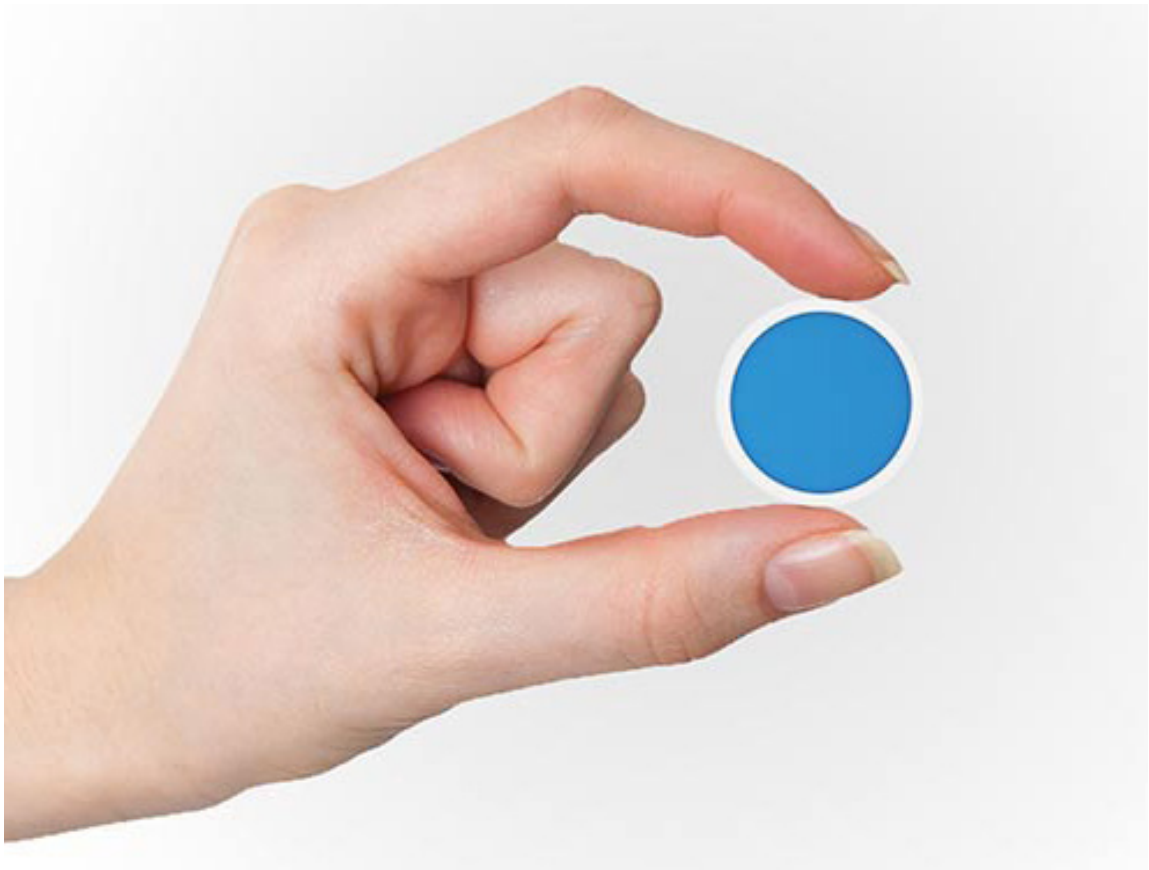


TEMPERATURE, HUMIDITY & DEW POINT SENSOR AND LOGGER

API AND COMMAND BOOKLET



BLUE MAESTRO'S STANDARD LICENSE AND DISCLAIMER

Copyright ©2016 Blue Maestro Limited. All Rights Reserved. The copyright in the software to which this document relates and in this document belong exclusively to Blue Maestro Limited and no permission to use, copy, modify, and distribute this software or this documentation is permitted unless with the express prior written authorisation of Blue Maestro Limited. The license to use the software to which this document relates is granted so long as such software resides in hardware provided by Blue Maestro Limited.

