



## RECTIFIER SYSTEM



Both Shelves with AS-REC-CM and 7 AS-REC-RMs

### For Hybrid Solar/Diesel Generator Power

- Hybrid PV/DG optimizes CAPEX & OPEX
- AC Input from Generators, Grid or both
- Settable Priority of All Energy Sources
- Up to 20kW of PV Input and 21kW of AC Input from the DG or Grid in one cabinet

### Complete AC Power Input System Wired & Tested inside the Apollo Cabinet

- Automatic Transfer Switch (DG/Grid)
- Single Phase or 3 Phase AC Inputs
- Healthy Phase Selector - option
- Smart control of external generator
- Algorithm stops DG when PV is available

### 21kW Rectifier in Apollo Solar Cabinet

- 7 slots for 3kW SMPS Modules
- N+1 Redundancy, Hot Swappable
- Current Leveling eliminates hot spots

### Complete Energy System Electronics

- Use any energy source available
- Comprehensive Remote Monitoring
- Outdoor Rated Cabinet
- Cabinet size: 1000 x 1200 x 300 mm
- Factory wired and tested in the USA
- 5 Year Warranty

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## TELECOM RECTIFIER SYSTEM

### Smart Diesel Generator Control

The Apollo System Controller firmware includes our Smart Energy Flow Algorithm which starts and stops the external generator at the optimum times. The fuel consumption and DG run time are minimized by stopping the generator when solar energy becomes available while ensuring that the telecom BTS loads are always powered and that the batteries are never deeply discharged. The lowest cost source of energy is prioritized to be used first.

### Complete Turn-Key System

The Apollo Inverter Systems provide TURN-KEY Energy Source Selection. The Apollo cabinets are completely assembled, wired, and tested in our factory in the USA to provide a single point of responsibility.

### Rectifier and Switchgear in the Solar Cabinet

This compact system provides all the AC components in the same cabinet as the MPPT Solar Energy System. In addition to Circuit Breakers on the inputs and outputs of the Rectifier, an optional Automatic Transfer Switch and Healthy Phase Detector fit in the housing.



The Apollo Cabinet



Rectifier & Breakers on the door

### Remote Monitoring Reports all Energy Sources

Remote monitoring includes the Voltage, Current, Power and Energy from each AC Source in addition to the PV input, Battery State of Charge, Temperatures and Individual Load Outputs.

# APOLLO RECTIFIER SHELF - SPECIFICATIONS:

Part Numbers AS-RECS1 and AS-RECS2

- 19" with 1 shelves 1U each
- Holds up to 7 of our 3kW Rectifier Modules and 1 Controller
- Total Power up to 21kW, 350Amps
- Breakers on AC inputs & DC outputs
- N+1 Redundant and Hot Swappable



(Photo shows 1 of the 2 shelves.)

## Input Specifications:

VOLTAGE	1P3W 240VAC (176~296Vac) 3Ø 4W 380VAC
FREQUENCY	45-66Hz
PROTECTION	Under & Over voltage
EFFICIENCY	95.5% Typical ( 3kW module ) 96.0% Typical ( 2kW module ) 95.0% Typical ( 1kW module )

## General Specifications:

OPERATING TEMP	-40°C to +75°C
(Derating above)	(3KW: +45°C / 1&2KW: +55°C)
STORAGE TEMP	-40°C ~ +80°C
OPERATING HUMIDITY	0% ~ 90%(Non-Condensing)
STORAGE HUMIDITY	0% ~ 95%(Non-Condensing)
COOLING	Fan cooling
ALTITUDE	2,000Meter
SIZE (W×D×H)	481.8mm X 417.1mm X 44.4mm

## Output Specifications:

VOLTAGE	Default -54.0VDC
CURRENT	166.5A Max (3KW 3 modules)
ADJUSTMENT RANGE	-42VDC~-58VDC
LINE REGULATION	±0.5% Max
LOAD REGULATION	±1.0% Max
TEMP REGULATION	±0.5% Max
NOISE	≤ 300mVp-p (3KW Module)
SETPOINT ACCURACY	±0.5%
OVER CURRENT	101~110%
PROTECTION	-59VDC over (recycle input to reset), Thermal Shutdown

