

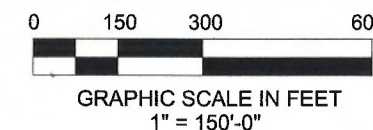
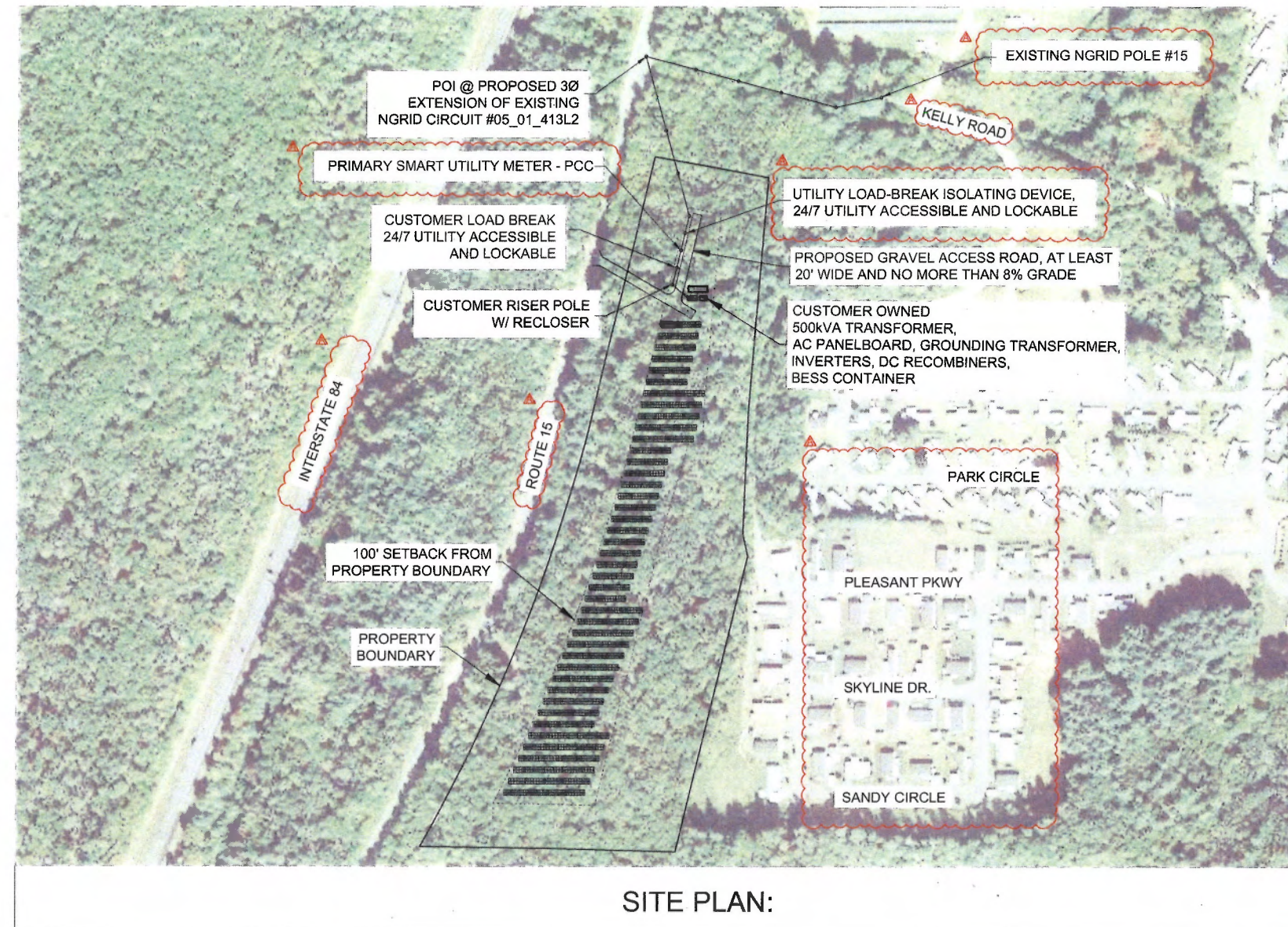
180° MODULE
ORIENTATION
25° TILT

SITE PLAN/LAYOUT IS REPRESENTATIVE
FOR INTERCONNECTION APPROVAL ONLY.
NOT FOR CONSTRUCTION.

