



Operating Instructions
optoCONTROL CLS1000

CLS1000-AU
CLS1000-AI
CLS1000-QN
CLS1000-2Q
CLS1000-OC

Sensory system for detecting presence, position, turbidity, gap, diameter and edges

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1. Safety

System operation assumes knowledge of the operating instructions.

1.1 Symbols Used

The following symbols are used in these operating instructions:



Indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.

NOTICE

Indicates a situation that may result in property damage if not avoided.



Indicates a user action.

i

Indicates a tip for users.

Measurement

Indicates hardware or a software button/menu.

1.2 Warnings



Connect the power supply and the display/output device according to the safety regulations for electrical equipment.

- > Risk of injury
- > Damage to or destruction of the sensor and/or the controller

NOTICE

The supply voltage must not exceed the specified limits.

- > Damage to or destruction of the sensor and/or the controller

Avoid shocks and impacts to the sensor and controller.

- > Damage to or destruction of the sensor and/or the controller

Never fold the sensor (optical fiber) and do not bend the sensor in tight radii.

- > Damage to or destruction of the sensor, failure of measuring device

Protect the ends of the optical fiber against contamination (use protective caps).

- > Functionality impaired due to contamination

- > Failure of the measuring device

1.3 Notes on CE Marking

The following apply to the optoCONTROL CLS1000:

- EU Directive 2014/30/EU
- EU Directive 2011/65/EU

Products which carry the CE mark satisfy the requirements of the EU directives cited and the relevant applicable harmonized European standards (EN). The measuring system is designed for use in industrial and home applications.

The EU Declaration of Conformity is available to the responsible authorities according to EU Directive, Article 10.

1.4 Intended Use

The optoCONTROL CLS1000 is designed for use in an industrial environment. It is used

- for optical and non-contact detection of a diameter, an edge, or a gap
 - for detecting the presence of a target
 - for detecting the position of components
 - for position and assembly control in automated assembly machines and supply systems
 - for presence control
 - for checking length and diameter.
- It is only permissible to operate the system with the values specified in the technical data, [see 2.3](#).
 - The system must be used in such a way that no persons are endangered or machines and other material goods are damaged in the event of malfunction or total failure of the system.
 - Take additional precautions for safety and damage prevention in case of safety-related applications.

1.5 Proper Environment

- Protection class: IP65
- Temperature range:
 - Operation: -5 ... +55 °C (+23 ... +131 °F)
 - Storage: -10 ... +70 °C (+14 ... +158 °F)
 - Humidity: 5 ... 95% (non-condensing)
- Ambient pressure: Atmospheric pressure

For use in environments in which there are particularly strong high-frequency influences, deviations in the specified precision tolerances can occur at certain frequencies.

2. Functional Principle, Technical Data

2.1 Short Description

The measuring system consists of a compact controller with display unit, setting keys and connection for sensors of the CFS series.

Sensors (optical fibers) for the optoCONTROL CLS1000 measuring system can be produced to customer specifications.

In adverse environmental conditions, such as high temperatures, small installation dimensions and poor accessibility in plants, the optical fibers can be used like an optical micrometer.

The controller consists of a compact transmitting and receiving unit for infrared light with integrated signal evaluation. The light intensity received via a sensor (optical fiber) is always measured for internal processing.

2.2 Measuring Principle

The controller is designed for adaptable sensors in reflection and transmitted light mode. The controller serves as a transmitting and receiving unit, as well as for analog signal processing. Digital processing is performed internally on the software side. Settings can be made and parameters can be read via a user-friendly operation and display field.

Light is transmitted to the target and back by means of a high-quality optical fiber that works according to 3 different functional principles, depending on the application:

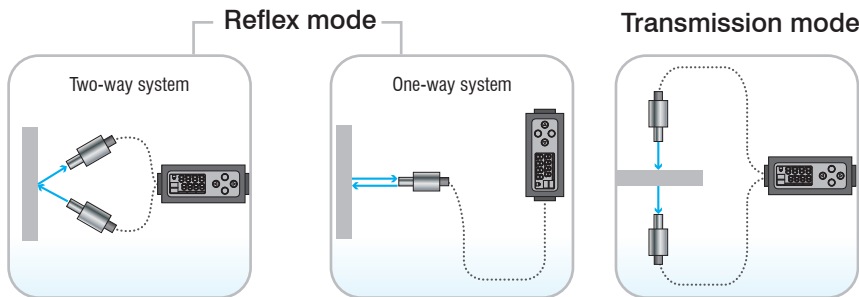
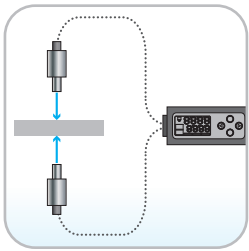


Fig. 1 Overview of the operating modes

2.2.1 Transmission Mode

In transmission mode, the light beam sent out by the transmitter is interrupted by the target to be detected, or is detected by the receiver. The transmitter and receiver of the one-way light barrier are housed in physically separate fiber-optic heads. The transmitter (S) beams directly onto the receiver (E). If an object (O) interrupts the light beam, the receiver voltage falls and the switching function is triggered.



Characteristics:

- Detection of opaque and mirroring targets
- Large ranges and high functional reserves, since the light beam only traverses the signal path once.
- Low susceptibility to failure, therefore well suited for use under difficult conditions, e.g. outdoor applications or those in dirty environments
- Field of application: Monitoring of production and packaging lines, fill-level measurement in transparent containers, as well as securing doors and hazard zones.

2.2.2 Reflex Mode (One-Way System)

In reflex mode (one-way system), the transmitter and receiver are in one housing. The light from the transmitter is reflected back to the receiver by a reflector. The switching function is triggered when the light beam is interrupted.

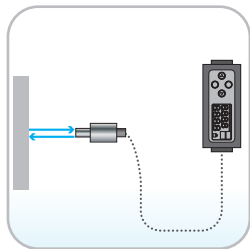


Fig. 2 Reflex mode (one-way system)

2.2.3 Reflex Mode (Two-Way System)

In reflex mode (two-way system), the transmitter and receiver of the one-way light barrier are housed in physically separate fiber-optic heads. The transmitter (S) beams light onto the object to be detected and the object reflects the light in the direction of the receiver. In this context, the surface structure or presence of an object can be detected, for example.

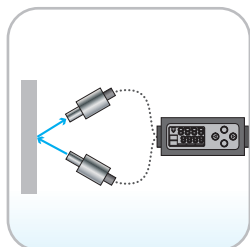


Fig. 3 Reflex mode (two-way system)

2.3 Technical Data

2.3.1 CLS1000-AU

Model	CLS1000-AU-NPN	CLS1000-AU-PNP	CLS1000-AU-PP	CLS1000-AU-NPN-T	CLS1000-AU-PNP-T	CLS1000-AU-PP-T
Operating range	max. 2000 mm (depending on transmission sensor)					
Detection range	max. 1200 mm (depending on reflex sensor)					
Response time	100 μ s					
Switching frequency	2.5 kHz (depending on pulse/pause ratio)					
Frequency response (-3 dB)	10 kHz					
Temperature stability	≤ 0.1 % FSO / K					
Light source	infrared LED 870 nm					
Permissible ambient light	50,000 lx					
Supply voltage ¹	12 ... 30 VDC					
Max. current consumption	50 mA					
Analog output	0 ... 10 V					
Switching output	NPN	PNP	PP	NPN	PNP	PP
Switching	light/dark switching (switchable)					
Signal input	-			Trigger in		
Connection	Optical	FA socket M18x1 for screwable optical fiber (length 0.3 m ... 15 m, min. bending radius 18 mm)				
	Electrical	4-pin M12 socket for power supply and signals (connection cable see accessories)		5-pin M12 socket for power supply and signals (connection cable see accessories)		
Mounting	DIN rail, DIN rail mounting (see accessories), mounting holes					
Temperature range	Storage	-10 ... +70 °C (+14 ... +158 °F)				
	Operation	-5 ... +55 °C (+23 ... +131 °F)				
Shock (DIN EN 60068-2-27)	20 g / 11 ms in 3 axes, two directions and 1000 shocks each					
Vibration (DIN EN 60068-2-6)	15 g / 10 ... 1000 Hz in 3 axes, 10 cycles each					
Protection class (DIN EN 60529)	IP67					
Material	Plastic housing (polycarbonate)					
Weight	200 g					
Compatibility	with all CFS sensors (FAR, FAD, FAZ and FAS)					
Control and display elements	Parameterization/operation via membrane keypad and OLED display on controller; LED for power on					
Special features	up to 9 teach-in modes; adjustable switching output functions on-delayed and off-delayed as well as pulse output; adjustable hysteresis 2 ... 25 %;			up to 9 teach-in modes; adjustable switching output functions on-delayed and off-delayed as well as pulse output; adjustable hysteresis 2 ... 25 %; many trigger types		

FSO = Full Scale Output

The specified data apply for a consistent room temperature of 22 °C, sensor is continuously in operation, open signal outputs.

1) Residual ripple $\leq 10\%$

2.3.2 CLS1000-AI

Model	CLS1000-AI-NPN	CLS1000-AI-PNP	CLS1000-AI-PP	CLS1000-AI-NPN-T	CLS1000-AI-PNP-T	CLS1000-AI-PP-T
Operating range	max. 2000 mm (depending on transmission sensor)					
Detection range	max. 1200 mm (depending on reflex sensor)					
Response time	100 μ s					
Switching frequency	2.5 kHz (depending on pulse/pause ratio)					
Frequency response (-3 dB)	10 kHz					
Temperature stability	≤ 0.1 % FSO / K					
Light source	infrared LED 870 nm					
Permissible ambient light	50,000 lx					
Supply voltage ¹	12 ... 30 VDC					
Max. current consumption	50 mA					
Analog output	Switchable 0 ... 20 mA or 4 ... 20 mA					
Switching output	NPN	PNP	PP	NPN	PNP	PP
Switching	light/dark switching (switchable)					
Signal input	-			Trigger in		
Connection	Optical	FA socket M18x1 for screwable optical fiber (length 0.3 m ... 15 m, min. bending radius 18 mm)				
	Electrical	4-pin M12 socket for power supply and signals (connection cable see accessories)		5-pin M12 socket for power supply and signals (connection cable see accessories)		
Mounting	DIN rail, DIN rail mounting (see accessories), mounting holes					
Temperature range	Storage	-10 ... +70 °C (+14 ... +158 °F)				
	Operation	-5 ... +55 °C (+23 ... +131 °F)				
Shock (DIN EN 60068-2-27)	20 g / 11 ms in 3 axes, two directions and 1000 shocks each					
Vibration (DIN EN 60068-2-6)	15 g / 10 ... 1000 Hz in 3 axes, 10 cycles each					
Protection class (DIN EN 60529)	IP67					
Material	Plastic housing (polycarbonate)					
Weight	200 g					
Compatibility	with all CFS sensors (FAR, FAD, FAZ and FAS)					
Control and display elements	Parameterization/operation via membrane keypad and OLED display on controller; LED for power on					
Special features	up to 9 teach-in modes; adjustable switching output functions on-delayed and off-delayed as well as pulse output; adjustable hysteresis 2 ... 25 %;			up to 9 teach-in modes; adjustable switching output functions on-delayed and off-delayed as well as pulse output; adjustable hysteresis 2 ... 25 %; many trigger types		

FSO = Full Scale Output

The specified data apply for a consistent room temperature of 22 °C, sensor is continuously in operation, open signal outputs.

1) Residual ripple $\leq 10\%$

2.3.3 CLS1000-QN

Model	CLS1000-QN-NPN	CLS1000-QN-PNP	CLS1000-QN-PP	CLS1000-QN-NPN-T	CLS1000-QN-PNP-T	CLS1000-QN-PP-T	
Operating range	max. 2000 mm (depending on transmission sensor)						
Detection range	max. 1200 mm (depending on reflex sensor)						
Response time	100 μ s						
Switching frequency	2.5 kHz (depending on pulse/pause ratio)						
Temperature stability	≤ 0.1 % FSO / K						
Light source	infrared LED 870 nm						
Permissible ambient light	50,000 lx						
Supply voltage ¹	12 ... 30 VDC						
Max. current consumption	50 mA						
Switching output	switchable NPN; PNP; PP	2x NPN normally open/ normally closed (Q/QN; NO/NC)	2x PNP normally open/ normally closed (Q/QN; NO/NC)	2x PP normally open/ normally closed (Q/QN; NO/NC)	2x NPN normally open/ normally closed (Q/QN; NO/NC)	2x PNP normally open/ normally closed (Q/QN; NO/NC)	2x PP normally open/ normally closed (Q/QN; NO/NC)
Switching	light/dark switching (switchable)						
Signal input	-			Trigger in			
Connection	Optical	FA socket M18x1 for screwable optical fiber (length 0.3 m ... 15 m, min. bending radius 18 mm)					
	Electrical	4-pin M12 socket for power supply and signals (connection cable see accessories)		5-pin M12 socket for power supply and signals (connection cable see accessories)			
Mounting	DIN rail, DIN rail mounting (see accessories), mounting holes						
Temperature range	Storage	-10 ... +70 °C (+14 ... +158 °F)					
	Operation	-5 ... +55 °C (+23 ... +131 °F)					
Shock (DIN EN 60068-2-27)	20 g / 11 ms in 3 axes, two directions and 1000 shocks each						
Vibration (DIN EN 60068-2-6)	15 g / 10 ... 1000 Hz in 3 axes, 10 cycles each						
Protection class (DIN EN 60529)	IP67						
Material	Plastic housing (polycarbonate)						
Weight	200 g						
Compatibility	with all CFS sensors (FAR, FAD, FAZ and FAS)						
Control and display elements	Parameterization/operation via membrane keypad and OLED display on controller; LED for power on						
Special features	up to 7 teach-in modes; adjustable switching output functions on-delayed and off-delayed as well as pulse output; adjustable hysteresis 2 ... 25 %;			up to 7 teach-in modes; adjustable switching output functions on-delayed and off-delayed as well as pulse output; adjustable hysteresis 2 ... 25 %; many trigger types			

FSO = Full Scale Output

The specified data apply for a consistent room temperature of 22 °C, sensor is continuously in operation, open signal outputs.

