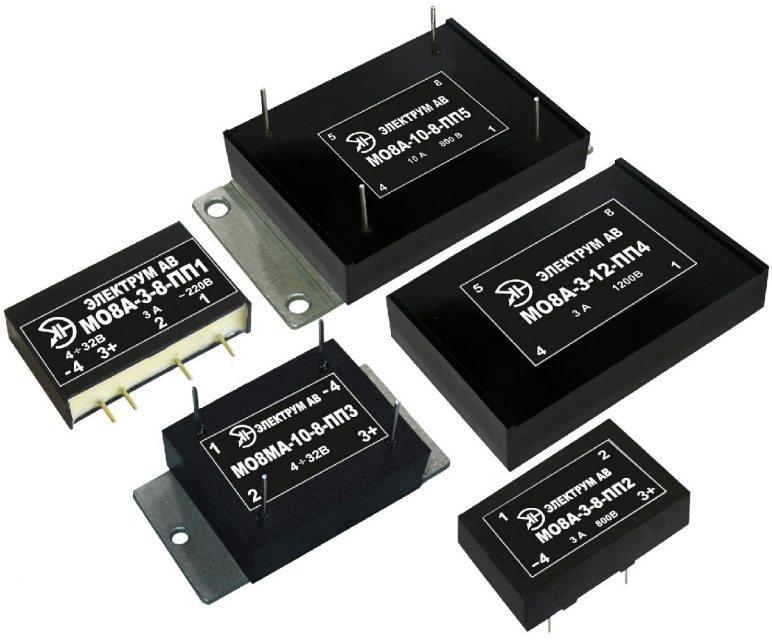
SINGLE-PHASE AND THREE-PHASE AC RELAYS
MO8, MO26

USER'S MANUAL



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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.

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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

Solid state thyristor optoelectronic single-phase (MO8) and three-phase (MO26) AC relays with "normal disconnected" contacts are intended to use in devices of automation as a part of a commutating element with maximum peak voltage up to 1600 V and rms current up to 250 A. The AC relays (hereinafter - modules) are represented with the next versions:

MO26 – three-phase optoelectronic thyristor relay. By the control type:
MO26A – control voltage 4…32 V (DC) without control of phase junction through "zero".
MO26B – control voltage 6…30 V (AC) without control of phase junction through "zero".
MO26C – control voltage 110…280 V (AC) without control of phase junction through "zero".
MO26MA – control voltage 4…32 V (DC) with control of phase junction through "zero".
MO26MB – control voltage 6…30 V (AC) with control of phase junction through "zero".
MO26MC – control voltage 110…280 V (AC) with control of phase junction through "zero".
By types of power assembly:
Peak voltage 1200 V with a number of maximum rms current 25,40,63,100 A.
Peak voltage 1600 V with a number of maximum rms current 25,40,63,100 A.

MO8 – single-phase optoelectronic thyristor relay.
By types of control:
MO8A – control voltage 4…32 V (DC) without control of phase junction through "zero".
MO8B – control voltage 6…30 V (AC) without control of phase junction through "zero".
MO8C – control voltage 110…280 V (AC) without control of phase junction through "zero".
MO8MA – control voltage 4…32 V (DC) with control of phase junction through "zero".
MO8MB – control voltage 6…30 V (AC) with control of phase junction through "zero".
MO8MC – control voltage 110…280 V (AC) with control of phase junction through "zero".
By type of power assembly:
Peak voltage 1200 V with a number of maximum rms current 25,40,63,100,160,250 A.
Peak voltage 1600 V with a number of maximum rms current 25,40,63,100,160,250 A.

