Legat-65

Voltage Stabilizer

Technical Certificate

www.novatek-electro.com

1. Application

Legat-65 single-phase voltage stabilizer, hereinafter referred to as the stabilizer, is designed for providing different consumers with high-stable power supply.

2. Technical Brief

Operation voltage range, V ……..90-300
Maximum output current, A ……30
Maximum output power (at input voltage of 200-240V), VA ……6500
Maximum output power at lower value of input voltage, VA ……3000
Output voltage, V ..…….adjustable, 220-240,
with the step of 1V
Output voltage stabilization accuracy, % ……1.5
Input voltage range at preserved operability, V ……90-380
Mains frequency, Hz ……50/60
Amount of phases ……single-phase
Maximum tripping time at abrupt input voltage deviation by 40V, sec ……0.08
Efficiency factor at 160V< Uinput (Uвх)<240V, not less than % ……...93
Power factor at stabilizer input at active output load of 2 kW, not less than ……0.98
Nonlinear distortion factor of output voltage, not more than ……1%
Weight, kg ……..12
Dimensions, mm ……175x335x290
Allowable cosφ ……0.4
Overload multiplicity ……1.5
Load tripping delay, sec ……adjustable 0-999
Load shedding delay at overloading, sec ……1-15
(depending on the overload extent with linear power-time relation of 110% - 15 sec, 150% - 1 sec)
Cooling ……...forced (fan)

Caution! It is strongly prohibited to put any objects, capable of blocking the air flow, onto the upper cap of the stabilizer.

3. Construction and Operation Principle

The stabilizer operation principle is based on output voltage adjustment by means of pulse-width modulation. At the input and output of the device, there are analog filters, effectively smoothing the impulse noise in the circuit. The stabilizer has the applied transit scheme of a "neutral wire" – from the input to the output of the device, which allows connecting the consumer's equipment, operability of which depends on input voltage phasing correctness.

The stabilizer has two operation modes:

- **VIP mode**, in which there is applied stabilization of **accurately** determined voltage with the error of ±1.5% within the output voltage adjustment (220-240V);

- **economical mode**, in which stabilization is accomplished beyond the established output voltage range. The output voltage within the limits, established by the user, equals the input voltage virtually without energy loss, which allows significant **saving** the electric energy. The minimum allowable range limit is 220V, the maximum one is 240V, which does not exceed the limits of technical information of the most of devices.

The stabilizer faceplate contains (see. figure):

- switch;
- voltage relay PH-111M;
- operation mode switch (bypass);
- socket for application of load of up to 10A;
- two buttons for setting the output voltage and the stabilizer startup delay time;
- indicator mode button;
- fault indicators;
- digital display information indicators (input and output voltage, stabilizer load indication).

On the right side of the stabilizer, there are cable gaskets of input and output, installed on the cover, under which there are terminal blocks.

From the moment of the stabilizer startup, with the period of 3 sec the digital voltage display alternately shows the input voltage, the stabilizer loading percentage, and the output voltage, indicated by the corresponding indicators. The load is tripped after the time, established by the user (factory setting is 3 sec).

In case of output overload, the overload indicator starts to glow. In cases of tripping of voltages with high values of starting current (induction motors, demagnetizing systems of television kinescopes, high-power incandescent lamps), the output voltage reduction is allowable for the period of startup of the aforementioned devices. This function allows reducing the high starting currents and prevents the stabilizer output form shedding.

In case of a load surge exceeding the 100% of power, the load will be cut off according to the linear power-time relation (see Clause 2). To remove false load shedding in cases of short-term overloads (non-startup), the load will be reset up to two times, after which the load will be cut off and the OVERLOAD indicator will be switched on. In case of short circuit (SC), the integrated SC protection trips, the load is cut off and the SC indicator starts to glow. In such a case, to resume the load tripping one should either reset the stabilizer, having preliminarily shut down some electric devices and reduced the power consumption to the allowed value, or remove the cause of SC.

If the input voltage becomes beyond the limits of the operation voltage range, the load will be cut off and the input fault indicator will start to glow. The stabilizer will automatically trip the load after input voltage resumption (with the delay, preset by the user). The load tripping delay is set by the user within 3-999 sec by quick one-time pressing the output voltage setting buttons (this mode is indicated by glowing of both buttons). After that, the user can set the necessary time by himself. If the delay exceeds 5 sec, the digital display will show the countdown to the moment of load application.

