

SEC

MHG Solar

Environmental Chambers

INSTRUCTION MANUAL



Doc. P/N 56352604
Rev. 3.0

**CAUTION!**

After electrical power is applied to the SEC unit and the Power switch is turned on, you must wait 24 hours before operating the system. This must be done to ensure all refrigerant condensate is removed from the compressor crankcases. (When the Power switch is on the crankcase heaters are also on.) Failure to observe this precaution will result in excess cycling and possible damage of the refrigeration system.

GENERAL EQUIPMENT SPECIFICATIONS

This page is a record of your equipment specifications. This information is found on the stamped nameplate of your instrument. Please fill in the blanks below when you receive your Atlas unit.

When contacting the sales or service department to order parts or obtain information, refer to this page. This will allow us to respond quickly and accurately to your request.

MODEL NO. _____

SERIAL NO. _____

VOLTS	CYCLES	PHASE
-------	--------	-------

MAIN FUSE (time delay, or “slow blow”)

SINGLE PHASE _____ AMPS

3 PHASE, 3 WIRE _____ AMPS

3 PHASE, 4 WIRE _____ AMPS

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1.0 INTRODUCTION

This instruction manual describes how to start and operate the Atlas MHG Solar Simulation Environmental Chamber (hereafter referred to as the SEC system or chamber). The SEC series has been created by Atlas to provide accelerated exposure testing of large component products. This serves as an alternative between long-term outdoor tests and indoor accelerated testing of only small specimens. Results may now be obtained readily for large-component exposure tests requiring extreme temperatures and/or high irradiance.

according to very specific procedures. Numerous safety systems have been included for your protection, ease of use and monitoring.

System Operators and Supervisors

Instrument operators must read and become familiar with Sections 4.0 – 6.0 before attempting to conduct an exposure test. Section 5.2 is very useful for learning the basics of operation. The SEC system (SEC 6100) has up to six MHG lamps and a separate, optional pyranometer may be used to configure preset irradiance levels according to your company's established practice for the procedure.

Section 5.0 Operation covers operating procedures for all of the user controls. It describes how to adjust settings for a test and how to interpret monitoring displays on the touchscreen. Custom test setup is also covered and includes the steps for keying in an example program.

Section 6.0 Maintenance covers routine maintenance procedures essential for proper operation.

Section 7.0 M

All Readers of this Manual

Follow all safety precautions shown in **BOLD** print throughout the text and read the warnings and precautions on the following pages. This instrument includes high voltage power and electronics systems which must be operated

2.0 SAFETY PRECAUTIONS

2.1 General Guidelines

- The design of the instrument as supplied by Atlas must not be altered in any manner.
- No warranty can be given in case of improper use contrary to these instructions.
- The instrument has been designed, manufactured and inspected before delivery with all due care in accordance with the CE guidelines.
- The system meets the specifications for conducted and emitted interference according to EN 61326.
- It is imperative for the safety of the test system that the necessary maintenance and repair work should be performed by Atlas service technicians or by authorized service affiliates.
- The user can service and clean the system in accordance with the maintenance procedures contained in these instructions.
- Use only original Atlas replacement parts when performing maintenance or repair work on the instrument.
- For translations into other languages, the statements and specifications of the English operating instructions are binding.
- Do not exceed the electrical ratings indicated on the instrument nameplate.

2.2 Normal Use and Application

The test system has been exclusively designed and constructed for conducting exposure tests. You can perform testing methods to determine the effects of irradiance, temperature and humidity on the material properties of test specimens.

2.3 Improper Use of the Instrument

DANGER

Improper use of the instrument means:

- 1) Placing flammable, explosive, toxic or corrosive specimens inside the instrument.

- 2) Placing test specimens, which become potentially hazardous when exposed to the temperature range of the test system, in or near the instrument.
- 3) Placing substances, which can create an explosive atmosphere with air, inside or near the instrument.
- 4) Using the system to heat or store food.
- 5) Conducting tests at temperatures or under conditions not in compliance with the recommendations of this manual.
- 6) Allowing any person, other than qualified service technicians, to be inside the instrument test chamber or electrical cabinets when power is applied to the unit.

2.4 General Safety Information

Certain basic rules must be observed even for reliable safety devices. Improper use may represent a danger to life and limb of the operator or third parties or result in damage to the test specimens or the instrument.

- Do not remove protective covers
- Do not render safety devices ineffectual
- Do not manipulate safety devices

Such manipulations are dangerous as others may not be aware of their implementation, and therefore may have a deficient understanding of the instrument and its reduced level of safety.

2.5 Requirements to Be Met by the User

- Operation of the instrument may only be performed by qualified, trained personnel.
- The user must compile an operating manual on the basis of these operating instructions taking into account the relevant local and facility conditions and the language of the operating personnel.
- The user must ensure that all personnel working with the instrument know and observe the safety instructions.

2.0 SAFETY PRECAUTIONS

- Work on electrical devices and the refrigeration unit should only be performed by Atlas service or a skilled technician so authorized. The necessary documentation, to be kept near the instrument, should be used by these persons only.
- The user must ensure that the directions regarding installation and operation of refrigerating plants as per EN 378-1 chap. 5.3, EN 378-2, appendix C, EN 378-4 chap. 4 and 5, are duly observed.

2.6 Definition of an Authorized Person

Personnel who, based on their training and experience, are in a position to prevent electrical and temperature-related potential hazards or dangers associated with operation and servicing of the instrument.

2.7 Safety and Warning Symbols



HIGH VOLTAGE!

Indicates precautionary information for avoiding electric shock due to high voltage.



DANGER!

Indicates instructions for avoiding hazardous conditions that if not obeyed will result in operator injury.



WARNING!

Indicates instructions for avoiding hazardous conditions that if not obeyed may result in operator injury.



CAUTION! INSTRUMENT DAMAGE

Indicates instructions for avoiding conditions that if not obeyed may result in instrument damage.



NOTE

Indicates procedural tips and special information.



WEEE Compliance

Per Guideline 2002/96/EG (WEEE, Waste of Electrical and Electronic Equipment, 1/27/2003): Do not dispose of the instrument as part of normal waste. Atlas MTT, LLC and its subsidiaries accepts serviceable instruments, sold after 3/23/2006, and recycles them in accordance with new legal requirements.

RoHS Compliance:

Per Category 9 guidelines: Monitoring and Control Instrumentation under RoHS categorization. This category 9 device currently lies outside of RoHS applicability. We are modifying our products to achieve RoHS conformity. This process will be completed far in advance of the legal requirement for such conformity.

2.8 Safety Instructions

Full knowledge and understanding of operation, maintenance and touchscreen instructions are essential for operating the instrument.

2.8.1 Basic Safety Guidelines

- 1) Keep the operating instructions near the instrument for easy reference.
- 2) In addition to these operating instructions, comply with the relevant national laws, regulations and guidelines when installing and operating the instrument.
- 3) Prior to closing the test chamber door, remove any tools or specimen holders on the floor of the chamber that could affect test procedures or results.
- 4) Prior to removing/installing the MHG lamp assembly or performing maintenance work:
 - A) Set the instrument power switch to the ("O" - off) position.
 - B) Shut off the wall-mounted, safety disconnect switch providing AC supply to the instrument.

2.0 SAFETY PRECAUTIONS

2.8.1 Basic Safety Guidelines (cont.)

C) Provide a safety clearance of at least 500 mm (20") between the instrument and any adjacent wall(s) as an escape route, in accordance with VDE 0100 Part 729.

2.8.2 Operational Precautions

Grounding Safety: Connect the PE terminal of the instrument to a low-resistance earth ground to ensure proper operation of the electrical fault-grounding safety systems.



WARNING!

The instrument PE ground must be connected to a low-resistance earth ground for safe operation.

MHG Lamp Assembly: Never handle the MHG lamp tube (shown at right) with bare hands. Skin oils will deposit and burn into the glass. Always wear cotton or rubber gloves when holding the lamp. If your skin contacts the glass lamp, clean it with optical glass cleaner.



Safety Disconnect Switch: Connect AC supply through a fused safety disconnect switch with properly rated fuses. Locate the switch as close to the instrument as possible and in view of the operator when standing in front of the instrument.



Lamp Installation: When installing or removing the MHG lamp, always turn off power at the safety disconnect switch (shown above) and at the instrument Main Power switch (shown at right).



WARNING!

Hot Surface! Condensation may cause hot water to accumulate on the inside of the chamber door during a test. Be careful opening the test chamber door after a test is complete.

2.9 Safety Devices

The system is equipped with protective and monitoring devices to ensure operator protection and awareness of system fault conditions.

1) **Chamber Door Handles:** The chamber door includes a safety release on the interior to allow exiting from the chamber even if the door is locked externally. The exterior handle includes a key lock which allows access prevention when the instrument is off. The MHG lamps shut off whenever a chamber door is opened.



Interior Door Release



Lockable Exterior Handle

2) **Chamber Door Proximity Sensor:** This sensor detects the chamber door position and triggers a warning if the door is open. This prevents system operation when an open chamber door would alter performance and invalidate test results.



Chamber Door
Electromagnet
Lock, Latch
and Sensor

3) **Emergency Off Switch:** When depressed, this switch shuts off all power to the instrument.

PUSH to activate.
To Reset: Twist the
red switch knob
clockwise.



2.0 SAFETY PRECAUTIONS

2.9 Safety Devices (cont.)

4) **Main Power Switch:** This device is normally used as the power on/off switch for the instrument. It switches the 3-phase, 4-wire AC power supplied to the instrument (including the Neutral line). It does not switch the PE ground line. (The main power switch mechanism and facility AC supply wiring is shown at right.)



5) **System Error Monitoring:** The Touchscreen controller is configured to monitor critical system conditions and provide alarm messages, as shown below. This helps to ensure safe operating conditions and prevent damage. Also refer to section 8.0 Alarm Responses.

System Error	Description	Priority
1	Luminary Temp Over Error	1
2	Leak Error	2
3	Door Open Error	2
4	EMS Error	3
5	Comp1 Error	3
6	Comp2 Error	3
7	Comp3 Error	3
8	Air Blower Error	3
9	NO Water Error	3
10	Dry Temp Over Error	3
11	Wet Temp Over Error	3

The list of errors/alarms is shown below.

System Alarms

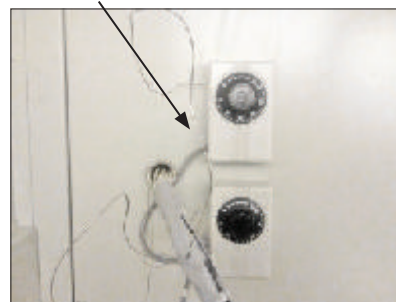
- 0 Luminary Temp Over Error (Temp. is above 60 °C)
- 1 Leak Error (Water leak from DI tank or drain lines)
- 2 Door Open Error (Interlock open)
- 3 EMS Error (Emergency power off switch activated)
- 4 Comp1 Error (High pressure or oil switch activated)
- 5 Comp2 Error (High pressure or oil switch activated)
- 6 Comp3 Error (High pressure or oil switch activated)
- 7 Air Blower Error (Motor trip error)
- 8 NO Water Error (DI water tank low or empty)
- 9 Dry Temp Over Error (Chamb. air heater >150 °C)
- 10 Wet Temp Over Error (Humidifier heater >120 °C)

6) Any system error that occurs sets the status light beacon (shown at right) to red and initiates an alarm message on the touchscreen.



7) **Overtemperature Safeties:** The instrument is protected from overtemperature conditions by three safety thermostats: two for the air (dry) heater inside the test chamber and one for the humidifier (beneath the evaporator coil in the test chamber). Each is user adjustable depending on test conditions and specimen tolerances. Refer to Alarms 7 and 8 at left.

Safety
Thermostats
Chamber Air
Heater



Safety
Thermostat
Humidifier



SEC4100

8) **Low-Water Safety:** A float switch in the humidifier reservoir stops humidifier operation when the water level is insufficient for proper operation. Refer to Alarm 6 at left.



Humidifier DI Water Tank and Float Valve



Humidifier Pan and Heating Coil

3.0 FACILITIES REQUIREMENTS

Although the installation and startup of the SEC Series instrument will be conducted and supervised by Atlas personnel, the customer is responsible for providing the proper electrical and water-supply facilities. Section 3.1 below and Table 3-1 at the right list these various requirements and other guidelines to consider.

3.1 Facilities Specifications

3.1.1 Dimensional & Environmental

Floor Loading and Flatness

Floor strength must be considered with respect to loading beneath the SEC instrument and especially its Refrigeration Module. The floor beneath the instrument must be level within 1/8" (3.2 mm).

Space Requirements

Note that the optimal space requirement is indicated by Footprint in the table above. Minimum clearance above the SEC unit is approximately 14 inches (35.6 cm). These requirements should be adhered to as closely as is practical. Failure to do so may inhibit service access.

Environmental Requirements

Install the SEC unit only in a laboratory or clean room environment. When this is not possible locate it in conditions specified below.

Temperature: 16-29°C (60-85°F)

Humidity: 0 to 85% non-condensing

The room should be ventilated properly and have minimal air pollution and airborne dust. Do not install the SEC unit in a corrosive or toxic environment.

3.1.2 Water Requirements

Tap or chilled water is required for the refrigeration system in the SEC 2100 through 6100 models. Deionized water is required for the humidification

system. If deionized water is not available, Atlas can supply Aquanizer units and filters to process your tap water. Refer to the Atlas Aquanizer handbook.

3.1.4 Electrical Requirements

Power to the SEC instrument must pass through a fused, safety disconnect switch. Power wiring enters at the port shown in Fig. 3-1 and connects directly to the main power switch. Refer to the listing at right for voltage and fusing requirements. If you need to convert 480V line voltage to 380V, see Appendix C Optional Equipment.



Figure 3-1 AC Supply Connections - SEC 4100

3.1.5 Water and Drain Connections

Make facility water and drain connections to the ports at the rear of the instrument. Prevent leakage by using Teflon, thread-sealing tape on all the plumbing connections. The ports should be clearly labelled on the instrument and match the diagrams below which may be used for facilities setup prior to instrument installation.

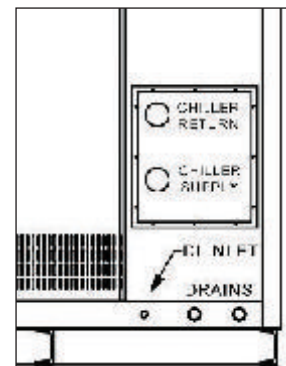


Figure 3-2 Facilities Ports - SEC 4100 (Right Rear)

Table 3-1 Instrument Dimensions and Facilities Requirements

Facility Requirements						
Model		SEC 600	SEC 1100	SEC 2100	SEC 4100	SEC 6100
Dimensions (meters)						
Test Space	(L x W x H)	0.8 x 0.8 x 0.95	1.1 x 1.1 x 0.95	2.1 x 1.2 X 1.6	2.6 x 2.25 x 1.8	3.6 x 2.2 x 1.8
Dimensions	(L x W x H)	1.02 x 1.97 x 2.44	1.32 x 2.27 x 2.44	3.27 x 2.1x 2.57	3.19 x 3.93 x 2.62	4.3 x 3.91 x 2.73
Footprint	(L x W x H)	2.02 x 3.95 x 2.94	2.32 x 4.35 x 2.94	4.37 x 4.81 x 3.07	4.29 x 6.5 x 3.12	5.4 x 6.97 x 3.23
Weight		1000 kg	1400 kg	2500 kg	3400 kg	4200 kg

Electrical Requirements						
Power consumption (KW)		23	34	64	123	160
Power Supply Configurations	200V 3Ph PE 50 / 60Hz					
	Load Amps	66	98	184	355	462
	Fuse Amps	75	125	225	400	500
	220V 3Ph PE 50 / 60Hz					
	Load Amps	60	89	167	322	420
	Fuse Amps	75	125	200	400	500
	380V 3Ph N PE 4 Wires 50 / 60Hz					
	Load Amps	34	51	97	186	243
	Fuse Amps	50	75	125	225	300
	400V 3Ph N PE 4 Wires 50 / 60Hz					
	Load Amps	33	49	92	178	231
	Fuse Amps	50	75	125	225	300

Water Requirements						
DI water needed (min.conductivity)	Flow rate	0.15 LPM .05 LPM	0.15 LPM .05 LPM	0.5 LPM .1 LPM	0.5 LPM .1 LPM	0.8 LPM .1 LPM
	Pressure	2.5~3.5 kg/cm ²	2.5~3.5 kg/cm ²	2.5~3.5 kg/cm ²	2.5~3.5 kg/cm ²	2.5~3.5 kg/cm ²
	Temperature	10~30 °C	10~30 °C	10~30 °C	10~30 °C	10~30 °C
Chilled Water	PCW Connection	N/A	N/A	50 A	50 A	50 A
	Flow rate	N/A	N/A	30 LPM 0 LPM	120 LPM 0 LPM	120 LPM 0 LPM
	Temperature	N/A	N/A	18~23 °C	18~23 °C	18~23 °C
Cooling Mechanism		Air-Cooled	Air-Cooled	Water-Cooled	Water-Cooled	Water-Cooled

4.0 SYSTEM DESCRIPTION

4.1 SEC Chamber Series Overview

Four models comprise the MHG Solar Simulation Environmental Chamber or SEC series. The SEC 600 and SEC 1100 provide MHG (Metal Halide Global) single-luminary exposure capability for automotive-interior parts and mini solar modules. The SEC 2100, SEC 4100 and SEC 6100 provide 2, 4 and 6 MHG luminary exposure, respectively, for larger (1.0 x 1.6 m) solar modules and automotive parts. All models employ refrigeration to achieve sub-zero temperatures, with the smaller models being air-cooled and the larger models using chilled water for heat transfer.

Similarity of Controls

Each of the instruments include similar user controls for routine operation:

- 1) Power switch
- 2) Emergency Power Switch (EMS)
- 3) Touchscreen interface and PC computer

Nearly all operation and control functions are conducted using the touchscreen, including manual set point adjustment, test initiation and monitoring, as well as custom-test programming.

System Error Monitoring and Alarms

The touchscreen includes a comprehensive error monitoring and alarm system that will alert the user to system faults and shut down the SEC unit to protect it and the test specimens.

4.2 External and Internal Components

The primary controls and components with which the user must interact are shown in Figures 4-3 and 4-4 following. Detailed descriptions of the main subsystems are provided.

4.3 Main Components and Controls

To achieve designed exposure conditions, the SEC units include subsystems to produce irradiance, high/low temperature, and humidity.

4.3.1 MHG Metal Halide Global Lamp

The MHG lamp provides irradiance output in a spectrum range of 280 - 3000 nanometers, closely simulating sunlight, as shown below.

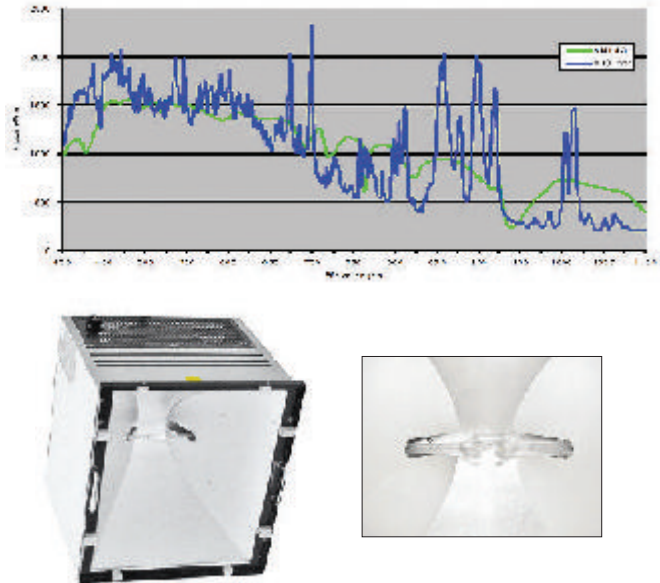


Figure 4-1 MHG Lamp Assembly & Spectral Distribution Curve

The MHG lamps in the SEC chambers are 2500W or 4000W, providing an adjustable irradiance output range of 800-1200 W/m². Various glass optical filters may be used on the lamp to adjust the output spectrum. Two panes of ODF (Out Door Flat) borosilicate filter glass comprise the windows beneath the SEC lamps. Users may insert an IDF (Indoor Filter) in the SEC lamp fixture frame. See section 6.3.5 for part numbers.

The MHG lamp receives electrical power from an EPS-modul 2500 or 4000 (Fig. 4-2) that provides current in a square-wave output. The EPS is an electronic power supply that also includes protective controls for current limit, open-circuit and lamp temperature. It includes a lamp hours meter and ignitions counter as well.

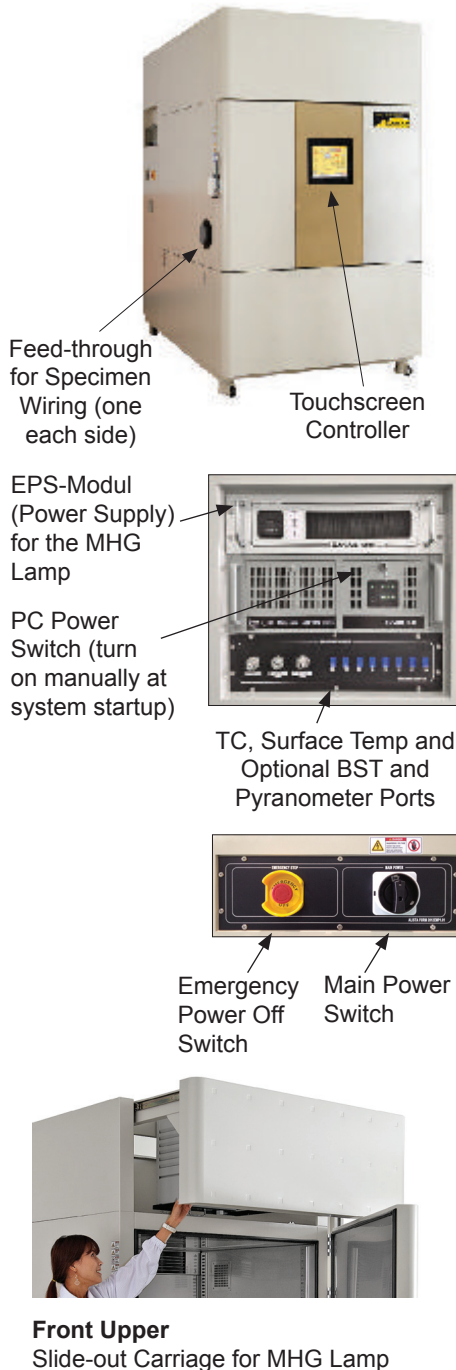


Figure 4-2 EPS-Modul 4000 (MHG Lamp Power Supply)

4.0 SYSTEM DESCRIPTION

SEC 600/1100

Single Luminary (2500 or 4000W)



NOTE: Component types & locations will differ with respect to model number.