FINAL PV DISCONNECT AND METER
LOCATION WILL BE DETERMINED BY THE
NATIONAL GRID METERING DEPARTMENT.

LOADS:

GROUND SNOW	40 PSF
WIND LOAD	124 MPH



PROJECT DATA	
INTEGRATOR:	BEAR PEAK POWER 1099 18TH ST, SUITE 2150 DENVER, CO 80202
SITE:	200 ROUTE 15 STURBRIDGE, MA 01566
CODES:	NEC-2020 IBC-2015 9TH EDITION CMR 780
SOLAR ARRAY:	
MODULE:	HT-SAAE HT72-166M 450W 2,912 MODULES
RACKING:	GROUND MOUNTED @ 25 DEGREES
INVERTER:	(4) SOLECTRIA XGI 1500-125/125
DC STORAGE:	(8) ALENCON BOSS-1500 DC-DC CONVERTERS 640kW / 1,280 kWh DC-COUPLED BESS
DC OUTPUT:	1,310,400 W DC - STC
AC OUTPUT:	500,000 W AC

ASHRAE TEMPERATURE:

WORCHESTER REGIONAL ARPT			
ELEV.	HIGH TEMPERATURE	LOW TEMPERATURE	
	0.4%	2% AVG.	EXTREME MINIMUM
310m	32°C	29°C	-20°C

200 ROUTE 15
1,310.4 - kW DC
500.0 - KW AC NOMINAL
500.0 - KW AC MAXIMUM
PHOTOVOLTAIC POWER SYSTEM
W/ 640kW / 1,280 kWh DC-COUPLED STORAGE

