DG5 VHand 3.0 OEM
Technical Datasheet

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PRELIMINARY VERSION

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Product Description

The new DG5 VHand 3.0 data glove is a complete and innovative sensor for motion detection. Thanks to its five embedded bend sensors, it is possible to accurately measure the finger movements, while the embedded Invensense™ 9 axes (3 axes accelerometer, 3 axes byroscope and 3 axes magnetometr) motion sensor allows to sense both the hand movements and the hand orientation (roll and pitch and yaw).

The glove communicates with external devices via USB cable or WiFi connection.

If USB connection is used, the proper FTDI driver must be installed (http://www.ftdichip.com/FTDrivers.htm), while the WiFi communication requires a WiFi router and a WiFi enabled PC.

WiFi communication uses standard TCP IP sockets, the standard port is the 2000. The use of WiFi communication, instead of Blueetooth or Zigbee, allows the use of multiple data gloves inside the same environment without reducing the sampling rate.

The glove can be powered directly from USB or use internal battery for a complete unwired use. The internal 3.7V 300mAh battery guarantees around 4 hours of operations. The internal battery can be recharged with the provided USB cable.

WARNING: for safety reasons do not recharge the battery while dress the dataglove. Undress the dataglove and plug the usb cable.

The data glove can be used in different applications: robotics, motion capture, virtual reality, innovative games, rehabilitation and also as an innovative aid for disabled people.

The innovative design allows users to completely remove all the sensors and the electronic board, so the glove can be easily cleaned or changed.

An internal 9 axis sensor fusion algorithm is used to provide stable and accurate hand attitude information.

The package sent by the dataglove can be defined from user.

Technical Characteristics

- **Power Supply:** from USB or with embedded rechargeable battery
- **Load Current:** max 220mA, 70mA in standard operation mode;
- **Operating Temperature:** from 0 to 50 °C
- **Storage Temperature:** from 0 to 70 °C
- **Finger Sensing Resolution:** 12 bit (4096 step)
- **Sampling rate:** 10 - 100Hz (customizable)[1]
- **Number of finger sensors:** 5 (one per finger);
- **Hand orientation resolution:**

[1] At the moment the frame rate is set to 100Hz, future firmware release will allow the user to change the package frame rate.

- ROLL: ± 0.01°
- PITCH: ± 0.01°
- YAW: ± 0.05°

- **Embedded Accelerometer:**
  - programmable full scale range: +-2g, +-4g +-8g;
  - digital 3 axis accelerometer;
  - 16 bit ADC acquisition;
  - High-g interrupt for falling detection;

- **Embedded Gyroscope:**
  - Digital-output X-, Y-, and Z-Axis angular rate sensors (gyroscopes) with a user-programmable fullscale range of ±250, ±500, ±1000, and ±2000°/sec;
  - Improved low-frequency noise performance;
  - Digitally programmable low pass filter;

- **Embedded Magnetometer:**
  - 3-axis silicon monolithic Hall-effect magnetic sensor with magnetic concentrator;
  - Output data resolution is 13 bit (0.3 µT per LSB);
  - Full scale measurement range is ±1200 µT;
  - Self-test function with internal magnetic source to confirm magnetic sensor operation on end products;

- **Glove dimension:** one size fits many size (elastic). The glove is available both in right and left version

- **Output Connector: micro USB;**

- **WiFi:**
  - Qualified 2.4 -GHz IEEE 802.11b/g transceiver;
  - High throughput, 1 Mbps sustained data rate with TCP/IP and WPA2;
  - On board ECOS-OS, TCP/IP stacks;
  - FCC/CE/ICS certified and RoHS compliant;

Communication Protocol:

Serial Port Setting for USB communication:

Once connected the dataglove to a PC USB port, a new COM PORT is created. Please check in the Device Manager for the comport number or run autodiscovery function of the Vhand Manager software..

Baud Rate: 115200 BPS
Data Bit: 8
Stop Bit: 1
Parity: NONE

Package structure:

The packages have the following structure:

HEADER CMD PKGLEN PACKAGE_DATA CRC ENDCAR

where:
HEADER = '$'
CMD = command to be executed;
PKGLEN: the number of byte in the PACKAGE (comprising CRC and ENDCAR)
PACKAGE_DATA: bytes representing the additional data
CRC = sum modulo 256 of the previous bytes of the package (from HEADER to the last byte of the PACKAGE_DATA)
ENDCAR = '#'

Communication Commands:

START SAMPLING:

Command ID: **0x0A**

This command starts the dataglove communication data streaming.

