Features

Regulated Converter

- 400/450 Watt convection cooled (115/230VAC)
- 600 Watt forced air or peak power
- 5VSB Output
- Redundant operation; active current sharing
- Remote sensing, CTRL ON/OFF, PMBus™
- IEC60601-1 2x MOPP insulation, BF-ready

RECOM
AC/DC Converter

RACM600-L

600 Watt 7.7” x 4” Open Frame Single Output

3 YEAR warranty

Description

RACM600-L/OF Series AC/DC power supply units are designed for operation in natural convection and in systems with certain airflow ventilation to deliver 400 to 600Watt output power. Safety approvals to Medical IEC 60601-1-2 and to IT and industrial IEC 62368 standards and operation with worldwide input voltage conditions from 80 to 275Vac in altitudes up to 5000m make these chassis mount units ideal for global use in medical, industrial or IT related automation processes. For enhanced reliability requirements of applications redundant operation is supported with active current sharing. An additional 5V Standby output powers housekeeping circuitry to control remote on/off and monitoring functions which are available via PMBus™ I²C interface. EN55032 class “B” EMC compliance is achieved without any external components which underlines the versatility of these power supplies.

Selection Guide

Part Number	Input Voltage Range [VAC]	Nom. Output Voltage [VDC]	Max. Output Current [A]	Max. Output Power [W]	Efficiency typ. (1) [%]
RACM600-12SL/OF	80-275	12	50	600	92
RACM600-24SL/OF	80-275	24	25	600	93
RACM600-48SL/OF	80-275	48	12.5	600	93

Notes:

Note1: Efficiency is tested at 230VAC and full load at +25°C ambient

Model Numbering

RACM600- SL/OF

- max. Output Power
- nom. Output Voltage
- Open frame package
- **S**ingle

Specifications (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

BASIC CHARACTERISTICS				
Parameter	**Condition**	**Min.**	**Typ.**	**Max.**
Nominal Input Voltage	50/60Hz	100VAC		240VAC
Operating Range (2, 3)	47-63Hz DC	80VAC 120VDC		275VAC 300VDC
Input Current	80VAC 120VDC			9A 5.7A
Inrush Current	cold start at 25°C			20A
Input Frequency Range	AC Input	47Hz		63Hz
Minimum Load		0%		
Power Factor	EN61000-3-2, Class A compliant		0.9	
Start-up Time	MAIN ON CTRL ON			2.5s 150ms
Rise Time				150ms
Hold-up Time			20ms	
Periodic and Random Deviation (PARD)	20MHz BW, 10µF Tan. and 1µF MLCC			1%p-p

Notes:

Note2: The products were submitted for safety files at AC and DC-Input operation.

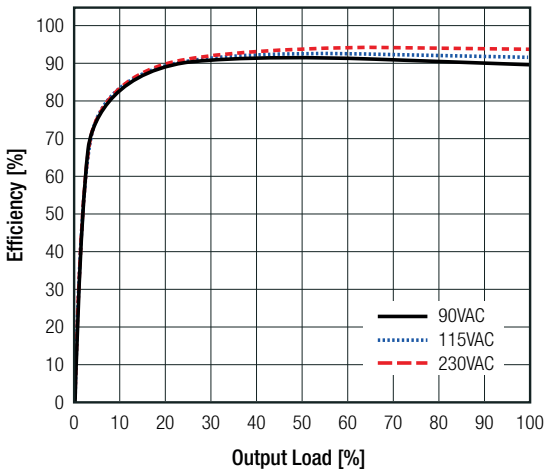
Note3: Refer to ***“Rating Graphs of continuous Operation”***

continued on next page

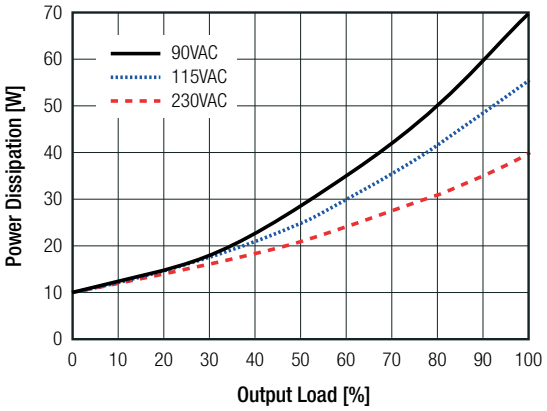
IEC/EN62368-1 certified
UL62368-1 certified
CSA/CAN C22.2 No. 62368-1 certified
ANSI/AAMI ES60601-1 certified
CSA/CAN C22.2 No. 60601-1:14 certified
IEC/EN60601-1 certified
EN55032 compliant
EN55024 compliant
EN60601-1-2 compliant
CB Report

