



**COLORVUE**

COLOR AID

**USER MANUAL**

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## **Introduction**

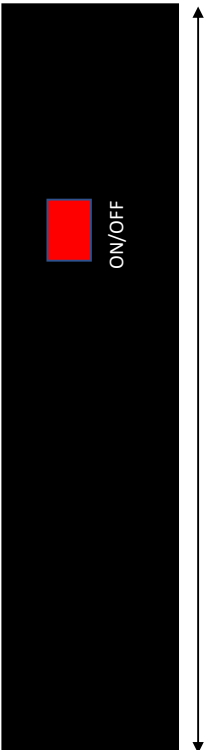
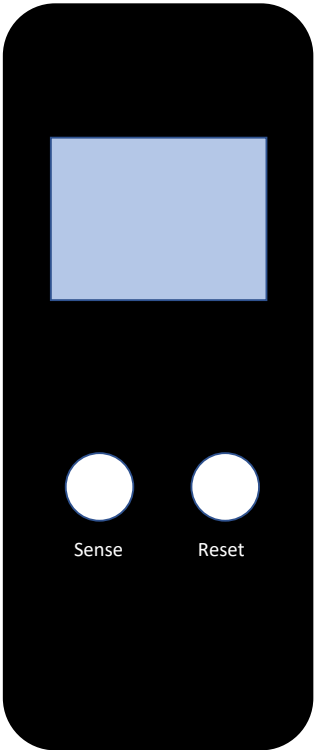
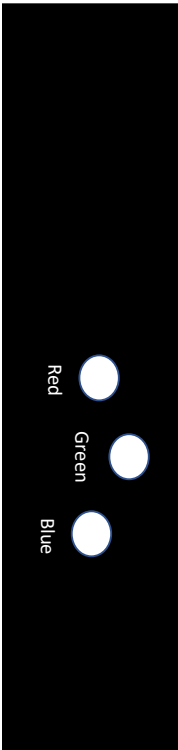
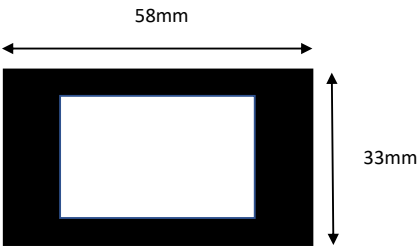
Visually disabled people rely on the sense of touch and sense of hearing to help them recognize anything in their everyday life. Colors, however, is also important in giving information about things such as the color of cash note, the color of spices and color of cloth. Without a sense of visual, they are not able to recognize color and perceive the beauty of color.

ColorVUE is an effective color identifier with cutting edge technology that recognizes up to 20 different colors. In addition it identifies the RGB values of any color and gives a percentage value. The outputs are twofold. It offers a visual output via OLED display and a vibration pattern via 3 vibration motors.

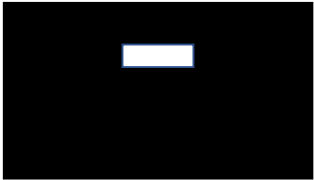
There are different methods for measuring color. Color VUE uses a sophisticated analysis based on the TCS 3200 color sensor module. TCS 3200 is a programmable current to frequency converter on a single monolithic CMOS integrated circuit. The output is a square wave with a 50% duty cycle with frequency directly proportional to the light intensity.

Each and everyone have his or her own perception and interpretation of color. Color VUE is programmed in more general way. However, the RGB measurements remain highly precise.

Device Description



140mm



## **Top surface of the device**

Top surface of the device contains the OLED display and two push buttons. One inch from the upper side of the device OLED display is centrally located. Two inches below the display, two buttons are in a horizontal line. Both buttons have clear tactile markings and allow users to perform all operating steps. Left button is for taking the measurements, whereas right button is for resetting the device.

## **Bottom surface of the device**

Bottom surface contains four countersunk screws that hold the case together.

## **Front surface of the device**

Front surface is carved one and a half inches in to the device because in order to take accurate measurements the sensor has to be placed within a fixed distance. By experimenting it is found that one and half inches is the most suitable distance for the accurate readings.

## **Side surface of the device**

On the side surface a switch can be found. Two inches from the upper side surface on/off switch can be

found. Going further down two more inches a hole can be found for a USB charging port. Whenever the battery level is low USB cable needs to be plugged In via this. On the other side surface contains three vibration motors. Which are placed in the middle of the side surface, each button half inch apart. When holding the device in order to take a measurement, first three fingers of the hand index finger, middle finger and the ring finger should be placed in the three vibration motors. Holding the device in above manner can feel the intensity of the RGB components of the color. Therefore, identifying the color.

