Alternative & Renewable Energy

SOLAR/WIND ENERGY TRAINING SYSTEM MODEL 46120

System shown with and without the sun and wind simulators

GENERAL DESCRIPTION

The Lab-Volt Solar/Wind Energy Training System, Model 46120, forms a complete hybrid energy training system. This program demonstrates how wind turbines and solar cells are being used in the consumer and industrial markets to supplement the world's power needs.

The Lab-Volt Solar/Wind Energy Training System is a modular program that covers the history, fundamentals, installation, operation, maintenance, and servicing of alternative energy systems. The program explores solar and wind as energy sources that can be used to help reduce dependence on non-renewable fuel sources. Students gain a global perspective when they understand the economics, efficiency, and low environmental impact of producing energy from non-polluting, renewable sources.

The Solar/Wind Energy Training System includes everything required to function as a stand-alone, hands-on learning workstation: Instructor Guide, Student Guide, training modules with fault insertion, and power-generating equipment. The trainer is made with real-world components that are used in industry; the same components that students will see in their own homes, schools, or workplace. Lab-Volt training systems are engineered for extreme ease of use and durability, and are manufactured to the highest quality standards.

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Courseware

The courseware for each of the topics consists of a student manual and an instructor guide, as well as textbooks titled *Photovoltaic Systems*, written by James P. Dunlop and *Wind Power*, written by Paul Gipe. Each student manual consists of a series of job sheets. The job sheets include a description of the objectives, a list of required equipment, a list of safety procedures, and a list of steps required to attain the objectives. However, to obtain detailed information about the covered topic, students should refer to the textbooks or ask their instructor to guide their learning process.

All student manuals and instructor guides as well as the textbooks are fully illustrated and color printed. All Lab-Volt student manuals, instructor guides, and electrical drawing sets are available as .PDF files on a CD-ROM (P/N 86514-A0). A Facilitator *PowerPoint* Presentation and a Facilitator Guide containing instructional strategies and activities are also available as options.

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TABLE OF CONTENTS OF THE STUDENT MANUALS

LIST OF EQUIPMENT FOR SOLAR/WIND ENERGY TRAINING SYSTEM, MODEL 46120-0

QTY	DESCRIPTION	ORDERING NUMBER[1]
1	Mobile Workstation (Assembled)	46801-J0
1	Digital Multimeter	6394-A0
1	Battery Bank	65917-00
1	Battery Bank Junction Box	66050-00
4	AC Outlet	66051-10
3	Ammeter	66052-00
1	DC Power Distribution Panel	66053-00
2	Disconnect Switch (Horizontal Mount)	66054-H0
2	Disconnect Switch (Vertical Mount)	66054-V0
1	Diversion Load Controller	66056-00
1	Dump Load	66057-00
3	DC Circuit Breaker	66058-00
1	kWh Meters with AC Circuit Breaker Box	66059-00
1	kWh Meters with AC Circuit Breaker Box (for Model 46120-H0)	66059-A0
4	AC/DC Wall Switch	66060-00
1	Lockout/Tagout Module	66061-00
1	Power Bus Bar	66062-00
1	Power Usage Monitor	66063-00
1	Power Inverter with Remote Control	66064-00
1	Solar Charge Controller	66065-00
1	Stop Switch	66066-00
3	DC Lamp Socket	66067-00
1	Photovoltaic Module Assembly	66070-00
1	Wind Turbine Generator with DC Motor (Wind Simulator)	66075-00
1	Solar Array Junction Box	66150-10
1	Sun Simulator Assembly	66151-00
1	DC Motor Controller	66153-00
1	Accessories Package	66154-00
1	*Photovoltaic Systems* Textbook (author, James P. Dunlop)	66166-00
1	*Wind Power* Textbook (author, Paul Gipe)	66177-00
1	Connection Cables Kit	87339-00
1	Energy Fundamentals (Job Sheets – Student)	86514-20
1	Energy Fundamentals (Job Sheets – Instructor)	86514-30
1	Trainer Familiarization and Safety (Job Sheets – Student)	86515-20
1	Trainer Familiarization and Safety (Job Sheets – Instructor)	86515-30
1	Solar Module (Job Sheets – Student)	86516-20
1	Solar Module (Job Sheets – Instructor)	86516-30
1	Wind Turbine (Job Sheets – Student)	86517-20
1	Wind Turbine (Job Sheets – Instructor)	86517-30
1	Solar/Wind Systems (Job Sheets – Student)	86518-20
1	Solar/Wind Systems (Job Sheets – Instructor)	86518-30
1	Going Green (Job Sheets – Student)	86519-20
1	Going Green (Job Sheets – Instructor)	86519-30
1	Assembly Instruction (DVD)	87372-30
1	Assembly, Wiring, and Installation (User Guide)	88023-E0

[1]The ordering numbers shown apply to the English 120V version. Other versions available. Refer to the Ordering Numbers section.

