

Quick Start Guide

NEXTIndustry, NextLabel, and NEXTPack WIFI + BLE Tracker

V.01 29/04/2024

Document revision and revision history

Version	Date	Changes
V01	29/04/2024	Document creation
	18/11/2024	Minor update in Manual Device Commands
	02/01/2025	Minor update in Remote commands, Added de-passivation process & Uplink Message

Firmware Type

Generic API 7 version 7.0.x (Downlinks and Settings are not backward compatible with API 6)

[Device provisioning, reconfiguring, and troubleshooting](#)

Specification

Connectivity:	Sigfox and, or LoRa
IP Rating:	IP68
Weight:	27-30 g SimplePack, 100-200 g SimpleIndustry(Depends on the product)
Battery:	3 volts, 1500mAh, Not replaceable (SimplePack) 3.6 volts, Replaceable (SimpleIndustry)
Sigfox Product Certificate:	RC1 P_00B1_2306_01 RC3 P_00B1_5494_01

LoRaWan network setting

Device class:	A
Authentication:	OTAA
ADR:	enabled
MAC version	1.0.3 , 1.0.4
Regional parameters:	RP002 1.0.4
Uplink port	1
Downlink port	1

- The device tries to join the network with the first uplink request. There are 5 join retries with different data rates and a random delay is applied before each join attempt. If the join was unsuccessful device will blink 3x every 5s with red and the device block any other request for join for 1 hour. Blocking time is canceled by a button press.
- The device needs to be activated in better radio condition/coverage area.
- It is recommended to not activate a higher number of devices at a time. It is better to do it in batches.

Physical Installation

1. To achieve maximum radio performance, ideally, it is recommended to place the device as high as possible with the antenna better in open space than near the wall.

2. Avoid Drilling through SimpleIndustry devices.
3. Avoid putting the device close to metal objects, the ideal distance is 20cm
4. Placing under the direct sun may cause discoloration of the case.

States of Device

<i>Factory Mode</i>	<i>Armed</i>	<i>Disarmed</i>
<ul style="list-style-type: none"> • Usecase application not running • Limited device control • Minimal consumption 	<ul style="list-style-type: none"> • Usecase application running • Full device control 	<ul style="list-style-type: none"> • Usecase application not running • Full device control

Factory mode

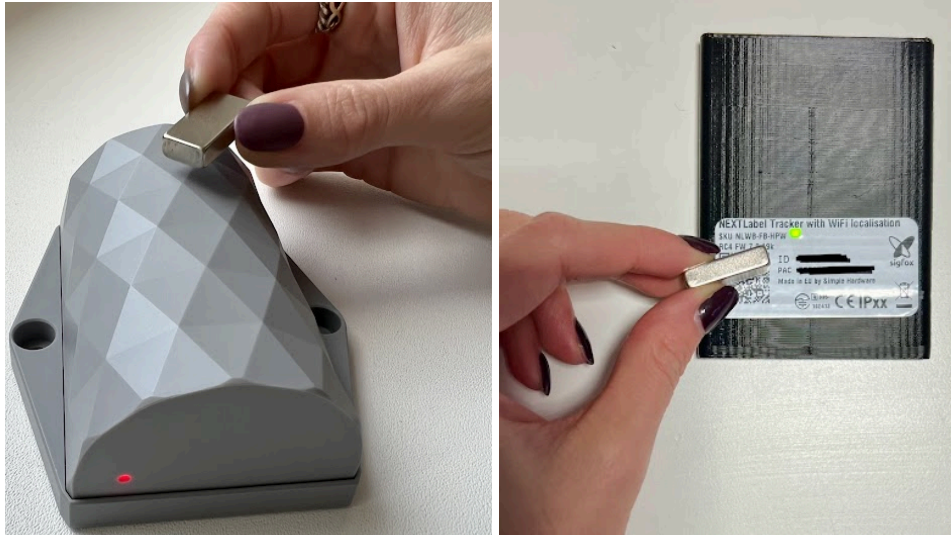
It is like a safe mode the devices are produced initially along with the intended mode of usage. Useful for transporting and storage of the devices to our customers as it has Low Power consumption.

When in this mode, the Control of the device is limited to sending the test messages if a short press via magnet or button is done. All other functions and transmissions are blocked.

You can refer to Uplink Definition below to know the msgs received in this mode.

