

# **OPERATING INSTRUCTIONS**

## **Digital sinus voltage converters 12V/24V DSW-300\_DSW-600\_DSW-1200\_DSW-2000\_DSW-2000S**

### **Dear customer,**

Thank you very much for the trust you have placed in us. You have acquired a reliable high-quality product which will deliver good services for a long time if used appropriately.

Please read these instructions for use thoroughly and completely prior to putting it into operation. You receive important information for safe operation and maintenance of the device.

### **The pack contains: Voltage converter, operating instructions**

### **Intended use**

The devices of the digital sinus voltage converter series DSW serve for mobile and mains-independent power supply of various 230V AC consumers from a 12V or 24V battery. They are used to operate equipment such as TV and Sat systems, audio systems, tools, pumps, household appliances, compressors, chargers for mobile phones or laptops easily and flexibly.

The user must ensure that the device is protected against humidity and damp. Any other use than described before may damage this device; in addition, improper use may result in serious hazards, such as short-circuiting, fire, electrical shock etc.

The entire product must not be modified or converted and the housing must not be opened in any manner whatsoever!

### **Safety instructions**

#### **Dear customer,**

**The following safety notes and hazard warnings serve not only for the protection of the device but also for the protection of your health. Please read the following points thoroughly.**

**In case of property damage or personal injuries caused by improper handling or non-observance of these operating instructions or the safety notes stated herein, the warrant/guarantee expires. We assume no liability for any consequential damages.**

#### **General**

- For safety and technical approval reasons (CE), the unauthorized conversion and/or modification of the product is not permitted.
- The voltage converter provides an output of 230V AC. Even in switched-off condition charged condensers may still produce 230V AC at the output for a short time.
- This device is no toy and must not be used by children! Please ensure childproof operation and storage of the device at any time.
- Maintenance, installation or repair works may only be performed by an expert/qualified workshop. Use only original spare parts for repair work. The use of any other spare parts may lead to serious damage to property and personal injury!  
The interior of the device does not contain any product components which must be adjusted or maintained by you.
- Don't leave packaging material heedlessly. It could become a hazardous toy for children!
- Handle the product with care; impacts, shocks or even a fall from a low height may cause damage. In this case have the voltage converter checked by a qualified expert before restart.
- If you detect damages, stop operating the device. Bring it to a qualified workshop or dispose of it in an environmentally compatible manner.

#### **Operation**

- The product may only be operated in a dry environment. It may not get humid or wet, otherwise there is a risk of life-threatening electrical shocks.
- The use of the product under unfavorable environmental conditions must be avoided under all circumstances. Unfavorable environmental conditions include: ambient temperatures above 50°C, flammable gases, solvents, vapours, dust, relative humidity in excess of 80%, and moisture.
- The device may not be operated or charged in the presence of flammable materials or gases. Explosion hazard!
- Ensure proper ventilation during the operational phase, never cover the voltage converter and connected devices.
- Protect the voltage converter against electro-magnetic fields as well as impacts and vibrations.
- Protect the voltage converter against heat! Should the voltage converter become too hot due to high ambient temperatures, the overheat protection switches the device off to avoid consequential damage. In this case, wait until the device has cooled down.
- Avoid sudden differences in temperature! This may cause the formation of condensation water in the voltage converter! In this case, the voltage converter must be adjusted to the new ambient temperature before start at a well ventilated place for a least one hour.
- Keep the voltage converter away from ignition sources or open fire! Explosion hazard!

- Operate fluorescent tubes only in conjunction with this voltage converter if they are equipped with an electronic starter or electronic ballast. Using conventional starters may lead to severe damage of the voltage converter.
- AC outputs of several power sources may not be connected in parallel! Do not connect AC generators or mains voltage to the AC output of the voltage converter. **This leads to the immediate destruction of the voltage converter!**
- Never open the voltage converter! Even after disconnecting the device from the battery there may be hazardous voltages in the interior of the device. This is why service and repairs may only be carried out by authorized and qualified personnel.

