

SENSO8 LoRaWAN® ENV Sensor Data Payload Format document

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The LoRaWAN® data payload format document describes the data payload format of downlink and uplink LoRaWAN® data for the following models:

- LRS30100-C000-11xx
- LRS30100-CV00-11xx
- LRS30100-CV00-00xx

LRS30100 LoRaWAN® Indoor Environmental Sensor (ENV Sensor) provides a simple and efficient solution in monitoring Ambient Temperature & Humidity, Carbon Dioxide, TVOC, Ambient Light and/or Motion.

LRS30100 is a Class A LoRaWAN® device. For the sensor to operate properly, it is required to configure the sensor as a Class A device on the Network Server. For Class A LoRaWAN® devices, downlink data are queued on Network Server until the next uplink data is received from the sensor.

1. Uplink Data

1.1. Data Reporting

The Indoor Environmental Sensor sends a data uplink data report in the following cases:

- Periodic heartbeat

- Button press
- Air condition exceeds preset threshold

1.1.1. Payload Format

Temperature & Humidity Reading (Port: 10)

Byte	0	1	2	3	4	5	6	7
		MSB	LSB	MSB	LSB	MSB	LSB	
Field	EVT	TEMP		HUM		TOFF		UPID

Field	Measurement	Calculation
EVT	Alert and Event	<p>Bitmask for the alerts and events. If the corresponding bit is “1”, an alert or an event is triggered.</p> <p>Bit 7 – Redundant Payload</p> <p>Bit 6 – Reserved</p> <p>Bit 5 – T/H Change</p> <p>Bit 4 – Humid Low</p> <p>Bit 3 – Humid High</p> <p>Bit 2 – Temp Low</p> <p>Bit 1 – Temp High</p> <p>Bit 0 – Heartbeat/Button</p>
TEMP	Temperature (°C)	Temperature = TEMP / 10
HUM	Humidity (%)	Humidity = HUM / 10
TOFF	Reserved	

Field	Measurement	Calculation
UPID	Uplink ID It increases by one where there is a new data sample on port 10. Roll back to 0 when it exceeds 255. It will not increase when the payload is redundant.	Uplink ID = UPID

LRS30100 supports two modes of operation for reporting temperature and humidity data on Port 10. They are Periodic Reporting Mode and Adaptive Reporting Mode.

ADTR_EN	Mode	Date Upload	Redundancy	EVT Field
0 (Default)	Periodic Reporting	Periodic according to Data Upload Period	No	Heartbeat/Button
1	Adaptive Reporting	When change of reading exceeds Temperature/Humidity Delta	Yes	T/H Change Redundant Payload

By default, Adaptive Reporting Mode (ADTR_EN) is disabled, and the number of redundant payload (REPEAT) is 0. They can be modified in the CONFIG port (Port: 26) on the sensor.

When Adaptive Reporting Mode (ADTR_EN) is enabled and the number of redundant payload (REPEAT) is larger than 0, there will be additional uplinks for all data samples. MSB (Bit 7) of EVT field (Byte 0) in the additional uplinks are set to indicate that the uplinks are redundant. The corresponding UPID field (Byte 7) will remain unchanged. Therefore, the UPID increment means for a new data sample.

1.1.2. Example

The following payload is for Periodic Mode.

Payload = 0100ED0275000A05

EVT = 0x01 = 0000 0001b Bit 0 = 1 => Heartbeat/Button

TEMP = 0x00ED Temperature = $237 / 10 = 23.7$ °C

HUM = 0x0275 Humidity = $629 / 10 = 62.9$ %

UPID = 0x05 Uplink ID = 5

Note: “Bit 0 of EVT is set” means “Adaptive Reporting Mode is disabled (or ADTR_EN = 0)”.

The following 3 payloads are received consecutively for Adaptive Reporting Mode and REPEAT > 0.

Payload = 2000F70270000506

EVT = 0x20 = 0010 0000b Bit 5 = 1 => T/H Change

TEMP = 0x00F7 Temperature = $247 / 10 = 24.7$ °C

HUM = 0x0270 Humidity = $624 / 10 = 62.4$ %

UPID = 0x06 Uplink ID = 6

Note: Adaptive Reporting Mode is enabled (or ADTR_EN = 1 & REPEAT = 1), it is a new data as Bit 7 of EVT is cleared and UPID is larger than the previous one.

Payload = A000F70270000506

EVT = 0xA0 = 1010 0000b Bit 7 = 1 => Redundant Payload

Bit 5 = 1 => T/H Change

TEMP = 0x00F7 Temperature = $247 / 10 = 24.7$ °C

HUM = 0x0270 Humidity = $624 / 10 = 62.4$ %

UPID = 0x06 Uplink ID = 6

Note: It is a redundant payload as Bit 7 of EVT is set and UPID is the same as the previous one.

