



Excellence In Power Solutions

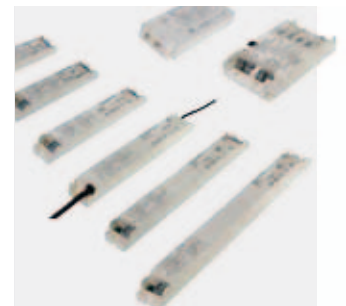
Power Supplies



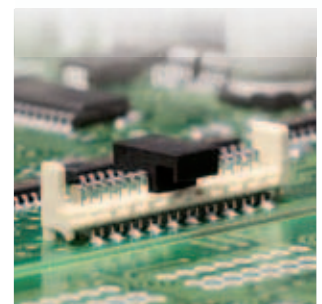
Chargers



LED Drivers



E²MS



Innovative, efficient and competitive LED drivers, power supplies and chargers

Competent R&D and manufacturing services for electronic modules

Sustainable value for our customers, employees, owners, suppliers and partners

Global Player

FRIWO operates worldwide as leading manufacturer of LED drivers, battery chargers and power supplies. FRIWO is the best resource for value-added electronics development and manufacturing. With our products and services we serve demanding clients in segments like electric mobility, power tools, high quality consumer equipment, medical, industrial automation, LED lighting and renewable energy.

We consider it a permanent challenge to keep up with current and future technologies. Customized products for contactless energy transfer have already been designed and are available for transmissions of up to 30 Watts.

Power Supplies / Chargers

Since FRIWO has developed the world's first power supply, the name has become a trademark. FRIWO stands for technical competence in standard and customized solutions, from concept to finished product. In 1971 FRIWO has laid the foundation for constant market success and sets landmarks for power supply and charging technology, in accordance with current safety standards and regulations.

Standards, Regulations and Responsibility

The stringent criteria and requirements of the various standards, are, of course, respected by FRIWO, many products remain even far below threshold limits.

FRIWO cooperates with leading test and inspection institutes, and the sophisticated development of the products allows worldwide approvals and marketing. All units are thoroughly tested for reliability in our own accredited test centers and leave our factory as „zero defect products“. FRIWO power supply and charging platforms are approved in Europe, the USA and Canada without any review. Laws and regulations regarding environmental responsibility and conservation of natural resources are becoming increasingly important. Based on the EU directive all FRIWO units meet the Electrical and Electronic Equipment Act – WEEE.





Switchmode Power Supplies

PP Series

All products conform to IEC 60950

Applications

- Audio
- Bluetooth/WLAN
- Digital cameras
- Communication accessories
- Measurement and weighing technology
- MPEG Player
- Modems DSL, ADSL, VDSL
- PDA
- Safety technology

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

Technical data

Input voltage

100 to 240 V AC ($\pm 10 \%$)

Input current

90 mA (PP 3)
150 mA (PP 6)
200 mA (PP 8)

Frequency

50 to 60 Hz

Efficiency

75 % typ. at full load

EMC

Conforms to EN 55011, 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

$\pm 2\%$ (without consideration of the output lead)

Environmental specification

Operating temperature

0 to 40° C at maximum load

Storage temperature

-20 to 70° C

Humidity

5 % to 95 % non condensing

Input transient susceptibility

Complies with IEC 61000 requirements

Safety specification

Standards

Fulfils class II, SELV according to following standards:
IEC/EN/UL 60950

Reliability specification

MTBF calculation

200.000 hours at maximum load and an ambient temperature of 25° C (in accordance with MIL-HDBK-217)

Mechanical specification

Weight approx.

60 g (PP 3)
105 g (PP 6)
110 g (PP 8)

Plug connector

AC input:
FRIWO exchangeable mains plug system:
EURO, UK, USA/Japan*
DC output:
Universal output plug system (page 34)

PP 3 FW 7600



PP 6 FW 7601



PP 8 FW 7333S



* Australia version available for OEM quantities



Switchmode Power Supplies

GPP Series

with exchangeable primary adapters

All products conform to IEC 60950

Applications

- Mobile applications
- Bluetooth
- Digital cameras
- Communication accessories
- Measurement and weighing technology
- Modems DSL, WLAN
- Elektronik cash systems
- Safety technology

Characteristics

- Universal input 100 to 240 V AC
- Constant voltage, current limited
- Exchangeable primary adapters
- Low leakage current $\leq 10 \mu\text{A}$ (GPP 6, GPP 10, GPP 18)
- Low standby power ≤ 0.3 Watts
- Continuously short circuit proof

Technical data

Input voltage

100 to 240 V AC ($\pm 10 \%$)

Input current

150 mA (GPP 6), 250 mA (GPP 10), 400 mA (GPP 18), 600 mA (GPP 30)

Frequency

50 to 60 Hz

Efficiency

80 % typ. at full load

EMC

Conforms to

EN 55011, 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

$\pm 2\%$ (without consideration of the output lead)

Environmental specification

Operating temperature

0 to 40° C at maximum load

Storage temperature

-40 to 70° C

Humidity

5 % to 95 % non condensing

Input transient susceptibility

Complies with IEC 61000 requirements

Safety specification

Standards

Fulfils class II, SELV according to following standards:
IEC/EN/UL 60950

Reliability specification

MTBF calculation

200.000 hours at maximum load and an ambient temperature of 25° C (in accordance with MIL-HDBK-217)

Mechanical specification

Weight approx.

