ICMv1 Software

User Guide

Contents

1.0 Disclaimer, Warning & Credits

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Warning.

By connecting the Development Kit to the parallel port using the I2C adapter, you are operating these two circuits together WITHOUT GALVANIC ISOLATION. DO NOT CONNECT OR DISCONNECT ANYTHING WHILE THE Development Kit OR THE PC IS SWITCHED ON !!! Doing so anyway may damage your PC and/or the Development Kit permanently.

Credits

Inpout32.dll port driver from http://www.logic4u.net. The Inpout32.dll parallel port driver is freeware.

CIE xy chart – Prof. Geoff Hoffman (http://www.fho-emden.de/~hoffmann/)

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2.0 Introduction.

This user guide describes the use of the ICMv1 program. The ICMv1 program is a tool to demonstrate the color and brightness control using the PC parallel port interface. It also has a calibration and measurement function to calibrate the Development Kit easily.

Other **HDJD-J822** system can also be demonstrated or calibrated, as long as the following conditions are fulfilled.

a. SDA and SCL pins are accessible.

b. The embedded microcontroller, or any other external controller must not be accessing the SDA and SCL pins when this program is running. This program does not check whether the I2C bus is free and will assume that the I2C bus is always free.

Refer to section 6.0, Hardware configuration to configure the program to work with the HDJD-J822 system.

3.0 Preliminary Information and set up

The parallel port should be set to "Standard Parallel Port" or "SPP" mode.

The default configuration file is config.txt. This file is located in the application directory.

The default configuration file is to setup the parallel port to work with the Development Kit.

The default configuration file will set the following defaults address.

a. The default parallel port base address is set to 0378h or decimal 888.

b. The default HDJD-J822 device address is 54h or decimal 84.

c. The default EEPROM address is 50h or decimal 80.

The default calibration file is calfile##.txt, where ## represent the HDJD-J822 device address in decimal. The calibration file is placed in the application path directory. This file is not available after the ICMv1 program installation is completed. The calibration file is obtained only after calibration is done. Refer to 8.0 Calibration Procedure section.

If the calibration file does not exist, the thirty-one calibration registers will be read from EEPROM. If the EEPROM does not contain calibration data, the external microcontroller should program the thirty-one calibration data registers, i.e. CALDATA0 to CALDATA30. If no external controller is available to write the thirty-one calibration data registers, then power on default values will be used.

The Development Kit EEPROM locations from 0 to 95 (or 0h to 5Fh) is reserved and used by this software program.

4.0 ICMv1

The ICMv1 is usually displayed when the application is started. This will control the HDJD-J822 in normal mode with optical feedback.

