

**FRIWO®**

POWERUNLIMITED

☐ ☐ **☐** ☐ CATALOGUE

Products





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# “Development, production and sale of innovative and competitive power supplies – worldwide”.

## Mission

That is our mission – we see this as our obligation towards you. **FRIWO** has been developing, producing and selling power supplies under this maxim for 34 years.

## Global Player

As a globally acting technology company, we have a presence on all the important markets – and above all where you need us – with our own development, production, and sales organizations.

The **FRIWO** Group comprises the holding company (**CEAG AG**) and two strategic business units that act independently of each other: **FRIWO** Mobile Power (**FMP**) and **FRIWO** Power Solutions (**FPS**).

The business area of **FRIWO** Mobile Power (**FMP**) spans mainly the high-volume product area such as mobile and cordless phones, CD/MD/DVD players, digital cameras.

**FRIWO** Power Solutions (**FPS**) on the other hand focuses on platform and customer specific power supplies and chargers for use in the areas of medical technology, IT & communications, domestic appliances and mobile tools as well as industrial applications.

## Plug-in power supply

Since the development and introduction of the world's first plug-in power supply in 1971, **FRIWO** has become a brand name that is synonymous with technical competence, know-how, standard and customer specific full solutions from the concept for power supplies through to the finished product. Thus **FRIWO** has not only laid the foundations for today's market success, but is establishing important benchmarks in the field of power supply and charging technology. All of this, of course, in accordance with the current safety standards and regulations.

## Standards, regulations and responsibility

Medical technology is a good example in this context. It is necessary to fulfil the strict criteria of the medical standards while at the same time promoting development in this area.

Already now **FRIWO** meets future legal requirements such as low power consumption in stand-by mode. Another example of innovation and responsible treatment of the environment and available resources is the introduction of lead-free soldering by the **FRIWO** Group. This is an important contribution to the implementation of the RoHS Directive (Restriction of the Use of Certain Hazardous Substances).



Europe, Ostbevern



Asia, Shajing



Asia, XiXiang



Asia, Beijing

■ **RoHS:**

Restriction of the use of certain Hazardous Substances

FRIWO completely abandoned the use of environmentally unfriendly substances; in this transition, we have for example implemented lead free soldering. Major investments in comprehensive laboratory and analysis equipment here at FRIWO will help us to secure such high quality standards.



■ **WEEE:**

Waste Electrical and Electronic Equipment

FRIWO products already bear today all the markings that will be required by international laws for an integrated recycling process tomorrow.



All devices are tested for operational safety in our own accredited testing centres and leave our factories as “zero-fault products”. FRIWO power supply and charger platforms are approved in Europe, USA, Canada, Japan and Australia without further testing.

**Leading position in power supplies**

Continuous further development of our high-quality products, their innovative design, and our technical expertise have made CEAG AG/FRIWO Group a reliable and experienced industry partner worldwide. Highly qualified, flexible employees guarantee the quick development cycles demanded by today’s market.

The market- and customer-oriented design of the individual product platforms, the flexible adjustment of production capacities and the optimum organisation of the sales result in a successful positioning on the global power supply market. Over 930 million power supplies and chargers sold in 33 years are a clear evidence of the Group’s high level of expertise and innovative ability.

**CEAG AG/FRIWO Group**

FRIWO is the wholly owned subsidiary of CEAG AG. Listed in the Prime Standard, CEAG AG is the holding company of the FRIWO Group, with its registered office in Bad Homburg and headquarters in Ostbevern/Westphalia. As such, it is the world’s leading provider – through the FRIWO brand – of charging units for mobile phones. The major shareholder of CEAG AG is DELTON AG with almost 77 percent of the share capital.



Asia, Shanghai



Asia, Tokyo



Asia, Seoul



North America, Colorado Springs



South America, São Paulo

# Switchmode Power Supply

## Switchmode Technology

Switchmode power supply units are particularly suited for feeding portable devices. Their low weight and extremely compact form mean they can be just as advantageously combined with all other types of applications.

An additional increase in attractiveness results from the wide-range input so that the power supply units can be operated all over the world using mains voltages from 100 to 240 V AC and 50 to 60 Hz. This makes worldwide use possible and means a drastic reduction in the logistics expenses on the part of our customers.

Such solutions can either be realised as desktop units with worldwide standardised IEC sockets (our DT series) or as plug-in power supply units with exchangeable mains plug adapters (our MPP series). Details regarding these products can be found on the following pages.

First, here is some important technical information:

### Primary Switched Power Supply Units

In such a power supply unit, the mains voltage is first rectified and smoothed. After that, it is switched at high frequencies and transferred via a converter transformer. The required low voltage is then generated within another rectification and smoothing step. A high-precision direct voltage with very low tolerances can be provided by means of an additional stabilisation circuit.

Beyond these advantages of the compact design and wide-range input, the high efficiency is of decisive importance: at an achievable 90 percent, the losses due to emission of heat are minimized. The requirements for very low stand-by power consumption (stand-by power) can only be met using this technology.

FRIWO offers an extensive range of standard devices with excellent features. At a corresponding volume, further variants for all kinds of special requirements can be developed. In the process, the application considerably determines the design:

- In addition to output current and voltage, requirements regarding control stabilisation and ripple of the output voltage, EMC behaviour, efficiency, etc. influence the power supply unit design.
- Specific requirements regarding size and shape have an effect on the component expense and thus the costs of the unit.
- Various circuit topologies can be used according to the requirements.
- Designs as plug-in power supply units, desktop devices, or even as modules (= open frame) for all special applications can also be realised.

### Safety Regulations, Protection Classes, and Connection Types

Power supply units can be found in a number of applications. For this reason, the specific safety regulations of the devices being powered, depending on the regulation of the testing authorities of the respective countries, such as the UL (Underwriter Laboratories), VDE (Association of German Electrical Engineers), etc., must be particularly observed.

The EMC conformity according to EN 61000-6-X, under consideration of system perturbations according to EN 61000-3-2 should be observed for power supply units independent of the switching concept.

When selecting the housing, the ambient conditions, for example in moist environments, must be considered. For general applications, the type of protection according to EN 60529-IP20 (Operation in Dry Rooms – Protection Against the Penetration of Solid Foreign Body) suffices. According to application, power supply units are designed in accordance with the respective applicable regulations. Due to the safe galvanic separation, all devices fulfil the low-voltage guideline and provide a safety extra-low voltage (SELV).

# Switchmode Power Supply

## PP 3

Conforms to IEC 60950

### Applications

- Telecom applications
- Portable instruments
- Peripherals

### Characteristics

- Universal input 100 to 240 V AC
- Constant voltage, current limited
- Low leakage current  $\leq 10 \mu\text{A}$
- Low standby power  $\leq 0.3 \text{ Watts}$
- Continuously short circuit proof



3 Watts

### Technical Data

#### Input voltage

100 to 240 V AC

#### Input current

approx. 90 mA

#### Frequency

50 to 60 Hz

#### Efficiency

75% typ. at full load

#### EMC

Conforms to EN 55011, EN 55014, EN 55022/B, FCC 47 part 15, EN 61000-3-2, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-11

### Output voltage tolerance

$\pm 5\%$

### Ripple

$\leq 300 \text{ mV RMS}$

### Environmental specification

#### Operating temp.

0 to 40° C at maximum load

#### Storage temp.

-10 to 70° C

#### Humidity

10% to 95% non condensing

#### Input transient susceptibility

Complies with IEC 61000 requirements

### Safety specification

#### Standards

Fulfils Class II SELV for the following applications: EN 60950/IEC 60950, VDE, CE label, resp. UL 60950

### Reliability specification

#### MTBF calculation

200,000 hours at maximum load levels and an ambient temperature of 25° C (in correspondence with MIL-HDBK-217)

### Mechanical specification

#### Weight approx.

60 g

#### Plug connector

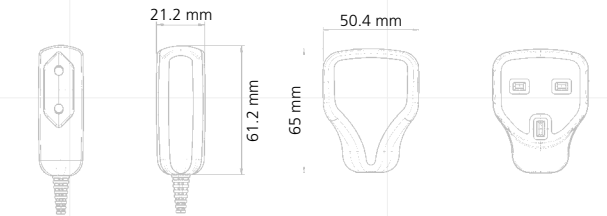
AC input: Mains plugs are available for the following regions: EURO, UK, USA/Japan\*  
DC output: Universal output plug system

PP 3 UK

PP 3 Australia

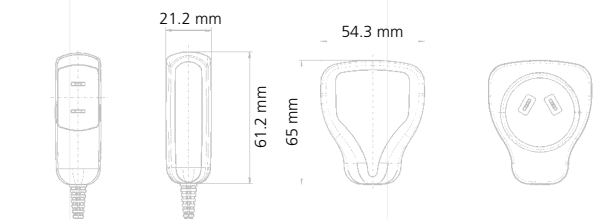
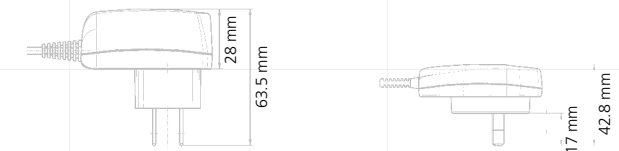
PP 3 USA/Japan

PP 3 EURO



PP 3 EURO

PP 3 UK



PP 3 USA/Japan

PP 3 Australia

\* Australia version and other output voltages available for OEM quantities

Output data		EURO	USA/Japan	UK
Voltage	Current	Order No.	Order No.	Order No.
5 V	650 mA	1882750	1882760	1824460
6 V	550 mA	1890574	1825734	1825733
7.5 V	450 mA	1826282	1822300	1826268
9 V	360 mA	1890562	1890576	1890575
12 V	270 mA	1882753	1882763	1824461
15 V	220 mA	1890714	1890716	1890715
24 V	135 mA	1890717	1890718	1890719

# Switchmode Power Supply

## PP 6

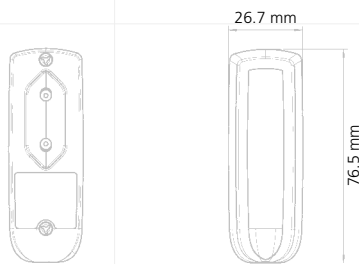
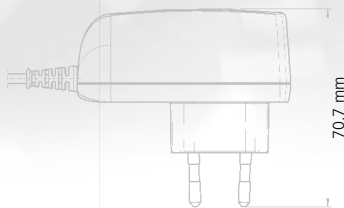
Conforms to IEC 60950

6 Watts

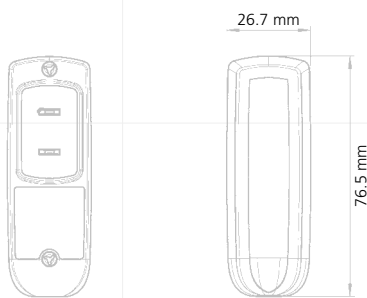
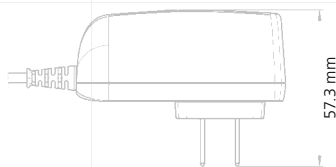


PP 6 EURO

PP 6 USA/Japan



PP 6 EURO



PP 6 USA/Japan

### Applications

- Modems
- Portable battery operated equipment
- Household appliances
- Communication accessories
- Bluetooth
- Audio

### Characteristics

- Universal input 100 to 240 V AC
- EMC conformity
- Constant voltage, current limited
- Light weight, compact size
- Low leakage current  $\leq 10 \mu\text{A}$
- Low standby power  $\leq 0.3$  Watts
- Continuously short circuit proof

### Technical data

**Input voltage**

100 to 240 V AC

**Input current**

150 mA

**Frequency**

50 to 60 Hz

**Efficiency**

75% typ. at full load

**EMC**

Conforms to EN 55011, EN 55014, EN 55022/B, FCC 47 part 15, EN 61000-3-2, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-11

**Output voltage tolerance**

$\pm 5\%$

### Environmental specification

**Operating temp.**

0 to 40° C at maximum load

**Storage temp.**

-10 to 70° C

**Humidity**

10% to 95% non condensing

**Input transient susceptibility**

Complies with IEC 61000 requirements

### Safety specification

**Standards**

Fulfils Class II SELV for the following applications: EN 60950/IEC 60950, VDE, CE label, resp. UL 60950

### Reliability specification

**MTBF calculation**

200,000 hours at maximum load levels and an ambient temperature of 25° C (in correspondence with MIL-HDBK-217)

### Mechanical specification

**Weight approx.**

70 g

**Plug connector**

AC input: Mains plugs are available for the following regions:  
EURO, UK, USA/Japan  
DC output: Universal output plug system

Output data			EURO	USA/Japan	UK
Voltage	Current	Ripple Volt.	Order No.	Order No.	Order No.
3 V	1300 mA	300 mV pp	1883765	1883767	1890729
5 V	1000 mA	200 mV pp	1882105	1814934	1890728
6 V	850 mA	180 mV pp	1882106	1814935	1890730
7.5 V	650 mA	150 mV pp	1882107	1814936	1890735
9 V	550 mA	150 mV pp	1882108	1814937	1890734
12 V	450 mA	150 mV pp	1882109	1814938	1890733
15 V	360 mA	150 mV pp	1882110	1814939	1890732
18 V	300 mA	150 mV pp	1882111	1814940	1890731
24 V	220 mA	150 mV pp	1882112	1814941	1890736



# Switchmode Power Supply

## PP 8

Conforms to IEC 60950

### Applications

- IT equipment
- Measurement and weighing technology
- Laser and lighting technology
- Security technology/camera technology
- Office and data transmission appliances

### Characteristics

- Universal input 100 to 240 V AC
- EMC conformity
- High performance
- Constant voltage, current limited
- Light weight, compact size
- Continuously short circuit proof



