Rotary gripper suitable for holding and reversing workpieces on transfer lines

- Compact integration of gripping and rotating functions
- Eliminates the rotating deflection of piping and wiring caused by the combination of equipment (rotary table + adapter + air gripper)
- Longitudinal dimension reduced by approx. 20% compared with the combined product
- 2 standard rotation angles of $90^\circ$ and $180^\circ$
- Equipped with standard magnet for auto switch retrofitting

**Rotary Gripper**

**MRHQ Series**

Gripper Inside Diameter/Size: $\varnothing10$, $\varnothing16$, $\varnothing20$, $\varnothing25$

**Modular construction**
Gripper section is unitized for simple replacement.

**Compact bearings add to a light weight and compact design**

**Simple alignment when mounting body**
Provided with reference diameters at the top and bottom of the body, and mounting guide pin holes on three sides of the body along its center axis (aligned with center of body).

**Easy adjustment of rotating range**
A scale indicator on the side of the gripper unit allows easy angle adjustments and is useful for verification of rotating positions.

**Angle adjustment bolts are standard**
Angle adjustment bolts allow the rotation range of the gripper unit to be adjusted by $\pm10^\circ$ for both $90^\circ$ and $180^\circ$ rotation angles. ($\pm5^\circ$ at the end of rotation)

**All piping and wiring centralized on one side for easy work operations**

**Auto switch capable**
Switches can be installed to verify positions for opening and closing of the gripper and the end of rotation.
MRHQ Series
Model Selection

### Operating conditions
1. Enumerate the operating conditions according to the mounting position and workpiece configuration.

### Procedure
1. **Operating conditions**
   - Model used
   - Operating pressure
   - Mounting position
   - Rotation time \( t \) (s)
   - Overhang \( H \) (mm)
   - Gripping point distance \( L \) (mm)
   - Distance between central axis and center of gravity \( h \) (mm)
   - Load mass \( m_1 \) (kg)
   - Mass of 2 attachments \( m_2 \) (kg)

### Calculation
- Load mass
  - 20 \( \times \) 9.8 \( \times \) 0.07 = 13.72 N < Effective gripping force \( \text{OK} \)
- Load mass and attachments (2 pcs.) into a load value and multiply by the overhang \( H \).
  - 20 \( \times \) 9.8 \( \times \) \( (0.07 + 0.05) \times 10/1000 = 0.24 \text{ N-m} < \text{Effective torque} \text{ OK} \)

### Example
- Rotary gripper: MRHQ16D-90S
- Pressure: 0.4 MPa
- Mounting position: Horizontal
- Rotation time \( t \): 0.2 s/90°
- Overhang \( H \): 10 mm
- Gripping point distance \( L \): 20 mm
- Distance between central axis and center of gravity \( h \): 10 mm
- Load mass \( m_1 \): 0.07 kg
- Mass of 2 attachments \( m_2 \): 0.05 kg

### Rotation time
2. Confirm that it is within the adjustable rotation time range.
   - 0.07 to 0.3 s/90°
   - 0.2 s/90° \text{ OK}

### Overhang and gripping point distance
3. Confirm that the overhang \( H \) and the gripping point distance \( L \) are within the operating pressure range limit.
   - Gripping point range limit
   - Graph (1)
   - Within the range limit \text{ OK}

4. Confirm that the load converted from the load mass is less than 1/20 of the effective gripping force.
   - A greater margin must be allowed if large impacts will be applied when work pieces are transported.
   - 20 \( \times \) 9.8 \( \times \) 0.07 = 13.72 N < Effective gripping force \( \text{OK} \)

### External force on finger
5. Make sure that the vertical load and each moment on finger are within allowable value.
   - Downward vertical load by load and attachment:
     - \( f = (0.07 + 2 \times 0.05) \times 9.8 = 1.67 \text{ (N)} < \text{Vertical allowable value} \text{ OK} \)

### Rotational torque (horizontal mounting only)
6. Convert the weight of the load and attachments (2 pcs.) into a load value and multiply by the overhang \( H \).
   - 20 \( \times \) 9.8 \( \times \) \( (0.07 + 0.05) \times 10/1000 = 0.24 \text{ N-m} < \text{Effective torque} \text{ OK} \)

### Kinetic energy
7. Find the moment of inertia, "\( I_n \)" for the load + attachments (2 pcs.)
   - \( I_n = K \times (a^2 + b^2 + 12h^2) \times (m_1 + m_2)/(12 \times 10^9) \)
   - \( K = 2: \text{Safety factor} \)
   - \( 1/2 \times I_n \times \omega^2 \text{ < Allowable energy (J)} \)

8. Confirm that the kinetic energy of the load + attachments (2 pcs.) is no more than the allowable value.
   - \( \omega = 2\pi \times \theta \times t \) \( \text{Angular speed at the end} \)
   - \( \theta \): Rotation angle (rad)
   - \( t \): Rotation time (s)
   - \( 1/2 \times 0.00005 \times (2 \times (3.14/2)/0.2)^2 = 0.0062 \text{ J < Allowable energy} \text{ OK} \)

---

**Note:** Refer to “Moment of Inertia Calculation and Allowable Kinetic Energy” for detailed formulas and calculations.
### Gripping Point

#### External gripping

![Diagram of External Gripping](image)

- L: Gripping point distance
- H: Overhang

#### Internal gripping

![Diagram of Internal Gripping](image)

- L: Gripping point distance
- H: Overhang

---

**Rotary Gripper MRHQ Series**

- Operate so that the workpiece gripping point distance “L” and the amount of overhang “H” stay within the range shown for each operating pressure given in the graphs above.

