

CS24D Startup Guide

Section 1-Initial Setup

The CS24D color sensor “sees” color by analyzing the diffused light from an object illuminated by its LED light source.

The CS24D can sort up to fifteen different colors by comparing against Teach values. That is, up to 15 Sort Outputs can be trained so that when the sensor sees an object it will turn on the specified sort output that was previously trained to that color.

The CS24D has four discrete outputs, which are binary coded to represent the 15 Sort Outputs (trained colors). All outputs off is a “No match” condition.

Once configured, typically only the discrete I/O on the CS24D is used for control, providing universal compatibility with any PLC. However, for a quick test of the CS24D, it is unnecessary to use the discrete I/O, as all functions, including the Teach function, can be done using Delta’s ColorSense program.

Wiring the CS24D for a Quick Test

As shown in the diagram, the PC connects up to J1 and the power supply to J2. Use the cables available from Delta, or refer to the Wiring section in the manual.

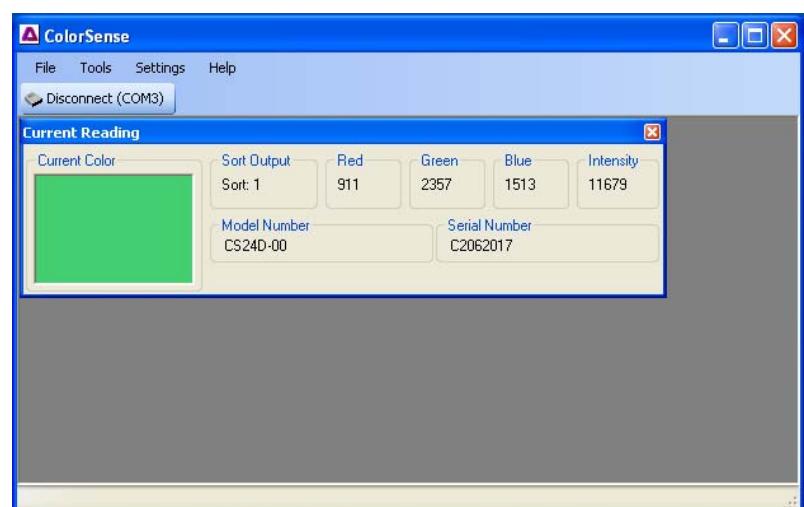
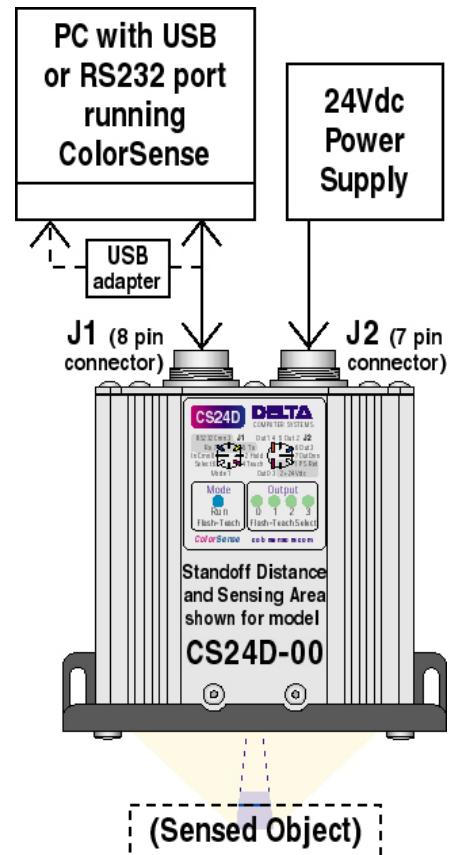
The Run LED is a steady blue when the unit is powered on and in normal operation. The four green Output LEDs indicate the binary code of the Sort Output that based on the Teach values and the color object that the sensor is presently seeing. All of these Output LEDs are off if the current color does not match a trained Sort Output (accept in Closest Color mode).