Specifications (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

Efficiency vs. Load



Power Dissipation vs. Load



ADDITIONAL FEATURES

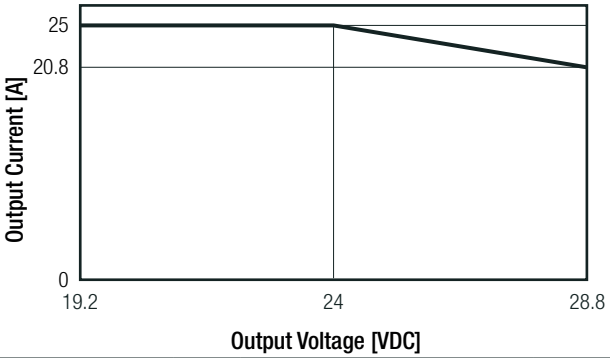
Parameter	Condition		Min.	Typ.	Max.
ON/OFF CTRL *(logic can be switched with PMBus™)*	CON3	MAIN OUTPUT ON MAIN OUTPUT OFF	CTRL (pin10) shorted to 5VSB_RTN (pin3,4,7)		open
Output Voltage Adjustability (4)	on-board poti, refer to ***"Output Current vs. Output Voltage"***	V_{OUT}= 12VDC V_{OUT}= 24VDC V_{OUT}= 48VDC	9.6VDC 19.2VDC 38.4VDC		14.4VDC 28.8VDC 56VDC
Remote Sense (5)	total voltage drop compensation for +Sense and -Sense connection				200mV
Power OK LED	LED = green		turn ON as soon as PSU_GOOD Signal is set to high		

Notes:

Note4: By trimming up, decrease output power. By trimming down, do not exceed maximum continuous output current

Note5: Do not short or reversely connect +Sense to -Sense, this can cause damage to the supply

Output Current vs. Output Voltage



5VSB OUTPUT (6)

Parameter	Condition	Min.	Typ.	Max.
Nominal Output Voltage				5VDC
Max. Output Current				500mA
Max. Output Power				2.5W
Max. Capacitive Load				1000µF
Over Voltage Protection (OVP)		5.5-6VDC, latch off		
Over Current Protection (OCP)	of rated I_{OUT}	1-1.3A, auto recovery		
Short Circuit Protection (SCP)		auto recovery		
Over Temperature Protection (OTP)		auto recovery		

Notes:

Note6: There is no galvanic isolation between AUX GND and Main Output GND. Regulations for 5VSB Output are stated under ***"REGULATIONS"***

Specifications (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

REGULATIONS

Parameter	Condition	Value
Output Accuracy (MAIN and 5VSB output)		±2.25% max.
Line Regulation (MAIN and 5VSB output)	low line to high line, full load	±0.25% typ.
Load Regulation (MAIN and 5VSB output)	0% to 100% load	1.0% typ.
Dynamic Load Regulation	50% step from 5% load (1A/µs), tested with 10µF Tan. and 1µF MLCC	5.0% max.

PROTECTIONS

Parameter	Type		Value
Internal Input Fuse	DC input compliant, dual-fusing		2x T10A
Short Circuit Protection (SCP)			hiccup, auto recovery
Over Voltage Protection (OVP)	V_{OUT}= 12VDC V_{OUT}= 24VDC V_{OUT}= 48VDC		15VDC - 17.5VDC, latch off 30VDC - 35VDC, latch off 58.5VDC - 63VDC, latch off
Over Voltage Category (OVC)			OVCII
Over Current Protection (OCP)	of rated I_{OUT}		108-140%, auto recovery
Over Temperature Protection (OTP)			auto recovery
Isolation Voltage (safety certified) (7)	I/P to O/P (reinforced) I/P and O/P to Case (basic)	1 minute	4kVAC (2MOPP) 1.5kVAC (1MOPP)
Insulation Grade			reinforced
Leakage Current Input to Earth GND	low line 132VAC , 63Hz	Normal condition	150µA max.
		Single Fault	250µA max.
	high line 264VAC , 60Hz	Normal condition	300µA max.
		Single Fault	500µA max.
Leakage Current Output to Earth GND	264VAC , 63Hz	Normal condition	60µA max.
		Single Fault (neutral open)	80µA max.
		Single Fault (ground open)	150µA max.
		AC Back-drive Fault	550µA max.
Class of Equipment			Class I
Medical Device Classification	according to IEC60601-1		designed to support Type BF applied part

