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P/N:	Tracker TRK31 - TRK33
Author:	AC

Tracker TRK31 - TRK33
Product Specification

Revisions

Revision	Issue Date	Author	Comments
1.0	August 23, 2011	AC	
1.1	January 1st, 2017	AC	TRK41 removed

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1   Introduction

Object:
Define the product specifications in term of physical dimensions, aperture and casing, performance and data format.

The main features are:
- Integrated sensors:
    o **3 axis accelerometer**
    o **temperature**
    o **humidity**
    o **luminosity**
- Measurements are stored and time stamped in the Tracker memory
- Measurements can be downloaded to a Personal Computer through radio link. The PC has to be equipped with a Newsteo radio bridge (standard RF-to-USB Key) and the RF Monitor software.

2 models of the same product are available. The differences are the following ones. All the other features are the same for the three models.

Model	Battery	Antenna
TRK31	3 primary AA 1.5V industrial batteries	Internal antenna
TRK33	1 AA Lithium Thionyl battery (allowing larger operating temperature)	Internal antenna

2   General TRK operation

The Tracker monitors the following parameters:
- Temperature, humidity, dew point, luminosity: measurements performed at a fixed frequency, defined by the user.
- Attitude (inclination of the product on 3 axes): measurement performed at a fixed frequency, defined by the user.
- Shocks: when the acceleration threshold (set by the user) is exceeded on any axis, the event is recorded into the tracker memory.
- Light event: if the product is suddenly exposed to light, it detects the change of light status
- Free fall: the product is able to calculate the height of a free fall, when a free fall is detected.

2.1 Periodic measurements (Temperature, humidity, dew point, luminosity, attitude, accelerations)

The frequency is user-defined.
Measurements are recorded into the tracker memory with the following format:

YEAR	MONTH	DAY	HOUR	MIN	SEC	TEMP (°C)	HUM (%)	Dew Point (°C)	Lum
2009	3	4	10	00	00	28	43	15	10

X(G)	Y(G)	Z(G)	AngleX(°)	AngleY(°)	AngleZ(°)				
0	0	0	0	90	-90				

Figure 1: Example of periodic measurement

2.2 Shock measurement

This measurement is done by a 3 axis accelerometer. The measurement unit is the g.
The accelerometer sensor is constantly running which guarantees that no shock can be missed. Once the user-defined threshold is exceeded, the following data are stored:
- Maximum shock level reached on each axis(g) and norm of the shock (g)
- Duration of the shock (ms)
- Energy on each axis (J / kg) and norm of the Energy (J / kg)
- Current temperature, humidity and luminosity level

YEAR	MONTH	DAY	HOUR	MIN	SEC	XMAX(G)	YMAX (G)	ZMAX(G)	Shock duration (ms)	Shock norm(G)	Ex(J/Kg)	Ey(J/Kg)	Ez(J/Kg)	Energy norm(J/Kg)
2009	3	4	10	52	48	8,1	7,6	6,575	1750	12,907	1650,1	884,744	1650,1	2495,682
						TEMP	HUM	LUM						
						28	42	10						

Figure 2: Example of shock measurement

2.2.1 Scheme of the shock storage

NOTA: if the acceleration threshold is too low, there will be many recorded alerts which will quickly fill the tracker memory.
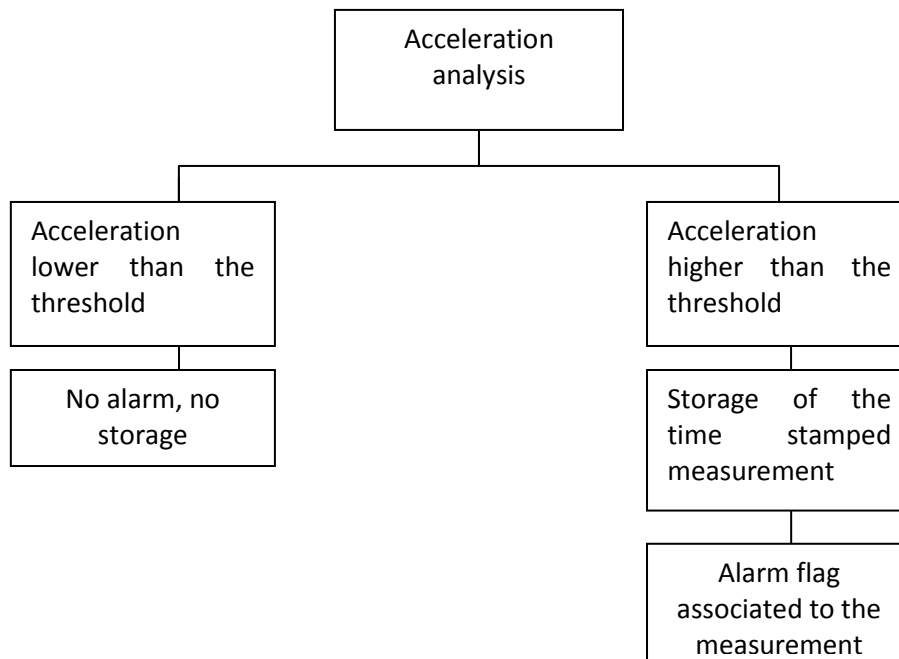
```
                    ┌─────────────────┐
                    │  Acceleration   │
                    │    analysis     │
                    └─────────────────┘
              ┌────────────┴────────────────┐
    ┌──────────────────┐          ┌──────────────────┐
    │  Acceleration    │          │  Acceleration    │
    │  lower than the  │          │  higher than the │
    │  threshold       │          │  threshold       │
    └──────────────────┘          └──────────────────┘
    ┌──────────────────┐          ┌──────────────────┐
    │  No alarm, no    │          │  Storage of the  │
    │  storage         │          │  time stamped    │
    └──────────────────┘          │  measurement     │
                                  └──────────────────┘
                                  ┌──────────────────┐
                                  │  Alarm flag      │
                                  │  associated to   │
                                  │  the measurement │
                                  └──────────────────┘
```