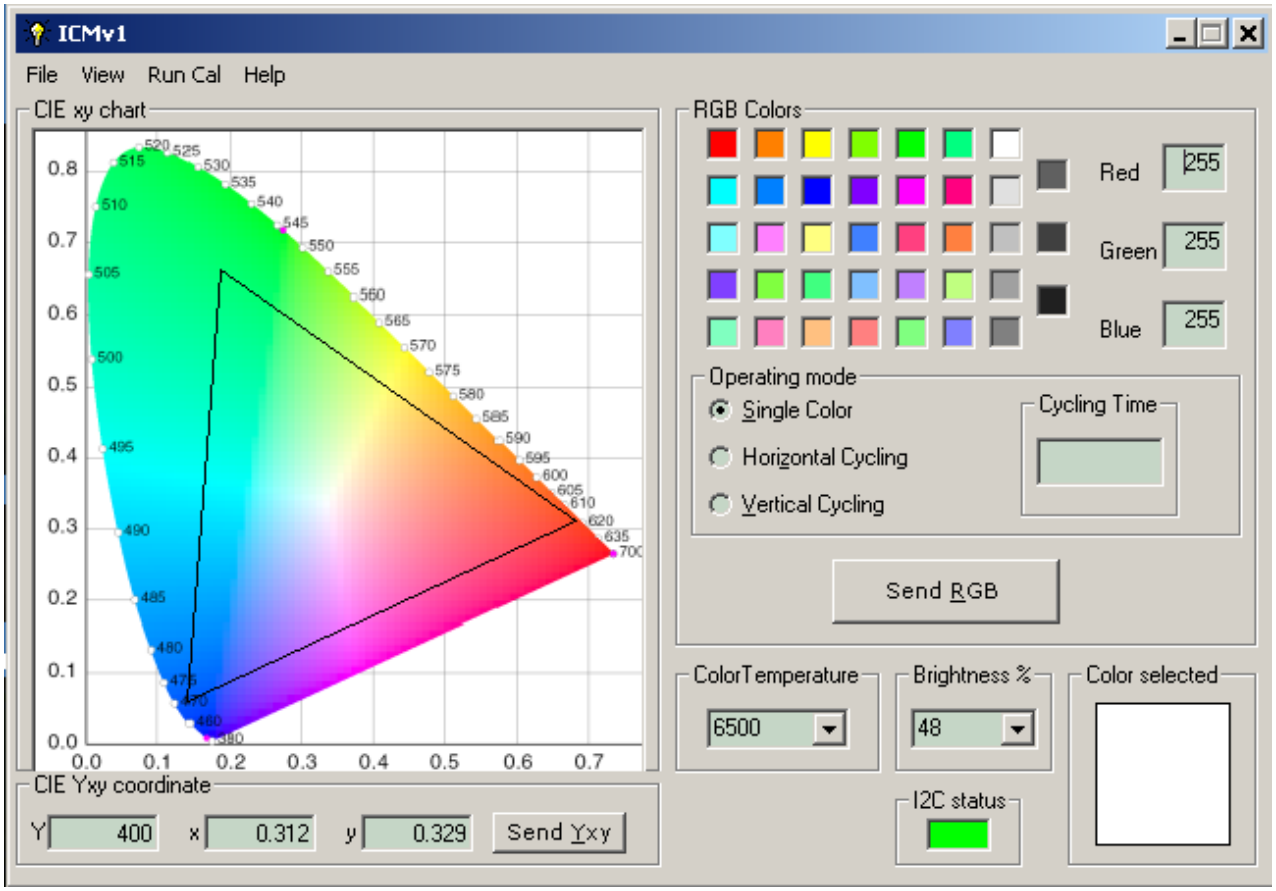

Figure 1. ICMv1

The ICMv1 allows the user to specify color set points to the HDJD-J822. The set point can be specified by the following methods.

a. CIE xy chart color picker

b. CIE Y, x, y input text box

c. RGB colored boxes

d. Red, Green and Blue input text boxes

e. Color temperature

f. Brightness %

CIE xy chart

Click on the CIE xy chart to select the chromaticity point. The chosen chromaticity point x, y coordinates is updated on the CIE x and y input text boxes. The Y set point is not changed and is at the current Y set point.

CIE Y, x, y input textboxes

Manually enter the Y, x-coordinate, and y-coordinate values of the requested color. The Y value must be less than 1000. The x-coordinate and y-coordinate values range from 0 to less than 1.

After the data are entered, the **Send Yxy** command button is clicked and the selected color is displayed.

RGB colored boxes

Click on the RGB colored boxes representing the color desired. The RGB input text boxes, RED, GREEN and BLUE will be updated and the selected color is displayed.

RGB input text boxes

Manually enter RGB input text boxes. Values must range from 0 to 255. Click **Send RGB** command button and the selected color is displayed.

Operating Mode

There are three operating modes.

1. Single color
2. Horizontal cycling
3. Vertical cycling

The second and third operating mode are only applicable in the RGB color space.

Click on **Single Color** if only one color response is needed.

Click on **Horizontal Cycling** to set to the horizontal cycle mode. The colors are cycled when the **Send RGB** command button is clicked.

Click on **Vertical Cycling** mode to set to the vertical cycle mode. The brightness level are cycled with the same chromaticity when the **Send RGB** command button is clicked.

When horizontal cycling or vertical cycling mode is selected, the View menu, Run Cal menu, CIE xy chart color picker, the CIE Y, x, y input textboxes and the color temperature selection will be disabled. The cycling time will be enabled and set to default value of 2.

Click **Send RGB** command button to start the cycling.

To stop the display cycling, the user must set the operating mode back to single color.

Cycle time

This input box sets the time interval for the color or brightness to be displayed before changing to the next color or brightness level. The cycle time input text box can be typed only when the operating mode is either horizontal cycling or vertical cycling. To change the cycling time, type the desired time interval. Hit the enter key to accept the cycling time.

Color temperature

Click to open a list of temperature values and select the desired color temperature. The CIE x, y input textboxes is updated. The CIE Y value is at the current value and the chosen color temperature is obtained.

Alternatively, the user can enter a custom color temperature. Hit the enter key to accept the custom color temperature.

Brightness %

Click to select the desired brightness level from a list of brightness available. Alternatively, a custom brightness level setting can be entered from the keyboard.

I2C Status

Green color indicates that the I2C communication between the computer and the HDJD-J822 is ok. Red color indicates that the computer could not communicate with HDJD-J822.

