


Amphenol Advanced Sensors	SM-UART-01L SPECIFICATION	DATE 30-AUG-16
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DATASHEET


DUST SENSORS SM-UART-01L

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Jintong Industrial Park, Wujin, Changzhou, Jiangsu, China
Web: www.amphenol-sensors.com

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REVISION HISTORY

Date	Revision	Changes	Author
30-Aug-2016	1.0	Initial release	Sherry Shao

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1 DESCRIPTION

SM-UART-01L laser dust sensor detects dust particle concentration in air by using an optical sensing method. A laser light emitting diode (laser LED) and a photo-sensor are optically arranged in the device. The photo-sensor detects the reflected laser LED light by dust particles in air. The dust sensor can detect the small particles like cigarette smoke and can distinguish small particles like smoke from large house dust by the pulse pattern of the signal output.

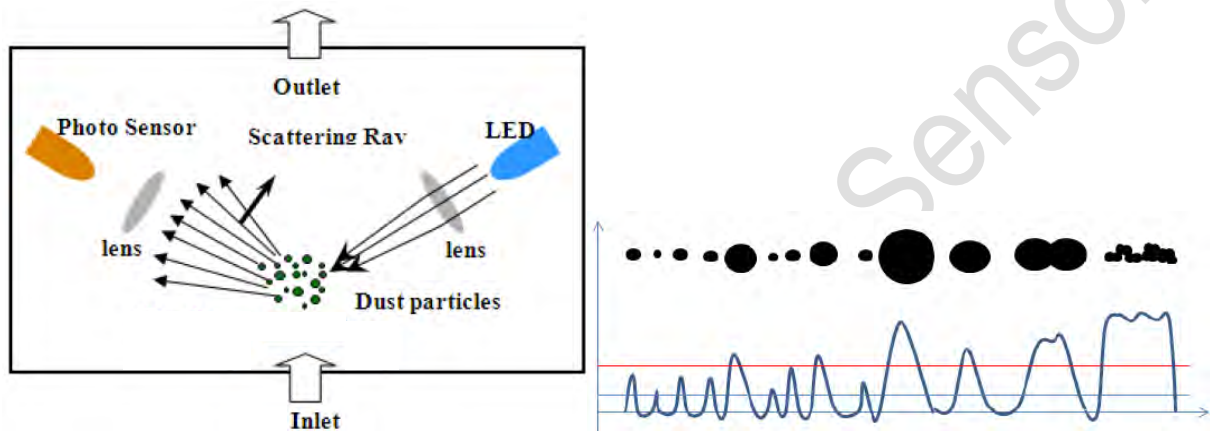


Fig.1 Detection principle

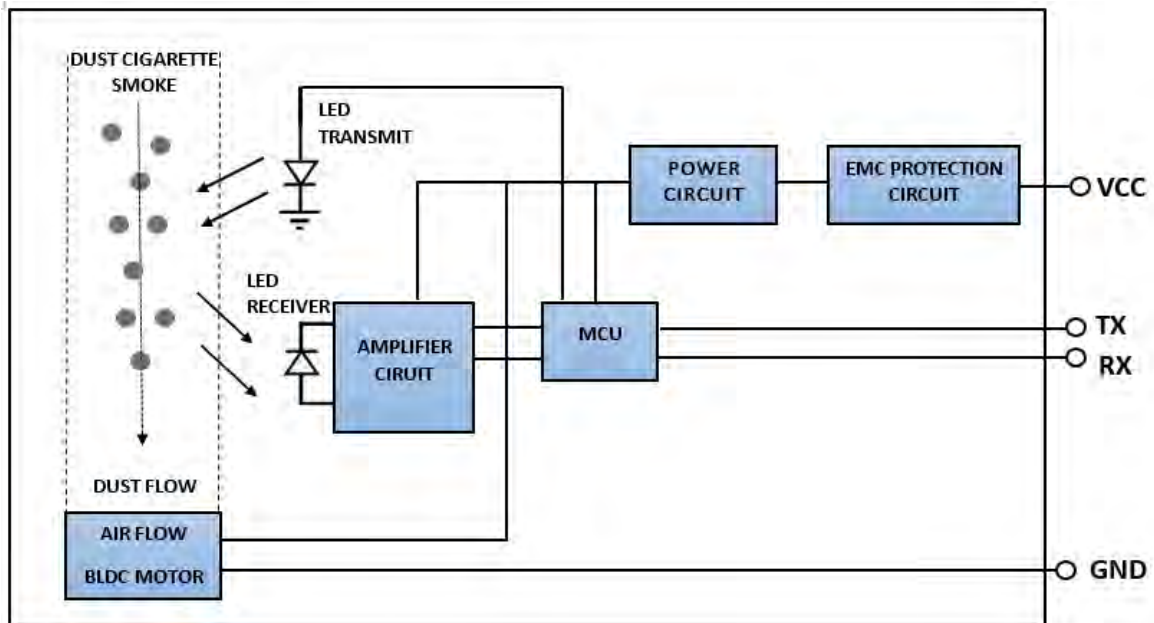
2 FEATURES

- Fast Response
- High Accuracy
- Digital UART Output
- Ultra-compact Size

3 APPLICATIONS

- Detection of dust in the air for Indoor Air quality monitoring
- Air cleaners and Air purifiers
- Air conditioners and HVAC
- Outdoor dust monitoring with the special mechanical design for customer

4 BLOCK DIAGRAM




5 ELECTRICAL CHARACTERISTICS

5.1 ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Rating	Unit
Supply voltage	V_{CC}	4.8 ~ 5.2	V
Operating temperature	T_{opr}	-10 ~ 50	°C
Storage temperature	T_{stg}	-20 ~ 70	°C
Operating humidity ^[1]	RH_{opr}	35 ~ 85	%
Storage humidity ^[1]	RH_{stg}	35 ~ 85	%

5.2 ELECTRO-OPTICAL CHARACTERISTICS

Parameter		Symbol	Min.	Typ.	Max.	Unit
Particle size		D	0.3	2.5	10	um
Detection range		D_{reg}	1	-	500	ug/m ³
Resolution		R	-	1	-	ug/m ³
Detection error ^[2]	0 ~ 100ug/m ³	D_{err}	-	-	+/-15	ug/m ³
