

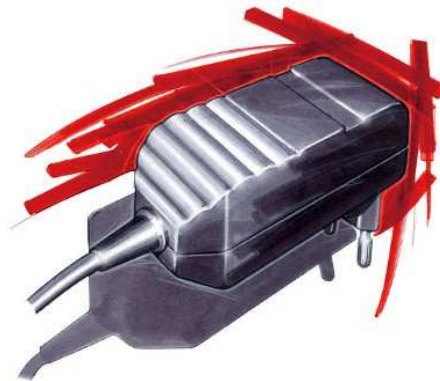
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			Revision
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EGSTON

Switch Mode Battery Charger for Li-ion/NiMH/NiCd cells

Product Name: C2xFzW3 24W

Input:	90 - 264 VAC
Output :	3,0 V – 25,5 V DC max. 24 W max. 2,5 A
Type:	C2xFzW3 24W



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1 REVISION HISTORY

1.1 Evolution

Edition	Date	Responsible	Reason of change
B	17.09.2004	Dolanský	preliminary
C	28.10.2004	Dolanský	
D	14.04.2006	Lambeck	
E	14.12.2006	Lambeck	
F	17.04.2007	Lambeck	Sign off
G	20.02.2008	Obritzhauser	Changeable plug housing implemented
H	20.01.2009	Mauritz	C2xFxW changed to C2xFzW3
I	15.04.2013	Mauritz	Signaling changed

1.2 Sign off

NAME	COMPANY	DATE
_____	_____	_____


Signoff indicated that the design and function of the charger are approved. Egston is responsible for maintaining the construction of the charger so that it continues to comply with regulatory agency requirements.

2 SCOPE

This document describes a switch mode power supply unit (AC/DC converter) with a sub board for charging Li-ion/NiMH/NiCd batteries.

The unit is designed as a Wall Plug In power supply or a Desk Top Module.

There are three possible configurations of the charger according to the standards: Standard, Medical and Household.

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3 TECHNICAL SPECIFICATION SHEET

3.1 Input Specification

Parameter	Key	Min	Typ.	Max	Unit	Test Cond.
Input Voltage	U_{IN}	90		264	V	AC
Input Current	I_{IN}	9		620	mA	
Input Frequency	f_{IN}	47		63	Hz	
Efficiency	η	73		83	%	At full load
Switching Frequency	f_{sw}		40		kHz	
Stand-by power	P_{stb}		850		mW	Without load

Input Voltage


If the input voltage is outside the operating range, the power supply does not meet the full specification. Above the specified upper limit of the input voltage the unit can get damaged. Below the specified lower limit of the input voltage the unit does not meet the specification.

Efficiency Under Load

The efficiency is defined as the ratio between the output power and input power.

3.2 Safety and Environmental Conditions

Sec	Parameter	Key	Min	Typ.	Max	Unit	Test Cond.
	Dielectric Strength		4,24			KV_{DC}	
	Operating Temperature		-5		40	$^{\circ}C$	
			23		104	$^{\circ}F$	
	Storage Temperature		-30	25	80	$^{\circ}C$	
			-22	77	176	$^{\circ}F$	
	Humidity				95	%	

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3.3 Output Specification

Parameter	Key	Min	Typ.	Max	Unit	Test Cond.	On request
Output Voltage	U_2	3		25,5	V	0 – 2,5 A	
Output Voltage Tolerance	T_{U2}			1	%	at PCB for Li-ion	
Output Current	$I_{2\text{Nominal}}$			2,5	A		3 A
Output Power	P_2		23,3		W		
Ripple Voltage	$U_{2,rms}$			80 100	mV_{rms}	$U_{IN} = 264V$ $U_{IN} = 90V$ Accu Load	

The unit is long time short circuit proof.

