

 <p>M.D. Micro Detectors Strada S. Caterina, 235 41122 Modena Italy Tel. +39 059 420411 Fax +39 059 253973 www.microdetectors.com info@microdetectors.com</p>	CR1 SERIES RETROREFLECTIVE AREA SENSOR		LANGUAGE
	Installation and Operation Manual		ENGLISH



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1.0 ABOUT THIS DOCUMENT

Please read carefully this document before installation, start-up, use and maintenance of **CR1** light curtains. This manual contains detailed instructions that must be carefully followed.

This manual is not valid for IO-Link models, where the button menu is very limited and complex functions can only be configured in the IOOD.

THIS MANUAL IS NOT IN THE ORIGINAL LANGUAGE

1.1 Function of this manual

This manual provides the user with the necessary instructions for safe and proper installation, electrical connection, start-up, use and maintenance of **CR1** retro-reflective area sensors.

1.1 Explanation of symbols



Warning

A warning sign indicates the presence of potential hazards. It indicates procedures and behaviours which can be useful to prevent accidents. Read and follow these instructions carefully.



Indication

It refers to indications that can help to achieve better performances.



Symbol

The symbol identifies optical devices with reflex function.

2.0 SAFETY AND PROPER USE



Warning

This is NOT a protective device. Therefore, it should not be used to guarantee personnel safety.



Warning

CR1 works in DC and with a low voltage (the maximum value is 30V_{DC}); the proper operation is guaranteed only in the range indicated in the technical data.

With voltages below 12V_{DC} all outputs remain in the OFF state, with voltages in excess of 30V_{DC} permanently, the device may be damaged.

When the device is switched ON, outputs are inactive for a certain amount of time known as **power on delay** (see the following documentation).



Warning

Some optics emit visible light that do not have dangerous levels; the device is classified RG0 (Exempt Group) according to IEC 62471 standard: 2006-07.



Warning!

Please make sure that light curtains are used in proper environmental conditions.

Manual or automatic calibration must always be carried out aiming at the best possible alignment. More than one calibration and alignment adjustment may be necessary to guarantee the best alignment.

Check any reflective surface next to the light beams which may influence them.

Check any transparent or similar panels which may change the beam angle of the area sensor.

Prevent the area sensor's optical window from getting scratched or tarnished.

Do not expose the area sensor to strong natural or artificial light sources, including stroboscopic light.

Do not expose the area sensor directly to optical beams projected by other optical devices.

Ensure that the ambient temperature does not exceed the stated limits.

Keep in mind that smoke, vapour, liquids and powders may alter transparency of air or dirty the optical window.

Dispose of unusable or irreparable devices always in accordance with national regulations regarding waste disposal.

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3.0 PRODUCT DESCRIPTION

3.1 Short description

CR1 light curtains are photoelectric devices built according to the **IEC 60497-5-2** norms and they must **not** be considered as safety devices. Therefore they must **not** be used to guarantee operators' safety nor to protect users on dangerous machines. They must rather be used to detect objects reducing or obscuring the intensity of light beams that returns from the reflector.

The housing is in aluminium painted in blue **RAL5002**, size **20x36mm**, (20 mm refers to the front side). A groove on the back allows connection with T-shaped components. The top side is in polycarbonate and the bottom side is in black **PBT**, the optical window is in **PMMA**. Protection degree is **IP67**.

In all models of the **CR** series, the sensors have two **LEDs** indicators: **Red** and **Green** indicating the states of the sensor (alignment, state optics and fault indication), they are arranged at the top of the curtain, the light is intense and diffused in all directions, this ensures a great visibility in all conditions.

All models in the **CR** series have an optic composed of a continuous array of **9x9mm** lenses with a step of **10mm**. **CR1** have fifteen lenses. The optical window has a height of **149mm**; the total height of the curtain is **187mm**.

Emitter and Receiver are alternate in the following sequence: **E1, R1, E2, R2, E3, R3, E4, R4, E5, R5, E6, R6, E7, R7, E8** with reference the cable side. This allows to realize a continuous succession of **14 pairs** of reflex elements; the emitted light is **polarized** and has a wave length of **617nm**.

The reflector positioning range is **0.2-4.5m** with the model **RL136** and is reduced with smaller reflectors, see **Tab.:2; Chapter 4.**

All **CR1** models have a Teach-in button, at the top of the sensor, dedicated to the activation of the menu functions: two **Teach-in** levels, **Standard** and **Precision**; **progressive Blanking**; reactivation of the **Factory Set Up**

Upon power on, all previous data are retained. By executing a Teach-in in good alignment conditions, the intervention thresholds are set which guarantee a homogeneous behaviour.

In difficult alignment conditions, it is advisable to perform a Teach-in with the obscured optic in order to activate the **Alignment** function, once the sensor has been correctly aligned, a Teach-in must be carried out again, if a Teach-in is not performed, after 120s, the parameters of the previous Teach-in are automatically assumed.

The sensor has two detection modes:

TEACH-IN	COMMENT
Standard Teach-in	Minimum detectable diameter (MDO): 5-30mm
Precision Teach-in	Minimum detectable diameter: 2.5-10mm

Tab.:1; Chap.:3. For more details see **Chap. 4.**

In Static function the stability of the sensor is based on an accurate compensation system of the thermal drift.

For the different modes different signal margins are defined, see **Tab.:1; Chap.:4.**

The Blanking of the beams, allows gradually eliminate pairs of beams; the active couples (E+R) may range from a maximum of 14 to a minimum of 1.

