

ANEVA INSTRUMENTS PRIVATE LIMITED

# AV1000AC30U Unidirectional AC/DC Power Module User Manual

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# Power Module Overview

AV1000AC30U is the unidirectional AC/DC power module, featuring a wide constant power voltage range, high efficiency, high power density, low electromagnetic radiation and interference, and high reliability. It can be widely used in applications such as EV DC fast chargers, energy storage, production testing equipment, and industrial DC power supplies.

Note: Certification against all standards referenced in this document is currently under process.

## 1.1 Specifications

Table 1-1 Unidirectional AC/DC module parameters

| Item                             | Specifications                                                            |
|----------------------------------|---------------------------------------------------------------------------|
| General                          |                                                                           |
| Dimension                        | 300mm (W) × 84mm (H) × 437.5mm (D)                                        |
| Weight                           | ≤15kg                                                                     |
| Efficiency (full load)           | >97%                                                                      |
| Cooling Mode                     | Fan cooling                                                               |
| Communication Protocol           | CAN 2.0, MODBUS                                                           |
| Indicator                        | Green: normal operation. Yellow: alarm. Red: fault                        |
| AC Side (Rectified/grid) - Input |                                                                           |
| Input System                     | 3P+PE                                                                     |
| Voltage Range                    | 250Vac~550Vac                                                             |
| Rated Voltage                    | 380Vac/480Vac                                                             |
| Rated Current                    | <60A                                                                      |
| Grid Frequency                   | 45Hz~65Hz, adjustable                                                     |
| Rated Frequency                  | 50Hz/60Hz                                                                 |
| Power Factor (Rectified)         | ≥0.97 at 20% to 50% output power, nominal input voltage and frequency     |
|                                  | ≥0.99 at 50% to 100% output power, nominal input voltage and frequency    |
| THD                              | ≤5% at 50% to 100% full-load output power                                 |
| DC Side - Output                 |                                                                           |
| Voltage Range                    | 100Vdc~1000Vdc                                                            |
| Current Range                    | 0~110A continuously adjustable                                            |
| Rated Current                    | 30A @ 1000V                                                               |
| Voltage Stabilized Accuracy      | <±0.5% (voltage stabilization status, input voltage 320Vac~460Vac, output |

|                                      |                                                                                                                                                                                            |
|--------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                      | voltage 100Vdc~1000Vdc, output current 0~ rated current)                                                                                                                                   |
| Current Stabilized Accuracy          | ≤±1% (voltage stabilization status, input voltage 320Vac~460Vac, output voltage 100Vdc~1000Vdc, output current 20%~100% rated current)                                                     |
| Load Regulation Rate                 | ≤±0.5%                                                                                                                                                                                     |
| Current Sharing in Parallel          | <±3%                                                                                                                                                                                       |
| Peak – Peak Ripple                   | <±1% (voltage stabilization status, input voltage 320Vac~460Vac, output voltage 100Vdc~1000Vdc, output current 0~ rated current)                                                           |
| <b>Environmental Conditions</b>      |                                                                                                                                                                                            |
| Operating Temperature                | -40~+75°C, derating from 55°C                                                                                                                                                              |
| Storage Temperature                  | -40°C~+75°C                                                                                                                                                                                |
| Humidity                             | ≤95%RH, non-condensing                                                                                                                                                                     |
| Altitude                             | No derating required for altitudes ≤2000m; when altitudes >2000m, actual altitude value shall be set, with a decrease of 1°C in operating temperature for every 100m increase in altitude. |
| MTBF                                 | >500,000 hrs                                                                                                                                                                               |
| <b>EMC</b>                           |                                                                                                                                                                                            |
| Surge                                | Line-Line: ±2kV, Line-Ground: ±4kV; Reference standard: IS 14700 (Part 4/Sec 5):2019                                                                                                       |
| EFT/Burst                            | ±4kV; Reference standard: IS 14700 (Part 4/Sec 4):2018                                                                                                                                     |
| ESD                                  | ±6kV contact discharge, ±8kV air discharge; Reference standard: IS 14700 (Part 4/Sec 2):2018                                                                                               |
| Radiated RF Immunity                 | 10V/m; Reference standard: IS 14700 (Part 4/Sec 3):2023                                                                                                                                    |
| Conducted RF Immunity                | 10V, 0.15MHz~80MHz; Reference standard: IS 14700 (Part 4/Sec 6):2016                                                                                                                       |
| Power Frequency Magnetic Field       | 100A/m; Reference standard: IS 14700 (Part 4/Sec 8):2018                                                                                                                                   |
| Voltage Dips and Short Interruptions | Performance criteria B/C; Reference standard: IS 14700 (Part 4/Sec 34):2017                                                                                                                |
| Harmonics                            | Complies with applicable grid limits; Reference standard: IS 17017 (Part 21/Sec 2):2019 and local grid code requirements                                                                   |
| Voltage Fluctuation and Flicker      | Complies with applicable grid limits; Reference standard: IS 17017 (Part                                                                                                                   |