8 Watts

### Technical data

#### Input voltage

100 to 240 V AC

#### Input current

200 mA

#### Frequency

50 to 60 Hz

#### Efficiency

75% typ. at full load

#### EMC

Conforms to EN 55011, EN 55014, EN 55022/B, FCC 47 part 15, EN 61000-3-2, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-11

### Output voltage tolerance

± 5%

### Environmental specification

#### Operating temp.

0 to 40° C at maximum load

#### Storage temp.

-10 to 70° C

#### Humidity

5% to 95% non condensing

#### Input transient susceptibility

Complies with IEC 61000 requirements

### Safety specification

#### Standards

Fulfils Class II SELV for the following applications: EN 60950/IEC 60950, VDE, CE label, resp. UL 60950

### Reliability specification

#### MTBF calculation

200,000 hours at maximum load levels and an ambient temperature of 25° C (in correspondence with MIL-HDBK-217)

### Mechanical specification

#### Weight approx.

110 g

#### Plug connector

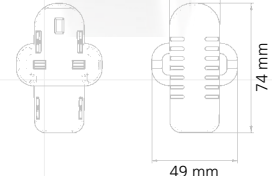
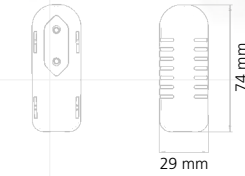
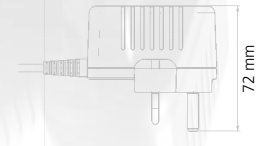
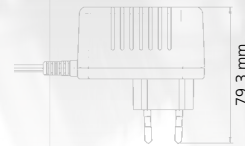
AC input: Mains plugs are available for the following regions:  
EURO, UK, USA/Japan\*  
DC output: Universal output plug system

PP 8 UK

PP 8 USA/Japan

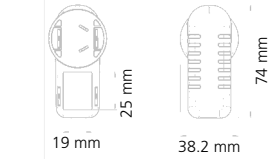
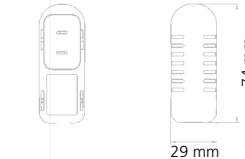
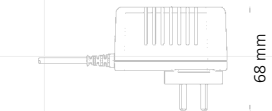
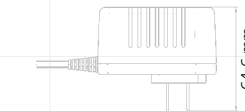
PP 8 Australia

PP 8 EURO



PP 8 EURO

PP 8 UK



PP 8 USA/Japan

PP 8 Australia

\* Australian version available for OEM quantities

Output data			EURO	UK	USA/Japan
Voltage	Current	Ripple Volt.	Order No.	Order No.	Order No.
3 V	1700 mA	300 mV pp	1819725	1819726	1819727
5 V	1300 mA	200 mV pp	1814804	1814894	1814902
6 V	1150 mA	180 mV pp	1814805	1814895	1814903
7.5 V	900 mA	150 mV pp	1814806	1814896	1814904
9 V	800 mA	150 mV pp	1814807	1814897	1814905
12 V	700 mA	150 mV pp	1814808	1814898	1814906
15 V	530 mA	150 mV pp	1814809	1814899	1814907
18 V	440 mA	150 mV pp	1814810	1814900	1814908
24 V	330 mA	150 mV pp	1814811	1814901	1814909

9 PP 8

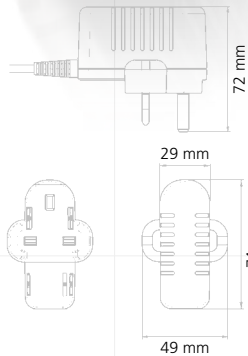
# Switchmode Power Supply PP 8 S (switchable)

Conforms to IEC 60950

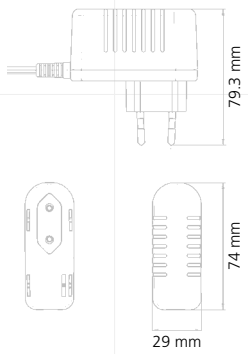


PP 8 S UK

PP 8 S EURO



PP 8 S UK



PP 8 S EURO

8 Watts

## Applications

- Battery operated equipment
- Digital photography
- Prototype development
- MP3 Player
- DVD and CD Player

## Characteristics

- Input 230 V AC
- Output switchable
- Constant voltage, current limited
- low leakage current  $\leq 250 \mu\text{A}$
- Low standby power  $\leq 0.5$  Watts
- Continuously short circuit proof

## Technical data

### Input voltage

230 V AC

### Input current

195 mA

### Frequency

45 to 55 Hz

### Efficiency

75% typ. at full load

### EMC

Conforms to EN 55011, EN 55014, EN 55022/B, FCC 47 part 15, EN 61000-3-2, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-11

### Output voltage tolerance

$\pm 6\%$

## Environmental specification

### Operating temp.

0 to 40° C at maximum load

### Storage temp.

-10 to 70° C

### Humidity

5% to 90% non condensing

### Input transient susceptibility

Complies with IEC 61000 requirements

## Safety specification

### Standards

Fulfils Class II SELV for the following applications: EN 60950/IEC 60950, resp. UL 60950, CSA 950 (cUL), VDE, CE label

## Reliability specification

### MTBF calculation

200,000 hours at maximum load levels and an ambient temperature of 25° C (in correspondence with MIL-HDBK-217)

## Mechanical specification

### Weight approx.

110 g

### Plug connector

AC input: EURO, UK

DC output: Universal output plug system

Output data		EURO	UK
Voltage	Current	Order No.	Order No.
3, 4.5, 6, 9, 12 V	1300 mA	1825988	1890708

10 PP 8 S (switchable)

# Switchmode Power Supply

## MPP 6

Conforms to IEC 60950

### Applications

- PDA's
- MPEG Players
- Digital Cameras

### Characteristics

- Universal input 100 to 240 V AC
- Interchangeable primary adapters
- Constant voltage, current limited
- Low standby power  $\leq 0.3$  Watts
- Continuously short circuit proof



9 Watts

### Technical data

**Input voltage**

100 to 240 V AC

**Input current**

150 mA

**Frequency**

50 to 60 Hz

**Efficiency**

75% typ. at full load

**EMC**

Conforms to EN 55011, EN 55014, EN 55022/B, FCC 47 part 15, EN 61000-3-2, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-11

**Output voltage**

$\pm 5\%$

**tolerance**

### Environmental specification

**Operating temp.**

0 to 40° C at maximum load

**Storage temp.**

-10 to 70° C

**Humidity**

5% to 95% non condensing

**Input transient**

**susceptibility**

Complies with IEC 61000 requirements

### Safety specification

**Standards**

Fulfils Class II SELV for the following applications: EN 60950/IEC 60950, UL 60950, VDE, CE label

### Reliability specification

**MTBF calculation**

200,000 hours at maximum load levels and an ambient temperature of 25° C (in correspondence with MIL-HDBK-217)

### Mechanical specification

**Weight approx.**

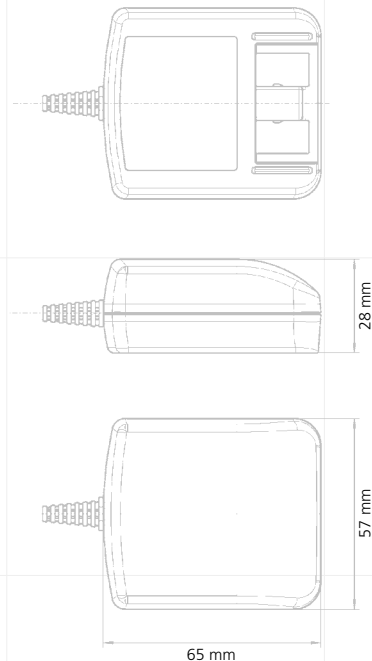
100 g

**Plug connector**

AC input: FRIWO exchangeable mains plug system: EURO, UK, USA/Japan, Australia, IEC

DC output: Universal output plug system

MPP 6



MPP 6

Output data			Worldwide
Voltage	Current	Ripple Volt.	Order No.
3 V	1300 mA	300 mV pp	1883766
5 V	1000 mA	200 mV pp	1814926
6 V	850 mA	180 mV pp	1814927
7.5 V	650 mA	150 mV pp	1814928
9 V	550 mA	150 mV pp	1814929
12 V	450 mA	150 mV pp	1814930
15 V	360 mA	150 mV pp	1814931
18 V	300 mA	150 mV pp	1814932
24 V	220 mA	150 mV pp	1814933

# Switchmode Power Supply

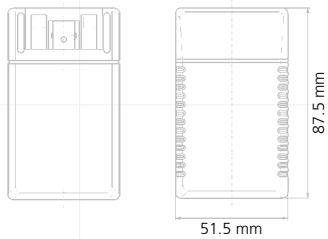
## MPP 15

Conforms to IEC 60950

15 Watts



MPP 15



MPP 15

### Applications

- Office equipment
- Data transmission devices
- IT equipment
- Measurement and weighing technology

### Characteristics

- Universal input 100 to 240 V AC
- Interchangeable primary adapters
- Constant voltage, current limited
- Light weight and universal use
- Continuously short circuit proof

### Technical data

#### Input voltage

100 to 240 V AC

#### Input current

400 mA

#### Frequency

50 to 60 Hz

#### Efficiency

80% typ. at full load

#### EMC

Conforms to EN 55011, EN 55014, EN 55022/B, FCC 47 part 15, EN 61000-3-2, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-11

### Output voltage tolerance

± 5%

### Environmental specification

#### Operating temp.

0 to 40° C at maximum load

#### Storage temp.

-10 to 70° C

#### Humidity

5% to 95% non condensing

#### Input transient susceptibility

Complies with IEC 61000 requirements

### Safety specification

#### Standards

Fulfils Class II SELV for the following applications: EN 60950/IEC 60950, UL 60950, CSA 950 (cUL), VDE, CE label

### Reliability specification

#### MTBF calculation

200,000 hours at maximum load levels and an ambient temperature of 25° C (in correspondence with MIL-HDBK-217)

### Mechanical specification

#### Weight approx.

160 g

#### Plug connector

AC input: FRIWO exchangeable mains plug system: EURO, UK, USA/Japan, Australia, IEC

DC output: Universal output plug system

Output data			Worldwide
Voltage	Current	Ripple Volt.	Order No.
3 V	2500 mA	45 mV pp	1812102
5 V	2400 mA	75 mV pp	1812037
6 V	2100 mA	75 mV pp	1812036
7.5 V	1700 mA	75 mV pp	1812038
9 V	1500 mA	90 mV pp	1811970
12 V	1250 mA	120 mV pp	1811971
15 V	1000 mA	150 mV pp	1812039
18 V	840 mA	180 mV pp	1812040
24 V	625 mA	240 mV pp	1812041

12 MPP 15

# Switchmode Power Supply

## MPP 30

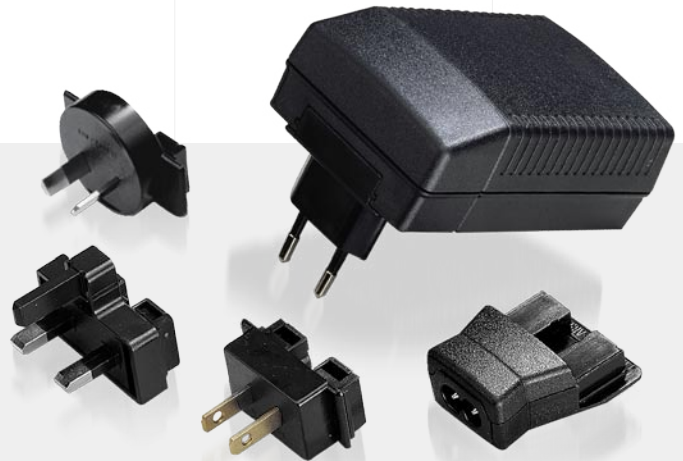
Conforms to IEC 60950

### Applications

- Office equipment
- Data transmission devices
- IT equipment
- Measurement and weighing technology

### Characteristics

- Universal input 100 to 240 V AC
- Interchangeable primary adapters
- Constant voltage, current limited
- Compact size and universal use
- Continuously short circuit proof



30 Watts

### Technical data

#### Input voltage

100 to 240 V AC

#### Input current

700 mA

#### Frequency

50 to 60 Hz

#### Efficiency

80% typ. at full load

#### EMC

Conforms to EN 55011, EN 55014, EN 55022/B, FCC 47 part 15, EN 61000-3-2, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-11

### Output voltage

#### tolerance

± 5%

### Environmental specification

#### Operating temp.

0 to 40° C at maximum load

#### Storage temp.

-10 to 70° C

#### Humidity

5% to 95% non condensing

#### Input transient

#### susceptibility

Complies with IEC 61000 requirements

### Safety specification

#### Standards

Fulfils Class II SELV for the following applications: EN 60950/IEC 60950, UL 60950, CSA 950 (cUL), VDE, CE label

### Reliability specification

#### MTBF calculation

200,000 hours at maximum load levels and an ambient temperature of 25° C (in correspondence with MIL-HDBK-217)

### Mechanical specification

#### Weight approx.

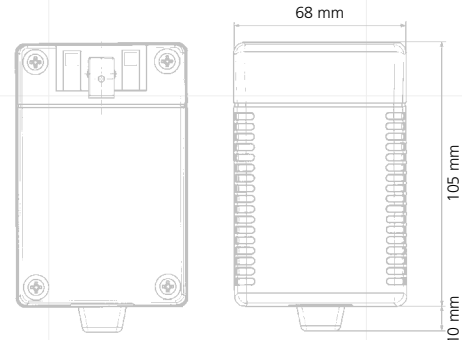
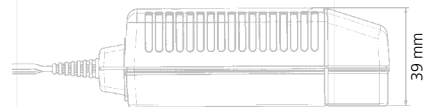
255 g