Notes:

Note7: For repeat Hi-Pot testing, reduce the time and/or the test voltage

ENVIRONMENTAL

Parameter	Condition		Value
Operating Temperature Range	refer to ***"Rating Graphs of continuous Operation"***	T_{BASE} temperature	-20°C to +70°C
Operating Altitude (8)	according to 62368-1 according to 60601-1		5000m 3000m
Operating Humidity	non-condensing		95% max.
Pollution Degree			PD2
Vibration (non-operating)	2.09Gr.m.s., 5Hz to 500Hz, 20 minutes per side (3 planes)		according to IEC 60068-2-6
Shock (non-operating)	50G, 11ms, 3 shocks for each direction		according to IEC 60068-2-27
MTBF	according to Telcordia SR-332, Issue 3, 25°C ambient, 90% confidence level		500 x 10^3 hours
Design Lifetime (capacitor)	nom. Vin, 80% load, 45°C ambient		87.6 x 10^3 hours

Notes:

Note8: Recognized by safety agency for safe operation up to 5000m. High altitude operation may impact the performance and lifetime
Ambient temperature decreases by 1°C per 305m altitude increase

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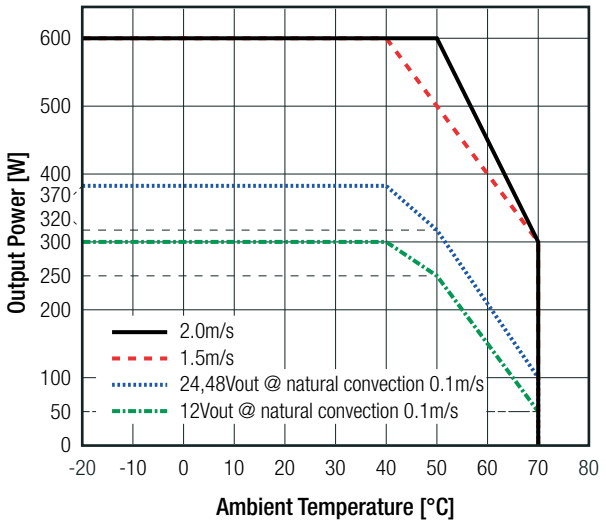
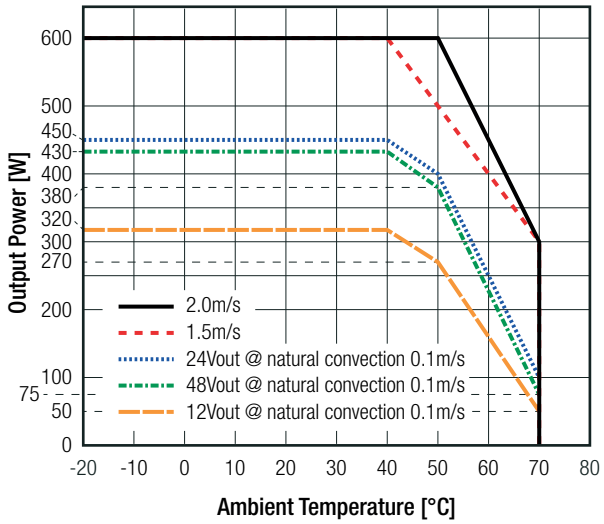
Specifications (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

Rating Graphs of continuous Operation

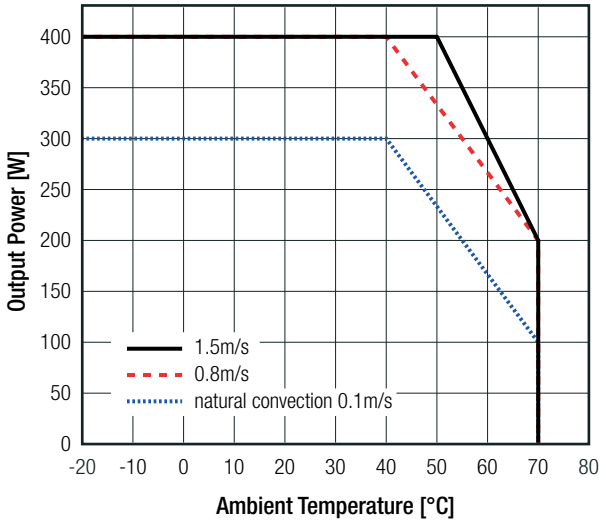
115VAC (±10%)