LIST OF EQUIPMENT FOR SOLAR ENERGY TRAINING SYSTEM, MODEL 46120-F

QTY	DESCRIPTION	ORDERING NUMBER[1]
1	Mobile Workstation (Assembled)	46801-J0
1	Digital Multimeter	6394-A0
1	Battery Bank	65917-00
1	Battery Bank Junction Box	66050-00
4	AC Outlet	66051-10
3	Ammeter	66052-00
1	DC Power Distribution Panel	66053-00
2	Disconnect Switch (Horizontal Mount)	66054-H0
1	Disconnect Switch (Vertical Mount)	66054-V0
1	Diversion Load Controller	66056-00
1	Dump Load	66057-00
3	DC Circuit Breaker	66058-00
1	kWh Meters with AC Circuit Breaker Box	66059-00
4	AC/DC Wall Switch	66060-00
1	Lockout/Tagout Module	66061-00
1	Power Bus Bar	66062-00
1	Power Usage Monitor	66063-00
1	Power Inverter with Remote Control	66064-00
1	Solar Charge Controller	66065-00
3	DC Lamp Socket	66067-00
1	Photovoltaic Module Assembly	66070-00
1	Solar Array Junction Box	66150-10
1	Sun Simulator Assembly	66151-00
1	Accessories Package	66154-00
1	*Photovoltaic Systems* Textbook (author, James P. Dunlop)	66166-00
1	*Wind Power* Textbook (author, Paul Gipe)	66177-00
1	Energy Fundamentals (Job Sheets – Student)	86514-20
1	Energy Fundamentals (Job Sheets – Instructor)	86514-30
1	Trainer Familiarization and Safety (Job Sheets – Student)	86515-20
1	Trainer Familiarization and Safety (Job Sheets – Instructor)	86515-30
1	Solar Module (Job Sheets – Student)	86516-20
1	Solar Module (Job Sheets – Instructor)	86516-30
1	Solar/Wind Systems (Job Sheets – Student)	86518-20
1	Solar/Wind Systems (Job Sheets – Instructor)	86518-30
1	Going Green (Job Sheets – Student)	86519-20
1	Going Green (Job Sheets – Instructor)	86519-30
1	Connection Cables Kit	87339-00
1	Assembly Instruction (DVD)	87372-30
1	Assembly, Wiring, and Installation (User Guide)	88023-E0

LIST OF EQUIPMENT FOR SMALL WIND ENERGY TRAINING SYSTEM, MODEL 46120-G

QTY	DESCRIPTION	ORDERING NUMBER[1]
1	Mobile Workstation (Assembled)	46801-J0
1	Digital Multimeter	6394-A0
1	Battery Bank	65917-00

1	Battery Bank Junction Box	66050-00
4	AC Outlet	66051-10
3	Ammeter	66052-00
1	DC Power Distribution Panel	66053-00
2	Disconnect Switch (Horizontal Mount)	66054-H0
2	Disconnect Switch (Vertical Mount)	66054-V0
1	Diversion Load Controller	66056-00
1	Dump Load	66057-00
3	DC Circuit Breaker	66058-00
1	kWh Meters with AC Circuit Breaker Box	66059-00
4	AC/DC Wall Switch	66060-00
1	Lockout/Tagout Module	66061-00
1	Power Bus Bar	66062-00
1	Power Usage Monitor	66063-00
1	Power Inverter with Remote Control	66064-00
1	Stop Switch	66066-00
3	DC Lamp Socket	66067-00
1	Wind Turbine Generator with DC Motor (Wind Simulator)	66075-00
1	DC Motor Controller	66153-00
1	Accessories Package	66154-00
1	*Wind Power* Textbook (author, Paul Gipe)	66177-00
1	Energy Fundamentals (Job Sheets – Student)	86514-20
1	Energy Fundamentals (Job Sheets – Instructor)	86514-30
1	Trainer Familiarization and Safety (Job Sheets – Student)	86515-20
1	Trainer Familiarization and Safety (Job Sheets – Instructor)	86515-30
1	Wind Turbine (Job Sheets – Student)	86517-20
1	Wind Turbine (Job Sheets – Instructor)	86517-30
1	Solar/Wind Systems (Job Sheets – Student)	86518-20
1	Solar/Wind Systems (Job Sheets – Instructor)	86518-30
1	Going Green (Job Sheets – Student)	86519-20
1	Going Green (Job Sheets – Instructor)	86519-30
1	Connection Cables Kit	87339-00
1	Assembly Instruction (DVD)	87372-30
1	Assembly, Wiring, and Installation (User Guide)	88023-E0

LIST OF EQUIPMENT FOR NETWORKED DATA ACQUISITION SYSTEM (NDAS) 46120-J

QTY	DESCRIPTION	ORDERING NUMBER[1]
1	Networked Data Acquisition System	46120-J0
1	Networked Data Acquisition Interface	46540-00
1	Connection Cables Kit	46541-00
1	Accessories Package	46542-00
1	User Guide	87655-E0

OPTIONAL EQUIPMENT for MODEL 46120-J

QTY	DESCRIPTION	ORDERING NUMBER[1]
1	Temperature Sensor	46543-00

OPTIONAL EQUIPMENT for MODEL 46120-0

DESCRIPTION	ORDERING NUMBER[1]
Manuals on DVD	86514-A0
Solar/Wind Facilitator Resource Package (Incl. Facilitator Guide and *PowerPoint* Presentation on DVD)	86862-A0

GRID-TIED SYSTEMS SIMULATION SOFTWARE (ADD-ON TO MODEL 46120) – MODEL 46120-A

DESCRIPTION	ORDERING NUMBER[1]
Grid-Tied Systems – Simulation Software on CD-ROM	86908-00
Grid-Tied Systems – Job Sheets – Student	86903-20
Grid-Tied Systems – Job Sheets – Instructor	86903-30