Color Selected

This shows the sample of the color selected. It may not be the exact color as the color displayed.

Menu bar

The menu bar consists of **File**, **View**, **Run Cal** and **Help**. The View and Run Cal menu are enable only if the operating mode is single.

On the **View** menu, click **Configuration** to check the configuration setting. Refer to 6.0 hardware configuration for further information.

On the **View** menu, click **Calibration** to read the calibration data. Refer to 5.0 view calibration menu for further information.

Click **Run Cal** menu to perform calibration to obtain the thirty-one calibration registers values.

Refer to 7.0 Calibration and measurement for more information.

On the **File** menu, click **Exit** to exit the ICM program. Alternatively, click "X" on the top right corner of the main menu.

On the **Help** menu, click **Help** to open this user guide.

On the **Help** menu, click **About** for information about this program.

5.0 View Calibration data

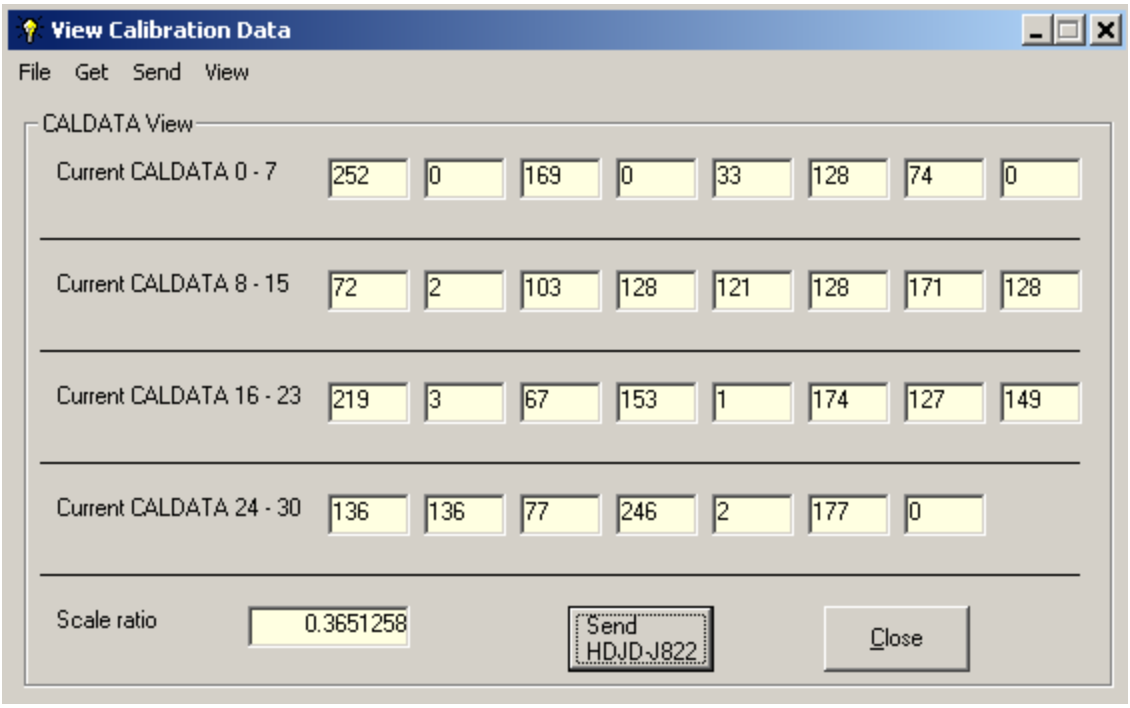

Figure 2. View Calibration Data

The View Calibration Data shows the following:

a. The loaded thirty-one calibration data, i.e. CALDATA0 to CALDATA31 values and

b. Scale ratio.

The scale ratio is not available if the calibration file does not exist. The scale ratio provides correlation if the color set point is picked using the CIE xy chart, color temperature or Y, x, y input text boxes. The actual programmed CIE Y luminance value can be obtained from the equation below:

Actual programmed CIE Y luminance value:

$$= \frac{\text{Y input text box value}}{\text{Scale ratio}}$$

On the **Get** menu, click **Default** to load the HDJD-J822 power on default calibration data values in the View Calibration Data.

On the **Get** menu, click **EEPROM**. The calibration data from EEPROM is loaded and shown in the View Calibration Data.

To send the calibration data shown in the View Calibration Data to the HDJD-J822,

a. Click **Send HDJD-J822** command button or

b. On the **Send** menu, click **HDJD-J822**.

On the **Send** menu, click **EEPROM**. The EEPROM is written with calibration data from the data shown in the View Calibration Data.