|                              |                                                                                                                                                                                                                                                      |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                              | 21/Sec 2):2019 and local grid code requirements                                                                                                                                                                                                      |
| Conducted Emission           | Class A; Reference standard: IS 17017 (Part 21/Sec 2):2019                                                                                                                                                                                           |
| Radiated Emission            | Class A; Reference standard: IS 17017 (Part 21/Sec 2):2019                                                                                                                                                                                           |
|                              | Others                                                                                                                                                                                                                                               |
| Safety Requirements          | Complies with the requirements for DC EV supply equipment (off-board charger); Reference standard: IS 17017 (Part 23):2021 and IS 17017 (Part 1):2018                                                                                                |
| Insulation Resistance        | $\geq 10\text{M}\Omega$ between isolated circuits and the enclosure, and between AC and DC circuits; Reference standard: IS 17017 (Part 23):2021, Clause 21                                                                                          |
| Dielectric Strength (Hi-Pot) | AC input to enclosure: 3.5kVdc, 1min;<br>AC input to DC output: 3.5kVdc, 1min;<br>DC output to enclosure: 3.5kVdc, 1min;<br>no breakdown or flashover, steady state leakage current $< 10\text{mA}$ ;<br>Reference standard: IS 17017 (Part 23):2021 |
| Startup Time                 | 3s~8s                                                                                                                                                                                                                                                |
| Step Response                | Load change 10% $\leftrightarrow$ 90%: transition time $\leq 200\text{ms}$ , voltage overshoot $\leq \pm 2\%$ ;<br>Reference standard: IS 17017 (Part 23):2021                                                                                       |
| Fault Response               | $\leq 10\text{ms}$ , output current reduced to $\leq 5\text{A}$ ;<br>Reference standard: IS 17017 (Part 23):2021                                                                                                                                     |

## 1.2 Function details

### 1.2.1 Hot-plugging

Hot-plugging charging modules, easy installation and maintenance.

### 1.2.2 Current sharing

Auto current sharing between modules, current sharing unbalance less than 3%.

### 1.2.3 AC input power limiting

The relationship between output power and input voltage is shown in Figure 1-1. When input voltage is between 323Vac~475Vac (hysteresis less than 15V), module can output at maximum power.

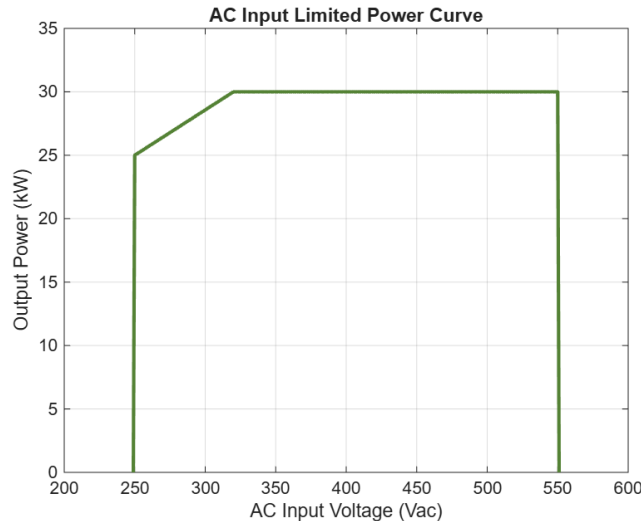


Figure 1-1 AC Input Power Limiting Curve

### 1.2.4 Output constant power control

The allowed output power of module is 30kW at rated input voltage. Relationship between output voltage and output current is shown in Figure 1-2.

