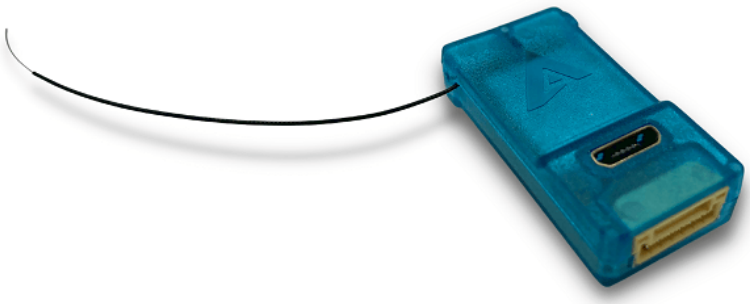
Aerobits

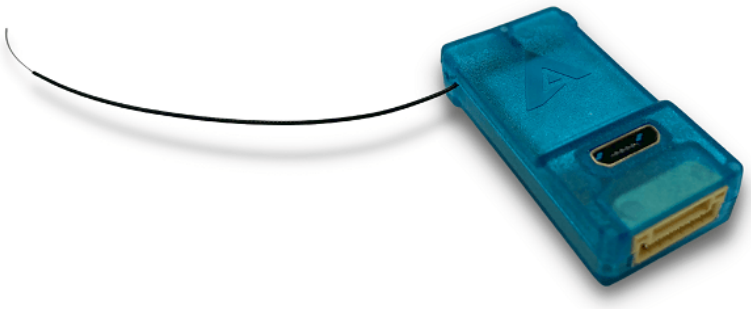
Subsystems for the
UAS intergration into
the airspace

E-identification idME



Data sheet & User manual

E-identification idME



Introduction

idME is designed to meet requirements of remote drone identification and localization in **ASTM/ASD-STAN standard**. Using the BLE broadcast technology the deviceprovides surveillance and drone operator identification capability based on anymodern mobile devices such as smartphone or tablet.

For more information please contact: support@aerobits.pl.

Contents

1 Technical parameters

1.1 Basic technical information

Parameter	Description	Typ.	Unit
Frequency	Bluetooth	2.402 - 2.480	GHz
Max. output	Maximum output power	+8	dBm
ESD protection	All connectors		-
Interface baud	Configuraton or MAVLink	115200	bps
Main connector	SM06B-GHS-TB(LF)(SN)		-
Antenna connector	2x RF-IPX125-1G-AU		-
Dimension		32.0 x 16.7 x 7.5	mm
Weight (with antenna)		4	grams

Table 1: General technical parameters.

1.2 Main features

- Capability to work with MAVLINK devices
- BLE broadcast technology compliant with ASTM and ASD-STAN
- Interfaces: UART, USB
- Supports Bluetooth 4.0 and 5.2
- Free Android application available
- Simple plug&play integration

2 Electrical specification

2.1 Basic electrical parameters

Parameter	Value
Input voltage	5 V
Current consumption	15 mA

Table 2: General electrical parameters.

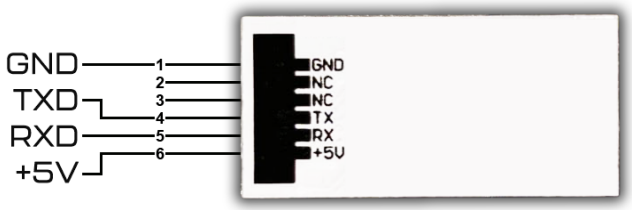


Figure 1: Appendant drawing of E-identification idME bottom.

2.2 PIN definition

PIN	Color	Name	Function
1	-	GND	Ground
2	-	NC	Not connected
3	-	NC	Not connected
4	-	TX	MAVLink, AERO TXD
5	-	RX	MAVLink, AERO RXD
6	-	+5 V	Power supply (5 V/ 70 mA)

Table 3: Pin definition.

2.3 LED indicators

LED	Color	Function
POWER	White	Power supply indicator
STATUS	White	Device operation status

Table 4: LED indicators.