Click the **View** menu to display the current thirty-one calibration data registers values programmed in HDJD-J822,

On the **File** menu, click **Open** to open another calibration file. The calibration data from the file is loaded and shown in the View Calibration Data. However, the loaded calibration data is not yet sent to the HDJD-J822.

On the **File** menu, click **Save** to save the calibration data shown in View Calibration Data to a file.

To discard the calibration data loaded in the View Calibration Data, click the **View** menu, or exit the View Calibration Data.

To exit the View Calibration Data,

a. On the **File** menu, click **Close** or

b. Click **Close** command button or

c. Click **X** on the top right corner of the View Calibration Data.

6.0 Hardware configuration

The default values should work well with the Development Kit.

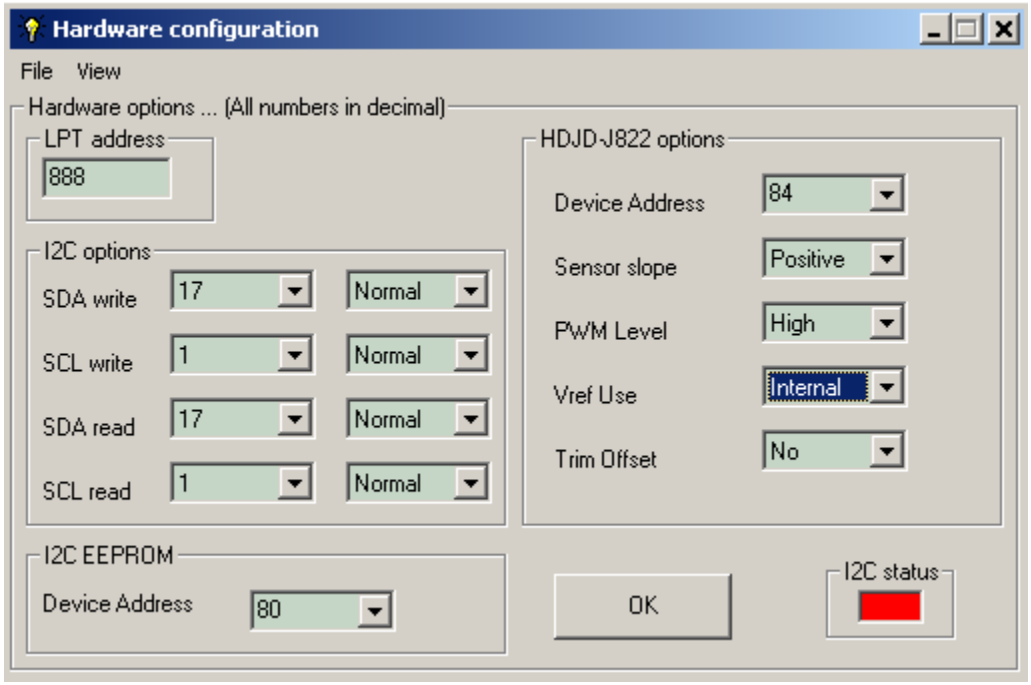

Figure 3. Hardware configuration.

All numbers are in decimal.

There are four sections, LPT address, I2C options, I2C EEPROM device address and HDJD-J822 options.

LPT address

This value is used as the parallel port base address. E.g. To enter base address 378h, type the decimal value '888' in the text box below LPT address.

I2C Options

This section setup the parallel port pins to communicate with the HDJD-J822 or EEPROM.

SDA write: Select the parallel port pins for SDA write. If the pin passes through an inverter, then the box beside the pin number needs to be changed from **Normal** to **Inverted**.

SCL write: Select the parallel port pins for SCL write. If the pin passes through an inverter, then the box beside the pin number needs to be changed from **Normal** to **Inverted**.

SDA read: Select the parallel port pins for SDA read. If the pin passes through an inverter, then the box beside the pin number needs to be changed from **Normal** to **Inverted**.

SCL read: Select the parallel port pins for SCL read. If the pin passes through an inverter, then the box beside the pin number needs to be changed from **Normal** to **Inverted**.

I2C EEPROM

The default device address is 50h or decimal 80. To prevent the EEPROM from being used by this program, set the EEPROM **Device Address** to **NONE**. This will make all menus concerning with EEPROM to be invisible. If an invalid address is entered, the EEPROM **Device Address** will be set back to **NONE**

HDJD-J822 options

Device address: Set the text box to the 7-bit **HDJD-J822** device address. The 7-bit address configuration is as follows.

