

# GENERAL TECHNICAL INFORMATION

## ABOUT THE CATALOG

This catalog provides you with an overview of the wide range of Marquardt standard switches. The portfolio includes rocker switches, pushbutton switches, toggle switches, slide switches, rotary switches, foot switches, power tool switches, keys, snap-action switches, micro-signal switches and sensors.

Basic types are distinguished within a series to group products with identical properties, e.g. the design.

In addition to the standard program, a number of modified, customized variants and special products and modules are available on request.

All standard versions are listed with their order numbers.

- ◆ The order numbers of other versions and further information are available on request.
- ◆ Sample switches, approvals and installation drawings with tolerance data can be provided.

The high quality, long-life switches from Marquardt are used in many different applications. We are constantly working on new developments and customized versions. Please ask.

All the products in our entire delivery program have one common feature: The consistently high quality level which has made us the favorite supplier of leading manufacturers worldwide. We are certified in accordance with ISO TS 16949: 2002, the latest QM standard of the automotive industry. Quality is a premium for us.

## APPROVALS

Almost all Marquardt switches have been tested in accordance with EN 61058-1 or IEC 61058-1 and designed for the application conditions specified therein unless specified otherwise. They carry the uniform European approval mark ENEC. The approvals for the USA and Canada are granted in accordance with UL 1054, on request also already in accordance with UL 61058 3rd ed. or CSA 61058. Please see the catalog for the respective granted approvals. A list of the approved Marquardt products can be found on the Internet pages of the respective test bodies (e.g. VDE, KEMA, UL and CSA). We will provide the appropriate certificate on request.

## APPROVAL MARKS

	ENEC	– Europe
	VDE	– Germany
	UL	– USA
	CSA	– Canada
	cCSAus	– Canada with confirmation of the national US requirements
	cULus	– USA with confirmation of the national Canadian requirements

Approval marks specified in the series overview are product-dependent. That means that the products are assignable in the tables based on the rating specifications (black print – Europe/ blue print – North America).

## ROHS (RESTRICTION OF THE USE OF CERTAIN HAZARDOUS SUBSTANCES)

From July 1, 2006 no more new electrical and electronic products may be offered in the EU which do not comply with the RoHS directive. The use of lead, mercury, hexavalent chromium, cadmium and the flame inhibitors containing bromide PBB and PBDE is prohibited for the protection of man and the environment.

Compliance with the legal regulations is a matter of principle for Marquardt.

As far as we know and based on the information available to us from our suppliers, the products presented in this catalog meet the requirements of the EU Directive 2002/95/EU (Edition 1.12.2007).

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## HOUSEHOLD APPLIANCES STANDARD IEC/EN 60335

Various switches in the Marquardt product portfolio are conformant with the Household Appliance Standard IEC/EN 60335-1:2001/2002, chapter 30. These switches are identified by a „G“ in the specification or drawing and on the label of the smallest packing unit. Materials are used here which comply with the values for the glow-wire-flammability index (GWFI) and the (glow-wire-ignition-temperature (GWIT) demanded by the standard. The appropriate switches are labeled in the catalog in the product tables of the individual series. The appropriate certificate with the confirmation of conformity is available on request.

## RATING FOR ALTERNATING CURRENT VOLTAGE (AC)

The electrical reference values, i.e. the maximum permissible electrical loads in continuous operation, are specified for the respective switch series. Most Marquardt switches are suitable for ohmic resistance load and motor load.

In the specification of the reference power using the bracket notation, e.g. 16 (4) A 250 V AC, the value in front of the brackets indicates the switch-off current and the value in brackets the nominal motor current. In switches which are additionally approved by test bodies in the USA (UL) and Canada (CSA) the corresponding ratings according to North American standards are listed additionally in blue. The motor loads may also be shown as HP (Horse Power) values according to North American conventions.

## RATING FOR DIRECT CURRENT VOLTAGE (DC)

Since the range of DC loads is very wide and extensive and also depends very greatly on the application, no DC values are specified for the majority of the series in this catalog. Explicit tests are recommended for this. Tests which have already been carried out are available on request and the results can be used as references. As a rule of thumb it can be assumed at low currents that the specified alternating current values (AC) correspond to the direct current values when the life is reduced to about one third. In series with DC voltage specifications the specified current always refers to an ohmic load. If inductive or capacitive loads are available, the application must be checked by tests with the original load.