IN NO EVENT SHALL BLUE MAESTRO BE LIABLE TO ANY PARTY FOR DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, INCLUDING LOST PROFITS, ARISING OUT OF THE USE OF THIS SOFTWARE AND ITS DOCUMENTATION, EVEN IF BLUE MAESTRO HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

BLUE MAESTRO SPECIFICALLY DISCLAIMS ANY WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE SOFTWARE AND ACCOMPANYING DOCUMENTATION, IF ANY, PROVIDED HEREUNDER IS PROVIDED "AS IS". BLUE MAESTRO HAS NO OBLIGATION TO PROVIDE MAINTENANCE, SUPPORT, UPDATES, ENHANCEMENTS, OR MODIFICATIONS UNLESS IT CONTRACTS TO DO SO.

Quick start

1. Download the free iOS or Android App: Tempo Utility App

To get the links to the latest apps, please visit www.bluemaestro.com/support

2. Turn on

The soft touch colour rubber on top of the Device is a button. Depress gently to turn it on. The LED indicator will blink two times to confirm that it is on. Please note it should not be depressed with excessive force, since this may damage the Device.

3. Turn off

The Device can be turned by depressing the button and holding it down for a period of 5 seconds. It will blink rapidly to indicate it is turned off.

4. Entering Commands

Type *(star) followed by command name in the command line in the Command Console screen and press send. The command name and examples are contained further on in this document.

For example type “*bur” into the command console and then send to see streaming temperature, humidity and dew point up dated every 0.5 seconds.

You will now see temperature, humidity and dew point data shown in the app window.

Introduction

This document sets out the specifications, API and the commands of the Blue Maestro Temperature & Humidity Tempo Disc™ Bluetooth® Low Energy Sensor and Data Logger (the “Device”).

The Device uses the nRF52 Bluetooth Low Energy System on Chip from Nordic Semiconductor and a high quality temperature and humidity sensor from Silicon Instruments. The Device utilises Bluetooth 4.0.

The Device adopts “ad-hoc” pairing where as much information is passed from Device to receiver (smart-phone, iPad, Bluetooth enabled computer or Gateway) without pairing/bonding being required as possible. This is done through encoding information within the advertisement packets of the Device. Pairing is reserved for the passing of commands from receiver to Device or for the extraction of data from the Device where this cannot be achieved in the advertisement packet (such as logged data, for example).

There has been a great deal of flexibility introduced into the Device to allow settings to be changed. However care must be taken to ensure that settings are changed correctly. For example if certain undefined/out of scope variables are input into settings the Device may not perform as desired and, possibly, lock-up such it may only be able to be recovered by removing and then applying power.

There is a button and LED in the Device. The button is a software button that will cause the Device to consume an ever so small amount of current, even when turned off. To maximise battery life in transportation and storage it is suggest that the battery is removed/not placed and is only inserted when the Device is to be deployed.

