edibon

Technical Teaching Equipment

Advanced Digital Synchronization Trainer

EESD

Key features:

- **Coupling operations between generator and electrical grid.**
- **Monitoring of voltages and phase angles in order to carry out a correct coupling.**
- **Main connections for the synchronization module to perform the appropriate readings of the phases angles.**
- **Monitoring of the generator's power flux before and after the synchronization.**
- **Search of the optimum point to couple the generator to the grid.**
- **Frequency and voltage control of the generator to carry out the synchronization to the grid.**

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Products
Products range
Units
4.-Electricity
or
5.-Energy

ISO 9000: Quality Management
(for Design, Manufacturing, Commercialization and After-sales service)

European Union Certificate
(total safety)

Certificates ISO 14000 and **ECO-Management and Audit Scheme**
(environmental management)

Worlddidac Quality Charter Certificate
(Worlddidac Member)

INTRODUCTION

The electrical system evolution towards a more decentralized generation, that is to say, with more electrical power generation points, has been a challenge in the development of new technologies that makes the synchronization of different electrical generation sources in a same electrical grid possible.

At this point, synchronization devices play a fundamental role. The objective of these devices is to couple one or more generating sources in the electrical grid. For that purpose, it is necessary to synchronize the phases of the network and those of the electric generator.

GENERAL DESCRIPTION

The EESD Trainer includes an advanced digital synchronoscope with a set of dynamics and static loads, designed to study the synchronization operations and to couple the generator-group to the electrical grid.

With an intuitive design, the EESD Trainer has a technology able to measure the voltage phase angle between two electrical power generation sources that, at the beginning, work independently. When the phase angle is within a permissible range, the synchronization device will automatically close a contact that will couple the generators. Diagram 1 represents the coupling of a generator to the electrical grid.

The trainer is formed by:

- EMSD. Advanced Digital Synchronoscope Module. This is the main module, the synchronization unit. This module includes a number of terminals to connect the phases of the generator and the electrical grid. Besides, the synchronization device has a switch to open and close the synchronization contact manually. On the other hand, the EMSD Module includes a microprocessor to carry out the synchronization automatically.
- EMT7. Asynchronous three-phase motor of squirrel cage. This motor is used as driver motor of the EMT6 machine (A.C. Synchronous three-phase motor alternator) in order to simulate the generation group.
- EMT6. A.C. Synchronous three-phase motor alternator. This unit, is drove by the motor EMT7 motor in order to electrical generation. When the voltage and frequency parameters of the generator are equal to the electrical grid, the EMSD Module carries out the coupling between the generator EMT6 and the electrical grid.
- EME/B. Electrical Machines Unit. This unit simulates the electrical grid which will be connected several loads and couple the electrical generator EMT6 by mean the EMSD Module.
- VVCC/M. DC Motor Speed Controller. This unit is used to control the excitation current of the inductor of the generator EMT6.
- VVCA/M. AC Motor Speed Controller. Variable-frequency drive whose aim is to control the speed of three-phase AC motors.
- REV-T. Three-Phase Variable Resistance Module.

What will the student learn with the EESD Trainer?

Main applications of synchronization devices in electrical grids.

Coupling operations between generator and electrical grid.

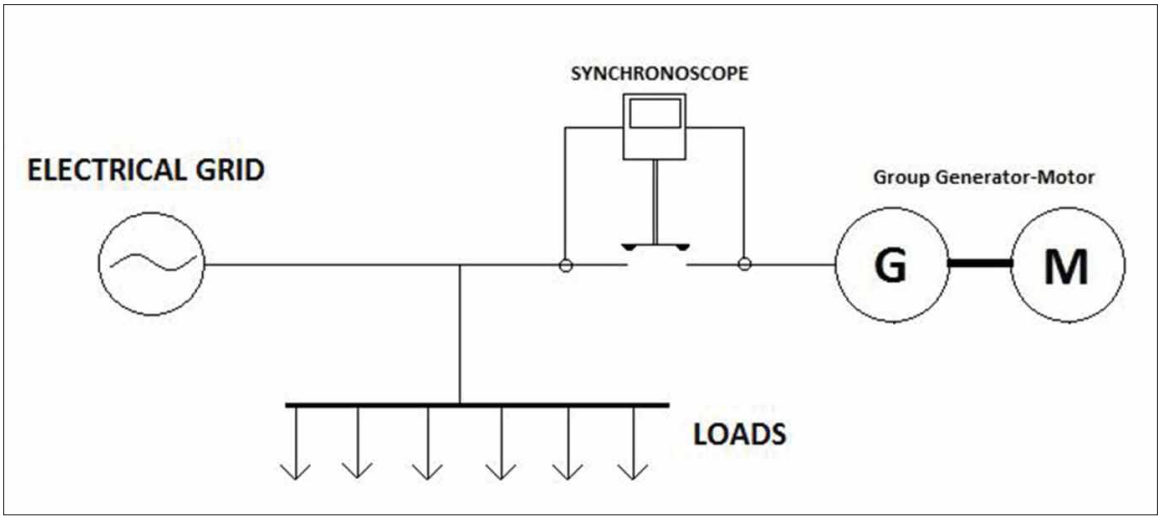
Monitoring of voltages and phase angles in order to carry out a correct coupling.

Main connections for the synchronization module to perform the appropriate readings of the phase angles.

Monitoring of the generator's power flux before and after the synchronization.

Search of the optimum point to couple the generator to the grid.

