Industrial Tracker

Reference Manual

Model Name: TNIT100

Table of Contents

1. Description

The Industrial Tracker is a general-purpose tracker, designed for GPS tracking on various applications: bicycles, cars, or pets. It is equipped with GPS and 3-axis accelerometer, which provides a much more cost-effective way for service providers to deploy this for tracking applications than to use the GPRS network.

2. Specifications

2.1 Mechanical

2.1.1 Sensor

Length x Width x Height	107mm x 52mm x 27mm
Weight	35g without battery 45g with batteries
Sensor	• GNSS module • 3D MEMs accelerometer • Hall-effect
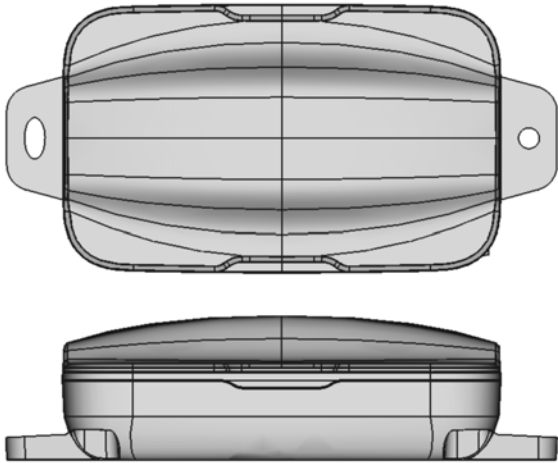
2.2 Environmental

Temperature	-20°C to +70°C
IP Rating	IP 66 equivalent

2.3 Radio

Frequency	• 863–870MHz for EU • 902–928MHz for North America
Tx Power	+19dBm conducted
Rx Sensitivity	-138dBm conducted
Antenna Gain	0dBi Peak, -3dBi Avg

2.4 Certifications and Conformity

FCC ID: 2AMUGTNIT100

IC: 22980-TNIT100

ANATEL

ROHS REACH

CE

2.5 Power

Source	3.6V ½ AA Li-SOCl2 1200mAh battery (*2)
Maximum Voltage	3.6V
Minimum Voltage	3.1V
Current	170mA max / 5uA minimum

2.6 Battery Life

Configuration	Estimated Lifetime
96 transmits per day	About 1 month
24 transmits per day	About 4 months
12 transmits per day	About 7 months
2 transmits per day	About 24 months

2.7 User Interface

LEDs	One green LED

2.8 Additional Features

PCB Temperature	NTC 100k ohm
Battery Monitoring	Resistor divider

3. Operation

3.1 Shipping Mode

When industrial trackers leave the factory, they are put into shipping mode, where the sensor is hibernating without functionality to prevent radioactivity and minimize battery usage. Devices are delivered in this mode.

3.2 User Mode

This mode is active when the device is in normal operating mode. To enter user mode from shipping mode, the user shall place a magnet near the hall sensor for at least 10 seconds. The LED will light continuous for 3 seconds indicating it is awake. There are two behaviors in user mode: stationary and moving.

3.2.1 Stationary Mode

1. Wake up every 15 minutes, and turn on GPS.
2. Analyze satellite status 5 seconds:
    a. If the number of satellites is less than 3, and the signal strength is lower than 20, it will turn off GPS and do LoRa uplink immediately.
    b. Or continuous positioning for 60 seconds, and then turn off the GPS and do LoRa uplink.
3. Set timer for the next round.
4. Enter moving mode when the g-sensor is triggered.
    a. Trigger condition: continuous triggering over 3 seconds.
    b. Immediately send an uplink when the mode changes from stationary to moving mode.

3.2.2 Moving Mode

1. LoRa uplinks every 60 seconds.
2. Turn on GPS every 5 minutes, and analyze satellites status 10 seconds:
    a. If the number of satellites is less than 3, and the signal strength is lower than 20, it will turn off GPS immediately.
    b. Or continuous positioning for 60 seconds, and then stop the GPS.
    c. If the GPS position is fixed in 60 seconds, the device will never close GPS until 2-a checking or entering the stationary mode.