- If operated with the workpiece gripping point outside of the range limit, an excessive eccentric load will be applied to the fingers and guide section, causing play in the fingers and adversely affecting the gripper’s life.

---

#### Gripping Point Range Limit

<table>
<thead>
<tr>
<th>MRHQ10</th>
<th>MRHQ16</th>
<th>MRHQ20</th>
<th>MRHQ25</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>External Gripping</strong></td>
<td><strong>Internal Gripping</strong></td>
<td><strong>External Gripping</strong></td>
<td><strong>Internal Gripping</strong></td>
</tr>
<tr>
<td><img src="image" alt="Graph (1)" /></td>
<td><img src="image" alt="Graph (1)" /></td>
<td><img src="image" alt="Graph (1)" /></td>
<td><img src="image" alt="Graph (1)" /></td>
</tr>
</tbody>
</table>

- Pressure: 0.2MPa, 0.3MPa, 0.4MPa, 0.5MPa, 0.6MPa, 0.7MPa

---
Effective Gripping Force

Expressing the effective gripping force

The effective gripping force shown in the graphs to the right is expressed as F, which is the impellent force of one finger, when both fingers and attachments are in full contact with the workpiece as shown in the figure below.

External gripping

Internal gripping

L: Gripping point distance (mm)

Model Selection Guidelines by Workpiece Mass

- Although conditions differ according to the workpiece shape and the coefficient of friction between the attachments and the workpiece, select a model that can provide a gripping force of 10 to 20 times the workpiece mass, or more.
- A greater margin of safety is required when high acceleration or impact occurs during workpiece transfer.
Rotational Torque and Gripping Point

Rotational Torque

Graph (3)

When mounting attachments on fingers, support the fingers with a tool such as a spanner to prevent them from twisting. Refer to the table on the right for the tightening torques of finger mounting bolts.

<table>
<thead>
<tr>
<th>Model</th>
<th>Bolt</th>
<th>Max. tightening torque N·m</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRHQ10</td>
<td>M2.5 x 0.45</td>
<td>0.31</td>
</tr>
<tr>
<td>MRHQ16</td>
<td>M3 x 0.5</td>
<td>0.59</td>
</tr>
<tr>
<td>MRHQ20</td>
<td>M4 x 0.7</td>
<td>1.4</td>
</tr>
<tr>
<td>MRHQ25</td>
<td>M5 x 0.8</td>
<td>2.6</td>
</tr>
</tbody>
</table>
Allowable Value of External Force on Fingers

<table>
<thead>
<tr>
<th>Model</th>
<th>Allowable vertical load Fv (N)</th>
<th>Maximum allowable moment</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRHQ10</td>
<td>58</td>
<td>0.26</td>
</tr>
<tr>
<td>MRHQ16</td>
<td>98</td>
<td>0.68</td>
</tr>
<tr>
<td>MRHQ20</td>
<td>147</td>
<td>1.32</td>
</tr>
<tr>
<td>MRHQ25</td>
<td>255</td>
<td>1.94</td>
</tr>
</tbody>
</table>

Fv: Allowable vertical load (N)
Mp: Pitch moment (N·m)
My: Yaw moment (N·m)
Mr: Roll moment (N·m)

Note) Values of load and moment in the above table are static values.

Calculation for allowable external force (with moment load):

\[
\text{Allowable load } F \text{ (N)} = \frac{M \times 10^{-3}}{L} \times \text{Unit conversion factor}
\]

Calculation example:

When static load \( f = 10 \text{ N} \), which produces pitch moment to the point \( L = 30 \text{ mm} \) from MRHQ16D guide, is applied. Operable condition requires that \( F \) be bigger than \( f \).

Example:

\[
\text{Allowable load } F = \frac{0.68}{30 \times 10^3}
\]

\[
= 22.7 \text{ (N)} > 10
\]

Since load \( F > f \), it is operable.
Moment of Inertia and Allowable Kinetic Energy

**Moment of Inertia Calculation and Allowable Kinetic Energy**

Calculate the moment of inertia as shown below, and confirm that the operating conditions are within the allowable kinetic energy shown in the graph “Moment of inertia and rotation time” on the right.

\[
I = \frac{(a^2 + b^2 + 12h^2)(m_1 + m_2)}{12 \times 10^6}
\]

**Practical moment of inertia** \(I_{\text{practical}}\): kg·m²

\[
I_{\text{practical}} = K \times I
\]

* Use \(I_{\text{practical}}\) for this product.

