



TO :

MULTI SENSOR MODULE

P/N : MDG501A

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SPECIFICATIONS

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1. Scope of application

This specification is applied to the dust sensor module MDG501A.

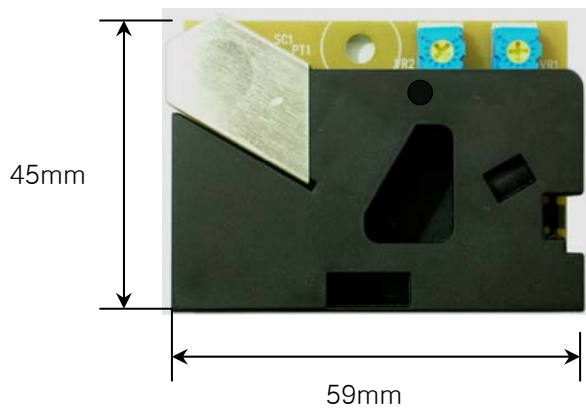
2. Type

MDG501A : 2mm pitch connector type (20010WR-05).

3. Configuration

The configuration of the multi sensor module

Fig. -1. Dimension (mm)



4. Electrical characteristics

- | | |
|------------------------------------|--|
| 4 - 1. Supply voltage | : DC5V±0.2V |
| 4 - 2. Power consumption | : 160mA |
| 4 - 3. Operating temperature range | : -10~ +50℃ |
| 4 - 4. Operating humidity range | : 95%RH or less (without dew condensation) |
| 4 - 5. Recommend storage condition | : -20~ +80℃ |
| 4 - 6. Dimension | : W59 * H45 * D20(mm) |

5. Dust sensor specifications

- 5 - 1. Detectable particle size : approx. 1 μ m (minimum)
- 5 - 2. Detectable range of concentration : 0 ~ 1.4mg/m³
- 5 - 3. Output signal : PWM (pulse width modulation)
- 5 - 4. Time for stabilization : 1 minute after power turned on
- 5 - 5. Sensor characteristics : To be maintained in between the upper and lower limit of the standard dust sensor unit. (Fig.-2)

6. Air quality (TVOC) sensor specifications

- 6 - 1. Heater resistance(room temp.) : 83 Ω at room temp. (typical)
- 6 - 2. Sensor power consumption : \leq 15mW
- 6 - 3. Optimal detection concentration : 1 ~ 10 ppm
- 6 - 4. Sensor resistance (Rs @ No gas) : 10k Ω ~ 90k Ω
- 6 - 5. Load resistance (RL) : 10k Ω
- 6 - 6. Detecting output voltage : $R_L / (R_s + R_L) * V_{cc}$ (5V)

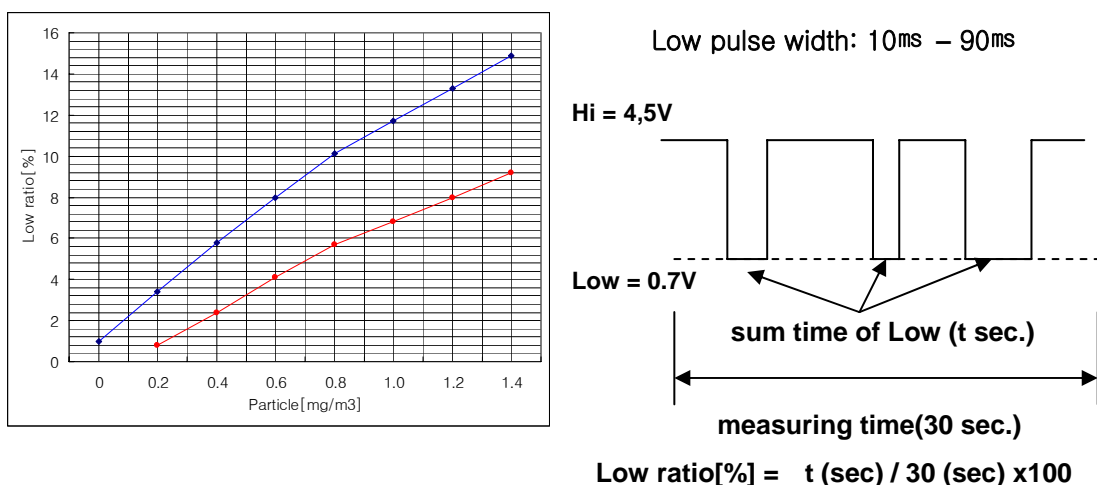
NOTE : Sensitivity characteristics are obtained under the following standard test condition :