The modules MO8 are also in compact versions (see Section 6):
MO8-PP1 – single-phase optoelectronic thyristor relay. By control type:
MO8A – control voltage 4…32 V (DC) without control of phase junction through "zero".
MO8MA – control voltage 4…32 V (DC) with control of phase junction through "zero".
By type of power assembly: peak voltage 800 V or 1200 V with maximum rms current 4 A.
MO8-PP2 – single-phase optoelectronic thyristor relay. By types of control:
MO8A – control voltage 4…32 V (DC) without control of phase junction through "zero".
MO8MA – control voltage 4…32 V (DC) with control of phase junction through "zero".
By types of power assembly: peak voltage 800 V or 1200 V with maximum rms current 4 A.
MO8-PP3 – single-phase optoelectronic thyristor relay. By types of control:
MO8A – control voltage 4…32 V (DC) without control of phase junction through "zero".
MO8MA – control voltage 4…32 V (DC) with control of phase junction through "zero".
By types of power assembly: peak voltage 800 V or 1200 V with maximum rms current 10 A.
2MO8-PP4 – dual optoelectronic thyristor relay. By types of control:
MO8A – control voltage 4…32 V (DC) without control of phase junction through "zero".
MO8MA – control voltage 4…32 V (DC) with control of phase junction through "zero".
By types of power assembly: peak voltage 800 V or 1200 V with maximum rms current 4 A.
2MO8-PP5 – dual optoelectronic thyristor relay. By types of control:
MO8A – control voltage 4…32 V (DC) without control of phase junction through "zero".
MO8MA – control voltage 4…32 V (DC) with control of phase junction through "zero".
By types of power assembly: peak voltage 800 V or 1200 V with maximum rms current 10 A.

Depending on the current the voltage and the version the modules are produced in designs that specified in Table 1.1. The modules are produced only in the versions where at crossing the module type line and the current column is specified the overall dimension corresponding to the version.

Table 1.1 – Produced modules MO8, MO26 and corresponding to them overall dimensions

Type	Maximum rms current, A							
	4	**10**	**25**	**40**	**63**	**100**	**160**	**250**
MO8			Fig. 6.1	Fig. 6.1	Fig. 6.1	Fig. 6.1	Fig. 6.2	Fig. 6.2
MO8-PP1	Fig. 6.3							
MO8-PP2	Fig. 6.4							
MO8-PP3		Fig. 6.5						
2MO8-PP4	Fig. 6.6							
2MO8-PP5		Fig. 6.7						
MO26			Fig. 6.8	Fig. 6.8	Fig. 6.8	Fig. 6.8		

On Figure 1.1 is shown modules name explanation.

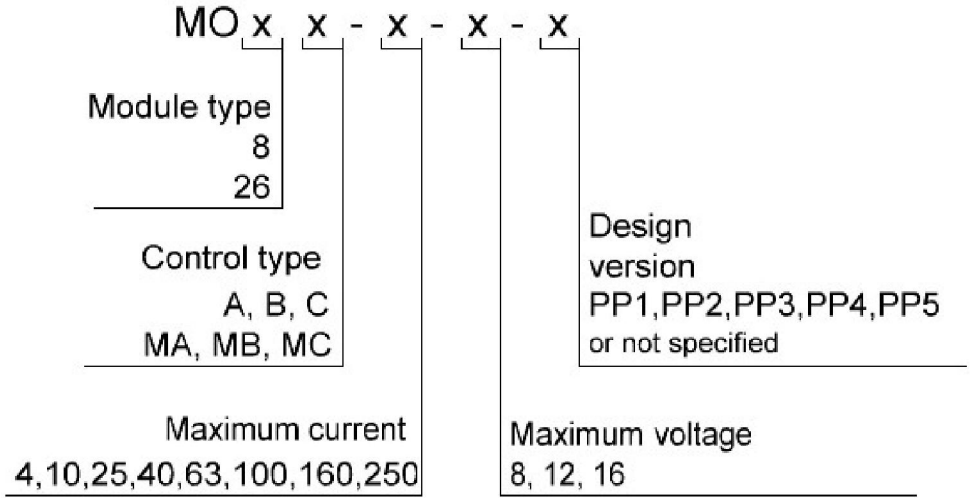

Figure 1.1 – Modules name explanation

For example, module MO8MA-10-12-PP3: a module with control voltage 4…32 V, with control of phase junction through “zero”, with peak voltage 1200 V and maximum rms current 10A in the design version corresponding to Figure 6.5.