**Description**

- **O**: Center of rotation
- **G**: Center of gravity of attachment and load
- **Gripper fingers**: 
- **Attachments**: 
- **Load**: 

**Graph (Moment of Inertia and Rotation Time)**

**How to Use the Graph**

**[Example 1]**
- Moment of Inertia: \(1 \times 10^{-5}\) kg·m²
- Rotation time: 0.3 s/90°
- To select model MRHQ10

It can be used because the point of intersection \(P_1\) on the graph is within the limiting range.

**[Example 2]**
- Moment of Inertia: \(5 \times 10^{-5}\) kg·m²
- Rotation time: 0.1 s/90°
- To select model MRHQ16

It cannot be used because the point of intersection \(P_2\) on the graph is outside the range limit. (Review is necessary.)

To confirm by calculation, use formula (1) on the right and check that the kinetic energy of load \(E\) is within the allowable values below.

\[
E = \frac{1}{2} I_{\text{practical}} \omega^2 \quad \text{(1)}
\]

**Kinetic energy of load** \(E\): J

\[
\omega = \frac{\theta}{t}
\]

- \(\omega\): Angular speed at the end
- \(\theta\): Rotating angle (rad)
- \(t\): Rotation time (s)

<table>
<thead>
<tr>
<th>Model</th>
<th>Allowable value J</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRHQ10</td>
<td>0.0046</td>
</tr>
<tr>
<td>MRHQ16</td>
<td>0.014</td>
</tr>
<tr>
<td>MRHQ20</td>
<td>0.034</td>
</tr>
<tr>
<td>MRHQ25</td>
<td>0.074</td>
</tr>
</tbody>
</table>
### Rotary Gripper MRHQ Series

#### How to Order

<table>
<thead>
<tr>
<th>Type Electrical entry</th>
<th>Wiring (output)</th>
<th>Load voltage</th>
<th>Auto switch symbol</th>
<th>Lead wire length (m)</th>
<th>Applicable load</th>
<th>Auto switch model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grommet</td>
<td>3-wire (NPN)</td>
<td>5 V</td>
<td>M9N</td>
<td>0.5</td>
<td>Nil</td>
<td>D-M9N-V-746</td>
</tr>
<tr>
<td></td>
<td>3-wire (PNP)</td>
<td>12 V</td>
<td>M9P</td>
<td>L</td>
<td>3</td>
<td>D-M9P-V-746</td>
</tr>
<tr>
<td></td>
<td>2-wire</td>
<td>12 V</td>
<td>M9B</td>
<td>L</td>
<td>5</td>
<td>D-M9B-V-746</td>
</tr>
</tbody>
</table>

- **Made to Order**
- **Number of auto switches**
  - Nil: 2 pcs.
  - S: 5 pcs.

#### Applicable Auto Switches

- **Type of auto switch for detecting rotation**
  - Nil: Without auto switch (Built-in magnet)

- **Number of auto switches**
  - Nil: 2 pcs.
  - S: 5 pcs.

#### Applicable Auto Switches

- **Type of auto switch for detecting rotation**
  - Nil: Without auto switch (Built-in magnet)

#### Unit list

<table>
<thead>
<tr>
<th>Model</th>
<th>Unit part no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRHQ10D</td>
<td>P407090-3D</td>
</tr>
<tr>
<td>MRHQ10S</td>
<td>P407090-3S</td>
</tr>
<tr>
<td>MRHQ10C</td>
<td>P407090-3C</td>
</tr>
<tr>
<td>MRHQ11D</td>
<td>P407060-3D</td>
</tr>
<tr>
<td>MRHQ11S</td>
<td>P407060-3C</td>
</tr>
<tr>
<td>MRHQ12D</td>
<td>P407080-3D</td>
</tr>
<tr>
<td>MRHQ12S</td>
<td>P407080-3C</td>
</tr>
<tr>
<td>MRHQ20D</td>
<td>P408080-3D</td>
</tr>
<tr>
<td>MRHQ20S</td>
<td>P408080-3S</td>
</tr>
<tr>
<td>MRHQ20C</td>
<td>P408080-3C</td>
</tr>
<tr>
<td>MRHQ25D</td>
<td>P408080-3D</td>
</tr>
<tr>
<td>MRHQ25S</td>
<td>P408080-3S</td>
</tr>
<tr>
<td>MRHQ25C</td>
<td>P408080-3C</td>
</tr>
</tbody>
</table>

#### Lead wire length

- Nil: 0.5 m
- L: 3 m
- Z: 5 m

- **Gripper bore**
  - 10 mm
  - 16 mm
  - 20 mm
  - 25 mm

- **Action**
  - D: Double acting
  - S: Single acting (Normally open)
  - C: Single acting (Normally closed)

- **Rotation angle**
  - 90°
  - 180°

- **Single vane**
  - Q: Parallel type: 2 fingers

- **Type of auto switch for detecting rotation**
  - Nil: Without auto switch (Built-in magnet)

