HIGH-PRECISION AC VOLTAGE SERVO STABILIZER

Automatic Voltage Regulator
Instruction Manual

Powerinverter
Líderes en transformaciones de energía

Technical description and
operating instructions for single-phase stabilizers

series.

General guidelines

Necessary checks at the purchasing of product:

- functioning;
- if there are any mechanical damages;
- if there are warranty card and operation manual detachable coupons indicating date sold and manufacture date and stamped with the shop stamp;
- if product serial numbers are the same as those indicated in warranty card and detachable coupons;
- the presence of seals on the product
- check product completeness.

Necessary points prior to the use of product:

- carefully read the operating instructions;
- in case when product was stored or transported at temperature below +5°C, please put the product in the place with room temperature for 2 hours;
- please read carefully safety instructions.

Contents

ATTENTION!!!
Please read carefully this operating instruction before using our product! Manufacturer guarantees the stable product operation subject to observance of all the requirements set forth in the present operation manual.
Product specifications, configuration and appearance may differ from those provided in operation manual. Manufacturer reserves a right to modify the product parameters not resulting in product performance deterioration without the advance notice.

1. Delivery package

1. Packing	1 pcs.
2. Operating instruction	1 pcs.
3. Voltage stabilizer	1 pcs.
4. Warranty card	1 pcs.
5. Attachment bracket*	1 pcs.

* – for the SDW–II series models only.

2. Purpose and application

ELECTROMECHANICAL PRECISION AC VOLTAGE STABILIZER

High accuracy voltage stabilizers of SDW*II* and SDF*II* series are intended for maintenance of stable voltage in the single–phase network with 220V 50 Hz and mains powering the household electrical appliances.
Application:

- household equipment (TV sets, refrigerators)
- lighting systems
- air conditioning and ventilation systems
- laboratories and test facilities
- heating and water–supply systems
- broadcasting and sound detection systems
- navigation systems
- charge equipment
- medical equipment
- office equipment

Options:

K – Reactive power compensator.
R – Input transformer protection relay;
U – Protective cutout device (PCD).
S – External signal contact.
F – Cooling fan

3. Specifications

Model	Maximum load, W	Maximum input current, A	Weight, kg	Overall dimensions, mm
SDF*II*–4000–L	3000	15	12	245x205x430
SDF*II*–6000–L	5000	25	16	245x205x430
SDF*II*–9000–L	8000	40	25	280x235x450
SDF*II*–12000–L	10000	48	29	280x235x450
SDW*II*–4000–L	3000	15	11	260x156x398
SDW*II*–6000–L	5000	25	15	260x156x398
SDW*II*–9000–L	8000	40	24	303x170x445
SDW*II*–12000–L	10000	48	27	303x170x445

Table 1

1. Regulation range, Input voltage, V	140–260
2. Output voltage, V	220 ± 3,5%
3. Maximum autotransformer operating winding heating temperature, °C	100
4. Harmonic distortion	no
5. Maximum output voltage, V	242
6. Minimum output voltage, V	190
7. Air humidity	< 80%
8. Ambient temperature, °C	0 ... 45

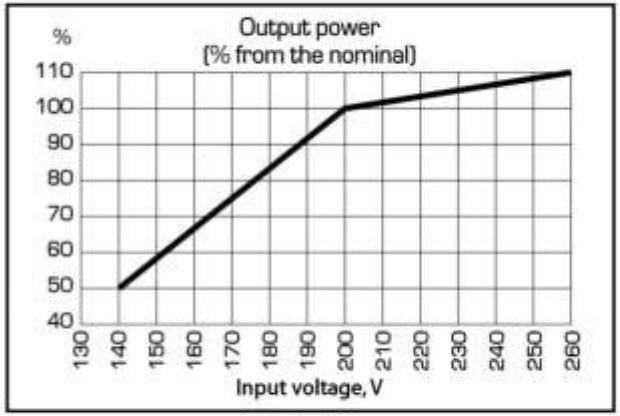

Fig.1

*– Parameters may change without notice!

