IPS Series Sensor 3100 / 5100 / 7100

Photon Counting Intelligent Particle Sensor for Accurate Air Quality Monitoring

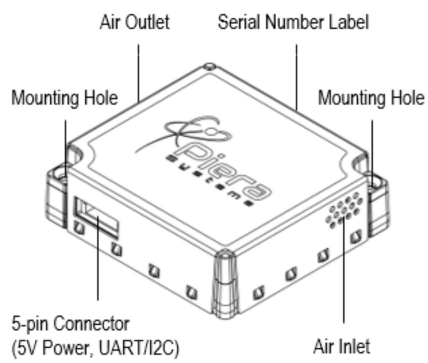
Product Specification

Product Summary

The Piera IPS is a photon counting readout-based highly sensitive optoelectronic particulate sensor. Utilizing Piera's PCIC as a core processor, the IPS is compact and consumes low power while capable of fast data acquisition and readout, as well as categorizing particulates based on the size. The IPS features an adjustable sensitivity control for various applications. Using the state-of the-art unique sizing and count algorithm to identify different particulates, the IPS is suitable for true real-time precise airborne particulate matter monitoring and particle size distribution analysis. Every IPS is calibrated to the US EPA approved FEM reference instrument GRIMM EDM180, via Piera Automated Calibration (PASCAL) System. The list of Designated Reference and Equivalent Methods can be found here, pg. 68.

Features

- Ultra-high sensitivity for detecting airborne particulates (PM0.1 – PM10*)
- All independent size bin output
- Fast data acquisition and sampling
- Supports UART and I^{2}C
- IoT/Network support*
- Plug-and-play
- Adjustable sampling/data acquisition timing
- Sensitivity control*
- Power saving mode
- Fan control and cleaning mode
- Built-in output data unit conversion options
- Firmware update capability*
- High accuracy and reliability
- Small, robust and long-term stability
- Mounting screw holes



⚠ Do not obstruct the air inlet and outlet during operation.

⚠ Do not operate in a heavily contaminated environment.

⚠ Intended for indoor use. Outdoor conditions may affect the sensor performance.

Applications

- Indoor air quality monitoring & management systems
- Ventilation systems
- Real-time particle distribution analysis
- Wide-range particle detection

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This datasheet is for firmware versions V3.1.5 or higher.

Table of Contents

1. Sensor Specifications
2. Electrical Specifications
3. Hardware and Settings
4. Communication Protocols
5. Technical Drawings
6. Product Lineup
7. Ordering Information
8. Important Notices

1. Sensor Specifications

	Conditions	Value	Units
Particle Count (PC) Resolution	Default	1	#/L
Mass Concentration (PM) Resolution	-	0.1	ug/m^3
Effective Particle Count Concentration (PC) Range [1]	-	0 – 100,000	#/cm^3
Particle Count (PC) Precision [2] (PC0.1, 0.3, 0.5, 1.0, 2.5)	0 – 200 #/cm^3	±20	#/cm^3 Ave.
	> 200 #/cm^3	±10	% Ave.
Particle Count (PC) Precision [2] (PC5.0, 10)	0 – 1,000 #/cm^3	±100	#/cm^3 Ave.
	> 1,000 #/cm^3	±10	% Ave.
Effective Mass Concentration (PM) Range [1]	-	0 – 6,000	ug/m^3
Mass Concentration (PM) Precision [2] (PM0.1, 0.3, 0.5, 1.0, 2.5)	0 – 50 ug/m^3	±5	ug/m^3 Ave.
	>50 ug/m^3	±10	% Ave.
Mass Concentration (PM) Precision [2] (PM5.0, 10)	0 – 50 ug/m^3	±10	ug/m^3 Ave.
	>50 ug/m^3	±20	% Ave.
Particle Size Bin Allocation (PC: differential, PM cumulative)	PC0.1 [3]	0.05 to < 0.1	um
	PC0.3	0.1 to < 0.3	um
	PC0.5	0.3 to < 0.5	um
	PC1.0	0.5 to < 1.0	um
	PC2.5	1.0 to < 2.5	um
	PC5.0	2.5 to < 5.0	um
	PC10	5.0 to < 10	um
Start-up Time [4]	Default: 5 (until stable output)	>5	s
Count Sampling Time	Default: 0.2	≥0.1	s
Data Output Interval	Default: 1 (0.2 in debug mode)	≥0.1	s
Lifetime [5]	-	>8	Years
Air flow rate	Standard atmosphere	0.13	LPM
Laser Wavelength	Typical	658	nm
Laser Diode Power Consumption [6]	Typical	3.5	mW
Dimensions	4.6 x 4.15 x 1.24		cm
Weight	26		g

Table 1. Piera IPS specifications

1. Device will report data with precision specified on this datasheet within the respective range. The precision is not guaranteed beyond the range.

