Booklet
Electrical engineering
Telecommunications

2021 edition

Pedagogical
Equipments & solutions

STEM   TVET

didalab
ELECTRICAL ENGINEERING

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.

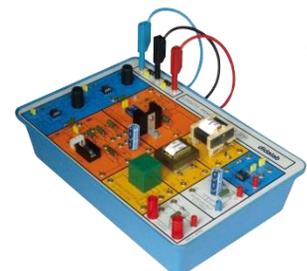## PED3767B Nodal Breakdown supplies

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.

EID430A Sensors

- Embedded sensors (Temperature, pressure, humidity, luminosity, heart pulse rate, accelerometer, 3-axis gyroscope …) magnetometer
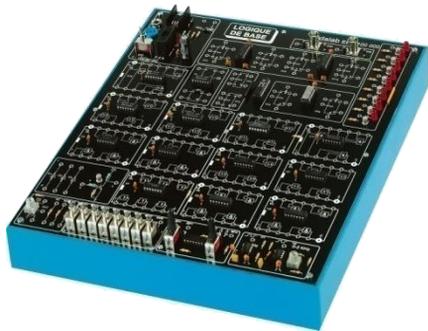- Vizualisation of I²C, SPI frames
- Programmation in C/ C++, Python
- Possibility to add new sensors via a schield Arduino

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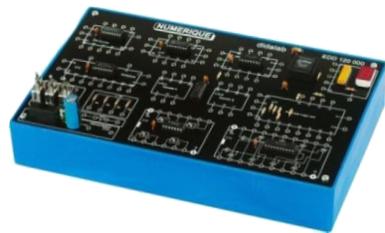
Linked to the **EDD - 100** Range, it enables the study of the basic digital circuits : Counters, comparators, registers, multiplexers et demultiplexers, Arithmetic and Logic Units,...

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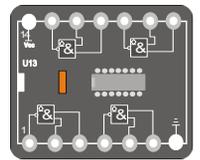
EDD 200 : PROGRAMMABLE LOGIC TRAINER
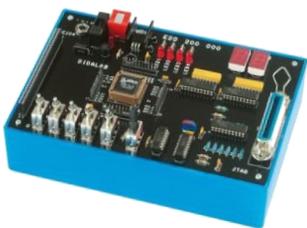
The **EDD 200** pack enables the study of EPLD- range programmable logic circuits, as well as learning and running VHDL language.

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
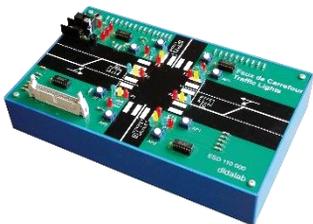PC editor, Cross assembler, Cross compiler, Debugger monitor

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..

EID 060 : SPEED & POSITION SERVO CONTROL

- Speed & position servo-system of a DC motor by µcontroller
- 2 coupled motors: 12 Vdc, 2100 RPM.
- 1 optic coding: 5 Vdc, 200 pts/rev, 2 channels.
- 1 frequency/voltage converter (to get an analog image of the speed).
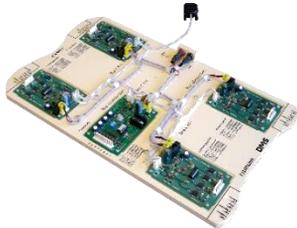- 1 counting circuit for a digital image of the position.