4. Recommendations on the stabilizer power capacity selection

4.1. Stabilizer capacity selection

The stabilizer overload is not allowed!

Prior to the start of operation, stabilizer load must be thoroughly calculated taking into account the required power margin. When calculating this margin amount, following points should be kept in mind:

Gross output is power consumed by electric appliance, which consists of active and reactive power (depending on the load type). Active power is always specified in kilowatts (kW), while gross output is specified in volt-amperes (VA). Electric power consumers must have both active and reactive load components.

Active load is effective power taken off by any load from electric main and further transformed into any energy type (mechanical, thermal, electric, etc.) This component is principal constituent for some devices. Examples are incandescent lamps, heaters, electric stoves, flat-irons, etc.

Reactive loads are all the other loads. Reactive component does not perform any effective work; it just produces magnetic fields in the inductive receivers circulating continuously between the source and consumer.

4.2. Reduced input voltage

Continuous stabilizer operation at voltage Uin < 170V could cause the stabilizer current overload. This results in the considerable heating of conductive parts and shortens product service life.

Coming from hereinabove, it is recommended to choose a stabilizer model with power margin making at least 25% of load power requirement, taking into account the planned purchasing of equipment to be connected to the stabilizer. Thus you provide the "gentle" stabilizer operation, whereby extending its service life.

It is necessary to determine the total wattage of all the consumers to be powered simultaneously. Approximate wattages of household electronic appliances are resulted in the table below.

Consumer	Power, W	Consumer	Power, W
Household appliances		Electric tools	
Hair drier	450-2000	Hand drill	400-800
Flat-iron	500-2000	Hand drilling hammer	600-1400
Electric stove	1100-6000	Electric grinder	300-1100
Toaster	600-1500	Saw wheel	750-1600
Coffee machine	800-1500	Power planer	400-1000
Heater	1000-2400	Power jigsaw	250-700
Grill	1200-2000	Grinding machine	650-2200
Vacuum cleaner	400-2000	Electric equipment	
Radio receiver set	50-250	Compressor	750-2800
TV Set	100-600	Water pump	500-1600
Refrigerator	150-600	Circular saw	1800-2100
Electric oven	1000-3600	Air-conditioner	1000-3000
Microwave oven	900-2000	Electric motors	550-3000
Computer	400-750	Fans	750-1700
Electric tea kettle	1000-2000	High pressure pump	2000-2900
Electric lamps	20-250	Welding machine	1500-5000
Boiler	1200-2000	Lawn mower	750-2500

Table 2.

4.3. Example of stabilizer power capacity calculation*

Refrigerator (300 W), TV set (400W), air-conditioner (1000W), radio set (100W) and electric lamps (200W) are operating under stationary conditions.

Total wattage: 300+400+1000+100+200 = 2000W. Flat iron (1000W), vacuum cleaner (800W) and electric tea kettle (1000W) can be connected simultaneously with stationary electric appliances. In this case the total load can be increased by 800-2800W. Thus maximum total wattage will make 2000+2800 = 4800W.

Let's add 25% to the obtained consumers' wattage, and resulting stabilizer power capacity will make 4800 + 25% = 6000W. Thus, at the simultaneous connection of above devices you need a stabilizer with power capacity of at least 6.0KW.

* Power is calculated for stabilizer operation at the input voltage of at least 200W. Should the voltage be below 200W, correction shall be taken into account in accordance with the Fig.1

5. Operation environment

- Operation environment shall be non-explosive one free of current-conducting dust, corrosive gases, etc.
- Minimum distance from the device body to the walls shall be 10 cm.
- Keep away from direct sunlight.
- Stabilizer should be grounded.
- Stabilizer SDW*II* is designed for operation on the vertical solid surface.
- Stabilizer SDF*II* is designed for operation on the horizontal solid surface.

Attachment stabilizer delivery package includes special bracket for stabilizer can be placed onto the wall. The stabilizer package bracket shall only be used for wall montage. Stabilizer can be mounted at any height, which is chosen so that to provide convenient stabilizer control, but at least 30 cm below the ceiling.

