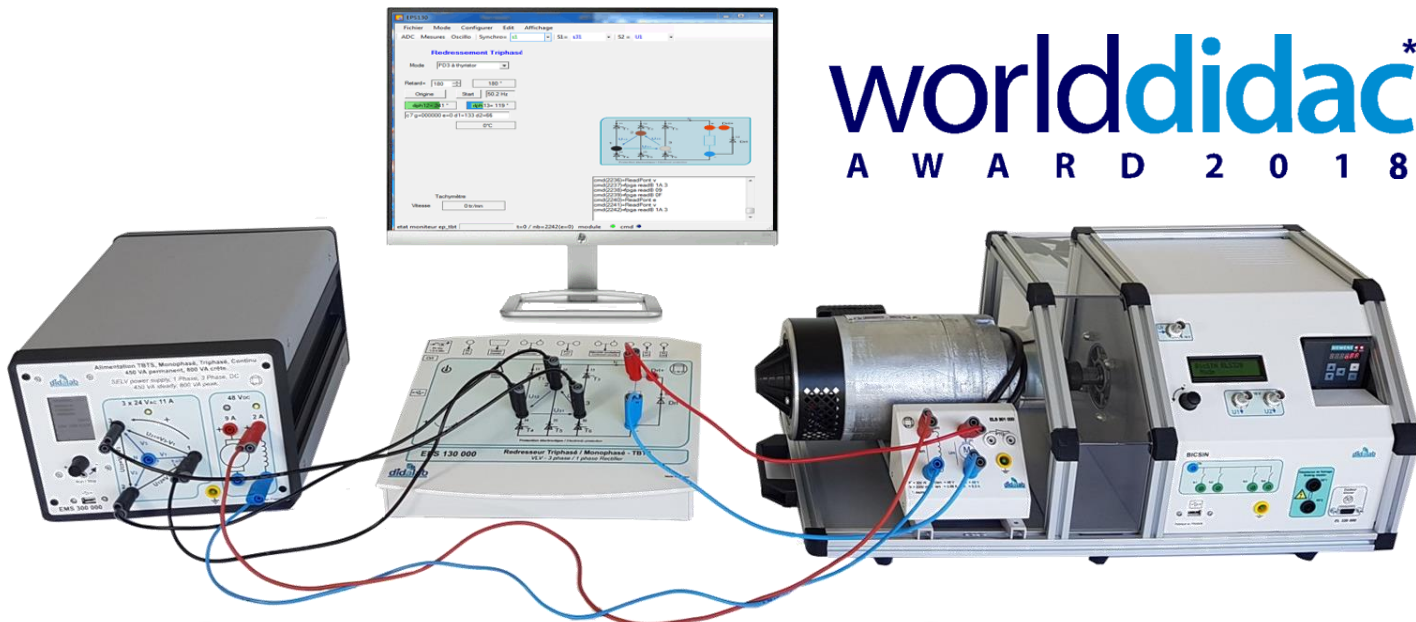




Electro-technical lab. Power electronics 300 W - SELV

worlddidac*
A W A R D 2 0 1 8



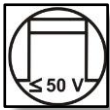
Our pedagogical Solutions

POWER SUPPLY

POWER BRIDGES

MOTOR BENCHES

ENVIRONMENT



SELV : Safety Extra Low Voltage

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:

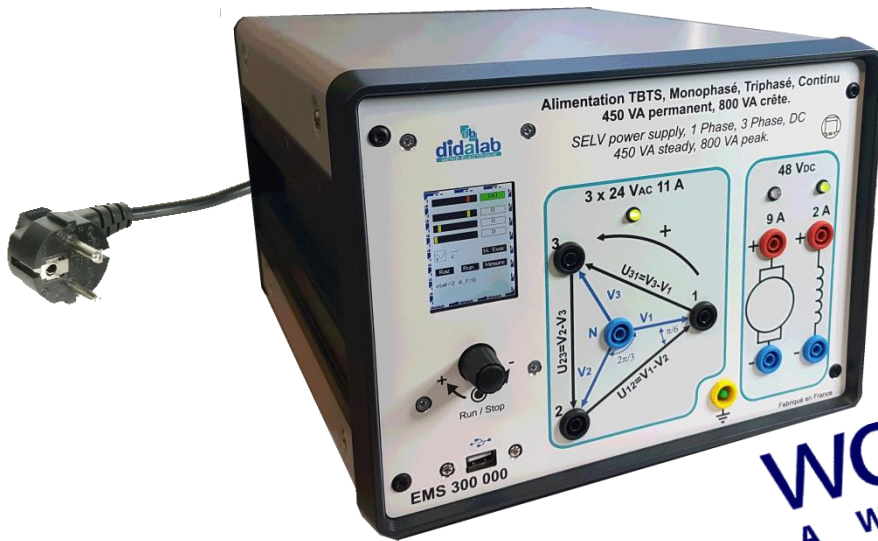
- Colleges, which must teach the power converters et motors but don't have electro-technical laboratories (with 3-phase power supplies ...)
- Several training in electro-technical engineering....
-

