"This Document needs to be updated."

1 Overall Packet Structure

The structure of the packet (and the data sub-packet) relies on byte positions and known values, rather than delimiters.

Field	Value	Byte Position	Length
Start	0xAA	0	1
Protocol version	0x00	1	1
Length of data (not whole packet)		2	1
Data		3	194
CRC of data (not whole packet)		197	1
End	0x55	198	1

Table 1: Overall packet structure

Important: If the *length of data* is 0, the packet immediately ends, meaning the *data, CRC,* and *end* fields do not exist.

2 Data Sub-Packet

The data sub-packet consists of 32 "chunks" (30 sensors and 2 MAC addresses). Each "chunk" follows one of seven formats.

2.1 Data Formats

Format	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
1	(1 « 7) | 7-bit int	(neg « 7) | 7-bit frac.	-	-	-	-
2	7 MSb	LSB	-	-	-	-
3	Addr5	Addr4	Addr3	Addr2	Addr1	Addr0
4	(1 « 7) | (neg « 6) | (4-bit int « 2) | 2 MSb of frac.	8 LSb of frac.	-	-	-	-
5	(neg « 6) | 6 MSb	8 LSb	-	-	-	-
6	(1 « 7) | (neg « 6) | 6 MSb	Middle 8 bits	8 LSb	-	-	-
7	First 8 "chunks"	8 "chunks"	8 "chunks"	Last 8 "chunks"	-	-

Table 2: Data formats

This version of the Waggle protocol does not use standard representations for floating point numbers. Instead, the location of the decimal point is pre-determined (between the integer and fractional components, if applicable).

The most significant bit in byte 0 of formats 1, 4, and 6 means the data is already converted. Formats 2 and 5 contain raw data.

Formats 1, 4, 5, and 6 contain a "negative" bit. If this bit is 1, the value is negative.

2.2 Data "Chunks"

The *length* in each data "chunk" represents the number of bytes of sensor data. The total "chunk" length is *length* + 2.

Field	ID	Validity | Length	Data
Main MAC address	0x00	(1 « 7) | 0x06	Table 4
TMP112	0x01	(0/1 « 7) | 0x02	Table 5
HTU21D	0x02	(0/1 « 7) | 0x04	Table 6
GP2Y1010AU0F	0x03	(0/1 « 7) | 0x02	Table 7
BMP180	0x04	(0/1 « 7) | 0x05	Table 8
PR103J2	0x05	(0/1 « 7) | 0x02	Table 9
TSL250RD	0x06	(0/1 « 7) | 0x02	Table 9
MMA8452Q	0x07	(0/1 « 7) | 0x08	Table 10
SPV1840LR5H-B	0x08	(0/1 « 7) | 0x02	Table 11
TSYS01	0x09	(0/1 « 7) | 0x02	Table 12
HMC5883L	0x0A	(0/1 « 7) | 0x06	Table 13
HIH6130	0x0B	(0/1 « 7) | 0x04	Table 6
APDS-9006-020	0x0C	(0/1 « 7) | 0x02	Table 9
TSL260RD	0x0D	(0/1 « 7) | 0x02	Table 9
TSL250RD	0x0E	(0/1 « 7) | 0x02	Table 9
MLX75305	0x0F	(0/1 « 7) | 0x02	Table 9
ML8511	0x10	(0/1 « 7) | 0x02	Table 9
D6T	0x11	(0/1 « 7) | 0x22	Table 14
MLX90614	0x12	(0/1 « 7) | 0x02	Table 5
TMP421	0x13	(0/1 « 7) | 0x02	Table 5
SPV1840LR5H-B	0x14	(0/1 « 7) | 0x02	Table 11
Total reducing gases	0x15	(0/1 « 7) | 0x02	Table 15
Ethanol	0x16	(0/1 « 7) | 0x02	Table 15
Nitrogen dioxide	0x17	(0/1 « 7) | 0x02	Table 15
Ozone	0x18	(0/1 « 7) | 0x02	Table 15
Hydrogen sulphide	0x19	(0/1 « 7) | 0x02	Table 15
Total oxidizing gases	0x1A	(0/1 « 7) | 0x02	Table 15
Carbon monoxide	0x1B	(0/1 « 7) | 0x02	Table 15
Sulfur dioxide	0x1C	(0/1 « 7) | 0x02	Table 15
Sensirion	0x1D	(0/1 « 7) | 0x04	Table 6
Bosh	0x1E	(0/1 « 7) | 0x03	Table 16
Intel MAC address	0x1F	(1 « 7) | 0x06	Table 4
Sensor status (health)	0xFE	(1 « 7) | 0x04	Table 17

Table 3: Data sub-packet structure (each row is a "chunk")

Byte 0	**Byte 1**	**Byte 2**	**Byte 3**	**Byte 4**	**Byte 5**
Address 5	Address 4	Address 3	Address 2	Address 1	Address 0
Format 3					

Table 4: MAC address

Byte 0	**Byte 1**
Temperature	
Format 1	

Table 5: Sensor data

Byte 0	**Byte 1**	**Byte 2**	**Byte 3**
Temperature		Humidity	
Format 1		Format 1	