OUTDOOR SOLAR MODULE OPTION (ADD-ON TO MODEL 46120) – MODEL 46120-B

DESCRIPTION	ORDERING NUMBER[1]
Solar Module, Photovoltaic (PV)	87293-10

OUTDOOR WIND TURBINE OPTION A (ADD-ON TO MODEL 46120) – MODEL 46120-C

DESCRIPTION	ORDERING NUMBER[1]
Wind Turbine Generator	87359-00
29’ EZ Tower Kit (complete tower kit including pipe and anchors)	87387-00

OUTDOOR WIND TURBINE OPTION B (ADD-ON TO MODEL 46120) – MODEL 46120-E

DESCRIPTION	ORDERING NUMBER[1]
Wind Turbine Generator	87359-00
27’ Air-Guyed Tower Kit (includes couplers, guide wire, and hardware. Pipe not included.)	87446-00

SOLAR ENERGY TRAINING SYSTEM – MODEL 46120-F

DESCRIPTION	ORDERING NUMBER[1]
Solar Energy Training System (Wind Power system not included)	46120-F0

SMALL WIND ENERGY TRAINING SYSTEM – MODEL 46120-G

DESCRIPTION	ORDERING NUMBER[1]
Small Wind Energy Training System (Solar Power System not included)	46120-G0

SOLAR/WIND ENERGY TRAINING SYSTEM (UL/CSA CERTIFIED) – MODEL 46120-H0

DESCRIPTION	ORDERING NUMBER
Solar/Wind Energy Training System (UL/CSA Certified)	46120-H0

TABLE OF CONTENTS OF THE OPTIONAL SOLAR/WIND FACILITATOR GUIDE (86862)

MODULE DESCRIPTION

Model 46801-J – Mobile Workstation

The mobile workstation consists of a sturdy steel frame painted using powder-coated paint for a durable surface. The unit is mounted on four swivelling casters with a lock mechanism to allow easy motion as well as stable operation. Workstation includes two perforated work surfaces

Model 46120-J – Networked Data Acquisition System

The Lab-Volt 46120-J0 Networked Data Acquisition System (NDAS), an add-on to the Model 46120, is a remote monitoring system that allows power and energy levels from the 46120 Solar/Wind Energy Training System to be monitored from a wide area network (WAN) or a local area network (LAN). The NDAS allows users to view real-time electrical, environmental, and ecological data via an internet or an intranet connection from most common web browsers. Compatible web browsers include: Microsoft Internet Explorer, Mozilla Firefox, Google Chrome, Apple Safari, Opera (may exclude E-mail feature), and Netscape Navigator. Up to 30 users can access the data simultaneously.

The Lab-Volt 46540 Networked Data Acquisition Interface (NDAI) has ten analog input signals that are used to monitor different parameters of the 46120 Solar/Wind Energy Training System. These analog input signals include: two channels for monitoring AC power levels, six channels for monitoring DC power levels, and two channels for monitoring environmental conditions. From these 10 measured values, at least 22 additional values are calculated and displayed on the screen. These measured and calculated values include:

Measured Values

- AC Load Voltage
- AC Load Current
- DC Load Current
- Wind Turbine Current
- Solar Module Voltage
- Solar Module Current
- Battery Bank / Wind Turbine / DC Load Voltage
- Battery Bank Current (negative = charging)
- Solar Irradiance
- Wind Speed

Calculated Values

- Solar Module Power
- Wind Turbine Power
- Battery Bank Power
- DC Load Power
- Inverter Input / Diverter Output Voltage
- Inverter Input / Diverter Output Current
- Inverter Input / Diverter Output Power
- Inverter Output / AC Load Power
- Power Inverter Efficiency
- Total Power Generated

- Total Power Consumed
- Total Energy Generated
- Total Energy Consumed
- Total Energy Generated (long term)
- Total Energy Consumed (long term)
- Energy Cost Savings
- CO_2 Emissions Avoided
- Energy Cost Savings (long term)
- CO_2 Emissions Avoided (long term)
- CO_2 Emissions Offset (for driving)
- CO_2 Emissions Sequestered (by planting)
- Server Access Time

Additional sensors are required to make environmental measurements. A pyranometer is provided to measure shortwave solar radiation, or irradiance. An anemometer is provided to measure average wind speeds.

Optional thermometers are also available to measure air and surface temperatures.

The web page that displays the parameters being monitored can be customized to suit individual user preferences. The user preferences that are available include:

- Webpage Title
- Website URL
- SI-Metric Units or US-Imperial Units
- Summary Period
- Values for:
  - Energy Cost
  - CO_2 Factor
  - CO_2 Emissions (per vehicle)
  - CO_2 Sequestered (per tree)
- Two Channels for Monitoring:
  - Solar Irradiance
  - Wind Speed
  - Air/Ambient Temperature (If Optional Thermometer is included)
  - Cell/Surface Temperature (If Optional Thermometer is included)
- IP Address
- E-mail Address (data can be e-mailed in CSV format)

Additional software is available for the customer to create their own data acquisition program that runs on a desktop PC. The additional software includes EZ Data Logger and DCon. The features offered by these applications may not be available across the Internet, but can be used to provide custom data logging.

MiniOS7 is the operating system of the NDAS, and the embedded application programs can be upgraded when necessary.

Model 6394-A – Digital Multimeter

Portable meter for measuring AC/DC voltage, DC current, and DC resistance.