This sensors has a standard output with M12 male flying connector (240 mm pigtail).

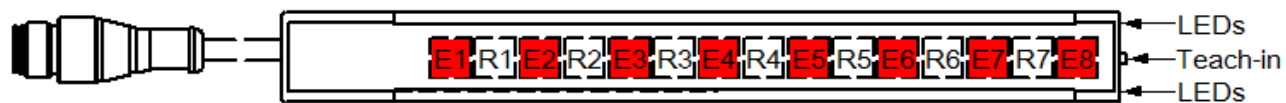




The **CR1** models have four interface circuits which can be combined in different ways depending on the model and the number of output cables, see **Tab.:2; Chap.:3 e Tab.:7...11; Chap.:3.**

3.2 Available models

MODEL	OPTICAL PITCH	OPTICAL HEIGHT	BODY HEIGHT	OPTICS	SENSING RANGE	RESPONSE TIME	CONNECTOR	POLES	Interface	
									INPUTS	OUTPUTS
CODE ARTICLE	P mm	h mm	H mm	N°	Sn m	Tr ms		No		
CR1/OB-1V	10	149	187	15	0.2... 4.5	1.8	M12	5	NC/NO	PNP NO and NPN NC
CR1/OT-1V	10	149	187	15	0.2... 4.5	1.8	M12	4	NC/NO	Push-Pull
CR1/BP-1V	10	149	187	15	0.2... 4.5	1.8	M12	4	None	PNP-NO and PNP-NC
CR1/BN-1V	10	149	187	15	0.2... 4.5	1.8	M12	4	None	NPN-NO and NPN-NC

Tab.:2; Chap.:3.

3.3 Description of how to select functions with the Teach button

MEANING OF LEDs SIGNALING METHODS	
	
To indicate the menu levels, the display's Green and Red LEDs are used.	
	Indication of light at full intensity and steady
	Indication of low intensity, or with periodic and rapid flashing
	Indication of slow and continuous flashing or of limited duration corresponding to the pressure of the button
	Turned off

Tab.3; Chap.: 3

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HOW TO ACTIVATE THE FACTORY SETUP									
To set the factory configuration it is necessary to start from the sensor not powered The factory configuration provides the following base setup of the functions Calibration for maximum flow. All optics active.									
	Optics from E1, R1 to R7, E8						Display		Comment
	E1	R1	En	Rn	En	R7	E8	LED G	LED R
FC	●		●		●		●	☀	
1	After releasing the button the sensor enters in Blanking menu ▶ To exit the function setting menu and set the sensor in the basic operation corresponding to the factory configuration it is mandatory to proceed following all the steps from ▶1 to ▶J of Tab.:6 without changing the settings, ie: three times, press the button and keep it pressed until the Red LED lights up, release the button. Otherwise from ▶G, in order not to change anything, go back to the configuration of the parameters prior to power-up, turn off and on again without pressing the button.								

Tab.4; Chap.: 3

TEACH-IN MENU									
	Optics from E1, R1 to R7, E8						Display		Comment
	E1	R1	En	Rn	En	R7	E8	LED G	LED R
A	Power-on and / or normal operation, see also notes 1-6 ▶: see the indicated row								
1	☀		☀		☀		☀	●	
2	☀		☀		☀		☀	☀	◼
B	Button activation for less than 3 seconds: enter the Standard Teach menu								
3	☀		☀		☀		☀	●	☀
C	Standard Teach in dark condition or insufficient signal: alignment is activated								
4	◼		◼		◼		◼	◼	◼
5	◼		◼		◼		◼	☀	●
D	Standard calibration in light condition								
6	☀		☀		☀		☀	●	☀
7	☀		☀		☀		☀	☀	●
E	Button activation for more than 3 seconds: enter the Standard Teach menu								
8	☀		☀		☀		☀	●	☀
9	☀		☀		☀		☀	☀	●
F	Precision Calibration in dark condition or with insufficient signal: alignment is activated								
10	◼		◼		◼		◼	◼	◼
11	◼		◼		◼		◼	☀	●
G	Precision calibration in light condition								
12	☀		☀		☀		☀	☀	●
13	☀		☀		☀		☀	☀	●
NOTES: Keeping the button pressed for a time > 6s you access the Timer, Blanking menus, see Tab.:6 1) After entering the Menu the only way to exit is to proceed through all the steps, the new parameters are recorded only in output. 2) In the event of uncertainty, exit the menu by switching off, the previous settings will be restored when switching back on. 3) If the 4 o10 alignment condition persists for more than 120s, the sensor returns to the normal state with the previous setting. 4) The stored parameters are used the next time the power is turned on. 5) Only emitters form 1 to 4 are used in the menu indication									

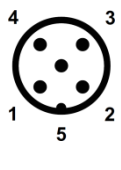
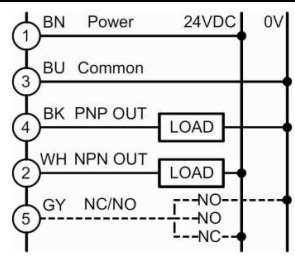
Tab.:5; Chap.: 3