2. Device-to-device variation based on average readings over multiple sampling concentration levels using 1.5% potassium chloride solution at 25 °C and 50%RH. Piera uses GRIMM EDM180 for individual device calibration for all output channels independently. Different reference instruments may yield different data under various conditions.
3. Extrapolated data. Contact Piera Systems for further details.
4. Start-up time is 5 seconds by default. Any data output during this period should be discarded. Subject to change depending on the user settings for the count sampling time. The start-up time may be longer if the concentration level is high.
5. Lifetime may vary depending on different operating conditions.
6. Complies with the IEC60825-12 specification.

2. Electrical Specifications

2.1. Electrical Characteristics

Parameter	Conditions	Value	Units
Supply voltage	-	4.5 – 5.5	V
Average supply current	Measurement mode	110	mA
	Sleep mode (UART)	10	mA
	Sleep mode (I^2C)	10	mA
Input high level voltage (V_{IH})	-	>2.31	V
Input low level voltage (V_{IL})	-	<0.99	V
Output high level voltage (V_{OH})	-	>2.9	V
Output low level voltage (V_{OL})	-	<0.4	V

Table 2. Electrical specifications

2.2. Absolute Minimum and Maximum Ratings

Parameter	Rating
Supply voltage VDD	-0.3 to 5.5 V
Interface Select SEL	-0.3 to 4.0 V
Rx, Tx I/Os	-0.3 to 4.0V
Operating temperature range	-10 to +60
Storage temperature range	-40 to +80
Operating humidity range	0 to 95% RH (non-condensing)
ESD CDM (Charge Device Model)	±4 kV contact, ±8 kV open air

Table 3. Absolute minimum and maximum ratings

This datasheet is for firmware versions V3.1.5 or higher.

2.3. Recommended Operation Conditions

The sensor best performs when operated within 10 – 40°C and 20 – 80% RH, should be placed in stable temperature and relative humidity locations.

Avoid operating in a heavily contaminated environment; under excessive ambient light, and/or wind.

3. Hardware and Settings

3.1. Hardware Interface

The interface connector and the description of the pin layout is shown in Fig. 1. The mating female connector should be 5-pin with1.5mm-pitch. A sample connector info can be found here.

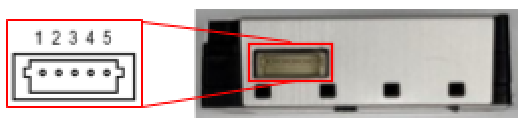

Fig. 1. Interface connector I/O pins

Pin	Name	Description	Comments
1	VDD	Supply voltage	5V ± 10%
2	Rx	UART: Receiving pin for communication	LVTTL 3.3V
	SDA	I^2C: Serial data input/output	
3	Tx	UART: Transmitting pin for communication	LVTTL 3.3V
	SCL	I^2C: Serial clock input	
4	SEL	Interface select	Floating: UART
			GND: I^2C
5	GND	Ground	-

Table 4. Interface connector I/O pin description

This datasheet is for firmware versions V3.1.5 or higher.

3.2. Default Settings

Features	Default Settings	Description
Auto Mode	On	IPS starts to readout data once power is on – Plug-and play.
Data Output Interval	1 second	IPS reads out all available bin data every 1 second interval.
PM Data Output	On	IPS reads out mass concentration (PM) data as well as particle counts (PC) data.
Serial Number Output	On	Device serial number is displayed at the end of each data string.
Auto Cleaning Mode	On, 1/week	IPS will initiate auto cleaning cycle every week for 10 seconds.
PC Data Output Unit	#/L	Displayed PC data is in number of particles per liter.
PM Data Output Unit	ug/m^3	Displayed PM data is in micrograms per cubic meter.
VSD Mode*	On	Vape/Smoke Detection feature is standard on IPS-7100 models, and the feature is enabled.
CRC	Off	CRC16 mode disabled.

Table 5. Default settings for UART

*For equipped models only. Please refer to the Product Lineup section.

4. Communication Protocols

4.1. Physical Layer

The IPS has Rx and Tx lines with unipolar logic levels. A transmitted byte over URAT is shown in Fig. 2. The data speed is 115,200 baud, 1 stop bit with no parity. The IPS offers both UART and I^2C interface modes.