COMMAND: **0x0A**
NUMBYTES_PACKAGE: 0x03

Command:

HEADER 0x0A 0x03 PACKAG BCC ENDCAR
Answer: streaming ON

PACKAGE: dataglove sampling package format;

1: quaternion orientation + finger sensors;
2: only quaternion;
3: raw gyroscope data + raw accelerometer data + raw magnetometer data + finger sensor;
4: only raw data;
5: only finger data;

Once this command is sent, the dataglove start transmitting continuously the data package. The package sent depends to the PACKAGE byte value.

If PACKAGE = 0 the dataglove stop to communicate;

If PACKAGE = 1 the data package will be 34 bytes length with the following structure:
HEADER 0x0A PKGLEN PKGTYPE ID CLK QUAT1 QUAT2 QUAT3 QUAT4 FING1 FING2 FING3 FING4 FING5 STATUS BCC ENDCAR

where:
- ID is the 2 bytes representation of the glove programmed ID
- QUAT1.. QUAT4 are 4 bytes signed integer values representing the values of the quaternion. To get real value divide the signed integer per 32768.0;
- FING1..FING5 are 2 bytes representing the percentage of bending in thousandths of percentage (0 = no bend, 1000 = maximum bend);

If PACKAGE = 2 the data package will be 14 bytes length with the following structure:
HEADER 0x0A PKGLEN PKGTYPE ID CLK QUAT1 QUAT2 QUAT3 QUAT4 STATUS BCC ENDCAR

If PACKAGE = 3 the data package will be 34 bytes length with the following structure:

HEADER 0x0A PKGLEN PKGTYPE ID CLK GYROX GYROY GYROZ MAGNX MAGNY MAGNZ ACCELX ACCELY ACCELZ FING1 FING2 FING3 FING4 FING5 STATUS BCC ENDCAR

where:
GYROX... GYROZ are 2 bytes signed integer representing the instantaneous rotation of the hand in cents of degrees per second;
ACCX...ACCZ: represents the raw accelerometer values;
MAGNX..MAGNZ: represents the raw magnetometer values;
FING1..FING5 are 2 bytes representing the percentage of flexion in thousandths of percentage (0 = no flexion, 1000 = maximum flexion);

If PACKAGE = 4 the data package will be 34 bytes length with the following structure:
HEADER 0x0A PKGLEN PKGTYPE ID CLK GYROX GYROY GYROZ MAGNX MAGNY MAGNZ ACCELX ACCELY ACCELZ STATUS BCC ENDCAR

If PACKAGE = 5 the data package will be 34 bytes length with the following structure:
HEADER 0x0A PKGLEN PKGTYPE ID CLK FING1 FING2 FING3 FING4 FING5 STATUS BCC ENDCAR

STOP SAMPLING:

Command ID: **0x0B**

This command stops the dataglove communication data streaming.

COMMAND: **0x0B**
NUMBYTES_PACKAGE: 0x02

Command:

HEADER 0x0B 0x02 BCC ENDCAR

Answer: NONE

Once received this command the dataglove stops to stream data package.

GET ID

Command ID: **0x0C**

This command stops the dataglove communication data streaming.

COMMAND: 0x0C
NUMBYTES_PACKAGE: 0x02

Once received this command the dataglove sends its identification informations;

Command:

HEADER 0x0C 0x02 BCC ENDCAR

Answer:

HEADER 0x0C PKGLEN DEV_TYPE MICRO_TYPE ID IP MASK GATEWAY DHCP STATUS BCC ENDCAR

where

DEV_TYPE: 1 → USB dataglove
2-> Wifi Dataglove

MICRO_TYPE: 1 → X32 micro device (important for firmware update)
2 → X128 microdevice (important for firmware update)

ID: 2 byte representation of the micro ID

IP: 4 bytes, ip address received from DHCP of the device (only for wifi device, otherwise all 0);
MASK: 4 bytes, netmask of the device
GATEWAY: 4 bytes, gateway set.
DHCP: dhcp settings of the dataglove (0=DHCP OFF, 1=DHCP ON)
STATUS: not yet implemented, in future release it will contain the battery status

NOTE: IP, MASK, GATEWAY and DHCP can be modified only for WiFi dataglove version, in the USB version they have the following standard values:
IP → 127.0.0.1, MASK → 255.255.255.0, GATEWAY->127.0.0.1, DHCP = 1;

SET ID:

Command ID: **0x0D**

This command set the identificator of the dataglove and store in the internal eeprom.