3.3.1 Maximal Power Ratings for NiMH/NiCd cells

Number of NiMH/NiCd cells	Nominal Battery Voltage [V]	Max. Output Voltage [V] (1,85V/cell)	Max. Output Current [A]
3	3,6	5,6	2,5 (3,0)
4	4,8	7,4	2,5 (3,0)
5	6,0	9,3	2,5
6	7,2	11,1	2,1
7	8,4	13	1,8
8	9,6	14,8	1,6
9	10,8	16,7	1,4
10	12	18,5	1,2
11	13,2	20,4	1,1
12	14,4	22,2	1,0
13	15,6	24,1	0,9
14	16,8	25,5 (1,82 V/cell)	0,9

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3.3.2 Maximal Power Ratings for Li-ion cells

Number of Li-ion cells	Nominal Battery Voltage [V]	Max. Output Voltage [V]	Max. Output Current [A]
1	3,7	4,2	2,5 (3,0)
2	7,4	8,4	2,5
3	11,1	12,6	1,8
4	14,8	16,8	1,4
5	18,5	21,0	1,1
6	22,2	25,2	0,9

3.3.3 Reverse Current

Battery Voltage [V]	3	10	25
Reverse Current [mA]	0,1	0,2	0,5

3.3.4 Thermistor in battery (optional)

Typical NTC: $10K\Omega \pm 5\%$ @25°C, $\beta_{25-85^\circ C} = 3477$, referenced to battery negative.

3.3.5 Modes of Operation

RESET – BATTERY AND NTC DETECTION

Battery cells are switched off, no signaling, μP measures if battery voltage and optionally battery thermistor are available.

POLLING


The battery is shorted, empty or intrinsically safe and thus the measured voltage is low, no signaling, charger is switched on for 1ms/1sec, μP measures if some charge current flows => There is a battery at disposal

PRECHARGE I

Battery is connected, but its voltage is very low, customer specified signaling, defined Time Out, charger applies pulses to the battery => average charge current of 12mA, when battery voltage exceeds 3V, mode "Precharge II" begins.

PRECHARGE II

Battery voltage is in range from 3V up to (1V/cell x No. Of cells for Ni, 3V x No. Of cells for Li), customer specified signaling, defined Time Out, customer specified charge current

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CHARGE PENDING

Battery temperature is either very low (typical below 0°C) or very high (typical over 40°C), customer specified signaling, defined Time Out, charger is switched off.

RAPID CHARGE

Battery is charged with maximum charge current (typical C/2), customer specified signaling.

Primary terminations for NiMH/NiCd: Temperature gradient dT/dt
 Drop Voltage –DV

Primary termination for Li-ion: I/10 - charge current falls below defined level

Default terminations: Maximum Cell Temperature
 Maximum Cell Voltage
 Time Out

TOP OFF CHARGE

NiMH/NiCd:

Pulsed charge using user defined current and 30% duty cycle with a period of 1 second. Top Off Charge ends after Time Out, Maintenance Charge begins. Customer specified signaling.

Li-ion:

Signaling shows “I am fully charged”, but the battery is still charged for defined time with a very low current

MAINTENANCE CHARGE

This is a low duty cycle current pulse applied after Top Off Charge to offset self discharge. The peak amplitude is the toff charge rate, pulse width is 1 s and the period is 60 seconds. Maintenance Charge ends after Time Out. Charger may restart if battery is simultaneously discharged and its voltage sinks below a defined level. Customer specified signaling.

Li-ion: This mode is skipped

CHARGE OVER


Charger is switched off, it may restart if the battery is simultaneously discharged and its voltage sinks under defined level. Customer specified signaling.

FAULT I

Charger is switched off because of high battery temperature, expired Time Out or short circuit during Rapid Charge. Unplug the battery to restart. Customer specified signaling.

FAULT II

Charger is switched off because of high battery voltage. Charger must be unplugged from mains to restart. Customer specified signaling.

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3.3.6 Signaling

There is a single LED indicator with red/green LED in the charger. The two colours can be mixed to produce amber light, and various flashing light patterns are also available.

