Nacelle - Wind Turbine Learning System
8046643 (46122-10)

LabVolt Series

Datasheet

Festo Didactic
en 0 V - 0 Hz
12/2020

Table of Contents

General Description

Maintaining and operating wind turbines requires essential technical and troubleshooting skills. The Nacelle - Wind Turbine Learning System offers hands-on training for real-world operation and maintenance situations, preparing students with the skills and training for jobs as wind turbine technicians.

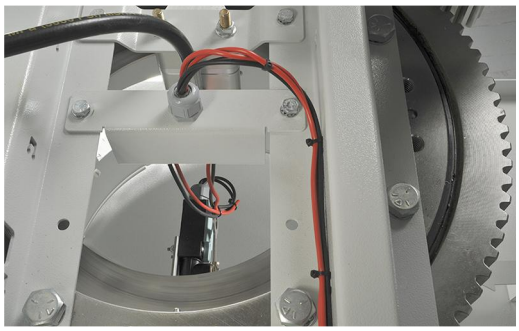
The Nacelle - Wind Turbine Learning System is a complete scaled-down version of commercial wind turbine nacelles, making it an excellent substitute for expensive actual equipment. Space efficient and affordable, the machine fully interacts with users, thus enhancing the learning experience.

The training system consists of a complete drive train that includes the main shaft, a gearbox with a transparent side cover, speed sensors, a hydraulic brake, and an asynchronous generator. The yaw system is fully operational and features a 61 cm (24 in) slewing bearing, a gear motor, a drive, a position sensor, and fail-safe hydraulic brakes. A manual hydraulic pump and an accumulator, as found in real-world wind turbines, are also included. A PLC controls the different functions of the nacelle and is located in a transparent electrical enclosure, with all the other electrical components.

Mobile Workstation

The mobile workstation consists of a sturdy, welded-steel frame painted using powder-coated paint for a durable surface. The unit is mounted on four swivel casters with a locking mechanism that allow easy motion and stable operation.

Yaw System

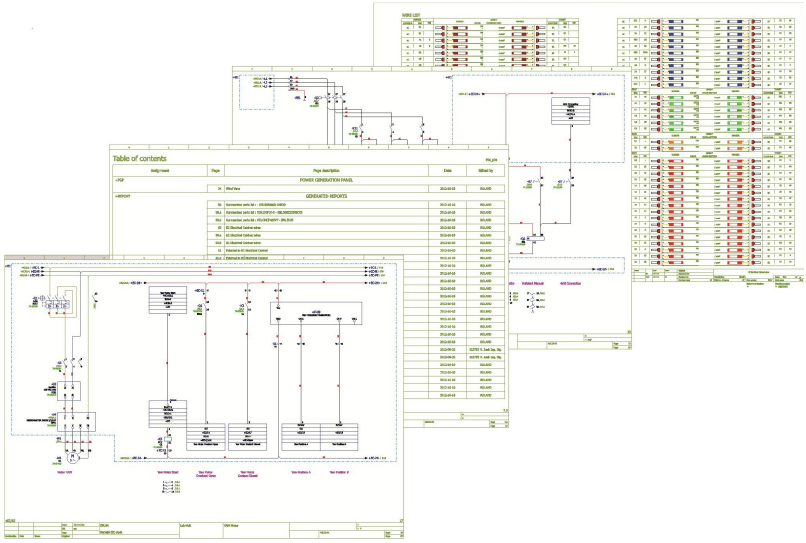


The yaw system consists of a tower attached to a slewing bearing which is moved by a gear motor and a variable-frequency drive. The tower also has a position indicator with 360° markings to visually monitor the actual position of the nacelle. A hydraulic brake is also included in the mechanism to lock the yaw into position when facing the wind. An optical encoder monitors the yaw position and a cable-twist detector is also installed.

Drive Train (Low Speed)

The entire drive train is driven by a 560 W (¾ hp) gear motor just beside the yaw mechanism. This motor drives the nacelle main shaft and blades (with a fixed pitch) through a chain. The main shaft passes through two pillow blocks and then into the gearbox. The main shaft also includes a rotor-lock mechanism and a speed sensor. The main shaft is attached to the gearbox with a shrink disc similar to that which can be seen in an actual nacelle.

Electrical Schematics



Complete electrical schematics are provided with the training system to help develop troubleshooting skills. These schematics follow IEC standards and are similar to what is currently found in the industry.

Hydraulic Unit

The training system includes a custom hydraulic unit which controls the two hydraulic brakes in the system. Pressure gauges are included and can be connected at several points in the hydraulic circuit for troubleshooting purposes. For the same purposes, all the solenoid valves can be activated manually to override the control system.