200-240VAC (±10%)



100VAC (±10%)



Output power derating for Line-input of less than 90VAC. Derate linearly from 100% at 90VAC to 80% at 80VAC to given thermal ratings

PEAK LOAD CAPABILITY OF 12V & 48V MODELS (not applicable for 24V model)

Guideline for sporadically occurring peak loads:

800 Watt max. @ 40°C ambient
with a maximum duty cycle of
0.5% .. for still air convection
4 % … at 1.5m/s provided system airflow

continued on next page

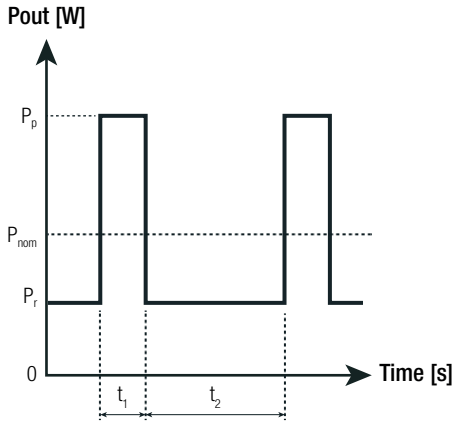
Specifications (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

PEAK LOAD CAPABILITY OF 12V & 48V MODELS (not applicable for 24V model)

Calculation Guideline for recurrent dynamic load cycles:

Peak Load calculation for recurrent dynamic loading		Peak Load calculation for still air convection		Peak Load Capability with 1.5m/s airflow
Parameters	**Units**	**RACM600-12SL/OF**	**RACM600-48SL/OF**	**RACM600-12SL/OF RACM600-48SL/OF**
P_{nom}= rated output power	[W]	≤320	≤430	≤600
P_P= peak output power	[W]	≤800	≤800	≤800
P_r= recovery output power	[W]			
t_1= peak time set	[s]	≤5s	≤5s	≤10s
t_2= recovery time	[s]	min. 10 x t_1	min. 8 x t_1	min. 3 x t_1
k= heat dissipation factor	[ ]	2	2	1.2

$$P_r = \frac{P_{nom} \times (t_1 + t_2) - (P_P \times t_1)}{t_2 \times k}$$



Practical Example (RACM600-48SL/OF for still air convection):

Take the RACM600-48SL/OF at 230VAC input Voltage and full load at T_{AMB}= 50°C, with still air convection.

P_P = 720W
t_1 = 4s
t_2 = 32s
k = 2

$$P_r = \frac{380 \times (4 + 32) - (720 \times 4)}{32 \times 2} = \underline{169W}$$

SAFETY AND CERTIFICATIONS (DESIGNED TO MEET)

Certificate Type (Safety)	Report Number	Standard
Audio/video, information and communication technology equipment. Safety requirements (CB)	T223-0662-21	IEC62368-1, 2nd Edition 2014
Audio/video, information and communication technology equipment. Safety requirements (LVD)		EN62368-1:2014 + A11:2017
Audio/Video, information and communication technology equipment - Part1: Safety requirements	E224736-A6026-UL	UL62368-1:2014 CAN/CSA-C22.2 No. 62368-1:2014
Medical Electric Equipment, General Requirements for Safety and Essential Performance	E314885-D1009-1/A0/C0-UL	ANSI/AAMI ES60601-1:2005A2:2010/(R)2012 CAN/CSA-C22.2 No. 60601-1:14, 3rd Edition
Medical electrical equipment Part 1: General requirements for basic safety and essential performance (CB Scheme)	T223-0661-21	IEC60601-1:2005, 3rd Edition + AM1:2012
Medical electrical equipment Part 1: General requirements for basic safety and essential performance		EN60601-1:2006 + A1:2013
RoHS2		RoHS 2011/65/EU