Blanking Menu: active emitters indication, from 1 to 14 E/R couples												
I	Only emitter are shown								Display		Comment Active optics current state	
	E1	E2	E3	E4	E5	E6	E7	E8	LED G	LED R		
14												Fourteen active optics (standard)
15												Thirteen active optics
16												Twelve active optics
17												Eleven active optics
18												Ten active optics
19												Nine active optics
20												Eight active optics
21												Seven active optics
22												Six active optics
23												Five active optics
24												Four active optics
25												Three active optics
26												Two active optics
27												One active optics
J	Active optics selections or confirm of the current setup											
28												Briefly press the button to scroll up to desideratum active optics number. The Green LED indicates the button pressed
29	X	X	X	X	X	X	X	X	X			Press the button and keep it pressed for 3 seconds to select the current active optic number
30	X	X	X	X	X	X	X	X	X			When the Red LED lights up release the button: the selected active optic number is confirmed
A	Normal operation, falls into the state (A) When exiting this menu it is advisable to execute a Teach-in, see Tab.:5.											
NOTE: From this Menu it is possible to exit only by executing the whole sequence from I to J; if you want to exit the menu and return to the previous setup, turn the sensor off and on again before exiting the Menu.												

Tab.:6; Chap.: 3

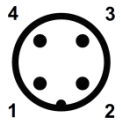
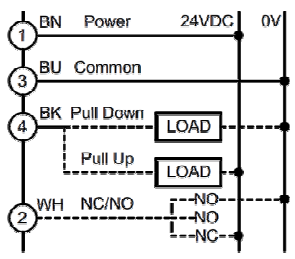
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3.4 Electrical drawing

SERIE CR1	REFLEX CURTAIN	CR1/0B MODEL PNP and NPN outputs, NC/NO selectable			
M12, 5 poles Male connector	Wiring	Connector			
		Pin	Color	Signal	Description
		1	BN	24V _{DC}	Power supply input from 12 to 30V.
		2	WH	NPN Out	Apply a load connected at the positive, maximum current 160mA
		3	BU	0V	Supply voltage reference
		4	BK	PNP Out	Apply a load connected to the common, maximum current 160mA.
5	GY or YE/GR	NC/NO	Input for outputs logic selection.		


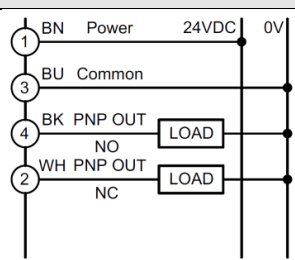
NOTE: The NC/NO input is read only when the sensor is switched ON. If it is left open or permanently wired to the common, it selects the output as DARK ON. If it is connected to the positive, it selects the output as LIGHT ON. Enabling the button it is possible to execute the Teach.

Tab.:7; Chap.:3

SERIE CR1	REFLEX CURTAIN	CR1/0T MODEL Push Pull output, NC/NO selectable			
M12, 4 poles Male connector	Wiring	Connector			
		Pin	Color	Signal	Description
		1	BN	24V _{DC}	Power supply input from 12 to 30V.
		2	WH	NC/NO	Input for outputs logic selection.
		3	BU	0V	Supply voltage reference.
4	BK	Push Pull Out	Apply a Pull up or a Pull down load, maximum current 160mA.		

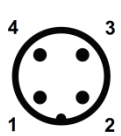
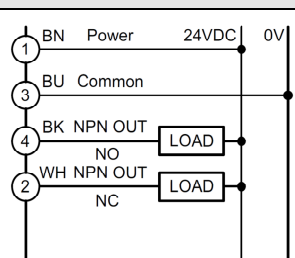
NOTE: The NC/NO input is read only when the sensor is switched ON. If it is left open or permanently wired to the common the Push driver is Dark switching and the Pull driver is Light switching. If it is connected to the positive the Push driver is Light switching and the Pull driver is Dark switching. Enabling the button it is possible to execute the Teach.

Tab.:8; Chap.:3

SERIE CR1	REFLEX CURTAIN	CR1/BP MODEL PNP outputs NO and NC			
M12, 4 poles Male connector	Wiring	Connector			
		Pin	Color	Signal	Description
		1	BN	24V _{DC}	Power supply input from 12 to 30V.
		2	WH	PNP Out NC	Apply a load connected to the common, maximum current 160mA.
		3	BU	0V	Supply voltage reference
4	BK	PNP Out NO	Apply a load connected to the common, maximum current 160mA.		

NOTE: Enabling the button it is possible to execute the Teach.

Tab.:9; Chap.:3

SERIE CR1	REFLEX CURTAIN	CR1/BN MODEL NPN outputs NO and NC			
M12, 4 poles Male connector	Wiring	Connector			
		Pin	Color	Signal	Description
		1	BN	24V _{DC}	Power supply input from 12 to 30V.
		2	WH	NPN Out NC	Apply a load connected to the positive, maximum current 160mA.
		3	BU	0V	Supply voltage reference
4	BK	NPN Out NO	Apply a load connected to the positive, maximum current 160mA.		

NOTE: Enabling the button it is possible to execute the Teach.