	> 100ug/m ³		-	-	+/-15	%
Response time		t_{rsp}		10		s

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Parameter	Symbol	Min.	Typ.	Max.	Unit
Supply Voltage	V _{CC}	-	5	-	V
Current consumption	I _{CC}	-	-	100	mA
Signal output(RX, TX)	L<0.8 @ 3.3V, H>2.7 @ 3.3V				
Lifetime ^[2]	30000 hr.				

[1] Non-condensing;

[2] Testing at T=25°C, RH=40-60%;

5.3 NOTES

➤ Connection of case and GND

The metal case connects with GND in sensor. Do not remove the metal case.

➤ Cleaning

Please don't do cleaning, because there is a case that this device is not satisfied with its characteristics by cleaning.

➤ Dust adhesion

The dust adhered to the inside of the sensor through hole may reflect into the detecting space which consist of emitter and detector light axis. Please take the structure and the mechanism of the equipment into consideration to avoid the influence of adhered dust. And when the dust is adhered, please consider the maintenance such as vacuuming or blowing off the dust by air.

In addition, please pay attention to structure and placing location of the application to avoid any adhesive particle like oil, etc. to gets into the sensor. If it sticks to optical part, malfunction may occur.

➤ Resolution

Please do not disassemble the device such as removing tapping screw and so on. Even if the device is reassembled, it may not satisfy the specification.

➤ Noise influence

If the sensor is located close to noise generator (ex. Electric dust collector, etc.), the sensor output may be affected by leaded noise. On top of that noise from power supply line also may affect the sensor output. When designing the system, please consider the effect from noise.

➤ Vibration influence

The sensor may change its value under mechanical oscillation. Before usage, please make sure that the device works normally in the application.

➤ Incident light influence

Please locate the sensor into a dark place in order to avoid any influence from outer-light.