Computer sciencs

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 sudy 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 serveur,,,
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
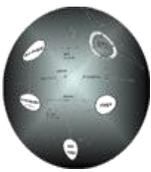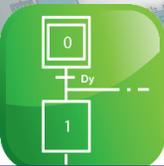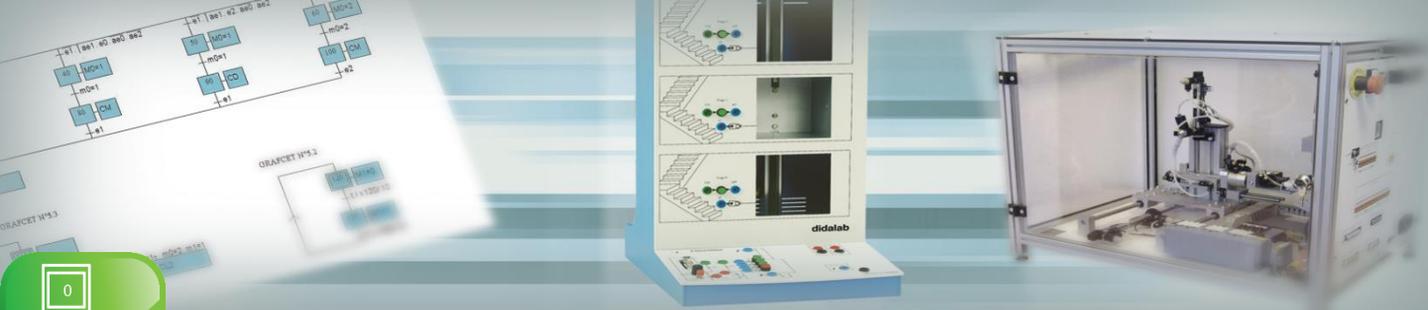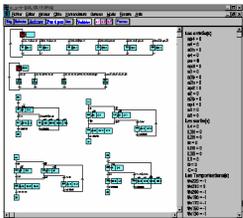
Automatic control

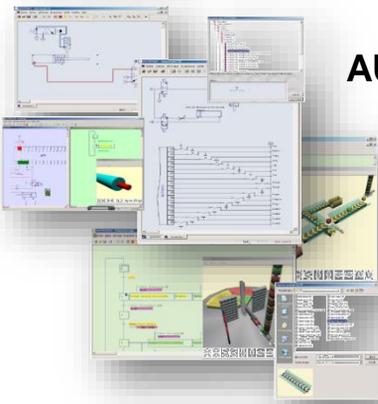## Software

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

AUTOMSIM – Simulation of Electrical, Hydraulic and Pneumatic Automatism

AUTOMGEN – Programme Designing for PLC

- Package (AUTOMGEN/AUTOMSIM), easy and quick ownership.
- Very big library, dynamic modification of diagrams during simulation.
- Most usual software in France.
- Used in the Industry.
- Standard programing 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 1analogue 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

- **Modular bench**
- **Pneumatic connections**
- **Electrical connections**
- **Electro-pneumatic connections**

Study of the components and their technology.
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
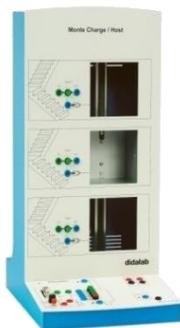
The control front-panel displays 21 Inputs/Outputs. The control is carried out by using patching leads (Ø 2 mm) or EPP standard connector.
- 3 tray calls and 3 level calls,
- 3 tray presence detections,
- 3 tray absence detections,
- 3 level presence displays,
- 1 emergency stop,
- 1 up control, 1 down control.

ESD 030 : ELECTROPNEUMATIC ROBOT WITH GRAFCET CONTROL

Schneider
Electric

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


Open Loop

PID

C corrector
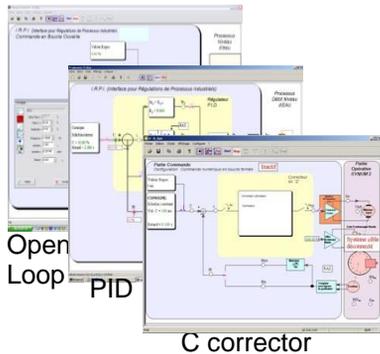
PARAMETERS WINDOW

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
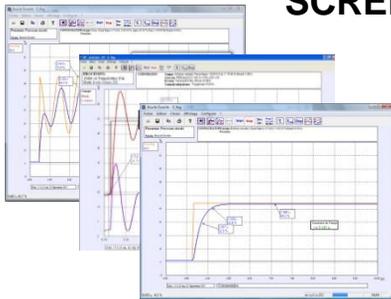
It enables to get /do:
Time response display of one (or several) characteristic value(s) : position, speed, acceleration, motor current, motor voltage, control signal, error, corrector output etc.
Modification of the time diagram scales (zoom in X, in Y)
- Determination of Automatic characteristic values (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).