ARC DESIGN
 409 NORTH MAIN STREET
 ELMER, NJ 08318
 (856) 712-2166 FAX: (856) 358-1511

PREPARED FOR:
 BEAR PEAK POWER
 1099 18TH ST, SUITE 2150
 DENVER, CO 80202

PROPOSED PHOTOVOLTAIC ARRAY
 200 ROUTE 15
 200 ROUTE 15
 STURBRIDGE, MA 01566

JAMES A. CLANCY
 MA PE. #000046775

REVISIONS

DATE	COMMENT
05-20-22	BESS REVISION
05-27-22	IN/VESS CHANGE
06-16-22	PER UTILITY REVIEW

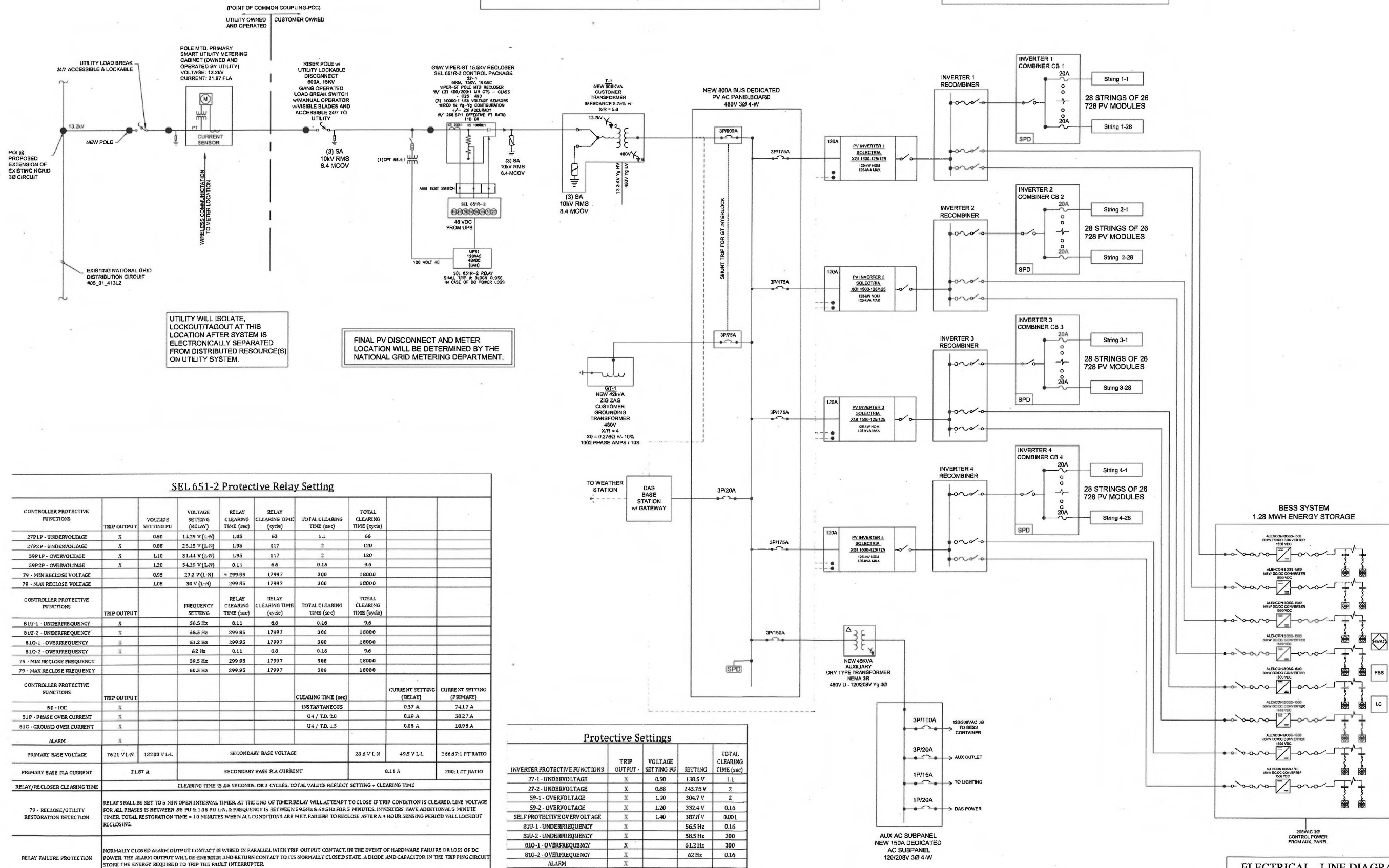
JOB #
 DRWN RCA
 CHKD JAC
 SCALE AS NOTED
 DATE 05-23-2022

C-1

(2,912) HT-SAAE HT72-166M 450W MODULES
 (4) SOLECTRIA XGI 1500-125/125 INVERTERS
 (8) ALENCON BOSS 1500-DC-DC CONVERTERS

SYSTEM SIZE = 1,310.4 kW DC
 500.0 kW AC NOMINAL
 500.0 kVA AC MAXIMUM
 640kW / 1,280KWH DC-COUPLED BESS

INVERTER 1-4
 PV Modules = 450 Watts STC
 728 Modules per Inverter = 327,600 watts DC STC
 28 Strings of 26 PV Modules per Inverter
 w/ 160kW / 320 KWH DC-Coupled Storage per Inverter



