CSI RD&D Solaria Alameda County Santa Rita Jail System Commissioning and Calibration Report

Alameda County Santa Rita Jail Solar Electric Facility, Dublin, CA

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Background

This project is supported with assistance from the California Solar Initiative (CSI) Research, Development, Demonstration, and Deployment (RD&D) Program. The purpose of this program is to help achieve the goal of creating a vibrant solar industry. This program makes investments to fund solar research and demonstration projects that will measurably reduce the cost and accelerate the installation of solar and other distributed technologies that could employ solar for generation, storage, or that could reduce the use of natural gas. This project's primary goal is to drive down the installed cost of solar.

Project Summary

Solaria, a Delaware Corporation, has developed photovoltaic modules that use less than half the silicon than other silicon modules and are designed to not have compromises in performance or reliability. Solaria modules are the first flat plate PV module to use optical concentration and the first low-concentration module to receive UL and IEC certification. Solaria's module is optimized for large-scale commercial and utility tracking applications.

The goal of this CSI RD&D project is to perform detailed analysis and reporting on the performance of Solaria low-concentrating photovoltaic installations that incorporate innovations to reduce costs, increase reliability, and improve system production and efficiency. Solaria is using CSI RD&D funds to support installing and operating PV test systems to demonstrate that the technology is financeable. The project will also provide performance and reliability data of Solaria's products on different tracking systems totaling 350 kWp for two installations of which 240 kWp is installed at Alameda County Santa Rita Jail located in Dublin, California and 110 kWp is installed at Solaria manufacturing facility located in Fremont, California.

This report documents the critical process of calibrating and commissioning the Alameda County Santa Rita Jail installation located in Dublin, CA. Calibration and commissioning of the 110 kWp Solaria manufacturing facility located in Fremont, CA was presented in the previous commissioning & calibration report. The Alameda County Santa Rita Jail installation utilizes the combination of Solaria STS Azimuth, Ideematec Azimuth and Mecca Solar Dual Axis tracking systems. The purpose for a 3rd party system commissioning is to ensure proper installation of all electrical and mechanical components and to correct any malfunctioning panels, balance of systems and tracker hardware components to optimize system performance and reliability.

Task 4: System Commissioning

On June 26th & 27th, 2012 Next Phase Solar of Berkeley CA performed system commissioning on the Alameda County Santa Rita Jail Solar Tracker installation in Dublin, California. In depth results of the commissioning efforts are included in attachment A. Overall, the systems were found to be in good working condition. The recommended corrective actions were addressed by replacing 5 tracker control boards that were possibly damaged in a power surge at the Santa Rita Jail and a thorough inspection of the field connectors installed for the PV source circuits. Alameda County sustainably maintains the landscape around the tracking systems by utilizing goats to periodically graze on the grass growing throughout the solar arrays.

Included in the commissioning efforts were inspections of the mechanical mounting systems; Electrical inspection of PV modules, array wiring, conduit, combiner boxes, disconnects and inverters. Voc and Imp testing, sting functionality, inverter installation, output voltages, infrared images of PV modules and BOS equipment and tracker installation to check proper operation and verify tracking angle. Attachment A includes a list for corrective actions; all of the recommended actions have been addressed by the Alameda County Contractors and or Solaria.

Data Acquisition System Calibration & Comparison

In March of 2012, the Solaria Corporation hired GroundWork Renewables for in-depth data acquisition system wide testing and calibration for the Alameda County Santa Rita Jail Solar Energy System in Dublin CA. Included in their tests were inspection and calibration for all components of the data acquisition system including, but not limited to the weather station, barometer, humidity and temperature sensors; Pyroheliometers, data loggers and temperature probes. In addition, GroundWork Renewables created detailed schematics for the as-built conditions of the entire data acquisition system.

Additional actions by GroundWork Renewables included training a local subcontractor to perform regular cleaning and upkeep of the pyranometers associated with the DAS in addition to a first time cleaning and calibration. GroundWork was responsible for setting up the network to capture data from the Campbell Scientific Data Loggers on site.

The objective of this report was to provide system-level irradiance calibration for all sensors and data acquisition equipment onsite. The accuracy of the data acquisition system in the solar electric facility is critical because of the uncertainty in measured power ratings and system performance ratios are directly related to the accuracy of these measurements. The complete results, calibration records and as-built schematics can be found within this report in attachment B.

SRJ Commissioning Report

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Berkeley, CA 94710
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Web: www.NextPhaseSolar.com

Solaria, SRJ Commissioning
June 26th & 27th, 2012

Introduction

Next Phase Solar performed a commissioning test on the Solaria tracker systems at Santa Rita Jail, Dublin, CA

The testing and inspection was performed by Larry Streif, Luis Sotomayor & Cristiana Cinceros on June 26th & 27th. This report and attached documentation comprise the full results of that work.

Services Performed

The following services were performed on all the systems:

Service
Voc and Isc testing of all PV source circuits
Visual inspection of PV modules and array wiring, mounting system, combiner boxes, wire ways and conduit, DAS and weather sensors.
Inverter- Check connections, clean enclosure and filters and check operation
Combiner Boxes- IR Images, tighten loose connections, check fuses and clean enclosures (if necessary)

Commissioning Checklist

Next Phase Solar Commercial Commissioning Inspection							
Project Name:		SRJ Solaria			Customer		Solaria Corp
System Type		Solaria concentrating trackers			Inspection Date		June 26 & 27, 2012
Kwp		238.9					
Lead Commission agent: Larry Streif							
Support representative name(s): Luis Sotomayor, Cristina Ceniceros							
Customer representative name: Todd Phillips							
System Component	Test	Scope	Required - Yes (Y)/ No (N)	Special Instructions	Inspection Completed (X)	Inspection Performed By	Comments
Combiner Box	Check operation of fuse holders	100%	Y		x	Next Phase Solar	
	VOC Testing	100% each string	Y		x	Next Phase Solar	
	Operating Current	100% each string	Y		x	Next Phase Solar	
Inverter	Perform a visual inspection of inside the inverter looking for cleanliness and all wires terminated.	Each Inverter	Y		x	Next Phase Solar	see punch list
	Check bolted conductor connections on the inverter DC, auxiliary power supply, and output AC buses for torque marks	Each Inverter	Y		x	Next Phase Solar	see punch list
	Verify the correct DC and AC inverters fuses are installed.	Each Inverter	Y		x	Next Phase Solar	

	Verify correct AC phase rotation for auxiliary power supplied to the inverter and at the AC connection side of the inverter AC bus.	Each inverter	N	Only required for inverter that are not designed to automatically adjust to the AC supply phase rotation. Refer to local utility for proper phase rotation direction (CW/CCW)		Next Phase Solar	
	Start the inverter after the above inverter tests are completed.	Each inverter	Y	Verify 5 minute delay in start-up	x	Next Phase Solar	
	Verify correct inverter AC output.	Each inverter	Y		x	Next Phase Solar	
	Verify no inverter alarms.	Each inverter	Y		x	Next Phase Solar	
	Verify the inverter shuts down with low irradiance and wakes up as it should.	Each inverter	N			Next Phase Solar	
DC wiring	Inspect exposed sections of conductors physical damage	100%	Y		x	Next Phase Solar	see punch list
	Verify cable identification is in place and correct	10% sample	Y		x	Next Phase Solar	
LV Circuits	Check for correct breaker trip set points.	All LV Circuit Breakers	N			Next Phase Solar	
DAS System	Data Validation	DAS system	N			Next Phase Solar	
	Connectivity	Cellular System	N			Next Phase Solar	Confirm that cell modem is active prior to mobilization. This information can be provided by the Commissioning

							Manager
	Data Acquisition System integrity	DAS system	N	Check penetrations and door seal for water penetration. Check terminals for signs of corrosion.		Next Phase Solar	
Met Station	Data Validation	MET stations	N			Next Phase Solar	
	Check Weather station integrity	MET stations	Y		x	Next Phase Solar	
	Pyranometer positioning	MET stations	Y		x	Next Phase Solar	
	Anemometer condition	MET stations	Y	Anemometer should spin with ease, be securely attached to MET station, and have all vanes.	x	Next Phase Solar	
	Reference cell in plane of array	MET stations	Y		x	Next Phase Solar	
Photovoltaic Array	Defects or damage (single / multiple cause)	All	Y	Note any defect identified with location of module and photograph of module	x	Next Phase Solar	
	Soiling	All	Y	Note if array needs to be cleaned	x	Next Phase Solar	
	Debris	All	Y	Check for construction debris	x	Next Phase Solar	
	Wire condition	All	Y	Inspect whole array and note any wire management that needs to be addressed	x	Next Phase Solar	

	Module connector condition	5%	Y	Inspect 5% of array for loose module connectors	x	Next Phase Solar	see punch list
	Shading	All	Y	Note any shading occurring while onsite	x	Next Phase Solar	
Grounds Inspection	Note any foreseeable safety concerns, conditions or fire hazards	All	Y	Any safety hazards must be reported immediately	x	Next Phase Solar	
	Signage	All	Y		x	Next Phase Solar	
	Debris	All	Y	Note excessive debris that is found on site	x	Next Phase Solar	
	Integrity of fence, gates and locks	All	Y	Document condition and location of security features if they are missing or damaged.	x	Next Phase Solar	
Line Side Connection	Field Evaluation by Listing Agency	Switchboard Connection	Y			Next Phase Solar	
Electrical Equipment Pad	Pad Inspection	100%	Y	Inspect inverter pad and note anything which may present an issue if left unresolved.	x	Next Phase Solar	
	Disconnect switch integrity	100%	Y	Inspect disconnect boxes and conduit entry seal. Document signs of water intrusion, corrosion or infestation. Interlock mechanism should allow positive throw of blades only with door closed.	x	Next Phase Solar	

	Verify ground continuity to conduit	100%	Y	Check continuity of conduit to grounding conductor in each Disconnect Enclosure.	x	Next Phase Solar	
	Isolation transformer physical condition	100%	Y	Check for dirt or debris buildup, heating, and/or noise. Isolations transformers are designed to operate in excess of 100°C.	x	Next Phase Solar	
	Inverter terminal connections - All power terminations checked for tightness	100%	Y	With all incoming energy sources locked out, check tightness on all bolted power cable connections.	x	Next Phase Solar	
	Inverter disconnect switch mechanical integrity and operation	100%	Y	Check for loose hardware and compromised components within Inverter switches and contactors. Close Inverter doors and turn switches to "ON" position.	x	Next Phase Solar	
	Remove Lock Out and RE-START Inverter,	Each Inverter	Y	Verify 5 minute interconnect delay	x	Next Phase Solar	
	Inverter display, keypad and key switch operation	Each Inverter	Y	Verify display is showing correct values for voltage, current, kW, and is set for maximum power output.	x	Next Phase Solar	

	Exterior physical condition	All equipment	Y	Inspect for oxidization and powder coat Delamination. While inverter is running, listen for fan rattling or whining which may indicate loose bearings. Verify inverter is bolted down.	x	Next Phase Solar	
DAS operation	Confirm that DAS is operating and reporting to Monitoring Team	DAS system	N			Next Phase Solar	Prior to leaving system running
Other Testing and Documentation Requirements	Submit all Commissioning Documentation	Whole System	Y		x	Next Phase Solar	
	IR images of combiner boxes		Y		x		

String Test Results

STRING TEST RESULTS

Name:	Larry Streif	Location:	Santa Rita Jail
Date:	6/27/2012		
Company:	Solaria	Condition:	Clear

Combiner Box: CB A1 strings 12

String #	Voc Time	Voc	Imp Time	Imp	Notes
1	11:21	384	12:02	5.7	Torque marks needed all terminaions
2		383		5.9	
3		382		5.8	
4		381		5.3	
5		382		5	
6		382		4.7	
7		381		5.3	
8		380		5.4	
9		380		4.7	
10		381		5.4	
11		380		4.9	
12	11:24	379	12:05	4.8	

Combiner Box: CB A2 strings 12

String #	Voc Time	Voc	Imp Time	Imp	Notes
1	11:26	382	12:11	5.3	
2		382		5.0	
3		380		5.2	
4		380		5.2	
5		380		3.5	
6		380		5.2	
7		380		5.0	
8		379		5.0	
9		379		5.0	
10		379		3.5	
11		379		5.0	
12	11:27	379	12:14	5.1	

Combiner Box: CB A3 strings 12

String #	Voc Time	Voc	Imp Time	Imp	Notes
1	11:30	382	12:15	5.4	
2		383		5.3	
3		382		5.1	
4		382		5.1	
5		386		4.7	
6		385		4.8	
7		380		5.0	
8		379		4.9	
9		382		5.0	
10		381		4.0	
11		384		4.6	
12	11:31	382	12:18	5.0	

Combiner Box: CB A4 strings 12

String #	Voc Time	Voc	Imp Time	Imp	Notes
1	11:32	382	12:20	5.0	
2		386		5.0	
3		383		4.5	
4		384		4.5	
5		384		4.6	
6		385		4.5	
7		385		5.0	
8		385		5.0	
9		384		4.5	*** Field installed MC connector was loose and popped out!
10		382		4.5	
11		383		4.5	
12	11:33	383	12:23	4.7	

Combiner Box: CB A5 strings 12

String #	Voc Time	Voc	Imp Time	Imp	Notes
1	11:37	390	12:30	5.4	
2		390		5.8	
3		387		5.2	
4		388		5.3	
5		387		5.2	
6		387		5.2	
7		386		4.7	
8		386		5.0	
9		385		4.8	
10		384		4.6	
11		382		4.8	
12	11:38	384	12:35	4.3	

Combiner Box: CB B01 strings 4

String #	Voc Time	Voc	Imp Time	Imp	Notes
1	1:54	463	2:02	5.5	
2		463		5.3	
3		463		5.6	
4		463	2:02	5.3	

Combiner Box: CB B02 Strings 4

String #	Voc Time	Voc	Imp Time	Imp	Notes
1	1:17	462	1:39	5.2	
2		462		5.9	
3		462		5.5	
4	1:17	462	1:40	5.5	

*C Combiner boxes re-tested 8/2/12 due to data recording issues

Combiner Box: CB C1 strings 8

String #	Voc Time	Voc	Imp Time	Imp	Notes
1	12:12	375	11:47am	4.7	
2		375		4.7	
3		374		4.6	
4		375		4.3	
5		373		4.4	
6		375		4.4	
7		375		4.6	
8		376		5.5	

Combiner Box: CB C2 strings 10

String #	Voc Time	Voc	Imp Time	Imp	Notes
1	12.15	376	11.56	4.4	
2		379		4.4	
3		377		4.3	
4		378		4.4	
5		377		4.3	
6		376		4.3	
7		377		4.4	
8		379		4.2	*** Field installed MC connector was loose and popped out!
9		376		4.1	
10		376		4.0	

Combiner Box: CB C3 strings 10

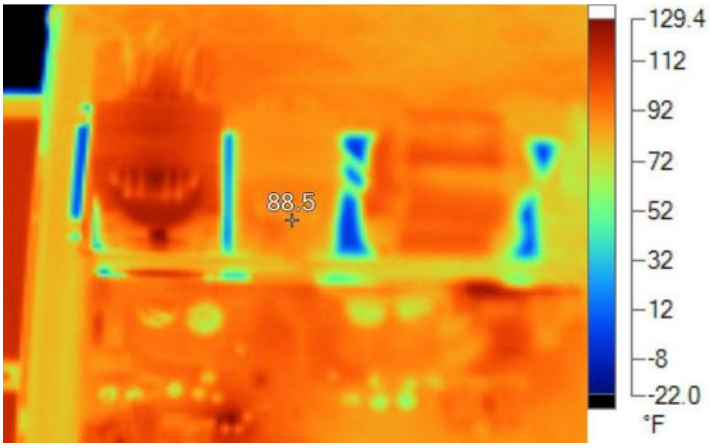
String #	Voc Time	Voc	Imp Time	Imp	Notes
1	12.19	377	12.00	4.5	
2		377		3.6	
3		377		4.4	
4		377		4.4	
5		377		4.3	
6		377		4.1	
7		376		4.2	
8		376		4.1	
9		375		4.3	
10		374		4.1	

Combiner Box: CB C4 strings 12

String #	Voc Time	Voc	Imp Time	Imp	Notes
1	12.23	390	12.04	5.8	
2		391		5.6	
3		389		5.6	
4		389		5.6	
5		388		5.2	
6		389		5.3	
7		388		5.3	
8		389		5.0	
9		387		5.2	
10		389		4.9	
11		389		4.7	
12		389		4.6	

IR Images

Array A Fronius



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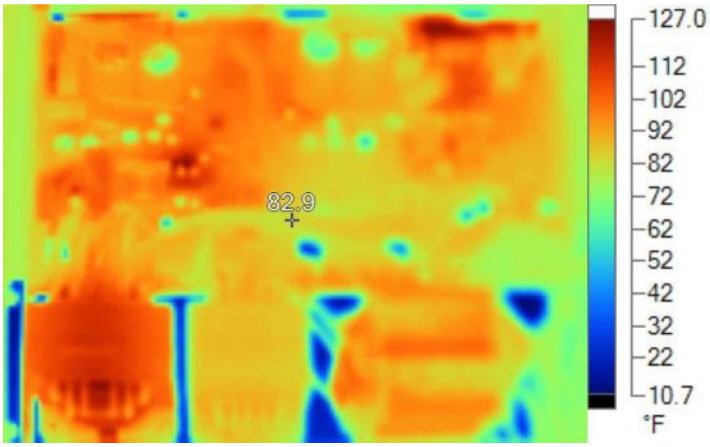
IR Sensor Size	160 x 120



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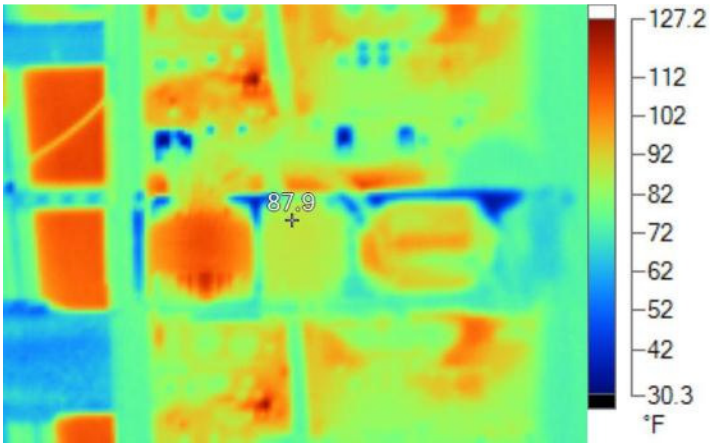

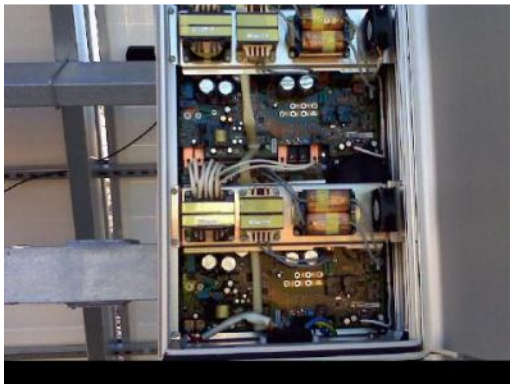

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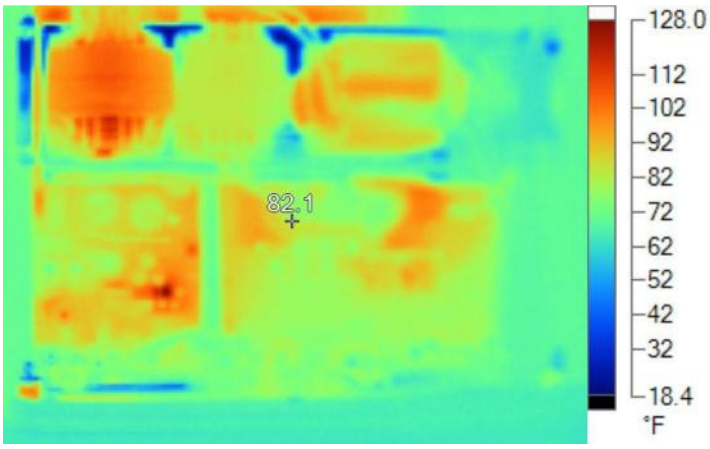

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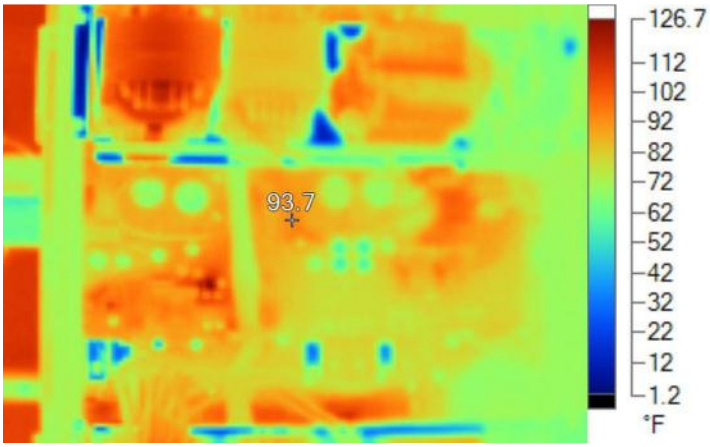

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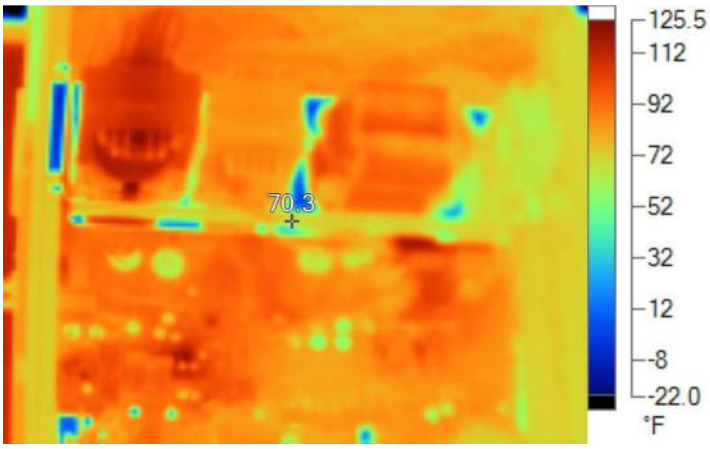

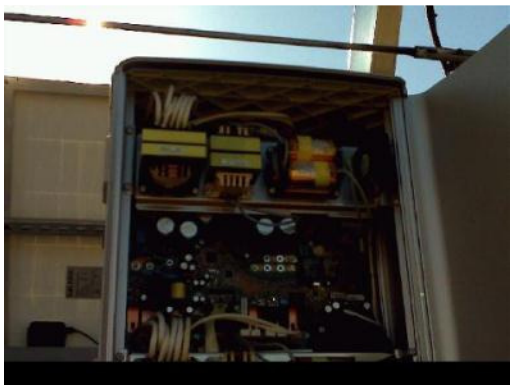

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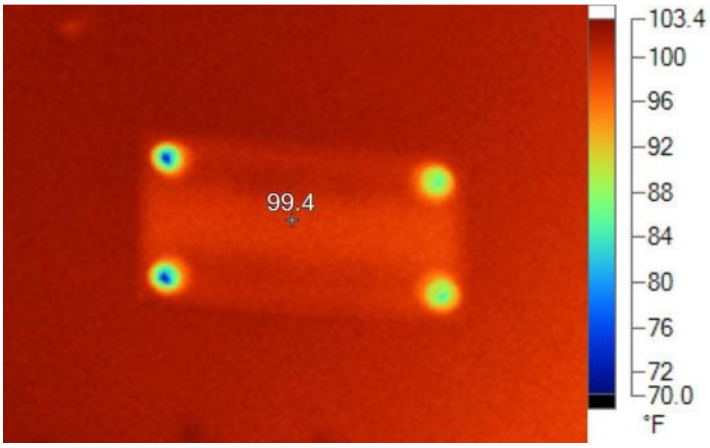

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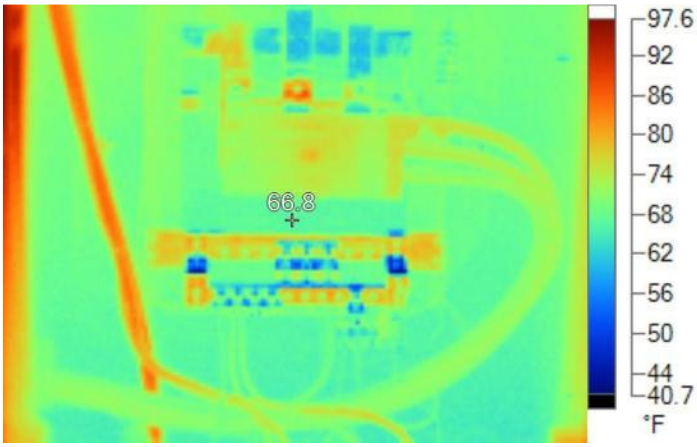