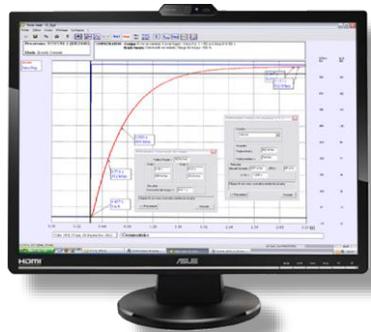## D_CCA enables to control all our operating parts
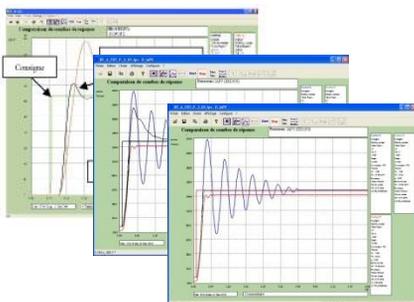
Automatic control

## Automatic generator of Real time correctors

D_Scil is a complete development process. It is a up-to-date development method in Automatic Control Engineering. This method presents 3 successive steps :

1 – IDENTIFICATION IN OPEN LOOP OF THE REAL PROCESS (DOMINANT ORDER, TIME CONSTANT, GAIN …)

The characterisation is done with D_CCA, (explained before).
You create the model in open loop with Scilab/Xcos you can then launch the simulation and draw the dynamic response curve of the system with a set value. Then, you compare the simulation and the experiment with D_Scil.

### 2 – CORRECTOR GENERATION WITH SCILAB/XCOS®
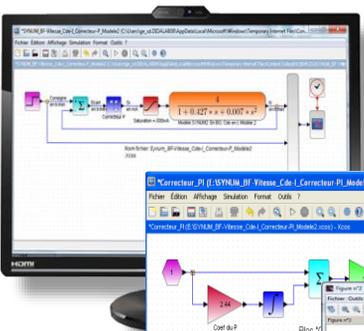
With Xcos, searching an appropriated corrector to the system : (P, PI, PID, RST, state return…). Creating and adjusting this corrector.

Simulating the process with its corrector and generating the time response curves in closed loop with Xcos
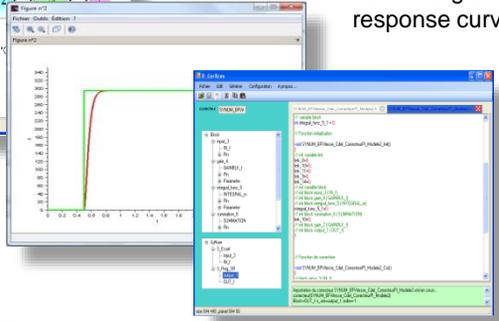
With D_Scil, there is an automatic generation of the C code of the above corrector.
The user can act at the C code level if he wishes so.

3 – CORRECTOR IMPLEMENTATION AND VALIDATION OF THE MODEL
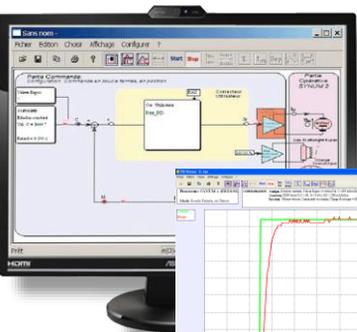
With D_CCA, you can load the corrector (in C code) in the operating unit (SYNUM in this example).
Test's results.
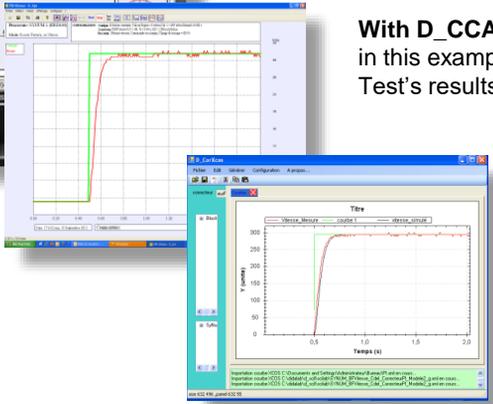
With D_Scil, you compare the test's results and check the consistency of the time curves (simulation and real), then confirm the corrector or go back to the corrector' search if the result is not satisfactory.