SEL 651-2 Protective Relay Setting

CONTROLLER PROTECTIVE FUNCTIONS	TRIP OUTPUT	VOLTAGE SETTING PU	VOLTAGE SETTING (RELAY)	RELAY CLEARING TIME (sec)	RELAY CLEARING TIME (cycle)	TOTAL CLEARING TIME (sec)	TOTAL CLEARING TIME (cycle)
27F1P - UNDERVOLTAGE	X	0.50	14.29 V (L-N)	1.05	63	1.1	66
27F2P - UNDERVOLTAGE	X	0.88	25.15 V (L-N)	1.95	117	2	120
59F1P - OVERVOLTAGE	X	1.10	31.44 V (L-N)	1.95	117	2	120
59F2P - OVERVOLTAGE	X	1.20	34.29 V (L-N)	0.11	6.6	0.16	9.6
79 - MIN RECLOSE VOLTAGE		0.95	27.2 V (L-N)	299.95	17997	300	18000
79 - MAX RECLOSE VOLTAGE		1.05	30 V (L-N)	299.95	17997	300	18000

CONTROLLER PROTECTIVE FUNCTIONS	TRIP OUTPUT	FREQUENCY SETTING	RELAY CLEARING TIME (sec)	RELAY CLEARING TIME (cycle)	TOTAL CLEARING TIME (sec)	TOTAL CLEARING TIME (cycle)
81U-1 - UNDERFREQUENCY	X	56.5 Hz	0.11	6.6	0.16	9.6
81U-2 - UNDERFREQUENCY	X	38.5 Hz	299.95	17997	300	18000
81O-1 - OVERFREQUENCY	X	61.2 Hz	299.95	17997	300	18000
81O-2 - OVERFREQUENCY	X	62 Hz	0.11	6.6	0.16	9.6
79 - MIN RECLOSE FREQUENCY		59.5 Hz	299.95	17997	300	18000
79 - MAX RECLOSE FREQUENCY		60.5 Hz	299.95	17997	300	18000

CONTROLLER PROTECTIVE FUNCTIONS	TRIP OUTPUT	CLEARING TIME (sec)	CURRENT SETTING (PRIMARY)	CURRENT SETTING (SECONDARY)
50 - IOC	X	INSTANTANEOUS	0.37 A	741.7 A
51P - PHASE OVER CURRENT	X	U4 / TD. 2.0	0.19 A	382.7 A
51G - GROUND OVER CURRENT	X	U4 / TD. 1.5	0.05 A	109.3 A

ALARM	PRIMARY BASE VOLTAGE	PRIMARY BASE FLA CURRENT	SECONDARY BASE VOLTAGE	SECONDARY BASE FLA CURRENT	PT RATIO
X	7621 V L-N 13200 V L-L	21.87 A	28.6 V L-N 49.5 V L-L	0.11 A	266.67:1 PT RATIO

RELAY/RECLOSER CLEARING TIME	CLEARING TIME (sec)	CLEARING TIME (cycle)
79 - RECLOSE/UTILITY RESTORATION DETECTION	RELAY SHALL BE SET TO 5 MIN OPEN INTERVAL TIMER. AT THE END OF TIMER RELAY WILL ATTEMPT TO CLOSE IF TRIP CONDITION IS CLEARED. LINE VOLTAGE FOR ALL PHASES IS BETWEEN 95 PU & 1.05 PU L-N, & FREQUENCY IS BETWEEN 59.5Hz & 60.5Hz FOR 3 MINUTES. INVERTERS HAVE ADDITIONAL 5 MINUTE TIMER. TOTAL RESTORATION TIME = 10 MINUTES WHEN ALL CONDITIONS ARE MET. FAILURE TO RECLOSE AFTER A 4 HOUR SENSING PERIOD WILL LOCKOUT RECLOSING.	

RELAY FAILURE PROTECTION	DESCRIPTION
X	NORMALLY CLOSED ALARM OUTPUT CONTACT IS WIRED IN PARALLEL WITH TRIP OUTPUT CONTACT. IN THE EVENT OF HARDWARE FAILURE OR LOSS OF DC POWER, THE ALARM OUTPUT WILL DE-ENERGIZE AND RETURN CONTACT TO ITS NORMALLY CLOSED STATE. A DIODE AND CAPACITOR IN THE TRIPPING CIRCUIT STORE THE ENERGY REQUIRED TO TRIP THE FAULT INTERRUPTER.

