

DTI_2_UM_V2.0 8122 357 24302

DTI-2


EN User manual

NL Gebruiksaanwijzing

DE Benutzerhandbuch

FR Mode d'emploi

SV Användarhandbok

SR Korisničko uputstvo

PHILIPS

# Contents

# 1 Important



## Important Safety Instructions

1. Read these instructions.
2. Keep these instructions.
3. Heed all warnings.
4. Follow all instructions.
5. Do not use this device under shower/in bath.
6. Clean only with dry or moist cloth.
7. Only use attachments/accessories specified by the manufacturer.
8. Refer all servicing to qualified service personnel. Servicing is required when the device has been damaged in any way, such as when the device has been exposed to water, does not operate normally, or has been dropped
9. Battery usage CAUTION – To prevent battery leakage which may result in bodily injury, property damage, or damage to the unit, the batteries (battery pack or batteries installed) shall not be exposed to excessive heat such as sunshine, fire or the like.

## Notice

Any changes or modifications made to this device that are not expressively approved by Philips may void the user's authority to operate the equipment.

This is a class 1 device.

Hereby Philips Research declares that this skin conductance wristband is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.

CE 0682

This product complies with the radio interference requirements of the European Community.

This device complies with Part 15 of the FCC Rules.

Operation is subject to the following two conditions:
(1) this device my not cause harmful interference, and
(2) this device must accept any interference received, including interference that may cause undesired operation.

NOTICE:
Changes or modifications made to this equipment not expressly approved by PHILIPS may void the FCC authorization to operate this equipment.

NOTE: 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 or more 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.

Radiofrequency radiation exposure Information:
The radiated output power of the device is far below the FCC radio frequency exposure limits. Nevertheless, the device shall be used in such a manner that the potential for human contact during normal operation is minimized.

## Recycling

Your product is designed and manufactured with high quality materials and components, which can be recycled and reused.
When you see the crossed-out wheel bin symbol attached to a product, it means the product is covered by the European Directive 2002/96/EC.

Never dispose of your product with other household waste. Please inform yourself about the local rules on the separate collection of electrical and electronic products. The correct disposal of your old product helps prevent potentially negative consequences on the environment and human health.
Your product contains batteries covered by the European Directive 2006/66/EC, which cannot be disposed of with normal household waste.

Please inform yourself about the local rules on separate collection of batteries. The correct disposal of batteries helps prevent potentially negative consequences on the environment and human health.
Always bring your product to a professional to remove the built-in battery.

# 2 Your Discreet Tension Indicator

Congratulations on your purchase and welcome to Philips!

## Introduction

The Discreet Tension Indicator (DTI-2) is a wrist worn sensor device for daily life use.

# What’s in the box

Check and identify the contents of your package:
1 x Sensor wristband
1 x USB cable
1 x USB charger
1 x quick start guide

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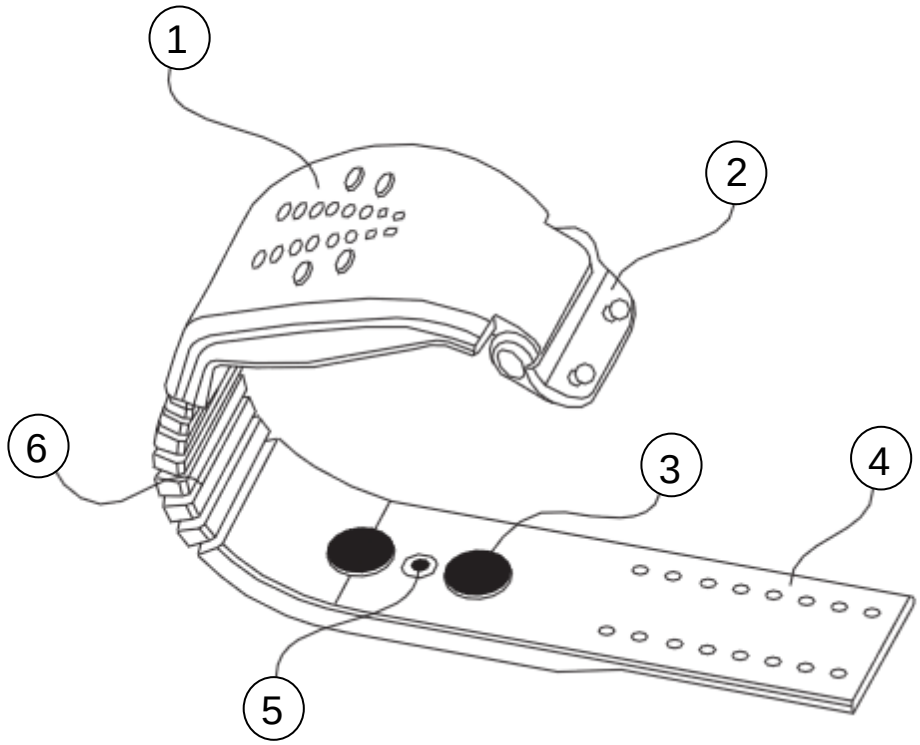
# Overview of the device