SEC 2100/4100/6100

Dual or Quad Luminary (8000 or 16000W)

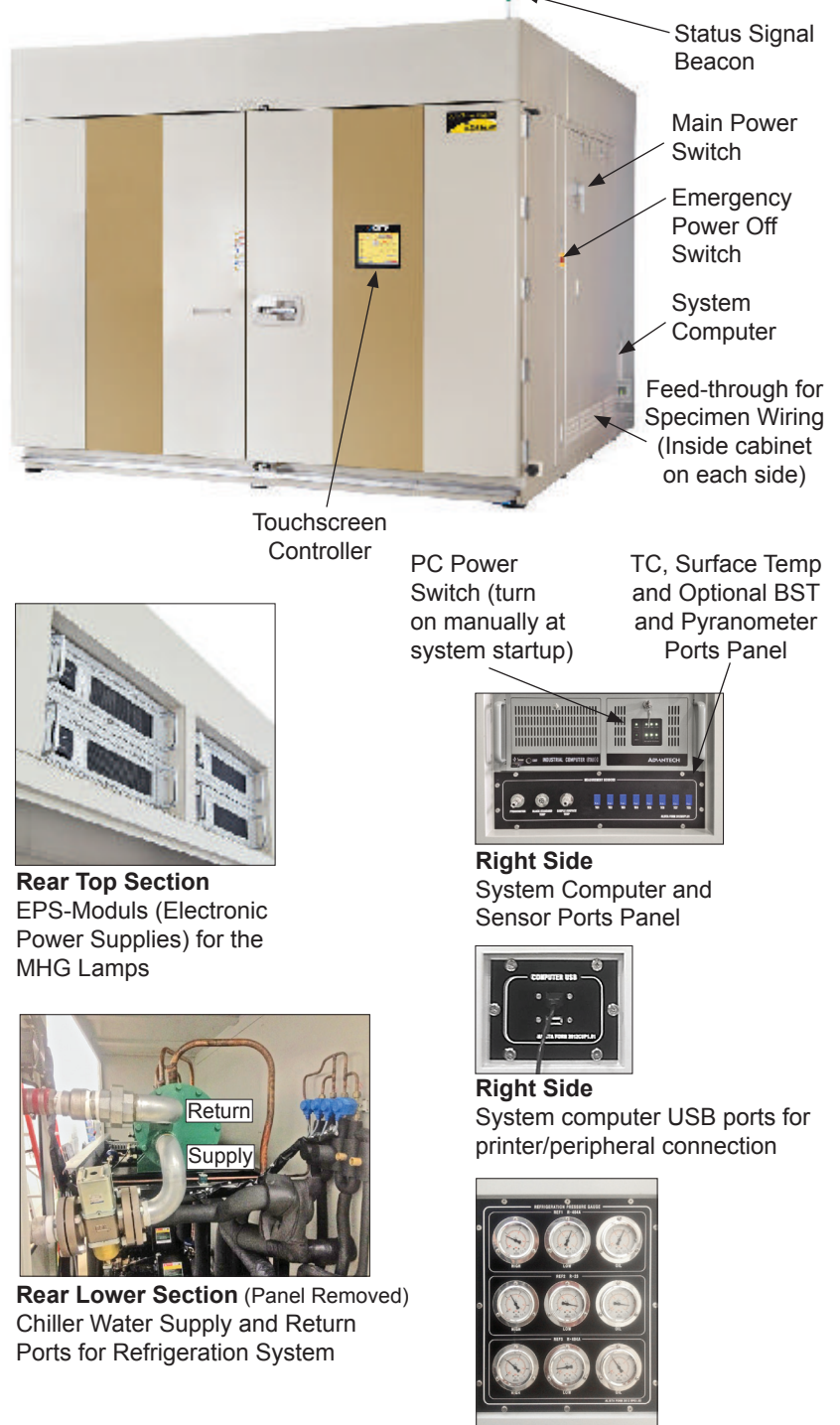


Figure 4-3 External Components and Controls

4.0 SYSTEM DESCRIPTION

SEC 2100/4100/6100

Dual or Quad Luminary



MHG Lamp

4000W Metal Halide Global lamp above sealed, electric anti-fogging window



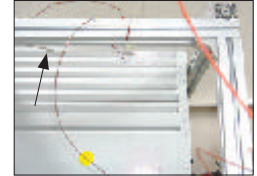
Anti-fogging Window

(with electric heater coil to prevent fogging / frosting)



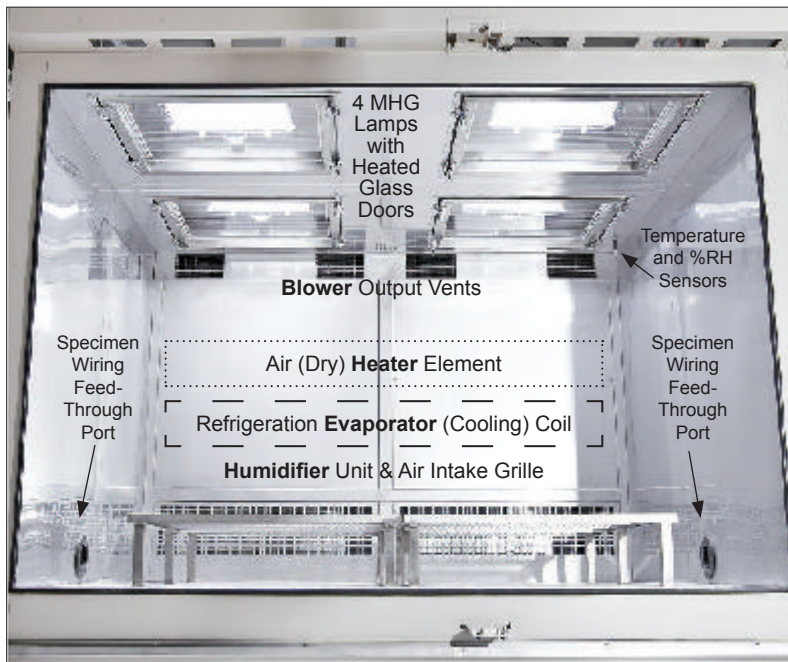
Top Section

Blower motors and MHG lamp housings

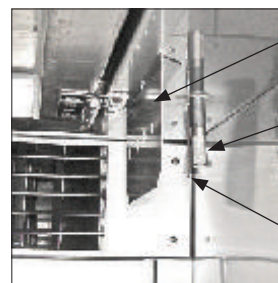


Top Section

Ambient temperature sensor near lamp



Test Chamber Interior



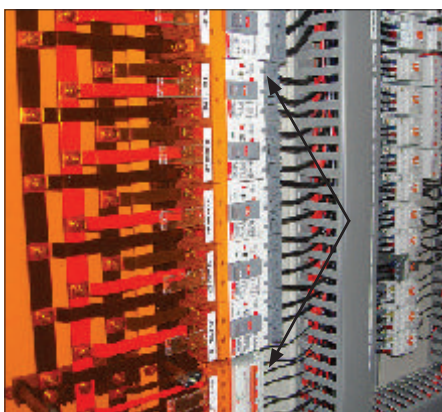
Test Chamber Ceiling

Sensor Deflector Plate
Relative Humidity (%RH) Sensor
RTD Temperature Sensor



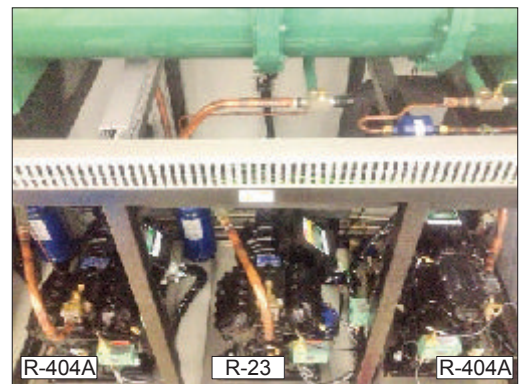
Rear Middle Section

Refrigeration plumbing and control valves



Right Side - Electrical Cabinet

Power circuit-breakers for refrigeration system, air and humidifier heaters



Rear Lower Section

Triple-compressor (cascading) refrigeration system

NOTE: Component types & locations will differ with respect to model number.

Figure 4-4 Internal Components and Controls

4.0 SYSTEM DESCRIPTION

4.3.1 MHG Metal Halide Global Lamp (cont.)

Specification		SEC 600(1 MHG)		SEC 1100(1 MHG)	
Exposure Dimension (WxDxH in m)	Exposure Vol (in Liter)	0.8 x 0.8 x 0.95	600	1.1 x 1.1 x 0.95	1100
Test PV Module Size		For Component/Mini Module Testing		For Component/Mini Module Testing	
Size of Exposure Plane		3000 ^{cm²}		5600 ^{cm²}	
IEC 60904 Class	Spectrum	Class A, B		Class A, B	
	Uniformity	Class B		Class B	
	Stability	Class A		Class A	

Specification		SEC 2100(2 MHGs)		SEC 4100(4 MHGs)	
Exposure Dimension (WxDxH in m)	Exposure Vol (in Liter)	2.1 x 1.2 X 1.6	4000	2.6 x 2.25 x 1.8	10500
Test PV Module Size		1 Module (Module Size: 1000 x 1600mm)		2 Modules (Module Size: 1000 x 1600mm)	
Size of Exposure Plane		13600 ^{cm²} (16000 ^{cm²})		32000 ^{cm²}	
IEC 60904 Class	Spectrum	Class A, B		Class A, B	
	Uniformity	Class B(13600 ^{cm²}) Class C(16000 ^{cm²})		Class B	
	Stability	Class A		Class A	

Area Uniformity : Class B

Class Type	Class A	Class B	Class C
Area Uniformity	≤ ±2 %	≤ ±5 %	≤ ±10 %

Solar Chamber Uniformity Data (Example)

[SEC I MHG Irradiation uniformity data-Final]

Class B 950~ 1050 watts

Class C 900 ~ 1100 watts

Pyranometer : 18.54 $\mu\text{V}/\text{w}/\text{m}^2$ /1000 = 0.01854mV/w/m²

P 16		P 1		P 2		P 3		P 17	
a. 1063	b. 1044	a. 1012	b. 992	a. 1001	b.	a. 1054	b. 1029	a. 1052	b.
c. 1607	d. 691	c. 1533	d. 654	c. 1522	d. 641	c. 1593	d. 670	c. 1582	d. 665
e.	f.	e.	f.	e.	f.	e.	f.	e.	f.
P 18		P 4		P 5		P 6		P 19	
a. 1081	b.	a. 1049	b. 1033	a. 1042	b.	a. 1092	b. 1045	a. 1080	b.
c. 1638	d. 702	c. 1588	d. 680	c. 1576	d. 667	c. 1656	d. 694	c. 1629	d. 689
e.	f.	e.	f.	e.	f.	e.	f.	e.	f.
P 20		P 7		P 8		P 9		P 21	
a. 1048	b.	a. 1024	b.	a. 1019	b.	a. 1065	b. 1043	a. 1066	b.
c. 1584	d. 674	c. 1551	d. 666	c. 1545	d. 654	c. 1615	d. 682	c. 1606	d. 683
e.	f.	e.	f.	e.	f.	e.	f.	e.	f.
P 22		P 10		P 11		P 12		P 23	
a. 1032	b.	a. 1004	b.	a. 1005	b.	a. 1050	b. 1026	a. 1057	b.
c. 1554	d. 670	c. 1526	d. 655	c. 1525	d. 650	c. 1590	d. 676	c. 1590	d. 679
e.	f.	e.	f.	e.	f.	e.	f.	e.	f.
P 24		P 13		P 14		P 15		P 25	
a. 1001	b.	a. 976	b.	a. 983	b.	a. 1031	b.	a. 1019	b.
c. 1509	d. 655	c. 1490	d. 639	c. 1494	d. 634	c. 1561	d. 662	c. 1563	d. 659
e.	f.	e.	f.	e.	f.	e.	f.	e.	f.

- Note
1. MHG measured value: 1-68%, 2-68%, 3-70%, 4-69%, 20°C Base
 2. It is measured in a-72%, controlled b-performance, and correct it as Class B,C.
 3. c-MHG 100% performance, d-MHG 50% performance
 4. 4 corners: top-left 999watts, top-right 956watts, bottom-left 921watts, bottom-right 921watts
 5. same as above

4.0 SYSTEM DESCRIPTION

4.3.2 Chamber Air Heater (Dry Heater)

In the SEC 4100 system, air in the test chamber is heated by nine heating elements rated at 7 kW each, for a total of 63 kW of heating power (see Figs. 4-5 and 4-9). The smaller SEC models use a subset of this capacity or smaller heating elements. This allows the chambers to achieve a maximum temperature of approximately 100°C.

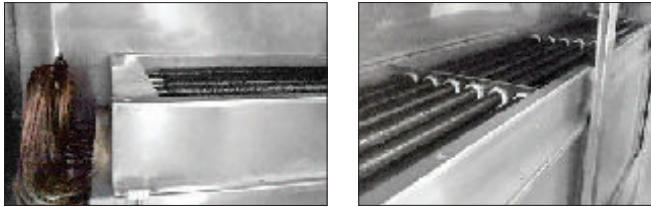


Figure 4-5 Air Heater Elements (mounted above Evaporator)

Specification	SEC 600(1 MHG)		SEC 1100(1 MHG)	
Temperature Operating Range	-40°C~+120°C (W/O Radiation)		-40°C~+120°C (W/O Radiation)	
	-20°C~+120°C (W/ Radiation)		-20°C~+120°C (W/ Radiation)	
Ramp Rate	↑4.0°C/min (W/O Irradiation)		↑4.0°C/min (W/O Irradiation)	
	↓2.5°C/min (W/O Irradiation)		↓2.5°C/min (W/O Irradiation)	
Temperature Accuracy	±1°C		±1°C	
Humidity Range and Accuracy	20~80% RH, ±5%	W/ Radiation	20~80% RH, ±5%	W/ Radiation
	30~95% RH, ±5%	W/O Radiation	30~95% RH, ±5%	W/O Radiation

Specification	SEC 2100(2 MHGs)		SEC 4100(4 MHGs)	
Temperature Operating Range	-40°C~+120°C (W/O Radiation)		-30°C~+100°C (W/O Radiation)	
	-20°C~+120°C (W/ Radiation)		-20°C~+100°C (W/ Radiation)	
Ramp Rate	↑3.0°C/min (W/ Irradiation)		↑3.0°C/min (W/ Irradiation)	
	↓2.4°C/min (W/O Irradiation)		↓2.4°C/min (W/O Irradiation)	
Temperature Accuracy	±1°C		±1°C	
Humidity Range and Accuracy	20~80% RH, ±5%	W/ Radiation	20~80% RH, ±5%	W/ Radiation
	30~95% RH, ±5%	W/O Radiation	30~95% RH, ±5%	W/O Radiation

4.3.3 Refrigeration System

The refrigeration system in the SEC 4100 is a triple-compressor cascading unit (Fig. 4-4). (Single-compressor units are used in the other SEC models.) These allow the test chamber to achieve a low temperature of -30°C with the MHG lamps off (or -20°C with the lamps on). The

evaporator (cooling coil) is mounted behind an access panel in the test chamber wall (Fig. 4-6).

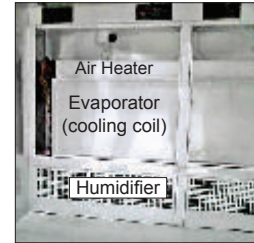


Figure 4-6 Refrigeration Evap. Coil (SEC4100)

4.3.4 Humidifier System

The humidifier system (Figs. 4-8 and 4-9) consists of the DI water tank and a boiler unit that is located beneath the evaporator coil inside the test chamber. The heated water vapor expands and flows into the test chamber air circulation system. A wall-mounted safety thermostat (Fig. 4-8) monitors the humidifier temperature and triggers a “Wet Temp Over” alarm if it overheats. This system allows the test chamber to achieve a relative humidity range of 30 - 95% with the MHG lamps off (or 20 - 80% with the lamps on).



Figure 4-7 Humidifier DI Water Tank & Safety Thermostat

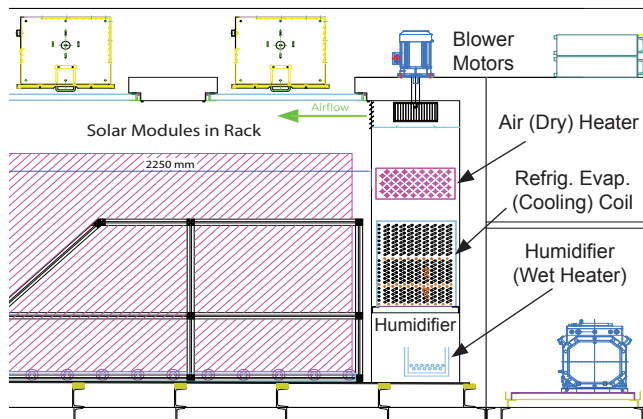


Figure 4-8 Main Air Stream Components

5.0 OPERATION

Operating procedures include:

- 5.1 MHG Lamp Installation
- 5.2 Touchscreen Operation
- 5.3 Custom Test Programming
- 5.4 Test Operation and Monitoring

For understanding and safety, read this section before attempting any operational procedures. Doing so will prevent mistakes and familiarize the reader with proper SEC instrument usage.

5.1 MHG Lamp Installation

5.1.1 Description

The standard lamp used in the SEC instruments is either a 2500W or 4000W Metal Halide Global lamp with an ODF optical filter. Coupled with an EPS-Modul 4000 power supply, the lamp provides 800-1200 W/m² of irradiance in the full-spectrum range of 280-3000 nm. The lamp is air-cooled by a circulation fan inside the housing. The spectral output of the lamp can be altered by installing various glass filter lenses in the lamp fixture.

5.1.2 Usage and Handling Precautions



WARNING!



HIGH VOLTAGE!

Make sure the main power switch is off when installing or removing the MHG lamp! This precaution must always be followed!



CAUTION! INSTRUMENT DAMAGE

Never handle the MHG lamp tube or glass filter plates with bare hands. Skin oils deposited on them can cause hot-spot heating, which may lead to poor light output and glass breakage. Clean the lamp tube and filter with methylated spirits if they have been touched directly.



CAUTION! INSTRUMENT DAMAGE

Never operate the MHG lamp without a glass filter plate installed, or with a damaged filter.



WARNING! MERCURY EXPOSURE

Be aware that there is a possibility of a lamp shattering. Such risk exists when the lamp is over-aged or pre-damaged. A shattered MHG lamp may expose the operator to mercury vapor and particulates. Mercury can enter the human body by inhalation through the lungs and by skin contact. Avoid mercury exposure as prescribed in the Mercury Safety Instructions for Metal Halide Lamps included in Appendix A of this manual.



WARNING!



DANGER!

Allow the test chamber interior to cool or warm to room temperature before replacing the MHG lamp or skin injury may result.

5.1.3 Lamp Replacement Frequency

Replace the lamp and ODF filter after 750 to 1000 hours of use (note the hours meter on the EPS lamp power supply module, Fig. 4-2). If recrystallization, haze or deformation on the glass tube is visible, replace the lamp due to increased risk of shattering.



CAUTION! INSTRUMENT DAMAGE

When replacing a lamp, check the lamp terminals/heatsinks for a tight fit with the new lamp. If the fit is loose, replace the lamp terminals or lamp overheating may result.



NOTE

When installing a new lamp, always clean the lamp with methylated spirits and clean dust from the reflector and front glass filter with optical glass cleaner.



NOTE

When installing the lamp tube, orient the fill melt bead upward toward the lamp reflector.



Fig. 5-1 MHG Lamp Tube
Fill Melt Orientation

5.0 OPERATION

5.1.4 Lamp Installation Procedure

1) Shut off power to the instrument at the main power switch on the side panel of the SEC instrument. Then turn off power at the safety disconnect switch mounted on the wall.

2) Inside the test chamber, open the luminary access door (Fig. 5-2) beneath the MHG lamp to be replaced. On SEC 600/1100 models, slide open the upper lamp access carriage (Fig. 4-3).



Figure 5-2 Luminary Access

3) Using a large flat-blade screwdriver, open the four rotary locks on the front of the lamp frame (turn clockwise) as indicated in Fig. 5-3.

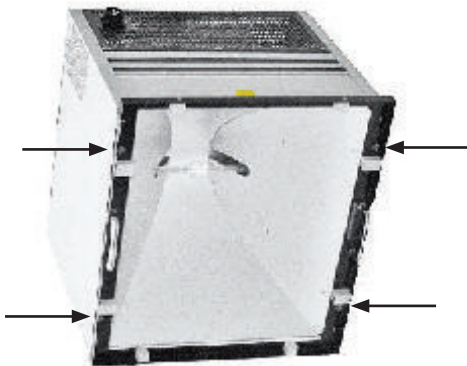


Figure 5-3 MHG Lamp Rotary Lock Screw Locations

4) Hold the front frame by the two chrome handles and pull it downward and out to access the lamp tube.

5) Using an 8 mm socket wrench, loosen the clamp nuts (Figure 5-4) on the lamp terminals so that the holder clamp can be opened and the lamp, along with the terminals/heatsinks, can be removed from the lamp housing.

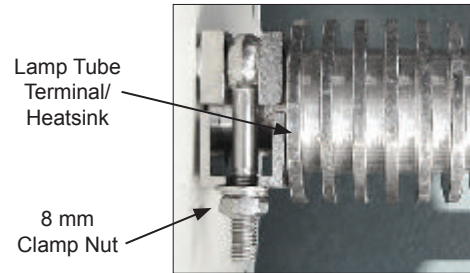


Figure 5-4 MHG Lamp Terminal Clamp

6) Swing out the threaded clamp bolts and then carefully lower the lamp tube out of the fixture.

7) Clean the lamp interior surfaces, reflector and front filter glass with a lint-free cloth and optical glass cleaner.

8) Remove the new lamp from its packing and clean it entirely with methylated spirits. Handle it only by the metallic ends.

9) Remove the terminal/heat sink ends from the old MHG lamp tube and place them onto the new lamp tube.

10) Locate the new lamp tube in the terminal clamps as indicated below in Figure 5-5. The lamp tube terminals/heatsinks must be located against the terminal clamp with no gap. This allows the lamp tube to expand when heated.

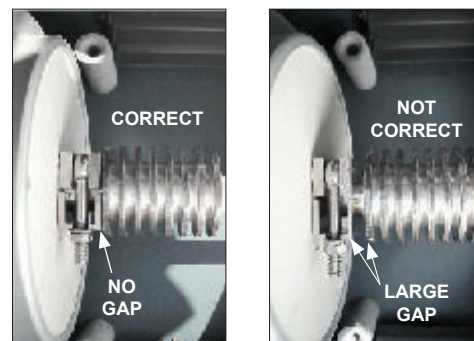


Figure 5-5 Lamp Tube Terminal Positioning in Clamp

11) Rotate the lamp tube to orient the fill melt upward (Fig. 5-1), then tighten the clamp bolts to secure the lamp tube in its mounting.

12) Reinstall the lamp front frame and secure it by turning the four rotary lock screws counter-clockwise. Close the luminary access door.

