Air-Quality Gas Sensor

(Model: MP503)

Manual

Version: 1.3
Valid From: 2014.05.01

Zhengzhou Winsen Electronics Technology Co., Ltd
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Zhengzhou Winsen Electronics Technology CO., LTD
MP503 Air-Quality Gas Sensor

Profile
MP503 gas sensor is for air quality. It adopts multilayer thick film manufacturing technology. The heater and metal oxide semiconductor material on the ceramic substrate of subminiature Al₂O₃ are fetched out by electrode down-lead, encapsulated in metal socket and cap. Conductivity of the sensor is affected by the concentration of target gas. The higher the concentration is, the higher conductivity of sensor gets. Users can adopt simple circuit to convert variation of conductivity into output signal corresponding to gas concentration.

Features
High sensitivity to alcohol, smoke; quick response and resume; low power consumption, simple detection circuit, good stability and long life.

Main Application
It is used in occasions such as household and office for harmful gas detection, automatic exhaust device, air cleaner & etc.

Technical Parameters Stable1.

<table>
<thead>
<tr>
<th>Model</th>
<th>MP503</th>
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<tbody>
<tr>
<td>Sensor Type</td>
<td>Semiconductor flat surfaced sensor</td>
</tr>
<tr>
<td>Standard Encapsulation</td>
<td>Metal Cap</td>
</tr>
<tr>
<td>Detection Gas</td>
<td>Alcohol, Smoke</td>
</tr>
<tr>
<td>Detection range</td>
<td>10 ~ 1000ppm (Alcohol)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Standard circuit</th>
<th>Loop voltage Vₜ</th>
<th>≤24V DC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Heating voltage Vₜ</td>
<td>5.0V±0.1V AC or DC</td>
</tr>
<tr>
<td></td>
<td>Load resistance Rₜ</td>
<td>Adjustable</td>
</tr>
<tr>
<td>sensor features in standard test condition</td>
<td>Heating resistance Rₜ</td>
<td>95Ω±10Ω(Room Tem.)</td>
</tr>
<tr>
<td></td>
<td>Heating consumption Pₜ</td>
<td>≤300mW</td>
</tr>
<tr>
<td></td>
<td>Surface resistance Rₛ</td>
<td>1KΩ ~ 30KΩ (in 50ppm Alcohol)</td>
</tr>
<tr>
<td></td>
<td>Sensitivity S</td>
<td>Rs(in air)/Rs(in 50ppm Alcohol)≥5</td>
</tr>
<tr>
<td></td>
<td>Concentration slope α</td>
<td>≤0.6(Rₜ100ppm/Rₜ30ppm alcohol)</td>
</tr>
</tbody>
</table>

| Standard condition of test | Temperature, humidity | 20℃±2℃; 65%±5%RH |
|                           | Standard test circuit | Vₜ: 5.0V±0.1V; Vₜ: 5.0V±0.1V |
|                           | Warm-up time         | More than 48 hours |

Fig1. Sensor Structure
Fig2. MP503 Test Circuit

Instructions: The above fig is the basic test circuit of MP503. The sensor requires two voltage inputs: heater voltage ($V_H$) and circuit voltage ($V_C$). $V_H$ is used to supply standard working temperature to the sensor and it can adopt DC or AC power, while $V_{RL}$ is the voltage of load resistance $R_L$ which is in series with sensor. $V_C$ supplies the detect voltage to load resistance $R_L$ and it should adopt DC power.

Description of Sensor Characters

Rs means resistance in target gas with different concentration, $R_0$ means resistance of sensor in clean air. All tests are finished under standard test conditions.

Fig4. Typical temperature/humidity characteristics
Rs means resistance of sensor in 50ppm alcohol under different temp. and humidity. $R_{so}$ means resistance of the sensor in 50ppm alcohol under 20℃/55%RH.
Fig7. long-term Stability of MP503

NOTE: Test is finished in standard test conditions, the abscissa is observing time and the ordinate is $V_{RL}$.