Model 65917 – Battery Bank

12VDC, 110Ah deep-cycle sealed lead-acid AGM (absorptive glass mat) storage battery for storing renewable energy from solar and/or wind power sources.

Model 66050 – Battery Bank Junction Box

Contains a 30A DC circuit breaker and a 0.5A DC ground fault protection device (GFPD).

Model 66051-1 – AC Outlet

120Vac electrical outlet (15A 3-conductor) for AC power distribution.

Model 66052 – Ammeter

SM Ammeter – Analog 30A DC ammeter for measuring current from solar energy source (SM = Solar Module).

WT Ammeter – Analog 30A DC ammeter for measuring current from wind energy source (WT = Wind Turbine).

DL Ammeter – Analog 30A DC ammeter for measuring current to dump load (DL = Dump Load).

Model 66053 – DC Power Distribution Panel

12VDC 5A for interconnectivity.

Models 66054-H and 66054-V – Disconnect Switch

Horizontal (H) or Vertical (V) mount.

SM Disconnect Switch (with key) – 40A SPST-type for opening connection between solar energy source and battery bank, commonly opened at night to prevent reverse leakage (SM = Solar Module)

WT Disconnect Switch (with key) – 40A SPST-type for opening connection between wind energy source and battery bank (WT = Wind Turbine)

DL Disconnect Switch (with key) – 40A SPST-type for opening connection between diversion/dump load controller and renewable energy sources (DL = Dump Load)

BAT/INV Disconnect Switch (with key) – 40A SPST-type for opening connection between power inverter and battery bank (BAT/INV = Battery and/or Inverter).

Model 66056 – Diversion Load Controller

35A PWM-type set to operate in shunt mode for controlling the renewable energy that is available, once the battery bank is fully charged.

Model 66057 – Dump Load

288W resistive element for harnessing excess renewable energy to generate heat, once the battery bank is fully charged.

Model 66058 – DC Circuit Breaker

50A resettable DC circuit breaker for circuit protection of 12VDC system.

Model 66059 – kWh Meters with AC Circuit Breaker Box

UG Watt-hour Meter – AC kWh meter for monitoring power usage to/from utility grid (UG). 1 kWh resolution.

RE Watt-hour Meter – AC kWh meter for monitoring power usage from (residential) renewable energy (RE) source. 1 kWh resolution.

AC Circuit Breaker Box – Resettable AC circuit breakers are located in this enclosure; one main two-pole 30A and two branch one-pole 15A breakers for circuit protection of 120VAC system.

Model 66059-A – kWh Meters with AC Circuit Breaker Box (UL/CSA Certified)

UG Watt-hour Meter – AC kWh meter for monitoring power usage to/from utility grid (UG). 1 Wh resolution.

RE Watt-hour Meter – AC kWh meter for monitoring power usage from (residential) renewable energy (RE) source. 1 Wh resolution.

AC Circuit Breaker Box – Resettable AC circuit breakers are located in this enclosure; one main two-pole 30A and two branch one-pole 15A breakers for circuit protection of 120VAC system.

Model 66060 – AC/DC Wall Switch

120Vac, 11 Amp or 12 Vdc, 5 Amp electrical switches for interrupting distributed AC/DC power. AC or DC is selectable by using switch on rear. AC and DC electrical paths are isolated from each other.

Model 66062 – Power Bus Bar

12VDC positive and negative rails for distributing battery voltage throughout the system.

Model 66061 – Lockout/Tagout Module

SPST-type switch for safety policy implementation.

Model 66063 – Power Usage Monitor

Portable meter for monitoring AC voltage, current, frequency, power, and power usage.

Model 66064 – Power Inverter with Remote Control

1kW DC-to-AC converter that changes 12VDC power to 120VAC (sinusoidal) power.

Model 66065 – Solar Charge Controller

30A PWM-type for controlling and conditioning solar power to properly charge the battery bank.

Model 66066 – Stop Switch

50A SPDT “break-before-make” type for stopping mechanical rotation of the wind turbine generator shaft during servicing or maintenance. Switch disconnects the battery bank, and then shorts the generator output.

Model 66067 – DC Lamp Socket

12VDC 5A lamp socket.

Model 66070-1 – Photovoltaic (PV) Module Assembly

85 Watts rating for generating electrical power from solar energy.

Model 66075 – Wind Turbine Generator with DC Motor (Component of the Wind Simulator)

The Wind Turbine Generator with DC Motor is comprised of a 90VDC permanent-magnet type 1800 rpm for mounting to the wind turbine shaft in order to simulate wind energy. A 180VDC version of this model is also available.

Model 66150-1 – Solar Array Junction Box

Contains a 150VDC, 8 Amp circuit breaker that also functions as a disconnect switch.

Model 66151 – Sun Simulator Assembly

120VAC light assembly for illuminating solar panel in order to simulate solar energy. A 240V version of this model is also available.