Operation/Device control

The device is controlled via a magnet in location [photo] (magnet acts as a button). Any “button press” mentioned in the document refers to “using a magnet”.



Devices are shipped to you in **Factory Mode**, which is like a sleep mode where all functions except short press and extra long press are disabled.

- To exit Factory mode, initiate a long press via a button/magnet for 5 seconds, and you will notice the LED blinking RED in response. [Video Link](#)
- Short press in Factory mode [video link](#) will be indicated by a 2x long LED blinking RED in response and a test message will be sent.
- The device sends a reset message after the "Manufacture mode" exits.

Any button (**magnet acts as a button**) pressed is indicated with LED while it is pressed

- GREEN = normal state
- RED = blocked state (the device will ignore button press, eg. press during arming)

Operational mode

- Single press - arms device - indicated by blinking green LED
- Long press (5-7s) - disarms arms device - indicated by blinking red LED
- Extra long press - initiate downlink sequence

De-passivation Process for 3.6 volts Lithium Batteries

Read through our [article](#) on ask about this topic.

Device Behavior/Description and Intended Usage

Control:

- A short Press will arm the device. **ARMING DELAY = 1 minute**
- A long press (more than 5s) will disarm the device. (disarm capability can be disabled)

- Extra long press (more than 10s) will reboot the device and request a downlink

While the device is armed:

- Sends periodic message (heartbeat 1) every **7 days** with appended battery voltage and temperature with downlink request
- Sends periodic message (heartbeat 0) every **24h** with appended battery voltage and temperature with downlink request
- Short press, double press, multi-click, and long press will report appropriate uplink messages.
- Every 10 minutes device
 - Scan for BLE Beacon if found sends a message with 3x MINOR ID
 - In BLE not found scan for WIFI if found sends a message with 3x MINOR ID

Priority	Location Technology	Payload
1	BLE	F9 + 3x MINOR ID
2	WIFI	FA + 3x WIFI MAC

NOTE - Sigfox Only: Because 3x MAC address + mandatory headers will not fit into one Sigfox message (12Bytes), a message will be fragmented into more messages. See the section “Sigfox Payload Fragmentation” for more details. We recommend implementing message de-fragmentation as the first step in data processing.

GPS coordinates, BLE IDs, and WIFI MACs are cached - if there was no movement from the acquisition (the device is on the same spot) then old ID, MAC, or coordinates are used to preserve the battery

All parameters above are configurable

[BLE beaconing setup](#)

Note: Randomisation of Message Sending

To prevent many devices from sending messages at the same time, the device adds a small **randomisation delay** to each transmission.

This delay is usually **1 or 2 minutes**, and it can be adjusted if needed.

Example:

If the device is set to send a heartbeat every **1 hour**, it may actually send it randomly between:

Selected registers for tuning

Parameter	Register	Default value	Value	Format
Heartbeat 0	0x005	0xC1	1 day	Simple time
Heartbeat 1	0x009	0xC1	1 day	Simple time
Heartbeat 2 - active tag	0x00D	0x4A	10 min	Simple time
Heartbeat 3 - resting tag	0x011	0x86	6 h	Simple time
Min movements	0x0A8	0x05	5	movements
Heartbeats selection	0x98	0x03	HB1, HB2	Binary LSB=HB1, 1=on, 0=off

NOTE: This is just a selection of the most important registers. In case of need please contact Simple Hardware for additional information.

Uplink definition

Factory Mode [Link](#)

Short press

E4	BTL											
-----------	-----	--	--	--	--	--	--	--	--	--	--	--

F0 (0) msg type

BTL (1) battery voltage with load (transmission) - should be used to determine the battery

User Mode

Armed by autoarm

D3												
-----------	--	--	--	--	--	--	--	--	--	--	--	--

D3 (0) msg type

WIFI

Start of Activity (movement)

22	10	FA	MAC1	MAC2	MAC3
----	----	----	------	------	------

End of Activity (movement)

23	10	FA	MAC1	MAC2	MAC3
----	----	----	------	------	------

22,23(0) msg-type
 10(1) source
 F9(2) custom payload set "F9"

Periodic messages

Periodic message 0 - heartbeat

00	00	0A	BTL	TMP						
----	----	----	-----	-----	--	--	--	--	--	--

00(0) msg-type - periodic msg 0
 00(1) mode
 0A(2) payload set (appended payload preset index)
 BTL(3) battery voltage with load (transmission) - should be used to
 determine battery
 TMP(4) simpletemp format