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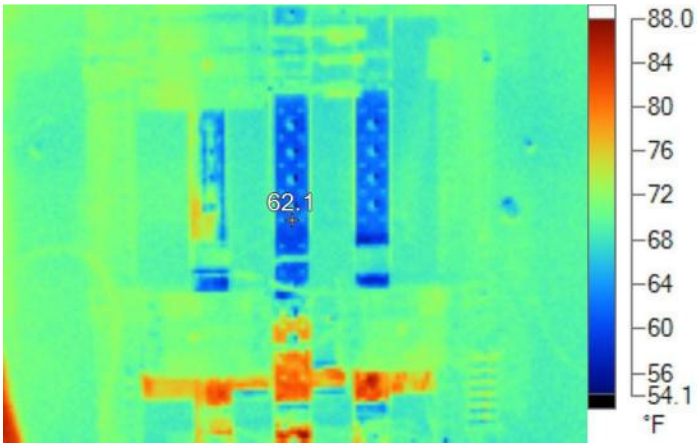

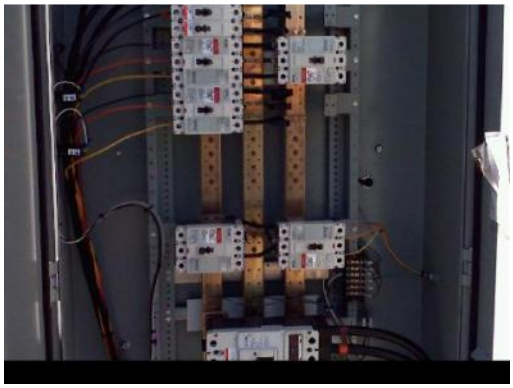

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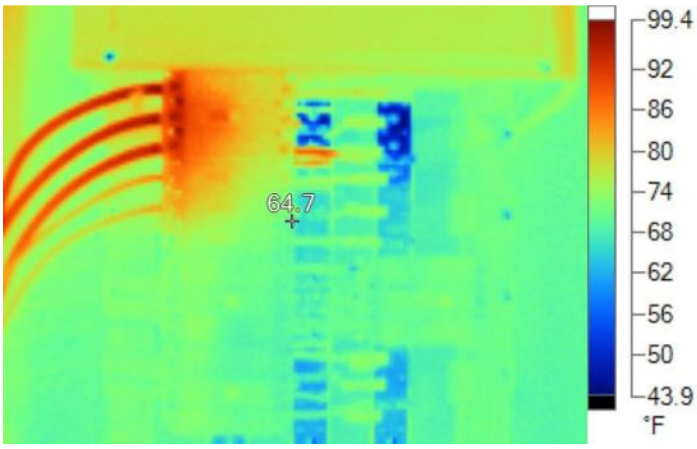

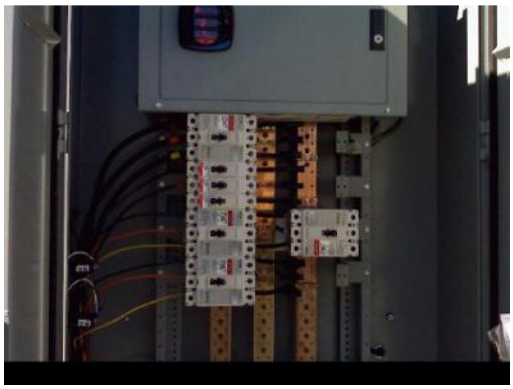

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IR Sensor Size	160 x 120

Array B Fronius

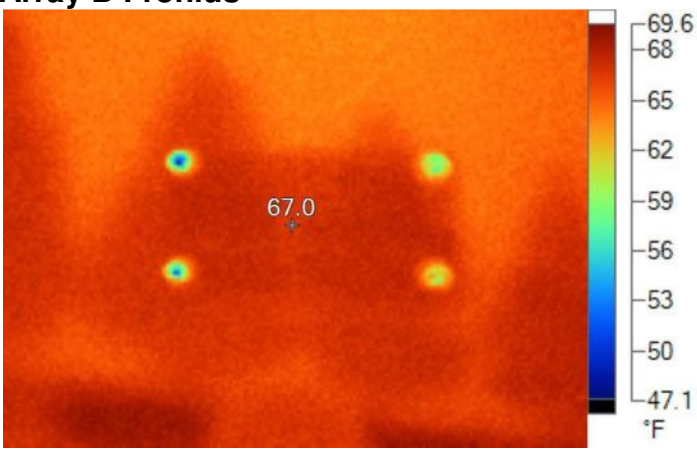

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Image Info

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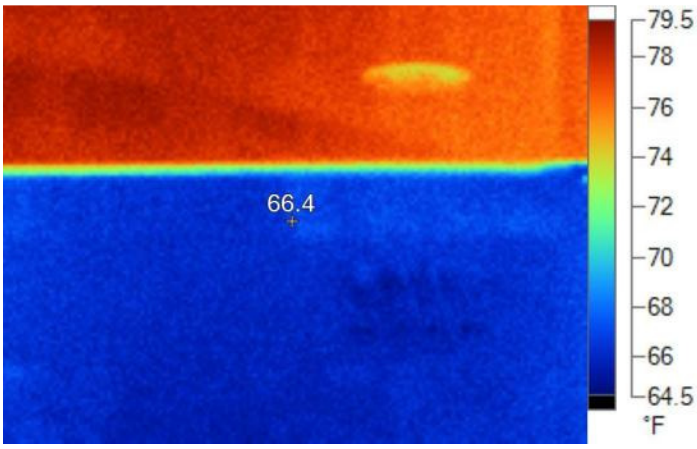

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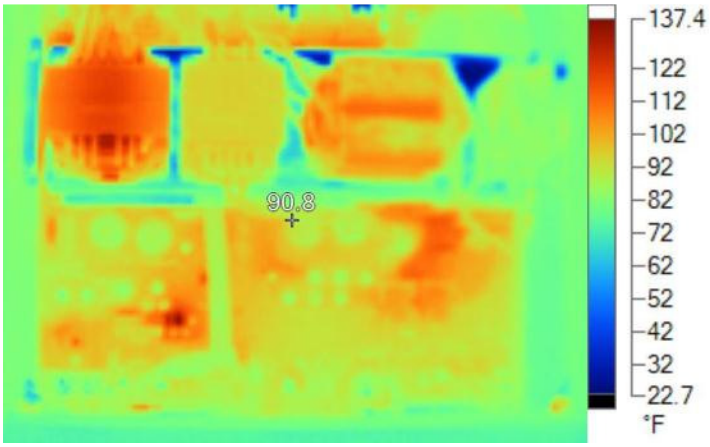

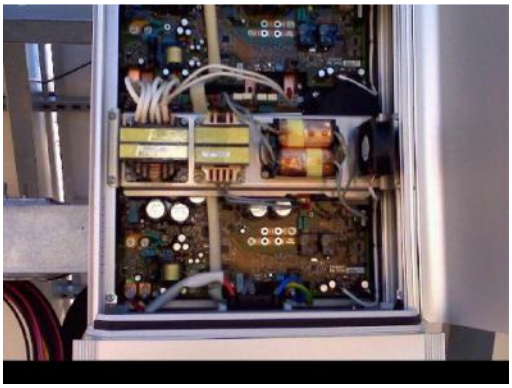

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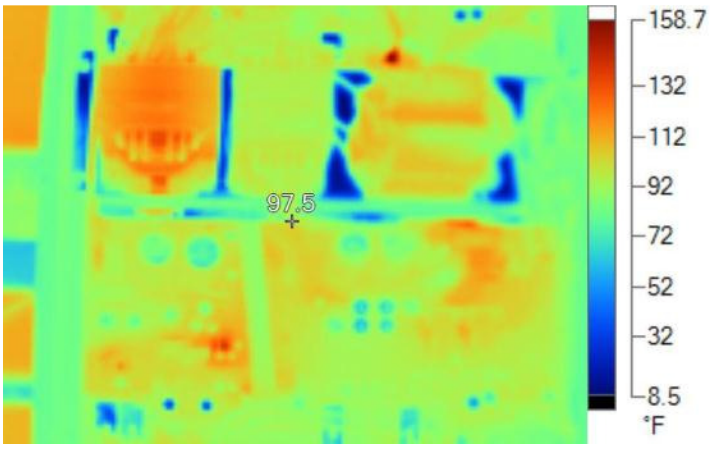
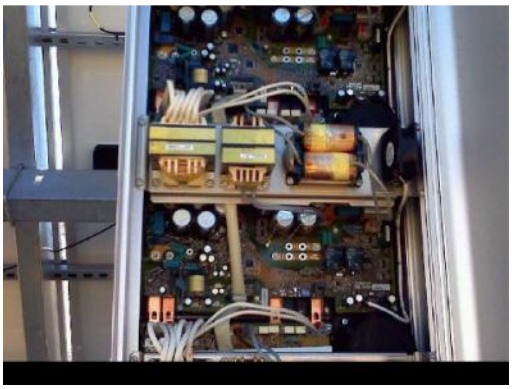
Average Temperature	90.1℉
Image Range	22.7℉ to 137.4℉
IR Sensor Size	160 x 120



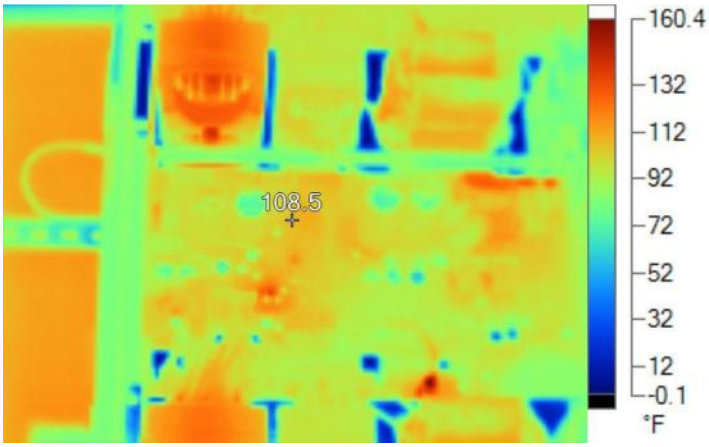


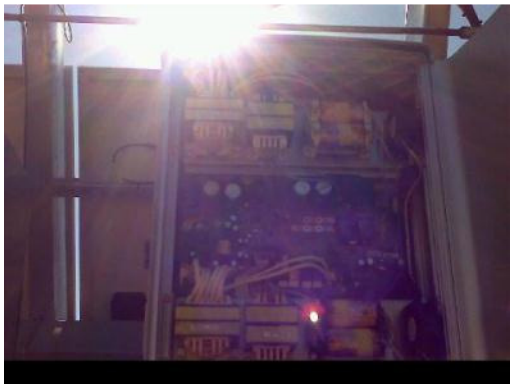
Visible Light Image

IR001855.IS2
6/27/2012 9:10:44 AM

Image Info

Background temperature	71.6℉
Average Temperature	92.6℉
Image Range	8.5℉ to 158.7℉
IR Sensor Size	160 x 120



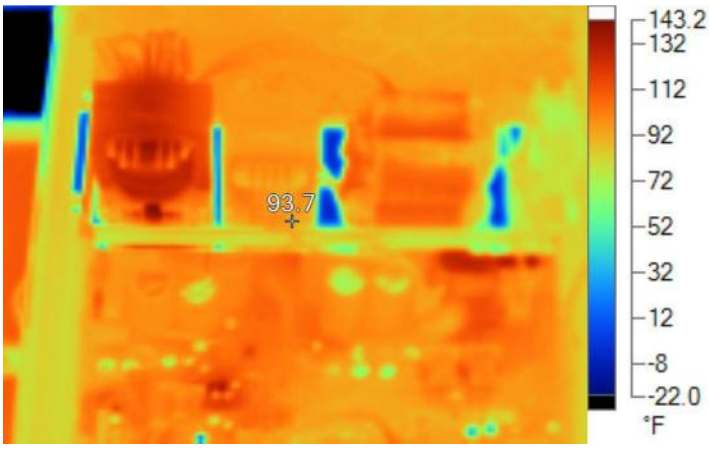


Visible Light Image

IR001856.IS2
6/27/2012 9:10:55 AM

Image Info

Background temperature	71.6℉
Average Temperature	96.4℉
Image Range	-0.1℉ to 160.4℉
IR Sensor Size	160 x 120

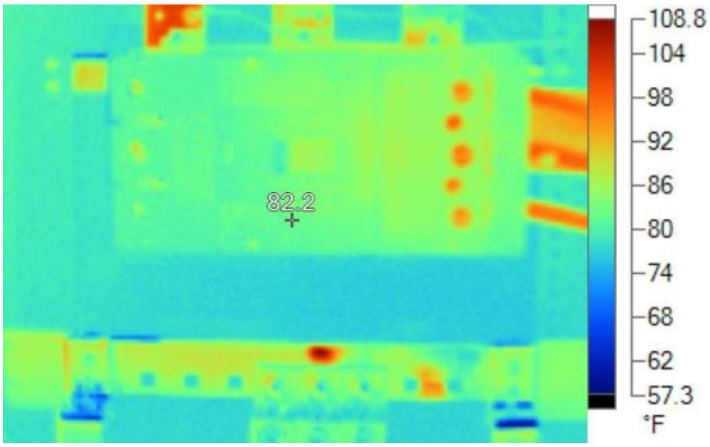


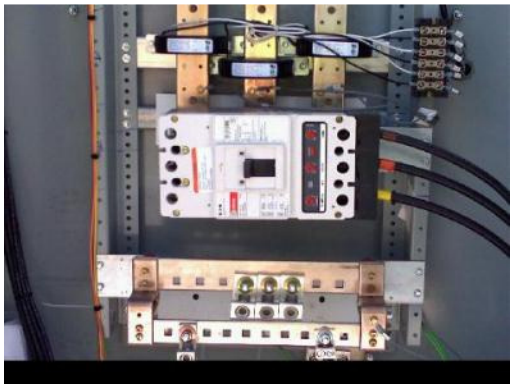
Visible Light Image

IR001857.IS2
6/27/2012 9:11:13 AM

Image Info

Background temperature	71.6℉
Average Temperature	92.4℉
Image Range	<-22.0℉ to 143.2℉
IR Sensor Size	160 x 120



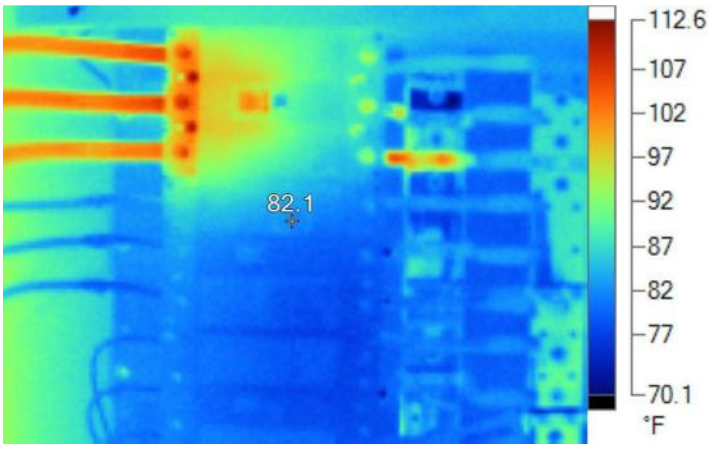


Visible Light Image

IR001859.IS2
6/27/2012 9:39:39 AM

Image Info

Background temperature	71.6℉
Average Temperature	81.2℉
Image Range	57.3℉ to 108.8℉
IR Sensor Size	160 x 120

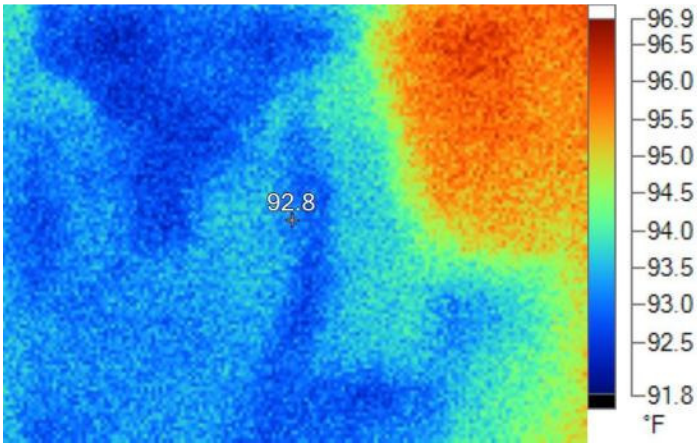


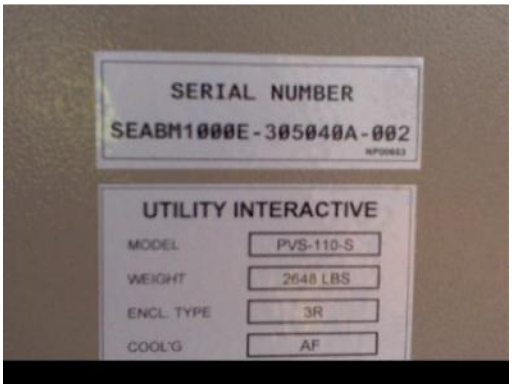
Visible Light Image

IR001860.IS2
6/27/2012 9:39:58 AM

Image Info

Background temperature	71.6℉
Average Temperature	85.0℉
Image Range	70.1℉ to 112.6℉
IR Sensor Size	160 x 120



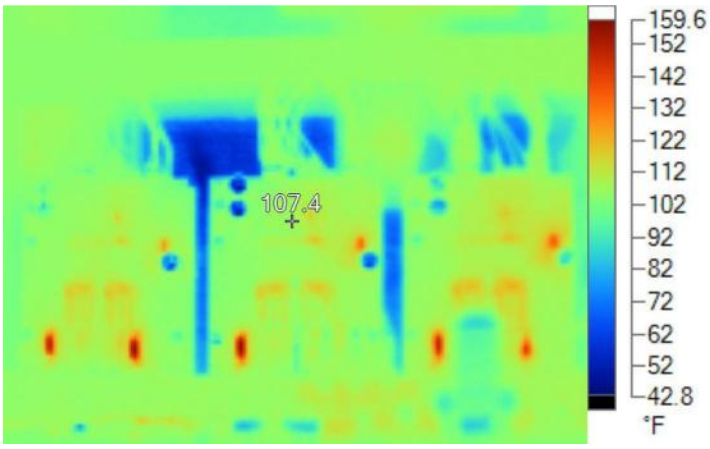


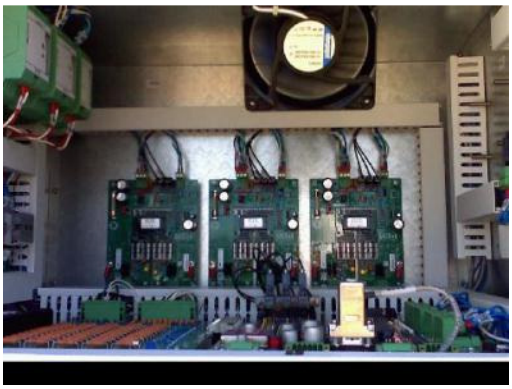
Visible Light Image

IR001861.IS2
6/27/2012 10:01:37 AM

Image Info

Background temperature	71.6℉
Average Temperature	93.7℉
Image Range	91.8℉ to 96.9℉
IR Sensor Size	160 x 120



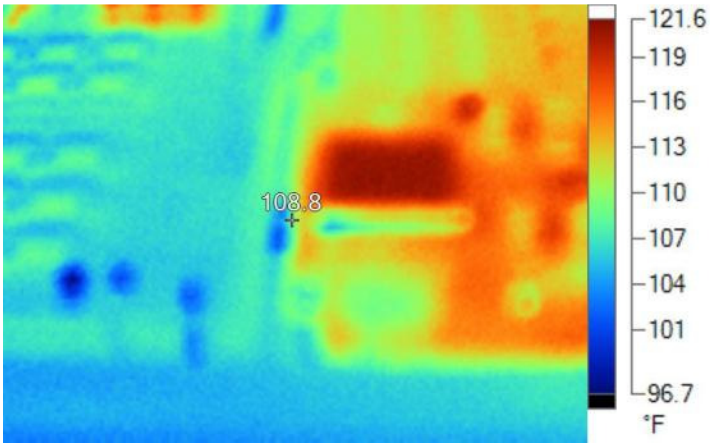


Visible Light Image

IR001862.IS2
6/27/2012 10:02:14 AM

Image Info

Background temperature	71.6℉
Average Temperature	103.1℉
Image Range	42.8℉ to 159.6℉
IR Sensor Size	160 x 120

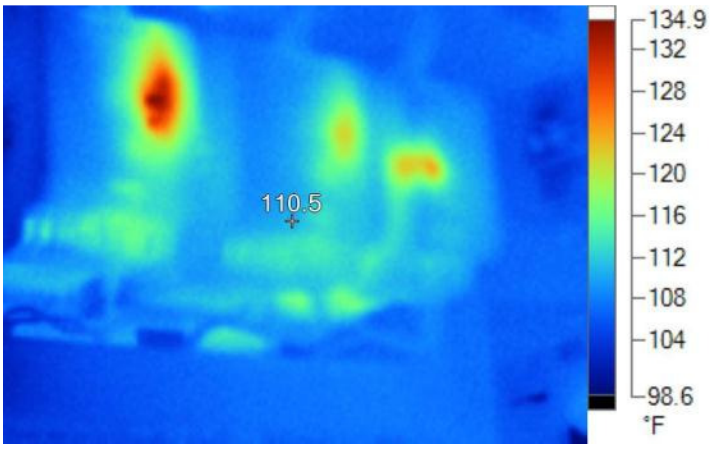


Visible Light Image

IR001863.IS2
6/27/2012 10:02:24 AM

Image Info

Background temperature	71.6℉
Average Temperature	109.3℉
Image Range	96.7℉ to 121.6℉
IR Sensor Size	160 x 120

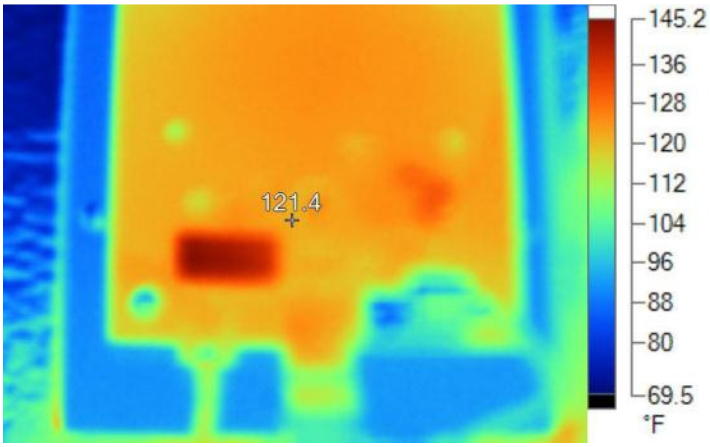


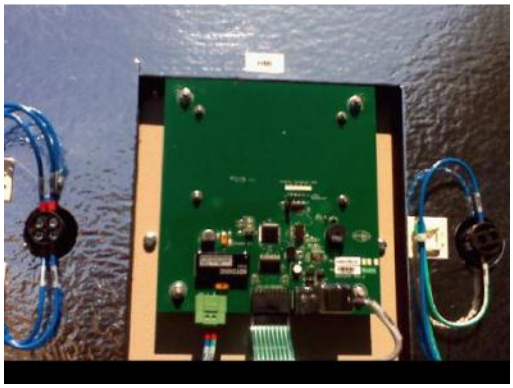
Visible Light Image

IR001864.IS2
6/27/2012 10:02:37 AM

Image Info

Background temperature	71.6℉
Average Temperature	108.7℉
Image Range	98.6℉ to 134.9℉
IR Sensor Size	160 x 120



