

Introduction:

MASTERGEAR offers a wide range of switch options for our family of Rotary Limit Switches and Proximity Sensors. Several factors should be considered when specifying switch contacts. Contacts last longest when sized properly to load conditions including maximum voltage, current and power. However, care should be taken to not oversize contacts either. Contacts designed for 15 amp loads do not always last as long when switching 8 mA loads.



This product specification provides guidelines for selecting a cost effective *and* reliable switch for your application.

General Switch Selection Criteria:

Load Type. Generally, there are two load types: resistive and inductive. Resistive loads include lights, solid-state relays, Programmable Logic Controller (PLC) discreet inputs, and Distributive Control System (DCS) discreet inputs. Less common inductive loads include solenoid coils and relay coils. Inductive loads are much more aggressive on contacts, because they store energy. Stored energy can overload switch contacts. ***Always specify switches rated for inductive loads when switching coil loads.***

Load Size. Switches are typically rated for maximum current, maximum voltage, and maximum power. Exceeding any parameter overheats the contact. In mild cases, the contact softens. In more severe cases, the contact can melt or weld. Power can be defined as voltage times current ($W=V \times I$) for resistive loads. In many cases, a switch's maximum current rating times its maximum voltage rating far exceeds its maximum power. ***Care should be taken to select a switch with voltage, current and power (when applicable) ratings higher than your load, without going overboard.*** MASTERGEAR recommends selecting switch ratings less than 100 times your actual load conditions.

Wiring Topography and Practice. Wire has capacitance. Longer wires and smaller diameter wires have higher capacitance. When switching loads over long distances with light gauge wire, this capacitance can store significant energy, shortening contact life. ***MASTERGEAR recommends heavy-duty switches or solid-state switches for these applications.*** Pulling wire through non-metallic conduit can result in buildup of static charge. ***Wire should always be grounded prior to hookup to prevent switch damage.***

Cycle Life. The maximum load ratings described above (see Load Size) are generally for low cycle applications. Underwriter's Laboratories, the agency that underwrites MASTERGEAR products, tests switches for 6,000 cycles at these maximum ratings. For higher-cycle applications, switches may need to be de-rated to assure performance. Consult the life cycle data in this guide for life expectancy under various loads.

Mechanical Switches:

Mechanical switches are the most cost effective choice for general switching applications. They feature snap-acting contacts tripped by physical contact with a cam.



Advantages:

- Heavy-duty contacts for high loads
- Compatible with inductive and capacitive loads
- Suitable for high cycle applications

Disadvantages

- Silver contacts subject to tarnishing under low power loads, such as PLC or DCS discreet inputs (Optional gold contacts are well suited to low power loads)
- Non-sealed mechanical components subject to corrosion in severe environments
- More moving parts result in lower mechanical life

Specifications:

Contact Configuration	SPDT	SPDT	DPDT	DPDT
Contact Material	Silver	Gold	Silver	Gold
MASTERGEAR Rotary Limit Switch Figure	01	03	05	06
Applications:				
Resistive	Y	Y	Y	Y
Inductive (Solenoid or Relay coils)	Y	N	Y	N
Capacitive (Long wire or small gauge wire)	Y	N	Y	N
UL Contact Rating	5 A @ 250 VAC 0.5 A @ 24 VDC	0.1 A @ 125 VAC	5 A @ 250 VAC	0.1 A @ 125 VAC
Maximum Current - Amps	5	0.1	5 AC / 0.1 DC	0.1
Maximum Voltage - Volts	250 AC, 48 DC	125 AC, 30 DC	250 AC, 30 DC	125 AC, 30 DC
Mechanical Life – Cycles	5,000,000	5,000,000	10,000,000	10,000,000
Electrical Life				
At UL rated load	100,000	100,000	100,000	100,000
At 20% UL rated current load	1,000,000	1,000,000	1,000,000	10,000,000
Ambient Temperature - °F (°C)	-40 to 175 (-40 to 80)	-40 to 175 (-40 to 80)	-40 to 175 (-40 to 80)	-40 to 175 (-40 to 80)
Relative Cost	\$	\$	\$\$	\$\$
Availability	Stock		Stock	

Proximity Reed Switches:

Reed switches are hermetically sealed for extended life in corrosive environments. They feature compact contacts tripped by a magnetic force. MASTERGEAR embeds magnet targets in “Easy-Set” cams for tool-free adjustment in our Rotary Limit Switches. Magnets are embedded in a 5/16-18UNC stainless steel “bolt” target for our proximity sensors.