## Electromagnetic Compatibility:

EMISSIONS	EN61204/EN55022 Class A
HARMONIC CURRENT - EMISSIONS	EN61000-3-2
FLUCTUATIONS & FLICKER	EN61000-3-3
ELECTROSTATIC-DISCHARGE	EN61000-4-2
RADIATED EMI	EN61000-4-3
EFT/BURSTS	EN61000-4-4
SURGE TRANSIENTS	EN61000-4-5
CONDUCTED IMMUNITY	EN61000-4-6
VOLTAGE DIPS AND - SHORT INTERRUPTIONS	EN61000-4-11

## Status & Control signal:

COMMUNICATION-INTERFACE	RS232, TCP/IP, CAN Digital In&Output Alarms(8ports)
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## Standards & Approvals: (TBD)

UL/CUL	60950-1
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# APOLLO 3kW RECTIFIER MODULE:

Part Number: AS-REC-RM

- 55 Amps Output at -54 Volts DC
- World Wide Safety Approvals
- N+1 Redundant and Hot Swappable
- Wide AC Input Voltage Range



## Input Specifications:

VOLTAGE	1Ø240VAC (85VAC ~ 297VAC) (Nominal 176~275Vac)
FREQUENCY	45-66Hz
INRUSH CURRENT	25A @ 240VAC
PROTECTION	Mains fuse in both lines
LEAKAGE	3.5mA Max @ 240VAC
EFFICIENCY	95.5% Typical
POWER FACTOR	> 0.98at 50% load or more
PROTECTION	Input Under voltage, Overvoltage

## Output Specifications:

VOLTAGE	54.0VDC
CURRENT	55.5A (Max 3KW)
ADJUSTMENT RANGE	42.0~58.0VDC
LINE REGULATION	±0.5% Max over entire input range
LOAD REGULATION	±0.5% Maximum
TEMP REGULATION	±0.5% Maximum
Overall REGULATION	±5.0% Maximum
RIPPLE	≤ 300mVp-p(3KW)
SETPOINT ACCURACY	±0.5%
OVER VOLTAGE PROTECTION	59VDC (recycle input to reset) Power derated, Thermal Shutdown

## Status & Control signals:

COMMUNICATION	CAN
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## General Specifications:

OPERATING TEMP	-40°C to +75°C, (Derating above +45°C)
STORAGE TEMP	-40°C to +85°C
OPERATING HUMIDITY	0% to 95% (Non-Condensing)
STORAGE HUMIDITY	5% to 95% (Non-Condensing)
COOLING	Controlled Fan in a module
VIBRATION	10-55Hz, 2G, 3min period/60 min each(3 axes)
ACOUSTIC NOISE	≤ 58dBA at nominal input and full load
RELIABILITY	>350,000 Hrs MTBF (Ambient : 25°C)
SIZE (W×D×H)	108mm × 340mm × 44mm

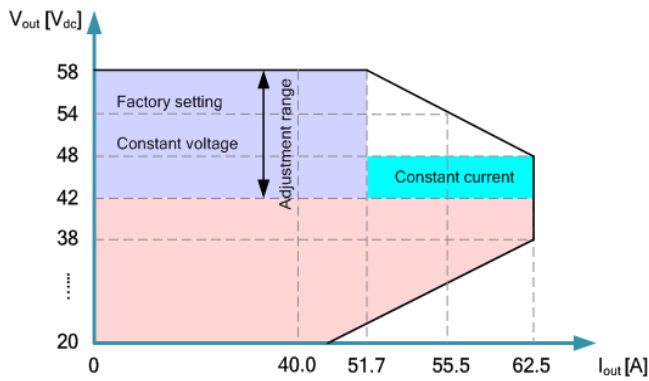
## Electromagnetic Compatibility:

EMISSIONS	EN55022 Level A (Conducted)
ELECTROSTATIC DISCHARGE	EN61000-4-2, 4KV Contact / 8KV Air
RADIATED SUSCEPTIBILITY	EN61000-4-3, 26-1000MHz, 10V/M, 80%AM
EFT/BURSTS	EN61000-4-4, 2KV
SURGE	EN61000-4-5
CONDUCTED IMMUNITY	EN61000-4-6, 0.15-800MHz, 10V 80%
VOLTAGE DIPS	EN61000-4-10, 95% Dip&10ms, 30% Dip&500ms
VOLTAGE INTERRUPTIONS	EN61000-4-11, 95% reduction, 5ms
FLUCTUATIONS & FLICKER	EN61000-3-3

## Standards & Approvals:

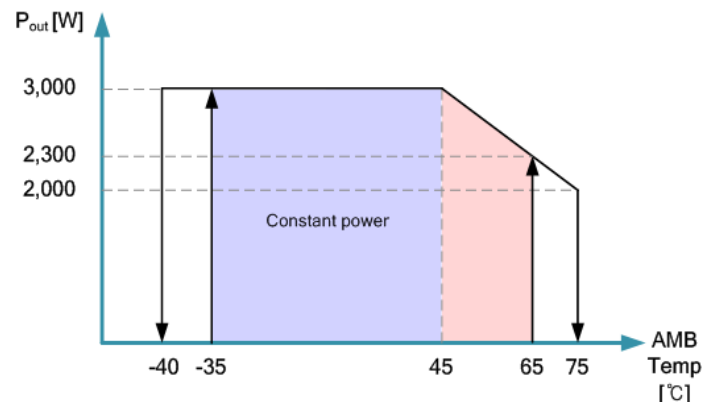
UL, CE, CB

## DC Output:



Voltage Range: -42.0 VDC to -58.0 VDC

## Temperature:



Shutdown Temperature: 75°C, Recovery: 65°C

# APOLLO CONTROL MODULE - SPECIFICATIONS:

Part Number: AS-REC-CM



- RS 232 interface for PC connection, TCP/IP, SNMP V1, SNMP V2C
- Adjustable Output Voltage
- AC Input High/Low Voltage Alarm

## Display :

- Status of the rectifier system is displayed on the LCD :
  - Output voltage/Input voltage
  - Output load current
  - Rectifier Temperature
  - Rectifier system setup value and alarms
  - Display output currents for individual rectifier modules

## Analog Measurements (Tolerance : Full Scale $\pm 0.5\%$ ):

- Rectifier input AC voltage
- Rectifier output DC voltage
- Rectifier load current
- Rectifier temperature

## Controller Unit Function :

- Failure of the rectifier controller shall not affect the operation of the rectifiers in the system
- Store and display 1,000 event alarm logs & 1,000 data logs
- †Digital Input Alarm (User Defined alarms)
- †Dry Contact Alarm (User Defined alarms)

† : The number of alarm can vary depending on the shelf

## Battery Managements :

- Battery charge/discharge current/the battery set and the total output/
- Battery Temperature Display and Measurement
- Manual/Float/Equal charging mode exchangeable
- Battery Charging Current Limiting
- Temperature Compensated Charge Voltage Curve

## CPU :

- Coretex-M4 Core
- CPU Clock – Up to 150MHz
- 32ch DMA, 16KB cache, DSP, floating-point
- Memory: Flash 1MB / RAM 128KB / EEPROM / Flax RAM, Flax NVM
- Ethernet, UART, RS485

## Interface :

- RS232 : 115,200 Baud, N-8-1
- LANs
  - Hardwired TCP/IP protocol (TCP/UDP/ICMP/Ethernet)
  - 10BaseT/100BaseTX Ethernet MAC/PHY Embedded
  - Auto Negotiation (Full and half duplex, 10/100-Based)
  - Auto MDI/MDIX (Straight-through or Crossover)

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