5.0 OPERATION

5.2 Touchscreen Operation

The majority of operational procedures are conducted with the use of the Touchscreen. It allows the user to perform and monitor the following functions:

Function	Touchscreen Page
Manual Test Control	Main
Programmed Test Control	Main + Test Setup
Monitor Test Status & Trend Plot	Main + Monitor
Data Acquisition (Settings - See below.)	DAQ
DAQ, Pyranometer, Password & Screen Lock Settings	System > User Setting (Password protected)
System Alarms	System > Alarm Signal (Password protected)
Computer Shutdown	Exit (Password protected)

To operate the Touchscreen, you must first become familiar with the various pages (screens) and their proper usage, as described in the following sections. Detailed, step-by-step procedures for operating the SEC instrument are included in section 5.4 Test Operation and Monitoring.

5.2.1 Solar Chamber Program

After the system computer is started, the Windows desktop screen appears as shown below.



Touch the Solar Chamber program icon to start the touchscreen program for SEC instrument operation. The program menu will appear as shown in section 5.2.2, next.

5.0 OPERATION

5.2 Touchscreen Operation (cont.)

5.2.2 Menu Page



FUNCTION

Allows the user to select the page desired to perform control, monitoring and programming functions. The basic functions are as listed below.

Touchscreen Page	Function
Main/Run/Stop	Manual and Program Test Control
Monitor	Monitor Test Status / Search Trend Plot Test Data
Test Setup	Test Selection / Custom Test Programming
DAQ	Data Acquisition Control
Exit	Computer Shutdown Before System Power Off
System	User Settings, I/O, DAQ, Alarms/History, Password & Pyranometer Setup

OPERATION

Touch one of the five buttons to advance to that touchscreen page.

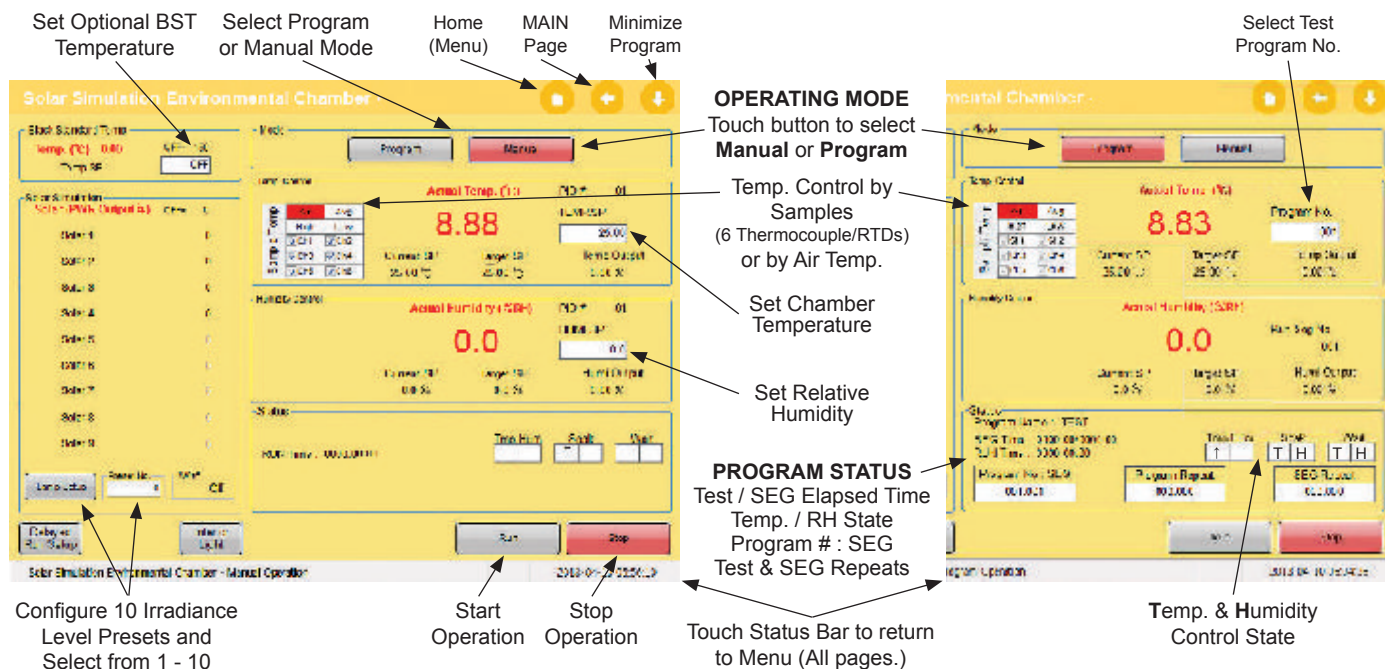
5.0 OPERATION

5.2 Touchscreen Operation

5.2.3 Main/Run/Stop Page

MANUAL MODE PAGE

PROGRAM MODE PAGE



FUNCTION

Allows the user to initiate operation in Manual mode or Program mode, observe test and process variable status, as well as input a name for the test and add remarks.

OPERATION

Select Operating Mode: Touch the large buttons that display Program or Manual and the page will change to include the features of that mode.

Manual Mode: Manually set the optional BST or Black Standard Temperature (Temp.SP at upper left), Humidity (Humi.SP) and the MHG lamp irradiance level (Preset No. under Solar Simulation). Under Temp. Control, select as the control feedback some or all of the thermocouples (Ch1 - Ch6) monitoring the test samples, the Low, High or Average (Avg) of them, or select Air to control by air temperature. Then touch the Run button to initiate operation. The instrument runs under these settings until the Stop button is touched. See section **5.4.2 Manual Mode Operation** for more information.

To Adjust Setpoint (.SP) Values: Touch the white value box and a virtual keypad appears. Input the desired set point value and then touch the Enter (ENT) key.

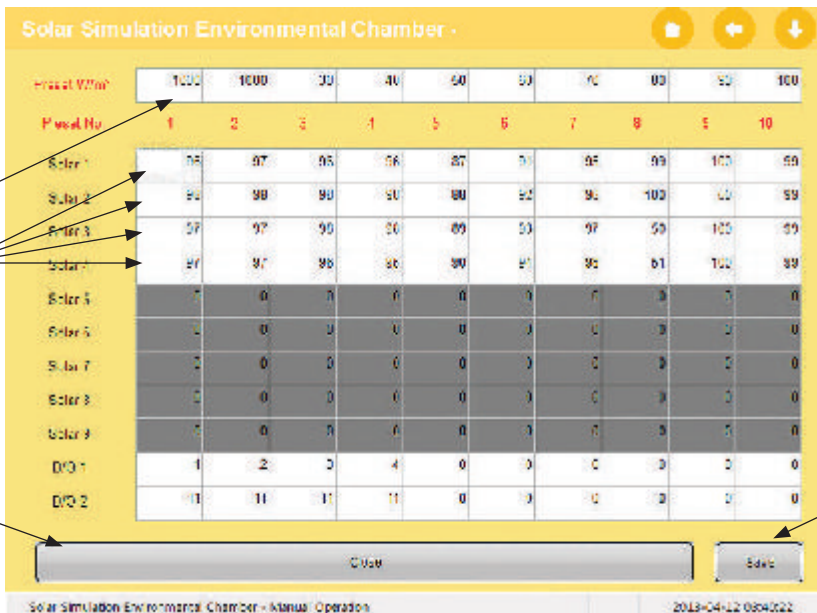
Program Mode: The user configures a custom test program (on the Test Setup touchscreen pages) and then selects that program for use in this Main page. The program may have multiple segments, multiple events (lamps on or off, changing temperature and humidity with wait and soak periods) and may include repeats of the program or of selected test segments. See section **5.4.4 Program Mode Operation**.

5.0 OPERATION

5.2 Touchscreen Operation

5.2.3 Main/Run/Stop Page (cont.)

MAIN/RUN/STOP - Lamp Setup



Solar Simulation Environmental Chamber - Lamp Setup

Preset W/m²	1	2	3	4	5	6	7	8	9	10
Power %	100	100	100	100	100	100	100	100	100	100
Preset No.	1	2	3	4	5	6	7	8	9	10
Lamp 1	00	07	05	06	07	01	05	09	100	09
Lamp 2	00	00	00	00	00	00	00	100	00	00
Lamp 3	07	07	00	00	00	00	07	00	100	00
Lamp 4	07	07	00	00	00	00	00	01	100	00
Lamp 5	00	00	00	00	00	00	00	00	00	00
Lamp 6	00	00	00	00	00	00	00	00	00	00
Lamp 7	00	00	00	00	00	00	00	00	00	00
Lamp 8	00	00	00	00	00	00	00	00	00	00
Lamp 9	00	00	00	00	00	00	00	00	00	00
D/O 1	1	2	3	4	0	3	0	3	0	0
D/O 2	11	11	11	11	0	3	0	3	0	0

Buttons: Close, Save

Status bar: Solar Simulation Environmental Chamber - Manual Operation, 2013-04-12 08:04:22

FUNCTION

Allows the user to create Lamp Presets (or preconfigured irradiance levels) for convenient lamp control.

OPERATION

Touch a white value text box and a virtual keyboard appears. Type in the desired value and then touch the Enter (ENT) key. Touch the Save button after inputting new settings.

NOTE

This feature requires the use of a pyranometer to accurately and traceably measure the irradiance level of the lamps. Please refer to section 7.0 Lamp Preset Configuration for a detailed procedure on creating Lamp Presets.

To return to the Menu page, touch the Home button at the upper right. To return to the Main/Run/Stop page, touch the Left arrow button at the upper right.

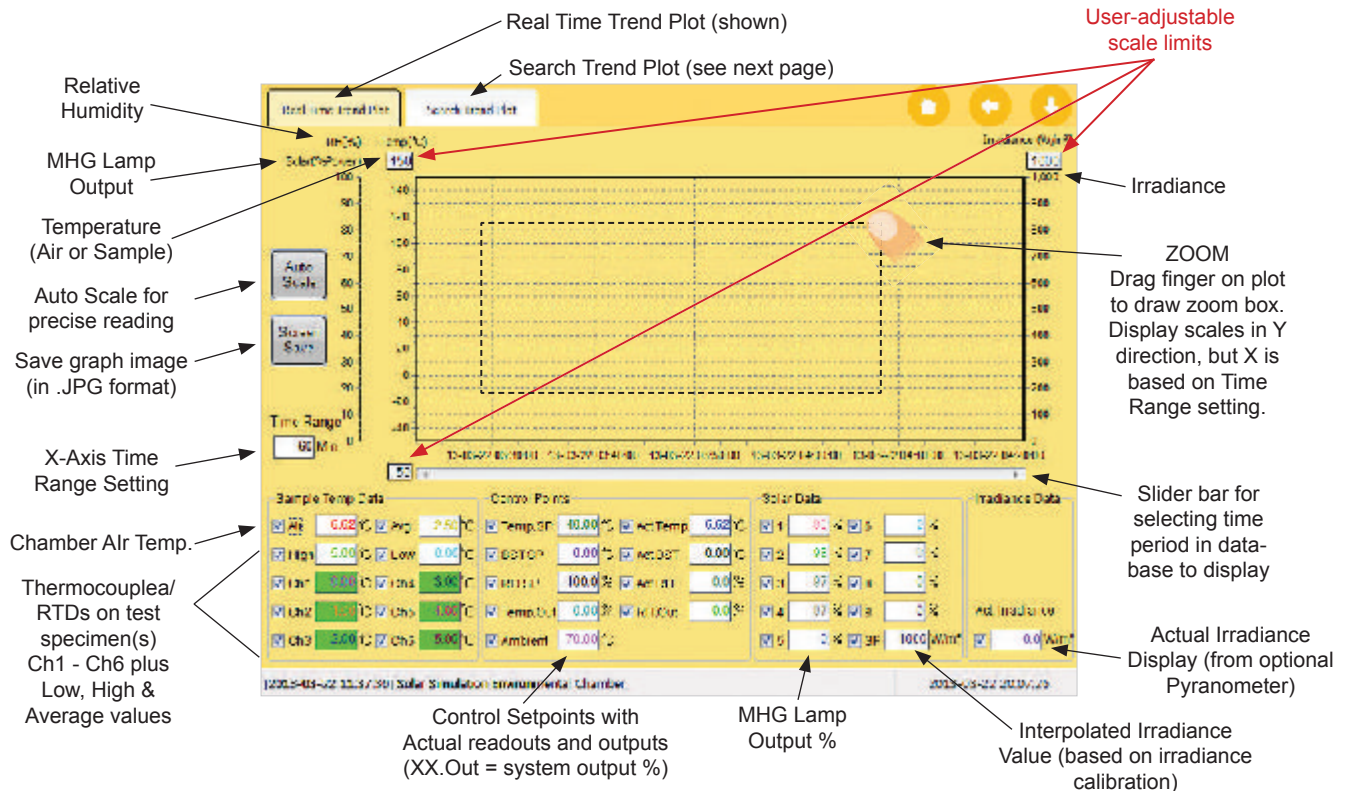
NOTE

To return to the Menu page, touch the status bar at the bottom of page. This applies to all the touchscreen pages that have a bottom status bar.

5.0 OPERATION

5.2 Touchscreen Operation

5.2.4 Monitor Page



FUNCTION

The Real Time Trend Plot provides a graphical display of test chamber temperature, humidity, lamp output and specimen temperatures Ch1 – Ch6 (thermocouples/RTDs). The Time Range may be increased or reduced to show the desired level of detail in the trend graph. The user may also select which process variables to display on the graph, as well as the scale limits for Temperature and Irradiance.

OPERATION

Select Variables to Display: In the lower portion of the page, touch the check box beside each variable you wish to display on the graph. A check mark appears to indicate a variable is selected.

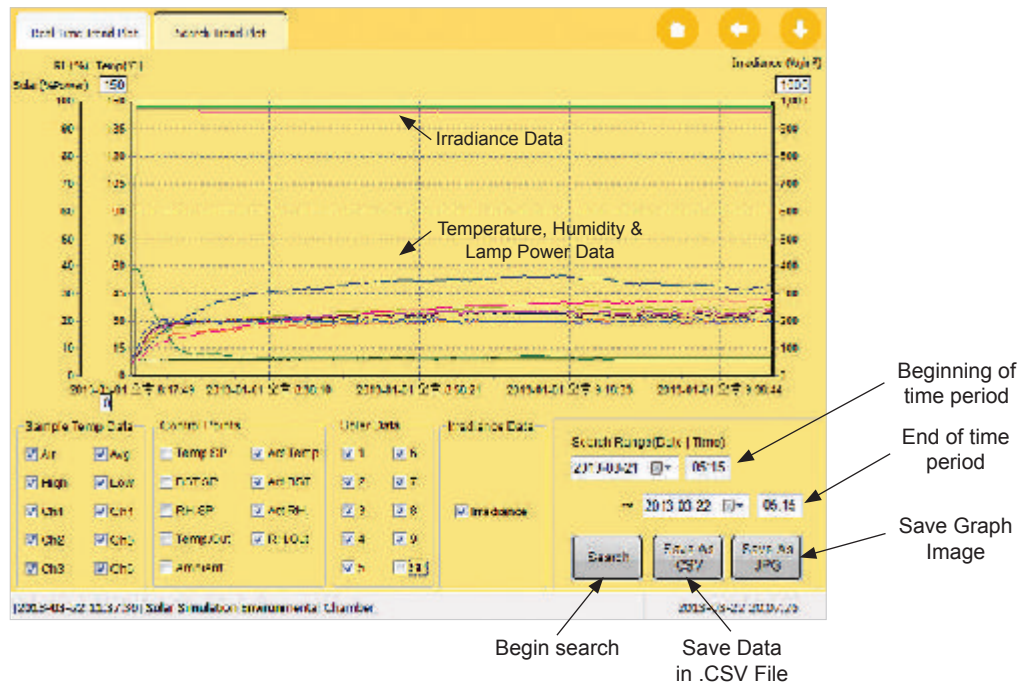
Change Time Range Displayed: Touch the value box beneath Time Range at the lower left and change the X-Axis scaling number to increase or decrease the time period displayed on the graph.

User Buttons: Observe the descriptions on the image above for usage guidance.

5.0 OPERATION

5.2 Touchscreen Operation

5.2.4 Monitor Page (cont.)



FUNCTION

The Trend Plot Search allows the user to view historical data for a selected period of hours, days or longer periods. The data may be saved in JPG image format or in CSV format for importation into Microsoft Excel or other spreadsheet programs.

OPERATION

Search Range: Touch the drop-down menu button on the left date display box and a virtual calendar will appear (shown at right). Touch the Left/Right month arrows and then the day desired as the starting point. Then touch the time display box and a virtual keypad appears. Touch in the desired time and touch the Enter (ENT) key. Perform the same procedures for the second Date/Time. Touch the Search button. The graphical display will update.



Save as .CSV: To save the data of the selected time period for export to Excel or another spreadsheet application, touch this button and a File Save dialog box appears. Save the data file with a descriptive name, typically including the time period it contains.

Save as .JPG: To save the data of the selected time period as an image of the touchscreen, touch this button and a File Save dialog box appears.

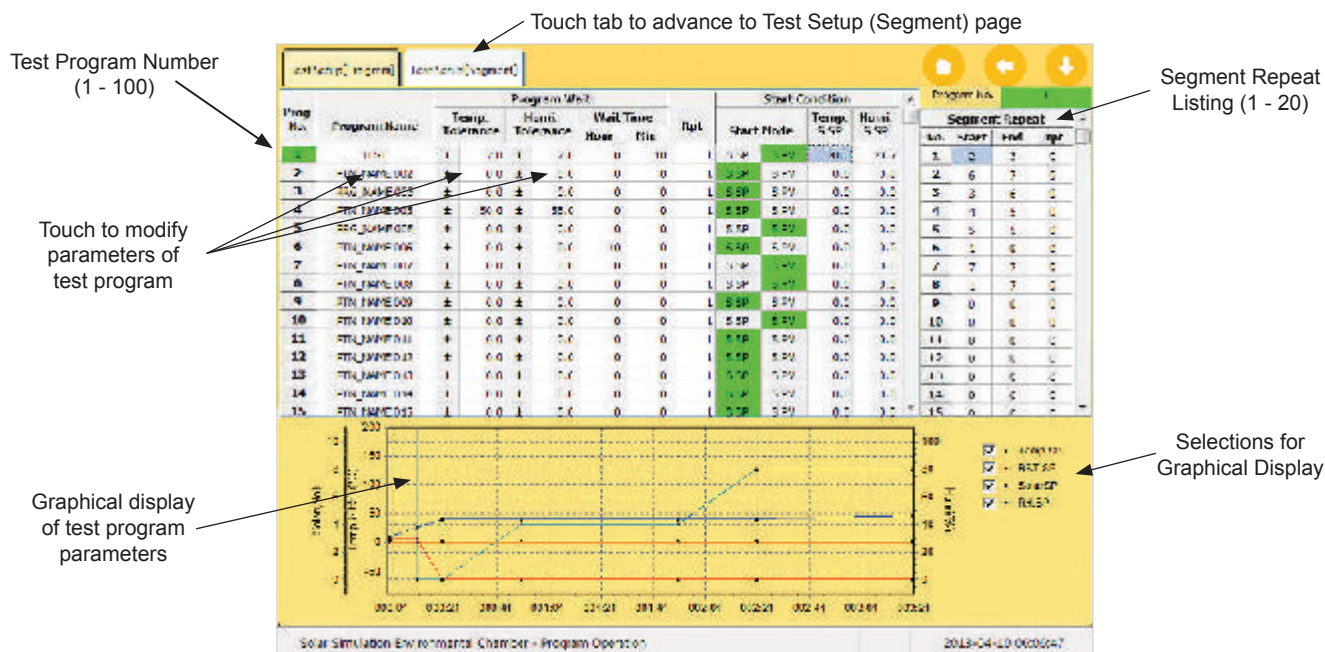
File Name: Typical file name configuration is Test Name_Date_Time, as in SK Test_20120918_124109.csv (or simply Date and Time for Manual tests).

5.0 OPERATION

5.2 Touchscreen Operation

5.2.5 Test Setup Page

TEST SETUP - PROGRAM PAGE



FUNCTION

Custom test programs may be created using this page and the Test Setup - Segment page (touch tab, upper left). Programs may be managed (edited, copied and cleared of settings) using the Prog/Seg Copy/Clear window in the Test Setup - Segment page. To create or modify programs, this page and the Test Setup - Segment page allow manipulation of program settings and segments, including repeat functions for both and control of four (4) digital output circuits to drive peripheral equipment. As a test program is configured, its parameters are displayed graphically as well as numerically in the Programs and Segments listings.

OPERATION

Custom test programming and management is described in detail in section **5.3 Custom Test Programming**. As an overview of the process, the typical sequence of tasks is:

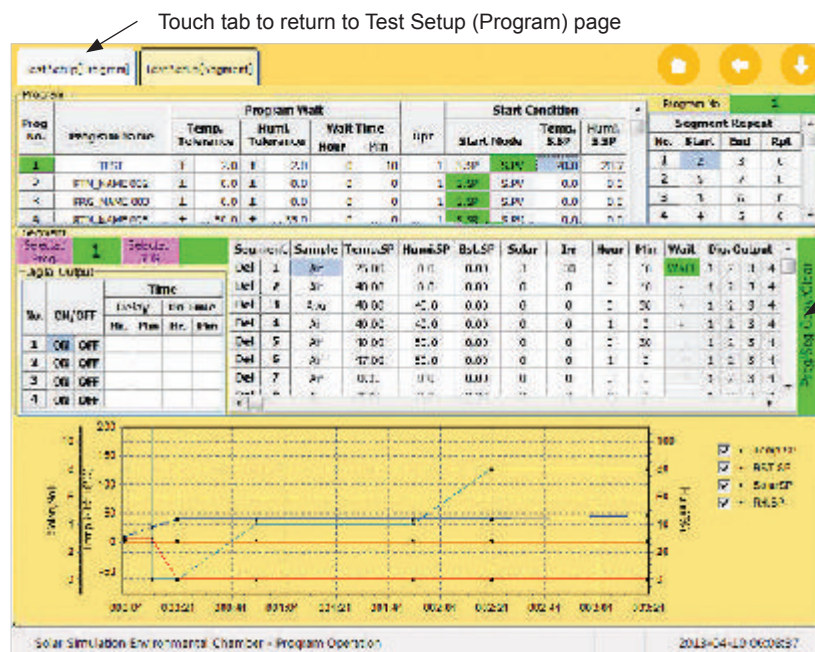
- 1) Select an unused test program number and rename the program.
- 2) Adjust parameters shown above and in the Test Setup - Segment page.
- 3) Add segments and adjust their parameters as needed.
- 4) Apply the repeat function to the test or one or more segments, as applicable.
- 5) Select and run the program in the Main/Run/Stop page (in PROGRAM mode).

5.0 OPERATION

5.2 Touchscreen Operation

5.2.5 Test Setup Page (cont.)

TEST SETUP - SEGMENT PAGE



FUNCTION

This page allows the setup of individual test segments, segment repeats and digital output control for each segment. On this page are entered the Temperature, Humidity, Irradiance and segment Duration settings. As well, selection is made for controlling Sample Temp. by individual sample sensor channel number, Low, High or Average of them, or Air temperature. Additionally, the WAIT function (as setup previously in the Program page) can be activated to delay segment initiation while temperature and/or humidity reach a specified setpoint tolerance. The test program settings are displayed graphically to facilitate comprehension and accuracy.