Temperature and humidity : 20 \pm 2 $^{\circ}$ C, 65% \pm 5RH

Circuit conditions : Circuit voltage = 5.0 \pm 0.05V DC
: Heater voltage = 5.0 \pm 0.05V DC
: Load resistance = 10k Ω \pm 1%

Preheating period : 7 days or more under standard circuit conditions.

Fig. -2. Sensor Characteristics vs Low ratio



7. Device overview

MDG501A is a compact sized multi-sensor module consisting of particle density and air quality (TVOC) sensors.

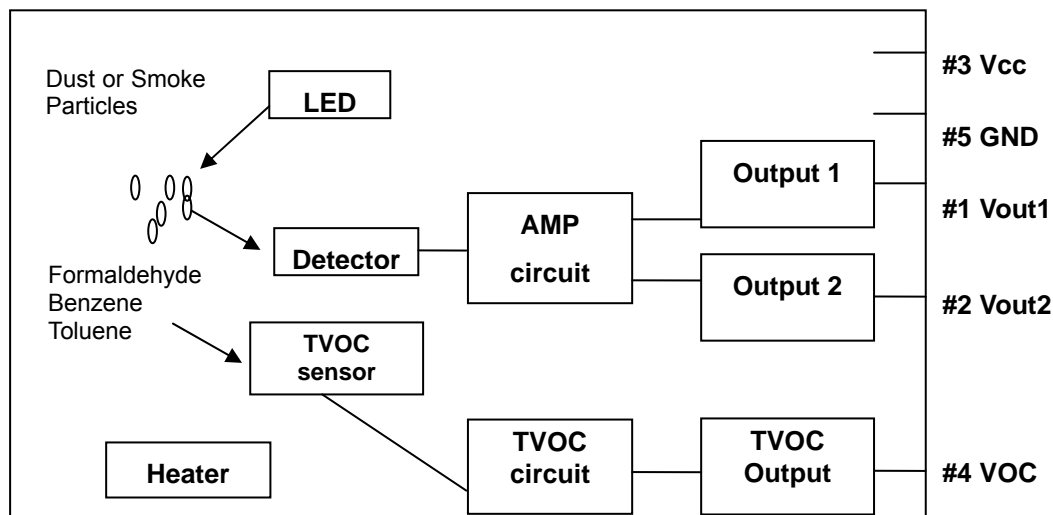
- * Quantitative particle density measurement with the principle of particle counter.
- * Fine particles of bigger than one micron could be detected with high sensitivity.
- * Inside heater induces air inflow to the module.
- * Two output contacts for particle and one output contact for TVOC.

A block diagram is illustrated in figure 7.1.

The MDG501A consists of :

- * Light Emitting Diode (LED) Lamp
- * Detector (Particle)
- * Signal amplifier circuit
- * Output drive circuit 1
- * Output drive circuit 2
- * Heater induced air flow
- * Air Quality or TVOC sensor & circuit

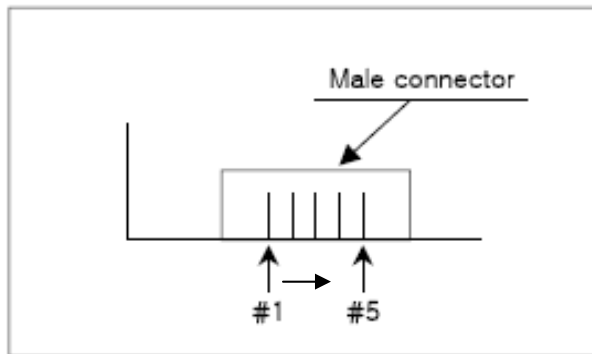
7-1. BLOCK DIAGRAM



7-2. PINOUT I/O DESCRIPTION

Pin number	Pin name	Description
#1	Vout 1	Vout 1 PWM output (particle)
#2	Vout 2	Vout 2 PWM output (particle)
#3	Vcc	Positive power supply
#4	VOC	TVOC output (Voltage)
#5	GND	Ground