2. GENERAL DESCRIPTION

The functional circuits combined with the circuits for switching the modules MO8 and MO26 are represented on Figures 2.1 - 2.4.

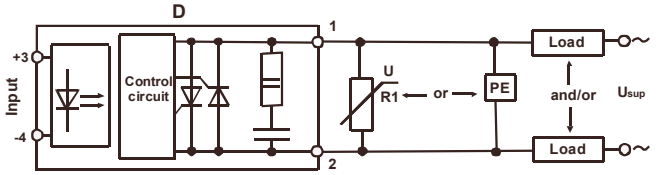

Figure 2.1 – Functional circuit MO8-25(40,63,100)-12(16), MO8-PP1, MO8-PP2, MO8-PP3

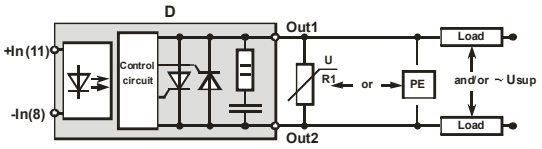

Figure 2.2 – Functional circuit MO8-160(250)-12(16)

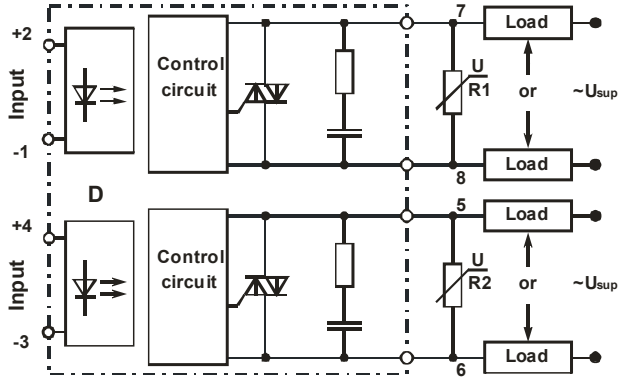

Figure 2.3 – Functional circuit MO8-PP4, MO8-PP5

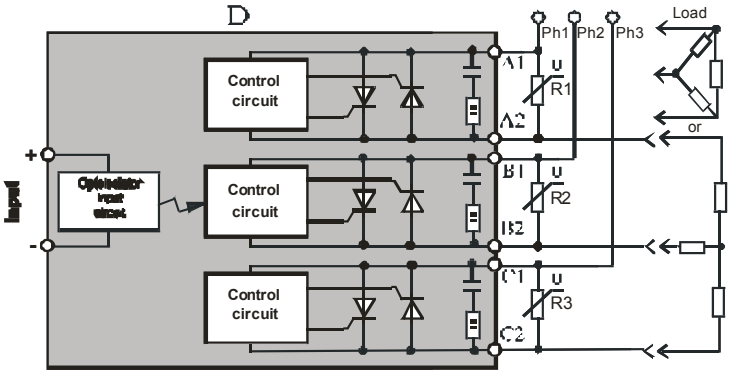

Figure 2.4 – Functional circuit MO26

Where D – module with parameters of internal RC – chain: R = 20 Ω, C = 0.01 μF
R1; R2 – protective varistors of types CH2 - 1; CH2 – 2 with maximum voltage:

$U\,max = U_{sup}^{rms} \cdot \sqrt{2} \cdot 1.1$ $\quad U_{peak} > U_{max} + 150$ V

3. BASIC PARAMETERS

Basic parameters and maximum permissible parameters of the modules at temperature 25^0C are represented in Tables 3.1 – 3.2.