Protective Settings

INVERTER PROTECTIVE FUNCTIONS	TRIP OUTPUT	VOLTAGE SETTING PU	SETTING	TOTAL CLEARING TIME (sec)
27-1 - UNDERVOLTAGE	X	0.50	138.5 V	1.1
27-2 - UNDERVOLTAGE	X	0.88	243.76 V	2
59-1 - OVERVOLTAGE	X	1.10	304.7 V	2
59-2 - OVERVOLTAGE	X	1.20	332.4 V	0.16
SELF PROTECTIVE OVERVOLTAGE	X	1.40	387.8 V	0.001
81U-1 - UNDERFREQUENCY	X		56.5 Hz	0.16
81U-2 - UNDERFREQUENCY	X		58.5 Hz	300
81O-1 - OVERFREQUENCY	X		61.2 Hz	300
81O-2 - OVERFREQUENCY	X		62 Hz	0.16
ALARM	X			
BASE VOLTAGE (L-N)		0.277	kV	277
			VOLT	

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E-1

ELECTRICAL - LINE DIAGRAM

Reliable State-owned Enterprise Deliver Solar Power since 1960s

HT72-166M Transparent
High Efficiency Low LID Bifacial PERC with Half-cut Technology

435W / 440W
445W / 450W / 455W

12 Ys Products Warranty
30 Ys Warranty on power output
EL Microcrack resistant high performance transparent backsheet structure enhance miscibility, triple EL tested of high quality control.

5W Positive tolerance 0-5W guaranteed
PID PID Resistant
Comprehensive and first-rate certification system

MULTIWAY+
Better Choice For Higher Efficiency!

1500V module **HT72-166M**
435W/440W/445W/450W/455W

Electrical Characteristics

Model	HT72-166M	HT72-166M	HT72-166M	HT72-166M	HT72-166M
Maximum Power at STC (Pmax)	435W	440W	445W	450W	455W
Open Circuit Voltage (Voc)	48.9V	49.5V	49.5V	49.5V	49.5V
Short Circuit Current (Isc)	11.75A	11.85A	11.85A	11.85A	11.85A
Maximum Operating Voltage (Vmp)	32.5V	32.5V	32.5V	32.5V	32.5V
Maximum Operating Current (Imp)	13.55A	13.55A	13.55A	13.55A	13.55A

Engineering Drawing

NMOT

BIFACIAL REAR SIDE POWER GAIN

Module	HT72-166M	HT72-166M	HT72-166M	HT72-166M	HT72-166M
Standard Power	435W	440W	445W	450W	455W
Power Gain	0%	0%	0%	0%	0%

Mechanical Characteristics

I-V Curves

Temperature Characteristics

Warranty

ALENCON

The BOSS: Alencon's Unique Bi-Directional DC-DC Converter for Battery Energy Storage Systems

The Most Powerful and Flexible Bi-Directional DC-DC Converter on the Market Today

Alencon's Bi-Directional DC-DC Optimizer for Storage Systems, the BOSS, is a unique solution for your next battery energy storage project. The BOSS enables the granular control of charge and discharge of individual battery racks with a patent pending, galvanically isolated approach. The Alencon BOSS is the only DC-DC optimizer on the market capable of managing the charge and discharge of batteries on the rack level while offering galvanic isolation.

The Alencon BOSS is a cost-effective way to DC couple solar and storage or to augment existing battery energy storage systems. The BOSS can also be used for battery balancing applications required for electric vehicles and other devices. The BOSS can charge and discharge batteries across a wide voltage range on either side of the battery. BOSS units can be installed between individual battery racks or placed in parallel in any variety of configurations or form factors.