OPERATION

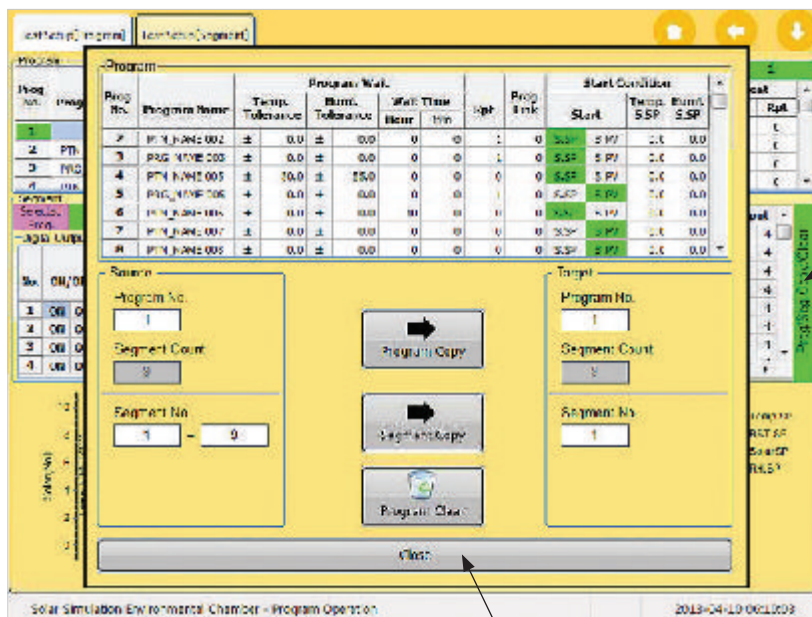
The user simply touches the parameter boxes and adjusts settings using a virtual keypad or a drop-down selection list. For details and the programming procedure, refer to section **5.3 Custom Test Programming**.

5.0 OPERATION

5.2 Touchscreen Operation

5.2.5 Test Setup Page (cont.)

TEST SETUP - PROG/SEG COPY/CLEAR



Touch green title bar to bring up the Program/Segment Copy/Clear window.

Touch Close button to conduct the desired Copy or Clear operation and return to the Test Setup (Segment) page.

FUNCTION

This Pro/Seg Copy/Clear window allows copying of a program over another program location (program Copy button) as well as copying of one or more segments to another program (Segment Copy button). It also allows clearing (zeroing of all settings) of a program (Program Clear button).

OPERATION

- 1) Under **Source** Program No., select the program number from which you wish to copy or clear.
- 2) If Clearing, touch the **Program Clear** button and then touch the **Close** button. If not Clearing, go to step 3.
- 3) Under **Source** Segment No., select the segment or group of segments you wish to copy.
- 4) Under **Target** Program No., select the program number to which you wish to copy.
- 5) Under **Target** Segment No., select the segment number to which you wish to copy.
- 6) Touch the **Copy Program** or **Copy Segment** button. **NOTE:** When copying multiple segments, they will overwrite the target segment and any subsequent segments equal to the number of segments being copied.
- 7) Touch the Close button to conduct the copy operation.

5.0 OPERATION

5.2 Touchscreen Operation

5.2.6 User Setting Page

Password

Enter password for System pages access and Exit control.

Factor

Conversion factor for mV to Watts/m² for pyranometer. (From pyranometer calibration certificate.) Used for pyranometer setup.

Screen Lock

When on (red button) causes touchscreen to lock after 1 minute of non-use. User must enter password to unlock and use the touchscreen.

DAQ Sampling Interval

Range: 1 - 999 Sec

DAQ File Save Location

File name will be test program name + time/date completed.

Use Time (Hour)

Lamp operation hours counters. Touch reset button(s) after replacing lamp burner (bulb).

Save

Touch this button to save changes made to values on this page.

Irradiance - Set to 1000. Thus pyranometer Factor (Sensitivity) in μV will be in mV.

FUNCTION

This page allows the user to set up the pyranometer for providing irradiance (W/m^2) measurements to the system, essential for conducting the Preset Configuration Procedure (see section 7.0). Values from the pyranometer calibration certificate are input under the Pyranometer Setup section of the page. This allows the Monitor page to show a direct and precise irradiance reading under the Irradiance Data - Actual Irradiance (285-2800nm) display (at that lower right of the page) when the pyranometer is in use. This User Setting page is accessed from the Menu page (**System** button) and requires entering of a password. This page also allows changing the DAQ file save location and setting of the data acquisition recording interval. Lamp operating hours are also recorded and resettable.

OPERATION

Depending on the pyranometer used, it may have up to four temperature ranges and Factors (Sensitivity values) that must be input in this page for proper operation. A typical calibration certificate is shown below.

KIPP & ZONEN SINCE 1930		CALIBRATION CERTIFICATE
CERTIFICATE NUMBER	00150100156	
PYRANOMETER MODEL	CM-4	
SERIAL NUMBER	100156	
SENSITIVITY	7.75 $\mu\text{V}/\text{m}^2$ at normal incidence with normal pyranometer	
IMPEDANCE	E16	
TEMPERATURE	22.1 $^{\circ}\text{C}$	
REFERENCE PYRANOMETER	Kipp & Zonen CMP 3 and 7775 active from 26/11/2012	
CALIBRATION DATE	26 June 2012 (recalibration is recommended every two years)	

5.0 OPERATION

5.2 Touchscreen Operation

5.2.7 Exit Page



FUNCTION

The Shutdown page allows the Solar Chamber program and the system computer to be shut off prior to turning off all power to the SEC instrument.

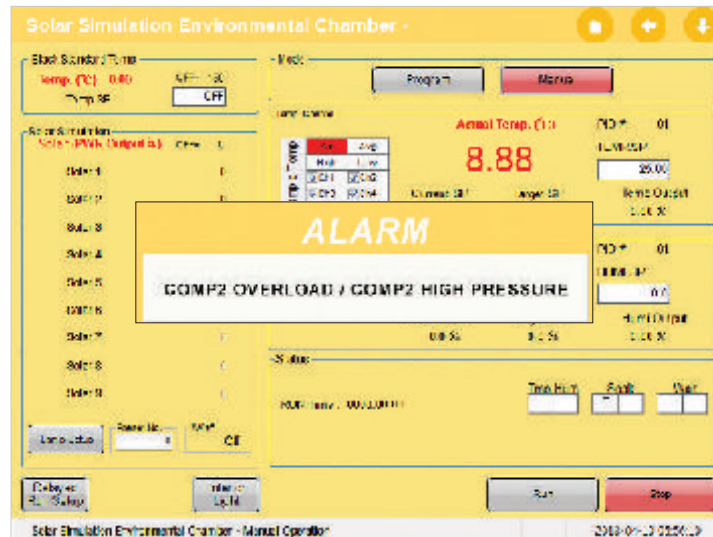
OPERATION

- 1) In the Menu page, touch the Exit button and the screen above appears.
- 2) Touch in the password 9999 on the virtual keyboard and then touch the Enter key.
- 3) Touch the OK button in the System Log-in dialog box.
- 4) The Solar Chamber program will terminate and the Windows desktop will appear.
- 5) Touch the Windows Start button and select Shut down to turn off the system computer.
- 6) Allow the computer to shut down completely.
- 7) Turn off the main power switch on the side of the SEC instrument.

5.0 OPERATION

5.2 Touchscreen Operation

5.2.8 Alarm Notice Example



FUNCTION

Provides visual indication about which subsystem error caused instrument shutdown.

OPERATION

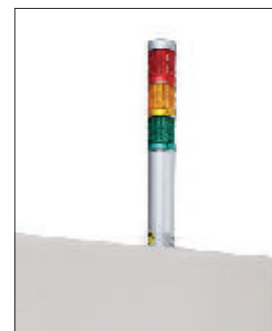
Any one of the 11 alarms shown below will cause a system shutdown and an Alarm message on the touchscreen display. As well, the status light beacon on top of the instrument will indicate Red. To shut off the audio alarm, touch the Alarm message on the touchscreen. **Refer to section 8.0 Alarm Responses for alarm details.**

Alarm Code	Description	Delay (seconds)
1	Emergency Temp Over Error	2
2	Lock Error	2
3	Door Closed Error	2
4		5
5		10
6		10
7		10
8		10
9		10
10		10
11		10

Alarm Code	Description
1	Temp Over Error
2	Comp1 Error
3	Comp2 Error
4	Comp3 Error
5	Comp4 Error
6	Comp5 Error
7	Comp6 Error
8	Comp7 Error
9	Comp8 Error
10	Comp9 Error
11	Comp10 Error

System Alarms List

DO NOT alter
Delay Time settings



Status Light Beacon

Red = Error
Yellow = Ready to run
Green = Operating (Normal)

5.0 OPERATION

5.2 Touchscreen Operation

5.2.9 Touchscreen Page Map

Touchscreen Page Map

**Main/Run/Stop
(Program mode)**



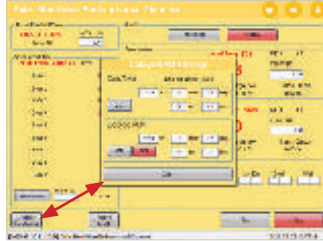
**Main/Run/Stop
(Manual mode)**



**Lamp Setup
(Configure Lamp Presets)**



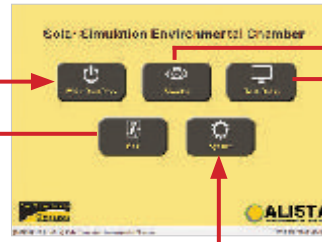
**Delayed Run Setup
(Start Delay Setup)**



**Main/Run/Stop
(Example Alarm)**



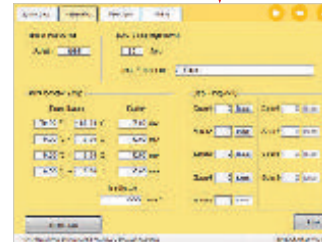
Main Menu



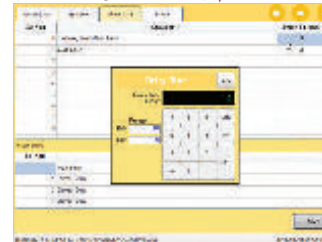
**System
(Password)**



**User Setting
DAQ, Pyranometer**



**Alarm Signal
(and Delay Time Set)**



**Exit
(Password)**

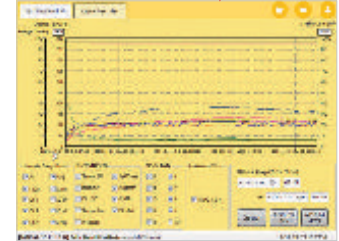


Monitor

Real Time Trend Plot



**Monitor
Search Trend Plot**



**Test Setup
Program**



**Test Setup
Segment**



**Test Setup
Prog/Seg Management**



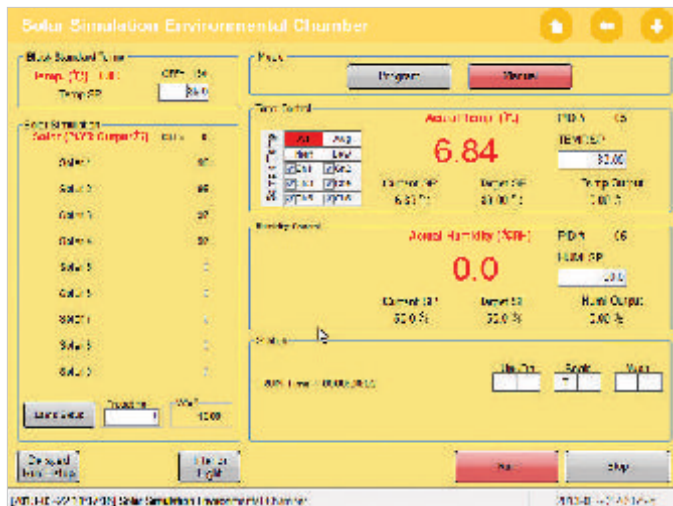
5.0 OPERATION

5.3 Custom Test Programming

Operating in Manual mode allows the user to run the SEC instrument only under steady-state conditions. To create cycling conditions, you must operate the instrument in Program mode where a sequence of differing operating conditions is executed automatically. Create test programs for use in Program mode as described below. (Or see section 5.4 for Manual mode operation.)

5.3.1 Test Programming Procedure

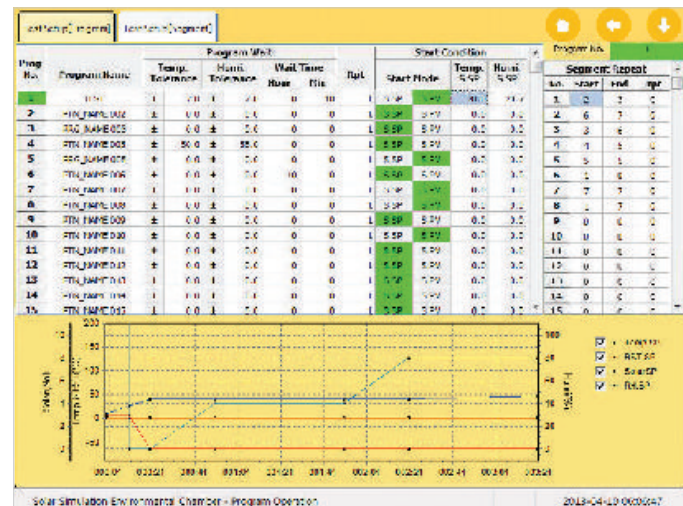
1) Stop any test that may be running by touching the **Stop** button in the touchscreen Main page, as shown below.



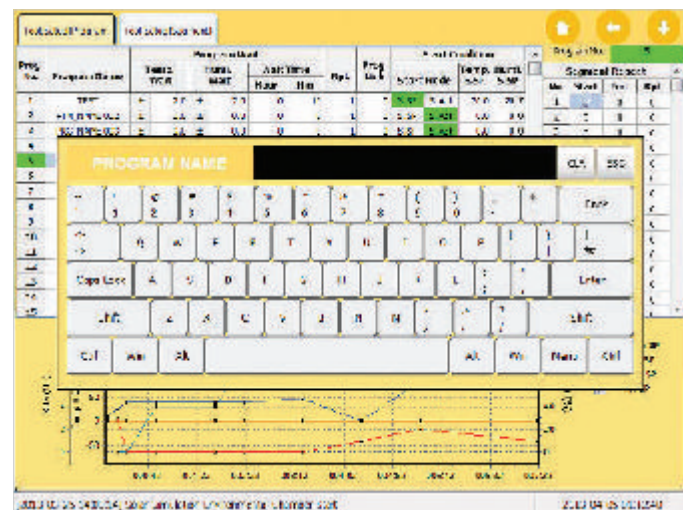
2) Touch the **status bar** at the bottom of the Main page and the Menu appears, as shown below.



3) Touch the **Test Setup** button and the page below appears.



4) In the Program Name list, touch the test name to edit and a virtual keyboard appears as shown below.



5) Touch in the name desired for the test program and then touch the **Enter** key. The new program name will appear in the Program Name list.

6) Touch the new program number in the Prog. No. column to highlight it (green), allowing modification and the adding of segments.

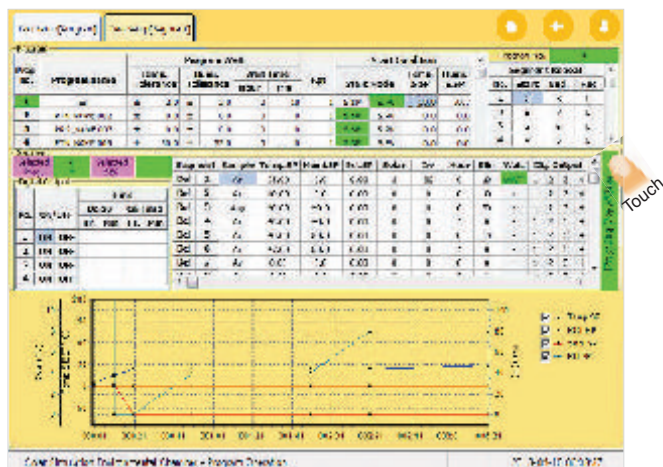
OPTIONS:

Edit Program Name: Touch the program name and a virtual keyboard appears. Edit the name as desired then touch the **Enter** key.

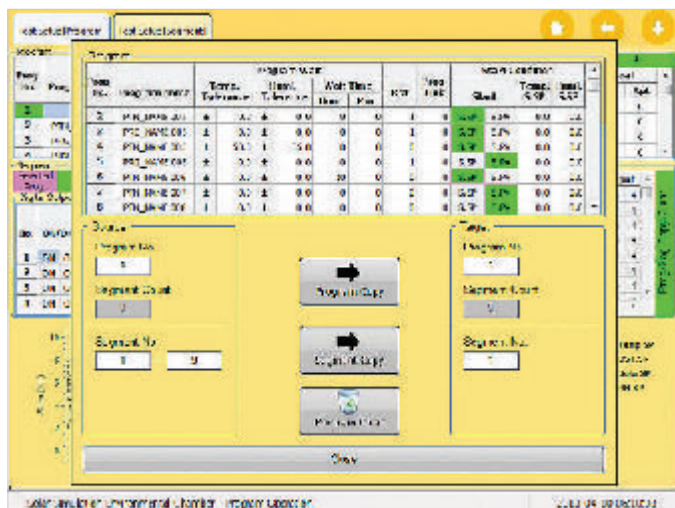
5.0 OPERATION

5.3.1 Test Programming Procedure (cont.)

Program Copy & Clear: Allows program or segment copying and resetting of all program settings to zero. Touch the **Test Setup [Segment]** tab at the upper left and the page below appears. Touch the green, vertical **Prog/Seg Copy-Clear** button as indicated below.



The page below appears to allow program and segment clearing and copying functions.



Follow the steps below to conduct a program clear or to copy a program over another program or to copy segments of one program to another.

- A) Under **Source** Program No., select the program number from which you wish to copy or clear. Use the virtual keypad that appears.

- B) If Clearing, touch the **Program Clear** button and then touch the **Close** button. If not Clearing, go to step C.

- C) Under **Source** Segment No., select the segment or group of segments you wish to copy.

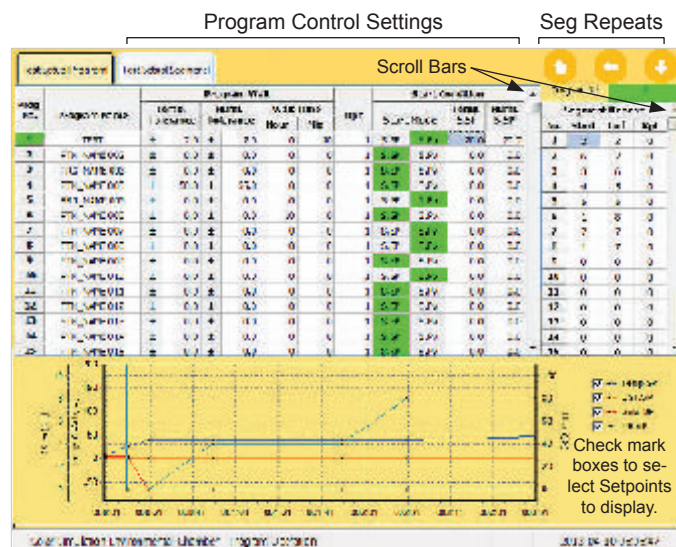
- D) Under **Target** Program No., select the program number to which you wish to copy.

- E) Under **Target** Segment No., select the segment number to which you wish to copy.

- F) Touch the **Copy Program** or **Copy Segment** button. **NOTE:** When copying multiple segments, they will overwrite the target segment and any subsequent segments equal to the number of segments being copied.

- G) Touch the **Close** button to conduct the copy operation.

- 7) Touch the **Test Setup (Program)** tab at the upper left and the page below appears.



- 8) Adjust the parameters of the test program as described on the following pages. These include **Program Wait**, **Rpt** (Repeats) and **Start Condition**. Depending on your test program, you may have a need to use some or all of these features.

5.0 OPERATION

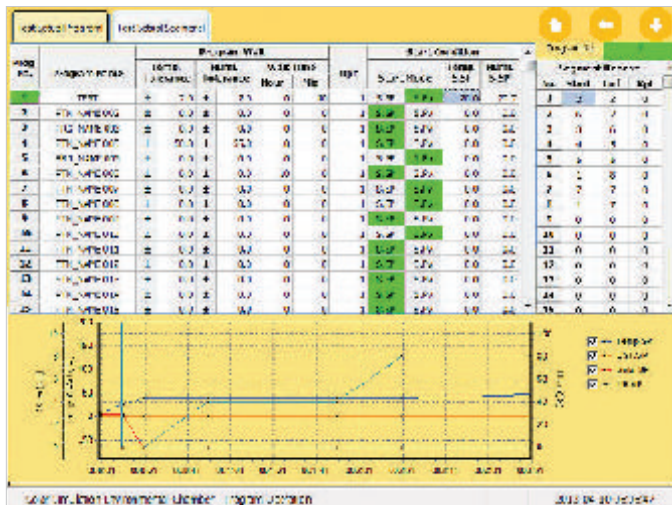
5.3.1 Test Programming Procedure (cont.)

PROGRAM CONTROL SETTINGS

These settings, Program Wait and Start Condition, apply to the test program and are used to control temperature and humidity behavior at program initiation and during segment transitions. There are two types of Repeat (or loop): Program Repeats and Segment repeats. These allow looping of an entire program, or of selected segments within a single program.

Program Wait

This feature allows the controller to wait (hold the segment time counting) until the temperature and/or humidity are within a specified tolerance of the setpoint value of the test segment. This ensures that the test samples are definitely exposed to the segment setpoint conditions for a specific period of time.

