WIND POWER PLANTS

DL WPP

This trainer allows the students to study the functions and operations of a modern wind power plant simulating the effects of the wind force and their effects on the plant.
This system operates through a brushless machine and the simulation software and the double-feed asynchronous machine allows a practical and effective approach to this trainer.

The trainer has a modular structure that will grant teachers and students extreme flexibility during the study of the related topics and the performance of the experiments.
An interactive multimedia software is also available to allow performing the experiments set-up as well as the visualization and management of the collected data through PC.

The control unit of this trainer allows controlling and operating a speed-variable double-feed asynchronous generator. Thanks to this control unit it is possible to simulate and investigate the operating principles of this topic.

This control unit allows approaching and theoretically in depth analyzing the following topics:

- Operation of the double-feed asynchronous generator;
- Integrated power switch for switching the generator on line;
- Reactive and active power, frequency and voltage control;
- Mains synchronization.

This trainer is complete with the relevant software that can control and set the several operations of the system; with this software it is possible to adjust the wind speed and profile and to examine the effects on the operating functions of a real wind power plant. Another important feature of this software is related to the possibility to control, parameterize and visualize the obtained data.

In particular, with this software it is possible to perform the following activities:

- Measurement, calculation and graphic representation of many mechanical and electrical operating parameters.
- Selection of the set-point values for reactive and active power.
- Definition and simulation of wind power and profiles.
- Interactive experiments set-up.
- Values and graphs can be stored.
- Experiments instructions can be viewed directly from the software.
- Possibility to print documents for easy hardcopy printing of experiments instructions with solutions.

With this wind power plant trainer it is possible to perform the following experiments:

- Study of functions and operations of a modern wind power plant.
- Relationships between a pitch control system and the wind.
- Analysis of the mechanical parameters within an induction generator.
- Analysis of the electrical parameters within an induction generator.
- Starting method of a wind system
- DFIG – doubly fed induction generator.

With the optional modules it is possible to perform also:

- Experiments on the Fault Ride Through

RENEWABLE ENERGIES

BRUSHLESS CONTROLLER with MOTOR

DL 2108T26

Study of the automatic control for a brushless motor.
Control and operation of a brushless motor in voltage.
The system allows the study of the operation of a brushless motor of a typical industrial process automation.
The student has the opportunity to learn to control and parameterize an automatic operation.
The control and monitoring system is done through a software that can:

- Set system parameters
- Draw graphic curves
- Monitor real-time system (torque, speed, etc.)

Specifications

- 1kW power brushless motor with electronic encoder
- Control of the system in frequency and voltage
- Mechanical braking system for the analysis of the torque
- Encoder outputs for the analysis of speed
- Display system for controlling and monitoring events
- Button start and stop action and automatic stop intervention in case of alarm
- Complete software for PC interfaced to the system via RS485

BRAKING RESISTANCE

DL 2108T26BR

With cooling fan.

SLIP RING THREE-PHASE ASYNCHRONOUS MOTOR

DL 1022P4

Induction motor with both stator and rotor three-phase windings.

Technical features:

- Power: 1.1 kW
- Voltage: 220/380 V Δ/Y
- Rated speed: 1500 rpm, 50 Hz
- Rated speed: 1800 rpm, 60 Hz

RENEWABLE ENERGIES

THREE PHASE SUPPLY UNIT

DL 2108TAL-CP

Power supply unit for three-phase connection with 4-pole cam mains switch.
25 A current operated earth leakage circuit breaker, sensitivity 30 mA.
Three-phase indicator lamps.
Output through 5 safety terminals:
L1, L2, L3, N and PE.
Switch for simulation of wind or photovoltaic energy power source.
Modbus RS485 Protocol Communication

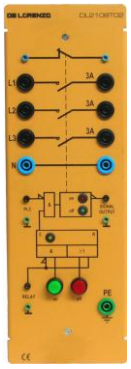
THREE-PHASE POWER METER

DL 2109T29

Microprocessor controlled three-phase power analyzer.
Measurement of voltages, currents, frequencies, active power, reactive power, apparent power.

- Input voltage: 450 V (max 800 Vrms)
- Input current: 5 A (max 20 Arms)
- Operating frequency: 47 ÷ 63 Hz
- Auxiliary supply: single-phase from mains

POWER CIRCUIT BREAKER

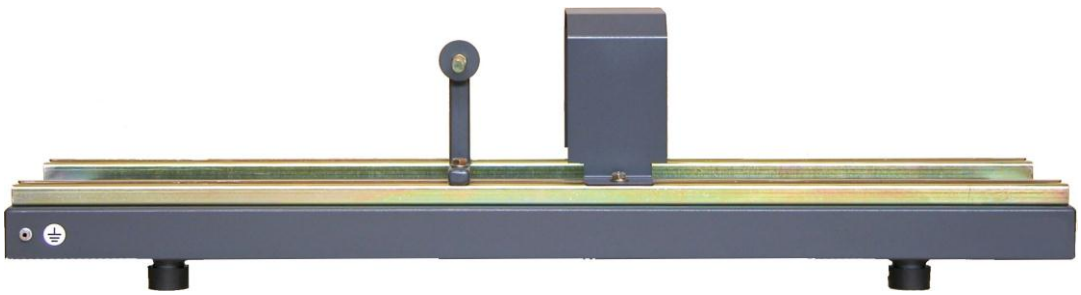


DL 2108T02

Three-phase power circuit breaker with normally closed auxiliary contact.