## LIFE ENDURANCE

The mechanical life endurance is the number of possible switching cycles *without* electrical loading of the contacts whilst the electrical life endurance is determined *with* the permissible rated electrical power for the contacts. The lower the electrical load is, the closer the electrical life is to the mechanical life when using the switch in the appliance.

## GOLD-PLATED CONTACTS

For applications with a rating of  $\leq 300$  mW or  $\leq 12$  V we recommend switches with gold-plated contacts, also for applications with rare actuation or in a sulfurous atmosphere or other corrosive environments.

## SWITCHING FREQUENCY

For switches which are expected to be actuated more than 2 000 times a year, the test bodies prescribe an electrical life endurance of  $\geq 50\,000$  switching cycles. The majority of our switches meets these requirements and is marked by the 5E4 symbol (50 000 switching cycles) as an additional specification in the rating data. Switches without specification of the switching cycles in the rating data are approved for a switching frequency of 10 000 cycles. These data refer to the load which is typical for and described in the IEC 61058-1 standard. For greatly differing, e.g. slower or faster actuations, we will be glad to advise you!

## CONTACT DISTANCE

The majority of our appliance switches and some of our snap-action switches have a contact distance which enables full disconnection from the mains. The opening distances are even more than 3 mm in most cases. Switches which are not suitable for full disconnection are marked with the  $\mu$  symbol.

The switch standard IEC 61058-1 demands a contact distance of  $> 1.5$  mm, the Household Appliances Standard EN60335  $\leq 3$  mm depending on the application for full mains disconnection. In switch variants with  $< 3$  mm the test bodies usually acknowledge the mains plug or a disconnection device in the installation as a disconnection from the mains. Ask your test body if in doubt.

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## PROOF TRACKING

The proof tracking (PTI/CTI value) indicates at what voltage the proof tracking test is passed. The tracking distance is the shortest distance along the surface of the insulating material between two conductive parts. The values specified in the catalogue correspond to the division according to EN 61058-1 or IEC 61058-1.

## INRUSH CURRENT

Short capacitive peak currents occur when switching on mainly in devices with power supply units (e.g. computers, printers, fax machines, etc.). The duration of these currents is typically < 10 ms. The test conditions with a special test circuit are defined in EN 61058-1 or IEC 61058-1.

Values above the possible capacitive inrush currents are available for most of our appliance switches. They are labeled with the specification of the continuous current and the maximum inrush current as well as the voltage, e.g. 5/100 A 250 V AC.

## AMBIENT TEMPERATURE

The designation of the permissible ambient temperature with e.g. T 85 means that the switch can be used for a maximum ambient temperature of 85 °C according to the test criteria of the European safety standards (EN 61058 or IEC 61058-1). The identification T85/55 indicates that the connection side of the switch is suitable for an ambient temperature of 85 °C, whilst the actuating part (e.g. rocker) is subject to the room temperature of 55 °C demanded by the standard. Using the switches outside the permissible temperature range and in a very humid or corrosive atmosphere can impair the functional capability.

For UL-approved switches, the ambient temperature is determined by the RTI (Relative Temperature Index) of the used materials. Generally, the permissible ambient temperature of polyamides is 65 °C. Switches for higher ambient temperatures are available on request.

## STORAGE CONDITIONS

The delivered products must be stored in the original Marquardt packaging in a temperature range between 5 and 45 °C and 30 to 75 % relative humidity. The storage time of 12 months may not be exceeded. Storage in different containers and different climates may impair the properties of the product. Products with solder terminals can be stored under the following conditions:

- ◆ Temperatures between 5 °C and 40 °C
- ◆ Mean relative humidity below 50 % (relative humidity max. 85 %)
- ◆ No condensation and sulfurous environments

We recommend you to examine the processing results in the case of different storage conditions or on exceeding a storage time of more than 6 months.

## SOLDERING CONDITIONS

### 1. Recommended handling instructions for lead-free hand soldering

The basis for the solderability of the products in this catalog in the as-delivered state is DIN IEC 60068-2-20.

We recommend:

Soldering devices	electronically controlled soldering station with the typical power consumption of 50 - 80 VA
Solder	flux-filled solder wire, flux type 1.2.2
Solder temperature	350 °C ±10 °C (setting on the appliance)
Soldering time	2 to 3 s

Notes:

No force may be applied to the switch terminals during soldering, otherwise the switch properties (operating position etc.) could be changed. Longer soldering times and multiple soldering can impair the mechanical properties of the solder point and adjacent areas.