3. Enter stationary mode when the device is not moving over 30 seconds (g-sensor is not triggered).

4. Messages

4.1 Uplink Payload

Port	136
Payload Length	11 bytes

Byte	1	2	3	4	5	6	7	8	9	10	11
Field	Status	Battery	Temp.	Lat				Long			

Status	**Sensors status**	
	Bit [0]	1 - moving mode, 0 - stationary mode
	Bit [2:1]	RFU
	Bit [3]	1 - no GNSS fix, 0 - GNSS fixed
	Bit [4]	1 - GNSS error, 0 - GNSS OK
	Bit[7:5]	RFU
Battery	**Battery level**	
	Bits [3:0]	unsigned value v, range 1 – 14; battery voltage in V = $(25 + v) \div 10$.
	Bits [7:4]	RFU.
Temp	**Temperature as measured by on-board NTC**	
	Bits [6:0]	unsigned value т, range 0 – 127; temperature in °C = т - 32.
	Bit [7]	RFU
Lat	**Latitude as last reported by GNSS receiver**	
	Bits [27:0]	signed value φ, little-endian format, range -90,000,000 – 90,000,000; WGS84 latitude in ° = φ ÷ 1,000,000. *Note: little-endian format. Example: 16 83 7b 01 → Lat = 01 7b 83 16 = 24871702 ÷ 1000000 = 24.871702
	Bits [31:28]	RFU

Long	**Longitude and position accuracy estimate as last reported by GNSS receiver**	
	Bits [28:0]	signed value λ, little-endian format, range -179,999,999 – 180,000,000; WGS84 longitude in ° = λ ÷ 1,000,000. *Note: little-endian format. Example: 0d 72 36 07 → Long = 07 36 72 0d = 121008653 ÷ 1000000 = 121.008653
	Bits [31:29]	unsigned value α, range 0-7; position accuracy estimate in m = $2^{\alpha+2}$ (max). The value 7 represents an accuracy estimate of worse than 256m.

Note: If there is no GNSS fix (see sensor status), the Lat and Long fields contain the last values reported by the GNSS receiver. If there has never been a GNSS fix acquired, the values may both be 0.

5. Battery

5.1 Replacement

Use ER14250 or equivalent.
Remove the screw and replace both batteries.
Do not mix old and new batteries.

5.2 Cautions

CAUTION: Disposal of a battery (or battery pack) into a fire or a hot oven, or mechanically crushing or cutting of a battery (or battery pack) can result in an EXPLOSION!

Leaving a battery (or battery pack) in an extremely high temperature surrounding environment can result in an EXPLOSION or leakage of flammable liquid or gas.

A battery (or battery pack) subjected to extremely low air pressure may also result in an EXPLOSION or leakage of flammable liquid or gas.
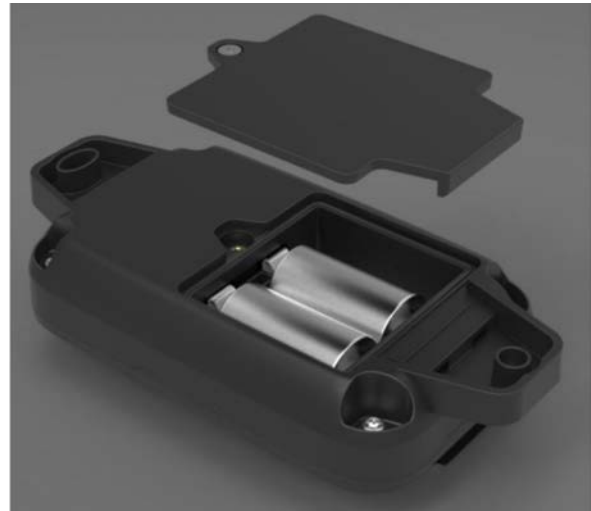
Discard used batteries according to the manufacturer's instructions.