Tab.:10; Chap.:3

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4.0 TECHNICAL SPECIFICATIONS

OPTICAL BEHAVIOR					
PARAMETERS		Min.	Nom.	Max.	NOTE
Standard detection range ^c	m	0		4,5	It depends on the reflector, see Tab.: 2
Standard reflector range (ExG≥1.5) ¹	m	0.20		4,5	It depends on the reflector, see Tab.: 2
Reflector range with ExG= 1 ¹	m	0.15		5,5	It depends on the reflector, see Tab.: 2
Total angle	°			2,5	Emitted beam
Detection capability Standard; S=3m	mm	6		35	MDO, minimum and maximum values of Tab.:4
Detection capability Precision; S=3m	mm	3,5		12	MDO, minimum and maximum values of Tab.:4
LED wavelength	nm		617		Red/Orange color, vertically polarized
LED life expectancy	h		100K		With maximum temperature and current
Margin for a Teach in Standard ^c			1,5		See note2
Hysteresis for a Teach in Standard ^c	%		20		See note2
Margin for a Teach in Standard ^c			1,1		See note2
Hysteresis for a Teach in Standard ^c	%		12		See note2
Immunity for artificial light, direct	Klux		50		Incandescent lamp
Immunity for artificial light, direct	Klux		5		Fluorescent lamp

Tab.:1; Chap.:4

- NOTES:**
- 1) The reported data refer to the RL136 reflector, but depend on the size and type of reflector, if placed near the sensor, the granularity of the reflector determines instability if there are vibrations. A fine grain causes an increase in the minimum distance, the type and the area determine the maximum distance. The best compromise is a 20x80mm reflector active area size and a 4mm prismatic cell size. The data in the tables are those obtained by carrying out a Teach-in, at a specific distance of the reflector. The factory calibration is performed for the maximum range, to obtain the specified MDO it is however always necessary to perform a calibration. If the indicated margin is not available, the calibration function is interrupted and the sensor remains in Alignment mode for 120s, then the parameters of the previous Teach-in are applied.
 - 2) S_G : Light signal reached in calibration; S_L : Light threshold; S_D : Dark threshold; Margin or ExG: S_G / S_L ; Hysteresis%: $((S_L - S_D) / S_L) * 100$

RANGE WITH SPECIFIC REFLECTORS					
Reflectors	ExG 1 (m)	ExG ≥1.5 (m)	ExG 1 (m)	Reflector active area (mm)	Reflector Size (mm)
RL136	0,15	0,2...4,5	5,5	38 x 195	40 x 200
RL 100DCR1	0,25	0,3...2,5	3	40 x 200	40 x 200

Tab.:2; Chap.:4

IDENTIFICATION OF THE ELEMENTS OF AN APPLICATION

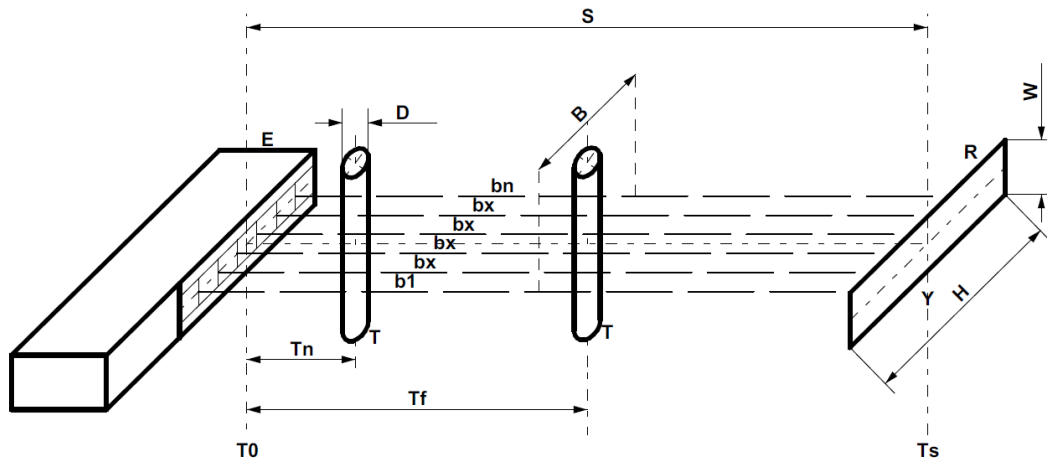


Fig.:1

E	Polarized reflex array sensor (only 7 optics are represented even if the CR1 model has 15 optics)
R	Reflector, only the corner type is capable of handling polarized light
H	Length of the active surface of the reflector (dimensions optimized for best compromise range and resolution) 200mm
W	Width of the active surface of the reflector (dimensions optimized for best compromise range and resolution) 40mm
S	Distance between sensor and reflector (length of controlled area), from Smin (dark zone) to Smax (maximum range)
b1...b14	Pair of beams (emitted / reflected) determined by the array formed by eight emitters and seven receivers
B	Minimum width of the controlled area (varies slightly according to dimension Tx) on average 150mm
T	Test rod of D diameter, the minimum diameter intercepted with continuity is indicated as MDO
D	Diameter of the test rod
T0	Minimum dimension assumed by Tx (grazing at the front of E), to which test rod, of diameter D, is continuously intercepted.
Tn	Minimum dimension assumed by the Tn...Tf tract in which the test rod, of diameter D, is continuously intercepted
Tf	Maximum dimension assumed by the Tn...Tf tract in which the test rod, of diameter D, is continuously intercepted
Ts	Maximum dimension assumed by T (grazing at the front of reflector), to which test rod, of diameter D, is continuously intercepted.