Features

- Full galvanic isolation between input and output
- Battery rack level charge and discharge
- Wide voltage mapping range between battery and DC bus or between batteries
- Numerous BOSS units can easily be installed and controlled in parallel
- Detect ground leaks with "Leak Locator" technology

Benefits

- Combine grounded PV arrays with floating batteries
- Maximize the utilization of each battery rack
- Match different voltages between batteries and solar or other DC sources and loads
- Easily augment energy storage systems with new battery racks with different charge characteristics and even different chemistries
- Improve the safety of battery energy storage systems

Advantages

- Flexibly design and deploy DC coupled Solar + Storage systems
- Get more energy from every battery rack
- Reduce overall BESS capital and operating expenses to improve storage project return on investment
- Improve battery energy storage system safety and prevent mishaps from occurring
- Increase system reliability and simplify O&M

Technical Specifications

Model	BOSS-1000	BOSS-1500
Standard DC Bus Specifications		
Max DC Bus Voltage	1000 V DC	1500 V DC
Operating DC Bus Voltage Range	400-1000 V DC	200-1500 V DC
Standard Battery Voltage Specifications		
Max Battery Voltage	1000 V DC	1500 V DC
Operating Battery Voltage Range	0-1000 V DC	0-1500 V DC
Unit Power Specifications		
Max Current - 25°C Ambient	77 A	56 A
Maximum Power - 25°C Ambient	77 kW	84 kW
Maximum Power - 50°C Ambient	58 kW	63 kW
Efficiency	98.5%	98.0%
CEC Weighted Efficiency	98.0%	97.5%
Standards & Compliance	UL1741, IEC 62109-1, CSA C22.2	
Environmental	Operating Temperature: -40°C to 60°C	
Humidity	0-95%	
Environmental Rating	NEMA 3R & IP66	
Operating Ambient Temp	-5°C to 30°C	
Form Factor	Rack Mounted, Indoor / Rack Mounted, Outdoor	
Size (H x W x D)	Rack Mount: 31" x 19" x 27"; Rail Mount: 24.8" x 16.5" x 15.0"	
Weight	Rack Mount: 33 kg; Rail Mount: 31 kg	
Aux Power	24V available	
Communications	Modbus TCP via Alencon Communications Environment (ACE)	

ALLENCON
888-410-7915
www.alenconsystems.com

SOLECTRIA™ XGI 1500
PREMIUM 3-PHASE TRANSFORMERLESS UTILITY-Scale INVERTERS

YASKAWA

NEW! Expanded DC/AC Ratio

FEATURES

- Made in the USA with global components
- Buy American Act (BAA) compliant
- Four models: 125kW/125kVA, 125kW/150kVA, 150kW/150kVA, 150kW/165kVA
- 99.0% peak efficiency
- Flexible solution for distributed and centralized system architecture
- Advanced grid-support functionality: Rule 21/UL1741SA
- Robust, dependable and built to last
- Lowest O&M and installation costs
- Access all inverters on site via WiFi from one location
- Remote diagnostics and firmware upgrades
- SunSpec Modbus Certified
- Tested compatible with the TESLA PowerPack Microgrid System
- app for system visibility

OPTIONS

- String combiners for distributed and centralized systems
- Web-based monitoring
- Extended warranty

