



ELECTRUM AV

www.electrum-av.com

01.01.2013
MO27, MO27.1

**REVERSIVE RELAYS
MO27, MO27.1**

USER'S MANUAL



5 Naugorskoe highway, Orel, 302020, Russia
Tel. +7(4862) 44-03-44, Fax +7(4862) 47-02-12, E-mail: mail@electrum-av.com

CONTENTS

| | | |
|---|--|---|
| 1. APPLICATION AND PRODUCED MODULES..... | | 3 |
| 2. GENERAL DESCRIPTION..... | | 3 |
| 3. BASIC PARAMETERS..... | | 5 |
| 4. INSTRUCTIONS FOR USE..... | | 5 |
| 5. RELIABILITY REQUIREMENTS..... | | 7 |
| 6. OVERALL AND CONNECTING DIMENSIONS..... | | 8 |

This document is a user's manual with a description of characteristics of this product for which are warranted. All the products in the production process pass a complete set of electrical tests, which are performed twice, once before encapsulation, and then again after it. Tests carried out by "Electrum AV" are exhaustive and include 100% control at the final testing.

Any such warranty is provided only in accordance with the terms of the supply agreement (supply contract or other documents in accordance with applicable law). The information presented in this document does not provide warranties and liability of "Electrum AV" by the use of such information and the suitability of products for your equipment. The data contained in this document are intended exclusively for technically trained staff. You and your technical expert will have to evaluate the suitability of the product for the application and the completeness of the product data, in connection with this application.

Any products of "Electrum AV" are not permitted for the use in devices and life support systems and special equipment without the prior written consent of "Electrum AV".

If you need information about the product, which is not shown in this user's manual or which concerns the specific application of our product, please contact the sales office to the manager who is responsible for your enterprise.

Engineers "Electrum AV" have a lot of experience in the design, manufacture and application of powerful force devices and smart drivers and has already implemented a large number of individual decisions. If you need power modules and drivers that are not included in the package, as well as products with differences from the standard devices in specifications or design, please contact to our managers and specialists who will offer you best solution for your application.

"Electrum AV" reserves the right to make changes without notice in this document to improve the reliability, functionality and design improvement.

1. APPLICATION AND PRODUCED MODULES

Three-phase optoelectronic semiconductor AC solid state relays with zero transient control of types MO27A, MO27.1A are intended for controlling of three-phase AC motor. The relay provides motor on/off and shaft rotation direction change and has an optocoupler of the control signals from the power circuits as well as blocking signal input of relay turn-on.

Relay MO27 (hereinafter - modules) are represented by the following versions:

MO27A – a three-phase optoelectronic thyristor relay for commutating of motor three phases. The modules are produced with an amount of maximum rms current 25,40,63 A, with peak voltage 1200 V.

MO27.1A – a three-phase optoelectronic thyristor relay for commutating of motor two phases. The modules are produced with an amount of maximum rms current 100 A, with peak voltage 1200 V.

On Figure 1.1 is represented the module name explanation.

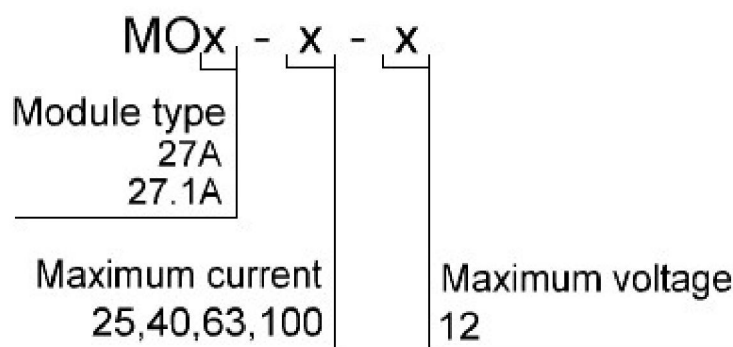


Figure 1.1 – Module name explanation

For example, the module MO27A-40-12: a relay with three controlled phases with peak voltage 1200 V and maximum rms current for each phase 40A.

2. GENERAL DESCRIPTION

The reverse relays provide the motor on/off and motor shaft rotation direction changes as well as have blocking signal input of relay turn-on. Tables of operation states of modules MO27A, MO27.1A are represented in Tables 2.1 and 2.2 respectively; the modules' controlled outputs and their application are represented in Table 2.3.

Table 2.1 – State of relay MO27A

| «Blkg» | «Frw» | «Bckw» | Phc - Lc | Phb - Lb | Pha - La | Pha - Lb | Phb - La |
|----------------|-------------------|------------------|----------|----------|----------|----------|----------|
| -0.8...0.8 V | Any state | Any state | O** | O | O | O | O |
| Circuit opened | U _{ON} * | U _{OFF} | C | C | C | O | O |
| | U _{OFF} | U _{ON} | C | O | O | C | C |
| | U _{ON} | U _{ON} | O | O | O | O | O |
| | U _{OFF} | U _{OFF} | O | O | O | O | O |

Table 2.2 – State of relay MO27.1A

| «Blkg» | «Frw» | «Bckw» | Ph2 - L2 | Ph3 - L3 | Ph3 - L2 | Ph2 - L3 |
|----------------|------------------|------------------|----------|----------|----------|----------|
| -0.8...0.8 V | Any state | Any state | O | O | O | O |
| Circuit opened | U _{ON} | U _{OFF} | C | C | O | O |
| | U _{OFF} | U _{ON} | O | O | C | C |
| | U _{ON} | U _{ON} | O | O | O | O |
| | U _{OFF} | U _{OFF} | O | O | O | O |

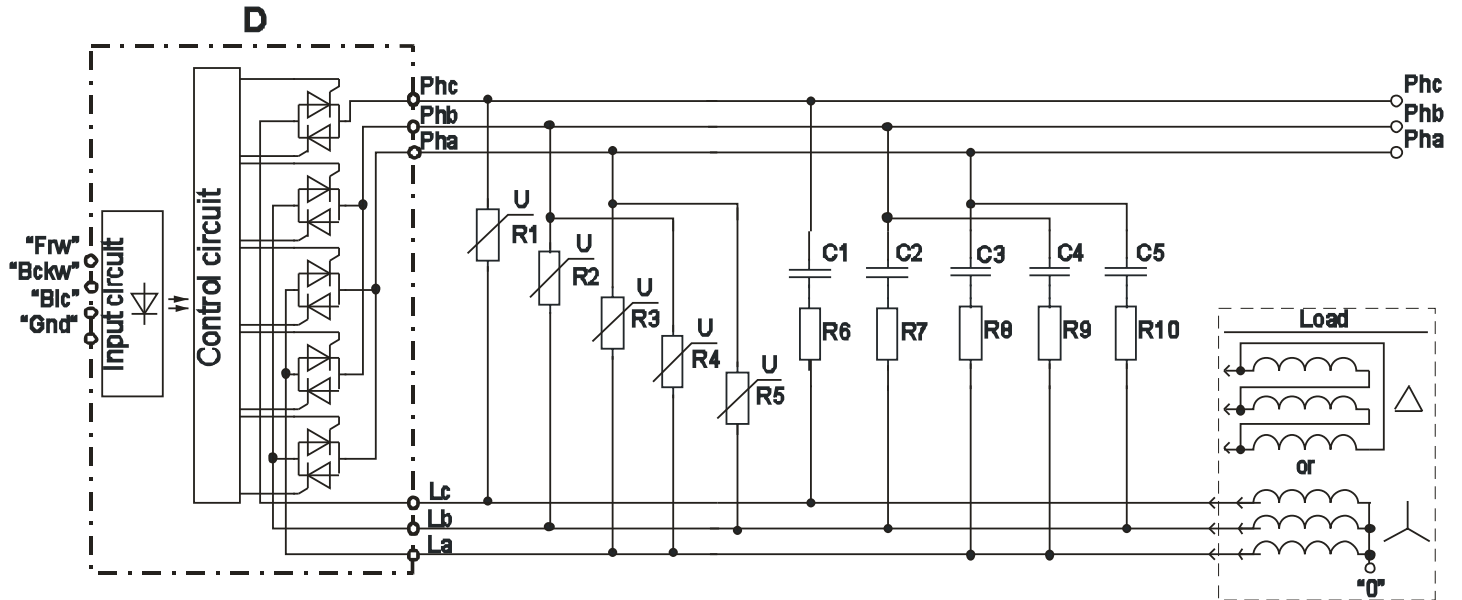
* - values of «U_{ON}» и «U_{OFF}» see in Table 3.1

** - where O – opened; C – closed.

Table 2.3 – Module outputs application

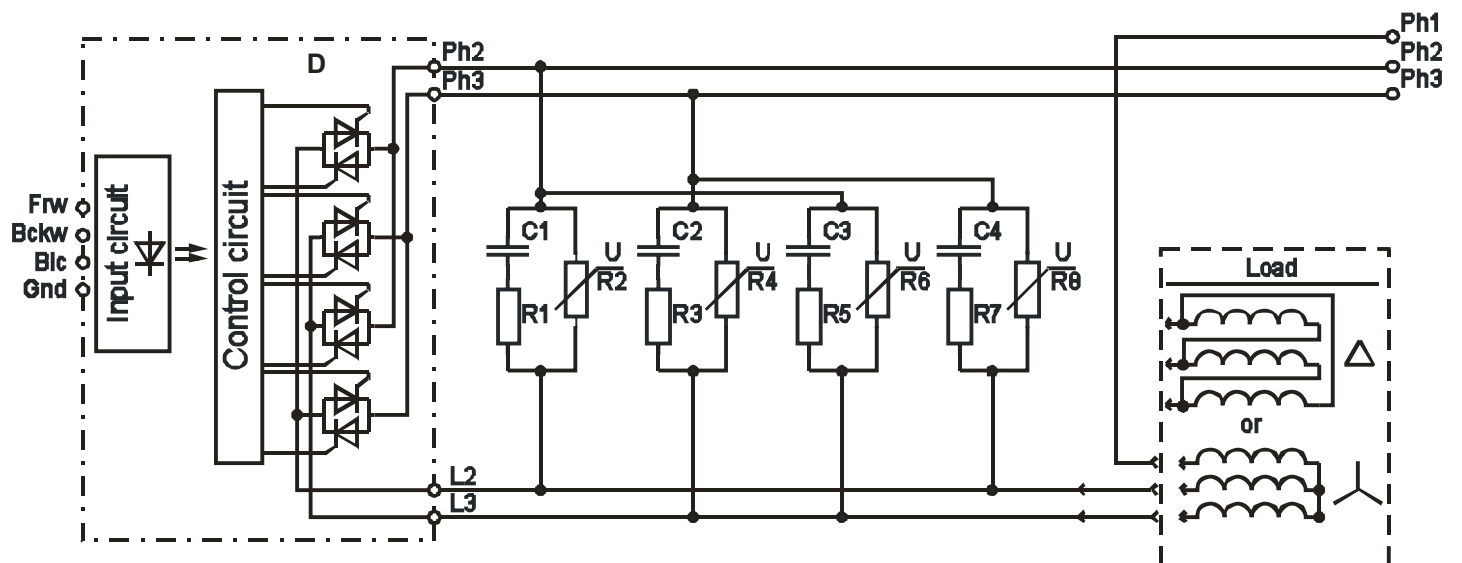
| Output | Application |
|--------|--|
| «Gnd» | Ground output of control circuits |
| «Blkg» | Relay switch-on blocking input |
| «Frw» | Input for setting direction of rotation «Forward» |
| «Bckw» | Input for setting direction of rotation «Backward» |

Functional circuits combined with the connecting circuits of modules MO27A и MO27.1A are represented on Figures 2.1 and 2.2.



D – relay (R1, R2, R3, R4, R5 – protective varistors of type FNR, JVR with $U_{\text{varistor}} = 680 \dots 750 \text{V}$);
Resistors R6, R7, R8, R9, R10 – 22... 39 Ω , 2W and capacitances C1... C5 – 0.05... 0.15 μF can be installed to smooth the varistors' operating mode and extend their life.

Figure 2.1 – Functional circuit of MO27A



D – relay;
C1... C4 – capacitances 0.05... 0.15 μF ;
R1, R3, R5, R7 – resistors 22... 39 Ω , 2W;
R2, R4, R6, R8 – protective varistors of type FNR, JVR ($U_{\text{varistor}} = 680 \dots 750 \text{V}$)

Figure 2.2 – Functional circuit of MO27.1A

3. BASIC PARAMETERS

Basic parameters and maximum permissible parameters of the modules at temperature 25°C are represented in Tables 3.1 – 3.2.

Table 3.1 – Basic and maximum permissible parameters of the modules' control
MO27A, MO27.1A

| Parameter name, unit | Symbol | Value |
|--|---------------------|----------------|
| Input current of inputs «Frw», «Bckw» (max), mA | I _{ON} | 100 |
| Input current of input «Blkg», mA | | -1...1 |
| Controlled voltage to connect inputs «Frw», «Bckw», V | U _{ON} | 4.5...5.5 |
| Controlled voltage to connect inputs «Blkg», V | | -0.8...0.8 |
| Controlled voltage to disconnect inputs «Frw», «Bckw», V | U _{OFF} | -0.8...0.8 |
| Controlled voltage to disconnect inputs «Blkg», V | | Circuit opened |
| On / off time (max), ms | t _{on/off} | 10/10 |

Table 3.2 – Basic and maximum permissible parameters of modules' power circuits
MO27A, MO27.1A

| Parameter name, unit | Symbol | Maximum module current, A | | | |
|--|---------------------------------------|---------------------------|-----|------|------|
| | | 25 | 40 | 63 | 100 |
| Repetitive pulse voltage: reverse / in off-state (max), V | V _{DRM} / V _{RRM} | ±1200 | | | |
| Switching voltage (rms), V | V _{O(RMS)} | ~ 50...430 | | | |
| Switching current (rms), (max), A | I _{O(RMS)} | 25 | 40 | 63 | 100 |
| Surge current in open state at t=10 ms (max), A | I _{TSM} | 150 | 400 | 960 | 1200 |
| Repetitive pulse current: in close state / reverse current (max), mA | I _{DRM} / I _{RRM} | ±1 | | | |
| Pulse voltage in open state at I= I _{O(RMS)} (max), V | V _{TM} | 1.5 | | | |
| Critical rise current rate in open state (max), A/μs | (di _T /dt) _{crit} | 160 | | | |
| Critical rise voltage rate in closed state (max), V/μs | (du _d /dt) _{crit} | 500 | | | |
| Junction-base thermal resistance of each thyristor (max), °C/W | R _{thjc t} | 0.8 | 0.6 | 0.45 | 0.25 |
| Junction temperature (max), °C | T _J | 125 | | | |
| Insulation strength (AC, 50 Hz, 1 minute), V | V _{ISOL} | 2500 | | | |

4. INSTRUCTIONS FOR USE

General requirements

It is recommended to operate the module at operating value of the average current not more than 80% from specified one in the name of the module and the junction temperature not more than (70÷80)% from the maximum one.

It is not allowed to operate the module in modes at simultaneous influence of two or more maximum permissible values.

In the electric circuit of equipment with using of the modules should be provided the fast-speed protection against prohibitive overloads, SCs and commutating overloads.

Module mounting

The module is mounted in the equipment to cooler (chassis, application housing, metal plates, etc.) in any orientation with screws M4 with torque (5±0.5) N·m, with obligatory installation of flat and spring washers. The module should be located in such a way to protect it against additional heat from neighbor elements. The planes of cooler ribs should be oriented in the direction of air flow.

The contact area of the cooler should have roughness not more than 2.5 μm and flatness tolerance – not more than 30 μm. Cooler surface should not have any rough edges, honeycombs. There should not be extraneous particles between the module and cooler. To improve the heat balance the module installation to

mounting area or cooler should be carried out by instrumentality of heat conducting pastes or having similar heat conducting properties.

When mounting, you should provide uniform pressure of module housing to cooler. For this purpose you should tighten all screws uniform in 2 – 4 steps by turns: first, located on one diagonal, then on the other one. When dismantling the module the screw tightening should be done in the reverse order.

Not earlier than in 3 hours after mounting the screws should be rotated to the end, keeping the prescribed torque, because the part of heat conducting paste under pressure will outflow and the fastening can fail.

You can mount the several modules without additional insulating spacer to one cooler, on condition that voltage between outputs of different modules will not exceed the minimum value of isolation breakdown voltage of each of them or when cooler is grounded.

Connection to module

Electric wires and cables will be connected to power contacts of the module by means of screws M6 or M5 with torque (4 ± 0.5) N·m or by means of bolts M8 or M10 with torque (5 ± 0.5) N·m and the washers that are supplied in the package.

Power wires should be connected by means of connectors with corrosion-inhibiting cover, which are purified of foreign layers. When the screws (bolts) are tightened it is recommended to fasten the connection with paint. It is recommended to tighten screws (bolts) repeatedly in 8 days and in 6 weeks after the start of operating. Afterwards tightening should be controlled at least once a half year.

The controlling module outputs (gate and control source output) are intended for mounting by means of soldering or split connectors. Permissible number of module outputs' re-soldering during electronic (assembly) edit is three. Outputs soldering should be performed at temperature not higher than (235 ± 5) °C. Soldering duration is not longer than 3 sec.

When mounting and operating it is necessary to make protection measures against static electricity impact and overvoltage in gate circuit; on mounting personnel should use a ground band and grounded low-voltage soldering irons with transformer supply.

Operation requirements

The module should be used under mechanical loads in accordance with Table 4.1.

Table 4.1 – Mechanical loads impact

| External exposure factor | External exposure factor value |
|---|--------------------------------|
| Sinusoidal vibration: - acceleration, m/s^2 (g); - frequency, Hz | 150 (15) 0.5 - 100 |
| Multiple-acting mechanic shock: - peak shock acceleration, m/s^2 (g); - shock acceleration duration, ms | 40 (4) 50 |
| Linear acceleration, m/s^2 (g) | 5000 (500) |

The module should be used under climatic loads in accordance with Table 4.2.

Table 4.2 – Climatic loads impact

| Climatic factor | Climatic factor value |
|--|-----------------------|
| Reduced ambient temperature: - operating, °C; - maximum, °C | - 40 - 45 |
| High ambient temperature: - operating, °C; - maximum, °C | + 85 + 100 |
| Relative humidity at temperature 35 °C without moisture condensation, %, max | 98 |

Safety requirements

1. Working with the module should only be performed by qualified personnel.
2. Do not touch the power terminals of the module when applying a voltage.
3. Do not connect or disconnect wires and connectors while the power to the circuit module is applying a voltage.
4. Do not touch the module radiator, if it is not grounded in and is applying a voltage on it.
5. Do not touch the cooler and the module housing during its operation, since their temperature can be very high.
6. Immediately turn off the power supply of the module if it discharges smoke, odor or abnormal noises, check if the module correctly connected.
7. It is not allowed to penetrate water and other liquids to the module.

5. RELIABILITY REQUIREMENTS

The manufacturer guarantees the quality of the module all the requirements of the passport if the consumer observes terms and conditions of storage, installation and operation, as well as guidance on the application specified in the user's manual.

Operating warranty is two years from the acceptance date, in case of requalification – from the date of the requalification.

Reliability probability of the module for 25000 hours must be at least 0.95.

Gamma percentage life (T_γ) of module at $\gamma = 90\%$ in typical operation conditions should not be less than 50 000 hours within lifetime.

Gamma-percent service life of the modules, subject to cumulative operating time is not more than gamma-percent life, not less than 10 years, at $\gamma = 90\%$.

Gamma-percent storageability time of the modules, at $\gamma = 90\%$ and storing – 10 years.

6. OVERALL AND CONNECTING DIMENSIONS

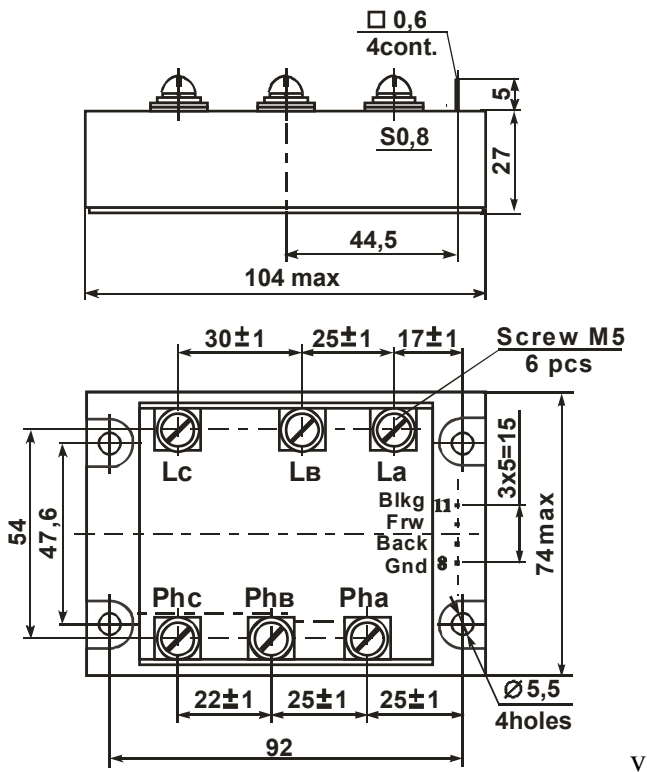


Figure 6.1 – Overall drawing of modules MO27A

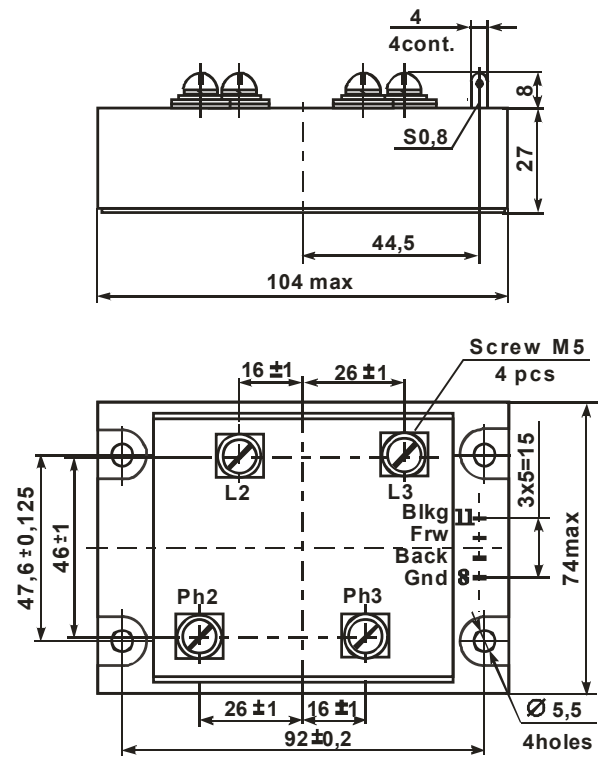


Figure 6.2 – Overall drawing of modules MO27.1A

Precious metals are not contained.