RS1xx LoRa Protocol

Sentrius™ RS1xx Sensor

Application Note *v2.5*

1 Introduction

The goal of this document is to detail the messages sent between the RS1xx sensor and a LoRa network server.

2 Conventions

2.1 Data Formats

2.1.1 Data Types

Data types are based on the C language definitions for fixed point data types define in *stdint.h* for C99 and newer compliers. These define whether a value is signed and how many bits are used to represent its value. For example, *int8_t* is a signed represented in 8 bits and *uint32_t* is a 32-bit unsigned value. The *_t* at the end is designates a type defined (rather than native) data type.

2.1.2 Data Format

Temperature and humidity values are represented as two-byte values. The first byte is the factional portion of the value and the second byte is the integer portion of the value. For example, a temperature of 27.43 degrees C has a fractional portion of 43 and an integer portion of 27. A temperature of -15.87 C would have a fractional portion of -87 and an integer portion of -15.

The following are the equations for temperature and humidity:

Temp = Integer Portion + (Fractional Portion/100)

Humidity = Integer Portion + (Fractional Portion/100)

Note: Temperature uses signed eight-bit values, while humidity uses unsigned eight-bit values. However, because humidity cannot be negative, the sign bit is never set and there is no practical difference between using signed or unsigned values for humidity.

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3 Server-To-Sensor Messages

3.1 Message Options

All Server-To-Sensor Messages have the same options byte format. The options byte is always at byte index 1.

Byte Index	Name	Description	Type	Default Value	Example Value	Min Value
[1]	Options	Mote Response Options: 0 None 1 Send simple configuration next uplink 2 Send advanced configuration next uplink 3 Send firmware version next uplink	enum	0x00	0x00	0x03

3.2 Message Name: Generic Data Retrieval Notification

Notification

Method Name: GenericDataRetrieval

Notes

Message Length = 2 bytes
Server Method: asGenericRequest
Direction: Downlink

Parameters

Byte Index	Name	Description	Type	Default Value	Example Value	Min. Value
[0]	MsgType	Message type	0x01	0x01	0x01	0x01
[1]	Options	See the *Message Options* section	enum	0x00	0x00	0x03

Example Message

```
Sent MSB First.

01 00
```

3.3 Message Name: Set UTC Notification

Notification

Method Name: SetUTC

Notes

Message Length = 8 bytes
Server Method: generateRTCDownlink
Direction: Downlink

Parameters

Byte Index	Name	Description	Type	Default Value	Example Value	Min Value
[0]	MsgType	Message type	0x02	0x02	0x02	0x02
[1]	Options	See the *Message Options* section	enum	0x00	0x00	0x03

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Byte Index	Name	Description	Type	Default Value	Example Value	Min Value
[2]	RTC_Year	Year	uint8_t	0x11	0x00	0xFF
[3]	RTC_Month	Month	uint8_t	0x01	0x00	0x0C
[4]	RTC_Day	Day	uint8_t	0x01	0x00	0x1F
[5]	RTC_Hours	Hours (24-hour format)	uint8_t	0x05	0x00	0x17
[6]	RTC_Minutes	Minutes	uint8_t	0x0F	0x00	0x3B
[7]	RTC_Seconds	Seconds	uint8_t	0x1E	0x00	0x3B

Example Message

```
Sent MSB First.

02 00 11 01 01 05 0F 1E
```

3.4 Message Name: Sensor Config Notification

Notification

Method Name: Config

Notes

Message Length = 16 bytes.

Server Method: asSetSensorParameters

Direction: Downlink

ReadSensorPeriod determines the time between individual temperature and humidity readings. The *SensorAggregate* determines how many readings are accumulated prior to sending a data packet to the gateway. For example, if the *SensorAggregate* is set to 2 and the *ReadSensorPeriod* is set to 60 seconds, the data is sent over LoRa 2 x 60 seconds or every 120 seconds. Increasing the *SensorAggregate* value has a positive effect on battery life.