1) Residual ripple $\leq 10\%$

2.3.4 CLS1000-2QN

Model		CLS1000-2Q-NPN	CLS1000-2Q-PNP	CLS1000-2Q-PP	CLS1000-2Q-NPN-T	CLS1000-2Q-NPN-T	CLS1000-2Q-PP-T
Operating range		max. 2000 mm (depending on transmission sensor)					
Detection range		max. 1200 mm (depending on reflex sensor)					
Response time		100 μ s					
Switching frequency		2.5 kHz (depending on pulse/pause ratio)					
Temperature stability		≤ 0.1 % FSO / K					
Light source		infrared LED 870 nm					
Permissible ambient light		50,000 lx					
Supply voltage ¹		12 ... 30 VDC					
Max. current consumption		50 mA					
Switching output	each switchable NPN; PNP; PP	2x NPN (Q1/QN)	2x PNP (Q1/QN)	2x PP (Q1/QN)	2x NPN (Q1/QN)	2x PNP (Q1/QN)	2x PP (Q1/QN)
Switching		light/dark switching (switchable)					
Signal input		-			Trigger in		
Connection	Optical	FA socket M18x1 for screwable optical fiber (length 0.3 m ... 15 m, min. bending radius 18 mm)					
	Electrical	4-pin M12 socket for power supply and signals (connection cable see accessories)			5-pin M12 socket for power supply and signals (connection cable see accessories)		
Mounting		DIN rail, DIN rail mounting (see accessories), mounting holes					
Temperature range	Storage	-10 ... +70 °C (+14 ... +158 °F)					
	Operation	-5 ... +55 °C (+23 ... +131 °F)					
Shock (DIN EN 60068-2-27)		20 g / 11 ms in 3 axes, two directions and 1000 shocks each					
Vibration (DIN EN 60068-2-6)		15 g / 10 ... 1000 Hz in 3 axes, 10 cycles each					
Protection class (DIN EN 60529)		IP67					
Material		Plastic housing (polycarbonate)					
Weight		200 g					
Compatibility		with all CFS sensors (FAR, FAD, FAZ and FAS)					
Control and display elements		Parameterization/operation via membrane keypad and OLED display on controller; LED for power on					
Special features		up to 7 teach-in modes; adjustable switching output functions on-delayed and off-delayed as well as pulse output; adjustable hysteresis 2 ... 25 %;			up to 7 teach-in modes; adjustable switching output functions on-delayed and off-delayed as well as pulse output; adjustable hysteresis 2 ... 25 %; many trigger types		

FSO = Full Scale Output

The specified data apply for a consistent room temperature of 22 °C, sensor is continuously in operation, open signal outputs.

1) Residual ripple $\leq 10\%$

2.3.5 CLS1000-OC

Model	CLS1000-OC	CLS1000-OC-T
Operating range	max. 2000 mm (depending on transmission sensor)	
Detection range	max. 1200 mm (depending on reflex sensor)	
Response time	100 μ s	
Switching frequency	2.5 kHz (depending on pulse/pause ratio)	
Temperature stability	≤ 0.1 % FSO / K	
Light source	infrared LED 870 nm	
Permissible ambient light	50,000 lx	
Supply voltage ¹	12 ... 30 VDC	
Max. current consumption	50 mA	
Switching output	Optocoupler (OC)	
Switching	light/dark switching (switchable)	
Signal input	-	Trigger in
Connection	Optical	FA socket M18x1 for screwable optical fiber (length 0.3 m ... 15 m, min. bending radius 18 mm)
	Electrical	4-pin M12 socket for power supply and signals (connection cable see accessories)
Mounting	DIN rail, DIN rail mounting (see accessories), mounting holes	
Temperature range	Storage	-10 ... +70 °C (+14 ... +158 °F)
	Operation	-5 ... +55 °C (+23 ... +131 °F)
Shock (DIN EN 60068-2-27)	20 g / 11 ms in 3 axes, two directions and 1000 shocks each	
Vibration (DIN EN 60068-2-6)	15 g / 10 ... 1000 Hz in 3 axes, 10 cycles each	
Protection class (DIN EN 60529)	IP67	
Material	Plastic housing (polycarbonate)	
Weight	200 g	
Compatibility	with all CFS sensors (FAR, FAD, FAZ and FAS)	
Control and display elements	Parameterization/operation via membrane keypad and OLED display on controller; LED for power on	
Special features	up to 7 teach-in modes; adjustable switching output functions on-delayed and off-delayed as well as pulse output; adjustable hysteresis 2 ... 25 %;	up to 7 teach-in modes; adjustable switching output functions on-delayed and off-delayed as well as pulse output; adjustable hysteresis 2 ... 25 %; many trigger types

FSO = Full Scale Output

The specified data apply for a consistent room temperature of 22 °C (71.6 °F), sensor is continuously in operation, open signal outputs.

1) Residual ripple $\leq 10\%$

3. Delivery

3.1 Unpacking/Included in Delivery

1 optoCONTROL CLS1000 controller

1 assembly instructions

- ▶ Carefully remove the components of the measuring system from the packaging and ensure that the goods are forwarded in such a way that no damage can occur.
- ▶ Check the delivery for completeness and shipping damage immediately after unpacking.
- ▶ If there is damage or parts are missing, immediately contact the manufacturer or supplier.

A CFS series sensor as well as a PC1000 signal/power supply cable is required to operate the CLS1000.

Optional accessories, including the optical fiber, are available in the appendix , [see A 1](#).

3.2 Storage

- Temperature range for storage: -10 ... +70 °C (+14 ... +158 °F)
- Humidity: 5 ... 95% (non-condensing)

4. Installation and Assembly

4.1 Installation and Mounting

- Ensure careful handling during installation and operation.

NOTICE

During installation of the optoCONTROL CLS1000, ensure that the sensors can be freely moved and are not exposed to any pronounced curvatures or sharp corners. Damage to or destruction and/or failure of the sensor and/or influence on the test result.

The smallest bending radius of the sensor (optical fiber) is 18 mm (3 x Ø cable diameter).

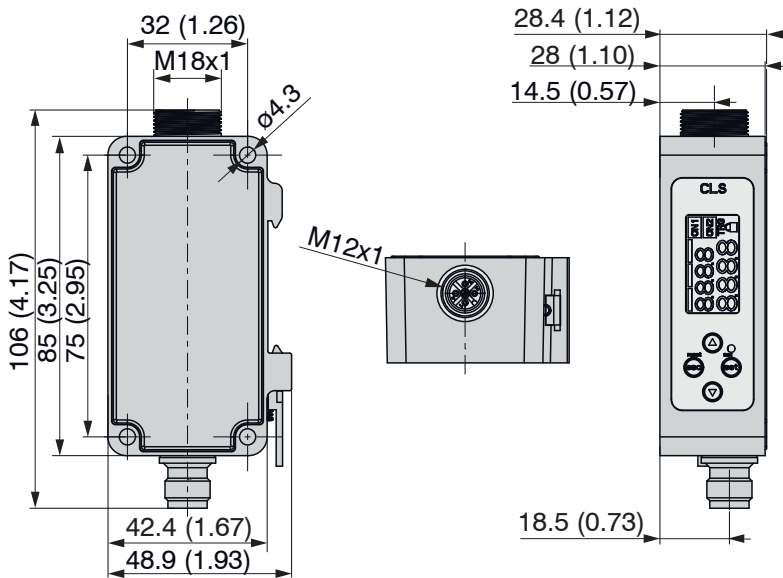


Fig. 4 Dimensional drawing of optoCONTROL CLS1000, dimensions in mm (inches)

NOTICE

Do not allow the end surfaces of the sensor to hit against edges or surfaces.
 > Reduced signal quality or failure of the measuring device.

- ▶ Mount the controller exclusively on a flat surface or a DIN rail using the existing through-holes on the housing, see 4.3.

Any type of clamping is not permitted.

- ▶ Connect the controller according to the pin assignment, see 4.5.3.

4.2 Installation of the Sensor

Various sensors are available for the optoCONTROL CLS1000, see A 1.

This makes it possible to use an optimal probe head, even in restricted spaces.

NOTICE

No sharp or heavy objects should be allowed to affect the cables and optical fibers. Always avoid folding the cables and optical fiber.
> Damage to or destruction of the cables and/or optical fiber, failure of the sensor

NOTICE

Do not bend more tightly than the bending radius of the optical fiber of 18 mm (3 x Ø the cable diameter). Do not use any cable ties to tighten the sensor.
> Breakage of the optical fiber, impairment of switching behavior

NOTICE

Do not touch the front surface of the sensor.
> Functionality impaired due to contamination

▶ Install the optical fiber to the provided socket of controller and lock it using the retainer nut.

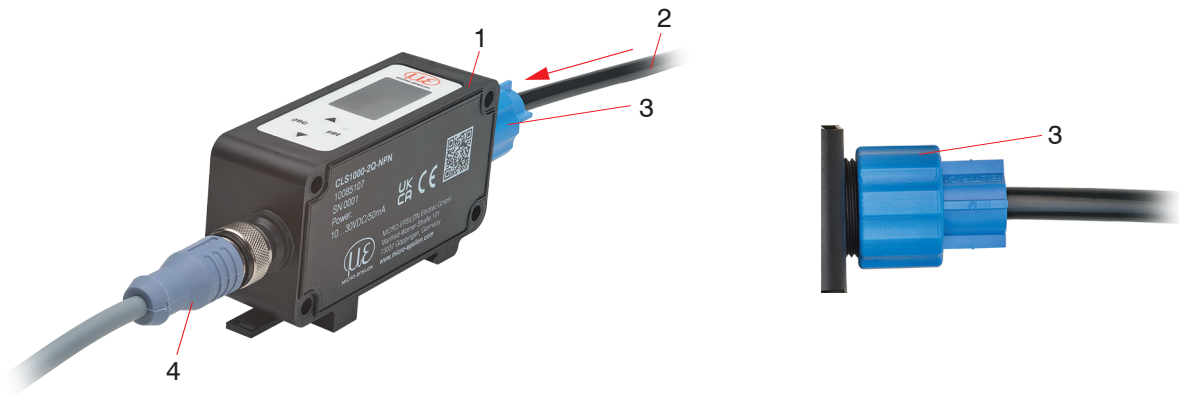


Fig. 5 Optical fiber installation

- 1 Controller
- 2 Optical fiber
- 3 Retainer nut
- 4 Supply voltage

▶ Position the probe head of the sensor in the necessary position relative to the target.

i Take background reflections into account when doing so. Objects in the background can influence the measurement; highly glossy surfaces have the greatest effect on the measurement

NOTICE

Do not install multiple optical fiber probe heads directly next to one another.
> Mutual influence, imprecise measurement values

4.3 Installation on a DIN Rail

- ▶ Install Controller 1 on a DIN rail (DIN EN 60715 / Type TH35).
- ▶ Install Controller 2 to Controller 1 and use M4 hexagon socket screws with the appropriate length to screw the controller.

i IP65 remains intact for the screw connection in the stacked state.

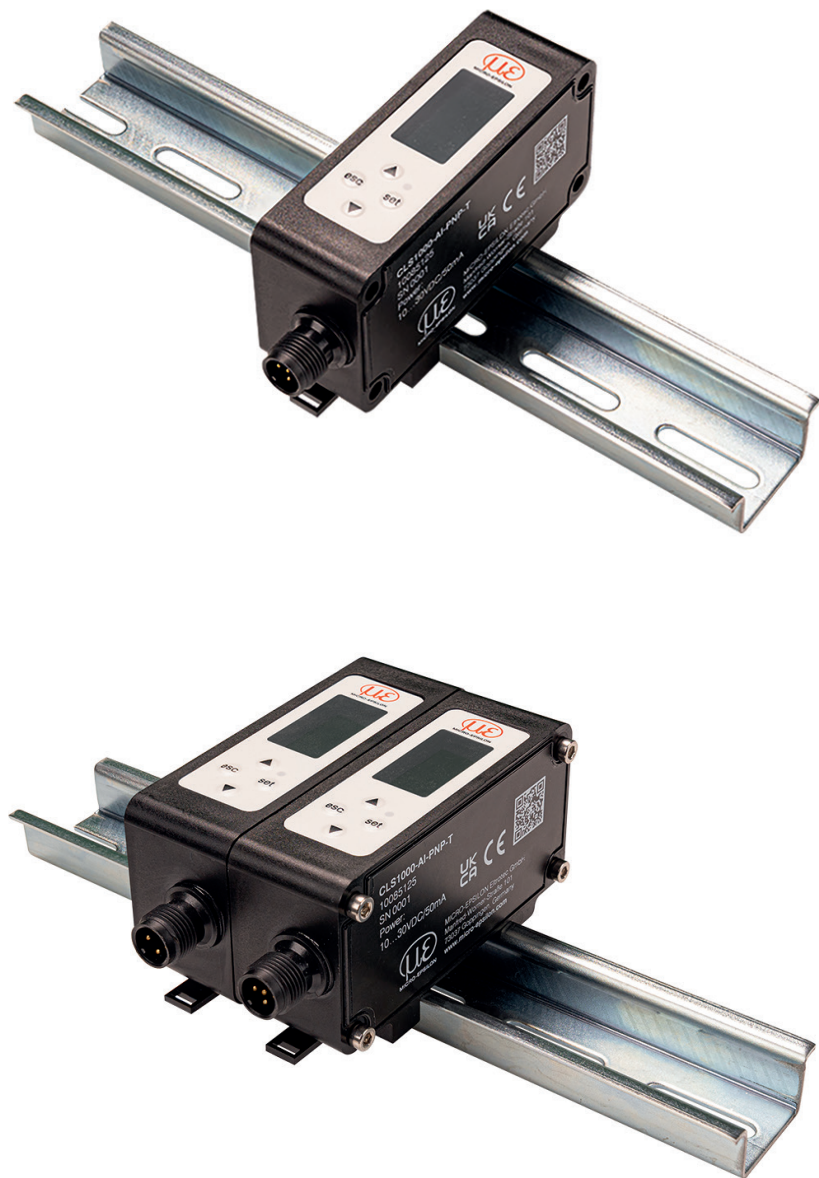


Fig. 6 Installation of the CLS1000 on a DIN rail

4.4 Control and Display Elements

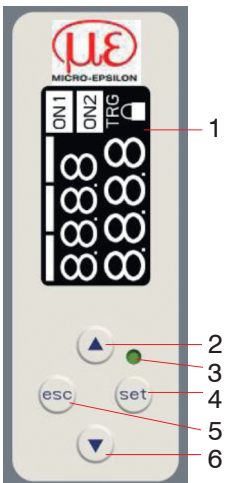


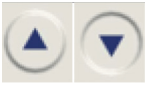



The Status LED on the controller signals the following information:

LED	Display	Function
Green	ON	Constant supply voltage
	Off	No supply voltage



Aside from the LED, the controller also has a display and membrane keyboard, see 4.4 via which the controller is operated.