Table 3.1 – Basic and maximum permissible control parameters of modules MO8, MO26

Parameter name, unit	Symbol	Control type		
		«A»	«B»	«C»
Input current at minimum switch-on voltage MO8 (max), mA	I_{ON}	12		
Input current at maximum switch-on voltage MO8 (max), mA		19		
Input current at minimum switch-on voltage MO26 (max), mA		30		
Input current at maximum switch-on voltage MO26 (max), mA		51		
Controlling switch-on voltage, V	U_{ON}	4…32	~ 6…30	~110…280
Controlling switch-off voltage (max), V	U_{OFF}	0.8	~ 2	~ 10
On/off time at frequency 50 Hz (max), ms	$t_{on/off}$	10/10	50/50	50/50
On/off time at frequency 400 Hz (max), ms		1.25/1.25	50/50	50/50
On/off time at frequency 400 Hz (max), ms For modules MO8A and MO26A		0.05/10		

Table 3.2 – Basic and maximum permissible parameters of power circuits of modules MO8, MO26

Parameter name, unit	Symbol	Maximum module current, A							
		4	**10**	**25**	**40**	**63**	**100**	**160**	**250**
Repetitive pulse voltage: reverse / in close state (max), V for modules of 8-th class	V_{DRM} /V_{RRM}	±800							
Repetitive pulse voltage: reverse / in close state (max), V for modules of 12-th class		±1200							
Repetitive pulse voltage: reverse / in close state (max), V for modules of 16-th class		±1600							
Commutating voltage (rms), V for modules of 8-th class	$V_{O(RMS)}$	~ 30…250							
Commutating voltage (rms), V For modules of 12-th class		~ 30…430							
Commutating voltage (rms), V For modules of 16-th class		~ 30…750							
Commutating current (rms), (max), A	$I_{O(RMS)}$	4	10	25	40	63	100	160	250
Surge current in open state t=10 ms (max), A	I_{TSM}	30	70	200	300	750	1250	2000	3200
Repetitive pulse current: in closed state / reverse current , max, mA	I_{DRM} / I_{RRM}	±1		±3					
Pulse voltage in open state at I= $I_{O(RMS)}$ (max), V	V_{TM}	1.3		1.5					
Critical current rise rate in open state (max), A/μs	$(di_T/dt)_{crit}$	20		160					
Critical voltage rise rate in closed state (max), V/μs	$(du_d/dt)_{crit}$	500							
Junction-base of each thyristor thermal resistance (max), ºC/W	$R_{thjc\ t}$	40	2	1	0.7	0.6	0.3	0.23	0.15
Junction temperature (max), °C	T_J	125							
Electric isolation strength in / out and circuit / housing (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 dismounting 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 install the several modules without additional insolating 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 pack.

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.

Operational 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 penetrating 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 the event of requalification – from the date of requalification.

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

Gamma percentage life ($T\gamma$) 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 than10 years, at $\gamma = 90$ %.

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

6. OVERALL AND CONNECTING DIMENSIONS

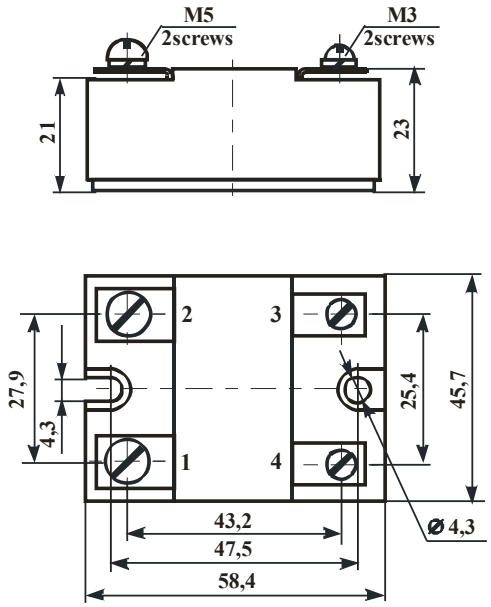

Figure 6.1 – Overall dimensions of modules MO8-25(40,63,100)-12(16)

