CRT448 — Color sensors

en 02-2013/01 50121262 068-14515

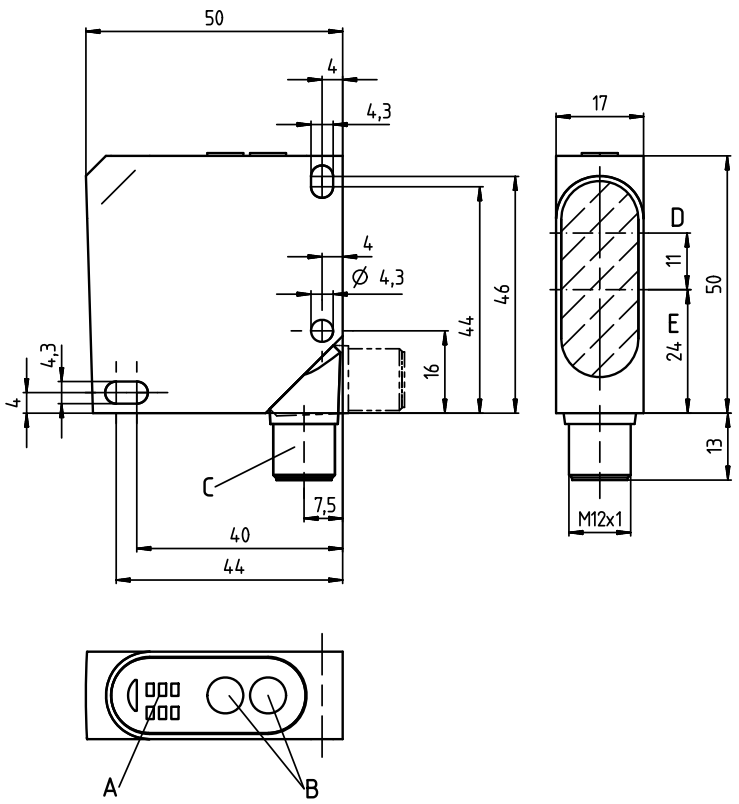
12mm ... 32mm

10 - 30 V DC

500 Hz

- Scanner for color detection
- Simultaneous selection of up to 3 colors
- Detection independent of distance
- Teach-in via buttons or control line
- Temperature compensation
- Other special functions

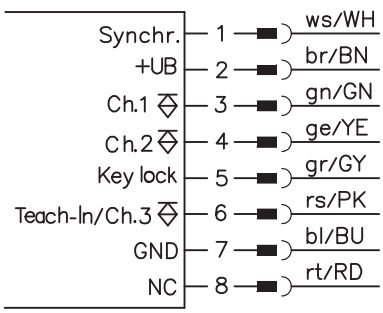
Dimensioned drawing



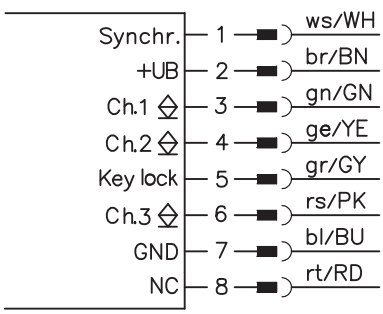
A Display
B Configuration
C Turning connector
D Transmitter
E Receiver

Electrical connection

CRT448.S3/444-M12
CRT448.L3/444-M12



CRT448.S3/222-M12
CRT448.L3/222-M12



Accessories:

(available separately)

