

# INTERFACE AND DATA FORMAT SPECIFICATION

(V4 FIRMWARE)

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WAGGLE SENSOR ARRAY

JUNE 2017, VERSION 0.01

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# 1 Sub-packets

As shortly explained in document section ??, data sub-packets are generated depending on its designated data format and length when data reading from each sensor if valid. The first byte of the sub-packet is sensor ID for each parameter, and the second byte means validity of the packet and length of the sensor data as shown in Table ??. Detail of sub-packet and sensor data will be explained in this section.

## 1.1 Parameters

The sensor boards output a set of parameters which are identified by a unique ID. Each parameter has a set of values associated with it which are encoded in an appropriate data format. The table below lists the various parameters produced by the sensor boards, the unique source ID used to identify them, the values produced by them and the format in which the value is encoded. Each parameter and its values are composed into a sub-packet based on the format described in document section ??. In the case of parameters with 2 or more values, the encoded values are arranged in the sub-packets sequentially.

Table 1: Data sub-packet structure (each row is a "chunk")

Parameter	Source ID	Values	Formats
Firmware version	0xFD	Firmware version (HW/SW)	Bit mask
		Build time	
		Build git	
Airsense board			
Airsense/Lightsense MAC address	0x00	MAC Address	Format 3
TMP112	0x01	Temperature	Format 6
HTU21D	0x02	Temperature	Format 6
		relative humidity	
BMP180	0x04	Temperature	Format 6
		Pressure	Format 4
PR103J2	0x05	Temperature	Format 1
TSL250RD	0x06	Visible Light	Format 1
MMA8452Q	0x07	Acceleration in X	Format 6
		Acceleration in Y	
		Acceleration in Z	
		Vibration	
Continued on next page			

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Parameter	Source ID	Values	Formats
SPV1840LR5H-B	0x08	RMS Sound Level	Format 1
TSYS01	0x09	Temperature	Format 6
Lightsense board			
HMC5883L	0x0A	Magnetic Field in Z	Format 8
		Magnetic Field in Y	
		Magnetic Field in Z	
HIH6130	0x0B	Temperature	Format 6
		relative humidity	
APDS-9006-020	0x0C	Ambient light intensity	Format 1
TSL260RD	0x0D	IR intensity	Format 1
TSL250RD	0x0E	Visible light intensity	Format 1
MLX75305	0x0F	Light	Format 1
ML8511	0x10	UV intensity	Format 1
TMP421	0x13	Temperature	Format 6
SPV1840LR5H-B	0x14	RMS Sound Level	Format 1
Chemsense board			
Total reducing gases	0x15	Raw Concentration	Format 5
Nitrogen dioxide	0x17		
Ozone	0x18		
Hydrogen sulphide	0x19		
Total oxidizing gases	0x1A		
Carbon monoxide	0x1B		
Sulfur dioxide	0x1C		
SHT25	0x1D	Temperature	Format 2
		relative humidity	
LPS25H	0x1E	Temperature	Format 2
		Pressure	Format 4
Si1145	0x1F	UV intensity	Format 1
		Visible light intensity	
		IR intensity	
Chemsense MAC address	0x20	MAC Address	Format 3
CO ADC temp	0x21	ADC temperature	Format 2
Continued on next page			

Table1 – continued from previous page

Parameter	Source ID	Values	Formats
IAQ IRR ADC temp	0x22	ADC temperature	Format 2
O3 NO2 ADC temp	0x23		
SO2 H2S ADC temp	0x24		
CO LMP temp	0x25		
Accelerometer	0x26	Acceleration in X	Format 2
		Acceleration in Y	
		Acceleration in Z	
		Vibration	Format 4
Gyro	0x27	Orientation in X	Format 2
		Orientation in Y	
		Orientation in Z	
		Orientation Index	Format 4
Alpha Sensor			
Histogram	0x28	Bin count	Raw reading
		Average Time	
		Sample flow rate	
		Temp/Pressure(alther)	
		Sampling period	
		Sum of the counts	
		PM 1	
		PM 2.5	
		PM 10	
Serial	0x29	Serial Number	
Firmware	0x30	Firmware version	
Configuration A	0x31	Bin Boundaries	
		Bin Particle Volumes A	
Configuration B	0x32	Bin Particle Volumes B	
		Bin Particle Densities A	
Configuration C	0x33	Bin Particle Densities B	
		Bin Sample Volume Weightings A	
Configuration D	0x34	Bin Sample Volume Weightings B	
		Gain Scaling Coefficient	
		Sample Flow Rate	
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**Table1 – continued from previous page**

Parameter	Source ID	Values	Formats
Configuration D	0x34	Laser DAC and Fan DAC	
		Conversion factor	
		Space Bytes	

## 2 Commands

This firmware sends sensor data in accordance of received command sent from plug-in/FW controller/or any equivalent command senders on a node controller. When the firmware receives a command line, which means when the firmware grasps a newline character, it starts to perform requests. Some of the commands need to be composed of multiple commands, for example one 1st command and multiple 2nd commands. However the commands need to be in one line. Detail of commands requesting data from coresense boards are explained in this section (see table 2).

Table 2: Commands for communication with firmware

1st command	2nd command	Values
ver		
id		
2write		
2read		
2request	<sensor name>	grasp the sensor from metsense or lightsense board
	met	grasp Mac address from metsense and chemsense board
	light	grasp data from all sensors in a metsense board
	chem	grasp data from all sensors in a lightsense board
	mac	grasp one line of data transmitted from a chemsense board

For the <sensor name>, see table 3. When user places a sensor name as a second command, the user will obtain data only for the sensor.

Table 3: Sensor name

sensor name	sensor ID	Values
Metsense board		
tmp112	0x01	
htu21d	0x02	
bmp180	0x03	
pr103j2	0x04	
tsl250	0x05	
Continued on next page		

**Table3 – continued from previous page**

Sensor name	sensor ID	Values
mma8452q	0x06	
spv1840	0x07	
tsys01	0x08	
Lightsense board		
hmc5883l	0x10	
hih6130	0x11	
apds9006	0x12	
tsl260rd	0x13	
tsl250rd	0x14	
mlx75305	0x15	
ml8511	0x16	
tmp421	0x17	