80 g (GPP 6), 113 g (GPP 10), 170 g (GPP 18)
200 g (GPP 30)

Plug connector

AC input:
FRIWO exchangeable mains plug system:
EURO, UK, USA/Japan, Australia, IEC
DC output:
Universal output plug system (page 34)

For primary adapters see page 34

GPP 6 FW 7662



GPP 10 FW 7660



GPP 18 FW 7556



GPP 30 FW 7540



Switchmode Power Supplies

MPP Series

with exchangeable primary adapters

All products conform to IEC 60950

Applications

- Weighing technology
- WLAN modems
- Bluetooth
- Communication accessories
- Measurement technology
- LED applications
- Laser technology
- IT accessories
- Safety technology

Characteristics

- Universal input 100 to 240 V AC
- Constant voltage, current limited
- Exchangeable primary adapters
- Low standby power ≤ 0.3 Watts
- Continuously short circuit proof
- High efficiency

Technical data

Input voltage

100 to 240 V AC ($\pm 10\%$)

Input current

150 mA (MPP 6),
400 mA (MPP 15),
700 mA (MPP 30)

Frequency

50 to 60 Hz

Efficiency

80% typ. at full load, resp. 75% (MPP 6)

EMC

Conforms to
EN 55011, 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

$\pm 2\%$ (without consideration of the output lead)

Environmental specification

Operating temperature

0 to 40° C at maximum load

Storage temperature

-40 to 70° C

Humidity

5% to 95% non condensing

Input transient susceptibility

Complies with IEC 61000 requirements

Safety specification

Standards

Fulfils class II, SELV according to following standards:
IEC/EN/UL 60950

Reliability specification

MTBF calculation

200.000 hours at maximum load and an ambient temperature of 25° C (in accordance with MIL-HDBK-217)

Mechanical specification

Weight approx.

105 g (MPP 6), 160 g (MPP 15), 255 g (MPP 30)

Plug connector

AC input:
FRIWO exchangeable mains plug system:
EURO, UK, USA/Japan, Australia, IEC
DC output:
Universal output plug system (page 34)

For primary adapters see page 34

MPP 6 FW 7650



MPP 15 FW 7520



MPP 30 FW 7530



Switchmode Power Supplies

DT Series

All products conform to IEC 61558 and 60950

Applications

- Audio
- Bluetooth/WLAN
- Digital cameras
- Communication accessories
- Measurement and weighing technology
- MPEG Players
- Modems DSL, ADSL, VDSL
- Safety technology
- Laboratory equipment

Characteristics

- Universal input 100 to 240 V AC
- Constant voltage, current limited
- Low standby power
 ≤ 0.3 Watts (DT 12) resp.
 ≤ 0.5 Watts (DT 60, DT 100, DT 150)
- Continuously short circuit proof
- High efficiency

Technical data

Input voltage

Input current

Frequency

Efficiency

EMC

100 to 240 V AC ($\pm 10\%$)
 300 mA (DT 12), 1500 mA (DT 100),
 1600 mA (DT 60), 2000 mA (DT 150)
 50 to 60 Hz
 up to 91% typ. at full load
 Conforms to EN 55011,
 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
 $\pm 2\%$ (without consideration of the output lead)

Output voltage tolerance

Environmental specification

Operating temperature

Storage temperature

Humidity

Input transient susceptibility

0 to 40° C at maximum load
 -10 to 70° C
 10% to 95% non condensing
 Complies with IEC 61000 requirements

Safety specification

Standards

Fulfils class II, SELV according to following standards: IEC/EN/UL 60950, DT 100 and DT 150 fulfils class I.

Reliability specification

MTBF calculation

200.000 hours at maximum load and an ambient temperature of 25° C (in accordance with MIL-HDBK-217)

Mechanical specification

Weight approx.

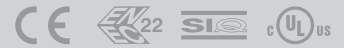
135 g (DT 12), 260 g (DT 60),
 500 g (DT 100), 622 g (DT 150)

Plug connector

AC input: 2-pole IEC 320,
 C8-socket (DT 12, DT 60)
 C14-socket (DT 100, DT 150)
 DC output (not DT 150):
 Universal output plug system (page 34)

For power cords see page 34

DT 12 FW 7402



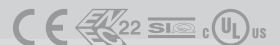
DT 60 DT 60



DT 100 DT 100



DT 150 DT 150



Switchmode Power Supplies Medical Series

with exchangeable primary adapters

All products conform to IEC 60601-1

Applications

- Blood analysers
- Patient monitors
- Measuring equipment
- Laboratory equipment
- Inhalers
- Patient lifts

Characteristics

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

Technical data

Input voltage
Input current

100 to 240 V AC ($\pm 10\%$)
250 to 110 mA (GPP6)
205 to 110 mA (GPP 10)
400 to 200 mA (GPP 18)
200 to 100 mA (GPP USB Medical)

Frequency

50 to 60 Hz

Efficiency

80% typ. at full load

EMC

Conforms to
EN 55011, EN 55022/B, IEC 60601-1-2,
FCC 47 Teil 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

$\pm 2\%$ (without consideration of the output lead)

Environmental specification

Operating temperature

0 to 40° C at maximum load

Storage temperature

-40 to 70° C

Humidity

5 % to 95 % non condensing

Input transient susceptibility

Complies with IEC 61000 requirements

Safety specification

Standards

Fulfils class II, SELV according to following standards:
ES 60601, IEC 60601-1, UL 2601, CE label,
fulfils medical application class B/BF/CF

Reliability specification

MTBF calculation

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

Mechanical specification

Weight

80 g (GPP 6), 113 g (GPP 10), 170 g (GPP 18),
60 g (GPP USB Medical)

Plug connector

AC input:
FRIWO exchangeable mains plug system:
EURO, UK, USA/Japan, Australia, IEC
DC output:
Universal output plug system (page 34)
USB socket: Type A (GPP USB Medical)

