

# Hexiwear

From MikroElektronika Documentation

**Hexiwear** is a wearable development kit for the Internet of Things era. **A small and sleek, low-power device packed with sensors to quantify yourself and the world around you.** Wirelessly enabled, it can connect both to devices nearby – or to cloud servers far away.

Developed in collaboration with NXP Semiconductors and funded through Kickstarter, Hexiwear is chiefly aimed at developers who need a complete IoT toolkit – low power yet versatile hardware, compatible smartphone and iOS apps, and cloud connectivity.

Unlike most MikroElektronika products, Hexiwear is completely open source.

This guide is an introductory overview of Hexiwear features. For a guide on setting up your development environment, read the guide to writing your first program. A separate guide for the Hexiwear Docking Station is also available..

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## Hexiwear



### Hexiwear - wearable dev kit for IoT

#### Microcontroller NXP Kinetis K64

([http://www.nxp.com/products/microcontrollers-and-processors/arm-processors/kinetis-cortex-m-mcus/k-series/k6x-ethernet-mcus/kinetis-k64-120-mhz-ethernet-usb-256kb-sram-mcus:K64\\_120?fsrch=1&sr=2&pageNum=1](http://www.nxp.com/products/microcontrollers-and-processors/arm-processors/kinetis-cortex-m-mcus/k-series/k6x-ethernet-mcus/kinetis-k64-120-mhz-ethernet-usb-256kb-sram-mcus:K64_120?fsrch=1&sr=2&pageNum=1))

#### BLE

NXP Kinetis KW4x  
(<http://www.nxp.com/products/microcontrollers-and-processors/arm-processors/kinetis-cortex-m-mcus/w-series/kinetis-bluetooth-low-energy-802.15.4-wireless-mcu:KW40Z>)

#### Sensors

Temperature, humidity, accelerometer, gyroscope, magnetometer, pressure, heart-rate, ambient light

#### Display

Full color OLED 96px x 96px

#### Interface

Hexiwear Docking station connector, Micro USB port

#### Power supply

600 mA Single-cell Li-Ion/Li-Polymer Battery

#### Color options:

Blue, Yellow, Green

#### Website

[www.hexiwear.com](http://www.hexiwear.com) (<http://www.hexiwear.com>)

## Getting started

### Wake up

Six capacitive buttons surrounding an OLED display make up Hexiwear's user interface.

A double tap on any of the buttons will wake up the device and light up the OLED display to show the home screen.

If double taps don't wake up the device, the battery is probably empty. Connect Hexiwear to a power supply through the Micro USB port on the side. Charge for a while then try again.

## Navigation

From the home screen, a single tap on the lower right button will bring you into the menu. Use the pair of buttons to the right side of the screen to browse through the list of available items. Two dots on the right edge of the screen are visible wherever vertical scrolling is available.

The two buttons below the screen are for entering and exiting folders or turning settings on and off.

If you are left-handed, you can set up your Hexiwear so that the buttons on the left side of the screen are used for vertical scrolling. From the Home Screen, go to Menu >>> Settings >>> Active buttons.

## Reset

If the Hexiwear unit becomes unresponsive, you can reset it using the button on the rear side. You will need a pin, needle, paper clip, or similar item to press reset (same type of tool used for ejecting SIM cards out of cell phones).

## Hardware features

### Buttons, ports and LEDs

Hexiwear has a hexagonal form factor suitable for a wearable or a standalone device deployed in the field. Here's what you see from the outside:



1. Ambient light sensor
2. One of six capacitive buttons surrounding the central OLED display
3. RGB LED
4. Hexiwear Docking Station connector
5. Optical heart rate sensor LED and photodiode

Not visible here, Hexiwear also a Micro USB port on the upper left edge (looking from the front)

## Specifications

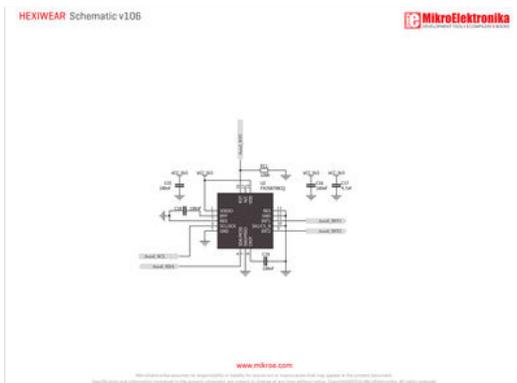
The following is a full list of components inside Hexiwear with links to relevant data sheets.