Table 1. HDJD-J822 device address

Bit	6	5	4	3	2	1	0
Value	1	0	1	0	1	A1	A0

Note: A1 and A0 are the logic value at HDJD-J822 pins A1 and A0.

If A1 = A0 = 0, the device address value is 1010100 or 54h or decimal **84**.

The program will use the 7-bit address to generate device write and device read address automatically.

Sensor slope: Select either **Positive** or **Negative**. If the sensor characteristics are increasing voltage output with increasing light, then positive sensor slope is used.

PWML: Select either **High** or **Low**. If the LED drivers are active high enable, select **Low**.

Vref Use: Select either **Internal** or **External**. If internal voltage reference is used, select **Internal**.

Trim Offsets: Select **Yes** or **No**. If **No** is selected, trim offset will be disabled.

Click the command button **OK** to accept the configuration. The ICMv1 will be displayed.

I2C Status

Green color indicates that the I2C communication between the computer and the HDJD-J822 is ok.

Red color indicates that the computer could not communicate with HDJD-J822.

On the **File** menu, Click **Save** to save the configuration setting. The default file name is config.txt.

On the **File** menu, click **Open** to open a configuration file. The configuration data is loaded.

To discard any changes, Click **View** menu or exit the Hardware configuration.

"To exit the hardware configuration, click **X** on the top right corner of the Hardware configuration.

7.0 Calibration and Measurement

This will operate the HDJD-J822 in calibration mode or open loop without optical feedback.

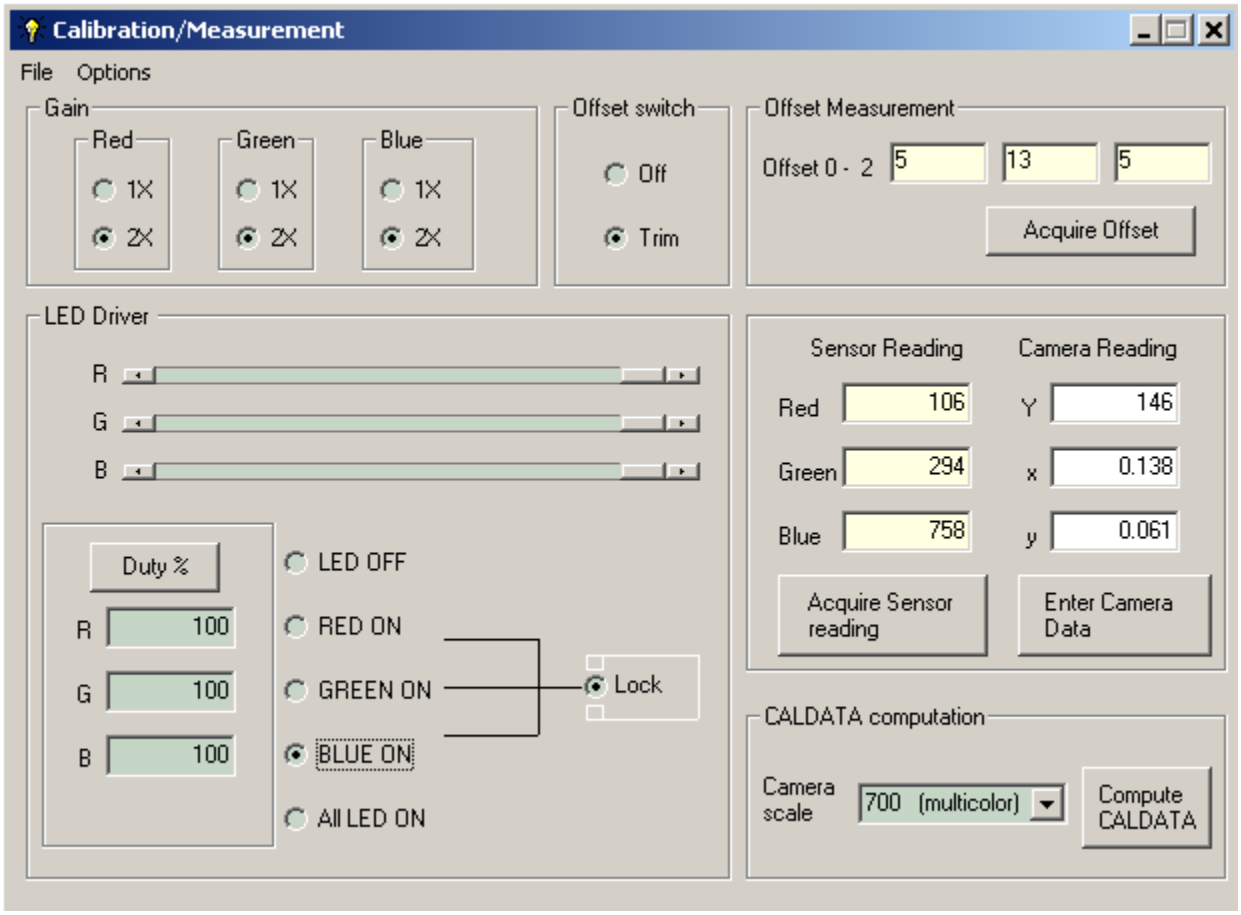

Figure 4. Calibration/Measurement

There are six sections in the calibration.