ATTENTION!
During stabilizer operation it is necessary to check periodically the total connected consumers' power compliance with maximum stabilizer power, taking into account dependence on the input voltage.

You need to remeber that some types of consumers (for example, electric motors) are featured by increase in starting power consumption being

3-5 times more than the normal power consumption!

These points should be taken into account at calculation of the total connected load power

6. stabilizer controls

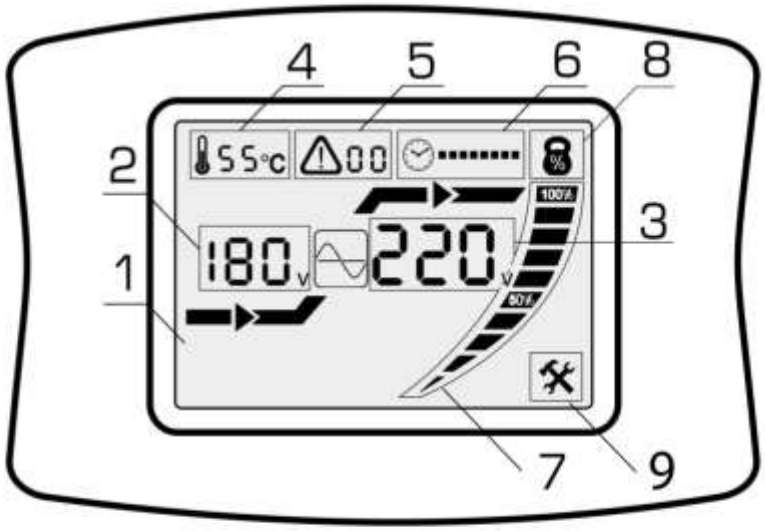

Fig. 2

1. Stabilizer screen display.
2. Input voltage indicator.
3. Output voltage indicator.
4. Autotransformer temperature indication.
5. Error code indication.
6. Stabilizer reaction delay indication.
7. Stabilizer load graduated scale.
8. Overload indication.
9. Necessary preventive measures alarm.

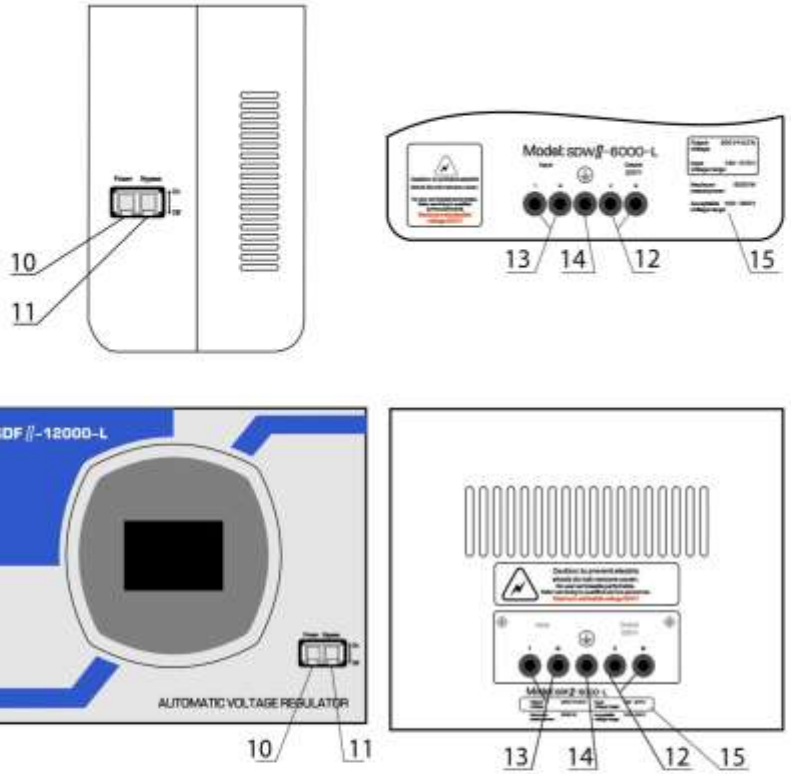

Fig.3

10. "Power" circuit breaker.
11. "Bypass" mode.
12. Load connection.
13. Input voltage connection.
14. Grounding cable connection.
15. Specifications.

