VMG 30 / VMG30+
Technical Datasheet

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Table of Contents

Product Description....3
Technical Characteristics....3
Communication Protocol:....5
Serial Port Setting for USB and Bluetooth communication:....5
Package structure:....5
Communication Commands:....6
START SAMPLING:....6
STOP SAMPLING:....7
GET ID....7
SET ID:....8
GET LABEL:....8
SET LABEL:....8
GET FIRMWARE VERSION:....9
START CALIBRATION....9
Command ID: 0x31....9
Finger reference:....11
Right Version:....11
Left Version:....11
Bluetooth Pairing:....12
Software and Manuals Download:....13
Contacts....13

Product Description

The new VMG 30 dataglove is a complete and innovative sensor for hand motion detection. Thanks to its ten embedded bend sensors (two per finger), four abduction sensors, one palm arch sensor, one thumb cross over sensor and five pressure sensors it is possible to accurately measure the finger movements, while the two embedded Invensense™ 9 axes (3 axes accelerometer, 3 axes gyroscope and 3 axes magnetometr) motion sensor allows to sense both the hand and wrist movements and orientations (roll and pitch and yaw).

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

If USB connection is used, the proper FTDI driver must be installed (http://www.ftdichip.com/FTDrivers.htm), while the Bluetooth communication requires a PC equipped with integrated Bluetooth or an external Bluetooth USB dongle.

Bluetooth communication uses a SPP protocol, then a virtual COM port is created once a connection is correctly established.

The glove can be powered directly from USB or use internal battery for a complete unwired use. The internal 3.7V 570mAh 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 100mA, 40mA 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:** 10 (one per finger);
- **Number of abduction sensors:** 4

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

- **Palm Arch and Thumb crossover sensors;**
- **Number of pressure sensors:** 5
- **Hand orientation resolution:**
  - ROLL: ± 0.1°
  - PITCH: ± 0.1°
  - YAW: ± 0.5°
- **Wrist orientation resolution:**
  - ROLL: ± 0.1°
  - PITCH: ± 0.1°
  - YAW: ± 0.5°
- **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 lycra). The glove is available both in right and left version
- **Output Connector: micro USB;**
- **Bluetooth:**
  - Bluetooth Class 2 Module;
  - Transmit Power: +3 dBm;
  - Receiver Sensitivity: -86 dBm;
  - FCC/CE/IC certified and RoHS compliant;

- **5 Vibrotactile engines for haptic feedback (only VMG30+ model);**

Communication Protocol:

Serial Port Setting for USB and Bluetooth communication:

Once connected the dataglove to a PC USB port and/or the Bluetooth communication is correctly paired, a new COM PORT is created. Please check in to Device Manager for the comport number or run autodiscovery function of the VMG30 Manager software..

Baud Rate: 230400 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: raw gyroscope data + raw accelerometer data + raw magnetometer data + finger sensor;

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 QUAT1W QUAT2W QUAT3W QUAT4W QUAT1H QUAT2H QUAT3H QUAT4H FING11 FING12 FING21 FING22 FING31 FING32 FING41 FING42 FING51 FING52 PALMARCH NOVAL THUMBCR NOVAL PRESS1 PRESS2 PRESS3 PRESS4 PRESS5 ABD1 ABD2 ABD3 ADB4 TIME BCC ENDCAR

where:
- ID is the 2 bytes representation of the glove programmed ID
- QUAT1W.. QUAT4W are 4 bytes signed integer values representing the values of the quaternion, which reports the wrist orientation. To get real value divide the signed integer per 65536.0;
- QUAT1H.. QUAT4H are 4 bytes signed integer values representing the values of the quaternion, which reports the hand orientation. To get real value divide the signed integer per 65536.0;
- FING11..FING52 are 2 bytes representing the percentage of bending in thousandths of percentage (0 = no bend, 1000 = maximum bend);
- PALMARCH are 2 bytes representing the percentage of palm bending (0..1000);
- THUMBCR: are 2 bytes representing the thumb flexion with respect to thepalm (0...1000)
- NOVAL: 2 bytes with no meaning
- PRESS1..PRESS5: 2 bytes representing the pressure applied over the fingertip (0 = maximum pressure, 1000 no pressure)
- ABD1..ABD4: 2 bytes representing the abduction distance between adjacent fingers (0...1000)

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-> Bluetooth 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, all 0 (these values are kept for compatibility with old Wifi VMG30 version)
MASK: 4 bytes, all 0 (these values are kept for compatibility with old Wifi VMG30 version)
GATEWAY: 4 bytes, all 0 (these values are kept for compatibility with Wifi VMG30 version)
DHCP: 4 bytes, all 0 (these values are kept for compatibility with Wifi VMG30 version)

STATUS: not yet implemented, in future release it will contain the battery status.

SET ID:

Command ID: **0x0D**

This command set the identification of the dataglove and store it into 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 version, 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.

Finger reference:

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

Right Version:

Thumb	FING11 – FING12	PRESS1
Index	FING21 – FING22	PRESS2
Middle	FING31 – FING32	PRESS3
Ring	FING41 – FING42	PRESS4
Little	FING51 – FING52	PRESS5

Left Version:

Thumb	FING51 – FING52	PRESS5
Index	FING41 – FING42	PRESS4
Middle	FING31 – FING32	PRESS3
Ring	FING21 – FING22	PRESS2
Little	FING11 – FING12	PRESS1

Bluetooth Pairing:

Once the device is turned on, it is discoverable by other devices. In order to connect the device to a Windows 10 O.S. PC follow these steps:

- click on “Windows” icon on the bottom left
- click on “Settings”
- open “Devices”
- click on “Bluetooth”
- Turn On Bluetooth if it is off, device discovery will start automatically;
- A device named “VIRTHAND” will appear;
- Click on “Pairing”
- Insert “0000” when the pairing device is requested;
- Wait for pairing process, a “Connected” label should appear below the VIRTHAND device;

FTDI driver Fix for low rate sampling

If the communication over USB is lagging and the reported frame rate is too low it is possible to fix this problem by changing two parameters directly on the device setting page.

Please follow these instructions to fix the problem:

- open “Device Manager”
- extend Ports (COM and LPT) and right click on USB Serial Port (COMxx)
- select “Properties”;
- select “Port Settings” on the top bar;
- click on “Advanced” button;
- change parameters “Receiver (bytes)” and “Trasmission (bytes)” from 4096 to 256;
- click “OK” to close the parameter window;
- clock “OK” again to apply modifications;
-

Software and Manuals Download:

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