Specifications

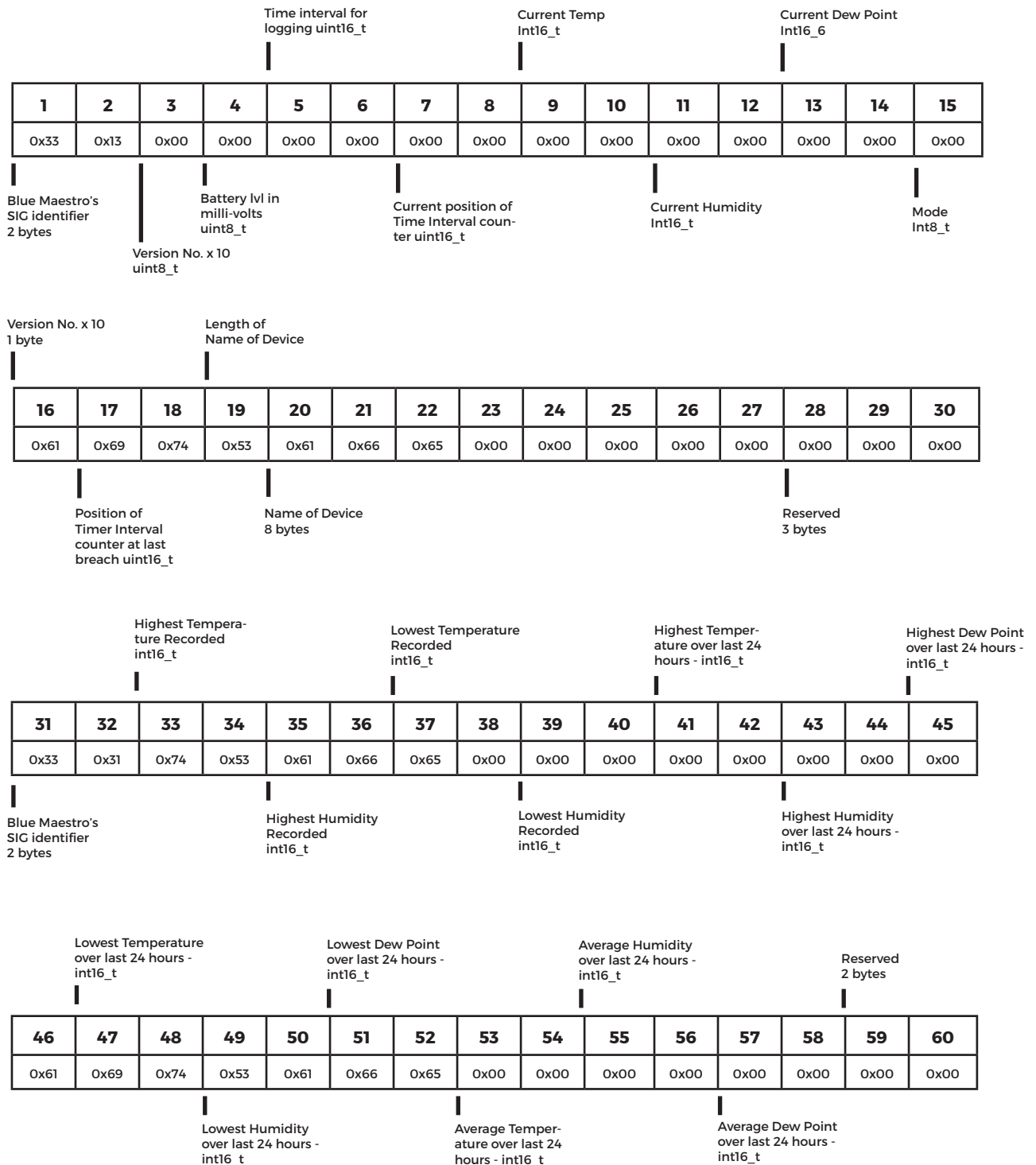
The following is the specification for the Tempo Disc unit. For physical dimensions and form see further in this document.

BLUETOOTH VERSION	4.0
BLUETOOTH SYSTEM ON CHIP	Nordic Semiconductor nRF52832
MEMORY	64k RAM, 512k Flash
PROCESSOR	ARM Cortex M4 32-bit
BATTERY	CR2032, changeable
TEMPERATURE SENSOR	+/- 0.3 Degrees Celsius with a range of -40 and +80 Degrees Celsius
HUMIDITY SENSOR	+/- 0.4% Relative Humidity. Full range 0% - 100% Relative Humidity
DEW POINT	Dew point is calculated using an algorithm with Temperature and Humidity as inputs
ANTENNA	Johannson Technology 2450AT18D0100 omni-directional chip antenna with matching tuning circuitry
RANGE	75 meters/250 feet line of sight
HARDWARE FEATURES	Polycarbonate exterior with TPE soft touch button and LED indicator
ENERGY CONSUMPTION	nRF52832 Peak TX (0dBm) 5.3 mA; running from Flash 58 μ A MPU6500 Low Power Mode 17.75 μ A
ESTIMATED BATTERY LIFE	9 - 12 months dependant on settings and use
ROHS COMPLIANT	Yes

