Data Format Specification

for Rain Gauge

and Soil Moisture Sensor

Waggle Group

Waggle Sensor Array

January 2017, Version 0.1 alpha 1

Contents

1   Physical Connections and Interfaces

Physical connections between a Metsense board and additional sensor will be shown in a figure below. The sensors will be connected through male-female connectors.

2   Data Transmission

The data from the sensor boards is sent as a formatted unit of data – a transmission packet. A transmission packet is composed of several data sub-packets, each of which carries information pertaining to the parameter listed in the sub-packet. The data sub-packet, especially for additional sensors, rain gauge and soil moisture sensor, are described here.

2.1   Data Sub-packets

The data segment of the transmission packet is further broken down into many sub-packets. The sub-packet starts with a source identifier. One bit validity field and seven bits "length of the sub-packet" field are packed together as the next byte. The length field counts the number of bytes following it which make up the sub-packet. The table below shows the organization of a rain gauge sub-packet.

If the field is set to 1, it indicates a valid measurement/reading, and if the validity bit is set to 0 if the sensor represented in the sub-packet is dead, disabled, unconnected, unresponsive or if data could not be collected from the sensor in the time window. If the validity is 0, the particular invalid sub-packet is not packed into a transmission packet.

2.1.1   Rain Gauge

As shown in Table 1, sensor identifier of rain gauge is 0xFC, which is 252 in decimal, and if the data are valid, second byte will be 0x84, which means the sub-packet is valid and length of the sub-packet is 4 Bytes.

Source ID (1 Byte)	1-bit Validity [0: invalid, 1: valid] | 7-bit Data Length (1 Byte)	Data (2 Bytes)
0xFC	0x84 (valid)	count of pendant event

Table 1: Sub-packet for rain gauge

2.1.2 Soil Moisture Sensor

As shown in Table 2, sensor identifier of soil sensor is 0xFB, which is 251 in decimal, and if the data are valid, second byte will be 0x84, which means the sub-packet is valid and length of the sub-packet is 6 Bytes.

Source ID (1 Byte)	1-bit Validity | 7-bit Data Length [0: invalid, 1: valid] (1 Byte)	Data (6 Bytes)
0xFB	0x86 (valid)	Dielectric permittivity in Format 6 (2 Bytes)
		Electric Conductivity in Format 6 (2 Bytes)
		Temperature in Format 6 (2 Bytes)

Table 2: Sub-packet for rain gauge

2.2 Data Formats

The data sent in each sub-packet is encoded in one or more formats. Currently we define eight formats for various types of data including integers, bytes, and floating point numbers. Rain gauge data encoded as format 1, which is integers in range 0 to 65535, as shown in Table 3. Therefore the data of the rain gauge is an integer, and it means the count of pendant event inside the rain gauge. One event of the pendant means 0.01 in. (0.254 mm) of precipitation. Soil sensor data is encoded as format 6, which is integers in range -127.99 to 127.99, as shown in Table 3. Therefore the data of the soil sensor are float point dielectric, conductivity, and temperature.

Format	Number of Bytes Used	Value Represented	Value Range
1	2	unsigned int_16 input	$0 - 65535$
6	2	float input	$[-127.99, 127.99]$

Table 3: Data format for rain gauge

3   Sensor Data Units

The outputs of sensors need to be processed to meaningful values. The Table 4 shows the unit for the sensor values. 'Raw Units' in the table means the unit for the packtized data, which you can get directly from the coresense boards, and 'Processed Units' means the unit which can be used after data conversion.

3.1   Rain Gauge

The conversion method for the rain gauge is provided as comments in the table.

Sensor	Sensor ID	Raw Units	Processed Units	Comments
Rain Gauge	0xFC	integer	in. or mm	One pendant event = 0.01 in. = 0.254 mm precipitation = output × 0.01 (or 0.254)

Table 4: Sub-packet data for sensors

3.2   Soil Moisture Sensor

And data from the Metsense board of this soil sensor does not need a conversion method since the data from the board are the processed values.

Sensor	Sensor ID	Raw Units	Processed Units	Comments
Soil sensor	0xFB	No unit, dS/m, °C	No unit, dS/m, °C	

Table 5: Sub-packet for rain gauge