Parameters

Byte Index	Name	Description	Type	Default Value	Example Value	Min Value	Max Value
[0]	MsgType	Message type	0x03	0x03	0x03	0x03	0x03
[1]	Options	See the *Message Options* section	enum	0x00	0x00	0x00	0x03
[2]	Config_BatteryType	1 Zinc-Manganese Dioxide (Alkaline) 2 Lithium/Iron Disulfide (Primary Lithium)	uint8_t	0x01	0x01	0x01	0x02
[3:4]	Config_ReadSensorPeriod	Period in seconds to read the sensor 0 Disabled	uint16_t	0x0000	0x000A	0x0000	0xFFFF
[5]	Config_SensorAggregate	Number of readings to aggregate before sending on LoRa	uint8_t	0x01	0x01	0x01	0x0B
[6]	Config_TempAlarmEnable	Enable temperature alarm	bool	0	1	0	1
[7]	Config_HumidityAlarmEnable	Enable humidity alarm	bool	0	0	0	1

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Byte Index	Name	Description	Type	Default Value	Example Value	Min Value	Max Value
[8]	Config_TempAlarmLimitLow	Temperature alarm limit - low	int8_t	0x00	0x00	0xD8	0x55
[9]	Config_TempAlarmLimitHigh	Temperature alarm limit - high	int8_t	0x00	0x32	0xD8	0x55
[10]	Config_RHAlarmLimitLow	Humidity alarm limit - low	int8_t	0x0A	0x0A	0x00	0x64
[11]	Config_RHAlarmLimitHigh	Humidity alarm limit - high	int8_t	0x50	0x50	0x00	0x64
[12:13]	Config_LED_BLE	Flash period in seconds when in BLE connection 0 | No flash	uint16_t	0x000A	0x000A	0x0000	0xFFFF
[14:15]	Config_LED_LoRa	Flash period in seconds 0 | No flash 65535 | Tx/Rx debug mode Tx – green Rx – orange	uint16_t	0x000A	0x000A	0x0000	0xFFFF

Example Message

```
Sent MSB First.

03 00 01 00 0A 01 01 00 00 32 0A 50 00 0A 00 0A
```

3.5 Message Name: Heater Control Notification

Notification

Method Name: HeaterControl

Notes

Message Length = 5 bytes
Server Method: asSetHeater
Direction: Downlink

Parameters

Index	Name	Description	Type	Default Value	Example Value	Min Value	Max Value
[0]	MsgType	Message type	0x04	0x04	0x04	0x04	0x04
[1]	Options	See the *Message Options* section	enum	0x00	0x00	0x00	0x03
[2]	Options_Si702x_Heater_Setting	Setting that controls the power sent to the heating element. See si7021 datasheet for more details	uint8_t	0x00	0x02	0x00	0x0F
[3:4]	Options_Si702x_Heater_Time	Time in milliseconds for the	uint16_t	0x0000	0x000A	0x0000	0xFFFF

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Index	Name	Description	Type	Default Value	Example Value	Min Value	Max Value
		unit to turn on the heating element 0 Heater disabled					

Example Message

```
Sent MSB First.

04 00 02 00 0A
```

3.6 Message Name: Backoff Notification

Notification

Method Name: Backoff

Notes

Message Length = 4 bytes
Server Method: asRequestBackoff
Direction: Downlink

Parameters

Index	Name	Description	Type	Default Value	Example Value	Min Value	Max Value
[0]	MsgType	Message type	uint8_t	0x05	0x05	0x05	0x05
[1]	Options	See the *Message Options* section	enum	0x00	0x00	0x00	0x03
[2:3]	BackoffPeriod	Amount of time in seconds to backoff the sensor	uint16_t	0x0000	0x003C	0x0000	0xFFFF

Example Message

```
Sent MSB First.

05 00 00 3C
```

3.7 Message Name: FIFO Backlog Retrieval Notification

Notification

Method Name: BacklogRetrievalFIFO

Notes

Message Length = 6 bytes
Server Method: asRequestBacklogFIFO
Direction: Downlink

This command instructs the module to upload the stored logs and alarms oldest record first.

Parameters

Index	Name	Description	Type	Default Value	Example Value	Min Value	Max Value

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Index	Name	Description	Type	Default Value	Example Value	Min Value	Max Value
[0]	MsgType	Message type	uint8_t	0x06	0x06	0x06	0x06
[1]	Options	See the *Message Options* section	enum	0x00	0x00	0x00	0x03
[2:3]	Backlog_PullReqNum	Number of records to send ***Note:*** *Alarm messages are sent first.* 0 Cancel pull request	uint16_t	0x0000	0x0001	0x0000	0xFFFF
[4:5]	Backlog_PullReqPeriod	How often to send a backlog LoRa packet (seconds)	uint16_t	0x0000	0x000A	0x0000	0xFFFF

Example Message

```
Sent MSB First.

06 00 00 01 00 0A
```

3.8 Message Name: Format Log Flash Notification

Notification

Method Name: FormatLogFlash.