Thus you can make your electro-technical and power electronics practical works in a "electronic" environment (a non-specialized laboratory)

Power supply



EMS 300: Electrical engineering power supply, SELV



Input voltage

1-phase AC power supply on mains sockets, 240 VAC 16 A,

Output voltages

3-phase alternative current + neutral 3x24 VAC 11 A
or **direct current** 48 VDC 9A,
Direct current (for excitation) 48 VDC 2 A

Steady power: 450 VA, Peak power: 800 VA

Integrated measurements:

voltages, currents, active power, reactive power, phase shift...

MAIN CHARACTERISTICS:

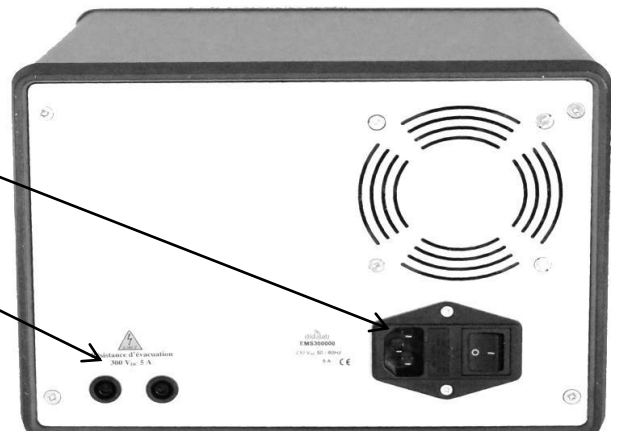
EMS 300 000 power supply is specially designed to carry out practical works in Power electronics and Electrotechnics in the DIDALAB 300-W range. Its main assets are:

- Output voltage comply with SELV standard s (avoiding expensive measuring and/or protection systems).
- **Pluggable directly to the mains: single-phase socket 240 V_{AC} 16A (available in any given classroom).**
- A LCD HMI associated to a digital potentiometer enables to select the values to display (DC/AC voltage, direct current, effective single or tri, phase difference, cosine φ , etc.
- *Optional: a software under Windows enables to retrieve the information of electrical power to carry out rotating machines yield studies (mechanical energy acquisition on the load module).*

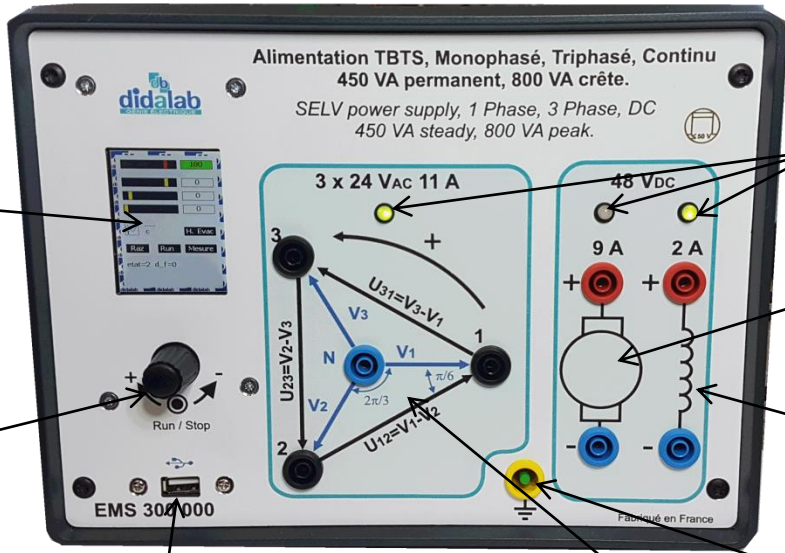
Back

Supply socket for mains 220 Vac/50 Hz

Ø 4-mm security sockets to connect a resistance for energy discharge.