3 Mechanical specification

3.1 Mechanical parameters

Parameter	Value
Dimensions	32.0 x 16.7 x 7.5mm
Weight	4 g

Table 5: Mechanical parameters of E-identification idME

3.2 Dimensions

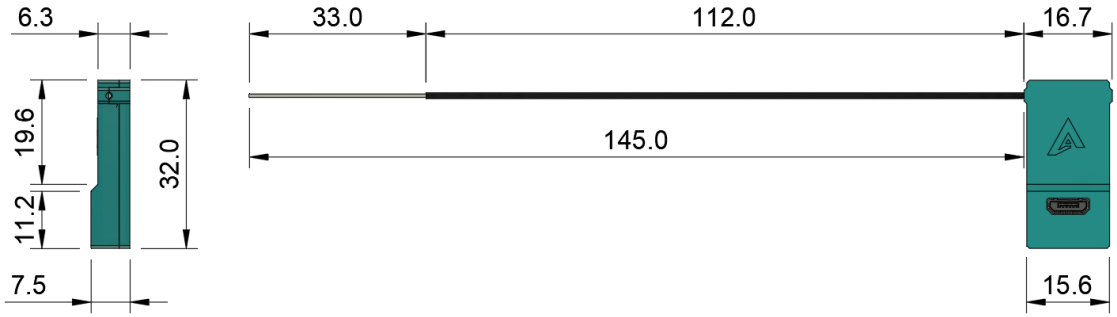


Figure 2: Dimensions of E-identification idME

3.3 Connectors

Connector	Type	Example
Main	Installed on board	SM06B-GHS-TB(LF)(SN)
	Mating connector	GHR-06V-S
	Pins	SSHL-002T-P0.2
Antenna	Installed on board	RF-IPX125-1G-AU
	Mating connector	GSM-IPX or GSM-IPX/SMA-1G-150

Table 6: Connectors

4 Principle of operation

During work module goes through multiple states. In each state operation of the module is different. Each state and each transition is described in paragraphs below.

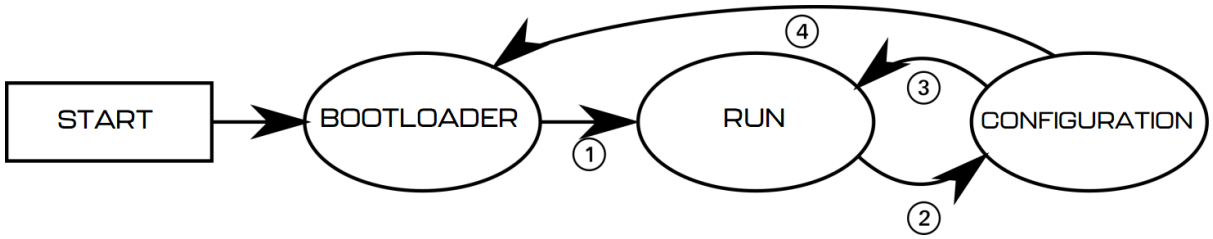


Figure 3: State machine of E-identification idME

4.1 States of operation

4.1.1 BOOTLOADER state

This is an initial state of E-identification idME after restart. Firmware update is possible here. Typically module transits automatically to RUN state. It is possible to lock module in this state (prevent transition to RUN state) using one of BOOTLOADER triggers. UART baud is constant and is set to 115200bps. After powering up module, it stays in this state for up to 3 seconds. If no BOOTLOADER trigger is present, module will transit to RUN state. Firmware upgrade is possible using Micro ADS-B App software. For automated firmware upgrading scenarios, aerobits_updater software is available. To acquire this program please contact: support@aerobits.pl.

4.1.2 RUN state

In this state module is broadcasting drone identification data.

4.1.3 CONFIGURATION state

In this mode change of stored settings is possible. Operation of the module is stopped and baud is set to fixed 115200bps. Change of settings is done by using AT-commands. Changes to settings are stored in non-volatile memory on exiting this state. Additional set of commands is also available in this state, allowing to e.g. reboot module into BOOTLOADER state, check serial number and firmware version. It is possible to lock module in this state (similarly to BOOTLOADER) using suitable command.

4.2 Transitions between states

For each of state transitions, different conditions must be met, which are described below. Generally, the only stable state is RUN. Module always tends to transit into this state. Moving to other states requires host to take some action.

4.2.1 BOOTLOADER to RUN transition

BOOTLOADER state is semi-stable: the module requires additional action to stay in BOOTLOADER state. The transition to RUN state will occur automatically after short period of time if no action will be taken. To prevent transition from BOOTLOADER state, one of following actions must be processed:

- Send `AT+LOCK=1` command while device is in BOOTLOADER state (always after power on for up to 3s)
- Send `AT+REBOOT_BOOTLOADER` command in CONFIGURATION state. This will move to BOOTLOADER state and will lock module in this state.