Table 6: Sensor data

Byte 0	**Byte 1**
Dust	
Format 2	

Table 7: Sensor data

Byte 0	**Byte 1**	**Byte 2**	**Byte 3**	**Byte 4**
Temperature		Atmospheric pressure		
Format 1		Format 6		

Table 8: Sensor data

Byte 0	**Byte 1**
Light	
Format 2	

Table 9: Sensor data

Byte 0	**Byte 1**	**Byte 2**	**Byte 3**	**Byte 4**	**Byte 5**	**Byte 6**	**Byte 7**
Acceleration X		Acceleration Y		Acceleration Z		RMS	
Format 1		Format 1		Format 1		Format 1	

Table 10: Sensor data

Byte 0	Byte 1
Sound pressure	
Format 2	

Table 11: Sensor data

Byte 0	Byte 1
Temperature	
Format 2	

Table 12: Sensor data

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Magnetic X		Magnetic Y		Magnetic Z	
Format 4		Format 4		Format 4	

Table 13: Sensor data

Byte 0	Byte 1	...	Byte 32	Byte 33
Temperature		Temperature	Temperature	
Format 1		Format 1	Format 1	

Table 14: Sensor data

Byte 0	Byte 1
Gas concentration	
Format 2	

Table 15: Sensor data

Byte 0	Byte 1	Byte 2
Atmospheric pressure		
Format 6		

Table 16: Sensor data

Byte 0	Byte 1	Byte 2	Byte 3
Health status (1 bit per "chunk")			
Format 7			

Table 17: Sensor status (health)

3 Sensor Data Units : Raw and Processed

Field	ID	Validity | Length	Data	Units
Main MAC address	0x00	(1 « 7) | 0x06	Table 4	MAC Address: Raw 6 Bytes
TMP112	0x01	(0/1 « 7) | 0x02	Table 5	Temperature: °C
HTU21D	0x02	(0/1 « 7) | 0x04	Table 6	Temperature: °C
GP2Y1010AU0F	0x03	(0/1 « 7) | 0x02	Table 7	Dust: Raw
BMP180	0x04	(0/1 « 7) | 0x05	Table 8	Temperature: °C, Pressure: hPa
PR103J2	0x05	(0/1 « 7) | 0x02	Table 9	UNITSHERE
TSL250RD	0x06	(0/1 « 7) | 0x02	Table 9	UNITSHERE
MMA8452Q	0x07	(0/1 « 7) | 0x08	Table 10	UNITSHERE
SPV1840LR5H-B	0x08	(0/1 « 7) | 0x02	Table 11	UNITSHERE
TSYS01	0x09	(0/1 « 7) | 0x02	Table 12	UNITSHERE
HMC5883L	0x0A	(0/1 « 7) | 0x06	Table 13	UNITSHERE
HIH6130	0x0B	(0/1 « 7) | 0x04	Table 6	UNITSHERE
APDS-9006-020	0x0C	(0/1 « 7) | 0x02	Table 9	UNITSHERE
TSL260RD	0x0D	(0/1 « 7) | 0x02	Table 9	UNITSHERE
TSL250RD	0x0E	(0/1 « 7) | 0x02	Table 9	UNITSHERE
MLX75305	0x0F	(0/1 « 7) | 0x02	Table 9	UNITSHERE
ML8511	0x10	(0/1 « 7) | 0x02	Table 9	UNITSHERE
D6T	0x11	(0/1 « 7) | 0x22	Table 14	UNITSHERE
MLX90614	0x12	(0/1 « 7) | 0x02	Table 5	UNITSHERE
TMP421	0x13	(0/1 « 7) | 0x02	Table 5	UNITSHERE
SPV1840LR5H-B	0x14	(0/1 « 7) | 0x02	Table 11	UNITSHERE
Total reducing gases	0x15	(0/1 « 7) | 0x02	Table 15	UNITSHERE
Ethanol	0x16	(0/1 « 7) | 0x02	Table 15	UNITSHERE
Nitrogen dioxide	0x17	(0/1 « 7) | 0x02	Table 15	UNITSHERE
Ozone	0x18	(0/1 « 7) | 0x02	Table 15	UNITSHERE
Hydrogen sulphide	0x19	(0/1 « 7) | 0x02	Table 15	UNITSHERE
Total oxidizing gases	0x1A	(0/1 « 7) | 0x02	Table 15	UNITSHERE
Carbon monoxide	0x1B	(0/1 « 7) | 0x02	Table 15	UNITSHERE
Sulfur dioxide	0x1C	(0/1 « 7) | 0x02	Table 15	UNITSHERE
Sensirion	0x1D	(0/1 « 7) | 0x04	Table 6	UNITSHERE
Bosh	0x1E	(0/1 « 7) | 0x03	Table 16	UNITSHERE
Intel MAC address	0x1F	(1 « 7) | 0x06	Table 4	UNITSHERE
Sensor status (health)	0xFE	(1 « 7) | 0x04	Table 17	UNITSHERE

Table 18: Data sub-packet structure (each row is a "chunk")