For more information, visit our website (www.didalab.fr), and see the video demonstration showing the process details and its pedagogical interest

Servo systems and Process control

ERD 050 : SPEED AND POSITION SERVOSYSTEM

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 SERVOSYSTEM (SYNUN)

ERD100 is a complete training system especifically 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 SERVOSYSTEM (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

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 55x : WATER LEVEL AND FLOW CONTROL

The ERD 552 / ERD552 water level/flow process control, industrial-type, is compatible with all 4/20 mA Inputs/Outputs Controllers. It can be supplied with 1 tank or 2 tanks .
Tme constants : from 70s to 200 s for level according to the configuration,
Pure delay : 10 s approx.
5% response time for flow : 0.5 ms
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

ERD 560 : AIR PRESSURE CONTROL

Air pressure process control, industrial-type,
Air tank 1000 cm3, 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
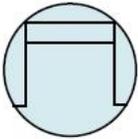Optional : silent compressor

[Power electronics](#)

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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.

300 W

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….

LV : Low Voltage

300 W

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 …).

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

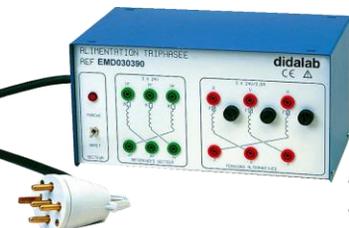## EMD 030 390 : 3-phase power supply

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-pahse 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 powe, 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 powe, reactive power, phase shift...

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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, DC 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, +/0/-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, +/0/-E,
- **3-phase Inverters :**
 Full wave, shifted control, fixed frequency, Full wave, shifted control, variable
frequency, PWM +/-E, +/0/-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
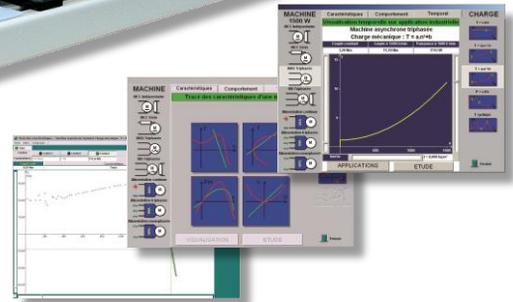 simulation (motor and load modelizations,
  corrector creation…)
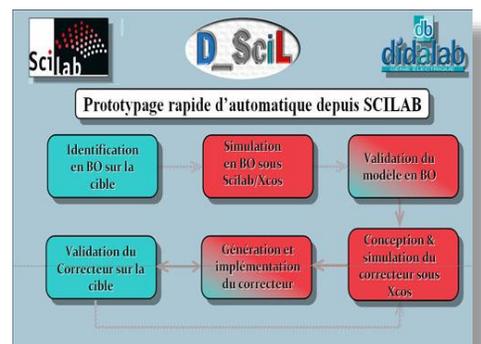
Power electronics

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

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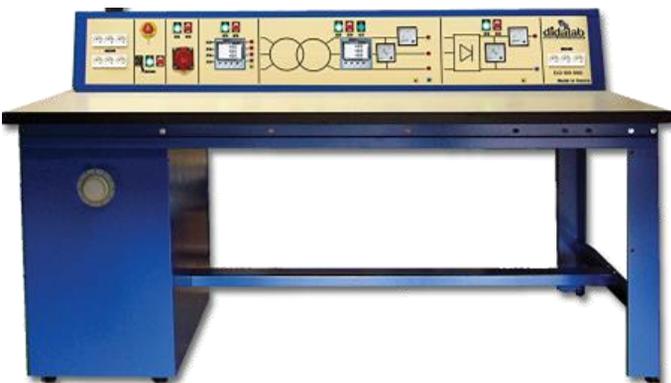
Includes all the power supplies necessary to power a motor bench or power bridges in a 1.5-kW electro-technical laboratory

- 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

Voix

Images Vidéos

Données

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

-> A mistake made by students would not cause any damae 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 manufacture's configurations in the main processing cabinet server, enabling complete secure reboot via LCD configuration interface,

-> A "miroring" 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,
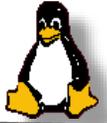
-> Evaluation tests with automatic marks.