### **Back surface of the device**

On the back surface of the device a charging port can be found.

## **Features**

### **Button functions**

Turn on the Color VUE by pressing the turn on/off button on the side surface of the device. By using the same button other way around the device can be turned off. As soon as this button is turned on a 5V voltage will be supplied to the circuit.

Top surface contains the color measurement button and the reset button. After the device is turned on, color measurement and reset button can be used to function the device. In order to take a color measurement the color measurement button has to be pressed and hold for few seconds. During the time it's hold and for few cycles afterward it will take samples in a one second interval in order to detect the color. Device should make contact with the surface for the entire time. Also, as soon as the color measurement button is released the device should not be removed from contact with the surface. Because the measuring cycle will go on for another few cycles.

On the right-hand side of the top surface, it contains the color measurement button and on the left hand side of the top surface it contains the reset button. Function of the



reset button is simple. It resets the already contained RGB values to zero and the color detected will be displayed as unknown. Whenever taking a new measurement it is recommended to press the reset button and then the color measurement button.

## **Charging the battery**

The device is equipped with an integrated battery. Two Lithium-Ion Polymer batteries are connected in series here to supply the required voltage. Each battery has the capability to supply 3.7 V and has a capacity of 350mAh. Since it is connected in series the batteries will supply 7.4 V voltage and it will be regulated to 5 V.

As soon as the battery becomes weaker OLED display will get blurred. This is a remainder to recharge the battery using a USB cable. It will take approximately 2 hours to get fully charged. It is recommended to switch off the device while charging. As soon as the charging is done the device is ready to operate. Once fully charged the battery will provide 350mA for an hour. Since there are two batteries connected in series it will provide 350mA for two hours.

## Color measurement

To ensure the correct color measurement position the measuring sensor of Color VUE at a right angle to the surface that is being analyzed. After that press and hold the color measurement button for few seconds. After releasing the color measurement button it will take few more seconds to stabilize the equipment. Therefore, during this time period, it is essential to hold the above position still. This time period can be seen as the OLED display will start to flicker. Few seconds later the Color VUE will start to give an output. After this period the device can be taken away from the measured surface and hand held. Name of the color and RGB values can be read from the OLED display. Vibration motor output can be felt as well.

TCS3200 is the color sensor used. It is a programmable color light-to-frequency converter with configurable silicon photodiodes and a current-to-frequency converter on a single monolithic CMOS integrated circuit. The TCS3200 reads an 8\*8 array of photodiodes and outputs a square. Following figure shows a wave which frequency is directly proportional to light intensity.

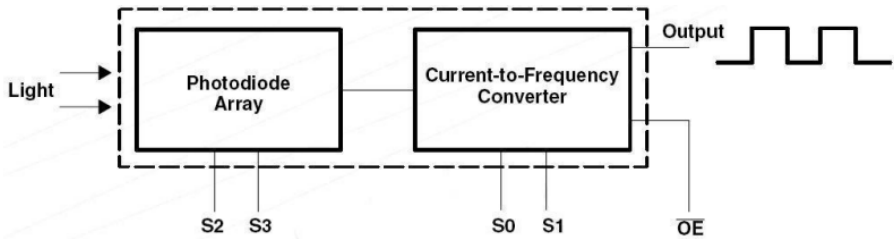


Figure 01: Functional block diagram of TCS 3200

TCS3200 comes with four types of filters: red, green, blue, and clear with no filter. When the sensor is illuminated by a ray of light, the device's filters (blue, green, red, or clear) can be selected using two logic inputs, S2 and S3. Table 2 depicts the relationship between S2, S3, and filter type.

Table 01: Relationship among S2, S3 and other filter types.

S2	S3	Filter Type
Low	Low	Red
Low	High	Blue
High	Low	Clear (No filter)
High	High	Green

The TCS3200 generates a square wave (50% duty cycle) with frequency proportional to light intensity and

color. The TCS3200D's typical output frequency ranges from 2Hz to 500KHz. As shown in Table 3, the user can control frequency values of 100%, 20%, and 2% using two programmable outputs, S0 and S1.

Table 02: Relationship among S0, S1 and output frequency scaling.

S0	S1	Output Frequency Scaling
Low	Low	Power down
Low	High	2%
High	Low	20%
High	High	100%

TCS3200 has different sensitivities to red, green and blue. As a result, the RGB output of pure white is not always 255. Therefore, white balance adjustment is required after power up within 2 seconds. Here in the device the sensor is preprogrammed therefore there is no need for a white balance adjustment.