Power supply



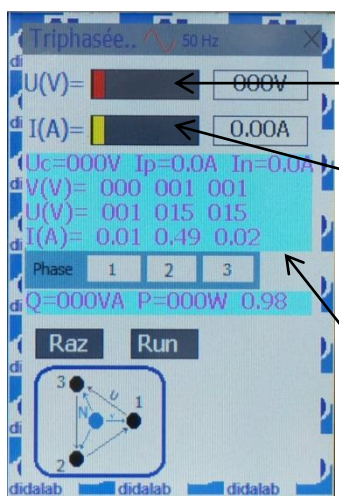
- Display leds
State of the power supply
- DC power supply
48Vdc 9A
- DC power supply
48Vdc 2A
- Earth socket

hMI

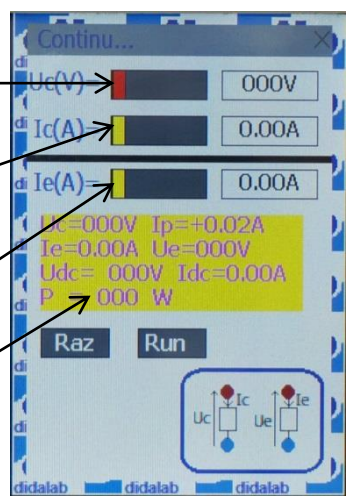
Digital potentiometer

USB socket for data registering on a computer (Voltage, Current, Power, cosineφ ...)

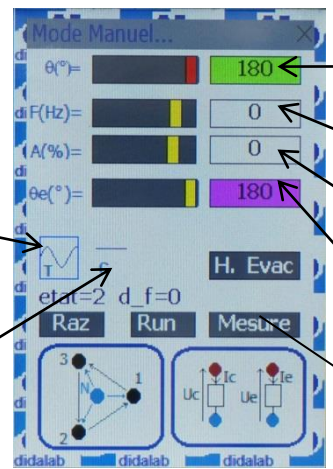
AC power supply
1-phase, 3-phase
24 Vac 11A



- Control slider for voltage
- Control slider for current
- Control slider for excitation current
- Measures



Manual mode



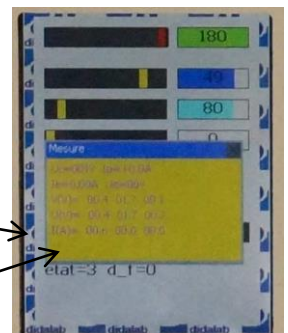
- Delay angle (0 to 180°)
- Inverter frequency (Hz)
- Inverter amplitude
- DC excitation power supply

Activation of the AC operating mode

Activation of the DC operating mode

The measures depend on the operating mode :

- In 3-ph AC mode: RMS voltage (V and U (phase voltage and compound voltage) in each phase ; RMS current in each phase
- In DC mode: average voltage and average current.





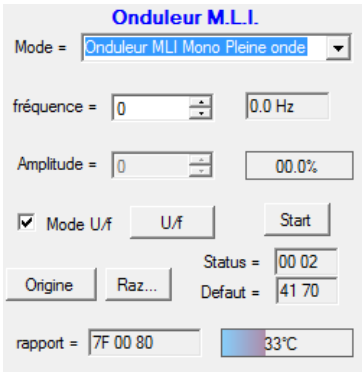
Power bridges

EP MONITOR : Program for setting the parameters and for acquisition

This program operates with Windows environment and is used to control all the power bridges (rectifier, chopper, inverter, AC controller) via USB.

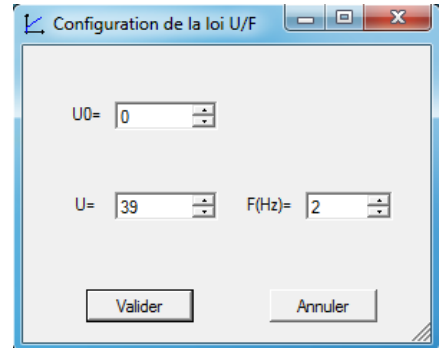
When you connect the bridge to the PC and launch the program, the program automatically recognizes the bridges it is connected to.

➤ The student chooses the bridge structure



Example with the EPS230 inverter

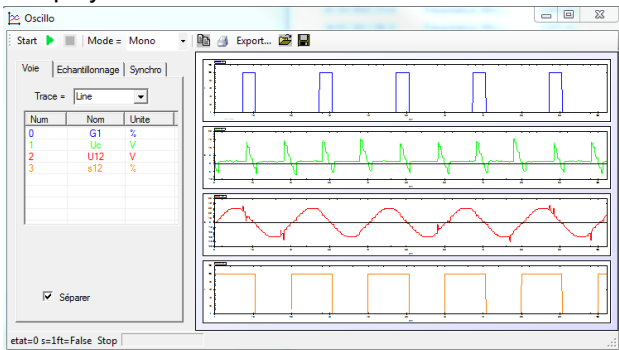
➤ He sets the operating parameters



➤ He chooses the values he wants to display on the internal oscilloscope,

➤ Due to calculation function in the internal oscilloscope, he can display harmonics ...