COMMAND: 0x0D
NUMBYTES_PACKAGE: 4

Command:

HEADER 0x0D 0x04 IDH IDL BCC ENDCAR

Answer:

HEADER 0x0D 0x04 IDH IDL BCC ENDCAR

where IDH and IDR represents the high and low part of the new dataglove ID.

GET LABEL:

Command ID: **0x11**

This command request the label of the dataglove.

COMMAND: 0x11
NUMBYTES_PACKAGE: 0x02

Command:

HEADER 0x11 0x02 BCC ENDCAR

Answer:

HEADER 0x0D 0x12 LABEL1 LABEL2 …. LABEL16 BCC ENDCAR

where LABEL1, …, LABEL16 represent the ASCII code of the label of the dataglove.

SET LABEL:

Command ID: **0x10**

This command sets the label of the dataglove and store it in the internal eeprom.

COMMAND: 0x11
NUMBYTES_PACKAGE: 0x12

Command:

HEADER 0x11 0x02 LABEL1 LABEL2 …. LABEL16 BCC ENDCAR

Answer:

HEADER 0x0D 0x12 LABEL1 LABEL2 …. LABEL16 BCC ENDCAR

where LABEL1, …, LABEL16 represent the ASCII code of the label of the dataglove, if the label length is less than 16 characters fill the remaining with 0.

GET FIRMWARE VERSION:

Command ID: **0x13**

This command request the current firmware version

COMMAND: 0x13
NUMBYTES_PACKAGE: 0x02

Command:

HEADER 0x13 0x02 BCC ENDCAR

Answer:

HEADER 0x0D 0x12 FW1 FW2 FW3 BCC ENDCAR

where FW1, FW2, and FW3 represent the firmware versione, in example FW1 = 1, FW2 = 1 ,FW3 = 2 represent the 1.1.2 version.

START CALIBRATION

Command ID: 0x31

This command starts the self calibration of the dataglove orientation module.

COMMAND: 0x31
NUMBYTES_PACKAGE: 0x02

Command:

HEADER 0x31 0x02 BCC ENDCAR

Answer:

HEADER 0x31 0x03 CALIBRSTAGE BCC ENDCAR

where:

CALIBRSTAGE reports the calibration status (from 0 to 100), when it reports 100 it means the calibration is terminated. A Value 0f 255 means an error in the calibration.

SET WIFI INFORMATION (only for WIFI version):

Command ID: **0x1A**

This command set the TCP/IP communication settings:

COMMAND: 0x1A
NUMBYTES_PACKAGE: 0x0F

Command:

HEADER 0x1A 0x0F IP MASK GATEWAY DHCP BCC ENDCAR

Answer:

HEADER 0x1A 0x12 IP MASK GATEWAY DHCP BCC ENDCAR

where:

IP: 4 bytes representation of the IP address;

MASK: 4 bytes representation of the netmask;

GATEWAY: 4 bytes representation of the gateway;

DHCP: 0 → DHCP off, 1->DHCP ON;

GET WIFI INFORMATION (only for WIFI version):

Command ID: **0x1B**

This command request the current TCP/IP communication settings:

COMMAND: 0x1B
NUMBYTES_PACKAGE: 0x0F

Command:

HEADER 0x1B 0x0F IP MASK GATEWAY DHCP BCC ENDCAR

Answer:

HEADER 0x1B 0x12 IP MASK GATEWAY DHCP BCC ENDCAR

where:

IP: 4 bytes representation of the IP address;

MASK: 4 bytes representation of the netmask;

GATEWAY: 4 bytes representation of the gateway;

DHCP: 0 → DHCP off, 1->DHCP ON;

GET MAC ADDRESS (only for WIFI version):

Command ID: **0x1d**

This command requets the mac address of the wifi module::