For primary adapters see page 34

GPP 6 FW 7662M



GPP 10 FW 7660M



GPP 18 FW 7556M



GPP USB Medical



Switchmode Power Supplies Medical Series

with exchangeable primary adapters
(MPP 15/30)

All products conform to IEC 60601-1

Applications

- Blood analysers
- Patient monitors
- Measuring equipment
- Laboratory equipment
- Inhalers
- Patient lifts

Characteristics

- Universal input 100 to 240 V AC
- Constant voltage, current limited
- Green LED indicator
- Low standby power
- Continuously short circuit proof
- Exchangeable primary adapters (MPP 15/30)
- 2 x MOPP
- Low leakage current $\leq 10 \mu\text{A}$

Technical data

Input voltage Input current

100 to 240 V AC ($\pm 10\%$)
200 to 80 mA (PP 8)
350 to 150 mA (MPP 15)
700 to 350 mA (MPP 30)

Frequency Efficiency EMC

50 to 60 Hz
80 % typ. at full load, PP 8 75%
Conforms to
EN 55011, EN 55022/B, IEC 60601-1-2
FCC 47 Teil 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

$\pm 2\%$ (without consideration of the output lead)

Environmental specification

Operating temperature

0 to 40° C at maximum load

Storage temperature

-40 to 70° C, PP 8 (-20 to 70° C)

Humidity

5 % to 95 % non condensing

Input transient susceptibility

Complies with IEC 61000 requirements

Safety specification

Standards

Fulfils class II, SELV according to following standards:
ES 60601, IEC 60601-1, UL 2601, CE label,
fulfils medical application class B/BF/CF

Reliability specification

MTBF calculation

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

Mechanical specification

Weight approx.

110 g (PP 8), 160 g (MPP 15), 255 g (MPP 30)

Plug connector

AC input:
FRIWO exchangeable mains plug system:
EURO, UK, USA/Japan, Australia, IEC
PP 8: EURO, UK, USA/Japan
DC output:
Universal output plug system (page 34)

For primary adapters see page 34



Switchmode Power Supplies Medical Series

All products conform to IEC 60601-1

Applications

- Blood analysers
- Patient monitors
- Measuring equipment
- Laboratory equipment
- Inhalers
- Patient lifts

Characteristics

- Universal input 100 to 240 V AC
- Constant voltage, current limited
- Green LED indicator
- Leakage current $\leq 10 \mu\text{A}$
(DT 80 $\leq 100 \mu\text{A}$, DT 150 $\leq 100 \mu\text{A}$)
- Continuously short circuit proof
- 2 x MOPP

Technical data

Input voltage

100 to 240 V AC ($\pm 10\%$)

Input current

230 to 140 mA (DT 12)

1.100 to 500 mA (DT 50)

1.700 to 850 mA (DT 80)

2.000 to 700 mA (DT 150)

Frequency

50 to 60 Hz

Efficiency

90 % typ. at full load

EMC

Conforms to

EN 55011, EN 55022/B, IEC 60601-1-2

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

$\pm 2\%$ (without consideration of the output lead)

Environmental specification

Operating temperature

0 to 40° C at maximum load

Storage temperature

-40 to 70° C

Humidity

5 % to 95 % non condensing

Input transient susceptibility

Complies with IEC 61000 requirements

Safety specification

Standards

Fulfils class II, SELV according to following

standards:

IEC 60601-1, UL 2601, ES 60601-1

fulfils medical application class B/BF/CF

(DT 12/ DT 50) and B/BF (DT 80, DT 150),

class I DT 150

Reliability specification

MTBF calculation

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

Mechanical specification

Weight approx.

135 g (DT 12), 295 g (DT 50),

350 g (DT 80), 622 g (DT 150)

Plug connector

AC input: 2-pole IEC 320,

C8-socket (DT 12, DT 50, DT 80)

C14-socket (DT 150)

DC output (not DT 150):

Universal output plug system (page 34)

For power cords see page 34

DT 12 FW 7401M



DT 50 FW 7405M



DT 80 FW 7488M



DT 150 DT 150M



Switchmode Power Supplies USB Series

with exchangeable primary adapters
(GPP USB, GUP)

All products conform to IEC 60950

Applications

- Bluetooth
- Digital cameras
- Wireless communication accessories
- PDAs
- Household applications
- MP3 Players
- E-Books

Characteristics

- Universal input 100 to 240 V AC
- Constant voltage, current limited
- Exchangeable primary adapters (GPP USB)
- Low standby power ≤ 0.3 Watts
- Continuously short circuit proof
- Low weight
- Compact design

Technical data

Input voltage

100 to 240 V AC ($\pm 10\%$)

Input current

100 mA (PP USB, GUP), 75 mA (GPP USB)

Frequency

50 to 60 Hz

Efficiency

70 % typ. at full load

EMC

Conforms to EN 55011, EN 55022/B, EN 55024, FCC 41 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

$\pm 2\%$ (without consideration of the output lead)

Environmental specification

Operating temperature

0 to 40° C at maximum load

Storage temperature

-20 to 70° C

Humidity

5 % to 95 % non condensing

Input transient susceptibility

Complies with IEC 61000 requirements

Safety specification

Standards

Fulfills class II, SELV according to following standards:
EN 60950/IEC 60950, UL 60950

Reliability specification

MTBF calculation

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

Mechanical specification

Weight approx.

