

INPROX sensors



true **color** recognition **system**
industrial quality & process control

MLC255

TC-true perception color sensor
255 color memory

INPROX sensors

true color perception system

This is our most advanced stand alone system that doesn't require a separate server controller. The MLC255 is a singular system. Running on our most advanced software package yet; TC-color scope.

industrial grade environmental duty

With a sturdy aluminum housing the MLC255 series color system is engineered to resist difficult production environments where temperature, dirt and other typical contaminants may impede performance.

TC-color scope© software

This advanced software platform allows the customer to control all aspects of color, contrast, power, event and output; down to the ground level of operations.

open file network

INPROX Sensors offers an open file network that can run in real time and deliver unlimited individual files or binary output for an unprecedented level of access and customization.

easy to set up

TC-color scope offers hassle-free installation and communication: RS232/USB software setup.+ PLC interfaces; and EEPROM stand alone operations after initial program.

8/20/255 individual color memories

With the ability to sort and recognize over 1,000,000 colors variations the MLC255 is the most advanced software driven stand alone color recognition platform in the industry.

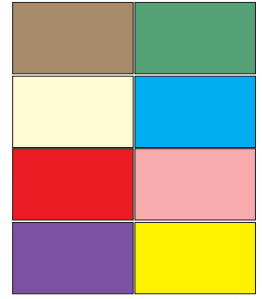


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MLC255 TC-true Perception Color Sensor System

This advanced sensor system can simultaneously process up to 255 colors with individual tolerances. Tests have shown that the MLC255 TC-true perception color sensor system can reach a maximum average color resolution of up to $\Delta E = 0.02$ in the $L^*a^*b^*$ mode. Practically, the resolution in the $L^*a^*b^*$ mode is approximately $\Delta E < 1$ and thus better than the human eye.

This sensor system provides three main processing methods as described in the following sections.

Color Sorting:

The actual measured color value is compared with pre-sampled and stored color values. The best matching color is then the color classification result. A classification is always done without considering whether the color values really match or not. This method is widely used for automatic sorting of colored objects.

Color recognition (Color checking)

This method checks if the actual measured color is within one of the tolerance rooms of presampled and stored colors. The tolerance rooms are predefined by colorimetric ΔE units. If the measured color is outside the tolerance room, the color check is said to be unsuccessful (Color was not recognized). This method is widely used for quality checking of colored products and provides a fast and reliable quality inspection within predefined tolerance boundaries.

Color sequence checking

This method examines a proper sequence of colors. The color recognition and classification results are directly sent to the 8 open-collector outputs of the sensor system and can be coded as “1-out-of-N” (“One hot coding”), 7-segment or as a binary number. Thus either up to 8 colors, up to 20 colors or up to 256 colors can be represented. The parameter configuration of the sensor system, as well as the color sampling procedure (“Teach-in”); is carried out by PC software connected either by RS232 or USB to the sensor system.

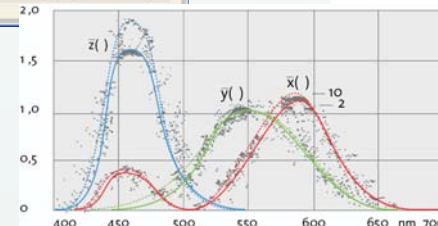
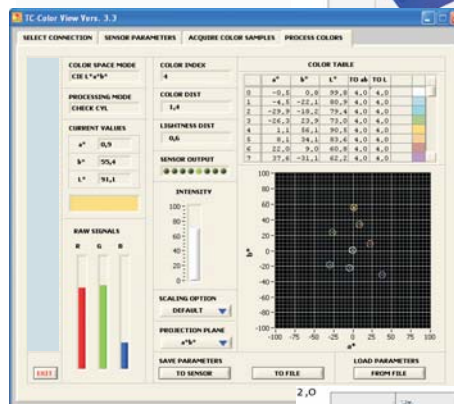
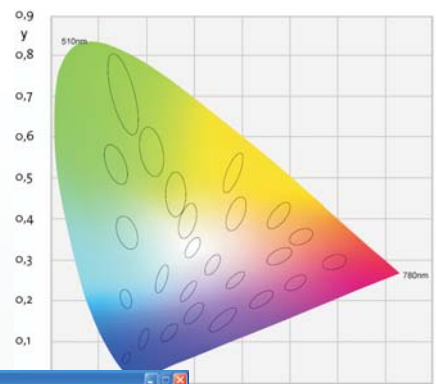
color variation vs. human perception

color variation ΔE	human perception
<1	very small color variation that can not be seen by the human eye
1...2	small color variation that can be seen by trained human eye
2...3,5	medium color variation that can be seen by average human eye
3,5...5	considerable color variation
>5	high color variation

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advanced color recognition system

multi-function graphing platform



	a*	b*	L*	TOL	GRP
0	0,2	0,4	99,9	4,0	0
1	-4,3	-22,3	80,6	6,2	1
2	-29,0	-17,4	79,8	7,9	2
3	-27,5	25,8	70,4	3,6	3
4	0,9	57,0	90,0	5,4	4
5	8,1	36,5	81,1	4,5	5
6	22,4	8,9	60,7	3,9	6
7	35,4	-31,2	63,7	4,8	7

3 memory-output options

- ▣ 8 individual color memories utilizing open collectors (1-8 wires)
- ▣ 20 individual color recognitions using a 7-segment coding system
- ▣ 255 individual color memories using a binary output system