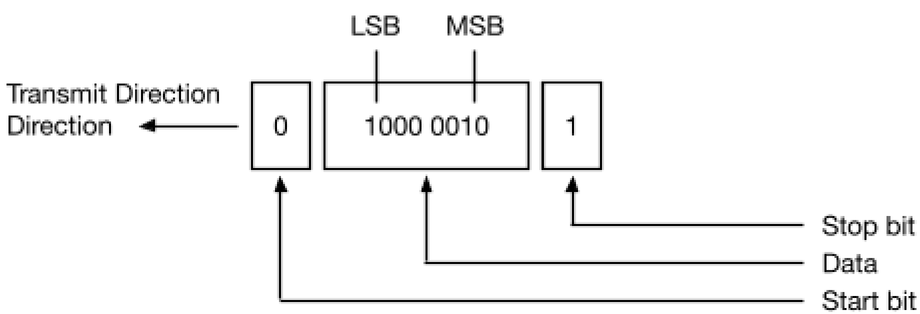

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Fig. 2. UART (Universal Asynchronous Receiver Transmitter) data transfer

4.2. UART Interface

Fig. 3 shows the typical UART application circuit, which has 5 I/O pins; VDD, Rx, Tx, SEL, and GND. All commands for IPS (slave) are in printable ASCII strings for convenience. The IPS also replies in printable ASCII string format. Therefore, any serial communication program available on PC and application systems (master devices) can be used to download commands and see the results. An UART cable length should be less than 5m, or 16.5ft.

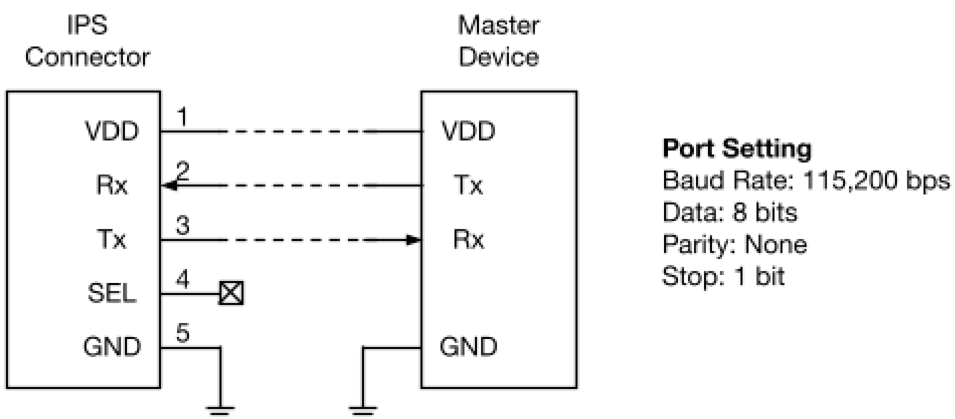

Fig. 3. Typical UART interfacing

4.2.1. Default Sensor Settings

By default, the IPS starts to send data automatically via UART every 1 second as the device is powered up: a series of ASCII characters containing particle counts (PC) and mass concentration (PM) data followed by both device serial number and its network serial key. The PC data is in #/L, and the PM is in ug/m^3. Allow at least 5 seconds to obtain stable data. Sensor may send Zero data before this initialization period. The IPS will run self-cleaning cycle for 10 seconds once a week by default.

If your device is equipped with the Vape/Smoke Detection (VSD) algorithm, the VSD mode is on by default. It is standard on IPS-7100 models.

Factory settings:

1. 1 second Data Output Interval Time $Winterval=1
2. PM Data Output $Wpmd=1
3. Output Serial Number in message $Wazure=1
4. Weekly Auto Cleaning $Wclnp=604800
5. Output Unit in #/*L* and ug/m^3 $Wunit=0
6. Vape-Smoke Detection Mode $Wvsd=1

To reset the sensor to default factory settings, use the following command.

$Wfactory=[CR][LF]

Note that ENTER key ([CR][LF]) must follow every command.

4.2.2. Operating Mode Setting – Manual or Automatic Mode

The IPS uses simple ASCII strings to communicate between the slave (IPS sensor) and the master device (application system). The internal blow fan is on as power is supplied.

Automatic Mode: Sensor starts operation and outputs data when the sensor is connected to power through USB connector. In this mode, the sensor outputs data automatically without the "Set Interval Time" command when plugged in a master system (like a PC). The sensor outputs data according to the set Interval Time.

To Change the Interval Time on Automatic Mode

$Winterval=<n>[CR][LF], where n is interval in seconds, ranging from 1 to 65,535s.

Manual Mode:

$Winterval=0[CR][LF] Set Interval Time to 0 to disable automatic mode

$Rget=[CR][LF] Use this command to poll the data when desired.

4.2.3. Real-time Data Retrieving

The IPS offers a special mode for getting data (PCx and PMx) immediately at any time. This can be used to poll data when Winterval=0 is set.

$Rget=[CR][LF] to retrieve a dataset for all PC and PM.

4.2.4. IoT Communication Mode

For models that are equipped with this feature, the IPS sends out its unique network serial key for IoT communication. When the IoT communication mode is enabled, device serial number will be displayed at the end of each data string. The sensor memorizes the previous settings once the mode is set.