Figure 3: Scheme of the shock storage

2.3 Free fall measurement

This measurement is done by a 3 axis accelerometer. The measurement unit is the centimeter. If the accelerometer detects no acceleration, it means that the product is in free fall. The tracker is then able to calculate the height of the free fall.

2.4 Product startup

The product is delivered without batteries inside (the batteries are delivered separately).
As soon as the product is powered (batteries inserted), the product starts communicating by radio (Live Mode). **To start recording, it is needed to send it an order, through the RF Monitor software.**

2.5 Product settings

The product has two operation modes:
- **Live Mode**: the product does not store measurement; it just sends the current measurements by radio. This mode allows the user:
    o to check that the tracker is working well
    o to configure the tracker
    o to download or erase the measurements stored in the tracker memory

- **Record Mode**: the product records shocks, attitude, temperature, humidity and luminosity. Its parameters cannot be changed in this mode.

The user has to send commands through the RF Monitor software and the radio bridge (RF-to-USB Key) in order to change the mode of operation.

Configuration of the product must be done in Live mode. The user has to set:
1. The Shock threshold (in g). An alarm will be recorded if an acceleration, on any one axis, is greater than this threshold.
2. The temperature, humidity and luminosity thresholds.
3. The attitude, temperature, humidity and luminosity record frequency (From 1 minute up to 4 hours)
4. Set the tracker's real time clock: if the product is not powered, it will keep the time (a backup battery is integrated to the product)
5. **Before starting a new campaign it is recommended to delete the measurements already stored (if any) in the Tracker. Indeed, when the memory is full, the Tracker stops recording to be sure not to delete data.** Only measurements that have already been downloaded to a PC can be removed.

To start the recording campaign, the user has to switch the product into Record Mode by sending a radio command through RFMonitor software.

2.6 Memory download

1. Set the Tracker from Record Mode to Live mode
2. Click on Download
3. All the measurements are then downloaded and available:
    a. In the database included in RF Monitor. It is then possible to use filters to sort the data.
    b. In a CSV file (compliant with Excel)
    c. In a PDF report

To start a new campaign, it is necessary to delete first the data and then to pass the Tracker in Record mode.

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3 Technical characteristics

3.1 General characteristics

General characteristics	TRK31	TRK33
RTC	Real Time Clock integrated for measurement time stamping. Resolution: 1s Maximum drift : 2 minutes / month at 25 °C	
Power supply	3 primary AA 1.5V, industrial range	1 x Lithium Thionyl Battery Size AA
Autonomy @25 °C	6 months with a frequency of one measure every 10 minutes	6 months with a frequency of one measure every 10 minutes
Operating temperature range	-10 to +60 °C (with compliant industrial batteries) Recommended temperature range for maximizing product autonomy: +5°C to +35°C.	-40°C to 85°C Recommended temperature range for maximizing product autonomy: +5°C to +35°C.
Flash memory	4Mbits Flash meaning 32256 measure blocks (shocks take 2 blocks) For example, it allows in a single measure campaign of 6 months: 1 attitude and temperature measure every 15 minutes (17 856 records) 7 200 shock records	
Wireless communication	Operating on the ISM band This device is designed for European market (uses 868MHz band). *A new device will be developed for both European and US market (868 & 915 MHz band).*	
Antenna	Internal antenna	
RF range	40 meters in free space (with ¼ wavelength antenna on the RF-to-USB key)	

