

**Montgomery County  
Department of Permitting Services  
Electrical Plan Review**

**A/P # 622341  
Scope: Revision (10/07/2013)  
Project: Hellerstein Residence- Rooftop PV Power System  
Address: 1909 Franwell Ave., Silver Spring, MD 20902**

**Date: -----10-07-2013  
Reviewer:--Ronald Cole  
Ph: -----240-777-6288  
Fax: -----240-777-6241**

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**General Electrical Notes**

**Note: This Revision removed the Battery Back- Up from the PV System.**

**All Comments dated 01/04/2013 by Ronald Cole are incorporated and part of the review of this Revision.**

*See Montgomery County conditionally approved statement on plan cover sheet.*

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255 Rockville Pike, 2<sup>nd</sup> Floor • Rockville, Maryland 20850-4166  
<http://permittingservices.montgomerycountymd.gov>

**Electric Permit Documentation Single Family Dwelling**  
**1909 Franwall Avenue, Silver Spring, Md 20902**

Owner's Building Permit 622341, Issued 1/14/2013

**ELECTRICAL ITEMS RELATED TO SOLAR ELECTRIC SYSTEM**

- Heavy-up to replace the 20 slot 200 ampere main service panel with a 30 slot 200 Ampere panel
- Grid Tie Photovoltaic System, Array 6,500 Watts DC STC Rating
- 25 PV monocrystal modules, Helios Solar 6T 260 Watts DC
- Two Aurora PVI-3.0 Grid Tie Inverters, 120/240, Transformerless, ungrounded system
- 25 Tigo Energy Maximizers added to PV modules with wireless gateway and PC connected management unit.
- 1-20 Amp breaker from inverter #1 in 200 amp main circuit breaker panel
- 1-20 Amp breaker from inverter #2 in main circuit breaker panel

1. All pv systems components shall be listed by a recognized testing agency (i.e. UL 1741, etc.)
2. Wiring materials shall be suitable for the sun exposure and wet location. Field applied protective coatings are not acceptable.
3. Where the terminal of the disconnecting means may be energized in the open position, a warning sign shall be mounted on or adjacent to the disconnecting means having the following words:  
 "warning-electric shock hazard, do not touch terminals. Terminals on both line and load sides may be energized in the open position"
4. Signs shall be posted adjacent to each pv disconnect and inverter to indicate "photovoltaic system"
5. All pv modules and associated equipment and wiring material shall be protected from physical damage.
6. All field installed junction, pull and outlet boxes located behind modules or panels shall be accessible directly or by displacement of a module(s) or panel(s) secured by removable fasteners.
7. Photovoltaic source circuits, output circuits, inverter output circuits and equipment shall be protected in accordance with the requirements of the applicable NEC for this jurisdiction.
8. Module frames and racking systems shall be grounded at UL listed location provided by the manufacturer using UL listed grounding lugs. The removal of one panel shall not interrupt the continuity of the grounding system for the rest of the panels or racking system.
10. All NEC required PV signage will be posted.
11. Any DC conductors indoors will be in metal conduit. Outdoor exposed solar wiring to be PV Wire.

PERMIT DOES NOT INCLUDE APPROVAL FOR ANY ELECTRICAL WORK YOU MUST HAVE A SEPARATE ELECTRICAL PERMIT TO DO ANY ELECTRICAL WORK.

*W*  
 ELECTRICAL PLANS RELEASED SUBJECT TO FIELD INSPECTION AND APPROVAL  
 ELECTRICAL WIRING MUST CONFORM TO THE 2008 NATIONAL ELECTRICAL CODE AND COUNTY AMENDMENTS

**REVISIONS**  
 CHANGES OR MODIFICATIONS TO THESE PLANS MAY REQUIRE RESUBMITTAL WITH ADDITIONAL PERMIT FEES. NO CHANGES SHALL BE MADE TO THE APPROVED SET OF CONSTRUCTION PLANS.

MONTGOMERY COUNTY EXECUTIVE REGULATION 6-12  
 THE FINAL INSPECTION MUST BE REQUESTED AND APPROVED BEFORE A BUILDING (OR PORTION THEREOF) IS USED OR OCCUPIED

GENERAL STRUCTURAL ARRANGEMENT APPROVED SUBJECT TO FURTHER APPROVAL OF CONSTRUCTION



Echo Electric Co. 301 949 8050  
 10528 Detrick Avenue Kensington, MD 20895

*Resubmission Permit # 622341*  
 MONTGOMERY COUNTY  
 Department of Permitting Services  
 Approved Date: *10/21/13*

Hellerstein, 1909 Franwall Ave, Silver Spring	
Grid Tie PV System	Scale NA
	9/6/2013