Loading the ColorSense Software

Delta’s ColorSense Configuration and Optimization software runs under Windows on a PC having an RS232 serial port or an USB port with an inexpensive USB-to-Serial adapter.

Using the installation CD-ROM that came with the sensor, install the ColorSense program by clicking on the ColorSense Software button or running the setup.exe file. The default installation location is C:\Program Files\ColorSense.

When the ColorSense program is launched, it will start with a large blank area and a top menu. Once the serial communication has been connected between the Sensor and the PC, clicking the **Connect (auto)** button will establish communications. The button will change to say **Disconnect (COMn)** and the Current Status window will automatically open. This window shows the color that the sensor is currently reading and other sensor information. Click the **Setup Wizard** button.



Section 2 – Using the Setup Wizard

When you start the Setup Wizard, it will open to an informational screen showing the model and serial number of the sensor and the number of Sort Outputs that have been taught. Pressing **Next** brings up a screen asking if you are ready to Teach. (If you are not ready to Teach, you can press the **Next** to see the rest of the Wizard).

Pressing the **Teach** button will bring up the Teach screen. To Teach, place the first object (target color) in the sensing area at the correct distance for the particular model of CS24D. Click on the Sort Output that you want to associate with the first target color.

Click the **Standard Teach** button when you are ready to take the first reading, and press it 7 more times; preferably with different samples or at least different locations on the same sample. (The CS24D uses eight readings of each target color in order to calculate a mean and standard deviation. If multiple samples of the same object are available these should be used in order to get an accurate representation of the color and color variation). For a quick demonstration, you can click the **Quick Teach** button to take all 8 readings at once; however performance cannot be fully optimized without representative Teach data.

To Teach the CS24D to another object, select another Sort Output and press the Teach button to take the 8 readings. Click the **Done** button when the sensor has been trained to all of the samples.

As soon as the sensor has been trained, it will immediately start recognizing colors based on the default configuration. Although the default parameters may provide acceptable performance, the next screens of the Setup Wizard cover selecting modes and parameters for better performance.

The Color Demo Sheet can be used to demonstrate the CS24D performance over a wide range of colors. (Although not recommended in practice, for a quick demo, one can avoid the Teach time and simply load in the values from a file—see manual for details).

Section 3 – Configure Options

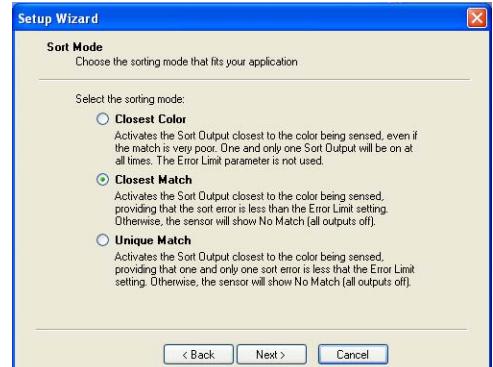
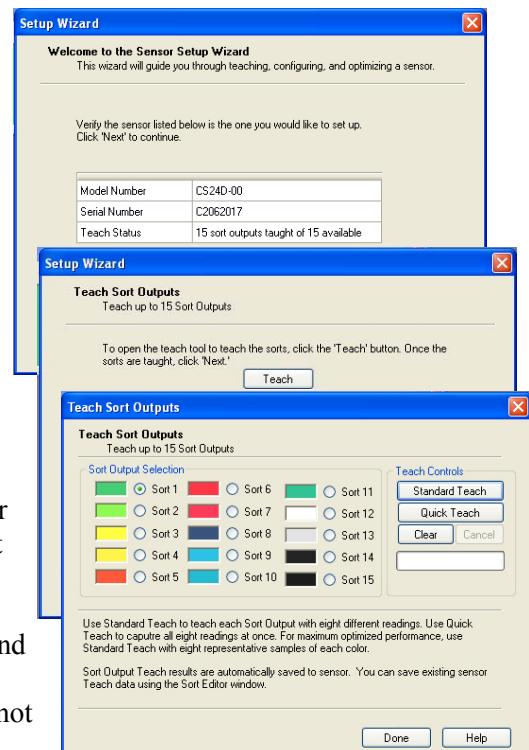
The next section of the **Setup Wizard** prompts you to set up all of the Color Sensor user-settable options.