Notes

Message Length = 2 bytes
Server Method: asFormatFlash
Direction: Downlink

Parameters

Index	Name	Description	Type	Default Value	Example Value	Min Value
[0]	MsgType	Message type	0x07	0x07	0x07	0x07
[1]	Options	See the *Message Options* section	enum	0x00	0x00	0x03

Example Message

```
Sent MSB First.

07 00
```

3.9 Message Name: Set Alkaline Thresholds Notification

Notification

Method Name: SetAlkalineThresholds.

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Notes

Message Length = 14 bytes
Server Method: asSetAlkalineThresholds
Direction: Downlink

Parameters

Index	Name	Description	Type	Default Value	Example Value	Min Value	Max Value
[0]	MsgType	Message type	uint8_t	0x08	0x08	0x08	0x08
[1]	Options	See the *Message Options* section	enum	0x00	0x00	0x00	0x03
[2:3]	EightyPercent	80% threshold in mV	uint16_t	0x0A96	0x0A96	0x0000	0xFFFF
[4:5]	SixtyPercent	60% threshold in mV	uint16_t	0x0A14	0x0A14	0x0000	0xFFFF
[6:7]	FortyPercent	40% threshold in mV	uint16_t	0x099C	0x099C	0x0000	0xFFFF
[8:9]	TwentyPercent	20% threshold in mV	uint16_t	0x0898	0x0898	0x0000	0xFFFF
[10:11]	FivePercent	5% threshold in mV	uint16_t	0x076C	0x076C	0x0000	0xFFFF
[12:13]	Offset	Offset from 20 degrees C in mV	uint16_t	0x0064	0x0064	0x0000	0xFFFF

Example Message

```
Sent MSB First.

08 00 0A 96 0A 14 09 9C 08 98 07 6C 00 64
```

3.10 Message Name: Set Lithium Thresholds Notification

Notification

Method Name: SetLithiumThresholds

Notes

Message Length = 14 bytes
Server Method: asSetLithiumThresholds
Direction: Downlink

Parameters

Index	Name	Description	Type	Default Value	Example Value	Min Value	Max Value
[0]	MsgType	Message type	0x09	0x09	0x09	0x09	
[1]	Options	See the *Message Options* section	0x00	0x00	0x00	0x03	
[2:3]	EightyPercent	80% threshold in mV	uint16_t	0x0B86	0x0B86	0x0000	0xFFFF
[4:5]	SixtyPercent	60% threshold in mV	uint16_t	0x0B40	0x0B40	0x0000	0xFFFF
[6:7]	FortyPercent	40% threshold in mV	uint16_t	0x0AF0	0x0AF0	0x0000	0xFFFF
[8:9]	TwentyPercent	20% threshold in mV	uint16_t	0x0A5A	0x0A5A	0x0000	0xFFFF
[10:11]	FivePercent	5% threshold in mV.	uint16_t	0x0834	0x0834	0x0000	0xFFFF
[12:13]	Offset	Offset from 20 degrees C in mV	uint16_t	0x0096	0x0096	0x0000	0xFFFF

Example Message

```
Sent MSB First.
```


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```
09 00 0B 86 0B 40 0A F0 0A 5A 08 34 00 96
```

3.11 Message Name: LIFO Backlog Retrieval Notification

Notification

Method Name: BacklogRetrievalLIFO

Notes

Message Length = 6 bytes

Server Method: asRequestBacklogLIFO

Direction: Downlink

This command instructs the module to upload the stored logs and alarms oldest record first.

Parameters

Index	Name	Description	Type	Default Value	Example Value	Min Value	Max Value
[0]	MsgType	Message type.	uint8_t	0x0A	0x0A	0x0A	0x0A
[1]	Options	See the *Message Options* section	enum	0x00	0x00	0x00	0x03
[2:3]	Backlog_PullReqNum	Number of records to send. ***Note:*** *Alarm messages are sent first.* 0 | Cancel pull request	uint16_t	0x0000	0x0001	0x0000	0xFFFF
[4:5]	Backlog_PullReqPeriod	How often to send a backlog LoRa packet (seconds).	uint16_t	0x0000	0x000A	0x0000	0xFFFF

Example Message

```
Sent MSB First.