3.3.6.1 Examples of typical patterns used

Standard

Condition	LED Color
Rapid Charge	AMBER
Charge Complete	GREEN
Precharge	FLASHING AMBER
Charge Pending	FLASHING RED
Charge Failure	RED
No AC/Standby	OFF

Medical

Condition	LED Color
Rapid Charge	GREEN 50/50
Charge Complete	GREEN
Precharge	GREEN 10/90
Charge Pending	GREEN 10/90
Charge Failure	RED
No AC/Standby	OFF

3.3.6.2 Selection of standard LED patterns

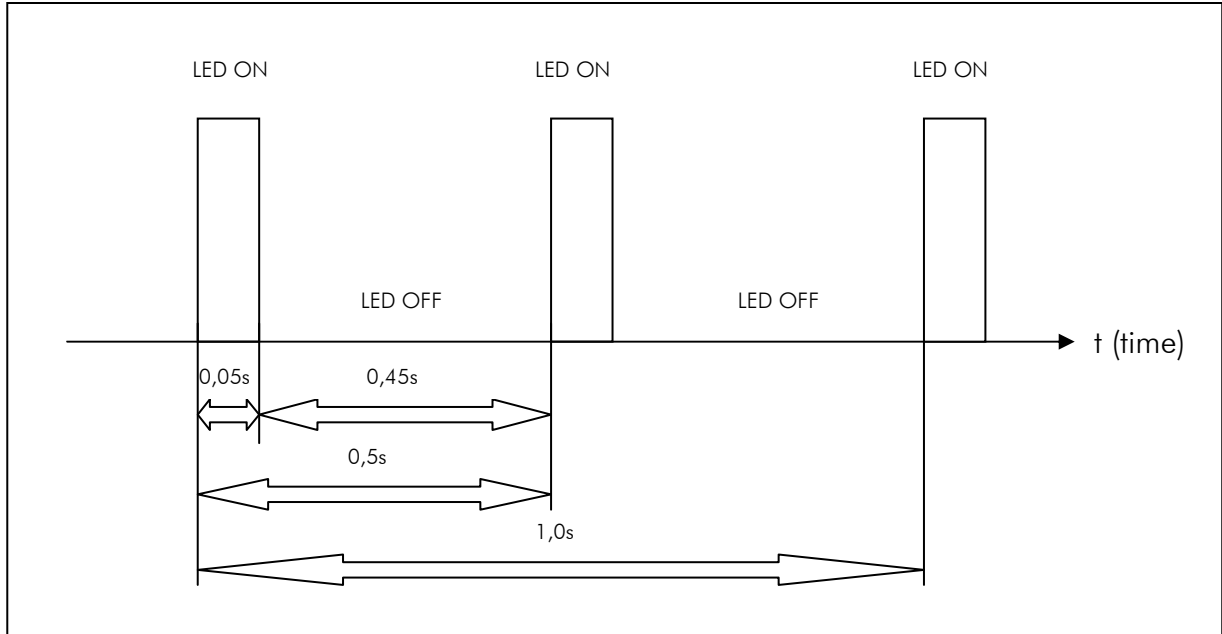
Visible Colour	Green LED	Red LED
Dark	OFF	OFF
Green	ON	OFF
Red	OFF	ON
Amber	ON	ON
Flashing Red	OFF	0,5 sec ON / 1 sec (50/50)
Flashing Amber	0,25 sec ON / 1 sec (25/75)	0,25 sec ON / 1 sec (25/75)
Flashing Green	0,5 sec ON / 1 sec (50/50)	OFF
Fast Flashing Green	0,05 sec ON / 0,5 sec (5/45)	OFF
Flashing Green, low duty cycle	0,1 sec ON / 1 sec (10/90)	OFF

It is possible to create other patterns as required.


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Schematical Example for cycle time:

Example for: 0,05 sec ON / 0,5 sec (5/45)



There are two types of LED lens available, the standard lens and the high diffusion lens. It is recommended to order the high diffusion lens for products using amber light to optimise light mixing and achieve a pleasing appearance.

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3.3.7 Special Features

Remote Voltage Sensing

Remote Voltage Sensing improves the battery voltage measurement precision, especially for intrinsically safe batteries or any other battery with diodes in series with a battery cell.

Output fuse

It is possible to add an output fuse (SMD case 1206) in the charger. It is not replaceable and insures increased safety.

Remote LED

Remote LED serves for remote signalling of the charge status. When the charger is hidden to the customer during charge, "Remote LED" lead is connected to Anode of an external LED, built for example into the battery pack. Signalling of this LED is customer defined.