1. Gain
2. LED driver
3. Offset trimming switch
4. Offset measurement
5. Sensor and Camera reading
6. CALDATA computation

When started, the CALDATA computation, Offset Measurement, Sensor and Camera reading are invisible.

Gain Section

There are three channels, Red, Green and Blue. For each channel, click **1X** if internal gain is not used. Click **2X** if 2X internal gain is used.

Offset trimming switch

The initial setting is no offsets. I.e. Offset switch is set to Off.

If offset trimming is to be used during measurement, click **Trim**.

The calibration program will automatically measure offsets for trimming.

As offsets are measured with all LEDs turned off, the **LED OFF** in the LED driver section will be automatically set.

The Offset Measurement frame will be visible to show the offsets measured.

Offset measurement section

This section is not displayed if the offset trimming switch is set to **OFF**.

The offsets displayed are Offsets 0, Offset 1 and Offset 2 and are read from offset registers OFFSET_X, OFFSET_Y and OFFSET_Z respectively.

To measure the offset again, click **Acquire Offset** command button.

Duty cycle format.

There are two formats, **Duty %** and **Duty** value. The duty cycle format will toggle between duty% and duty values each time the duty% or the duty button is clicked.

Initially, the format is in percentage and the **Duty %** button is visible. Click the **Duty %** button once to change the format to **Duty** value. The **Duty** button will be visible. Click the **Duty** button once to change the format back to **Duty %**. The **Duty %** button will be visible.

Duty Cycle

There are three duty cycles, **R** duty cycle for Red LEDs, **G** duty cycle for Green LEDs and **B** duty cycle for Blue LEDs. All the three duty cycles are set to 100% initially.

There are three scroll bars. **R** scroll bar for RED LEDs duty cycle, **G** scroll bar for Green duty cycle and **B** scroll bar for Blue LEDs duty cycle.

To change the duty cycles, there are two methods:

a. Drag the scroll bar corresponding to the desired duty cycle.

b. Enter the duty cycle in the **R**, **G** and **B** text boxes.

The Duty % ranges from 0 to 100 and the Duty value ranges from 0 to 4095.

Lock toggle

When ON, the R, G and B duty will have the same values. Any change in any of the R or G or B duty % or value will change the other two duty % or values automatically so that the values are the same. When OFF, the R, G and B duty can be set to different values.

The initial setting is ON (i.e. locked). To turn OFF, click **LOCK** once. To turn ON again, click **LOCK** once only when the LED control is set to either

a) **RED ON** or

b) **GREEN ON** or

c) BLUE ON

When the lock toggles from OFF to ON, all the duty % or values will be set to the same value which is the duty % or duty value of the LEDs that is turned ON.

Note: The lock toggle cannot be changed from OFF to ON if the LED control is set to LED OFF or ALL LED ON.

LED control

Click **LED OFF** to turn off all the LEDs.

Click **RED ON** to turn on only red LEDs at **R** duty cycle.

Click **GREEN ON** to turn on only Green LEDs at **G** duty cycle

Click **BLUE ON** to turn on only Blue LEDs at **B** duty cycle

Click **ALL LED ON** to turn on Red LEDs at **R** duty cycle, green LEDs at **G** duty cycle and blue LEDs at **B** duty cycle.

Sensor & Camera Reading section.

When the LEDs of one color are turned on, the sensor reading can be measured.

Click the **Acquire Sensor Reading** command button to start sensor measurement.

When the HDJD-J822 digital to analog circuitry is acquiring the sensor measurement, the LED light can be measured with a CIE camera.

The camera values are entered for luminance Y, CIE x and CIE y coordinates.

Once camera values are entered, click **Enter Camera Data** to accept the values entered.

Repeat these measurements for the other two colors.

Compute CALDATA section.

When all the sensor and camera measurements are completed, the CALDATA computation frame will be displayed.

Select the **camera scale** value. For multicolor applications, a value of 700 is recommended. For white only or several white points applications, a value of 1000 is recommended.

