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 $\times \cdot i \sim$ triaxial inclinometer sensor

Contents

1	Lis	st of a	all messages Types	6				
2	Sa	Satevis® Device Startup : Which messages are transmitted ?						
3	Μ	lessag	ges Transfer Method : GET and POST	13				
4	Er	ror m	nessage	14				
5	He	ello N	Nessage	17				
	5.1	Н	Iello Message transmitted on-site	19				
	5.2	Н	Iello message requested Remotely	19				
6	Se	ensor	zeroing	21				
	6.1	Se	ensor zeroing messages (when sensor zeroing is done on monitoring site)	21				
	6.2	Se	ensor zeroing requested remotely	22				
7	Μ	lonito	pring mode	23				
	7.1	sl	low monitoring mode	23				
	7.2	A	larm mode	23				
	7.3	A	II the Timing values in Alarm mode	24				
	7.4	A	larm notification Rule	25				
	7.4	4.1	OR Alarm notification Rule	26				
	7.4	4.2	AND Alarm Notification Rule	27				
	7.5	A	larms Thresholds	28				
	7.	5.1	High Threshold Alarms	28				
	7.	5.2	Low Threshold Alarms	29				
	7.	5.3	Mixed High-Low Thresholds alarms	29				
8	Di	iagnos	stic Report	31				
	8.1	W	Vhich Information are transmitted frequently ?	31				



1 LIST OF ABBREVIATIONS AND ACRONYMS

LNS	Lora Network server
RSSI	Radio Signal Strength Indicator



2 LIST OF ALL MESSAGES TYPES

Message Type ID (by clicking on message type you will reach POST message related to Message Type)	Value	Uplink	Downlink	Related Sensor Type ID	Default LoraWan Port ID	Short description
Device Main Profile	0x11	POST	GET	all sensor type ID	0x0F	Fisrt Message Tx at startup - Important to build up Satevis profile on LNS/ cloud software
Sensor Profile	0x12	POST	GET	all sensor type ID	0x0F	Second Message Tx at Startup- Important to build up Satevis profile on LNS/ cloud software
System Diag Report	0x21	POST	GET	all sensor type ID	0x10	Cyclic Diag Report - Refresh rate can be remotely configured (SDRR) System Diag Report can be also transmitted on user request
Slow Monitoring' Message	0x22	POST	N.A.	all sensor type ID	0x12	Cyclic Data neasurement transmission , several measurement samples can be encapsulated in the message
Alarm Notification message ('Alarm Monitoring' mode)	0x23	POST	N.A.	all sensor type ID	0x12	Alarm notification transmitted in the case if an alarm threshold is reached based on the logical AND/OR alarm notification Rule and Thresholds Values
N.A for future applications	0x24	N.A.	N.A.	N.A.	0x12	Not available for future update
N.A for future applications	0x25	N.A.	N.A.	N.A.	0x12	Not available for future update

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Hello Data Transmission message	0x26	POST	GET	all sensor type ID	0x12	Hello Message transmitted: during startup, on GET request and after Sensor zeroing
Keep Alive Message ('Alarm Monitoring' mode)	0x27	POST	N.A.	all sensor type ID	0x12	Keep Alive data transmission in the case if there is no Alarm Threshold reached
LORAWAN Stack Info	0x30	POST	GET	all sensor type ID	0x13	LoraWan stack info (For security reasons Lora settings can be only changed from Satevis Link software). Only GET request is available
Monitoring Full Config	0x31	POST	POST, GET	all sensor type ID	0x13	All the Timing parameters related to Monitoring mode
Sensor Channel Alarm config	0x32	POST	POST, GET	all sensor type ID	0x13	Sensor Channel configuration including alarm thresholds type, and values
Monitoring Mode config	0x33	POST	POST, GET	all sensor type ID	0x13	Monitoring Mode configuration. Can be used to START/STOP the Monitoring application
System Diag Settings	0x34	POST	POST, GET	all sensor type ID	0x13	System diag refresh rate configuration
Hardware Reset Request	0x35	POST	POST	all sensor type ID	0x13	Remote Request to RESET Satevis device
LoraWan RejoinFrequ config	0x36	POST	GET, POST	all sensor type ID	0x13	Configuration related to LoraWan Rejoin cycle

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N.A for future applications	0x37	N.A.	N.A.	N.A.	0x13	Not available for future update
Clock Source config	0x38	POST	GET, POST	all sensor type ID	0x13	Configuration related to clock source. Currently only LNS Clock source is available
Sensor calib. Config	0x39	POST	GET	all sensor type ID	0x13	Date of calibration for all the sensor channels
N.A for future applications	0x3A to 0x4F	N.A.	N.A.	N.A.	0x13	Not available for future update
DataLogger Config	0x50	POST	POST, GET	all sensor type ID	0x11	Datalogger settings
DataLogger Status	0x51	POST	GET	all sensor type ID	0x11	Provides datalogger status