CAUTION: The unit is provided with a battery-powered circuit.

There is a danger of explosion if the battery is incorrectly replaced.

Replace only with the same or equivalent type recommended by the manufacturer. Discard used batteries according to the manufacturer's instructions.

Risk of Explosion if Battery is replaced by an Incorrect Type. Dispose of Used Batteries According to the Instructions.
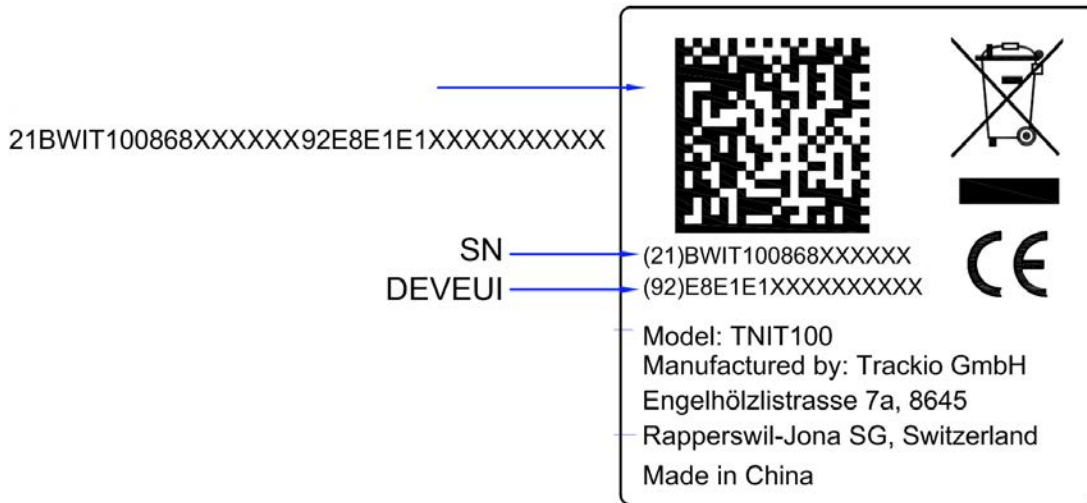
6. Label format information

6.1 DevEUI Label

E8E1E1XXXXXXXXXX

Uses a hexadecimal representation resulting in 16 characters.

6.2 Unit Label

Definition of the unit label:

GS1 DataMatrix

- The GS1 Application Identifier (21) indicates that the GS1 Application Identifier data field contains a serial number.
- The GS1 Application Identifier (92) assigned to the company's internal information is DevEUI.

7. Important Product & Safety Instructions

For the most current and more detailed information about Tabs features and settings as well as safety instructions, please download the user manual for the products online at www.browan.com before the use of any Tabs products or services.

Certain sensors contain magnets. **Keep away from ALL Children!** Do not put in your nose or mouth. Swallowed magnets can stick to intestines causing serious injury or death. Seek immediate medical attention if magnets are swallowed.

These products are not toys and contain small parts that can be dangerous to children under 3 years old. Do not allow children or pets to play with products.

Observe proper precautions when handling batteries. Batteries may leak or explode if improperly handled.

Observe the following precautions to avoid a sensor explosion or fire:
- Do not drop, disassemble, open, crush, bend, deform, puncture, shred, microwave, incinerate, or paint the sensors, Hub, or other hardware.
- Do not insert foreign objects into any opening on the sensors or Hub, such as the USB port.
- Do not use the hardware if it has been damaged—for example, if cracked, punctured, or harmed by water. 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.