- Contact load capability: 400 Vac, 3 A
- Supply voltage: single-phase from mains.

BASE



DL 1013A

Duralumin alloy varnished structure mounted on anti-vibration rubber feet, provided with slide guides to fix one or two machines and with coupling guard.

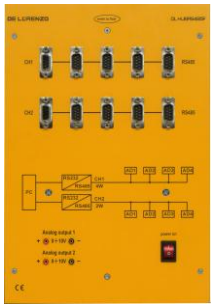
RENEWABLE ENERGIES

BACK TO BACK INVERTER

DL 2108T29

The architecture of a back-to-back converter, needed to feed the rotor windings of a 3-phase doubly-fed induction machine and such that power can flow both ways.
A back-to-back converter is needed for a control of a doubly-fed induction machine (an induction machine fed from both the rotor and the stator) because in some operation ranges the rotor energy may come back to the converter.
Inverter: 1.5 kW, 400 V with DC BUS
AFE (Active front End) Regenerative Interface
DC Bus Monitor Display
Three Phase instrument Monitor Grid Side
Fuse Protection
Modbus RS485 Protocol Communication

COMMUNICATION MODBUS + SOFTWARE SCADA



DL HUBRS485F – DL SCADA-WEB

WIND SIMULATOR

DL WINDSIM

System composed of: wind speed and direction sensor, power supply, fan, potentiometer, measurement circuit, RJ45 and RS485 port.

It allows simulating the wind force and direction.

RENEWABLE ENERGIES

KIT OF CONNECTING LEADS **DL 1155WPP**

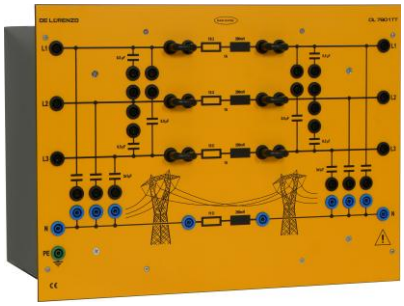
FRAME **DL 2100-3M-AS**

THREE-PHASE TRANSFORMER **DL 2600TT**

The system includes an All-In-One Personal Computer.

OPTIONS

LINE MODEL



DL 7901TT

Three-phase model of an overhead power transmission line 360 km long, voltage 380 kV and current 1000 A.
Scale factor: 1:1000
Line resistance: 13 Ω
Line inductance: 290 mH
Mutual capacitance: 1 µF
Earth capacitance: 2 µF
Earth resistance: 11 Ω
Earth inductance: 250 mH

MULTIFUNCTION THREE-PHASE OVERVOLTAGE/UNDERVOLTAGE RELAY

DL 2108T18

Three-phase voltage relay, suitable for protection of HV, MV, LV power transmission and distribution systems. The relay measures the true RMS value of the 3 phase to neutral voltages fed to three transformers isolated high-impedance inputs.
Two Under Voltage elements. Two Over Voltage elements. One Under Frequency element. One Over Frequency element.
One omopolar sequence Over Voltage element. One negative sequence Over Voltage element. One positive sequence Under Voltage element.
Time tagged multiple event recording. Oscillographic wave form capture.
Modbus RTU / IEC870-5-103. Display LCD 16 (2x8) characters.

RESISTIVE LOAD

DL 1017R

- Single or three-phase resistive step-variable load.
- Max power: 3 x 400 W
- Max voltage: 220/380 V Δ/Y

CONFIGURATIONS

DL WPP

DL 2108T26	BRUSHLESS CONTROLLER WITH MOTOR	1
DL 2108T26BR	BRAKING RESISTANCE	1
DL 1022P4	SLIP RING THREE-PHASE ASYNCHRONOUS MOTOR	1
DL 1013A	BASE	1
DL 2108TAL-CP	THREE PHASE SUPPLY UNIT	1
DL 2109T29	THREE-PHASE POWER METER	1
DL 2108T29	BACK TO BACK INVERTER	1
DL 2108T02	POWER CIRCUIT BREAKER	3
DL HUBRS485F	MODBUS COMMUNICATION HUB	1
DL WINDSIM	WIND SIMULATOR	1
DL SCADA3	SOFTWARE SCADA	1
DL 1155WPP	KIT OF CONNECTING LEADS	1
DL 2100-3M-AS	FRAME	1
DL PCGRID	ALL-IN-ONE PERSONAL COMPUTER	1
SOCKET-MAINS	THREE-PHASE SOCKETS HOLDER	1
DL 1001-1-AS	WORKBENCH	1
DL 2600TT	THREE-PHASE TRANSFORMER	1

OPTIONS FOR THE FAULT RIDE THROUGH

DL 7901TT	LINE MODEL	1
DL 2108T18	MULTIFUNCTION THREE-PHASE OVERVOLTAGE/UNDERVOLTAGE RELAY	1
DL 1017R	RESISTIVE LOAD	1
DL 2108T02	POWER CIRCUIT BREAKER	1
DL 2100-3M-AS	FRAME	1