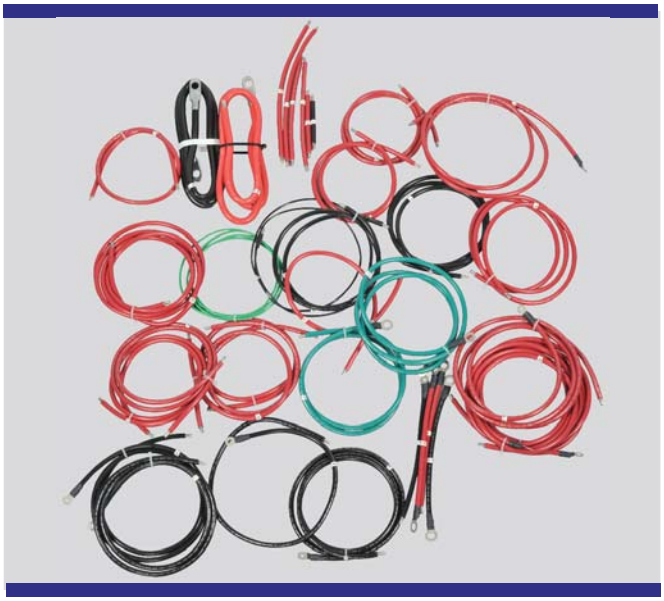
Model 66154 – Accessories Package

Accessories package includes a battery charger, 5-amp fuses, power strip, LED lamps, fluorescent lamps, incandescent lamps, 4mm and 2mm leads, and two-prong outlet bulb socket adapters. A 240V version of this model is also available.

Model 66153 – DC Motor Controller (Component of the Wind Simulator)

The DC Motor Controller, a component of the Wind Simulator, varies speed by controlling the 90VDC motor from a 120VAC source. A 240VAC version of this model is also available.

Model 87339 – Connection Cables Kit



The Model 87339 Connection Cables Kit provides all the connection cables required for interconnecting the trainer components.

SPECIFICATIONS

Model 46120 – Solar/Wind Energy Training System		**120V – 60 Hz**	**220V – 50 Hz**	**240V – 50 Hz**
Power Requirements	Current	15A	15A	10A
Physical Characteristics	Dimensions (H x W x D)	86 x 88 x 31.5 in (235.6 x 223.5 x 85.1 cm) with Sun Simulator 87 x 88 x 31.5 in (214 x 223.5 x 85.1 cm) Solar Module tilted 72 x 88 x 31.5 in (190.5 x 223.5 x 85.1 cm) Solar Module flat		
	Shipping Weight (Crated)	226.8 kg (500 lb)		
Model 46540 – Networked Data Acquisition Interface				
Physical Characteristics	Dimensions (L x W x H) Net Weight	34 x 17 x 16 in (86.4 x 43.2 x 40.6 cm) 8.9 lb (4.04 kg)		
Power Requirement	Voltage Current	10-30 Vdc (24 Vdc typical) 0.22A @ 24 Vdc		
Sample Rate	Frequency	3.33 Hz		
Inputs				
1. AC Load/Inverter Voltage	Setting Scaling Voltage	±20 mA mA x 7.5 0-150 Vac ±0.25% of FS		
2. AC Load/Inverter Current	Setting Scaling Current	±20 mA mA x 0.25 0-5Aac ±0.25% of FS		
3. DC Load Current	Setting Scaling Current	±150 mV mV / 2.5 0-60 Adc ±0.5% of FS (Hardware Limit 15A)		
4. Wind Turbine Current	Setting Scaling Current	±150 mV mV / 2.5 0-60 Adc ±0.5% of FS (Hardware Limit 20A)		
5. Solar Module Voltage	Setting Scaling Voltage	±5V V x 5 0-25 Vdc ±0.5% of FS		
6. Solar Module Current	Setting Scaling Current	±150 mV mV / 2.5 0-60 Adc ±0.5% of FS (Hardware Limit 20A)		
7. Battery/Turbine/ DC Load Voltage	Setting Scaling Voltage	±5 V V x 5 0-25 Vdc ±0.5% of FS (Hardware Limit 40A)		
8. Battery Bank Current	Setting Scaling Current	±150 mV mV x 1 0-150 Adc ±0.5% of FS		
9. Solar Irradiance	Setting Scaling Irradiance	±500 mV mV x 5 0-1750 W/m^2 (300-1175 nm) ±5% of FS (5 W/m^2 per mV)		
Temperature (optional)	Setting Scaling Temperature	4-20 mA ((mA - 4) x 19.1875) - 99 -60° C to 208° C ±0.9% of FS		
10. Wind Speed	Setting Scaling Speed	±5 V (V + 0.09) x 33.8 8-172mph ±3% of FS (displays > 4mph)		
Temperature (optional)	Setting Scaling Temperature	4-20 mA ((mA - 4) x 19.1875) - 99 -60° C to 208° C ±0.9% of FS		

SPECIFICATIONS (cont'd)