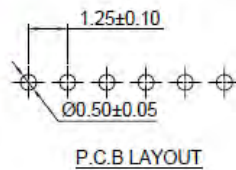
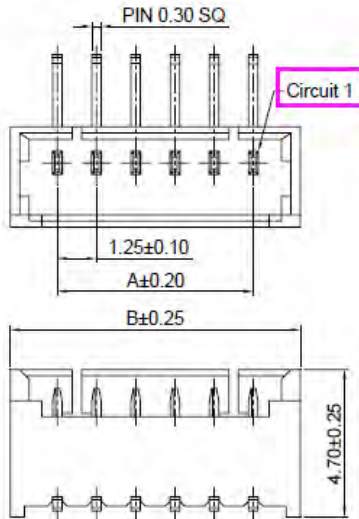
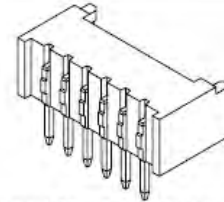
6 CONNECTOR

Name	Part NO.	Description	Maker
Connector	A1251WR-8P	1.25mm pitch	CJT
Housing	A1251H-8P		
Terminal	A1251-TP		

A1251WR 1.25mm pitch 90° Water

Reference Informations:

- *Material: Pin: Phosphor Bronze/Tin over Nickel
Insulator: Nylon 66, UL94V-0
- *Mates with CJT A1251 series Housing
- *Color: Ivory



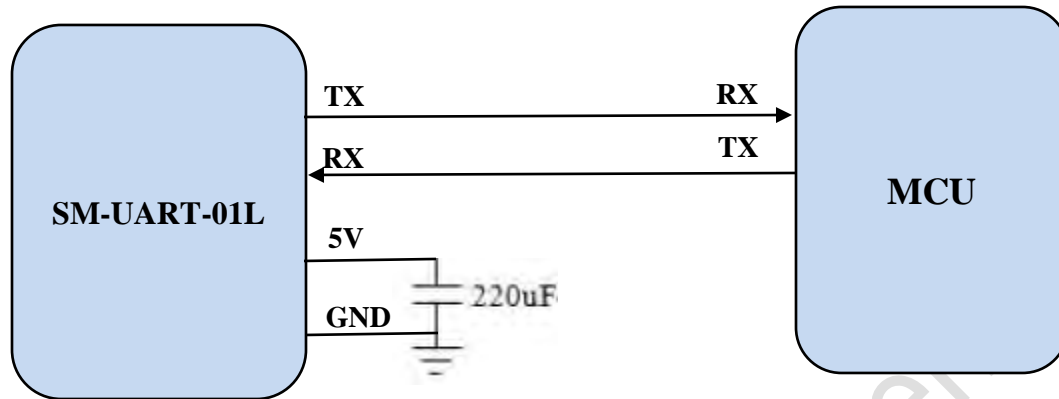
Ordering Information & Dimensions:

PART NO.	Dimensions	
	A	B
A1251WR-2P	1.25	4.30
A1251WR-3P	2.50	5.55
A1251WR-4P	3.75	6.80
A1251WR-5P	5.00	8.05
A1251WR-6P	6.25	9.30
A1251WR-7P	7.50	10.55
A1251WR-8P	8.75	11.80
A1251WR-9P	10.00	13.05
A1251WR-10P	11.25	14.30
A1251WR-11P	12.50	15.55
A1251WR-12P	13.75	16.80
A1251WR-13P	15.00	18.05
A1251WR-14P	16.25	19.30
A1251WR-15P	17.50	20.55
A1251WR-16P	18.75	21.80
A1251WR-17P	20.00	23.05
A1251WR-18P	21.25	24.30
A1251WR-19P	22.50	25.55
A1251WR-20P	23.75	26.80

Unit: mm

PIN MAP		
PIN1	NC	Not connected
PIN2	NC	Not connected
PIN3	NC	Not connected
PIN4	TXD	UART Transceiver @ 3.3V TTL
PIN5	RXD	UART Receiver @ 3.3V TTL
PIN6	NC	Not connected
PIN7	GND	Ground
PIN8	VCC	Input supply voltage

7 APPLICATION CIRCUIT




8 COMMUNICATION PROTOCOL

UART Serial Configuration	
Baud rate	9600
Data bits	8
Parity	None
Stop bits	1

SM-UART-01L uses the Modbus protocol for all communication. It is important to note that for Modbus over serial lines the user must include CRC fields at the end of the Modbus communication.