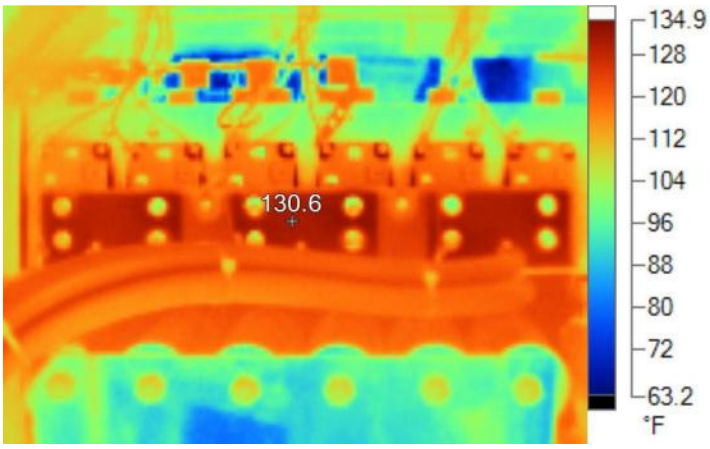


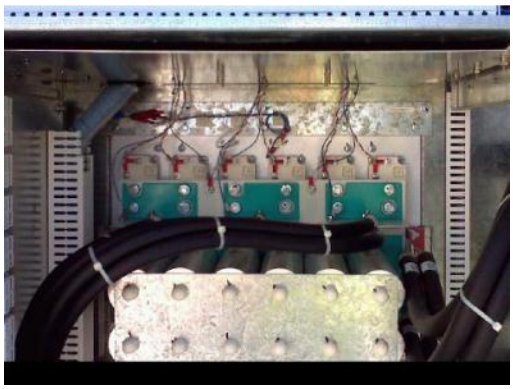
Visible Light Image

IR001865.IS2
6/27/2012 10:02:46 AM

Image Info

Background temperature	71.6℉
Average Temperature	108.8℉
Image Range	69.5℉ to 145.2℉
IR Sensor Size	160 x 120



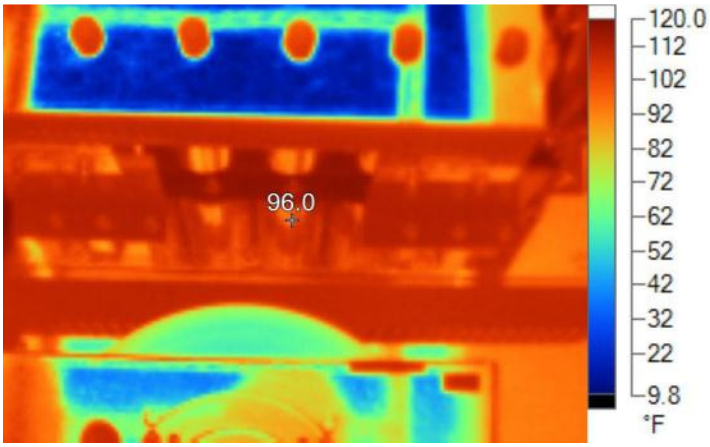


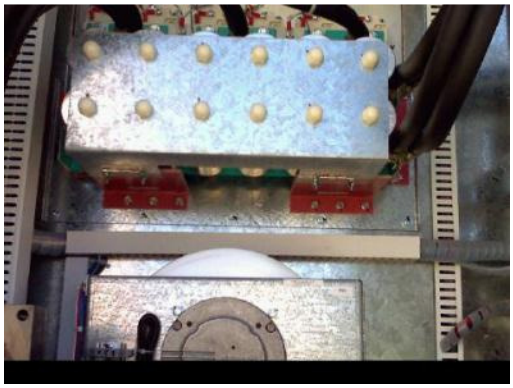
Visible Light Image

IR001866.IS2
6/27/2012 10:02:54 AM

Image Info

Background temperature	71.6℉
Average Temperature	110.1℉
Image Range	63.2℉ to 134.9℉
IR Sensor Size	160 x 120



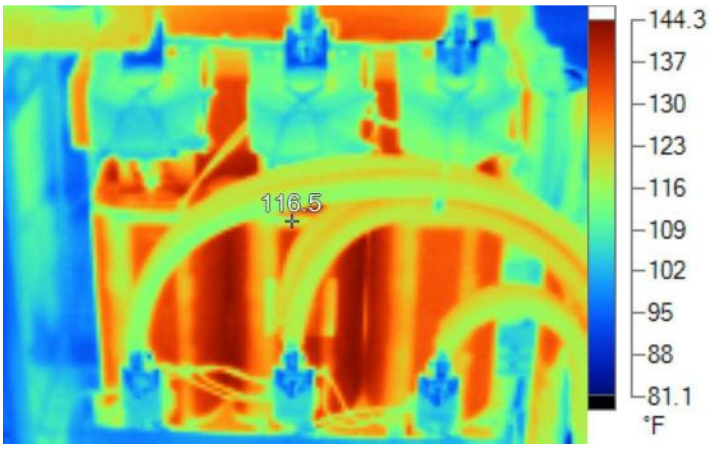


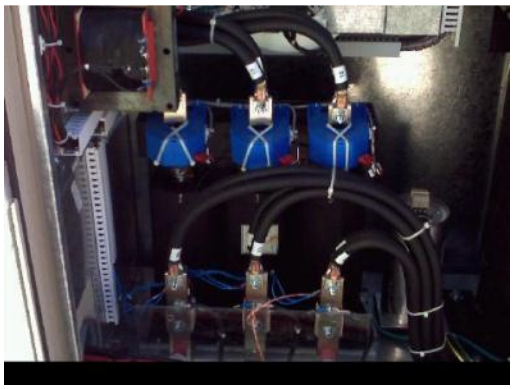
Visible Light Image

IR001867.IS2
6/27/2012 10:03:05 AM

Image Info

Background temperature	71.6℉
Average Temperature	84.7℉
Image Range	9.8℉ to 120.0℉
IR Sensor Size	160 x 120



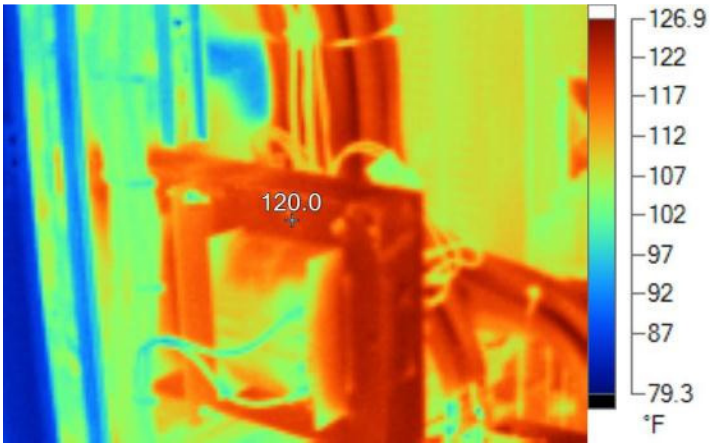


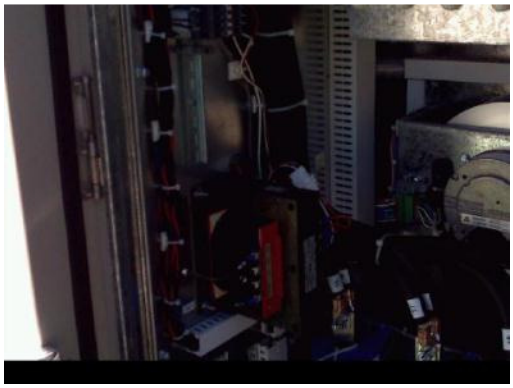
Visible Light Image

IR001868.IS2
6/27/2012 10:03:14 AM

Image Info

Background temperature	71.6℉
Average Temperature	116.9℉
Image Range	81.1℉ to 144.3℉
IR Sensor Size	160 x 120



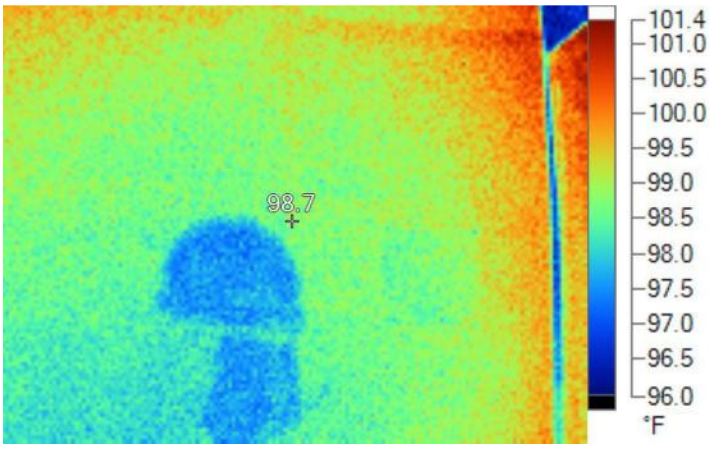


Visible Light Image

IR001869.IS2
6/27/2012 10:03:21 AM

Image Info

Background temperature	71.6℉
Average Temperature	109.1℉
Image Range	79.3℉ to 126.9℉
IR Sensor Size	160 x 120

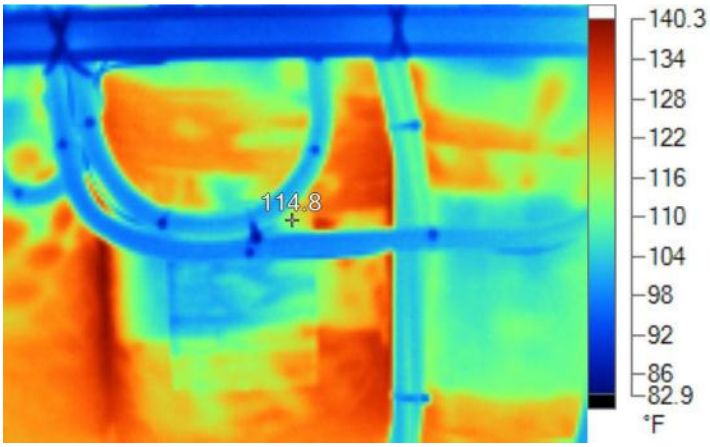


Visible Light Image

IR001870.IS2
6/27/2012 10:03:40 AM

Image Info

Background temperature	71.6℉
Average Temperature	98.8℉
Image Range	96.0℉ to 101.4℉
IR Sensor Size	160 x 120

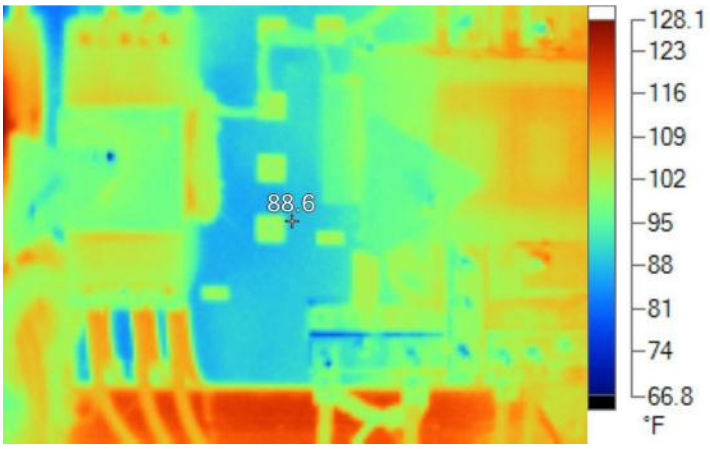


Visible Light Image

IR001871.IS2
6/27/2012 10:06:07 AM

Image Info

Background temperature	71.6℉
Average Temperature	112.4℉
Image Range	82.9℉ to 140.3℉
IR Sensor Size	160 x 120

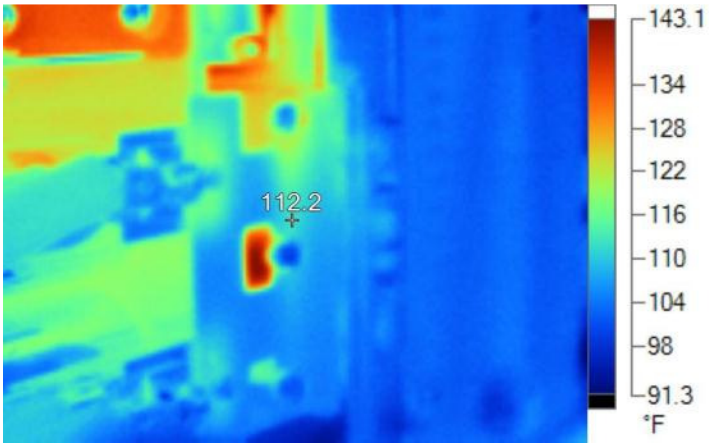


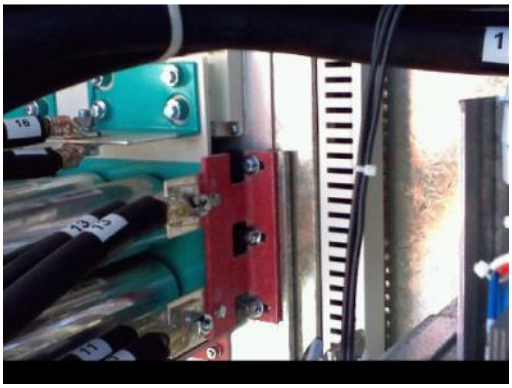
Visible Light Image

IR001872.IS2
6/27/2012 10:12:19 AM

Image Info

Background temperature	71.6℉
Average Temperature	100.4℉
Image Range	66.8℉ to 128.1℉
IR Sensor Size	160 x 120



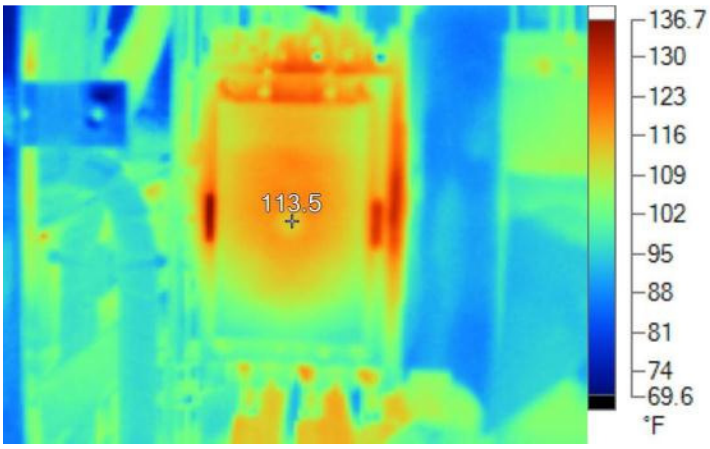


Visible Light Image

IR001873.IS2
6/27/2012 10:12:45 AM

Image Info

Background temperature	71.6℉
Average Temperature	109.4℉
Image Range	91.3℉ to 143.1℉
IR Sensor Size	160 x 120

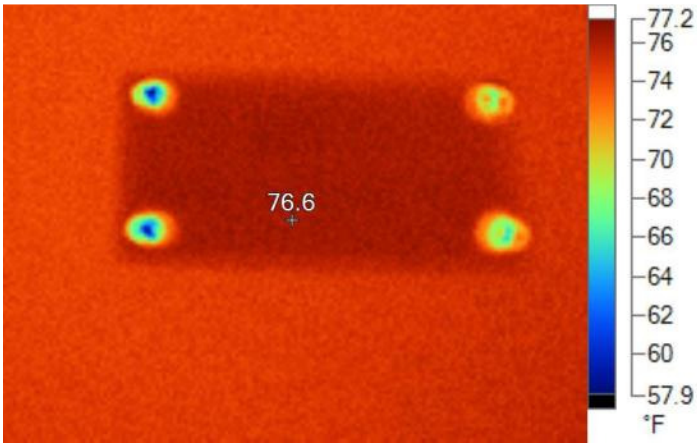


Visible Light Image

IR001874.IS2
6/27/2012 10:12:58 AM

Image Info

Background temperature	71.6℉
Average Temperature	101.2℉
Image Range	69.6℉ to 136.7℉
IR Sensor Size	160 x 120

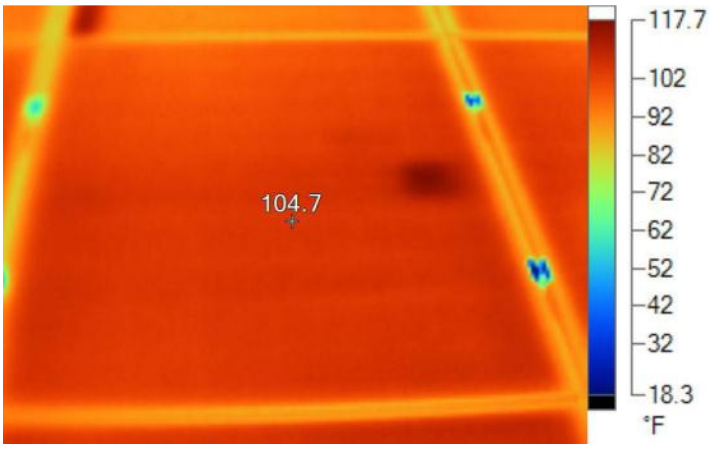


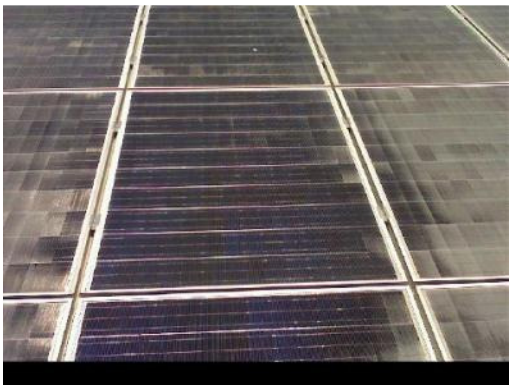
Visible Light Image

IR001875.IS2
6/27/2012 10:15:31 AM

Image Info

Background temperature	71.6℉
Average Temperature	75.0℉
Image Range	57.9℉ to 77.2℉
IR Sensor Size	160 x 120



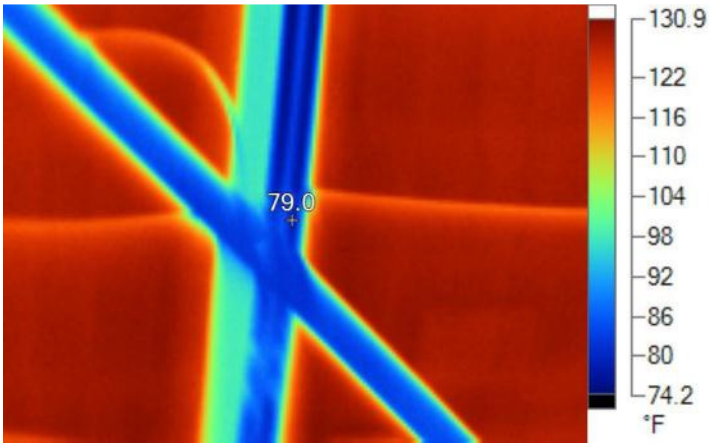


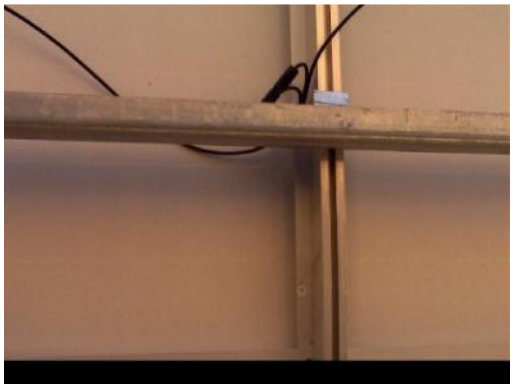
Visible Light Image

IR001876.IS2
6/27/2012 10:16:48 AM

Image Info

Background temperature	71.6℉
Average Temperature	100.9℉
Image Range	18.3℉ to 117.7℉
IR Sensor Size	160 x 120



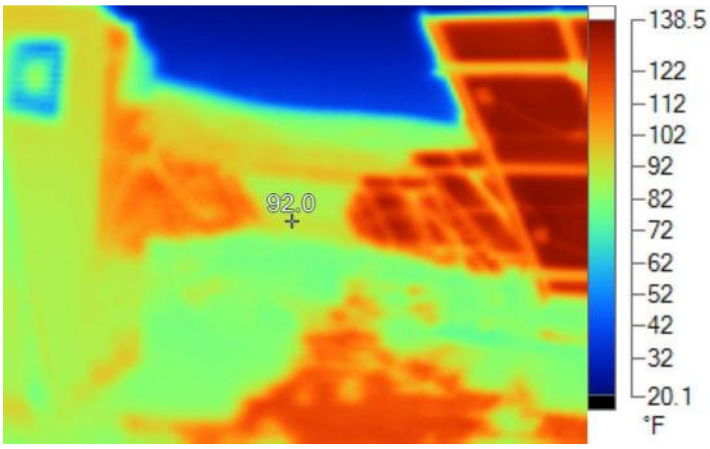


Visible Light Image

IR001877.IS2
6/27/2012 10:17:49 AM

Image Info

Background temperature	71.6℉
Average Temperature	117.9℉
Image Range	74.2℉ to 130.9℉
IR Sensor Size	160 x 120

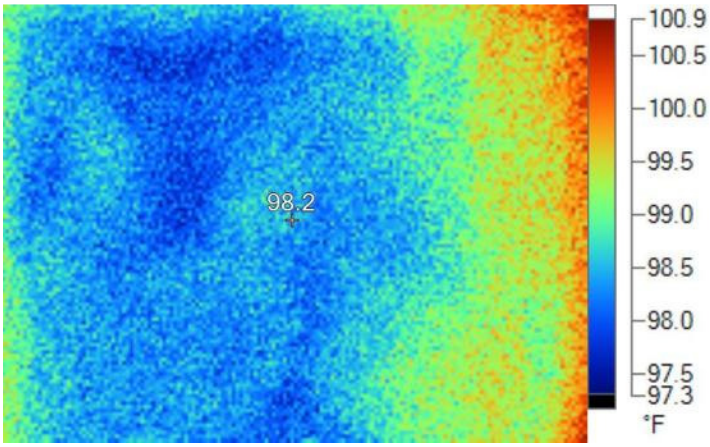


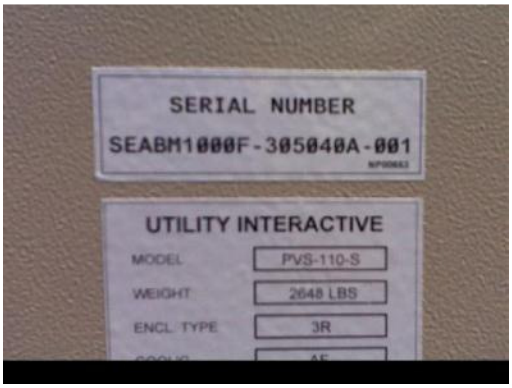
Visible Light Image

IR001878.IS2
6/27/2012 11:35:13 AM

Image Info

Background temperature	71.6℉
Average Temperature	89.4℉
Image Range	20.1℉ to 138.5℉
IR Sensor Size	160 x 120



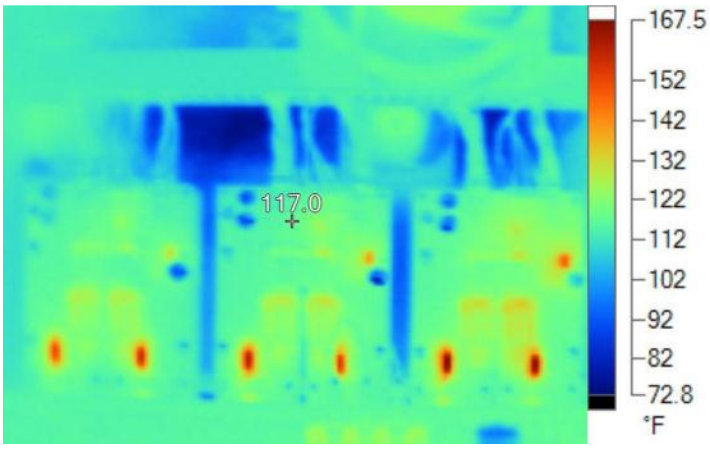


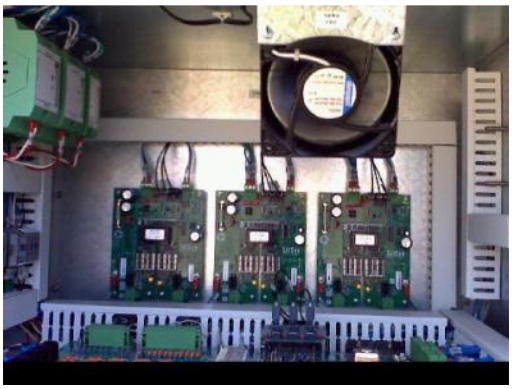
Visible Light Image

IR001879.IS2
6/27/2012 11:35:24 AM

Image Info

Background temperature	71.6℉
Average Temperature	98.7℉
Image Range	97.3℉ to 100.9℉
IR Sensor Size	160 x 120