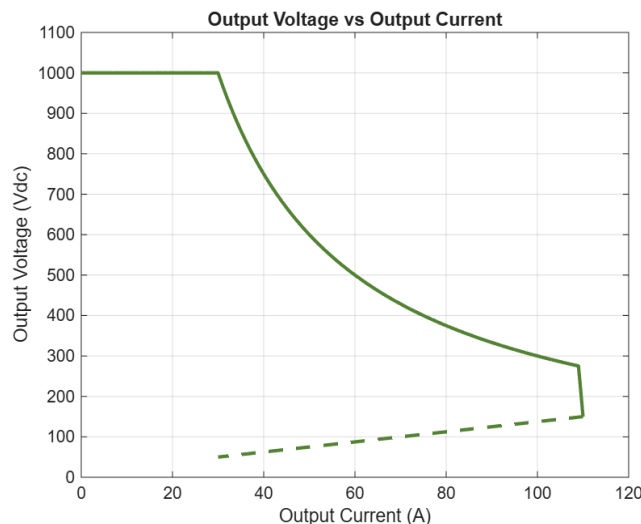


Figure 1-2 Output Voltage vs Output Current

### 1.2.5 Temperature derating

This module provides full power output at ambient temperature below 55°C;

This module is operated by derating at ambient temperature above 55°C. It is a piecewise linear limit power;

The output power of the module is 10kW at the ambient temperature of 75°C;

The output power of the module reduces till 0 when the ambient temperature is above 75°C.

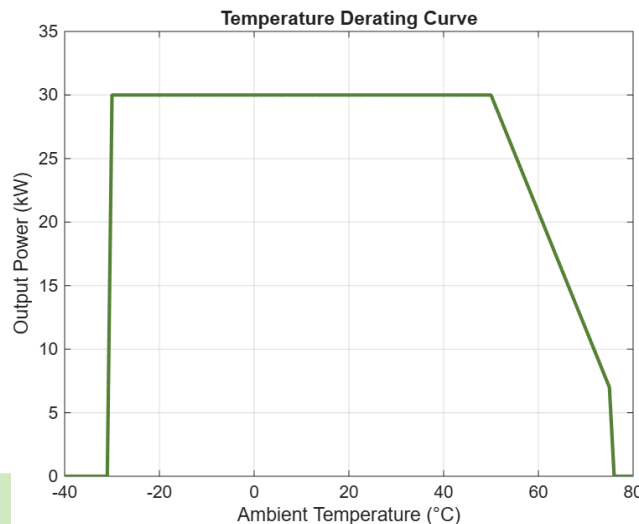


Figure 1-3 Temperature Derating Curve

### 1.2.6 Output current configuration

Through external monitor module, current of module can be configured continuously from 0A to 110A.

### 1.2.7 Output voltage configuration

Through external monitor module, output voltage of module can be configured continuously from 100Vdc to 1000Vdc, minimum adjustable pace is 0.1Vdc.

### 1.2.8 Input over/under voltage protection

When input voltage is less than 240Vac or greater than 560Vac, yellow indicator lights up, the module stops working, no output.

When overvoltage or under voltage alarm occurs, module reports it to the monitor; LED nixie tube shows fault code E03.

### 1.2.9 Output over/under voltage protection

The fixed overvoltage protection point for the charging module is 1025 Vdc, and the fixed under voltage protection point is 95Vdc. The default value of software overvoltage protection point is 1025 Vdc, which can be set from 100 Vdc to 1025 Vdc by monitoring module.

The red indicator lights on after overvoltage protection and LED nixie tube shows fault code E06. The module needs to be reset by removing from the system to start.

The yellow indicator lights on and the module shuts down after under voltage protection and LED nixie tube shows fault code E01. The module clears the alarm and resumes the startup in 5s.

### 1.2.10 Over temperature protection

The over temperature protection point for ambient temperature is 75°C. The module shuts down automatically at ambient temperature above 75°C, the yellow indicator on the panel turns on and LED nixie tube displays the fault code E02.

### 1.2.11 Bus fault protection

If the internal bus voltage exceeds the overvoltage/under voltage protection point or encounters imbalance, the module automatically shuts down, and the yellow indicator on the panel turns on.

### 1.2.12 Short circuit protection

The module shuts down when a short circuit situation occurs, red indicator lights on and module reports "module failure" to the monitor. LED nixie tube shows fault code E05.

### 1.2.13 Background communication failure

If the communication of the module is interrupted for more than 10s, the module provides shutdown protection, has no voltage output, the yellow indicator on the panel turns on. After the communication is recovered, the yellow indicator on the panel switches off, and the module resumes.