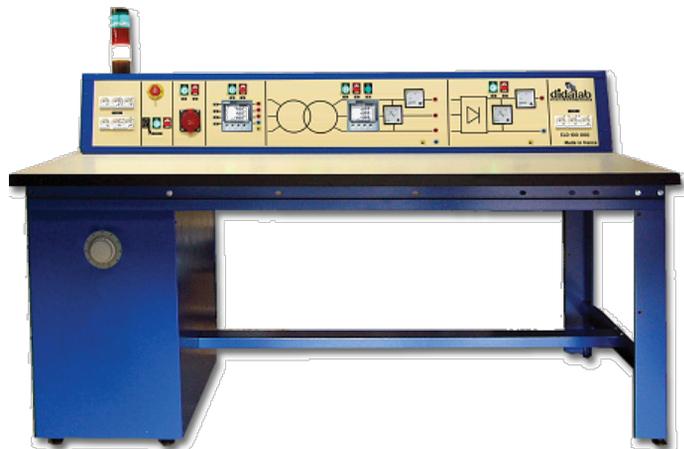
**ELD 150 : Motor bench with DC and AC 3-phase motors, Active load, electro-technical measurement & load generation unit for DC & AC motors**



**Motor bench including:**

- 1500-W active load including:  
2200-W brushless motor with encoder,  
System for the control of the load and the acquisition of electrical and mechanical values,  
Load resistance for energy evacuation and recovery  
Software for control and acquisition on PC
- 3-ph asynchronous squirrel motor, 1.5 kW, 230V 5,5A, 400V 3,2A
- Direct current motor, 1.5 kW with separate excitation,
- Stand on castors

**ELD 100: Electro-technical table**



Includes all the power supplies necessary to power a motor bench or power bridges in a 1.5-kW electro-technical laboratory

- Fixed DC
- Adjustable DC
- 1-phase AC
- Fixed 3-phase AC
- Adjustable 3-phase AC



ETR 300STI2D: Laboratory for the initiation to VDI Convergence

## Networks & VDI convergence



Winners of the 15th Worlddidac Award 2012



**Did@VDI+ is a stand-alone laboratory. It is not connected to the Internet. This peculiarity presents 4 main advantages:**

- > A mistake made by students would not cause any damage on the school
  - > Because it is insulated from the exterior world, only the teacher will have access to the choice of images, videos ... available on the HTTP and FTP services,
  - > There is a back-up copy of all programs and manufacturer's configurations in the main processing cabinet server, enabling complete secure reboot via LCD configuration interface,
  - > A "mirroring" port allows the display of the whole network traffic without any "indiscretions" risk.
- Moreover, it includes:
- > Gradual practical works,
  - > Pedagogical Video-demonstrations explaining the protocols functioning,
  - > Evaluation tests with automatic marks.

## Example of installation





# Networks & VDI convergence

ETR 440 LRT Did@VDI++, Laboratory for the advanced study of VDI Convergence



1 to 8 workstations

### For the study and implementation:

The laboratory is composed of 1 main computer cabinet with all the Dida@VDI services, and 1 up to 8 students development workstation. Each student workstation includes:

- 1 6-U cabinet with 1 server with Linux, 1 router 1 STB switch,
- 1 PC for development, Full HD screen, 1 webcam and all software,
- 1 Videophone.