The stabilizer has the overheat protection. In case of overheat, the load is cut off and the overheat fault indicator starts to blink. After cooling the device, the load trips with the preset tripping time.

The Table 1 shows the correspondences between the possible fault variants and the fault indicators, as well as the methods of troubleshooting.

Table 1.

	Fault description	Fault indicator			Troubleshooting
		Input	Short circuit/ Overheat	Overload	
1	Overload	-	-	+	Reduce the total load power
2	Input SC	-	+ (yellow)	-	Remove SC, stabilizer on/off
3	input voltage $U_{input}<U_{input.\ min}$ $U_{input}>U_{input.\ max}$	+	-	-	Stabilizer is not appropriate for this circuit
4	Thermal fault	-	+ (red blinking)	-	De-energize the stabilizer, check fan condition

4. Preparing the Stabilizer for Operation

– perform the external inspection of the stabilizer to discover any damage to the housing and to the power cable;

– **make sure to provide ground connection to the circuit socket**;

– connect the stabilizer to the circuit without application of any load, set the switch to the OFF position (shut down);

– apply load;

– set the switch to the ON position (startup).

5. Bypass Mode

The stabilizer includes the possibility of direct load application to the circuit (power not more than 7 kVA): when the stabilized failed, turn the bypass switch to the “I” position and switch on the stabilizer by using the switch (“ON” position), if it had been switched off. The mode operation is controlled by means of the PH-111M voltage relay. ***The distinctive feature of this mode is that the consumer (load) continues being under protection of automation by means of complete shedding.***

PH-111M is able to operate in three independent modes:

— voltage relay;

— minimum voltage relay;

— tripping delay time relay.

PH-111M indicates the actual input voltage value and the output relay condition (on/off).

5.1. Applied terms and abbreviations

The term **normal voltage** means that the input voltage corresponds to all the parameters, preset by the user.

AR abbreviation means automatic reset.

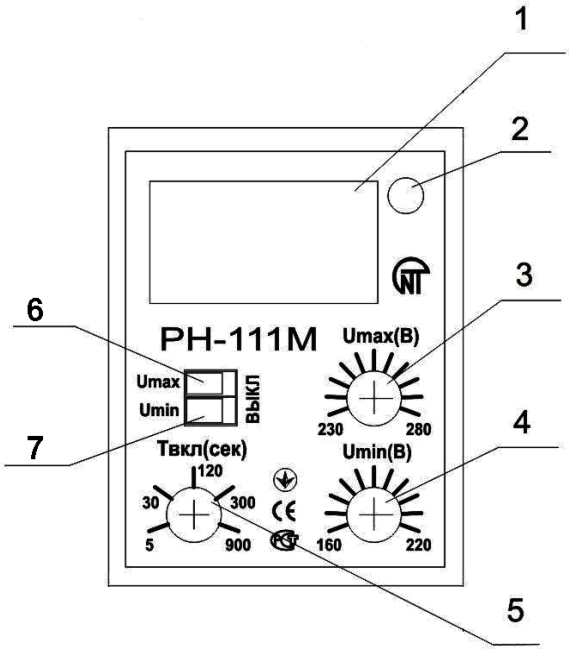

Figure 1 – Faceplate Fragment

1- tricharged seven-segment indicator
2- load tripping indicator
3- maximum voltage relay tripping threshold adjustment (Umax)
4- minimum voltage relay tripping threshold adjustment (Umin)
5- AR time adjustment
6- maximum voltage control switch (Umax)
7- minimum voltage control switch (Umin)

5.2. Technical brief in the bypass mode

Rated voltage, V	220
Mains frequency, Hz	48 – 52
Adjustment range:	
- U_{min} tripping, V	160 – 220
- U_{max} tripping, V	230 – 280
- automatic reset delay time, sec	5 – 900
Fixed U_{max} tripping time, sec	1
Fixed turning off delay time, sec	12
Fixed tripping time at voltage reduction to less than 60 V U_{min} from the setting, sec	0.1
Fixed tripping time at voltage build-up to over 30 V U_{max} from the setting, sec	0.1
Maximum voltage, at which operability of the bypass mode is preserved, V	115
Maximum voltage, at which operability is preserved, V	400
Hysteresis (voltage return factor), V, not less	5

5.3. Preparation to operation in the bypass mode

5.3.1. By means of the switches on the faceplate, set the necessary operation mode (see clause 4.2). It is recommended to toggle the maximum and minimum voltage control modes at the same time, and it is **PROHIBITED to toggle the maximum voltage control mode separately**.