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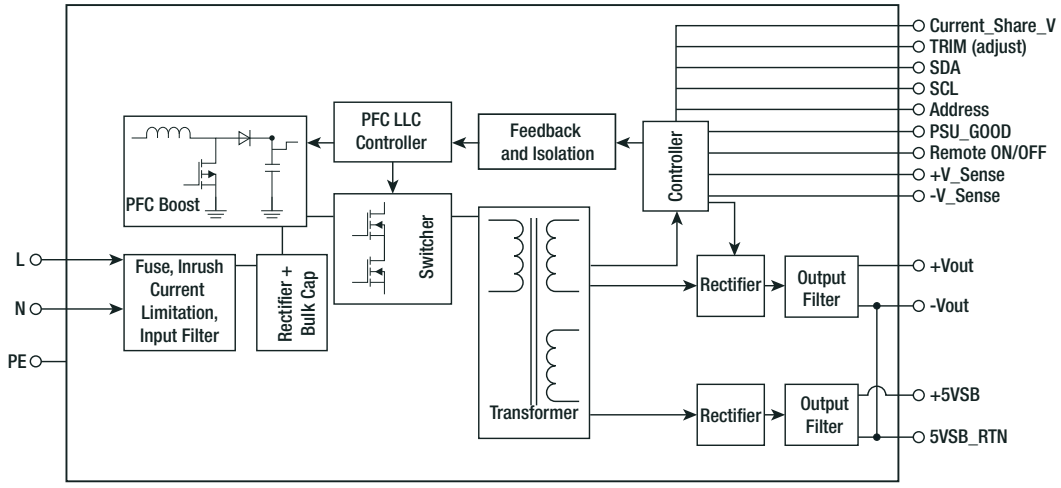
Specifications (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

EMC Compliance	Condition	Standard / Criterion
Electromagnetic compatibility of multimedia equipment – Emission Requirements		EN55032:2015
Information technology equipment - Immunity characteristics - Limits and methods of measurement		EN55024:2010+A1:2015
Medical electrical equipment Part 1-2: General requirements for basic safety and essential performance – Collateral Standard: Electromagnetic disturbances – Requirements and tests		EN60601-1-2:2015
ESD Electrostatic Discharge Immunity Test	Air: ±15kV Contact: ±4,8kV	EN61000-4-2, Criteria A
Radiated, Radio-Frequency, Electromagnetic Field Immunity Test	level 3= 10V/m	EN61000-4-3, Criteria A
Fast Transient and Burst Immunity	level 4= ±4kV	EN61000-4-4, Criteria A
Surge Immunity	level 4= ±2kV DM, ±4kV CM	EN61000-4-5, Criteria A
Immunity to Conducted Disturbances, Induced by Radio-Frequency Fields	level= 3, 6Vrms in ISM band	EN61000-4-6, Criteria A
Power Magnetic Field Immunity	30A/m	EN61000-4-8, Criteria A
Voltage Dips	30%, 500ms 60%, 100ms 100%, 20ms	EN61000-4-11, Criteria A EN61000-4-11, Criteria B EN61000-4-11, Criteria A
Voltage Interruptions	30%, 500ms 60%, 100ms 100%, 20ms 100%, 5000ms	EN61000-4-11, Criteria A EN61000-4-11, Criteria B EN61000-4-11, Criteria A EN61000-4-11, Criteria B
Ring wave immunity test	level 3= 1kV DM, 2kV CM	EN61000-4-12, Class A
Voltage fluctuation immunity test for equipment with input current <16 A per phase	class 3	EN61000-4-14, Class A
Limits of Harmonic Current Emissions		EN61000-3-2:2014
Voltage Fluctuations and Flicker in Public Low-Voltage Systems		EN61000-3-3:2013

BLOCK DIAGRAM



DIMENSION AND PHYSICAL CHARACTERISTICS

Parameter	Type	Value
Material	case/baseplate PCB	aluminum FR4
Dimension (LxWxH)		196.8 x 101.6 x 40.6mm
Weight		1000g typ.