➤ The student can display the measures in all the arms of the power converter (Voltage, control current for the or the IGBT, in the load, ...)



Example with the EPS130 rectifier

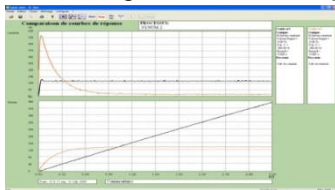
Nom	Valeur	Heure	Valeur	V. d.
I1	0401	1025	0.05A	
I2	0402	1026	0.06A	
I3	0403	1027	0.05A	
I4	0404	1028	0.13A	
I5	0402	1026	0.06A	
I6	0401	1025	0.05A	
Ic	03FE	1022	-0.06A	
U11	0400	1024	0.00V	
U12	0403	1027	0.24V	
U13	0400	1024	0.00V	
Uc	0403	1027	0.24V	
Ic	0402	1026	0.06A	
U12	0008	8	0.64V	
U23	0003	3	0.24V	
U51	0FFE	4054	-0.08V	
Iref	750	1872	-7 mA	
ED	9ED	1773	43 %	

Optional extra: D_CCA, Program for speed and position servo-control

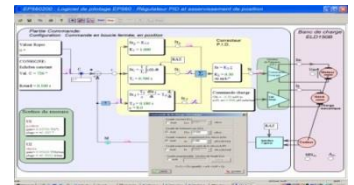
In a Windows environment, this program allows the control of the power converters via a USB port. Its graphic interface is very friendly and allows:

- Selection of the system structure: open loop, closed loop for speed,...
- Selection of the set value: constant value, ramp, sine, trapezoid, its characteristics
- Selection of the corrector and the adjustment of its parameters (P, PI, PID, digital Z corrector, fuzzy logic, tachometer feedback)
- The recording of the current test, comparison with previous tests.
- The measure of the characteristic value in servo-control (time constant, 5% response time, overflow amplitude, harmonics : ratio between average values and amplitudes, phase shift etc...).

Comparison in open loop of the response in voltage control, then in current control, without frictional disturbance



Screen for settings Example of a speed control with a 1 loop PID corrector



Optional extra: Prototyping and new correctors

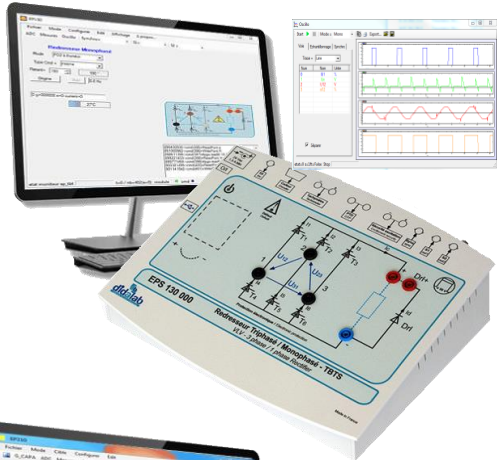
In order to accentuate the pedagogical qualities, or even make research with our converters, a software module is proposed..

It can synthesize any type of command (Open loop, Closed loop, PI, PID, state return...) under Scilab® environment, then generate the executable code which will be downloaded in the converter thus allowing its control in real time.

This graphical tool has all the power of Scilab® / Xcos simulation software; the comparison between simulation and reality is then possible during practical works (speed control of a DC motor ..)



EPS 130: 1-phase, 3-phase rectifier, 300W, SELV

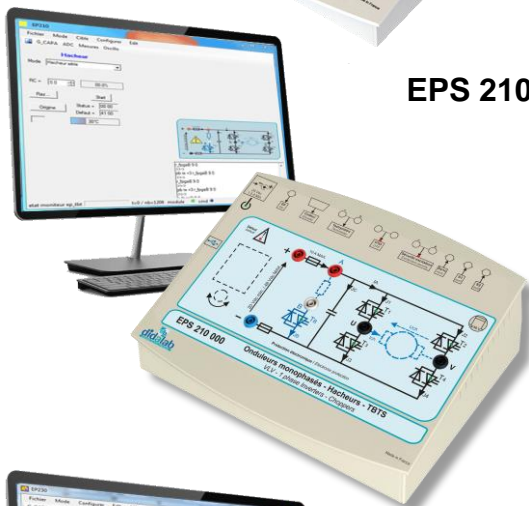


For the study of:

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

-Optional extra: speed servo control, prototyping

EPS 210: 4-quadrants chopper/ 1-phase inverter, 300W , SELV

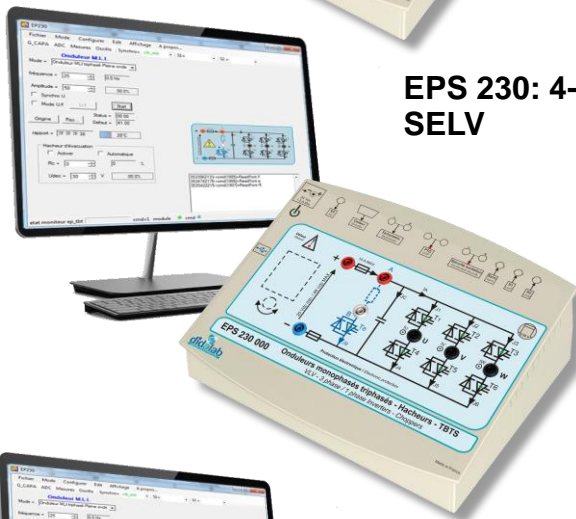


For the study of:

- Chopper
Serial, voltage reversible, current reversible, four quadrants, over-fitted double serial
- 1-phase inverter
Shift control full wave with fixed frequency, with adjustable frequency, PWM +E/-E, PWM +E/0/-E, constant U/f

-Optional extra: speed and position servo control, prototyping

EPS 230: 4-quadrants chopper/ 1-phase, 3-phase inverter, 300W , SELV

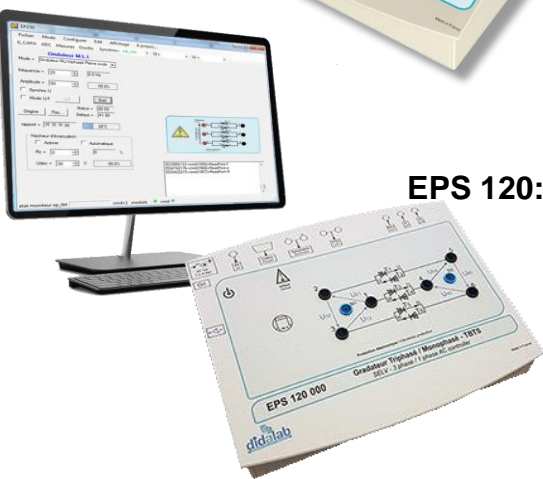


For the study of:

- Chopper
Serial, voltage reversible, current reversible, four quadrants, over-fitted double serial
- 1-phase inverter
Shift control full wave with fixed frequency, with adjustable frequency, PWM +E/-E, PWM +E/0/-E, constant U/f
- 3-phase inverter
Shift control full wave with fixed frequency, with adjustable frequency, PWM +E/-E, PWM +E/0/-E, constant U/f

- Optional extra: speed and position servo control, prototyping

EPS 120: 1-phase, 3-phase AC controller, 300 W, SELV



For the study of:

- Up-line 1-phase AC controller
Phase angle controller,
- Up-line 3-phase AC controller
Phase angle controller with neutral, phase angle controller without neutral



Motors

The bench can accept various motors to test, we suggest the following motors but you can ask us for other ones.

ELS 3x1: DC motor with separate excitation, 300W , SELV

MOTOR CHARACTERISTICS	Value	Units
Power supply	48	Vdc
Nominal current	7,2	A
Excitation current	1,4	A
Electric power	412	W
Speed (for nominal current)	2 000	Tr/min
Mechanical power	270	W/S2*
Nominal torque	1,87	Nm
Maximum gain	65	%
Protection	klixon	



ELS 3x2: DC motor with permanent excitation, 300W, SELV



MOTOR CHARACTERISTICS	Value	Units
Power supply	48	Vdc
Nominal current	6,7	A
Electric power	321	W
Speed (for nominal current)	2 000	Tr/min
Mechanical power	180	W/S2*
Nominal torque	1,25	Nm
Maximum gain	60	%
Protection	klixon	

ELS 3x3: 3-phase AC squirrel motor, 300W, SELV

MOTOR CHARACTERISTICS	Value	Units
Nominal voltage	24 / 42	Vac
Nominal current	11,5 / 6,6	A
Cosine φ	0,68	
Operating power	180	W
Nominal torque	1,23	Nm
Performance	60%	%
Speed (synchronism)	1 360 (1 500)	tr/min
Thermal protection	Par Klixon	