#### Plug connector

AC input: FRIWO exchangeable mains plug system: EURO, UK, USA/Japan, Australia, IEC

DC output: Universal output plug system

MPP 30



MPP 30

Output data			Worldwide	Internally adjustable			Worldwide
Voltage	Current	Ripple Volt.	Order No.	Voltage	Current	Ripple Volt.	Order No.
5 V	4000 mA	75 mV pp	1811463	5 to 15 V	1700 to 2700 mA	ca. 1% U out	1811820
6 V	3600 mA	80 mV pp	1811464	15 to 48 V	550 to 1400 mA	ca. 1% U out	1811819
7.5 V	3300 mA	90 mV pp	1811465				
9 V	3000 mA	90 mV pp	1811466				
12 V	2500 mA	100 mV pp	1806413				
15 V	2000 mA	100 mV pp	1811467				
18 V	1660 mA	120 mV pp	1811483				
24 V	1250 mA	80 mV pp	1811484				

13 MPP 30

# Switchmode Power Supply

## MPP 15 S (switchable)

Conforms to IEC 60950

15 Watts



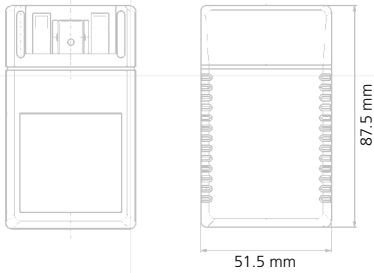
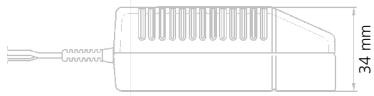
### Applications

- Battery operated equipment
- Digital photography
- Prototype development
- MP3 Player
- DVD and CD Player

### Characteristics

- Universal input 100 to 240 V AC
- Output switchable
- Interchangeable primary adapters
- Constant voltage, current limited
- Low leakage current  $\leq 100 \mu\text{A}$
- Low standby power  $\leq 0.5 \text{ Watts}$
- Continuously short circuit proof

MPP 15 S



MPP 15 S

### Technical data

**Input voltage**

100 to 240 V AC

**Input current**

400 mA

**Frequency**

50 to 60 Hz

**Efficiency**

80% typ. at full load

**EMC**

Conforms to EN 55011, EN 55014, EN 55022/B, FCC 47 part 15, EN 61000-3-2, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-11

**Output voltage tolerance**

$\pm 5\%$

### Environmental specification

**Operating temp.**

0 to 40° C at maximum load

**Storage temp.**

-10 to 70° C

**Humidity**

5% to 95% non condensing

**Input transient susceptibility**

Complies with IEC 61000 requirements

### Safety specification

**Standards**

Fulfils Class II SELV for the following applications: EN 60950/IEC 60950, UL 60950, CSA 950 (cUL), VDE, CE label

### Reliability specification

**MTBF calculation**

200,000 hours at maximum load levels and an ambient temperature of 25° C (in correspondence with MIL-HDBK-217)

### Mechanical specification

**Weight approx.**

160 g

**Plug connector**

AC input: FRIWO exchangeable mains plug system: EURO, UK, USA/Japan, Australia, IEC  
DC output: Universal output plug system

14 MPP 15 S (switchable)

Output data			Worldwide
Voltage	Current	Ripple Volt.	Order No.
3, 3.5, 5, 6, 7 V	1700 mA	75 mV pp	1890682
3, 4.5, 6, 9, 12 V	1300 mA	150 mV pp	1823255

# Switchmode Power Supply

## DT 12

Conforms to IEC 60950

### Applications

- Office equipment
- Data transmission devices
- IT equipment
- Measurement and weighing technology

### Characteristics

- Universal input 100 to 240 V AC
- EMC conformity
- High performance
- Constant voltage, current limited
- Compact desktop unit
- Low leakage current  $\leq 10 \mu\text{A}$
- Low standby power  $\leq 0.5 \text{ Watts}$
- Continuously short circuit proof



12 Watts

### Technical data

#### Input voltage

100 to 240 V AC

#### Input current

300 mA

#### Frequency

50 to 60 Hz

#### Efficiency

80% typ. at full load

#### EMC

Conforms to EN 55011, EN 55014, EN 55022/B, FCC 47 part 15, EN 61000-3-2, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-11

#### Output voltage tolerance

$\pm 5\%$

### Environmental specification

#### Operating temp.

0 to 40° C at maximum load

#### Storage temp.

-10 to 70° C

#### Humidity

5% to 95% non condensing

#### Input transient susceptibility

Complies with IEC 61000 requirements

### Safety specification

#### Standards

Fulfils Class II SELV for the following applications: EN 60950/IEC 60950, UL 60950, CSA 950 (cUL), VDE, CE label

### Reliability specification

#### MTBF calculation

200,000 hours at maximum load levels and an ambient temperature of 25° C (in correspondence with MIL-HDBK-217)

### Mechanical specification

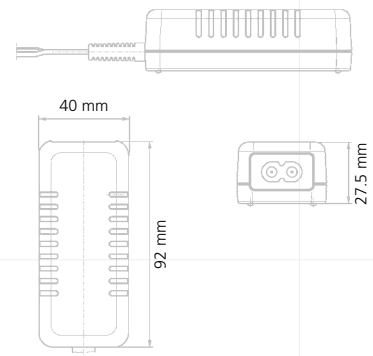
#### Weight approx.

135 g

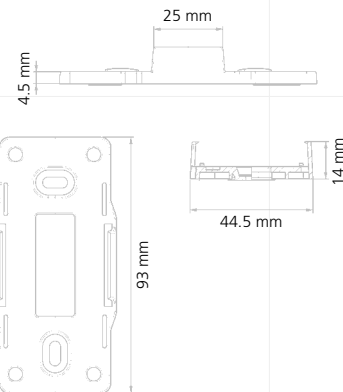
#### Plug connector

AC input: 2 pin IEC 320, C8 input socket  
DC output: Universal output plug system

DT 12



DT 12



Wall fastening (optional)

Output data			Worldwide
Voltage	Current	Ripple Volt.	Order No.
5 V	2000 mA	120 mV pp	1890577
6 V	1700 mA	120 mV pp	1890578
7.5 V	1400 mA	115 mV pp	1890579
9 V	1200 mA	135 mV pp	1890581
12 V	1000 mA	180 mV pp	1890580
15 V	800 mA	112 mV pp	1890584
18 V	660 mA	135 mV pp	1890583
24 V	500 mA	300 mV pp	1890582
48 V	250 mA	480 mV pp	1812311
Wall fastening			1813578

15 DT 12

# Switchmode Power Supply

## DT 40

Conforms to IEC 60950



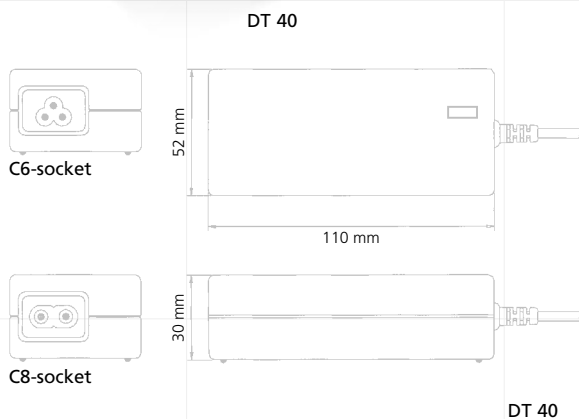
40 Watts

### Applications

- Printers
- Computer accessories
- Telecommunication equipment
- Automation technology
- TFT displays

### Characteristics

- Universal input 100 to 240 V AC
- High performance
- Compact desktop unit
- Overvoltage and short circuit protection
- Overload protection
- LED indicator



### Technical data

**Input voltage**  
**Input current**  
**Frequency**  
**Efficiency**  
**Inrush current**  
**EMC**

100 to 240 V AC  
1.5 A  
47 to 63 Hz  
70% typ. at full load  
max. 30 A at 100 V cold start  
Conforms to FCC, CISPR 22, EN 55022/B,  
IEC 61000-4-3, IEC 61000-4-6

**Output voltage tolerance**

± 5%

### Environmental specification

**Operating temp.**  
**Storage temp.**  
**Humidity**  
**Input transient susceptibility**

0 to 40° C at maximum load  
-20 to 85° C  
5% to 95% non condensing  
Complies with IEC 61000 requirements

### Safety specification Standards

Fulfils Class II SELV for the following applications: EN 60950/IEC 60950, TÜV GS, UL 60950, CSA 950 (cUL), VDE, CE label, CCEE/CCIB GB 4943

### Reliability specification

**MTBF calculation**

50,000 hours at maximum load levels and an ambient temperature of 25° C (in correspondence with MIL-HDBK-217)

### Mechanical specification

**Weight approx.**  
**Plug connector**

260 g  
AC input: 2-pin IEC 320, C8\* input socket  
DC output: Universal output plug system

\* 3-pin IEC 320, C6 available for OEM quantities

Output data			Worldwide
Voltage	Current	Ripple Volt.	Order No.
5 V	5 A max.	250 mV pp	1823742
6 V	5 A max.	190 mV pp	1823743
7.5 V	4 A max.	150 mV pp	1823744
9 V	4 A max.	90 mV pp	1826019
12 V	3.75 A max.	150 mV pp	1823745
15 V	3.0 A max.	150 mV pp	1823746
18 V	2.5 A max.	180 mV pp	1826030
19 V	2 A max.	190 mV pp	1823747
24 V	1.6 A max.	240 mV pp	1823748



# Switchmode Power Supply

## DT 60

Conforms to IEC 60950

### Applications

- Notebooks
- Computer accessories
- Telecommunication equipment
- Automation technology
- TFT displays

### Characteristics

- Universal input 100 to 240 V AC
- High performance
- Compact desktop unit
- Overvoltage and short circuit protection
- Overload protection
- LED indicator



60 Watts

### Technical data

#### Input voltage

100 to 240 V AC

#### Input current

1.5 A

#### Frequency

47 to 63 Hz

#### Efficiency

80% typ. at full load

#### Inrush current

max. 30 A at 100 V cold start

#### EMC

Conforms to FCC, CISPR 22, EN 55022/B, IEC 61000-4-3, IEC 61000-4-6

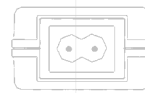
#### Output voltage tolerance

± 5%

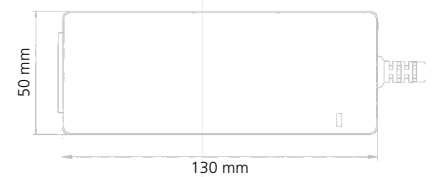
DT 60



C6-socket



C8-socket



### Environmental specification

#### Operating temp.

0 to 40° C at maximum load

#### Storage temp.

-20 to 85° C

#### Humidity

5% to 90% non condensing

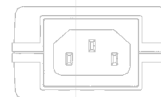
#### Input transient susceptibility

Complies with IEC 61000 requirements

### Safety specification

#### Standards

Fulfils Class II SELV for the following applications: EN 60950/IEC 60950, TÜV GS, UL 60950, CSA 950 (cUL), VDE, CE label, CCEE/CCIB GB 4943



C14-socket



DT 60

### Reliability specification

#### MTBF calculation

50,000 hours at maximum load levels and an ambient temperature of 25° C (in correspondence with MIL-HDBK-217)

### Mechanical specification

#### Weight approx.

290 g

#### Plug connector

AC input: 2-pin IEC 320, C8\* input socket  
DC output: Universal output plug system

\* 3-pin IEC 320, C6 or C 14 available for OEM quantities

Output data			Worldwide
Voltage	Current	Ripple Volt.	Order No.
7.5 V	6 A max.	200 mV pp	1823750
9 V	6 A max.	90 mV pp	1826020
12 V	5 A max.	150 mV pp	1823751
15 V	4 A max.	150 mV pp	1823752
18 V	4 A max.	180 mV pp	1826031
19 V	3 A max.	200 mV pp	1823753
20 V	3 A max.	200 mV pp	1826169
24 V	2.5 A max.	240 mV pp	1823754

# Switchmode Power Supply PP 8 Medical

Conforms to IEC 60601-1

8 Watts



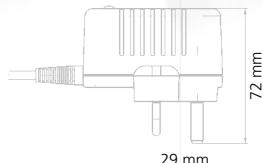
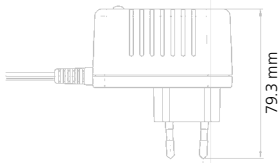
## Characteristics

- Universal input 100 to 240 V AC
- EMC conformity
- High performance
- Constant voltage, current regulated
- Light weight, compact size
- Low leakage current  $\leq 10 \mu\text{A}$
- Low standby power  $\leq 0.3$  Watts
- Continuously short circuit proof
- Green LED indicator

## Applications

- Blood analyzer
- Patient monitors
- Measuring instruments
- Laboratory equipment

PP 8 Medical



## Technical data

### Input voltage

100 to 240 V AC

### Input current

200 mA

### Frequency

50 to 60 Hz

### Efficiency

75% typ. at full load

### EMC

Conforms to EN 55011, EN 55014, EN 55022/B, FCC 47 part 15, EN 61000-3-2, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-11

## Output voltage tolerance

$\pm 5\%$

## Environmental specification

### Operating temp.

0 to 40° C at maximum load

### Storage temp.

-10 to 70° C

### Humidity

5% to 95% non condensing

## Input transient susceptibility

Complies with IEC 61000 requirements

## Safety specification Standards

Fulfils Class II SELV for the following applications: IEC 60601-1, UL 2601, VDE, CE label, fullfills class B/BF/CF for medical applications

