

OPERATION AND INSTALLATION MANUAL

Vaping gas mix and aggression sensor – VAPELESS, VAPELESS PRO

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1. General information

The **VAPELESS/VAPELESS PRO** is advanced technology gas detection indoor sensor applied for the full sensing of the Vaping gases exhaust by the electronic cigarettes together with environment temperature and humidity, anti-tampering protection. Integrated holistic noise processing algorithms enable detection of the violence in the premises. Sensor detects chemical gas concentrations. **Sensor** enclosed in a room sensor box and designed to be wall mounted. **Sensor** is powered with 7-12 V DC voltage and is enclosed with AA type, 3.6 V batteries for the feeding LoRaWAN infrastructure in the sensor. The data transmitted from the sensor is based on Class A LoRaWAN® wireless network. Sensor has sophisticated **“Pattern Recognition”** AI technology and detects any kind of Vaping gas mix of any kind of Vaping fluids and flavors, even with mixed drugs.



VAPELESS vs VAPELESS PRO



CLEANER
SAFER
ENVIRONMENT

Feature	VAPELESS	VAPELESS PRO
Vaping detection	✓	✓
Violence detection	—	✓
Temperature sensor	✓	✓
Humidity sensor	✓	✓
LoRaWAN communication	✓	✓
AI / Pattern Recognition	✓	✓
Over-the-air configuration	✓	✓
Auto self-calibration and self-cleaning	✓	✓
VOC Index (1 – 500)	✓	✓
Anti-tampering function	—	✓
Additional gas measurements	—	✓



Feature availability is shown in the comparison table above.

CREATING
A SAFER
TOMORROW



2. The main technical characteristics and benefits of VAPELESS /VAPELESS PRO sensor:

- Compatible with LoRaWAN® specification 1.0.3;
- Measures Vaping gas mix Index Points.
- Aggression and violence detection
- Uses intellectual algorithms based on “Pattern recognition” and automatic calibration;
- Indoor use;
- Easy to use and deploy;
- Powered by batteries + power supply for processing power of gas mix detection and recognition.
- Data transmission up to 10 km;
- Battery life is up to 10 years depending on settings and environmental and trigger conditions;

3. Markings

On the backside of the sensor there will be label indicating sensor name, serial number, production date and QR code, device id.

Applications

- Indoor environment measuring
- Smart buildings
- Schools, universities
- Government buildings
- Public buildings
- Banks
- Industrial facilities

Product features

- Indoor Vaping detection
- LoRaWAN communication
- Computational AI algorithm
- Indoor temperature sensor
- Indoor humidity sensor
- Configuration over the air
- Pattern recognition technology
- Auto self-calibration

4. Installation and MAINTENANCE

- VAPELESS PRO sensor must be installed in ceiling of bathroom / room.



Sensor covers up to 5 meter radius zone depending on vaping intensity and barriers inside the premises.
Best sensor mounting height is up to 3 – 3.5 meters.

- Batteries are already inside the device, so before installation please pull-out battery enabling belts from sensor grill.
- Once the sensor is installed, connect sensor to 110-230 AC power supply.
- Reset button is placed in the grill gap of the sensor.

5. Push button and LED indicator description:

- Once batteries belt is removed, or reset button will be pushed in the sensor, it will automatically attempt to connect to the LoRaWAN network, and the LED indicator will start to be blinking / flashing for 15 seconds.
- In case of the successful connection to the LoRaWAN network LED indicator will stay on for 3 seconds and LED indicator will stop flashing and go dark. This means sensor successfully connected to the LoRaWAN network.
- If the sensor does not connect on the initial try, it will attempt to connect to the LoRaWAN network after 10 seconds, then after 60 seconds, then after 10 minutes, then after 1 hour, then after 24 hours till successful connection to the LoRaWAN network.
- The sensor will restart by pressing the button on the sensor and it will attempt instantly to connect the LoRaWAN network.