$Wazure=1[CR][LF] to enable IoT Communication Mode

$Wazure=0[CR][LF] to disable IoT Communication Mode

4.2.5. Fan Control and Cleaning Mode

The fan is automatically on when the power is supplied to the module. To turn on or off the fan manually, use the following commands as below:

$Wfan=1[CR][LF] to turn on the fan

$Wfan=0[CR][LF] to turn off the fan

$Wcln=1[CR][LF] to initiate the cleaning cycle manually

$Wcln=0[CR][LF] to stop the cleaning cycle manually

$Wclnp=<n>[CR][LF] to set the auto self-cleaning interval where n is interval in second (604,800 by default)

$Wclnp=0[CR][LF] to stop the auto self-cleaning mode

4.2.6. PC and PM Unit Change

To change measured data unit, use the following command:

$Wunit=<n>[CR][LF] where n==0, 1, 2, or 3

1 for PC, PM values per ft^3, 2 for PC, PM value per m^3, 3 for PC, PM value per *liter*.

The default factory setting is n==0 for count number per *liter* and mass number per m^3.

4.2.7. Power Saving Mode (PSM)

The IPS can hibernate to save energy depending on applications. The IPS will enter hibernation, disabling power to the sensor. The fan, laser diode will all be turned off, and the CPU also goes into deep-sleep mode to reduce power consumption. Any UART or I2C Command will wake up the sensor and it will start gathering data normally after a 5 second warmup period.

$Wpsm=1[CR][LF] to initiate PSM

This datasheet is for firmware versions V3.1.5 or higher.

4.2.8. Vape/Smoke Detection (VSD) Mode

If equipped, the IPS can function as a vape/smoke sensor. The device will detect any event of vaping or smoking, and it will send out alerts (print strings “Smoke Detected” or “Vape Detected) when the VSD is enabled. The device will continue to readout data normally even when the VSD Mode is on.

This feature is standard on every IPS-7100 model. Other models may be upgraded to access this feature on demand.

$Wvsd=1 [CR][LF] to enable VSD Mode

$Wvsd=0 [CR][LF] to disable VSD Mode

Warning: IPS is not meant for replacing standard indoor smoke/fire alarms!

4.2.9. Cyclic Redundancy Check (CRC)

Supports CRC16 code. Please refer to the CRC16 code functions.

$Wcrc=1 [CR][LF] to enable data transfer with CRC code.

$Wcrc=0 [CR][LF] to disable CRC code.

Adds CRC16 to the end of data output. Each output line will now include two extra bytes just before [CR][LF].

4.2.10. Low Data Mode (LDM)

LDM can be enabled to reduce the amount of data sent from IPS sensor. Also supports CRC16 code. The Serial number will not be sent in this mode.

$Wldm=1 [CR][LF] to enable low data mode.

$Wldm=0 [CR][LF] to set standard data transfer mode.

A data string example for PC0.1, PC0.3, PC0.5, PC1.0, PC2.5, PC5.0, PC10, PM0.1, PM0.3, PM0.5, PM1.0, PM2.5, PM5.0, PM10 is as follows.

32750000,8492000,4520500,428500,11500,780,268,0.2736459,0.21894411,0.69106513,0.90588760,
0.95394840,0.98977848,1.8606841

If $Wpmd=0 [CR][LF] is not used, any PM data will be removed, only sending PC data as an example below.

32750000,8492000,4520500,428500,11500,780,268

4.2.11. VSD Mode

Control detection sensitivity

Initial event detection sensitivity. Default: 40 = 4.0x increase in PC0.1 and PC1.0 to trigger event detection (Range: 11-100)

$Wvsddetect=(11-100)[CR][LF]

Control classification threshold

VSD classification threshold. Default 45 Divide by 1,000 to get P1.0. Range: 1-200

$Wvsdclassify=(1-200)[CR][LF]

Control classification delay

VSD classification delay in seconds. (Default : 30 seconds) Range: 1-600, longer delay can increase accuracy. decrease to improve alerting time.

$Wvsddelay=(1-600) [CR][LF]

Control initial detection threshold

To set the initial detection threshold. Defaults to 250, which means > 250,000 PC0.1 to trigger an event.

$Wvsdthreshold=250 [CR][LF]

This datasheet is for firmware versions V3.1.5 or higher.