Model 6394-A0 – Digital Multimeter		
Physical Characteristics	Dimensions (H x W x D) Net Weight	6.7 x 2.75 x 1.5 in (170 x 70 x 38 mm) 0.8 lb (0.36 kg)
	Shipping Weight (Crated)	226.8 kg (500 lb)
	Type Functions Accuracy Display Features	Digital, handheld (portable) AC/DC voltage, DC current, resistance, continuity diode test, and battery test ±2.0% or better 3½ digit, liquid-crystal Safety recessed test lead connections, low battery indication, audible continuity, overload protection, mounted on a base that clamps to the work surface using push-lock fasteners
	Quantity	1
Model 65917 – Battery Bank		
Physical Characteristics	Dimensions (H x W x D) Net Weight	6.75 x 10.5 x 13 in (17.2 x 26.7 x 33.0 cm) 71.10 lb (32.25 kg)
Battery	Type Rating	Sealed lead-acid glass-mat storage battery 110Ah AGM 12Vdc
	Quantity	1
Model 66050 – Battery Bank Junction Box		
Physical Characteristics	Dimensions (H x W x D) Net Weight	6.75 x 6.25 x 4.75 in (17.15 x 15.88 x 12.1 cm) 5.2 lb (2.36 kg)
Contacts	Type Rating	Resettable Circuit Breakers (for Battery Bank, GFPD) 150Vdc, One 30 Amp, One 0.5A/63A GFPD
	Quantity	1
Model 66051-1 – AC Outlet		
Physical Characteristics	Dimensions (H x W x D) Net Weight	4.75 x 4.75 x 3.25 in (12.1 x 12.1 x 8.3 cm) 0.9 lb (0.41 kg)
Contacts	Type Rating	Single snap-in receptacle 120Vac, 15 Amp
	Quantity	4
Model 66052 – Ammeter		
Physical Characteristics	Dimensions (H x W x D) Net Weight	4.75 x 4.75 x 4.0 in (12.1 x 12.1 x 10.2 cm) 1.3 lb (0.6 kg)
Contacts	Type Rating	Analog 0-30 Amp dc
	Quantity	3
Model 66053 – DC Power Distribution Panel		
Physical Characteristics	Dimensions (H x W x D) Net Weight	4.75 x 4.75 x 3.25 in (12.1 x 12.1 x 8.3 cm) 0.9 lb (0.41 kg)
Contacts	Type Rating	4 N.C. contact sets 12Vdc, 5 Amp
Fault Switches		4
	Quantity	1
Model 66054-H – Disconnect Switch (Horizontal Mount) **Model 66054-V – Disconnect Switch (Vertical Mount)**		
Physical Characteristics	Dimensions (H x W x D) Net Weight	5.0 x 3.0 x 4.75 in (12.7 x 7.62 x 12.1 cm) 0.95 lb (.043 kg)
Contacts	Type Rating	1 N.O. contact set with key 48Vdc, 40 Amp
	Quantity	2

SPECIFICATIONS (cont'd)

Model 66056 – Diversion Load Controller		
Physical Characteristics	Dimensions (H x W x D) Net Weight	9.0 x 13.0 x 2.75 in (22.7 x 33.0 x 7.0 cm) 4.6 lb (2.1 kg)
Contacts	Type Rating	Diversion Load 35 Amp dc
	Quantity	1
Model 66057 – Dump Load		
Physical Characteristics	Dimensions (H x W x D) Net Weight	9.0 x 13.0 x 3.25 in (22.7 x 33.0 x 9.53 cm) 4.3 lb (1.95 kg)
Contacts	Type Rating	Resistive 0.5 ohm, 288 W
	Quantity	1
Model 66058 – DC Circuit Breaker		
Physical Characteristics	Dimensions (H x W x D) Net Weight	4.75 x 4.75 x 3.0 in (12.1 x 12.1 x 7.6 cm) 0.9 lb (0.41 kg)
Contacts	Type Rating	N.C. bi-metal resettable circuit breaker 12Vdc, 50 Amp
	Quantity	3
Model 66059 – kWh Meters with AC Circuit Breaker Box		
Physical Characteristics	Dimensions (Dia. x D) Net Weight	8.0 x 6.5 in (20.3 x 16.5 cm) 5.4 lb (2.45 kg)
Meter	Type Rating	Analog 120Vac watt-hour (kWh)
AC Circuit Breaker Box		
Physical Characteristics	Dimensions (H x W x D) Net Weight	7.0 x 3.5 in 13.0 x (17.78 x 13.02 x 8.89 cm) 10.0 lb (4.55 kg)
Contacts	Type Rating	Resettable Circuit Breakers 120Vac, Two 30 Amp, Two 15 Amp
	Quantity	1
Model 66060 – AC/DC Wall Switch		
Physical Characteristics	Dimensions (H x W x D) Net Weight	4.75 x 4.75 x 3.25 in (12.1 x 12.1 x 8.3 cm) 0.9 lb (0.41 kg)
Contacts	Type Rating	1 SPST Toggle Switch 120Vac, 11 Amp 12Vdc, 5 Amp
Fault Switches		1
	Quantity	4
Model 66061 – Lockout/Tagout Module		
Physical Characteristics	Dimensions (H x W x D) Net Weight	4.75 x 5.5 x 4.0 in (12.1 x 14.0 x 10.2 cm) 2.6 lb (1.18 kg)
Contacts	Type Rating	1 SPST Toggle Switch (with hasp) 120Vac, 15 Amp
	Quantity	1
Model 66062 – Power Bus Bar		
Physical Characteristics	Dimensions (H x W x D) Net Weight	4.75 x 4.75 x 2.5 in (12.1 x 12.1 x 6.4 cm) 1 lb (0.45 kg)
Contacts	Type Rating	Negative, and Positive terminal screws 48Vdc, 150 Amp
	Quantity	1

SPECIFICATIONS (cont'd)