7. Product operating principle and design.

The stabilizers are the stabilizers of electromechanical type providing the stepless high-accuracy output voltage control. Voltage is regulated by means of servo motor, which automatically traces input voltage fluctuations. The output voltage is measured and compared to the control unit reference voltage. In case that any deviations are detected, servo motor comes in action adjusting the boost voltage so that the output voltage is equal to the reference value. Bot voltage value is either added or subtracted from the distorted mains voltage depending on input fluctuations.

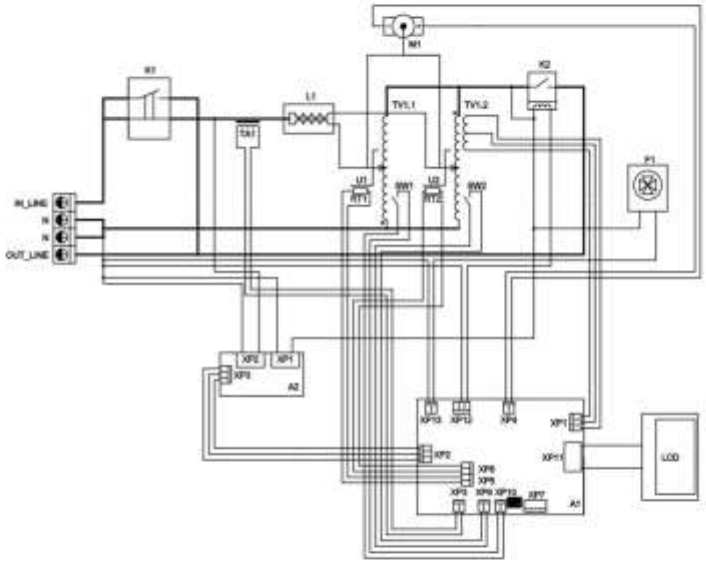

Fig. 4

A1 – circuit board of the servocontrolled stabilizer control unit
F1 – fan – 220V
K1 – input circuit breaker with "Bypass" function
K2 – load disconnection relay
L1 – matching transformer
M1 – servo actuator motor
RT1, RT2 – temperature sensors installed at U1 and U2
TA1 – current sensor
TV1 – power autotransformer
U1, U2 – current collector heat sinks

Following controls are located on the stabilizer front side:

• Network automatic circuit breaker "POWER" with electromagnetic releaser.

• Network automatic circuit breaker "BYPASS" provided for the unregulated transit input voltage.

• LCD display.

Displayed information:

1. Output voltage:

unregulated voltage information.

2. Input voltage:

regulated voltage information.

3. Temperature:

autotransformer and brush current collector temperature Information These data are displayed when temperature reaches 55°C and over.

4. Error:

stabilizer starting and run error information Errors are resulted in the table below.

5. Delay:

this reading is displayed when stabilizer operates in delay mode). The "delay" mode is the time of output voltage switching-on delay after the stabilizer connection to mains or after the load voltage disconnection as a result of protection operation caused by the errors 1, 2, 3, 4, 5, 6. This mode is disabled immediately after the stabilizer regulates output voltage at 220V; mode duration makes 5 seconds. Delay start time can be adjusted up to 270 seconds by operation of the delay push-button pos. 13.

6. Load scale:

it indicates approximate percentage of load power connected to the stabilizer.

The stabilizers are equipped with the digital circuit board with the microprocessor control, which carries out the logical control of stabilizer operation, taking into account input and output voltage, connected load power and temperature conditions. The control circuit board is powered from the power supply source with extended input voltage range (from 0V to 400V), thus ensuring the reliable stabilizer and consumers operation and protection against the critical voltage surges.