4.3. I²C Interface

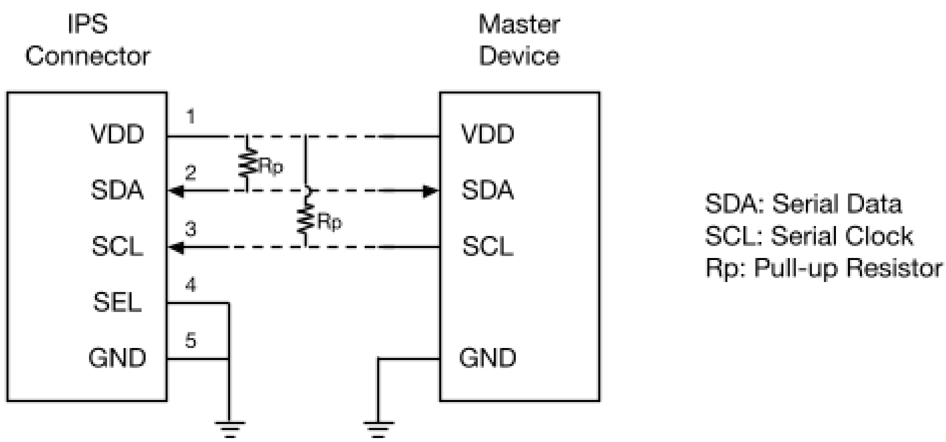

Fig. 4. Typical I²C interfacing

SDA is the serial data input/output pin and SCL is the serial clock pin between IPS and a master device. The Rp is pull-up resistor as the SDA and SCL are open drains, and IPS has internal 4.7kΩ resistors built-in. Because the I²C interfacing is generally used for communication between short distance devices less than 10cm, a particular attention must be paid to electromagnetic interference and crosstalk with well shielded connection cables/PCB patterns. I²C device ID is 0x4b.

Note: Data from IPS's in I²C mode is available only with polling method (read commands)

4.3.1. Header Byte

Write Command: 0x96, Read Command: 0x97

	Header: 0x96						
S	'1001 011'	W	A	Command	A	●●●	Header byte = I2C address (0x4b) <<1+W(0)

	Header: 0x97				
S	'1001 011'	R	A	●●●	Header byte = I2C address (0x4b) <<1+R(1)

4.3.2. Write Format

You must wait at least 1 second after sending a write command before sending another write command.

Command without Data

S	I^2C address (7)	W	A	Command (8)	A	P

I^2C address (7) = 0x4b

Ex: 0x2d, 0x2e Commands

Command with 1 parameter (1byte)

S	I^2C address (7)	W	A	Command (8)	A	Parameter (8)	A	P

Ex: 0x10, 0x22, 0x23, 0x24, 0x2b, 0x2c Commands

Command with 2 parameters (2byte)

S	I^2C address (7)	W	A	Command (8)	A	Parameter (8)	A	Parameter (8)	A	P

Ex: 0x26, 0x27, 0x28, 0x29 Commands

Command with 4 parameters (4byte)

S	I^2C address (7)	W	A	Command (8)	A	Parameter (8)	A	Parameter (8)	A

Ex: 0x21 Commands

Parameter (8)	A	Parameter (8)	A	P

Write commands are defined on the following table:

CMD	Function	Parameters	Description
0x10	Start/Stop Sampling	1 or 0	Enable sampling mode Stop measurement (n=0) or start measurement with (n=1)
0x21	Set Cleaning Interval	[n1],…,[n4]	[n1]<<24+[n2] <<16+[n3] <<8+[n2]&0xff
0x23	Power Saving Mode	1 or 0	0x01: Enter Power Saving Mode , 0x0: Wake up pulse
0x24	Set Data Unit	[n=0,1,2,3]	For PC: 0 for #/L, 1 for $\#/ft^3$, 2 for $\#/m^3$ and 3 for #/L For PM: 0 for ug/m^3, 1 for ug/ft^3, 2 for ug/m^3 and 3 for ug/L
0x2b	Fan Operation	1 or 0	0x01: Start fan, 0x0: Stop fan
0x2c	Start Cleaning	1 or 0	0x01: Start cleaning, 0x0: Stop cleaning
0x2d	Reset	None	Resets the sensor module Allow approx. 5 seconds for normal communication
0x2e	Factory Reset	None	Restore all factory default settings
0x40	VSD detect	11-100	Default: 40 = 4.0x increase in PC0.1 and PC1.0 to trigger event detection
0x41	VSD classify	1-200	Default 45 Divide by 1,000 to get P1.0.
0x42	VSD delay	1-600	VSD classification delay in seconds.
0x43	VSD threshold	100-650	Defaults to 250, which means > 250,000 PC0.1 to trigger an event.

Table 6. I2C write commands

When using 0x10 or 0x23 commands, sampling is reset. Please allow approximately 5 seconds for warmup.