Output current of 3A

This option is available on request for 3 or 4 NiMH / NiCd cells or 1 Li-ion cell. A special temperature conducting filler must be added between case and main board.

Auxiliary Power

It is possible to supply an unregulated voltage for some low energy device connected to the charged battery. This voltage varies, it is maximum (Open Voltage) when battery is switched off (because of high or low temperature or when full), its minimum value depends on the battery voltage when charger is switched on.

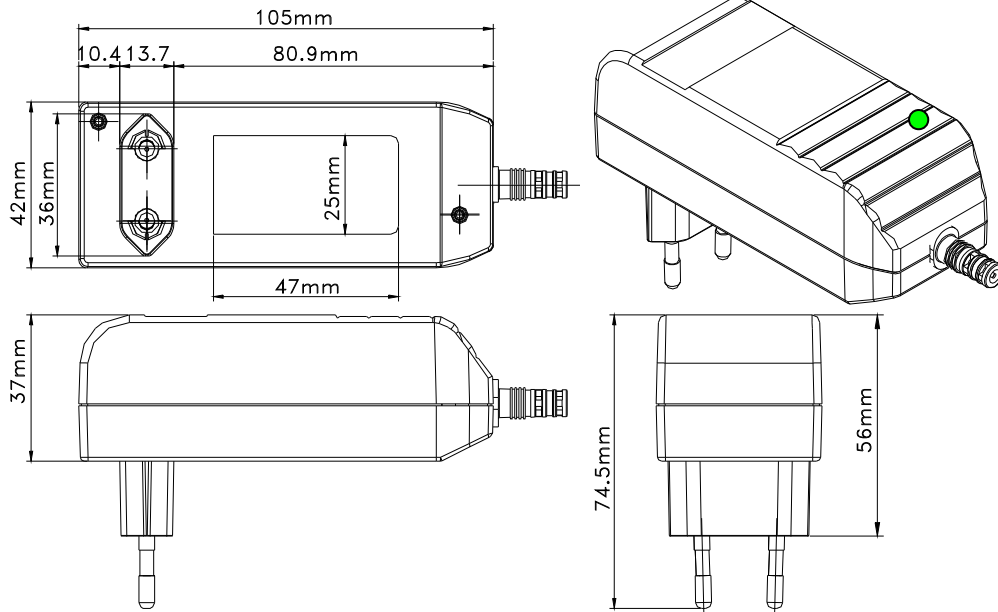
Customer specific secondary Plug

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3.4 Mechanical Parameters

3.4.1 Housing dimension

3.4.1.1 Euro housing



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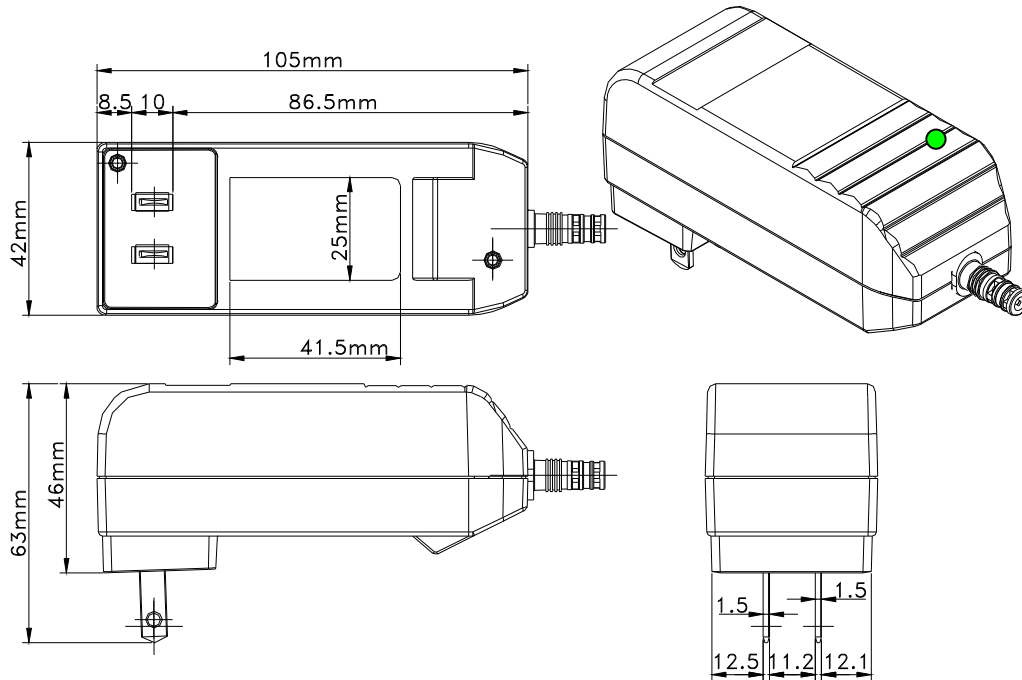
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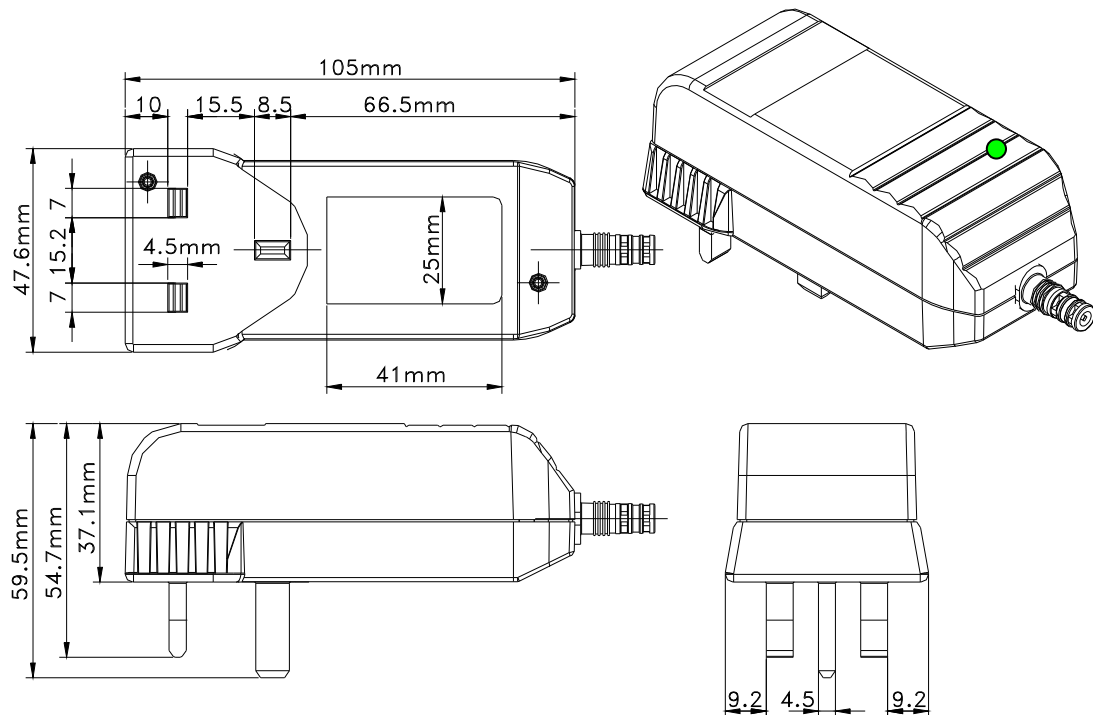
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3.4.1.2 US Housing