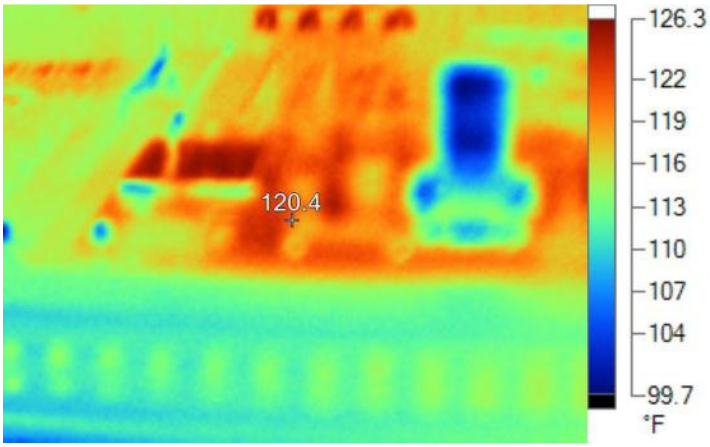


Visible Light Image

IR001880.IS2
6/27/2012 11:35:44 AM

Image Info

Background temperature	71.6℉
Average Temperature	113.3℉
Image Range	72.8℉ to 167.5℉
IR Sensor Size	160 x 120

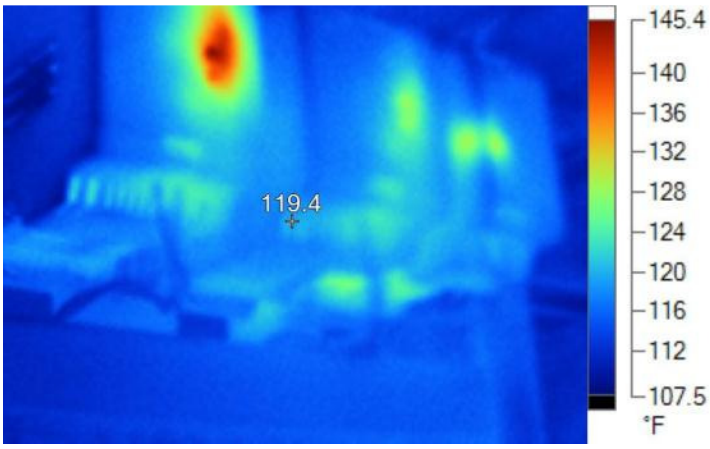


Visible Light Image

IR001881.IS2
6/27/2012 11:36:02 AM

Image Info

Background temperature	71.6℉
Average Temperature	115.0℉
Image Range	99.7℉ to 126.3℉
IR Sensor Size	160 x 120

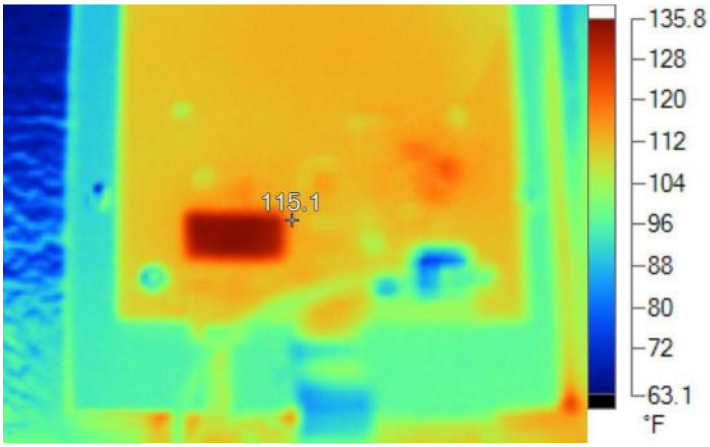


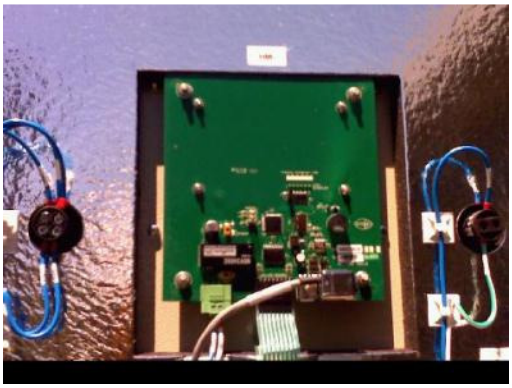
Visible Light Image

IR001882.IS2
6/27/2012 11:36:09 AM

Image Info

Background temperature	71.6℉
Average Temperature	116.1℉
Image Range	107.5℉ to 145.4℉
IR Sensor Size	160 x 120



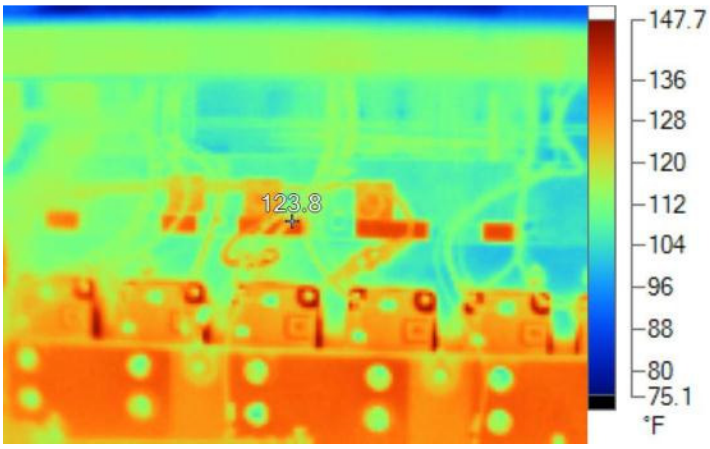


Visible Light Image

IR001883.IS2
6/27/2012 11:36:18 AM

Image Info

Background temperature	71.6℉
Average Temperature	102.6℉
Image Range	63.1℉ to 135.8℉
IR Sensor Size	160 x 120

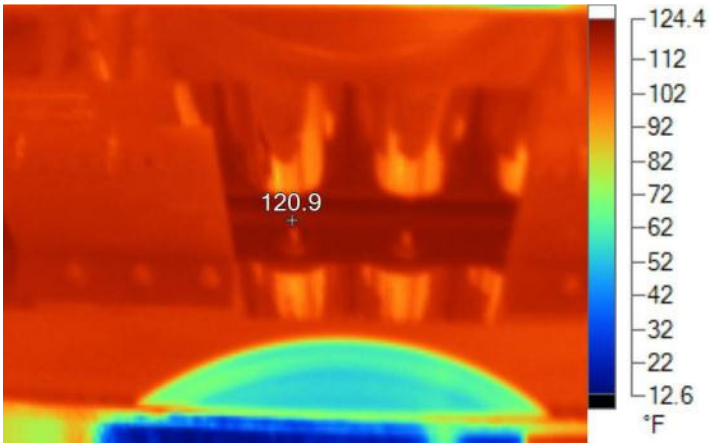


Visible Light Image

IR001884.IS2
6/27/2012 11:36:29 AM

Image Info

Background temperature	71.6℉
Average Temperature	116.4℉
Image Range	75.1℉ to 147.7℉
IR Sensor Size	160 x 120

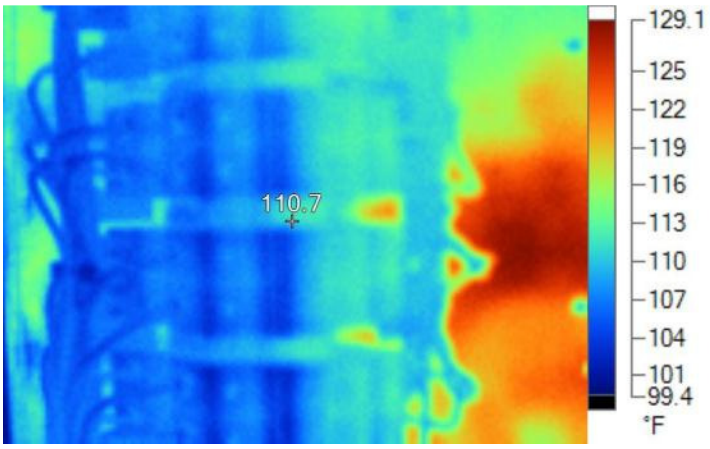


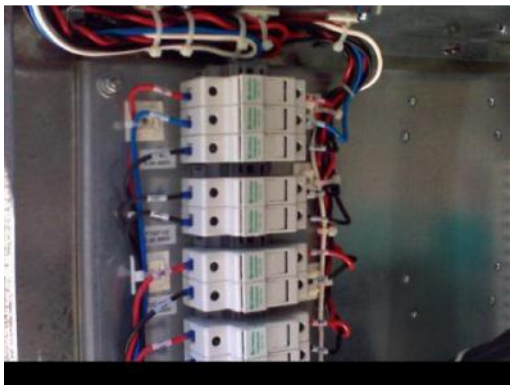
Visible Light Image

IR001885.IS2
6/27/2012 11:36:39 AM

Image Info

Background temperature	71.6℉
Average Temperature	104.1℉
Image Range	12.6℉ to 124.4℉
IR Sensor Size	160 x 120



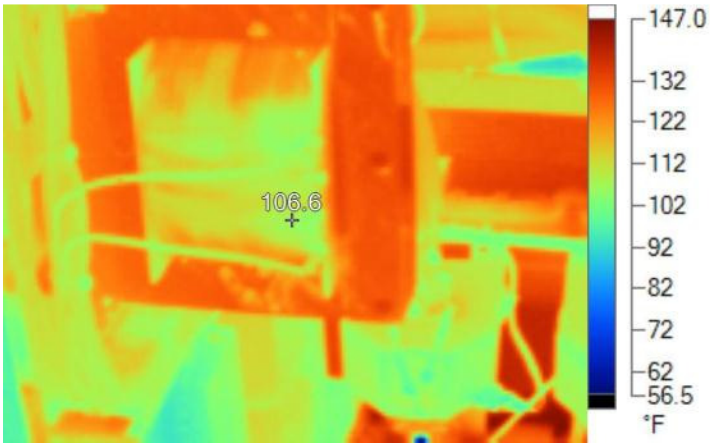


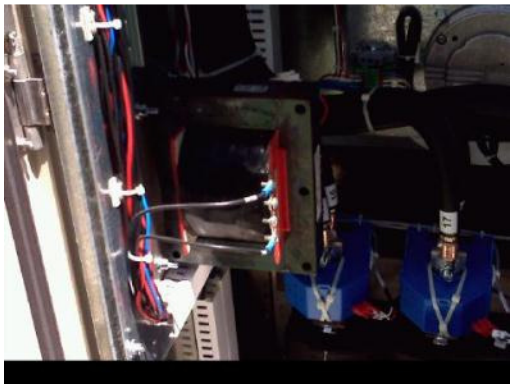
Visible Light Image

IR001886.IS2
6/27/2012 11:36:50 AM

Image Info

Background temperature	71.6℉
Average Temperature	111.2℉
Image Range	99.4℉ to 129.1℉
IR Sensor Size	160 x 120



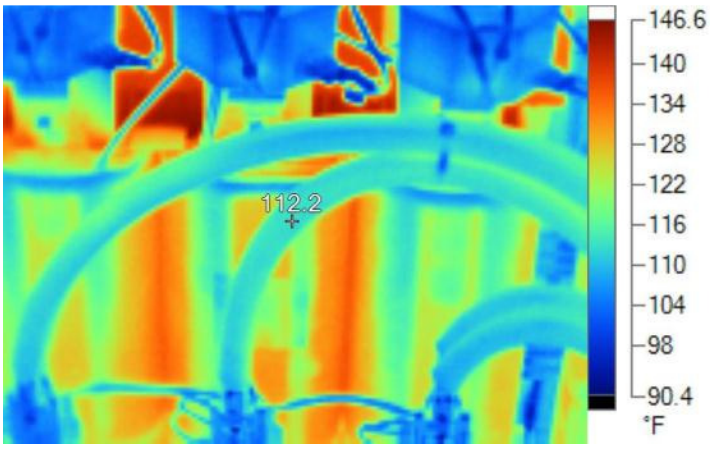


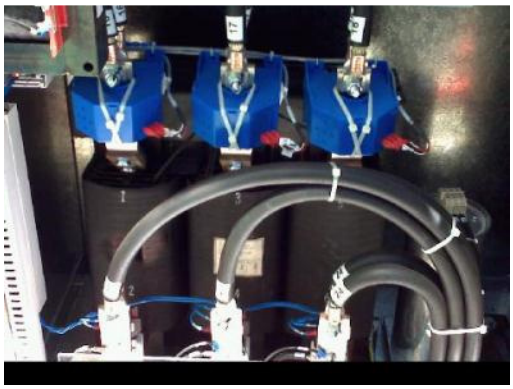
Visible Light Image

IR001887.IS2
6/27/2012 11:36:54 AM

Image Info

Background temperature	71.6℉
Average Temperature	117.0℉
Image Range	56.5℉ to 147.0℉
IR Sensor Size	160 x 120



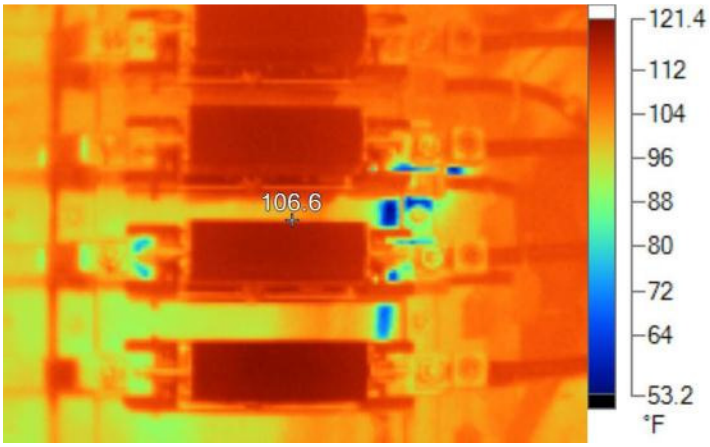


Visible Light Image

IR001888.IS2
6/27/2012 11:37:05 AM

Image Info

Background temperature	71.6℉
Average Temperature	117.2℉
Image Range	90.4℉ to 146.6℉
IR Sensor Size	160 x 120

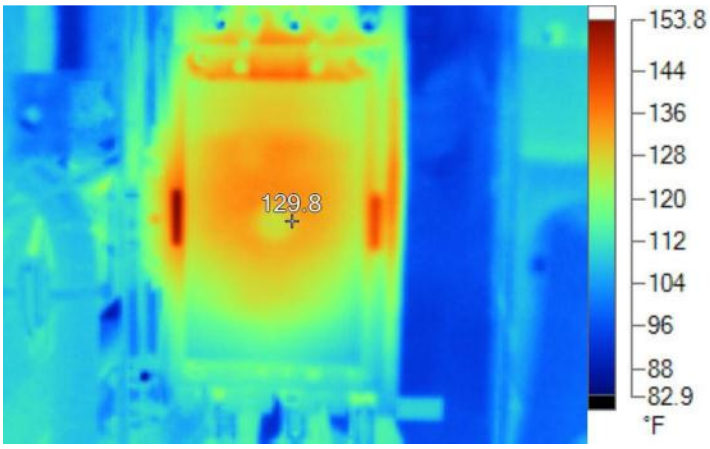


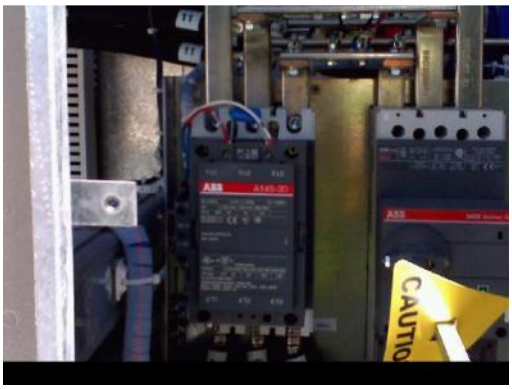
Visible Light Image

IR001889.IS2
6/27/2012 11:37:14 AM

Image Info

Background temperature	71.6℉
Average Temperature	105.7℉
Image Range	53.2℉ to 121.4℉
IR Sensor Size	160 x 120



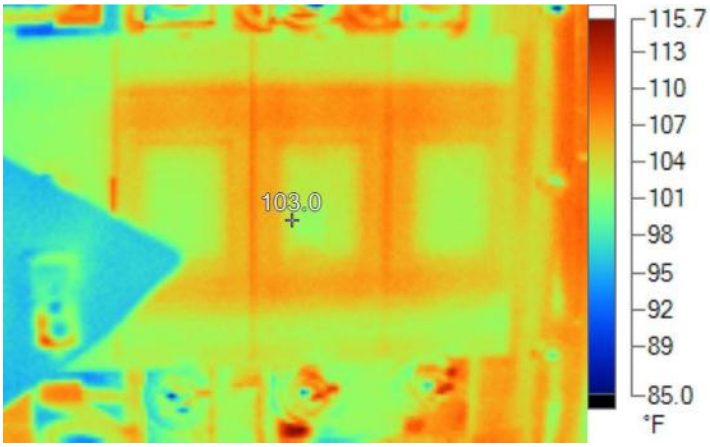


Visible Light Image

IR001890.IS2
6/27/2012 11:37:19 AM

Image Info

Background temperature	71.6℉
Average Temperature	111.3℉
Image Range	82.9℉ to 153.8℉
IR Sensor Size	160 x 120

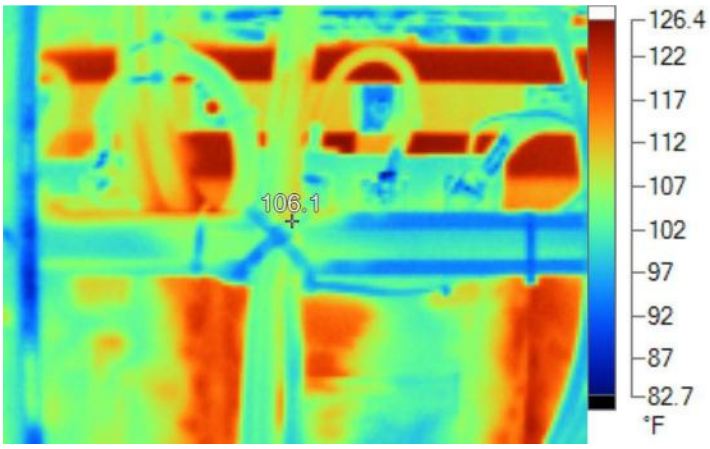


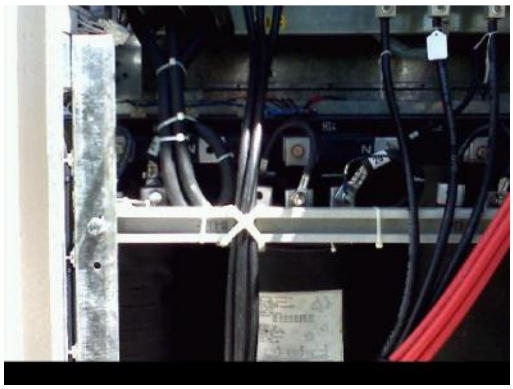
Visible Light Image

IR001891.IS2
6/27/2012 11:37:25 AM

Image Info

Background temperature	71.6°F
Average Temperature	103.5°F
Image Range	85.0°F to 115.7°F
IR Sensor Size	160 x 120



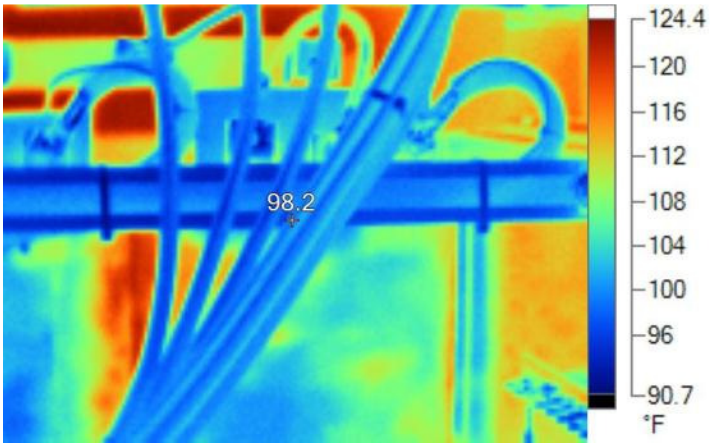


Visible Light Image

IR001892.IS2
6/27/2012 11:37:41 AM

Image Info

Background temperature	71.6°F
Average Temperature	107.0°F
Image Range	82.7°F to 126.4°F
IR Sensor Size	160 x 120

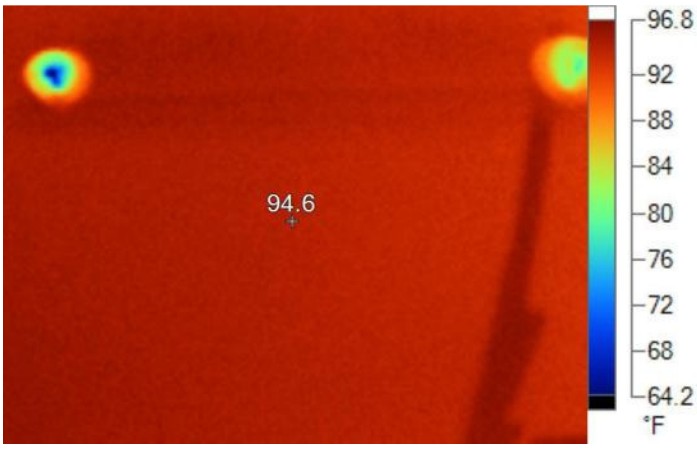


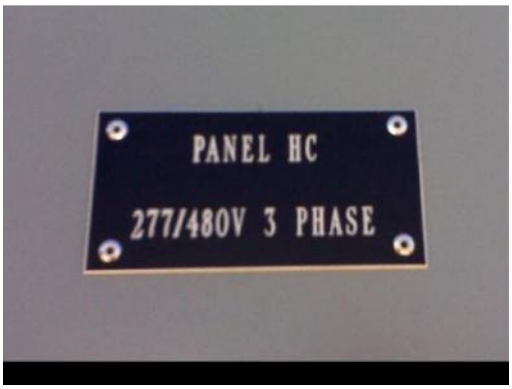
Visible Light Image

IR001893.IS2
6/27/2012 11:37:48 AM

Image Info

Background temperature	71.6℉
Average Temperature	105.5℉
Image Range	90.7℉ to 124.4℉
IR Sensor Size	160 x 120



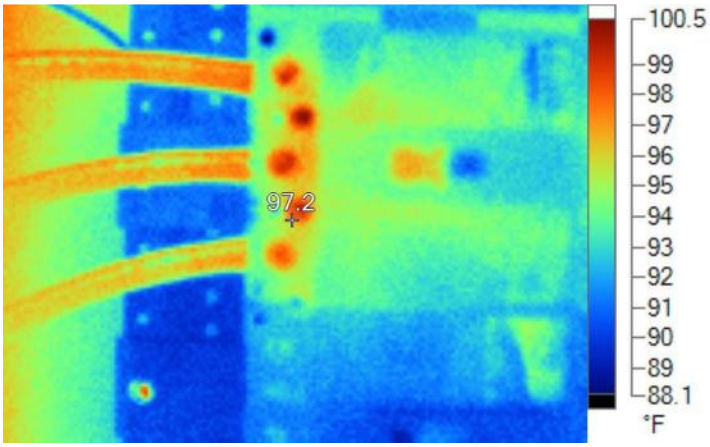


Visible Light Image

IR001894.IS2
6/27/2012 11:38:00 AM

Image Info

Background temperature	71.6℉
Average Temperature	94.5℉
Image Range	64.2℉ to 96.8℉
IR Sensor Size	160 x 120

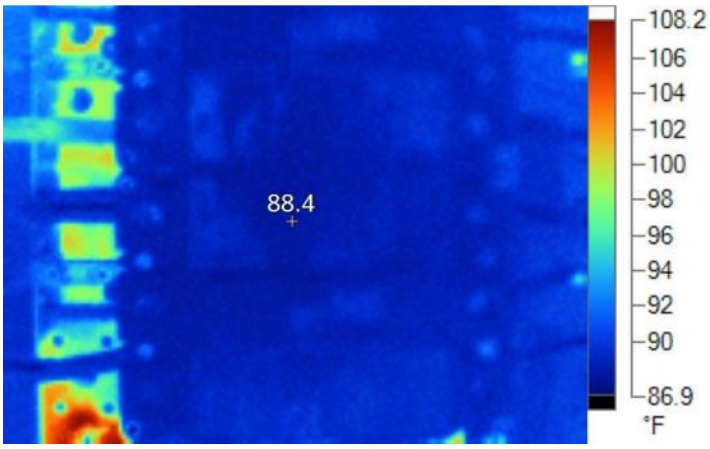


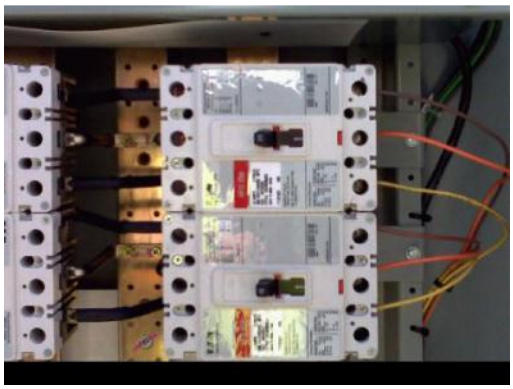
Visible Light Image

IR001895.IS2
6/27/2012 11:38:18 AM

Image Info

Background temperature	71.6℉
Average Temperature	93.4℉
Image Range	88.1℉ to 100.5℉
IR Sensor Size	160 x 120