Model 66063 – Power Usage Monitor		
Physical Characteristics	Dimensions (H x W x D) Net Weight	1.60 x 5.13 x 2.40 in (4.1 x 13.0 x 6.1 cm) 0.3 lb (0.14 kg)
Contacts	Type Rating	Outlet, (single) 120Vac, 15 Amp
	Quantity	1
Model 66064 – Power Inverter with Remote Control		
Physical Characteristics	Dimensions (H x W x D) Net Weight	10.75 x 14.75 x 4.25 in (27.3 x 37.5 x 10.8 cm) 12.45 lb (5.65 kg)
Inverter	Type Rating	Pure sinusoidal power inverter (with remote) 12Vdc input, 120Vac, 1kW output
	Quantity	1
Model 66065 – Solar Charge Controller		
Physical Characteristics	Dimensions (H x W x D) Net Weight	8.75 x 8.75 x 2.75 in (22.2 x 22.2 x 7.0 cm) 2.6 lb (1.18 kg)
Charge Controller	Type Rating	PWM series battery charging (not shunt) 12Vdc, 30 Amp (with temperature sensor)
	Quantity	1
Model 66066 – Stop Switch		
Physical Characteristics	Dimensions (H x W x D) Net Weight	4.75 x 4.75 x 4.25 in (12.1 x 12.1 x 10.8 cm) 0.9 lb (0.41 kg)
Contacts	Type Rating	SPDT center off toggle switch 12Vdc, 50 Amp
	Quantity	1
Model 66067 – DC Lamp Socket		
Physical Characteristics	Dimensions (H x W x D) Net Weight	4.75 x 4.75 x 3.25 in (12.1 x 12.1 x 8.3 cm) 0.9 lb (0.41 kg)
Charge Controller	Type Rating	Socket 12Vac, 5 Amp
	Quantity	3
Model 66070-1 – Photovoltaic Module Assembly		
Physical Characteristics	Dimensions (H x W x D) Net Weight	26.0 x 40.0 x 3.25 in (66.0 x 101.6 x 8.3 cm) 32 lb (14.51 kg)
Solar Panel	Type Rating	Solar Photovoltaic Module 12Vdc, 85 watts
	Quantity	1
Model 66075 – Wind Turbine Generator with DC Motor (Wind Simulator)		
Physical Characteristics	Dimensions (H x W x D) Net Weight	15.0 x 27.0 x 9.0 in (38.1 x 68.58 x 22.86 cm) 17 lb (7.4 kg)
Wind Turbine Generator	Type Rating	3 Phase Alternator with Rectified DC Output 12Vdc output, 27 Amps, 400 watts
	Quantity	1
Model 66150-1 – Solar Array Junction Box		
Physical Characteristics	Dimensions (H x W x D) Net Weight	6.75 x 6.25 x 4.75 in (17.2 x 15.9 x 12.0 cm) 4.5 lb (2.40 kg)
Contacts	Type Rating	Resettable Circuit Breaker (for solar array) 150Vdc, 8 Amp
	Quantity	1

SPECIFICATIONS (cont'd)

Model 66151 – Sun Simulator Assembly			
Physical Characteristics	Dimensions (H x W x D) Net Weight	26.0 x 40.0 x 14.0 in (66.0 x 101.6 x 35.6 cm) 18 lb (8.16 kg)	
Lamp	Type Rating	Quartz Flood 120Vac, 600 watts (with 5 minute timer switch)	
	Quantity	1	
Model 66153 – DC Motor Controller			
Physical Characteristics	Dimensions (H x W x D) Net Weight	4.75 x 8.75 x 3.5 in (12.1 x 22.2 x 8.9 cm) 2.7 lb (1.22 kg)	
Controller	Type Rating	Variable Speed 115Vac 50/60 Hz input, 0-90Vdc output, 3.5Adc	Variable Speed 230Vac 50/60 Hz input, 0-180Vdc output, 3.5Adc
	Quantity	1	
Model 66154 – Accessories Package			
Fuse	Type, Voltage, Quantity	Fuses, 12Vdc, 5 Amp, 1 pk	
Power Strip	Type, Quantity	6 Outlets, 1	
Outlet Bulb Socket	Quantity	4	
Lamp	Type, Voltage, Quantity	LED, 120Vac 2.5W, 1 LED, 12Vdc 2.5W, 1 Fluorescent, 120Vac, 13W, 1 Fluorescent, 12Vdc 13W, 1 Incandescent, 120Vac 60W, 1 (4pk) Incandescent, 12Vdc 25W, 1	
Battery Charger	Type, Voltage, Quantity	Smart, 12Vdc, 1	
Leads	Type Length, Color, Quantity	4mm, safety plug 11.81 in (30 cm), Green, 7 35.43 in (90 cm), Green, 3 35.43 in (90 cm), Black, 5 47.24 in (120 cm), Black, 5 47.24 in (120 cm), White, 10	
Leads	Type Length, Color, Quantity	2mm, banana plug 23.62 in (60 cm), Red, 10 23.62 in (60 cm), Black, 10	