## Reliability specification

### MTBF calculation

200,000 hours at maximum load levels and an ambient temperature of 25° C (in correspondence with MIL-HDBK-217)

## Mechanical specification

### Weight approx.

110 g

### Plug connector

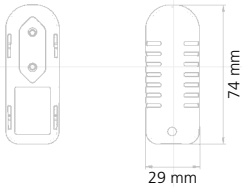
AC input: Mains plugs are available for the following regions:  
EURO, UK, USA/Japan\*  
DC output: Universal output plug system

## Market leading Medical power supplies

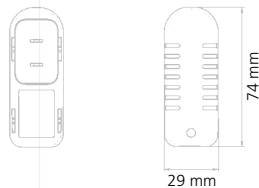
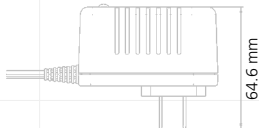
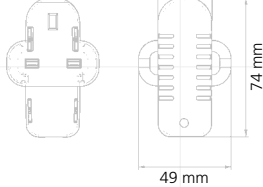
100 to 240 V input voltage without earthing, leakage current  $\leq 10 \mu\text{A}$

\* Australian version available for OEM quantities

PP 8 Medical EURO



PP 8 Medical UK



PP 8 Medical USA/Japan

Output data			EURO	UK	USA/Japan
Voltage	Current	Ripple Volt.	Order No.	Order No.	Order No.
3 V	1700 mA	300 mV pp	1819728	1819729	1819730
5 V	1300 mA	200 mV pp	1883631	1814910	1814918
6 V	1150 mA	180 mV pp	1883632	1814911	1814919
7.5 V	900 mA	150 mV pp	1883633	1814912	1814920
9 V	800 mA	150 mV pp	1883634	1814913	1814921
12 V	700 mA	150 mV pp	1883635	1814914	1814922
15 V	530 mA	150 mV pp	1883636	1814915	1814923
18 V	440 mA	150 mV pp	1883637	1814916	1814924
24 V	330 mA	150 mV pp	1883638	1814917	1814925

# Switchmode Power Supply

## DT 12 Medical

Conforms to IEC 60601-1

### Applications

- Blood analyzer
- Patient monitors
- Measuring instruments
- Laboratory equipment

### Characteristics

- Universal input 100 to 240 V AC
- EMC conformity
- High performance
- Constant voltage, current limited
- Compact desktop unit
- Low leakage current  $\leq 10 \mu\text{A}$
- Standby power  $\leq 0.5$  Watts
- Continuously short circuit proof
- Green LED indicator



12 Watts

### Technical data

**Input voltage**  
**Input current**  
**Frequency**  
**Efficiency**  
**EMC**

100 to 240 V AC  
300 mA  
50 to 60 Hz  
80% typ. at full load  
Conforms to EN 55011, EN 55014, EN 55022/B,  
FCC 47 part 15, EN 61000-3-2, EN 61000-4-2,  
EN 61000-4-3, EN 61000-4-4, EN 61000-4-5,  
EN 61000-4-6, EN 61000-4-11

**Output voltage tolerance**

$\pm 5\%$

### Environmental specification

**Operating temp.**  
**Storage temp.**  
**Humidity**  
**Input transient susceptibility**

0 to 40° C at maximum load  
-10 to 70° C  
5% to 95% non condensing

Complies with IEC 61000 requirements

**Safety specification Standards**

Fulfils Class II SELV for the following applications: IEC 60601-1, UL 2601, VDE, CE label, fulfils medical application class B/BF/CF

### Reliability specification

**MTBF calculation**

200,000 hours at maximum load levels and an ambient temperature of 25° C (in correspondence with MIL-HDBK-217)

### Mechanical specification

**Weight approx.**  
**Plug connector**

135 g  
AC input: 2 pin IEC 320, C8 input socket  
DC output: Universal output plug system

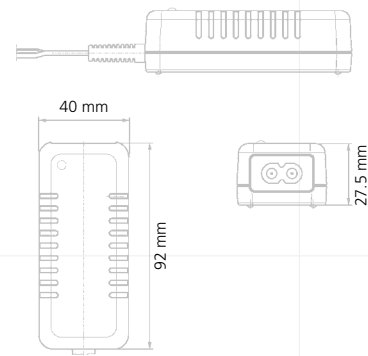
### Market leading

**Medical power supplies**

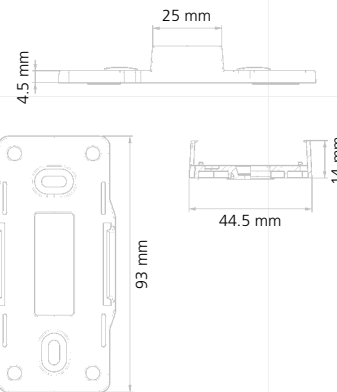
100 to 240 V input voltage without earthing, leakage current  $\leq 10 \mu\text{A}$

Scheduled for Q1/2006

DT 12 Medical



DT 12 Medical



Wall fastening (optional)

Output data			Worldwide
Voltage	Current	Ripple Volt.	Order No.
5 V	2000 mA	120 mV pp	1826391
6 V	1700 mA	120 mV pp	1826392
7.5 V	1400 mA	115 mV pp	1826393
9 V	1200 mA	135 mV pp	1826394
12 V	1000 mA	180 mV pp	1826395
15 V	800 mA	112 mV pp	1826396
18 V	660 mA	135 mV pp	1826397
24 V	500 mA	300 mV pp	1826398
Wall fastening			1813578

19 DT 12 Medical

# Switchmode Power Supply

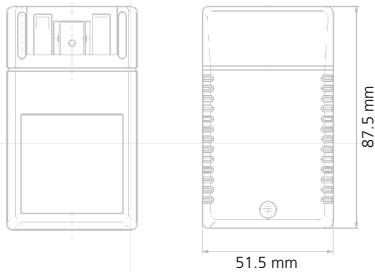
## MPP 15 Medical

Conforms to IEC 60601-1

15 Watts



MPP 15 Medical



MPP 15 Medical

### Applications

- Blood analyzer
- Patient monitors
- Measuring instruments
- Laboratory equipment

### Characteristics

- Universal input 100 to 240 V AC
- Interchangeable primary adapters
- Constant voltage, current limited
- Green LED indicator
- Low leakage current  $\leq 10 \mu\text{A}$
- Low standby power  $\leq 0.5$  Watts
- Continuously short circuit proof

### Technical data

<b>Input voltage</b>	100 to 240 V AC
<b>Input current</b>	400 mA
<b>Frequency</b>	50 to 60 Hz
<b>Efficiency</b>	80% typ. at full load
<b>EMC</b>	Conforms to EN 55011, EN 55014, EN 55022/B, FCC 47 part 15, EN 61000-3-2, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-11

### Output voltage tolerance

$\pm 5\%$

### Environmental specification

<b>Operating temp.</b>	0 to 40 °C at maximum load
<b>Storage temp.</b>	-10 to 70°C
<b>Humidity</b>	5% to 95% non condensing
<b>Input transient susceptibility</b>	Complies with IEC 61000 requirements

### Safety specification

**Standards**  
Fulfils Class II SELV for the following applications: IEC 60601-1, UL 2601, VDE, CE label, fulfils medical application class B/BF/CF

### Reliability specification

<b>MTBF calculation</b>	200,000 hours at maximum load levels and an ambient temperature of 25° C (in correspondence with MIL-HDBK-217)
-------------------------	--

### Mechanical specification

<b>Weight approx.</b>	160 g
<b>Plug connector</b>	AC input: FRIWO exchangeable mains plug system: EURO, UK, USA/Japan, Australia, IEC DC output: Universal output plug system

### Market leading Medical power supplies

100 to 240 V input voltage without earthing, leakage current  $\leq 10 \mu\text{A}$

Output data			Worldwide
Voltage	Current	Ripple Volt.	Order No.
5 V	2400 mA	75 mV pp	1883256
6 V	2100 mA	75 mV pp	1883257
7.5 V	1700 mA	75 mV pp	1883258
9 V	1500 mA	90 mV pp	1883259
12 V	1250 mA	120 mV pp	1883260
15 V	1000 mA	150 mV pp	1883261
18 V	840 mA	180 mV pp	1883262
24 V	625 mA	240 mV pp	1883263

20 MPP 15 Medical

# Switchmode Power Supply

## MPP 30 Medical

Conforms to IEC 60601-1

### Applications

- Inhalers
- Patient monitors
- Patient lifts
- Measuring instruments
- Laboratory equipment

### Characteristics

- Universal input 100 to 240 V AC
- Interchangeable primary adapters
- Constant voltage, current limited
- Green LED indicator
- Low leakage current  $\leq 10 \mu\text{A}$
- Low standby power  $\leq 0.5$  Watts
- Continuously short circuit proof



MPP 30 Medical

### Technical data

#### Input voltage

100 to 240 V AC

#### Input current

700 mA

#### Frequency

50 to 60 Hz

#### Efficiency

80% typ. at full load

#### EMC

Conforms to EN 55011, EN 55014, EN 55022/B, FCC 47 part 15, EN 61000-3-2, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-11

#### Output voltage tolerance

$\pm 5\%$

### Environmental specification

#### Operating temp.

0 to 40° C at maximum load

#### Storage temp.

-10 to 70° C

#### Humidity

5% to 95% non condensing

#### Input transient susceptibility

Complies with IEC 61000 requirements

### Safety specification

#### Standards

Fulfils Class II SELV for the following applications: IEC 60601-1, UL 2601, VDE, CE label, fulfils medical application class B/BF/CF

### Reliability specification

#### MTBF calculation

200,000 hours at maximum load levels and an ambient temperature of 25° C (in correspondence with MIL-HDBK-217)

### Mechanical specification

#### Weight approx.

255 g

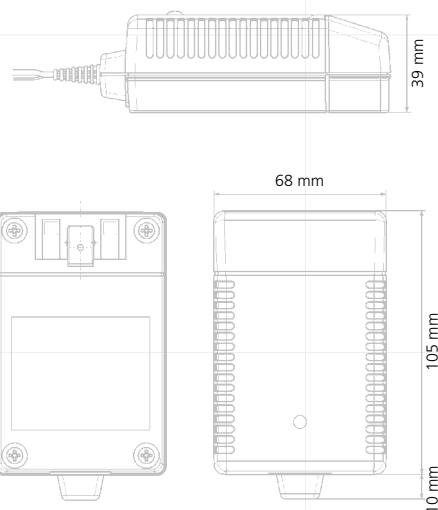
#### Plug connector

AC input: FRIWO exchangeable mains plug system: EURO, UK, USA/Japan, Australia, IEC  
DC output: Universal output plug system

### Market leading

#### Medical power supplies

100 to 240 V input voltage without earthing, leakage current  $\leq 10 \mu\text{A}$



MPP 30 Medical

Output data			Worldwide
Voltage	Current	Ripple Volt.	Order No.
5 V	4000 mA	75 mV pp	1883264
6 V	3600 mA	75 mV pp	1883265
7.5 V	3300 mA	75 mV pp	1883266
9 V	3000 mA	90 mV pp	1883267
12 V	2500 mA	100 mV pp	1883268
15 V	2000 mA	100 mV pp	1883269
18 V	1660 mA	120 mV pp	1883270
24 V	1250 mA	120 mV pp	1883271

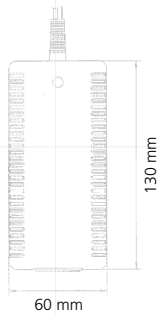
# Switchmode Power Supply DT 50 Medical

Conforms to IEC 60601-1

50 Watts



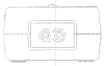
DT 50 Medical



DT 50 Medical



C6-socket



C8-socket



C14-socket

Scheduled for Q1/2006

## Applications

- Inhalers
- Patient monitors
- Infusion pumps
- Measuring equipment
- Laboratory equipment

## Characteristics

- Universal input 100 to 240 V AC
- EMC conformity
- High performance
- Constant voltage, current limited
- Compact desktop unit
- Low leakage current  $\leq 10 \mu\text{A}$
- Standby power  $\leq 0.75$  Watts
- Continuously short circuit proof
- Green LED indicator

## Technical data

### Input voltage

100 to 240 V AC

### Input current

1000 mA

### Frequency

50 to 60 Hz

### Efficiency

80% typ. at full load

### EMC

Conforms to EN 55011, EN 55014, EN 55022/B, FCC 47 part 15, EN 61000-3-2, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-11

### Output voltage tolerance

$\pm 5\%$

## Environmental specification

### Operating temp.

0 to 40° C at maximum load

### Storage temp.

-10 to 70° C

### Humidity

5% to 95% non condensing

### Input transient susceptibility

Complies with IEC 61000 requirements

## Safety specification

### Standards

Fulfils Class II SELV for the following applications: IEC 60601-1, UL 2601, VDE, CE label, fulfils medical application class B/BF/CF

## Reliability specification

### MTBF calculation

200,000 hours at maximum load levels and an ambient temperature of 25° C (in correspondence with MIL-HDBK-217)

## Mechanical specification

### Weight approx.

295 g including a 2 metre output cable

### Plug connector

AC input: 2 pin IEC 320, C8\* input socket  
DC output: Universal output plug system (12V / 24V)  
Lead with ends stripped and tinned (5V)

## Market leading

### Medical

### power supplies

100 to 240 V input voltage without earthing, leakage current  $\leq 10 \mu\text{A}$

\* 3-pin IEC 320, C6 and C14 available for OEM quantities

Output data			Worldwide
Voltage	Current	Ripple Volt.	Order No.
5 V	6000 mA	100 mV pp	1890649
12 V	3800 mA	150 mV pp	1890650
24 V	2200 mA	240 mV pp	1825898

# Linear Power Supply

## Linear Technology

Linear Power supply units are used to supply devices with direct or alternating current for applications in all kinds of areas: information and communication technology, electrical devices in medical applications, automation, devices for open and closed loop control, testing, etc.