The most important settings and controller operations can be activated via the keys. The display serves display purposes. All functions are explained in the Operations chapter, see 5.3, see 5.4, see 5.5.

	Field in display	Display	Meaning	Model
	ON1	Illuminated	Q1 active QN active	AU, AI, 2Q, OC QN
	ON2	Inactive, no display Illuminated	Q2 active	AU, AI, OC, QN 2Q
	TRG	Illuminated	Trigger active	
		Illuminated	Lock = active	
	Small numeric display		Switching value / current menu item	
	Large numeric display		Measurement value / Measurement value selection	
		Off Flashing	Concluding the teach-in process Active teach-in process	
2 6			Buttons for navigating the menu items and changing values	
3		LED green Off	Supply voltage is active No supply voltage	
4			Button for selecting/confirming menu item/value. Deactivate the key lock by pressing for 2 seconds	
5			Button to undo the menu selection or go back one menu level; to abort or discard	

4.5 Electrical Connections Controller

4.5.1 General Pin Assignment



Fig. 7 4-pin M12 cable socket for voltage supply



Fig. 8 5-pin M12 cable socket for voltage supply for controller with trigger function

The frequently used and standardized M12 sockets allow use of standard commercial cables to match the specific, special requirements of the specific operating environment.

4.5.2 Supply Voltage

To connect the supply voltage:

- 12 ... 30 VDC; $I_{\max} < 50 \text{ mA}$
- 4-pin ¹ or 5-pin connector (with trigger function)

MICRO-EPSILON recommends use of the signal/power supply cable PC1000-5, which is included in the delivery.

CAUTION

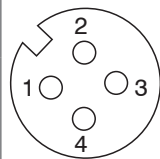
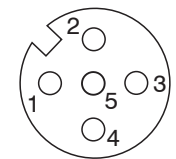
Perform all electrical connections only in the switched-off state.
> Risk of injury from high voltage.

-
- ▶ Install the shielded signal/power supply cable PC1000-5 on the controller, or PC1000-2 for the trigger function.
 - ▶ Activate the supply voltage.

The green LED is illuminated when the supply voltage is active.

4.5.3 Model CLS1000-AU

4.5.3.1 Pin Assignment

Pin	Signal/assignment	Description	Comments, circuitry	PC1000-x cable color		
1	V_+	Supply voltage	12 ... 30 VDC $I_{max} < 50 \text{ mA}$	Brown		
2	OUT2	Analog output	0 ... 10 VDC $R_a > 10 \text{ kOhm}$	White	<i>Fig. 9 4-pin cable socket, view of solder side</i>	<i>Fig. 10 5-pin cable socket, view of solder side ¹</i>
3	GND	Ground	Ground for supply, switching output Q and analog output and trigger (IN) ¹	Blue		
4	OUT1	Switching output Q1	V_+ max. 12 ... 30 VDC, $I_{max} = 100 \text{ mA}$, Signal level depends on supply voltage, switching behavior programmable: NPN, PNP, PP	Black		
5 ¹	TRG ¹	Trigger (IN) ¹	max. 30 VDC; input current $I_{max} = < 1 \text{ mA}$	Gray ¹		

1) Only for controller CLS1000-AU-xx-T with trigger function

Alternatively, for the model without trigger function, an angled signal/power supply cable PC1000/90-x with a connector angled at 90° (or open ends) is available, see A 1 (optional accessories).

4.5.3.2 Analog Output

The sensor supplies an output voltage of 0 ... 10 VDC.

Analog output properties		Sensor pin	PC1000-x cable color	Comments
Voltage output	0 ... 10 V	2	White	Analog output
	$R_a > 10 \text{ KOhm}$			
		3	Blue	Ground

Fig. 11 Analog output switching

4.5.3.3 Switching Output

The switching variants of the switching output (PP/PNP/NPN) as well as the switching thresholds can be changed and adjusted using the Operating menu.

The switching behavior (NPN, PNP, push-pull (PP)) of the switching output depends on the programming.

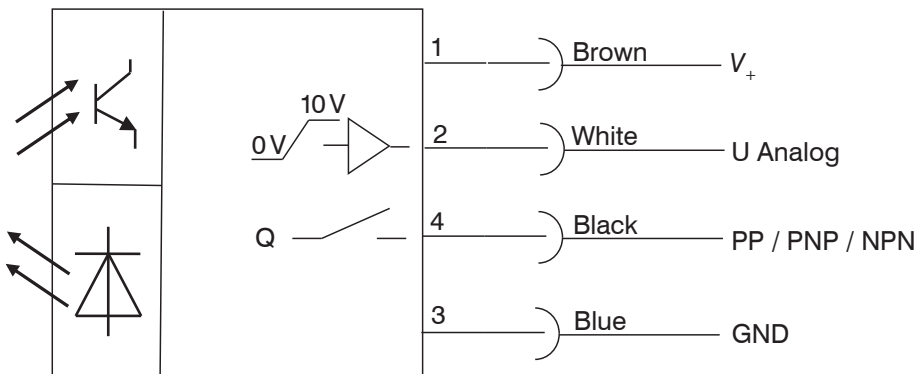


Fig. 12 Circuit for switching output CLS1000-AU

Switching output Q1 properties	Sensor pin	PC1000-x cable color	Comments
V_+ max. 12 ... 30 VDC, $I_{max} = 100 \text{ mA}$ Signal level depends on supply voltage Switching behavior programmable: NPN, PNP, PP	4	Black	Switching output Q1
	3	Blue	Ground

4.5.3.4 Trigger Input CLS1000-AU-xx-T

Only applies for controller CLS1000-AU-xx-T with trigger function.

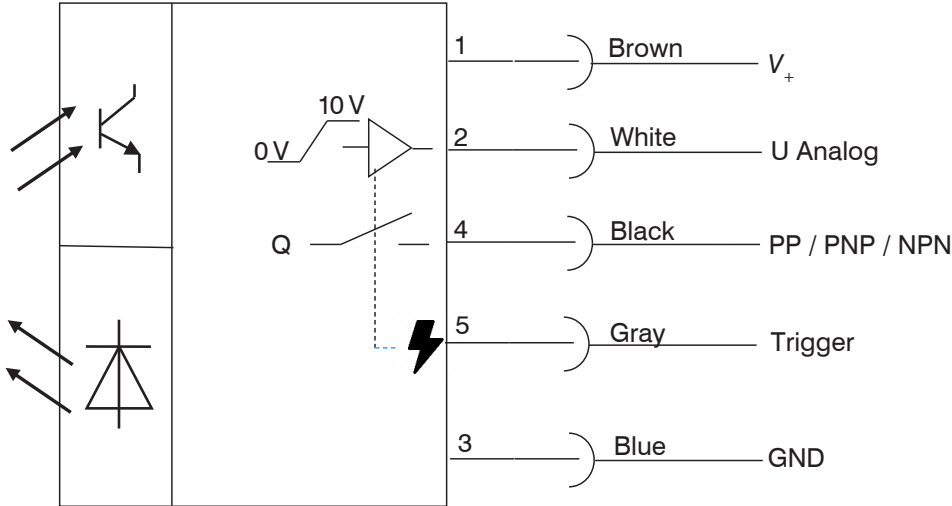


Fig. 13 Circuit for CLS1000-AU-xx-T

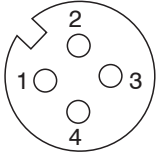
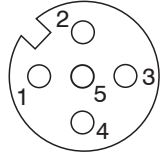
Trigger input properties	Sensor pin	PC1000-x cable color	Comments
	3	Blue	Ground
max. 30 VDC; input current $I_{max} = < 1 \text{ mA}$	5	Gray	Trigger (IN)

NOTICE

When wiring the trigger input with an NPN output, an external resistance $\geq 4.7 \text{ k}\Omega \leq 10 \text{ k}\Omega$ is necessary.

4.5.4 Model CLS1000-AI

4.5.4.1 Pin Assignment

Pin	Signal/assignment	Description	Comments, circuitry	PC1000-x cable color		
1	V ₊	Supply voltage	12 ... 30 VDC $I_{max} < 50 \text{ mA}$	Brown		
2	OUT2	Analog output	0 ... 20 mA / 4 ... 20 mA switchable $\leq R_L$ max 500 Ohm	White	<i>Fig. 14 4-pin cable socket, view of solder side</i>	<i>Fig. 15 5-pin cable socket, view of solder side ¹</i>
3	GND	Ground	Ground for supply, switching output Q and analog output and trigger (IN) ¹	Blue		
4	OUT1	Switching output Q1	V ₊ max. 12 ... 30 VDC, $I_{max} = 100 \text{ mA}$, Signal level depends on supply voltage, switching behavior programmable: NPN, PNP, PP	Black		
5 ¹	TRG ¹	Trigger (IN) ¹	max. 30 VDC; input current $I_{max} = < 1 \text{ mA}$	Gray ¹		

1) Only for controller CLS1000-AI-xx-T with trigger function

Alternatively, for the model without trigger function, an angled signal/power supply cable PC1000/90-5 with a connector angled at 90° (or open ends) is available with shielding.

4.5.4.2 Analog Output

The sensor supplies a current output of 0 ... 20 mA or 4 ... 20 mA.

Analog output properties		Sensor pin	PC1000-x cable color	Comments
Current output	0 ... 20 mA or 4 ... 20 mA;	2	White	Analog output
	switchable $\leq R_L$ max. 500 Ohm			
		3	Blue	Ground

Fig. 16 Analog output switching

4.5.4.3 Switching Output

The switching variants of the switching output (PP/PNP/NPN) as well as the switching thresholds can be changed and adjusted using the operating menu.

The switching behavior (NPN, PNP, push-pull (PP)) of the switching output depends on the programming.

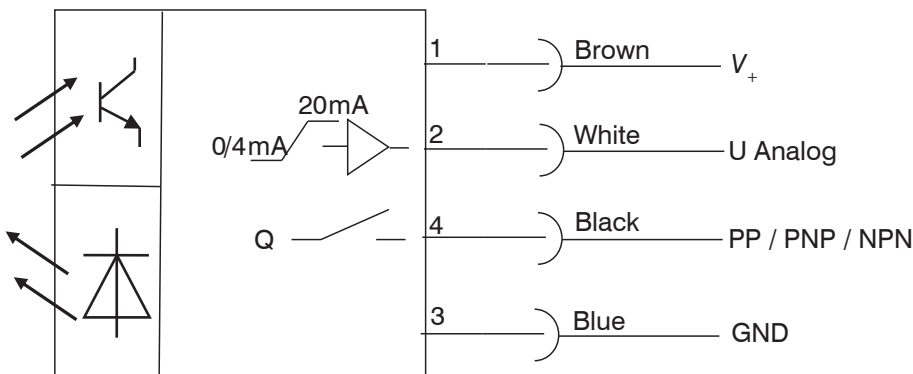


Fig. 17 Circuit for CLS1000-AI

Switching output Q1 properties	Sensor pin	PC1000-x cable color	Comments
V_+ max. 12 ... 30 VDC, $I_{max} = 100 \text{ mA}$ Signal level depends on supply voltage Switching behavior programmable: NPN, PNP, PP	4	Black	Switching output Q1
	3	Blue	Ground

4.5.4.4 Trigger Input CLS1000-AI-xx-T

Only applies for controller CLS1000-AI-xx-T with trigger function.

The trigger input enables recording of measurement values/output of measurement values with averaging, as well as various trigger types, see 5.4.6.

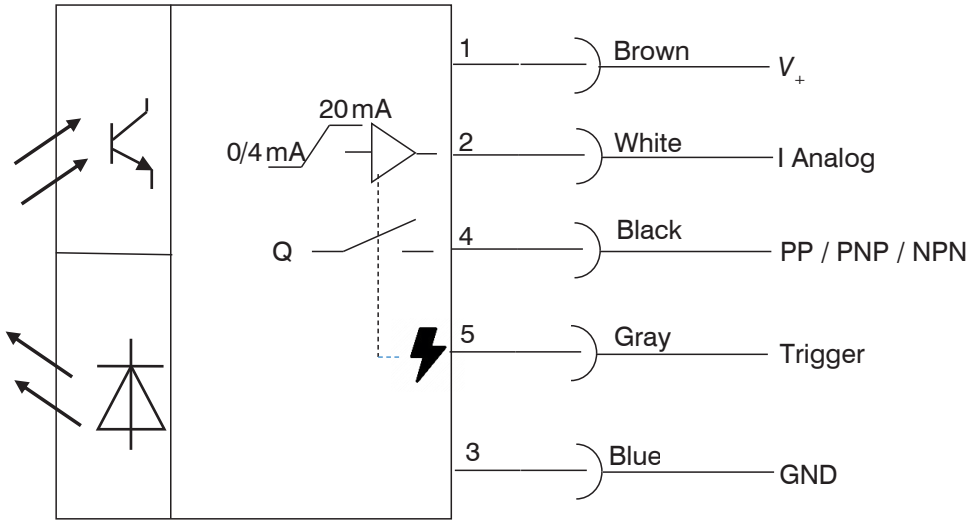


Fig. 18 Circuit for CLS1000-AI-xx-T

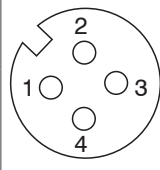
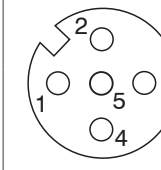
Trigger input properties	Sensor pin	PC1000-x cable color	Comments
	3	Blue	Ground
max. 30 VDC; input current $I_{max} = < 1 \text{ mA}$	5	Gray	Trigger (IN)

NOTICE

When wiring the trigger input with an NPN output, an external resistance $\geq 4.7 \text{ k}\Omega \leq 10 \text{ k}\Omega$ is necessary.