6. Measurements

The VAPELESS sensor has integrated complex e-vape gas recognition learning algorithm. Vape index is measured in p.u. and it is from 0 to 500. The Vape Index value below index of 120-150 indicates the complex gas background which is normally under 120-150 index. That means no Vaping is occurring in the environment.

In the Vapeless, there is set default threshold value of the vape index which is 120-140 and can be changed via downlink. When the e-vaping gas is detected (usually index is above 120-150) and vape index value exceeds threshold value e.g. 120 the sensor sends data in intensive intervals in seconds: 1s, 30s, 30s, 30s, 60s, 60s, 60s*15, 60s*30, 60s*30, 60s*60. If the threshold value is not exceeded than Vapeless sends the value one time per hour. That data sending cycle has reset of the sending intervals algorithm if still the index threshold value is exceeded after data sending intervals in a row 1, 30, 30, 30, 60, 60, when again measurement cycle starts from 1s, 30s, 30s, 30s, 60s, 60s, 60s*15, 60s*30, 60s*30, 60s*60.

The baseline (120-140 or more Index points) is set by sensor installer after checking natural background level in the room. Vape index interpretation presented in Fig. 1.

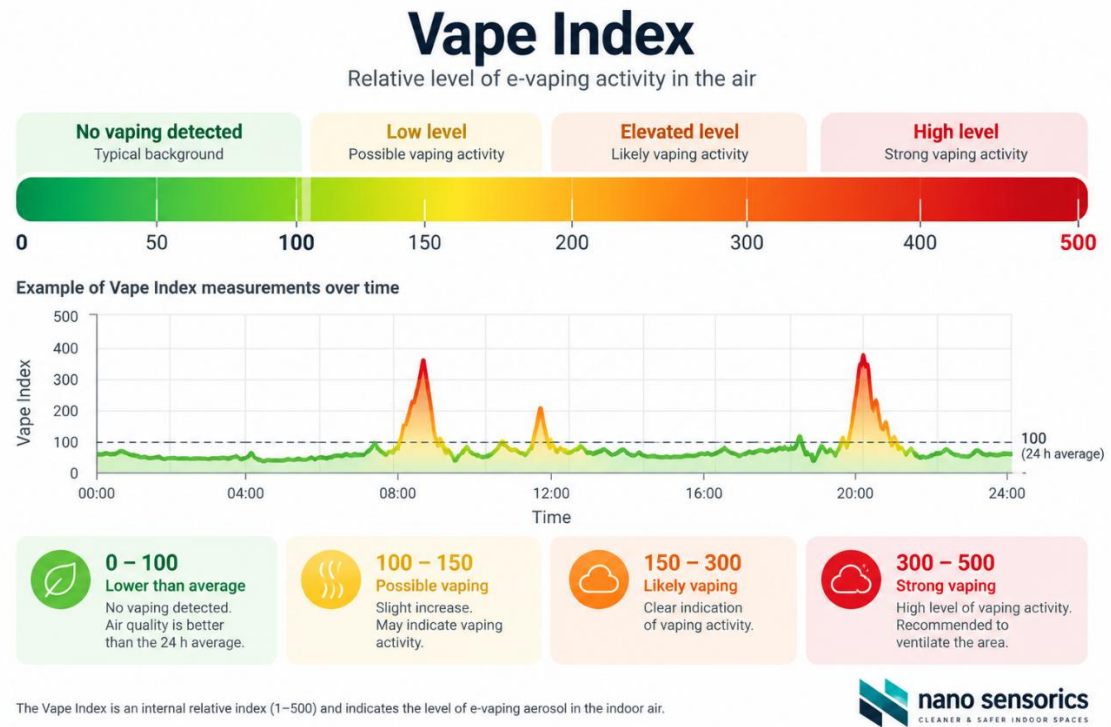


Fig.1. Vape index interpretation

The VAPELESS sensor detects aggression and violent activity using intelligent pattern-recognition algorithms. The system automatically analyzes acoustic patterns and applies a holistic detection approach to classify detected events using a Violence Index ranging from 0 to 11. Under normal ambient conditions, the Violence Index typically ranges from 0 to 5. Values from 5 to 7 may indicate low-level aggressive activity or minor impact events, while values from 7 to 9 indicate strong impact events, such as forceful striking or damage to property. Values from 9 to 11 indicate highly intense events, such as severe impacts, significant property damage, or loud shouting. Violence index interpretation presented in Fig. 2.