ELECTRICAL REVIEW BY: *RJC*

*W-DESK*

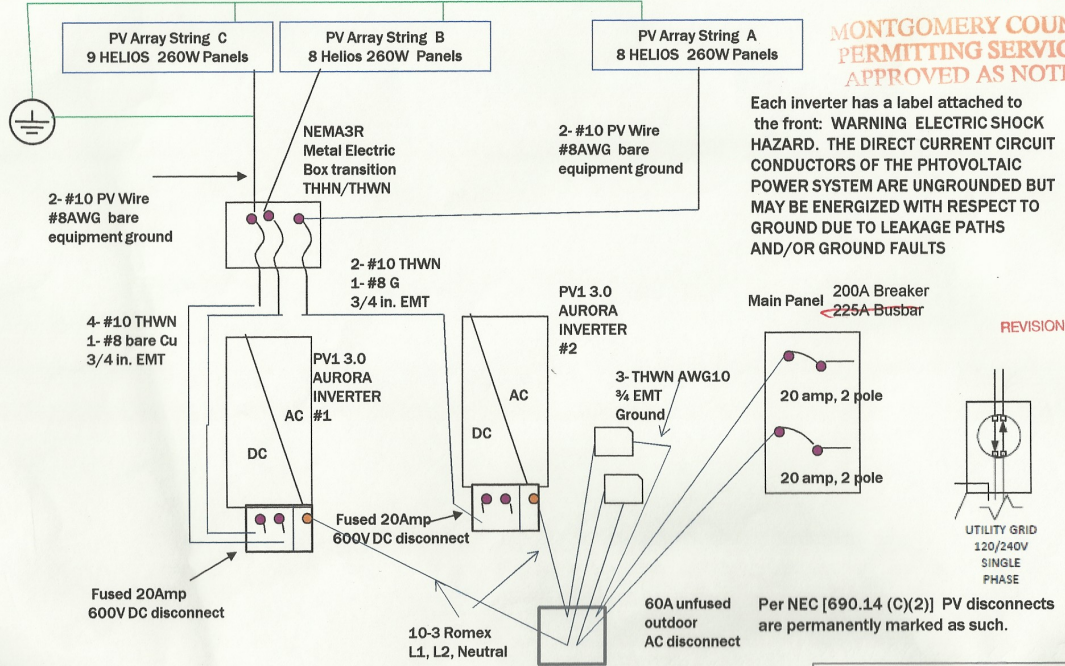


Revised version

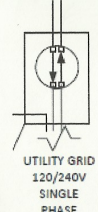
SINGLE LINE DIAGRAM (6,500 Watts DC)

ELECTRICAL PLANS RELEASED  
SUBJECT TO FIELD INSPECTION  
AND APPROVAL

**MONTGOMERY COUNTY  
PERMITTING SERVICES  
APPROVED AS NOTED**



REVISIONS



Per NEC [690.14 (C)(2)] PV disconnects are permanently marked as such.



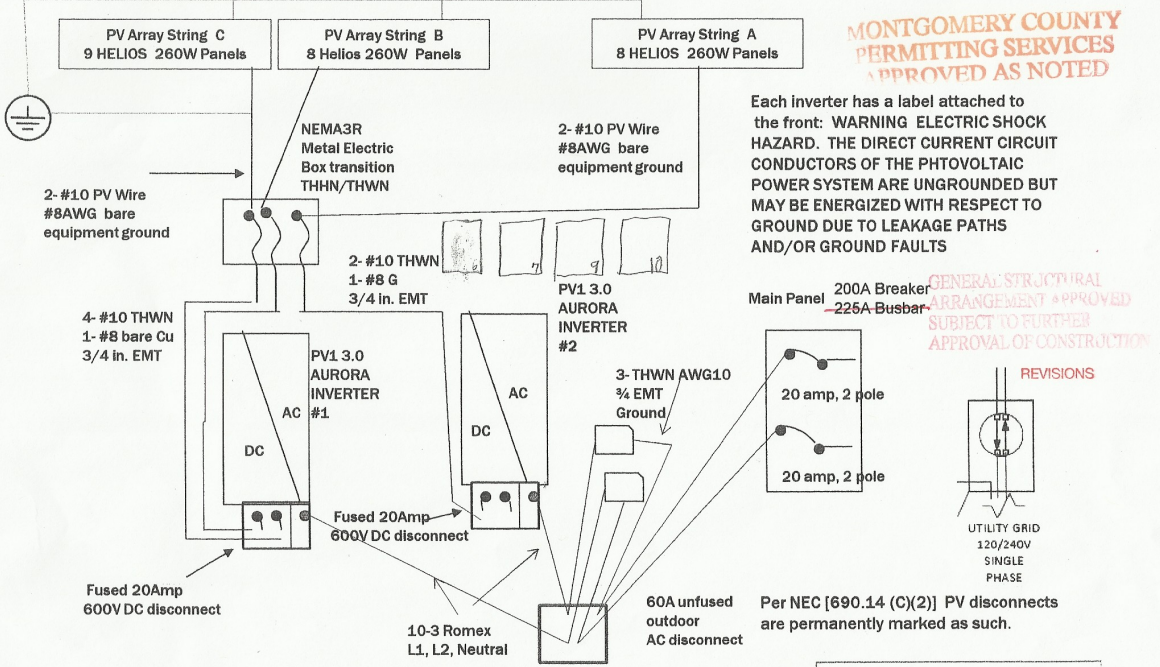
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GENERAL STRUCTURAL  
ARRANGEMENT APPROVED  
SUBJECT TO FURTHER  
APPROVAL OF CONSTRUCTION

Hellerstein, 1909 Franwall Ave, Silver Spring	
Grid Tie PV System	Scale NA
	9/6/2013

Revision showing changes

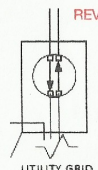
SINGLE LINE DIAGRAM (6,500 Watts DC)



MONTGOMERY COUNTY PERMITTING SERVICES APPROVED AS NOTED

Each inverter has a label attached to the front: WARNING ELECTRIC SHOCK HAZARD. THE DIRECT CURRENT CIRCUIT CONDUCTORS OF THE PHOTOVOLTAIC POWER SYSTEM ARE UNGROUNDED BUT MAY BE ENERGIZED WITH RESPECT TO GROUND DUE TO LEAKAGE PATHS AND/OR GROUND FAULTS

GENERAL STRUCTURAL ARRANGEMENT APPROVED SUBJECT TO FURTHER APPROVAL OF CONSTRUCTION



UTILITY GRID 120/240V SINGLE PHASE

Per NEC [690.14 (C)(2)] PV disconnects are permanently marked as such.