SETTINGS FEATURES	<p>The following represent some of the settings that can be changed using the Command Console:</p> <p>Transmit Power, Advertising Timeout, Name of Device, Rate of Logging, Password Protect, Reset Device, Device Information, Device Firmware Upgrade, Flight Safe Mode, Threshold Alarms for Temperature, Humidity or Dew Point (x2)</p>
FREQUENCY OF LOGGING	Configurable from measuring and logging Temperature, Humidity and Dew Point every 1 second to every 24 hours. Default is hourly
NUMBER OF LOGS	4,000 data points for each of Temperature, Humidity and Dew Point. More can be specified (up to 200,000)
DEVICE FIRMWARE UPGRADE	Over the air available
FLIGHT SAFE MDOE	The Device can be put into airplane mode such that it logs data but does not transmit radio signals. When the button is depressed, the Device will advertise for 5 minutes and it can be taken out of airplane mode.
CUSTOMISABLE	Colouring, branding, advertising packet and firmware possible
IP RATING	IP68 available (battery non changeable), Otherwise IP42
REGULATORY	EC compliant

Advertisement Data Structure

The following represents the advertisement packet for the sensor. The first 30 bytes is the standard Advertisement payload and the second 30 bytes is the Scan Response payload. They are represented in bytes with an offset beginning with Blue Maestro's Bluetooth SIG company identifier 0x33 0x31. This is usually located at the 16th byte in the full observed advertisement packet. The data structure is little endian.



1. UART over BLE Communication

The following are a list of the command line syntax and field requirements to allow settings in the Device to be changed.

The application includes one service: the Nordic UART Service. The 128-bit vendor-specific UUID of the Nordic UART Service is 6E400001-B5A3-F393-E0A9-E50E24DCCA9E (16-bit offset: 0x0001).

This service exposes two characteristics: one for receiving and one for transmitting (as seen from the nRF5 application).

TX Characteristic (UUID: 6E400002-B5A3-F393-E0A9-E50E24DCCA9E)

If the peer has enabled notifications for the TX Characteristic, the application can send data to the peer as notifications. The application will transmit all data received over UART as notifications.

RX Characteristic (UUID: 6E400003-B5A3-F393-E0A9-E50E24DCCA9E)

The peer can send data to the device by writing to the RX Characteristic of the service. ATT Write Request or ATT Write Command can be used. The received data is sent on the UART interface.

All commands and responses are ascii characters unless otherwise stated. The parameter fields of commands and responses are indicated by 'X'. It is important that the correct number of fields in the parameters are complied with.

If a command is not recognised, the message "Unknown Command" will be transmitted. If a command is recognised a "Command Recognised" will be transmitted. However even though the command is recognised the parameter may still be incorrect/out of bounds and the Device will not pass any indication.

Where a command is recognised the Device will disconnect and recommence advertising after processing the command. Where a password is entered incorrectly the Device will disconnect and recommence advertising.

2. Transmission Strength [*txpX]

This sets the transmission strength of the radio from a choice of three settings of -4dBm, 0dBm and +4dBm. This can be useful for extending the battery life of the Device but has a negative impact on range. The default setting is +4dBm.

Parameters:

- 000 sets to +4dBm
- 001 sets to 0dBm
- 003 sets to -4dBm

3. DFU Mode [*dfu]

This puts the Device in bootloader mode for new firmware upgrade. The Device will advertise as a new device with the name “DFUTarg” and will adopt Nordic Semiconductor’s DFU over BLE communication protocol.

Parameters: None

4. Logging Interval [*lintX]

This sets the logging interval in seconds. The logging interval represents how frequently the sensor values are stored in memory. The default is 3600 seconds which represents one hour. When changed, the current recorded data will be erased and logging will commence afresh. The minimum is 2 seconds and the maximum is 86,400 seconds (or one day).

Parameters: x in seconds (default is 3600 = 1 hourly logging interval)

5. Sensor Interval [*sintX]

This sets the sensor interval in seconds. The sensor interval represents how frequently the sensors take readings. The advertisement packets of the device are updated with the latest sensor readings. The default is 10 seconds.