ORDERING NUMBERS

120 V – 60 Hz			220 V – 50 Hz			240 V – 50 Hz
ENGLISH	FRENCH	SPANISH	ENGLISH	FRENCH	SPANISH	ENGLISH
6394-A0	TBE	6394-A0	6394-A0	TBE	6394-A0	6394-A0
46120-00	TBE	46120-02	46120-05	TBE	46120-7	46120-0A
46120-A0	TBE	46120-A2	TBE	TBE	TBE	TBE
46120-B0	46120-B0	46120-B0	46120-B0	46120-B0	46120-B0	46120-B0
46120-C0	46120-C0	46120-C0	46120-C0	46120-C0	46120-C0	46120-C0
46120-E0	46120-E0	46120-E0	46120-E0	46120-E0	46120-E0	46120-E0
46120-F0	TBE	TBE	46120-F5	TBE	TBE	TBE
46120-G0	TBE	TBE	46120-G5	TBE	TBE	TBE
46120-H0	TBE	TBE	46120-H5	TBE	TBE	46120-HA
46120-J0	TBE	46120-J2	TBE	TBE	TBE	TBE
46540-00	TBE	46540-02	TBE	TBE	TBE	TBE
46541-00	TBE	46541-00	TBE	TBE	TBE	TBE
46542-00	TBE	46542-00	TBE	TBE	TBE	TBE
46543-00	TBE	46543-02	TBE	TBE	TBE	TBE
46801-J0	TBE	46801-J2	46801-J0	TBE	46801-J2	46801-J0
65917-00	TBE	65917-00	65917-00	TBE	65917-00	65917-00
66050-00	TBE	66050-00	66050-00	TBE	66050-00	66050-00
66051-10	TBE	66051-10	66051-10	TBE	66051-10	66051-10
66052-00	TBE	66052-02	66052-00	TBE	66052-02	66052-00
66053-00	TBE	66053-02	66053-00	TBE	66053-02	66053-00
66054-H0	TBE	66054-H0	66054-H0	TBE	66054-H0	66054-H0
66054-V0	TBE	66054-V0	66054-V0	TBE	66054-V0	66054-V0
66056-00	TBE	66056-02	66056-00	TBE	66056-02	66056-00
66057-00	TBE	66057-02	66057-00	TBE	66057-02	66057-00
66058-00	TBE	66058-00	66058-00	TBE	66058-00	66058-00
66059-00	TBE	66059-02	66059-00	TBE	66059-02	66059-00
66059-A0	TBE	TBE	66059-A5	TBE	TBE	66059-AA
66060-00	TBE	66060-00	66060-00	TBE	66060-00	66060-00
66061-00	TBE	66061-00	66061-00	TBE	66061-00	66061-00
66062-00	TBE	66062-00	66062-00	TBE	66062-00	66062-00
66063-00	TBE	66063-00	66063-00	TBE	66063-00	66063-00
66064-00	TBE	66064-00	66064-00	TBE	66064-00	66064-00
66065-00	TBE	66065-00	66065-00	TBE	66065-00	66065-00
66066-00	TBE	66066-02	66066-00	TBE	66066-02	66066-00
66067-00	TBE	66067-00	66067-00	TBE	66067-00	66067-00
66070-10	TBE	66070-10	66070-10	TBE	66070-10	66070-10
66075-00	TBE	66075-00	66075-05	TBE	66075-05	66075-0A
66150-10	TBE	66150-12	66150-10	TBE	66150-12	66150-10
66151-00	TBE	66151-02	66151-05	TBE	66151-07	66151-0A

120 V – 60 Hz			220 V– 50 Hz			240 V– 50 Hz
ENGLISH	**FRENCH**	**SPANISH**	**ENGLISH**	**FRENCH**	**SPANISH**	**ENGLISH**
66153-00	TBE	66153-02	66153-05	TBE	66153-07	66153-0A
66154-00	TBE	66154-00	66154-05	TBE	66154-05	66154-0A
66166-00	TBE	66166-00	66166-00	TBE	66166-00	66166-00
66177-00	TBE	66177-00	66177-00	TBE	66177-00	66177-00
86514-A0	TBE	TBE	86514-A0	TBE	TBE	86514-A0
86514-20	TBE	86514-22	86514-20	TBE	86514-22	86514-20
86514-30	TBE	86514-32	86514-30	TBE	86514-32	86514-30
86515-20	TBE	86515-22	86515-20	TBE	86515-22	86515-20
86515-30	TBE	86515-32	86515-30	TBE	86515-32	86515-30
86516-20	TBE	86516-22	86516-20	TBE	86516-22	86516-20
86516-30	TBE	86516-32	86516-30	TBE	86516-32	86516-30
86517-20	TBE	86517-22	86517-20	TBE	86517-22	86517-20
86517-30	TBE	86517-32	86517-30	TBE	86517-32	86517-30
86518-20	TBE	86518-22	86518-20	TBE	86518-22	86518-20
86518-30	TBE	86518-32	86518-30	TBE	86518-32	86518-30
86519-20	TBE	86519-22	86519-20	TBE	86519-22	86519-20
86519-30	TBE	86519-32	TBE	TBE	TBE	TBE
86862-00	TBE	TBE	86862-00	TBE	TBE	86862-00
86862-A0	TBE	TBE	86862-A0	TBE	TBE	86862-A0
87293-10	87293-10	87293-10	87293-10	87293-10	87293-10	87293-10
87339-00	TBE	87339-00	87339-00	TBE	87339-00	87339-00
87359-00	87359-00	87359-00	87359-00	87359-00	87359-00	87359-00
87372-30	TBE	87372-30	87372-30	TBE	87372-30	87372-30
87387-00	87387-00	87387-00	87387-00	87387-00	87387-00	87387-00
87446-00	87446-00	87446-00	87446-00	87446-00	87446-00	87446-00
87655-E0	TBE	TBE	TBE	TBE	TBE	TBE
88023-E0	TBE	88023-E0	TBE	TBE	88023-E0	88023-E0

SOLAR/WIND ENERGY TRAINING SYSTEM
MODEL 46120

The Solar/Wind Energy Training System is supported by extensive courseware.

Reflecting Lab-Volt's commitment to high quality standards in product, design, development, production, installation, and service, our manufacturing and distribution facility has received the ISO 9001 certification.

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