0A 00 00 01 00 0A
```

3.12 Message Name: Cancel Backlog Retrieval

Notification

Method Name: CancelBacklogRetrieval

Notes

Message Length = 2 bytes

Server Method: asCancelBacklogRetrieval

Direction: Downlink

This command instructs the module to cancel the uploading of the logs and alarms.

Parameters

Index	Name	Description	Type	Default Value	Example Value	Min Value	Max Value
[0]	MsgType	Message type.	uint8_t	0x0B	0x0B	0x0B	0x0B
[1]	Options	See the *Message Options* section	enum	0x00	0x00	0x00	0x03

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Example Message

```
Sent MSB First.

0B 00
```

4 Sensor-To-Server Messages

4.1 Sensor-To-Server Message Options

All Sensor-To-Server messages have the same options byte format. The options byte is always at byte index 1

Byte Index	Name	Description	Type	Default Value	Example Value	Min Value	Max Value
[1]	Options	BIT POSITION	bitfield	0x00	0x00	0x00	0x0F
		0 Sensor request for server time					
		1 Sensor configuration error					
		2 Sensor alarm flag					
		3 Sensor reset flag					

4.2 Message Name: Send Temp RH Data Notification

Notification

Method Name: SendTempRHData

Notes

Message Length = 11 bytes

Server Method: asTempAndRhData Ni

Direction: Uplink

Note: There is no timestamp in this message. The server must assume the time it receives this message is the timestamp and this should almost always be within a few seconds of the actual time.

A *Sensor Configuration Error* in the Options byte means that the sensor is operating in North America at DR0, where the maximum LoRa payload is 11-bytes, but it is configured with an aggregate count > 1, which results in a payload greater than 11-bytes. In this case, the sensor stores the data it can't send to FLASH. The server should change the sensor aggregate count in this case.

Parameters

Byte Index	Name	Description	Type	Default Value	Example Value	Min Value	Max Value
[0]	MsgType	Message type	uint8_t	0x01	0x01	0x01	0x01
[1]	Options	See the *Sensor-To-Server Message Options* section	bitfield	0x00	0x00	0x00	0x0F
[2]	HumidityFractional	Fractional portion of humidity measurement in %	uint8_t	0x1E	0x1E	0x00	0x64
[3]	HumidityInteger	Decimal portion of humidity measurement in %	uint8_t	0x01	0x01	0x00	0xFF
[4]	TempFractional	Fractional portion of temperature measurement in C	int8_t	0x41	0x41	0x00	0xFF
[5]	TempInteger	Integer portion of temperature	int8_t	0x19	0x19	0xD8	0x55

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Byte Index	Name	Description	Type	Default Value	Example Value	Min Value	Max Value
		measurement in C					
[6]	BatteryCapacity	Index for percentage of battery capacity remaining 0 = 0-5% 1 = 5-20% 2 = 20-40% 3 = 40-60% 4 = 60-80% 5 = 80-100%	uint8_t	0x05	0x02	0x00	
[7:8]	AlarmMsgCount	Number of backlog alarm messages in sensor FLASH	uint16_t	0x0000	0x0000	0x0000	0x0FF0
[9:10]	BacklogMsgCount	Number of backlog non-alarm messages in sensor FLASH	uint16_t	0x0000	0x0000	0x0000	0x0FF0

Example Message

```
Sent MSB First.