- **MCU:** NXP Kinetis K64 MCU ([http://www.nxp.com/products/microcontrollers-and-processors/arm-processors/kinetis-cortex-m-mcus/k-series/k6x-ethernet-mcus/kinetis-k64-120-mhz-ethernet-usb-256kb-sram-mcus:K64\\_120?fsrch=1&sr=2&pageNum=1](http://www.nxp.com/products/microcontrollers-and-processors/arm-processors/kinetis-cortex-m-mcus/k-series/k6x-ethernet-mcus/kinetis-k64-120-mhz-ethernet-usb-256kb-sram-mcus:K64_120?fsrch=1&sr=2&pageNum=1)) (ARM® Cortex®-M4, 120 MHz, 1M Flash, 256K SRAM)

- **BLE:** NXP Kinetis KW4x (<http://www.nxp.com/products/microcontrollers-and-processors/arm-processors/kinetis-cortex-m-mcus/w-series/kinetis-bluetooth-low-energy-802.15.4-wireless-mcu:KW40Z>) (ARM® Cortex®-M0+, Bluetooth Low Energy & 802.15.4 Wireless MCU)
- **3D Accelerometer and 3D Magnetometer:** NXP FXOS8700CQ (<http://www.nxp.com/products/sensors/6-axis-sensors/digital-sensor-3d-accelerometer-2g-4g-8g-plus-3d-magnetometer:FXOS8700CQ?fsrch=1&sr=1&pageNum=1>)
- **3-Axis Digital Gyroscope:** NXP FXAS21002 ([http://www.nxp.com/products/sensors/gyroscopes/3-axis-digital-gyroscope:FXAS21002C?lang\\_cd=en](http://www.nxp.com/products/sensors/gyroscopes/3-axis-digital-gyroscope:FXAS21002C?lang_cd=en))
- **Absolute Digital Pressure sensor:** NXP MPL3115A2R1 ([http://www.nxp.com/products/sensors/pressure-sensors/barometric-pressure-15-to-115-kpa/20-to-110kpa-absolute-digital-pressure-sensor:MPL3115A2?lang\\_cd=en](http://www.nxp.com/products/sensors/pressure-sensors/barometric-pressure-15-to-115-kpa/20-to-110kpa-absolute-digital-pressure-sensor:MPL3115A2?lang_cd=en))
- **600 mA Single-cell Li-Ion/Li-Polymer Battery Charger:** NXP MC34671 ([http://www.nxp.com/products/power-management/battery-management/battery-chargers/600-ma-single-cell-li-ion-li-polymer-battery-charger:MC34671?lang\\_cd=en](http://www.nxp.com/products/power-management/battery-management/battery-chargers/600-ma-single-cell-li-ion-li-polymer-battery-charger:MC34671?lang_cd=en))
- **Light-to-digital converter:** TAOS TSL2561
- **Digital humidity and temperature sensor:** MEAS HTU21D
- **Heart-rate sensor:** Maxim's MAX3010x
- **1.1" full color OLED display**
- **Haptic feedback engine**
- **190 mAh 2C Li-Po battery**
- **Capacitive touch interface**
- **RGB LED**
- **8 MB of additional Flash memory**

## Schematic



The Hexiwear schematic is available as a printable PDF file ([http://cdn-docs.mikroe.com/images/c/c0/Sch\\_Hexiwear\\_MainBoard\\_v106c.pdf](http://cdn-docs.mikroe.com/images/c/c0/Sch_Hexiwear_MainBoard_v106c.pdf))

## Built-in applications and settings

The following is an overview of all the applications and settings on Hexiwear.

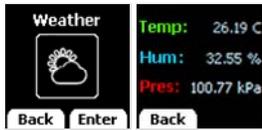
### Home screen



- Time and date (synced when paired with Hexiwear smartphone app. More information on cellphone app is below.)
- Battery status
- Ambient temperature
- Bluetooth connection status (blue when connected to smartphone)
- Smartphone notifications

### Apps

#### Weather Station



Shows ambient temperature, humidity and pressure data in real time.

#### Motion



Displays readings from accelerometer and gyroscope in real time (single data point for each axis)

#### Flashlight



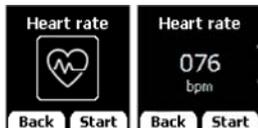
Toggles front-facing RGB LED.

#### Fitness – Pedometer



Step and calorie counter next to each other. Walking steps are inferred from accelerometer readings. Calories are calculated using a formula. "Stop" button resets count.