36 g (PP USB), 50 g (GPP USB), 35 g (GUP), 25 g (PP Mini USB)

Plug connector

AC input:
FRIWO exchangeable mains plug system (GPP USB, GUP): EURO, UK, USA/Japan, Australia, IEC
DC output:
USB socket type A

For primary adapters see page 34

GPP USB FW 7711



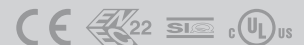
PP USB FW 7710 (700 mA)
FW 7715 (1.000 mA)



GUP FW 7712



PP Mini USB FW 7713





Switchmode Power Supplies

CPP Series

All products conform to IEC 60950;
PP18 additional to IEC 60601-1

Applications

- Router
- E-Books
- Blood analysers
- Inhalers

Characteristics

- Universal input 100 to 240 V AC
- Constant voltage, current limited
- Continuously short circuit proof
- Low weight
- Low standby power
≤ 0.3 Watts
- 2 x MOPP (PP18)

Technical data

Input voltage

100 to 240 V AC ($\pm 10\%$)

Input current

300 mA (PP12), 550 mA (PP30),
400-180 mA (PP18)

Frequency

50 to 60 Hz

Efficiency

up to 78% typ. at full load

EMC

Conforms to EN55011, EN 55022/B, EN55024,
FCC41 part 15, EN61000-3-2, EN 61000-4-2,
EN61000-4-3, EN 61000-4-4, EN 61000-4-5, EN
61000-4-6, EN 61000-4-11, EN 60601-1-2

Output voltage tolerance

$\pm 2\%$ (without consideration of the output lead)

Environmental specification

Operating temperature

0 to 40°C at maximum load

Storage temperature

-20 to +70°C

Humidity

5% to 95% non condensing

Input transient susceptibility

Complies with IEC 61000 requirements

Safety specification

Standards

Fulfils class II, SELV according to
following standards:
EN/IEC/UL 60950, EN/IEC 60601-1 (PP18)

Reliability specification

MTBF calculation

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

Mechanical specification

Weight approx.

120g (PP12), 125g (PP18), 150g (PP30)

Plug connector

AC input: EURO
DC output:
Universal output plug system (page 34)

PP 12 FW 7599



PP 18 FW 7598 M



PP 30 FW 7583





Switchmode Power Supplies In-wall Series

All products conform to
IEC 61558, 60335

Applications

- Safety technology
- Water taps
- Shutter control
- Door opener
- LED applications (UP 6)
- E-Books
- PDAs
- MP3-Players
- Tablets

Characteristics

- Universal input 100 to 240 V AC
- Constant voltage, current limited
- Low standby power
≤ 0.3 Watts
- High output power
- Continuously short circuit proof
- Compact design
- IP 64 protection class

Technical data

Input voltage
Input current

100 to 240 V AC (± 10 %)
150 mA (UP 6), 400 mA (UP 12, UP 18),
180 mA (UP USB)

Frequency

50 to 60 Hz

Efficiency

up to 80 % typ. at full load

EMC

Conforms to EN 55011, 55014, EN 55022/B,
EN 55024, FCC 41 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,
±2% (without consideration of the output lead)

Output voltage tolerance

Environmental specification

Operating temperature

0 to 40° C at maximum load

Storage temperature

- 20 to 70° C

Humidity

5 % to 95 % non condensing

Input transient susceptibility

Complies with IEC 61000 requirements

Temperature range

0 to 70° C

Safety specification

Standards

Fulfils class II, SELV according to
following standards:
EN 61558/IEC 61558

Reliability specification

MTBF calculation

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

Mechanical specification

Weight approx.

95 g (UP 6), 130 g (UP 12), 130 g (UP 18),
70 g (UP USB)

Plug connector

AC input:
150 mm cable (UP 6, UP 12, UP 18)
Spring clip 2 x 2,5 mm² (UP USB)
DC output:
150 mm cable (UP 6, UP 12, UP 18)
USB-socket type A (UP USB)

Optional – upon request:

Customer-specific output voltages
Customer-specific cable length

UP 6 FW 7801



UP 12 FW 7802



UP 18 FW 7803



UP USB 153380



Switchmode Power Supplies

Open Frame

All products conform to 61558;
OF 150 additional to 60601-1

Applications

- Laboratory equipment
- Patient lifts
- Label printers
- Measuring equipment
- Laser
- Lighting
- Automation
- Climate chambers
- Electric tools
- Professional kitchen equipment

Characteristics

- Universal input 100 to 240 V AC
- Constant voltage, current limited
- Low standby power
- High efficiency
- Continuously short circuit proof
- Leakage current $\leq 100 \mu\text{A}$
- Small package
- Without active fan

Technical data

Input voltage Input current

100 to 240 V AC ($\pm 10\%$)
1600 mA (OF 65), 2500 mA (OF 100),
1800 mA (OF 150)

Frequency

50 to 60 Hz

Efficiency

$\geq 87\%$ typ. at full load

Standby Losses

≤ 0.5 Watts typ.

EMC

Conforms to
EN 55011, EN 55022/B, FCC47 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, EN 60601-1-2

Output voltage tolerance

$\pm 2\%$

Power factor

≥ 0.9 typ.

Environmental specification

Operating temperature

0 to 70° C

Storage temperature

-20 to +70° C

Humidity

5 % to 95 % non condensing

Input transient susceptibility

Complies with IEC 61000 requirements

Safety specification

Standards

Fulfils class I, SELV according to
following standards: IEC 60601, UL 2601,
fulfils medical application class B/BF

Reliability specification

MTBF calculation

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

Mechanical specification

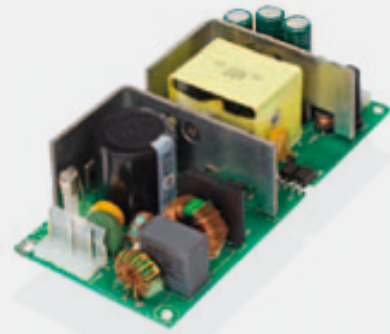
Weight approx.