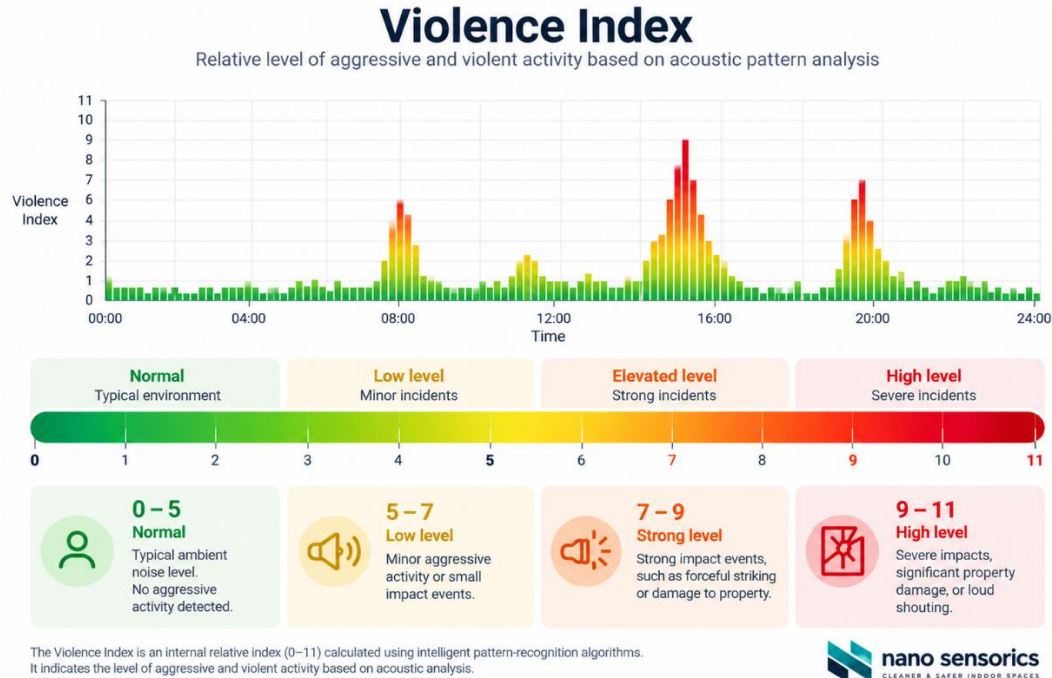


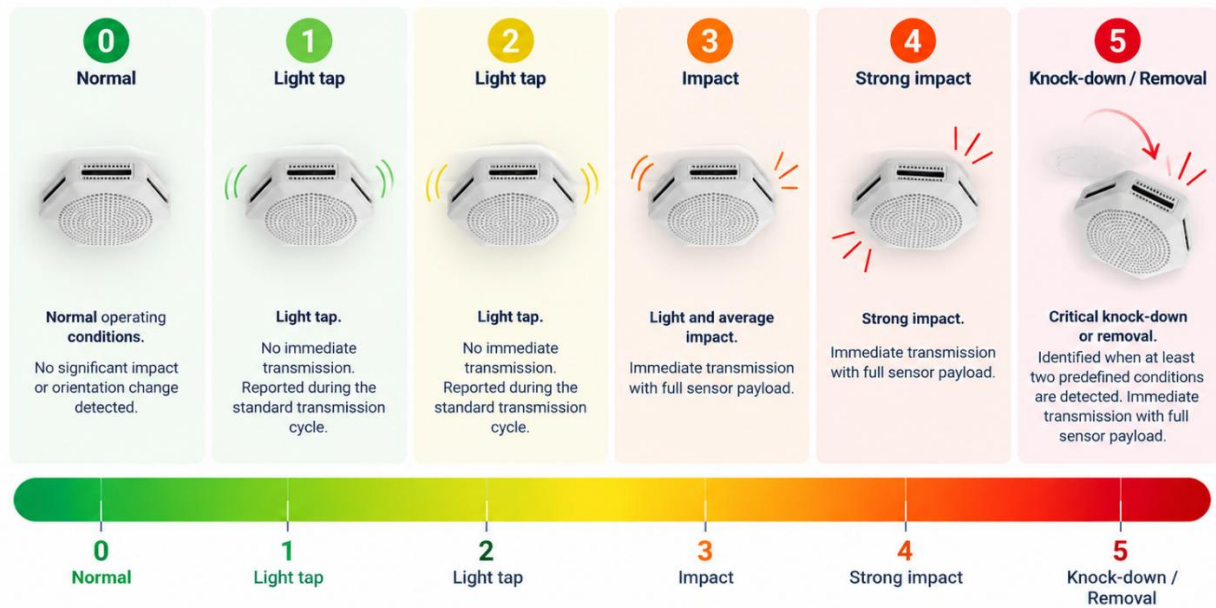
Fig.2 Violence index interpretation

VAPELESS PRO incorporates physical tampering, impacts, and device knock-down or fall events, even silent removal detection is integrated. The accelerometer data are internally evaluated and converted into a Tamper Index ranging from 0 to 5. A Tamper Index of 0 represents normal operating conditions, and no significant impact or orientation change detected. These conditions are continuously monitored but do not trigger an event transmission. A Tamper Index of 1-2 indicates a light tap. This event does not trigger an immediate transmission and is reported only during the standard transmission cycle. A Tamper Index of 3 indicates a light and average impact. A Tamper Index of 4 represents a strong impact. A Tamper Index of 5 represents a critical knock-down. This level is identified when at least two predefined conditions are detected, including an impact of approximately. A Tamper Index is sent with full sensor's payload when tamper index 3 is reached. Tamper index interpretation presented in Fig.3.



Tamper Index

Detection of physical tampering, impacts, and device removal



The Tamper Index is an internal relative index (0–5) calculated using intelligent pattern-recognition algorithms. It indicates the level of physical tampering, impact, or device removal. Detailed detection parameters are proprietary.

Fig.3. Tamper index interpretation

VAPELESS PRO measures the Volatile Organic Compounds (VOC) Index using an integrated advanced intelligent computational algorithm. The algorithm continuously evaluates VOC levels, adapts to the prevailing indoor environment, and maps detected VOC events to a VOC Index scale ranging from 1 to 500 points (see Figure below). A VOC Index value of 100 represents the average indoor VOC composition over the preceding 24 hours and serves as the reference baseline. Values above 100, up to 500, indicate a deterioration in air quality associated with increased VOC levels, while values below 100 indicate an improvement relative to the established baseline. VOC index interpretation presented in Fig.4.