The **Sorting Mode** selection is dependant on the application.

Closest Color always turns on the Sort Output that is the closest to the current color being seen by the sensor—even if the match is very poor. And if the current color is a good match to more than one output, it will indicate whichever one is closest. **Closest Color** mode can be the best mode for some sorting applications, but is rarely useful for the common color verification applications.

Closest Match not only finds the closest match between the Teach colors and the current color, but also requires that the calculated error on the match be less than the **Error Limit** (more later). Otherwise the sensor reports a “no match” condition with all outputs OFF. **Closest Match** mode provides more intuitive operation for the majority of applications.

Unique Match adds one more criteria—there can only be one Sort Output with a calculated error less than the Error Limit, or the sensor will report a “no match” condition. **Unique Match** mode provides more flexibility in flagging colors that may be out of the normal range.



The next important selection is the **Teach Criteria**.

Color Only is the best choice for accommodating large variations in sensor-to-target distance but it cannot be used if any of the target colors are shades of the same color (e.g. light gray and dark gray). **Color plus Intensity** handles shades of colors, and gives equal weighting to the RGB readings and the Intensity or “darkness” of the color.

The **Error Limit** parameter is also calculated for you by the optimize routine, although the default value will also probably work fine for a quick test. **Averaging** should be set as high as possible, especially with dark colors. The **Stretch Outputs** parameter can be left at zero for most applications.

The last Setup Wizard screen allows you to review the parameters. Pressing the **Finish** button will download the parameters to the CS24D color sensor.

That's all there is to it! The CS24D can now differentiate between the Teach colors, with the result displayed on the four green Output LEDs.

Section 4 – Exploring ColorSense

By clicking on the icons in the **Sort Editor** screen, you can:

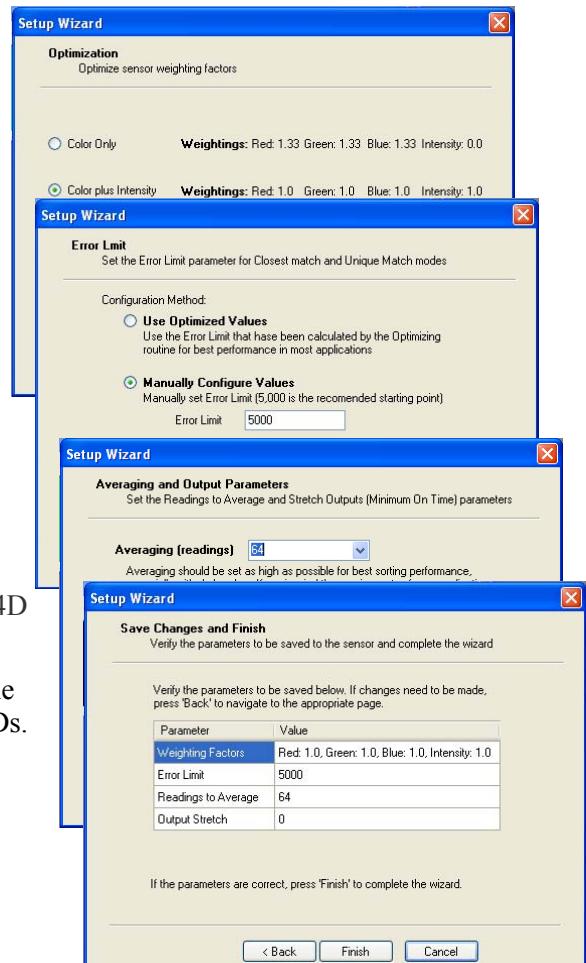
- Upload Teach data from the sensor
 - Download Teach data to the sensor
 - Save Teach data to a file
 - Read Teach from a file.