220 g (OF 65), 230 g (OF 100), 340 g (OF 150)

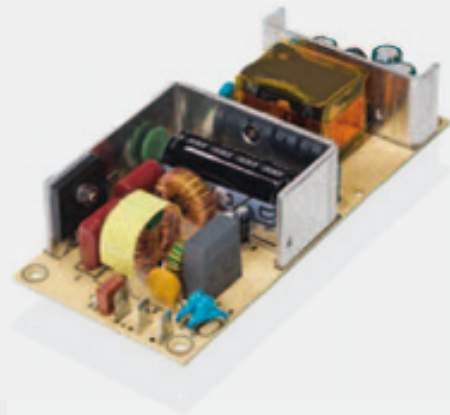
Plug connector

Pin connector, flat-pin plug or screw terminal

OF 65 OF65-2



OF 100 OF100



OF 150 OF150



Switchmode Power Supplies

Open Frame

All products conform to 61558;
OF 250 and OF 450 additional to 60601-1

Applications

- Laboratory equipment
- Patient lifts
- Label printers
- Measuring equipment
- Laser
- Lighting
- Automation
- Climate chambers
- Electric tools
- Professional kitchen equipment

Characteristics

- Universal input 100 to 240 V AC
- Constant voltage, current limited
- Low standby power
- High efficiency
- Continuously short circuit proof
- Leakage current $\leq 100 \mu\text{A}$
- Small package
- Without active fan

Technical data

| | |
|---------------------------------|--|
| Input voltage | 100 to 240 V AC ($\pm 10 \%$) |
| Input current | 3500 mA (OF 250), 5500 mA (OF 450) |
| Frequency | 50 to 60 Hz |
| Efficiency | $\geq 87 \%$ typ. at full load |
| Standby Losses | ≤ 0.5 Watts typ. |
| EMC | Conforms to EN 55011, EN 55022/B, FCC47 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, EN 60601-1-2 |
| Output voltage tolerance | $\pm 2 \%$ |
| Power factor | ≥ 0.9 typ. |

Environmental specification

| | |
|---------------------------------------|--------------------------------------|
| Operating temperature | 0 to 70° C |
| Storage temperature | -20 to +70° C |
| Humidity | 5 % to 95 % non condensing |
| Input transient susceptibility | Complies with IEC 61000 requirements |

Safety specification

| | |
|------------------|--|
| Standards | Fulfils class I, SELV according to following standards: IEC 60601, UL 2601, fulfils medical application class B/BF |
|------------------|--|

Reliability specification

| | |
|-------------------------|--|
| MTBF calculation | typ. 200,000 hours at maximum load and an ambient temperature of 25° C (in accordance with MIL-HDBK-217) |
|-------------------------|--|

Mechanical specification

| | |
|-----------------------|--|
| Weight approx. | 600 g (OF 250), 1,250 g (OF 450) |
| Plug connector | Pin connector, flat-pin plug or screw terminal |

OF 250 OF250



OF 450 OF450



Switchmode Chargers

Chargers

with exchangeable primary adapters
(MPP 15 and GPP 18/36)

All products conform to IEC 60335
and IEC 60601-1 (not FW 7574, 7290, 7219)

Applications

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

Characteristics

- Universal input 100-240 V AC
- Constant voltage, current limited
- Exchangeable primary adapters (MPP and GPP system)
- Low leakage current
- Low standby power
- LED charge indication
- Continuously short circuit proof
- Reverse polarity protection (not MPP 15 Li-Ion)
- 10KNTC, B = 3977 (GPP 18/36)
- Characteristics:
PP 8 = IU0U, MPP 15 = IOIU
GPP 18/36 = IU0

Technical data

Input voltage
Input current

100 to 240 V ($\pm 10\%$)
PP 8 (0,13 – 0,2 A), MPP 15 (0,25 – 0,3 A),
MPP 30 (0,4 – 0,5 A), GPP 18 (0,2 – 0,4 A)
GPP 36 (0,18 – 0,45 A)

Frequency
Efficiency
EMC

50 to 60 Hz
75 % at full load
Conforms to
EN 55011, 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, EN 60601-1

Output current tolerance

$\pm 10\%$

Environmental specification

Operating temperature 0 to 40° C at maximum load
Storage temperature -40 to 70° C
Humidity 5 % to 95 % non condensing
Input transient susceptibility Complies with IEC 61000 requirements

Safety specification

Standards
Fulfills class II, SELV according to following standards:
IEC 60601-1, IEC 60335-2-29,
UL 1310, UL 2601-1

Reliability specification

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

Mechanical specification

Weight
PP 8 Li-Ion (125 g),
MPP 15 (140 g), MPP 30 (278 g),
GPP 18 (200 g), GPP 36 (320 g), GPP 36 7S (260 g)
Plug connector
AC input:
MPP/GPP: FRIWO exchangeable mains plug system, PP 8: Euro, USA/Japan, UK
DC output:
Universal output plug system (page 34)

For primary adapters see page 34

Li-Ion



LiFePO₄



| Product | FW Type | Approvals |
|-------------------------------|---------|--|
| PP 8 Li-Ion | FW 7574 | CE |
| MPP 15 Li-Ion | FW 7219 | CE, ENEC, GS, C-UL US |
| GPP 18 Li-Ion | FW 7290 | CE, SI, C-UL US, V |
| GPP 36 Li-Ion | FW 7300 | CE, SI, C-UL US, V, SI (Approved Medical Device IEC60601-1 IEC60601-2) |
| GPP 36 Li-Ion 7 Cells | FW 7310 | CE |
| GPP 18 LiFePO ₄ | FW 7290 | CE, ENEC, GS, C-UL US |
| GPP 36 LiFePO ₄ | FW 7300 | CE, ENEC, GS, C-UL US, V, SI (Approved Medical Device IEC60601-1 IEC60601-2) |