COMMAND: 0x1B
NUMBYTES_PACKAGE: 0x02

Command:

HEADER 0x1D 0x02 BCC ENDCAR

Answer:

HEADER 0x1D 0x08 MAC BCC ENDCAR

where:

MAC: 6 bytes representation of the MAC address;

SET ACCESS POINT SSID (only for WIFI version):

Command ID: **0x21**

This command set the name of the access point, used for the WiFi communication:

COMMAND: 0x21
NUMBYTES_PACKAGE: 0x22

Command:

HEADER 0x21 0x22 SSID1 …. SSID32 BCC ENDCAR

Answer:

HEADER 0x21 0x22 SSID1 … SSID32 BCC ENDCAR

where:

SSID1, … SSID32 represents the ASCII code of the access point SSID, if the SSID length is less than 32 bytes fill the reamining with 0.

GET ACCESS POINT SSID (only for WIFI version):

Command ID: **0x23**

This command set the name of the access point, used for the WiFi communication:

COMMAND: 0x23
NUMBYTES_PACKAGE: 0x02

Command:

HEADER 0x23 0x02 BCC ENDCAR

Answer:

HEADER 0x23 0x22 SSID1 … SSID32 BCC ENDCAR

where:

SSID1, … SSID32 represents the ASCII code of the access point SSID, if the SSID length is less than 32 bytes fill the reamining with 0.

SET ACCESS POINT PASSWORD (only for WIFI version):

Command ID: **0x22**

This command set the name of the access point, used for the WiFi communication:

COMMAND: 0x22
NUMBYTES_PACKAGE: 0x22

Command:

HEADER 0x22 0x22 PWD1 …. PWD32 BCC ENDCAR

Answer:

HEADER 0x22 0x22 PWD1 … PWD32 BCC ENDCAR

where:

PWD1, … PWD2 represents the ASCII code of the access point password SSID, **at the moment only WPA2-PSK passwords can be used, so check your access point settings to make it works properly with the dataglove.**

GET ACCESS POINT PASSWORD (only for WIFI version):

Command ID: **0x24**

This command set the name of the access point, used for the WiFi communication:

COMMAND: 0x24
NUMBYTES_PACKAGE: 0x02

Command:

HEADER 0x24 0x02 BCC ENDCAR

Answer:

HEADER 0x24 0x22 PWD1 … PWD32 BCC ENDCAR

where:

PWD1, … PWD2 represents the ASCII code of the access point password SSID, at the moment only WPA2-PSK passwords can be used, so check your access point settings to make it works properly with the dataglove.

STORE WIFI SETTINGS

Command ID: 0x1E

This command store the WiFI information (IP, GATEWAY, NETMASK, SSID and PASSWORD) in the wifi module.

COMMAND: 0x1E
NUMBYTES_PACKAGE: 0x02

Command:

HEADER 0x1E 0x02 BCC ENDCAR

Answer:

HEADER 0x1E 0x03 OK BCC ENDCAR

where:

OK = 1

Finger reference:

In the following picture are reported the finger reference for both the right and the left dataglove versions.

Right Version:

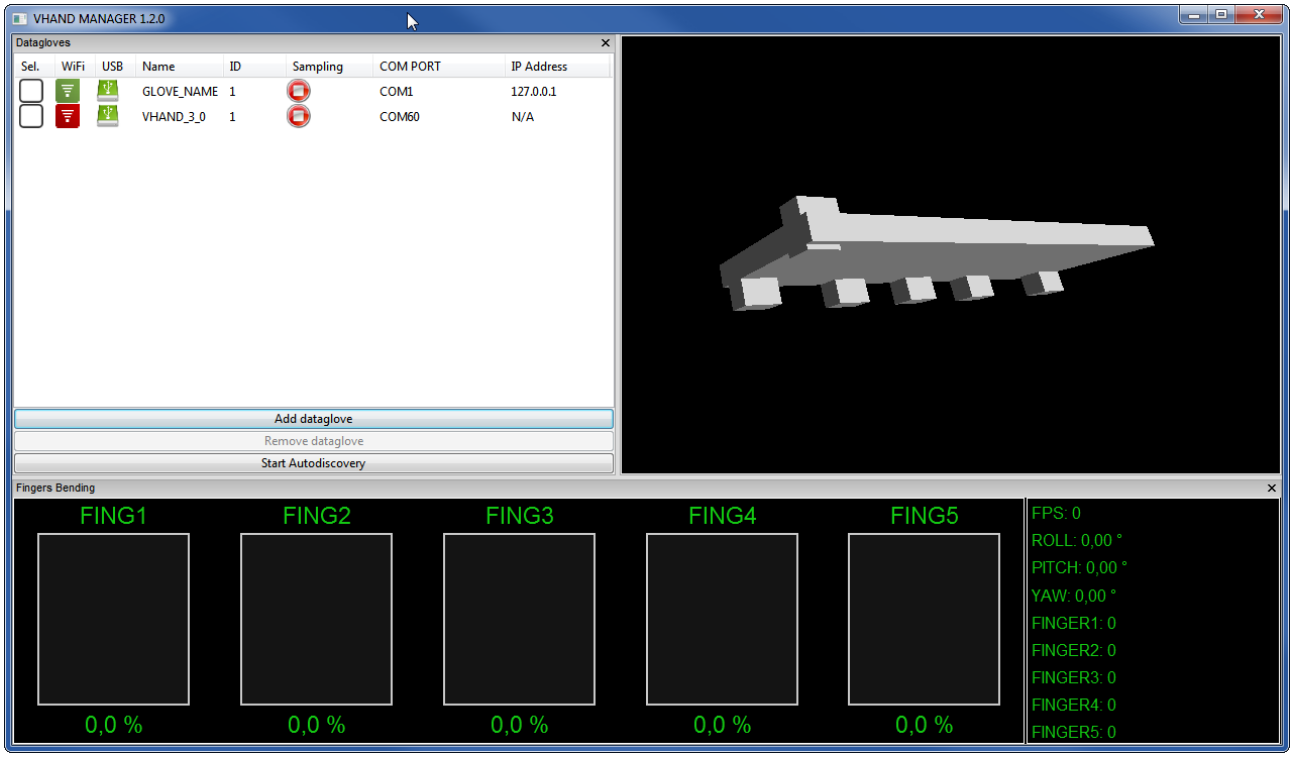
Thumb	Bend 5
Index	Bend 4
Middle	Bend 3
Ring	Bend 2
Little	Bend 1

Left Version:

Thumb	Bend 1
Index	Bend 2
Middle	Bend 3
Ring	Bend 4
Little	Bend 5

VHAND MANAGER SOFTWARE

The VHAND MANAGER SOFTWARE can be used to test and program the dataglove, it can be used for both the USB and WiFi versions.



The GUI is divided in three sections:

- dataglove lists;
- orientation windows;
- fingers windows;