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
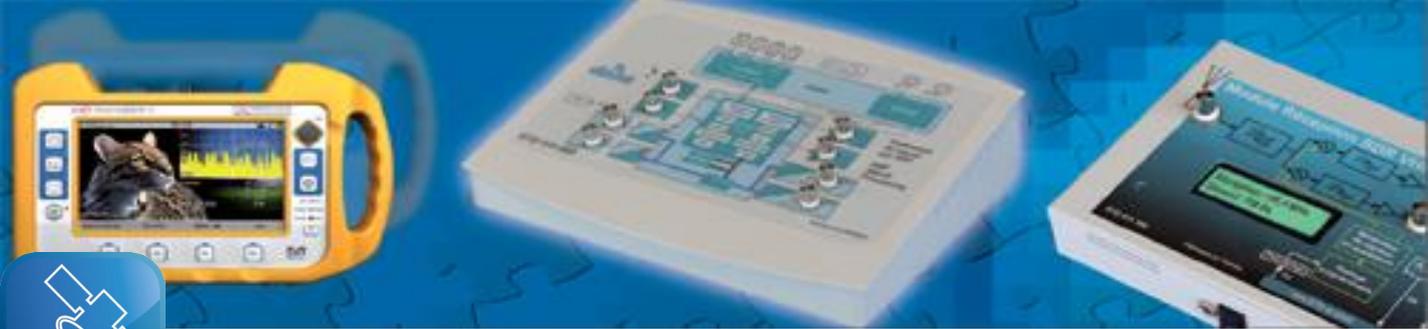
Telecomunications

ETD 410 : DSP /FIBULA GRAPHIC KIT

For the study of:

-**Signal theory**:
Sampling, quantification, FFT, IIR or FIR filters, random signals…
- **Introdution to digital tansmissions:**
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)
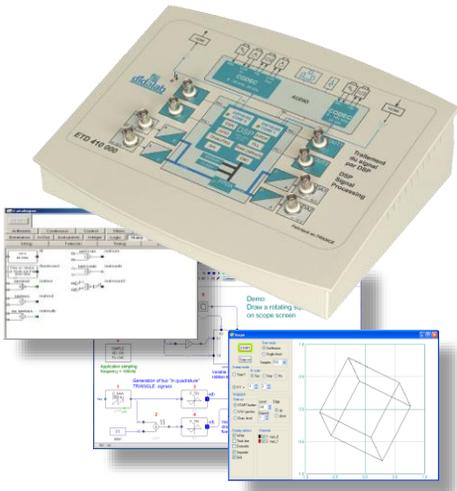
OPTIONAL EXTRA : ANALOGIQUE & DIGITAL RECEPTION

3 modules for the study of analogue and digital telecommunications, coaxial hertzian transmissions , HF and VHF, usin SDR method (Sofware 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 transpositon (0 to 96 kHz,)
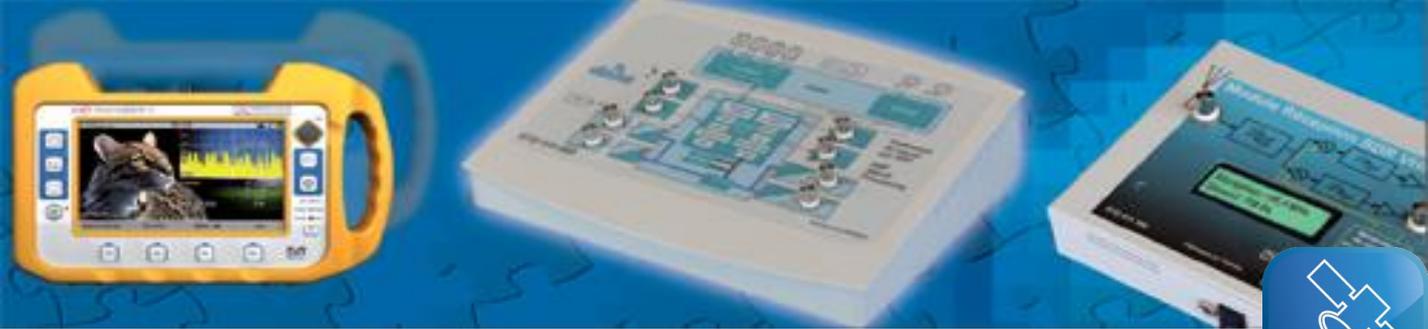
Analogue : AM, FM, BLU,
Digital : ASK, PSK, FSK, QPSK, QAM…
Coding : AMI, RZ, NRZ, Manchester...