ELS 3x6: Brushless motor, 300W, SELV



MOTOR CHARACTERISTICS	Value	Units
Sine voltage power supply	23	3xAC
DC voltage power supply (trapezoïd)	35	VDC
Speed (for nominal current)	2000	Tr/min
Mechanical power	300	W
Nominal torque	1,5	Nm
Nominal current	7,9	A
Thermal protection		PTC
Connection for Hall effect probe via DB15	3	

** : puissance électrique
S2* : intermittent 30 mn

Load benches



ELS31x : BICMAC Instrumented load bench for AC and DC motors

300-W motor bench:

- The load is a magnetic brake
- A control board and its power supply carries out the load generation and the acquisition of results (constant load, load according to speed, to square speed ...)
- Various testing settings are available (with 3-phase asynchronous motor, DC motor, Brushless motor...),

Settings of the load:

The load is set via potentiometer and display,

In our case (magnetic brake), it is a **braking** load,

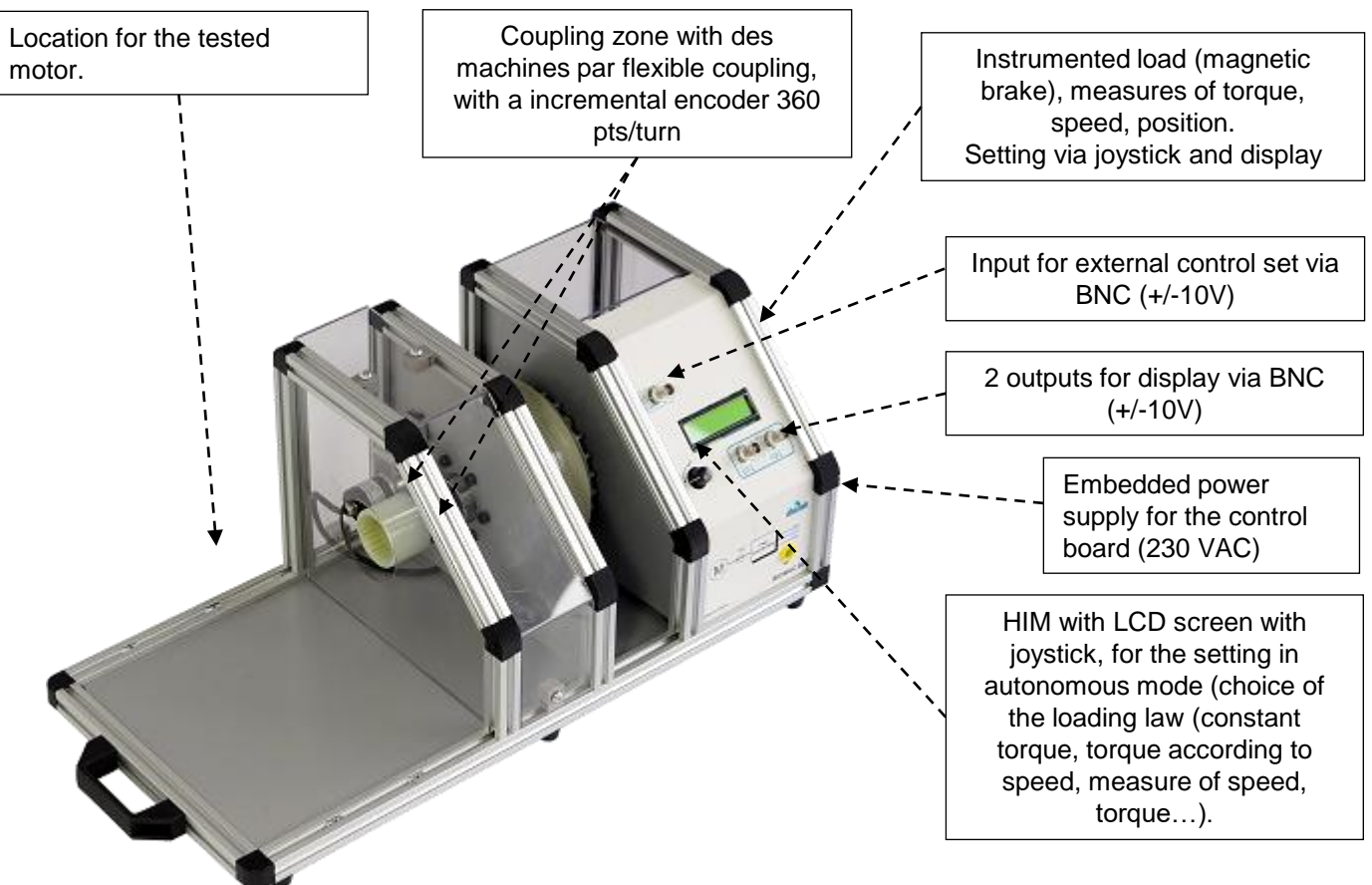
Choice between: constant torque (-sign(N).C), proportional to the speed (a.N), proportional to the square speed (b.n²), external