Periodic Message 1 - heartbeat

01	00	09	BTL	GEN	MAJ	MIN	PCH	HW Ver	HW Ver	CRC	CRC
----	----	----	-----	-----	-----	-----	-----	-----------	-----------	-----	-----

01(0) msg-type- periodic message 1
 00(1) mode
 09(2) appended payload
 BTL(3) battery voltage with load (transmission) - should be used to
 determine battery
 GEN(4) firmware general version
 MAJ(5) firmware major version
 MIN(6) firmware minor version
 PCH(7) firmware patch version
 HW Ver(8-10) HW version
 CRC(11-12) Content of all registers

BLE

Periodic message 2

D4 (0) msg type

Reset message

E0	RF	MC	AF	AF	GEN	MAJ	MIN	PCH	BC	BC	AC	
E0 (0)												msg-type
RF (1)												reset flag
MC (2)												monitor code
AF (3-4)												application flag
GEN (5)												firmware general version
MAJ (6)												firmware major version
MIN (7)												firmware minor version
PCH (8)												firmware patch version
BC (9-10)												board code
AC (11)												application code

Exception

FB	FC	FC	SM	SM	SM	SM	AL	AL	AL	AL	FL	
FB (0)												msg-type
FC (1-2)												fail code
SM (3-6)												source code mark
SM (7-10)												arm link register value
FL (11)												arm flags

Remote command done

EE	RCC											
EE (0)												msg type
RCC (1)												remote command done

Phrasing Examples:

"00 00 ff 31 4f a0"

0x00 periodic message 0 event
 0x00 mode 0
 0xFF custom payload set
 0x31 3.1V bat voltage
 0x4fa $1274 / 10 - 100 = 27,4^{\circ}\text{C}$

[Examples of 12 bit Temp calculation](#)

"22 10 ff 45 e4 50 09 f3 86 10 28 15"

22 event type - start movement
 10 source - 10=acc
 FF custom payload
 45 e4 50 LAT: $4580432/92000 = 49.78730435$ (800000 = nofix)

09 f3 86 LON: 652166/46000 = 14.17752174 (800000 = nofix)
10 16 seconds to initial fix
28 0010 1000 → [5-7] → 001 → fix = 1
28 0010 1000 → [0-4] → 01000 → sat = 8
15 HDOP = 21 / 10 = 2.1

Sigfox Payload Fragmentation

In case the configured payload is longer than 12B (sigfox maximum), the payload will be automatically fragmented into multiple 12B messages. Fragmented messages have always ascending seq. number without gaps and we recommend checking it during the de-fragmentation process

Fragmented messages format:

Cx	PAYLOAD 11B
----	-------------

x = LNNN

- L is single bit marking last fragment
- N is number of current fragment

Example 1:

Payload: 0x0000ffb4fbe421b87db4fbee497136db4fbe491bc95

SGF1: c0 00 00 ff b4 fb e4 21 b8 7d b4 fb (12B)

SGF2: c9 e4 97 13 6d b4 fb e4 91 bc 95 (11B)

Example 2:

Payload: 0000ffb4fbe421b87db4fbee497136db4fbe491bc95b4fbee497136db4

SGF1: c0 00 00 ff b4 fb e4 21 b8 7d b4 fb (12B)

SGF2: c1 e4 97 13 6d b4 fb e4 91 bc 95 b4 (12B)

SGF3: ca fb e4 97 13 6d b4 (7B)

Data encoding

Simpletime (8bit time interval definition)

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	0	1	0	Reserved			
1	0	1	1	Time Interval (0 - 15) * 1 ms			
1	1	1	0	Time Interval (0 - 15) * 10 ms			
1	1	1	1	Time Interval (0 - 15) * 100 ms			
0	0	Time interval 0 – 63 seconds					
0	1	Time interval 0 – 63 minutes					
1	0	0	Time interval 0 – 31 hours				
1	1	0	Time interval 0 – 31 days				

Simpletemp (8bit temperature)

= DEC2HEX (Real temp + 40) * 2

Simplehum (8bit humidity)

= DEC2HEX (Real hum * 2)

12bit temperature

= DEC2HEX (Real temp + 100) * 10

12bit humidity

= DEC2HEX (Real hum * 10)

Battery voltage

BCD encoding

3.2V = 0x32

Exp number

[bit7-4] EXP

[bit3-0] NUM

VALUE = NUM * 10^{EXP}

[Examples of 12 bit Temp calculation](#)

Downlink

Downlink Process (Sigfox case)

- Downlinks are processes in so-called Downlink sequences
- The downlink sequence can consist of up to 8 downlinks.
- For the purpose of downlinks, the registers are split into pages of 255 registers.