Payload = 8000F50277000A07

EVT = 0x80 = 1000 0000b Bit 7 = 1 => Redundant Payload

TEMP = 0x00F5 Temperature = $245 / 10 = 24.5$ °C

HUM = 0x0277 Humidity = $631 / 10 = 63.1$ %

ID = 0x07 Uplink ID = 7

Note: It is a redundant payload but a new data. It is because Bit 7 of EVT is set and UPID has an increment. It may happen if the previous uplink for the new data is lost. UPID helps to determine whether the data is a new one or not.

CO2, TVOC, Occupancy and Light Reading (Port: 11)

Byte	0	1	2	3	4	5	6	7	8	9
		MSB	LSB	MSB	LSB		MSB	LSB		
Field	EVT	CO2		TVOC		OCC	LIGHT		Reserved	

Field	Measurement	Calculation
EVT	Alert and Event	Bitmask for the alerts and events. If the corresponding bit is “1”, an alert or event is triggered. Bit 3-7 – Reserved Bit 2 – TVOC High Bit 1 – CO2 High Bit 0 – Heartbeat/Button
CO2	CO ₂ (ppm)	CO ₂ = CO2
TVOC	Total Volatile Compound Reading (µg/m ³)	TVOC = TVOC
OCC	Occupancy	1 – Occupied 0 – Unoccupied
LIGHT	Light Intensity (Lux)	Light Intensity = LIGHT

1.1.3. Example

Payload = 0104DE000F01010E0000

EVT = 0x01 Bit 0 = 1 => Heartbeat/Button

CO2 = 0x04DE CO₂ = 1246 ppm

TVOC = 0x000F TVOC = 15 µg/m³

OCC = 0x01 Occupancy = Occupied

LIGHT = 0x010E Light Intensity = 270 Lux.

1.2. Device Configuration Reporting

The Indoor Environmental Sensor uploads the device information and settings on receiving a downlink request.

1.2.1. Payload Format

Device Version (Port: 8)

Byte	0	1	2	3
	XX	YY	ZZZ	
Field	FWV			

Field	Description	Format
FWV	Firmware Version	Firmware Version = XX.YY.ZZZ

Device Status (Port: 9)

Byte	0	1	2	3	4	5	6	7	8	9	10
	XX	YY	ZZZ		MSB	LSB		MSB			LSB
Field	FWV				BAT_L		BAT_P	UL_CNT			

Field	Description	Format
FWV	Firmware Version	Firmware Version = XX.YY.ZZZ
BAT_L	Battery Level (mV)	Battery Level = BAT_L
BAT_P	Reserved	0
UL_CNT	Uplink count since last reboot	Uplink count = UL_CNT

The device status is sent automatically every 24 hours.

Device Settings (Port: 12)

Byte	0	1	2	3	4	5
	MSB	LSB				
Field	ULT		TYP	STS	OWIN	DACK

Field	Description	Format	Default
ULT	Data Upload Interval (minute)	Data Upload interval = ULT	10

Field	Description	Format	Default
TYP	Sensor Installed	Bitmask for sensor installed. A sensor is installed if the corresponding bit is “1”. Bit 7 – Reserved Bit 6 – Reserved Bit 5 – LIGHT Bit 4 – OCC Bit 3 – Reserved Bit 2 – CO2 Bit 1 – TVOC Bit 0 – Temperature & Humidity	
STS	Sensor Status	Bitmask for sensor status. A sensor is functional if the corresponding bit is “1”. Bit 7 – Reserved Bit 6 – Reserved Bit 5 – LIGHT Bit 4 – OCC Bit 3 – Reserved Bit 2 – CO2 Bit 1 – TVOC Bit 0 – Temperature & Humidity	
OWIN	Occupancy Window (minute, 1-60) Idle time on PIR for transiting from occupied to unoccupied	Occupancy Window = OWIN	1

Field	Description	Format	Default
DACK	Reserved	1	1

Threshold Settings (Port: 13)

Byte	0	1	2	3	4	5	6	7	8	9
	MSB	LSB	MSB	LSB			MSB	LSB	MSB	LSB
Field	HTTH		LTTH		HHTH	LHTH	CO2TH		TVOCTH	

Field	Description	Default
HTTH	High Temperature Threshold (°C)	30
LTTH	Low Temperature Threshold (°C)	18
HHTH	High Humidity Threshold (% , 0-100)	80
LHTH	Low Humidity Threshold (% , 0-100)	40
CO2TH	CO ₂ High Threshold (ppm, 0-5000)	1500
TVOCTH	TVOC High Threshold (µg/m ³ , 0-2000)	1000