Measures:

The measures displayed are:

Measured values: torque C_m (N.m), rotation speed N (en tr/min),

Calculated measures: mechanical power P (W), with $P_m = C_m \cdot \omega$





Load benches

ELS32x : BICSIN Instrumented load bench with active load and simulation of Digital Industrial Systems



- Instrumented load generator, based on:**
- Brushless 750W SIMOTICS® S-1FL6,
 - Variator SINAMICS ® V90,
 - PC-board Interface,
 - Display/ digital potentiometer for setting parameters
 - Control software with PC via USB (EL320100, basic version).



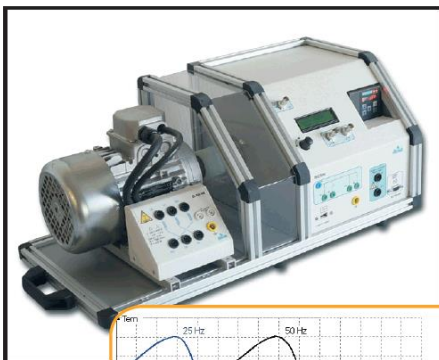
SIMOTICS S-1FL6



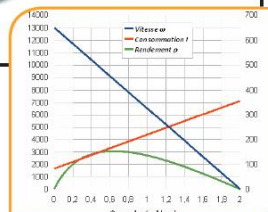
SINAMICS V90

Motor characteristics plotting

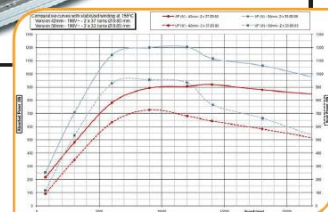
Torque speed relation
3-ph AC motor (ELS 323 000)



Torque speed relation
DC motor (ELS 322 000)



Torque speed relation
Brushless motor (ELS 326 000)



Load benches



ELS32x : BICSIN Instrumented load bench with active load and simulation of Digital Industrial Systems

300-W motor bench:

- The load is a brushless motor, controlled by an industrial variator
- A control board and its power supply carries out the load generation and the acquisition of results (constant load, load according to speed, to square speed ...)
- Various testing settings are available (with 3-phase asynchronous motor, DC motor, Brushless motor...),

Settings of the load:

The load is set via potentiometer and display,

In our case (controlled brushless motor), it is a **braking or driving** load,

Choice between: constant torque (-sign(N).C), proportional to the speed (a.N), proportional to the square speed (b.n²), inertial (J.A), external