01 00 1E 01 41 19 02 00 00 00 00
```

4.3 Message Name: Send Temp and RH Aggregated Data Notification

Notification

Method Name: SendTempRHAggregatedData

Notes

Server Method: asTempAndRhAggregate

Direction: Uplink

The length of this message is variable.

The MsgType, Options, Msg Counts, NumberReadings and Timestamp = 11 bytes

One Temperature and Humidity Reading = 4 bytes

Message Length = NumReading * 4 + 11. Since NumReadings max is 10: 10 x 4 = 40. 40 + 11 = 51.

It is important that this packet be 51 bytes or less since the max EU packet across datarates is 51 bytes in length.

A *Sensor Configuration Error* in the Options byte means that the sensor is operating in North America at DR0, where the maximum LoRa payload is 11-bytes, but it is configured with an aggregate count > 1, which results in a payload greater than 11-bytes. In this case, the sensor stores the data it can't send to FLASH. The server should change the sensor configuration.

The timestamp is the time of the last sensor reading. The server must use the sensor read period parameter (part of the device configuration) to calculate the timestamps of the remaining data.

Parameters

Byte Index	Name	Description	Type	Default Value	Example Value	Min Value	Max Value
[0]	MsgType	Message type.	uint8_t	0x02	0x02	0x02	0x02

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Byte Index	Name	Description	Type	Default Value	Example Value	Min Value	Max Value
[1]	Options	See the *Sensor-To-Server Message Options* section	bitfield	0x00	0x00	0x00	0x0F
[2:3]	AlarmMsgCount	Number of backlog alarm messages in sensor FLASH.	uint16_t	0x0000	0x0000	0x0000	0x0FF0
[4:5]	BacklogMsgCount	Number of backlog non-alarm messages in sensor FLASH	uint16_t	0x0000	0x0000	0x0000	0x0FF0
[6]	NumberReadings	Number of sensor readings in packet.	uint8_t	-	0x02	0x01	0x0B
[7:10]	Timestamp	Seconds since Jan 1 2015	uint32_t	-	0x00000064	0x00000000	0xFFFFFFFF
[11]	HumidityFractional	Fractional portion of humidity measurement in %	uint8_t	-	0x01	0x9D	0x64
[12]	HumidityInteger	Decimal portion of humidity measurement in %	uint8_t	-	0x1E	0x00	0x64
[13]	TempFractional	Fractional portion of temperature measurement in C	int8_t	-	0x19	0x9D	0x63
[14]	TempInteger	Integer portion of temperature measurement in C	int8_t	-	0x41	0xD8	0x55
[15]	HumidityFractional	Fractional portion of humidity measurement in %	uint8_t	-	0x03	0x1E	0x64
[16]	HumidityInteger	Decimal portion of humidity measurement in %	uint8_t	-	0x1D	0x01	0xFF
[17]	TempFractional	Fractional portion of temperature measurement in C	int8_t	-	0x19	0x19	0xFF
[18]	TempInteger	Integer portion of temperature measurement in C	int8_t	-	0x41	0xD8	0x55

Example Message

```
Sent MSB First.

02 00 00 00 00 00 05 02 00 00 00 64 01 1E 19 41 03 1D 19 41
```


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4.4 Message Name: Send BackLog Message Notification

Notification

Method Name: SendBackLogMessage

Notes

Message Length = 10 bytes.

Server Method: asBacklogTempAndRh

Direction: Uplink

The Timestamp is the time the sensor data was sampled.

Parameters

Byte Index	Name	Description	Type	Default Value	Example Value	Min Value	Max Value
[0]	MsgType	Message type	uint8_t	0x03	0x03	0x03	0x03
[1]	Options	See the *Sensor-To-Server Message Options* section	bitfield	0x00	0x00	0x00	0x0F
[2:5]	Timestamp	Seconds since Jan 1 2015	uint32_t	-	0x00000064	0x00000000	0xFFFFFFFF
[6]	HumidityFractional	Integer value of humidity measurement in %	uint8_t	-	0x1E	0x00	0x63
[7]	HumidityInteger	Decimal value of humidity measurement in %	uint8_t	-	0x01	0x00	0x64
[8]	TempFractional	Decimal value of temperature measurement in C	int8_t	-	0x00	9D	0x63
[9]	TempInteger	Integer value of temperature measurement in C	int8_t	-	0x19	0xD8	0x55

Example Message

```
Sent MSB First.