In the RGB color model, a color is described by indicating how much of each of the red, green, and blue components is present. The color is represented as an RGB triplet, with each component ranging from 0 to a

predefined maximum value. Component values are frequently stored in computers as unsigned integer numbers in the range 0 to 255, which is the range that a single 8-bit byte can provide. Each color can be represented as a combination of RGB components. Therefore, identifying these components individually can detect the corresponding color.

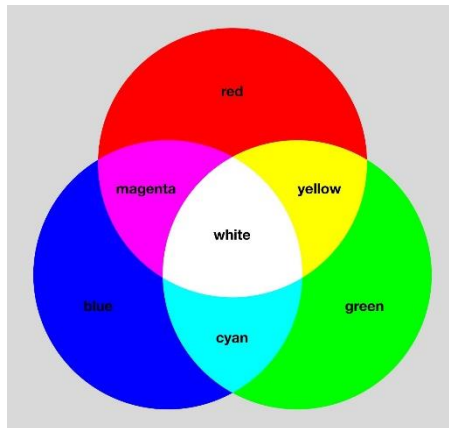


Figure 02: RGB color model

Light interference from outside should be avoided, which may affect the result of color identification. It is recommended to place the light source and Color Sensor in a close, light reflection free box. Therefore, when taking a measurement front of the device should make full contact

with the measuring surface. Otherwise, it will result in erroneous readings thus outputting an inaccurate color to the display.

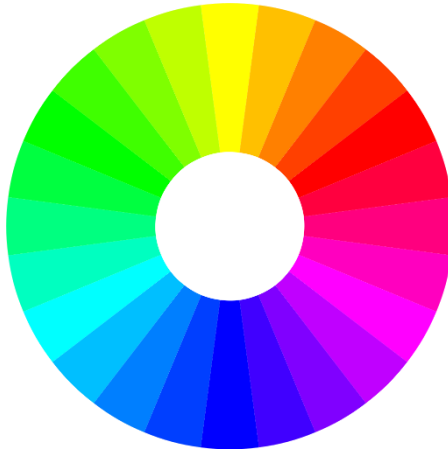


Figure 03: RGB color wheel

## **Display**

A SSD1306 128×64 Mono 0.96 Inch I2C OLED Display is used as the display for this device. SSD1306 OLED Display is a single-chip CMOS OLED/PLED driver with a controller for organic / polymer light emitting diode dot-matrix graphic display system. It consists of 128 segments and 64 commons. This IC is designed for a Common Cathode type OLED panel. The resolution of the display is 128x64 dot matrix.



Figure 04: OLED Display

As in above figure, color name is displayed. Then red value, green value and blue value is displayed correspondingly. RGB values are displayed as a percentage, highest value of the sensor output being 255 and the lowest value of the sensor output being 0.

### **Vibration motor**

Vibration motor gives haptic feedback to the user. It is designed in such a way that when the contribution of a certain color component is high the motor will vibrate for a longer period and vice versa. For an example when placed

to a red dominant color surface, vibration motor corresponding to red will vibrate a longer period than the other two. When placed near a yellow colored surface, vibration motors corresponding to blue and green will vibrate for almost equal time and vibration motor corresponding to red will vibrate a less amount of time. Thus, it will provide unique haptic feedback for each color.

Vibration motors are placed in the bottom surface of the device. First three fingers of the hand, index finger, middle finger and the ring finger should be placed on the vibration motors accordingly. From top first vibration motor which the index finger is placed will vibrate according to the red component value, second vibration motor which the middle finger is placed will vibrate according to the green component value and third vibration motor which the ring finger is placed will vibrate according to the blue component value. Colors can be identified from variation of vibration duration of motors.



## **Setup and Operation**

In this chapter how to setup the device an operation of the device is discussed. Initially the device needs to be turned on. Turn on/off button is placed in the side surface of the device. After turning on it is relevant to make sure that the battery level is sufficient. If the battery level is insufficient OLED display will get blurred. If the OLED is blurred the battery needs to be recharged. Otherwise, the equipment is ready to use.

After making sure that the device is ready for use it needs to be placed in right angle to measuring surface. Light interference from outside should be avoided, which may affect the result of color identification. Therefore it is needed to make sure that the front surface of the device should be tightly enclosed with the measuring surface.

After above conditions are fulfilled press and hold the color measurement button which is on the right hand side of the top surface for few seconds. After releasing the color measurement button, it is necessary to hold the position for few more seconds because the device needs to be stabilized. Thereafter, device can be removed from the contact with the surface. While stabilizing the OLED will

keep refreshing. As soon as the device is stabilized, it can be removed from the contact with the measured surface. Moreover, the vibration motor output will be felt at this point.