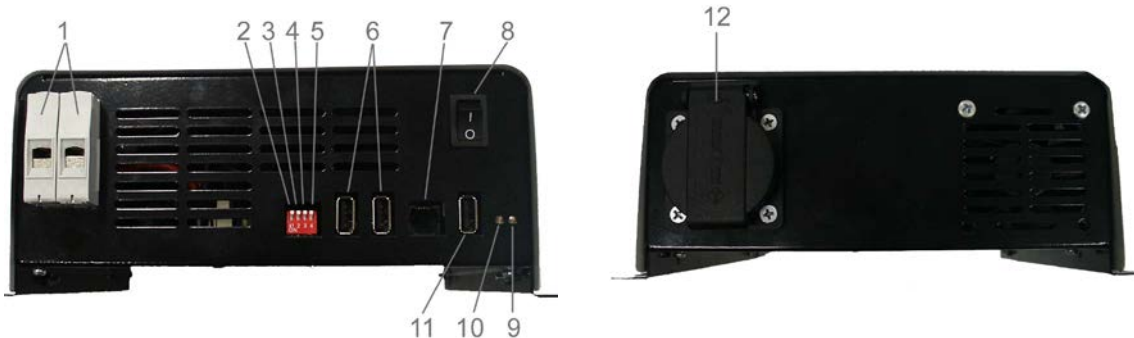
**Warning:** Improper assembly may cause hazardous contact voltages even on the closed device!

**Notes on the battery**

- If used improperly, lead batteries are a high risk for humans, animals and the environment. Always observe the safety instructions of the battery manufacturer!
- Lead batteries contain aggressive corrosive acids. Avoid eye and skin contact with liquids from the battery! Never disassemble lead batteries! Wash the parts of the skin affected thoroughly with water and soap. If acid enters the eye, immediately flood the eye with running, clear and cool water! Then seek medical help immediately! If acid contacts your clothing, wash immediately with soap and water!

**Operation and display elements**

1. Connection terminals 12V/24V DC input	6. Connector for remote control FB-02 or FB-03
2. Switch without configuration	7. Connector for remote control FB-01
3. On/Off switch, standby function	8. On/Off switch
4. Switch for addresses, assignment for remote control FB-02 or FB-03	9. LED control indicator for DC input
5. Switch for addresses, assignment for remote control FB-02 or FB-03	10. LED control indicator for AC output
	11. USB output
	12. 230V AC output



**LED indicators**

The LED control indicators 9 (DC input) and 10 (AC output) provide important information on the operating status of your converter. Both LEDs work independently from one another. I.e., a failure in the DC input area has direct impact on the function of the AC output; or a failure in the output area affects the input function directly.

Operating status/ fault indicators	LED 9 (DC input)	LED 10 (AC output)
Device is switched on and ready for operation	LED is on (green)	LED is on (green)
Early warning for deep discharge protection	Slow blinking (green)	LED is on (green)
Cut-off due to deep discharge protection	Fast blinking (green)	Fast blinking (green)
Input overvoltage	Fast blinking (green)	Fast blinking (green)
Output short-circuit or overload	Fast blinking (green)	Fast blinking (green)

**Description of functions**

The voltage converters of the DSW series are modern, microprocessor-controlled devices which were developed for mobile power supply. The voltage converters of the DSW series convert lower DC input voltage into higher AC output voltage and thus allow for the usage of conventional 230V AC consumers on the road.

These devices offer real sinus alternating voltage which allows for a trouble-free operation also of difficult consumers such as PCs, TV systems and devices with transformers.

Of course, all devices of the DWS sinus voltage converter series are equipped with all necessary safety features which correspond to a state-of-the-art product.

## **Features:**

- Real 230V AC 50Hz sinus output voltage
- Galvanically isolated
- High efficiency
- Precise 50Hz frequency
- Standby function
- Output- and temperature-controlled fan
- Soft start function for consumers with high starting current
- Various remote controls as accessories available
- Overvoltage shutdown
- Adjustable, dynamic deep discharge protection
- Overload management
- Short-circuit shutdown
- Reverse polarity protection
- Temperature-activated protective circuit

## **Connection**

For connecting the DC line, please use cable as short as possible with sufficient cross-section and ensure good contact, both to the battery and to the voltage converter.