- Cable with M12 connector, 8-pin
- Reflectors

Specifications

	S light spot	L light spot
Optical data		
Scanning range (see remarks)	12mm … 32mm	18mm … 22mm
Light spot dimensions (in scanning range)	round=4.0mm	1mm x 5mm
Operating range with reflector [1]	50 … 200mm	
Light spot orientation		vertical
Light source [2]	LED, white	
Timing		
Switching frequency [3]	500Hz	
Response time [3]	1ms	
Delay before start-up	≤ 500ms	
Storage time for teach values	≤ 50ms, non-volatile storage	
Electrical data		
Operating voltage U_B	12 … 28VDC	
Residual ripple [4]	≤ 10% of U_B	
Switching output	3x PNP or 3x NPN	
Function characteristics	light switching for all outputs	
Signal voltage high/low	PNP: ≥ (U_B-3V/0V) NPN: U_B/≤ 3V	
Output current	max. 100mA per output	
Open-circuit current	≤ 40mA	
Indicators		
LED green	ON: ready OFF: teach event active	
Ch.-LED(s) yellow	Ch. 1 … Ch. 3: object 1 … 3 detected	
Tol.-LED(s) red	tolerance level 1 … 5	
Mechanical data		
Housing	ABS plastic	
Optics cover	PMMA	
Weight	40g	
Connection type	M12 connector, 8-pin	
Environmental data		
Ambient temp. (operation/storage)	-10°C … +55°C / -20°C … +70°C	
Protection class	IP 67	
Eye safety	in acc. with EN 62471: exempt group	
VDE safety class [5]	II, all-insulated	
Protective circuit [6]	2, 3	
Standards applied	IEC 60947-5-2	
Certifications	UL 508 [7]	
Options		
Synchronous input		
PNP: Stop/Start measurement	> 12V … 28V/0V or not connected	
NPN: Stop/Start measurement	> 12V … 28V/0V or not connected	
Synchronization delay	< 2ms	
Key lock input		
PNP: lock / unlock	> 12V … 28V/0V or not connected	
NPN: lock / unlock	> 12V … 28V/0V or not connected	
Delay	< 2ms	

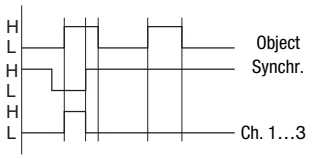
1) With reflector TKS 100x100
2) Average life expectancy 100,000h at an ambient temperature of 25°C
3) With light-dark ratio 1:1
4) Must lie within U_B ± tolerance
5) Rating voltage 50VDC
6) 2=polarity reversal protection, 3=short circuit protection for all outputs
7) For UL applications: for use in class 2 circuits according to NEC only

Order guide

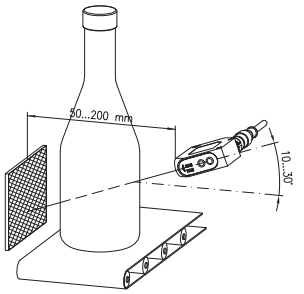
See section **Preferred types**

Diagrams

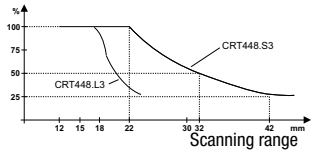
Synchronous input



Reflector operation for transparent objects

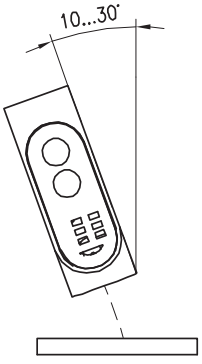


Typ. color resolution for remissions >20%



Remarks

- **Approved purpose**:
  The CRT448 color sensors are optoelectronic sensors and are used for optical, contactless detection of colored objects with incident light (scanner operation) and transmitted light (reflector operation). A reflector is necessary for operation in transmitted light.
- With shiny objects, the sensor is to be mounted at an angle of approx. 10 … 30° to the object surface.