Tab.:3; Chap.:4

DEFINITION OF THE MINIMUM DETECTABLE OBJECT WITHOUT INTERRUPTION DETERMINED BY THE DISTANCE OF THE REFLECTOR AND THE POSITION OF THE SAME OBJECT

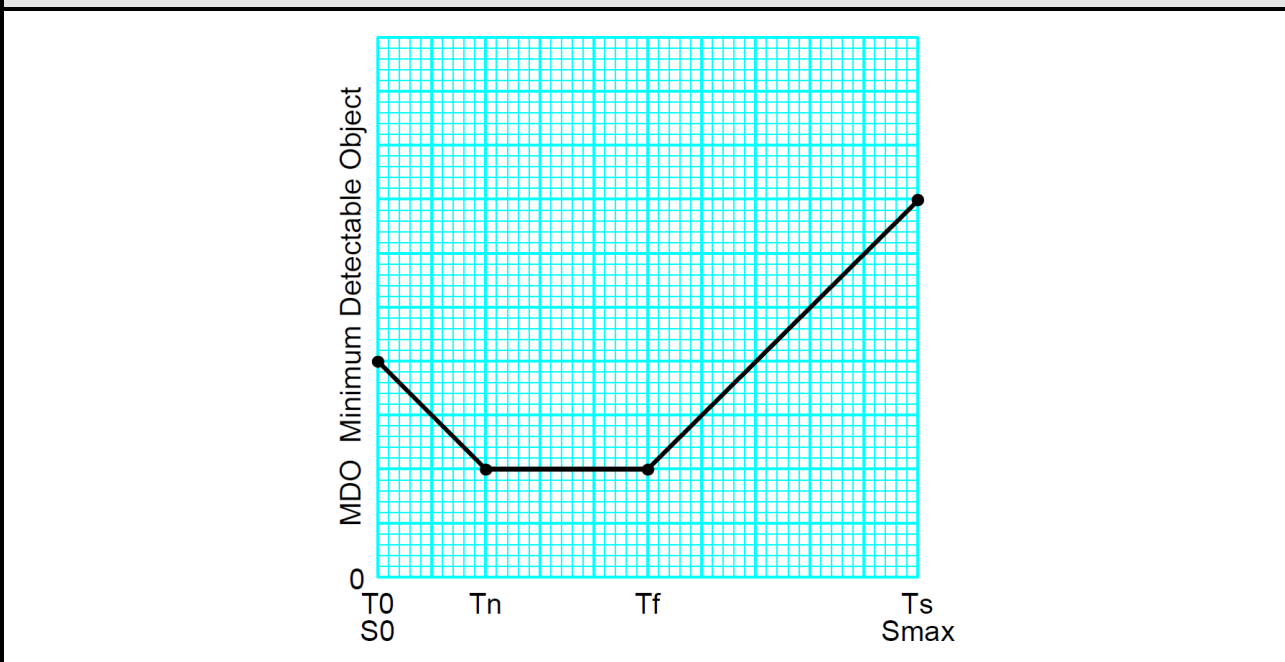


Fig.:2: Shape of the characteristic curve and identification of reference points on the graph.

Range (mm)	MDO (mm) @ Tx (mm)								
	Standard Teach-in				Precision Teach-in				
Smax	T0	Tn	Tf	Ts	T0	Tn	Tf	Ts	Tx
100	0	0	100	100	0	0	100	100	Tx
	10	10	10	10	6	6	6	6	MDO
150	0	0	150	150	0	0	150	150	Tx
	10	10	10	10	6	6	6	6	MDO
200	0	0	200	200	0	0	100	200	Tx
	10	10	10	10	4,5	4,5	4,5	6	MDO
250	0	0	100	250	0	0	100	250	Tx
	7	7	7	10	4	4	4	6	MDO
500	0	0	150	500	0	0	350	500	Tx
	6	6	6	12	3	3	3	4	MDO
1000	0	0	200	1000	0	800	800	1000	Tx
	5	5	5	14	3	3	3	5	MDO
1500	0	0	250	1500	0	0	1000	1500	Tx
	5	5	5	18	3	3	3	6	MDO
2000	0	0	400	2000	0	0	1100	2000	Tx
	5	5	5	24	3	3	3	8	MDO
2500	0	0	600	2500	0	0	1100	2500	Tx
	6	6	6	30	3	3	3	10	MTO
3000	0	0	600	3000	0	0	1400	3000	Tx
	6	6	6	35	3,5	3,5	3,5	12	MDO
4000	0	0	700	4000	0	0	1200	4000	Tx
	6	6	6	50	3,5	3,5	3,5	16	MDO
4500	0	0	800	4500	0	0	1300	4500	Tx
	6	6	6	55	3	3	3	16	MDO

Tab.:4; Chap.:4

<p>Between T0 ... Tn and Tf ... Ts MDO varies in a quasi-linear way, so formulas can be used to obtain an approximate MDO value in these traits.</p>
<p>Formula for calculating an MDO for a Tx between Tf and Ts</p>
$(((MDO_{Ts} - MDO_{Tf}) / (Ts - Tf)) * (Tx - Tf)) + MDO_{Tf}$
<p>Formula for calculating an MDO for a Tx between T0 and Tn</p>
$(((MDO_{Tn} - MDO_{T0}) / Tn) * Tx) + MDO_{T0}$