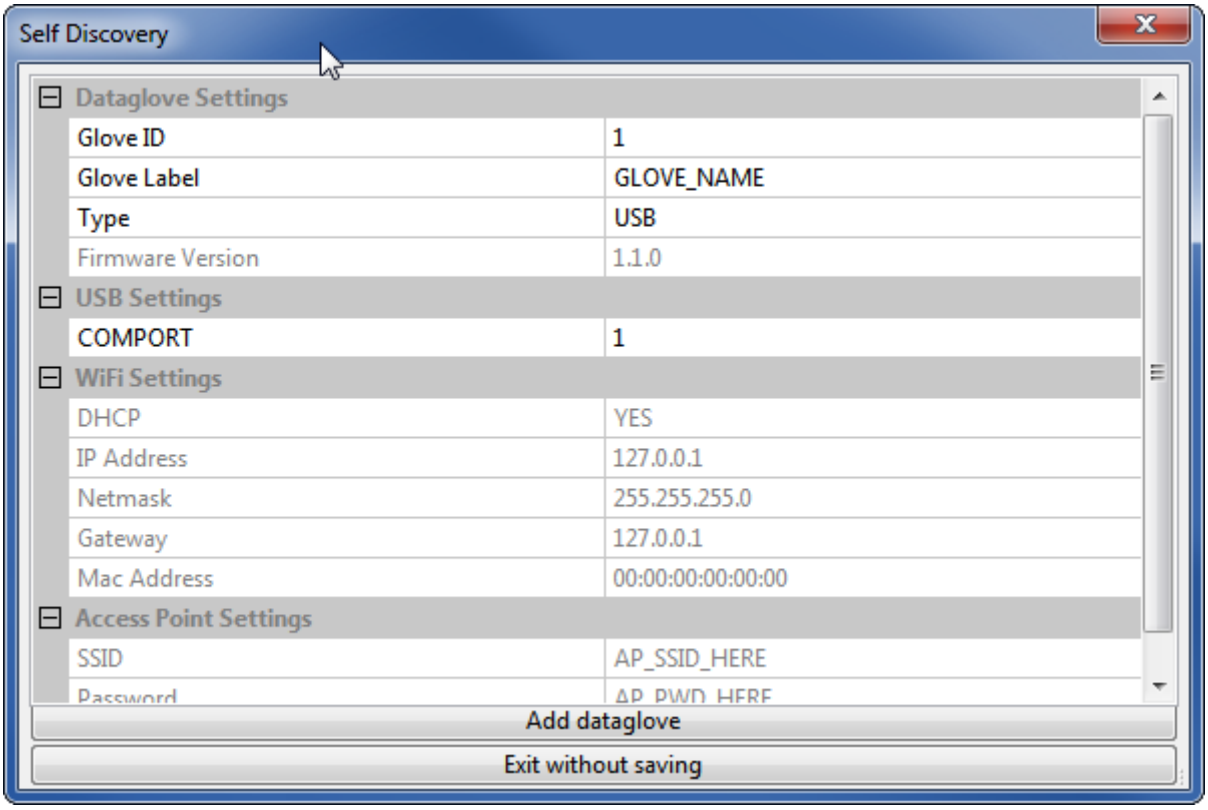
Dataglove list window:

In this window are shown all the detected datagloves. It reports the followind information:

- WiFi: a green icon reports Wifi module present and detected;
- USB: a green icon reports USB communication available;
- Name: the label of the dataglove;
- ID: the stored id of the dataglove;
- Sampling: a green icon reports sampling active (on USB or Wifi);
- COMPORT: the detected communication COM port;
- IP Address: the detected IP address (only for WiFi version).

On the bottom are placed 3 buttons:

Add dataglove: opens the “Add data glove” dialog.



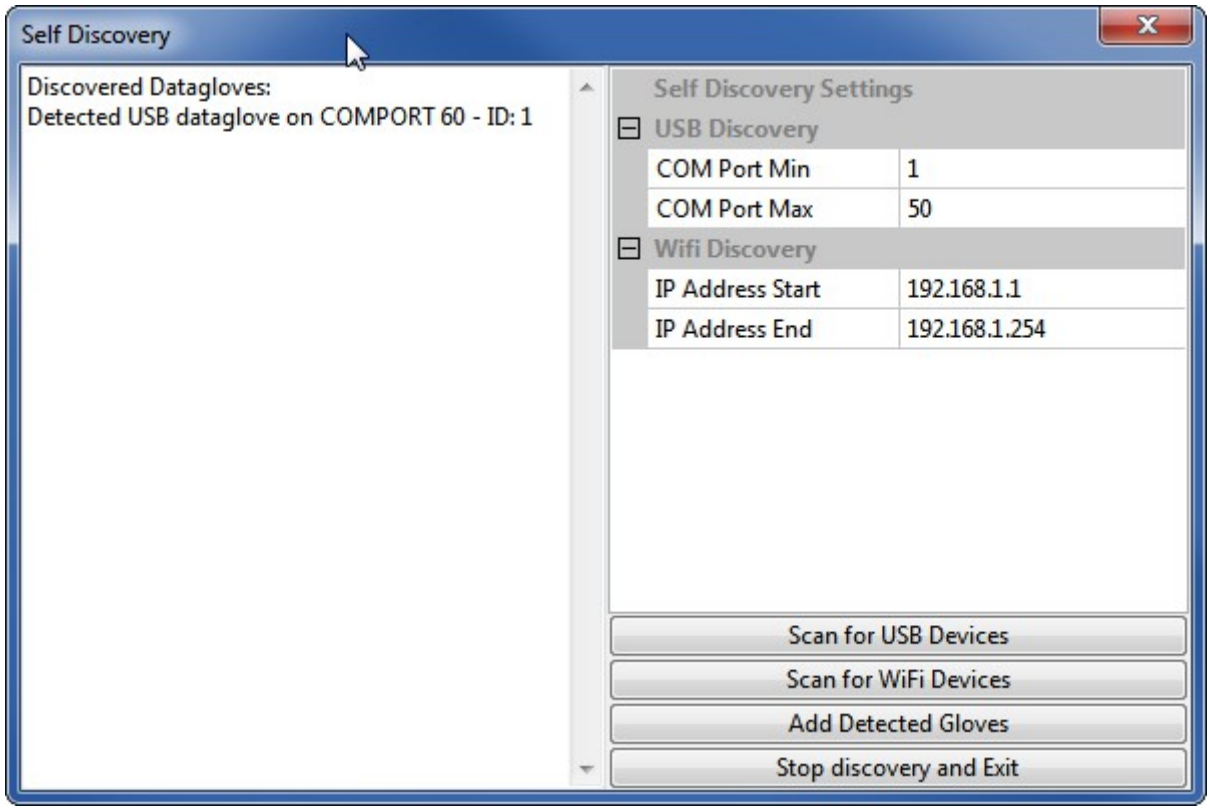
Here it is possible to manually add a dataglove. It is possible to specify the dataglove type (USB or WIFI), the ID, the label, the USB communication port and all the WiFi settings.