4.3.3. Read Format

Command expecting data from the host

S	I^2C address (7)	W	A	Command (8)	A	Sr	I^2C address (7)	R	A

Data1 (8)	A	●●●	DataN (8)	N	P

Ex: 0x11, 0x12, 0x61, 0x62, 0x64, 0x65, 0x66, 0x6a, 0x77, 0x78, 0x79 Commands

S: Start; Sr: Repeat Start; A: Ack; N: Nack; P: Stop

You must wait at least 100msec between sending I2C read commands to IPS Devices.

Read commands are defined on the following table:

CMD	Function	Parameters	Description
0x11	Read PC data (3 Series)	[n1],…,[n12] [n13][n14]	Read measured PC data for all 3 bins Each data has 4 unsigned bytes Number of data: [n1~n28] = 4byte x 3 CRC16: [n13]x256+[n14]
	Read PC data (5 Series)	[n1],…,[n20] [n21][n22]	Read measured PC data for all 5 bins Each data has 4 unsigned bytes Number of data: [n1~n28] = 4byte x 5 CRC16: [n21]x256+[n22]
	Read PC data (7 Series)	[n1],…,[n28] [n29][n30]	Read measured PC data for all 7 bins Each data has 4 unsigned bytes Number of data: [n1~n28] = 4byte x 7 CRC16: [n29]x256+[n30]
0x12	Read PM data (3 Series)	[n1],…,[n12] [n13][n14] [n15][n16]	Read measured PM data for all 3 bins Each data has 4 bytes Float (IEEE-754) format The ordering method of the data conversion is Little Endian, i.e, if 4 byte data of ABCD is input, then DCBA is output with real number (floating point number). Number of data: [n1 – n28] = 4byte x 3 EVENT INFO: [n13]x256+[n14] (0: Nothing 1: event 2: smoke 3: vape … reserved) CRC16: [n15]x256+[n16]
	Read PM data (5 Series)	[n1],…,[n20] [n21][n22] [n23][n24]	Read measured PM data for all 5 bins Each data has 4 bytes Float (IEEE-754) format The ordering method of the data conversion is Little Endian, i.e, if 4 byte data of ABCD is input, then DCBA is output with real number (floating point number).

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			Number of data: [n1 – n28] = 4byte x 5 EVENT INFO: [n21]x256+[n22] (0: Nothing 1: event 2: smoke 3: vape … reserved) CRC16: [n23]x256+[n24]
	Read PM data (7 Series)	[n1],…,[n28] [n29][n30] [n31][n32]	Read measured PM data for all 7 bins Each data has 4 bytes Float (IEEE-754) format The ordering method of the data conversion is Little Endian, i.e, if 4 byte data of ABCD is input, then DCBA is output with real number (floating point number). Number of data: [n1 – n28] = 4byte x 7 EVENT INFO: [n29]x256+[n30] (0: Nothing 1: event 2: smoke 3: vape … reserved) CRC16: [n31]x256+[n32]
0x61	Read Cleaning Interval	[n1],…,[n4] [n5][n6]	4 bytes are unsigned integer in second Default value = 604,800 [s] or 1 week CRC16: [n5]x256+[n6]
0x64	Read Data Unit	[n1=0,1,2,3] [n2][n3]	For PC: 0 for #/L, 1 for #/ft^3, 2 for #/m^3 and 3 for #/L For PM: 0 for ug/m^3, 1 for ug/ft^3, 2 for ug/m^3 and 3 for ug/L CRC16: [n2]x256+[n3]
0x65	Read Start/Stop	[n1],…,[n4]	Measurement period reading, [n1]x256+[n2] in ms CRC16: [n3]x256+[n4]
0x66	Read Vth	[n1],…,[n4]	Detection range control voltage reading, [n1]x256+[n2] CRC16: [n3]x256+[n4]
0x69	Read Vref	[n1],…,[n4]	Sensitivity control voltage reading, [n1]x256+[n2] CRC16: [n3]x256+[n4]
0x6a	Read Status	[n1],…,[n3]	Read status byte (b0: fan on/off, b1: cleaning on/off, b2: PSM on/off) Each bit is 0 for off and 1 for "On" b3=1 is for UART and 0 is for I^{2}C. CRC16: [n2]x256+[n3]
0x77	Read Serial Number	[n1],…,[n19]	[n1] – [n17] : Serial Number CRC16: [n18]x256+[n19]
0x78	Read version number	[n1],…,[n9]	[n1] – [n7] : Version number CRC16: [n8]x256+[n9]
0x79	Read Network Serial key	[n1],…,[n26]	[n1] – [n24] : Serial key CRC16: [n25]x256+[n26]
0x80	Read VSD detect	[n1],…,[n4]	Read VSD initial event detection sensitivity, [n1]x256+[n2] CRC16: [n3]x256+[n4]
0x81	Read VSD classify	[n1],…,[n4]	Read VSD classification threshold, [n1]x256+[n2] CRC16: [n3]x256+[n4]
0x82	Read VSD delay	[n1],…,[n4]	Read VSD classification delay in seconds, [n1]x256+[n2] CRC16: [n3]x256+[n4]
0x83	Read VSD threshold	[n1],…,[n4]	Read VSD value to set the initial detection threshold, [n1]x256+[n2] CRC16: [n3]x256+[n4]