For the entire product, the selection of the power supply unit has considerable influence on important viewpoints such as function, safety, and service life of the operated devices and installations. Especially for stationary applications, the use of linear power supply units (i.e. power supply units with transformers) continues to be an option that can be selected for reasons of long-term stability, the avoidance of high-frequency disturbances, or due to cost and availability.

In the selection of the "right" power supply unit, all technical requirements should be taken into consideration from the start, whereby both mechanical and electrical requirements are included. This results in criteria for the selection of the various circuitry options dealt with in the following. The requirements on the stability of the output voltage, its type (direct or alternating voltage), any load fluctuations occurring during use, and their acceptability in regard to the output values, ripple, etc. must be clarified. In addition, any requirements from the application in regard to mechanical stability and use in a particular environment (e.g. humidity, temperature) must be taken into consideration. On the basis of these values, the optimum solution for guaranteeing a malfunction-free operation of the devices can be determined.

### **Power Supply Units with Alternating Voltage (AC/AC)**

In the case of these power supply units, the alternating voltage of the low-voltage mains (usually 230 V AC/50 Hz in Europe or 120 V AC/60 Hz in the United States) is reduced to an extra-low voltage such as 24 V AC using a safety transformer. In addition, the transformer also provides the safety isolation function from the mains voltage.

### **Unregulated Power Supply Units (AC/DC)**

In addition to the transformer, a rectifier for creating a direct voltage has been installed in this case. This pulsing direct voltage can be smoothed by using an additional capacitor. External influences on the input or output side, such as mains voltage or load fluctuations, however, still lead to fluctuations in the output voltage. The efficiency of these simple devices lies under 70%.

### **Regulated Power Supply Units (AC/DC reg.)**

For the better stabilisation of the output voltage, that is, for protection against mains voltage and load fluctuations, a semiconductor circuit can be added. A power transistor, for example, is installed behind the smoothing capacitor. According to the circuit concept, the output voltage, the output current or both can be stabilised. Depending on the system, however, the efficiency only lies at about 50%.

# OEM Linear Program

## EI 28/EI 35

Conforms to IEC 61558



EI 35

EI 28

### Applications

- Consumer products
- Small office equipment
- Personal electronic power
- Household applications

### Characteristics

- Lowest cost linear
- Enclosed plastic case
- Sturdy Design

### EI 28

#### Versions

USA/Japan, China

(other versions upon request)

#### Output values

AC/AC	3 V AC to 24 V AC	2.4 VA max.
AC/DC	3 V DC to 24 V DC	1.9 VA max.

### EI 35

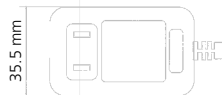
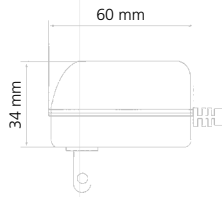
#### Versions

EURO, USA/Japan, China

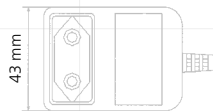
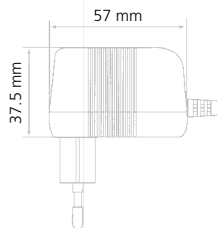
(other versions upon request)

#### Output values

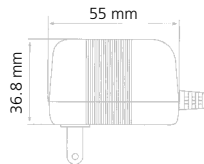
AC/AC	3 V AC to 24 V AC	9 VA max.
AC/DC	3 V DC to 24 V DC	7.2 VA max.



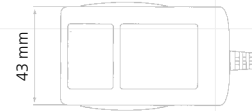
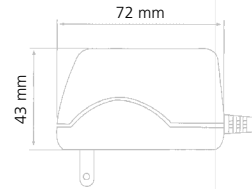
EI 28 USA/Japan



EI 35 EURO



EI 35 USA/Japan



EI 35 USA/Japan



# OEM Linear Program

## EI 41/EI 48

Conforms to IEC 61558

### Applications

- Consumer products
- Small office equipment
- Personal electronic power
- Household applications

### Characteristics

- Lowest cost linear
- Enclosed plastic case
- Sturdy Design



EI 41

EI 48

### EI 41

#### Versions

#### Output values

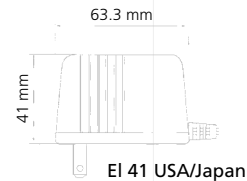
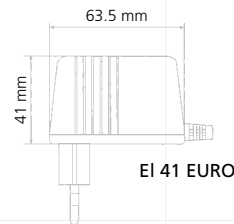
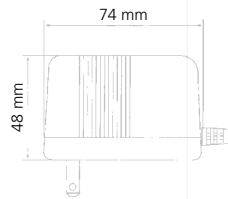
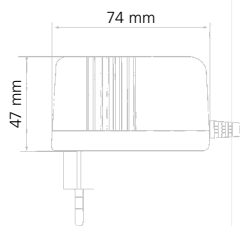
	EURO, USA/Japan, UK, Australia, China	
AC/AC	3 V AC to 27 V AC	12 VA max.
AC/DC	3 V DC to 24 V DC	9.6 VA max.

### EI 48

#### Versions

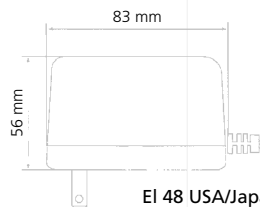
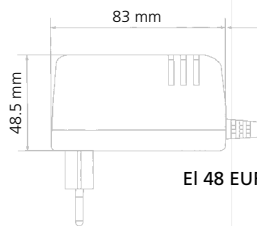
#### Output values

	EURO, USA/Japan, UK, Australia, China	
AC/AC	5 V AC to 27 V AC	25 VA max.
AC/DC	3.35 V DC to 25 V DC	20 VA max.



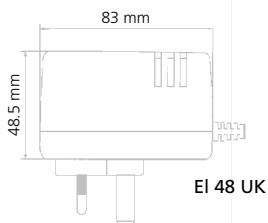
EI 41 EURO

EI 41 USA/Japan

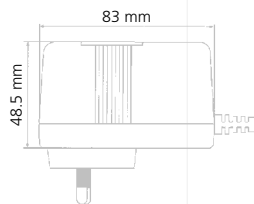


EI 48 EURO

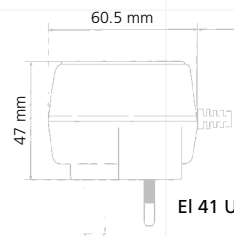
EI 48 USA/Japan



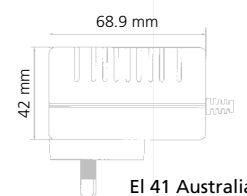
EI 48 UK



EI 48 Australia



EI 41 USA/Japan



EI 41 EURO

In the field of charger technology, FRIWO offers an extensive range of lead acid, nickel cadmium, nickel metal hydride, and lithium ion chargers. These chargers are used in various areas, e.g. in medical applications for stationary or portable medical devices, electrical wheelchairs, bicycles in the mobility sector, remote-controlled vehicles in the toy area, and portable devices, such as mobile telephones and laptop computers.

### **Lead Acid Chargers:**

Lead acid cells are still very important today. Their power density cannot compete with NiCd, NiMH, or even lithium cells, but in regard to price/performance ratio, these cell types are always first choice.

In the area of large-scale charging technology, lead acid cells are still preferred for reasons of cost. A modern charger must be able to recognise various situations and react accordingly. It must recognise an optimum, fully charged state, activate or reactivate a cell that has been stored for a long time or a new cell, detect a fault, or just charge as quickly as possible without exceeding the parameters of the cell. Some chargers are equipped with an electronic protective mechanism that makes it possible for the charger to survive a reversal of the batteries without damage. This is only necessary, however, if the connecting lines are not permanently wired or not using polarised connectors.

Like any technical device, chargers, too, are not secure against breakdowns. For this reason, general protective mechanisms have been provided that intervene in case of control system failures. This is also a performance feature of good chargers.

To be able to fulfil these requirements, FRIWO concentrates its efforts on the further development of switchmode chargers that are attractive for the end customer due to their light and compact design and high power outputs.

### **NiCd/NiMH Chargers:**

If devices with a high power consumption, such as cordless screwdrivers, photo flashes, etc. are to be supplied, nickel cadmium batteries are the first choice because they have a very low inner resistance and thus supply higher currents with low voltage drops. Nickel metal hydride cells essentially have a very similar design, with the exception of the replacement of cadmium with the more environmentally friendly metal hydride. A welcome side effect is that the self-discharge is considerably lower and the capacity is higher within the same volume. Due to the higher inner resistance, NiMH batteries are predestined for use in devices with average power consumption, such as toy applications, torches, etc..

To prevent an overcharging of the battery, these chargers have a minus-delta-U cutout and recognition of temperature gradients (static or dynamic), maximum temperature, and time.

### **Li-Ion Chargers:**

Due to the very high power density of lithium ion cells (approx. 120 to 170 Wh/kg) and the resulting low weight, this battery and the required charger are being used more and more often in high-priced devices, such as laptop computers and mobile telephones. The currently higher price of this technology becomes relative in comparison with other batteries due to the higher number of cycles (500 to 1000), the very low self-discharging (5% to 10%/month at 20° C), the high source voltage (3.6V/cell), and the non-existent memory effect.

To be able to utilize the advantages of this type of battery for a long time and to neutralise the high acquisition price, a higher technical charging effort is required since this type of battery does not have an overcharging or excessive discharging tolerance. This necessary technical charging effort is realised by the Li-Ion chargers of FRIWO using a charging and discharging monitoring circuit.

# Switchmode Chargers

## Lead Acid

Conforms to IEC 60335 and IEC 60601-1 (for PP8, MPP 15/30)

### Applications

- Starter batteries
- Cleaning machines
- Stair lifts/patient lifts
- Electrical vehicles
- Mobile lighting
- Mobile measuring technology
- Professional photographic technology

### Characteristics

- Low leakage current  $\leq 10 \mu\text{A}$  (except DT 80)
- Medical standard EN 60601-1
- EMC conformity
- Low standby power
- Constant current
- Light weight, compact size
- High performance
- LED charging display

### Technical data

#### Input voltage

230 V AC (DT 80),  
100 to 240 V AC (PP 8, MPP 15/30)

#### Input current

130 mA (PP8), 250 mA (MPP 15),  
500 mA (MPP 30), 600 mA (DT 80)

#### Frequency

50 to 60 Hz

#### Efficiency

75% typ. at full load

#### EMC

Conforms to EN 55011, EN 55014, EN 55022/B,  
FCC 47 part 15, EN 61000-3-2, EN 61000-4-2,  
EN 61000-4-3, EN 61000-4-4, EN 61000-4-5,  
EN 61000-4-6, EN 61000-4-11

### Environmental specification

#### Operating temp.

0 to 40° C at maximum load

#### Storage temp.

-10 to 70° C

#### Humidity

5% to 95% non condensing

#### Input transient susceptibility

Complies with IEC 61000 requirements

### Safety specification

#### Standards

Fulfils Class II SELV for the following applications:  
IEC 60601-1, UL 60601-1 (PP 8, MPP 15/30),  
IEC 60335-2-29 (DT 80), VDE, CE label

### Reliability specification

#### MTBF calculation

200,000 hours at maximum load levels and  
an ambient temperature of 25° C  
(in correspondence with MIL-HDBK-217)

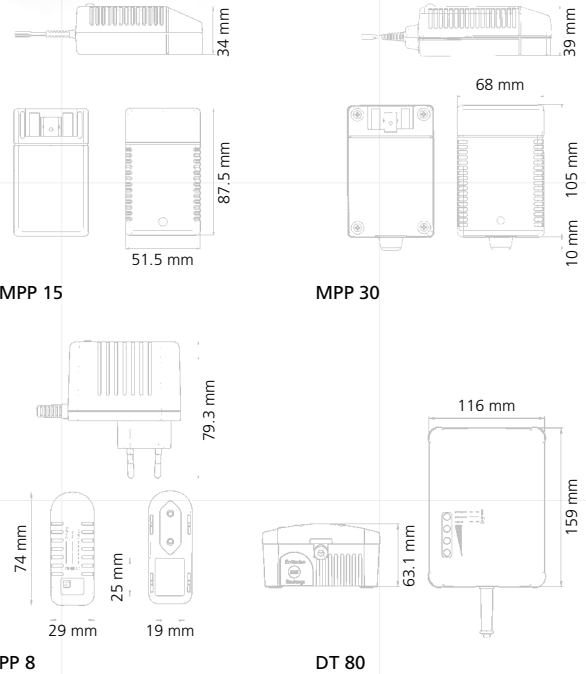
### Mechanical specification

#### Weight approx.

700 g (DT 80), 72 g (PP 8), 130 g (MPP 15),  
278 g (MPP 30)

#### Plug connector

AC input: EURO, UK, USA/Japan (PP 8\*),  
FRIWO exchangeable mains plug  
system: EURO, UK, USA/Japan,  
Australia, IEC (MPP 15/30),  
2 Pin IEC 320, C8 socket (DT 80)



#### Plug connector

DC output: Universal output plug system  
(optionally customer specific)  
(PP 8, MPP 15/30), pole clamps (DT 80)

#### Reverse polarity and short circuit

Protected against reverse polarity (only  
MPP 15/30 and DT 80) and continuously  
short circuit proof.