Switchmode Chargers

Chargers

with exchangeable primary adapters
(MPP 15/30 and GPP 18/36)

All products conform to IEC 60335 and IEC 60601-1 (not FW 7304, 7219, 7290)

Applications

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

Characteristics

- Universal input 100–240 V AC
- Constant voltage, current limited
- Exchangeable primary adapters (MPP and GPP system)
- Low leakage current
- Low standby power
- LED charge indication
- Continuously short circuit proof
- Reverse polarity protection (not PP 8 Pb)
- 10KNTC, B = 3977
- Characteristics: Pb = IU0U

Technical data

Input voltage
Input current

100 to 240 V ($\pm 10\%$),
PP 8 (0.13 – 0.2 A),
MPP 15 (0.25 – 0.3 A), MPP 30 (0.4 – 0.5 A),
GPP 18 (0.2 – 0.4 A) GPP 36 (0.18 – 0.45 A)

Frequency
Efficiency
EMC

50 to 60 Hz
75 % at full load
Conforms to
EN 55011, 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 current tolerance

$\pm 10\%$

Environmental specification

Operating temperature

0 to 40° C at maximum load

Storage temperature

-40 to 70° C

Humidity

5 % to 95 % non condensing

Input transient susceptibility

Complies with IEC 61000 requirements

Safety specification

Standards

Fulfils class II, SELV according to following standards:
IEC 60601-1 (NiCd/NiMH only MPP 15)
IEC 60335-2-29, UL 1310, UL 2601-1 (only Li-Ion),
VDE, CE label, CSA

Reliability specification

MTBF calculation

200,000 hours resp. 100,000 hours (NiCd/NiMH) at maximum load and an ambient temperature of 25° C (in accordance with MIL-HDBK-217)

Mechanical specification

Weight approx.

PP 8 Li-Ion (125 g),
MPP 15 (140 g), MPP 30 (278 g),
GPP 18 (200 g) GPP 36 (320 g)

Plug connector

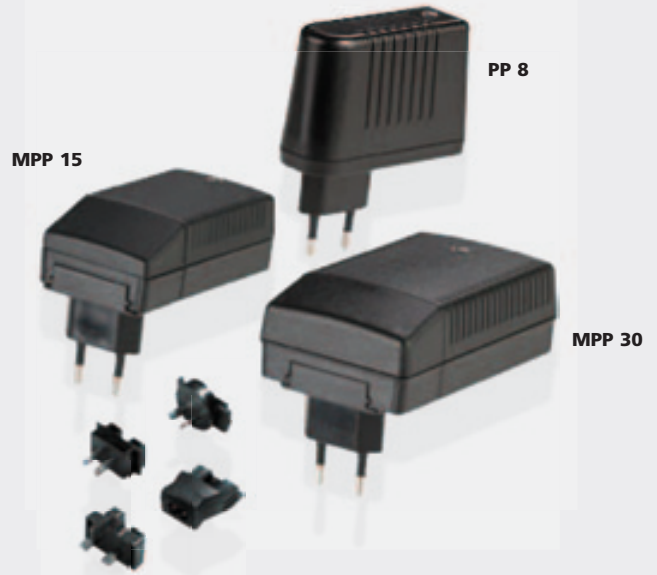
AC input:
MPP/GPP: FRIWO exchangeable mains plug system, PP 8: Euro, USA/Japan, UK
DC output:
Universal output plug system (page 34)

For primary adapters see page 34

NiCd/NiMH



Pb



Product

FW Type

Approvals

MPP 15 NiCd/NiMH FW 7219

MPP 30 NiCd/NiMH FW 7304

GPP 18 NiCd/NiMH FW 7290

GPP 36 NiCd/NiMH FW 7300

PP 8 Lead Acid FW 7118

MPP 15 Lead Acid FW 7218

MPP 30 Lead Acid FW 7318

Accessories

Primary adapters

The MPP/GPP line is available with country-specific mains plugs. The products are therefore universally applicable. Not only do the plugs enhance mobility and reliability of the corresponding product, they even facilitate the management of the country versions of power supplies and chargers.

In countries with other mains plug types, the IEC adapter with the 2-pin IEC 320 C8 socket provides a standardized alternative.

Primary adapters GPP system



Primary adapters MPP system

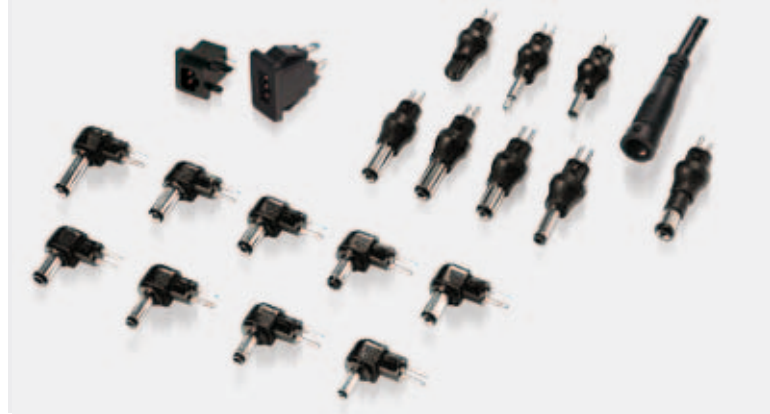


Secondary adapters

All standard units come with a round lead of 1.83 m length and our approved secondary adapter system. Depending on the required output voltage, the wire diameter is between 0.25 mm² (AWG30) and 1,31 mm² (AWG16). FRIWO also offers a broad range of secondary output plugs, including coaxial plugs (acc. to DIN 45323) and jack plugs (acc. to DIN 45318). Polarity is adjustable by reversing connector.