4.5.5 Model CLS1000-QN

4.5.5.1 Pin Assignment

Pin	Signal/assignment	Description	Comments, circuitry	PC1000-x cable color		
1	V_+	Supply voltage	12 ... 30 VDC $I_{max} < 50 \text{ mA}$	Brown		
2	OUT2	Switching output QN	V_+ max 12...30 V DC, $I_{max} = 100 \text{ mA}$, signal level depends on supply voltage. Switching behavior programmable ² : NPN, PNP, PP	White	<i>Fig. 19 4-pin cable socket, view of solder side</i>	<i>Fig. 20 5-pin cable socket, view of solder side¹</i>
3	GND	Ground	Ground for supply, switching output QN and switching output Q and trigger (IN) ¹	Blue		
4	OUT1	Switching output Q	V_+ max 12...30 V DC, $I_{max} = 100 \text{ mA}$, signal level depends on supply voltage. Switching behavior programmable ² : NPN, PNP, PP	Black		
5 ¹	TRG ¹	Trigger (IN) ¹	max. 30 VDC; input current $I_{max} = < 1 \text{ mA}$	Gray ¹		

1) Only for controller CLS1000-QN-xx-T with trigger function

2) The switching behavior is programmable and identical for switching output QN and switching output Q.

Alternatively, for the model without trigger function, an angled signal/power supply cable PC1000/90-5 with a connector angled at 90° (or open ends) is available with shielding, [see A 1](#).

4.5.5.2 Switching Outputs

The switching variants of the switching outputs (PP/PNP/NPN) as well as the switching threshold can be changed and adjusted using the operating menu.

NO (Q) + NC (QN) = antivalent

The controller supplies both signals. Both outputs are switched upon detection of an object.

This is often required for detection with wire breakage protection. The PLC always expects an active or passive signal; when this state is not the case, wire breakage or another error is the cause.

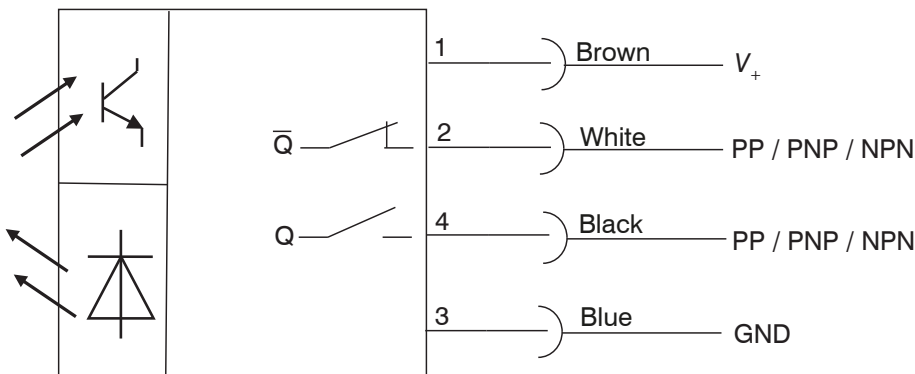


Fig. 21 Circuit for CLS1000-QN

Switching output QN properties	Sensor pin	PC1000-x cable color	Comments
V_+ max 12... 30 VDC, I_{max} = 100 mA, signal level depends on supply voltage. Switching behavior programmable ¹ : NPN, PNP, PP	2	White	Switching output QN
Properties of switching output Q			
V_+ max 12...30 V DC, I_{max} = 100 mA, signal level depends on supply voltage. Switching behavior programmable ¹ : NPN, PNP, PP	4	Black	Switching output Q
For switching outputs QN and Q	3	Blue	Ground

1) The switching behavior is programmable and identical for QN and Q

4.5.5.3 Trigger Input CLS1000-QN-xx-T

Only applies for controller CLS1000-QN-xx-T with trigger function. The trigger input enables recording of measurement values/output of measurement values with averaging, as well as various trigger types, see 5.4.6.

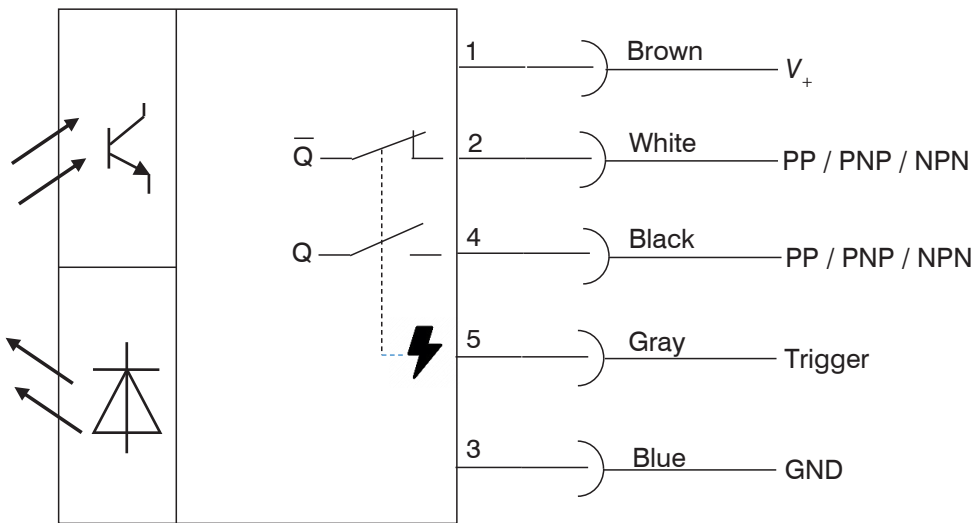


Fig. 22 Circuit for CLS1000-QN-xx-T

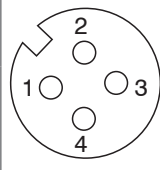
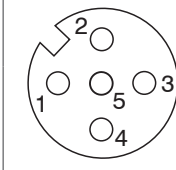
Trigger input properties	Sensor pin	PC1000-x cable color	Comments
	3	Blue	Ground
max. 30 VDC; input current I_{max} = < 1 mA	5	Gray	Trigger (IN)

NOTICE

When wiring the trigger input with an NPN output, an external resistance $\geq 4.7 \text{ k}\Omega \leq 10 \text{ k}\Omega$ is necessary.

4.5.6 Model CLS1000-2Q

4.5.6.1 Pin Assignment

Pin	Signal/assignment	Description	Comments, circuitry	PC1000-x cable color		
1	V_+	Supply voltage	12 ... 30 VDC $I_{max} < 50 \text{ mA}$	Brown		
2	OUT2	Switching output Q2	V_+ max 12...30 V DC, $I_{max} = 100 \text{ mA}$, signal level depends on supply voltage. Switching behavior programmable ² : NPN, PNP, PP	White	<i>Fig. 23 4-pin cable socket, view of solder side</i>	<i>Fig. 24 5-pin cable socket, view of solder side ¹</i>
3	GND	Ground	Ground for supply, switching output Q1 and switching output Q2 and trigger (IN) ¹	Blue		
4	OUT1	Switching output Q1	V_+ max 12...30 V DC, $I_{max} = 100 \text{ mA}$, signal level depends on supply voltage. Switching behavior programmable ² : NPN, PNP, PP	Black		
5 ¹	TRG ¹	Trigger (IN) ¹	max. 30 VDC; input current $I_{max} = < 1 \text{ mA}$	Gray ¹		

- 1) Only for controller CLS1000-2QN-xx-T with trigger function
- 2) The switching behavior is individually programmable.

Alternatively, for the model without trigger function, an angled signal/power supply cable PC1000/90-5 with a connector angled at 90° (or open ends) is available with shielding, [see A 1](#).

4.5.6.2 Switching Outputs

The switching variants of the two switching outputs (PP/PNP/NPN) as well as the switching thresholds can be changed and adjusted individually for Q1 and Q2, respectively, using the operating menu.

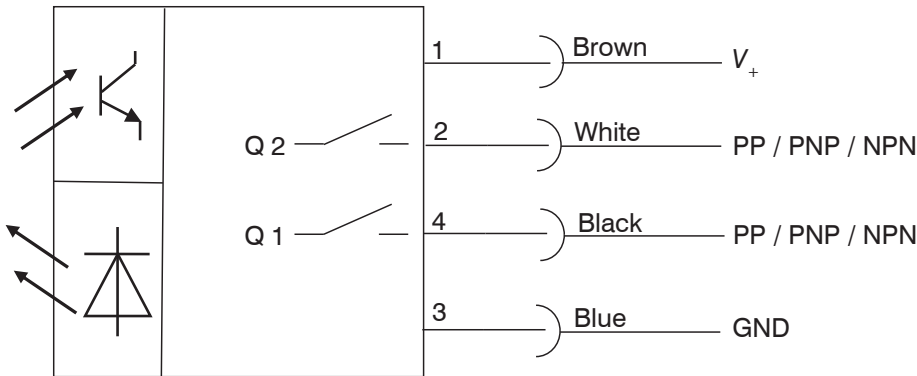


Fig. 25 Circuit for Model CLS1000-2Q

Switching output Q1 properties	Sensor pin	PC1000-x cable color	Comments
V_+ max 12...30 V DC, I_{max} = 100 mA, signal level depends on supply voltage. Switching behavior programmable ¹ : NPN, PNP, PP	2	White	Switching output Q2
Properties of switching output Q2			
V_+ max 12...30 V DC, I_{max} = 100 mA, signal level depends on supply voltage. Switching behavior programmable ¹ : NPN, PNP, PP	4	Black	Switching output Q1
For switching outputs Q1 and Q2	3	Blue	Ground

1) The switching behavior is individually programmable and identical for Q1 and Q2.

4.5.6.3 Trigger Input CLS1000-2Q-xx-T

Only applies for controller CLS1000-2Q-xx-T with trigger function. The trigger input enables recording of measurement values/output of measurement values with averaging, as well as various trigger types, see 5.4.6.

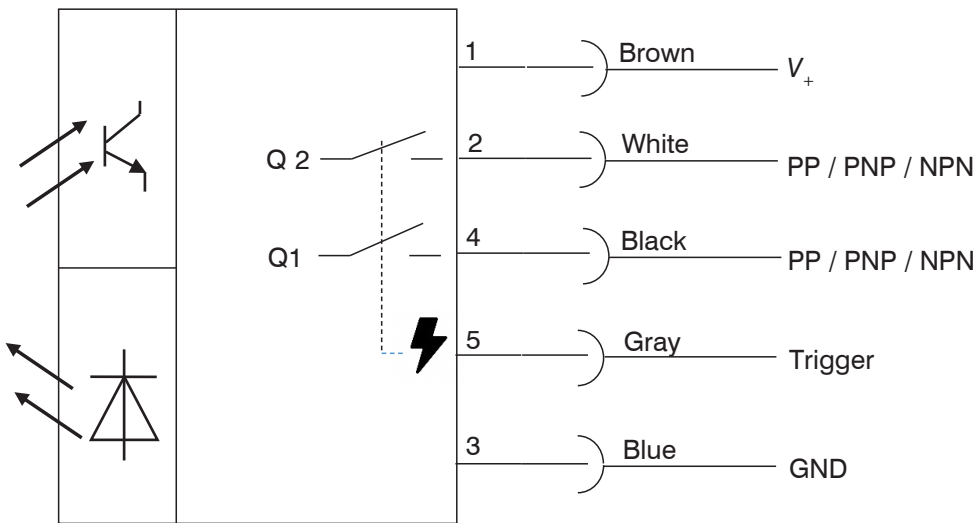


Fig. 26 Circuit for CLS1000-2Q-xx-T

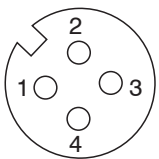
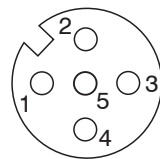
Trigger input properties	Sensor pin	PC1000-x cable color	Comments
	3	Blue	Ground
max. 30 VDC; input current I_{max} = < 1 mA	5	Gray	Trigger (IN)

NOTICE

When wiring the trigger input with an NPN output, an external resistance $\geq 4.7 \text{ k}\Omega \leq 10 \text{ k}\Omega$ is necessary.

4.5.7 Model CLS1000-OC

4.5.7.1 Pin Assignment

Pin	Signal/assignment	Description	Comments, circuitry	PC1000-x cable color		
1	V ₊	Supply voltage	12 ... 30 VDC $I_{max} < 50 \text{ mA}$	Brown	<i>Fig. 27 4-pin cable socket, view of solder side</i>	<i>Fig. 28 5-pin cable socket, view of solder side ¹</i>
2	OUT2	Switching output Q1 optocoupler OC	max 30 VDC; $I_{max} = 50 \text{ mA}$, OC-openCollector	White		
3	GND	Ground	Ground for supply and trigger (IN) ¹	Blue		
4	OUT1	Switching output Q1 optocoupler OE	max 30 VDC; $I_{max} = 50 \text{ mA}$, OE-openEmitter	Black		
5 ¹	TRG ¹	Trigger (IN) ¹	max. 30 VDC; input current $I_{max} = < 1 \text{ mA}$	Gray ¹		

1) Only for controller CLS1000-OC-xx-T with trigger function

Alternatively, for the model without trigger function, an angled signal/power supply cable PC1000/90-5 with a connector angled at 90° (or open ends) is available with shielding, see A 1.