3.4.1.3 UK Housing

3.4.1.4



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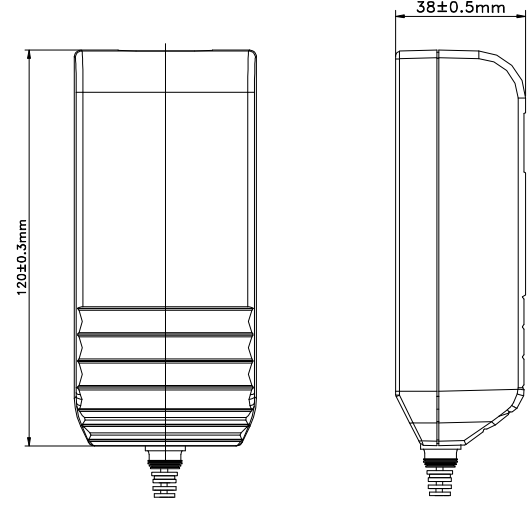
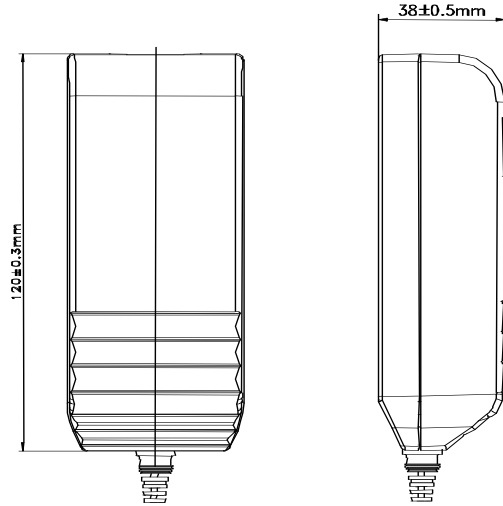
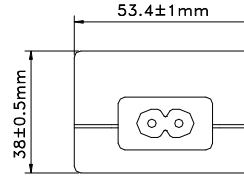
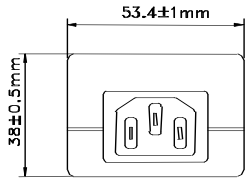
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Desk Top Housing

With IEC 320 C14 Primary Plug

With IEC 320 C8 primary Plug

(Medical device only IEC 320 C8 or C18)



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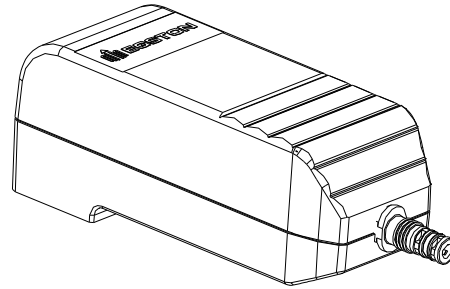
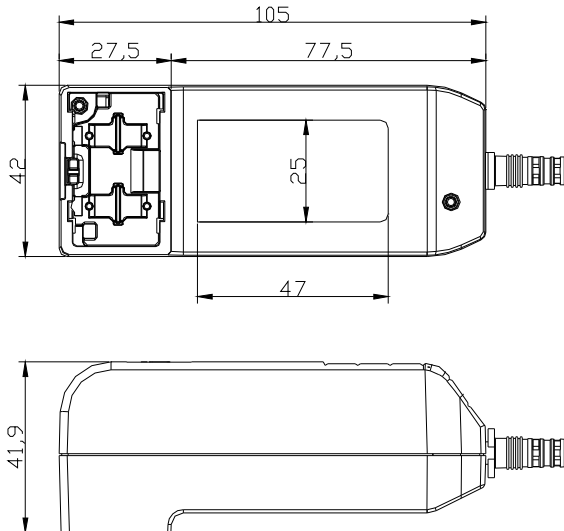
Year

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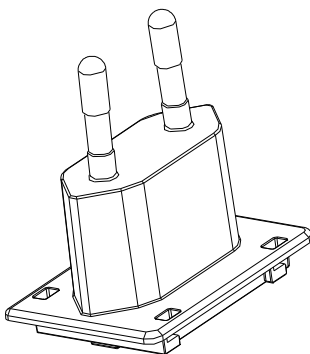
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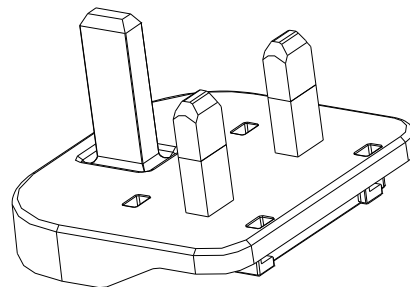
3.4.1.5 Changeable Plug Housing