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PV1.3.0 #2 NOW CONNECTS TO MAIN PANEL, NOT SUB PANEL

NOT INSTALLED/DRAWN  
6 CRITICAL LOAD SUB PANEL  
7 MAGNUM INVERTER/CHARGER  
9 BATTERY DISCONNECT  
10 BATTERIES

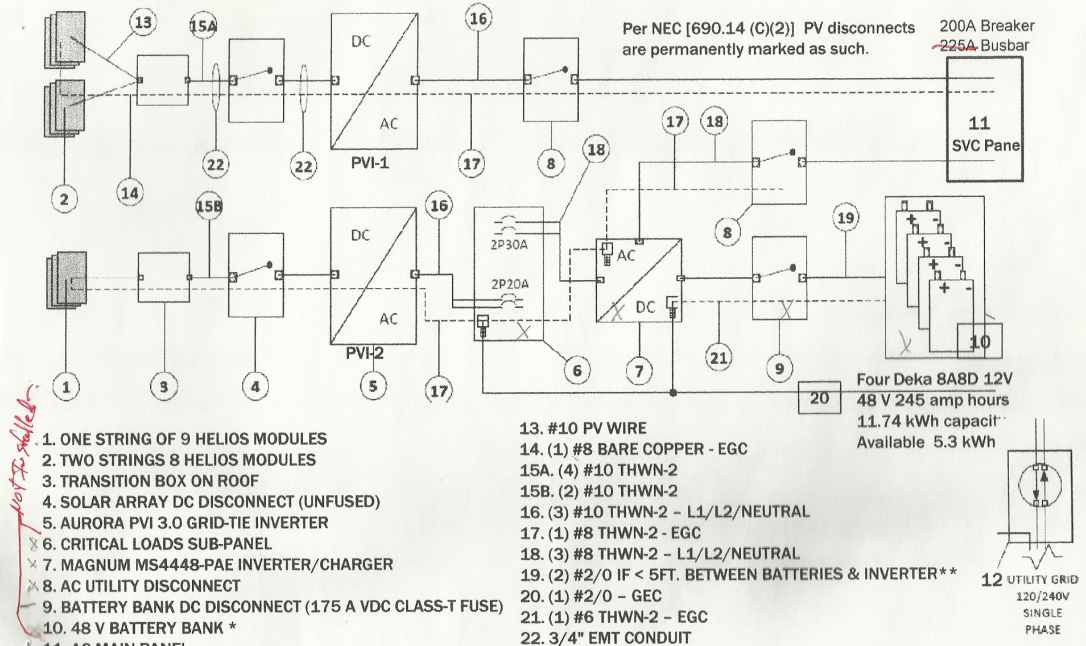
Hellerstein, 1909 Franwall Ave, Silver Spring	
Grid Tie PV System	Scale NA
	9/6/2013

6 is pre existing and is no longer mod field



*OLD VERSION*

**SINGLE LINE SYSTEM SCHEMATIC**



*not to scale*

- 1. ONE STRING OF 9 HELIOS MODULES
- 2. TWO STRINGS 8 HELIOS MODULES
- 3. TRANSITION BOX ON ROOF
- 4. SOLAR ARRAY DC DISCONNECT (UNFUSED)
- 5. AURORA PVI 3.0 GRID-TIE INVERTER
- 6. CRITICAL LOADS SUB-PANEL
- 7. MAGNUM MS4448-PAE INVERTER/CHARGER
- 8. AC UTILITY DISCONNECT
- 9. BATTERY BANK DC DISCONNECT (175 A VDC CLASS-T FUSE)
- 10. 48 V BATTERY BANK \*
- 11. AC MAIN PANEL
- 12. BI-DIRECTIONAL UTILITY METER

- 13. #10 PV WIRE
  - 14. (1) #8 BARE COPPER - EGC
  - 15A. (4) #10 THWN-2
  - 15B. (2) #10 THWN-2
  - 16. (3) #10 THWN-2 - L1/L2/NEUTRAL
  - 17. (1) #8 THWN-2 - EGC
  - 18. (3) #8 THWN-2 - L1/L2/NEUTRAL
  - 19. (2) #2/0 IF < 5 FT. BETWEEN BATTERIES & INVERTER\*\*
  - 20. (1) #2/0 - GEC
  - 21. (1) #6 THWN-2 - EGC
  - 22. 3/4" EMT CONDUIT
- \* BATTERY SERIES CABLING SHOULD BE THE SAME SIZE AS BATTERY TO INVERTER CABLING (#19)  
\*\* IF DISTANCE BETWEEN 5 FT and 10 FT, USE #4/0

**REVISIONS**

#4/0 INSTEAD Hellerstein, 1909 Franwall Ave, Silver Spring	
Grid Tie PV System	Scale NA
6/6/2013	