Click **Compute CALDATA** command button to start calibration data processing.

Once calibration data processing is completed, New Calibration Data (Figure 5) is displayed.

On the CALDATA menu, click **Save New CALDATA** to save the calibration data. The calibration data is saved in the file and to the Development Kit's EEPROM. The file is saved in the ICMv1 program application directory. The file name format is calfile##.txt, where ## is the HDJD-J822 device address.

On the CALDATA menu, click **View Current CALDATA** to compare the new CALDATA with the current CALDATA. Current Calibration Data (Figure 6) is displayed.

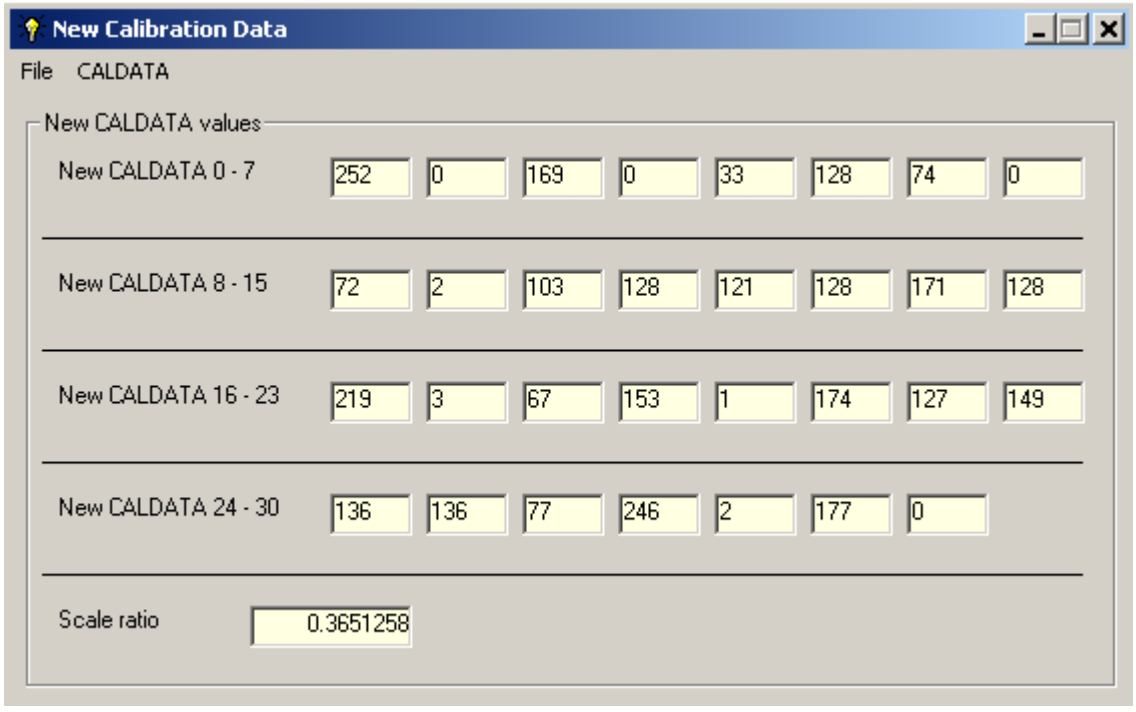

Figure 5. New Calibration Data

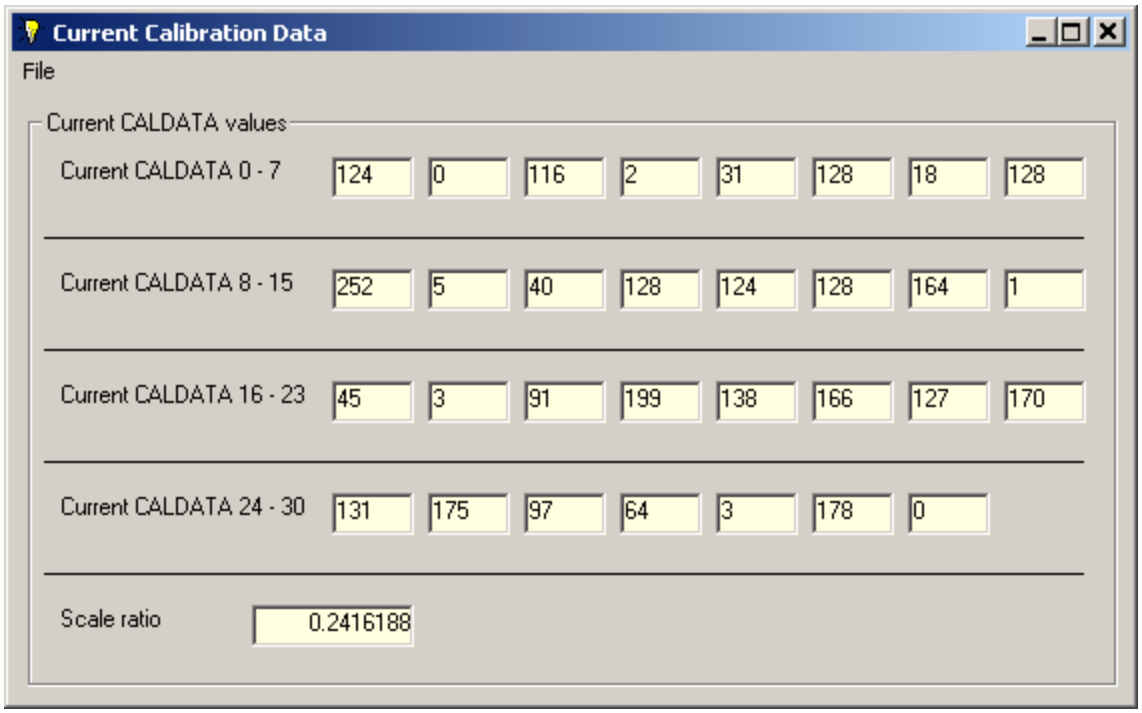

Figure 6. Current Calibration Data.

On the **CALDATA** menu, click **Measure again** to continue with calibration with the previous measurement data intact.

To erase all measurements and start a new calibration, click **X** on the top left corner of the Calibration/Measurement to go back to ICMv1. Next, click **Run Cal** menu. The Calibration/Measurement will be displayed and all previous measurements are erased.

8.0 Calibration Procedure.

1. Click the **Run Cal** menu. The Calibration/Measurement will be displayed
2. The **R**, **G** and **B** duty cycles are automatically set to default at 100%. Do not change the duty cycle.
3. Click on **All LED ON** in the LED driver section to turn on all LEDs
4. Click on **Acquire Sensor Reading** command button to measure the sensor reading when all LEDs turned on.

   The sensor values for the three channels must range from 400 to 800. If any of the color channel values is less than 400, click **2X** internal gain for that channel.
5. If offsets are to be trimmed, click **Trim** to start offset measurement and enable trim offsets. All LEDs will turn off after offset measurements.
6. Click **RED ON** to turn only the red LEDs on.
7. Click on **Acquire Sensor Reading** command button to get sensor measurements.