Press “Add dataglove” to add the dataglove to the dataglove list;

Press “Exit” to abort the operation.

Remove Dataglove: remove the selected dataglove from the list;

Start Autodiscovery: starts the autodiscovery procedure.



It is possible to discover device connected on the USB port (“Scan for USB devices”) or connected to the WiFi (“Scan for Wifi devices”). Once a dataglove is detected a row in the left panel is added, press “Add detected Gloves” button to add the discovered dataglove to the glove list.

By clicking with the mouse right button on a dataglove in the list a menu will appear:

START SAMPLING OVER USB: start the sampling on the USB ports;

START SAMPLING OVER IFI: starts the sampling over Wifi transmission;

SETTINGS: open the settings dialog, where it is possible to modifiy the dataglove parameters;

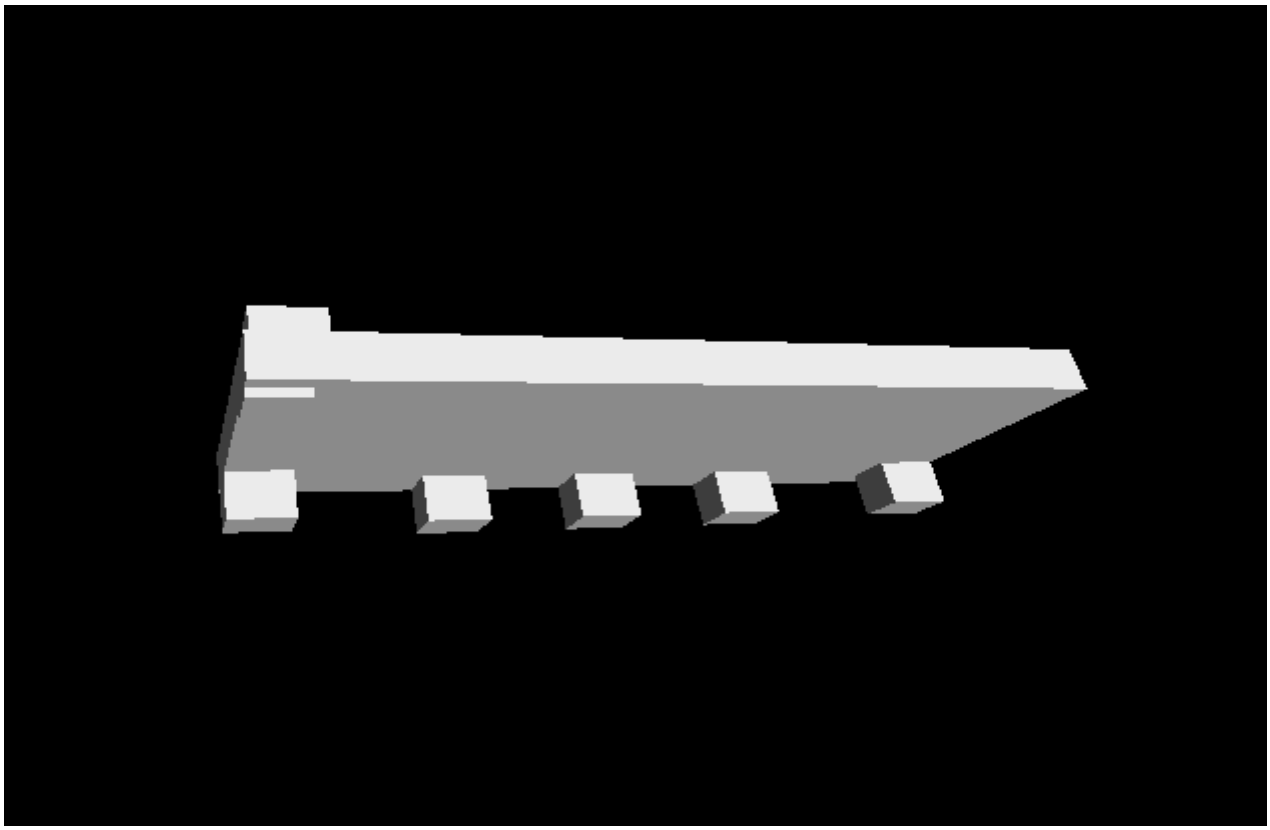
UPDATE FIRMWARE: opend the “Update Firmware” dialog, where it is possible to update the firmware of the dataglove;