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

For:

▪ Study of ring remote communication.
▪ Study of HDB3 encoding & PCM transmission at the ETSI/UIT-T standard.
▪ Re-synchronization of remote time frames.
▪ Control of 1 semaphore channel, signalization protocol (industrial data processing).

EFO 100 000 : Implementation of a transmission with optical fibre (PON)
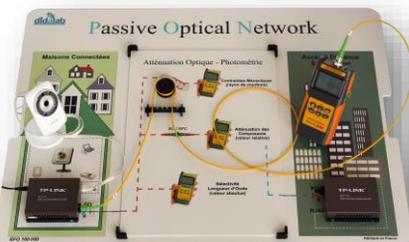
▪ Manipulation and cleanliness of a single-mode telecom fiber.
▪ Calibration of the power meter.
▪ Absolute (dBm) and relative (dB) relative measurements.
▪ Research of the sensitivity threshold of the receiver with the adjustable attenuator.
▪ Measurement of the maximum authorized loss.
▪ Study of a WDM bidirectional link.

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.
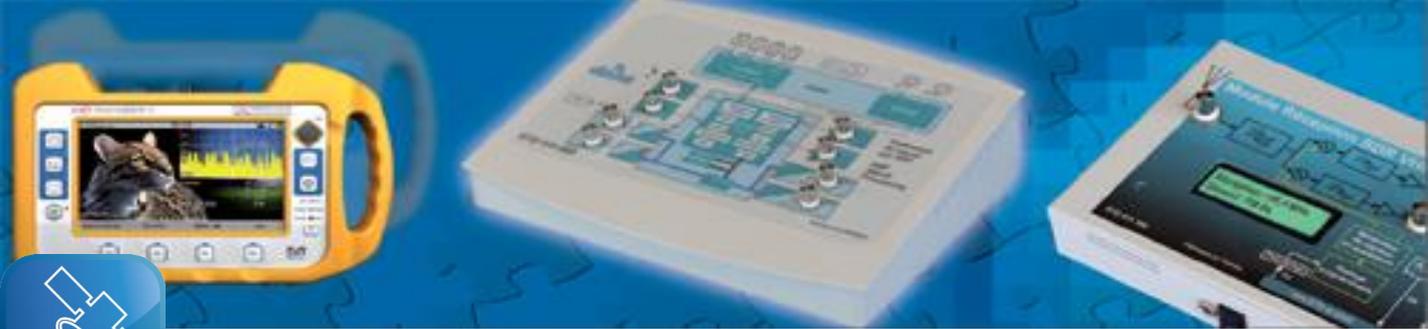
Telecommunications