Modbus Request (UART)

0x20 Byte 1: Slave address, default 0x20
0x0C Byte 2: Function code
0x00 Byte 3: parameter
0x00 Byte 4: parameter
0x00 Byte 5: parameter
0x00 Byte 6: parameter
xx Byte 7: CRC (LSB)
xx Byte 8: CRC (MSB)

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Modbus Reply (UART)

- 0x20 Byte 1: Slave address, default 0x20
- 0x0C Byte 2: Function code
- xx Byte 3~8: not used
- xx Byte 9: PM2.5 MSB of 16-bit data
- xx Byte 10: PM2.5 LSB of 16-bit data
- xx Byte 11: CRC (LSB)
- xx Byte 12: CRC (MSB)

PM2.5 = MSB * 256 + LSB

For example:

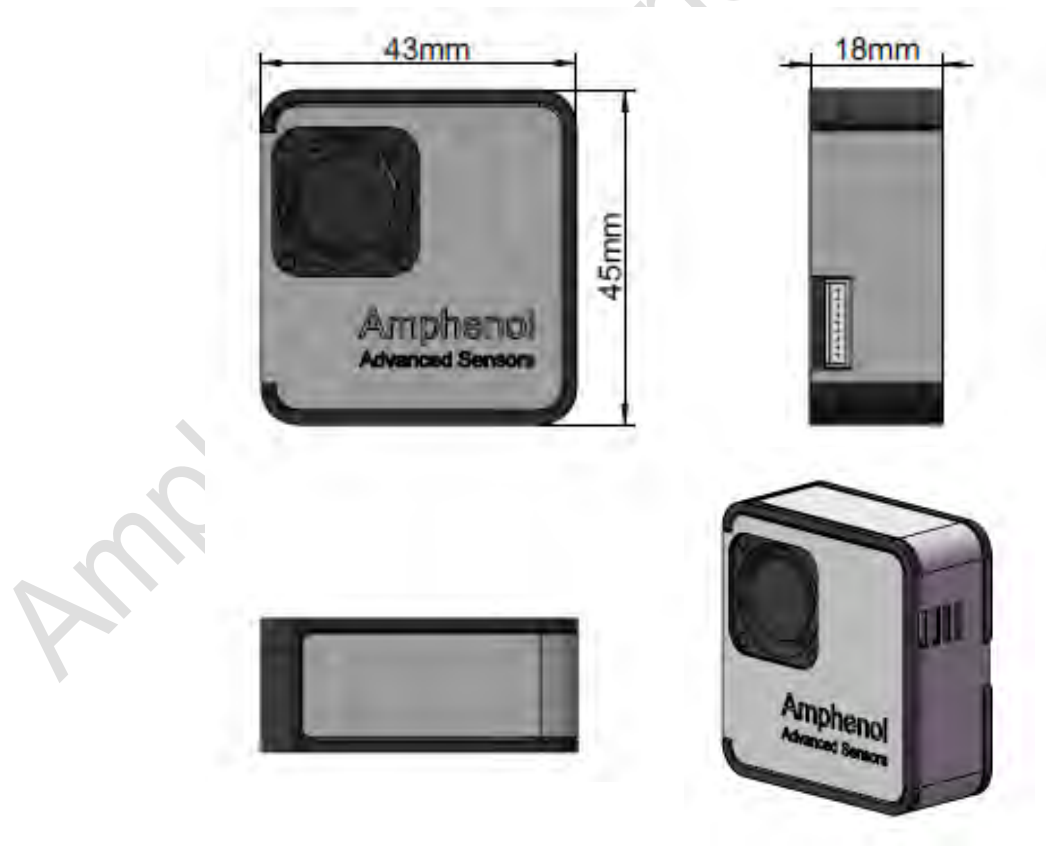
Request: 20 0C 00 00 00 00 17 7A (in HEX, last 2 bytes are CRC)