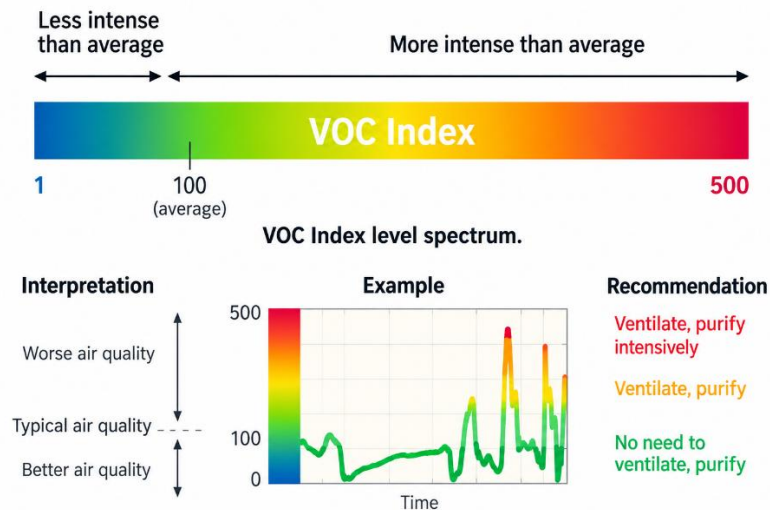


Fig.4. VOC index interpretation

If the sensor is disconnected from 12 V DC power supply, then the vape index value is sent 0. Automatic threshold selectively (according to running baseline characteristics) forces the send full payload then violence index value is increased.

The VAPELESS provides estimated concentration values for carbon monoxide (CO), ethanol, hydrogen (H₂), and ammonia (NH₃), expressed in parts per million (ppm). The measurements are continuously evaluated using an automatically adjusted baseline to account for changes in the ambient environment. These values are intended for indicative monitoring and event detection, and intensive chemical cleaning detection.

7. The main guide for installation

The VAPELESS PRO sensor must be installed reliably and with appropriate screws. The sensor must not be placed near any air vents windows, door openings where the constant fresh air flow is possible. The sensor is not suitable to be installed for the outdoor locations. The sensor cannot be stored at dusty or dirty areas with excess operation and storage temperature. The sensor is not washable, but paintable. The open holes of the case must not be blocked, glued with any material. Do not throw the battery into a fire to prevent the battery from exploding. Damaged batteries may also explode. All the above suggestions apply equally to your device, battery and accessories.

8. Maintenance

The VAPELESS PRO sensor is maintenance free except for the replacement of the batteries.

9. Calibration

Factory calibrates the VAPELESS PRO sensor when it is produced. The VAPELESS PRO sensor is maintenance-free in normal indoor environments due to the Nano sensorics integrated intelligent computational algorithms (AI) and holistic Automatic Baseline Correction (ABC) technology.

10. Regulations

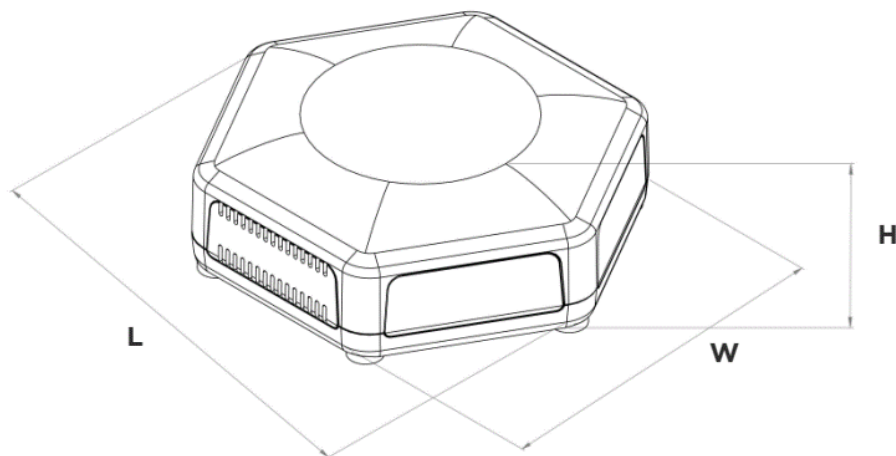
UAB "Nano sensorics" is the company which develops and produce highly innovative sensors with integrated intelligent computational algorithms (AI) enabling extremely low power data transmission. Declaration of conformity Hereby, UAB „Nano sensorics“ declares that VAPELESS PRO complies with the essential requirements and other relevant provisions of Directive CEM 2014/30/UE, BT 2014/35/UE, RED 2014/53/UE, CE, RoHS

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11. Sensor dimensions:



H: 45 mm
W: 130 mm
L: 146 mm

12. Important safety information

Read this manual before attempting to install the device. UAB „Nano sensorics” will not accept responsibility for any damage or injury resulting from not following the instructions in this manual.