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Error Status	0xFF	POST	N.A.	all sensor type ID	0x13	Error status tramsitted by Satevis device if the GET/POST message transmitted by the LNS is not correct
Disp Sensor Zeroing Results	0x65	POST	POST, GET	Only Distance and Displacement sensors ID range 0x7x	0x13	Transmits offsets values on Displacement/Distance sensor
Disp Sensor Zeroing config	0x64	POST	POST, GET	Only Distance and Displacement sensors ID range 0x7x	0x13	Enable/Disable Displacement/Distance sensor zeroing
IR Temp config	0x63	POST	POST, GET	Only IR sensor ID 0x15	0x13	IR Temperature sensor config
Inclino sensor config	0x62	POST	POST, GET	Only Motion sensors ID Range 0x3x	0x13	Inclinometer sensor range config
Inclino Sensor Zeroing Results	0x61	POST	GET	Only Motion sensors ID range 0x3x	0x13	Transmits offsets values on Inclinometer sensor
Inclino Sensor Zeroing config	0x60	POST	POST, GET	Only Motion sensors ID Range 0x3X	0x13	Enable/Disable Inclinometer sensor zeroing

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Field Type

Messages type transmitted by satevis device duing startup

Message Type related to data measurement and diag transmitted frequently (user configurable)

Message Type Posted during Init or on User Request(Push Button)

Message Transmitted during Init or frequently (user configurable)

Remote device config. Transmitted only on GET request from LNS

Datalogger config & status

Error Message

Specific sensor config or Status

N.A. - for future applications

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3 SATEVIS® DEVICE STARTUP : WHICH MESSAGES ARE TRANSMITTED ?

At device startup, the following messages are automatically transmitted to the cloud software:

- Main Profile: Contains the Satevis[®] Device ID, version IDs (Hardware, Firmware, Lora Stack), Lorawan[®] Settings, and timing parameters for various monitoring modes.
- Sensor Profile: contains all the sensor channels profile connected to Satevis[®] Device, this will allow the user to create a database on the cloud software containing the Sensor Type, Conversion Method to the physical unit
- Hello Message: contains first data measurement and a quick diagnostic for every sensor channel

Satevis® device will receive a clock synchronization message from LNS on PORT 202.

When Profile Information is transmitted, Satevis[®] device starts to send Hello Message followed by System Diagnostic Report, confirming the device is working properly.

Clock synchronization is a critical function used on data timestamping and alarm management. Ensure your LNS (LoRaWAN[®] Network Server) supports clock synchronization on PORT 202, as this feature is included in recent and popular LNS. This service doesn't need specific development on your side.

For more information about Clock synchronization, please read Lora Alliance Spec : click here





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4 MESSAGES TRANSFER METHOD : GET AND POST

To facilitate data exchange, a message transfer method inspired by the HTTP protocol has been implemented:

GET request

GET Request is transmitted by the LNS to read Satevis[®] device status or currents settings, Satevis[®] device will answer with a POST request



POST Request

A POST request can be transmitted by the Satevis[®] device to the cloud software, and it includes the following:

- Device profile at Startup,
- Device current configuration (as a response to a GET request)
- Diagnostic
- Data Measurement

When POST request is transmitted by Cloud software it contains:

- New device settings (ex: alarms thresholds, new measurement mode.....)
- Initiate datalogger download



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5 ERROR MESSAGE







6 HOW MESSAGES ARE ORGANIZED

Every message comes with a Header followed by Payload Data.



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7 MESSAGES TRANSMITTED DURING SATEVIS DEVICE STARTUP

After powering on your Satevis[®] device, If the Lorawan[®] Join Process is successful, the following messages are transmitted





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7.2 HELLO MESSAGE





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7.3 HELLO MESSAGE TRANSMITTED ON-SITE



Caption 1: After installing the Alpha-Inc-Kompakt inclinometer, the field operator can check at any moment if the sensor is working properly



Caption 3: The Activity Led blinks in green color, confirming that a data measurement is transmitted to the Lorawan network.



Caption 2: By Holding the magnet on the 'Hello' label for more than 5s, the sensor wakes-up and transmits to the Lorawan network the data measurement followed by the system diagnostic (battery status and network quality)



Caption 4: The field operator can check on Satevis® Cloud software (or a third-party cloud software) if his sensor is working properly.

7.4 HELLO MESSAGE REQUESTED REMOTELY

User can also send a GET request to receive Hello Message:



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8 SENSOR ZEROING

8.1 SENSOR ZEROING MESSAGES (WHEN SENSOR ZEROING IS DONE ON MONITORING SITE)



Caption 1: Even if an angle bracket is used, it's sometimes difficult to bring a zero-offset on both X and Y axis (in the case if Z axis is on the same direction than Earth Gravity). In some cases, the field operator can not spend too much time on this task.