### Output data

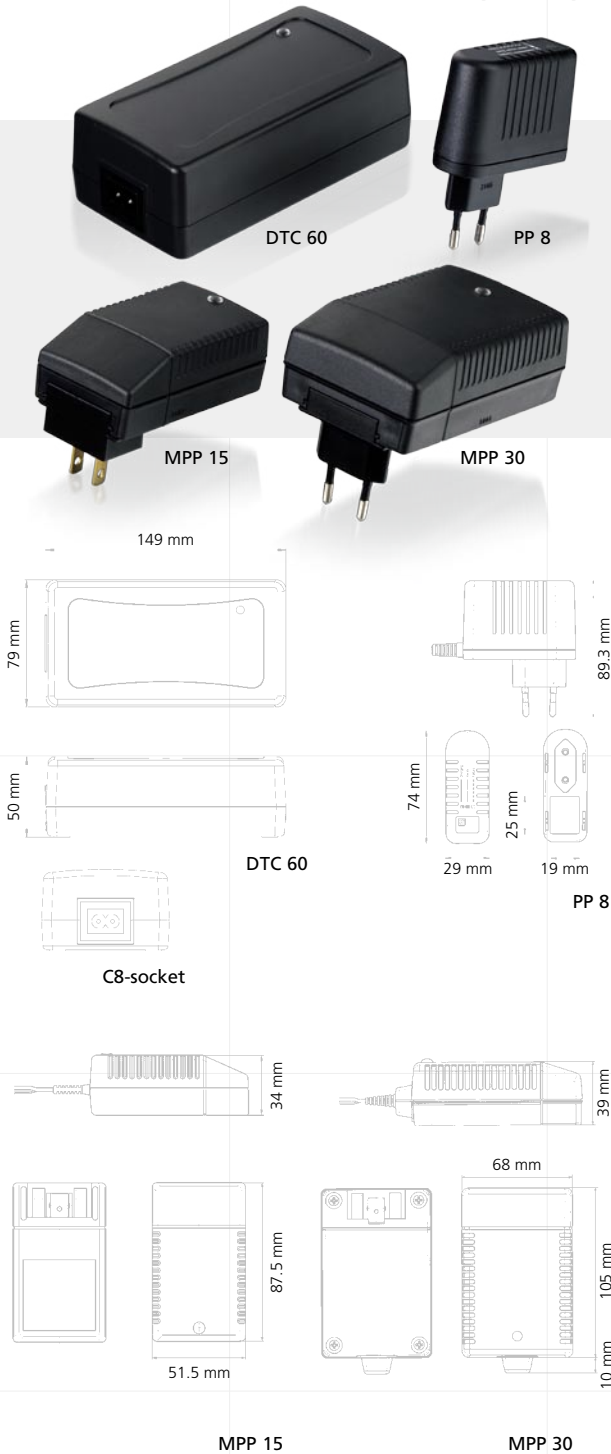
Voltage	Current	No. of cells	Capacity	Characteristics	Housing	Order No.
6 V	900 mA	3	2.4 to 16.0 Ah	IUOU	PP 8 EU	1890125
6 V	900 mA	3	2.4 to 16.0 Ah	IUOU	PP 8 UK	1824106
6 V	900 mA	3	2.4 to 16.0 Ah	IUOU	PP 8 US	1824107
6 V	1600 mA	3	4.8 to 32.0 Ah	IUOU	MPP 15	1890126
6 V	3000 mA	3	9.0 to 60.0 Ah	IUOU	MPP 30	1890129
12 V	500 mA	6	1.5 to 10.0 Ah	IUOU	PP 8 EU	1824396
12 V	500 mA	6	1.5 to 10.0 Ah	IUOU	PP 8 US	1825090
12 V	1000 mA	6	3.0 to 20.0 Ah	IUOU	MPP 15	1890240
12 V	2000 mA	6	6.0 to 40.0 Ah	IUOU	MPP 30	1890243
12 V	5000 mA	6	25.0 to 40.0 Ah	IUOU	DT 80 EU/UK	1882566
24 V	500 mA	12	1.5 to 10.0 Ah	IUOU	MPP 15	1890241
24 V	1000 mA	12	3.0 to 20.0 Ah	IUOU	MPP 30	1890130
24 V	1500 mA	12	4.5 to 30.0 Ah	IUOU	MPP 30	1890222
24 V	2000 mA	12	10.0 to 16.0 Ah	IUOU	DT 80 EU/UK	1882567

\* Australian version available for OEM quantities

# Switchmode Chargers

## NiCd/NiMH

Conforms to IEC 60335 and IEC 60601-1 (MPP 15)



Scheduled for Q1/2006 (MPP 15/DTC 60)

### Applications

- Diving lights
- Electrical vehicles
- Cleaning machines
- Stair lifts/patient lifts
- Medical technology
- Mobile lighting

### Characteristics

- Interchangeable primary adapters (MPP 15/30)
- Low standby power
- EMC conformity
- Constant Current
- -delta-U or gradient recording of the temperature ( $\Delta T/\Delta t$ )

### Technical data

**Input voltage**  
**Input current**

230 V AC (DTC 60), 100 to 240 V AC (PP 8, MPP 15/30)  
0.45 A (DTC 60), 0.2 A (PP 8),  
0.28 A (MPP 15), 0.4 A (MPP 30)

**Frequency**  
**Efficiency**  
**EMC**

50 to 60 Hz  
80% typ. at full load  
Conforms to: EN 55011, EN 55014, EN 55022/B,  
EN 61000-3-2, EN 61000-4-2, EN 61000-4-3,  
EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-11

**Output current tolerance**

$\pm 10\%$

### Environmental specification

**Operating temp.**  
**Storage temp.**  
**Humidity**  
**Input transient susceptibility**

0 to 40°C at maximum load  
-10 to 70°C  
5% to 95% non condensing

Complies with IEC 61000 requirements

### Safety specification

**Standards**

Fulfils Class II SELV for the following applications: IEC 60335-2-29, VDE, CE label, UL 1310, IEC 60601-1 (MPP 15)

### Reliability specification

**MTBF calculation**

100,000 hours at maximum load levels and an ambient temperature of 25° C (in correspondence with MIL-HDBK-217)

### Mechanical specification

**Weight approx.**  
**Plug connector**

85 g (PP8), 140 g (MPP15), 278 g (MPP 30), 450 g (DTC 60)  
AC input: EURO, UK, USA/Japan (PP 8), FRIWO exchangeable mains plug system: EURO, UK, USA/Japan, Australia, IEC (MPP 15/30), 2 Pin IEC 320, C8 socket (DTC 60)  
DC output: Universal output plug system (optionally customer specific) (PP 8, MPP 15/30), 3-cond. lead, ends stripped and tinned (temperature control) (MPP 15, DTC 60)

### Highlight

**Protection**

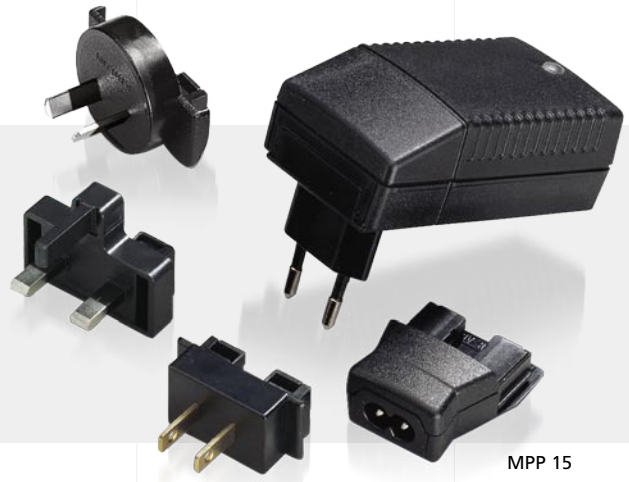
Conforms to IEC 60601-1 Class BF (MPP 15)  
Protected against reverse polarity and continuously short circuit proof (MPP 15, DTC 60)

Output data				Switch-off criteria			Worldwide	EURO	UK	USA/Japan
Capacity	Current	No. of cells	Housing	Time	T. grad	-delta-U	Order No.	Order No.	Order No.	Order No.
1.0 to 20.0 Ah	1700 mA	10 to 20	DTC 60	•	•	•		1890132	1890132	
3.5 to 7.0 Ah	950 mA	10 to 20	MPP 30	•	•	•	1811894			
2.8 to 7.0 Ah	1000 mA	10 to 12	MPP 30	•	•	•	1812609			
2.5 to 4.5 Ah	1400 mA	8 to 12	MPP 30	•	•	•	1880408			
2.5 to 10.0 Ah	2000 mA	5 to 6	MPP 30	•	•	•	1818681			
1.0 to 10.0 Ah	800 mA	4 to 10	MPP 15	•	•	•	1826002			
1.0 to 10.0 Ah	800 mA	4 to 10	MPP 15	•	•	•	1890127			
0.8 to 1.6 Ah	550 mA	5 to 8	PP 8	•	•	•		1824466	1824468	1824467

# Switchmode Chargers

## Li-Ion

Conforms to IEC 60335 and IEC 60601-1



MPP 15

### Applications

- Medical devices
- Commercial applications
- Industrial applications

### Characteristics

- Medical standard EN 60601-1 Class BF
- Leakage current  $\leq 100 \mu\text{A}$
- Low standby power
- IUI0 – characteristic curve
- NTC – control
- Light weight, compact size
- High performance
- LED charging display

### Technical data

#### Input voltage

100 to 240 V AC

#### Input current

130 to 280 mA (240 V AC/100 V AC)

#### Frequency

50 to 60 Hz

#### Efficiency

75% typ. at full load

#### EMC

Conforms to EN 55011, EN 55014, EN 55022/B, FCC 47 part 15, EN 61000-3-2, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-11

### Environmental specification

#### Operating temp.

0 to 40° C at maximum load

#### Storage temp.

-10 to 70° C

#### Humidity

5% to 95% non condensing

#### Input transient susceptibility

Complies with IEC 61000 requirements

### Safety specification

#### Standards

Fulfils Class II SELV for the following applications: IEC 60601-1, UL 2601-1, IEC 60335-2-29, VDE, CE label

### Reliability specification

#### MTBF calculation

200,000 hours at maximum load levels and an ambient temperature of 25° C (in correspondence with MIL-HDBK-217)

### Mechanical specification

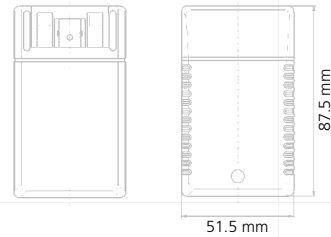
#### Weight approx.

140 g

#### Plug connector

AC input: FRIWO exchangeable mains plug system: EURO, UK, USA/Japan, Australia, IEC

DC output: Universal output plug system, 3 pole Texas connector (NTC) (optionally customer specific)



MPP 15

### Highlight

#### Protection

Conforms to IEC 60601-1 Class BF  
Protected against reverse polarity and continuously short circuit proof

Scheduled for Q1/2006

Output data						Worldwide
Voltage	Current	No. of cells	Capacity*	Characteristics	Housing	Order No.
8.4 V	800 mA	2	0.8 to 10 Ah	IUI0	MPP 15	1826003
12.6 V	800 mA	3	0.8 to 10 Ah	IUI0	MPP 15	1826004
16.8 V	800 mA	4	0.8 to 10 Ah	IUI0	MPP 15	1826006
<b>with NTC</b>						
8.4 V	800 mA	2	0.8 to 10 Ah	IUI0	MPP 15	1826458
12.6 V	800 mA	3	0.8 to 10 Ah	IUI0	MPP 15	1826459
16.8 V	800 mA	4	0.8 to 10 Ah	IUI0	MPP 15	1826460

\* Refer to battery manual

# Linear Chargers NiCd/NiMH

Conforms to IEC 60335



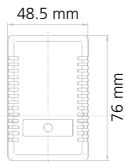
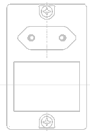
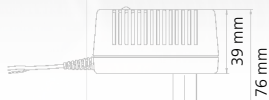
## Applications

- Mobile lighting
- Mobile measuring instruments
- Toy applications
- Photographic technology

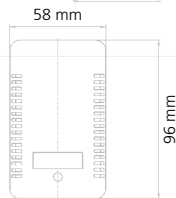
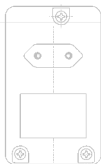
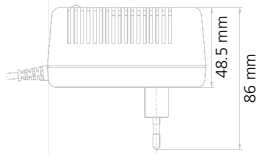
## Characteristics

- Overload protection
- Gentle charging
- LED charging display
- Low EMC emissions

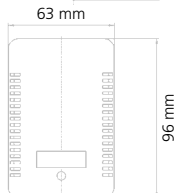
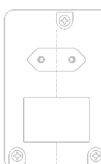
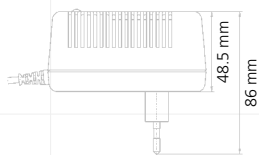
L-54



L-38



L-48



L-54

## Technical data

### Input voltage

120 or 230 V AC

### Input current

280 mA (L-38), 600 mA (L-48), 850 mA (L-54)

### Frequency

50 or 60 Hz

### EMC

Conforms to FCC, CISPR 22, EN 55022/B, EN 61000-4-3, EN 6100-4-6

### Output current tolerance

± 12%

## Environmental specification

### Operating temp.

0 to 40° C at maximum load

### Storage temp.

-10 to 70° C

### Humidity

5% to 95% non condensing

### Input transient susceptibility

Complies with IEC 61000 requirements

## Safety specification

### Standards

Fulfills Class II SELV for the following applications: IEC 60335-2-29, CE label, VDE, UL 1310