8. Warnings

- Do not place naked flame sources, such as lighted candles, on or near the equipment.
- The battery shall not be exposed to excessive heat such as sunshine, fire, or the like.
- Do not dismantle, open or shred battery pack or cells.
- Do not expose batteries to heat or fire. Avoid storage in direct sunlight.
- Do not short-circuit the battery. Do not store batteries in a box or drawer where they may short-circuit each other or be short-circuited by other metal objects.
- Do not remove a battery from its original packaging until required for use.
- Do not subject batteries to mechanical shock.
- In the event of a battery leaking, do not allow the liquid to come in contact with the skin or eyes. If a contact has been made, wash the affected area with copious amounts of water, and seek medical advice.
- Do not use any charger other than that specifically provided for use with the equipment.
- Observe the plus (+) and minus (-) marks on the battery and equipment and ensure correct use.
- Do not use any which is not designed for use with the product.
- Do not mix cells of different manufacture, capacity, size, or type within a device.
- Keep batteries out of the reach of children.
- Seek medical advice immediately if a battery has been swallowed.
- Always purchase the correct battery for the equipment.
- Keep batteries clean and dry.
- Wipe the battery terminals with a clean dry cloth if they become dirty.

9. Notices

- Avoid exposing your sensors or batteries to very cold or very hot temperatures. Low or high-temperature conditions may temporarily shorten the battery life or cause the sensors to temporarily stop working.
- Take care in setting up the Hub Gateway and other hardware. Follow all installation instructions in the User Guide. Failure to do so may result in injury.
- Do not install hardware equipment while standing in water or with wet hands. Failure to do so can result in electric shock or death. Use caution when setting up all electronic equipment.
- When charging the sensors, do not handle the sensors with wet hands. Failure to observe this precaution could result in electric shock.

- PROP 65 WARNING: This product contains chemicals known to the State of California to cause cancer and birth defects or other reproductive harm
- Cleaning Tabs Products: Use a clean dry cloth or wipe to clean Tabs products. Do not use detergent or abrasive materials to clean the Tabs products, as this may damage the sensors.

10. Cautions

CAUTION: Disposal of a battery (or battery pack) into a fire or a hot oven, or mechanically crushing or cutting of a battery (or battery pack) can result in an **EXPLOSION!**

Leaving a battery (or battery pack) in an extremely high temperature surrounding environment can result in an **EXPLOSION** or leakage of flammable liquid or gas.

A battery (or battery pack) subjected to extremely low air pressure may also result in an **EXPLOSION** or leakage of flammable liquid or gas.

Discard used batteries according to the manufacturer's instructions.

CAUTION: The unit is provided with a battery-powered circuit.

There is a danger of **EXPLOSION** if the battery is incorrectly replaced.

Replace only with the same or equivalent type recommended by the manufacturer. Discard used batteries according to the manufacturer's instructions.

Risk of **EXPLOSION** if Battery is replaced by an Incorrect Type. Dispose of Used Batteries According to the Instructions.

11. Regulatory

CE **FC**	Hereby, Browan Communications Inc. declares that the radio equipment for Tabs products complies with Directive 2014/53/EU. This device complies with Part 15 of the FCC Rules and RSS Standards of Industry Canada. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
[crossed-out wheelie bin symbol]	This symbol means that according to local laws and regulations your product should be disposed of separately from household waste. When this product reaches its end of life, take it to a collection point designated by local authorities. Some collection points accept products for free. The separate collection and recycling of your product at the time of disposal will help conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment.

11.1 Federal Communication Commission Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

-     Reorient or relocate the receiving antenna.
-     Increase the separation between the equipment and receiver.
-      Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
-     Consult the dealer or an experienced radio/TV technician for help.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

 This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

 IMPORTANT NOTE:

 Radiation Exposure Statement:

The product complies with the US portable RF exposure limit set forth for an uncontrolled environment and is safe for intended operation as described in this manual. Further RF exposure reduction can be

achieved if the product can be kept as far as possible from the user body or set the device to lower output power if such a function is available.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

11.2 Industry Canada statement:

This device contains license-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's license-exempt RSS(s). Operation is subject to the following two conditions :