- **Type of auto switch for detecting rotation**
  - Nil: Without auto switch (Built-in magnet)

- **Unit part no.**
  - P407090-3D
  - P407090-3S
  - P407090-3C
  - P407060-3D
  - P407060-3S
  - P407060-3C
  - P407080-3D
  - P407080-3S
  - P407080-3C
  - P408080-3D
  - P408080-3S
  - P408080-3C

- **Each unit includes two of each of the parts indicated left.**
- **Auto switches are not included with a unit.**
### Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>MRHQ10</th>
<th>MRHQ16</th>
<th>MRHQ20</th>
<th>MRHQ25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluid</td>
<td>Air</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating pressure</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rotary unit</td>
<td>0.25 to 0.7 MPa</td>
<td>0.25 to 1.0 MPa</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gripper unit</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Double acting</td>
<td>0.25 to 0.7 MPa</td>
<td>0.1 to 0.7 MPa</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single acting</td>
<td>0.35 to 0.7 MPa</td>
<td>0.25 to 0.7 MPa</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rotation angle</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>90° ±10°, 180° ±10° (Both ends of vibration ±5° adjustable)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gripper action</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Double acting, Single acting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finger opening/closing repeatability</td>
<td>±0.01 mm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gripper maximum operating frequency</td>
<td>180 c.p.m</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient and fluid temperature</td>
<td>5 to 60°C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjustable rotation time range (1)</td>
<td>0.07 to 0.3 s/90° (at 0.5 MPa)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allowable kinetic energy</td>
<td>0.0046 J</td>
<td>0.014 J</td>
<td>0.034 J</td>
<td>0.074 J</td>
</tr>
<tr>
<td>Auto switch</td>
<td>Rotary unit</td>
<td>Solid state auto switch (2-wire, 3-wire)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gripper unit</td>
<td>Solid state auto switch (2-wire, 3-wire)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note 1) Operate within the speed adjustment range, as speed control exceeding the limit value of the low speed may cause sticking or failure to operate.

### Model

<table>
<thead>
<tr>
<th>Action</th>
<th>Model</th>
<th>Cylinder bore (mm)</th>
<th>Opening/Closing stroke (mm)</th>
<th>Rotating angle (°)</th>
<th>Weight (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Double acting</td>
<td>MRHQ10D</td>
<td>10</td>
<td>4</td>
<td>90</td>
<td>306</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>180</td>
<td>305</td>
</tr>
<tr>
<td></td>
<td>MRHQ16D</td>
<td>16</td>
<td>6</td>
<td>90</td>
<td>593</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>180</td>
<td>591</td>
</tr>
<tr>
<td></td>
<td>MRHQ20D</td>
<td>20</td>
<td>10</td>
<td>90</td>
<td>1055</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>180</td>
<td>1052</td>
</tr>
<tr>
<td></td>
<td>MRHQ25D</td>
<td>25</td>
<td>14</td>
<td>90</td>
<td>1561</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>180</td>
<td>1555</td>
</tr>
<tr>
<td></td>
<td>MRHQ10S</td>
<td>10</td>
<td>4</td>
<td>90</td>
<td>307</td>
</tr>
<tr>
<td></td>
<td>MRHQ10C</td>
<td></td>
<td></td>
<td>180</td>
<td>306</td>
</tr>
<tr>
<td>Single acting</td>
<td>MRHQ16S</td>
<td>16</td>
<td>6</td>
<td>90</td>
<td>594</td>
</tr>
<tr>
<td></td>
<td>MRHQ16C</td>
<td></td>
<td></td>
<td>180</td>
<td>592</td>
</tr>
<tr>
<td></td>
<td>MRHQ20S</td>
<td>20</td>
<td>10</td>
<td>90</td>
<td>1060</td>
</tr>
<tr>
<td></td>
<td>MRHQ20C</td>
<td></td>
<td></td>
<td>180</td>
<td>1057</td>
</tr>
<tr>
<td></td>
<td>MRHQ25S</td>
<td>25</td>
<td>14</td>
<td>90</td>
<td>1566</td>
</tr>
<tr>
<td></td>
<td>MRHQ25C</td>
<td></td>
<td></td>
<td>180</td>
<td>1560</td>
</tr>
</tbody>
</table>

Note 1) Values do not include auto switch weight.