03 00 00 00 00 64 1E 01 41 19
```

4.5 Message Name: Send BackLog Messages Notification

Notification

Method Name: SendBackLogMessages

Notes

Server Method: asBacklogTempAndRhAggregate

Direction: Uplink

The length of this message is variable.

The MsgType, NumberReadings, and Options = 3 bytes.

The Timestamp, Temperature, and Humidity = 8 bytes.

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Message Length = NumReading * 8 + 3. Since NumReadings max is 6: 6 x 8 = 48. 48 + 3 = 51.

It is important that this packet be 51 bytes or less since the max EU packet across datarates is 51 bytes in length.

A *Sensor Configuration Error* in the Options byte means that the sensor is operating in North America at DR0, where the maximum LoRa payload is 11-bytes, but it is configured with an aggregate count > 1, which results in a payload greater than 11-bytes. In this case, the sensor stores the data it can't send to FLASH. The server should change the sensor configuration.

The *Timestamp* is the time the sensor data was sampled.

Parameters

Byte Index	Name	Description	Type	Default Value	Example Value	Min Value	Max Value
[0]	MsgType	Message type	uint8_t	0x04	0x04	0x04	0x04
[1]	Options	See the *Sensor-To-Server Message Options* section	bitfield	0x00	0x00	0x00	0x0F
[2]	NumReading	Number of sensor reading backlogs in packet	uint8_t	0x01	0x01	0x01	0x06
[3:6]	Timestamp	Seconds since Jan 1 2015	uint32_t	-	0x00000064	0x00000000	0xFFFFFFFF
[7]	HumidityFractional	Integer value of humidity measurement in %	uint8_t	-	0x1E	0x00	0x64
[8]	HumidityInteger	Decimal value of humidity measurement in %	uint8_t	-	0x01	0x00	0x64
[9]	TempFractional	Decimal value of temperature measurement in C	int8_t	-	0x41	0x9D	0x64
[10]	TempInteger	Integer value of temperature measurement in C	int8_t	-	0x19	0xD8	0x7D

Example Message

```
Sent MSB First.

04 00 01 00 00 00 64 1E 01 41 19
```

4.6 Message Name: Send Sensor Config Simple Notification

Notification

Method Name: SendSensorConfigSimple

Notes

Message Length = 10 bytes.

Server Method: asSensorConfigSimple

Direction: Uplink

A *Sensor Configuration Error* in the Options byte means that the sensor is operating in North America at DR0, where the maximum LoRa payload is 11-bytes, but it is configured with an aggregate count > 1, which results in a payload greater than 11-bytes. In this case, the sensor stores the data it can't send to FLASH. The server should change the sensor configuration.

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The *SensorAggregate* setting aggregates or collects sensor data every *ReadSensorPeriod* and only sends them over LoRa when the *SensorAggregate* number is reached. For example, if the *SensorAggregate* is set to 2 and the *ReadSensorPeriod* is set to 60 seconds, the data is sent over LoRa 2 x 60 seconds or every 120 seconds. This has a positive effect on battery life.

Parameters

Byte Index	Name	Description	Type	Default Value	Example Value	Min Value	Max Value
[0]	MsgType	Message type	uint8_t	0x05	0x05	0x05	0x05
[1]	Options	See the *Sensor-To-Server Message Options* section	bitfield	0x00	0x00	0x00	0x0F
[2]	BatteryType	1 Zinc-Manganese Dioxide (Alkaline) 2 Lithium/Iron Disulfide (Primary Lithium)	uint8_t	0x01	0x01	0x01	0x02
[3]	ReadSensorPeriod	Period in seconds to read the sensor 0 Disabled	uint16_t	0x003C	0x003C	0x001E	0xFFFF
[4]	SensorAggregate	Number of readings to aggregate before sending on LoRa	uint8_t	0x01	0x01	0x01	0x0B
[5]	TempAlarmEnabled	False Disabled True Enabled	bool	0	0	0	1
[6]	HumidityAlarmEnabled	False Disabled True Enabled	bool	0	0	0	1

Example Message

```
Sent MSB First.