UPDATE CALIBRATION: start the self calibration procedure of the dataglove;

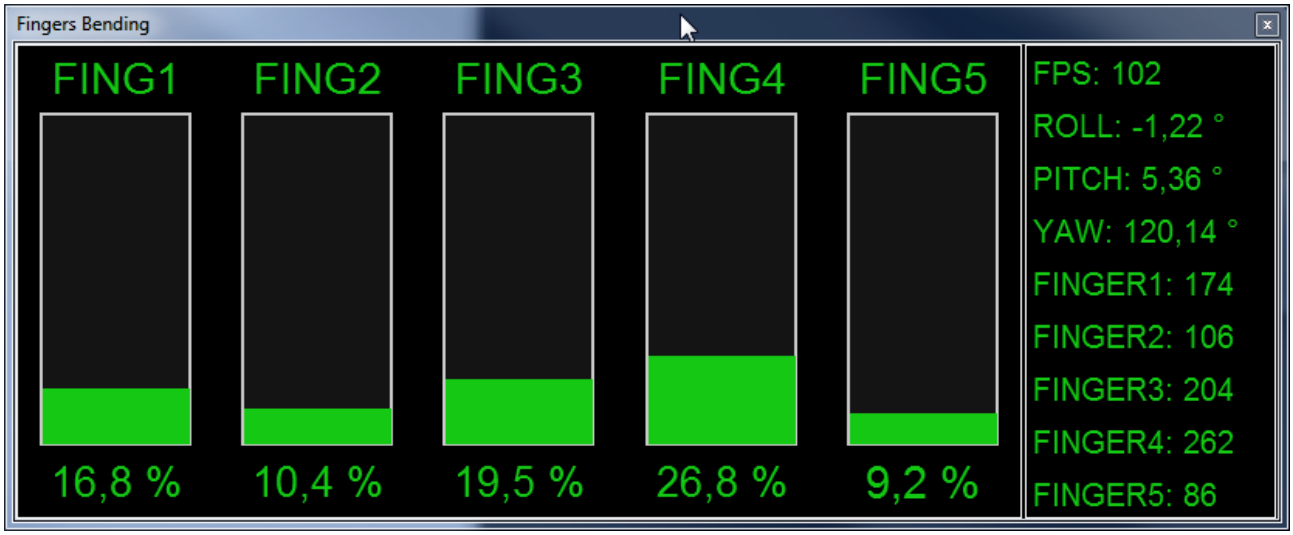
TURN OFF MODULE: turn off the dataglove (only for battery operated dataglove).

Orientation window:

In this windows the orientation of the dataglove is reported.



Fingers Windows:



In this windows are reported the detected finger bend (for 0% to 100%) and the information about the dataglove orientation in the space (roll, pitch and yaw).

Software and Manuals Download:

The latest software and manual versions can be found here:

www.dg-tech.it/vhand3/

Contacts

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