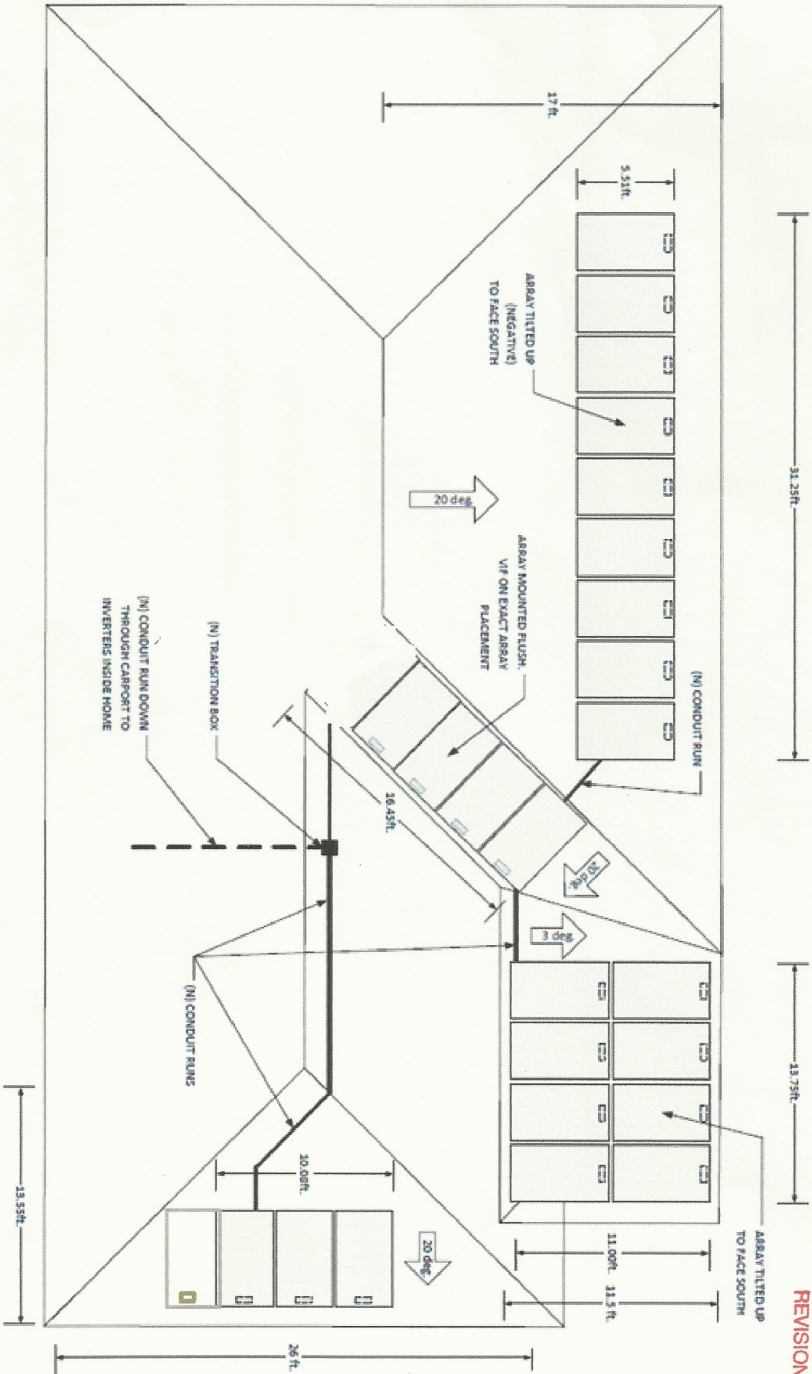


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GENERAL STRUCTURAL  
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SOLAR COLLECTOR ARRAY PER BUILDING PERMIT

REVISIONS



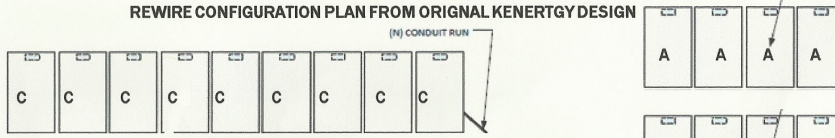
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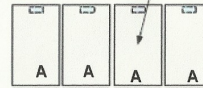


ROOF PLAN	
Scale: 1/4" = 5ft. 0"	
Hellerstein, 1909 Framwall Ave, Silver Spring	
Grid The PV System	Scale NA
9/6/2013	

**REWIRE CONFIGURATION PLAN FROM ORIGINAL KENERGY DESIGN**



ARRAY C CONNECTS TO AURORA PVI 3 KILOWATT INVERTER #1

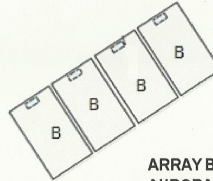


ARRAY A CONNECTS TO PVI 3 KILOWATT INVERTER #2



DC disconnect for onsite operator or emergency personnel to deactivate the entire array

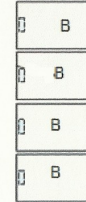
Tigo Energy® PV-SAFE™ red button on the Maximizer Management Unit installed next to outdoor PV AC is a



ARRAY B CONNECTS TO AURORA PVI 3 KILOWATT INVERTER #1

AURORA 1 17 PANELS  
AURORA 2 8 PANELS

REVISIONS

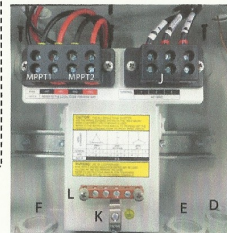


**GROUNDING**

With no isolation transformer, Aurora inverters are installed per NFPA 70, 690.35 with an ungrounded PV array. These models have no grounded input. The Aurora DC integrated DC disconnect disconnects both the positive and the negative PV conductors.

Panels and aluminum mounting rail are grounded with tin-coated copper lugs and bare AWG#8 wire that connects to a ground rod and to PE terminal "L" in the Aurora DC switches.

The Aurora DC switches are bonded to a ground rod. The heavy up 200A service panel is grounded to a ground rod and to the incoming water pipe.



GENERAL STRUCTURAL ARRANGEMENT APPROVED SUBJECT TO FURTHER #11111 APPROVAL OF CONSTRUCTION



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Grid Tie PV System	Scale NA
	9/6/2013



**CONDUCTOR SIZING:**

Transition box to inverter

- Max. current per string = 13.91 A
- Max. ampacity of conductor [NEC 2008 Table 310.16] for #10 THWN-2 Copper at 90C = 40 A
- Conduit fill adjustment [NEC 2008 Table 310.15 (B)(2)(a)]
- For 6 current carrying conductors use .80 correction factor:  $40 \times 0.80 = 32 \text{ A}$
- Ambient Temperature Adjustment [NEC 2008 Table 310.15 (B)(2)(c)]
- For 1/2" - 3 1/2" roof clearance, use +22C
- Temperature Correction Factor [NEC 2008 Table 310.16]
- For 22C + 30C = 52C, use .76 correction factor for #10 THHN/THWN-2 (90C column)
- $32 \text{ A} \times 0.76 = 24.32$  maximum ampacity

**CONDUIT FILL CALCULATION: (Transition box to inverter)**

- Conduit type = 3/4 EMT
- Maximum fill (2+conductors) = 40% (0.213 in. sq.) (NEC Table 4)
- Conduit contents = [6] #10 THWN-2, [1] #8 THWN-2
- Cross sectional area (CSA) of #10 THWN-2 = 0.0211 in. sq. (NEC Table 5)
- CSA of #8 THWN-2 = 0.0366 in. sq. (NEC Table 5)
- Total CSA =  $(0.0211 \times 6) + 0.0366 = 0.0974$  in. sq.
- $0.163$  in. sq. <  $0.213$  in. sq.