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

ETD 700 : Antenna Trainer

For the study of:
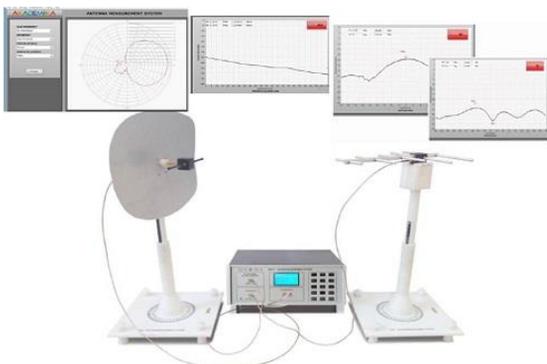
Radiation pattern of wired antenna
Radiation pattern of aperture antenna
Radiation pattern of array antenna
Radiation pattern of planar antenna
Measure of co-polarization, cross polarization
Measure the variation of field strength/inverse square law
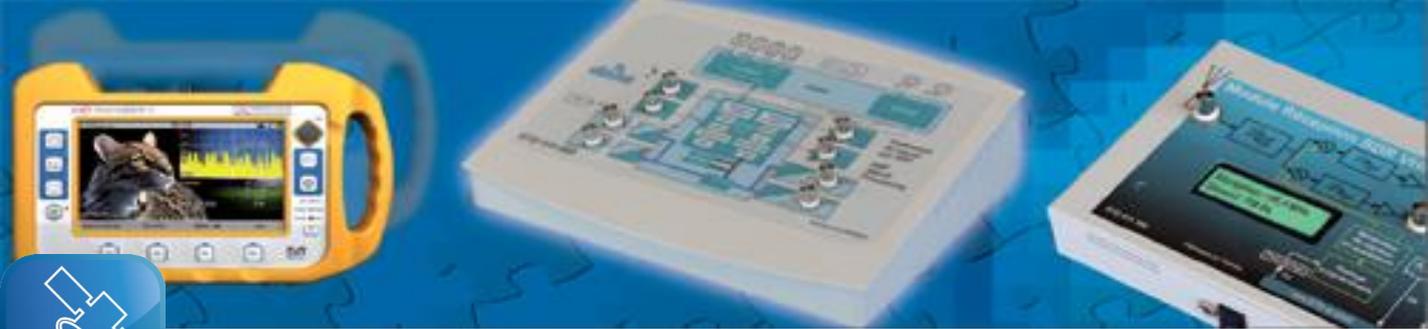
Telecommunications

ETR 100 : Internet of Things (IoT), via LoRa protocol


Programmations

Protocoles

Bus Série

Strong points:

- Long range, low consumption
- 7 embedded sensors (hygrometry, pressure, temperature, luminosity, pulse, magnometer, gyroscope)
- Compatible with Arduino sensors
- Prototyping

Study of:

- LoRa and LoRAWAN protocols
- Sensors
- Programation in C, C++ , Python, Node RED
- Complete transmission (from the sensor to the server)
- Analysis Analysis of the SPI – I²C frames

Internet of Things : LoRaWAN technology
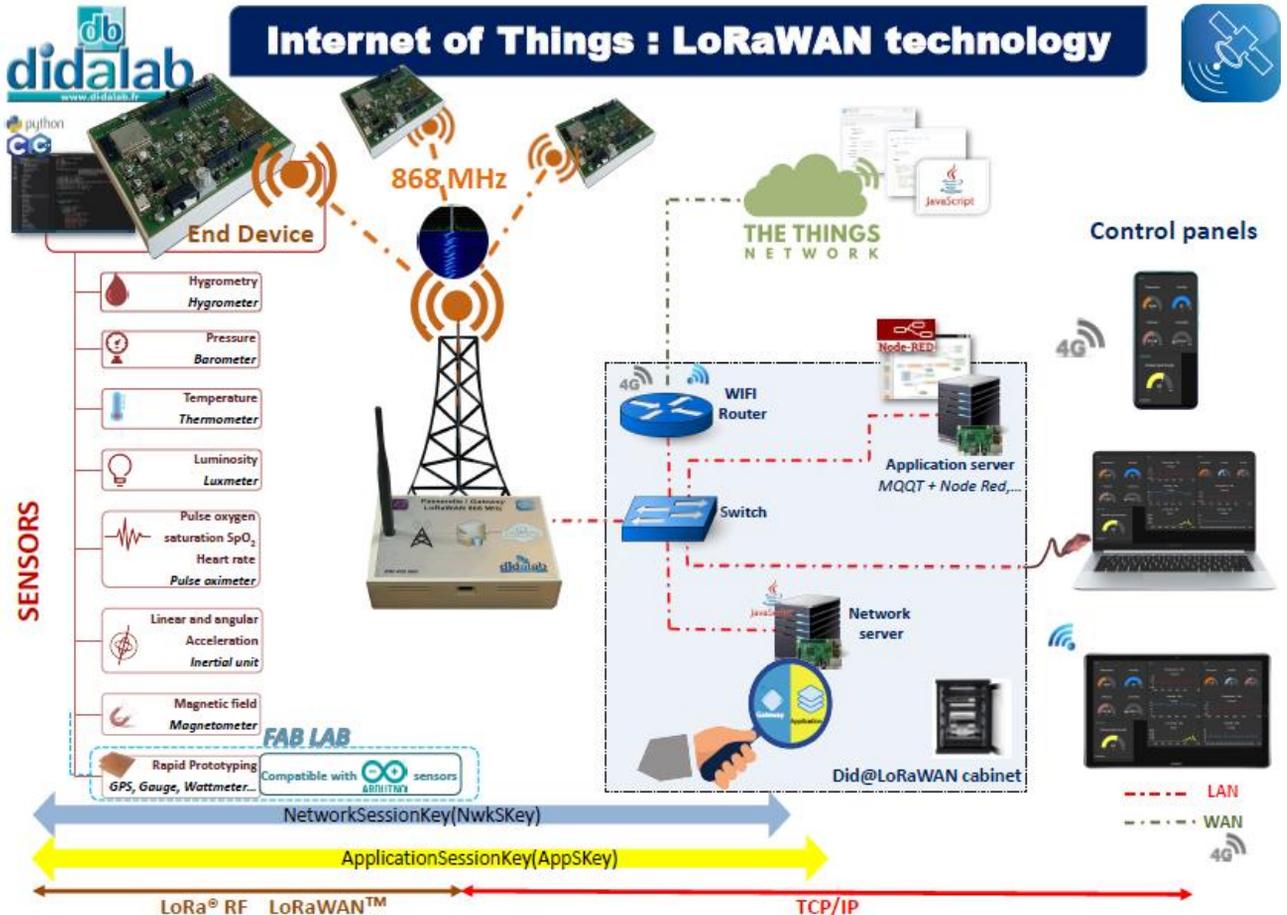
Renewable energies