Tab.:5; Chap.:4

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ELECTRICAL MECHANICAL BEHAVIOR					
PARAMETERS		Min.	Nom.	Max.	NOTES
Power supply					
Operatin voltage	V	12	24	30	From PELV power supply according to EN 60204-1 Chap.6.4
Ripple	V			1.2	Supply voltage must stay within the stated limits
No load supply current	mA	135		40	Maximum current with the minimum voltage range (constant power)
Digital Outputs					
Output type (model 0B)		1xPNP, 1xNPN			Completely protected, selectable NO or NC, 5 wires
Output type (model 0T)		1xPush-Pull			Completely protected, selectable NO or NC, 4 wires
Output type (model BP)		1xPNP NO; 1xPNP NC			Completely protected, 4 wires
Output type (model BN)		1xNPN NO, 1xNPN NC			Completely protected, 4 wires
Load current	mA			160	Higher values are interpreted as overload or short circuit
Voltage drop @100mA	V	1.0		1.6	Reduction in output voltage compared to the supply voltage
Resistive load (@24V)	Ω	145			Lower values are interpreted as short circuit
Leakage current, models 0I, 0B, BP, BN	μA			100	Value at which the OFF state of the load must be guaranteed
Leakage current, models 0T, 0P, 0N	μA			10	Value at which the OFF state of the load must be guaranteed
Tolerated capacitive load	μF			0.7	Higher values can be interpreted as short circuit.
Switching time ON	μs		0.05		With load of 220/1000Ω
Switching time OFF	μs	2		10	With load of 220/1000Ω
Response times					
Time delay before availability (Static mode)	ms			300	All outputs are in the OFF state during this time
Teach-in	s			1,5	From the initial pressure of the button
Outputs response time, Light to Dark	ms	0,53		1,60	All beams active, it is reduced if Blanking is active
Outputs response time, Dark to Light	ms	1,93		3,80	All beams active, it is reduced if Blanking is active
Switching frequency	Hz			250	All beams active, standard test: Dark / Light ratio = 1/2
Input levels					
Low level	V	0		0.8	Normally connected to common
Open level	V	1.3	1.9	2.35	Normally leaved open
High level	V	5.8		30	Normally connected to supply voltage
Integration time	ms		20		The input state must persist for at least this time
Input current for low level	μA	-250		520	Outgoing or incoming current
Input current for high level	mA	0.52		1.2	Incoming current
Menu button pressure times					
Short push time	s		0,5		Starting a Standard Teach-in or menu item selection
Medium push time	s		3		Starting a Precision Teach-in, or confirm selection and menu progress
Long push time	s		4,5		Entrance into the menu function
Environmental parameters					
Enclosure rating		IP67			Dust and water protection (immersion for 60 min. at a depth of 1m)
Working temperature	°C	-10		55	Without condensation
Storage temperature	°C	-25		70	To be respected also during transportation
Humidity	%			95%	Without condensation
Vibrations		Sec. IEC 60947-5-2			It complies with limits and conditions stated in the rule
Shock		Sec. IEC 60947-5-2			It complies with limits and conditions stated in the rule
Sensing range correction factors					
Environmental factors		0.50 / 0.25			In presence of dust, fog, smoke (approximate values)
Connections					
Cable sections	mm ²		0.34		To be respected to guarantee the maximum indicated length
Total length of power cables	m			100	With cable of the indicated sections, standard models
Size/Materials					
Housing section	mm	20 (frontal) x 36			Painted aluminum, blue color RAL5002
Total height	mm	187			
Fixing groove, for T shaped insert	mm	2/10/6.5			In the rear part of the sensor: depth/width/opening width
Width of the frontal window	mm	15mm			Active width: 9mm central, material: PMMA
Height of the frontal window	mm	104mm			Active height: 69mm top
Number/Size/Pitch of the lenses		15/ 9*9mm/10mm			Central part of the window, see Pic.: 1
Top closure	N°	1			Material: PC, transparent
Bottom closure	N°	1			Material: PBT + 30%GF, black colour
Closing screws	N°	2+2			M2, FE37 burnished
Weight	g	167			Sensor only
Connectors/Cables					
Models 0I, 0T, BP, BN, 0P, 0N		1xM12, 4p, male			Pigtail length 240mm, PVC, Ø 4,7mm, 0,34mm ²
Models 0B		1xM12, 5p, male			Pigtail length 240mm, PVC, Ø 4,7mm, 0,34mm ²

Tab.:6: Chap.:4

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5.0 START-UP INSTRUCTIONS

5.1 Mechanical mounting of CR models

It is extremely important to fix the sensors and the reflectors to a rigid structure, not subject to deformation or to strong vibrations. Choose the position of the sensor so as not to expose it to strong sources of natural or artificial light and to light interference with other sensors in the visible emission.

Keep in mind that the devices are not suitable for outdoor installation, IP67 despite being declared, it is not guaranteed that the long exposure to the weather does not cause water penetration and performance degradation.

Choose the most suitable reflector to the required detection capabilities and sensing range.

Mount the sensor with the optical axes as much as possible perpendicular to the reflector surface. The mutual distance depends on the type of reflector and must be included in the field of specification. To secure the sensors to a support, use the corresponding inserts to be applied in the rear groove and the brackets in the normal provisioning.

If the application is subject to vibrations, which anyway do not prevent the optical alignment, use damping supports.

Though used polarized light, the light beams can in part be deflected by reflective surfaces parallel and near to the beams, this can lead to a missed detections of the interruption of direct path of the of the optical beam, or incorrect calibration values that may generate unstable operation, so all reflective surfaces and reflective objects should maintain a minimum distance from the direct path of the rays. This distance depend on the aperture angle of optics.

Keep in mind that even if a surface is black, if it is shiny, it can be highly reflective.

If you can't eliminate or reduce the effect of a reflective surface, it is important that this effect remains stable or that the system behaves in an acceptable and predictable manner.

Temporarily block the sensor and reflector so that they are aligned and parallel to each other.

5.2 Electrical installation

Use **PELV** power supplies, in compliance with Chap.6.4. of EN 60204-1.