5.3.2. By using the potentiometer knobs, located on the faceplate, set the maximum (U_{max}) and minimum (U_{min}) voltage values, at which the relay must trip, as well as the AR time (T_{on}), depending on what device will be protected by the relay (air-conditioners, refrigerators and other compressor devices allow resetting not less than after 3-4 minutes, while other devices – according to their service instructions).

5.3.3. Turn the bypass switch to the "I" position and, if necessary, set improved values of minimum and maximum voltage, as well as the AR time.

While rotating the potentiometer knob, the indicator displays the corresponding parameter value together with point blinking.

5.4. PH-111M Operation

5.4.1. The relay may be in one of the following conditions:

— normal operation: load is applied, LED glows, and the indicator displays the controlled voltage value;

— fault: load is not applied, LED does not glow, and the indicator displays the controlled voltage value in the blink mode;

— AR delay time indication: load is cut off, LED does not glow, the indicator displays the time in seconds, left until the AR delay time is over, and there is a glowing point in the low-order of the indicator. After the AR time has finished, the relay will turn to the normal operation condition, provided the normal input voltage.

5.4.2. The relay can operate in three independent modes:

— voltage relay (at Umin and Umax switches on): turning to the fault condition either at input voltage reduction to less than the minimum voltage threshold or at input voltage build-up to more than the maximum voltage threshold;

— minimum voltage relay (at the Umin switch on and the Umax switch off): turning to the fault condition at input voltage reduction to less than the minimum voltage threshold;

— tripping delay time relay (at at Umin and Umax switches off).

5.4.3. First switch-on features

If the relay was de-energized, then after normal voltage supply to the input the operation preparation time (0.3-0.4 sec) is added to the AR time, set by the Ton knob, and the indicator shows the "StA" message for a short period.

5.4.4. Minimum voltage relay

If the relay was de-energized, then at normal voltage supply to the input after AR time the relay turns to the normal condition and applies the load.

At input voltage reduction to less than the minimum voltage threshold for a period of over 12 seconds, the relay turns to the fault condition and cuts the load off.

At input voltage reduction to less than 60 V from the minimum voltage threshold, the relay turns to the fault condition after 0.1 sec (operation acceleration Tacc = 0.1 sec is tripped).

At resumption of the controlled voltage level to over the minimum threshold by the hysteresis value, being 4-5 V, the relay operation cycle is repeated.

5.4.5. Voltage relay

If the relay was de-energized or was in the fault condition, then after normal voltage supply to the input, after AR time the relay turns to the normal condition and applies the load.

At input voltage reduction to less than the minimum voltage threshold for a period of over 12 seconds, the relay turns to the fault condition and cuts the load off.

At input voltage reduction to less than 60 V from the preset minimum voltage threshold, the relay turns to the fault condition after 0.1 sec (operation acceleration Tacc = 0.1 sec is tripped).

At resumption of the controlled voltage level to over the minimum threshold by the hysteresis value, being 4-5 V, the relay operation cycle is repeated.

Either at input voltage build-up to over the maximum threshold for the period of more than one second or at input voltage build-up to 30 V more than the maximum threshold for the period of more than0.1 sec, the relay turns to the fault condition and cuts the load off.

At input voltage reduction to over the minimum threshold by the hysteresis value, being 4-5 V, after the AR time the relay returns to the normal condition and applies the load.

5.4.6. Tripping delay time relay

At supply of over 160 V to the input of the voltage relay, after the AR time the relay returns to the normal condition and applies the load.

At voltage reduction to less than 120V the relay turns to the fault condition and cuts the load off.

6. Adjustment

Economical mode. For performing adjustment one should separately set the lower and the upper limits of the output voltage range, when the output voltage is equal to the input one. Setting the lower limit is performed by one-time pressing the lower button. The lower button will start to glow, which means entering the lower limit adjustment mode by means of the upper and the lower buttons. To save the set voltage value in the memory of the stabilizer and exit this setting, one should wait for 2 sec. To set the upper limit one should perform the aforementioned actions with the upper button. **The economical mode** is indicated by *green* Uoutput (Uвых) indicator glowing. In case of input voltage deviation beyond the preset output voltage range, the Uoutput indicator will become *yellow*.