MADE IN THE USA

YASKAWA SOLECTRIA SOLAR

SOLECTRIA™ XGI 1500 TECHNICAL DATA

SPECIFICATIONS

SOLECTRIA XGI 1500 Model	XGI 1500-125/125	XGI 1500-125/150	XGI 1500-150/150	XGI 1500-150/165
Absolute Maximum Input Voltage	1500 VDC	1500 VDC	1500 VDC	1500 VDC
Maximum Power Input	860-1250 VDC	860-1250 VDC	860-1250 VDC	860-1250 VDC
Voltage Range (48PPT)	860-1450 VDC	860-1450 VDC	860-1450 VDC	860-1450 VDC
Operating Voltage Range (MPPPT)	860-1450 VDC	860-1450 VDC	860-1450 VDC	860-1450 VDC
Number of MPP Trackers	1 MPPPT	1 MPPPT	1 MPPPT	1 MPPPT
Maximum Operating Input Current	148.5 A	148.5 A	175.0 A	175.0 A
Maximum Operating PV Power	128 kW	128 kW	153 kW	172 kW
Maximum DC/AC Ratio Max Rated PV Power	2.4 332 kW	2.4 432 kW	2.2 335 kW	2.0 335 kW
Max Rated PV Short-Circuit Current (Isc x 1.25)	800 A	800 A	500 A	500 A
Nominal Output Voltage	600 VAC, 3-Ph	600 VAC, 3-Ph	600 VAC, 3-Ph	600 VAC, 3-Ph
AC Voltage Range	-12% to +10%	-12% to +10%	-12% to +10%	-12% to +10%
Continuous Real Output Power	125 kW	150 kW	150 kW	150 kW
Continuous Apparent Output Power	125 kVA	150 kVA	156 kVA	156 kVA
Maximum Output Current	360 A	360 A	360 A	360 A
Nominal Output Frequency	60 Hz	60 Hz	60 Hz	60 Hz
Power Factor (Unity default)	Adjustable	Adjustable	Adjustable	Adjustable
Total Harmonic Distortion (THD) @ Rated Load	<3%	<3%	<3%	<3%
Grid Connection Type	1-Ph, 1-W/GND	3-Ph, 3-W/GND	3-Ph, 3-W/GND	3-Ph, 3-W/GND
Grid Current Contribution (1 cycle RMS)	144 A	172 A	192 A	192 A
Peak Efficiency	98.9%	98.5%	98.0%	98.0%
CEC Average Efficiency	98.0%	97.5%	97.0%	97.0%
Yield Loss	-1 W	-1 W	-1 W	-1 W
Ambient Temperature Range	-40°F to 140°F (-40°C to 60°C)	-40°F to 140°F (-40°C to 60°C)	-40°F to 140°F (-40°C to 60°C)	-40°F to 140°F (-40°C to 60°C)
De-Rating Temperature	122°F (50°C)	122°F (50°C)	122°F (50°C)	122°F (50°C)
Storage Temperature Range	-40°F to 187°F (-40°C to 75°C)	-40°F to 187°F (-40°C to 75°C)	-40°F to 187°F (-40°C to 75°C)	-40°F to 187°F (-40°C to 75°C)
Relative Humidity (non-condensing)	0-95%	0-95%	0-95%	0-95%
Operating Altitude	Full Power up to 9,840 ft (3,000 m); De-Rate to 70% of Full Power at 13,125 ft (4,000 m)			
Advanced Graphical User Interface	Web			
Communication Interface	Ethernet			
Third-Party Monitoring Protocol	SunSpec Modbus TCP/IP (optional)			
Firmware Updates	Remote and on-site			
Safety Listings & Certifications	UL 1741, IEEE 1547, UL 1998, Rule 21, UL 1741SA			
Advanced Grid Support Functionality	ETL			
Testing Agency	FCC Compliance			
Standard and Options	FCC Part 15 (Subpart B, Class A)			
Acoustic Noise Rating	5 Years Standard; 10 Years 7.5' (2.3 m) up to 160dB @ 4 ft Integrated 2-Port 250 A DC Disconnect			
Mounting Angle	Vertical only			
Dimensions	Height: 28.5 in (730 mm) Width: 39.4 in (1000 mm) Depth: 13.1 in (333 mm)			
Weight	270 lbs (122 kg)			
Enclosure Rating and Finish	Type 4X, Polyester Powder-Coated Aluminum			

YASKAWA SOLECTRIA SOLAR

SOLECTRIA™ XGI 1500 TECHNICAL DATA

SPECIFICATIONS

MADE IN THE USA

YASKAWA SOLECTRIA SOLAR

SOLECTRIA™ XGI 1500 TECHNICAL DATA

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JAMES A. CLANCY
MA PE 06775
Professional Engineer
Professional Engineer
Professional Engineer
Professional Engineer

REVISIONS

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E-4

EQUIPMENT SPECIFICATIONS