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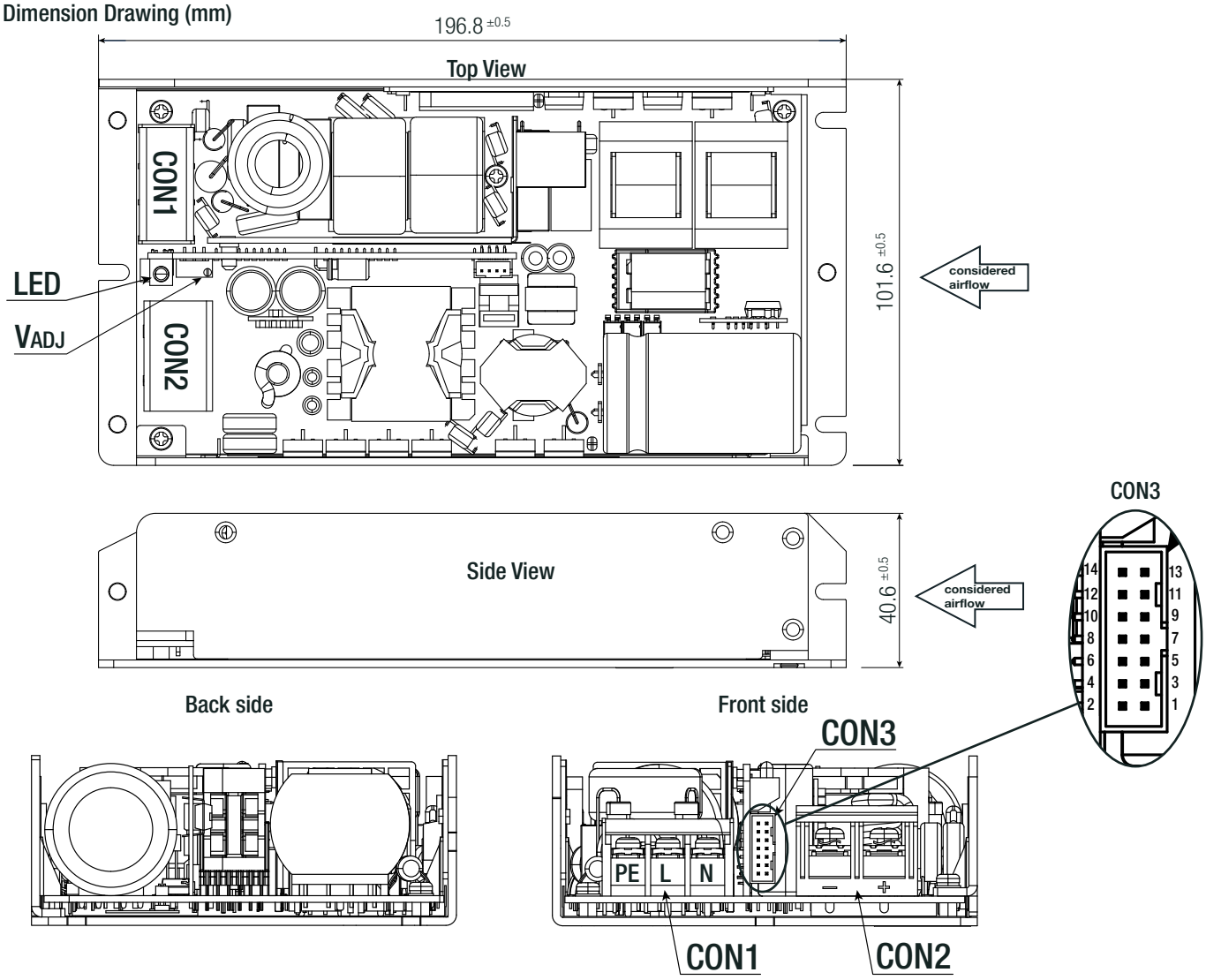
Specifications (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

Dimension Drawing (mm)



Signal CON3 (Molex PCB Header 87833-1420)			
#	Function	#	Function
14	-Sense	13	+Sense
12	address	11	Current_share_V
10	Remote ON/OFF	9	PSU_GOOD
8	+5VSB	7	5VSB_RTN
6	SDA	5	SCL
4	5VSB_RTN	3	5VSB_RTN
2	+5VSB	1	+5VSB

Compatible Connector CON3
Housing
Molex 51110 Series or equivalent
Crimp Terminal
Molex 50394 Series or equivalent

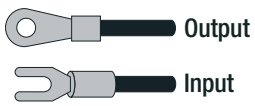
Input Terminal Block CON1 (9) (M3.5 screws) Dinkle: DT-4C-B01W-03-GN)	
Function	AWG
PE	12-18
L (line)	12-18
N (neutral)	12-18
wire stripping length: 7-8mm recommended tightening torque : 1.3Nm	