Remark:

The temperature and humidity thresholds must meet the following conditions:

- HTTH > LTTH
- HHTH > LHTH

Adaptive Reporting Mode Settings for T/H (Port: 16)

Byte	0	1	2	3	4	5	6	7
	MSB	LSB	MSB	LSB	MSB	LSB		
Field	SILENT		DELTA_T		DELTA_H		REPEAT	ADTR_EN

Field	Description	Default
SILENT	Maximum Silent Time (minute, 0-1440)	60
DELTA_T	Temperature Delta for Uplink (°C, 0-10)	0
DELTA_H	Humidity Delta for Uplink (% , 0-10)	0
REPEAT	Number of Redundant Payload (0-5)	0

Field	Description	Default
ADTR_EN	Adaptive Reporting Mode Enable 0 – Disable 1 – Enable	0

2. Downlink Data

The downlink data is used for updating the Indoor Environmental Sensor settings online. The format of the downlink commands is described in [Downlink Data Format](#). After issuing a downlink configuration request command, the device will acknowledge with a response/acknowledgment command described in [Device Configuration Reporting](#).

2.1. Downlink Data Format

Device Version Request (Port: 20)

Byte	0
Field	0

Response command: Device Version (Port: 8)

Device Settings Request (Port: 21)

Byte	0
Field	0

Response command: Device Settings (Port: 12)

Threshold Settings Request (Port: 21)

Byte	0
Field	1

Response command: Threshold Settings (Port: 13)

Adaptive Reporting Mode Settings for T/H Request (Port: 21)

Byte	0
Field	3

Response command: Adaptive Reporting Mode Settings for T/H (Port: 16)

Device Settings Configuration (Port: 22)

Byte	0	1	2	3
	MSB	LSB		
Field	ULT		OWIN	DACK

Field	Description	Format
ULT	Data Upload Interval (minute) (min: 3)	ULT = Data Upload Interval
OWIN	Occupancy Window (1-60) Idle time on PIR for transiting from occupied to unoccupied	OWIN = Occupancy Window
DACK	RESERVED	1

Acknowledgement command: Device Settings (Port: 12)

Threshold Settings Configuration (Port: 23)

Byte	0	1	2	3	4	5	6	7	8	9
	MSB	LSB	MSB	LSB			MSB	LSB	MSB	LSB
Field	HTTH		LTTH		HHTH	LHTH	CO2TH		TVOCTH	

Field	Description	Format
HTTH	High Temperature Threshold (°C)	HTTH = High Temperature Threshold
LTTH	Low Temperature Threshold (°C)	LTTH = Low Temperature Threshold
HHTH	High Humidity Threshold (% , 0-100)	HHTH = High Humidity Threshold
LHTH	Low Humidity Threshold (% , 0-100)	LHTH = Low Humidity Threshold
CO2TH	CO ₂ High Threshold (ppm, 0-5000)	CO2TH = CO ₂ High Threshold
TVOCTH	TVOC High Threshold (µg/m ³ , 0-2000)	TVOCTH = TVOC High Threshold

Acknowledgement command: Threshold Settings (Port: 13)

Remark:

The temperature and humidity thresholds must meet the following conditions:

- HTTH > LTTH

- HHTH > LHTH

Adaptive Reporting Mode Settings for T/H Configuration (Port: 26)

Byte	0	1	2	3	4	5	6	7
	MSB	LSB	MSB	LSB				
Field	SILENT		DELTA_T		DELTA_H		REPEAT	ADTR_EN

Field	Description	Format
SILENT	Maximum Silent Time (minute, 0-1440)	SILENT = Maximum Silent Time
DELTA_T	Temperature Delta for Uplink (°C, 0-10)	DELTA_T = Temperature Delta x 10
DELTA_H	Humidity Delta for Uplink (% , 0-10)	DELTA_H = Humidity Delta x 10
REPEAT	Number of Redundant Payload (0-5)	REPEAT = Number of Redundant Payload
ADTR_EN	Adaptive Reporting Mode Enable 0 – Disable 1 – Enable	ADTR_EN = Adaptive Reporting Mode Enable

Acknowledgement command: Adaptive Reporting Mode Settings for T/H Settings (Port: 16)

3. Revision History

Revision	Description	Date
1.00	• Initial Release.	27 March 2025
1.01	• Update the unit of temperature delta and humidity delta.	6 May 2025
1.02	• Fixed a typo for LTHH.	26 May 2025
1.03	• Changed BAT_P on device status report to reserved.	15 Aug 2025
2.0	First release on docs.senso8.com	Oct 2026