When using flux, make sure that no flux gets inside the switch via the terminals. In such cases, the switch may not be soldered "upside down", i.e. with the terminals on top.

In open switching systems the soldering fumes must be kept away from the switch by suitable means.

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## 2. Recommended handling instructions for lead-free wave soldering

Soldering profiles are published in DIN IEC 61670 which must be adapted to the respective modules and the production conditions.

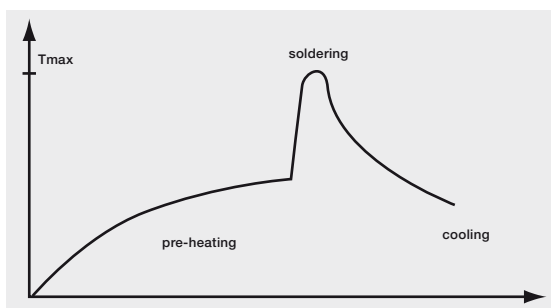
Typical and maximum values:

Pre-heating duration 80 s typical at 110 °C,  
max. 125 °C

Wave soldering duration 2 - 7 s at 235 °C,  
Tmax. 245 °C

Gradient pre-heating max. 2 °C/s

Gradient cooling max. -4 °C/s



These notes are guidelines which must be adapted respectively to the concrete process.

## IP TYPE OF PROTECTION

The IP types of protection according to DIN EN 61058-1 and IEC 60529 specified in our documents refer to the actuating side of the switch unless stated otherwise. The customer must provide the seal between the switch and customer appliance and test for leaks at this point.

## EMC (ELECTROMAGNETIC COMPATIBILITY)

Marquardt switches for use in appliances meet the requirements for interference emissions in accordance with EN 61058-1 when they are used according to our specifications. Requirements for interference suppression in the appliances can be found in the appliance or EMC specifications.

## APPLIANCE SAFETY LAW

If you need to observe the valid German appliance safety law, we recommend you to use switches which have been tested and approved according to the specifications EN 61058-1 or VDE 0630. Switches without approval marks must be tested by the approval body in connection with your appliance.














## CE MARK

The CE mark is an identification according to EU law for certain products with regard to the product safety. It is not a seal of quality (quality mark). By attaching the CE mark, the manufacturer confirms that the product complies with valid European regulations. The CE mark does not mean that the product has been checked for compliance with regulations by an independent body.

Following revisions of the EU regulations in 2007 some of our switches have no labeling obligation, some are subject to the low voltage directive and some are subject to the machine directive. The CE mark and the issuing of the declaration of conformity depend on the respective situation.

A CE mark is not prescribed for the components but for the smallest packing unit.

## TERMINAL SYMBOLS

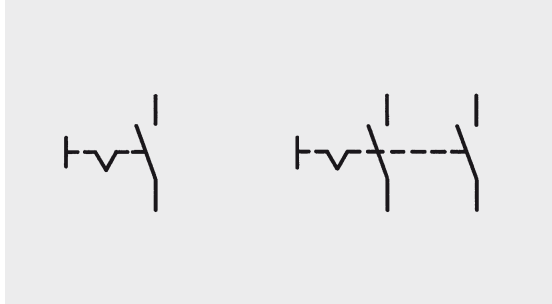
-  Quick-connect terminal
-  Solder terminal
-  Short solder terminal
-  PCB terminal
-  PCB terminal angled to left
-  PCB terminal angled to right
-  Socket terminal
-  Cable
-  Terminal strip
-  Push-in terminal
-  Snap-in terminal
-  Cut terminal
-  Screw terminal

## CONTACT RESISTANCE

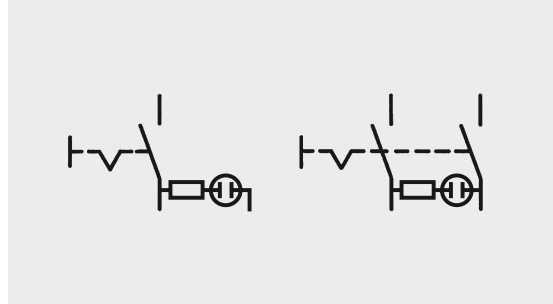
The contact resistance is the electrical resistance which can be measured at the switch terminals with closed contacts. The data refer to unwired contacts in the new condition with a typical measuring current of greater than 100 mA. For silver-based contact materials this value is below 100 mΩ (measuring current 1 A at 12 V DC), for gold-based contact materials below 50 mΩ.