8. While sensor measurement is being measured, use a CIE camera to measure the luminance Y values, CIE x coordinate and CIE y coordinate values. Click **Enter Camera Data** command button to accept readings entered.
9. Click on **GREEN ON** to turn only the green LEDs on. Repeat step 7 and 8.
10. Click on **BLUE ON** to turn only the blue LEDs on. Repeat step 7 and 8.
11. The **CALDATA computation** frame will be visible once all measurements are completed.
12. Select the camera scale value depending on application. For multicolor, select 700. For white only, select 1000.
13. Click **Compute CALDATA** command button to start calibration data processing.
14. When Calibration data processing is completed, the New Calibration data is displayed.
15. On the **CALDATA** menu, click **Save New CALDATA** to save the calibration data. The calibration data is saved in a calibration file. File saved is Calfile##.txt where ## is the HDJD-J822 device address. The file is saved in the default application directory.

    If a valid EEPROM exists, the EEPROM will also be automatically written with the calibration data.

    The EEPROM is written starting with the address location 0. The address location 0 stores the gain setting and a marker to indicate if a valid calibration file exists in the EEPROM.

    Notes:

    1. Bit 0 to 3 form a marker. Value of 1001 indicates a valid calibration data has been stored.
    2. Gain X - Red sensor channel gain. Value is 1 if 2X gain is used
    3. Gain Y – Green sensor channel gain. Value is 1 if 2X gain is used.
    4. Gain Z – Blue sensor channel gain. Value is 1 if 2X gain is used.

    If no gain or 1X gain, then value is 0.

    The calibration data, i.e. CALDATA0 to CALDATA30 is stored in address location 1 to 31 respectively.

    The EEPROM locations from 0 to 95 or 0h to 5Fh is reserved by this program.
16. On **File** menu, click **Exit** to return to the ICMv1.

Table 2. Data format at EEPROM address location 0.

Bit	7	6	5	4	3	2	1	0
Value	GAINX	GAINY	GAINZ	N/A	1	0	0	1

For product information and a complete list of distributors, please go to our web site: **www.avagotech.com**

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