#### Fitness – Heart rate



Heart-rate readings from the optical sensor. Two wavelengths of light from two LEDs (red and green) are emitted from the small slit on the rear of Hexiwear. When you place your wrist or fingertip over the slit, the sensor measures the light absorbance of pulsing blood through a photodetector and derives heart-rate info. Current firmware version is able to show rough estimates.

#### Notifications



A more detailed overview of smartphone notifications visible from the home screen. Displays the number of missed calls, unread messages (from Gmail inbox) and unread SMS messages. Requires Hexiwear to be paired with a phone. Updated in real time.

## Settings

### Bluetooth



Toggles bluetooth on and off. White when turned OFF, Blue when turned ON.

### OTAP



OTAP stands for "Over the Air Programming e.g. wireless firmware updating. You can choose to update either the KW64 (main MCU) or the KW40 (BLE chip). Requires Hexiwear smartphone app. See this video for instructions (<https://www.youtube.com/watch?v=NI5x6QPofw8>).

### Active buttons



Sets active buttons to either left or right side (used for vertical scrolling). Left-handers will want to set it to the left, in order not to obstruct their view of the screen while tapping buttons.

### Haptic



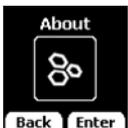
Toggles haptic feedback engine on and off. White when turned OFF, Blue when turned ON. Haptic engine gives tactile feedback on button presses. Deactivating it conserves battery.

### Get app



Displays QR codes for fetching and installing the Hexiwear smartphone app. Choose between Android and iOS. Requires a QR Code reader on your smartphone. Alternatively, you can download the apps directly from Google Play or the iTunes store.

### About



Manufacturer info, hardware and firmware version.

### Reset



Software reset button.

### Sensor tag mode



Toggles Sensor tag mode. When active, Hexiwear will continually broadcast readings from all its internal sensors over BLE. The readings can be accessed from the Hexiwear smartphone app, or directly from the WolkSense cloud. White when turned OFF, Blue when turned ON.

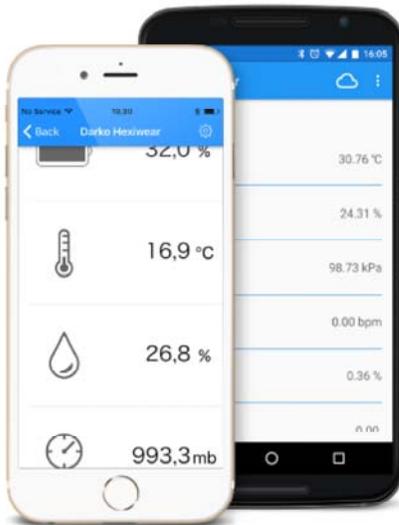
## Hexiwear smartphone apps

The Hexiwear smartphone app will significantly expand the functionality of your Hexiwear. It will allow you to remotely access the readings from all of Hexiwear's sensors, and log the data into a cloud. Since Hexiwear uses Bluetooth Low Energy for wireless communication, you will need a phone that supports Bluetooth 4.1.

### Installing the smartphone app

Android app (version 4.4 and up): Google Play (<https://play.google.com/store/apps/details?id=com.wolkabout.hexiwear&hl=en>)

iOS app (version 8.4 and up): iTunes (<https://itunes.apple.com/us/app/hexiwear/id1080657183?ls=1&mt=8>) (compatible with iPhone, iPad, and iPod touch)



### Pairing Hexiwear with smartphone

#### Video walkthrough

A video walkthrough on using the Hexiwear app is available on Youtube (<https://www.youtube.com/watch?v=Eg-k020bEB4>). Minor differences from the current version of application may exist.

#### Step by step

1. Turn ON Bluetooth on Hexiwear
2. Turn on Sensor Tag mode on Hexiwear
3. Launch Hexiwear app from your phone
4. The app will prompt you to turn ON the Bluetooth on your phone
5. Log-in to your WolkSense account (first time users will need to register, it's free)
6. From the main screen, swipe down to scan for available Hexiwear devices; select one.
7. A six digit passkey will appear on Hexiwear's display. At the same time the smartphone app will prompt you to type in the passkey.
8. Hexiwear is now connected to your smartphone. Sensor readings will appear shortly.

## Troubleshooting

If errors occur, to restart the pairing process, go to the Bluetooth settings on your smartphone and "forget" the Hexiwear device. This removes all the initialization data and enables you to start over.