Customer-specific leads are also an option. If necessary, customer-specific flat or round leads can be fitted. Special versions as well as types and dimensions of low voltage plugs are available too.

Secondary adapters



Power cords

Power cords with 2 contact IEC 320 C7 mains plug provide a specific solution for each country. All power cords are 2 m of length and can be used with our IEC 320 CB socket for the MPP/GPP and DT lines.

Power cords





LED Drivers Standard Range

All products comply with
EN61347-1 and EN61347-2-13

Applications

- Lighting

Characteristics

- Voltage and current regulation within single design
- Compact design: 21 x 30 mm (LT 10 – LT 60), 24 x 30 mm (LT 100)
- Active PFC \geq LT 40
- Continuously short circuit proof
- Overload protection
- Overtemperature protection
- Fastening by screws, rivets, cable straps or clips...
- LED dimmable with DALI, 1-10V or Push-Dim via connectable DIMMbox
- IP rating: IP20, IP67 (LT-UP, LT 40 WP)

Technical data

Input voltage

100 to 120 V AC
220 to 240 V AC

Input current

150 mA (LT 10 UP), 200 mA (LT 20 UP),
90 mA (LT 10), 200 mA (LT 20), 180 mA (LT 40)

Frequency

50 to 60 Hz

Efficiency

up to 91% typ. at full load

EMC

Conforms to

EN 55012, EN 61000-3-2, EN 62384, EN 61547
 $\pm 2\%$

Output voltage tolerance

Environmental specification

Operating temperature

-20 to +45°C at maximum load

Storage temperature

-40 to +70°C

Humidity

5% to 90% non condensing

Input transient susceptibility

 Complies with IEC 61000 requirements

Safety specification

Standards

Fulfils class II, SELV according to
following standards:
EN/IEC 61437-1, EN/IEC 61347-2-13

Reliability specification

MTBF calculation

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

Mechanical specification

Weight approx.

90 g (LT 10 UP), 125 g (LT 20 UP), 50 g (LT 10),
82 g (LT 20), 106 g (LT 40)

Plug connector

connecting bracket 0.5..1.5 mm²

LT Accessories



LT SQ Cap

Order No. 1840704
for LT 40 SQ, LT 60 SQ

LT Cap

Order No. 1839772
for LT 10, LT 20, LT 40, LT 60,
LT 100 and DIMMbox

LT Cap slim

Order No. 1844170
for LT 10, LT 20, LT 40, LT 60,
LT 100 and DIMMbox

LT UP FW7804



LT 10 LT 10



LT 20 LT 20



LT 40 LT 40





LED Drivers Standard Range

All products comply with
EN61347-1 and EN61347-2-13

Applications

- Lighting

Characteristics

- Voltage and current regulation within single design
- Compact design: 21 x 30 mm (LT 10 – LT 60), 24 x 30 mm (LT 100)
- Active PFC \geq LT 40
- Continuously short circuit proof
- Overload protection
- Overtemperature protection
- Fastening by screws, rivets, cable straps or clips...
- LED dimmable with DALI, 1-10V or Push-Dim via connectable DIMMbox
- IP rating: IP20, IP67 (LT-UP, LT 40 WP)

Technical data

Input voltage

100 to 120 V AC
220 to 240 V AC

Input current

180 mA (LT 40 WP), 300 mA (LT 60),
450 mA (LT 60 SQ), 700 mA (LT 60 SQ US)

Frequency

50 to 60 Hz

Efficiency

up to 91% typ. at full load

EMC

Conforms to
EN 55012, EN 61000-3-2, EN 62384, EN 61547
 $\pm 2\%$

Output voltage tolerance

Environmental specification

Operating temperature

-20 to +45°C at maximum load

Storage temperature

-40 to +70°C

Humidity

5% to 90% non condensing

Input transient susceptibility

 Complies with IEC 61000 requirements

Safety specification

Standards

Fulfils class II, SELV according to
following standards:
EN/IEC 61437-1, EN/IEC 61347-2-13

Reliability specification

MTBF calculation

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

Mechanical specification

Weight approx.

200 g (LT 40 WP), 130 g (LT 60),
150 g (LT 60 SQ), 160 g (LT 60 SQ US)
connecting bracket 0.5..1.5 mm²

Plug connector

LT 40 WP LT 40 WP



LT 40 SQ LT 40 SQ



LT 60 LT 60



LT 60 SQ LT 60 SQ



LT Accessories



LT SQ Cap

Order No. 1840704
for LT 40 SQ, LT 60 SQ

LT Cap

Order No. 1839772
for LT 10, LT 20, LT 40, LT 60,
LT 100 and DIMMbox

LT Cap slim

Order No. 1844170
for LT 10, LT 20, LT 40, LT 60,
LT 100 and DIMMbox

LED Drivers Standard Range

All products comply with
EN61347-1 and EN61347-2-13

Applications

- Lighting

Characteristics

- Voltage and current regulation within single design
- Compact design: 21 x 30 mm (LT 10 – LT 60), 24 x 30 mm (LT 100)
- Active PFC \geq LT 40
- Continuously short circuit proof
- Overload protection
- Overtemperature protection
- Fastening by screws, rivets, cable straps or clips...
- LED dimmable with DALI, 1-10V or Push-Dim via connectable DIMMbox
- IP rating: IP20, IP67 (LT-UP, LT 40 WP)