**PV SYSTEM CALCULATIONS (DC) (PER INVERTER)**

MAX DC SYSTEM VOLTAGE: 525 V  
 MAX DC CURRENT PER STRING:  $8.91 \times 1.25\% \times 1.25\% = 13.91 \text{ A}$   
 OPERATING VOLTAGE: 418 V  
 OPERATING CURRENT: 8.7 A

**OPEN CIRCUIT DC VOLTAGE PER STRING**

- A = 328.8 Voc [From panel label]
- B = 328.8 Voc
- C = 369.9 Voc

**MONTGOMERY COUNTY**  
**PERMITTING SERVICES**  
 APPROVED AS NOTED  
 ELECTRICAL PLANS RELEASED  
 SUBJECT TO FIELD INSPECTION  
 AND APPROVAL

**PV SYSTEM CALCULATIONS (AC)**  
(PER AURORA INVERTER)

REVISIONS

AC SYSTEM VOLTAGE: 240V  
 MAXIMUM AC CURRENT:  $14.5 \text{ A} \times 1.25\% = 18.12 \text{ A}$   
 OCPD SIZING = 20 A

**MAIN PANEL LOAD CALCULATION:**

120% OF 225 Amp busbar = 270 Ampere  
 PV INPUT BREAKERS = 20 A + 20 A = 40 A  
 MAIN BREAKER = 200 A  
 TOTAL SUPPLY AMPS = 40 A + 200 A = 240 A  
 240A is less than limit of 270A

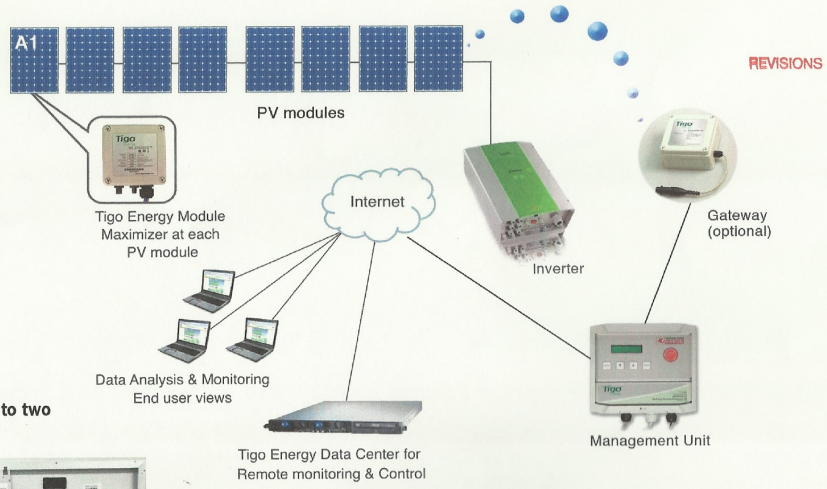
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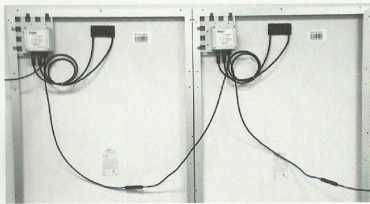
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Grid Tie PV System	Scale NA
	9/6/2013

**TIGO SYSTEM ARCHITECTURE**



REVISIONS

**Tigo Maximizers attached to two solar panels**



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Hellerstein, 1909 Franwall Ave, Silver Spring	
Grid Tie PV System	Scale NA
	9/6/2013