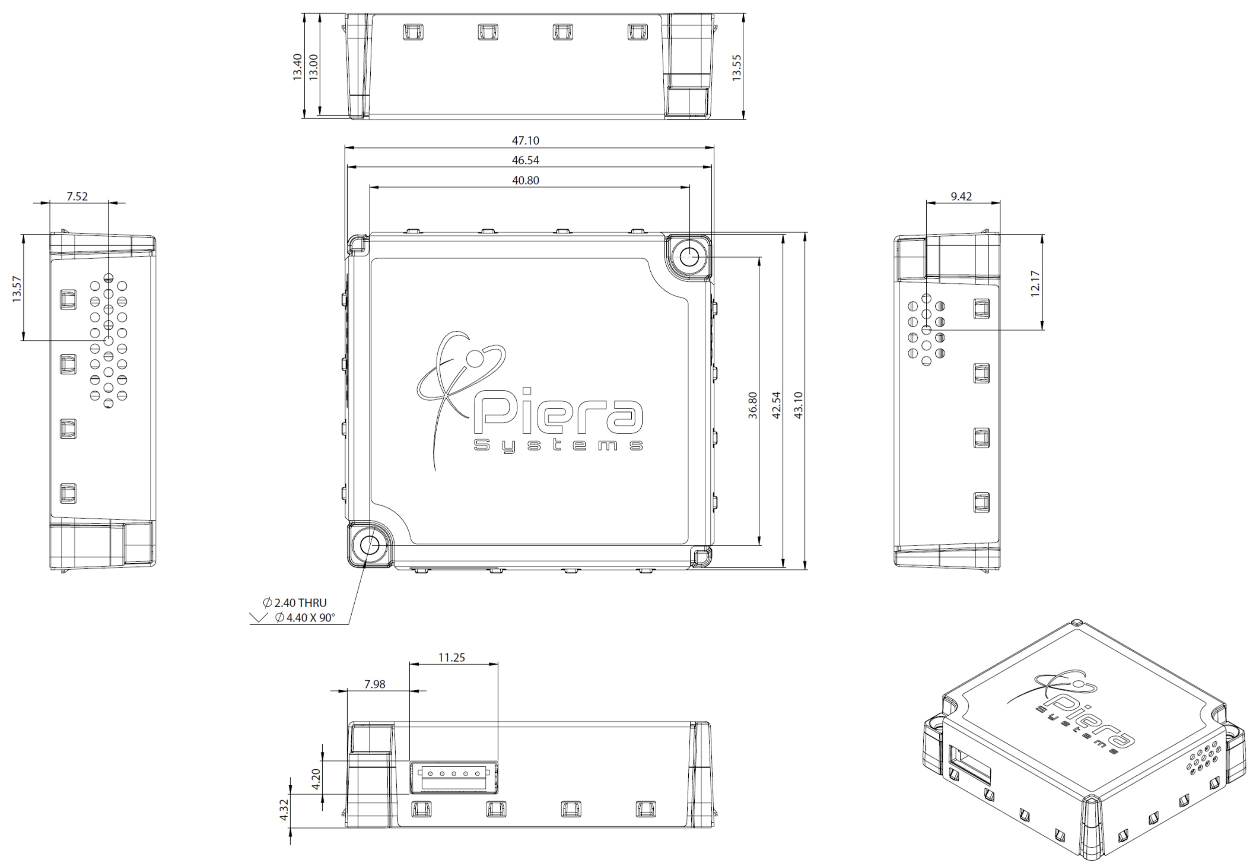
0x84	Read Fan Speed	[n1],…,[n4]	Read Fan speed per minute. [rpm]. CRC16: [n3]x256+[n4]
0x85	Read Fan Duty Cycle	[n1],…,[n4]	Read Fan duty cycle value. [%] CRC16: [n3]x256+[n4]
0x86	Read Total Operating Minutes	[n1],…,[n6]	Read Total Operating Time / Total Run Time (Minutes) = ([n1]<<24)|([n2]<<16) |([n3]<<8) |[n0]&0xff (32bit) [min] (Big Endian) CRC16: [n5]x256+[n6]