3.2 Physical description
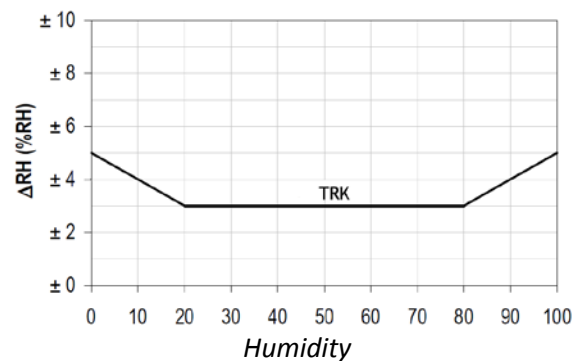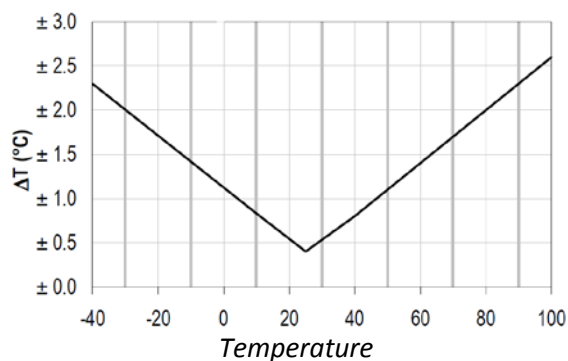

Figure 4: TRK31 – TRK33 picture

General characteristics				
Color	**Black**			
Casing features	**The casing integrates 2 holes for fixation on a wall or inside a parcel.**			
Dimensions (without antenna)		Without flanged lid	Flanged lid included	
	Length	84,80 mm	110,00 mm	
	Width	56,00 mm	56,20 mm	
	Height	22,00 mm	26,2 mm	
Weight	**About 160g (including batteries)**			
IP level	**IP54, cannot be used in a condensing area**			

3.3 Performance of the accelerometer sensor

Accelerometer	
Sensor	1 accelerometer measuring 3 axis (XYZ)
Sensor range	-6g to +6g on each axis
Accuracy at 25°C	Static: 0,06g Dynamic: 0,5g
Calibration	Calibration done in factory by the manufacturer
Bandwidth	320 Hz
Measurement frequency	In Live mode only : 7 measurements and transmissions per second in live mode 44 measurements and transmissions per second in live booster mode

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3.4 Performance of the temperature and humidity sensor

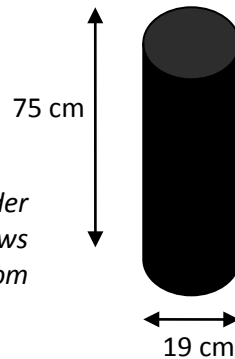| Temperature & Humidity	
Sensor range	See below
Accuracy	See below
Resolution	Temperature @10 bits Humidity @8 bits
Response time	Temperature : between 10 and 20 min Humidity ≤10 min Dew point: between 10 and 20 min
Calibration	The integrated sensor is a digital sensor. The level of accuracy of the sensor is factory certified by the sensor manufacturer, excepting contamination by a chemical product such as solvent, alcohol or silicone that may damage the humidity sensor.
Sensor drift	Temperature: not significant drift during 4 years as the sensor does not undergo a change greater than 125 °C, no guarantee beyond Humidity: loss of accuracy less than 0.5% per year (without contamination) for 4 years, no guarantee beyond

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3.5 Performance of the light sensor

Light sensor	
Sensor range	0 to 220 Lux
Accuracy	± 30 Lux at 90° of incidence
Resolution	8 bits
Response time	<0,1s
Calibration	See below

Important remark on calibration of the light sensor:
The light sensor has been calibrated in accordance with the following installation:

Ambient Light at 90° of incidence (radiated into the cylinder)

75 cm

Empty cylinder without cover (allows light to enter from top)

At the bottom of the black cylinder, we put the TRK313 and a VOLTCRAFT LUXMETER MS-1300.

19 cm

4 Batteries recommendations

4.1 TRK31

The product is delivered with 3 batteries.

Use only 3 **primary** AA 1.5V industrial batteries!
Validated models: Varta Industrial ref 4006 or higher
>2000 mAh batteries.
Industrial range (-20 -> +85°C).

If you use a non industrial battery, its temperature of functioning won't be the same (-20°C to + 60°C only).
DON'T USE Rechargeable (secondary) NiCd or NiMh batteries.

4.2 TRK33

The Tracker is delivered with 1 battery.
The same battery has to be used in case of battery exchange (1 x Lithium Thionyl Battery Size AA).