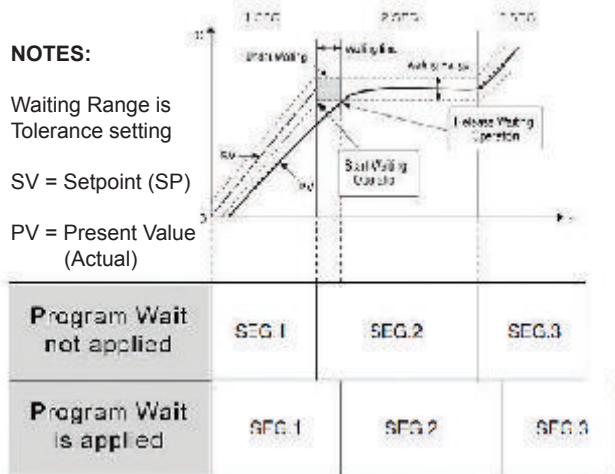


Temp. Tolerance: Set this to the tolerance (in °C) of the segment temperature setpoint that you require the actual temperature (PV) to be within before continuing the segment time countdown. Set it by touching the white value box in line with your test program number and name. Use the virtual keypad that appears to adjust the setting and then touch the Enter (ENT) key to update the setting. Illustrations of this setting are shown

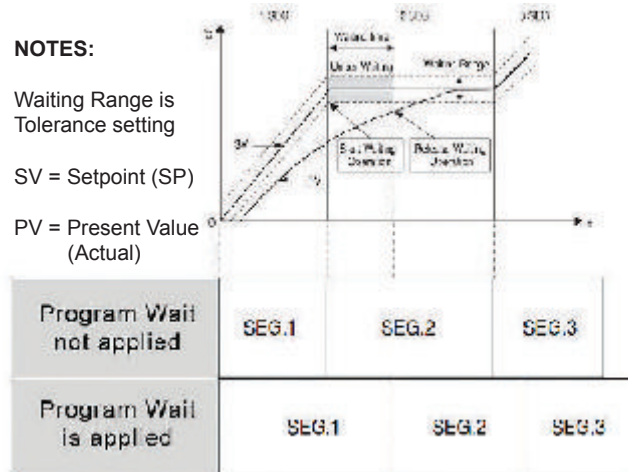
below.

i IMPORTANT NOTE

The Program Wait settings are selectively applied by the user during the segment setup procedure. If you do not wish to use this feature, adjust the Program Wait settings to zero (0).



Program Wait vs. No Program Wait



No Program Wait vs. Too Short a Wait Time

Wait Time: Set this to the period of time you require the test program to wait to allow the Temperature or Humidity actual (PV) to reach the specified parameter tolerance previously set.

5.0 OPERATION

5.3.1 Test Programming Procedure (cont.)

Program Repeat

The **Rpt** (repeat) setting allows you to define how many times the entire program will repeat its operation.

Rpt: Set this to the number of program repeats required.

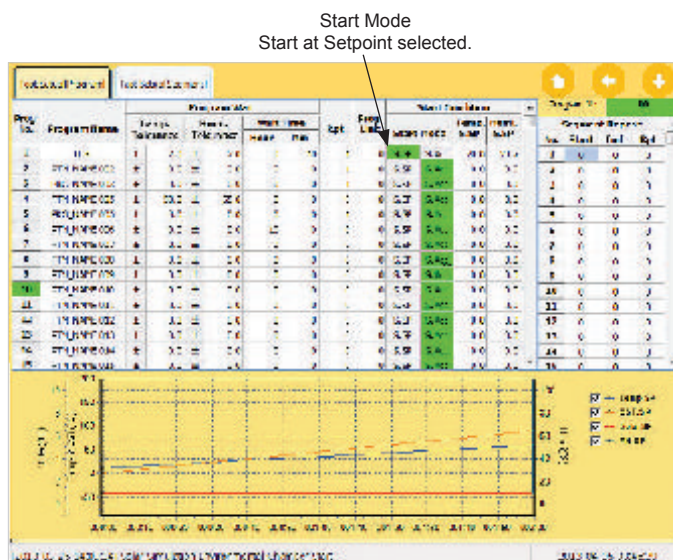
Start Condition

The Start Condition feature allows you control whether the test program starts operating immediately, regardless of the temperature and humidity conditions in the test chamber, or at the temperature and humidity conditions you specify with this feature. This allows you to maximize the initial exposure of test specimens to stable, Segment 1 conditions. The mode options are:

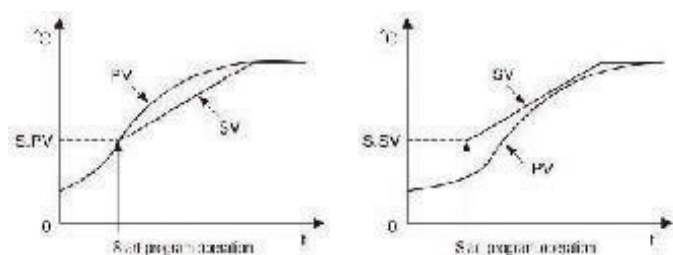
S.SP - Start at Setpoint: Start the test program when conditions are as specified by the Temp. S.SP and Humi. S.SP values.

S.Act - Start at Actual (PV): Start the test immediately at test chamber conditions.

Start Mode: Set this to S.SP if you wish to specify the start conditions or set it to S.Act if you want the test program to start from the current (**Actual**) conditions present in the test chamber. Make your selection by touching the appropriate indicator and it will change to green, as shown below.



The conditions of the two modes are illustrated below.



Start at Setpoint (S.SP)

Start at Actual (S.Act)

Temp. S.SP: Set this to the desired temperature setpoint (typically, the Temperature setpoint of your first test program segment). Touch the value box, enter the setting on the keypad and touch the Enter (ENT) key.

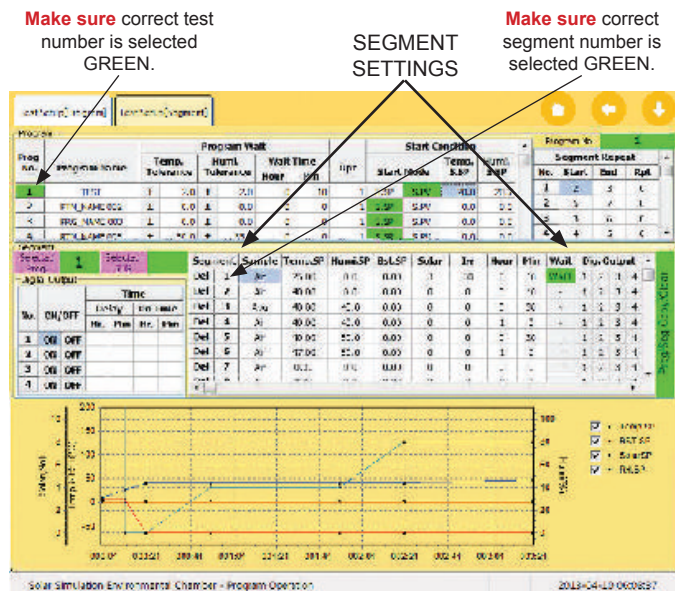
Humi. S.SP: Set this to the desired humidity setpoint (typically, the Humidity setpoint of your first test program segment). Touch the value box, enter the setting on the keypad and touch the Enter (ENT) key.

5.0 OPERATION

5.3.1 Test Programming Procedure (cont.)

SEGMENT SETUP

9) Touch the **Test Setup [Segment]** tab at the upper left and the page below appears.



Allowable Ranges for Control Parameters

Temperature: -20 to 120°C Lamps on (100° - 4100)
-40 to 120°C Lamps off (600/1100/2100)
-30 to 100°C Lamps off (4100)

Optional BST: Set to required BST temp. in °C
(Black Std. Temp.) Set to 150 for BST = OFF

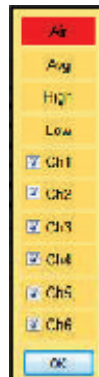
RH: 20 to 80% (±5%) Lamps on
(Relative Humidity) 30 to 95% (±5%) Lamps off

SOLAR#: 75 to 100% Output
(MHG Lamps) (800 - 1200 W/m² Full Spectrum)



Below 75% power output, MHG lamps do not provide full-spectrum irradiance.

10) Set the **Sample** parameter by touching the white value box. A selection list appears as shown at right. Touch the desired temperature feedback control type. Then touch the **OK** button.



Air = Control by air sensing

Avg = By Average of sample sensor channels selected

High = By Highest sample sensor channel selected

Low = By Lowest sample sensor channel selected

Ch1 - 6 = Touch the check box to select with check mark. Touch to right to select (red highlight) a single channel as the temperature feedback control.

In this page you will set the following for each segment of your test program.

Sample (Temp. Sensing Type): Air or Sample:
Low High Avg. Ch1 Ch2 Ch3 Ch4 Ch5 Ch6

Temp.SP: Temperature Setpoint

Humi.SP: Humidity Setpoint

Bst.SP: Black Standard Temp. Setpoint (Optional)

Solar: Lamp Preset number. Irradiance level (W/m²) is displayed in the Irr. column.

Hour and Min: Time duration of segment

Wait: Selection for activating Program Wait (applying it to a segment).

Dig. Outputs: Digital Outputs On/Off, Delay time and On Time (or active time) per segment.

11) Set the **Temp.SP** by touching the white value box. A virtual keypad appears. Touch in the new value, then touch the Enter (ENT) key.

12) Set the **Humi.SP** by touching the white value box. A virtual keypad appears. Touch in the new value, then touch the Enter (ENT) key.

13) Set the optional **Bst.SP** by touching the white value box. A virtual keypad appears. Touch in the new value, then touch the Enter (ENT) key. To disable BST, set it to 150.

5.0 OPERATION

5.3.1 Test Programming Procedure (cont.)

14) Set the **Solar** parameter by touching the white value box. A selection list appears as shown at right. Touch the desired irradiance level. The selection appears in the **Irr. (Irradiance)** column of the segment listing.

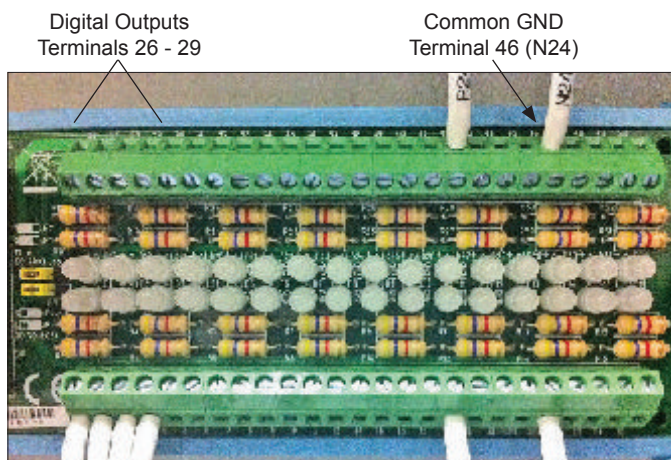
Watt/m ²
0 = off
1 = 1000
2 = 1000
3 = 30
4 = 40
5 = 50
6 = 60
7 = 70
8 = 80
9 = 90
10 = 100

15) Set the **Hour** and **Min** parameters by touching the white value box. A virtual keypad appears. Touch in the new value, then touch the Enter (ENT) key.

16) Set the **WAIT** parameter by touching the selection box and it will change from a dash (-) to WAIT with a green highlight. Select WAIT if you require a program waiting period at the beginning of the segment to allow the actual temperature to reach the tolerance (of this segment's Temp. SP) you have set under Program Wait, previously (see Step 8).

Digital Outputs

The SEC unit is equipped with four (4), user-configurable digital outputs. This is achieved using a Digital I/O PCI card and a terminal block in the electrical-controls cabinet. Output voltage is adjustable from 5 to 40 Vdc, with a current sinking ability of 200 mA per channel, max.



Digital Output	Output Terminal
1	26
2	27
3	28
4	29
	46 (Com)

The digital outputs are useful for driving relays or other controls, such as for switching an electrical load across the solar modules under test. And this can be performed on a segment-by-segment basis with controlled Delay and On Time.

Digital output control includes the ability to set a delay period before the output turns on within a test segment, and setting a duration period for adjusting how long the output remains activated, as shown by the Delay and On Time settings below (from the Test Setup [Segment] page).

No.		Time			
		On Delay		On Time	
	ON/OFF	Hr.	Min	Hr.	Min
1	ON OFF	5	0	0	0
2	ON OFF	1	3	0	0
3	ON OFF	0	0	4	0
4	ON OFF	0	0	0	5

Setting Digital Outputs for a Segment



In the segments listing, **make sure the correct segment number is selected and Green highlighted.**

17) To turn on a digital output for a segment, touch the ON box to the right of the output number and it will turn green, as shown above. To turn it off, touch the OFF box. Set the Delay and On Time by touching the white value boxes and using the virtual keypad. The segment listing below indicates the digital output settings selected.

Segment	Sample	Temp.SP	Humid.SP	Dst.SP	Solar	Irr	Hour	Min	Wait	Dig. Outputs	
Seg 1	Al	25.00	0.0	0.00	1	1000	0	10	WAIT	1	2
Seg 2	Al	40.00	0.0	0.00	0	0	0	10	-	1	2
Seg 3	Any	40.00	40.0	0.00	0	0	0	30	-	1	2
Seg 4	Al	40.00	40.0	0.00	0	0	1	0	-	1	2
Seg 5	Al	40.00	80.0	0.00	0	0	0	30	-	1	2
Seg 6	Al	40.00	100.0	0.00	0	0	1	0	-	1	2
Seg 7	Al	0.00	70.0	0.00	1	1000	1	0	-	1	2

Off = gray, On = green

Indicator Only
(shows digital
output settings)

5.0 OPERATION

5.3.1 Test Programming Procedure (cont.)

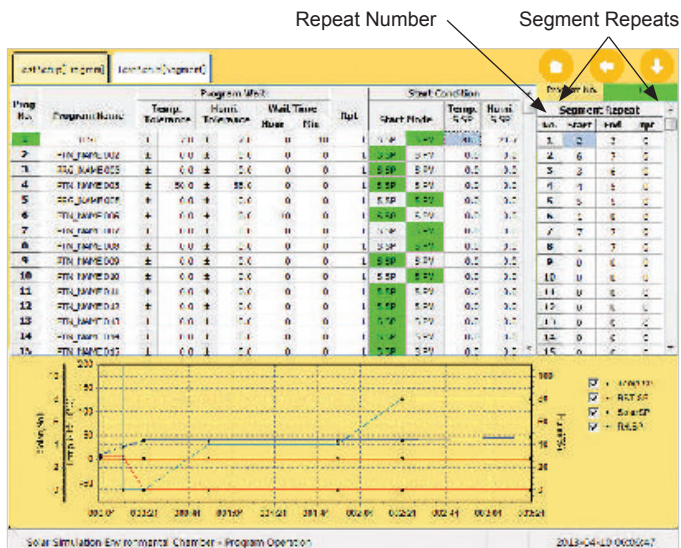


NOTE

The test program will consist of only those segments that you configure. You may delete a configured segment by touching the Del button and then touching the Y (Yes) button in the confirmation dialog.

18) Adjust the settings for additional segments by following the instructions in steps 10 through 17 previously.

19) When segment setup is complete, touch the **Test Setups [Program]** tab at the upper left and the page below appears.



NOTE

If you wish to repeat only one segment, enter the same segment number in the **End** column that you entered previously in the **Start** column.

21) To the right of Repeat no. 1, touch the white value box in the **End** column and a virtual keypad appears. Touch in the required ending segment number and then touch the Enter (**ENT**) key.

22) To the right of Repeat no. 1, touch the white value box in the **Rpt** (repeat) column and a virtual keypad appears. Touch in the number of repeats required for the segment (or group of segments) selected and then touch the Enter (**ENT**) key.

23) Repeat steps 20 through 22 to set each additional repeat required for the test program.

24) Review all your test settings and confirm they are as required.

25) Test programming is complete. To initiate a Manual or Program test, refer to section 5.4 Test Operation and Monitoring.

Segment Repeats

Use a segment repeat to loop or repeat a segment, or a group of segments, one or more times. You may repeat only consecutive segments.

Setting Segment Repeats

20) To the right of Repeat no. 1, touch the white value box in the **Start** column and a virtual keypad appears. Touch in the required starting segment number and then touch the Enter (**ENT**) key.

5.0 OPERATION

5.4 Test Operation and Monitoring

This section describes how to conduct a test using Manual mode or Program mode. To use Program mode, you must create a custom test, as covered in section 5.3 Custom Test Programming.

5.4.1 Specimen Loading Considerations

Instrumentation Sensors: Before loading the specimens, be sure to place and connect the specimen thermocouples/RTDs, the sample surface temp. sensor and optional BST sensor (if applicable) to the sensor ports shown below.



SEC 4100 / 6100



SEC 600 / 1100 / 2100

Route the device leads through the feed-through ports and into the test chamber. Locate the BST sensor on the exposure plane near the module.

Solar Module - Non-operational Exposure

The test chamber of the SEC 4100 accommodates mini and large solar modules. Up to two 1.0 x 1.6 m modules may be tested lying flat (Fig. 5-6) while numerous modules may be tested in a vertical orientation (Fig. 5-7).

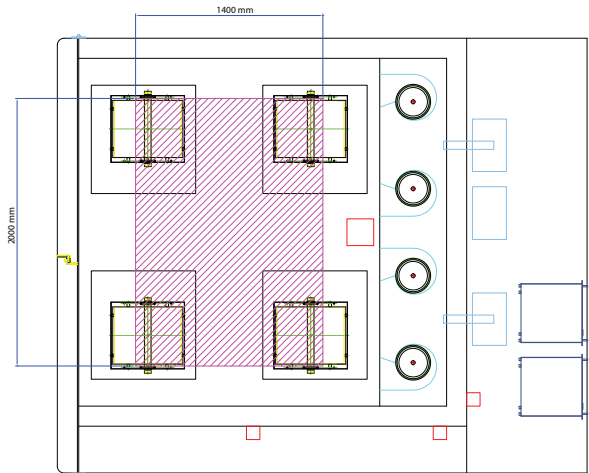


Figure 5-6 SEC 4100 Test Chamber Overhead View

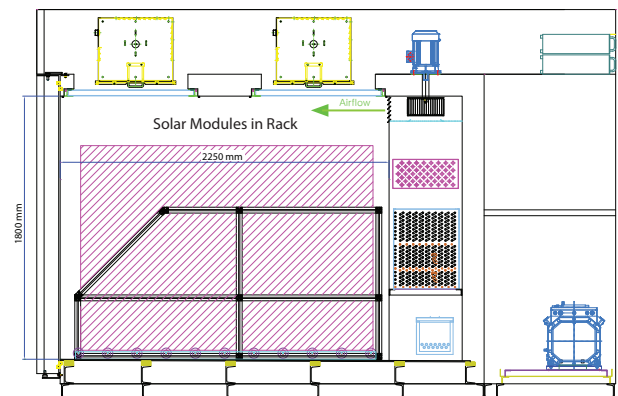


Figure 5-7 SEC 4100 Test Chamber Right-side View

Solar Module - Operational Exposure

Modules tested in a horizontal orientation may be operated beneath the MHG lamps for IV curve attainment. They may be instrumented with the thermocouples/RTDs (Ch1–Ch6) for temperature monitoring. The test chamber includes two wiring feed-through ports for this purpose (Fig. 5-8).

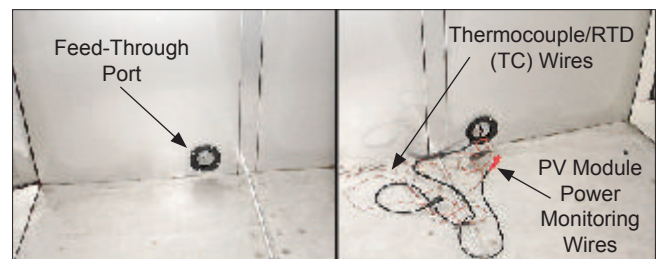


Figure 5-8 SEC 4100 Test Chamber Feed-Through Ports

5.0 OPERATION

5.4.2 Manual Mode Operation

MANUAL mode is useful for running constant or steady-state conditions with no automatic cycling of any test parameters. To initiate this type of operation, conduct the following procedure.

i NOTE

For low-temperature tests without lamp operation, see Appendix B on the use of lamp window insulator panels.

- 1) Place your test specimens in the test chamber and, if applicable, instrument them with monitoring or control wiring (thermocouples/RTDs, etc.).
- 2) Close the test chamber door(s).
- 3) Apply power to the SEC instrument at the wall-mounted safety disconnect switch.
- 4) Turn on the main power switch (Fig. 5-9) on the right side of the instrument.



Figure 5-0 SEC 4100 - Main Power Switch

- 5) Turn on the system computer by pressing the switch indicated in Figure 5-10. View the touchscreen and wait until the Windows program and desktop screen is displayed.

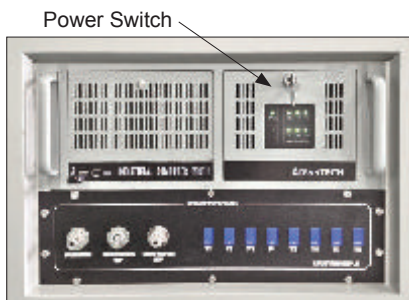


Figure 5-10 SEC PC Power Switch

- 6) On the touchscreen, double touch the Solar Chamber program icon to start the SEC system control application, as shown at the upper right.



- 7) The program Menu page then appears, as shown below.



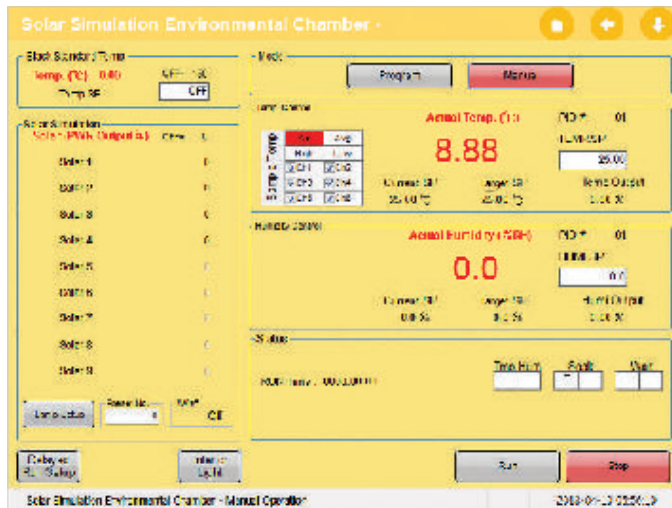
- 8) Touch the **Main/Run/Stop** button.
- 9) The Main page appears, as shown at the upper left, next page. (If the wrong page appears, touch the Home button at the top right of the page or the Status Bar at the bottom of the page to return to the Menu page. Then touch the **Main/Run/Stop** button in the Menu).

i NOTE

If the Program button is red (On), touch the Manual button to activate Manual operation mode.

5.0 OPERATION

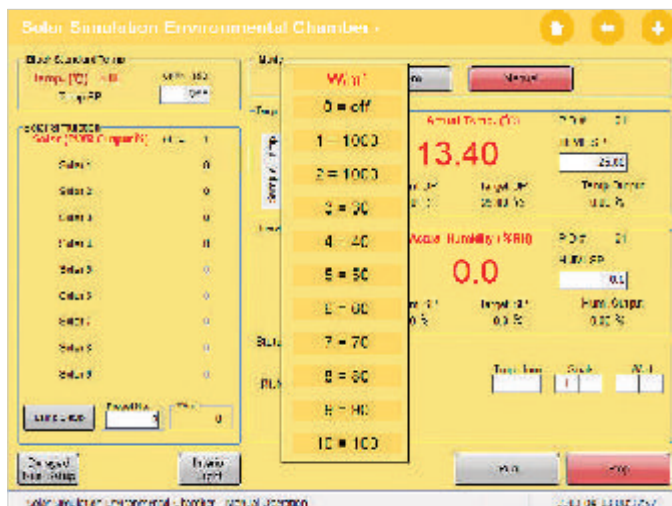
5.4.2 Manual Mode Operation (cont.)