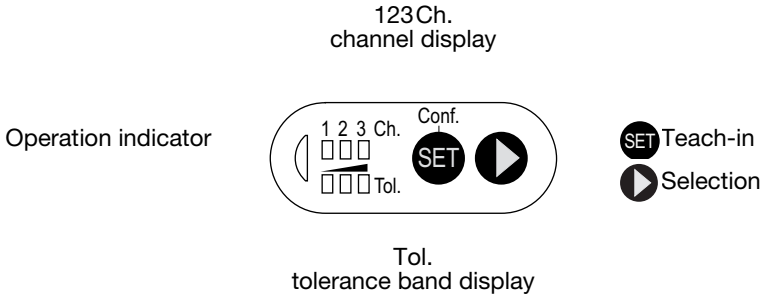
Function principle of the color sensor

Many sensors are capable of differentiating between light and dark or matt and shiny. As soon as color is to serve as a distinguishing criterion, however, normal sensors are quickly pushed to their limits.
As a result, color sensors are of increasing importance in industrial automation.
The applications range from sorting colored objects to the detection or inspection of colored surfaces. Materials such as powders, granulates, fluids as well as metals, glasses, papers, plastics and textiles can be reliably detected in this way.

Simple operation makes it possible to teach-in individual reference colors and reference color gradients as well as adjust the tolerance bands.

During operation, the color sensor compares the taught-in color with the measured color. If the values lie within the set tolerance range, the sensor passes on the match to the controller via a switching output.

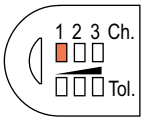
Controls and indicators



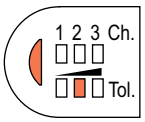
Operation

During operation, the assignment of the detected color to the switching output is shown via the 123ch. display. In normal mode, only one of these LEDs should be illuminated, otherwise the tolerance bands of the individual colors should be changed.

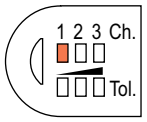
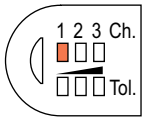
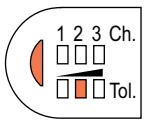
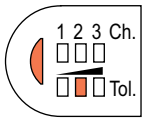
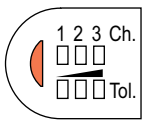
Channel/switching output assignment

	The detected color is assigned to switching output 1.

Tolerance band assignment

	The assignment of the tolerance band is only displayed in teach-in mode.

Teach-in of the switching outputs and tolerance band

<table>
<tr><th colspan="2">▯ = LED ON</th><th>Teaching in multiple colors (normal mode)</th></tr>
<tr><td> 
</td><td> 
</td><td>1. Start setting mode + teach in color
Position object to be detected within the scanning range
(make sure it is tipped 10-30°).
Press SET BUTTON for ≥ 3s >> green LED goes out and Ch. 1 illuminates yellow (locking input open or 0 volt).</td></tr>
<tr><td> 
</td><td>  </td><td>2. Select channel
With ▶, select one of the color channels (Ch. 1, Ch. 2 or Ch. 3).
The selected channel is indicated with a corresponding yellow LED.
Do <u>not</u> select position Ch. 1+Ch. 2+Ch. 3 (i.e. all three yellow LEDs <u>cannot</u> illuminate at the same time).</td></tr>
<tr><td> 
</td><td> 
</td><td>3. Confirm channel
Confirm the selected color channel with the SET BUTTON (press for ≥ 3s) >> green LED and middle red LED illuminate.
Factory setting = Tol. 3 graphic shows the factory setting. If the color differences are large, a high tolerance level should be chosen; for small color differences, a low tolerance level makes sense.</td></tr>
<tr><td> 
</td><td>  </td><td>4. Select tolerance level
With ▶, select one of the five tolerance levels.
<table>
<tr><td> 
</td><td>Tolerance 1 (small)</td><td rowspan="6">The green LED is an orientation aid. If the green LED does not illuminate, the tolerance level is too small; it must be increased until the green LED illuminates.</td></tr>
<tr><td> 
</td><td>Tolerance 2</td></tr>
<tr><td> 
</td><td>Tolerance 3 (medium)</td></tr>
<tr><td> 
</td><td>Tolerance 4</td></tr>
<tr><td> 
</td><td>Tolerance 5 (large)</td></tr>
<tr><td> 
</td><td>Color channel is switched off</td><td>Renewed programming results in reactivation.</td></tr>
</table></td></tr>
<tr><td> 
</td><td> 
</td><td>5. Exit setting mode
Press SET BUTTON for ≥ 3s to confirm tolerance selection.
>> The sensor is ready (green LED illuminates; taught Ch. X may also illuminate).
Set all three channels one after another in this way.</td></tr>
</table>

Notice on determining tolerance level:

After an object has been taught, e.g. with Tol. 2, move this object manually within the different distances or positions occurring in the application, and test for error-free function by checking if the yellow LED of the corresponding output channel is illuminated. If an object is not reliably detected, select the next-highest tolerance level. By repeating this process, the optimal tolerance level can be determined.