4.5.7.2 Switching Outputs

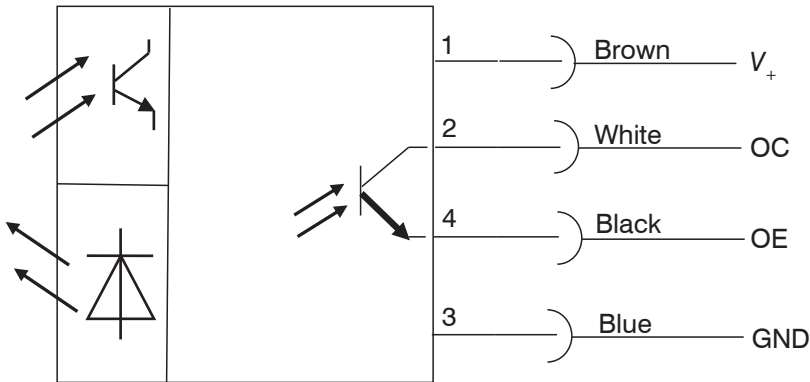


Fig. 29 Circuit for CLS1000-OC

Switching output Q1/ optocoupler OC properties	Sensor pin	PC1000-x cable color	Comments
max. 30 VDC; $I_{max} = 50 \text{ mA}$ OC-openCollector Maximum switching frequency: 2.5 kHz	2	White	Switching output Q1 optocoupler OC
Switching output Q1 optocoupler OE properties			
max. 30 VDC; $I_{max} = 50 \text{ mA}$ OE-openEmitter Maximum switching frequency: 2.5 kHz	4	Black	Switching output Q2 optocoupler OE

4.5.7.3 Trigger Input CLS1000-OC-xx-T

Only applies for controller CLS1000-OC-xx-T with trigger function. The trigger input enables recording of measurement values/output of measurement values with averaging, as well as various trigger types, see 5.4.6.

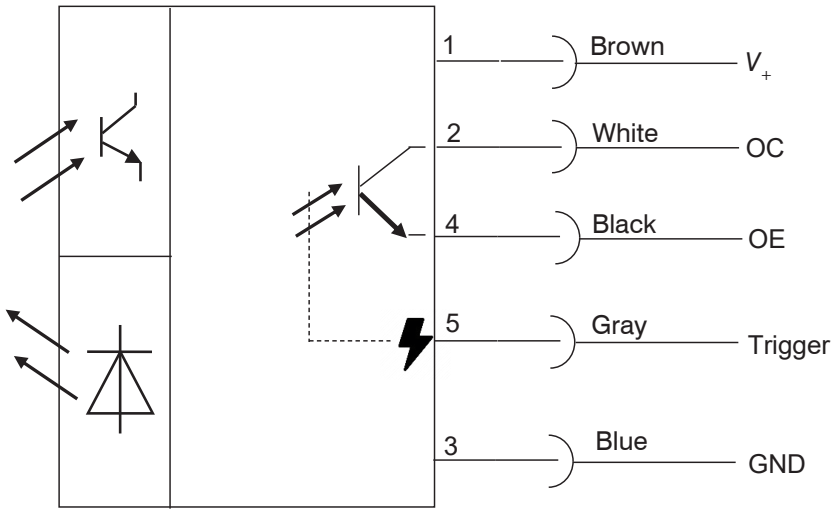


Fig. 30 Circuit for CLS1000-OC-xx-T

Trigger input properties	Sensor pin	PC1000-x cable color	Comments
	3	Blue	Ground
max. 30 VDC; input current $I_{\max} = < 1 \text{ mA}$	5	Gray	Trigger (IN)

NOTICE

When wiring the trigger input with an NPN output, an external resistance $\geq 4.7 \text{ k}\Omega \leq 10 \text{ k}\Omega$ is necessary.

5. Operation

5.1 Initial Operation

- ▶ Install the optoCONTROL CLS1000 controller as per the installation instructions, see 4.1.
- ▶ Connect the controller to the downstream display or monitoring units and to the power supply.

NOTICE

The sensor may only be connected to peripherals when it does not carry power, that is, only when the supply voltage has been switched off.

The green LED is illuminated after the supply voltage is activated.

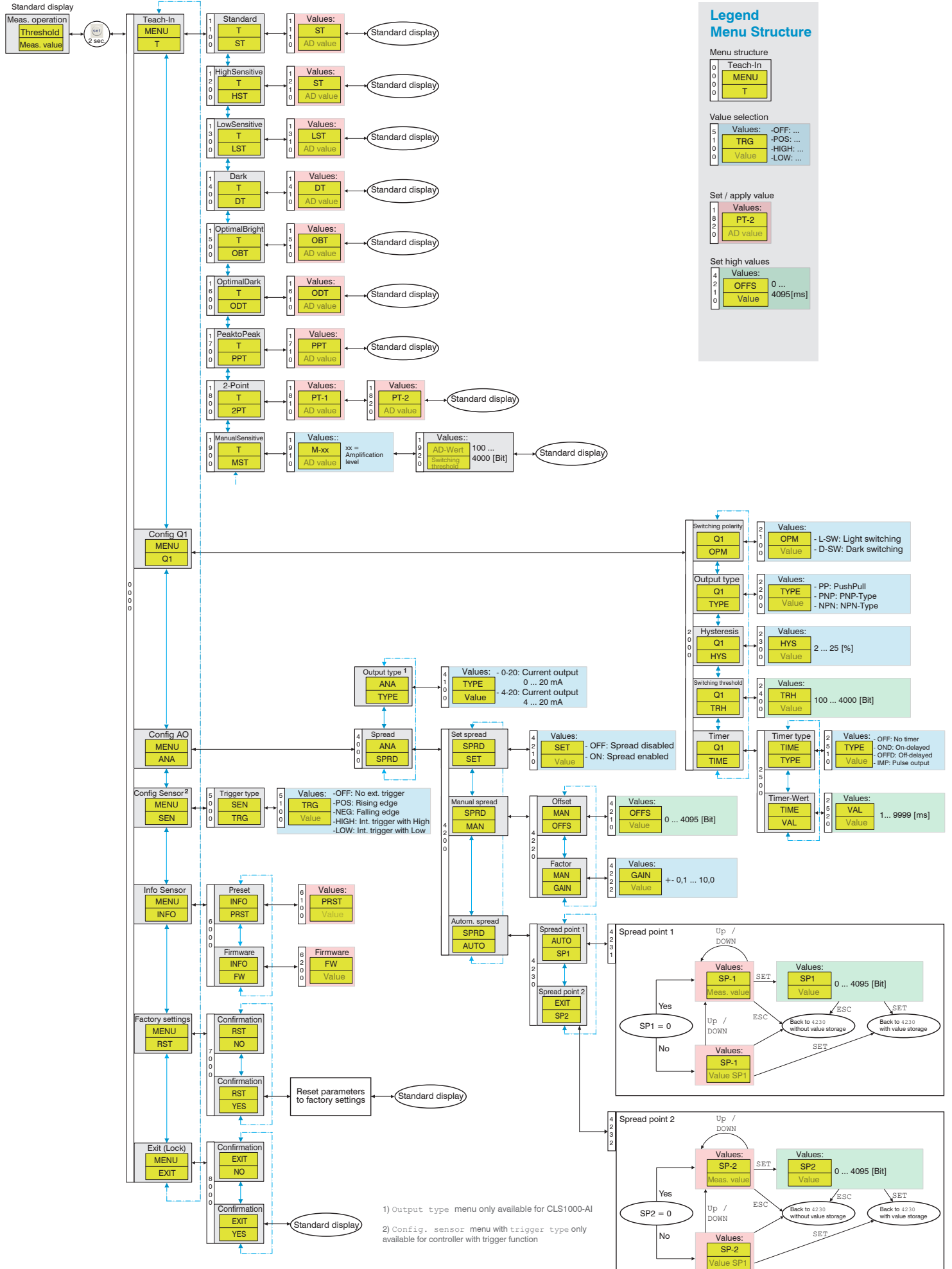
5.2 Membrane Keys

Aside from the LED, the controller also has a display and membrane keyboard, see 4.4 via which the controller is operated.

The most important settings and controller operations can be activated via the keys and then displayed.

	1	Field in display	Display	Meaning	Model
		ON1	Illuminated	Q1 active QN active	AU, AI, 2Q, OC QN
		ON2	Inactive, no display Illuminated	Q2 active	AU, AI, OC, QN 2Q
		TRG	Illuminated	Trigger active	
			Illuminated	Lock = active	
		Small numeric display		Switching value / current menu item	
		Large numeric display		Measurement value / measurement value selection	
			Off	Concluding the teach-in process	
			Flashing	Active teach-in process	
		2			Buttons for navigating the menu items and changing values
6					
3		LED green	Constant supply voltage		
		Off	No supply voltage		
4			Button for selecting/confirming menu item/ value. Deactivate the key lock by pressing for 2 seconds		
5			Button to undo the menu selection or go back one menu level; to abort or discard		

5.3 Overview of Operating Menu



5.4 Operating Menu

The individual menu items differ depending on the model of optoCONTROL CLS1000 controller.

5.4.1 Legend of the Menu Structure

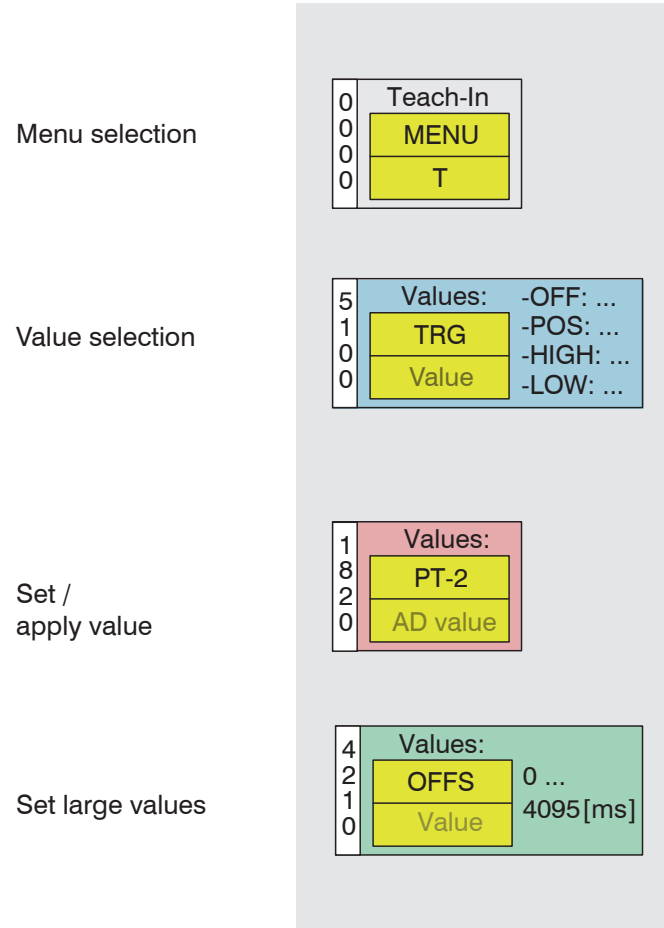


Fig. 31 Legend of the menu structure

5.4.2 Start

Starting in the menu structure is identical in all models of the optoCONTROL CLS1000. The most important settings and controller operations can be activated via the keys. The display serves display purposes, see 4.4.

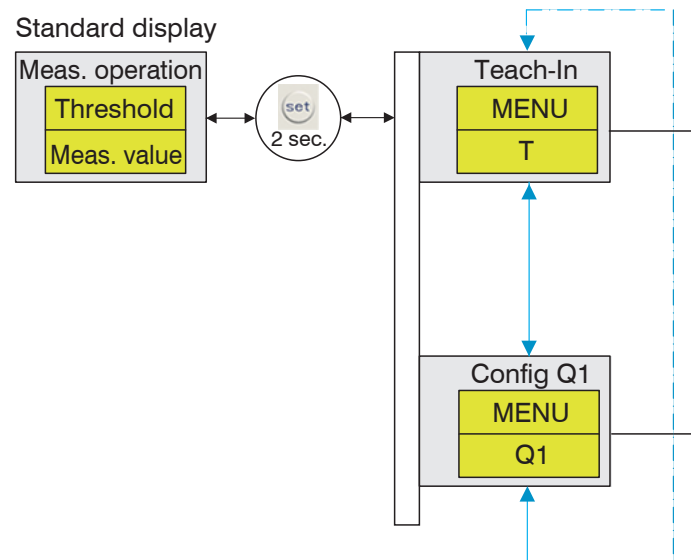


Fig. 32 Starting in the menu structure

5.4.3 T / Teach-in

The Teach-in menu is available in all models of the optoCONTROL CLS1000.

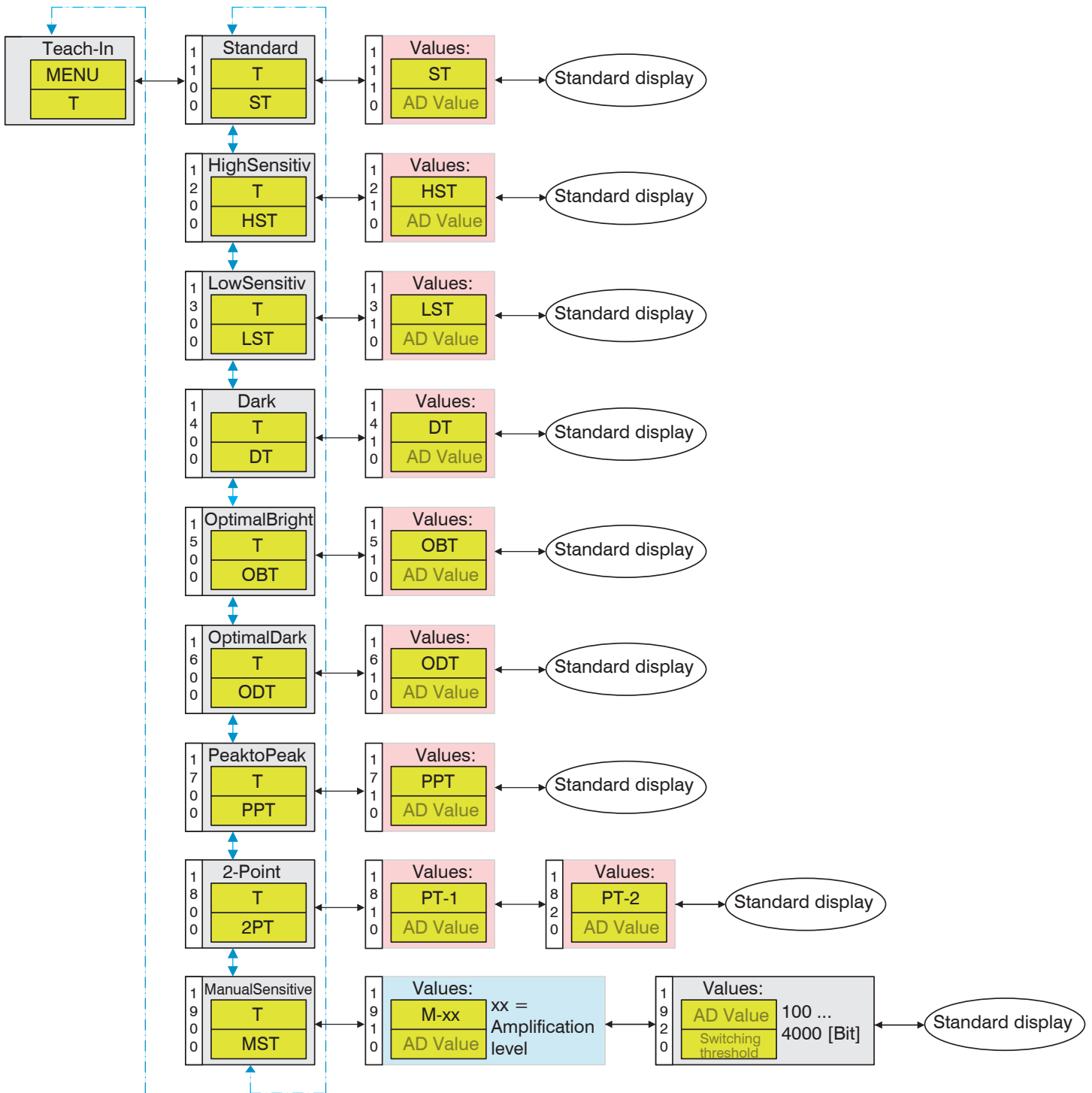


Fig. 33 T / Teach-in menu

The controller itself selects the appropriate amplifier level for the given application. Depending on the controller model, there are up to 9 Teach-in modes for various requirements (or measurement and testing tasks):

