

Basic Workstations:

ESG 1 Smart Grid Trainer

Basic Workstation 1: ESG 1.1 Three-phase double busbar system

Training contents:

- Basic circuits of a three-pole, double busbar system
- Three-phase, double busbar system with load
- Busbar changeover without interruption of the branch
- Preparation of algorithms for various switching operations
- Busbar coupling

Investigations on Three-phase Transmission Lines

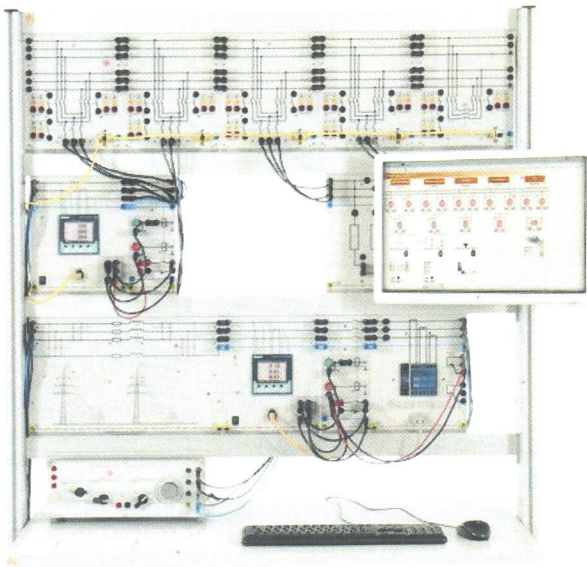
Training contents:

- Voltage increases on open-circuit lines
- Voltage drop as a function of line length
- Voltage drop as a function of $\cos\phi$
- Capacitive and inductive power losses on a line as a function of U and I
- Phase shift on a line

Overcurrent time protection for lines

Training contents:

- Designing and parameterizing overcurrent time protection
- Determining the reset ratio in the case of single-, double- and triple-pole short circuit
- Determining a relay's shortest release time
- Checking a circuit breaker's release behavior in the event of a failure



Equipment set comprising the following:

Line items	1	Double busbar unit, three-phase, incoming / outgoing feeder
	2	Double busbar unit, three-phase, coupler panel
	3	Transmission line model 150km/300km (93.2miles/186.4miles)
	4	Time Overcurrent Relay
	5	Ohmic load 3x 560 Ohm

CO3301-5R
CO3301-5S
CO3301-3A
CO3301-4J
CO3301-3H

Description	Order No.
<u>Power supply:</u>	
6 Adjustable 3-phase power supply, 0-450V/2A	CO3301-3Z7
7 Power switch module	CO3301-5P
8 Multiple power outlet strip, 6 outlets, US-standard	ST8010-4J8
<u>Measuring instruments:</u>	
9 Three-phase power quality meter, display and long-term memory	CO5127-1S
<u>Media:</u>	
10 Interactive Lab Assistant: Smart Grid	SO2800-3Z7
11 Interactive Lab Assistant: Bus bar systems	SO2800-9N
12 Interactive Lab Assistant: High-voltage transmission lines	SO2800-3L7
13 Interactive Lab Assistant: Protective systems for high-voltage transmission line	SO2800-6L7
<u>Software:</u>	
14 Software SCADA for Power Engineering, designer software	SO4001-3F
<u>Accessories:</u>	
15 Patch cable Cat5E 1x 1 m yellow, 2x 2 m yellow	LM9057
16 USB 2.0 Ethernet adapter, 10/100	LM8257
17 5-Port Ethernet Switch (International)	LM9988-8
18 Safety connecting plug 4mm with tap (2x), black, 1000V/32A CAT II	SO5126-3R
19 Safety connecting plug 4mm with tap (2x), blue, 1000V/32A CAT II	SO5126-3V
20 Safety connecting plug 4mm with tap (2x), gr/ye, 1000V/32A CAT II	SO5126-3W
21 Set of safety measurement cables, 4mm, 31 pcs	SO5148-1L
22 Safety measurement cable 4mm, 25cm/10", black, 600V CAT III ~1000V CAT II / 32A	SO5126-8B
23 Interface converter USB/RS485	LM9025
24 Mobile workstation, 3 level frame, 6 sockets, 1250x1970x800 mm, 49"x77.5"x31.5" (WxHxD)	ST7200-7A7
25 Monitor holder for flat screen monitor of weight up to 15kg/33lbs	ST8010-4T
26 Display for Smart Grid equipment	ST8000-4A

Basic Workstation 2: ESG 1.2 Complex loads, power consumption measurement and peak load monitoring

Training contents:

- Three-phase consumers with star and delta connections (R, L, C, RL, RC and RLC loads)
- Measurement with active and reactive energy meters:
 - for symmetric and asymmetric RL loads
 - in the event of a phase failure
 - in the event of over-compensation (RC load)
 - for active loads
 - in the event of energy-flow reversal
- Determination of the first and second power maxima
- Determination of the power maximum in the event of an asymmetric load
- Recording of load profiles

Dynamic loads

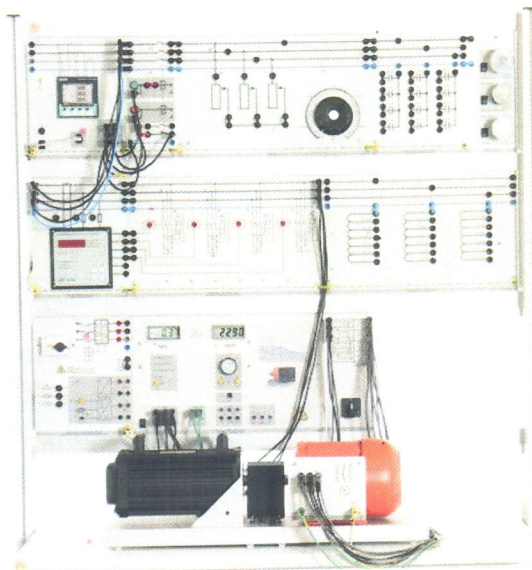
Training contents:

- Dynamic, three-phase load (asynchronous motor)
- Power measurement in the case of energy-flow reversal

Manual and automatic compensation of reactive power

Training contents:

- Operating an asynchronous machine and recording its characteristic parameters
- Calculating parameters for compensation capacitors
- Compensation using various capacitors
- Determining stage power
- Manual compensation of reactive power
- Automatic identification of a reactive power controller's connections
- Automatic compensation of reactive power



Equipment set comprising the following:

- | | |
|----|--|
| 27 | Lamp board 120V |
| 28 | Inductive load, three-phase, 1kW |
| 29 | Capacitive load, three-phase, 1kW |
| 30 | Variable Ohmic load, three-phase, 1kW |
| 31 | Three-phase asynchronous motor, squirrel-cage, 1 kW, 360/208 V |
| 32 | Star-Delta switch |
| 33 | Reactive power controller |
| 34 | Switchable Capacitor Battery |

CO3208-4L7

CO3301-3D

CO3301-3E

CO3301-3F

SE2683-1R7

CO3212-2D

CO3301-5C7

CO3301-5J7

Additionally required, dynamic servo machine test stand:

- | | |
|----|---|
| 35 | Servo machine test stand for 1kW machines incl. software ActiveServo (D,GB,F,E) |
| 36 | Rubber coupling sleeve for 1kW machines |
| 37 | Coupling guard with LED lighting for 1kW machines |

CO3636-6Y7

SE2662-6A

SE2662-7D

Description	Order No.
<u>Power supply:</u>	
38 Three-phase power supply with motor protection switch	CO3212-5V7
39 Motor protection switch, 3 pole, 2,8-4A	CO3212-1P7
40 Power switch module	CO3301-5P
41 Multiple power outlet strip, 6 outlets, US-standard	ST8010-4J8
<u>Measuring instruments:</u>	
42 Three-phase power quality meter, display and long-term memory	CO5127-1S
43 Power-Multimeter	CO5127-2A
<u>Media:</u>	
44 Interactive Lab Assistant: Energy management	SO2800-3Y7
<u>Accessories:</u>	
45 Patch cable Cat5E 1x 1 m yellow, 2x 2 m yellow	LM9057
46 USB 2.0 Ethernet adapter, 10/100	LM8257
47 5-Port Ethernet Switch (International)	LM9988-8
48 Safety connecting plug 4mm with tap (2x), black, 1000V/32A CAT II	SO5126-3R
49 Safety connecting plug 4mm with tap (2x), blue, 1000V/32A CAT II	SO5126-3V
50 Safety connecting plug 4mm with tap (2x), gr/ye, 1000V/32A CAT II	SO5126-3W
51 Set of safety measurement cables, 4mm, 31 pcs	SO5148-1L
52 Set of safety measurement cables, 4mm, 10m, 5 pcs, incl. fastening	SO5148-1Z
53 Mobile workstation, 3 level frame, 6 sockets, 1250x1970x800 mm, 49"x77.5"x31.5" (WxHxD)	ST7200-7A7
54 Protected power distribution for working stations	ST8008-8N7
55 Monitor holder for flat screen monitor of weight up to 15kg/33lbs	ST8010-4T
56 Display for Energy Management equipment	ST8000-4C