If $C > 0$: BicSIN carries out a braking torque

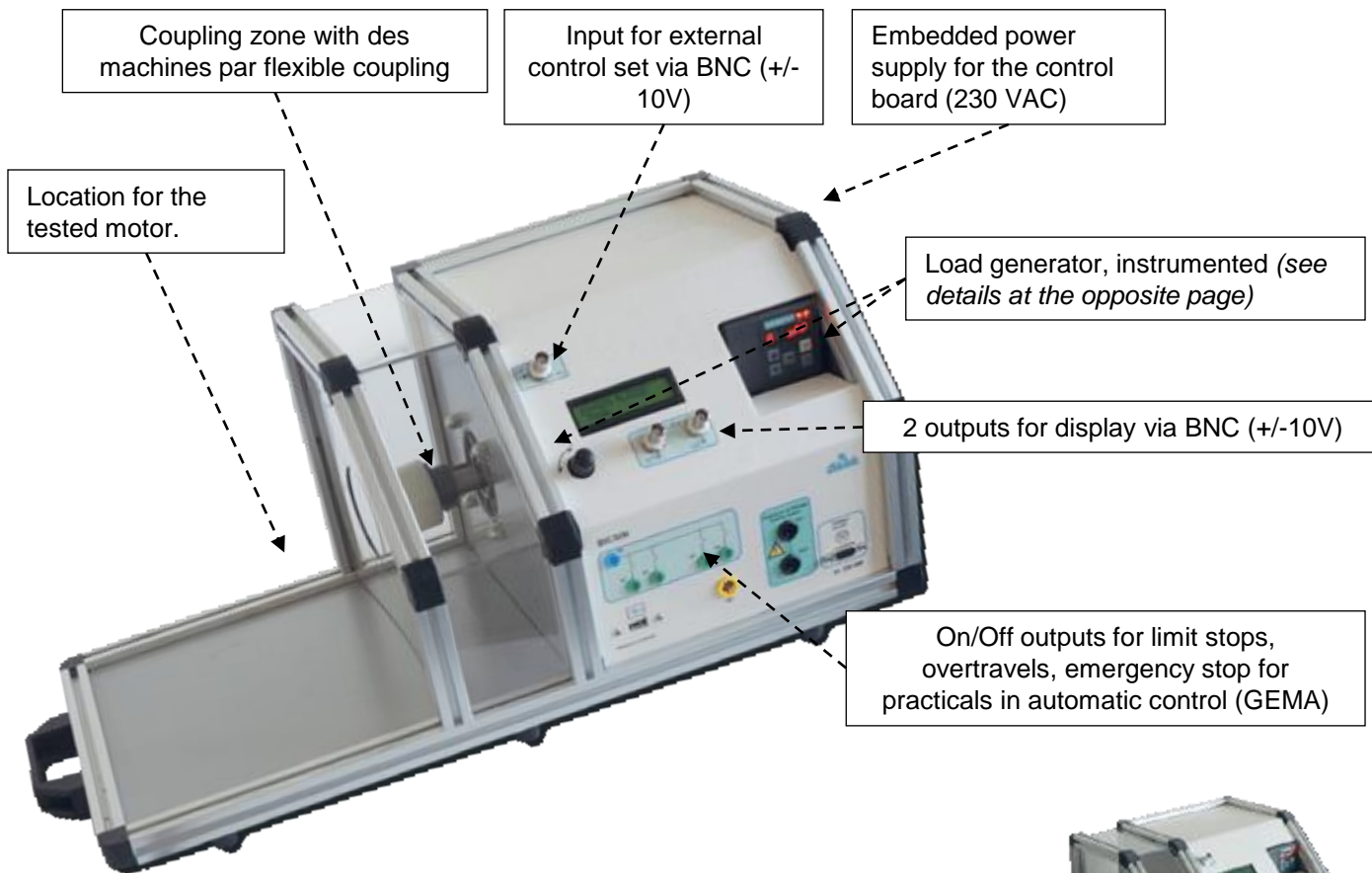
If $C < 0$: le BicSIN carries out a driving torque

Measures:

The measures displayed are:

Measured values: torque C_m (N.m), rotation speed N (en tr/min),

Calculated measures: mechanical power P (W), with $P_m = C_m \cdot \omega$



Example of setting : ELS322 : 300 W, SELV, DC motor, coupled with an active load with acquisition of mechanical values





R and L loads



ELD 103 000 Load rheostat

11 Ohms 960 VA

For a 3-phase load; put a set of 3 rheostats



ELD 102 000 Self

35 mH 400V with protecting fuse

For a 3-phase load; put a set of 3 selfs



Environment

For each working station

- ✓ 1 electronic table (with 5 to 6 sockets, 220V-16A / 50 Hz)
- ✓ Set of 52 patching cords (25, 50, 100, 200 cm) insulated, 36A, stackable
- ✓ 1 PC with Windows
- ✓ 1 Oscilloscope with differential probes
- ✓ 1 ampermeter probe
- ✓ 1 TRMS multimeter

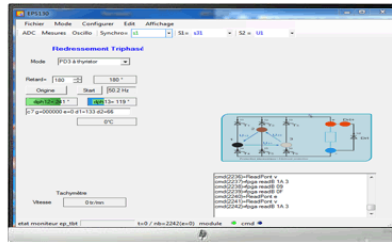
Note : The software supplied with the power bridges has an internal oscilloscope and thus allows to trace on your computer the various curves for voltage/current ... However, he is always interesting for the students to make the "real" measures with more traditional measuring instruments



Examples of settings



Control of a DC motor with a rectifier

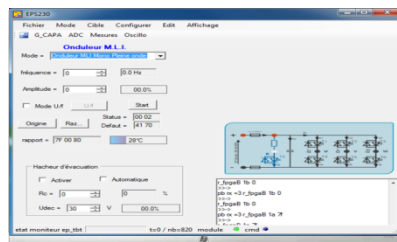


SELV power supply
(réf EMS300)

1-ph, 3-ph rectifier (réf EPS130)

DC motor with active load (réf ELS321)

Control of a 3-ph asynchronous motor with a PWM inverter



SELV power supply
(réf EMS300)

1-ph, 3-ph inverter (réf EPS230)

Asynchronous motor with active load
(réf ELS321)

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