Advantages:

- Alloy contacts won't tarnish or corrode, even under low current loads
- MASTERGEAR type 13 is well suited for inductive/capacitive loads
- Suitable for high cycle applications
- Meets non-incendive requirements for Division 2 hazardous locations

Disadvantages

- Lighter duty versions not compatible with inductive or capacitive loads
- More hysteresis than mechanical switches

Specifications:

Contact Configuration	SPST	SPST	SPDT / DPDT	SPDT
Contact Material	Rhodium	Silver Cadmium Oxide	Rhodium	Tungsten
MASTERGEAR Rotary Limit Switch Proximity Sensor Figure	10	13	14 / 16	15
MASTERGEAR BL Proximity Sensor Figure	03	01	04	05
Applications:				
Resistive	Y	Y	Y	Y
Inductive (Solenoid or Relay coils)	N	Y	N	N
Capacitive (Long wire or small gauge wire)	N	Y	N	N
UL Contact Rating	0.25 A @ 120 VAC 0.416 A @ 48 VDC	1.5 A @ 120 VAC 0.55 A @ 24 VDC	0.25 A @ 120 VAC 0.416 A @ 48 VDC	0.83 A @ 120 VAC 3 A @ 33 VDC
Maximum Current - Amps	2	3	1	3
Maximum Voltage - Volts	400	240 AC / 115 DC	150	120
Maximum Power – Watts	40	180 AC / 69 DC	20	100
Mechanical Life – Cycles	100,000,000	100,000,000	100,000,000	
Electrical Life				
At UL rated load	50,000	100,000	50,000	250,000
At stated load	1M – 0.5A@20V	500K – 1A@110V	800K – 0.5A@20V 800K - 0.01A@100V	N/A
Ambient Temperature - °F (°C)	-40 to 176 (-40 to 80)	-40 to 176 (-40 to 80)	-40 to 176 (-40 to 80)	-40 to 176 (-40 to 80)
Relative Cost	\$\$	\$\$\$	\$\$	\$\$\$
Availability	Stock	Stock	Stock	

Solid-State Proximity Switches:

Solid-state switches are sealed for extended life in corrosive environments. They feature electronic switching technology tripped by the presence of ferrous material. MASTERGEAR embeds ferrous targets in our “Easy-Set” cams for tool-free adjustment.



Advantages:

- No contacts to tarnish or corrode
- Suitable for low current applications
- Some models suitable for capacitive or inductive loads
- Suitable for extreme high cycle applications

Disadvantages

- Generally not suitable for higher-current loads
- Limited ambient temperature ranges when compared to mechanical and reed switches
- Can have voltage drops and/or leakage current

Specifications:

Output Configuration	NAMUR	Transistor Normally Open	Transistor PNP Sourcing Normally Open
Conductors	2	2	3
MASTERGEAR Rotary Limit Switch Figure	70	71	73
Applications:			
NAMUR	Y	N	N
Resistive	N	Y	Y
Inductive (Solenoid or Relay coils)	N	Y	N
Capacitive (Long wire or small gauge wire)	N	Y	Y
Load Current – mA	3-15	5-200	100
Leakage Current (“Off”) – mA	<1	<0.8	<0.01
Current Consumption (“On”) - mA	N/A		<15
Inrush Current Tolerance - Amps	N/A	<0.9, <20 ms	
Supply Voltage - Volts	5-25 DC	20-140 AC, 10-140 DC	10-30 DC
Voltage Drop - Volts	N/A	<5	<2
Ambient Temperature - °F (°C)	-14 to 176 (-25 to 80)	-14 to 158 (-25 to 70)	-14 to 158 (-25 to 70)
Relative Cost	\$\$\$	\$\$\$	\$\$\$
Availability	Stock		