Adjust Control Settings

10) **Adjust optional Black Standard Temp (BST):** Touch the white value box and a virtual keypad appears. Touch in the desired value and then touch the Enter (ENT) key. Or set it to OFF (150).

11) **Adjust Solar Simulation (Irradiance):** Touch the white, **Preset No.** value box and then touch the irradiance level (W/m^2) in the list that appears, as shown below.



If no values appear in the list, configure the Preset levels as described in section 7.0.



About Lamp Presets

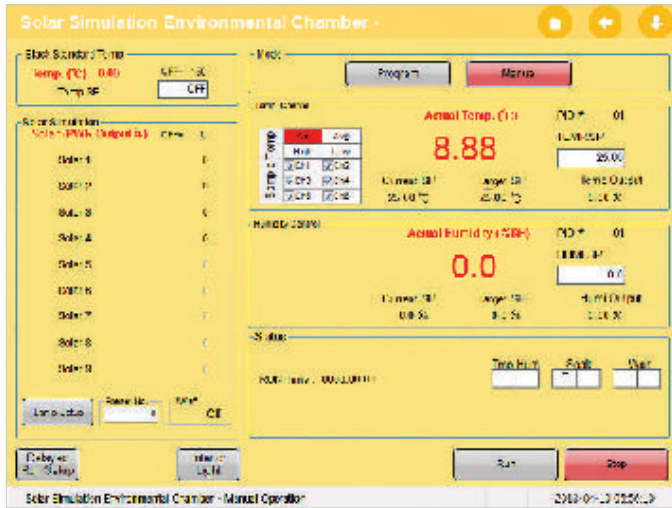
The SEC unit contains MHG lamps numbered Solar 1 through Solar (), as indicated by the white value boxes above. You may configure up to 10 presets of differing irradiance levels. This is achieved with the use of a pyranometer and by adjusting the power setting (output %) of each lamp in the white value boxes beneath a red Preset No.

NOTE

The irradiance value for each preset must be predetermined by operating the instrument and adjusting the output % value of each lamp while using the pyranometer and recording the final settings that equate with each of the desired Preset W/m^2 levels. Refer to section 7.0 for the Lamp Preset Configuration procedure.

5.0 OPERATION

5.4.2 Manual Mode Operation (cont.)



12) Adjust Temp. Control:

This feature manages chamber temperature control. You may choose from among five feed-back methods for controlling temperature. They are:

Sample Temp	Air	Avg
	High	Low
	<input checked="" type="checkbox"/> Ch1	<input checked="" type="checkbox"/> Ch2
	<input checked="" type="checkbox"/> Ch3	<input checked="" type="checkbox"/> Ch4
	<input checked="" type="checkbox"/> Ch5	<input checked="" type="checkbox"/> Ch6

- 1) **Air** Temperature - Air temp. sensing
- 2) Sample **Avg.** - Average of sample temps. (of Ch1 - Ch6 that are selected by check mark).
- 3) **Low** sample temp. (lowest sample temp.)
- 4) **High** sample temp. (highest sample temp.)
- 5) Any single sample temp. of Ch1 - Ch6

Select Temperature Control Method

Select the desired control method by touching the descriptor block of that method. It will change to red. NOTE: When using Low, High or Avg. control, be sure to touch the desired sample sensor channel(s) (Ch1 - Ch6) to select them with a check marked box.

Select Temperature Setpoint

Touch the white value box under TEMP.SP and a virtual keypad appears. Touch in the desired value and then touch the Enter (ENT) key. The setting range is: -100 to 200 °C

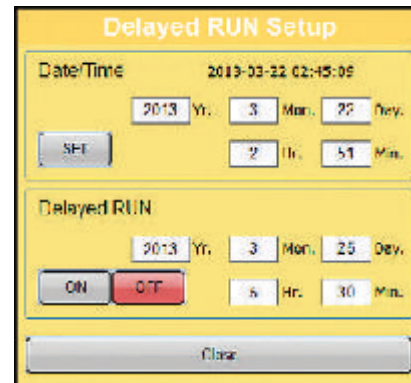
13) Adjust Relative Humidity Level

In the Humidity Control section, touch the white value box under HUMI.SP. A virtual keypad appears. Touch in the new value and then touch the Enter (ENT) key. The setting range is: 0 to 100%.

14) The instrument is now set for manual operation. If you wish to start the test at a later time or date, got to step 15. If not, go to step 16.

Delayed Run Setup

15) You may set the instrument to wait until a specific date & time to initiate operation. To do so, touch the **Delayed Run Setup** button at the lower left of the Main/Run/Stop page. The dialog box below appears.



Set the date and time by touching the white value boxes in the Date/Time section and inputting the correct values. Then set the desired start date and time in the Delayed RUN portion. Touch the **ON** button to activate the delay control. Touch the **Close** button to exit.

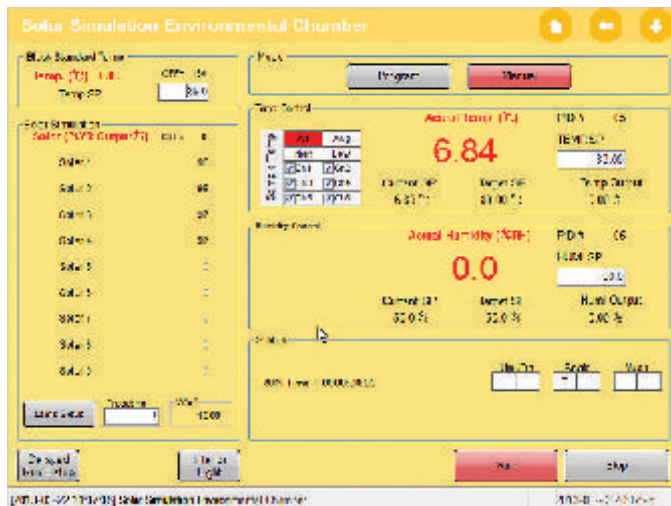
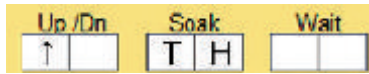
Start the Exposure System

16) Touch the **Run** button and then touch the **Y (Yes)** button in the confirmation dialog box to start system operation. The **Run** button turns red (active or running). As applicable, the MHG lamps will ignite, the heating or cooling system will operate and the humidification system will heat up. The instrument will run in this state until either the operator touches the **Stop** button or the test times out (Manual Time setting is met). In the **Status** section of the **Main/Run/Stop** page the **RUN Time**: counter indicates the elapsed time.

5.0 OPERATION

5.4.2 Manual Mode Operation (cont.)

Additionally in the Status section, the white boxes indicate current operating conditions: T (for Temp.) rise/decline and Soak, as well as H (for Humidity) rise/decline and Soak.



Stop the Exposure System

18) Touch the **Stop** button and then touch the **Y (Yes)** button in the confirmation dialog box and all SEC control systems will turn off. The **Run** button turns gray and the **Stop** button turns red.

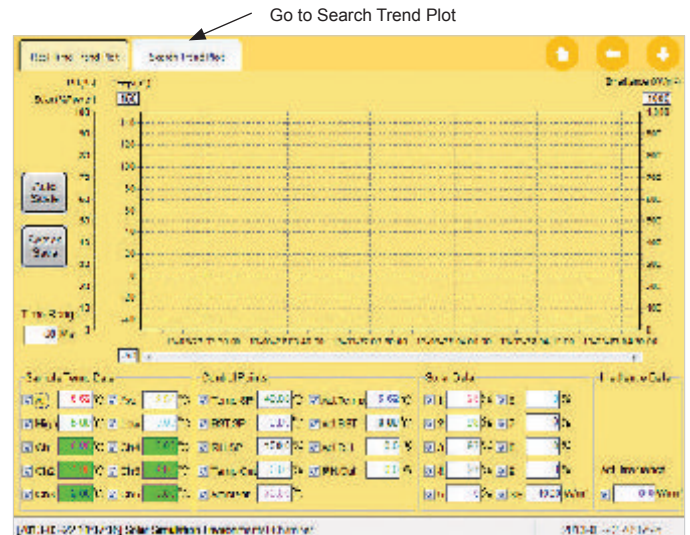
Besides viewing the Main/Run/Stop page information, you may observe the temperature, humidity and irradiance trends in the touchscreen Monitor - Real Time Trend Plot page while the SEC system is operating. As well, you may search the recorded database to examine earlier operating conditions in the Monitor - Search Trend Plot page.

5.4.3 Test Monitoring

Real Time Trend Plot

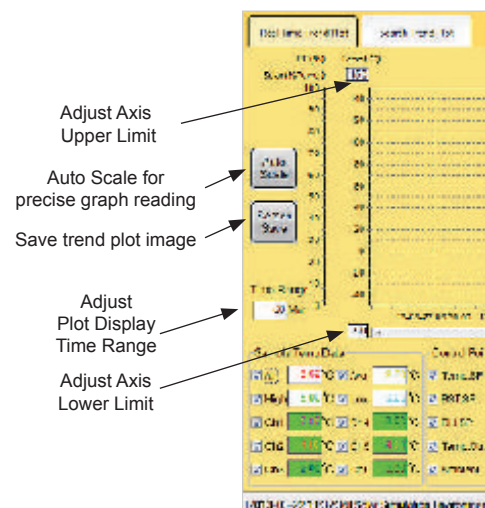
1) In the Main page, touch the **Home** button or the **Status Bar** at the bottom of the page to return to the Menu page.

2) In the Menu page, touch the **Monitor** button and the page below appears.



3) Select the operating variables (Temp., RH, etc.) you wish to display by touching the check boxes in the lower portion of the page.

4) Use the buttons described below to perform the various functions indicated.

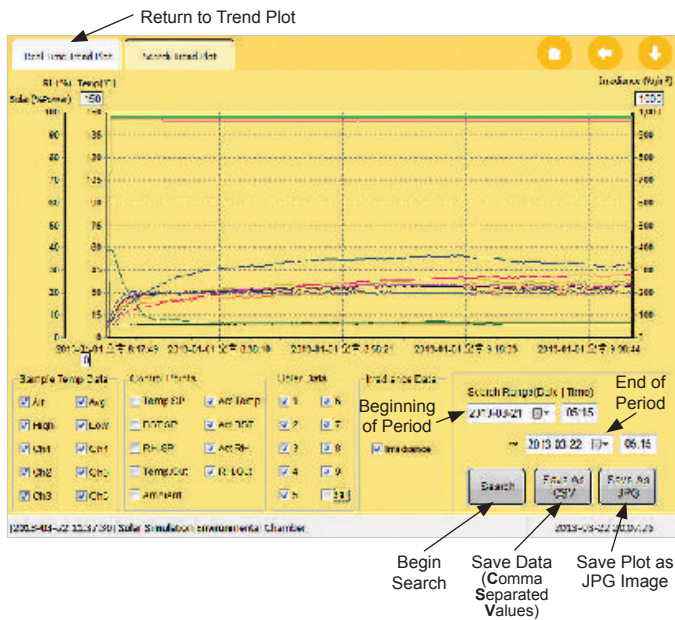


5.0 OPERATION

5.4.3 Test Monitoring (cont.)

Trend Plot Search

5) To search the data base for an earlier time period, touch the **Search Trend Plot** tab at the top of the page and the features below appear.



6) Touch the Date and Time boxes to insert values defining the beginning and end of the time period for which you wish to search. Then touch the **Search** button to display that period.

7) Save data or a page image by touching the **Save As** buttons.

8) Touch the **Real Time Trend Plot** tab or the **Home** button to exit the page.

5.0 OPERATION

5.4.4 Program Mode Operation

i NOTE

This procedure assumes that you have previously created one or more custom tests, according to the instructions in section 5.3 Custom Test Programming, for use in Program mode. If you have not already done so, read section 5.3 and create a custom test.

i NOTE

For low-temperature tests without lamp operation, see Appendix B on the use of lamp window insulator panels.

- 1) Place your test specimens in the test chamber and instrument them with monitoring or control wiring (thermocouples/RTDs, etc.) if applicable.
- 2) Close the test chamber door(s).
- 3) Apply power to the SEC instrument at the wall-mounted safety disconnect switch.
- 4) Turn on the main power switch (Fig. 5-12) on the right side of the instrument.



Figure 5-11 SEC 4100 - Main Power Switch

- 5) Turn on the system computer by pressing the switch indicated in Figure 5-13. View the touchscreen and wait until the Windows program and desktop screen is displayed.

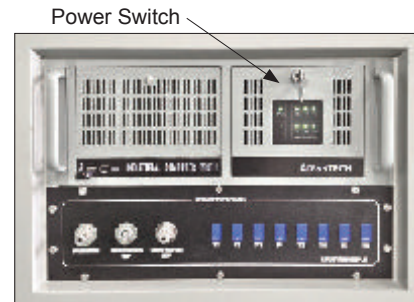


Figure 5-12 SEC PC Power Switch

- 6) On the touchscreen, double touch the Solar Chamber program icon to start the SEC system control application, as shown below.



- 7) The program Menu page then appears, as shown below.

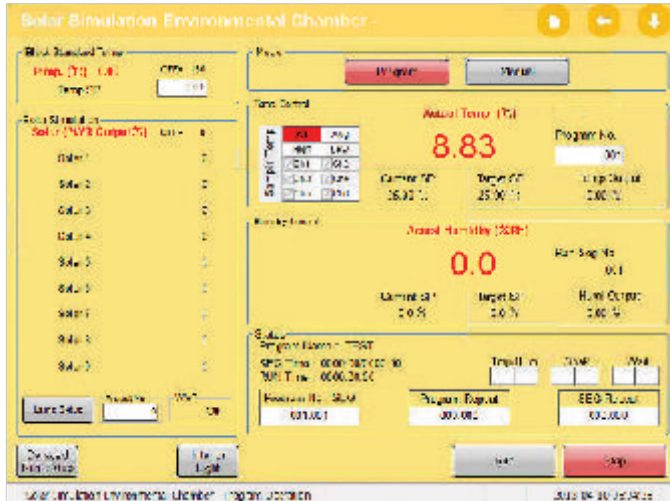


- 8) Touch the **Main/Run/Stop** button.

5.0 OPERATION

5.4.4 Program Mode Operation

9) The Main page appears, as shown below.



i NOTE

If the Manual button is red (On), touch the Program button to activate Program mode and the page will refresh.

10) In the **Temp. Control** section, touch the white value box under **Program. No.** and a virtual keypad appears. Touch in the number of the test program you wish to run and then touch the Enter (ENT) key. Confirm that the correct test program name appears below in the **Status** section.

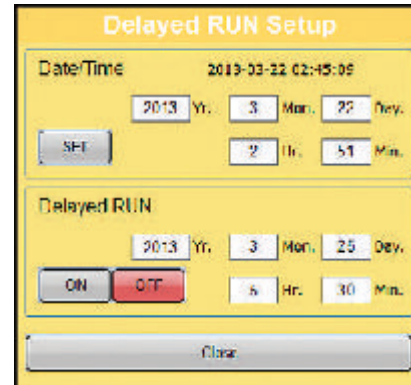
i NOTE

Since the test program is already configured to control BST, Irradiance, Chamber Temperature, Humidity and the Sample Temperature feedback method, none of these variables require setting in this page.

11) The instrument is now set for manual operation. If you wish to start the test at a later time or date, got to step 12. If not, go to step 13.

Delayed Run Setup

12) You may set the instrument to wait until a specific date & time to initiate operation. To do so, touch the **Delayed Run Setup** button at the lower left of the Main/Run/Stop page. The dialog box at the upper right appears.

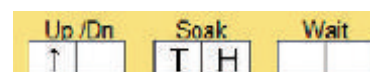


Set the date and time by touching the white value boxes in the Date/Time section and inputting the correct values. Then set the desired start date and time in the Delayed RUN portion. Touch the **ON** button to activate the delay control. Touch the **Close** button to exit.

Start the Exposure Program

13) Touch the **Run** button and then touch the **Y (Yes)** button in the confirmation dialog box to start system operation. The **Run** button turns red (active or running program). As applicable, the MHG lamps will ignite, the heating or cooling system will operate and the humidification system will heat up. The instrument will run until either the operator touches the **Stop** button or the test program times out.

In the **Status** section of the **Main/Run/Stop** page, the **RUN Time:** counter indicates the elapsed time. Additionally in the Status section, the white boxes indicate current operating conditions: T (for Temp.) rise/decline, Soak and Wait, as well as H (for Humidity) rise/decline, Soak and Wait.



As well, Segment and Repeat status are shown.

5.0 OPERATION

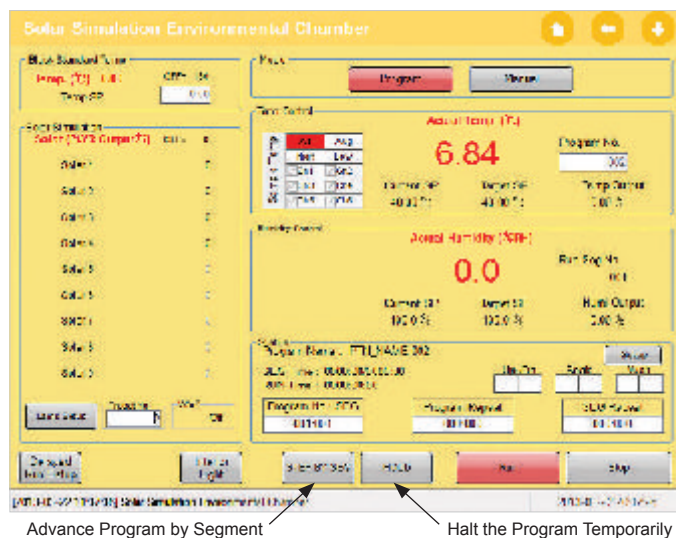
5.4.4 Program Mode Operation

Stop (Abort) the Test Program

14) Touch the **Stop** button and then touch the **Y (Yes)** button in the confirmation dialog box and all SEC control systems will turn off. The **Run** button turns gray and the **Stop** button turns red.

15) Monitor the running test by observing the Monitor page, as described previously in section 5.4.3 Test Monitoring.

Test Program Advance and Hold



16) **Program Advance:** During test program operation, you may advance the running program by touching the **STEP BY SEG** button shown above. This advances the program by one segment each time it is touched. To do so, touch the **STEP BY SEG** button and then touch Y (Yes) in the confirmation dialog box to advance the test one segment.

17) **Program Hold:** Under certain conditions, such as to change test samples or examine a light fixture, you may wish to temporarily halt the test program. To do so, touch the **HOLD** button and then touch Y (Yes) in the confirmation dialog box to halt the test. The **HOLD** button turns red to indicate Hold mode. Touch the button again and confirm to resume program operation.

6.0 MAINTENANCE

6.1 General Considerations

Regular care and maintenance are essential for optimal operation and ensuring a long service life of the exposure system.

The inspection/service intervals for the refrigeration system, electrical equipment and safety devices are specified in a maintenance contract with our service organization.

NOTE

Annual inspection of the refrigeration dual pressure switch is necessary according to EN 378-2, Appendix C.6 Safety Requirements. The inspection should be performed only by a factory-qualified service representative.

WARNING! HIGH VOLTAGE!

CAUTION! INSTRUMENT DAMAGE

Maintenance procedures must be performed on the refrigeration system and electrical equipment only by a factory-qualified service representative or personal injury and system damage may result.

Contact our service organization and we will provide a qualified maintenance specialist to perform service procedures or recommend an authorized company that supplies such services.

6.2 Temperature and Humidity Calibration

The Temperature and Humidity measurement/control systems should be calibrated at the intervals below. Contact Atlas Technical Service to arrange these service procedures.

System	Calibration Interval
Air/Sample Temp.	6 months
Optional BST	6 months
Relative Humidity	6 months

6.3 Maintenance Procedures

6.3.1 Test Chamber Cleaning

Over time, water residues will collect on the test chamber floor, walls, ceiling and the glass luminary access doors in the chamber ceiling.

Clean the chamber walls, floors and specimen support structures with a soft cloth and stainless steel polish. For heavy deposits, 3M Scotch-brite pads, emery paper, and stainless steel-wool may be used. Do not use ordinary steel wool or the test chamber surfaces will rust!



CAUTION! INSTRUMENT DAMAGE

Never use chlorinated solvents in the test chamber! Chlorides attack and corrode stainless steel!

Cleaning the Luminary Access Doors

Clean glass panes are essential for allowing full and constant irradiance from the MHG lamps. Use standard detergent or methylated spirits to clean the glass in the luminary access doors.

Corrosion Prevention

To prevent corrosion, the chamber walls and floor must be cleaned after each test with clean water and a regular detergent, and then dried.



NOTE

Be careful not to damage the temperature and humidity sensors (Fig. 4-4). If corrosive deposits have formed, use a regular stainless steel cleanser. Be sure to remove all cleanser residue afterwards. If corrosive spots cannot be eliminated this way, polish with stainless steel cleaning wool or 3M Scotch-brite pads.

6.3.2 Refrigeration System Inspection

The refrigeration system normally requires little maintenance. Check the compressor oil levels once a month by looking at the oil-level windows beneath the Oil Fill port. You should also examine

6.0 MAINTENANCE

each compressor's Sight Glass for bubbles during operation after the compressors have been running 10 minutes. If bubbles are observed, the compressors may need to be charged with refrigerant. Have maintenance performed only by a certified refrigeration technician or an Atlas-qualified service representative.

6.3.3 MHG Lamp Maintenance

To ensure optimal lamp output and reliability, perform the following maintenance procedures at the prescribed intervals.

Electrical and Mechanical Connections: At least once per year, check all electrical wiring plug/socket connections and mechanical connections of the MHG bulbs and the mounting hardware of the lamp housing for secureness and integrity.

Cleaning: Lamps, reflectors and filters should be cleaned to remove dust and any residues. Accumulated dust on the lamps, reflectors and the flat glass filters will shorten their lifetimes and reduce irradiance output.

Clean the metal reflectors with standard glass cleaner. Clean the lamps (bulbs) and the flat glass optical filters only with methylated spirits. New lamps must be so cleaned prior to installation in the lamp housing.

Lamp Replacement: Generally, replace the lamps (bulbs) after 750 to 1000 hours of operation. Additionally, if recrystallization on the quartz glass tube is visible, the lamp should be replaced because the risk of shattering increases. Replace the ODF filter glass when replacing the lamp.

Filter Glass Replacement: Replace the ODF optical filter pane after 750-1000 hours of use.

Lamp Sockets: Every time a lamp is replaced check the lamp sockets for a tight fit on the lamp and replace them if they are loose.

Modul 4000 Lamp Power Supplies: To prevent overheating of the power supplies, clean the air filters in the housing front panel as necessary with a vacuum cleaner.



CAUTION! INSTRUMENT DAMAGE

When replacing a lamp, check the lamp terminals/heatsinks for a tight fit with the new lamp. If the fit is loose, replace the lamp terminals or lamp overheating may result.



NOTE

When installing a new lamp, always clean the lamp with methylated spirits and clean dust from the reflector and front glass filter with glass cleaner.