If none of above conditions are met, the module will try to transit into RUN state. Firstly it will check firmware integrity. When firmware integrity is confirmed, module will transit into RUN state, if not, it will stay in BOOTLOADER state.

To transit into RUN state:

- If module is locked, send `AT+LOCK=0` command

When module enters RUN mode it will send `AT+RUN_START` command.

4.2.2 RUN to CONFIGURATION transition

To transit from RUN into CONFIGURATION state, host should do one of the following:

- Send `AT+CONFIG=1` (using current baud).

When module leaves RUN state it sends `AT+RUN_END` message, then `AT+CONFIG_START` message on entering CONFIGURATION state. The former is sent using baud from settings, the latter always uses 115200bps baud.

4.2.3 CONFIGURATION to RUN transition

To transit from CONFIGURATION into RUN state, host should do one of the following:

- Send `AT+CONFIG=0` command.

When module leaves CONFIGURATION state it sends `AT+CONFIG_END` message, then `AT+RUN_START` message on entering RUN state. The former is always sent using 115200bps baud, the latter uses baud from settings.

4.2.4 CONFIGURATION to BOOTLOADER transition

To transit from CONFIGURATION into BOOTLOADER state, host should do one of the following:

- Send `AT+REBOOT_BOOTLOADER` command.
- Send `AT+REBOOT` and when module enters BOOTLOADER state, prevent transition to RUN state.

When entering the bootloader state, the module sends `AT+BOOTLOADER_START` .

5 UART configuration

Communication between module and host device is done using UART interface.

The UART interface uses settings as described in table 7.

UART Settings				
Parameter	Min.	Typ.	Max	Unit
Baud	-	115200	-	bps
Stop Bits Number	-	1	-	-
Flow Control	-	None	-	-
Parity Bit	-	None	-	-

Table 7: UART settings.

6 Settings

In RUN state, operation of the module is determined based on stored settings. Settings can be changed in CONFIGURATION state using AT-commands. Settings can be written and read.

NOTE: New values of settings are saved in non-volatile memory when transitioning from CONFIGURATION to RUN state.

Settings are restored from non-volatile memory during transition from BOOT do RUN state. If settings become corrupted due to memory fault, power loss during save, or any other kind of failure, the settings restoration will fail, loading default values and displaying the `AT+ERROR (Settings missing, loaded default)` message as a result. This behavior will occur for each device boot until new settings are written by the user.

6.1 Write settings

After writing a new valid value to a setting, an `AT+OK` response is always sent.

`AT+SETTING=VALUE`
For example `AT+PROTOCOL=1`
Response: `AT+OK`

6.2 Read settings

`AT+SETTING?`
For example: `AT+PROTOCOL?`
Response: `AT+PROTOCOL=1`

6.3 Settings description

`AT+SETTING=?`
For example: `AT+PROTOCOL=?`
Response:

```
Setting: PROTOCOL
       Description: Selected protocol (0: NONE, 2: CSV, 3: MAVLINK)
       Type: Integer decimal
       Range (min.): 0
       Range (max.): 5
       Is preserved: 1
       Is restart needed: 0
```

6.4 Errors

Errors are reported using following structure:
`AT+ERROR (DESCRIPTION)`
DESCRIPTION is optional and contains information about error.

6.5 Command endings

Every command must be ended with one of the following character sequences: “\n”, “\r” or “\r\n”. Commands without suitable ending will be ignored.

6.6 Uppercase and lowercase

All characters (except preceding `AT+`) used in command can be both uppercase and lowercase, so following commands are equal:

```
AT+PROTOCOL?
AT+pRoToCoL?
```

NOTE: This statement is true in configuration state, not in bootloader state. in bootloader state all letters must be uppercase.