To thin or loose connectors may cause fire due to overheating!

- Switch 8 on the front of the device must be set to "Off".
- A high-current fuse must be installed directly at the battery. If this fuse is missing, there is a risk of fire in case of short-circuit of the two connection cables.
- Now connect both connection cables to the battery (positive pole = red; negative pole = black.)

**Attention!** The charge of the big capacitors may cause a spark inside the voltage converter when the fuse is connected. This is perfectly harmless.

## **Recommended minimum cable cross-sections for connection cables**

The recommended minimum cable cross-section for connection cables depends on the input voltage and the length of the used cable.

<b>Model No.</b>	<b>Cable length up to 2 m</b>	<b>Cable length up to 3 m</b>
<b>DSW-300</b>	16 mm <sup>2</sup>	16 mm <sup>2</sup>
<b>DSW-600</b>	16 mm <sup>2</sup>	16 mm <sup>2</sup>
<b>DSW-1200</b>	25 mm <sup>2</sup>	35 mm <sup>2</sup>
<b>DSW-2000</b>	35 mm <sup>2</sup>	50 mm <sup>2</sup>
<b>DSW-2000S</b>	35 mm <sup>2</sup>	50 mm <sup>2</sup>

## **Initial operation**

**In order to guarantee appropriate initial operation, please read these operating instructions including safety information completely and carefully before use.**

Check the voltage converter before every start on possible damages. In case of damages, don't start operation but contact an authorized expert or our service.

Always ensure appropriate ventilation of your voltage converter. Never cover the ventilation slots of the voltage converter. Never use the device in the vicinity of highly flammable materials.

Set up the voltage converter in such a way that it may not fall over or down.

During assembly ensure that the voltage converter is mounted in such a way that it is not accessible for children. **Danger of life!**

Check the voltage requirements of the consumers to be connected. Connect only consumers whose voltage specifications and output correspond with those of the voltage converter. Do not connect defect or damaged consumers.

## **Operation**

To switch the voltage converter on and off activate the on/off switch 8. Now you may connect your 230V AC consumer. The sequence of switching on/off and connecting the consumers is reversible.

**Note:** When you switch off the voltage converter using on/off switch 8 or the remote control FB-01, no own power is required. When you use the remote control FB-02 or FB-03 for this purpose, however, you only switch off the 230 V AC output with it, but not the voltage converter. This is why it continues to require own power. To save energy, we recommend using switch 8 or the remote control FB-01 only for switching off.

## **General notes on using AC consumers on voltage converters**

In principle, all AC consumers may be operated on a sinus voltage converter. Observe, however, that for doing so you are always restricted by the availability of the battery capacity and the output requirements of the individual AC consumers. For a better assessment of the battery reserve, we recommend to familiarize yourself with some relevant characteristics of AC consumers.

One important factor is the own power. Most consumers require a significantly higher starting current than indicated on the type plate of the device. E.g. bulbs require starting current which is up to 8 times higher for approx. 1sec; refrigerators and TV systems require starting current which is up to 10 times higher for 3 sec resp. approx. 1sec. This is why it is necessary when choosing the voltage converter to ensure that corresponding output capacity is available. Therefore, a voltage converter must provide a continuous output of 500 W (50 W x 10) to operate a small refrigerator with a continuous output of 50 W.

### **Standby function**

To conserve the life of the connected battery, you can activate the standby function on your voltage converter. For this purpose activate switch 3 on your device. Now the voltage converter is in standby mode. This reduces the own power consumption significantly. Now the device checks whether load is connected in intervals of 20 seconds. When the voltage converter recognizes a load above standby level (see technical specs), it connects the 230 AC output and is thus in normal operation again.

### **USB output**

The USB output may be used to supply various 5 V consumers with voltage.