If using a non-stabilized power supply, the transformer must have double insulation and adequate power, the secondary winding must not exceed 18Vac. Use a bridge rectifier, a filtering capacitor with a minimum value of 1000µF.

Connect the supply cables directly to the source and not downstream of other power or highly inductive devices.

Run the cables of the sensor in dedicated raceways or where only signals run; do not use raceways already carrying power cables.

Comply with the specification of the maximum length of the connection cables. Make sure that the part or parts of the metal structure on which the sensors, power supply and loads are installed are effectively connected to the same earth ground.

Before inserting the connector, check that the mains voltage and the supply voltage are within the required limits, apply the connector and check again that the supply voltage has a correct nominal value and remains within the limits defined in all working conditions.

Check the limits in the two extreme conditions of minimum and maximum absorption of all devices connected to the same power supply, especially if this is **not** a stabilized power supply.



Danger!

In order to carry out the following operations, a voltage supply to the sensor is needed. Before starting this phase, make sure that the outputs' switch cannot lead to any danger.

Make the minimum electrical connections for proper operation, connect the power cables, connected to the necessary inputs devices; suitably connected the NC / NO input if it is available, this status is only acquired at power on.

5.3 Alignment of CR1 models

Once applied the supply voltage, the Green LED must switch on, if it is off or flashes the supply voltage is not sufficient. If the LED flashes @1.5Hz the supply voltage is present but too low. If Green and Red LED are both active but the signal is not sufficient. If only the Green LED is active, the sensor is aligned. In order to provide a good alignment it is necessary to run a teach-in without reflector visibility to setup the best alignment. If possible, look at the reflector near the optical axis and regulate the emitter position to keep all the red light image on the reflector; in the meanwhile look at the Green and Red LEDs to regulate the position to obtain the smallest intensity on the Red LED.

When the alignment is at the best, fix the sensor and the verify that the alignment does not decrease; now execute a Precision calibration: if the Red LED is off and the Green LED is on the alignment is good and Teach-in procedure is successfully. If both LED are flashing, the alignment is not correct so try to find a better alignment and execute a second Precision Calibration, if accepted verify the mechanical stability of the system and the expected sensor behavior. If LED lights up in a non-recognizable manner, execute a Factory setting (Tab.:4; Cap.:3) and check the error codes (Tab.:1, 2).








Indication

A correct optical alignment with a good signal margin prevents unstable functioning of the light curtains, reduces optical interferences and reflection by shiny surfaces and guarantees better stability in general.









If the range is short, the graininess of the reflector can cause instability, check the behaviour of the system by shifting the reflector, as an alternative use of reflective paper composed of micro prisms.

Please do not forget to reconnect all the cables and to control the correct functioning of the application.
























5.4 Display indications and diagnostics.

MEANINGS OF LEDs SIGNALLING MODES	
	Indication of full light and steady
	Indication of low intensity or intermittently with fast periodic flashing
	Indication of slow continuous flashing
	Off
	Any

Tab.:1; Chap:5

LEDs INDICATIONS			
GN		No power supply or below 5V. Memory reading error.	RD
		Power supply below 12V. Emission LEDs failed.	
		Alignment. Outputs in short circuit	
		Normal operation.	
		Light state. No power supply.	
		Memory reading error.	
		Alignment. Some optics in Dark	
		Many or all optics in the DARK Fault or outputs in short circuit	