## Wolksense cloud platform

By registering an account in Hexiwear's smartphone app, you automatically gain access to the WolkSense cloud. To send Hexiwear sensor readings to the cloud do the following:

1. Pair Hexiwear with smartphone
2. Make sure that Hexiwear is in Sensor Tag mode
3. Enable "Publish to cloud" inside the smartphone app settings menu
4. Go to [app.wolksense.com](https://app.wolksense.com) (<https://app.wolksense.com>), and log-in with the same username and password you use for the Hexiwear smartphone app.

Once logged in, you will be able to use all the functionalities that the WolkSense platform offers: sensor readings, alarms, reports and more.

## Sensor readings

The first thing you see when you log-in to the WolkSense cloud is a dashboard with sensor readings. The dashboard is customizable so you will be able to choose which sensor readings you want to see.

By default, Hexiwear will publish sensor readings every 10 seconds. You can increase the interval to 30 seconds, 1 minute, or 5 minutes from within the smartphone app.

## Setting up alarms

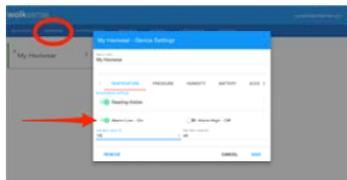
The WolkSense platform also allows you to configure thresholds for each sensor to set off alarms when certain low or high values are reached. To set alarms, click on the "Sensors" tab and open the Hexiwear device settings. You can apply different settings for individual sensors.

## Creating reports

The "Reports" tab on the WolkSense cloud will allow you to generate reports of logged sensor readings. Graphs give you daily, weekly and monthly views. It is also possible to export data into a CSV file.



Hexiwear sensor readings on WolkSense cloud

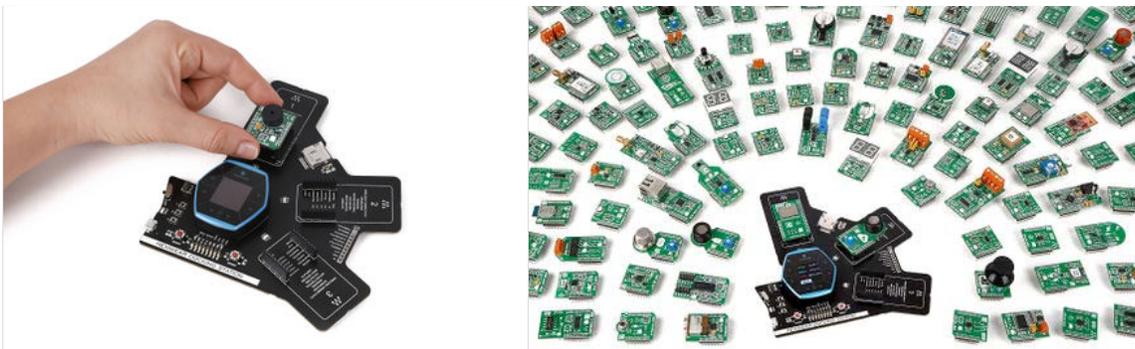


Setting alarms in the Device settings menu from the SENSORS tab



A graph showing room temperature changes over a half hour period, measured by Hexiwear

## Hexiwear Docking Station



The Hexiwear Docking Station is an expansion board that provides an interface for programming, debugging, and enhancing Hexiwear with additional functionalities (by adding click boards™). The Docking Station vastly increases the possibilities of Hexiwear as a development tool. For more information, read the Docking Station User Guide ([http://docs.mikroe.com/Hexiwear\\_Docking\\_Station](http://docs.mikroe.com/Hexiwear_Docking_Station)).

## Resources

- Hexiwear official landing page (<http://www.hexiwear.com>)

- Hexiwear on Kickstarter (<https://www.kickstarter.com/projects/1351029401/hexiwear-a-wearable-development-kit-for-the-iot-er/description>)
- Dedicated repository on MikroElektronika's GitHub channel (<https://github.com/MikroElektronika/HEXIWEAR>)
- Hexiwear Docking Station user guide ([http://docs.mikroe.com/Hexiwear\\_Docking\\_Station](http://docs.mikroe.com/Hexiwear_Docking_Station))
- Hexiwear Creating Your First project guide
- NXP Semiconductors Hexiwear page (<http://www.nxp.com/products/software-and-tools/reference-designs-and-development-kits/kinetis-designs/hexiwear-complete-wearable-and-iot-solution:HEXIWEAR>)
- Homepage of WolkSense, cloud solution provider for Hexiwear (<https://wolksense.com/>)
- MikroElektronika's Technical Support hub (<http://helpdesk.mikroe.com>)