

WIND TURBINE SIMULATOR - NETWORK INJECTION

EOLYP is a test bench dealing with the study of the hyper synchronous activity of a wind turbine for its electricity production aspects, excluding the mechanical aspects. Due to noise pollution and draughts, which are incompatible with a classroom environment, the propeller has been replaced by a variable speed drive motor.

The functional diagram presents the operating principle. The safety components placed in the electrical cabinet are not represented to simplify reading. The propeller, for which the operator adjusts the speed, drives the generator from 0 to 1800 rpm. Two sensors placed on the shaft, returns rotation speed and torque information to the console which displays this information. The generator is coupled to the public three-phase network, through an electrical measurement bench indicating the:

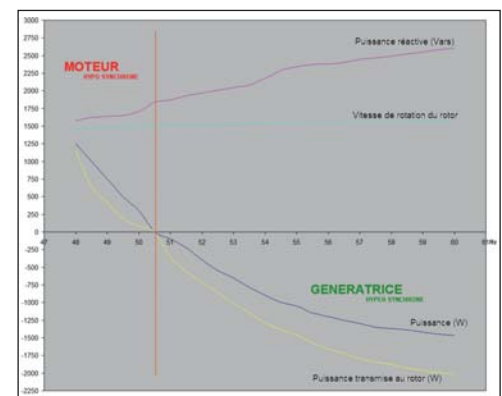
- active power injected into the network.
- voltage between phases
- current
- power factor.

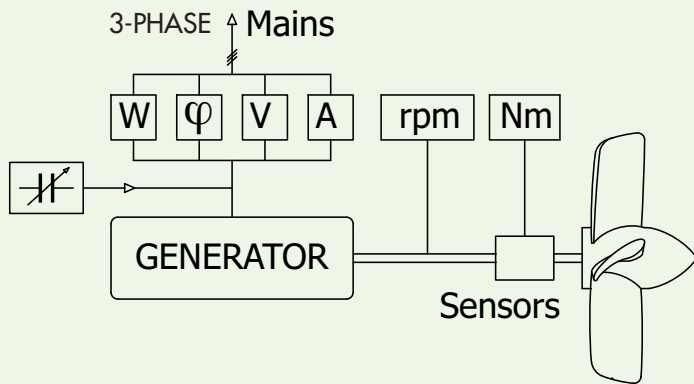
The central-zero wattmeter shows that depending on the drive speed, the generator consumes or produces energy highlighting the hypersynchronous and hyposynchronous operations. The voltage/current distortion also changes with the rotation speed as indicated by the central-zero power factor meter. The adjustable capacitors battery is used to adjust the power factor to around 1 depending on the speed and power produced.



ref. EOLYP

ref. EOLYP-ECO without sensor and display unit





Block diagram

EDUCATIONAL OBJECTIVES

- Understanding the mechanical & electrical principles of a wind turbine.
- Studying the hypo-synchronous and hyper-synchronous operating modes of an asynchronous motor.
- Studying the synchronization of the electrical network.
- Calculating the efficiency of the energy production system.
- Using a clamp-on Ammeter.

TEACHING RESOURCES STUDENT & TEACHER

Proposed Practical Works

- Reminders on the wind turbine functioning.
- Synchronization procedure on the electrical network.
- Raising the power factor by a capacitors bank and study the results.
- Plotting the electrical characteristics of the energy production system.
- Calculating the overall efficiency.
- Studying of the functioning in an isolated site.

COMPRISES

- 1 frame on casters, dim. 1200x750mm height : 1820mm. Weight: 143kg.
- 1 asynchronous motor 1.5 kVA
- 1 generator
- 1 DC tachogenerator / 1 torque sensor
- 1 command console
- 1 electrical cabinet
- 1 network coupling unit

GENERATOR FEATURES

- Generator: 3 x 400VAC Asynchronous motor.
- Active power injected into the network: 0 to 1.2kVA
- Generator efficiency: 78%
- Speed variation: 0 to 1800 rpm

ELECTRICAL CABINET FEATURES

Inside

- 30 mA circuit breakers & thermal-magnetic and thermal circuit breakers.
- 2.2kVA speed controller with control unit on the console.
- stepped capacitors battery

On the front

- 1 emergency stop circuit breaker
- 1 switch disconnecter
- 1 stop/Start button with push button
- 4 switches triggering the capacitors to rectify the $\cos\phi$
- 2 indicator lights show a thermal fault on the motor and generator

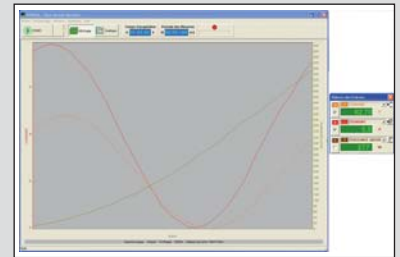


ACQUISITION PACK



ref. EOL-COM2

EOL-COM2 is an option for EOLYP and EOLYP-ECO. This option allows recording and plotting on PC the electrical values as voltage, current and power provided to the Electrical network. The software supplied displays these electrical values in real time and collects them in Excel format.



During the acquisition, the values of U/I/P are displayed at the same time as curves and numerical values. Connection on PC by a USB cable of 2m (supplied). Mains supply: 230Vac – 50/60Hz

DISPLAY

By two displays 2000 pts and one display 2000 pts with LEDs.

INPUTS

Voltage inputs: Three floating potential voltage terminals, situated at the rear of the apparatus allowing either the application of an alternating, continuous or composite voltage, or a balanced three phase voltage. These inputs are electronically protected against over voltages. Max. voltage: 400Vrms single phase, 700Vrms three phase

Current inputs: Two floating potential current terminals, situated at the rear of the apparatus allowing the application of an alternating, continuous or composite current. $I_{max} = 20A$. The current input is protected by a delay fuse, allowing measurements on starting up a motor

RECOPY OUTPUTS

Voltage output: 0 to 10V DC signal for 0 to 1000Vrms entering.

Current output: 0 to 10V DC signal for 0 to 20Arms entering.

Power output: 0 to 10V DC for 0 to 0.2kW - 0 to 2kW - 0 to 20kW; these three ratings are switched automatically.

Important: these three outputs are insulated from the voltage and currents applied to the input terminals of the apparatus.

OTHER CHARACTERISTICS

Dimensions of each case : 375 x 80 x 275mm. Weight : 5kg.

Function	U	I	W
Ranges	400Vrms single-phase 700Vrms 3-phase	20Arms	0.2 - 2 - 20kW
Accuracy			
in %	1% from 0 to 70kHz	2% 0 ~ 20kHz 3% 20 ~ 70kHz	2% 0 ~ 20kHz 3% 20 ~ 30kHz 5% 30 ~ 70kHz
Protection	Electronic breaker	20A delayed fuse	
Impedance	1.5MΩ	<5mΩ	
Recopy outputs	10VDC/1000Vrms	10VDC/20Arms	10VDC/ 0.2kW - 2kW - 20kW