**Note:** This output is not suitable for data transmission.

### **Safety and protection mechanisms**

#### **Overvoltage shutdown**

The voltage converter switches off as soon as the value of the input voltage exceeds the starting value.

**Attention!** The voltage converter restarts automatically as soon as the voltage drops to the starting value.

#### **Deep discharge protection**

The voltage converter switches off as soon as the input voltage drops below the set value. This is to protect your battery against deep discharge. The remote controls FB-02 and FB-03 are used to make your own adjustment of the deep discharge protection individually between 9 V-11.5 V on the 12V version or 18-23 V on the 24V version. This adjustment is not possible without the remote control FB-02 and FB-03. Ex works adjustment of the deep discharge protection for the 12 V versions is 10.5 V and 21 V for the 24 V versions.

**Attention!** The voltage converter restarts automatically, if the restart threshold is reached. This voltage converter series is equipped with a dynamic deep discharge protection. I. e., at high output the deep discharge protection is automatically reduced by up to maximum 1.0 V of the set value.

**Note: The restart threshold is a permanently set value which cannot be changed. The value is 12.5 V for the 12 V versions and 25 V for the 24 V versions.**

#### **Temperature-activated protective circuit**

The voltage converter switches off when the temperature inside the device is too high.

**Attention!** The voltage converter restarts automatically when it has reached its normal operating temperature.

#### **Overload management**

The voltage converter switches off when the output or the starting current of the connected devices is too high. Then the voltage converter tries to restart (soft start). Should the device does not restart after repetitive attempts the voltage converter is not suitable for the connected consumer.

**Attention!** The device restarts automatically when the overload is disconnected from the voltage converter.

#### **Short-circuit shutdown:**

The voltage converter switches off when the output is short-circuited.

**Attention!** The voltage converter restarts automatically when short-circuit is fixed.

#### **Reverse polarity protection**

The voltage converter is protected against reverse polarity. This means that your voltage converter continues to be functional when you connect it with correct polarity.

### **Operation with remote control**

Optionally, all models of this voltage converter series may be operated with remote control. You may choose between three various versions.

**FB-01:** This model is a cable version which is directly connected to the voltage converter. It is equipped with an on/off switch and two control indicators for DC input and AC output.

**FB-02:** This model is also cable-connected to the voltage converter and is additionally equipped with an LC Display. The display serves for both monitoring important values and making adjustments, e.g. deep discharge protection. The remote control is also equipped with a SD card slot. This allows for storing important values and easily transferring them to your PC.

**FB-03:** This model is a radio version. The receiver is connected to the voltage converter. The display offers the same functions and adjustment features as the DSW FB-02 display.

#### **Address settings:**

Address settings enable control and data readout for up to 4 converters with one LCD remote control. The converter is assigned an address from 1 to 4 by changing the DIP switch position (see picture). This setting is only required if the Remote is used for more than one DSW converter.



## Digital Sinus Inverter 12V/24V DSW-2000S (synchronous)

### Brief description of the synchronous version:

Two DSW-2000S inverters are connected in parallel via an additional connection socket and synchronised to achieve a permanent output of 4000 W. Please use only the synchronous cable supplied by the manufacturer.

The inverter DSW-2000S can be operated by remote control.

The two inverters can also be operated individually with the respective continuous output of 2000 W.

All of the other features and operation elements correspond to the DSW-2000, and were described in detail at the start of these operating instructions.



Fig. 1

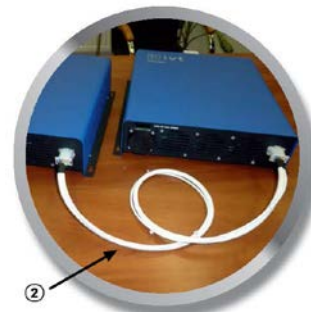


Fig. 2

1. Connection socket for synchronous cable
2. Synchronous cable

### Connection of the DSW-2000S

In order to ensure a correct start-up, make sure to read these operating instructions and the safety warnings thoroughly and attentively, and to observe these accordingly.