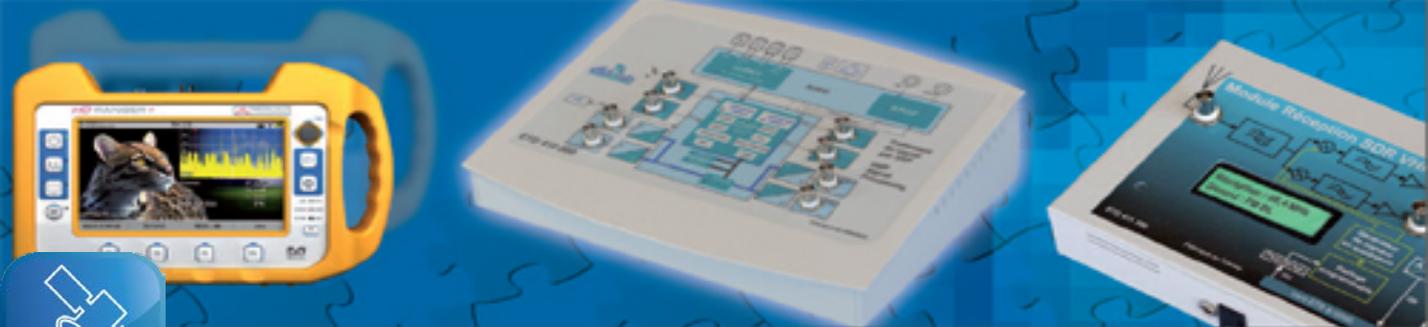
### Subjects:

- Switch configuration, Router configuration
- Implementation of Data Services in the server (configuration, implementation of a Web server, FTP server, MySQL data base creation, installation and configuration of a mail server)
- Implementaton of Voice Services (SIP and RTP protocols , implementation of IPBX architecture and IP phones ..)
- Installation and configuration of a IPTV service, digital video recorder ...



# Example of installation





# Telecommunications

## ETD 410 : DSP /FIBULA GRAPHIC KIT

For the study of:

**-Signal theory:**

Sampling, quantification, FFT, IIR or FIR filters, random signals...

**- Introduction to digital transmissions:**

Baseband, ASK, PSK, QAM modulation, multiplexing...

**- Information theory and coding :**

entropy of a source, mutual information between input and output of a noisy channel without memory, Linear block codes and correction with the syndrome, Code 3 interlaced redundancy

...

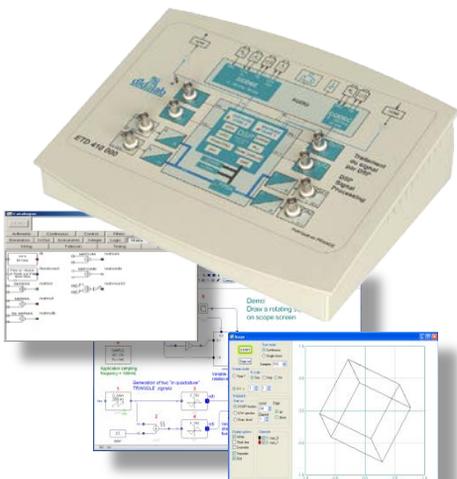
Graphical editor and textual :

- Complete library of more than 200 configurable graphics functions (arithmetics, telecommunications, filters ...)

- Opportunity to complete the library by creating their own graphics functions ,  
Switching between text mode and graphic mode

A virtual oscilloscope with 8 channels, real time.

A plotter to draw frequency behaviour of a filter or a system (Bode, Nyquist's diagram)



## OPTIONAL EXTRA : ANALOGIQUE & DIGITAL RECEPTION

3 modules for the study of analogue and digital telecommunications, coaxial hertzian transmissions , HF and VHF, using SDR method (Software Defined Radio)

### ETD411100 : Transmission module : 27 to 27.4 MHz



Analogue : AM, FM, BLU,  
Digital : ASK, PSK, FSK, QPSK, QAM...  
Coding : AMI, RZ, NRZ, Manchester...