Cautions

1. Following conditions must be prohibited

1.1 Exposed to volatilizable organic silicon steam

Sensing material will lose sensitivity and never recover if the sensor absorbs organic silicon steam. Sensors must avoid exposing to silicon bond, fixture, silicon latex, putty or plastic contain silicon environment.

1.2 High Corrosive gas

If the sensors are exposed to high concentration corrosive gas (such as $\text{H}_2\text{S}$, $\text{SO}_x$, $\text{Cl}_2$, $\text{HCl}$ etc.), it will not only result in corrosion of sensors structure, also it cause sincere sensitivity attenuation.

1.3 Alkali, Alkali metals salt, halogen pollution

The sensors performance will be changed badly if sensors be sprayed polluted by alkali metals salt especially brine, or be exposed to halogen such as fluorine.

1.4 Touch water

Sensitivity of the sensors will be reduced when spattered or dipped in water.

1.5 Freezing

Do avoid icing on sensor’s surface, otherwise sensing material will be broken and lost sensitivity.

1.6 Applied higher voltage

Applied voltage on sensor should not be higher than stipulated value, even if the sensor is not physically damaged or broken, it causes down-line or heater damaged, and bring on sensors’ sensitivity characteristic changed badly.

1.7 Voltage on wrong pins

As Fig8, Pin 1&2 connects to heater circuit, Pin 3&4 connects to measuring circuit; Under the requested conditions, heating and measuring can use the same power circuit.

NOTE: the two pins near the protuberance mark is heating electrode.
2. Following conditions should be avoided

2.1 Water Condensation
Indoor conditions, slight water condensation will influence sensors’ performance lightly. However, if water condensation on sensors surface and keep a certain period, sensors’ sensitive will be decreased.

2.2 Used in high gas concentration
No matter the sensor is electrified or not, if it is placed in high gas concentration for long time, sensors characteristic will be affected. If lighter gas sprays the sensor, it will cause extremely damage.

2.3 Long time storage
The sensors resistance will drift reversibly if it’s stored for long time without electrify, this drift is related with storage conditions. Sensors should be stored in airproof bag without volatile silicon compound. For the sensors with long time storage but no electrify, they need long galvanical aging time for stability before using. The suggested aging time as follow:

<table>
<thead>
<tr>
<th>Storage Time</th>
<th>Suggested aging time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than one month</td>
<td>No less than 48 hours</td>
</tr>
<tr>
<td>1 ~ 6 months</td>
<td>No less than 72 hours</td>
</tr>
<tr>
<td>More than six months</td>
<td>No less than 168 hours</td>
</tr>
</tbody>
</table>

2.4 Long time exposed to adverse environment
No matter the sensors electrified or not, if exposed to adverse environment for long time, such as high humidity, high temperature, or high pollution etc., it will influence the sensors’ performance badly.

2.5 Vibration
Continual vibration will result in sensors down-lead response then break. In transportation or assembling line, pneumatic screwdriver/ultrasonic welding machine can lead this vibration.

2.6 Concussion
If sensors meet strong concussion, it may lead its lead wire disconnected.

2.7 Usage Conditions
2.7.1 For sensor, handmade welding is optimal way. The welding conditions as follow:
- Soldering flux: Rosin soldering flux contains least chlorine
- homothermal soldering iron

Fig8. Pin Schematic Diagram

- Pin 1&2 is heating electrode,
- Pin 3&4 is measuring electrode.

Protuberance Mark
● Temperature: 250℃
● Time: less than 3 seconds

2.7.2 If users choose wave-soldering, the following conditions should be obeyed:

● Soldering flux: Rosin soldering flux contains least chlorine
● Speed: 1-2 Meter/ Minute
● Warm-up temperature: 100±20℃
● Welding temperature: 250±10℃
● One time pass wave crest welding machine

If disobey the above using terms, sensors sensitivity will reduce.