- Connect the two DSW-2000S units with the aid of the synchronous cable, as shown in Figs. 1 and 2.
- Use the shortest possible cable with an adequate cross section for the DC line, and make sure there is a good contact at the battery and at the inverter.
- The recommended minimum cable cross section of connections cables for the DSW-2000S is 35 mm<sup>2</sup> for cable lengths of 2 metres and 50 mm<sup>2</sup> for a cable length of 3 metres. Please see also the section **“Recommended minimum cable cross sections for connection cables”**.
- **Attention!** Cables which are too thin, or loose connections can lead to fire due to overheating!
- The switch 8 on the front of the device must be at the “Off” position.
- A high current fuse must be installed directly at the battery. If this fuse is missing, a short circuit of the two connection cables can cause a fire.
- Now connect both cables to the battery (plus pole = red; minus pole = black).
- **Attention!** The charging of the large capacitors inside the inverters can cause a spark when the fuse is connected. This is completely harmless.

### Starting up

- Before starting up, always check the inverter for possible damage. If there is damage, do not start the device, but contact an authorised expert or our service department.
- Always make sure that the inverter is adequately ventilated. Never cover the ventilation slots on the inverter. Do not operate the device in the proximity of easily flammable materials.
- Set up the inverter in such a way that it cannot tilt or fall over.
- Mount the inverter in such a way that it is inaccessible to children. Risk of death!
- Check the voltage requirements of the consumers to be connected. Only connect consumers whose voltage and current specifications match those of the inverter. Do not connect any defective or damaged consumers.

For further information on the operation and the individual functions of the device, please see the sections **“Operation”** and **“General Instructions for the operation of AC consumers with inverters”**

Technical data DSW Synchron	DSW-2000S 12 V	DSW-2000S 24 V
Rated voltage DC	12 V	24 V
Input voltage range	11-15 V	22-30 V
Max. input current	248 A	124 A
Input rating in no-load operation	13 VA	13 VA
Continuous output rating	2000 VA	2000 VA
Peak output rating	4000 VA	4000 VA
Output voltage AC	230 V AC $\pm$ 2 %	230 V AC $\pm$ 2 %
Frequency	50 Hz $\pm$ 1 %	50 Hz $\pm$ 1 %
Remote control	yes	yes
Dimensions	391 x 334 x 88	391 x 334 x 88