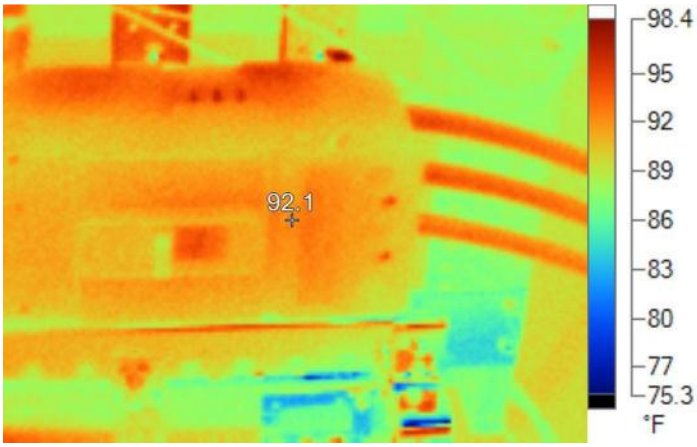


Visible Light Image

IR001896.IS2
6/27/2012 11:38:26 AM

Image Info

Background temperature	71.6℉
Average Temperature	89.9℉
Image Range	86.9℉ to 108.2℉
IR Sensor Size	160 x 120



Visible Light Image

IR001897.IS2
6/27/2012 11:38:49 AM

Image Info

Background temperature	71.6℉
Average Temperature	90.1℉
Image Range	75.3℉ to 98.4℉
IR Sensor Size	160 x 120

Punch list

COMMISSIONING PUNCH LIST

From:	Next Phase Solar
Job Name:	Santa Rita Jail
To:	
Contractor's Rep:	Larry Streif
Date:	6/28/2012
PUNCH LIST #: 1	

Item #	Description/Reference
1	**Satcom Inverters-**Torque marks needed on all terminations (Reference Photo 1)
2	**Satcom Inverters-**Bottom Plates missing (Reference Photo 2)
3	**Satcom Inverters-**Seal incoming conduits (Reference Photo 3)
4	**All Combiners-**Torque marks needed on all terminations (Reference Photo 4)
5	**Combiner 1 (Trackers Co2,Co3,Co5,Co6)-**Bond bushing needed on incoming 2" conduit (Reference Photo 5)
6	**Combiner 2 (Trackers Co8,Co9,Co11,Co12,Co14)-**Bond bushing needed on incoming 2" conduit
7	**Panel HC-** Missing label on main breaker (Reference Photo 6)
8	**Panel HA**- Missing label on main breaker
9	**Inverter HA-** Door on the right is tweaked, difficult to open and closed
10	**Inverter HA-**Positive and negative wires are resting on ground lugs, separation or rubber insulation placed between the two is needed (Reference Photo 7)
11	No Lox is recommend for all aluminum to copper connections to prevent oxidization and prolong the life of the termination
12	**Hill Side Combiner 1 (Trackers A2, A3, A4, A5, A6, A7)-**Bond bushing needed on incoming 2" conduit
13	**Hill Side Combiner 2 (Trackers A10, A11, A12, A13, A14, A15)-**Bond bushing needed on incoming 2" conduit
14	**Hill Side Combiner 3 (Trackers A18, A19, A20, A21, A22, A23)-**Bond bushing needed on incoming 2" conduit
15	**Hill Side Combiner 4 (Trackers A18, A19, A20, A21, A22, A23)**-Bond bushing needed on incoming 2" conduit

16	**Hill Side Combiner 4 (Trackers A18, A19, A20, A21, A22, A23)-**Bond bushing needed on incoming 2" conduit
17	**Hill Side Combiner 5 (Trackers A18, A19, A20, A21, A22, A23)-**Bond bushing needed on incoming 2" conduit
18	**Hill Side Combiner 5 (Trackers A18, A19, A20, A21, A22, A23)-**Torque marks needed on all terminations
19	**Hill Side String Combiners-** Seal incoming conduits to prevent ground bar internals from corroding (Reference Photo 7)
20	**All Array's-**Several MC connectors were loose causing loss of connectivity from string to home run. I would recommend going through all MC connectors to check for a secure connection.

Array and Equipment Images

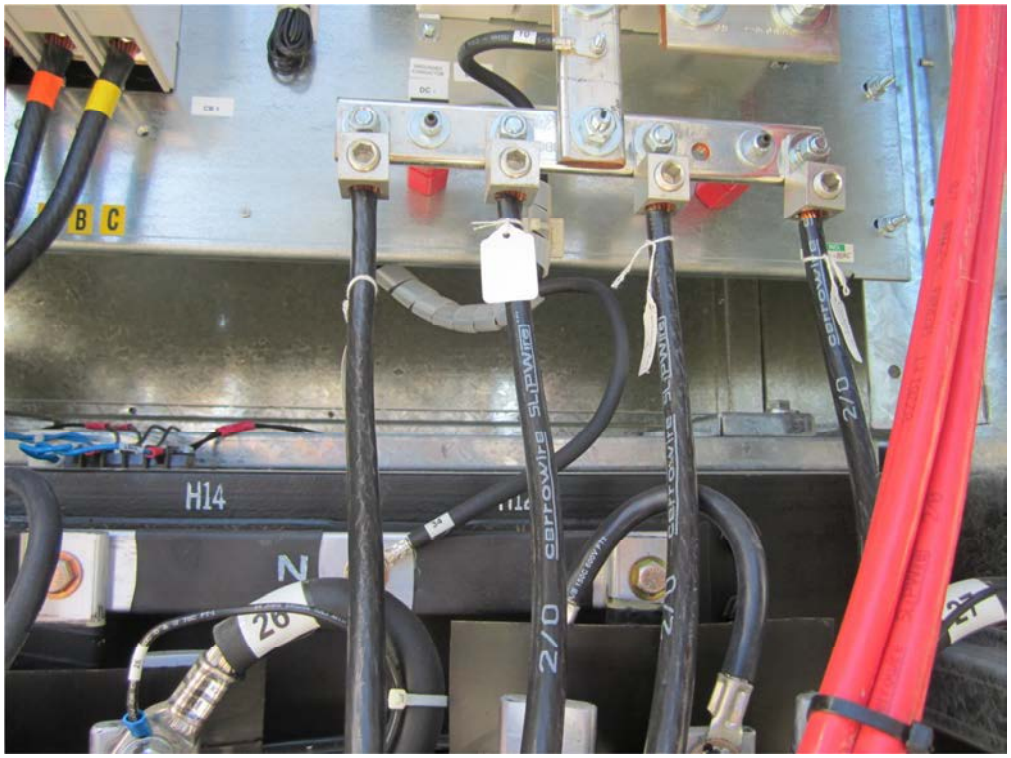


Photo 1

Photo 2

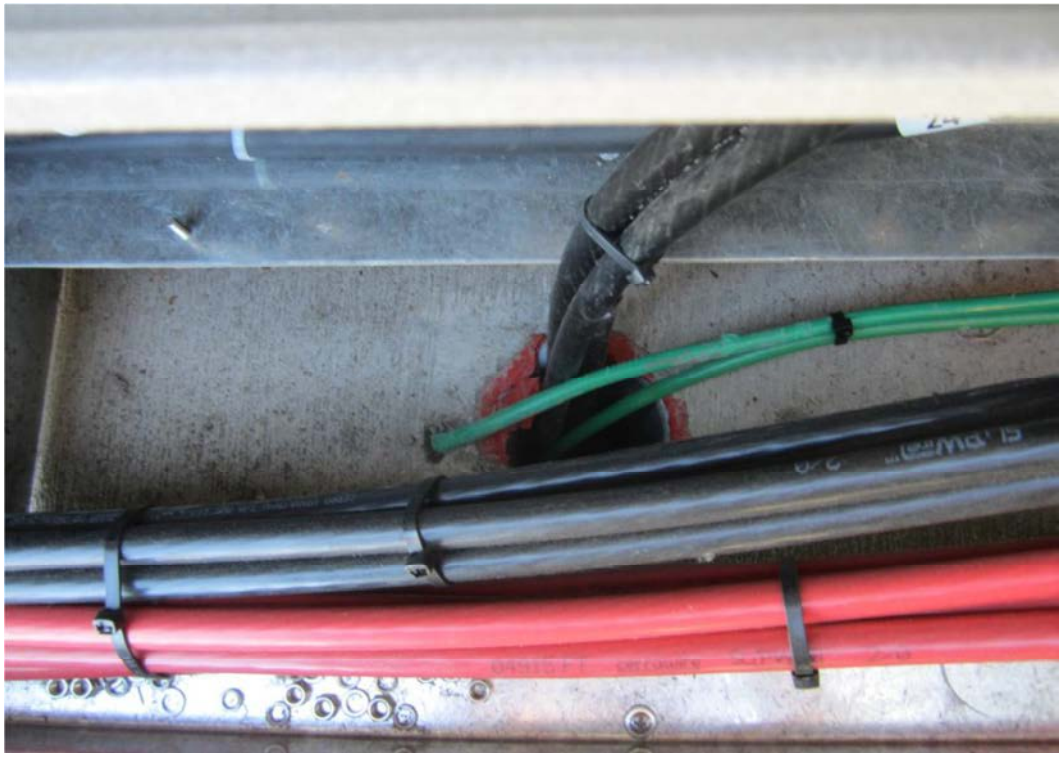


Photo 3

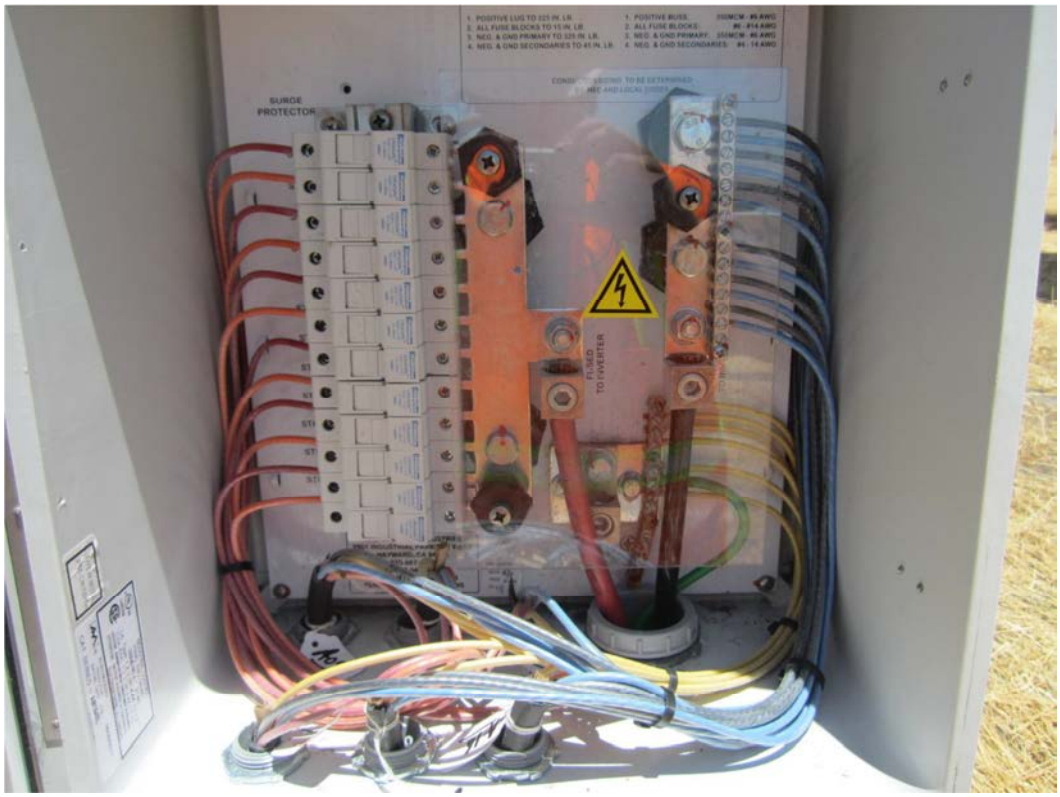


Photo 4

Photo 5

Photo 6

Photo 7

Photo 8

Contact

If you have questions or comments, please contact us at the following location:

Next Phase Solar, Inc.
2802 10th Street
Berkeley, CA 94710
(510) 984-2027
info@nextphasesolar.com
http://www.nextphasesolar.com

Maximizing peace of mind™

Attachment B

Santa Rita Jail Solar Monitoring System

Commissioning Information

Installed 23 March 2012

Onboarded by GroundWork Renewables, Inc.

6 June 2012

Prepared for Solaria Corporation

Attachment B

Prepared for Solaria Corporation

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Attachment B

Solaria Corporation
Solar Monitoring Station
(To Be Completed by Lead Installer)

Project Identification & Location					
Project Name	Santa Rita Jail	**Actual Latitude**	37°42'57.37"N	**Topography**	Jail
Project Number	N/A	**Actual Longitude**	121°53'15.53"W	**Soil Type**	Dirt, concrete
Start Date	Friday, March 23, 2012	**Former Lat, Long (if any)**	0	**Location Notes (security, shading, etc.)**	Security clearance needed to access site.
GR Onboarding Date	Wednesday, June 06, 2012	**Datum**	WGS 84		
Time Zone Offset	GMT -8	**Elevation (Meters)**	115.8M		
Country, State/ Province	California, USA	**Compass**	True South		

Project Contact Information					
Lead Installer	David Siskind	**Client POC**	Raphael Varieras	**Client At-site Contact**	0
Cell Number	(310) 709-1795	**Cell Number**	(510) 270-2709	**Cell Number**	0
E-mail	dsiskind@grndwork.com	**E-mail**	Raphael Varieras <rvarieras@solaria.com>	**E-mail**	0
Alternative Contact		**Alternative Contact**		**Alternative Contact**	
Local Technician	Cal Harris	**Alt Client Contact**	Charith Tammineedi	**Host/Landowner**	
Cell Number	(925) 766-3483	**Cell Number**	(814) 321-7007	**Cell Number**	
E-mail	charris@harriselectric.com	**E-mail**	ctammineedi@solaria.com	**E-mail**	
Alternative Contact		**Alternative Contact**		**Alternative Contact**	

Communication					
Modem IP Address	166.130.6.106:6785	**Device Port**	6785	**Phone Number**	Unknown
PakBus Address	WS: 1 BF: 2 Meca: 3 Hillside: 4	**IMEI**	353229024979393	**Serial Number**	1137633460

Equipment - Weather Station

	Make	Model	Serial Number	Callibration Date	Channel #	Channel Name	Multiplier	Height	Orientation	Function Check (Initials/Notes)
Datalogger	Campbell Sci	CR1000	43344	10/3/2011	N/A	N/A	N/A	N/A	True South	DS
Pyrheliometer	Kipp & Zonen	CHP1	110661	8/22/2011	diff2	DNI	8.01	8'	True South	DS
Pyranometer	Kipp & Zonen	CMP11	114765	8/5/2011	diff1	GHI	10.11	8'	True South	DS
RH Temp Sensor	Vaisala	HMP45C	F4540046	11/12/2010	diff4, c1	rh & ambient temp	N/A	6'	True South	DS
Barometer	Vaisala	PTB110	G2860030	7/18/2011	se9	air pressure	N/A	5'	True South	DS
Rain Gauge	Texas Electronics	TR-525I	48683-711	N/A	p2	precipitation	N/A	6'	True South	DS
Wind	MetOne	034A-034B	N/A	N/A	se5, p1	wind speed & direction	N/A	10'	True South	DS
Battery	Campbell Sci	PS200	N/A	N/A	N/A	N/A	N/A	N/A	True South	DS
Wide Spectrum Radio	Campbell Sci	RF450	N/A	N/A	csio	comm	N/A	N/A	True South	DS
Tracker	EKO	Sun Tracker	S11062.02	9/22/2011	N/A	N/A	N/A	7.5'	True South	DS
Notes:	Datalogger, pyrheliometer, pyranometer, RH/Temp sensor & barometer calibration certificates attached.									

Equipment - Hillside Unit A13

	Make	Model	Serial Number	Callibration Date	Channel #	Channel Name	Multiplier	Height	Orientation	Function Check (Initials/Notes)
Datalogger	Campbell Sci	CR800	19425	10/3/2011	N/A	N/A	N/A	N/A	Tracking	DS
Pyranometer	Kipp & Zonen	CMP6	112344	9/22/2011	diff1	Global POA	12.99	7'	Tracking	DS
Wide Spectrum Radio	Campbell Sci	RF450	N/A	N/A	csio	comm	N/A	N/A	Tracking	DS
Interface	Campbell Sci	MD485	N/A	N/A	csio	comm	N/A	N/A	Tracking	DS
Back of Panel Sensors	Campbell Sci	110PVL	N/A	N/A	se3, se4, se5, se6	Back of module temp	N/A	N/A	Tracking	DS
Notes:	Datalogger & pyranometer calibration certificates attached.									

Equipment - MECA Unit

	Make	Model	Serial Number	Callibration Date	Channel #	Channel Name	Multiplier	Height	Orientation	Function Check (Initials/Notes)
Datalogger	Campbell Sci	CR800	19424	10/3/2011	N/A	N/A	N/A	N/A	Tracking	DS
Pyranometer	Kipp & Zonen	CMP6	112345	9/22/2011	diff1	Global POA	11.19	N/A	Tracking	DS
Wide Spectrum Radio	Campbell Sci	RF450	N/A	N/A	csio	comm	N/A	N/A	Tracking	DS
Interface	Campbell Sci	MD485	N/A	N/A	csio	comm	N/A	N/A	Tracking	DS
Back of Panel Sensor	Campbell Sci	110PVL	N/A	N/A	se3, se4, se5, se6	Back of module temp	N/A	N/A	Tracking	DS
Notes:	Datalogger & pyranometer calibration certificates attached.									

SOLARIA®

Solaria Corporation
Solar Monitoring Station
(To Be Completed by Lead Installer)

Equipment - Behind the Fence Unit C04										
	Make	Model	Serial Number	Callibration Date	Channel #	Channel Name	Multiplier	Height	Orientation	Function Check (Initials/Notes)
Datalogger	Campbell Sci	CR800	19426	10/3/2011	N/A	N/A	N/A	N/A	Tracking	DS
Pyranometer	Kipp & Zonen	CMP6	112346	9/22/2011	diff1	Global POA	10.96	4'	Tracking	DS
Wide Spectrum Radio	Campbell Sci	RF450	N/A	N/A	csio	comm	N/A	N/A	Tracking	DS
Interface	Campbell Sci	MD485	N/A	N/A	csio	comm	N/A	N/A	Tracking	DS
Interface	B&B Electronis	BB485	N/A	N/A	com1	comm	N/A	N/A	Tracking	DS
Back of Panel Sensor	Campbell Sci	110PVL	N/A	N/A	se3, se4, se5, se6	Back of module temp	N/A	N/A	Tracking	DS
Notes:	Datalogger & pyranometer calibration certificates attached.									

Miscellany	Yes/No	Notes	Additional Security	Yes/No	Notes
Fencing	Yes	(if leased, provide fencing contact information)	Camo Paint	No	
Grounded	Yes		Razor Wire	Yes	
Enclosure Lock	No		Fence anchored to ground	Yes	
Gate Lock	No		Security Camera	Yes	(IP or other contact info)
Notes			Signage	No	

Data	
Instrument configuration by:	Campbell Sci/ Solaria
Responsible Party	Solaria
Point of Contact	Charith
Confirmed Receipt	Yes
Days of Data on Logger	WS: 23 days, BF: 21 days, M: 23 days, HS: 69 days

Maintenance Program		
Activity	Initials	Notes
Technician Trained	RB	
Kit provided	RB	
Online log created	CH	

Weather Station

Calibration Certificates

- CR1000 Datalogger #43344
- EKO Sun Tracker #S11062.02
- CHP1 Pyrheliometer #110661 & Measurement Report
- CMP11 Pyranometer #114765
- HMP45C Relative Humidity & Temperature Sensor #F4540046
- PTB110 Barometer #G2860030

Validation Report

Wiring Diagram

Photo Set

CAMPBELL SCIENTIFIC, INC.

815 W. 1800 N. Logan, Utah 84321-1784 (435)753-2342 Fax (435)750-9540 www.campbellsci.com

Certificate of Calibration

Customer Information:

The Solaria Corporation
6200 Paseo Padre Pkwy
Fremont, CA 94555

Contract/PO #: 3065
RMA #: N/A

Model: CR1000 Serial Number: 43344

Temperature Option: Standard Temperature Tested
Test Panel Location: 23
CSI Calibration Number: 110812724
Calibration Procedures: TST12215A R12 TST12215C R16 PRC33A R16

Instrument Calibration Condition

Received Disposition: N/A
Returned Disposition: In Tolerance

Recommended Calibration Schedule

If the customer has not requested a calibration interval , a non-mandatory recommended interval is provided. Based on past experience and assumed normal usage, it is recommended that this instrument be calibrated by the due date stated below to insure sustained accuracy and reliable performance.

Calibration Date: 03-Oct-11 **Calibration Due Date:** 03-Oct-13

Report of Calibration Standards Used

Make/Model	Serial Number	Cal. Due Date	Trace Number
Krohn Hite 523	II50313	18-Jul-12	II50313
CSI Oscillator	08/20/06	09-Jun-12	05/27 03

CSI certifies the above instrument meets or exceeds published specifications and has been calibrated using standards and instruments whose accuracies are traceable to the National Institute of Standards and Technology, an accepted value of a natural physical constant or a ratio calibration technique. The collective measurement uncertainty of the calibration process exceeds a 4:1 accuracy ratio. Policies and procedures at this facility comply with ISO-9001.

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Instrument Data Report

Analog Inputs

S/N: 43344

Datalogger Option: Standard Temperature Tested

			Single-Ended (Full Scale)		Differential		
Range	**Input (mV)**	***Tolerance (mV)**	**Before (mV)**	**After (mV)**	**Before (mV)**	**After (mV)**	**Temp. (°C)**
6	5000	±3	N/A	5000.045	N/A	5000.335	24.5
6	-5000	±3	N/A	-5000.626	N/A	-5000.674	24.5
5	2500	±1.5	N/A	N/A	N/A	2500.337	24.5
4	250	±0.15	N/A	N/A	N/A	249.9891	24.5
3	25	±0.015	N/A	N/A	N/A	25.00144	24.5
2	7.5	±0.0045	N/A	N/A	N/A	7.500108	24.5
1	2.5	±0.0015	N/A	N/A	N/A	2.50023	24.5
1	-2.5	±0.0015	N/A	N/A	N/A	-2.500949	24.5
6	5000	±6	N/A	4999.56	N/A	4998.979	-25
6	5000	±6	N/A	4999.521	N/A	5000.334	50
6	5000	±9	N/A	N/A	N/A	N/A	-55
6	5000	±9	N/A	N/A	N/A	N/A	85

*Tolerance values are specified accuracy not including offset. Offset voltages are not included because an offset removal procedure is used to account for calibrator offset. Refer to CSI Process Control Document PRC7A.

Quiescent System Power

Tolerance Approx. (mA)	**As Received (mA)**	**As Returned (mA)**	**Temp. (°C)**
~0.75	N/A	0.56	24.5

Real-Time Clock

Tolerance (min/year)	**As Returned(min/year)**	**Temp. (°C)**
± 3 minutes	Within Tolerance	-25 to +50

Laboratory temperature and relative humidity at the time of calibration

Temperature (°C): 24.5 **Relative Humidity (%):** 31.7

Functions tested per test document (see page 1)

Excitation Channels
Analog Input Ranges
System Power
Pulse Counters
Period Averaging
Control Ports

Calibration Technician

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Attachment B

EKO INSTRUMENTS CO., LTD.