7-3. PIN ARRAY (component view)



7-4. CONNECTOR PART NUMBER

Model name	Part No.		Description	Connector's maker
MDG501A	Male	20010WR-05	2mm pitch	Yeonho Electronic
	Female	20010HS-05		

8. CIRCUIT DESCRIPTION

This section gives a circuit description of the external connections and components of the MDG501, and can be used as a starting point for designs.

8-1. Vout 1 (Pin #1)

Use this pin when adjustment of detecting level of the minimum particle size is desired.

The sensitivity of Vout 1 is duller than that of Vout 2 about 2.5times.

(Vout1's sensitivity x 2.5times = Vout2's sensitivity).

Adding a resistor on R22 position on PCB, the minimum size of the particles can be adjusted from 1 μ m to 2.5 μ m.

The standard (open) minimum size of particles is 2.5 μ m. (refer to [Table 8.1](#))

Vout1 (Pin #4) gives PWM output.

Table 8.1. RESISTOR VALUE

Resistor value (R22)	Description
open	Preset sensitivity (over 2.5 micrometer)
47K	Half sensitivity
18.2K	Equal sensitivity of Vout 2 (over 1 micrometer)

8-2. Vout 2 (Pin #2)

The Vout 2 is Standard Output Port.

The sensitivity of Vout 2 pin is preset at factory.

This port gives PWM output for density of particles over 1 μ m.

8-3. Vcc (Pin #3)

Positive power (DC 5V) supply.

8-4. VOC (Pin #4)

Voltage output of TVOC (refer to [Table 10-4](#)).

8-5. Ground (Pin #5)

This pin is used for Ground.

9. Application

This section provides general information on application for the DSM501.

9-1. Heater

This module has a heater (resistor) to generate heat. Heat creates updraft (upward current of air) which draws outside air into the module.

9-2. Detectable Particles

This module is designed to detect the particle of the size bigger than one micrometer, which usually includes cigarette smoke, house dust, tick, spore, pollen and mildew.

9-3. Installation

The dust sensor module DSM501 should be installed vertically and kept away from any artificial current of air by fans. In case it is used for air purifier of which fan located in front or rear part, it should be installed at either side of the housing, but not too much deep inside of the housing. There also need to have slits near the module so that air can come inside.

In addition, please pay attention to structure and placing location of the application to avoid any adhesive particles (such as oil, etc) getting into the module, which may cause malfunction by sticking to the optical part.

Moisture presence inside of the module may cause malfunction of the sensor. Please avoid the location where condensation may frequently occur.

9-4. Lens

Lens is coated with anti static and anti dust polymer. But for better performance, it needs to be cleaned depending on the condition. Cleaning every six months for office environment and every three months for industrial environment is recommended. When cleaning, wet one side of swab with water and rub the lens with it and then dry lens with the other end of swab.