Downlink sequence:

- The downlink sequence starts with any uplink with a downlink request.
- When this downlink is processed and resolved if more downlinks should be processed or not.
 - If no more downlink is requested: Then the device sends uplink type "Downlink confirmation" without a downlink request ("DA").
 - If more downlink is requested: Then the device sends uplink type "Downlink confirmation next downlinks pending" with the downlink request ("DB").
- More downlinks are requested WHEN:
 - The previous downlink payload doesn't try to update the virtual register 0x000 (register 0x00 on page 0).
 - **All registers are written in ascending order.**

- If write to equal or descending register is detected then evaluation of payload is stopped.
 - The length of the previous sequence is less than 7.

Writing to registers 0RR

RR VALUE RR VALUE RR VALUE RR VALUE

Writing to registers 1-7RR

FF 1-7 RR VALUE RR VALUE RR VALUE

Examples:

Change periodic message 0:

Register: 0x005

Value: 0x02C (2days)

Downlink string: 00 00 00 00 00 00 05 2C

Change battery threshold:

Register: 0x718 (page 7)

Value: 0x023 (2,3V)

Downlink string: 00 00 00 00 FF 07 18 23

When it comes to downlinks for LoRa, the limitation is 51 bytes, so 25 registers can be used in one single downlink in LoRa.

Remote Commands

Syntax:

FF <REMOTE_COMAND>

Eg. SGF downlink: 0000 0000 0000 FF17 -> disarm device

Command HEX	Function
0x10	Store current configuration as factory default
0x11	Restore factory (or previously stored) config
0x15	Switch to factory(transport) mode
0x16	Arm device

0x17	Disarm Device
0x18	Force re-arm (e.g. new for new tilt reference)
0x19	Clear LoRaWan join keys (de-join)
0x1C	Sends CRC16 of current configuration
0x1E	SET_LORAWAN_ACT_TYPE
0x24	Execute de-passivation procedure (immediately w/o reset) (FW 7.0.26e)

Registers for tuning

Parameter	Register	Default value	Value	Format
Heartbeat 0	0x005	0x81	1 hour	Simple time
Heartbeat 1	0x009	0xC7	7 days	Simple time
Heartbeat 2	0x00D	0x4A	10 min	Simple time

NOTE: This is just a selection of the most important registers and commands. In case of need please contact Simple Hardware for additional information.

Factory Reset

It will reset the device to the same state as was delivered.

Via Downlink

1. Setup downlink "000000000000FF11"
2. Wait.
3. The device sends message 0xE1

Manual Device Commands

Allow simple re-configuration of the device using the button or magnet (Next Industry).

To enter command mode do: (Up to FW 7.0.25d)

1. Press the button(**magnet acts as a button**) to achieve Extra-Long-Press (typically more than 10s)
2. The device will play a red-green pattern and reset.
3. After reset will the device indicate:
 - 1s green (if Sigfox radio service is enabled in reg 0x710)
 - 1s orange (if LoRaWAN radio service is enabled in reg 0x710)
 - both above if both radio services are enabled
4. You have a 2-second window to do any of the below-mentioned actions.

To enter command mode do: (FW 7.0.25e onwards)

1. Press the button(**magnet acts as a button**) to achieve 9 clicks
2. The device will play a red-green pattern and reset.
3. After reset will the device indicate:
 - 1s green (if Sigfox radio service is enabled in reg 0x710)
 - 1s orange (if LoRaWAN radio service is enabled in reg 0x710)
 - both above if both radio services are enabled
4. You have a 3-second window to do any of the below-mentioned actions.

Supported manual device commands

Button Action	Command
2x Press	Clear LoraWAN Join Info and join again (feature enabled from FW17.0.17s)
3x Press	Enter Factory Mode
4x Press	Restore Manufactured Default
Extra Long Press	Toggle LoRaWAN/SigFox Service (Manipulate 2 LSB in reg 0x710)

Firmware update

It is available via OTA and is a proprietary protocol. There is the possibility to update many devices at once. (Broadcast)

For more information on this, contact support.