05 00 01 00 00 01 00 00
```

4.7 Message Name: Send Sensor Config Advanced Notification

Notification

Method Name: SendSensorConfigAdvanced

Notes

Message Length = 16 bytes.

Server Method: asSensorConfigAdvanced

Direction: Uplink

A *Sensor Configuration Error* in the Options byte means that the sensor is operating in North America at DR0, where the maximum LoRa payload is 11-bytes, but it is configured with an aggregate count > 1, which results in a payload greater than 11-bytes. In this case, the sensor stores the data it can't send to FLASH. The server should change the sensor configuration.

The *SensorAggregate* setting aggregates or collects sensor data every *ReadSensorPeriod* and only sends them over LoRa when the *SensorAggregate* number is reached. For example, if the *SensorAggregate* is set to 2 and the *ReadSensorPeriod* is set to 60 seconds, the data is sent over LoRa 2 x 60 seconds or every 120 seconds. This has a positive effect on battery life.

Parameters

Byte Index	Name	Description	Type	Default Value	Example Value	Min Value	Max Value
[0]	MsgType	Message type	uint8_t	0x06	0x06	0x06	0x06

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Byte Index	Name	Description	Type	Default Value	Example Value	Min Value	Max Value
[1]	Options	See the *Sensor-To-Server Message Options* section	bitfield	0x00	0x00	0x00	0x0F
[2]	BatteryType	1 – Zinc-Manganese Dioxide (Alkaline) 2 – Lithium/Iron Disulfide (Primary Lithium)	uint8_t	0x01	0x01	0x01	0x02
[3:4]	ReadSensorPeriod	Period in seconds to read the sensor 0 – Disabled, sensor is not read	uint16_t	0x003C	0x003C	0x0000	0xFFFF
[5]	SensorAggregate	Number of readings to aggregate before sending on LoRa	uint8_t	0x01	0x01	0x01	0x0B
[6]	TempAlarmsEnabled	True – Temperature alarms enabled False – Temperature alarms disabled	bool	0	0	0	1
[7]	HumidityAlarmsEnabled	True – Humidity alarms enabled False – Humidity alarms disabled	bool	0	0	0	1
[8]	TempAlarmLimitLow	Temperature alarm limit - low in C	int8_t	0x00	0x00	0xD8	0x55
[9]	TempAlarmLimitHigh	Temperature alarm limit - high in C	int8_t	0x00	0x32	0xD8	0x55
[10]	HumidityAlarmLimitLow	Humidity alarm limit - low in %	int8_t	0x0A	0x0A	0x00	0x64
[11]	HumidityAlarmLimitHigh	Humidity alarm limit - high in %	int8_t	0x50	0x50	0x00	0x64
[12:13]	LED_BLE	Flash period in seconds when in BLE connection 0 – No flash	uint16_t	0x000A	0x000A	0x0000	0xFFFF
[14:15]	LED_Heartbeat	Flash period in seconds 0 – No flash 65535 – LED in LoRa Tx/Rx mode Tx – green Rx – orange	uint16_t	0x000A	0x000A	0x0000	0xFFFF

Example Message

```
Sent MSB First.

06 00 01 00 00 01 00 00 00 32 0A 50 00 0A 00 0A
```


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4.8 Message Name: Send FW Version Notification

Notification

Method Name: SendFWVersion

Notes

Message Length = 11 bytes.

Server Method: asFwVersion

Direction: Uplink

A *Sensor Configuration Error* in the Options byte means that the sensor is operating in North America at DR0, where the maximum LoRa payload is 11-bytes, but it is configured with an aggregate count > 1, which results in a payload greater than 11-bytes. In this case, the sensor stores the data it can't send to FLASH. The server should change the sensor configuration.

Parameters

Byte Index	Name	Description	Type	Default Value	Example Value	Min Value	Max Value
[0]	MsgType	Message type	uint8_t	0x07	0x07	0x07	0x07
[1]	Options	See the *Sensor-To-Server Message Options* section	bitfield	0x00	0x00	0x00	0x0F
[2]	Year	Version year	0x00	0x11	0x00	0x00	0xFF
[3]	Month	Version month	0x00	0x01	0x01	0x01	0x0C
[4]	Day	Version day	0x00	0x01	0x01	0x01	0x1F
[5]	VersionMajor	Version major	0x00	0x01	0x00	0x01	0xFF
[6]	VersionMinor	Version minor	0x00	0x00	0x00	0x00	0xFF
[7:10]	PartNumber	Part number of firmware	uint32_t	0x00000000	0x00493E6F	0x00000000	0xFFFFFFFF

Example Message

```
Sent MSB First.

07 00 11 01 01 01 00 00 49 3E 6F
```


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5 Revision History

Version	Date	Notes	Contributor(s)	Approver
1.0	17 Dec 2017	Initial Release		Jonathan Kaye
2.0	16 March 2018	Updated to latest messages		Chris Hofmeister
2.1	11 April 2018	Corrected message type values, put them in numeric order		Mark Monson
2.2	3 August 2018	Updated to new template. Updates to BatteryCapacity.		Seokwoo Yoon
2.3	5 September 2018	Updated options byte in uplink messages for version 4.2 FW		Chris Hofmeister
2.4	25 Jan 2019	Updated *seconds* to *milliseconds* for **Options_Si702x**	Mark Monson	Jonathan Kaye
2.5	15 Aug 2019	Updated formatting and aggregate uplink	Mark Monson	Jonathan Kaye

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