Sasazuka Center Bldg. 2-1-6, Sasazuka Shibuya-ku, Tokyo 151-0073 Japan TEL:81.3.5352.2911 FAX:81.3.5352.2917 E-mail: info@eko.co.jp www.eko.co.jp

To whom it may concern;

Inspection Certificate

Manufacturer :	EKO Instruments Co., Ltd.	Calibration date :	September 22, 2011
Model :	STR-21G	Serial number :	S11062.02
Description :	Sun Tracker	EKO Ref. number :	EX11-228G

We hereby certify that this instrument has passed our strict inspection.

Factory setting of the site parameters

Latitude	35.671° North
Longitude	139.675° East
Clock time	UTC

Accessories

Cables	Communication cable 3m
	AC power cable 10m
Software	Parameter setting software STRConfig_V334.exe

AC power voltage : AC100 - 240V

I. Sunaga / Manager of Mfg. Dept.

T. Konuma / Inspector

Attachment B

KIPP & ZONEN
SINCE 1830

CALIBRATION CERTIFICATE

CERTIFICATE NUMBER	005602110661
PYRHELIOMETER MODEL	CHP 1
SERIAL NUMBER	110661
SENSITIVITY	8.01 μV/W/m²
IMPEDANCE	27.75 Ohm
TEMPERATURE	22 ±2 °C
REFERENCE PYRHELIOMETER	Kipp & Zonen CHP 1 snREF1 active from January 3, 2011
CALIBRATION DATE	22-Aug-2011 (recalibration is recommended every two years)
IN CHARGE OF TEST	K. Lansbergen

Calibration procedure

Exact interchange of test pyrheliometer and reference pyrheliometer in a horizontal parallel beam of light from a Xenonlamp. Full collimation angle of beam is 1.0°. Irradiance 500 ± 50 W/m². Roomtemperature 22 ±2 °C.

Hierarchy of traceability

This reference pyrheliometer was compared with the reference radiometer PMO2 of the World Radiation Center (WRC) using the sun as source. The reference radiometer is periodically calibrated against the World Standard Group (WSG), maintained at the WRC Davos. The readings are referred to the World Radiometric Reference (WRR) as stated in the WMO Technical Regulations. The originally estimated uncertainty of the WRR relative to SI is ±0.3%. The measurements were performed in Davos (latitude: 46.8143°, longitude: -9.8458°, altitude: 1588 m above sea level).

During the comparisons, the reference pyrheliometer received direct solar radiation with intensities ranging from 728 to 1029 W/m², with a mean of 944 Wm⁻². The ambient air temperature ranged from +13.6 to +26.6 °C with a mean of +21.5 °C. The sensitivity calculation is based on 1662 individual measurements. The sensitivity and its expanded uncertainty (95% level of confidence) are only valid for similar environmental conditions and amount: 7.92 ± 0.04 μVW⁻¹m².
WRR- factor of PMO2: 0.998618 (from the last international Pyrheliometer Comparison, IPC-2005).
Date of measurements: 2010, July 8, 9, 12, 14 - 16, 19 - 21, 31, August 1

Correction applied 0.0 %

No correction to the Davos sensitivity figure has been applied.

Justification of total instrument calibration uncertainty

The combined uncertainty of the result of the calibration is the positive "root sum square" of two uncertainties.
1. The expanded uncertainty due to random effects and instrumental errors during the calibration of the reference CHP 1 as given by the World Radiation Center in Davos is ±0.04/7.92= ±0.51%. (See traceability text).
2. Based on experience the expanded uncertainty of the transfer procedure (calibration by non-simultaneous comparison) is estimated to be ±1%.
The estimated combined expanded uncertainty is the positive "root sum square" of these two uncertainties: √(0.51^2 + 1^2)= ±1.1%.

Notice

The calibration certificate supplied with the instrument is at the date of first use. Even though the calibration certificate is dated relative to manufacture, or recalibration, the instrument does not undergo any sensitivity changes when kept in the original packing. From the moment the instrument is taken from its packaging and exposed to irradiance the sensitivity may deviate with time. See the 'non-stability' value (% change in sensitivity per year) given in the radiometer specifications.

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www.kippzonen.com

VAT no.: NL0055.74.857.B.01
Trade Register no.: 27239004
Member of HMEI

KIPP & ZONEN
SINCE 1830

MEASUREMENT REPORT

PYRHELIOMETER

Routine measurement of temperature dependency during final inspection.

DATE OF MEASUREMENT : 19/08/2011

PERFORMED BY : M. Elshout

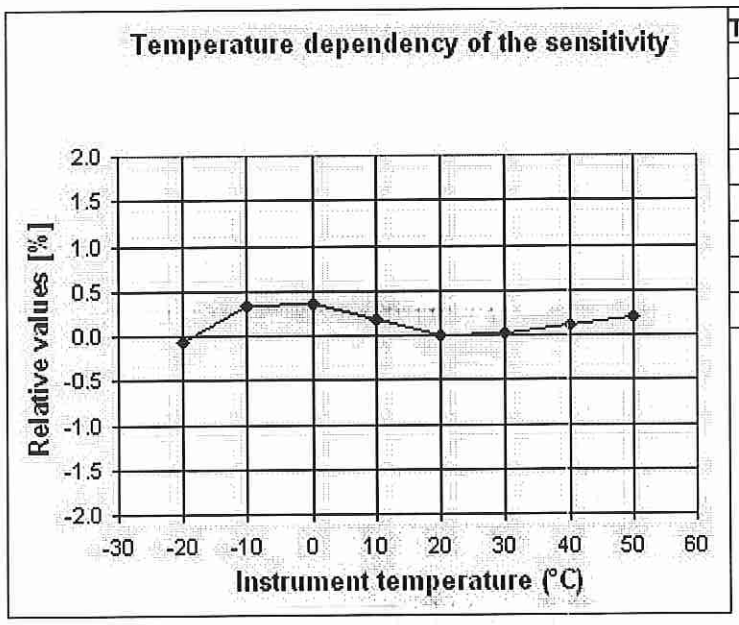
PYRHELIOMETER TYPE : CHP 1

SERIAL NUMBER : 110661

PROCEDURE:

The pyrheliometer is mounted on a vertical table in the climate chamber. Outside the chamber a 250 W Tungsten-Halogen lamp, at a distance of 60cm, illuminates the pyrheliometer at normal incidence. During the test, the pyrheliometer is ventilated at a windspeed of 5 m/s.

The pyrheliometer is tested in a temperature range over 50 °C down to -20 °C in steps of 10 °C. The relative temperature dependency is plotted below



T [°C]	deviation [%]
50	0.21
40	0.12
30	0.01
20	0.00
10	0.19
0	0.36
-10	0.33
-20	-0.07

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Attachment B

KIPP & ZONEN
SINCE 1830

CALIBRATION CERTIFICATE

~~MECA - 2 AXIS~~
SRJ WEATHER

CERTIFICATE NUMBER	005611114765
PYRANOMETER MODEL	CMP 11
SERIAL NUMBER	114765
SENSITIVITY	10.11 µV/W/m² at normal incidence on horizontal pyranometer
IMPEDANCE	33 Ohm
TEMPERATURE	22 ±2 °C
REFERENCE PYRANOMETER	Kipp & Zonen CMP 21 sn070115 active from 03/01/2011
CALIBRATION DATE	05 August 2011 (recalibration is recommended every two years)
IN CHARGE OF CALIBRATION	F. de Wit

Calibration procedure

The indoor calibration procedure is based on a side-by-side comparison with a reference pyranometer under an artificial sun fed by an AC voltage stabiliser. It embodies a 150 W Metal-Halide high-pressure gas discharge lamp. Behind the lamp is a reflector with a diameter of 16.2 cm. The reflector is 1 m above the pyranometers producing a vertical beam. The reference and test pyranometers are mounted horizontally on a table, which can rotate. The irradiance at the pyranometers is approximately 500 W/m². During the calibration procedure the reference and test pyranometer are interchanged to correct for any non-homogeneity of the beam.

Hierarchy of traceability

The reference pyranometer was compared with the sun and sky radiation as source under mainly clear sky conditions using the "continuous sun-and-shade method". The measurements were performed in Davos (latitude: 46.8143°, longitude: -9.8458°, altitude: 1588 m above sea level). The readings are referred to the World Radiometric Reference (WRR) as stated in the WMO Technical Regulations. The originally estimated uncertainty of the WRR relative to SI is ±0.3%.

The inclination of the receiver surface versus the true horizontal plane was set to 0.0 degrees, the instrument signal wire to the north. During the comparisons, the instrument received global radiation intensities from 639 to 973 with a mean of 823 W/m². The angle between the solar beam and the normal of the receiver surface varied from 24.5 to 50.0 with a mean of 37.1 degrees. The ambient temperature ranged from +18.2 to +26.8 with a mean of +23.5 °C. The sensitivity calculation and the single measurements deviation (σ) are based on 384 individual measurements. The obtained sensitivity value and its expanded uncertainty (95% level of confidence) are valid for similar conditions and are: 8.75 ± 0.11 µV/W/m² (but is corrected by Kipp & Zonen to 8.77 µV/W/m². See "correction applied" below.)
Dates of measurements: 2010, July 7 - 9, 12

Global radiation data were calculated from the direct solar radiation as measured with the absolute cavity pyrheliometer PMO2 (member of the WSG, WRR-Factor: 0.998618, based on the last International Pyrheliometer Comparison IPC-2005) and from the diffuse radiation as measured with a continuous disk shaded pyranometer Kipp & Zonen CM 22 sn020059 with sensitivity 8.91 (ventilated with heated air, instrument-wire to the north).

Correction applied +0.3 %

This correction is necessary to compensate for the mean directional errors of the reference CMP 21 in Davos. This error is estimated at Kipp & Zonen by measuring the directional error for the mean angle of incidence at azimuth S-30° and S+30°. The reference CMP 21 now measures the vertical beam of the indoor calibration facility more correctly.

Justification of total instrument calibration uncertainty

The combined uncertainty of the result of the calibration is the positive "root sum square" of three uncertainties.
1. The expanded uncertainty due to random effects and instrumental errors during the calibration of the reference CMP 21 as given by the World Radiation Center in Davos is ±0.11/8.75= ±1.26%. (See traceability text).
2. The uncertainty in the correction for the systematic effect of a directional error (cosine error) during the calibration in Davos. Based on experience this cosine error can be estimated with an expanded uncertainty of ±0.5%.
3. Also based on experience the expanded uncertainty of the transfer procedure (calibration by comparison) is estimated to be ±0.5%.
The estimated combined expanded uncertainty is the positive "root sum square" of these three uncertainties: √(1.26^2 + 0.5^2 + 0.5^2)= ±1.4%.

Notice

The calibration certificate supplied with the instrument is at the date of first use. Even though the calibration certificate is dated relative to manufacture, or recalibration, the instrument does not undergo any sensitivity changes when kept in the original packing. From the moment the instrument is taken from its packaging and exposed to irradiance the sensitivity may deviate with time. See the 'non-stability' value (% change in sensitivity per year) given in the radiometer specifications.

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Trade Register no.: 27239004
Member of HMEI

VAISALA

Certificate report no. H09-10450173

CALIBRATION CERTIFICATE

Instrument HMP45AC Humidity and temperature probe
Serial number F4540046
Manufacturer Vaisala Oyj, Finland
Calibration date 12th November 2010

The above instrument was calibrated by comparing the relative humidity and temperature readings to two HMP233 factory working standards. At the time of shipment, the instrument described above met its operating specifications.

The relative humidity readings of the two HMP233 factory working standards have been calibrated at the Vaisala factory by using Hygro M-3 dewpoint meter. Hygro M-3 dewpoint meter has been calibrated at Centre for metrology and accreditation (MIKES) by using a MIKES working standard traceable to National Institute of Standards and Technology (NIST). The temperature readings of the two HMP233 factory working standards have been calibrated at Vaisala Measurement Standards Laboratory (MSL) by using the MSL working standard traceable to the NIST. The temperature calibration at MSL has been accredited by the FINAS according to the ISO/IEC 17025.

Calibration results

Reference humidity* % RH	Observed humidity % RH	Difference %RH	Permissible difference %RH
0.4	1.3	+ 0.9	±2.0
38.4	37.3	- 1.1	±2.0
70.4	71.1	+ 0.7	± 2.0
Reference temperature* °C	**Observed temperature °C**	**Difference °C**	**Permissible difference °C**
+ 23.27	+23.20	- 0.07	± 0.2

*Average of two references.

Equipment used in calibration

Type	Serial number	Calibration date	Certificate number
HMT337 / RH	E0840011	2010-09-30	H09-10390047
HMT337 / RH	E0840010	2010-09-30	H09-10390048
HMT337 / T	E0840011	2010-04-28	K008-T00838
HMT337 / T	E0840010	2010-04-28	K008-T00837
HYGRO M-3	361095	2010-07-07	M-10H039
HP 34401A	3146A30507	2009-12-30	K004-09S885

Uncertainties (95 % confidence level, k=2)
Humidity ±1.0%RH @ 0..15%RH, ±1.5%RH @ 15..78%RH
Temperature ± 0.13 °C
Ambient conditions / Humidity 37 ± 5%RH, Temperature 23 ± 1 °C, Pressure 983 ± 1 hPa.

Technician

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Doc21425-B

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Email firstname.lastname@vaisala.com | www.vaisala.com
Domicile Vantaa, Finland | VAT FI01244162 | Business ID 0124416-2

VAISALA

Certificate report no. H47-11290030

CALIBRATION CERTIFICATE

Instrument PTB110 Barometer
Serial number G2860030
Manufacturer Vaisala Oyj, Finland
Calibration date 18th July 2011

This instrument has been calibrated against a Vaisala PTB220 factory working standard. The Vaisala PTB220 is traceable to the National Institute of Standards and Technology (NIST, USA) via Vaisala Measurement Standards Laboratory (MSL). Vaisala MSL has been accredited by FINAS according to ISO/IEC 17025 standard.

At the time of shipment, the instrument described above was within its operating specifications.

Calibration results

Reference pressure hPa	Calculated pressure hPa	Observed voltage Vdc	Correction* hPa	Uncertainty** hPa
509.9	509.9	0.042	0.0	± 0.15
609.9	609.9	0.458	0.0	± 0.15
700.2	700.2	0.834	0.0	± 0.15
810.2	810.2	1.292	0.0	± 0.15
899.7	899.7	1.665	0.0	± 0.15
999.9	999.9	2.083	0.0	± 0.15
1059.8	1059.8	2.333	0.0	± 0.15
1099.7	1099.8	2.499	-0.1	± 0.15

*To obtain the true pressure, add the correction to the barometer reading. Interpolated corrections may be used at intermediate readings of the scale of the barometer.
**The calibration uncertainty given at 95 % confidence level, k = 2

Equipment used in calibration

Type	Serial number	Calibration date	Certificate number
HP34970A	EM 13409	2011-04-06	K004-11S208
PTB220	PA 9575	2011-05-09	K008-U01188

Ambient conditions
Humidity: 45 ± 5 %RH Temperature: 23 ± 2 °C Pressure: 1007 ± 20 hPa

Technician

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Email firstname.lastname@vaisala.com | www.vaisala.com
Domicile Vantaa, Finland | VAT FI01244162 | Business ID 0124416-2

Quality Control Summary

Client	Solaria	**Lat/Lon**	37.7205N, 121.88600W	**Time of Solar Noon**	12:06:22 PST
Station Name	Weather Station	**Date**	6/6/2012	**Sky Conditions**	Clear

Station Type	Tracking CHP1 + CMP11	**Acceptable Percent Variance**	CMP11: 2.0%	**Within Acceptable Limit**	Yes ☑

Start	6/6/2012 12:32	**End**	6/6/2012 13:30	**Duration**	0:58

Results

	Reference CMP11	Station GHI CMP11
Count	59	59
Average	994.9674186	1005.325485
Standard Dev	13.03687128	13.87583051
% Variance	1.03%	
R^2	0.9946	

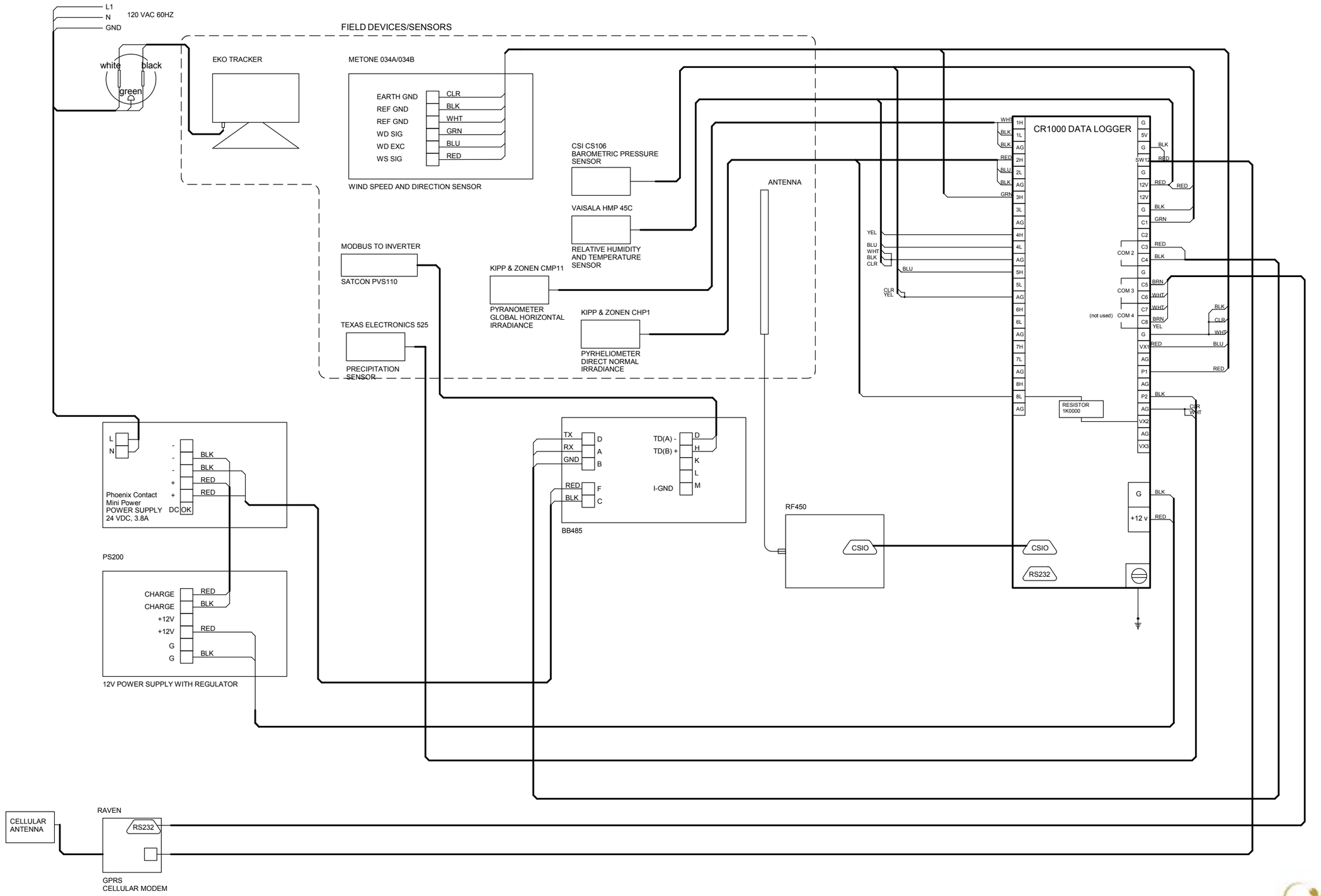
	Reference CHP1	Station CHP1
Count	59	59
Average	943.2990661	949.1396712
Standard Dev	3.264411922	2.905576052
% Variance	0.62%	
R^2	0.9677	

Notes

Enclosures

Global Cluster Data Diagrams	☑	Data Comparison	☑	QC Kit Calibration Certs	☑
QC Sky Photos	☑	Raw Data Table	☑	Direct Cluster Data Diagram	☑

Attachment B



Rev 1	AS BUILT REVISED	08/03/2012	GroundWork Renewables, Inc.	

CLIENT: SOLARIA

TITLE: SANTA RITA JAIL
MEASUREMENT STATION
WEATHER STATION
WIRING DIAGRAM

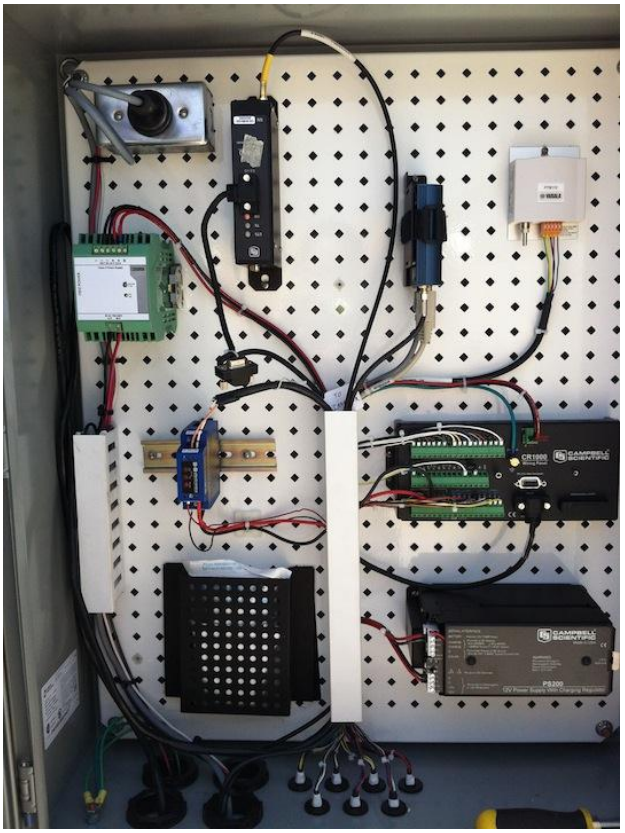
SIZE	DATE	DWG NO	REV
B	06/13/2012	1210SL1	0

SCALE: NA

SHEET: 1/1

Attachment B

Weather Station Photos



Behind the Fence Array

Calibration Certificates

- **CR800 Datalogger #19426**
- **CMP6 Pyranometer #112346**

Validation Report

Wiring Diagram

Photo Set

CAMPBELL SCIENTIFIC, INC.

815 W. 1800 N. Logan, Utah 84321-1784 (435)753-2342 Fax (435)750-9540 www.campbellsci.com

Certificate of Calibration

Customer Information:

The Solaria Corporation
6200 Paseo Padre Pkwy
Fremont, CA 94555

Contract/PO #: 3065
RMA #: N/A

Model: CR800 Serial Number: 19426

Temperature Option: Standard Temperature Tested
Test Panel Location: 1
CSI Calibration Number: 110803157
Calibration Procedures: TST12215A R12 TST12215C R16 PRC33A R16

Instrument Calibration Condition

Received Disposition: N/A
Returned Disposition: In Tolerance

Recommended Calibration Schedule

If the customer has not requested a calibration interval , a non-mandatory recommended interval is provided. Based on past experience and assumed normal usage, it is recommended that this instrument be calibrated by the due date stated below to insure sustained accuracy and reliable performance.

Calibration Date: 03-Oct-11 **Calibration Due Date:** 03-Oct-13

Report of Calibration Standards Used

Make/Model	Serial Number	Cal. Due Date	Trace Number
Krohn Hite 523	II50313	18-Jul-12	II50313
CSI Oscillator	08/20/06	09-Jun-12	05/27 03

CSI certifies the above instrument meets or exceeds published specifications and has been calibrated using standards and instruments whose accuracies are traceable to the National Institute of Standards and Technology, an accepted value of a natural physical constant or a ratio calibration technique. The collective measurement uncertainty of the calibration process exceeds a 4:1 accuracy ratio. Policies and procedures at this facility comply with ISO-9001.

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Attachment B

Instrument Data Report

Analog Inputs

S/N: 19426

Datalogger Option: Standard Temperature Tested

			Single-Ended (Full Scale)		Differential		
Range	**Input (mV)**	***Tolerance (mV)**	**Before (mV)**	**After (mV)**	**Before (mV)**	**After (mV)**	**Temp. (°C)**
6	5000	±3	N/A	5000.899	N/A	5000.674	24.6
6	-5000	±3	N/A	-5001.123	N/A	-5000.674	24.6
5	2500	±1.5	N/A	N/A	N/A	2500.086	24.6
4	250	±0.15	N/A	N/A	N/A	250.0026	24.6
3	25	±0.015	N/A	N/A	N/A	24.99718	24.6
2	7.5	±0.0045	N/A	N/A	N/A	7.499207	24.6
1	2.5	±0.0015	N/A	N/A	N/A	2.500561	24.6
1	-2.5	±0.0015	N/A	N/A	N/A	-2.499535	24.6
6	5000	±6	N/A	4999.348	N/A	5001.189	-25
6	5000	±6	N/A	4997.599	N/A	4998.158	50
6	5000	±9	N/A	N/A	N/A	N/A	-55
6	5000	±9	N/A	N/A	N/A	N/A	85

*Tolerance values are specified accuracy not including offset. Offset voltages are not included because an offset removal procedure is used to account for calibrator offset. Refer to CSI Process Control Document PRC7A.