10. Output Characteristics

Vcc=5V, Ta=25°C

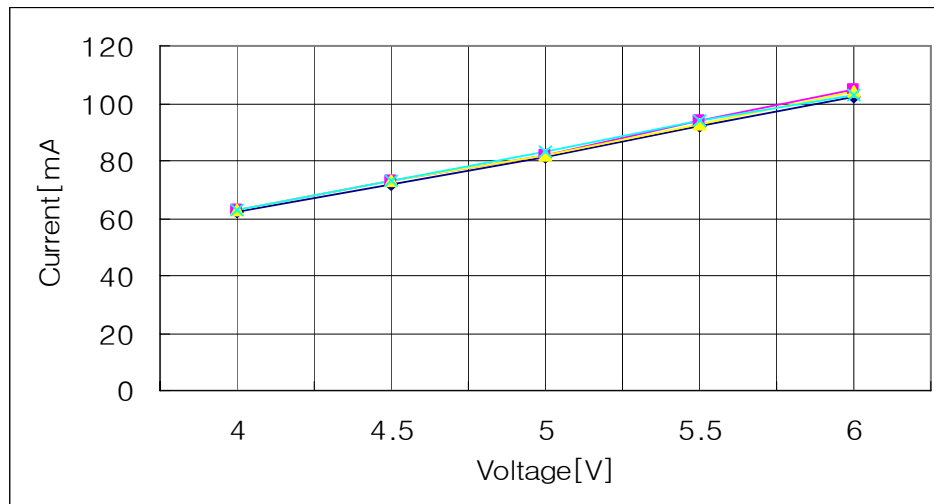
Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Vout 1, 2 at high ^{*1}	Voh	No particle	4.0	4.3	-	V
Vout 1, 2 at low ^{*2}	Vol	Particle	-	0.7	1.0	V
Supply current	Icc		-	-	90	mA
Time for stabilization ^{*3}			1	-	minute	

*1 : Vout 1 and Vout 2 are high state when particles are not detected. (=clean room)

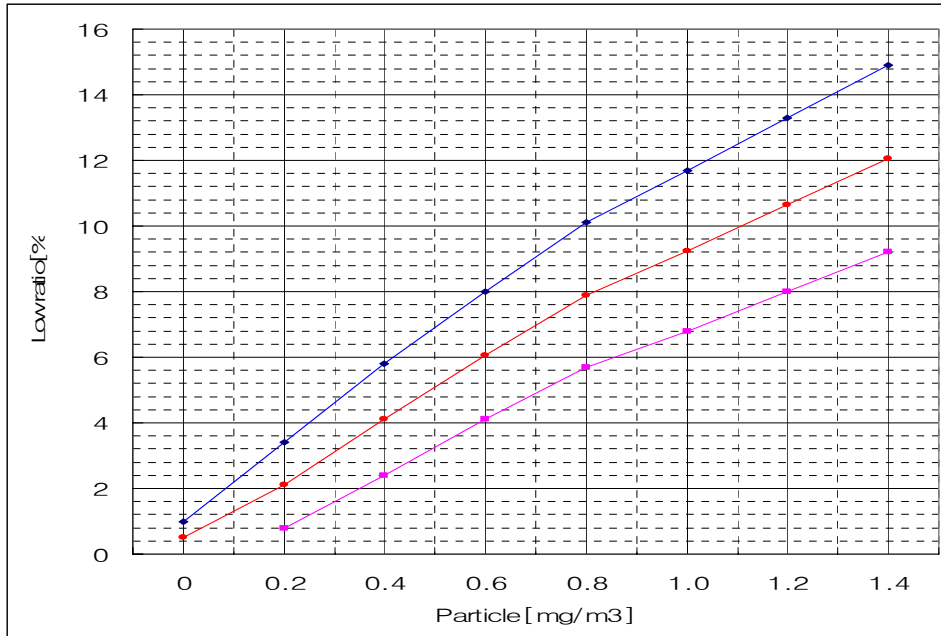
*2 : Vout 1 and 2 go to low state when particles are detected.

*3 : After the power is turned on.