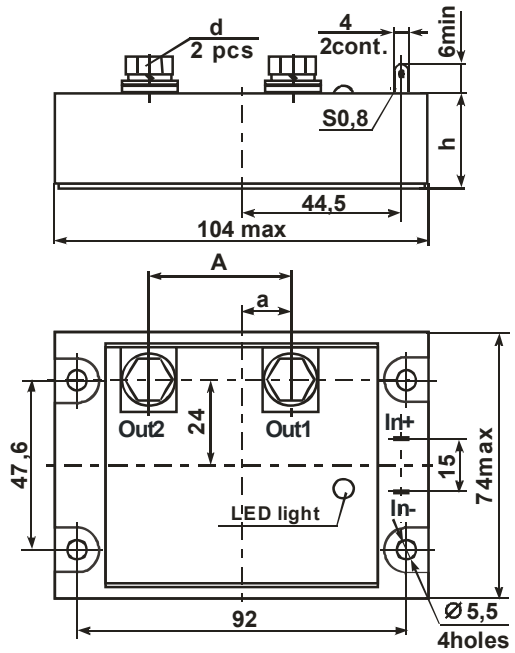

Figure 6.2 – Overall dimensions of modules MO8-160(250)-12(16)

Module current	d	A, mm	a, mm	h, mm
160 A	Screw M6	40±1	20±1	27
250 A	Bolt M8	40±1	14.5±1	27