- Detecting a threshold value
- Automatic setting of the amplification and switching threshold
- Details of the Teach-in modes:
 - EMR: End of measuring range (\cong 4095 bits of the AD value at the set amplifier level)
 - MV: Measurement value (AD value that results from the desired goal [e.g. XX % of EMR])
- Various Teach-in modes:

ST	Standard Teach-in, see 5.4.3.1
HST	HighSensitive Teach-in, see 5.4.3.2
LST	LowSensitive Teach-in, see 5.4.3.3
DT	Dark Teach-in, see 5.4.3.4
OBT	OptimalBright Teach-in (CLS1000-AU/-AI), see 5.4.3.5
ODT	OptimalDark Teach-in (CLS1000-AU/-AI), see 5.4.3.6
PPT	PeakToPeak Teach-in, see 5.4.3.7
2PT	2Point Teach-in, see 5.4.3.8
MST	ManualSensitive Teach-in, see 5.4.3.9

5.4.3.1 ST/ Standard Teach-in

In Standard Teach-in mode (ST), teach-in is based on the desired target. In this context, the controller searches to identify the amplifier level at which approx. 50 % of the end of measuring range (end of measuring range = 4095) is achieved, and then sets the threshold value 20 % below the measurement value at the previously determined amplifier level.

- 1 Measurement value at identified amplifier level = approx. 2200
- 2 Switching threshold (20 % below the measurement value) = approx. 1800

If the target leaves the measuring range and is replaced by another part or gap, the switching threshold is no longer exceeded and no signal is output. This is represented by the ON symbol in the upper corner of the display.

- 1 ON symbol
- 2 Measurement value below switching threshold

- Reflex mode: A target is detected against a background. The target must be within the visual range of the sensor during teach-in
- Transmission mode: The target must be outside the visual range of the sensor during teach-in

After teach-in, the measurement value should become smaller if the distance is increased.

5.4.3.2 HST / HighSensitive Teach-in

In HighSensitive teach-in mode (HST), the smallest differences in reflectivity are detected. For example, if a black object is located against a black background, the controller/sensor can only detect this object if its reflectivity differs from the background.

This teach-in process therefore involves teach-in on a free or very dark (hardly reflective) background. The sensor/controller detects even the smallest reflections in this manner.

For detection, the sensor/controller increases the measurement value to 50 % of EMR (end of measuring range = 4095). The switching threshold is then set 20 % above the measurement value:

- Measurement value 50 % of EMR ($4095 * 0.5$) = approx. 2000
- Switching threshold (20 % above the measurement value) = approx. 2500

- In Reflex mode, teach-in is done on a free or very dark background (without a target)
- In Transmission mode, teach-in is done on the target to be detected.

5.4.3.3 LST / LowSensitive Teach-in

The LowSensitive teach-in mode (LST) can be used when small objects are to be detected against a rough background. This teach-in mode prevents a result in which no differences can be detected between the background and the object due to the amplification level being too high. In this regard, the sensor/controller measures a comparatively low intensity, i.e. the amplifier level is moderately increased - low amplifier level is used so that smaller reflection differences do not trigger a signal.

The amplification is increased until the measurement value is at approx. 30 % of EMR (end of measuring range = 4095). The switching threshold is then set 10 % lower:

Measurement value 30 % of EMR (4095)	= approx. 1300
Switching threshold (10 % below the measurement value)	= approx. 1200

In Reflex mode, teach-in is done on the target. The target must be within the visual range of the sensor during teach-in

In Transmission mode, teach-in is done on a clear path. The target must be outside the visual range of the sensor for the transmission path.

5.4.3.4 DT / Dark Teach-in / Background Teach-in

In Dark teach-in mode (DT), objects of different sizes are to be detected against a dark or free background.

To do so, the amplifier level is increased until the measurement value is at approx. 10 % of EMR (end of measuring range = 4095). The associated switching threshold is then set at 20 % above the measurement value:

Measurement value 10 % of EMR (4095)	= approx. 400
Switching threshold 20 % above the measurement value	= approx. 490

- In Reflex mode, teach-in is done without a background or against a dark background. This increases the reflection due to intruding objects, the measurement value increases.
Example: Drops against a black background
- In Transmission mode, an interrupted path is used for teach-in so that even the tiniest parts are detected.
Advantage: Transmitter and receiver can be spaced farther apart.
Example: Detection of hairs (lower transmission power so the hair is not radiated on all sides)
- Detection mode dark teach-in; the measurement value should increase as the distance decreases.

5.4.3.5 OBT / OptimalBright Teach-in

The OptimalBright teach-in mode (OBT) is used to set the maximum possible amplifier level and simultaneously to scale the analog value to it, for example, an object that enters the light beam (edge detection). This teach-in mode is only available in sensors with analog output (CLS1000-AU/-AI).

- Transmission mode: Optimal setting for free light path.
- In Reflex mode, teach-in can be done on a target.

The analog output is thus also automatically scaled 0 ... 10 V or 0/4 ... 20 mA.

Measurement value 95 -100 % of EMR (4095)	= approx. 4095
Switching threshold 20 % under the measurement value	= approx. 3300

5.4.3.6 ODT / OptimalDark Teach-in

The OptimalDark teach-in mode (ODT) is used to set the minimum possible amplifier level and simultaneously to scale the analog value to it. This allows for precise detection of very small movements of edges. This teach-in mode is only available in sensors with analog output (CLS1000-AU/-AI).

- Transmitted light mode: Optimal setting for closed free light path
- Reflex mode: Use of ODT in Reflex mode is not recommended

The analog output is thus also automatically scaled 0 ... 10 V or 0/4 ... 20 mA.

Measurement value 0 ... 0.5% of EMR (4095)	= approx. 0
Switching threshold 20 % above the measurement value (4095)	= approx. 800

5.4.3.7 PPT / PeakToPeak Teach-in

In PeakToPeak teach-in mode (PPT), the optoCONTROL CLS1000 controller is placed in a recording mode that enables automatic teach-in. After the recording mode ends, a switching point is calculated between the minimum and maximum measurement values. The mode can be used for running (cyclical) processes, such as detection of saw tooth sheets, turbine blades and gaps.

During this process, measurement values are recorded in a certain period of time specified or required by the user (recommended: at least one cycle).

- ▶ Activate the SET key to activate PPT teach-in mode, which enables automatic teach-in.
- ▶ Allow the recording to run during the desired timeframe.
- ▶ End the measurement by pressing the SET key again.

The 3 bars flash during the recording.

The sensor/controller automatically detects the positive (high) and negative (low) peak values. The sensor/controller uses this to increase the amplification until approx. 80 % of EMR (end of measuring range = 4095) is reached.

In this measuring range, the high and low values continue to be recorded and the peak values are stored in a data field (array) and averaged after the measurement has ended. The switching value is then set approx. in the middle of the high and low values.

5.4.3.8 2PT / 2Point Teach-in

In 2Point teach-in mode (2PT), the controller is taught-in on two different targets or surfaces so that they can be differentiated.

For this purpose, first the target with the higher reflection (e.g. white paper) is measured as a point . This value is set at 80 % of the end of measuring range (end of measuring range = 4095).



The object with the lower reflection (e.g. background of the postal envelope) is then measured as PT-2, also in the same amplification range (80 %) as the target measured first.

- Ensure that Target A (PT-1) supplies higher reflection than Target B (PT-2).

The sensor calculates the switching point between the measurement values detected and stored in this manner such that the switching point lies between the two teach-in points (PT-1 and PT-2).

5.4.3.9 MST / ManualSensitive Teach-in

In ManualSensitive teach-in mode (MST), you (on the customer side) can manually determine and set the amplifier level (sensitivity) at your own discretion. You can then also manually adjust the associated switching threshold by successively determining the 4-digit bit value position by position, using the arrow keys.

The amplification level can be set using the   keys.

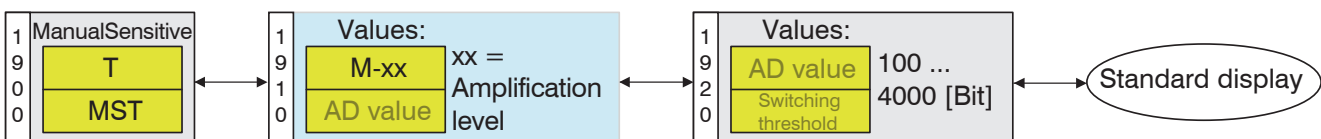


Fig. 34 ManualSensitive teach-in mode

To change the switching threshold, set the switching threshold back to the last setting using the membrane keyboard, see 5.2.

5.4.4 Q1 / Config Q1

The Q1 menu for the switching output Q1 is available in all models of the optoCONTROL CLS1000.

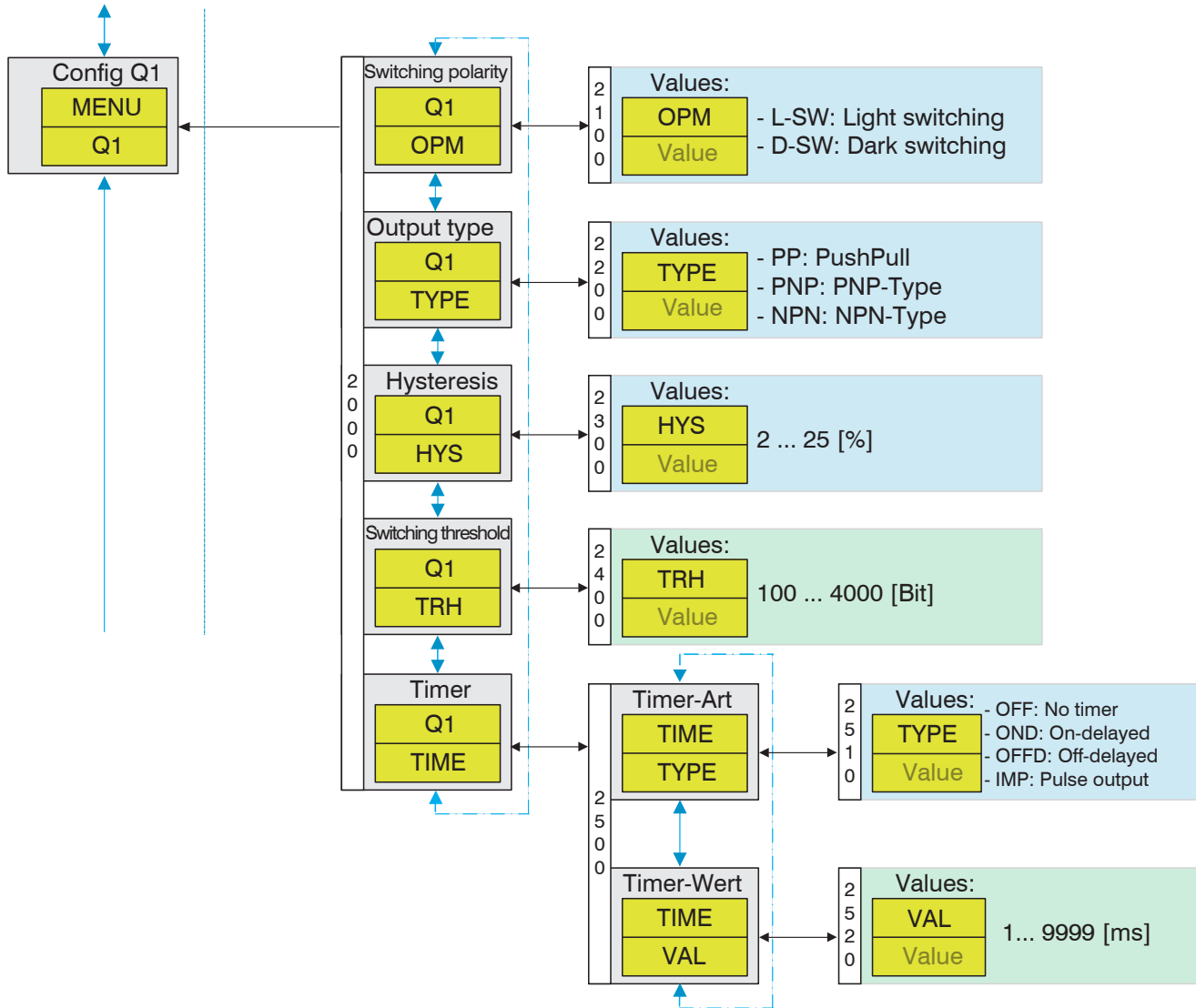


Fig. 35 Q1 / Config Q1 menu

5.4.4.1 OPM / Switching Polarity

In OPM mode, the setting can be Light switching or Dark switching, see 5.5,.