- The sensor is for indoor use;
- Do not disassemble, crush, puncture, short internal circuits;
- Remove batteries if the sensor is not used, discharged battery has to be removed from the battery sensor, in this case left batteries might leak and damage the sensor;
- Keep the battery or device dry and away from water or any liquid as it may cause a short circuit;
- Replace batteries only with the same or equivalent type recommended by the manufacturer;
- Discard used batteries according to the manufacturer's instructions;
- Do not bend, deform, shred, microwave, paint the sensors, or other hardware;
- Do not insert external material into any opening on the sensors;
- Disassembling or puncturing the battery (whether integrated or removable) can cause an explosion or fire;
- Do not dry the sensors or battery with an external heat source such as a microwave oven or hairdryer;
- Observe proper precautions when handling batteries. Batteries may leak or explode if improperly handled;
- The sensor is not applied as metrological, commercial accounting purposes and UAB „Nano sensorics” will not be held liable for any damage which may result from inaccurate readings;
- Do not use any detergent or alcohol to clean the device;
- Clean gently with soft moisture cloth.
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13. Waste disposal

The sensor disposed according to the Waste Electrical and Electronic Equipment Directive, (WEEE Directive) 2012/19/EU. The sensor and its individual parts has to be disposed according to local laws and regulations your product should be disposed of separately from household waste and industrial waste. When this product reaches its end of life, you have to bring the sensor, its components to the collection point designated by local authorities in order to protect the environment and to reduce waste through recycling. The battery must be disposed of separately.



14. Sensor technical details

Sensing characteristics	
Vaping Index	ranging from 1 to 500 Vaping Index points
Vaping repeatability	<±5 of Vaping Index points
Violence detection	from 1 to 11
Temperature	-10 to +70 °C
Temperature Accuracy	Max '+/-0.2°C@ 0°C—70°C; Max '+/-0.3°C@ -10°C—0°C
VOC Index	ranging from 1 to 500 VOC Index points (PRO VERSION)
VOC repeatability	<±5 of VOC Index points
Humidity	0 to 100 % RH (non-condensing)
Humidity Accuracy	"±1.8%RH @20°C, >90% "±3%RH @20°C
Additional measured parameters	Ethanol, Hydrogen, Ammonia, CO/measured by ppms
Anti-tampering protection	Optionally, sensor has anti tamper function from silent tilting, turning, impacting (PRO VERSION), ranging from 1 to 5 tamper Index points
Mechanical specification	
Weight	Up to 230 g without batteries, up to 290 g with batteries
Dimensions	Up to 146 x 130 x 45 mm
Enclosure	Plastic
Storage Temperature	-40 to 70 °C
Sensor Power Supply	
Battery Type and voltage	2x3.6 V AA Lithium Battery ER14505 AA lithium batteries (3.6Vx 2700mAh/section) And external 12 V DC power supply
Expected Battery Life time	<10 years (Depending on configurations and environment)
Sensor logging Function	
Sampling Interval	Configurable via downlink configuration, NFC configuration is optional
Data Upload Interval	Configurable via downlink configuration, NFC configuration is optional
Radio / Wireless specification	
Wireless Technology	LoRaWAN® 1.0.3
Wireless Security	LoRaWAN® End-to-End encryption (AES-CTR), Data Integrity Protection (AES-CMAC)
LoRaWAN Device Type	Class A End-device

Supported LoRaWAN® features	Default - OTAA , Optional - ABP, ADR, Adaptive Channel Setup
Supported LoRaWAN® regions	EU863 – 870 Optional: US902 – 928, EU863 – 870, AU915 – 928, EU433, RU864, IN865
Link Budget	137 dB (SF7) to 151 dB (SF12)
TX Power	14dBm±1dBm (Region specific)
Rx Sensitivity	132 dBm (LoRa, Spreading Factor=12, Bit Rate=293bps) -118 dBm (FSK, Frequency deviation=5kHz, Bit Rate=1.2kbps)
Communication range	10 km (line-of-sight, actual transmission distance depends on the environment)

Downlink messages

The downlink data messages must be sent via port No. 3 (except CO alarm port) in the specific format. Minimal data size is 3 bytes.