8 recognition-setup modes

- « XY
- « RGB (multiple reads)
- « Raw R (contrast structural control)
- « Raw G (contrast structural control)
- « Raw B (contrast structural control)
- « INT (intensity/gloss control)

6 color space systems

- « XYZ
- « xyZ
- « L*a*b*
- « L*u*v*
- « u'v'L
- « DIN99

specifications overview

- ¥ 10 kHz maximum response speed
- ¥ RS232/USB connection via TC-color scope software
- ¥ 12 bit A/D conversion
- ¥ Real-Time or EEPROM intellisense monitoring



TC-color scope© software included

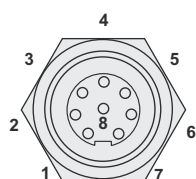
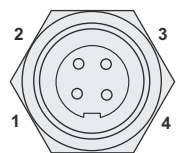
INPROX sensors

advanced color recognition system

Electrical data	Supply voltage	9-26 VDC
	Current consumption	typ. 500 mA
	Interfaces	RS232, USB2.0
	Colour memory	up to 255 colours
	Signal amplification	1, 5, 25, 100
	A/D conversion	12 Bit per colour channel
	Switching frequency	up to 10 kHz (100 µs)
Measuring value specification	Colour resolution	(L*a*b - mode) D E _{Lab} £ 1
	Relative accuracy at const. ambient conditions	(L*a*b - mode) D E _{Lab} £ 1
	Colour spaces	XYZ, L*a*b, L*u*v, DIN 99
Light source	White light LED	1 W, colour temperature 5500 K
	Brightness	adjustable, can be switched of for self-shining objects
Receiver	3-range color photo diode	Type MTCSi (True-Color perceptive)
	Sensitivity	0-8 µW (red channel, 600 nm)
Outputs	OUT 0 to OUT 8	open collector max. 500 mA, up to 50 V
	Interfaces	RS232, max. 115 kBit/s USB 2.0
	Trigger output	1x trigger output for external light source or for synchronisation with additional sensors
	Control input	2x for trigger and synchronization purposes
Data on ambient conditions	Operating temperature	0°C to +50°C
	Ambient light comp.	dynamic, can be switched of for self-shining objects
	Protection	IP65
Housing	Aluminium	blue anodized
	Weight	approx. 150 g

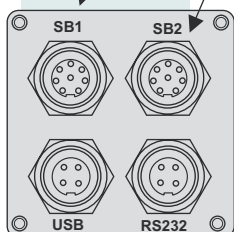
SB2

Pin	Function
1 white	OUT1
2 brown	OUT2
3 green	OUT3
4 yellow	OUT4
5 grey	OUT5
6 pink	OUT6
7 blue	OUT7
8 red	OUT8



Power supply
Trigger and CLK_OUT

Switching outputs



SB1

Pin	Function	Description
1 white	N.C.	
2 brown	N.C.	
3 green	TRG1	INPUT trigger signal for external. synchron. purposes
4 yellow	TRG0	INPUT for updating the sensor outputs (rising edge) in „EXTERN“ mode INPUT for trigger controlled color sequence in „TRIGG.SEQU.“ mode (rising edge) INPUT for starting timed colour sequence in „TIMED.SEQU.“ mode (rising edge) INPUT for external triggered Teach-In in „EXT. TEACH“ mode (rising edge)
5 grey	CLK_OUT	OUTPUT signal for synchronization of an additional external light source or an additional sensor
6 pink	N.C.	
7 blue	GND	Ground INPUT
8 red	(+) Vcc	Supply voltage (+9 to 26 V)

RS232

Pin	Function	Pin SUB-D (PC)
1	GND	5
2	TxD	2
3	RxD	3
4	N.C.	

USB

Pin	Function	Standard cable col.
1	GND	black
2	VBUS	red
3	D-	white
4	D+	green

INPROX sensors

Primary sensor	Three range color photo diode MTCSi
Signal amplification gains	1, 5, 25, 100
A/D conversion	12 Bit per color channel
Sensitivity (light radiation power)	0-8 μ W (red color channel at 600 nm)
Color resolution (L*a*b*-mode)	$\Delta E_{Lab} \leq 1$
relative accuracy (L*a*b*-mode) under constant ambient conditions	$\Delta E_{Lab} \leq 1$
Switching frequency (response time)	Up to 10 kHz (100 μ s)
Ambient light compensation	Dynamic, can be switched off for self-shining objects
Object illumination	<input type="checkbox"/> 1 W White light-LED, color temperature 5500 K <input type="checkbox"/> Adjustable brightness <input type="checkbox"/> Can be switched off for self-shining objects
Connectors	<input type="checkbox"/> RS232 (max. 115 kBit/s) <input type="checkbox"/> USB2.0 <input type="checkbox"/> 8 switching outputs (open collector) <input type="checkbox"/> 1 trigger output for external light source or for synchronization with additional sensors <input type="checkbox"/> 2 control input signals for trigger and synchronization purposes
Fiber connector	Adapter for optical fiber with M18x1 connector
Power supply	Rev. 6566, 7577: 5-7 V direct current, 500 mA Rev. 8678: 9-26 V direct current, 500 mA
Protection standard	IP65
Weight	ca. 150g
Environmental temperature for operation	0-50 $^{\circ}$ C