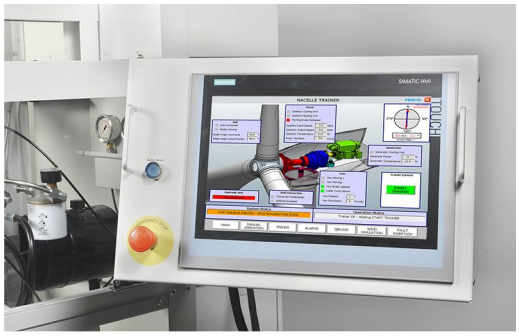
Weather Sensors

A wind vane and an anemometer are located in transparent enclosure on top of the training system to monitor wind speed and wind direction. Although they are not actually measuring actual wind, the control system managed by the user simulates the process, causing the weather sensors to react and send to the control system signals that take into account the simulated parameters.

Electrical Panel

An electrical panel with transparent glass is installed on the back of the nacelle. All the components necessary for its operation are included inside: contactors, variable-frequency drives, breakers, fuses, power supplies, and remote inputs/outputs for the PLC.

HMI



The nacelle controller consists of a touch-screen panel that runs the human-machine interface (HMI) connected to the PLC used to command and monitor the system. The interface is available in English, French, German, and Spanish.

Protections

The training system includes protective devices, such as emergency buttons and protective guards. The protective guards are fitted with safety position switches that de-energize the trainer when a panel is open. The system has two emergency buttons for emergency shutdown.

Leakage Current

The leakage current of this device is high (› 30 mA) due to its industrial components. This can cause 30 mA residual current devices (RCDs) to trip. Local regulations may require the use of RCDs to detect leakage current. As an alternative to a 30 mA RCD, it is possible to use a 300 mA RCD. In this case, users' safety remains ensured due to the additional grounding cable supplied with the system. If the use of 300 mA RCDs is prohibited by local regulations, an isolation transformer is available as an option. This transformer is specially designed to eliminate high leakage currents and avoid the undesired tripping of RCDs.

Topic Coverage

- Nacelle Familiarization, Safety, and Control System
- User Interface and Wind Simulation

- Hub and Low-Speed Shaft
- Gearbox, Coupling, and Alignment
- Basic Hydraulic Circuit
- Hydraulic Brakes
- Electrical Circuit and Panel
- Troubleshooting
- Estimated program duration: 32 hours

Features & Benefits

- Demonstrates how a wind turbine nacelle, an electrical hub, and a hydraulic hub operate
  - Fully operational yaw system
  - Touch-screen industrial computer that controls the whole system. Communications are via a software PLC and remote inputs and outputs.
  - Complete drive train with gearbox, main shaft, speed sensors, disk brake, and generator
  - Electrical panel with frequency drives, breakers, and power supplies
  - Weather sensors to monitor wind speed and direction
- Helps practice maintenance and troubleshooting skills in a safe environment
  - Full electrical schematics provided
  - Fault panel to enable teachers to insert faults
  - Emergency buttons and protective guards with limit switches for safe operation
- Cost-effective, realistic training solution
  - Large-scale, proportional components perfect for an educational environment
- Safe working environment
- Faultable through the HMI
- Full hands-on training with rugged equipment
- Comprehensive curriculum and lab exercises

List of Manuals

Description	Manual number
Nacelle – Electrical Schematics (Drawing Set)	589753 (52071-10)
EDS® Nacelle - Wind Power Generation (User Guide)	590078 (52070-E0)

Additional Equipment Required to Perform the Exercises

Qty	Description	Model number
1	Power Cord - Nema 5-15	582145 (86331-00)
1	Power Cord - Type B	789405 (95451-00)

Optional Equipment

Qty	Description	Model number
1	EDS® Nacelle Courseware - Campus License	8060754 (52734-00)
1	Matériel de cours du EDS® Nacelle - Licence campus	8060755 (52734-01)
1	Material didáctico de la EDS® Nacelle - Licencia universitaria	8060756 (52734-02)

Optional Manual(s)

Qty	Description	Model number
1	EDS® Nacelle – Operation and Maintenance (Student Manual)	8060747 (52070-00)
1	EDS® Nacelle – Fonctionnement et entretien (Student Manual)	8060749 (52070-01)
1	EDS® Nacelle – Operación y mantenimiento (Student Manual)	8060753 (52070-02)
1	EDS® Nacelle – Operation and Maintenance (Instructor Guide)	8060746 (52070-10)
1	EDS® Nacelle – Fonctionnement et entretien (Instructor Guide)	8060748 (52070-11)
1	EDS® Nacelle – Operación y mantenimiento (Instructor Guide)	8060752 (52070-12)