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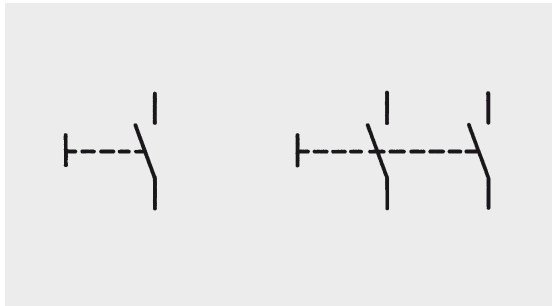
## SWITCHING FUNCTIONS



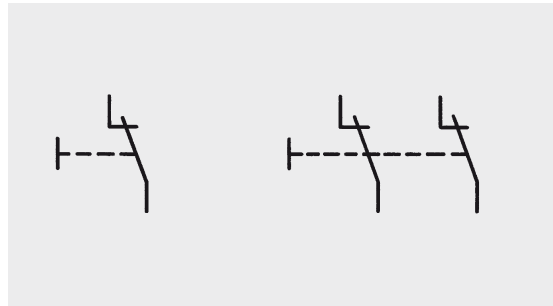
ON/OFF switch  
(SPST, DPST)



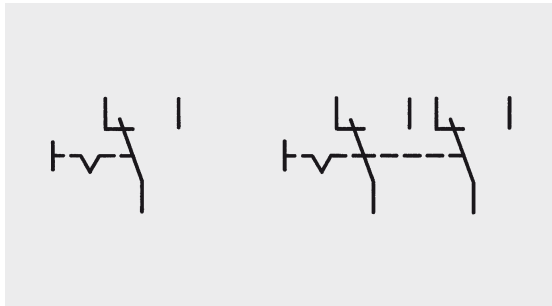
ON/OFF switch with signal lamp  
(SPST-Illuminated, DPST-Illuminated)



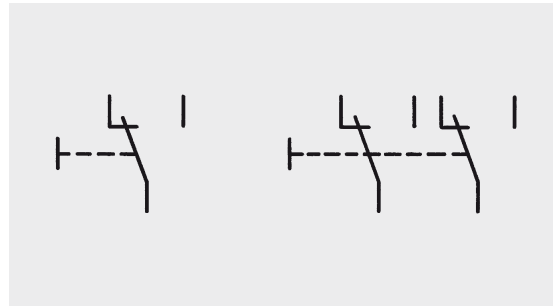
Normally open contact / pushbutton  
(SPNO, DPNO)



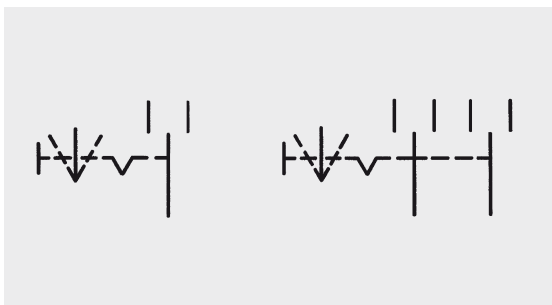
Normally closed contact / pushbutton  
(SPNC, DPNC)



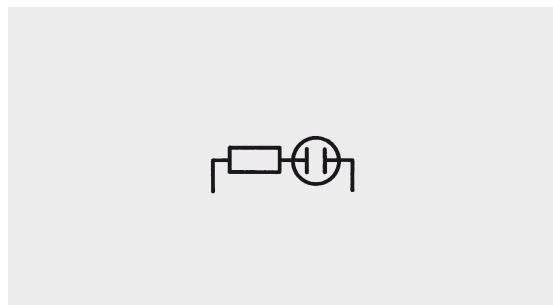
Changeover switch  
(SPDT, DPDT)



Changeover switch / pushbutton  
(SPDT, DPDT) momentary



Changeover switch with OFF position in center  
(SPDT-Center OFF, DPDT-Center OFF)



Lamp

ROCKER SWITCHES

PUSHBUTTON SWITCHES

TOGGLE SWITCHES

SLIDE SWITCHES

ROTARY SWITCHES

FOOT SWITCHES

POWER TOOL SWITCHES

TACT AND KEY SWITCHES

SNAP-ACTION SWITCHES

MICRO-SIGNAL SWITCHES

SENSORS