The control circuit board operation principle is as follows:

Once the stabilizer is connected to mains, it regulates the output voltage to 220V and switches the load power supply on after 5 sec. In case that output voltage regulation within the limits of 190 – 242V fails for 8 sec (input voltage is much different from set value), error No.7 is displayed.

In the case of output voltage drop below 190V, the load power supply is switched off, and error No.2 is displayed. After the output voltage normalization, "delay" mode is enabled for 5 sec, whereupon the load power supply is switched on.

In case that output voltage exceeds 242V the load power supply is switched off, and error No.3 is displayed. After the output voltage normalization, "delay" mode is enabled for 5 sec, whereupon the load power supply is switched on.

№	Name	Description
1	Temperature exceeds 95°C, or temperature sensor No.1 is closed.	Temperature protection is reset when temperature is lowered to 55°C.
2	Reduced stabilizer output voltage.	See Table 4. Protection is reset when output voltage is stabilized at level of over 190V for 5 seconds.
3	Increased stabilizer output voltage	See Table 4. Protection is reset when output voltage is stabilized at level of below 242V for 5 seconds.
4	Reduced stabilizer input voltage.	Input voltage is below 100V. Protection is reset when input voltage is stabilized at level of over 110V.
5	Increased stabilizer input voltage.	Input voltage exceeds 300V for two seconds. Protection is reset when input voltage is stabilized at level of below 280V for 5 seconds.
6	Current protection operation (overload).	See Table 5. Protection is reset when output voltage is stabilized at level of below 110% of the nominal current for 5 seconds..
7	Stabilizer starting error.	In case that output voltage regulation within the limits of 190 – 242V fails for 8 sec at the stabilizer starting, starting error occurs, thus the stabilizer operation is locked out. Disconnect stabilizer momentary from the 220V mains in order to restore normal operation.
8	Fatal error.	In case that current protection operates 3 times for one hour, fatal error flag is set, and stabilizer operation is locked out. Disconnect stabilizer momentary from the 220V mains in order to restore normal operation..
9	Temperature sensor fault.	Detection of this fault causes the stabilizer operation locking out.

Table. 3.

Stabilizer output overvoltage/undervoltage protection ranges and time frames.

Output overvoltage		Output undervoltage	
Output voltage	Switch-off delay	Output voltage	Switch-off delay
242V	30 sec	190V	30 sec
244V	18 sec	182V	18 sec
246V	9 sec	178V	9 sec
248V	4 sec	175V	4 sec
250V	2 sec	172V	2 sec
253V	1 sec	169V	1 sec
256V	0.2 sec	163V	0.6 sec
		160V	0.2 sec

Table. 4.

In the case of input voltage drop below 100V, protection relay is actuated, and error No.4 is displayed. Once the input voltage exceeded 110V, "delay" mode is enabled for 5 sec, whereupon the load power supply is switched on.

In case that output voltage exceeds 242V the load power supply is switched off, and error No.3 is displayed. After the output voltage normalization, "delay" mode is enabled for 5 sec, whereupon the load power supply is switched on.

Stabilizer input overvoltage/undervoltage protection ranges.

Input overvoltage	
Load disconnection	Input voltage > 300V
Error reset	Input voltage < 290V
Input undervoltage	
Load disconnection	Input voltage < 100V
Error reset	Input voltage > 110V

Table. 5.

In the case that load power connected to stabilizer exceeds maximum permissible value, the load power supply is disconnected, and error No.6 is displayed. After the load power reduction, the delay is enabled for 5 sec, whereupon the output voltage supply is restored. Should this situation occur 3 times for 30 minutes, stabilizer switches input circuit breaker off. In order to restore normal stabilizer operation, total load power shall be revised (total load power connected to stabilizer shall not exceed rated stabilizer power capacity), and then stabilizer shall be switched on.

Time-current protection. Ranges and trip time

Input current range in relation to the rated stabilizer current.	Trip time
110% – 120%	30 sec
120% – 130%	6 sec
130% – 150%	5 sec
> 150%	0,2 sec

Table 6.