## Technical specifications

	DSW-300/12	DSW-300/24	DSW-600/12	DSW-600/24
<b>INPUT</b>				
DC rated voltage	12V	24V	12V	24V
DC voltage range	11-15V	22-30V	11-15V	22-30V
Max. input current	31A	15.5A	62A	31A
Adjustable deep discharge protection	9.0 – 11.5V	18.0-23.0V	9.0-11.5V	18.0-23.0V
Early warning deep discharge protection	1.0V by shutdown	1.0V by shutdown	1.0V by shutdown	1.0V by shutdown
Deep discharge protection factory setting	10.5V in neutral 9.5V with nominal load	21.0V in neutral 19.0V with nominal load	10.5V in neutral 9.5V with nominal load	21.0V in neutral 19.0V with nominal load
Restart voltage	12.5V	25V	12.5V	25V
Shutdown, overvoltage	16V	32V	16V	32V
Input power, neutral	4VA	4VA	5VA	5VA
Input power, standby	0.4VA	0.4VA	0.5VA	0.5VA
<b>OUTPUT</b>				
Output voltage	230V AC +/-2%	230V AC +/-2%	230V AC +/-2%	230V AC +/-2%
Frequency	50Hz +/-1%	50Hz +/-1%	50Hz +/-1%	50Hz +/-1%
Permanent output current	1.3Aeff	1.3Aeff	2.6Aeff	2.6Aeff
Permanent output power (cos $\phi > 0.8$ )	300VA	300VA	600VA	600VA
Peak output power (cos $\phi > 0.8$ ) max. 2sec	600VA	600VA	1200VA	1200VA
Efficiency	typ. 90%	typ. 90%	typ. 90%	typ. 90%
Standby level	Output current < 0.1A	Output current < 0.1A	Output current < 0.2A	Output current < 0.2A
<b>GENERAL</b>				
230VAC output	1x push socket	1x push socket	1x push socket	1x push socket
USB output, type A socket	5VDC 500mA	5VDC 500mA	5VDC 500mA	5VDC 500mA
Permissible temperature range	-25 to +60°C at 66% nominal output -25 to +40°C at 100% nominal output	-25 to +60°C at 66% nominal output -25 to +40°C at 100% nominal output	-25 to +60°C at 66% nominal output -25 to +40°C at 100% nominal output	-25 to +60°C at 66% nominal output -25 to +40°C at 100% nominal output
Dimensions LxWxH	263x164x88mm	263x164x88mm	277x234x88mm	277x234x88mm
Weight	1.8kg	1.8kg	2.9kg	2.9kg
<b>DSW-1200/12      DSW-1200/24      DSW-2000/12      DSW-2000/24</b>				
<b>INPUT</b>				
DC rated voltage	12V	24V	12V	24V
DC voltage range	11-15V	22-30V	11-15V	22-30V
Max. input current	124A	62A	248A	124A
Adjustable deep discharge protection	9.0-11.5V	18.0-23.0V	9.0-11.5V	18.0-23.0V
Early warning deep discharge protection	1.0V by shutdown	1.0V by shutdown	1.0V by shutdown	1.0V by shutdown
Deep discharge protection factory setting	10.5V in neutral 9.5V with nominal load	21.0V in neutral 19.0V with nominal load	10.5V in neutral 9.5V with nominal load	21.0V in neutral 19.0V with nominal load
Restart voltage	12.5V	25V	12.5V	25V
Shutdown, overvoltage	16V	32V	16V	32V
Input power, neutral	9VA	9VA	13VA	13VA
Input power, standby	0.9VA	0.9VA	1.3VA	1.3VA
<b>OUTPUT</b>				
Output voltage	230V AC +/-2%	230V AC +/-2%	230V AC +/-2%	230V AC +/-2%
Frequency	50Hz +/-1%	50Hz +/-1%	50Hz +/-1%	50Hz +/-1%
Permanent output current	5.2Aeff	5.2Aeff	8.7Aeff	8.7Aeff
Permanent output power (cos $\phi > 0.8$ )	1200VA	1200VA	2000VA	2000VA
Peak output power (cos $\phi > 0.8$ ) max. 2sec	2400VA	2400VA	4000VA	4000VA
Efficiency	typ. 90%	typ. 90%	typ. 90%	typ. 90%
Standby level	Output current < 0.3A	Output current < 0.3A	Output current < 0.4A	Output current < 0.4A
<b>GENERAL</b>				
230VAC output	1x push socket	1x push socket	1x push socket	1x push socket
USB output, type A socket	5VDC 500mA	5VDC 500mA	5VDC 500mA	5VDC 500mA
Permissible temperature range	-25 to +60°C at 66% nominal output -25 to +40°C at 100% nominal output	-25 to +60°C at 66% nominal output -25 to +40°C at 100% nominal output	-25 to +60°C at 66% nominal output -25 to +40°C at 100% nominal output	-25 to +60°C at 66% nominal output -25 to +40°C at 100% nominal output
Dimensions LxWxH	391x234x88mm	391x234x88mm	391x334x88mm	391x334x88mm
Weight	3.5kg	3.5kg	4.8kg	4.8kg



### Environmental protection note

At the end of its useful life, this product must not be disposed of together with normal household waste, but has to be dropped off at a collection centre for the recycling of electrical and electronic devices. This is indicated by the symbol on the product, on the instruction manual or on the packaging.

The materials of which this product is made are recyclable pursuant to their labeling. With the reuse, the recycling of the materials or other forms of scrap usage you are making an important contribution to the protection of the environment. Please ask your local administration office for the appropriate disposal center.

Technical specifications are subject to change. We assume no liability for typographical errors. V5\_11/2013

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