**Aurora PVI 3.0 Grid Tie Inverter**

		3000			3600		
Nominal Output Power	W	3000	3300**	3300**	3600	4000**	4000**
Maximum Output Power	W	3000	3300**	3300**	3600	4000**	4000**
Rated Grid AC Voltage	V	208	240	277	208	240	277
<b>Input Side (DC)</b>							
Number of Independent MPPT Channels		2			2		
Maximum Usable Power for Each Channel	W	2000			3000		
Absolute Maximum Voltage (Vmax)	V	600			600		
Start-Up Voltage (Vstart)	V	200 (adj. 120-350)			200 (adj. 120-350)		
Full Power MPPT Voltage Range	V	160-530			120-530		
Operating MPPT Voltage Range	V	0.7xVstart-580			0.7xVstart-580		
Maximum Current (Idcmax) for both MPPT in Parallel	A	20			32		
Maximum Usable Current per Channel	A	10			16		
Maximum Short Circuit Current Limit per Channel	A	12.5			20		
Number of Wires Landing Terminals Per Channel		2 Pairs (1 on -S version)			2 Pairs (1 on -S version)		
Array Wiring Termination		Terminal block, Pressure Clamp, AWG10-AWG6					
<b>Output Side (AC)</b>							
Grid Connection Type		1Ø/2W	Split-Ø/3W	1Ø/2W	1Ø/2W	Split-Ø/3W	1Ø/2W 1Ø
Adjustable Voltage Range (Vmin-Vmax)	V	183-228	211-264	244-304	183-228	211-264	244-304 183
Grid Frequency	Hz	60			60		
Adjustable Grid Frequency Range	Hz	57-60.5			57-60.5		
Maximum Current (Iacmax)	A <sub>RMS</sub>	14.5	14.5	12	17.2	16	16
Power Factor		> 0.995			> 0.995		
Total Harmonic Distortion At Rated Power	%	< 2			< 2		
Grid Wiring Termination Type		Terminal block, Pressure Clamp, AWG10-AWG6					
<b>Protection Devices</b>							
Input		Yes			Yes		
Reverse Polarity Protection		Yes			Yes		
Over-Voltage Protection Type		Varistor, 2 for each channel			Varistor, 2 for each channel		
PV Array Ground Fault Detection		Pre start-up Riso and dynamic GFDI (Requires Floating Output)					
<b>Output</b>							
Anti-Islanding Protection		Meets UL 1741/IEEE1547 requirements			Meets UL 1741/IEEE1547 requirements		
Over-Voltage Protection Type		Varistor, 2 (L <sub>1</sub> - L <sub>2</sub> / L <sub>1</sub> - G)			Varistor, 2 (L <sub>1</sub> - L <sub>2</sub> / L <sub>1</sub> - G)		
Maximum AC OCPD Rating	A	20	20	15	25	20	20
<b>Efficiency</b>							
Maximum Efficiency	%	96.9			97		
CEC Efficiency	%	96			96		
<b>Operating Performance</b>							
Stand-by Consumption	W <sub>MAX</sub>	< 8			< 8		
Night time consumption	W <sub>MAX</sub>	< 0.6			< 0.6		
<b>Communication</b>							
User-Interface		16 characters x 2 lines LCD display					
Remote Monitoring (1xRS485 incl.)		AURORA-UNIVERSAL (opt.)					
Wired Local Monitoring (1xRS485 incl.)		PVI-USB-RS485 232 (opt.), PVI-DESKTOP (opt.)					
Wireless Local Monitoring		PVI-DESKTOP (opt.) with PVI-RADIOMODULE (opt.)					

ELECTRICAL PLANS RELEASED  
SUBJECT TO FIELD INSPECTION  
AND APPROVAL

NEMA 4X (IP65)  
Relative Humidity  
< 100% Condensing  
MECHANICAL  
Dimensions (H x W x D)  
21.5" x 12.8" x 8.3"  
31" x 12.8" x 8.3" (-S version)  
Weight 38 lb 47 lb (-S Version)

Stand-By Consumption < 8W  
Feed In Power Threshold 20.0W  
Night Time Consumption < 0.3W  
Isolation Level  
NONE due Transformerless Topology  
Display Alphanumeric-2 Lines  
Communication RS 485

Standards  
UL 1741, IEEE 1547,  
CSA - C22.2 N. 107.1-01.

REVISIONS

GENERAL STRUCTURAL  
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Hellerstein, 1909 Franwall Ave, Silver Spring	
Grid Tie PV System	Scale NA
	9/6/2013



### Aurora PVI 3000 Grid Tie Inverter

ELECTRICAL PLANS RELEASED  
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Environmental			
Ambient Air Operating Temperature Range	°F (°C)	-13 to +140 (-25 to +60) with derating above 131 (55)	-13 to +140 (-25 to +60) with derating above 131 (55)
Ambient Air Storage Temperature Range	°F (°C)	-40 to 176 (-40 to +80)	-40 to 176 (-40 to +80)
Relative Humidity	% RH	0-100 condensing < 50	0-100 condensing < 50
Acoustic Noise Emission Level	db (A) @1m	< 50	< 50
Maximum Operating Altitude without Derating	ft/m	6560 (2000)	6560 (2000)
Mechanical Specifications			
Enclosure rating		NEMA 4X	NEMA 4X
Cooling		Natural Convection	Natural Convection
Dimensions (H x W x D)	in (mm)	33.8 x 12.8 x 8.7 (859 x 325 x 222) -S Version	33.8 x 12.8 x 8.7 (859 x 325 x 222) -S Version
Weight	lb/(kg)	< 47.3 (21.3) -S version	< 47.3 (21.3) -S version
Mounting System		Wall bracket	Wall bracket
Conduit Connections***		Trade size KOs: (2ea x 1/2") and (2ea x 1-1/4", 3 places side, front, rear)	Trade size KOs: (2ea x 1/2") and (2ea x 1-1/4", 3 places side, front, rear)
DC Switch Rating (Per Contact)	AV	25 / 600	25 / 600
Safety		Transformerless (Floating Array)	Transformerless (Floating Array)
Isolation Level		UL 1741, CSA - C22.2 N. 107.1-01	UL 1741, CSA - C22.2 N. 107.1-01
Safety and EMC Standard		UL 1741, CSA - C22.2 N. 107.1-01	UL 1741, CSA - C22.2 N. 107.1-01
Safety Approval		,CSA <sub>UL</sub>	,CSA <sub>UL</sub>
Warranty			
Standard Warranty	years	10	10
Extended Warranty	years	15 & 20	15 & 20
Available Models			
Standard - Without DC Switch and Wiring Box		PVI-3.0-OUTD-US	PVI-3.6-OUTD-US
With DC Switch and Wiring Box		PVI-3.0-OUTD-S-US	PVI-3.6-OUTD-S-US

REVISIONS

AURORA I/MD

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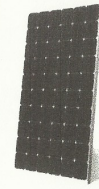
Hellerstein, 1909 Franwall Ave, Silver Spring	
Grid Tie PV System	Scale NA
	9/6/2013