Quiescent System Power

Tolerance Approx. (mA)	**As Received (mA)**	**As Returned (mA)**	**Temp. (°C)**
~0.75	N/A	0.55	24.6

Real-Time Clock

Tolerance (min/year)	**As Returned(min/year)**	**Temp. (°C)**
± 3 minutes	Within Tolerance	-25 to +50

Laboratory temperature and relative humidity at the time of calibration

Temperature (°C): 24.6 **Relative Humidity (%):** 51.8

Functions tested per test document (see page 1)

Excitation Channels
Analog Input Ranges
System Power
Pulse Counters
Period Averaging
Control Ports

Calibration Technician

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Attachment B

KIPP & ZONEN
SINCE 1830

CALIBRATION CERTIFICATE

AZIMUTH – FENCE

CERTIFICATE NUMBER	005720112346
PYRANOMETER MODEL	CMP 6
SERIAL NUMBER	112346
SENSITIVITY	10.96 µV/W/m² at normal incidence on horizontal pyranometer
IMPEDANCE	49 Ohm
TEMPERATURE	22 ±2 °C
REFERENCE PYRANOMETER	Kipp & Zonen CM 6B sn920545 active from 03/01/2011
CALIBRATION DATE	22 September 2011 (recalibration is recommended every two years)
IN CHARGE OF TEST	F. de Wit

Calibration procedure

The indoor calibration procedure is based on a side-by-side comparison with a reference pyranometer under an artificial sun fed by an AC voltage stabiliser. It embodies a 150 W Metal-Halide high-pressure gas discharge lamp. Behind the lamp is a reflector with a diameter of 16.2 cm. The reflector is 1 m above the pyranometers producing a vertical beam. The reference and test pyranometers are mounted horizontally on a table, which can rotate. The irradiance at the pyranometers is approximately 500 W/m². During the calibration procedure the reference and test pyranometer are interchanged to correct for any non-homogeneity of the beam.

Hierarchy of traceability

The reference pyranometer was compared with the sun and sky radiation as source under mainly clear sky conditions using the "continuous sun-and-shade method". The measurements were performed in Davos (latitude: 46.8143°, longitude: -9.8458°, altitude: 1588 m above sea level). The readings are referred to the World Radiometric Reference (WRR) as stated in the WMO Technical Regulations. The originally estimated uncertainty of the WRR relative to SI is ±0.3%.

The inclination of the receiver surface versus the true horizontal plane was set to 0.0 degrees, the instrument signal wire to the north. During the comparisons, the instrument received global radiation intensities from 639 to 973 with a mean of 823 W/m². The angle between the solar beam and the normal of the receiver surface varied from 24.5 to 50.0 with a mean of 37.1 degrees. The ambient temperature ranged from +18.2 to +26.8 with a mean of +23.5 °C. The sensitivity calculation and the single measurements deviation (σ) are based on 384 individual measurements. The obtained sensitivity value and its expanded uncertainty (95% level of confidence) are valid for similar conditions and are: 13.00 ± 0.3 µV/W/m² (but is corrected by Kipp & Zonen to 13.07 µV/W/m². See "correction applied" below.)
Dates of measurements: 2010, July 7 – 9, 12

Global radiation data were calculated from the direct solar radiation as measured with the absolute cavity pyrheliometer PMO2 (member of the WSG, WRR-Factor: 0.998618, based on the last International Pyrheliometer Comparison IPC-2005) and from the diffuse radiation as measured with a continuous disk shaded pyranometer Kipp & Zonen CM 22 sn020059 with sensitivity 8.91 (ventilated with heated air, instrument-wire to the north).

Correction applied +0.5 %

This correction is necessary to compensate for the mean directional errors of the reference CM 6B in Davos. This error is estimated at Kipp & Zonen by measuring the directional error for the mean angle of incidence at azimuth S-30° and S+30°. The reference CM 6B now measures the vertical beam of the indoor calibration facility more correctly.

Justification of total instrument calibration uncertainty

The combined uncertainty of the result of the calibration is the positive "root sum square" of three uncertainties.
1. The expanded uncertainty due to random effects and instrumental errors during the calibration of the reference CM 6B as given by the World Radiation Center in Davos is ±0.3/13.00= ±2.3%. (See traceability text).
2. The uncertainty in the correction for the systematic effect of a directional error (cosine error) during the calibration in Davos. Based on experience this cosine error can be estimated with an expanded uncertainty of ±0.5%.
3. Also based on experience the expanded uncertainty of the transfer procedure (calibration by comparison) is estimated to be ±0.5%.
The estimated combined expanded uncertainty is the positive "root sum square" of these three uncertainties: √(2.3^2 + 0.5^2 + 0.5^2)= ±2.4%.

Notice

The calibration certificate supplied with the instrument is at the date of first use. Even though the calibration certificate is dated relative to manufacture, or recalibration, the instrument does not undergo any sensitivity changes when kept in the original packing. From the moment the instrument is taken from its packaging and exposed to irradiance the sensitivity may deviate with time. See the 'non-stability' value (% change in sensitivity per year) given in the radiometer specifications.

Kipp & Zonen B.V.
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info@kippzonen.com
www.kippzonen.com

VAT no.: NL0055.74.857.B.01
Trade Register no.: 27239004
Member of HMEI

Quality Control Summary

Client	Solaria	**Lat/Lon**	37.7193333N, 121.885833W	**Time of Solar Noon**	12:06:22 PST
Station Name	Behind the Fence	**Date**	6/6/2012	**Sky Conditions**	Clear

Station Type	POA CMP6	**Acceptable Percent Variance**	CMP11: 2.0%	**Within Acceptable Limit**	Yes ☑

Start	6/6/2012 8:22	**End**	6/6/2012 9:22	**Duration**	1:00

Results

	Reference CMP11	Station POA CMP6
Count	61	61
Average	993.0724754	997.3772213
Standard Dev	20.93991158	18.17322771

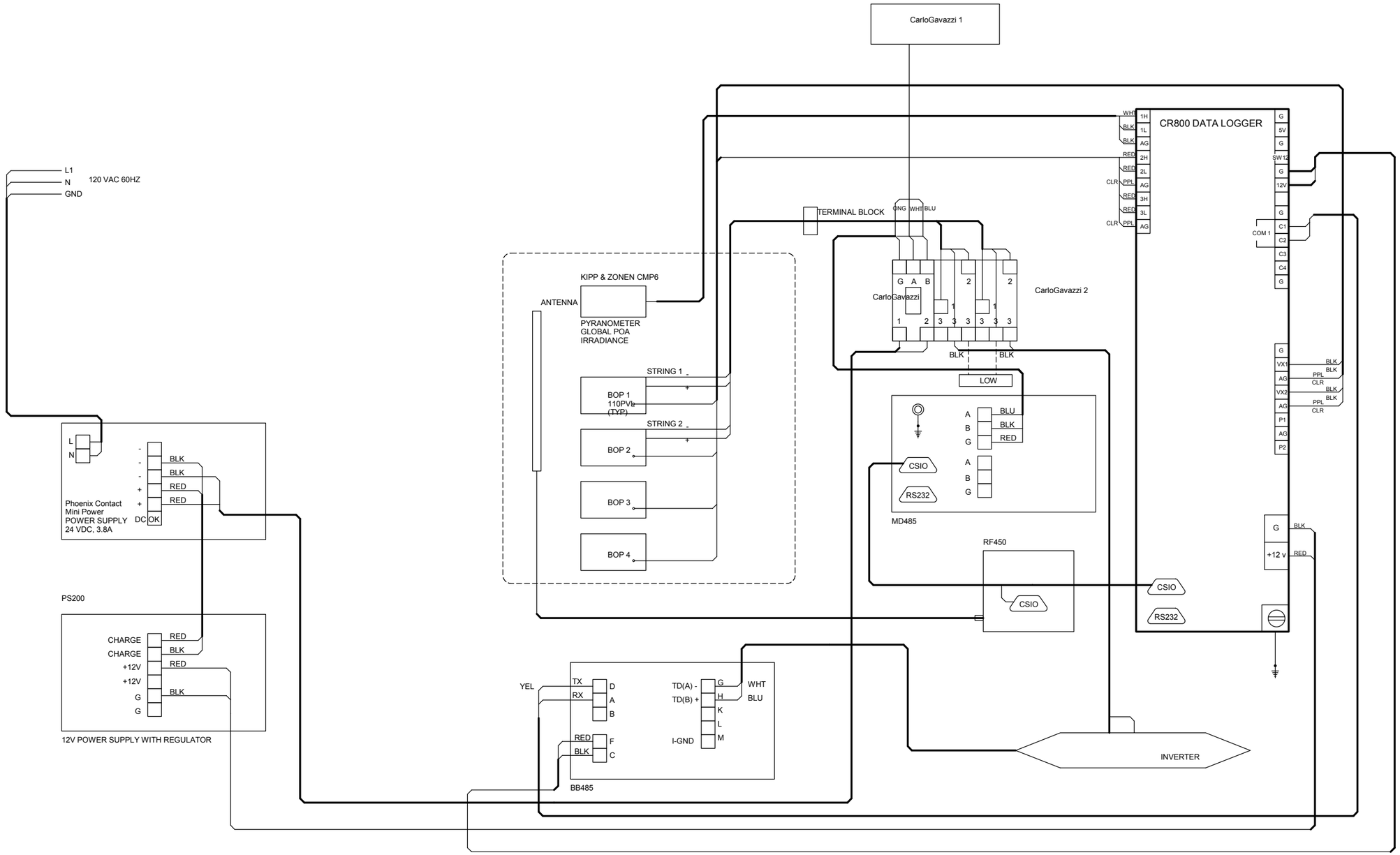
% Variance	0.44%
R^2	0.973

Notes

Enclosures

Global Cluster Data Diagrams	☑	Data Comparison	☑	Reference Calibration Certs	☑
QC Sky Photos	☑	Raw Data Table	☑		

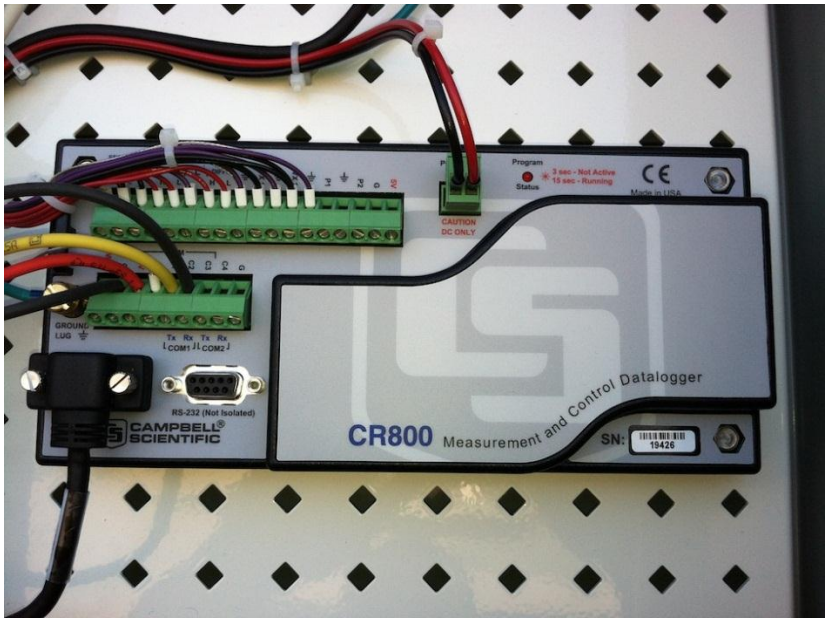
Attachment B

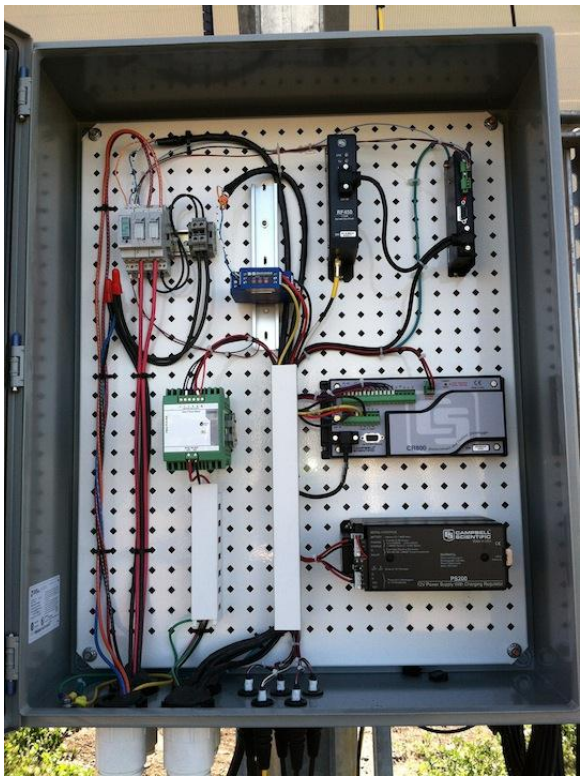


Rev 1	AS BUILT REVISED	08/03/2012	GroundWork Renewables, Inc.	CLIENT: SOLARIA			
				TITLE: SANTA RITA JAIL MEASUREMENT STATION BEHIND THE FENCE WIRING DIAGRAM			
				SIZE: B	DATE: 06/13/2012	DWG NO: 1210SL2	REV: 0
				SCALE: NA		SHEET: 1/1	

Attachment B

Behind the Fence Photos





Hillside Array A13

Calibration Certificates

- **CR800 Datalogger #19425**
- **CMP6 Pyranometer #112344**

Validation Report

Wiring Diagram

Photo Set

CAMPBELL SCIENTIFIC, INC.

815 W. 1800 N. Logan, Utah 84321-1784 (435)753-2342 Fax (435)750-9540 www.campbellsci.com

Certificate of Calibration

Customer Information:

The Solaria Corporation
6200 Paseo Padre Pkwy
Fremont, CA 94555

Contract/PO #: 3065
RMA #: N/A

Model: CR800 Serial Number: 19425

Temperature Option: Standard Temperature Tested
Test Panel Location: 19
CSI Calibration Number: 110802143
Calibration Procedures: TST12215A R12 TST12215C R16 PRC33A R16

Instrument Calibration Condition

Received Disposition: N/A
Returned Disposition: In Tolerance

Recommended Calibration Schedule

If the customer has not requested a calibration interval , a non-mandatory recommended interval is provided. Based on past experience and assumed normal usage, it is recommended that this instrument be calibrated by the due date stated below to insure sustained accuracy and reliable performance.

Calibration Date: 03-Oct-11 **Calibration Due Date:** 03-Oct-13

Report of Calibration Standards Used

Make/Model	Serial Number	Cal. Due Date	Trace Number
Krohn Hite 523	CH50193	28-Dec-11	CH50193
CSI Oscillator	05/27 05	28-Dec-11	05/27 05

CSI certifies the above instrument meets or exceeds published specifications and has been calibrated using standards and instruments whose accuracies are traceable to the National Institute of Standards and Technology, an accepted value of a natural physical constant or a ratio calibration technique. The collective measurement uncertainty of the calibration process exceeds a 4:1 accuracy ratio. Policies and procedures at this facility comply with ISO-9001.

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Attachment B

Instrument Data Report

Analog Inputs

S/N: 19425

Datalogger Option: Standard Temperature Tested

			Single-Ended (Full Scale)		Differential		
Range	**Input (mV)**	***Tolerance (mV)**	**Before (mV)**	**After (mV)**	**Before (mV)**	**After (mV)**	**Temp. (°C)**
6	5000	±3	N/A	5000.705	N/A	5000.673	24.3
6	-5000	±3	N/A	-5000.643	N/A	-5000.001	24.3
5	2500	±1.5	N/A	N/A	N/A	2500.254	24.3
4	250	±0.15	N/A	N/A	N/A	250.0377	24.3
3	25	±0.015	N/A	N/A	N/A	25.00002	24.3
2	7.5	±0.0045	N/A	N/A	N/A	7.500412	24.3
1	2.5	±0.0015	N/A	N/A	N/A	2.49994	24.3
1	-2.5	±0.0015	N/A	N/A	N/A	-2.50027	24.3
6	5000	±6	N/A	4999.93	N/A	5000	-25
6	5000	±6	N/A	5000.123	N/A	5000	50
6	5000	±9	N/A	N/A	N/A	N/A	-55
6	5000	±9	N/A	N/A	N/A	N/A	85

*Tolerance values are specified accuracy not including offset. Offset voltages are not included because an offset removal procedure is used to account for calibrator offset. Refer to CSI Process Control Document PRC7A.

Quiescent System Power

Tolerance Approx. (mA)	**As Received (mA)**	**As Returned (mA)**	**Temp. (°C)**
~0.75	N/A	0.64	24.3

Real-Time Clock

Tolerance (min/year)	**As Returned(min/year)**	**Temp. (°C)**
± 3 minutes	Within Tolerance	-25 to +50

Laboratory temperature and relative humidity at the time of calibration

Temperature (°C): 24.3 **Relative Humidity (%):** 51.4

Functions tested per test document (see page 1)

Excitation Channels
Analog Input Ranges
System Power
Pulse Counters
Period Averaging
Control Ports

Slyla Hanson
Calibration Technician

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Attachment B

KIPP & ZONEN
SINCE 1830

CALIBRATION CERTIFICATE

AZIMUTH – HILLSIDE

CERTIFICATE NUMBER	005720112344
PYRANOMETER MODEL	CMP 6
SERIAL NUMBER	112344
SENSITIVITY	12.99 µV/W/m² at normal incidence on horizontal pyranometer
IMPEDANCE	49 Ohm
TEMPERATURE	22 ±2 °C
REFERENCE PYRANOMETER	Kipp & Zonen CM 6B sn920545 active from 03/01/2011
CALIBRATION DATE	22 September 2011 (recalibration is recommended every two years)
IN CHARGE OF TEST	F. de Wit

Calibration procedure

The indoor calibration procedure is based on a side-by-side comparison with a reference pyranometer under an artificial sun fed by an AC voltage stabiliser. It embodies a 150 W Metal-Halide high-pressure gas discharge lamp. Behind the lamp is a reflector with a diameter of 16.2 cm. The reflector is 1 m above the pyranometers producing a vertical beam. The reference and test pyranometers are mounted horizontally on a table, which can rotate. The irradiance at the pyranometers is approximately 500 W/m². During the calibration procedure the reference and test pyranometer are interchanged to correct for any non-homogeneity of the beam.

Hierarchy of traceability

The reference pyranometer was compared with the sun and sky radiation as source under mainly clear sky conditions using the "continuous sun-and-shade method". The measurements were performed in Davos (latitude: 46.8143°, longitude: -9.8458°, altitude: 1588 m above sea level). The readings are referred to the World Radiometric Reference (WRR) as stated in the WMO Technical Regulations. The originally estimated uncertainty of the WRR relative to SI is ±0.3%.

The inclination of the receiver surface versus the true horizontal plane was set to 0.0 degrees, the instrument signal wire to the north. During the comparisons, the instrument received global radiation intensities from 639 to 973 with a mean of 823 W/m². The angle between the solar beam and the normal of the receiver surface varied from 24.5 to 50.0 with a mean of 37.1 degrees. The ambient temperature ranged from +18.2 to +26.8 with a mean of +23.5 °C. The sensitivity calculation and the single measurements deviation (σ) are based on 384 individual measurements. The obtained sensitivity value and its expanded uncertainty (95% level of confidence) are valid for similar conditions and are: 13.00 ± 0.3 µV/W/m² (but is corrected by Kipp & Zonen to 13.07 µV/W/m². See "correction applied" below.)
Dates of measurements: 2010, July 7 – 9, 12

Global radiation data were calculated from the direct solar radiation as measured with the absolute cavity pyrheliometer PMO2 (member of the WSG, WRR-Factor: 0.998618, based on the last International Pyrheliometer Comparison IPC-2005) and from the diffuse radiation as measured with a continuous disk shaded pyranometer Kipp & Zonen CM 22 sn020059 with sensitivity 8.91 (ventilated with heated air, instrument-wire to the north).

Correction applied +0.5 %

This correction is necessary to compensate for the mean directional errors of the reference CM 6B in Davos. This error is estimated at Kipp & Zonen by measuring the directional error for the mean angle of incidence at azimuth S-30° and S+30°. The reference CM 6B now measures the vertical beam of the indoor calibration facility more correctly.

Justification of total instrument calibration uncertainty

The combined uncertainty of the result of the calibration is the positive "root sum square" of three uncertainties.
1. The expanded uncertainty due to random effects and instrumental errors during the calibration of the reference CM 6B as given by the World Radiation Center in Davos is ±0.3/13.00= ±2.3%. (See traceability text).
2. The uncertainty in the correction for the systematic effect of a directional error (cosine error) during the calibration in Davos. Based on experience this cosine error can be estimated with an expanded uncertainty of ±0.5%.
3. Also based on experience the expanded uncertainty of the transfer procedure (calibration by comparison) is estimated to be ±0.5%.
The estimated combined expanded uncertainty is the positive "root sum square" of these three uncertainties: √(2.3^2 + 0.5^2 + 0.5^2)= ±2.4%.

Notice

The calibration certificate supplied with the instrument is at the date of first use. Even though the calibration certificate is dated relative to manufacture, or recalibration, the instrument does not undergo any sensitivity changes when kept in the original packing. From the moment the instrument is taken from its packaging and exposed to irradiance the sensitivity may deviate with time. See the 'non-stability' value (% change in sensitivity per year) given in the radiometer specifications.

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info@kippzonen.com
www.kippzonen.com

VAT no.: NL0055.74.857.B.01
Trade Register no.: 27239004
Member of HMEI

Quality Control Summary

Client	Solaria	**Lat/Lon**	37.7208333N, 121.886167W	**Time of Solar Noon**	12:06:22 PST
Station Name	Hillside	**Date**	6/6/2012	**Sky Conditions**	Clear

Station Type	POA CMP6	**Acceptable Percent Variance**	CMP11: 2.0%	**Within Acceptable Limit**	No ☐

Start	6/6/2012 11:20	**End**	6/6/2012 12:18	**Duration**	0:58

Results

	Reference CMP11	Station POA CMP6
Count	59	59
Average	1000.001402	977.2129966
Standard Dev	7.734302876	8.492138767

% Variance	-2.33%
R^2	0.9774

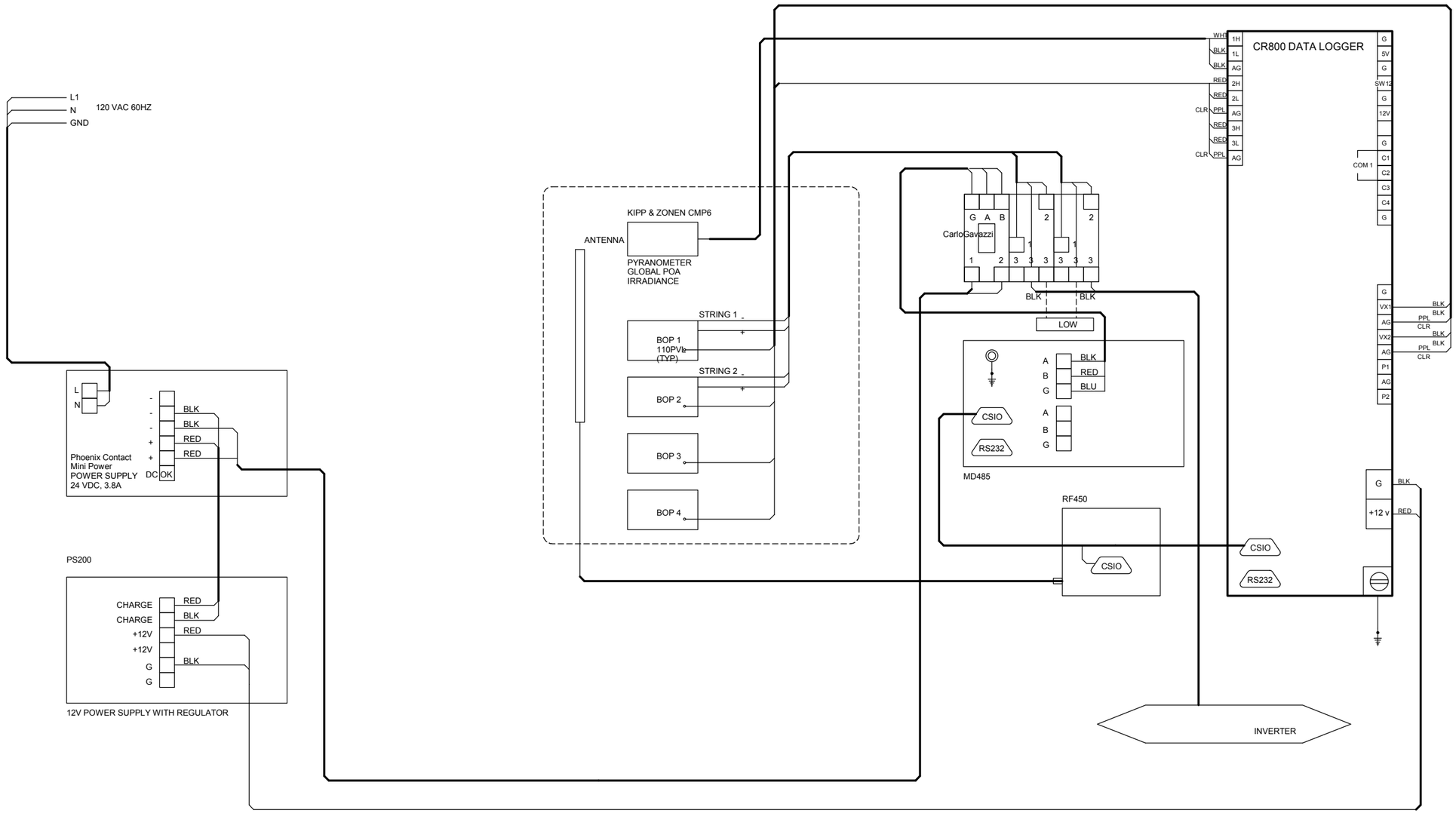
Notes

Most likely out of array plane although this degree of accuracy is within instrument specs. Recommend following leveling then angle set procedure.