Caption 3: The Activity LED blinks in blue, the sensor zeroing starts on both X and Y axis . When this process is done, the Activity led will blink again in blue color and transmits a data measurement to the Lorawan® network. If the sensor zeroing process is not done correctly (the device is moving) the Activity Led will blink in Red color.



Caption 2: To enable the sensor zeroing function, hold the magnet on 'Sensor Zeroing" Label for more than 20s.



Caption 4: The Sensor-zeroing process can be also done remotely from the cloud software.





8.2 SENSOR ZEROING REQUESTED REMOTELY (MESSAGE TYPE 0X60)

Sensor zeroing can also be done remotely from your LNS, there is no need to send a technician on the monitoring to do this operation.





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9 ALL THE MONITORING MODE EXPLAINED

9.1 SLOW MONITORING MODE

User-configurable settings related to Slow Monitoring Mode:

- MRR Monitoring Refresh Rate
- Max Number of data samples per sensor channel in a transmission message (NB_MON_DATA_SAMPLES)



Gives the date of first measurement sample

How to get the date of Last Measurement sample:

Date_Sample_N = DATE_FIRST_SAMPLE + MRR (seconds)

9.2 ALARM MODE

Three level of Alarm notifications can be transmitted to cloud software Minor/Severe/Critical.

Several settings are available for an accurate alarm configuration:

- Low or High Alarms Thresholds can be configured;
- For a real-time alarm tracking, the Monitoring refresh cycle can be accelerated when a threshold is reached,
- Alarms can be independently enabled/disabled on the measurement channels;

User can create 'OR' or 'AND' alarm notification rule between each measurement channel .

If the Alarm threshold is not reached:

• Satevis[®] device transmits frequently a Keep Alive Message to keep informed the user about the device operation;



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• For each measurement channel, Max/Min/Average values and Latest measurement are encapsulated in the Keep Alive Message;

9.3 ALL THE TIMING VALUES IN ALARM MODE

- AMRR (Alarm Monitoring Refresh Rate) : In the case of an Alarm threshold is reached , the monitoring rate is accelerated to track closely the alarm evolution;
- MRR (Monitoring Refresh rate) : In the case if an Alarm threshold is not reached, the device monitors an alarm at a slower rate





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9.4 ALARM NOTIFICATION RULE

Two alarms notifications rules are present:

- Logical 'OR' Alarm Notification: An alarm notification is sent to the cloud software if a Minor, Severe, or Critical Threshold is reached on any of the sensor channels (Alarm Notification should be enabled on the sensor channel).
- Logical 'AND' Alarm Notification: An alarm is sent to cloud software if Minor/Severe/Critical thresholds are reached on all sensor channels simultaneously (Alarm notification must be enabled on each sensor channel).



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9.4.1 OR Alarm notification Rule





9.4.2 AND Alarm Notification Rule

Logical 'AND' alarm notification rule can be enabled if a correlation is present between the sensor channels. Example of an Inclinometer sensor combined with structure/equipment temperature, a temperature raise on the structure can lead to its deformation.

Example 1: No Alarm notification is transmitted to cloud software as on Sensor Channel 2 , Minor/Severe/Critical Thresholds were not reached.



Example 2 : An alarm notification is transmitted to cloud software as all the sensor channels reached a Minor/Severe/Critical Thresholds.





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9.5 ALARMS THRESHOLDS

Three levels of alarms notifications are available allowing users to redirect the alarm notification to different emails or to activate a relay:

- Minor level: lowest level of alarm,
- Severe level: medium level of alarm notification
- Critical level: critical level, field intervention is requested

User can configure High/Level Thresholds alarms, explained hereafter.

9.5.1 High Threshold Alarms

High thresholds alarms can be used to trigger an alarm when a data measurement is rising. Example of temperature sensor:





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9.5.2 Low Threshold Alarms

Low thresholds alarms can be used to trigger an alarm when a data measurement is falling. Example of Temperature sensor :



9.5.3 Mixed High-Low Thresholds alarms

Mixed High-Low can be used for sensors used to track a structure/equipment moving to one direction and the opposite.

Mixed High Low Threshold are only available for Inclinometer and Displacement sensor Channels.



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10 DIAGNOSTIC REPORT

10.1 WHICH INFORMATION ARE TRANSMITTED FREQUENTLY ?

Internal Temperature for Battery Monitoring and internal sensor drift	Battery Diag: Status, Voltage, Level	Data Logger Status & Memory used
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Power source update (USB Power/Battery or other mains power if available)