Technical data

Input voltage

100 to 120 V AC
220 to 240 V AC

Input current

325 to 300 mA (LT 60 DPA), 480 mA (LT 100),
0 to 5A (DIMMbox)

Frequency

50 to 60 Hz

Efficiency

up to 91% typ. at full load

EMC

Conforms to
EN 55012, EN 61000-3-2, EN 62384, EN 61547
 \pm 2%

Output voltage tolerance

Environmental specification

Operating temperature

-20 to +45°C at maximum load

Storage temperature

-40 to +70°C

Humidity

5% to 90% non condensing

Input transient susceptibility

Complies with IEC 61000 requirements

Safety specification

Standards

Fulfils class II, SELV according to
following standards:
EN/IEC 61437-1, EN/IEC 61347-2-13

Reliability specification

MTBF calculation

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

Mechanical specification

Weight approx.

200 g (LT 40 WP), 130 g (LT 60),
150 g (LT 60 SQ), 160 g (LT 60 SQ US)
connecting bracket 0.5..1.5 mm²

Plug connector

LT 60 DPA LT 60 DPA



LT 100 LT 100



DIMMbox DIMMbox



LT Accessories



LT SQ Cap

Order No. 1840704
for LT 40 SQ, LT 60 SQ

LT Cap

Order No. 1839772
for LT 10, LT 20, LT 40, LT 60,
LT 100 and DIMMbox

LT Cap slim

Order No. 1844170
for LT 10, LT 20, LT 40, LT 60,
LT 100 and DIMMbox

LS 12 – Light Control LS 12



E²MS

Excellence in Engineering & Electronic Manufacturing Services



FRIWO is your competent partner for the implementation and development of visions and ideas up to series production of your electronic systems. From PCB assembly, production of entire units and worldwide shipping – with E²MS FRIWO offers a service platform that allows you to focus on your core business and competencies.

We support you throughout the entire value chain: from engineering and prototyping through purchasing and manufacturing and ultimately approval assistance.

FRIWO's lead and competence factory Ostbevern, certified in accordance with DIN EN ISO 9001 and TS 16949, handles the initial production of products by means of modern manufacturing processes (auto assembly, AOI, selective soldering, X-ray, etc...).



Short distances between R&D and production allow innovative production techniques and streamlined processes, which can also be pursued and implemented after a subsequent shift to our global manufacturing locations. This leads to short lead times and consistently high quality, enabling us to support you in accelerating the market introduction of your products.

In case of unplanned or unexpected market developments we are able to respond flexibly with our fast-line production.

Through constant follow-up and continuous improvement of process technology in all areas of manufacturing, we ensure high quality at optimized costs and maximize your business success in the market.

Glossary

| Battery type | Lead Acid | NiCd | NiMH | Li-Ion cobalt manganese | LiFePO ₄ |
|--------------------------------|------------------------------|---|------------|---|---|
| Cell voltage | 2.0 V | 1.2 V | 1.2 V | 3.6 resp. 3.7 V | 3.3 V |
| Energy density [Wh/kg] | 30–50 | 45–80 | 60–120 | 110–190 110–120 | 90–130 |
| Self-discharge ratio per month | 5% | 20% | 30% | 2–5% | 2–5% |
| Overload tolerance | high | moderate | low | very low | very low |
| Charging cycles | 200–400 | 1500 | 300–500 | 300–500 | 1000–2000 |
| Charging method | U = const. | I = const. | I = const. | 300–500 | U = const. |
| Charging characteristic | IU0U, IU1a | I0I | I0I | IUa | IUa |
| | Phase 1: constant current | Charging criteria: -dV, dT/dt, dU/dt, T _{max} | | Phase 1: constant current | Phase 1: constant current |
| | Phase 2: constant voltage | Identification and control via microcontroller | | Phase 2: constant voltage ± 1 % tolerance | Phase 2: constant voltage ± 1 % tolerance |
| | Phase 3: trickle charge | | | | |

Abbreviations

| | |
|-------------------|---|
| CPP | = Customized Power Plug |
| DT | = Desktop |
| E ² MS | = Engineering & Electronic Manufacturing Services |
| GPP | = Global Power Plug |
| LED | = Light Emitting Diode |
| LT | = LED Driver |
| MPP | = Multi Power Plug |
| OF | = Open frame |
| PP | = Power Plug |
| SMT | = Surface Mount Technology |
| UP | = In-wall |
| USB | = Universal Serial Bus |

Cell chemistries

| | |
|---------------------|--------------------------|
| Li-Ion | = Lithium Ion |
| LiFePO ₄ | = Lithium Iron Phosphate |
| NiCd | = Nickel Cadmium |
| NiMH | = Nickel Metal Hydride |
| Pb | = Lead Acid |

Ambient temperature

Temperature of inactive air which surrounds the power supply. It is usually measured approx. 10 mm apart from the running power supply.

Class B

Protection against electric shock in due consideration of the leakage current.

Class BF

Like B, but taking into account the so-called „F parts“ which may accidentally come into contact with the patient and which are isolated from other parts.

Class CF

Class with the highest protection.

Current limited

Electronic overload protection which limits the maximum output current to a preset value.

Efficiency

Efficiency is calculated as the ratio of output to input power and is always smaller than 1. To reduce the power loss under the given load prerequisites, the maximum efficiency ratio is aspired. For a power supply it is measured at full load and at nominal input. The difference between input and output is transposed into heat, hence each increase of the efficiency ratio means less thermal stress on the components and therefore a life-cycle increase. Even a minor improvement of the efficiency ratio can have a dramatic impact on the life-cycle.

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