### Helios Solar US 6T 260Watt Monocrystal Panel



ELECTRICAL DATA STC		6T 265	6T 260	6T 255	6T 250	6T 245	6T 240
Rated Power PMPP (W)	=	265	260	255	250	245	240
MPP Voltage (V)	=	31.03	30.84	30.65	30.30	30.03	30.00
MPP Current (A)	=	8.55	8.46	8.32	8.22	8.18	8.00
Open Circuit Voltage (V)	=	37.91	37.73	37.50	37.40	37.26	36.80
Short Circuit Current (A)	=	8.91	8.90	8.86	8.72	8.71	8.70
Module Efficiency (%)	=	15.93	15.63	15.33	15.03	14.73	14.43

Measured at (STC) Standard Test Conditions 25° C, Insolation 1,000 W/m<sup>2</sup>, AM 1.5



ELECTRICAL DATA NOCT		6T 265	6T 260	6T 255	6T 250	6T 245	6T 240
Rated Power PMPP (W)	=	193	190	187.00	183.00	179.00	175.00
MPP Voltage (V)	=	28.01	27.77	27.50	27.30	27.10	27.00
MPP Current (A)	=	6.89	6.84	6.80	6.70	6.60	6.50
Open Circuit Voltage (V)	=	35.15	34.90	34.60	34.50	34.40	34.30
Short Circuit Current (A)	=	7.35	7.32	7.30	7.25	7.20	7.15

Nominal Operating Cell Temperature (NOCT) values are typical values, 45°C.  
Typical cell temperature: insolation 600W/m<sup>2</sup>, ambient temperature 20°C, wind speed 1m/s.

ELECTRICAL PLANS RELEASED  
SUBJECT TO FIELD INSPECTION  
AND APPROVAL

REVISIONS

OTHER ELECTRICAL PARAMETERS			
System Voltage (V)	=	600/1,000	Temp. Coefficient PMPP (% / °C) = -0.41
Temp. Coefficient ISC (% / °C)	=	0.03	Temp. Coefficient VOC (% / °C) = -0.32

DESIGN			
Cells	=	60 mono-crystalline, 3 bus bar	Backside = Multilayer sheet
Cell Dimensions	=	156 mm x 156 mm, pseudo-square	Frame = Anodized aluminum (clear or black)
Front glass	=	3.2mm solar glass, low iron content and highly transparent	Connection = 2 x 1.2 m solar cables with MC4 connectors or compatible
Encapsulation	=	EVA - Solar Cells - EVA	Bypass Diodes = 3 pieces

LIMIT VALUES		QUALIFICATIONS	
Module Temperature	-40°C to +80°C	IEC 61215, IEC 61730, ULC/ORD-C1703-01, CEC, FSEC, TÜV NORD, CEC, JET	
Wind Load	2400 Pa   Snow Load 5400 Pa		

WARRANTY		PERFORMANCE OUTPUT	
25-year linear performance warranty. Also 10 years workmanship.		-0/+3 percent	



Echo Electric Co. 301.949.8050  
10528 Detrick Avenue Kensington, MD 20895

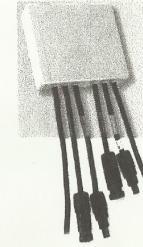
Hellerstein, 1909 Franwall Ave, Silver Spring	
Grid Tie PV System	Scale NA
	9/6/2013

ELECTRICAL PLANS RELEASED  
SUBJECT TO FIELD INSPECTION  
AND APPROVAL

### TIGO DUAL ENERGY MAXIMIZER

For residential, commercial and utility scale photovoltaic solar arrays, the Tigo Energy® Maximizer™ system optimizes the power output of each module; delivers module-level data for operational management and performance monitoring; and provides the ability to deactivate the high voltage DC bus for safer installation, maintenance or fire fighting. Tigo Energy Dual Maximizers are key components of the system which reside at each Module. Connected to two solar modules, a Dual Maximizer provides data acquisition, communication to the Tigo Energy® Maximizer™ Management Unit, and power point control. It can operate with single Maximizers in the array as well.

The Tigo Energy Dual Maximizer is packaged in a NEMA3R enclosure (water and weather resistant), and conforms to UL and IEEE safety standards. There are Module Maximizer options to fit any PV module, crystalline silicon or thin-film, regardless of output voltage or power rating.



Input data (per module) MM-2ES50      Maximum power 300W  
Maximum input DC voltage (Voc) 52V      Vmp range\* 16-48V  
Maximum continuous current (Imp) 9.5A      Maximum input current (Isc) 10A  
Maximum output power 600W

Nominal Voltage at maximum power range 16 to 48VDC

#### Mechanical Data

Operating temperature range -30 °C +70 °C      Cooling Natural Convection

Enclosure environmental rating IP-65, NEMA3R

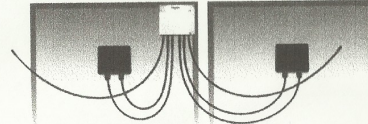
Compliance per UL1741      FCC part 15, class B      EN 61000

Panel connector NEC 2008 compliant, MC4 compatible (for retrofit) MC3 connectors

Bus connector NEC 2008 compliant 40AMP

Specifications subject to change.

Always check the table on the Tigo Energy Module Maximizer label for specifications as supported by that particular unit.



GENERAL STRUCTURAL  
ARRANGEMENT & APPROVED  
SUBJECT TO FURTHER  
APPROVAL OF CONSTRUCTION

**ECHO**  
ELECTRIC CO. INC.

Echo Electric Co. 301.949.8050  
10528 Detrick Avenue Kensington, MD 20895

Hellerstein, 1909 Franwall Ave, Silver Spring	
Grid Tie PV System	Scale NA
	9/6/2013



**TIGO ENERGY® MAXIMIZER™ SYSTEM**

Individual electronic units attached to each solar collector optimizes power output per each module (solar panel); delivers module-level data for operational management and performance monitoring; and provides the ability to deactivate the high voltage DC bus for safer installation, maintenance or fire fighting. The Tigo Energy Maximizer Management Unit (MMU) communicates between the Module Maximizers and the Inverter, controls processes in real time and sends data to a remote server in order to allow multiple users to observe and interact with the monitoring system.