Diagram 1:



SPECIFICATIONS

The Advanced Digital Synchronization Trainer is formed by:

- **EMSD Advanced Digital Synchronoscope Module.**

  The EMSD Module is used to visualize the phase sequence and the voltage quantity from two power generation sources and to carry out the synchronization operation.

  Besides, the EMSD Module includes a display that indicates the phase angle between both sources' voltages and the modules of theses voltages.

  The EMSD Module can be programmed with a series of conditions to trigger the synchronization contact:

  Difference between both voltages' modules.

  Difference between the phase angles of the phases.

  The trigger safety time.

  The technical specifications are:

  Input voltage: 110, 230, 400 or 440 Vac.

EMSD

- **EMT7. Asynchronous three-phase motor of squirrel cage.**

  Power: 370W. Speed: 2730 r.p.m. Frequency: 50/60Hz.

  V.Armature: 230/400V. I. Armature: 1.67/0.97A.

  Connections: Star/triangle.


EMT-7

- **EMT6. A.C. Synchronous three-phase motor alternator.**

  Power: 200W. Speed: 3000 r.p.m. Frequency: 50Hz.

  V.excitation: 200V. I.Excitation: 0.7A.

  V.Armature: 220V. I.Armature: 1A.


EMT-6

- **EME/B. Electrical Machines Unit** (basic option).

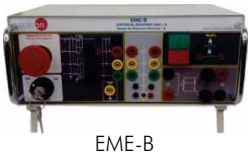
  Metallic box. Diagram in the front panel.

  Thermal Magnetic Circuit Breaker. DC supply 200 Vdc with fuses.

  Connection Key. Emergency stop push button.

  Two push buttons (1NO + 1NC).

  One contactor, with three power connections, one control connection and supply control.


EME-B

- **VVCC/M. DC Motor Speed Controller** (intermediate option).

  This unit consists in a variable transformer followed by a rectifier bridge and an anti-ripple capacitor with a resistor to get discharged.

  Metallic box.

  Adjustable voltage: up to 320 Vdc.

  Maximum current: 2 A.

  All the top of the unit there is a krob to adjust the DC voltage.

  Front panel including:

  Positive, negative and ground connections. ON/OFF switch.


VVCC/M

- **VVCA/M. AC Motor Speed Controller** (intermediate option).

  This unit consist in a simple AC motor speed controller.

  Metallic box.

  Power: 3kVA. Frequency: 1-50 Hz. Phase voltage: 230 Vac. Max. current: 8A.

  Overcurrent thermal protection.

  ON/OFF switch.

  It has two blocks in the front panel:

  Speed control: Start/Stop switch and speed control potentiometer.

  Connections to motor: Three-phase connection to AC motor and ground connection.


VVCA/M

- **REV-T. Three-phase Variable Resistance Module.**

  Metallic box. Diagram in the front panel.

  3 Variable resistive loads of 150Ω (500W).


REV/T

Cables and Accessories, for normal operation.

Manuals: This trainer is supplied with the following manuals: Required Services, Assembly and Installation, Starting-up, Safety, Maintenance & Practices Manuals.

EXERCISES AND PRACTICAL POSSIBILITIES

1.- Main applications of synchronization units in electrical grids.

2.- Coupling operations between the generator and the electrical grid.

3.- Supervision of voltages and phase angles for a correct coupling.

4.- Main connections for the synchronization module to carry out the appropriate readings of the phase angles.

5.- Monitoring of the generator's power flux before and after of the synchronization.

6.- Control of the generator frequency for a correct coupling to the electrical grid.

7.- Control of the generator voltage module for its coupling to the electrical grid.

REQUIRED SERVICES

- Electrical supply: three-phase, 380 V./50 Hz. or 220 V./60 Hz.

DIMENSIONS & WEIGHTS

EESD Trainer:

EMSD:	-Dimensions:	490 x 450 x 470 mm. approx. (19.29 x 17.72 x 18.50 inches approx.)
	-Weight:	20 Kg. approx. (44 pounds approx.)
EMT7:	-Dimensions:	300 x 250 x 250 mm. approx. (11.81 x 9.84 x 9.84 inches approx.)
	-Weight:	8 Kg. approx. (17.64 pounds approx.)
EMT6:	-Dimensions:	300 x 250 x 250 mm. approx. (11.81 x 9.84 x 9.84 inches approx.)
	-Weight:	8 Kg. approx. (17.64 pounds approx.)
EME/B:	-Dimensions:	300 x 190 x 120 mm. approx. (11.81 x 7.48 x 4.72 inches approx.)
	-Weight:	5 Kg. approx. (11 pounds approx.)
VVCC/M:	-Dimensions:	300 x 190 x 120 mm. approx. (11.81 x 7.48 x 4.72 inches approx.)
	-Weight:	3 Kg. approx. (6.6 pounds approx.)
VVCC/A:	-Dimensions:	300 x 190 x 120 mm. approx. (11.81 x 7.48 x 4.72 inches approx.)
	-Weight:	3 Kg. approx. (6.6 pounds approx.)
REV-T:	-Dimensions:	490 x 330 x 310 mm. approx. (19.29 x 12.99 x 12.20 inches approx.)
	-Weight:	5 Kg. approx. (11 pounds approx.)

✱Specifications subject to change without previous notice, due to the convenience of improvements of the product.

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Issue: ED01/13
Date: March/2013

REPRESENTATIVE: