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CEV Series, 300 Watt

AC-DC Battery Charger

The CEV series of ruggedized IP67 rated (sealed enclosure) convection cooled AC-DC battery chargers are intended for harsh environment deployments and provide a single regulated Constant Voltage (CV) or Constant Current (CC) mode output, designed for use as a battery charger/current source for battery packs.[1]

The power module is encapsulated in a thermally conductive material that transfers internal heat into the extruded aluminum chassis for environmental management.

The series offers chargers for both 24V and 48V li-ion battery systems, making them ideal for applications such as e-mobility, electric scooters, and electric utility carts.

1 A separate Battery Management System (BMS) shall be provided by the End User to manage the cell temperature protection, and charge initiation/termination.

Features

- Universal AC input with active PFC
- 57.5Vdc & 28.5Vdc continuous constant current models for battery charging applications
- IP67 Enclosure
- 300W convection cooled
- True zero load operation
- 6.29” x 3.90” x 2.24” (159.8mm x 99mm x 57mm) footprint
- High efficiency 93% nominal, 100% load
- RoHS2 & REACH compliant
- 2 Year Standard Warranty

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Ordering Guide

Model Number	Output Control Characteristic	Nominal Output Voltage (Vdc)	Output Current (Adc)	Typ Power Capability (W)	Max Power
ACS48.250CEV	CC[1]	57.5 (CV mode)	5.00	288	300
ACS24.250CEV	CC[1]	28.5 (CV mode)	10.0	285	300

1 Designed and intended to operate indefinitely in CC mode.

Input Characteristics

Parameter	Conditions	Min	Typ	Max	Units
Input Voltage AC Operating Range	AC single phase from utility outlet	90	100-240	264	Vac
Turn-on input voltage	Input rising	75		90	
Turn-off input voltage	Input falling	65		80	
Input Frequency	Standard utility supply	47	50/60	63	Hz
Input Current	100 – 240Vac Nom.			3.2	A
Peak Inrush Current	230Vac; cold start, 25°C		40		Apk
Input Fuse	Single fuse in AC "Line" time lag; high breaking capacity		6.3		Arms
Efficiency[1]	230Vac; full load, 25ºC	93			%
Hold-Up Time	90VAC; Full Load; 50/60Hz; 25ºC	10			msec

1 ACS48.250CEV Model

Output Characteristics; Constant Current Variants

Parameter	Conditions		Min	Typ	Max	Units
Constant Voltage Regulation Window	Point at which the output recovers from Constant Current (constant voltage mode)	ACS48.250CEV	56.5	57.5	58.5	Vdc
		ACS24.250CEV	27.5	28.5	29.5	
Constant Current Brick Wall Regulation Window	Current limit threshold; regulation window to be maintained down to 55% of CV set point, before onset of hiccup mode; see curves for details	ACS48.250CEV	4.80	5.00	5.20	Adc
		ACS24.250CEV	9.60	10.00	10.40	
Minimum Load Capability	Stable Operation		0			
Short Circuit Protection	Shutdown/Hiccup, no damage to power module					%
Output Ripple[1,3]	Voltage Zero to Full Load; 20MHz bandwidth	Constant Voltage			1.5	%
		Constant Current			10	
Transient Response[2]	50% load step, from 10% minimum load 1A/µsec slew rate			± 5		%
Settling Time to 1% of Nominal				50		msec
Turn On Delay	After application of input power			3		sec
Output Voltage Rise	Monotonic					

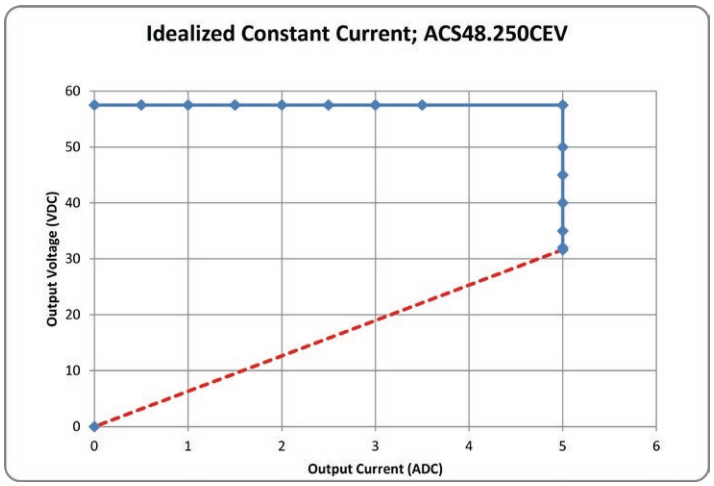
[1] minimum 0.2A load may be required to keep the ripple within above limits in CV models.

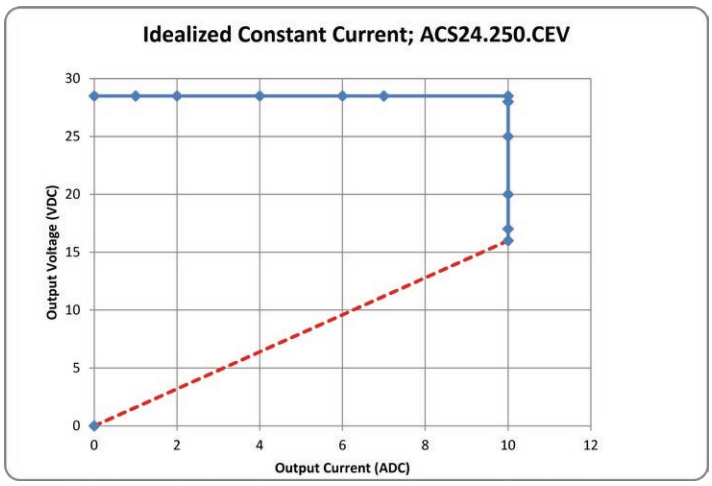
[2] percentage of constant current set point; min. 1 second time between consecutive transients.

[3] measured with a parallel combination of ceramic and OSCON capacitors at the power module output cables. A short coaxial cable connected directly to the input of a scope is required

Constant Current Performance Curves

The Constant Current characteristic is shown in the following curves. Brick wall operation shall be maintained indefinitely without the ACSxx.250CEV entering OTP[1] to circa 55% of Vnom. Any further increase in demand will cause the output to enter hiccup mode protection.

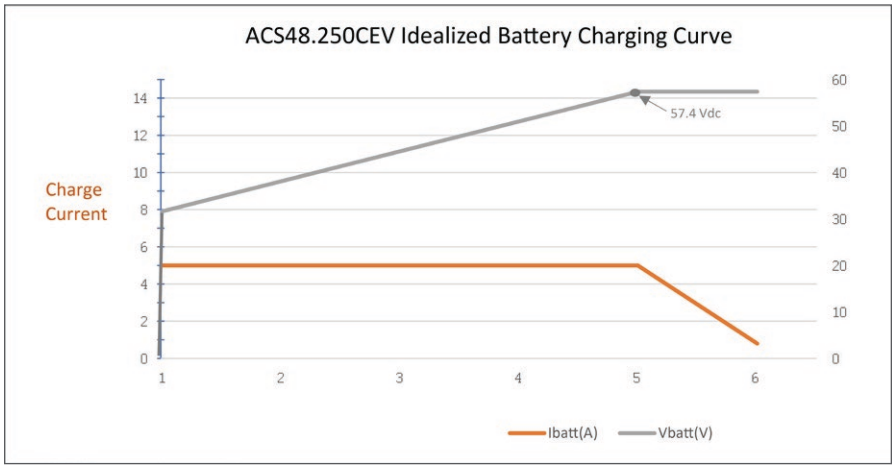


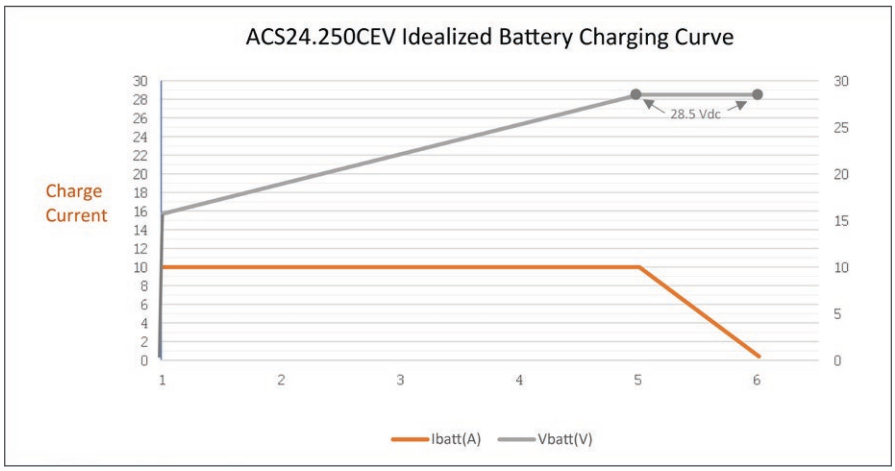


[1] Overtemperature Protection; overall deployment temperature limits to be maintained.

Battery Charging Performance Curves

Constant current charging characteristic is maintained as long as the output voltage remains within approximately 55% of Vout nom; further decrease in output voltage (due to overload) will force the power module into hiccup protection. Operation continuously under either of these conditions will not cause damage to the power module. Refer to “overtemperature protection”, “thermal considerations” and “battery charging considerations” for additional details.

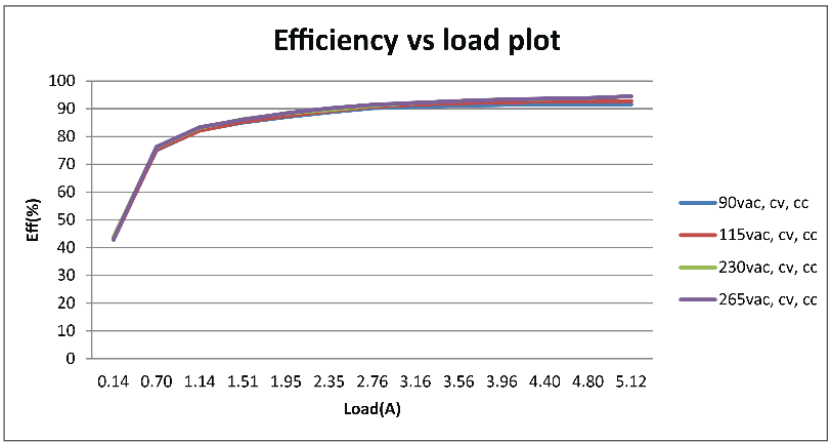




[1] Overtemperature Protection; overall deployment temperature limits to be maintained by end user/ system/host, see “thermal considerations” for additional details

Efficiency Performance Curves (25ºC Ambient Temperature)

Typical example; ACS48.250CEV Model



Environmental Characteristics

Parameter	Conditions	Min.	Typ	Max.	Units
Storage Temperature Range		-40		85	°C
Operating Temperature Range	External local temperature (ambient) surrounding case. Refer to Thermal Considerations	-20		50	
Operating Case Temperature		-20		100	°C
Operating Humidity	Non-condensing	10		95	%
MTBF	Telcordia SR-332 Issue 3; M1C3 @ 40°C Telcordia SR-332 Issue 3; M1C3 @ 25°C		2,145k 4,500k		Hours
Shock	30G, non-operating	Compliant			
Operational Vibration	Sine Sweep; 5-150Hz, 2G Random Vibration, 5-500Hz, 1.11G	Compliant			
ITE Standards Audio/Video & Consumer Standards (Planned submissions):	CB: IEC 60950-1:2005; IEC 60950-1:2005/AMD1:2009; IEC 60950-1:2005/AMD2:2013 CSA: CAN/CSA-C22.2 No. 60950-1-07, Amendment 1:2011, Amendment 2:2014 (MOD); ANSI/UL 60950-1-2014 IEC 62368-1, CAN/CSA-C22.2 No. 62368-1, UL 62368-1 (pending) CE Marking per LVD				
Fuse	Single 6.3A time lag; 250V, high breaking capacity				
Outside Dimensions	6.29" x 3.90" x 2.24" (159.8mm x 99mm x 57mm) nominal				
Weight (typ.)	1.57 (3.46 lbs.)				kg

Protection Characteristics

Parameter	Conditions	Min.	Typ.	Max.	Units
Overvoltage Protection; latching requires recycle of AC source or toggle of PS_ON signal to reset.	ACS48.250CEV			58.8	V
	ACS24.250CEV			29.8	V
Short Circuit Current Protection; all variants	V1, hiccup	140		150	%[1]
Overtemperature Protection (Chassis Temperature); Auto-recovery (approximately 18ºC hysteresis); refer to Thermal Considerations		105	110	120	°C

[1] Percentage of max CC level.

Isolation Characteristics

Parameter	Conditions		Min.	Typ	Max.	Units
Isolation Test Voltage	Primary to Chassis (basic)		2680			Vdc
	Primary to Secondary (reinforced)		4242			
	Secondary to Chassis		500			
Earth Leakage Current	264Vac, 60Hz, 25°C	single fault condition		300		µA
		normal conditions		150		

Emissions and Immunity

Characteristic	Standard	Compliance
Input Current Harmonics	IEC/EN 61000-3-2	Class A
Voltage Fluctuation and Flicker	IEC/EN 61000-3-3	Compliant
Conducted Emissions[1]	CISPR32/EN 55032	Class B
	FCC Part 15	Class B
Radiated Emissions[1]	CISPR 22 -3 meter	Class B
	FCC 15.109 - 3 meter	Class B
ESD Immunity	IEC/EN 61000-4-2	Level 4, ±8kV Contact; ±15kV air discharge; Criteria A
Radiated Field Immunity	IEC/EN 61000-4-3	Level 3, Criterion A
Electrical Fast Transient Immunity	IEC/EN 61000-4-4	Level 4, 2kV, Criterion A
Surge Immunity	IEC/EN 61000-4-5	Level 3, Criterion B (1kV CM, 2kV DM)
Radiated Field Conducted Immunity	IEC/EN 61000-4-6	Level 3, 10V/m, Criterion A
Magnetic Field Immunity	IEC/EN 61000-4-8	Level 3, Criterion A
Voltage dips, interruptions	IEC/EN 61000-4-11	Level 3, Criterion B

[1] Requires a common mode choke on the blue and black wires of output cable. Four (4) turns of these wires need to be wound in same direction around a toroid (such as FAIR-RITE#5943001801) See additional "EMI considerations"

Status and Control Signals

Parameter	Conditions	
PRESENT_x	A passive signal line directly connected to the DC Output. When used in conjunction with a battery (for charging purposes) this signal will alert the BMS that a charging source is connected and the BMS shall configure the battery into charge mode. Factory configurable1 and capable of connection to either: +VE Output Connection -VE Output Connection	
PS_ON_x	This signal is intended to turn on/off (enable/disable) the output for the following purposes: For general deployments in the industrial sector When used as charging source for a battery the PS_ON connection shall enable/disable the DC output as commanded by the BMS Reset the output following abrupt disconnection of a charging battery (load dump). There are two possible options for the “logic” of this signal:	
	PS_ON_H (Default)	Active “high”; this signal can be left unterminated to enable (turn on) the output. If it is desired to turn off the Output (during normal operation) then this pin can be pulled “low” to the output ground “-VE”. Signal is pulled up to internal +5V bias supply via 10kOhm; when pulled low (externally) sink current approx. 2mA.
	PS_ON_L	Active “low” i.e. externally pulled “low” to the output ground “-VE” to enable (turn on) the output. Signal is pulled up to +5V internally via 10kOhm. When pulled low (externally) sink current approx. 2mA.

Input & Output Connections

Two permanently attached SJTW, VW-1 type cables are provided for the input and output connections

Input Wires: 3x17AWG

Wire Color:	Function:
Brown	AC Line 1
Blue	AC Line 2 Neutral
Green/ Yellow	PE/Ground

Output Wires: 4x17AWG

Wire Color:	Function:
Blue	Output “+VE”
Black	Output Return “-VE”
Brown	PRESENT
Green/ Yellow	PS_ON

Application Notes

This series of power modules have been evaluated as components for building-in. A suitable electrical and fire enclosure shall be provided in the end use equipment and shall be installed in compliance with the enclosure, mounting, clearances, creepage distances and segregation requirements of the ultimate application.

EMI Considerations

For optimum EMI performance, the power supply should be mounted to a metal plate grounded to all 4 mounting holes of the power supply. To comply with safety standards, this plate must be properly grounded to protective earth (see mechanical dimension notes). Pre-compliance testing has shown the stand-alone power supply to comply with EN55022 class B radiated emissions with a metal enclosure with grounded base plate. Radiated emission results vary with system enclosure and cable routing paths.

Battery Charging Considerations

The power module does not provide any battery management capability. Therefore the end user is responsible to provide their own BMS appropriate for the batteries being used.

It is recommended that the end user selects a BMS that is capable of monitoring the battery discharge voltage and also has the ability to disconnect the battery form discharge load at a voltage >55% of Vout Nom in order to avoid the power module output voltage being “pulled-down” to < 55% Vout Nom.

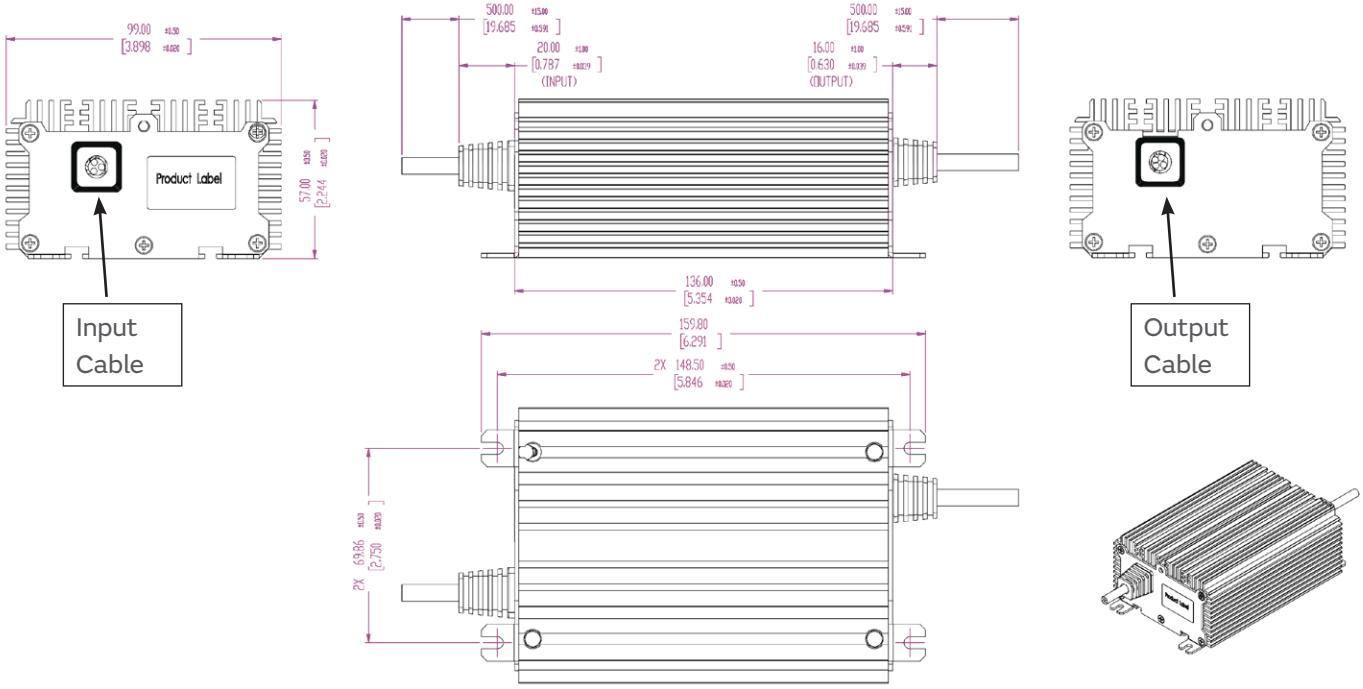
Should the power module be operated with a battery terminal voltage of <55% Vout Nom, the power module will be forced into overload protection and will hiccup (refer to the “Constant Current Performance Curves” for details). Under this hiccup condition, the output ripple current may impact battery health and may reduce the life of the battery, even though the power module will not be damaged by operating under such conditions.

The power module provides a control signal “PS ON x” which may provide a convenient method to shut off the output voltage under such conditions.

Thermal Considerations

- System thermal management is critical to the performance of this series. Performance is not derated provided that the power module’s chassis/case temperature does not exceed the maximum rated temperature.
- The power module may be capable of operation above the maximum operating temperature however doing so may shorten the life of the power module. Such operating conditions are considered “abnormal” and are not recommended.
- The power module contains several electroytic capacitors within the encapsulated assembly and can be considered to be the same temperature as the power module’s external case temperature. Because life expecancy of the power module is inversely proportional to case temperature of the electroyltic capacitors, it is the responsibility of the end user to provide proper thermal management to maintain the case temperature below the maximum temperature during the operation of the charger.
- The surfaces of the power supply may be hot to the touch and system/host design; including special installation instructions shall make necessary provisions and precautions.

Mechanical Dimensions (Nominal)



NOTES:
1. THE DRAWING IS A GRAPHIC REPRESENTATION OF THE REAL RODUCT. THE PATTERNS OF FEATURE MAY NOT SHOW ALL FINE DETAILS OR CORRECT PATTERNS. FOR EXAMPLE, THE SCREW FACE PATTERNS OR FAN PATTERNS OR CONNECTORS MAY LOOK DIFFERENT THAN REAL PART. QA USES THIS DRAWING FOR MEASUREMENTS & QUALIFICATION OF OUTGOING PRODUCTS.