Parameters: x in seconds (default is 3600 = 1 hourly logging interval)

6. Password Protect [*pwdXXXX]

This locks the Device from receiving commands or having its log accessed. The Device is not password protected on shipping. Entering a password will lock the Device until the password is re-entered whereby the Device will be unlocked until a password is again entered.

Parameters: 4 characters or numbers.

7. Change Name [*namXXXXXXXX]

This changes the Device name from its default. Please note that for some models of smartphone (both iOS and Android) the name change will not necessarily be recognised until Bluetooth is turned off and back on in the smartphone settings.

Parameters: 8 characters

8. Temperature, Humidity and Dew Point Streaming Mode [***bur**]

Once connection is made to the Device through the Nordic UART Service, the Device will be in “burst” mode. That is the device will update and transmit temperature, humidity and dew point every 0.5 seconds. The format is T:XX.X H:XX.X D:XX.X together with a timestamp. If having connected to the Nordic UART Service the Device does not appear to be in burst mode and has recently been in a connected state, enter *clr to ensure the Device is its normal state. N.B- this is the only command that does not automatically disconnect after 10 seconds.

9. Advertising Timeout [***atoXXX**]

This sets the timeout parameters where advertising will cease after a button push. In all of these cases advertising will commence in “fast mode” for 180 seconds and then in “slow mode” for a further number of seconds as defined in this command. The default is 300 seconds or 5 minutes. It is important to note that without advertising, the Device is not able to be connected to per Bluetooth 4.x protocols.

Parameters: XXX in seconds

10. Information [***info**]

This gives you a list of the current setting including the devices name , version number etc

Parameters: None

11. Telemetrics [***tell**]

This gives you a list of the devices telemetrics including sensor frequency, log frequency, number of records, current temperature and the last 24hours metrics and other key data.

Parameters: None

12. Units of Measure [***unitsf**] [***unitsc**]

This will convert temperature measurements into either fahrenheit or celsius.

Parameters: None

13. Battery level [***batt**]

This gives you the battery level as a percentage.

14. Alarm one and two [***alarmUYZXXX**]

There are two alarms which track how many times a sensor reading goes below or above a set threshold. The occurrence of these alarms form part of the advertisement packet and when scanned by a smart-phone or other receiving device can set off an "alarm". The Device itself does not alarm.

The alarms can be set for temperature, humidity or dew point. Since there are two, you can set them for any combination of these.

Parameters: U is the alarm number, either 1 or 2. So ***alarm1t>25** sets alarm 1 for temperature over a threshold of 25 Celsius (if this is the units sets for the Device at the time)

Y is the sensor which the threshold applies, either t for temperature, h for humidity or d for dew point. For example ***alarm2h>50** sets alarm 2 for humidity over a threshold of 50% relative humidity.

XXX is the threshold to apply. It is in round numbers, so no decimal points can be specified. For example ***alarm2d<10** sets alarm 2 for dew point below 10 Celsius (if this is the units set for the Device at the time).

15. Clear alarms [***alarmclr**]

This clears the settings for the alarms.

Parameters: None

16. Alarm information [***alarmi**]

This provides informations on the alarms, such as settings and how many times the sensor has breached any thresholds.

Parameters: None

17. Air mode on [***airon**]

This sets the air mode on. This causes the Device to log information but not transmit, ideal for transportation by air. Once this command is entered, the Device will continue to transmit for a further 5 minutes before ceasing. Depressing the Device's button will cause the Device to transmit for a further 5 minutes.

Parameters: None

18. Air mode off [***airoff**]

This sets the air mode off and the Device will continue to continuously transmit as normal.

Parameters: None

14. Download log in readable form [*loggert] [*loggerh] [*loggerd]

Either of these commands will download the relevant log for temperature, humidity or dew point for analysis. Note using these commands does not store the data in the smartphone, for this use the specific download button on the smartphone.

Dimensions and form

The following represents the dimensions and form of the temperature & humidity sensor and logger.