Enclosures

Global Cluster Data Diagrams	☑	Data Comparison	☑	QC Kit Calibration Certs	☑
QC Sky Photos	☑	Raw Data Table	☑		

Attachment B



Rev 1	AS BUILT REVISED	08/03/2012	GroundWork Renewables, Inc.	

CLIENT: SOLARIA

TITLE: SANTA RITA JAIL
MEASUREMENT STATION
HILLSIDE
WIRING DIAGRAM

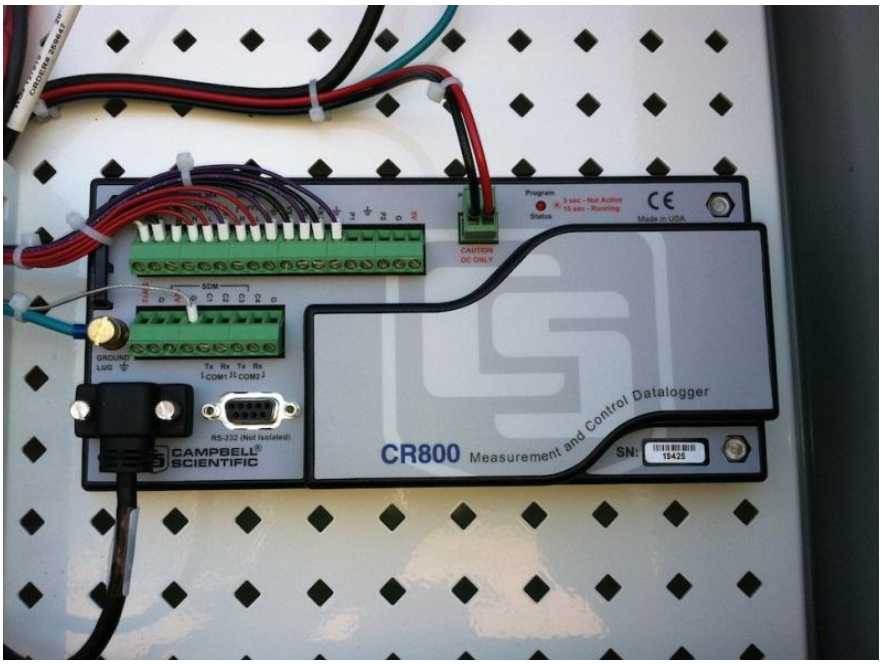
SIZE	DATE	DWG NO	REV
B	06/13/2012	1210SL3	0

SCALE: NA

SHEET: 1/1

Attachment B

Hillside Photos



MECA Array

Calibration Certificates

- **CR800 Datalogger #19424**
- **CMP6 Pyranometer #112345**

Validation Report

Wiring Diagram

Photo Set

CAMPBELL SCIENTIFIC, INC.

815 W. 1800 N. Logan, Utah 84321-1784 (435)753-2342 Fax (435)750-9540 www.campbellsci.com

Certificate of Calibration

Customer Information:

The Solaria Corporation
6200 Paseo Padre Pkwy
Fremont, CA 94555

Contract/PO #: 3065
RMA #: N/A

Model: CR800 Serial Number: 19424

Temperature Option: Standard Temperature Tested
Test Panel Location: 18
CSI Calibration Number: 110802142
Calibration Procedures: TST12215A R12 TST12215C R16 PRC33A R16

Instrument Calibration Condition

Received Disposition: N/A
Returned Disposition: In Tolerance

Recommended Calibration Schedule

If the customer has not requested a calibration interval , a non-mandatory recommended interval is provided. Based on past experience and assumed normal usage, it is recommended that this instrument be calibrated by the due date stated below to insure sustained accuracy and reliable performance.

Calibration Date: 03-Oct-11 **Calibration Due Date:** 03-Oct-13

Report of Calibration Standards Used

Make/Model	Serial Number	Cal. Due Date	Trace Number
Krohn Hite 523	CH50193	28-Dec-11	CH50193
CSI Oscillator	05/27 05	28-Dec-11	05/27 05

CSI certifies the above instrument meets or exceeds published specifications and has been calibrated using standards and instruments whose accuracies are traceable to the National Institute of Standards and Technology, an accepted value of a natural physical constant or a ratio calibration technique. The collective measurement uncertainty of the calibration process exceeds a 4:1 accuracy ratio. Policies and procedures at this facility comply with ISO-9001.

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Attachment B

Instrument Data Report

Analog Inputs

S/N: 19424

Datalogger Option: Standard Temperature Tested

			Single-Ended (Full Scale)		Differential		
Range	**Input (mV)**	***Tolerance (mV)**	**Before (mV)**	**After (mV)**	**Before (mV)**	**After (mV)**	**Temp. (°C)**
6	5000	±3	N/A	4999.889	N/A	4999.833	24.3
6	-5000	±3	N/A	-5000.656	N/A	-5001.008	24.3
5	2500	±1.5	N/A	N/A	N/A	2500.084	24.3
4	250	±0.15	N/A	N/A	N/A	250.033	24.3
3	25	±0.015	N/A	N/A	N/A	25.00325	24.3
2	7.5	±0.0045	N/A	N/A	N/A	7.500142	24.3
1	2.5	±0.0015	N/A	N/A	N/A	2.501077	24.3
1	-2.5	±0.0015	N/A	N/A	N/A	-2.500084	24.3
6	5000	±6	N/A	4999.201	N/A	5000	-25
6	5000	±6	N/A	5001.111	N/A	5001.678	50
6	5000	±9	N/A	N/A	N/A	N/A	-55
6	5000	±9	N/A	N/A	N/A	N/A	85

*Tolerance values are specified accuracy not including offset. Offset voltages are not included because an offset removal procedure is used to account for calibrator offset. Refer to CSI Process Control Document PRC7A.

Quiescent System Power

Tolerance Approx. (mA)	**As Received (mA)**	**As Returned (mA)**	**Temp. (°C)**
~0.75	N/A	0.73	24.3

Real-Time Clock

Tolerance (min/year)	**As Returned(min/year)**	**Temp. (°C)**
± 3 minutes	Within Tolerance	-25 to +50

Laboratory temperature and relative humidity at the time of calibration

Temperature (°C): 24.3 **Relative Humidity (%):** 51.4

Functions tested per test document (see page 1)

Excitation Channels
Analog Input Ranges
System Power
Pulse Counters
Period Averaging
Control Ports

Calibration Technician

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Attachment B

KIPP & ZONEN
SINCE 1830

CALIBRATION CERTIFICATE

~~SRS WEATHER~~

MECA - 2AXIS

CERTIFICATE NUMBER	005720112345
PYRANOMETER MODEL	CMP 6
SERIAL NUMBER	112345
SENSITIVITY	11.19 µV/W/m² at normal incidence on horizontal pyranometer
IMPEDANCE	44 Ohm
TEMPERATURE	22 ±2 °C
REFERENCE PYRANOMETER	Kipp & Zonen CM 6B sn920545 active from 03/01/2011
CALIBRATION DATE	22 September 2011 (recalibration is recommended every two years)
IN CHARGE OF TEST	F. de Wit

Calibration procedure

The indoor calibration procedure is based on a side-by-side comparison with a reference pyranometer under an artificial sun fed by an AC voltage stabiliser. It embodies a 150 W Metal-Halide high-pressure gas discharge lamp. Behind the lamp is a reflector with a diameter of 16.2 cm. The reflector is 1 m above the pyranometers producing a vertical beam. The reference and test pyranometers are mounted horizontally on a table, which can rotate. The irradiance at the pyranometers is approximately 500 W/m². During the calibration procedure the reference and test pyranometer are interchanged to correct for any non-homogeneity of the beam.

Hierarchy of traceability

The reference pyranometer was compared with the sun and sky radiation as source under mainly clear sky conditions using the "continuous sun-and-shade method". The measurements were performed in Davos (latitude: 46.8143°, longitude: -9.8458°, altitude: 1588 m above sea level). The readings are referred to the World Radiometric Reference (WRR) as stated in the WMO Technical Regulations. The originally estimated uncertainty of the WRR relative to SI is ±0.3%.

The inclination of the receiver surface versus the true horizontal plane was set to 0.0 degrees, the instrument signal wire to the north. During the comparisons, the instrument received global radiation intensities from 639 to 973 with a mean of 823 W/m². The angle between the solar beam and the normal of the receiver surface varied from 24.5 to 50.0 with a mean of 37.1 degrees. The ambient temperature ranged from +18.2 to +26.8 with a mean of +23.5 °C. The sensitivity calculation and the single measurements deviation (σ) are based on 384 individual measurements. The obtained sensitivity value and its expanded uncertainty (95% level of confidence) are valid for similar conditions and are: 13.00 ± 0.3 µV/W/m² (but is corrected by Kipp & Zonen to 13.07 µV/W/m². See "correction applied" below.)
Dates of measurements: 2010, July 7 - 9, 12

Global radiation data were calculated from the direct solar radiation as measured with the absolute cavity pyrheliometer PMO2 (member of the WSG, WRR-Factor: 0.998618, based on the last International Pyrheliometer Comparison IPC-2005) and from the diffuse radiation as measured with a continuous disk shaded pyranometer Kipp & Zonen CM 22 sn020059 with sensitivity 8.91 (ventilated with heated air, instrument-wire to the north).

Correction applied +0.5 %

This correction is necessary to compensate for the mean directional errors of the reference CM 6B in Davos. This error is estimated at Kipp & Zonen by measuring the directional error for the mean angle of incidence at azimuth S-30° and S+30°. The reference CM 6B now measures the vertical beam of the indoor calibration facility more correctly.

Justification of total instrument calibration uncertainty

The combined uncertainty of the result of the calibration is the positive "root sum square" of three uncertainties.
1. The expanded uncertainty due to random effects and instrumental errors during the calibration of the reference CM 6B as given by the World Radiation Center in Davos is ±0.3/13.00= ±2.3%. (See traceability text).
2. The uncertainty in the correction for the systematic effect of a directional error (cosine error) during the calibration in Davos. Based on experience this cosine error can be estimated with an expanded uncertainty of ±0.5%.
3. Also based on experience the expanded uncertainty of the transfer procedure (calibration by comparison) is estimated to be ±0.5%.
The estimated combined expanded uncertainty is the positive "root sum square" of these three uncertainties: √(2.3^2 + 0.5^2 + 0.5^2)= ±2.4%.

Notice

The calibration certificate supplied with the instrument is at the date of first use. Even though the calibration certificate is dated relative to manufacture, or recalibration, the instrument does not undergo any sensitivity changes when kept in the original packing. From the moment the instrument is taken from its packaging and exposed to irradiance the sensitivity may deviate with time. See the 'non-stability' value (% change in sensitivity per year) given in the radiometer specifications.

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info@kippzonen.com
www.kippzonen.com

VAT no.: NL0055.74.857.B.01
Trade Register no.: 27239004
Member of HMEI

Quality Control Summary

Client	Solaria	**Lat/Lon**	37.7203333N, 121.8875W	**Time of Solar Noon**	12:06:22 PST
Station Name	Meca	**Date**	6/6/2012	**Sky Conditions**	Clear

Station Type	POA CMP6	**Acceptable Percent Variance**	CMP11: 2.0%	**Within Acceptable Limit**	Yes ☑

Start	6/6/2012 9:54	**End**	6/6/2012 10:53	**Duration**	0:59

Results

	Reference CMP11	Station POA CMP6
Count	60	60
Average	1048.600417	1047.29085
Standard Dev	3.309091986	5.282152084

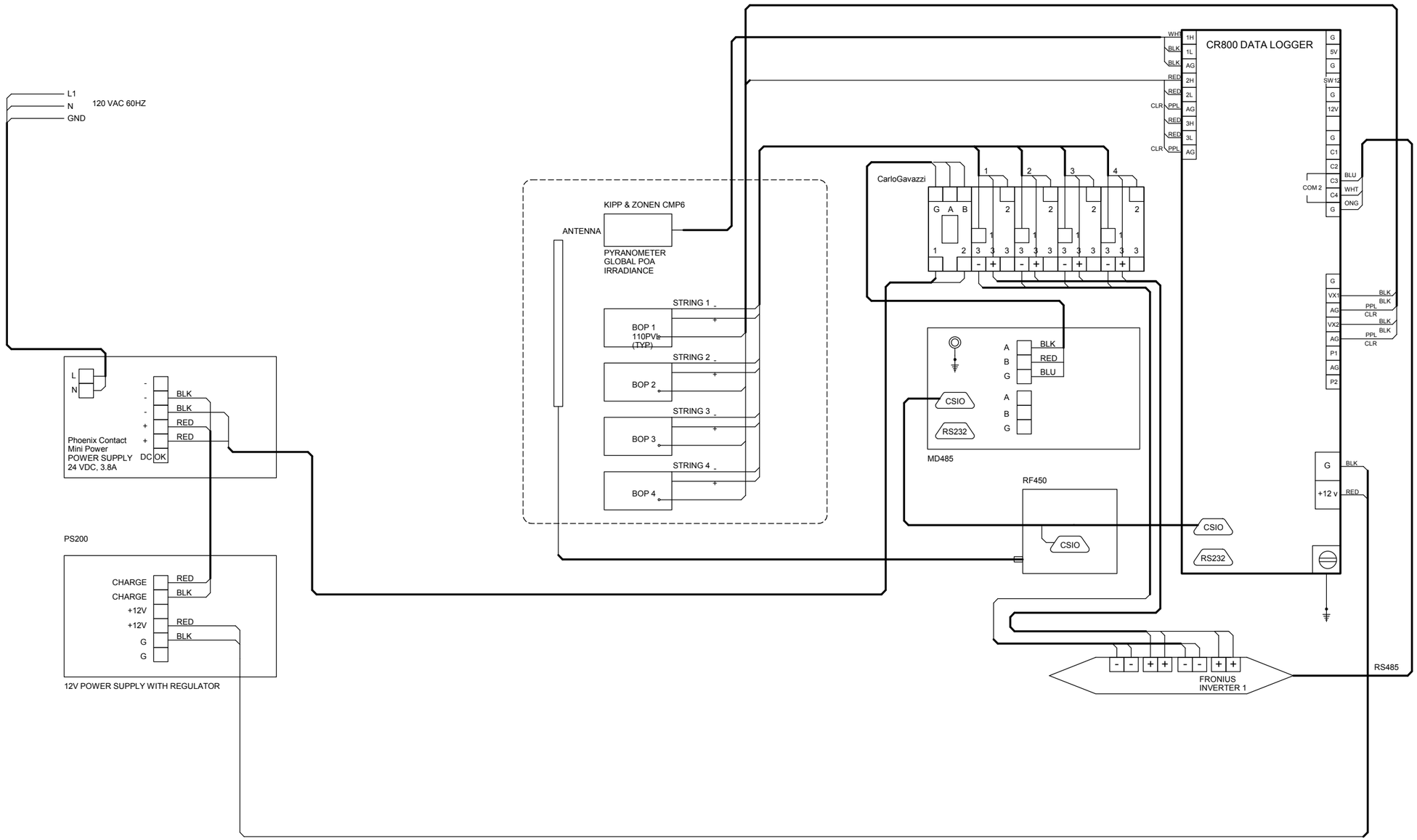
% Variance	-0.13%
R^2	0.82

Notes

Enclosures

Global Cluster Data Diagrams	☑	Data Comparison	☑	QC Kit Calibration Certs	☑
QC Sky Photos	☑	Raw Data Table	☑		

Attachment B



Rev 2	AS BUILT REVISED	08/08/2012	GroundWork Renewables, Inc.	

CLIENT: SOLARIA

TITLE: SANTA RITA JAIL
MEASUREMENT STATION
MECA
WIRING DIAGRAM

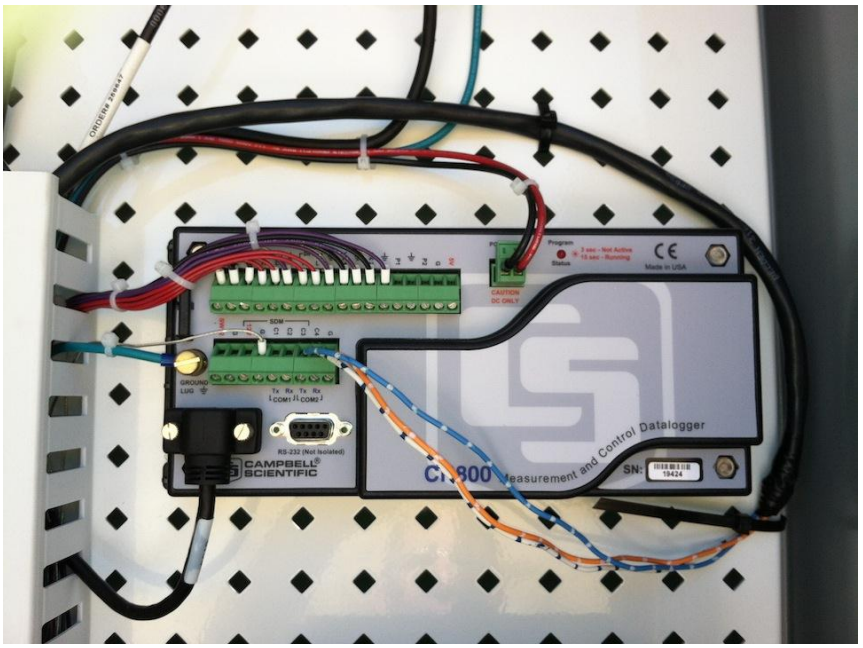
SIZE	DATE	DWG NO	REV
B	06/13/2012	1210SL4	2

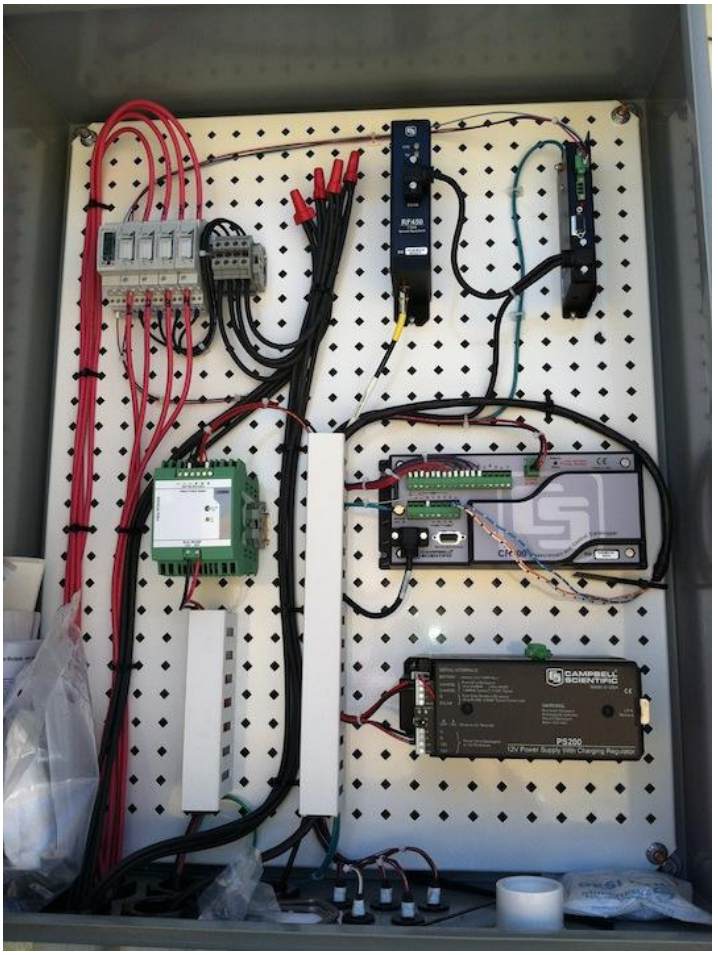
SCALE: NA

SHEET: 1/1

Attachment B

MECA Photos





Station: Santa Rita Jail
Location: Dublin, CA
Date: June 05, 2012 and June 06, 2012

Meca

As Found	Actions Performed	Recommendations
Soiled POA CMP6 pyranometer	Cleaned 06JUN 2012, trained local technician (LT) to perform scheduled maintenance	Successful
CMP6 performance not validated against standard	Performed validation procedure 06JUN2012	Met GroundWork specification
As Built documentation incomplete	Catalogued and photographed system components	New As Built documentation submitted
CR800 logger not visible in PakBus network	Added network configuration to work scope. Setup and Tested PakBus Network	Set up Solaria LoggerNet with PakBus Network to acquire data from all Loggers
Fronius inverter does not communicate with DAS	None at time of onboarding	Assist toward resolution; work in progress
Pyranometer desiccant is spent	Noted and trained LT to change	Action Item: LT to change desiccant after receipt of replacement desiccant

Hillside

As Found	Actions Performed	Recommendations
Soiled POA CMP6 pyranometer	Cleaned 06JUN 2012, trained local technician to perform scheduled maintenance	Successful
CMP6 Performance not Validated against Standard	Performed validation procedure 06JUN2012	Did not meet GroundWork specification. Action Item: Document further for final report to be drafted. Action Item: Recommend adjustment of CMP6 to precise Plane of Array
As Built documentation incomplete	Catalogued and photographed system components	New As Built documentation submitted
CR800 logger not visible in PakBus network	Added network configuration to work scope. Setup and Tested PakBus Network	Set up Solaria LoggerNet with PakBus Network to acquire data from all Loggers; work in progress
Pyranometer desiccant is spent	Noted and trained LT to change	Action Item: LT to change desiccant after receipt of replacement desiccant

Behind The Fence

As Found	Actions Performed	Recommendations
Soiled POA CMP6 pyranometer	Cleaned 06JUN 2012, trained local technician to perform scheduled maintenance	Successful
CMP6 Performance not validated against standard	Performed validation procedure 06JUN2012	Met GroundWork specification
As Built documentation incomplete	Catalogued and photographed system components	New As Built documentation submitted
CR800 logger not visible in PakBus network	Added network configuration to work scope. Setup and Tested PakBus Network	Set up Solaria LoggerNet with PakBus Network to acquire data from all Loggers; work in progress
Pyranometer desiccant is spent	Noted and trained LT to change	Action Item: LT to change desiccant after receipt of replacement desiccant

Weather Station

As Found	Actions Performed	Recommendations
Soiled GHI CMP11 pyranometer, and DNI CHP1 pyrheliometer	Cleaned 06JUN 2012, trained local technician to perform scheduled maintenance	Successful
CMP11 and tracking CHP1 performance not validated against standard	Performed validation procedure 06JUN2012	Met GroundWork specification
As Built documentation incomplete	Catalogued and photographed system components.	New As Built documentation submitted
CR800 logger not visible in PakBus network	Added network configuration to work scope. Setup and Tested PakBus Network	Set up Solaria LoggerNet with PakBus Network to acquire data from all Loggers; work in progress
Pyranometer and pyrheliometer desiccants are spent	Noted and trained LT to change	Action Item: LT to change desiccant after receipt of replacement desiccant