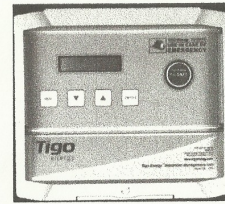
Each Tigo Energy Maximizer system includes one MMU. The MMU has a manual user interface and LCD display housed in a NEMA3 enclosure for onsite programming. The MMU mounts near the inverter and communicates with each PV module in the system, provides management and control functions for the module Maximizers, and serves as a gateway to the Data Center.

The Maximizer Management Unit is pre-configured with CAT-5 Ethernet access and can ship with optional wi-fi or cellular communication modules. The MMU can be used as a qualifying inverter and overall system performance monitoring interface for legacy installations.

The MMU includes the Tigo Energy® PV-SAFE™ button - a unique onsite safety feature located on the front of the Maximizer Management Unit. With one push of the red button, an onsite operator or emergency personnel can deactivate the entire array for maintenance or emergency purposes (patented).

PV-Safe enables each module to be electrically removed from the high voltage DC cabling limiting the voltage exposure to the open-circuit voltage (Voc) of a single module. As part of the Tigo Energy system, this function can be activated with the safety button or via a remote management console. The system can be installed, maintained or approached by fire personnel without the exposure to voltage levels typically in excess of 400 volts.

Tigo Energy® PV-SAFE™ red button on the Maximizer Management Unit installed next to outdoor PV system lets an onsite operator or emergency personnel deactivate the entire array and no high voltage DC current will be present.



**Mechanical Specifications**  
**Dimensions**  
(LWH) 245 x 150 x 80 mm  
Weight 1000 gm

**Operating Temperature**  
0° to +70° C

ELECTRICAL PLANS RELEASED  
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GENERAL STRUCTURAL  
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Echo Electric Co. 301.949.8050  
10528 Detrick Avenue Kensington, MD 20895

Hellerstein, 1909 Franwall Ave, Silver Spring	
Grid Tie PV System	Scale NA
	9/6/2013



# WOLFMAN & ASSOCIATES, P.C.

CONSULTING STRUCTURAL ENGINEERS



8720 GEORGIA AVENUE, SUITE 908  
SILVER SPRING, MARYLAND 20910

Ronald F. Wolfman, P.E. President  
Steve Jiau, P.E. Sr. Associate

December 17, 2012

Attention: Ken Stadin, Principal  
Kenergy Solar, Inc.  
7059 Blair Road, NW  
Washington, DC 20012

Re: Hellerstein Residence  
1909 Franwall Ave  
Silver Spring, Maryland 20902  
12195.LT1

THIS PERMIT DOES NOT  
INCLUDE APPROVAL FOR  
ANY ELECTRICAL WORK.  
YOU MUST HAVE A SEPARATE  
ELECTRICAL PERMIT TO DO  
ANY ELECTRICAL WORK.

MONTGOMERY COUNTY REGULATION 2-12  
THE FINAL INSPECTION MUST BE  
OBTAINED AND APPROVED BEFORE  
A BUILDING (OR PORTION THEREOF)  
IS USED OR OCCUPIED

CHANGES OR MODIFICATIONS TO  
THESE PLANS MAY REQUIRE  
REVISIONS WITH ADDITIONAL  
PERMITS. NO CHANGES  
SHALL BE MADE TO THE APPROVED  
SET OF CONSTRUCTION PLANS.  
ELECTRICAL WIRING MUST CONFORM TO  
THE NATIONAL ELECTRICAL  
CODE AND COUNTY AMENDMENTS

GENERAL STRUCTURAL  
ARRANGEMENT APPROVED  
SUBJECT TO FURTHER  
APPROVAL OF CONSTRUCTION

Dear Mr. Stadin:

We have completed our design check of the existing roof system to carry a new solar panel system. The existing roof system consists of 2 x 6 rafters spaced at 16" on center. In the attic are knee walls to cut down the span of the rafters. The solar panel system with tracks weighing approximately 3.09 pounds per square foot. Our design check is based on IRC 2012 code. Our design check is based on 30 pounds a square foot snow loads and 20 psf (90 MPH 3 second gust) wind loads.

The design verification has been based on the following:

1. Design check based on IRC 2012, ASCE7-05
2. American Forest & Paper Association / American Wood Council NDS design manual 2005 edition.
3. Wind loads of 20 psf, snow loads of 30 psf, and seismic  $S_s = 15.58\%$ ,  $S_1 = 5.03\%$  which qualifies for seismic design category of A.

Based on the information we were furnished it is our professional opinion that the existing roof system has the capacity to carry the new above referenced solar panel system. It should be noted that we are not responsible for any water infiltration due to the installation of the solar panel system.

I here by certify that this letter was prepared or approved by me, and I am a duly licensed professional engineer under the laws of the state of Maryland license number 8998, expiration date February 3, 2013

If there are any questions concerning this matter, please do not hesitate to contact our office.

Sincerely,  
  
Ronald F. Wolfman, P.E.  
For: Wolfman & Associates, P.C.

A SEPARATE ELECTRICAL  
PERMIT IS REQUIRED



RFW/rw

# 622341

TELEPHONE 301-587-0260

FAX 301-587-0470

MONTGOMERY COUNTY  
Department of Permitting Services  
Approved:   
Date: 1/3/13

ELECTRICAL REVIEW BY: ORIGINAL

WORKING

GENERAL STRUCTURAL  
ARRANGEMENT APPROVED  
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Note : several pages of the old plan (from Kenergy) are part of the official package, but I are not included here.