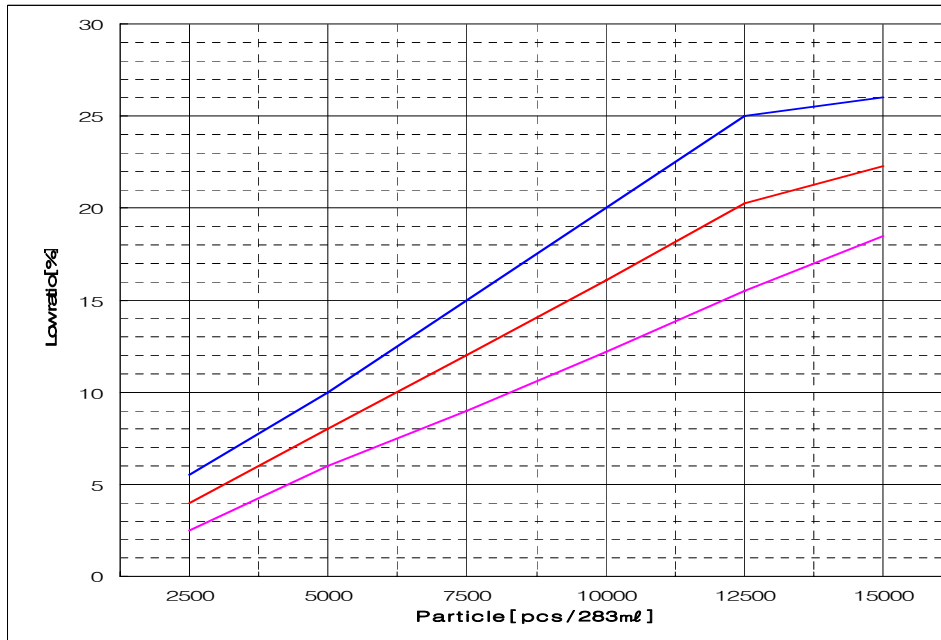
10-1. VOLTAGE vs. CURRENT



10-2. LOW RATIO vs. CONCENTRATION



10-3. LOW RATIO vs. PARTICLE



* X-axis shows number of particles and Y-axis shows output characteristics. Upper curve shows upper limit output characteristics and lower one shows lower limit.



Table 10-4 MDG501A - TVOC Output Characteristics

(Units : kΩ)

		Rs/kOHM						
		Rs(air)	0.1ppm	0.3ppm	1ppm	3ppm	10ppm	30ppm
H2 (Hydrogen)	avg	33.93857			23.61714	17.431	10.91343	6.082286
	max	45.02			32.4	24.2	15.16	8.278
	min	19			13.13	9.857	6.432	3.873
CO (Carbon monoxide)		33.66571			32.06	29.66571	24.54286	18.18357
		45.23			43.45	40.6	34.27	25.93
		18.27			17.15	15.64	12.77	9.535
C2H5OH (Ethanol)		34.03857			28.95714	23.71429	16.66186	10.46414
		46.06			40.6	34.34	25.08	16.2
		17.87			13.85	10.54	6.944	4.316
NH3 (Ammonia)		34.27286			32.29429	28.02143	18.46571	10.05657
		46.37			44.18	38.94	26.07	13.72
		17.99			16.96	14.92	10.83	7.283
CH3CHO (Acetaldehyde)		33.18429	32.41143	31.68857	29.53429	25.98286		
		45.02	44.15	43.37	40.96	36.83		
		17.8	17.25	16.63	14.96	12.52		
C6H5CH3 (Toluene)		33.66857			27.51286	22.38143	14.63929	8.934714
		45.66			39	32.83	22.69	14.56
		17.84			13.11	10.07	6.298	3.913
C6H4(CH3)2 (Xylene)		33.90429			26.33143	20.64286	13.76371	8.683143
		46.1			37.89	30.9	21.67	14.07
		17.94			11.84	8.656	5.532	3.517
C6H6 (Benzene)		34.72429			25.71	19.44643	12.13643	6.974
		47.43			36.92	28.85	18.61	10.8
		17.66			12.67	9.715	6.453	4.125
CH3COOH (Acetic acid)		34.74143			31.08857	27.11857	20.79971	14.006
		46.99			43.38	38.93	31.12	21.85
		18.65			15.23	12.34	8.788	5.798
CH3(CH2)4CH3 (n-Hexane)		31.92571			19.97143	13.46057	7.899143	4.616429
		42.74			27.49	18.46	10.6	5.976
		18.4			12.23	8.851	5.715	3.685
CH3(CH2)5CH3 (n-Heptane)		29.15429			20.25429	14.55957	8.751286	5.071714
		39.67			28.76	20.98	12.62	7.141
		16.52			11.33	8.457	5.533	3.572
CH3(CH2)6CH3 (n-Octane)		29.02429			21.84571	15.92314	9.955857	5.856286
		39.7			31.26	23.49	15.09	8.92
		16.28			11.6	8.439	5.5	3.556
CH3(CH2)8CH3 (n-Decane)		29.13714			22.95857	19.28129	12.87429	8.252714
		39.94			32.96	28.37	19.79	13.2
		16.21			11.73	9.509	6.16	4.048
CH3(CH2)9CH3 (n-Undecane)		28.77429			23.95286	19.93571	14.55943	10.15814
		40.22			34.68	29.66	22.5	16.27
		15.08			11.72	9.37	6.622	4.641
CH3(CH2)4OH (1-Pentanol)		30.60429			23.40857	18.30386	12.65	9.137286
		42.01			34.34	27.94	17.65	14.86
		16.66			10.59	7.54	5.715	3.572
CH3CH(OH)C2H5 (2-Butanol)		30.57429			24.49857	19.91943	14.14914	9.066571
		42.43			35.65	29.9	22.06	14.62
		15.86			11.27	8.622	5.85	3.756
CH3OH (Methanol)		31.85			24.03	20.67957	15.38071	10.45786
		43.51			34.79	30.52	23.4	16.33
		17.36			11.45	9.497	6.799	4.588
(CH3)2CHCH2OH (Isobutyl alcohol)		32.59			25.60857	21.03543	14.43843	9.125714
		44.37			36.98	31.36	22.52	14.78
		17.94			12.08	9.238	5.908	3.705
(CH3)2CHOH (Isopropyl alcohol)		28.85			23.33143	19.097	13.55757	8.769714
		39.55			33.53	28.31	20.9	13.97
		16			11.54	8.881	5.973	3.834