### Gripper Rotation Range/View from Gripper Side

- The figure at the right indicates the position of the gripper when pressure is applied to port B.
- When pressure is applied to port A, the gripper rotates clockwise.
- Both ends of vibration can be adjusted ±5° with the adjusting bolt.
Component Parts

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Material</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Air gripper</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Rotary actuator</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Body C</td>
<td>Aluminum alloy</td>
<td>Anodized</td>
</tr>
<tr>
<td>4</td>
<td>Stopper lever</td>
<td>Carbon steel</td>
<td>Heat treatment (90° and 180°)</td>
</tr>
<tr>
<td>5</td>
<td>Stopper guide</td>
<td>Stainless steel</td>
<td>Nitrizing</td>
</tr>
<tr>
<td>6</td>
<td>Lever retainer</td>
<td>Carbon steel</td>
<td>Zinc chromated</td>
</tr>
<tr>
<td>7</td>
<td>Switch guide</td>
<td>Resin</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Switch holder A</td>
<td>Resin</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Switch case</td>
<td>Resin</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Switch holder B</td>
<td>Resin</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Bearing</td>
<td>High carbon bearing steel</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>O-ring</td>
<td>NBR</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Adjustment bolt</td>
<td>Carbon steel</td>
<td>Heat treatment</td>
</tr>
<tr>
<td>14</td>
<td>Nut</td>
<td>Carbon steel</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Hexagon socket head cap screw</td>
<td>Carbon steel</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Parallel pin</td>
<td>Stainless steel</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Hexagon socket head cap screw</td>
<td>Carbon steel</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Hexagon socket head cap screw</td>
<td>Resin</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Magnet</td>
<td>Resin</td>
<td>Nickel plated</td>
</tr>
<tr>
<td>20</td>
<td>Hexagon socket head set screw</td>
<td>Resin</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Resin case</td>
<td>Resin</td>
<td></td>
</tr>
</tbody>
</table>

* Individual part cannot be shipped. Please purchase the whole unit. (Refer to pages 757 and 771.)
**MRHQ Series**

**Dimensions**

**MRHQ10**

- **Angle adjustment bolt**
  - 4 x M4 x 0.7 depth 6
  - (two on opposite side)

- **Max. 6.1 long groove depth 3**
  - Ø31

- **M5 x 0.8**
  - Finger opening port
  - Finger closing port

- **2 x 4.5 through 2 x 8 depth of counter bore 2.5**

- **M5 x 0.8 Port A**
  - Ø37h9

- **M5 x 0.8 Port B**
  - Ø37h9

- **4 x M5 x 0.8 depth 6**
  - (two on opposite side)

- **3 x Ø31 1/2 long groove depth 4**
  - (one each on three sides)

- **Side A**
- **Side B**

---

**Additional Measurements**

- **ø54.5**
- **24.5**
- **22.5**
- **21.5**
- **15.5**
- **41.5**
- **33**
- **25**
- **15.2 opened 1/2**
- **11.2 closed 1/2**
- **4 5/16**
- **10**
- **8.7**
- **6.3**
- **4.5**
- **2.5**
- **1.5**
- **0.7**

---

**Notes:**
- Dimensions and tolerances are subject to manufacturing specifications.
- Diagrams illustrate the various configurations and components of the MRHQ10 series.
- SMC product specifications.
Dimensions

MRHQ25

4 x M6 x 1 depth 10

4 x M5 x 0.8
(attachment mounting screw)

M5 x 0.8
Finger opening port

2 x 8.5 through
2 x 14 depth of counter bore 4

M5 x 0.8
Port A

M5 x 0.8
Port B

4 x M5 x 0.8
(Finger closing port)

M5 x 0.8

Angle adjustment bolt

Max. 14

33.3 opened
19.3 closed

3 x 6H9 \( h^9 \) depth 8
(one each on three sides)

3 x 6H9 \( h^9 \) long groove depth 4
(one each on three sides)

4 x M8 x 1.25 depth 12
(two on opposite side)

2 x 14 depth
of counter bore 4

M5 x 0.8
Finger closing port

4 x M6 x 1 depth 10

Side A

Side B
MRHQ Series
Auto Switch Specifications

Applicable Series

<table>
<thead>
<tr>
<th>Series</th>
<th>Application</th>
<th>Auto switch model</th>
<th>Electrical entry</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRHQ10</td>
<td>Gripper opening/closing verification</td>
<td>Solid state</td>
<td>Grommet/2-wire</td>
</tr>
<tr>
<td>MRHQ16</td>
<td>Gripper opening/closing verification</td>
<td>Solid state</td>
<td>Grommet/3-wire</td>
</tr>
<tr>
<td>MRHQ20</td>
<td>Rotation verification</td>
<td>Solid state</td>
<td>Grommet/2-wire</td>
</tr>
<tr>
<td>MRHQ25</td>
<td>Rotation verification</td>
<td>Solid state</td>
<td>Grommet/3-wire</td>
</tr>
</tbody>
</table>

Auto Switch Hysteresis

Auto switches have hysteresis similar to micro switches. Use the table below as a guide when adjusting auto switch positions, etc.

<table>
<thead>
<tr>
<th>Model</th>
<th>Hysteresis (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRHQ10</td>
<td>0.5</td>
</tr>
<tr>
<td>MRHQ16</td>
<td>0.5</td>
</tr>
<tr>
<td>MRHQ20</td>
<td>1.0</td>
</tr>
<tr>
<td>MRHQ25</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Mounting of Auto Switch

Mounting Auto Switches to Verify Rotation

1. First, remove the slotted set screw installed in a standard switch.

2. Insert the auto switch into the switch case, and install switch holder B into the first groove (MRHQ20/25) or the second groove (MRHQ10/16) and secure the auto switch.