Reply: 20 0C xx xx xx xx xx xx 00 7D xx xx xx xx (in HEX, last 2 bytes are CRC)

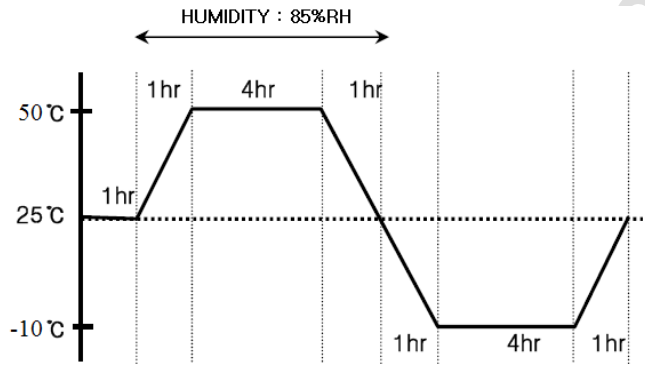
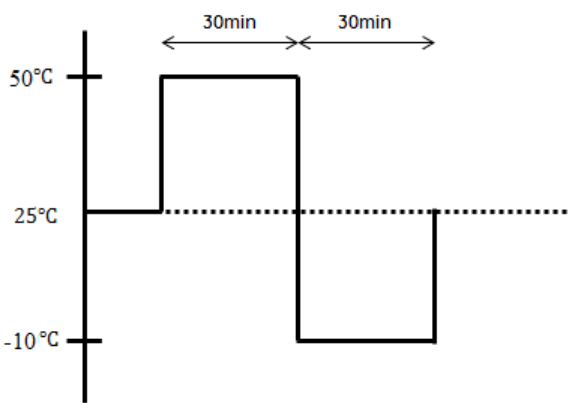
PM2.5 reading is calculated as following


0x00 * 256 + 0x7D = 125 ug/m3

9 PRODUCT DIMENSION



10 RELIABILITY

1	Drop	Drop it unintentionally from 100cm height down to the hard wooden board three times at random direction	No damage after testing. N=5, C=0
2	High Temp. Storage	Leave in the atmosphere 70°C for 96 hours	
3	Low Temp. Storage	Leave in the atmosphere -20°C for 96 hours	
4	Thermal Cycle	Repeat 20 times in the following cycle 	
5	Thermal Shock	Repeat 20 times in the following cycle. 	
6	Mechanical Shock	Frequency range: 5 Hz to 500 Hz sinusoidal, Change of frequency: 1 oct/min Amplitude : 10mm Acceleration : 20 m/S ² Cross-over frequency: 13 Hz Testing time per spatial axis(X,Y,Z) : 8 h	

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7	High Temp. Operation	Operating it in the atmosphere of 50°C for 96 hours	
8	Low Temp. Operation	Operating it in the atmosphere of -10°C for 96 hours	

11 APPENDIX

CRC CALCULATION IN C LANGUAGE:

UINT16_T CRC16 (UINT8_T *PUCHMSG, UINT8_T U8_LENGTH) /* THE FUNCTION RETURNS THE CRC AS A UNSIGNED SHORT TYPE */

```

{
  UINT16_T U16_REG_CRC = 0XFFFF;
  UINT8_T I, J = 0;
  UINT8_T U8_TEMP_REG = 0;
  FOR (I=0; I<U8_LENGTH; I++)
  {
    U16_REG_CRC ^= *PUCHMSG++;
    FOR (J = 0; J < 8; J++)
    {
      IF (U16_REG_CRC & 0X0001)
      {
        U16_REG_CRC = U16_REG_CRC >> 1 ^ 0XA001;
      }
      ELSE
      {
        U16_REG_CRC >>= 1;
      }
    }
  }
  U8_TEMP_REG = U16_REG_CRC >> 8;
  RETURN (U16_REG_CRC<<8 | U8_TEMP_REG);
}

```