5.4.4.2 TIME / Timer

In TIME mode, the TYPE (timer type) can be set:

- OFF: No timer
- OND: On-delayed
- OFFD: Off-delayed
- IMP: Pulse output

In VAL mode (timer value), the value for the respectively set time switching can be set, on-delay, off-delay or pulse output between 1 9999 ms.

5.4.4.3 Q2 / Config Q2

The Q2 menu is available in the optoCONTROL CLS1000-2Q model.

The menu structure is identical to the menu structure of Q1 / Config Q1, see Fig. 35.

5.4.5 ANA / Config AO

The ANA menu is only available in the optoCONTROL CLS1000-AU and -AI models.

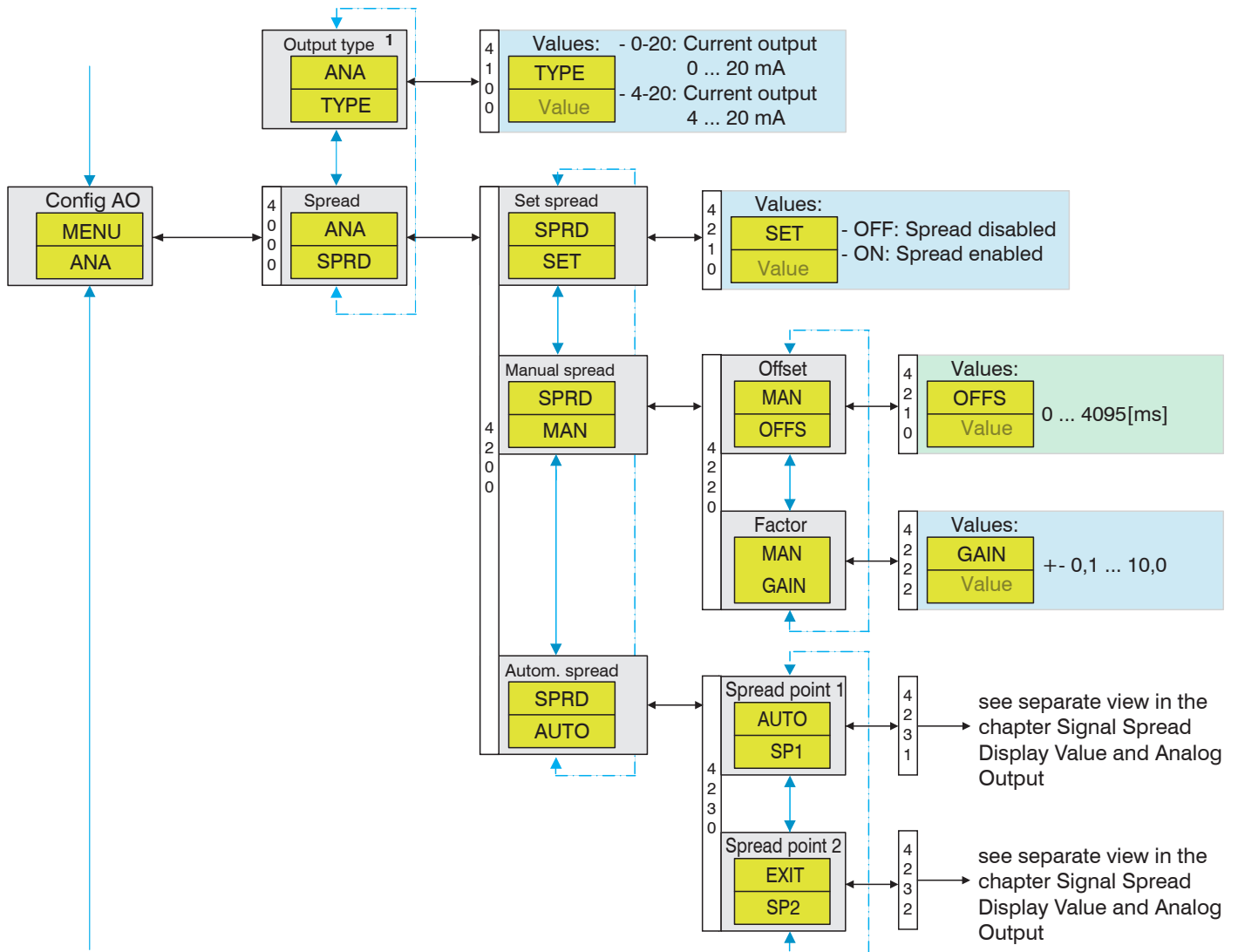


Fig. 36 ANA / Config AO menu

The output values depend on the teach-in and value range signal spread, see 5.4.5.1, for analog output.

5.4.5.1 Signal Spread Display Value and Analog Output

It is possible to scale an important signal range to the entire analog range.

The measurement value spread/signal spread spreads a partial measurement value region to the entire display range (0 ... 4096) or the entire analog value output range (0 ... 10 V, 0 ... 20 mA, 4 ... 20 mA).

There is a difference between manual and automatic spreading.

Requirements

Before the spread settings, the basic setting of the controller must be set using a teach-in mode, [see 5.4.3](#).

Manual Spread

- Create your testing/measurement situation and note the displayed measurement values.
- Determine the desired offset and factor value.
- Navigate to the menu ANA (Config AO) > SPRD (Spread) > MAN (Manual spread) and confirm by pressing the set key.

You are now in the menu item OFFS (Offset) and the current offset value is displayed.

- Set the previously determined offset value using the keys and confirm with set.
- Use the keys to navigate to the menu item GAIN (Factor).

The current value is displayed.

- Set the previously determined offset value using the keys and confirm with set.

This ends the MAN (Manual spread) setting.

- Press the esc key multiple times to return to the standard view.

Automatic Spread

i In automatic spread, the set spread points are spread over the entire display range or analog output range (0 ... 10 V).

A gain value < 1 cannot be realized with automatic spread.

- Navigate to the menu ANA (Config AO) > SPRD (Spread) > AUTO (Manual spread) and confirm by pressing the set key.

You are now in the menu item SP1. If a spread point SP1 is present, it is displayed. Pressing the

keys can switch to the current measurement value display.

If no SP1 is available yet, the current measurement value is displayed and simultaneously the 3 bars at the top flash to indicate that the displayed value is the current measurement value.

Procedure for Spread point 1:

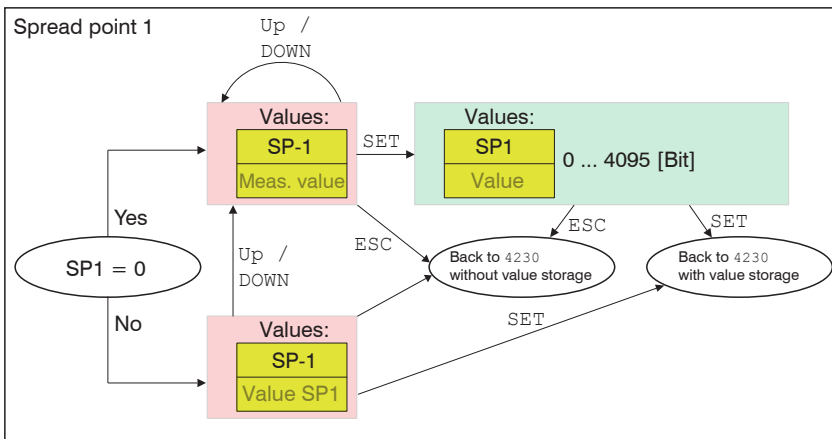


Fig. 37 ANA / Config AO / SPRD - Spread point 1 menu

- Create your testing/measurement situation and note the displayed measurement values.
- Apply the current measurement value as SP1 by pressing the `set` key.

The values from SP1 must be confirmed but can still be adjusted.

- Set the thousands position with . Confirm with the `set` key.
- Set the hundreds position with . Confirm with the `set` key.
- Set the tens position with . Confirm with the `set` key.
- Set the ones position with . Confirm with the `set` key.

The set value is applied as SP1, the factor is determined. An offset is not necessary at this point in time because the value 0 is applied for SP2 (Spread point 2).

If you only need one spread point (teach point), the automatic spread is finished.

- Press the `esc` key multiple times to return to the standard view.
- If you require 2 spread points (teach points), press the keys to navigate to the menu item SP2 (Spread point 2).

If a spread point SP2 is present, it is displayed. You can switch to the current measurement value display by pressing the keys.

If no SP2 is available yet, the current measurement value is displayed and simultaneously the 3 bars at the top flash to indicate that the displayed value is the current measurement value.

Procedure for Spread point 2:

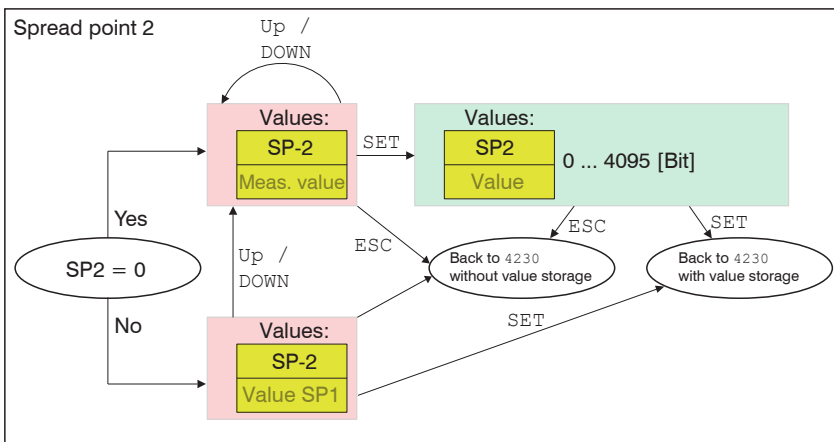


Fig. 38 ANA / Config AO / SPRD - Spread point 2 menu

- Create your testing/measurement situation and note the displayed measurement values.
- Apply the current measurement value as SP2 by pressing the `set` key.

The values from SP2 must be confirmed but can still be adjusted.

- Set the thousands position with . Confirm with the `set` key.
- Set the hundreds position with . Confirm with the `set` key.
- Set the tens position with . Confirm with the `set` key.
- Set the ones position with . Confirm with the `set` key.

The set value is applied as SP2, the factor is determined.

If you need 2 spread points, the automatic spread is finished.

- Press the `esc` key multiple times to return to the standard view.

- If the $SP1$ value $>$ $SP2$ value, a non-inverted curve results.
 (Offset = $SP2$ value-1;
 factor = $EMR / [SP1$ Spread point 1 value - $SP2$ Spread point 2 value];
 Spread value = If $MV < SP2$; then 0; otherwise, if $MV > SP1$; then EMR ; otherwise, $(MV + Offset) * factor$)

If Spread point 1 ($SP1$) value $<$ Spread point 2 ($SP2$) value, a non-inverted curve results.
 (Offset = $EMR - Spread$ point 2 value;
 Factor = $EMR / [Spread$ point 2 value - Spread point 1 value];
 Spread value = If $MV \leq SP1$; then EMR ; otherwise, if $MV > SP2$; then 0; otherwise, $(MV + Offset-EMR) * factor$)

MV = measurement value EMR = end of measuring range

5.4.6 SEN / Config Sensor

- The SEN menu is only available in optoCONTROL CLS1000 models with trigger function.

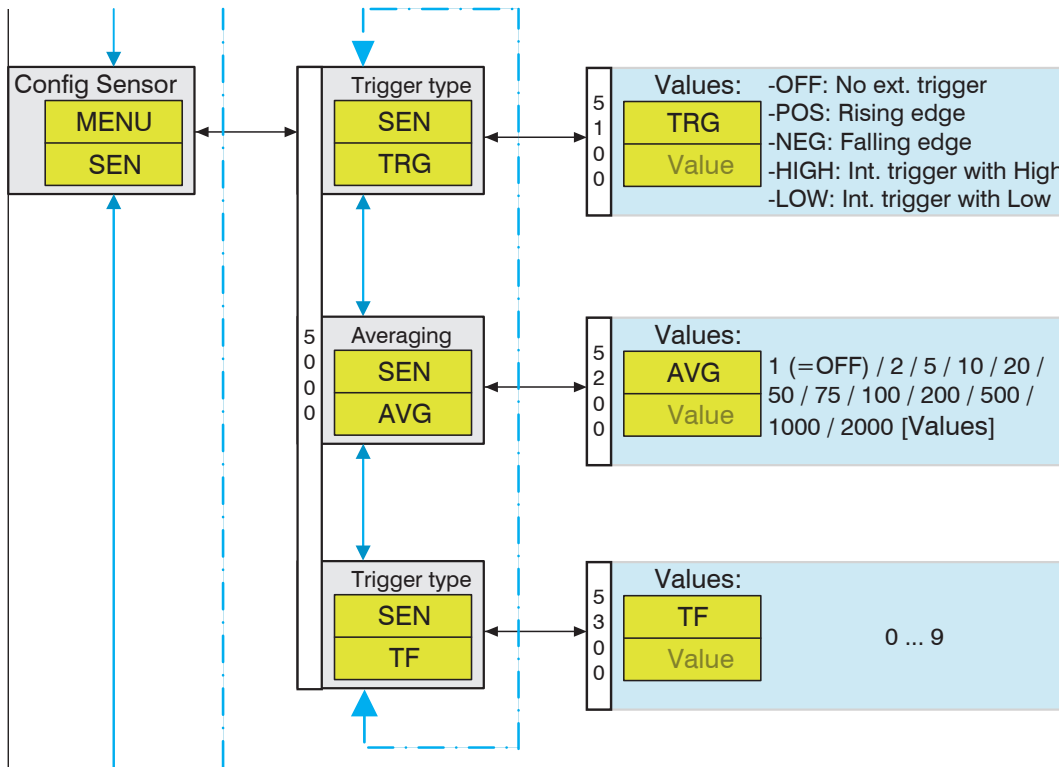


Fig. 39 SEN / Config Sensor menu

5.4.7 INFO / Info Sensor

The INFO menu is available in all models of the optoCONTROL CLS1000.