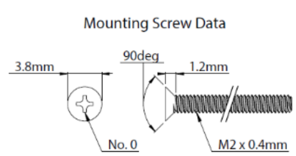
Table 7. I2C read commands

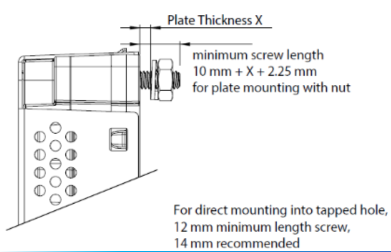
CRC16 code for reference:

```
#define POLY 0x8408

uint16_t CRC16(uint8_t *byte, int len)
{
  int i, j;
  u16 data=0;
  u16 crc=0xffff;

  for(j=0;j<len;j++)
  {
     data = (u16)0xff & byte[j];
     for(i=0;i<8;i++, data >>= 1)
     {
       if((crc & 0x0001) ^ (data & 0x0001))
         crc = (crc >> 1) ^ POLY;
       else
         crc >>= 1;
     }
  }

  crc = ~crc;
  data = crc;
  crc = (crc << 8)|(data>>8 &0xff);

    return crc;
}
```

5. Technical Drawings







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This datasheet is for firmware versions V3.1.5 or higher.

6. Product Lineup

<table>
<tr><th colspan="2">Models</th><th>IPS-3100</th><th>IPS-5100</th><th>IPS-7100</th><th>IPS-7100C*</th></tr>
<tr><td colspan="2"># of Bins</td><td>3</td><td>5</td><td>7</td><td>7</td></tr>
<tr><td rowspan="7">Binning Output</td><td>0.1</td><td></td><td></td><td>o</td><td>o</td></tr>
<tr><td>0.3</td><td></td><td></td><td>o</td><td>o</td></tr>
<tr><td>0.5</td><td></td><td>o</td><td>o</td><td>o</td></tr>
<tr><td>1.0</td><td>o</td><td>o</td><td>o</td><td>o</td></tr>
<tr><td>2.5</td><td>o</td><td>o</td><td>o</td><td>o</td></tr>
<tr><td>5.0</td><td></td><td>o</td><td>o</td><td>o</td></tr>
<tr><td>10</td><td>o</td><td>o</td><td>o</td><td>o</td></tr>
<tr><td rowspan="7">Key Features</td><td>Output in particle counts</td><td>o</td><td>o</td><td>o</td><td>o</td></tr>
<tr><td>Output data unit conversion</td><td>o</td><td>o</td><td>o</td><td>o</td></tr>
<tr><td>IoT network support</td><td>o</td><td>o</td><td>o</td><td>o</td></tr>
<tr><td>USB firmware update</td><td>o</td><td>o</td><td>o</td><td>o</td></tr>
<tr><td>Customizable sensitivity</td><td></td><td></td><td>o</td><td>o</td></tr>
<tr><td>Customizable binning</td><td></td><td></td><td>o</td><td>o</td></tr>
<tr><td>Calibration certificate</td><td></td><td></td><td></td><td>o</td></tr>
<tr><td colspan="2">Remarks</td><td colspan="2">Mass quantity order only</td><td>-</td><td>-</td></tr>
</table>

Table 6. IPS series product lineup and features

*Contact Piera systems for details.

7. Ordering Information

Please visit www.pierasystems.com or email to info@pierasystems.com.

8. Important Notices

8.1. Warning, Personal Injury

Do not use this product as safety or emergency stop devices or in any other application where failure of the product could result in personal injury. Do not use this product for applications other than its intended and authorized use. Before installing, handling, using or servicing this product, please consult the data sheet and application notes. Failure to comply with these instructions could result in death or serious injury.

If the Buyer shall purchase or use IPS for any unintended or unauthorized application, Buyer shall defend, indemnify and hold harmless Piera and its officers, employees, subsidiaries, affiliates and distributors against all claims, costs, damages and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if Piera shall be allegedly negligent with respect to the design or the manufacture of the product.

8.2. ESD Precautions

The inherent design of this component causes it to be sensitive to electrostatic discharge (ESD). To prevent ESD-induced damage and/or degradation, take customary and statutory ESD precautions when handling this product.

8.3. Warranty

Piera warrants solely to the original purchaser of this product for a period of 12 months (one year) from the date of delivery that this product shall be of the quality, material and workmanship defined in Piera's published specifications of the product. Within such period, if proven to be defective, Piera shall repair and/or replace the product, in Piera's discretion, free of charge to the Buyer, provided that:

- notice in writing describing the defects shall be given to Piera within 14 (fourteen) days after their appearance;
- such defects shall be found, to Piera's reasonable satisfaction, to have arisen from Piera's faulty design, material, or workmanship;
- the defective product shall be returned to Piera at the Buyer's expense; and
- the warranty period for any repaired or replaced product shall be limited to the unexpired portion of the original period.

This warranty does not apply to any equipment which has not been installed and used within the specifications recommended by Piera for the intended and proper use of the equipment.

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