## Reliability specification

### MTBF calculation

100,000 hours at maximum load levels and an ambient temperature of 25° C (in correspondence with MIL-HDBK-217)

## Mechanical specification

### Weight approx.

219 g (L-38), 384 g (L-48), 516 g (L-54)

### Plug connector

AC input: EURO, USA/Japan

DC output: Universal output plug system

Output data		No. of cells	Charg. time	Housing	Switch-off criteria	EURO	USA
Capacity	Current						
0.5 to 0.75 Ah	180 mA	2 to 6	4	38/15	-	1815549	
0.5 to 0.75 Ah	115 mA	7 to 11	6	38/15	-	1811315	
1.2 to 1.4 Ah	260 mA	2 to 12	6	48/ 2	-	1811179	
4.0 to 5.0 Ah	400 mA	2 to 12	12	54/ 5	-	1811182	
4.0 to 5.0 Ah	400 mA	2 to 12	12	54/ 6	-		1811827

# DC/DC Adapter Car-Adapter

Conforms to IEC 60950

## Applications

- PDA's
- Navigation systems
- MP3/DVD Player
- Satellite telephones

## Characteristics

- LED indicator
- Constant voltage, current limited



9 Watts

## Technical data

**Efficiency**  
**EMC**

80% typ. at full load  
ECCD 95/54 EG

## Environmental specification

**Operating temp.**  
**Storage temp.**

0 to 40° C at maximum load  
-40 to 70° C

**Safety specification**  
**Standards**

EN 60950/IEC 60950

**Reliability specification**  
**MTBF calculation**

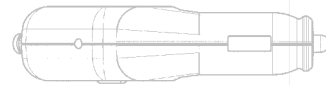
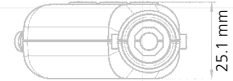
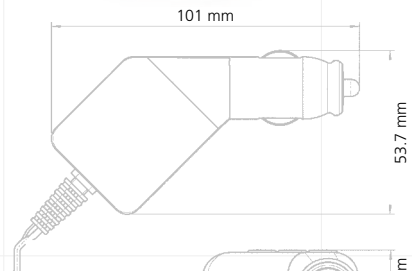
200,000 hours at maximum load levels and  
an ambient temperature of 25° C  
(in correspondence with MIL-HDBK-217)

## Mechanical specification

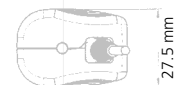
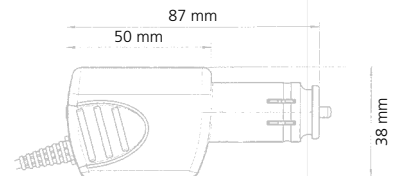
**Weight approx.**  
**Plug connector**

100g  
DC input: Cigarette lighter socket  
DC output: Several output leads are  
available

CLA 6



Type 1



Type 2

Input data		Output data		
Voltage	Voltage	Current	Housing	Order No.
11 to 16 V	6 V	1000 mA	Type 1	1823113
11 to 32 V	8 V	600 mA	Type 2	1882655
11 to 32 V	6 V	800 mA	Type 2	1890333
11 to 32 V	10 V	700 mA	Type 2	1881877
11 to 32 V	6 V	500 mA	Type 2	1881871

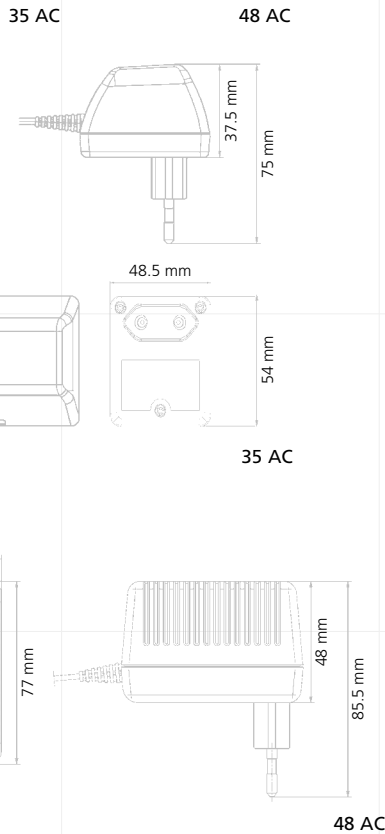
# Linear Power Supply

# AC/AC L 35/48

Conforms to IEC 61558



3 to 20 Watts



### Applications

- Consumer products
- Small office equipment
- Personal electronic power
- Household applications

### Characteristics

- Lowest cost linear
- Enclosed plastic case
- Sturdy product design

### Technical data

**Input voltage**  
**Frequency**  
**EMC**

230 V AC  
50 Hz  
Conforms to FCC, CISPR 22, EN 55022/B,  
IEC 61000-4-3, IEC 61000-4-6

### Environmental specification

**Operating temp.**  
**Storage temp.**

0 to 40° C at maximum load  
-10 to 70° C

### Safety specification

**Standards**

Fulfils Class II SELV for the following applications: EN 61558, CE label

### Reliability specification

**MTBF calculation**

100,000 hours at maximum load levels and an ambient temperature of 25° C (in correspondence with MIL-HDBK-217)

### Mechanical specification

**Weight approx.**  
**Plug connector**

110 g (35 AC), 400 g (48 AC)  
AC input: Mains plugs are available for the following regions: EURO, UK  
AC output: Universal output plug system

Output data			EURO	UK
Voltage	Current	Housing	Order No.	Order No.
6 V	400 mA	35 AC	1883559	
9 V	300 mA	35 AC	1883465	
9 V	1800 mA	48 AC	1883466	1883564
12 V	230 mA	35 AC	1883556	
12 V	1540 mA	48 AC	1883467	
15 V	190 mA	35 AC	1883555	
15 V	1250 mA	48 AC	1883561	
18 V	1000 mA	48 AC	1883554	
24 V	125 mA	35 AC	1883563	
24 V	750 mA	48 AC	1883560	



# Linear Power Supply

## AC/DC L 41/48

Conforms to IEC 61558

### Applications

- Consumer products
- Small office equipment
- Personal electronic power
- Household applications

### Characteristics

- Lowest cost linear
- Enclosed plastic case
- Sturdy product design



5 to 12 Watts

### Technical data

**Input voltage**  
**Frequency**  
**EMC**

230 V AC  
50 Hz  
Conforms to FCC, CISPR 22, EN 55022/B,  
IEC 61000-4-3, IEC 61000-4-6

### Environmental specification

**Operating temp.**  
**Storage temp.**

0 to 40° C at maximum load  
-10 to 70° C

### Safety specification

**Standards**

Fulfils Class II SELV for the following applications: EN 61558, CE label

### Reliability specification

**MTBF calculation**

100,000 hours at maximum load levels and an ambient temperature of 25° C (in correspondence with MIL-HDBK-217)

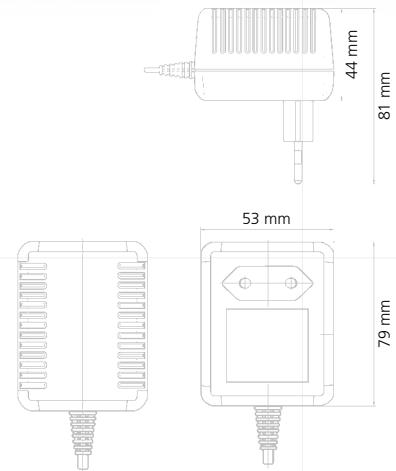
### Mechanical specification

**Weight approx.**  
**Plug connector**

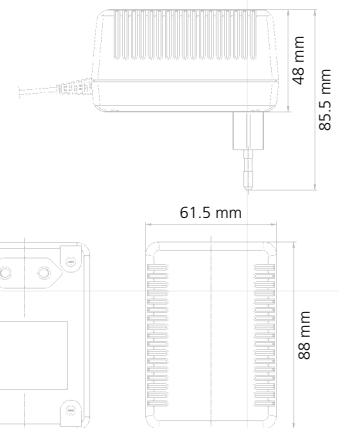
270 g (41 DC), 410 g (48 DC)  
AC input: Mains plugs are available for the following regions: EURO, UK  
DC output: Universal output plug system

41 DC

48 DC



41 DC



48 DC

Output data		Housing	EURO	UK
Voltage	Current		Order No.	Order No.
6 V	900 mA	41 DC	1883557	
9 V	1000 mA	48 DC	1883468	
9 V	680 mA	41 DC	1883558	
12 V	580 mA	41 DC	1883472	1883565
12 V	1000 mA	48 DC	1883469	
18 V	500 mA	48 DC	1883562	
24 V	500 mA	48 DC	1883482	

# Linear Power Supply

# DC Adjustable and Regulated

Conforms to IEC 61558

1.5 to 7 Watts



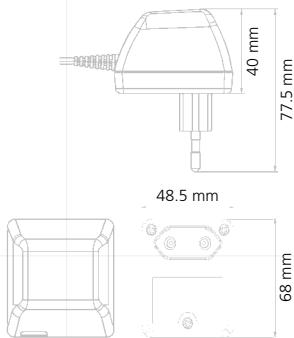
### Applications

- Consumer products
- Small office equipment
- Personal electronic power
- Household applications

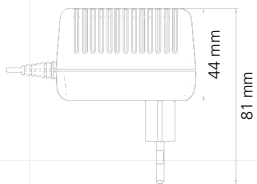
### Characteristics

- Lowest cost linear
- Enclosed plastic case
- Sturdy Design

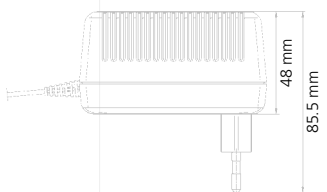
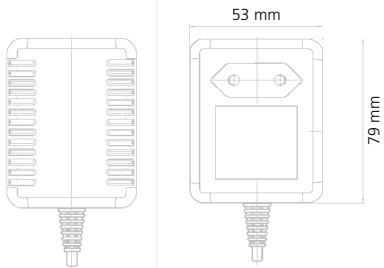
35 DC



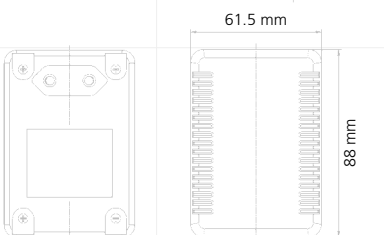
35 DC



41 DC



48 DC



### Technical data

**Input voltage**

230 V AC

**Frequency**

50 Hz

**EMC**

Conforms to FCC, CISPR 22, EN 55022/B, IEC 61000-4-3, IEC 61000-4-6

### Environmental specification

**Operating temp.**

0 to 40° C at maximum load

**Storage temp.**

-10 to 70° C

### Safety specification

**Standards**

Fulfils Class II SELV for the following applications: EN 61558, CE label

### Reliability specification

**MTBF calculation**

100,000 hours at maximum load levels and an ambient temperature of 25° C (in correspondence with MIL-HDBK-217)

### Mechanical specification

**Weight approx.**

200 g (35 DC), 250 g (41 DC), 500 g (48 DC)

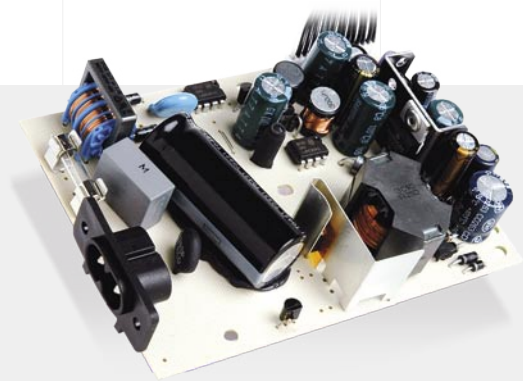
**Plug connector**

AC input: Mains plugs are available for the following regions: EURO, UK  
DC output: Universal output plug system

34 DC Adjustable and Regulated

Output data			EURO	UK
Voltage	Current	Housing	Order No.	Order No.
1 to 11 V	600 to 60 mA	48 DC	1589369	1463586
10 to 24 V	280 to 60 mA	48 DC	1587897	1463594
5 V	270 mA	35 DC	1883470	
5 V	500 mA	41 DC	1883473	
6 V	500 mA	41 DC	1883474	
7.5 V	500 mA	41 DC	1883475	
9 V	190 mA	35 DC	1883471	
9 V	300 mA	41 DC	1883476	
12 V	600 mA	48 DC	1883477	

# OEM Open Frame



## Applications

- Set top boxes
- Safety technology
- Medical equipment
- Automation technology

## Characteristics

- Universal input voltage
- Compliant with EMC standards
- High efficiency
- Low stand-by losses
- Several output voltages
- Customised PCB contours

## Open Frame

FRIWO develops the optimum open frame solution, according to your individual requirements, with specific dimensions and for your environmental conditions.

All enclosed units from our broad standard range can be supplied as open frame versions.

## Technical Data

### Input voltage

100 to 240 V AC or single range  $\pm 10\%$

### Frequency

50 to 60 Hz

### Efficiency

> 80% typ. at full load

### EMV

Conforms to: EN 55011, EN 55014, EN 55022/B, FCC 47 Teil 15, EN 61000-3-2, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 610004-5, EN 610004-6, EN 61000-4-11

## Environmental Specification

### Operating Temp.

0 to 110° C at maximum load

### Storage Temp.

-10 to 70° C

### Humidity

5% to 95% non condensing

### Input transient susceptibility

Complies with IEC 61000 requirements

## Safety Specifications

### Standards

Fulfils Class II SELV for the following applications: EN 60950/IEC 60950, VDE, CE label, resp. UL 60950

## Reliability specification

### MTBF calculation

200,000 hours at maximum load levels and an ambient temperature of 25° C (in correspondence with MIL-HDBK-217)

## FRIWO – Service Provider for Electronic Subassemblies and Devices

In addition to classical batch manufacturing, we also offer complete commission manufacturing. We are able to manufacture, inspect, pack, and deliver complete devices or systems to the final consumer on the basis of your technical documents, such as customer's bill of material and drawings.