At setting the same values of the lower and the upper limits, the stabilizer turns to the **VIP mode**, which is indicated by *red* Uoutput indicator glowing.

To change the stabilizer tripping time, one should simultaneously press both buttons, and after entering the tripping time adjustment mode – set the necessary time in seconds. The stabilizer will automatically exit the adjustment mode in 3 sec after the latest pressing any of the buttons.

7. Maintenance

CAUTION! All maintenance works must be performed, when the mains voltage is off (disconnect the cable from the lead-in socket, having preliminarily de-energized the circuit input by the external knife switch).

To maintain reliable stabilizer operation one should clean the dust off the ventilator not less than one time per six months, and blow through the whole stabilizer with a vacuum cleaner not less than one time a year. To clean the dust off the ventilator, one should remove the inspection cover on the foundation side. Before blowing through the stabilizer, one should remove the inspection cover and the side panel, in order to get access to the interior of the device.

8. Rules of Transportation, Storage and Operation

It is allowed to transport the stabilizer in the vertical position by any means of transport.

The stabilizer must be stored at the air temperature starting from -40°C to +60°C and at the relative air humidity – up to 80%.

In the storage room, there must not be any dust, acid and alkali vapor, which may cause corrosion.

Service conditions:

– the environment is non-explosive, it does not contain any current-conducting and abrasive dust, aggressive vapor and gases in the concentration, destroying metals and the insulation;

– the environment temperature range is from -10°C to +40°C;

– the relative air humidity is from 60 to 80%;

– the atmospheric pressure, KPa – from 86 to 106.5;

– protection class IP20 (untight).

Caution: Legat-65 stabilizer is a mains capacitive load (around 30 microfarad), therefore while being powered by an independent gasoline (diesel) generator, it may sustain the parasitic resonance of the generator winding with the aforementioned input capacitance. The result of this resonance may be increasing the output voltage on the unloaded generator and the stabilizer input voltage, which can be seen on the Uinput panel of the stabilizer. To make the voltage increase after the resonance be small 10/20%, one should fulfill the following requirement: the total generator power must be not less than twice as high as the power of the stabilizer.

9. Contents

Stabilizer	1 piece
Connection wire lug	6 pieces
Certificate	1 piece
Package	1 piece

10. Things to Remember while Choosing a Stabilizer

While choosing a stabilizer, one should take into account the total power consumption of the load, which you want to connect to the stabilizer. The total power – is all the power, consumed by an electric device, and it consists of active and reactive power (depending on the type of load). The active power is always specified in Watts (W), while the total power – in volt-amperes (VA). The devices are consumers of the electric energy, having both active and reactive components of the load. The total power (VA) and the active power (W) are interrelated by the cosφ factor.

The active load. At this type of load, all the consumed energy is transformed into heat. Some devices have this component as the main one. Examples: incandescent lamps, heaters, electric stoves, irons etc.

The reactive load. All the other types. The reactive component of the power does not perform any useful work, it only serves for conducting magnetic fields in inductive receivers, while circulating all the time between the source and the consumer.

High starting currents. At the moment of start-up, any electric motor consumes the energy, which is several times bigger than in the normal mode. In case when the load contains an electric motor, which is the main consumer in the device (for instance, submersible pump, refrigerator etc.), its nameplate power consumption must be multiplied by 3 to avoid the stabilizer overload at the moment of starting.

Proceeding from all the aforementioned, it is recommended to choose the stabilizer model with a 25% margin of the load power consumption. You will provide the partial load mode of the stabilizer, thereby increasing its service life.

11. Precautions

While choosing a stabilizer one should take into account the total power consumption of the load.

Inside the housing of the stabilizer, there is voltage that is dangerous to life.

It is strongly prohibited:

- to disassemble the stabilizer;
- to connect to the mains and to operate an ungrounded stabilizer;
- to operate the stabilizer, when any of its housing parts is deformed so that it contacts the current-conducting parts;
- to operate the stabilizer at inefficient work of the switch, at the signs of smoke or smell, typical for burning insulation;
- to store and to operate the stabilizer in the rooms with chemically active or explosive environment.

12. Warranty

The manufacturer guarantees the fail proof operation of the ***Legat-65*** stabilizer within twelve months after the date of sale, provided:

- correct connection;
- manufacturer's quality control department seal integrity;
- integrity of the housing, no traces of intrusion, cracks, chips, spalls etc..