6.7 Available settings

Setting	Min	Max	Def	Comment
BAUDRATE	0	2	0	Baudrate in RUN state 0 - 115200bps 1 - 921600bps 2 - 3000000bps
DRONE_ID_ADVERTISING_ENABLE	0	1	1	Enable Bluetooth advertising
DRONE_ID_SCAN_ENABLE	0	1	0	Enable Bluetooth scan
DRONE_ID_HEIGHT_TYPE	0	1	0	Device Height type 0 - Above Takeoff 1 - AGL
MAVLINK_CONNECTION_TIMEOUT	0	99	5	Mavlink connection timeout in seconds
DRONE_ID_OPERATOR_ID	-	-	-	Operator ID (20 bytes)
DRONE_ID_OPERATOR_ID_TYPE	0	255	0	Operator ID type 0 - Operator ID 201-255 - Available for private use
DRONE_ID_OPER_STATUS	0	2	0	Operation status 0 - Undeclared 1 - Ground 2 - Airborne
DRONE_ID_SELF_ID	-	-	-	Self ID (20 bytes)
DRONE_ID_SELF_ID_TYPE	0	255	0	Self ID type 0 - Text Description 201-255 - Available for private use
DRONE_ID_STANDALONE	0	1	0	Ignore streams from Mavlink protocol
DRONE_ID_TYPE	0	3	0	UAS ID type 0 - None 1 - Serial Number 2 - CAA Assigned Registration ID 3 - UTM Assigned UUID
DRONE_ID_UAS_TYPE	0	15	0	Specification of the type of UAS 0 - None 1 - Aeroplane 2 - Helicopter or Multirotor 3 - Gyroplane 4 - Hybrid Lift 5 - Ornithopter 6 - Glider 7 - Kite 8 - Free Balloon 9 - Captive Balloon 10 - Airship 11 - Free Fall 12 - Rocket 13 - Tethered Powered Aircraft 14 - Ground Obstacle 15 - Other
DRONE_ID_UAS_NAME	-	-	Device serial number	UAS ID (20 bytes)
SETTINGS_DEFAULT				Load default settings

Table 8: Settings

6.8 Example

As an example, to set parameter DRONE_ID_OPERATOR_ID for E-identification idME device, one should send following commands. “<<” indicates command sent to module, “>>” is a response.

```
<< AT+CONFIG=1\r\n
>> AT+OK\r\n
<< AT+DRONE_ID_OPERATOR_ID=Aerobits\r\n
>> AT+OK\r\n
>> AT+OK\r\n
<< AT+CONFIG=0\r\n
```

7 Commands

Apart from settings, module supports set of additional commands. Format of this commands are similar to those used for settings, but they do not affect operation of module in RUN state.

7.1 Commands in BOOTLOADER and CONFIGURATION state

7.1.1 AT+LOCK

`AT+LOCK=1` - Set lock to enforce staying in BOOTLOADER or CONFIGURATION state
`AT+LOCK=0` - Remove lock
`AT+LOCK?` - Check if lock is set

7.1.2 AT+BOOT

`AT+BOOT?` - Check if module is in BOOTLOADER state

Response:

`AT+BOOT=0` - module in CONFIGURATION state
`AT+BOOT=1` - module in BOOTLOADER state

7.2 Commands in CONFIGURATION state

7.2.1 AT+CONFIG

`AT+CONFIG=0` - Transition to RUN state.
`AT+CONFIG?` - Check if module is in CONFIGURATION state.

Response:

`AT+CONFIG=0` - module in RUN state
`AT+CONFIG=1` - module in CONFIGURATION state

7.2.2 AT+SETTINGS?

`AT+SETTINGS?` - List all settings. Example output:

```
AT+PROTOCOL=2
AT+SUBPROTOCOL=0
AT+BAUDRATE=0
```

7.2.3 AT+HELP

`AT+HELP` - Show all settings and commands with descriptions. Example output:

```
SETTINGS:
AT+PROTOCOL=2          [Selected protocol (0: NONE, 2: CSV, 3: MAVLINK)]
AT+SUBPROTOCOL=0       [Subprotocol of selected protocol]
COMMANDS:
AT+HELP                [Show this help]
AT+TEST                [Responds "AT+OK"]
AT+SETTINGS_DEFAULT    [Load default settings]
AT+REBOOT              [Reboot system]
```

7.2.4 AT+SETTINGS_DEFAULT

`AT+SETTINGS_DEFAULT` - Set all settings to their default value.

7.2.5 AT+SERIAL_NUMBER

`AT+SERIAL_NUMBER?` - Read serial number of module.

Response:

```
AT+SERIAL_NUMBER=07-0001337
```

7.2.6 AT+FIRMWARE_VERSION

`AT+FIRMWARE_VERSION?` - Read firmware version of module.

Response:

```
AT+FIRMWARE_VERSION=10101017(May 11 2018)
```

7.2.7 AT+REBOOT

`AT+REBOOT` - Restart module.