1. User interface
2. Fastening hinge – the USB connector is behind it
3. Skin conductance electrode
4. Wrist strap
5. Skin temperature sensor
6. Personal fit segments

| | | | |
|---|---|---|---|
| XXS | 5 segments | L | 9 segments |
| XS | 6 segments | XL | 10 segments |
| S | 7 segments | XXL | 11 segments |
| M | 8 segments | | |

## User interface


1 LED arrays
2 Bluetooth button
3 On/off button
4 Bluetooth LED
5 Status button
6 Event marker button

Two 8-piece LED arrays are available for communications to the wearer. The arrays lit when the device switches on or off. When the status button is switched the skin conductance level and skin temperature are visible for 10 seconds. When the Bluetooth active a blue LED is visible above the Status button.

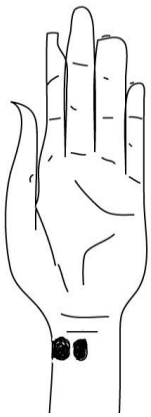
# 3 Intended use

The device is to be used to monitor at the left or right wrist of humans: the skin conductance, skin temperature, ambient temperature, ambient light level, and 3-dimensional acceleration. The sensor data can be streamed live to a receiving station via a Bluetooth wireless link. The device is to not to be used as a medical device. Hence no diagnosis or treatment of a medical illness can or may be performed based on the data obtained by this device.

# 4 How to use the device

## Wearing instructions

The device is worn on the left or right wrist. If a wristwatch is worn, the DTI-2 should be worn on the other wrist. The position should as close to the hand as possible without discomfort or hindering any hand postures. The strap closure is at the side of the thumb. The DTI-2 is fixed to the wrist with a flexible strap. Please pay attention to the level of tightening. The wrist band should be fixed to the wrist, i.e. not dangling loose. The wrist band should however be comfortable to wear and not strapped too tight. Optimal is the loosest strap position without dangling.
Place the rubber strap on the underside of the wrist, such that the skin conductance electrodes contact a desired area of the skin: recommended is to center the electrode furthest from the thumb and wrap the strap towards the electronics module.



Recommended position of the wristband sensor skin conductance electrode for best results.

## Switching the device on/off

The unit is switched on by pressing the on/off button continuously **for more than 4 seconds**. When activated the device flashes the LED arrays to indicate readiness.
The device goes into sleep mode by pressing continuously **for more than 4 seconds** on the on/off button when the device is in active mode. When this happens the rows of LEDs light up briefly.

## Bluetooth wireless data transmission

During use the Bluetooth wireless data transmission can be started by pressing the top right button, which is the Bluetooth activation button. A Blue LED situated top right starts blinking and stays lit during Bluetooth listening. For first time use the device needs to be linked to the receiving device. The pairing code is 0000. On the embedded microSD card a program called DTI-2 Streaming Data Viewer is available, which can visualize the transmitted data on a Windows computer. Connect the DTI-2 to the computer with the USB cable to mount the microSD card as a directory, and run setup to install the program.