Also, you can use the Arrow buttons to “move” Sort data up or down in order to change the output assigned to a taught color. The “X” button deletes the data from the selected output.

The **Analyze** screen shows the predicted performance for the Teach data, which is shown as the number of standard deviations separating each Sort Output. Values less than 3 indicate that the sensor has a hard time differentiating between the target colors, and values greater than 5 indicate a high degree of confidence.

By selecting **Custom** from the pull-down box, you can manually adjust the weighting factors and see the affect on performance. This unique capability allows the RGB and Intensity weightings to be optimized to the actual Teach data.

CAUTION: In order for the standard deviation prediction to be correct, it is essential that the Teaching be done optimally. All eight Teach readings must be taken, the eight readings must include representative samples of the range of colors that are considered permissible for that Sort Output, and the sample objects

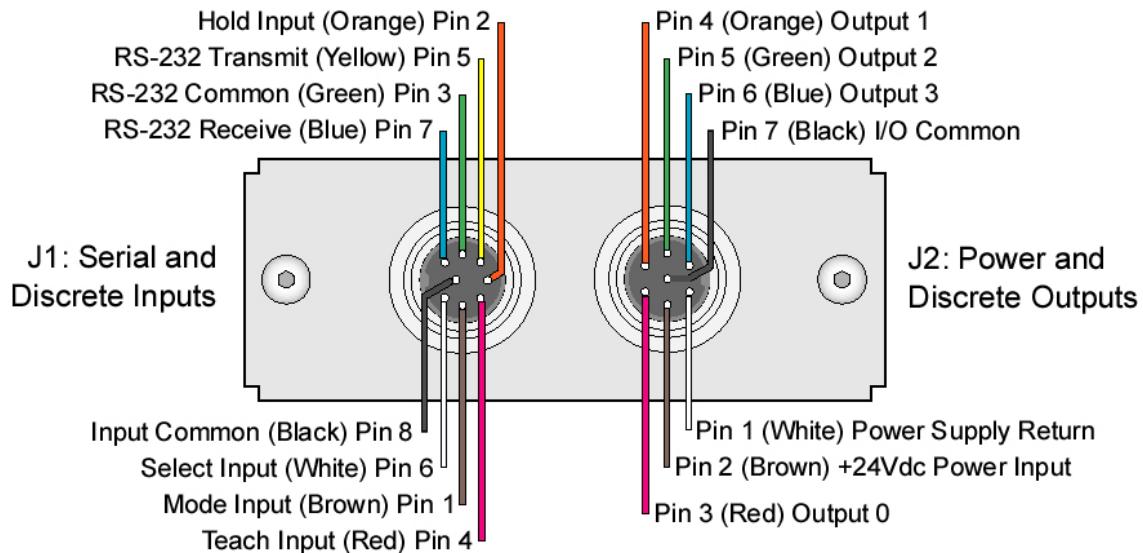


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must be at the exact distance from and orientation to the sensor as they will be in actual operation. If the distance and/or orientation can vary, then the eight samples should include this variation.

For more details about optimizing the sensor and saving sets of trained target colors to the PC, see the appropriate sections in the CS24D Color Sensor Manual.

CS24D J1 and J2 Pin Designations



Support and Testing Services

Pre-sale and post-sale Technical Support on the CS24D Series color sensors is available from Delta via telephone or internet.

Telephone (360) 254-8688 Fax (360) 254-5435
email: support@deltacompsys.com

To help ensure success on your project, Delta can test samples and provide results and recommendations. Send the samples, along with a brief description of the application to Delta at:

Delta Computer Systems, Inc.
1818 SE 17th Street
Battle Ground, WA 98604
Attn: Color Sensor Samples for Testing

Alternately, since the CS24D is so easy to use and optimize, you may want to try one yourself. Contact Delta for availability of demo units.

Company Profile

Delta Computer Systems, Inc. manufactures motion controllers, color sensors, and other electronic controls for a wide variety of industrial applications. You can rely on Delta for practical expertise, reliable products, responsive support and lasting value.



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