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
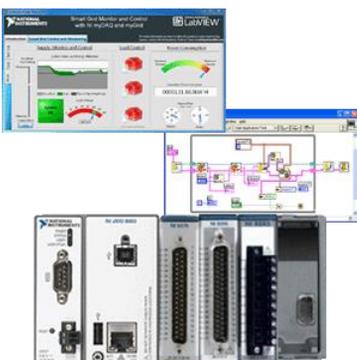
Optional extra :
- 90-W wind turbine,
- 20-W solar panel.

RS7 1200B: Siemens PLC control

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

RNI 200 B: Compact Rio board control

Control system based on National Instruments CompactRIO board with Input/Output modules adapted to Hydrelec 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

SER 330 : didaPAC, Heat pump

Operating part

- 1 evaporator, 1 compressor, 1 expansion valve, 1 plate exchanger
- 1 pump for water circulation
- 1 set of sensors (8 temperature sensors, 2 safety pressure switches)
- 2 analog switches to read the LP and HP pressures
- 1 flowmeter (water flow in the tank or in the external load in real time)
- 1 electric power pulse counter with display of current consumption
- 1 water tank of about 20 liters mounted under the system
- 1 output on the side of the heat pump for the connection of an external consumer
- Reversibility valve : the 4-way valve on the fluid part ensures reversibility by successively rising temperature and cooling of the water in the tank or of the external circuit
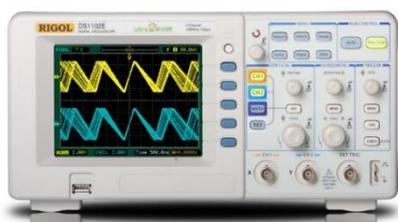
Control part

- S7 SIEMENS PLC 1200 Data acquisition with web server function (optional)
- Ethernet port for programming and reading of data systems
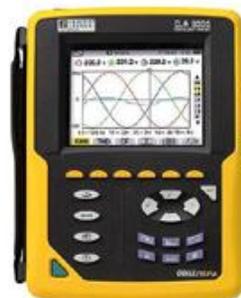
Instruments - Accessories

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

Rheostats

Inductances

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The best of physics
at your disposal

Experiments and
Products

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OPTICS

THERMODYNAMICS

ELECTRICITY

PHYSICS OF
THE MATTER

MEASURING
INSTRUMENTS

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Turnkey laboratories

Didalab Electrical Engineering department can offer turkey laboratories. These laborarories 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 equiments.
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

Telecomunications

Networks – VDI convergence

Systems and Renewable energies