3. Install the auto switch case, with a switch attached securely in the hole, in the direction indicated in Figure (1).

Mounting Auto Switches to Verify Opening/Closing of Gripper

1. Position switch holder A in the groove of the switch guide in the direction indicated in Figure (2).

2. Insert an auto switch into the switch guide and align the set screw with the hole of switch holder A.

3. Secure the auto switch at an appropriate position with a flat head watchmakers screwdriver as indicated in Figure (3).

   **Figure (2)**
   
   **Figure (3)**

   **Tightening torque: 0.05 to 0.1 N·m**

---

764
**Auto Switch Specifications**

**D-M9□-746 (With indicator light)**

<table>
<thead>
<tr>
<th>Auto switch part no.</th>
<th>D-M9N-746</th>
<th>D-M9P-746</th>
<th>D-M9B-746</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical entry</td>
<td>Lateral</td>
<td>Lateral</td>
<td>Lateral</td>
</tr>
<tr>
<td>Wiring type</td>
<td>3-wire</td>
<td>2-wire</td>
<td></td>
</tr>
<tr>
<td>Output type</td>
<td>NPN Type</td>
<td>PNP Type</td>
<td></td>
</tr>
<tr>
<td>Applicable load</td>
<td>IC circuit, Relay, for PLC</td>
<td>24 VDC relay, for PLC</td>
<td></td>
</tr>
<tr>
<td>Power supply</td>
<td>5, 12, 24 VDC(4.5 to 28 V)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current consumption</td>
<td>10 mA or less</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Load voltage</td>
<td>28 VDC or less</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Load current</td>
<td>40 mA or less</td>
<td>2.5 to 40 mA</td>
<td></td>
</tr>
<tr>
<td>Internal voltage drop</td>
<td>0.8 V or less at 10 mA (2 V or less at 40 mA)</td>
<td>4 V or less</td>
<td></td>
</tr>
<tr>
<td>Leakage current</td>
<td>100 µA or less at 24 VDC</td>
<td>0.8 mA or less</td>
<td></td>
</tr>
<tr>
<td>Indicator light</td>
<td>Red LED illuminates when turned ON.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard</td>
<td>CE marking</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Lead length symbols:**
- 0.5 m (Example)D-M9N-746
- 3 m (Example)D-M9NL-746
- 5 m (Example)D-M9NZ-746

**Oilproof Heavy-duty Cord Specifications**

<table>
<thead>
<tr>
<th>Auto switch models</th>
<th>D-M9□□-746</th>
<th>D-M9□□-746</th>
<th>D-M9□□-746</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheath</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insulator</td>
<td>Number of cores</td>
<td>3-wire (Brown, Black, Blue)</td>
<td>2-wire (Brown, Blue)</td>
</tr>
<tr>
<td></td>
<td>Outside diameter</td>
<td>2.7 x 3.2 ellipse</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Outside diameter</td>
<td></td>
<td>0.9</td>
</tr>
<tr>
<td>Conductor</td>
<td>Effective area [mm²]</td>
<td>0.15</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Strand diameter [mm]</td>
<td>0.05</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Minimum bending radius [mm] (Reference value)</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>

Note 1) Refer to page 800 for solid state auto switch common specifications.
Note 2) Refer to page 800 for lead wire lengths.

**Auto Switch Weight**

<table>
<thead>
<tr>
<th>Auto switch part no.</th>
<th>D-M9N-746</th>
<th>D-M9P-746</th>
<th>D-M9B-746</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead wire length</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.5 m (Nil)</td>
<td>8</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>3 m (L)</td>
<td>41</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>5 m (Z)</td>
<td>68</td>
<td>63</td>
<td></td>
</tr>
</tbody>
</table>

**Auto Switch Dimensions**

D-M9N-746/D-M9P-746/D-M9B-746

- Mounting screw M2.5 x 4L
- Slotted set screw
- Indicator light
- Most sensitive position

---

**Grommet**
- Reduce the 2-wire load current (2.5 to 40 mA)
- Use a flexible cord as a standard
Various auto switch applications will be available with combinations of using different numbers of auto switches and varieties of detecting positions.