## Event marker

During use events can be marked into the database using the lower left button, which is the Event marker button. Both rows of LEDs light up to indicate that an event marker has been recorded into the database.

## Status button

During use the current skin conductance and skin temperature status can be visualized by means of the two LED arrays using lower right button, which is the status button. The left array shows the skin temperature: all LEDs on means 38 degrees Celsius. The decrement is 1 degree per LED, so one LED lit means 31 degrees Celsius. The right array shows the skin conductance normalized to the average of the last minute (3LEDs on). Per increment of 1%, a LED switches on or off. This allows a visualization of the recent skin conductance changes.

## Time synchronization

The DTI-2 can keep track of time and date. In active mode and in sleep mode the internal real time clock takes care of this. All measured sensor data is time stamped and stored in a data file on the microSD card. Before active use of the DTI-2 it needs to be synchronized with a Windows 7 PC to ensure accurate time stamping.
Two methods are available for synchronization:

1) Connect the DTI-2 to a PC the USB cable. In the DTI2-0XXX drive (XXX being the serial number of the DTI-2) double click CreateDTITIME.bat to create a file named *DTITime.txt.* Unhook the device immediately after writing and switch it on. The creation time/date of the *DTITime.txt* file is used as synchronization time. CAUTION: the latency between the creation time/date of the *DTITime.txt* file and switching on the DTI-2 is not taken into

account, which causes an error in the synchronization of at least several seconds.

2) Establish a Bluetooth link with the DTI-2 and start up the DTI-2_BT_StreamingDataViewer program that can be found on the internal data storage of the DTI-2. After opening the communication in this program synchronization will take place automatically.

## Battery charging

Battery recharging is done with the supplied USB charger via the USB cable, which needs to be inserted into the USB connector that can be found behind the fastening hinge. A red LED placed close to the USB connector indicates active charging. It takes about 2 hours to charge the device from empty to full. The red LED may not switch off when a full charge state is realized. The sure way to check whether the battery has a full charge is to unplug the USB cable, and to plug it in again: when the red LED stays out the battery is fully charged.

## Data Readout

1) Connect it to a Windows7/Vista/XP™ PC with the USB cable. A blue LED close to the USB connector indicates a functional USB connection.
2) The device mounts as ‘’Device with Removable Storage’’ on your PC. Open the explorer and click the drive associated with the DTI-2 (should this fail to happen unplug the USB cable and reconnect it). When asked to scan and fix the device, please comply, and tick both check disk options. After the scan the DTI-2 drive mounts normally.
3) Copy the data files to a location of your choice on your own computer.
4) Undock the device after this operation

## Data format and data visualization

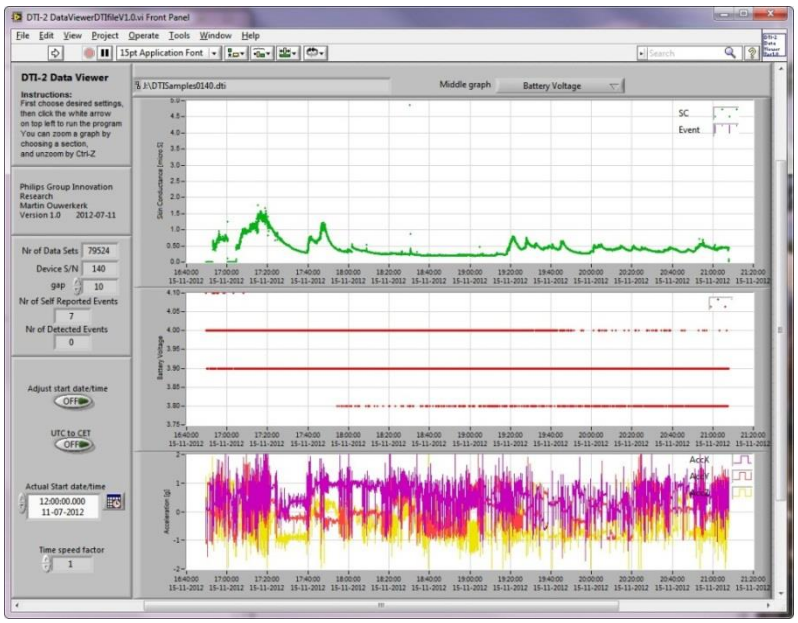
The measured data is stored in a binary file named DTISamples0XXX.dti, where XXX is the serial number of the device. This file can be converted into a text file with the DTI-2_SampleFileParser-P program which is present on the DTI-2 data storage disk. Run this program, select the .dti file, and choose Convert DTI Sample File. This will generate a text file with all data in lines with this format:

yyyymmddHHMMSSmmm|NNNN|ev|ttttt|sksks|xxxxx|yyyyy|zzzzz|vb|etete|eieie|rrrrr

A minus sign may precede the accelerometer data xxxxx, yyyyy or zzzzz. The description of the line coding is given in the next Table.

| Layout code | Description | width | Format |
|---|---|---|---|
| yyyy | Year | 4 | 201x |
| mm | Month | 2 | 01-12 |
| dd | Day | 2 | 01-31 |
| HH | Hours | 2 | 00-24 |
| MM | Minutes | 2 | 00-60 |
| SS | Seconds | 2 | 00-60 |
| mmm | milli seconds | 3 | 000-999 |
| NNNN | Serial number | 4 | 0001-9999 |
| ev | Event | 2 | 1=button; 2=detected |
| ttttt | Skin Temperature | 5 | 100x °C |
| sksks | Skin Conductance | 5 | nano Siemens |
| xxxxx\|yyyyy\|zzzzz | 3D acceleration (x,y,z) | 15 | counts (16384 = 1 g) |
| vb | Battery voltage | 2 | 10x Voltage |
| etete | Ambient temperature | 5 | 100x °C |
| eieie | Ambient light level | 5 | Counts |
| rrrrr | Skin conductance ADC | 5 | 16bit raw ADC output |
| snr | Dataset number | 8 | |

The visualization can be done using the DTI-2 Data Viewer program. This can be installed from the integrated data storage of the DTI-2. Connect the device to a computer with a USB cable.The DTI-2 mounts as ‘’Device with Removable Storage’’ on your computer. Open the explorer and click the drive associated with the DTI-2 (should this fail to happen unplug the USB cable and reconnect it). In the directory DTI-2_DTIfileDataViewerV1.0 Installer a program called setup.exe is located, which installs the data viewer program onto your (Microsoft Windows7/Vista/XP™) computer. A screenshot is shown below.



# 5 Product Information

| | |
|---|---|
| Dimensions | 39.5 x 12 x 63.5 mm |
| Weight | 40 g |
| Power supply | Charger: Input: AC 100-240V, 50/60 Hz<br>Output: DC 5V 0.5A<br>Battery: 3.7V 400mAh Lithium Polymer |
| Battery life | 30 hours without wireless data streaming<br>12 hours with wireless data streaming |
| Operating temperature range | -20 – 50°C (-4 – 122°F) |
| USB | 2.0 |
| Skin conductance sensor | 0.01-65.5 micro Siemens range<br>0.001 micro Siemens sensitivity<br>Silver coated Eyelet A3822C2 Micron electrodes |
| Skin temperature sensor | -20 – 85°C range<br>0.02°C sensitivity<br>100° field of view |
| Ambient temperature sensor | -40 – 125°C range<br>0.5 – 2°C accuracy (best at 40°C) |
| Ambient light sensor | 24.4 counts/µW/cm$^2$ responsivity at 640nm for the VIS-IR diode<br>6.9 counts/µW/cm$^2$ responsivity at 940 nm for the IR diode |
| 3D accelerometer | ±2g range<br>0.001 g per bit sensitivity |
| Wireless connection | Bluetooth 2.1 |
| Data storage | 2GB microSD card |
| Sampling frequency | 2-25 Hz firmware dependent |