LoRaWan network setting

- OTAA authentication
- ADR enabled

Device tries to join the network with the first uplink request. There are 5 join retries with different data rates and a random delay is applied before each join attempt. If the join was unsuccessful device will blink 3x every 5s with red and the device blocks any other request for join for 1 hour. Blocking time is canceled by a button press.

Switch device operation from Sigfox to LoRa:

Register the device into Sigfox backend and then initiate a downlink as such to use in LoRa

SGF -> LR - set 0x710 0x22 -->

00 00 00 00 FF 07 10 22

LoRa to Sigfox

- set 0x710 0x01 -->

00 00 00 00 FF 07 10 01

Miscellaneous

Storage and transportation

The devices are stored and transported to you in factory mode.

Battery and battery replacement instructions

To replace the batteries, the devices are to be sent to Simple Hardware Office and is done as per the refurbishment service procedure.

Troubleshooting and support

In case of issue with the devices, please contact our Support team by raising a ticket at <https://www.simplehw.eu/helpdesk> and we will be happy to assist you.

Make sure to provide us with as much information as possible to understand the issue.

For example,

Firmware

simple hw

simple things

Simple Hardware s.r.o.
Nad Spadem 650/12,
147 00, Prague, Czech Republic
<https://simplehw.eu> | +420 228 882 205 | info@simplehw.eu

Device ID

Number of Messages received approximately

Warranty

Simple Hardware manufactures high quality and durable Sigfox devices that have been tested and approved in accordance with our stringent Quality Control standards.

For our Warranty terms and conditions, please view here: <https://www.simplehw.eu/terms-conditions>

IO Frog Platform

IO Frog is an IoT data management platform. We **endorse** the use of this platform for Simple Hardware devices.

To have the messages from our NEXT variant devices be parsed and displayed correctly on the IO Frog Platform, Processing Parameters have to be set.

Processing Parameters JSON for this device:

```
{
  "presets": {
    "F9": [
      "SOURCE_BLE_IBEACON_MINOR1",
      "SOURCE_BLE_IBEACON_MINOR2",
      "SOURCE_BLE_IBEACON_MINOR3"
    ],
    "FA": [
      "SOURCE_WIFI_MAC1",
      "SOURCE_WIFI_MAC2",
      "SOURCE_WIFI_MAC3"
    ]
  }
}
```

Follow the steps mentioned below:

The screenshot shows the IO Frog mobile app interface. On the left, a device card for 'NI_...' is visible with a three-dot menu icon in the top right corner. An arrow points from this icon to a settings menu that includes 'Settings', 'Data details', 'Connectivity', 'Remove device', and 'Documentation'. The 'Settings' option is selected, leading to a 'Settings' screen for the device. The 'Processing parameters' tab is active, displaying a JSON structure for message processing parameters. The JSON is partially filled with 'SOURCE_GPS_LATLON_2X24B' and 'SOURCE_GPS_LAST_FIX_INFO'. At the bottom of the settings screen, there are 'Update' and 'Cancel' buttons.

- Click on the **three dots** on the right-side corner > **Settings**> **Processing Parameters**> Fill up the JSON > **Update**.
- This step has to be done for each device.
- In case it is a Project Based on a Large Number of Devices, Contact **Simple Hardware Support** for help setting up the Processing Parameters for a batch of devices.

Manufacturing commands (configuration)

```
setrcz 1
```

```
set 0x003 0x42 // randomisation at 2 mins
```

//Choose De-passivation settings, based on the battery used w.r.t the RC zones/Products

//de-passivation Bobbin Batt

```
set 0x722 0x03 //depass 2 LED  
//on factory mode enter  
set 0x723 0x32 //depass 3.2V  
set 0x724 0x5E //depass timeout 30min  
//on factory mode exit  
set 0x725 0x31 //depass 3.1V  
set 0x726 0x4F //depass timeout 15min
```

//de-passivation Spiral Battery

```
set 0x722 0x03 //depass 2 LED  
//on factory mode enter  
set 0x723 0x34 //depass 3.4V  
set 0x724 0x5E //depass timeout 30min  
//on factory mode exit  
set 0x725 0x32 //depass 3.2V  
set 0x726 0x4F //depass timeout 15min
```

```
set 0x7F0 0x71 //mf on + depass
```

```
set 0x7F1 0x00 //mf no exit
```

```
set 0x7F2 0x12 //append battery voltage
```