(1) This device may not cause interference
(2) This device must accept any interference, including interference that may cause undesired operation of the device

Cet appareil contient des émetteurs / récepteurs exempts de licence qui sont conformes au (x) RSS (s) exemptés de licence d'Innovation, Sciences et Développement économique Canada. L'opération est soumise aux deux conditions suivantes :

(1) Cet appareil ne doit pas causer d'interférences
(2) Cet appareil doit accepter toute interférence, y compris les interférences pouvant provoquer un fonctionnement indésirable de l'appareil

The product complies with the Canada portable RF exposure limit set forth for an uncontrolled environment and is safe for intended operation as described in this manual. Further RF exposure reduction can be achieved if the product can be kept as far as possible from the user body or set the device to lower output power if such a function is available.

This equipment should be installed and operated with a minimum distance of 0cm between the radiator & your body.

Déclaration d'exposition aux radiations :

Le produit est conforme aux limites d'exposition pour les appareils portables RF pour les Etats-Unis et le Canada établies pour un environnement non contrôlé. Le produit est sûr pour un fonctionnement tel que décrit dans ce manuel. La réduction aux expositions RF peut être augmentée si l'appareil peut être conservé aussi loin que possible du corps de l'utilisateur ou que le dispositif est réglé sur la puissance de sortie la plus faible si une telle fonction est disponible.

Cet équipement doit être installé et utilisé avec un minimum de 0 cm de distance entre le radiateur et

votre corps.

Appendix. Configuration Downlink Comment

Port	204
Payload Length	33 bytes

Byte	1	2 to 33
Field	Cmd	Config

Cmd	**Command** Bits [7:0]　　　　0x00 - Set configuration 　　　　　　　　　0x01 - Get configuration, uplink all configurations (32 bytes)
Config	**Industrial Tracker Configuration** Bytes [3:0]　　　　g-sensor timeout (second) for switch moving mode to stationary mode 　　　　　　　　　default: 30 sec　(*Note: little-endian format.) Bytes [7:4]　　　　RFU **Stationary Mode Configuration** Bytes [11:8]　　　reporting interval (second,　0 : off, max : 65535) 　　　　　　　　　default: 900 sec　(*Note: little-endian format.) Bytes [13:12]　　　timeout to turn off GPS in periodic GPS tracking (second) 　　　　　　　　　default: 60 sec　(*Note: little-endian format.) Bytes [15:14]　　　timeout to turn off GPS in full tracking (second) 　　　　　　　　　default: 0 sec　(*Note: little-endian format.) Bytes [16]　　　　tracking type: 　　　　　　　　　● 0x00 - no GPS 　　　　　　　　　● **0x01 - periodic GPS (default)** 　　　　　　　　　● 0x02 - full tracking Bytes [17]　　　　number of satellites, the threshold for status checking 　　　　　　　　　default: 3 satellites Bytes [18]　　　　satellites' signal strength (dbHz), the threshold for status checking 　　　　　　　　　default: 20 dbHz Bytes [19]　　　　checking timeout (second) for status checking 　　　　　　　　　default: 5 sec **Moving Mode Configuration** Bytes [23:20]　　　reporting interval (second,　0: off, max: 65535) 　　　　　　　　　default: 60 sec　(*Note: little-endian format.) Bytes [25:24]　　　timeout to turn off GPS in periodic GPS tracking (second) 　　　　　　　　　default: 60 sec　(*Note: little-endian format.)

Bytes [27:26]	timeout to turn off GPS in full tracking (second) default: 300 sec (*Note: little-endian format.)
Bytes [28]	tracking type: • 0x00 - no GPS • 0x01 - periodic GPS • **0x02 - full tracking (default)**
Bytes [29]	number of satellites, threshold for status checking default: 3 satellites
Bytes [30]	satellites' signal strength (dbHz), threshold for status checking default: 20 dbHz
Bytes [31]	checking timeout (second) for status checking default: 10 sec

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