### 1) Detection when Gripping Exterior of Workpiece

<table>
<thead>
<tr>
<th>Detection example</th>
<th>1. Confirmation of fingers in reset position</th>
<th>2. Confirmation of workpiece held</th>
<th>3. Confirmation of workpiece released</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position to be detected</td>
<td>Position of fingers fully opened</td>
<td>Position when gripping a workpiece</td>
<td>Position of fingers fully closed</td>
</tr>
<tr>
<td>Operation of auto switch</td>
<td>Auto switch turned ON when fingers return. (Light ON)</td>
<td>Auto switch turned ON when gripping a workpiece. (Light ON)</td>
<td>When a workpiece is not held (Abnormal operation): Auto switch to turn ON (Light ON)</td>
</tr>
</tbody>
</table>
| Detecting conditions | One auto switch
  * One position, any of q, w, and e can be detected. |
| | Two auto switches
  * Two positions of q, w, and e can be detected. |
| How to determine auto switch installation position | Step 1) Fully open the fingers. | Step 1) Position fingers for gripping a workpiece. | Step 1) Fully close the fingers. |
| At no pressure or low pressure, connect the auto switch to a power supply, and follow the directions. | Step 2) Refer to “Mounting Switches to Verify Opening/Closing of Gripper” on page 764 and position an auto switch in auto switch mounting groove. |
| Step 3) Slide the auto switch in the direction of the arrow until the indicator light illuminates. | Step 3) Slide the auto switch in the direction of the arrow until the light illuminates and fasten it at a position 0.5 to 1.0 mm in the direction of the arrow beyond the position where the indicator light illuminates. |
| Position where light turns ON | 0.5 to 1.0 mm |
| Position to be secured | 0.5 to 1.0 mm |

**Note:**
- It is recommended that gripping of a workpiece be performed close to the center of the finger stroke.
- When holding a workpiece close at the end of open/close stroke of fingers, detecting performance of the combinations listed in the above table may be limited, depending on the hysteresis of an auto switch, etc.
2) Detection when Gripping Interior of Workpiece

<table>
<thead>
<tr>
<th>Detection example</th>
<th>1. Confirmation of fingers in reset position</th>
<th>2. Confirmation of workpiece held</th>
<th>3. Confirmation of workpiece released</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position to be detected</td>
<td>Position of fingers fully closed</td>
<td>Position when gripping workpiece</td>
<td>Position of fingers fully opened</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operation of auto switch</th>
<th>Auto switch turned ON when fingers return. (Light ON)</th>
<th>Auto switch turned ON when gripping a workpiece. (Light ON)</th>
<th>When a workpiece is not held (Abnormal operation): Auto switch to turn ON (Light ON)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Detection combination</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>One auto switch</td>
<td>.</td>
<td>.</td>
<td>.</td>
<td>.</td>
</tr>
<tr>
<td>Two auto switches</td>
<td>A</td>
<td>.</td>
<td>.</td>
<td>.</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>.</td>
<td>.</td>
<td>.</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>.</td>
<td>.</td>
<td>.</td>
</tr>
</tbody>
</table>

How to determine auto switch installation position

Step 1) Fully close the fingers.
Step 1) Position fingers for gripping a workpiece.
Step 1) Fully open the fingers.

At no pressure or low pressure, connect the auto switch to a power supply, and follow the directions.

Step 2) Refer to “Mounting Switches to Verify Opening/Closing of Gripper” on page 764 and position auto switch in switch mounting groove.

Step 3) Move the auto switch in the direction of the arrow and fasten it at a position 0.5 to 1.0 mm beyond the position where the indicator light illuminates.

Position where light turns ON

Position to be secured

0.5 to 1.0 mm

Step 4) Slide the auto switch in the direction of the arrow until the indicator light goes out.

Step 5) Move the auto switch in the opposite direction, and fasten it at a position 0.5 to 1.0 mm in the direction of the arrow beyond the position where the indicator light illuminates.

Note) • It is recommended that gripping of a workpiece be performed close to the center of the finger stroke.
• When holding a workpiece close at the end of open/close stroke of fingers, detecting performance of the combinations listed in the above table may be limited, depending on the hysteresis of an auto switch, etc.
**MRHQ Series**
**Made to Order**
Please contact SMC for detailed dimensions, specifications and lead times.

1. **Flat Type Fingers**

The distance to the workpiece can be shortened.
The finger option of the air gripper MHZ series is mounted.

### How to Order

![Diagram of MRHQ Series]

**MRHQ □□□ □ SX □□ □□ X50**

- **Bore size**
- **Action**
- **Rotation angle**
- **Switch type 1**
- **Switch type 2**
- **Finger option/Flat type fingers**

For details, refer to the standard type on page 757.

### Dimensions

(Dimensions other than shown below are the same as standard type.)

<table>
<thead>
<tr>
<th>Model</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>F</th>
<th>G</th>
<th>J</th>
<th>K</th>
<th>MM</th>
<th>L</th>
<th>R</th>
<th>Q</th>
<th>W</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRHQ10</td>
<td>2.46</td>
<td>6</td>
<td>5.2</td>
<td>10.9</td>
<td>2</td>
<td>5.4</td>
<td>1.4</td>
<td>4.45</td>
<td>2M2.5x0.45</td>
<td>5</td>
<td>5.7</td>
<td>25.7</td>
<td>5.5</td>
</tr>
<tr>
<td>MRHQ16</td>
<td>3.06</td>
<td>8</td>
<td>8.3</td>
<td>14.1</td>
<td>2.5</td>
<td>7.4</td>
<td>1.4</td>
<td>5.8</td>
<td>2.5M3x0.5</td>
<td>6</td>
<td>9.5</td>
<td>32.7</td>
<td>8</td>
</tr>
<tr>
<td>MRHQ20</td>
<td>3.96</td>
<td>10</td>
<td>10.5</td>
<td>17.9</td>
<td>3</td>
<td>11.6</td>
<td>1.6</td>
<td>7.45</td>
<td>3M4x0.7</td>
<td>8</td>
<td>12.5</td>
<td>39.2</td>
<td>10</td>
</tr>
<tr>
<td>MRHQ25</td>
<td>4.9</td>
<td>12</td>
<td>13.1</td>
<td>21.8</td>
<td>4</td>
<td>16</td>
<td>2</td>
<td>8.9</td>
<td>4M5x0.8</td>
<td>10</td>
<td>15.1</td>
<td>48</td>
<td>12</td>
</tr>
</tbody>
</table>
Mounting attachments inside the fingers allows a simple configuration.
The finger option of the air gripper MHZ series is mounted.