Tab.:2; Chap:5

COMBINED INDICATIONS							
							
							
GN							
RD							
STATUS	Power 						Out 
	OFF or LOW	MEMORY ERROR	FAULT	LIGHT	DARK	ALIGNEMENT	OVERLOAD

Tab.:3; Chap:5

6.0 MECHANICAL DIMENSIONS OF LIGHT CURTAINS AND STANDARD ACCESSORIES

6.1 Mechanical dimensions of CR1/-1V reflex curtains**

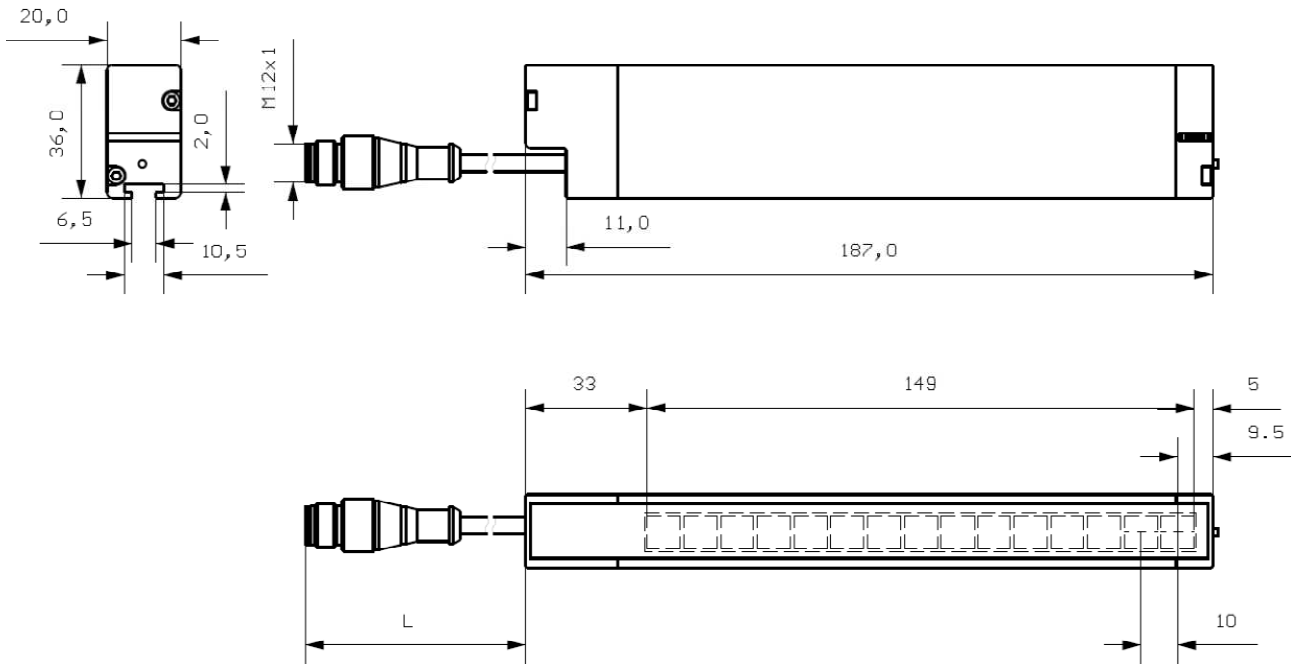


Fig.: 1; Chap.:6
Pigtail cable length L= 240mm

6.2 Standard Mounting accessories

One unit is supplied by type

Kit mounting accessories ST151	
<p>Pict.: 2; Chap.:6 T-shaped insert, with two M5 nuts and two split washers.</p>	<p>Pict.: 3; Chap.:6 L-shaped mounting bracket</p>

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7.0 INSTALLATION

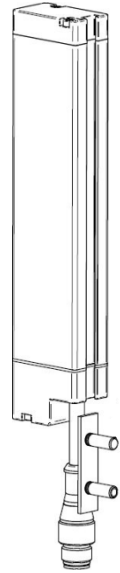
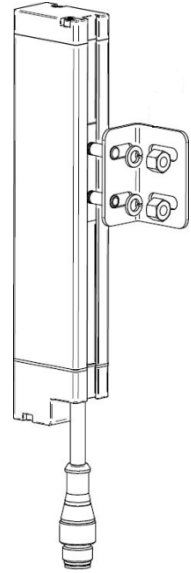
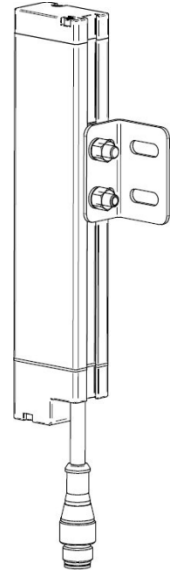
Securing CR1 light curtains with accessories' kit ST151		
		
Place the T-shaped insert	Mount the L-shaped bracket on the T-shaped insert	Secure light curtains to the wall

Fig.: 2; Chap.:7

8.0 LIST OF AVAILABLE ACCESSORIES

M12 CONNECTORS, 4 POLES, WITH CABLE	
CD12M/OB-020A1	M12 connector, straight, 4 poles, female, 2m PVC cable
CD12M/OB-050A1	M12 connector, straight, 4 poles, female, 5m PVC cable
CD12M/OB-100A1	M12 connector, straight, 4 poles, female, 10m PVC cable
M12 CONNECTORS, 4 POLES, WITH CABLE	
CD12M/OB-050A5	M12 connector, straight, 4 poles, female, 5m PUR cable
CD12M/OB-100A5	M12 connector, straight, 4 poles, female, 10m PUR cable
M12 CONNECTORS, 5 POLES, WITH CABLE	
CD12M/OH-050A5	M12 connector, straight, 5 poles, female, 5m PUR cable
CD12M/OH-100A5	M12 connector, straight, 5 poles, female, 10m PUR cable
STANDARD MOUNTING KIT FOR LIGHT CURTAINS	
ST151	Kit with T-shaped insert with four M5 screws complete with nuts and washers and an L-shaped bracket
VIBRATION DAMPING SUPPORTS	
ST 4V S	Kit of 4 vibration-damping supports

Tab.:1; Chap.:7

9.0 PACKAGE CONTENT

Each package has the following content:

- A retroreflective area sensor **CR1**
- An accessories' kits **ST151** (T-shaped insert and L-shaped bracket)
- Reflector **RL136**
- Multilingual installation short manual.

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10.0 CONTROL OF THE INSTALLED RETROREFLECTIVE AREA SENSOR

10.1 Purpose of controls.

The controls described here below are meant to ensure the functional and reliable performances required.

10.2 Preliminary controls before start-up

- All devices must be correctly installed and well secured.
- The maximum response time must be adequate to the application. Make sure that the sensor's response time is compatible with the specific application, detecting objects of minimum and maximum size, in different positions and, if possible, with even faster movements compared to what the application allows.
- Make sure that no optically interfering devices are in the visual field of the sensor. Make sure that other devices do not undergo interferences by the emitted light.
- Make sure that sensors and reflector are not exposed to any substance which might dirty or damage the optics.
- Make sure that technical documentation is available for operators in charge of maintenance.

10.3 Controls device efficiency

- State and efficiency of the device can be checked using a test stick, which must be detected in a way that is repetitive in time.
- Make sure that there are no damages nor dirt on sensor and reflector optical windows' surface. Scratches and tarnished surfaces can negatively affect the light curtain's resolution.
- If necessary, clean the optical surface with a humid antistatic cloth. Do not use any alcohol, nor solvents, nor abrasive substances.