Teach-in of color gradients

1. Start setting mode
Position object to be detected within the scanning range
(make sure it is tipped 10-30°).
Press SET BUTTON for ≥ 3s >> green LED goes out and Ch. 1 illuminates yellow
(locking input open or 0 volt).

2. Select color scan function
With ▶, select one of the color channels (Ch. 1, Ch. 2 or Ch. 3).
(Do not select position Ch. 1+Ch. 2+Ch. 3).

3. Scan color range + exit setting mode
Press SET BUTTON and hold it down, green LED blinks after 10s.
The color scan function is active. The sensor now permanently learns the colors which it "sees", provided the SET BUTTON remains pressed. By moving the detected object, all colors are scanned which occur on the white light spot of the sensor.
Release SET BUTTON to end the scanning process.
The sensor is immediately ready to use again.
Function test by checking if yellow LED of the assigned output channel illuminates.

Notice on color scan:

The color scan serves to teach in entire color gradients or to teach in objects with strongly fluctuating scanning ranges which cannot be detected with a tolerance level. To scan in color gradients of different objects, one object can be scanned in per channel. By connecting the output channels via an OR function in the downstream control, color gradients of up to three different objects can be represented as a color scan.

Special function

1. Start setting mode
Press SET BUTTON for ≥ 3s >> green LED goes out and Ch. 1 illuminates yellow.
(Locking input open or < 3 volt).

2. Select special function
With ▶, select position Ch. 1+Ch. 2+Ch. 3. (all three LEDs illuminate).

3. Confirm selection
With SET BUTTON (press for ≥3s), confirm setting >> first red LED (Tol. 1) illuminates.

4. Select special function
With ▶, select the desired special function.

Tol. display	Function characteristics
	Output menu
	50ms pulse stretching
	External teach-in *
	Factory settings

Notices on special functions

a. Pulse stretching 50ms
Extension of the switching signals to 50ms. Acts on all three outputs.

b. External teach-in *
Output Q3 becomes a teach-in input. When the HIGH signal is present, a new color with tolerance 3 is taught on channel 1. An acknowledgement signal (50ms) is output at output Q2 after a successful external teach-in.

c. Factory settings
Resetting to factory settings. All special functions are deactivated.

* only available for PNP types

5. Confirm selection
Press SET BUTTON (for ≥ 3s) to confirm the selected special functions. (For testing purposes: the selected special function is indicated by the illuminated green LED).

6. Delete display
Press ▶ until all red LEDs go out.

7. Exit setting mode
Press SET BUTTON (for ≥ 3s) >> green LED illuminates.
The sensor is ready in the new operating mode.

Preferred types

Selection table Equipment ↓	Order code →	CRT448.S3/444-M12 Part no. 50121294	CRT448.L3/444-M12 Part no. 50121292	CRT448.S3/222-M12 Part no. 50121293	CRT448.L3/222-M12 Part no. 50121291
Scanning range	12mm … 32mm	●		●	
	18mm … 22mm		●		●
Light-spot profile	S-profile (round, D=4mm)	●		●	
	L-profile (1mm x 5mm)		●		●
Switching output	3x PNP	●	●		
	3x NPN			●	●
Configuration	Teach-in via control buttons	●	●	●	●
Options	Synchronization	●	●	●	●
	50ms pulse stretching	●	●	●	●
	Teach-in via cable	●	●		

Additional types on request