Output Terminal Block CON2 for 24 & 48Vout Version(9) (M4 screws) Dinkle: DT-7C-B01W-0137-02	
Function	AWG
-VOUT	8-12
+VOUT	8-12
wire stripping length: 10-11mm recommended tightening torque 1.5Nm	

Output Terminal Block CON2 for 12Vout Version(9) (M5 screws) Dinkle: 0166-80-S1531802C	
Function	AWG
-VOUT	4-12
+VOUT	4-12
wire stripping length: 14-15mm recommended tightening torque 2.4Nm	

Notes:

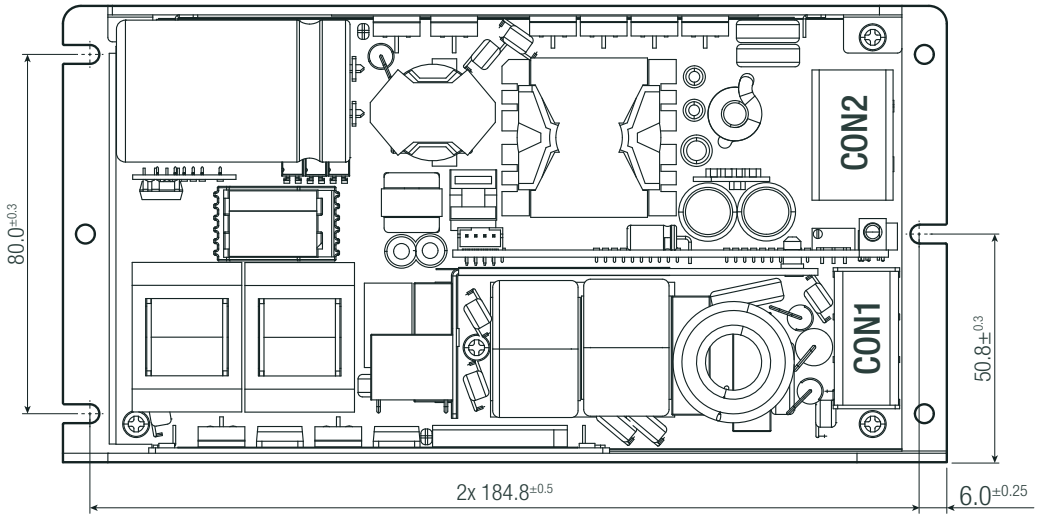
Note9: Use flexible cable with below lugs:

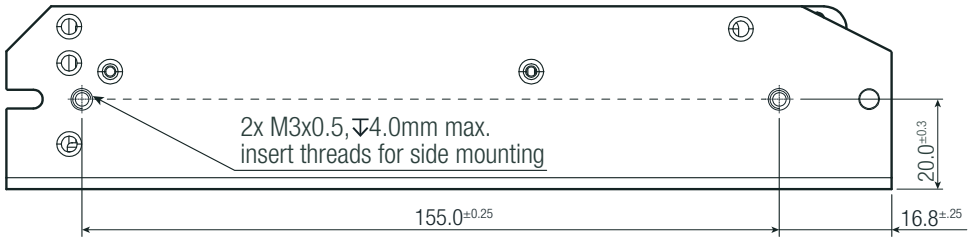


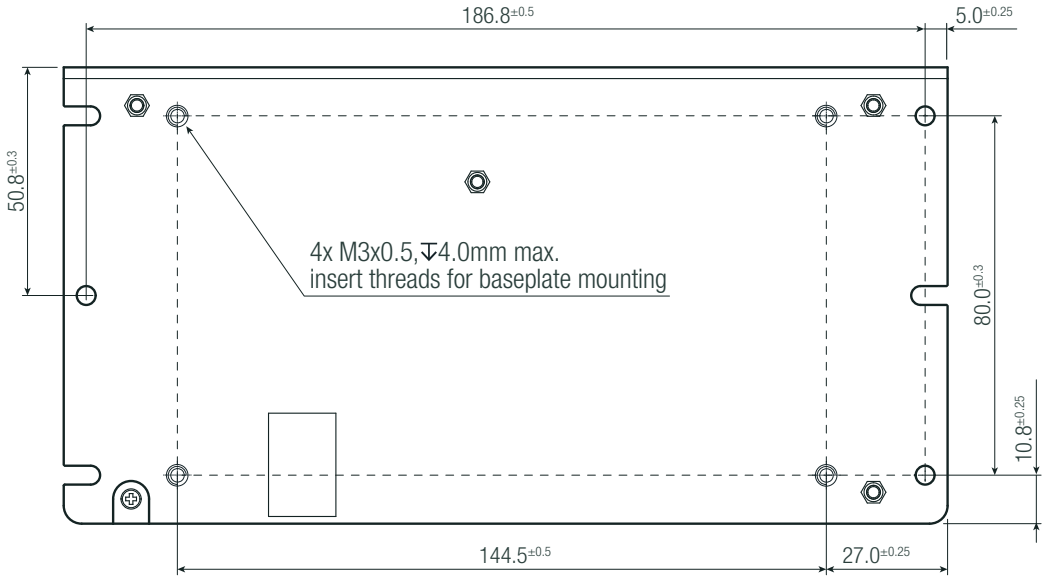
Specifications (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

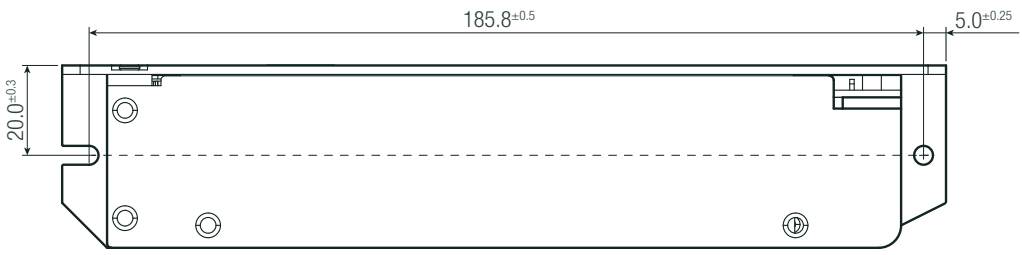
MOUNTING INSTRUCTIONS

Mounting Dimensions









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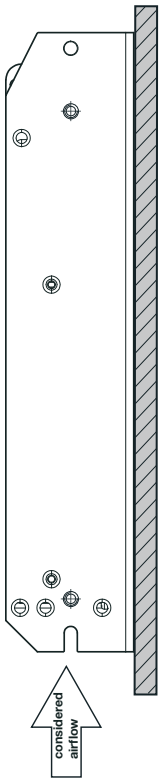
Specifications (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

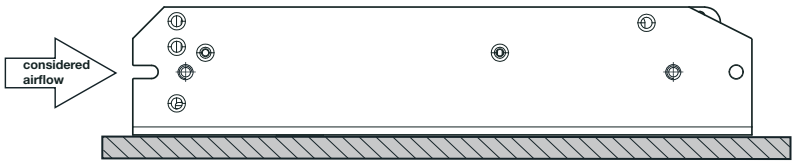
MOUNTING INSTRUCTIONS

Mounting Orientations

vertical mounting



horizontal (standard) mounting



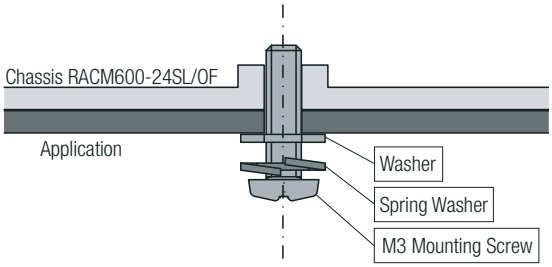
With forced air cooling, mounting orientation has no impact on output power. Upside down mounting is not recommended.

Forced air conditions as specified are valid for indicated airflow direction only (back side).

The PSU should be placed on a metal surface. It should not be placed on isolating and low thermal conductive surfaces.

Take care that no objects can fall into the PSU.

Mounting Equipment



Recommended mounting tightening torque= 0.6Nm.
Screw length= min. 2mm / max. 4mm

PACKAGING INFORMATION

Parameter	Type	Value
Packaging Dimension (LxWxH)	cardboard box	400.0 x 318.0 x 150mm
Packaging Quantity		7pcs
Storage Temperature Range		-40°C to +85°C
Storage Humidity	non-condensing	95% RH max.

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