In order to feel the vibration first three fingers of the hand, index finger, middle finger and the ring finger should be placed on the vibration motors accordingly. Depending on the vibration duration, contribution from each RGB component can be determined. Thus, visually impaired person can detect the color. Other than that name of the color and percentage values of the RGB components are displayed in the OLED display.

When taking a second measurement the device needs to be reset. Just pressing the reset button which is on the left hand side of the top surface once is enough to execute this procedure. When executed the OLED display will show color name as unknown and it will set the all three RGB values to zero. Now the above stated procedure is needed be followed from the beginning to determine a color of a new surface. When the device is needed to be shut off simply press the turn on/off button.

## Specifications

Dimensions	140mm(L) x 33mm(H) x 58mm (W)
Weight	100g
Power supply	2 x 3.7 V, 350mAh Lithium-ion Polymer
Input current	350mA
Input voltage	5+-0.5V
Charging duration	1 hour
On battery duration	2 hours
Color recognition	20colors
Full scale frequency	500-600 kHz
Nonlinearity error	0.2% at 50kHz
Operating temperature	0°C - 50°C
Storage temperature	-10°C - 60°C
USB port	Micro USB port for charging unit
Display	SSD1306 128×64 Mono 0.96 Inch I2C OLED
Refresh time	1 s
Response time	2.5 s

## **Troubleshooting**

If OLED display is blurred, please charge the device. For further instructions seek 3.3 Charging the battery.

If the device does not work at all, then follow these instructions: Connect the device for at least an hour to the USB-charger which was included in the package. Now try to turn the device ON again. If it does not show any effect, the device must be repaired. In this case contact the distributor or manufacturer.

Please keep in mind that color recognition is also affected by the texture of the measured object. As a result, a rough knitted pullover may appear darker than it is. Furthermore, the surface of transparent (or rough woven) fabrics can shimmer and distort the result. We recommend folding the cloth several times, smoothing it, and then pressing a finger against the measuring head from behind.

If the display is frozen press the reset button. If it does not show any effect, try switching off and on the device.

If the sensing is inaccurate, software may have been corrupted. If the software is corrupted or outdated contact the distributor or manufacturer.

## **Health and Safety**

Ensure that no moisture enters the device.

Take care that the measuring head is not contaminated, especially when the device is used with wet or creamy material (for example lipstick).

Do not expose the Color Star to extremely high humidity, extremely high or low temperatures or any dust or dirt.

The operating temperature of the device is between 0 and 50 degrees Celsius (32 to 104 degrees Fahrenheit).

If any liquid enters the device, wipe the case dry with a cloth and let the device dry completely before starting it again.

Only use the device if it works correctly.

Please note that this device is not a children's toy.

Use a slightly damp or dry cloth to clean the case of the device. Do not use abrasive or aggressive cleaning products.



Caution: No liquid should enter the device! Avoid using strong acids or scrubbing cleaners, and do not clean the surface with rough sponges as they may damage the device's case.



Caution: It is critical to protect the area next to the measuring sensor from contamination in order to obtain a reliable color measurement. Only a service technician can clean this area.



This device must be discarded separately from household waste at specially designated collection and recycling points. Please contact your local authorities for more information.



Batteries should not be thrown away in regular garbage. As a consumer, you are required by law to bring your old batteries to public collection points (Directly to the manufacturer or any shop that provides these batteries).

Pb-Cd-Hg These signs can be found on contaminant-laden batteries.

Pb = containing lead

Cd = containing cadmium

Hg = containing mercury

## **Guarantee and Service**

The original purchaser of this product is provided with a guarantee of:

- Twenty four (24) months on the device itself
- Twelve (12) months on accessories (e.g. power supply)
- Six (6) months on durable parts from the date of purchase (e.g. case, battery)
- Please keep in mind that we do not provide warranties for the charging cable.


During the above-mentioned warranty periods, if the device stops working or malfunctions and the troubleshooting tips do not help restore working conditions, the product will be repaired or replaced at no cost. Manufacturer will not be liable for any indirect, special, or consequential damages. The device's exposure to liquids, strong electromagnetic fields, heat, as well as dropping or opening the case, results in an immediate loss of guarantee. If problems arise, please contact manufacturer or a local distributor before returning the device for unknown reasons. Procedures will be

communicated as needed. Only an authorized technician can open the device!


Manufacturer reserves the right to make any changes or improvements to its products without further notice.



**Symbols**

	Caution
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	Note
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	Dispose separately from household waste
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	Manufacturer
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ColorVUE - Sri Lanka is the manufacturer of this product.

ColorVUE,  
Peradeniya,  
Kandy,  
Sri Lanka.

Telephone: +94811231234

Email: [colorvue@gmail.com](mailto:colorvue@gmail.com)

Web: [www.colorvue.com](http://www.colorvue.com)