//select bearer

```
set 0x710 0x12 //Lora only
```

//magnet instead of button

```
set 0x73C 0x00 //button off
```

```
set 0x73E 0x01 //hall probe as button
```

```
set 0x73F 0x80 //irq
```

//Battery settings

```
set 0x719 0xD0 //REG_BATTERY_PERCENTAGE_MIN_MV_LSB 2V
```

```
set 0x71A 0x07 //REG_BATTERY_PERCENTAGE_MIN_MV_MSB 2V
```

```
//set 0x71B 0x80 //REG_BATTERY_PERCENTAGE_MAX_MV_LSB 3.2V //industry
```

```
//set 0x71C 0x0C //REG_BATTERY_PERCENTAGE_MAX_MV_MSB 3.2V //industry
```

```
set 0x71B 0xBB //REG_BATTERY_PERCENTAGE_MAX_MV_LSB 3.0V //label
```

```
set 0x71C 0x08 //REG_BATTERY_PERCENTAGE_MAX_MV_MSB 3.0V //label
```

```
//Generic settings
set 0x0F0 0x19 //arm by click, disarm by long press
set 0x0F5 0x41 //1 min arming delay
set 0x718 0x24 //low battery warning

//ACC settings
set 0x790 0x02 //acc shock event
set 0x792 0x60 //acc threshold LSB
set 0x793 0x00 //acc threshold MSB

//cache reset event
set 0x0B8 0x10 //source1 event - ACC
set 0x0BA 0x00 //EF options no uplink, no led indication, discrete mode
set 0x0BB 0x01 //EF input blanking time 1s
set 0x0BC 0x05 //EF input counter 5 movements
set 0x0BD 0x1E //EF input timeout 30s
set 0x0BE 0x00 //EF input max time without activity 0m
set 0x0BF 0x00 //EF output blanking
set 0x0C0 0x00 //append payload

//cache def
set 0x1B0 0x68 //source GPS
set 0x1B1 0x00 //cache options
set 0x1B2 0xC7 //cache validity
set 0x1B3 0x18 //cache reset by event 3 rise

set 0x1B6 0x6C //source WIFI123
set 0x1B7 0x00 //cache options
set 0x1B8 0xC7 //cache validity
set 0x1B9 0x18 //cache reset by event 3 rise

set 0x1BC 0xAF //source MINOR123
set 0x1BD 0x00 //cache options
set 0x1BE 0xC7 //cache validity
set 0x1BF 0x18 //cache reset by event 3 rise

//GPS settings
set 0x7A0 0x03 //GNSS when armed
set 0x7A1 0x28 //GNSS time fix 40s
set 0x7A2 0x43 //GNSS max fix 3m
set 0x7A3 0x0F //GNSS improve 15s
set 0x7A4 0x00 //GNSS ephemeris download
set 0x7A5 0x85 //GNSS max ephemeris validity 5h

//WIFI and BLE settings
set 0x1A0 0x07 //REG_WIFI_BLE_SCAN_CONFIG: ENABLE Wifi, Enable BLE, Filter BLE
set 0x1A2 0x01 //scan time 1s
set 0x1A3 0xFF
set 0x1A4 0xFF
set 0x1A5 0x06 //minimal count BLE, WIFI to be valid 1,2
```

```
//payload definition
//ALTERNATING 1 definition
set 0x3C0 0xAF //F9 - MINOR123
set 0x3C7 0x01 //alternating 1 options

//ALTERNATING 2 definition
set 0x3C8 0x6C //FA - MAC123
//set 0x3CF 0x01 //alternating 2 options
set 0x3CF 0x00 //alternating 2 options - NO GPS (switch off GPS)

//ALTERNATING 3 definition
set 0x3D0 0x68 //FB - GPS coordinates 2x24b
set 0x3D1 0x6A //FB - GPS fix info
set 0x3D7 0x00 //alternating 2 options

set 0x005 0xC1 //hb1 1d
set 0x006 0x02 //armed only
set 0x007 0x03 //voltage batt load, temp

set 0x009 0xC7 //hb2 7d
set 0x00A 0x01 //DL
set 0x00B 0x01 //ver

set 0x00D 0x4A //hb3 10min
set 0x00E 0x02 //armed only
set 0x00F 0xF9 //ALTERNATING PAYLOAD 1

commit
valid
```

Internal Information

MO Number	Firmware version