This means that our buyers assume the acquisition of the electronic or mechanical components (worldwide). The task-oriented purchasing organisation of our company with Strategic Purchasing, Operative Purchasing guarantees the use of specialists starting with the selection of suppliers up to and including material acquisition.

Our technically and commercially qualified buyers use their material and market experience as an important basis for the economic success of our customers' products. With our modern, technical equipment and an experienced team, we are able to offer our customers a high manufacturing standard.

We are specialists in the handling of fine-pitch, chip-scale package (CSP), and flip-chip components. To guarantee high-level process consistency, inspection systems such as automated optical inspections (AOI) are used. In addition to component assembly and soldering, inspection of manufacturing processes is also one of our core competences. In our PCB inspection, we use various testing robots such as in-circuit and functional testers. In addition, we can make laser settings, such as voltage and current values (active laser trimming) in order to minimize circuit tolerances to the minimum required.

All mechanical assembly tasks can be handled by our Construction Support Team which enables us to support our customers with the complete manufacturing of electrical and electronic devices.

Throughout the whole operation our Quality Department monitors all manufacturing steps, from supplier auditing to finished goods testing.

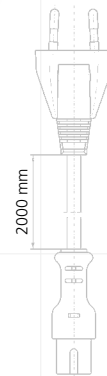
We are certified according to DIN EN ISO 9001: 2000 and DIN EN ISO 14001.

Service Portfolio		Technical Equipment	
<b>PCB assembly</b>	Through-hole technology (THT) Surface mounting technology (SMT)	<b>SMT assembly</b> 60000 to 70000 components/h	3 Ekra printers 3 Gemini 2 dispensers 5 Assembleon Topaz 4 Assembleon Emerald with LCS feeder 1 Assembleon ACM
<b>Joining/connecting</b>	Glueing Soldering (reflow, wave, nitrogen, lead-free)	<b>THT assembly</b> 40000 to 45000 components/h	1 Fuji FBA-8336 1 Universal 8 XT Triple Scan 1 Universal VCD/Sequencer 8
<b>Inspections</b>	Automatic-Optical-Inspection In-circuit test Functional test Special tests (e.g. boundary scan) Safety tests	<b>Reflow soldering</b>	4 HERAEUS VC 36 1 SMT QPM (nitrogen)
<b>Painting</b>		<b>Wave soldering</b>	2 SEHO nitrogen plants (lead-free) 1 SEHO air plant
<b>Potting technology</b>		<b>Inspections</b>	2 AOI systems Mitutoyo BHN 506 3D coordinate measuring machine 10 in-circuit/combitesters (Reinhardt KMFT 470) 3 in-circuit/combitesters (SPEA 100 AP) 2 in-circuit/combitesters (SPEA 50 MDA) 1 laser trimmer (general scanning) 1 boundary scan system (Jtag) PC functional testing technology 2 high-voltage and leakage current tester (Sefelec)
<b>Assembly</b>	Tightening technology Ultrasonics	<b>Potting/Varnishing</b>	1 Scheugenpflug vacuum potting system 1 Scheugenpflug potting system 1 PCB varnishing unit
<b>Prototype manufacturing</b>			
<b>Handling of complete subassemblies (outsourcing/insourcing)</b>			
<b>Testing equipment development and construction</b>			
<b>Material management (worldwide)</b>			
<b>Certifications:</b>	DIN EN ISO 9001: 2000, DIN EN ISO 14001		

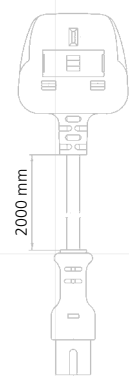
# Power Cords



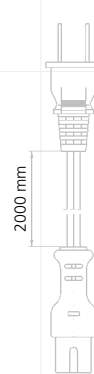
Mains Power Cords with the 2 contact IEC 320 C 7 mains plug provide the specific solution for each country. All Power Cords are 2 metres long. These Power Cords are suitable for use with our IEC 320 C8 socket for FRIWO's MPP and DT lines.



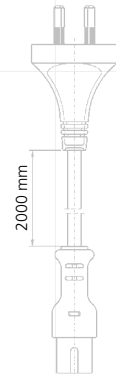
Power Cords EURO



Power Cords UK



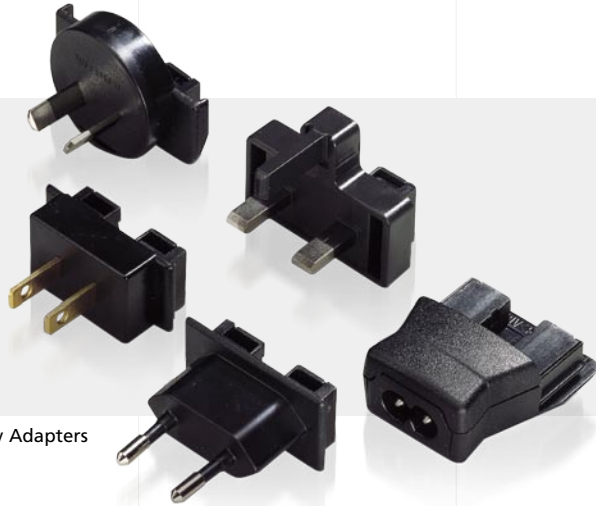
Power Cords USA/Japan



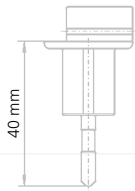
Power Cords Australia

Power cords	
Type	Order No.
<b>EURO</b>	<b>1812274</b>
<b>UK</b>	<b>1812275</b>
<b>USA/Japan</b>	<b>1812276</b>
<b>Australia</b>	<b>1812277</b>

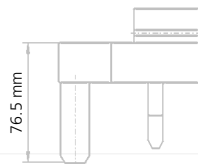
# Exchangeable Primary Adapters



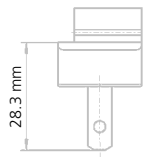
Primary Adapters



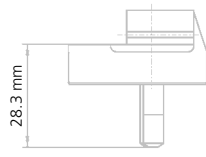
EURO



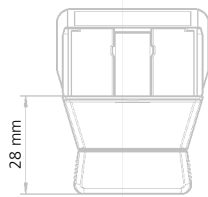
UK



USA/Japan



Australia



IEC

The MPP-series can be variably equipped with the mains plugs as shown. Your applications and products can be sold and used worldwide due to the set of all country mains plugs which can be inserted with the unit.

Mobility and dependability with respect to the use of the product are increased in this way and provide a constant level of functionality and availability – wherever you are in the world. Beyond that, these plug modules help reducing the logistic complexity, avoiding the need to plan and stock mains adapters and chargers in various mains plug configurations.

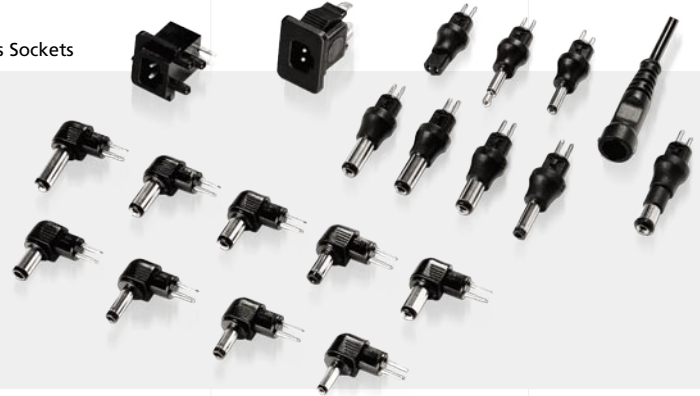
In countries with mains plugs which are not covered by EURO, UK, USA/Japan and Australia mains plug types, the IEC adapter with the 2-pin IEC 320 C8 socket provides a standardized alternative.

Primary adapters	
Type	Order No.
<b>EURO</b>	<b>1717707</b>
<b>UK</b>	<b>1717618</b>
<b>USA/Japan</b>	<b>1717715</b>
<b>Australia MPP 15</b>	<b>1800496</b>
<b>Australia MPP 6/30</b>	<b>1804237</b>
<b>IEC</b>	<b>1809281</b>

# Secondary Adapter Plug System

Straight Plug Inserts

Texas Sockets

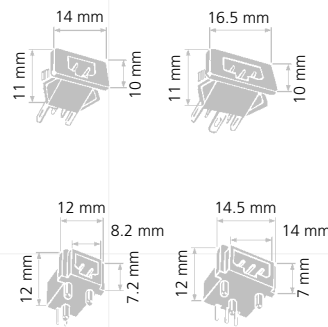


Angled Plug Inserts

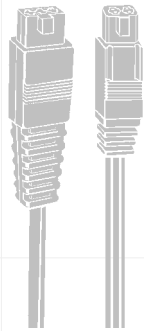
In addition to the standardized low voltage plug-in connections such as coaxial (in accordance with DIN 45323) and jack connectors (in accordance with DIN 45318), FRIWO also provides customized connecting cables. The wire diameter which is generally used in our units ranges from 0.25 mm<sup>2</sup> to 1.5 mm<sup>2</sup>. Both flat and round cables can be used.

FRIWO has its own plug system with self-cleaning fork contacts and the corresponding sockets for snap-in or PCB installation. This plug connection is available in 2- or 3-pin design. Beyond the safe contact due to the self-cleaning of the fork terminals, this system also provides the advantage of extremely small dimensions.

The low-voltage plugs shown only represent a selection of the comprehensive range. Customized designs, special versions and types with other dimensions can be obtained upon request.

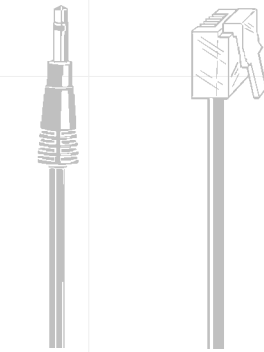


Texas Sockets

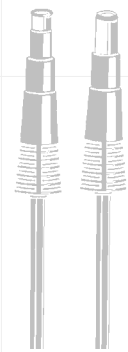


Texas Plugs

Connectors/Sockets	
Description	Order No.
<b>Texas connector</b>	
<b>Straight Texas connector</b>	<b>1807706</b>
<b>Angled Texas connector</b>	<b>1822486</b>
<b>Texas sockets 2-pin</b>	
<b>Snap-in type</b>	<b>1323938</b>
<b>PCB type</b>	<b>1321609</b>
<b>Texas sockets 3-pin</b>	
<b>Snap-in type</b>	<b>1327259</b>
<b>PCB type</b>	<b>1363506</b>



Male Jacks Phone Connectors (upon request)



Coaxial Plugs

Straight coaxial connectors				Straight jack connectors			Angled coaxial connectors				Angled jack connectors		
o. Ø	i. Ø	Length mm	Order No.	o. Ø	Length mm	Order No.	o. Ø	i. Ø	Length mm	Order No.	o. Ø	Length mm	Order No.
3.5	1.3	9.5	1807699	2.5	13	1807704	3.5	1.3	9.5	1822478	2.5	13	1822484
4.0	1.7	9.5	1822557	3.5	14	1807705	4.0	1.7	9.5	1822558	3.5	14	1822485
4.0	1.7	11.0	1811994				4.0	1.7	11.0	1822482			
4.8	1.7	9.5	1822559				4.8	1.7	9.5	1822560			
5.5	2.1	9.5	1807700				5.5	2.1	9.5	1822479			
5.5	2.1	11.5	1807701				5.5	2.1	11.5	1822480			
5.5	2.1	14.0	1807697				5.5	2.1	14.0	1822476			
5.5	2.5	9.5	1807698				5.5	2.5	9.5	1822477			
5.5	2.5	11.5	1807702				5.5	2.5	11.5	1822481			
5.5	3.3	9.5	1822561				5.5	3.3	9.5	1822562			
<b>DIN 45323</b>			<b>1807703</b>				<b>DIN 45323</b>			<b>1822483</b>			

# Standards



## Approval Markings

Quite often the safety requirements for power supplies and chargers are very complex, and sometimes represent a hurdle even for the specialist. In order to ensure a standardised project processing FRIWO has defined its own minimum requirements for the development of new power supplies and chargers.

In case the customer did not specify detailed requirements, this proprietary standard always applies. It essentially refers to the latest revisions of applicable national and international standards on safety and EMI/EMC. You can therefore rely on a uniform safety for all FRIWO power supplies and chargers.

Input voltages (Tolerance $\pm 10\%$ )					Safety standards		
Wide range	EURO	USA	Australia	Japan	EURO	USA	Worldwide
<b>100 to 240 V</b>	<b>230 V</b>	<b>120 V</b>	<b>240 V</b>	<b>100 V</b>	<b>EN 61558</b>	<b>UL 1310</b>	<b>IEC 61558</b>
					<b>EN 60950</b>	<b>UL 60950</b>	<b>IEC 60950</b>
					<b>EN 60335</b>	<b>UL 1310</b>	<b>IEC 60335</b>
					<b>EN 60601</b>	<b>UL 60601</b>	<b>IEC 60601</b>
Mains frequency		Temperature range			Interference suppression		
					ISM devices	Electronic household appliances	ITE devices
<b>50 to 60 Hz</b>		<b>0 to 40° C</b>			<b>EN 55011</b>	<b>EN 55014</b>	<b>EN 55022</b>



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