Header	Payload length	Payload	
Settings ID	Settings data		
0xBA	1 byte	1 byte	0-n bytes

The downlink data messages are as follows:

Setting ID	Setting Length	Comment
0x1B	1 byte	LED control: • 0x00 – green LED OFF • 0x01 – green LED ON • 0x02 – green LED toggle for 5 s
0x1C	0 byte	Reset device
0x1D	2 bytes	Vaping / SPS trigger threshold. Sets the Vaping Index threshold value. Example: 140 DEC = 0x008C HEX.
0x1F	1 byte	Humidity alarm threshold in %RH. Example: 70% RH = 70 DEC = 0x46 HEX. Humidity alarm threshold in %RH. Configurable from 10% to 100% RH. Default threshold is 80% RH. The alarm is triggered when the measured humidity exceeds the configured threshold.
0x20	2 bytes	CO alarm threshold in ppm. Example: 5 ppm = 5 DEC = 0x0005 HEX. O alarm threshold in ppm. Configurable from 1 to 32000 ppm. When the measured CO value exceeds the configured threshold, the sensor sends alarm messages on LoRaWAN FPort 4 every 1 minute. The alarm condition ends

		when the CO value drops below the configured threshold or after 10 minutes. Values 0x0000 and 0xFFFF disable the CO alarm.
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The examples of the downlink single messages:

- BA021B01 – green LED ON.
- BA011C – Reset device.
- BA031D008C - last four numbers indicates the setting up vaping threshold index value of the downlink where 8C (HEX is 140 DEC (HEX)
- BA021F46 – last two numbers indicate the humidity alarm threshold value, where 46 (HEX) = 70 DEC = 70% RH.
- BA03200005 – last four numbers indicate the CO alarm threshold value, where 0005 (HEX) = 5 DEC = 5 ppm CO.
- BA03200005 – sets the CO alarm threshold to 5 ppm, where 0005 (HEX) = 5 DEC.
- BA03200000 – disables the CO alarm, where 0000 (HEX) = alarm OFF.
- BA0320FFFF – disables the CO alarm, where FFFF (HEX) = alarm OFF.

It is recommended to send downlink data messages each by each after setting actual operational validation. When downlink message is sent for the setting of the vaping threshold index value, the new index setting is deployed after time interval which is equal corresponds the data sending sequence in relation with time intervals. The forced new vaping threshold index value setting deployment can be performed after resetting the sensor in order to shorten new vaping threshold index value deployment time duration. The same logic applies when configuring other downlink parameters.

In case if downlink message is sent to the sensor working on “ABP” mode, the vaping threshold index value change will take effect only after the time interval equal to the previous time interval.

The example to send the downlink message through the “Things Of The Network”:

Uplink
Download

Schedule downlink

Insert Mode

☐ Replace downlink queue
☒ Push to downlink queue (append)

FPort *

Payload type

☒ Bytes ☐ JSON

Payload

The desired payload bytes of the downlink message

☐ Confirmed downlink

Schedule downlink

Transportation and Storage

Packed sensors may be transported in any type of covered vehicle. Equipment should be anchored reliably to avoid shock and possibility to shift inside vehicle. Sensors should be protected against mechanical damage and shock. No aggressive chemical substances should be stored together because of corrosion hazard.

Warranty

Manufacturer gives warranty that sensor parameters will meet the technical requirements, listed in the “Sensor technical details” paragraph of this document, if transportation, installation, storage and operation conditions will be followed. Warranty period is 12 months from manufacturing date, with additional possibility of extending it for additional charge. Warranty applies, when device is used as intended and if there was no tampering done with the device or other external damage done to the device from outside sources.