7.2.8 AT+REBOOT_BOOTLOADER

`AT+REBOOT_BOOTLOADER` - Restart module to BOOTLOADER state.

NOTE: This command also sets lock.

7.3 Commands in RUN state

`AT+CONFIG=1` - transition to CONFIGURATION state.

NOTE: This command also sets lock.

8 Quick start

8.1 Configuration

1. Connect appropriate antenna to UFL connector.

2. Configure device settings using Micro ADS-B software via USB or UART interface.

Mavlink dependent mode

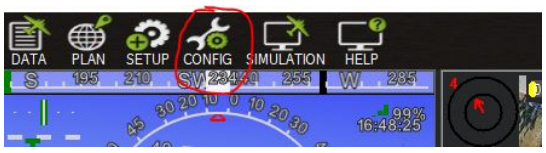
3. Connect IdMe to device supports Mavlink V2 protocol. In this example IdMe will be connected to Pixhawk TELEM1 port using JST connectors with not crossed wire(TX and RX are not swiched).

NOTE: In mavlink dependent mode DRONE_ID_STANDALONE parameter should be configure to 0.

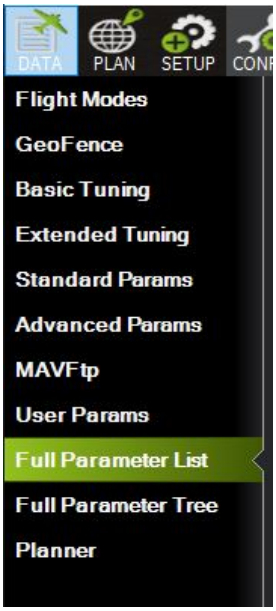
4. Using Mission Planner software enable Mavlink V2 protocol on TELEM 1 port.

5. Connect Pixhawk to Mission Planner.

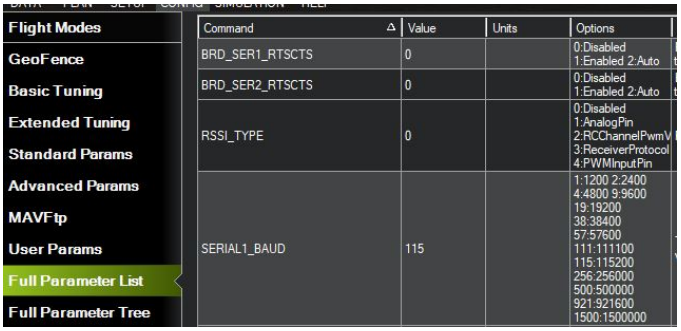
6. Select CONFIG tab.



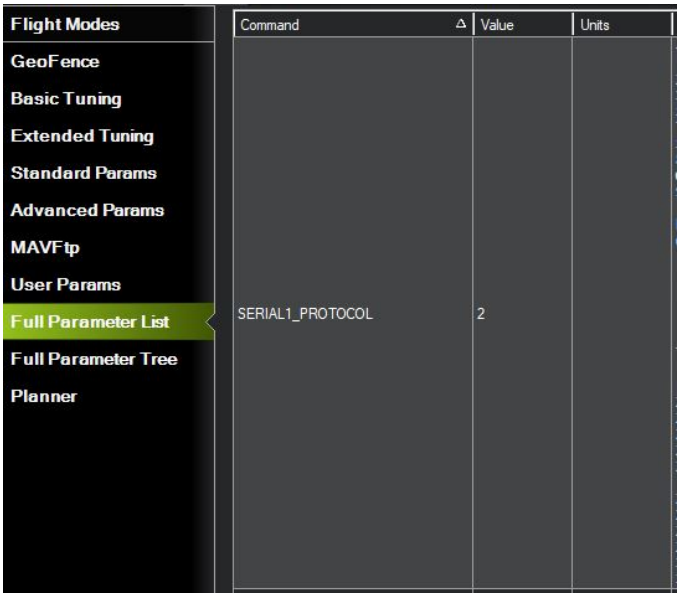
7. Select Full Parameter List.



8. Find SERIAL1_BAUD parameter and set a value to 115.



9. Find SERIAL1_PROTOCOL parameter and set a value to 2.



10. Reboot Pixhawk.

After configuration device is ready to work when status led starts blinking slowly (once every second).

9 Revision history

Date	Revision	Changes
21-July-2021	1	Initial release.

Table 9: Revision history.

Please read carefully

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