NOTE

When installing the lamp tube, orient the fill melt nib or bead upward, as shown below, toward the lamp reflector.



6.3.4 Irradiance Uniformity Calibration

Irradiance uniformity over the test plane is calibrated at system installation by the factory technicians. It is achieved not only by independent adjustment of the MHG lamp output levels, but also by adjustment of each lamp fixture's mounting angle. Due to vibration and servicing of the lamps, mechanical fixture readjustment may be required. Contact Atlas Technical Service to arrange this service procedure.

6.3.5 Replacement MHG Lamp Parts

Lamp Burner, 4000W P/N 09540383

Lamp Burner Socket P/N 09540226

ODF Outdoor Filter Glass, 2500/4000W P/N 09540091

IDF Indoor Filter Glass, 2500/4000W P/N 09540091

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7.0 LAMP PRESET CONFIGURATION

7.1 Overview

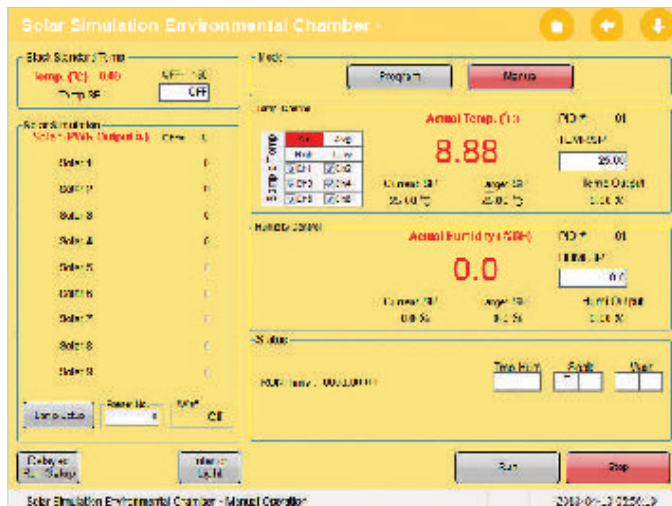
To configure the lamp-irradiance presets you must setup the pyranometer in the test chamber and connect its lead to the sensor panel. You will then adjust lamp power (in the Lamp Preset page) and operate the lamps. Five readings must be taken by moving the pyranometer to five locations on the test plane in the test chamber. You must then adjust the lamp power (% output) values independently to obtain acceptable uniformity in the irradiance distribution among the five measurement locations.



If you have not already done so, enter the calibration factor of your pyranometer into the User Setting page as described in section 4.2.6 User Setting Page.

7.2 Configuration Procedure

1) In the touchscreen Menu page, touch the **Main/Run/Stop** button and the page below appears.



2) Place the pyranometer in the test chamber at the center of the exposure plane. Adjust its height so that it is at the same level as that of a test specimen when placed on the exposure plane.

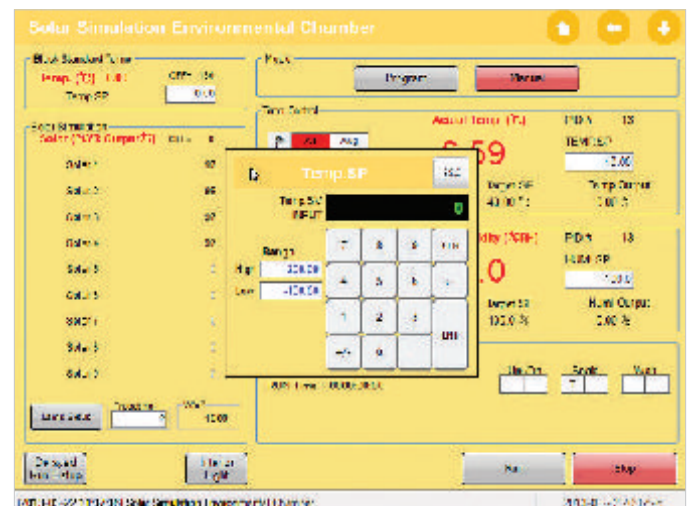
3) Route the pyranometer cable through the feed-through port and connect it to the applicable sensor port as shown below.



4) Close the test chamber doors.

5) On the touchscreen Main/Run/Stop page, select Manual mode by touching the **Manual** button. It will turn red (as shown below).

6) **Set temperature:** Under **Temp. Control**, select **Air** in the Sample Temp. matrix. Touch the **TEMP.SP** and a virtual keypad appears, as shown below. Touch in a value matching the Actual ambient temperature and then touch the Enter (**ENT**) button, as shown below.



7.0 LAMP PRESET CONFIGURATION

7.2 Configuration Procedure (cont.)

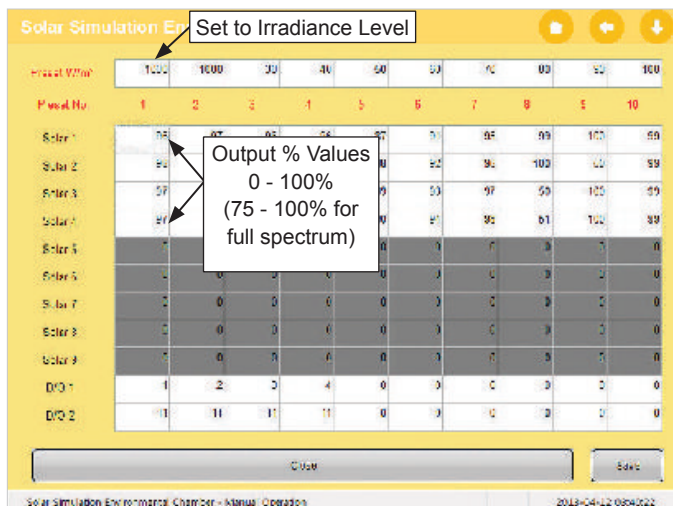
7) **Set optional BST to 150 (Off):** Touch the white value box to the right of **BST Temp.SP** and a virtual keypad appears. Touch in 150 to set BST to Off. Then touch the **OK** button.

8) **Set RH (Relative Humidity) to ambient:** Touch the white value box beneath **HUMI.SP** and a virtual keypad appears. Touch in a value matching the Actual (ambient) RH reading and then touch the **OK** button.

NOTE

For full-spectrum operation, the lamps may be operated at 75 to 100% output, which equates approximately with an irradiance range of 800 to 1200 W/m². Use this as a guideline for determining the power output percentage that will approximate the irradiance level you wish to configure for a lamp preset.

9) **Lamps Output % settings:** Touch the gray **Lamp Setup** button. Configure a new Preset by adjusting the lamp output % values (for Solar 1, Solar 2, etc.) to the estimated initial power level. In the column in which you are adjusting settings, touch the white Preset W/m² box and input the irradiance level you are configuring. Save the Preset by touching the **Save** button.

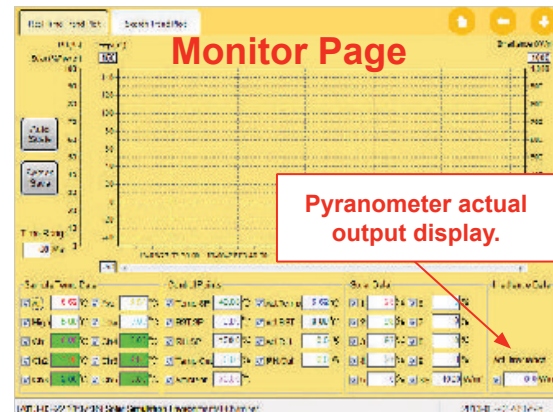


10) Touch the **Close** button. Then touch the **Preset No.** value box and touch the number of the preset just configured.

11) Close the test chamber door(s).

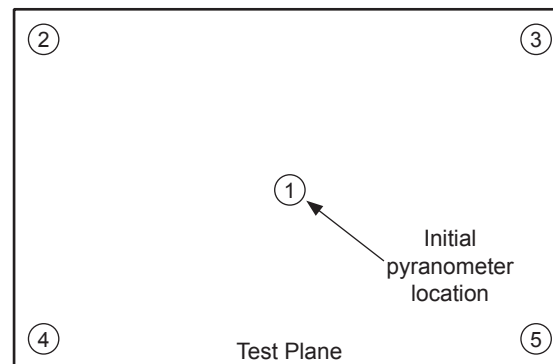
12) Start lamp operation by touching the **Run** button. It will change to red (activated). Allow the lamps to operate and stabilize for a few minutes.

13) Observe the actual output of the pyranometer on the Monitor page, as shown below. Record the **Actual Irradiance** (W/m²) reading shown.



14) Based on the lamp-power/irradiance note at left, adjust the output % values of your Lamp Preset to obtain the irradiance level required. Operate the lamps and check the irradiance level shown in the Monitor page. Repeat as required.

17) When the irradiance reading is correct, stop instrument operation and move the pyranometer to the next location (2) in the layout shown below.



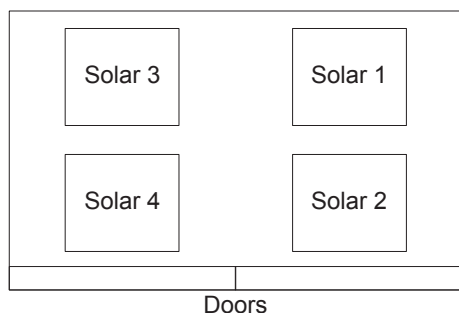
18) Operate the lamps and record the irradiance value. Repeat this for the remaining pyranometer locations (3 - 5).

7.0 LAMP PRESET CONFIGURATION

7.2 Configuration Procedure (cont.)

19) Stop lamp operation.

20) Take the average of your irradiance readings and then compare the average to each reading. If some readings are out of tolerance by more than the percentage allowable for your test specification, you must adjust the lamp output % for that zone, higher or lower, to achieve the required uniformity. Refer to the layout below. Also refer to the irradiance uniformity data sheet in Appendix D.



21) Perform the five irradiance measurements again and record the irradiance values.

NOTE

When the SEC instrument was installed, the angles of the lamps were adjusted to achieve the irradiance distribution uniformity required. Thus the lamps should not require mechanical adjustment. Over time, with vibration and lamp service performed, the lamp fixtures may require readjustment. Please contact Atlas Technical Service for assistance with this procedure.

22) Repeat steps 20 and 21 until the irradiance distribution meets your uniformity requirements.

23) Touch the **Save** button at the lower right of the Lamp Setup page to save the final Lamp Preset values. Touch the **Close** button.

24) Turn off the MHG lamps by stopping Manual mode operation.

25) Remove the pyranometer from the test chamber.

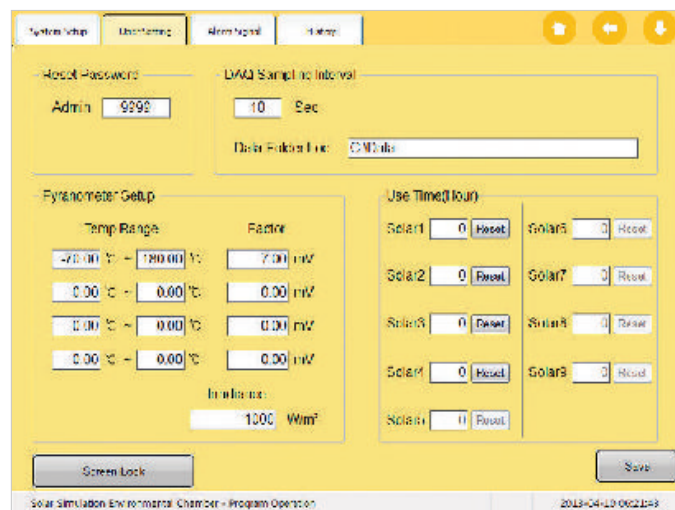
7.3 Lamp Preset Maintenance

As the MHG lamps age, they will exhibit a gradual decline in output from their original peak. Because of this, we recommend that the irradiance levels for the lamp presets be checked on a regular basis. Check them according to the previous procedure every 500 hours of lamp operation or according to your test specification or facility quality-program requirements. You may monitor lamp operating hours by looking at the control panel of the lamp EPS power supplies, as shown below. (The lower counter on the EPS panel indicates lamp ignitions).



Figure 7-1 EPS-Modul 4000 (MHG Lamp Power Supply)

You also may view lamp operating hours in the System - User Setting page as shown below.



8.0 ALARM RESPONSES

The Touchscreen controller is configured to monitor critical system conditions and provide alarm messages, as shown below. This helps to ensure safe operating conditions and prevent damage to the SEC system and test specimens.

System Status	User Settings	Alarm Signal	History
ALL Error		Description	History (minutes)
1		Luminary Temp Over Error	10
2		Leak Error	10
3		Door Open Error	10
4			10
5			10
6			10
7			10
8			10

System Status	User Settings	Alarm Signal	History
ALL Error		Description	History (minutes)
1		EMS Error	10
2		Comp1 Error	10
3		Comp2 Error	10
4		Comp3 Error	10
5		Air Blower Error	10
6		NO Water Error	10
7		Dry Temp Over Error	10
8		Wet Temp Over Error	10

The list of errors/alarms is shown below.

System Alarms

- 0 Luminary Temp Over Error (Temp. is above 60 °C)
- 1 Leak Error (Water leak from DI tank or drain lines)
- 2 Door Open Error (Interlock open)
- 1 EMS Error (Emergency power off switch activated)
- 2 Comp1 Error (High pressure or oil switch activated)
- 3 Comp2 Error (High pressure or oil switch activated)
- 4 Comp3 Error (High pressure or oil switch activated)
- 5 Air Blower Error (Motor trip error)
- 6 NO Water Error (DI water tank low or empty)
- 7 Dry Temp Over Error (Chamb. air heater >150 °C)
- 8 Wet Temp Over Error (Humidifier heater >120 °C)

Responses

When an alarm occurs, perform the applicable procedure below and then touch the alarm message on the touchscreen to acknowledge it and turn it off, unless specified otherwise.

Alarms From Computer

1) Luminary Temp Over Error

Temperature is above 60°C. Shut off lamps and have a technician examine the MHG lamps and cooling fans.

2) Leak Error

Water leak from the DI tank or drain lines onto the floor of the refrigeration compartment. Shut off instrument and check for water and source.



Check for water around red X and other areas of compressor-compartment floor

3) Door Open Error

Interlock open. Check test chamber door and secure.

Alarms From System Monitor

4) EMS Error - Emergency Power Switch

Check for cause and then reset the emergency switch by twisting its red knob clockwise.

5) Comp1 Error - Compressor 1

High pressure or oil switch activated. **First**, touch the alarm box displayed on the touchscreen to acknowledge the compressor error. Check and press the RED reset switches on the compressor safety switches as shown below. (Each compressor has two.) Also check the oil level in the compressor if the oil switch activated.



Compressor oil low switch



Compressor refrigerant high pressure switch

8.0 ALARM RESPONSES (cont.)

6) Comp2 Error - Compressor 2

High pressure or oil switch activated. See 5 previously.

7) Comp3 Error - Compressor 3

High pressure or oil switch activated. See 5 previously.

8) Air Blower Error

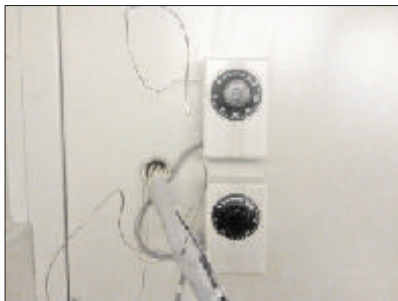
Motor trip error. Shut down and restart the SEC instrument.

9) No Water Error

DI water tank level low or empty. Check water supply and float valve for clogging.

10) Dry Temp Over Error

Test chamber air heater above 150 °C. Check heater element and the settings on the safety thermostats shown below.



Chamber heater safety thermostats

11) Wet Temp Over Error

Humidifier heater above 120 °C. Check heater element and safety thermostat shown below.



Humidifier safety thermostat

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Appendix A

Metal Halide Lamp Mercury Safety Instructions

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APPENDIX A - Metal Halide Lamp Mercury Safety Instructions

NOTE: MHG lamp = HMI lamp.

Technical Information No. FO 4898

Edition: 11/00 - subject to change
 Substitutes: 02/99
 Status: valid

Mercury Safety Instructions for Metal Halide Lamps

■ Product and operation description

OSRAM metal halide lamps are lamps of the families HMI[®], HTI[®] and VIP[®] for DC and/or AC operation in which the light arc burns in an atmosphere of rare earth elements, halogen and mercury vapour at high pressure. The lamps are available in wattages ranging from 35 W to 12000 W. The families named above includes HMI[®], HSR[®], HSLD[®] and LMD[®] lamps.

In cold lamps of higher wattage (i.e. at room temperature) metallic droplets of mercury can be seen in the lamp bulb. During operation of the lamp the mercury vaporizes due to heating of the discharge tube (lamp body) and the gas between the electrodes approaches temperatures of up to 10.000 °C. The temperature of the discharge tube reaches approximately 800-900 °C. After the lamp is in thermal equilibrium (1 to 10 minutes after ignition), the vaporized mercury gives rise to a pressure up to 200 times the atmospheric pressure.

Mercury fillings of OSRAM HMI[®] and HTI[®] lamp families

Wattages	Mercury (mg)
≤ 250 W versions	max. 10
360 W to 700 W versions	max. 120
1200 W to 2500 W versions	max. 180
4000 W to 6000 W versions	max. 450
12 kW to 18 kW versions	max. 1020

Mercury fillings of OSRAM VIP[®] lamps

Wattages	Mercury (mg)
≤ 120 W versions	max. 10
170 W to 400 W versions	max. 25
≥ 1200 W versions	max. 180

■ Health hazards

Inhaling vapour or small particles of mercury or its compounds can be harmful to lung, kidney and nervous system. Injuries to one's health can also arise by penetration of the skin or resorption via the gastro-enteric tract.

■ Lamp breakage

In the rare case that metal halide lamps broke or burst and the mercury content is released, we recommend to consider the following security instructions:

- All persons should leave the surrounding area at once, in order that no mercury is inhaled.
- The area should be ventilated thoroughly (at least 20 to 30 minutes).
- After the lamp housing or luminary has cooled, any mercury residue should be picked up with a special adsorbent as for example Mercurisorb (source: Karl Roth GmbH & Co. KG, Schömpferlestr. 3, D 76185 Karlsruhe, Phone: 0049 / (0)721 / 560 60; Germany).

■ Disposal of Metal halide lamps

Metal halide lamps contain specific quantities of potentially harmful substances (such as mercury; see table). Therefore they must be treated as special waste in accordance with the relevant national regulations.

■ OSRAM contact

If you need any further information please contact your local OSRAM representatives or the Photo Optics division, Marketing department at Berlin / Germany:

- Phone: 0049 30 / 3386 2174
- Telefax: 0049 30 / 3386 2359
- E-mail: entertainment-light@info.osram.com

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Appendix B

Lamp Window Insulator Panels

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APPENDIX B - Lamp Window Insulator Panels

When running a low temperature test that requires no lamp operation, use the Lamp Window Insulator Panels provided with the SEC instrument. These can help to stabilize temperature and improve low-end capability by 5 to 10 °C. Each panel is hinged and secures securely with two latches. The instrument ceiling is pre-drilled and tapped for easy panel installation.



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Appendix C

Optional Equipment & Accessories

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APPENDIX C - Optional Equipment & Accessories

Power Transformer

Atlas can supply a power transformer for converting 480 Vac line voltage to 380 V. Contact Atlas technical Service for details and recommendations.



MHG Lamp Parts & Accessories

P/N 09540381	Lamp Burner, 2500W
P/N 09540383	Lamp Burner, 4000W
P/N 09540226	Lamp Burner Socket
P/N 09540091	ODF Outdoor Filter Glass, 2500/4000W
P/N 09540091	IDF Indoor Filter Glass, 2500/4000W

Temperature Monitoring Accessories

P/N 09540337	Black Standard Temperature (BST) sensor with 5 m cable
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Irradiance Monitoring & Solar Module Accessories

P/N 09540304	Pyranometer CM4 - Class 2 - High Temp.
P/N 09540303	Pyranometer CMP6 - Class 1 General Purpose
P/N	I-V Tracer DS-100C

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Appendix D

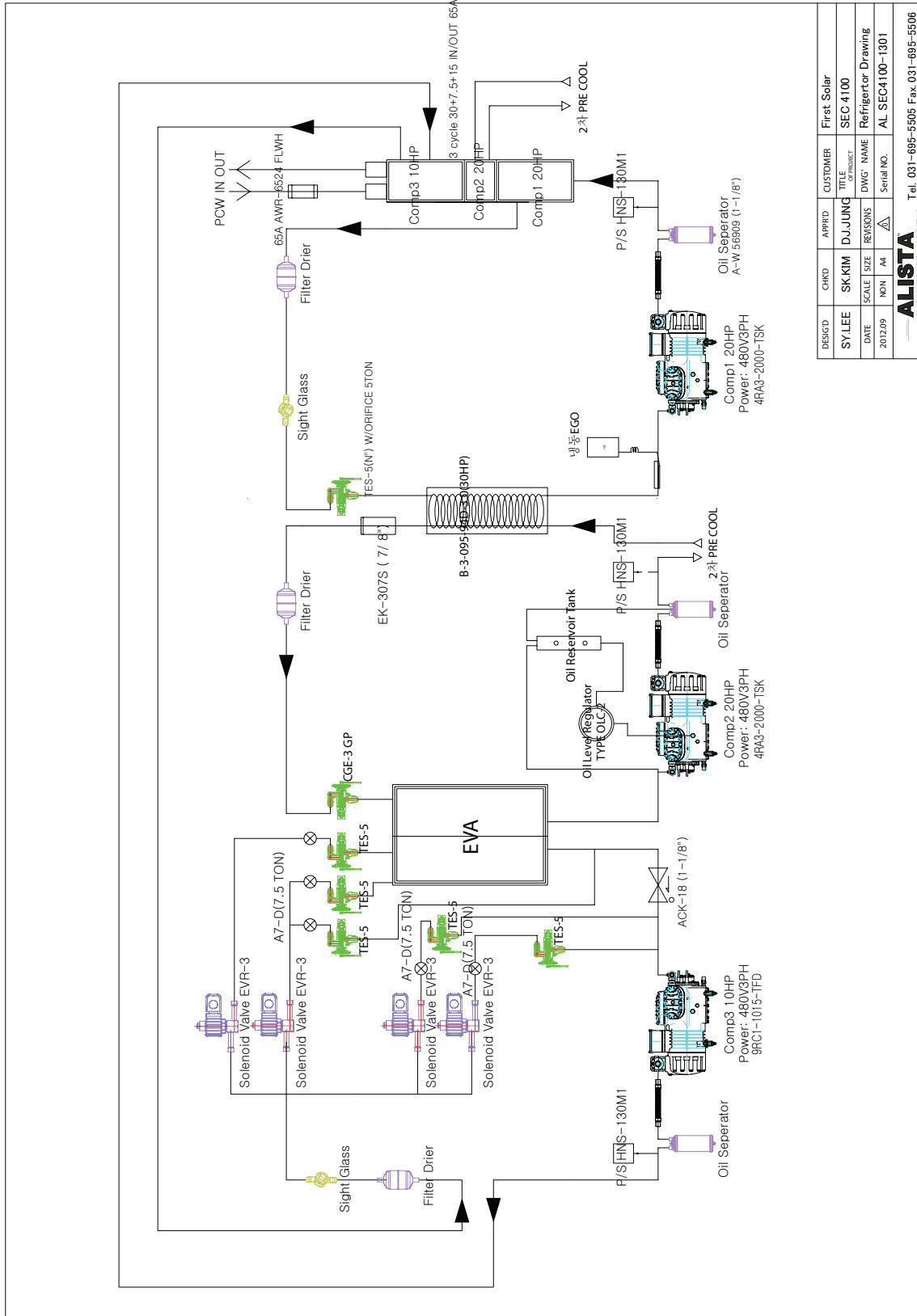
SEC

Technical Information

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APPENDIX D - SEC Technical Information