Thermal protection

Fan is switched on, if either of two temperature sensors detects temperature raise to 65°C. Fan is switched off when both temperature sensors detect temperature drop to 55°S simultaneously. Thermal protection is activated when autotransformer temperature exceeds 100°C. The load power supply is disconnected, errors No.1 or No.12 are displayed, and autotransformer temperature is displayed as well.

The control circuit board continuously monitors performance of individual stabilizer components. In the case of temperature sensor or servo-actuator motor malfunction, the output voltage is switched off, and errors No.9 or No.11 or No.10 are displayed, respectively.

"Bypass" mode

Stabilizer is featured with "Bypass" function allowing voltage supply to the stabilizer output bypassing the regulation circuit without the need in wiring work.

"Bypass" mode is enabled at stabilizer start locking-out or for period of maintenance work. Display does not light with the "Bypass" mode enabled.

8. Stabilizer connection.

ATTENTION!
Prior to stabilizer connection, make sure that there are no any mechanical damages.

In case that stabilizer was transported at subzero temperature, it shall be kept at room temperature for at least 2 hours in order to prevent condensation.

ATTENTION!
Stabilizer connection shall only be performed by qualified specialist.

- Unpack stabilizer and inspect it visually for possible body or circuit breaker damages.
- Stabilizer installation location shall meet to operation conditions requirements.

- Stabilizer body shall be grounded.
- Prior to stabilizer connection, make sure that "Mains" and "Bypass" switches are set in "OFF" position.
- Connect load to the terminals or electric outlet.
- Connect power supply voltage 220V to the input terminals.
- Set the "Mains" push-button or switch in "ON" position.

9. Safety precautions

ATTENTION!
Stabilizer is electric device designed for alternating current of 50 Hertz. Total power consumption of electric equipment connected to the stabilizer must not exceed calculated total load power (page 4).

Stabilizer connection to network with frequency other then 50 Hertz is PROHIBITED.

Stabilizer connection to direct current network is PROHIBITED. Stabilizer connection at the air humidity exceeding 80% and in case of moisture ingress is PROHIBITED.

Hazardous voltage is present inside the product body. Qualified personnel, who have read and understood this manual, are only permitted to work with product.

Product shall be handled with care; bumps and exposure to liquids, dust and dirt shall not be allowed.

The product operation at occurrence of smoke or smell characteristic for the burning insulation, increased noise, breakage or body cracks occurrence and with damaged connectors is PROHIBITED.

Stabilizer covering, placing of instruments and objects on it and closing of vent opening is PROHIBITED.

Product operation in explosive or chemically active environment, under conditions of exposure to drops or sparks, and outdoor is PROHIBITED.

Product operation without GROUNDING is PROHIBITED. Product shall be grounded via terminal.

Voltage stabilizer connection without dielectric pad or with mechanical damage of any one dielectric pad is PROHIBITED.

Voltage stabilizer operation with damaged wire insulation and stripped wires extending outside the terminal block is PROHIBITED.

Voltage stabilizer building into furniture is PROHIBITED.

ATTENTION!
Failure to meet the above requirements can result in electric shock, stabilizer overheat and even fire outbreak.

10. Maintenance

During stabilizer operation following items shall be inspected once every 12 months:

- grounding, load and input voltage wiring connection security;
- unobstructed air circulation for free-convection cooling system;
- zero body damage;
- proper functionality of measurement instruments.

Always switch stabilizer off when removing found contaminations and tightening loose connections.

Should any malfunction be found, please contact the service center.

11. Transportation and storage regulations

Product shall be transported in the manufacturer's packing.

Transportation is allowed by any type of the surface (in closed compartments), river, marine, air (in closed pressurized compartments) transport vehicles without distance and speed limitations as may be permissible for any particular transportation mode.

Stabilizers shall be stored in the manufacturer's packing at the environment temperature from minus 10°C to plus 45°C and relative humidity not exceeding 80%.

Storage location shall be free of dust and corrosive acid and alkali fume

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