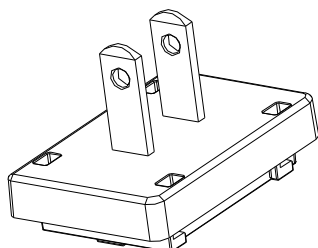
**EU Plug according:
EN50075**



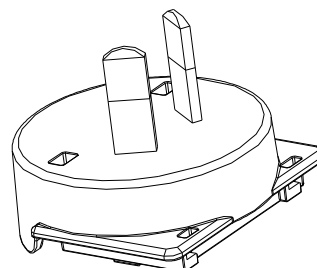
**UK Plug according:
BS1363**




**US Plug according:
UL1310**



**Australia Plug according:
AS/NZS 3112**



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3.4.2 Housing Material

	6W UK,EURO,US	12W UK,EURO,US	24W UK,EURO,US	DESKTOP
Material	PA6,V0	PA6,V0	PA6,V0	PA6,V0
Flammability rate	V0	V0	V0	V0

3.5 Cable And Connector

According to customer's requirements.

Minimum two leads:

Charger Negative Output (e.g. white)


Charger Positive Output (e.g. red)

Optionally:

Thermistor (e.g. green)

Positive Voltage Sense (e.g. yellow)


Remote LED Output or Auxiliary Power (e.g. blue)

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4 ORDERING INFORMATION

4.1 SMPS

C	POWER CLASS	24 Watt
2	SUPPLY TYPE	C = New Charger Generation
E	OPERATION TEMP. RANGE	2 = -5°C to +40°C
F	PRIMARY CONNECTOR	E = Euro plug U = US/Japan/Canada Plug G = United Kingdom Plug D = Desktop Module C = Changeable Plug
S	CABLE CONNECTION	F = Fixed
W	APPLICATION	S = Standard M = Medical H = Household
24W	WIDE INPUT RANGE	W = 90V-264V
12V	HOUSING DIMENSION	24W
2A	OUTPUT VOLTAGE	3.0V-25,5V
	OUTPUT CURRENT	2500mA max.

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4.2 Charger

For setting of charge parameters we need the following information:

1/ Type of the battery

(Li-ion, NiMH, NiCd, other)

2/ Datasheet of the battery

(battery capacity, maximum charge current, maximum temperature during charge, charge curves at various ambient temperatures, manufacturer)

3/ Configuration of the battery Pack

(number of cells in series, parallel, NTC specification – when used, define “Special features” – see 3.3.7, elements in series with the battery cell, parallel discharge operation)

4/ Signaling

(e.g. A8/B6/C5/D2/E7, see 3.3.6)

5/ Required standards

6/ Marking


7/ Definition of the output cord (number of leads, length)

+ nominal length 1,5m

8/ Definition of the output connector

+ standard connectors upon request

9/ Amount of required samples

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5 PACKAGING AND WEIGHT

Cable with connector 5.5/2.1		38 G											
Instruction Manual		3.6 G											
Euro pallet empty (wooden):		21 Kg											
SINGLE PACKAGING													
	PS 1.5m cable+ connector 5.5/2.1	Single carton empty	Single carton full	Packing case empty	Packing unit	Packing case full	Cartons per pallet	Euro pallet full	Single carton	Packing case	Euro pallet		
P2	EU	24W	178	15	193	180	50	9.6	18	211	136x76x43.5	388x280x226	1200x800x
P2	US	24W	178	15	193	180	50	9.6	18	194	136x76x43.5	388x280x226	1200x800x
P2	Uk	24W	178	16	194	180	50	9.6	18	194	136x76x50.5	388x280x260.5	1200x800x
	Unit		g	g	g	g	Pcs.	kg	Pcs.	kg	mm	mm	mm

6 STANDARDS

EN 60950-1
 EN 61558-2-17
 EN 60355-2-29
 EN 60601-1

EN 61000-6-1
 EN 55022 Class B
 EN 61204-3
 EN 60601-1-2

UL 1310 / CAN/CSA Standard C22.2 No. 223-M91
 UL 60601-1 / CAN/CSA Standard C22.2 No. 601.1-M90

7 APPROVALS

CE Conformity with the applicable EU directives
 GS GS mark
 UL UL listed according UL 1310