H2S	15.87571	15.75714	15.46714	14.40429	12.65571		
	18.98	18.86	18.53	17.28	15.01		
	13.22	13.08	12.81	11.78	10.31		
CH3SH	14.10571	13.99	13.84143	13.37571	12.30143		
	16.74	16.63	16.48	15.99	14.74		
	11.87	11.75	11.59	11.11	10.09		
(CH3)3N	13.90143	13.79571	13.41429	11.79557	8.727857		
(Trimethyl amine)	16.59	16.56	16.26	14.48	10.96		
	11.68	11.51	11.2	9.879	6.861		
C6H5CH2OH	23.25143			21.15571	19.05071	15.47157	12.43771
(benzyl alcohol)	31.72			29.68	27.37	23.12	19.19
	13.83			11.66	9.895	7.479	5.799
(C2H5)2O	23.56143			17.64157	14.35014	10.471	7.04
(diethyl ether)	32.91			25.78	21.37	15.92	10.85
	12.91			8.811	6.993	5.064	3.537
C5H10	26.45			14.03214	9.838571	6.529857	4.203857
(cyclopentane)	36.4			19.53	13.43	8.634	5.341
	14.88			8.896	6.837	5.017	3.57

11. Packaging information

11-1. Package Marking Information

Model no.	DSM501A or DSM501B
Qt'y	000 pcs

11-2. Package Details

Module dimensions	: W59 x H45 x D20 mm
Weight	: Approx. 25g ea
Tray	: modules of 25pcs.(5x5) per tray
Inner box	: 5 trays per box (module 125pcs)
Outer box	: 4 inner boxes per one outer box (module 500pcs)
Outer Box Dimensions	: W670 x H250 x D420mm
Weight	: Max. 13Kg per outer box



■ **Caution for Use**

VR trimmer for sensitivity adjustment is set up at shipping from Samyoung S&C.

Please do not touch the VR trimmer.

Please do not disassemble the device. If the device is reassembled, it may not satisfy the specification.

If the device is used in heavily smoked or dusted environment, more frequent cleaning of the lens and maintenance such as vacuuming or air blowing is recommended.

Please **NEVER use** this device for **Emergency** or **fire alarm** application.

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