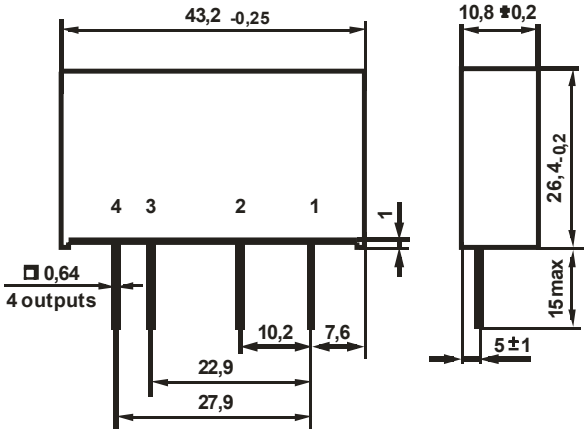

Figure 6.3 – Overall dimension of modules MO8–PP1

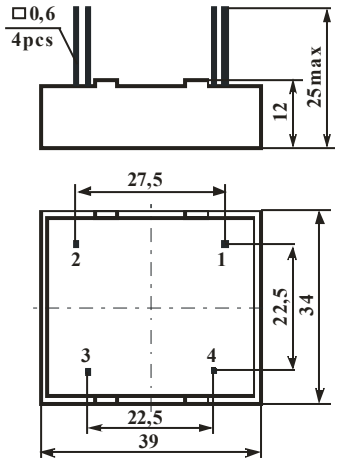

Figure 6.4 – Overall dimension of modules MO8–PP2

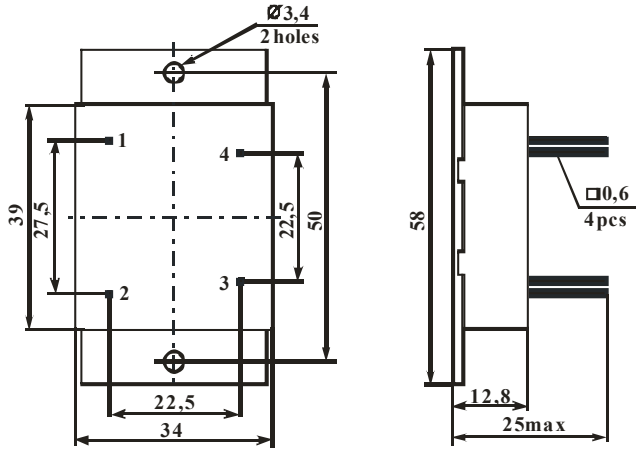

Figure 6.5 – Overall dimension of modules MO8–PP3

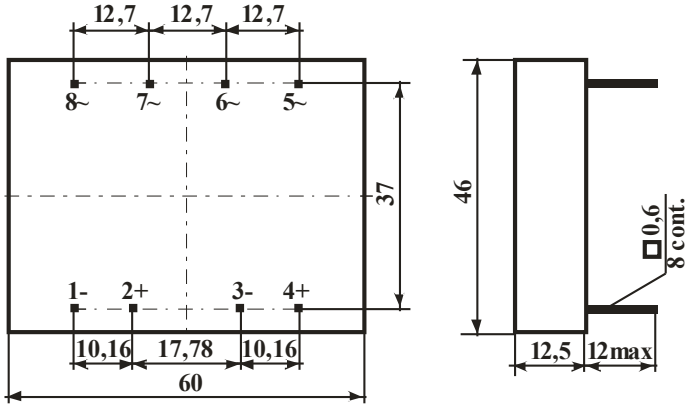

Figure 6.6 – Overall dimension of modules 2MO8–PP4

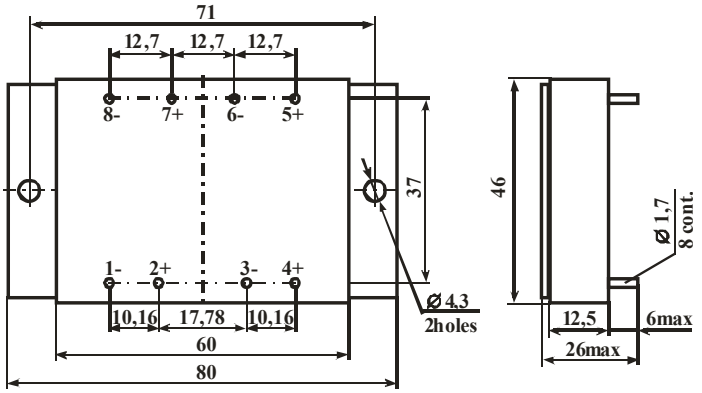

Figure 6.7 – Overall dimension of modules 2MO8–PP5

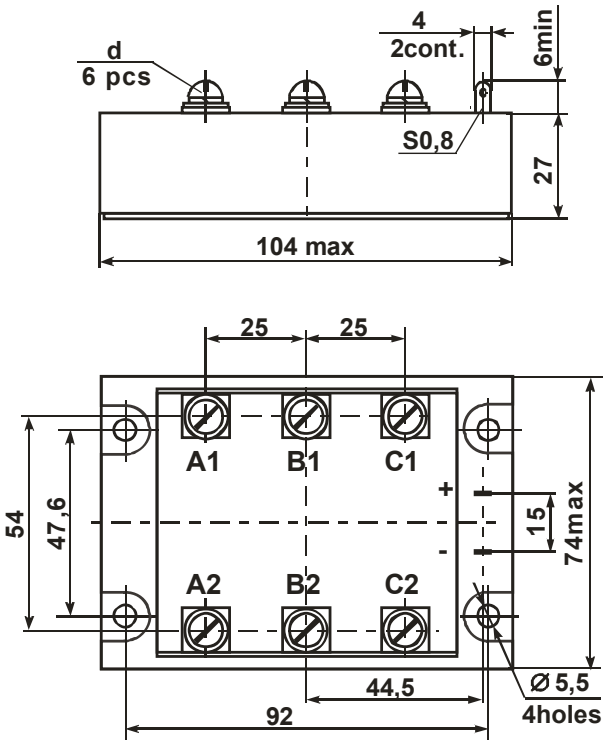

Figure 6.8 – Overall dimension of modules MO26
d – M5 for modules 25,40,63 A;
d – M6 for modules 100 A

Precious metals are not contained.

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