### How to Order

<table>
<thead>
<tr>
<th>MRHQ</th>
<th>SX</th>
<th>X51</th>
</tr>
</thead>
</table>

- **Bore size**
- **Action**
- **Rotation angle**
- **Switch type 1**
- **Switch type 2**
- **Finger option/Through-holes in opening/closing direction**

For details, refer to the standard type on page 757.

### Dimensions

(Dimensions other than shown below are the same as standard type.)

![Diagram of MRHQ Series with dimensions]

<table>
<thead>
<tr>
<th>Model</th>
<th>A (mm)</th>
<th>B (mm)</th>
<th>H (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRHQ10</td>
<td>3</td>
<td>5.7</td>
<td>2.9</td>
</tr>
<tr>
<td>MRHQ16</td>
<td>4</td>
<td>7</td>
<td>3.4</td>
</tr>
<tr>
<td>MRHQ20</td>
<td>5</td>
<td>9</td>
<td>4.5</td>
</tr>
<tr>
<td>MRHQ25</td>
<td>6</td>
<td>12</td>
<td>5.5</td>
</tr>
</tbody>
</table>

Made to Order **MRHQ Series**
Dust cover offers excellent dust proof. Three types of dust cover materials are available. The dust cover is equivalent to the air gripper MHZJ2 series.

How to Order


- MRHQ Series
- Symbol
- X111 to X113

Dimensions

(Dimensions other than shown below are the same as standard type.)

For details, refer to the standard type on page 757.

<table>
<thead>
<tr>
<th>Model</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRHQ10</td>
<td>34</td>
<td>21</td>
<td>36.5</td>
</tr>
<tr>
<td>MRHQ16</td>
<td>45</td>
<td>29.6</td>
<td>44.3</td>
</tr>
<tr>
<td>MRHQ20</td>
<td>58</td>
<td>34.6</td>
<td>54</td>
</tr>
<tr>
<td>MRHQ25</td>
<td>73</td>
<td>42</td>
<td>66.9</td>
</tr>
</tbody>
</table>
1. Keep the rotation angle within the prescribed ranges: 90° ±10°; 180° ±10° (±5° at end of rotation).

2. Adjust the opening/closing speed of the fingers with a speed controller so that they do not operate any faster than necessary.

3. Adjust the rotation time within the prescribed values using a speed controller. (0.07 to 0.3 s/90°)

1. Gripper unit

Replace a gripper unit. When replacing it follow the gripper unit replacement procedures on the next page. Confirm the correct unit part number.

Gripper unit

- A gripper unit includes not only an air gripper, but also three O-rings (12) and three hexagon socket head cap screws (15) as shown in the construction on page 759.

2. Rotary unit

Replace a rotary unit.

- Note that the rotation angle cannot be changed even though the rotary unit has been changed.

For maintenance, order units with a part number suitable for the model being used.

3. O-ring in the body C

((12) O-ring in the construction on page 759: 3 pcs.)

- Special grease is applied.
- This O-ring is included in the gripper unit.
Maintenance

**Caution**

**Gripper Unit Replacement Procedure**

1. Loosen the four bolts ① and remove the rotary unit.
2. Loosen the three bolts ②, remove the stopper lever and pull out the gripper unit.
3. Replace the three O-rings inside body C.
4. Reinstall the two bearings securely in their original positions.
5. Insert a new gripper unit into body C. Then reinstall the stopper lever and parallel pin in their original positions and secure in place by tightening with the three bolts ②.
6. Reinstall the rotary unit in its original position and secure in place by tightening with the four bolts ①.

<table>
<thead>
<tr>
<th>Model</th>
<th>Tightening torque N·m</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRHQ10</td>
<td>0.9 to 1.2, 1.4 to 1.7</td>
</tr>
<tr>
<td>MRHQ16</td>
<td>2.5 to 3.0, 3.2 to 3.7</td>
</tr>
<tr>
<td>MRHQ20</td>
<td>4.5 to 5.0, 6.5 to 7.0</td>
</tr>
<tr>
<td>MRHQ25</td>
<td>4.5 to 5.0, 10.0 to 10.5</td>
</tr>
</tbody>
</table>