Module Options Description

EDS® Nacelle Courseware - Campus License 8060754 (52734-00)

List of Manuals

Description	Manual number
EDS® Nacelle – Operation and Maintenance (Manuals on CD-ROM)	589750 (52070-A0)
Nacelle – Electrical Schematics (Drawing Set)	589753 (52071-10)
EDS® Nacelle – Operation and Maintenance (Student Manual)	591512 (52070-00)
EDS® Nacelle – Operation and Maintenance (Instructor Guide)	591514 (52070-10)
Nacelle – Electrical Schematics (Drawing Set)	591519 (52071-10)
Grid-Tied Nacelle (Student Manual)	595685 (54795-00)
Grid-Tied Nacelle (Instructor Guide)	595686 (54795-10)
Grid-Tied Nacelle (Student Manual)	595773 (54795-00)
Grid-Tied Nacelle (Instructor Guide)	595774 (54795-10)
EDS® Nacelle – Operation and Maintenance (Instructor Guide)	8060746 (52070-10)
EDS® Nacelle – Operation and Maintenance (Student Manual)	8060747 (52070-00)

Table of Contents of the Manual(s)

EDS® Nacelle – Operation and Maintenance (Student Manual) (8060747 (52070-00))

Matériel de cours du EDS® Nacelle - Licence campus 8060755 (52734-01)

List of Manuals

Description	Manual number
EDS® Nacelle – Fonctionnement et entretien (Manuals on CD-ROM)	589751 (52070-A1)
Nacelle – Electrical Schematics (Drawing Set)	589753 (52071-10)
EDS® Nacelle – Fonctionnement et entretien (Student Manual)	591513 (52070-01)
EDS® Nacelle – Fonctionnement et entretien (Instructor Guide)	591515 (52070-11)
Nacelle – Electrical Schematics (Drawing Set)	591519 (52071-10)
Grid-Tied Nacelle (Student Manual)	595685 (54795-00)
Grid-Tied Nacelle (Instructor Guide)	595686 (54795-10)
Grid-Tied Nacelle (Student Manual)	595773 (54795-00)
Grid-Tied Nacelle (Instructor Guide)	595774 (54795-10)
EDS® Nacelle – Fonctionnement et entretien (Instructor Guide)	8060748 (52070-11)
EDS® Nacelle – Fonctionnement et entretien (Student Manual)	8060749 (52070-01)

Table of Contents of the Manual(s)

EDS® Nacelle – Fonctionnement et entretien (Student Manual) (8060749 (52070-01))

Material didáctico de la EDS® Nacelle - Licencia universitaria 8060756 (52734-02)

List of Manuals

Description	Manual number
Nacelle – Electrical Schematics (Drawing Set)	589753 (52071-10)
Nacelle – Electrical Schematics (Drawing Set)	591519 (52071-10)
EDS® Nacelle – Operación y mantenimiento (Student Manual)	594174 (52070-02)
EDS® Nacelle – Operación y mantenimiento (Instructor Guide)	594179 (52070-12)
(Job Sheets - Student)	595674 (52070-A2)
Grid-Tied Nacelle (Student Manual)	595685 (54795-00)
Grid-Tied Nacelle (Instructor Guide)	595686 (54795-10)
Grid-Tied Nacelle (Student Manual)	595773 (54795-00)
Grid-Tied Nacelle (Instructor Guide)	595774 (54795-10)
EDS® Nacelle – Operación y mantenimiento (Instructor Guide)	8060752 (52070-12)
EDS® Nacelle – Operación y mantenimiento (Student Manual)	8060753 (52070-02)

Table of Contents of the Manual(s)

EDS® Nacelle – Operación y mantenimiento (Student Manual) (8060753 (52070-02))

Power Cord - Nema 5-15
582145 (86331-00)

This power cord connects the equipment to a wall outlet. It is intended for use in North America, Central America, Brazil, Colombia, Ecuador, Korea, Japan, Taiwan, Thailand, and the Philippines.

Power Cord - Type B
789405 (95451-00)

Reflecting the commitment of Festo Didactic to high quality standards in product, design, development, production, installation, and service, our manufacturing and distribution facility has received the ISO 9001 certification.

Festo Didactic SE

Rechbergstrasse 3
73770 Denkendorf
Germany

P. +49(0)711/3467-0
F. +49(0)711/347-54-88500

Festo Didactic Inc.

607 Industrial Way West
Eatontown, NJ 07724
United States

P. +1-732-938-2000
F. +1-732-774-8573

Festo Didactic Ltée/Ltd

675 rue du Carbone
Québec QC G2N 2K7
Canada

P. +1-418-849-1000
F. +1-418-849-1666

www.labvolt.com

www.festo-didactic.com