### ETD411200 : VLF, LF, MF and HF reception module ( 150 kHz to 27.4 MHz IQ transposition (0 to 96 kHz, )

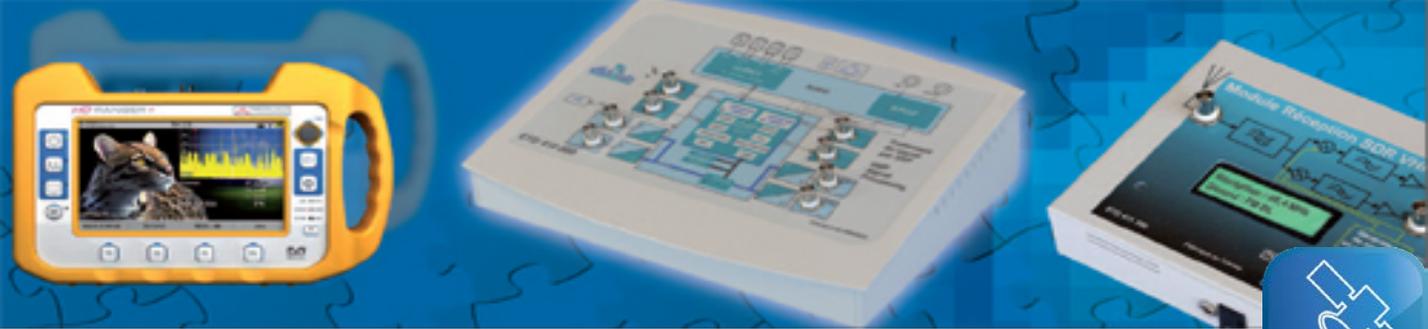


Analogue : AM, FM, BLU,  
Digital : ASK, PSK, FSK, QPSK, QAM...  
Coding : AMI, RZ, NRZ, Manchester...

### ETD411300 : VHF reception module ( 88/108 MHz)



Analogue : AM, FM, BLU,  
Digital : ASK, PSK, FSK, QPSK, QAM...  
Coding : AMI, RZ, NRZ, Manchester...

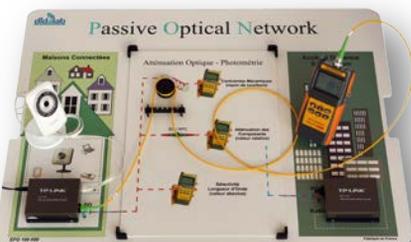


# Telecommunications

## ETD 500 : Time division switching unit



## EFO 100 000 : Implementation of a transmission with optical fibre (PON)



## EFO 200 000 : Compact optical fibre fusion splicer

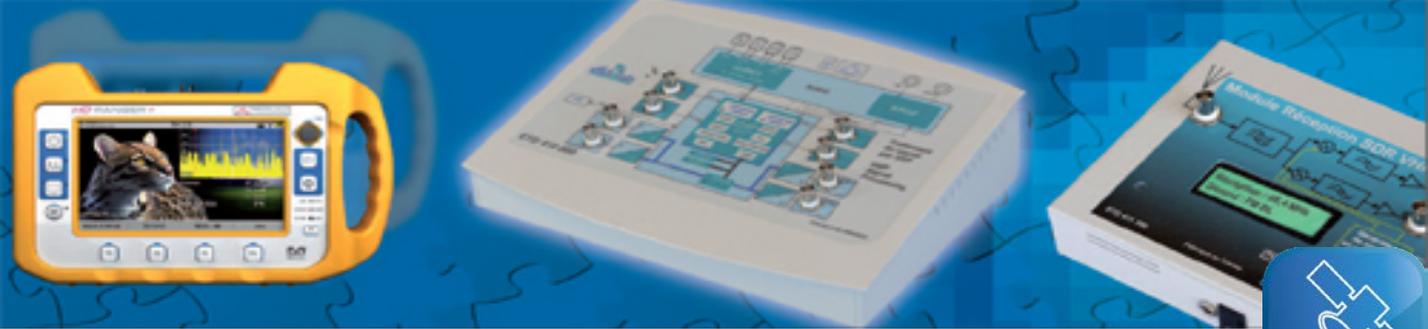


- Skills acquisition for the fibre preparation to fusion / splicing.
- Essential and much used tool for the connection technicians.
- Automatic fibre aligning.
- Manipulation and fibre preparation.
- Cleaning, stripping and cleaving.
- Fusion, fibre protection.
- Loss estimation.

## EFO 400 000 : Mechanical splicer



Realisation of a mechanical splicer on a optical fibre. This method is very widely used on the construction sites of installation or maintenance of lines of optical transmission. The used process ( transparent splice) allows to check on construction site the quality of the junction without expensive measuring instrument.



# Telecommunications



## ETD038300: Digital transmissions



For the study of :

- Selection of the transmitter or receiver structure parameters,
- Several transmission supports are provided: leads, coaxial cable, fiber optics,
- Modulation : ASK, FSK, BPSK, DPSK, QPSK & QAM.
- Eye Diagram
- Phase modulation constellations

## ETD 038600 : Communications with fibre optics



Fibre optics pedagogical bench with 6 different photo transmitters / receivers.

The transmitter presents 6 photo transmitters, different wavelengths, WDM applications

The receiver presents 2 units, one for the signal processing and the other for the measurement of optical power.

## PED 022170: Guided waves



**X range, from 9 to 11 GHz.**

It includes:

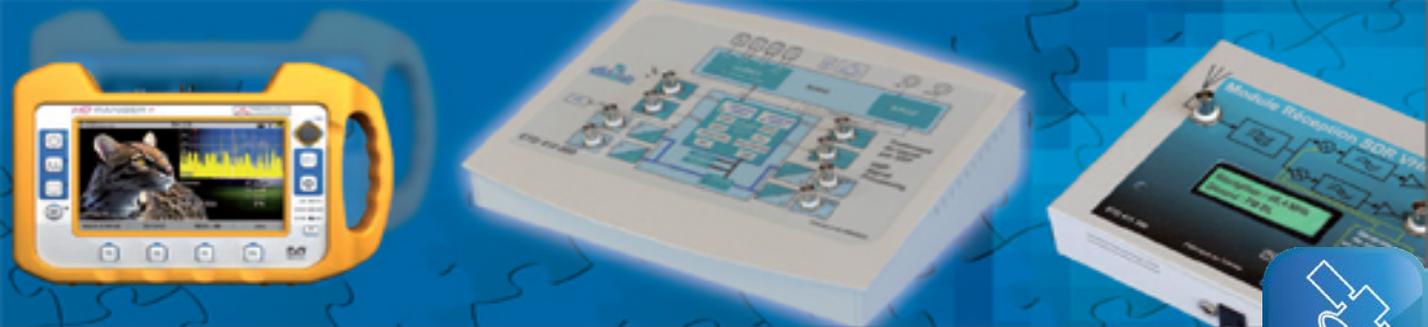
- GUN diode oscillator with its power supply,
- PIN diode modulator,
- Cristal detector,
- Fixed attenuator, adjustable attenuator,
- Transmission horn, Receiving horn,
- SWR meter,
- Accessories.

## ETD 600 : Study of antennas



**It allows the study of:**

- $\frac{1}{2}$ -wave antenna
- Folded dipole antenna
- $\frac{1}{4}$ -wave antenna
- Radial antenna
- Yagi Antenna
- Loop Antennas
- Helical antenna
- Spiral antenna
- Patch Antenna
- Microstrip planar Antenna (rectangular)



# Telecommunications



## ETV 100 000 : Study of DTTv (Digital Terrestrial Television) & Satellite television



### Strong points:

- HDMI DVB-T transmission
- Insertion of a private channel in a DTTv package
- Multistreams measure and decoding
- Constellation visualization
- Transmissions encoding
- Transmission and reception with a cable
- Transmission and reception with a clear channel
- Quality measurements (Power, MER, CBER, VBER)

## ETV 200 000 : Wall of images



Dynamic display can also be transformed in a unique wall of images.

### Strong points:

- Implementation of a wall of images via Raspberry Pi3
- Installation and configuration of a Raspbian distribution
- Transmission/ Reception of flows  
Unicast (HTTP, RTSP)  
Multicast (IGMP, UDP)
- Synthetisation of a video stream tor realize a wall of images

## EID 430 : Internet of Things (IoT), via LoRa protocol



### Strong points:

- Connection of the sensors
- Connection of the actuators
- Realization of a networks of LoRa End Nodes modules
- Configuration of the server
- Management of the sensors through LoRa protocol



## Renewable energies



### SER130 : Autonomous 3-energy power plant, Hydredlec 3E



#### Operative part

- Aluminium frame, table-top
- Headbay for accumulation of kinetic energy
- Hydraulic pump (emulation of a 25-m height water fall)
- Upwelling pump with a 15-l/min nominal flow
- Analogue flow and pressure transmitters
- Pelton turbine with 1 injector
- 12-V DC generator with regulation
- Battery for chemical energy storage
- Contextualisation panel with a 3 priority levels for users (hospital residential building and factory)
- Measuring probes for voltage and current in each energy branch

#### Control part

Choice of two kind of controls

- S7-1200 PLC with HMI from Siemens
- Compact RIO from National Instruments

#### Optional extra :

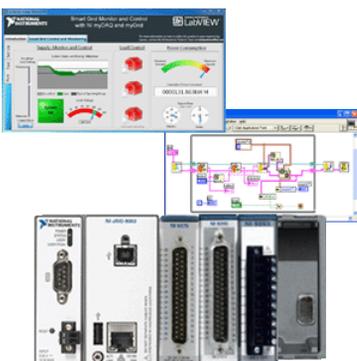
- 90-W wind turbine,
- 20-W solar panel.

### RS7 1200B: Siemens PLC control



Control system based on S7 1200 PLC, Its KTP700 Human Machine Interface with Input/Output modules adapted to Hydredlec 3E

### RNI 200 B: Compact Rio board control



Control system based on National Instruments CompactRIO board with Input/Output modules adapted to Hydredlec 3E



## Renewable energies



### **SER430 : 250-W Hydraulic power plant**



#### **Operative part**

- Tail bay for energy storage (130 liters) on a frame with 4 castors
- Head bay for accumulation of potential energy (85 liters)
- Hydraulic pump (emulation of a 40-m height waterfall)
- Submerged upwelling pump with a 30-l/min nominal flow
- Pelton turbine with 1 injector
- 300-W asynchronous generator

#### **Control and Measuring unit**

- S7 1512C Siemens PLC with KTP700 HMI
- PAC3200 measuring unit
- 3-phase variator, G120 type, 1.1 kW, controlled by Profinet
- Pressure controller, 0 to 10 bar with 4-20 mA or 0-10 VDC output
- Flowmeter with pulse output, 45 Hz/ms
- Capacitance level sensor

### **SID 410 : didaSAM, Automated handling system**



#### **Operating part**

Introduction of bottles by manual rotary tray with 6 locations

Up/down axis for the bottles:

Handling of the bottle by motorized BRUSHLESS arm

Translation axis between the checkpoint and the packaging post

Band axis with 0.12 kW geared motor and incremental encoder

#### **Control part**

S7-1200 PLC with 1 embedded Ethernet port (S7 1500 as optional extra)

Embedded WEB server, possibility to develop WEB pages

Supervision of the system: TP 700 operator panel with 7" touch-sensitive screen»



## Instruments - Accessories

### Measuring instruments, function generators ...

Multimeters, oscilloscopes, probes, function generators, power supplies, ... please contact us for more information



### Specialised measuring instruments

Field strength meters, OTDR, Power analyser, radio frequency generator ... please contact us for more information



### Resistive and inductive loads, adapted to the 4 ranges of electro-technical and power electronics equipment (30 W – 300 W (SELV and LV) – 1500 W)

For the characteristics, visit our website



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# Turnkey laboratories



Didalab Electrical Engineering department can offer turnkey laboratories. These laboratories include:

- Pedagogical equipment, (electronics, servosystems, computer cabinets ...)
- Measuring instruments ,
- PCs,
- Desks, chairs, cupboards.

We are doing the installation and commissioning of these laboratories ; all the equipment are tested, parametrized, the software installed.

Then we train you in the utilisation of these equipments.

There are 2 kinds of laboratories :

- High school level,
- University level.

Digital and analogical electronics

Computer sciences

Automatic control

Servo Systems and Process Control

Power electronics / Electrotechnics

Telecommunications

Networks – VDI convergence

Systems and Renewable energies



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