Refrigeration System Diagram



DESIGD	CHKD	APPRD	CUSTOMER	First Solar
SY LEE	SK KIM	DJ JUNG	SEC 4100	
DATE	SCALE	SIZE	REVISIONS	DWG' NAME
201209	NON	A4	Δ	Refrigerator Drawing
				Serial NO. AL SEC4100-1301

Tel. 031-695-5505 Fax 031-695-5506

ALISTA
SCIENTIFIC INSTRUMENTS

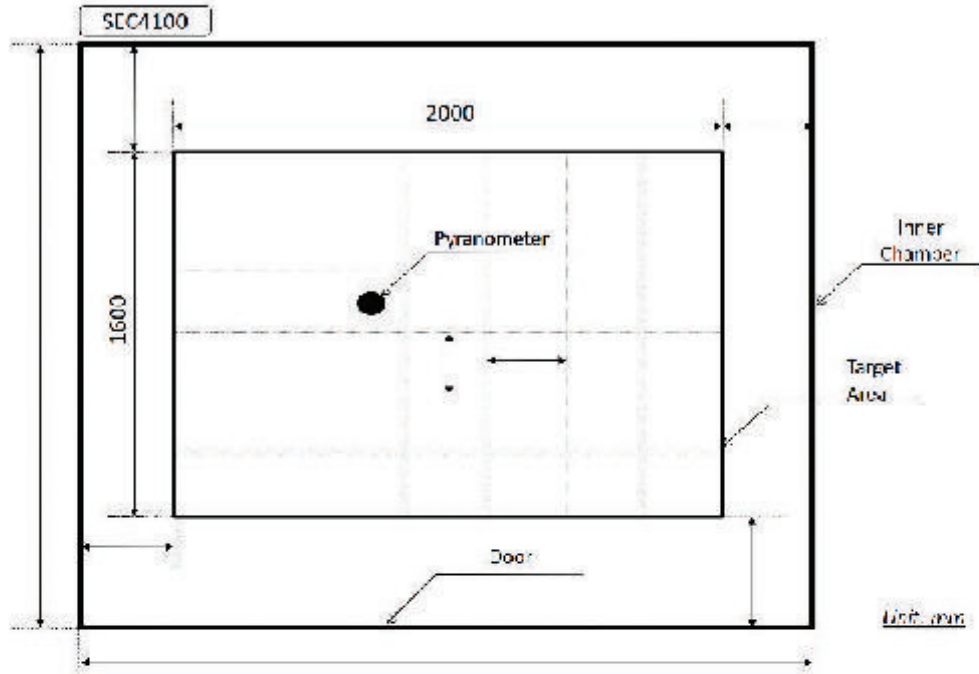
APPENDIX D - SEC Technical Information



ALISTA Solar Environmental Chamber Irradiance Spatial Uniformity Data



Model: SEC4100 # of Luminary: 4 Measurement Date: 2012-11-07
Capacity: 3000L Luminary Type: 4000W MHG Measured by: JO Lee
Exposure: 2h x 2h x 0.5h Serial Number: AL SEC100 1101 021 Radiometer: K&F C&P



Irradiance Data (W/m²)

P1	P2	P3	P4	P5	P6	P7
947.0	1021.0	972.0	940.0	930.0	945.0	936.0
P8	P9	P10	P11	P12	P13	P14
1036.0	1098.0	1009.0	945.0	934.0	1014.0	963.0
P15	P16	P17	P18	P19	P20	P21
1059.0	1099.0	1030.0	973.0	1039.0	1080.0	990.0
P22	P23	P24	P25	P26	P27	P28
1053.0	1098.0	1030.0	963.0	1040.0	1077.0	1010.0
P29	P30	P31	P32	P33	P34	P35
1015.0	1054.0	997.0	947.0	1005.0	1057.0	976.0
P36	P37	P38	P39	P40	P41	P42
904.0	990.0	933.0	900.0	952.0	948.0	903.0

Measurement Point Data:

Input Power (%): 1.84% 2.85% 3.77% 4.75%
Distance from Center of Luminary to Target Area:

Statistics:

	Watts	Limits	Confirm
Average:	999.9	1000.0	Yes
Max:	1099.0	1100.0	Yes
Min:	900.0	900.0	Yes
Std Dev:	55.3	50.0	

	%	Limits	Confirm
Average:	100%	100	Yes
Max:	9.97%	10.00%	Yes
Min:	9.99%	10.00%	Yes
Std Dev:	5.53%	N/A	

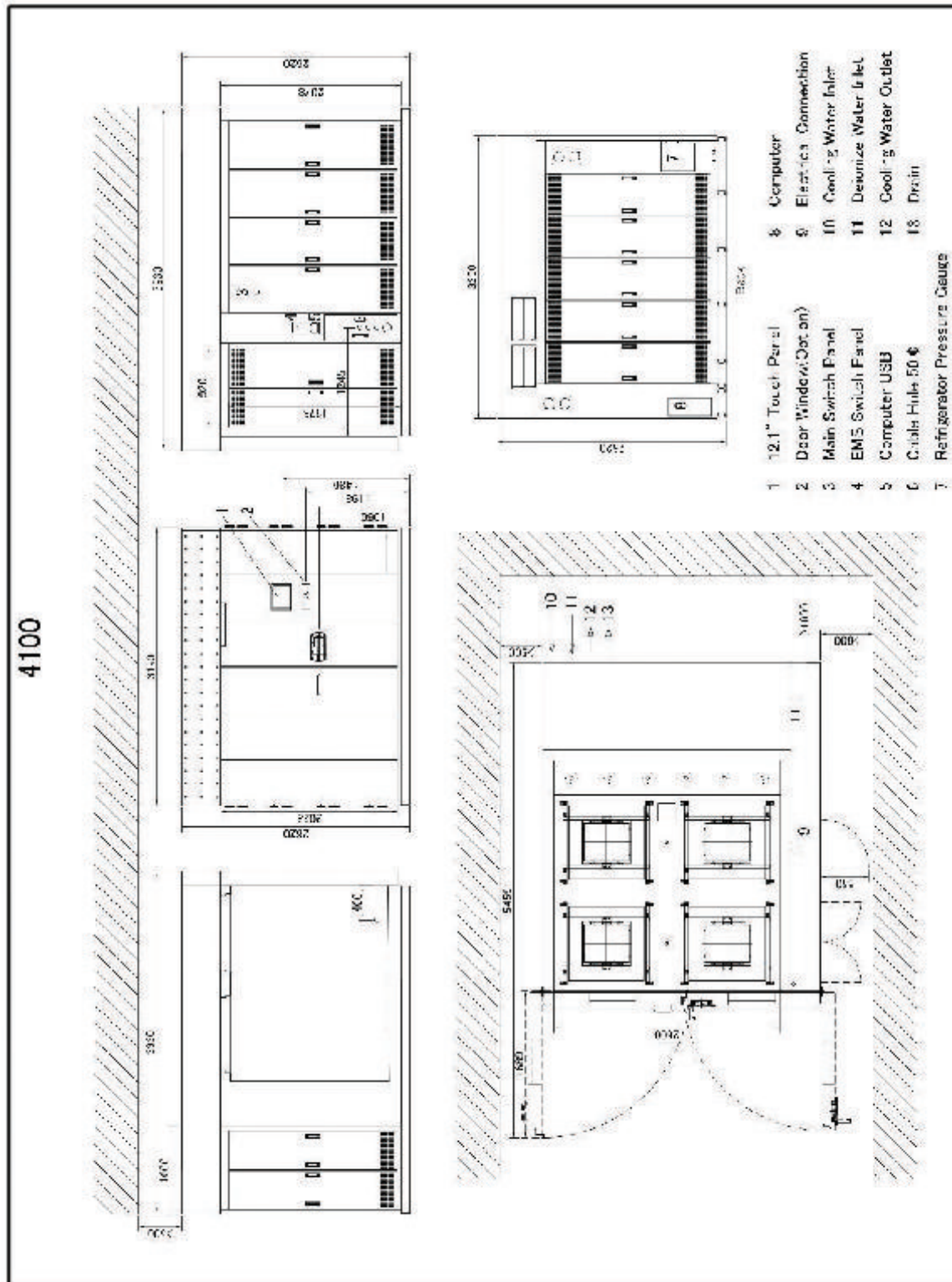
Radiometer Data:

Maker: Kipp and Zonen
Model: CMP 11 Pyranometer
Serial #: 113738

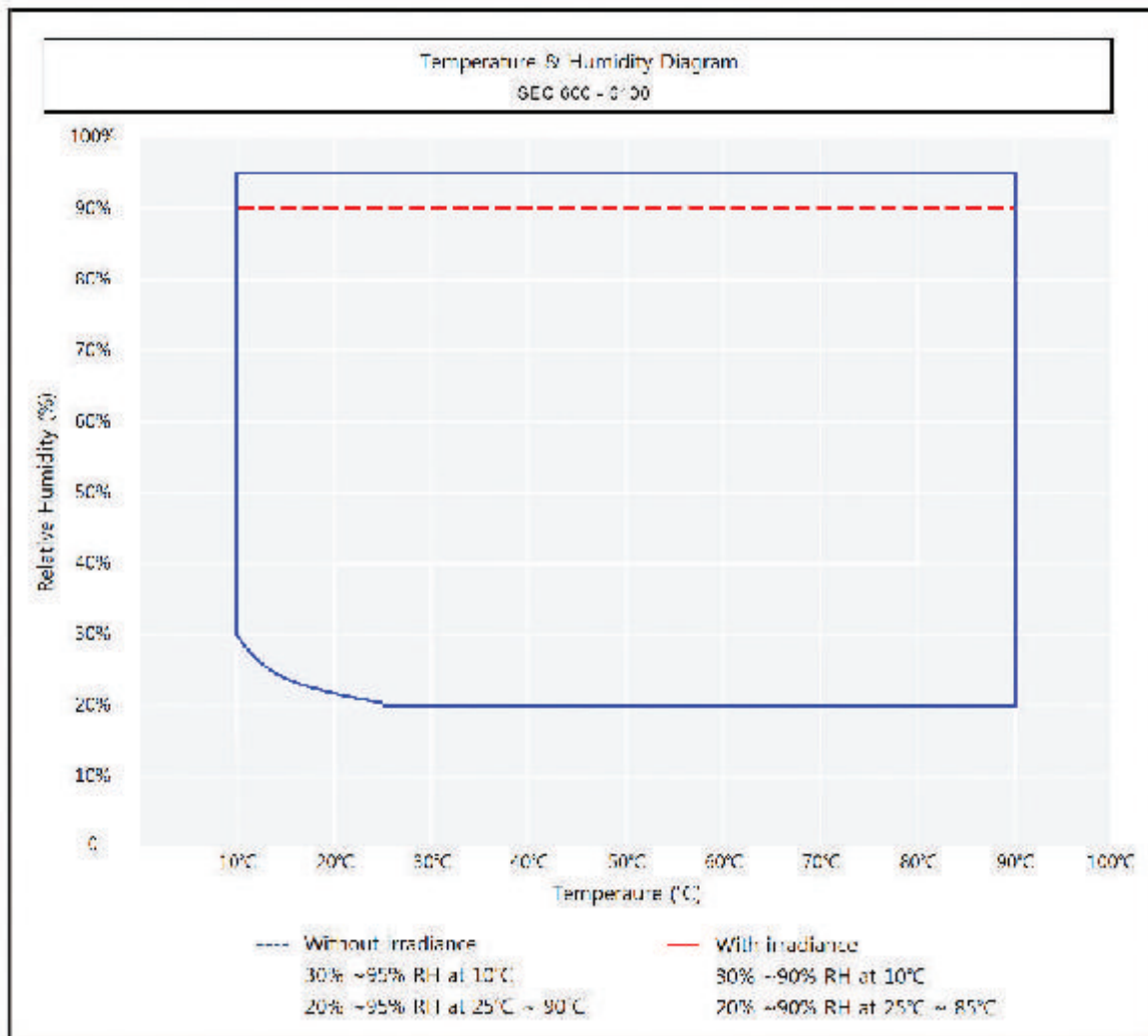
Sensitivity: $8.55 \times 10^{-6} \text{ V/Wm}^2$
Calibration: 543/11

Spectral Range: 285-2800nm
Field of View: 180°
Maximum Irradiance: 4000W/m²

APPENDIX D - SEC Technical Information



APPENDIX D - SEC Technical Information



APPENDIX D - SEC Technical Information

TEST REPORT

1. Applicant

Name

: ALISTA

Address

: 364-1 Chuja-ri, Opo-eup, Gwangju-si, Gyeonggi, Korea
a

2. Products

Name

: Light Spectrum analysis (Solar Chamber)

Model/Type

: SEC-1100

Manufacturer

: ALISTA

Serial Number

: AL SEC-1100-1219

3. Test Standard/Method : KS C IEC 60068-2-5

4. Test Results

: Suitable

5. Use of Report

: submit

6. Date of Application

: 2012. 07. 30.

7. Date of Issue

: 2012. 09. 24.

Tested by



Approved by



Choi Jong-Doo

New&Renewable Energy Assessment Center

Park Jun-Seok

New&Renewable Energy Assessment Center

The test results contained apply only to the test sample(s) supplied by the applicant, and this test report shall not be reproduced in full or in part without approval of KTL in advance.

Korea Testing Laboratory

87, Digital-ro 26-gil, Guro-gu, Seoul, SEOUL 152-718 Rep. of KOREA

<http://www.ktl.re.kr>

FP204-03-02

Tel. : +82-31-500-0326

Fax. : +82-2-860-1469

APPENDIX D - SEC Technical Information

[제12-047230 호]

Name of Product	Solar Simulation Chamber(SEC-1100)
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1. Test summary

The results of this trial test result of the applicant Solar Simulation Chamber (SEC-1100), made against solar radiation at ground level.

2. Name of Product

Product Model : SEC-1100
Manufacturer : ALISTA
Product S/N : AL SEC-1100-1219

3. Test Standard

"KS C IEC 60068-2-5 Basic environmental testing procedures
- Part 2 : Tests-Test Sa : Simulated solar radiation at ground level"

4. Test Procedure

Distance : From the center of the radiation source to the radiometer - 1,160mm

5. Test Equipment

Description	Manufacture&Type	Serial Number	Calibration valid until	Calibration Laboratory
Spectrometer	Avates(Avalight-HAL-CAL) Range 200 - 2500nm	1202028	23-02-2013	NIST

APPENDIX D - SEC Technical Information

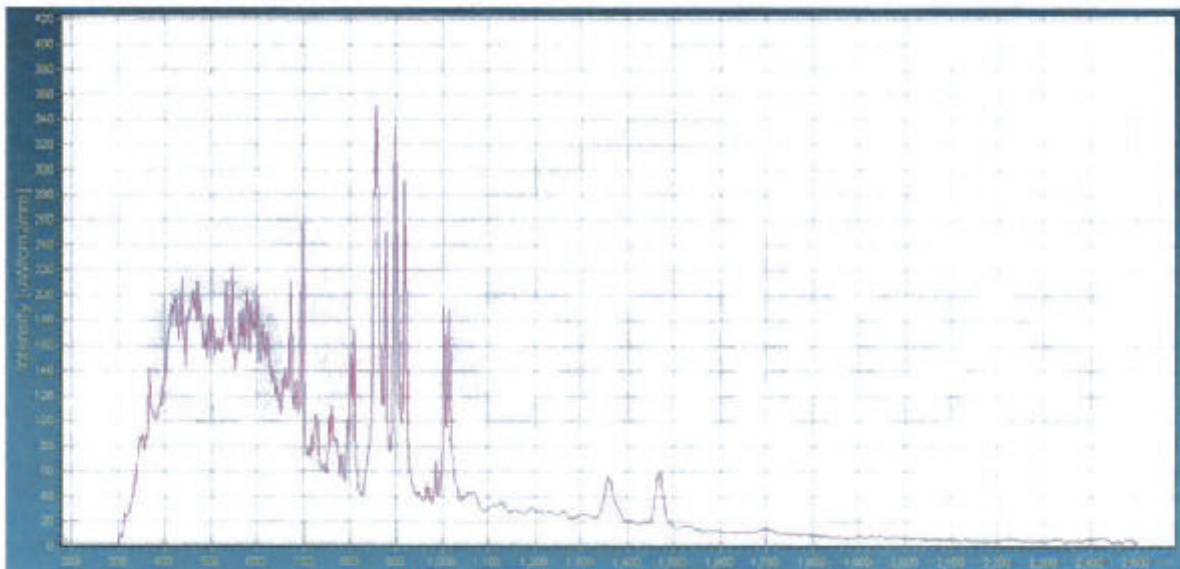
6. Test Result

[제12-047230 호]

1) Table 1 : Results measured in accordance with IEC 60068-2-5

Wavelength range (nm)	IEC60068-2-5 Min	IEC60068-2-5 Max	Spectrum ratio	Standards Radiances	Radiances tolerance
280-320	0.3%	0.6%	0.3%	5	±35
320-400	4.2%	7.0%	6.3%	63	±25
400-520	16.1%	19.6%	19.1%	200	±10
520-640	14.9%	18.3%	18.1%	186	±10
640-780	12.4%	18.5%	18.1%	174	±10
780-3000	35.1%	52.7%	43.2%	182	±20
Irradiance(W /m2)	1008	1232	1111.8	1120	±10

2) Measured spectrum distribution of irradiation intensity



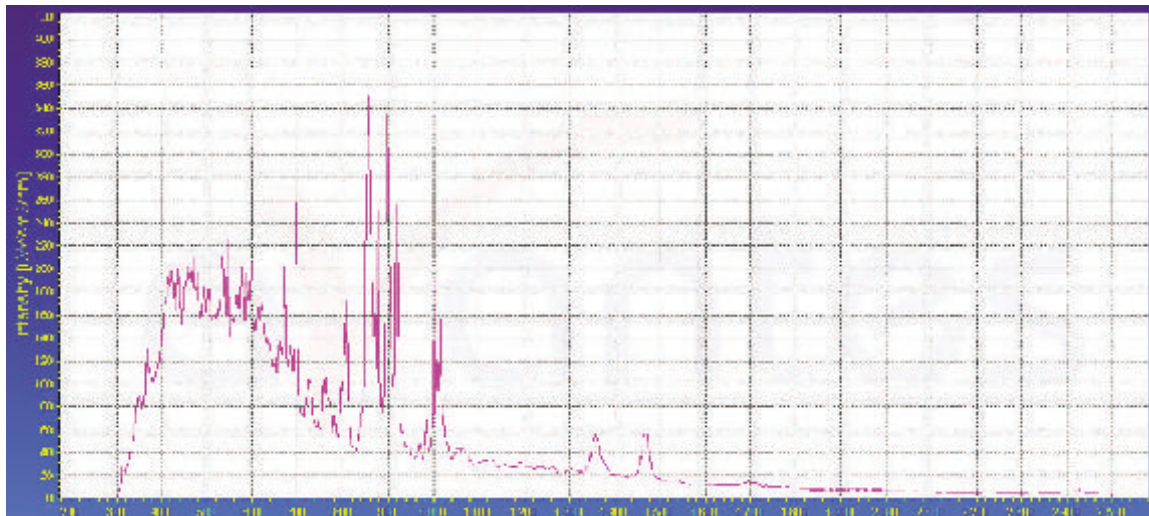
APPENDIX D - SEC Technical Information

Spectrum Consistency Evaluation

Chamber Model	SEC1100		chamber irradiance(W/m2)	1112.36			
Measurement regulation	IEC60068-2-5						
Result							
IEC 60068-2-5 : 2002							
IEC 60068-2-5 (280 - 2500 nm)							
Wavelength	280~320	320~400	400~520	520~640	640~780	780~3000	280~3000
Irradiance(w/m2)	3.339	69.733	212.241	201.747	160.122	465.176	1112.4
Spectrum rate	0.3%	6.3%	19.1%	18.1%	13.1%	43.1%	100%
Measurement result of IEC 60098-2-5							
Wavelength	IEC60068-2-5 Min	IEC60068-2-5 Max	Spectrum rate	Radiation	Tolerance		
280-320nm	0.3%	0.6%	0.3%	5	±35		
320-400nm	4.2%	7.0%	6.3%	63	±25		
400-520nm	16.1%	19.6%	19.1%	200	±10		
520-640nm	14.9%	18.3%	18.1%	186	±10		
640-780nm	12.4%	18.6%	13.1%	174	±10		
780-3000nm	35.1%	52.7%	43.1%	192	±20		
Irradiance (W/m2)	1008	1232	1112.4	1120	±10		
Spectrum Level of IEC 60904-9 : 2010							
Wavelength	Class A Min	Class A Max	Spectrum rate	Spectrum level	Etc		
400-500nm	13.8%	23.0%	21.2%	A	18.4%	A : ±25	
500-600nm	14.9%	24.9%	20.5%	A	19.9%		
600-700nm	13.8%	23.0%	16.9%	A	18.4%		
700-800nm	11.2%	18.6%	9.4%	B	14.9%	B : ±40	
800-900nm	9.4%	15.6%	16.1%	B	12.5%		
900-1100nm	11.9%	19.9%	15.8%	A	15.9%	C : +60 ~ -100	
Irradiance (W/m2)	-	-	843.4	-			

Standard of Consistency Evaluation

Performance requirement of Solar Chamber for IEC 60904-9 : 2010							
IEC 60904-9 (400 - 1100 nm)							
Wavelength	400~500	500~600	600~700	700~800	800~900	900~1100	400~1100
Irradiance(w/m2)	179.276	173.275	142.496	79.062	136.039	133.225	843.374
Spectrum Rate	21.25%	20.54%	16.89%	9.37%	16.12%	15.83%	100%



APPENDIX D - SEC Technical Information

**Applicable
Test Standards**
(SEC 600 - 1100)
BMW Prv 306
DIN 75220
IEC 68-2-5
ISO 9022-9/ 12097-2
MIL STD 810 G Procedure 2
VW1211
VW 82511
AK-LV 01/2005

**Applicable
Test Standards**
(SEC 2100 - 6100)
BMW Prv 306
DIN 75220
IEC 68-2-5
ISO 9022-9/ 12097-2
MIL STD 810 G Procedure 2
VW1211
VW 82511
AK-LV 01/2005
ATLAS 25+
IEC 61215 & 61646