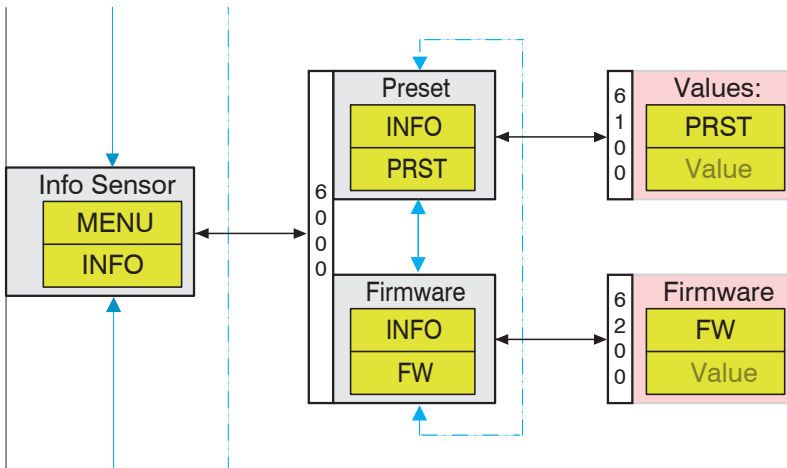


Fig. 40 INFO / Info Sensor menu

5.4.8 RST / Factory settings

The RST menu is available in all models of the optoCONTROL CLS1000.

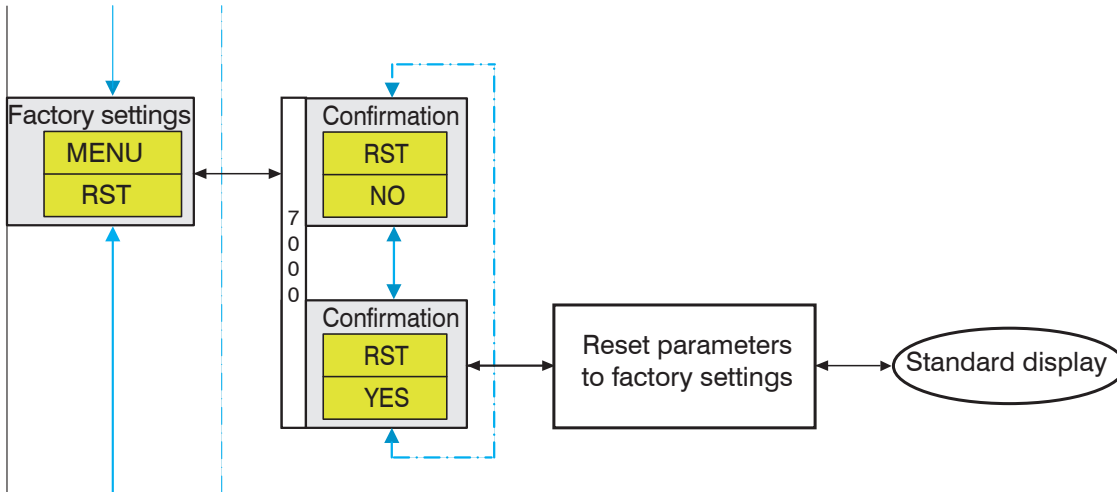


Fig. 41 RST / Factory settings menu

5.4.9 EXIT / Exit (Lock)

The EXIT menu is available in all models of the optoCONTROL CLS1000.

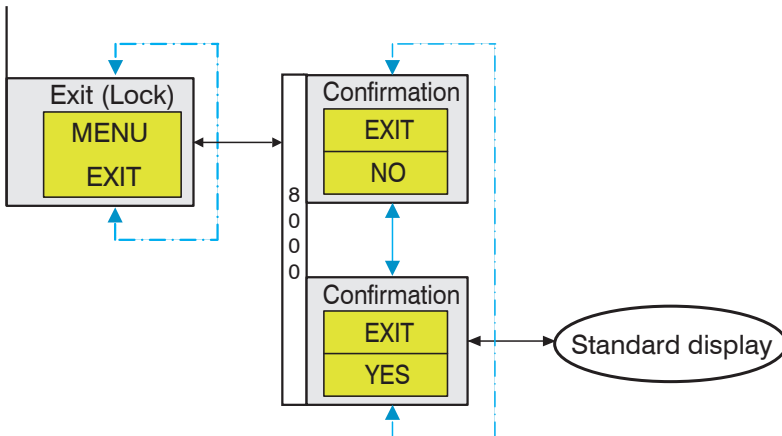



Fig. 42 EXIT / Exit (Lock) menu

If you activate the key lock, it is no longer possible to operate the manual teach-in menu. If not operated, the automatic key lock activates after one minute.

▶ Press the  key for 2 seconds to unlock.

The Standard teach-in is displayed again.

5.5 Functions

Function	Description	Menu
Dark switching	The <code>dark switching</code> function means that the given output is activated (carries current) when no light hits the receiver; this corresponds to the opener function (N.C.). The switching output of a photoelectric device is activated (e.g. output relay is operated) when no light hits the light receiver. If the light receiver is not illuminated in dark switching, the switching output is activated and the output relay is operated. The relay drops when the light receiver is illuminated. Parameterization/operation via membrane keyboard and Operating menu, see 5.4.4 ; indicated via display on controller.	Q1 > OPM
Intensity display	Intensity display via display; parameterization and operation via membrane keyboard and Operating menu, see 5.3 ; indicated via display on controller. The light received at the receiver diode is output on the display as an intensity value depending on the amplifier level and is also output at the analog output, depending on the version.	
Inverting the analog output	The analog signal can be inverted. Reverse scaling Parameterization/operation via membrane keyboard and Operating menu, see 5.3 ; indicated via display on controller.	INA
Ambient light/pulsed light	Ambient light can disrupt the effectiveness of an optical system. The receiver cannot differentiate whether the light it is receiving originates from the associated transmitter or from another source (e.g. the sun). To minimize this influence, the light emitted by the transmitter is pulsed at a certain frequency. The receiver only takes into account the portion of received light that has the same frequency. The effect of all other light (ambient light) is suppressed. The respectively applicable permissible ambient light can be found in the Technical Data, see 2.3 . • This function cannot be switched off. l	-
Light switching	The <code>light switching</code> function means that the given output is activated (carries current) when light hits the receiver; this corresponds to the closer function (N.O.). If a photoelectric device is set to the <code>light switching</code> function, the switching output is activated (e.g. a relay is operated) when light hits the receiver. In one-way and reflection light barriers, this is the case when the light path is free, and for light scanners, when something to be sensed is present. If the light receiver is illuminated in light switching, this means the controller is active and the output relay is operated. The relay drops when the light path is interrupted. Parameterization/operation via membrane keyboard and Operating menu, see 5.4.4 ; indicated via display on controller.	Q1 > OPM
Averaging	Sliding; 1 (= OFF) / 2 / 5 / 10 / 20 / 50 / 75 / 100 / 200 / 500 / 1000 / 2000 [values] Parameterization/operation via membrane keyboard and Operating menu, see 5.4.6 ; indicated via display on controller.	SEN > AVG
Parameterization	Parameterization is done via the membrane keyboard and Operating menu, see 5.3 ; indicated via display on controller..	All menus

Function	Description	Menu
Switching output	The switching output is set according to the switching threshold. This depends on the T (Teach-in) menu, see 5.4.3 . The switching outputs can be individually configured, provided they do not mutually influence on one another. Parameterization/operation via membrane keyboard and Operating menu, see 5.3 PP (Push-Pull), PNP, NPN	T
Switching polarity SP	Light switching and Dark switching, see 5.5 Parameterization/operation via membrane keyboard and Operating menu, see 5.4.4.1 ; indicated via display on controller.	Q1 > OPM
Switching threshold	1 ... 99 % light intensity; corresponds to 100 ... 4000 bits; 80 % = 3200 bits; hysteresis 2 ... 25 %; 5 %	T Q1
Signal spread/ Measurement value spread	Analog spread of the analog output. It is possible to scale an important signal range to the entire analog range. Parameterization/operation via membrane keyboard and Operating menu, see 5.3 , see 5.4.5.1 ; indicated via display on controller..	ANA > SPRD
Teach functions	Parameterization/operation via membrane keyboard and Operating menu, see 5.4.3 ; indicated via display on controller.	T
Triggering	The sensor can be triggered via Pin 5 in the trigger versions. Operation via membrane keyboard and Operating menu, see 5.4.6 ; indicated via display on controller.	SEN > TRG
WatchDog	Restart in case of error. In the event of a controller error, the controller restarts (Error recovery).	-

6. Cleaning

We recommend cleaning the sensor at regular intervals.

Dry Cleaning

This can be accomplished with an anti-static lens brush or by blowing off the sensors with dehumidified, clean, oil-free compressed air.

Wet Cleaning

Use a clean, soft, lint-free cloth or lens cleaning paper and lens cleaner to clean the lenses. Never use commercially available glass cleaner or other cleaning agents.

7. Disclaimer

All components of the device have been checked and tested for functionality in the factory. However, should any defects occur despite careful quality control, these shall be reported immediately to MICRO-EPSILON or to your distributor / retailer.

MICRO-EPSILON undertakes no liability whatsoever for damage, loss or costs caused by or related in any way to the product, in particular consequential damage, e.g., due to

- non-observance of these instructions/this manual,
- improper use or improper handling (in particular due to improper installation, commissioning, operation and maintenance) of the product,
- repairs or modifications by third parties,
- the use of force or other handling by unqualified persons.

This limitation of liability also applies to defects resulting from normal wear and tear (e.g., to wearing parts) and in the event of non-compliance with the specified maintenance intervals (if applicable).

MICRO-EPSILON is exclusively responsible for repairs. It is not permitted to make unauthorized structural and / or technical modifications or alterations to the product. In the interest of further development, MICRO-EPSILON reserves the right to modify the design.

In addition, the General Terms of Business of MICRO-EPSILON shall apply, which can be accessed under Legal details | Micro-Epsilon <https://www.micro-epsilon.de/impressum/>. For translations into other languages, the German version shall prevail.

8. Service, Repair

If the controller or sensor is defective:

- Please send us the affected parts for repair or exchange.

If the cause of a fault cannot be clearly identified, please send the entire measuring system to:

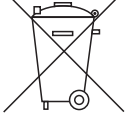
MICRO-EPSILON Eltrotec GmbH
Manfred-Wörner-Straße 101
73037 Göppingen / Germany
Tel: +49 (0) 7161 / 98872-300
Fax: +49 (0) 7161 / 98872-303
eltrotec@micro-epsilon.com
www.micro-epsilon.com

9. Decommissioning, Disposal

In order to avoid the release of environmentally harmful substances and to ensure the reuse of valuable raw materials, we draw your attention to the following regulations and obligations:

- Remove all cables from the sensor and/or controller.
- Dispose of the sensor and/or the controller, its components and accessories, as well as the packaging materials in compliance with the applicable country-specific waste treatment and disposal regulations of the region of use.
- You are obliged to comply with all relevant national laws and regulations



For Germany / the EU, the following (disposal) instructions apply in particular:



- Waste equipment marked with a crossed garbage can must not be disposed of with normal industrial waste (e.g. residual waste can or the yellow recycling bin) and must be disposed of separately. This avoids hazards to the environment due to incorrect disposal and ensures proper recycling of the old appliances. 
- A list of national laws and contacts in the EU member states can be found at https://ec.europa.eu/environment/topics/waste-and-recycling/waste-electrical-and-electronic-equipment-weee_en. Here you can inform yourself about the respective national collection and return points.
- Old devices can also be returned for disposal to MICRO-EPSILON at the address given in the imprint at <https://www.micro-epsilon.com/impressum/>.
- We would like to point out that you are responsible for deleting the measurement-specific and personal data on the old devices to be disposed of.
- Under the registration number WEEE-Reg.-Nr. DE28605721, we are registered at the foundation Elektro-Altgeräte Register, Nordostpark 72, 90411 Nuremberg, as a manufacturer of electrical and/or electronic equipment.

Appendix

A 1 Optional Accessories

Name	Description	Article number
Signal/power supply cable, 5-pin unshielded with trigger		
PC1000-2-T signal/power supply cable	Signal/power supply cable for CLS1000 with trigger function, 5-pin, M12, straight connector, 2 m, OE	11245551
PC1000-5-T signal/power supply cable	Signal/power supply cable for CLS1000 with trigger function, 5-pin, M12, straight connector, 5 m, OE	11245300
PC1000-10-T signal/power supply cable	Signal/power supply cable for CLS1000 with trigger function, 5-pin, M12, straight connector, 10 m, OE	11245301
Power supply/output cable 4-pin unshielded		
PC1000-2 signal/power supply cable	Signal/power supply cable for CLS1000, 4-pin, M12, straight connector, 2 m, OE	11245302
PC1000-5 signal/power supply cable	Signal/power supply cable for CLS1000, 4-pin, M12, straight connector, 5 m, OE	11245303
PC1000-10 signal/power supply cable	Signal/power supply cable for CLS1000, 4-pin, M12, straight connector, 10 m, OE	11245304
Power supply/output cable 4-pin, angled 90°, unshielded		
PC1000/90-2 signal/power supply cable	Signal/power supply cable for CLS1000 for CLS1000 with socket angled 90°, M12 connector, 4-pin 2m long with open ends	11245305
PC1000/90-5 signal/power supply cable	Signal/power supply cable for CLS1000 for CLS1000 with socket angled 90°, M12 connector, 4-pin 5m long with open ends	11245306
Other lengths and/or 90° angled are also possible on request.		

Name	Photo	Description	Article number
Sensors (optical fiber)			
CFS4-C20-P-600		Reflected-light optical fiber	10810373
CFS3-A20-P		Transmitted-light optical fiber	10810322
You can find additional sensors (optical fibers) in the optoCONTROL CLS-K catalog			

Name	Photo	Description	Article number
Power supply			
PS2031		Plug-in power pack 24V/24W/ 1A; 2m-PVC; Terminal-2P-BU-ge	2420096
PS2020		Power supply for DIN rail installation, input 230 VAC, output 24 VDC/2.5 A	2420062

A 2 Factory Settings

You can use the `RST` menu in the Operating menu, [see 5.4.8](#), to reset to factory settings.

A 3 Circuit Examples

A 3.1 CLS1000-QN and CLS1000-2Q

Setting:

Switching behavior = PP (Push/Pull) V_+ and GND switching

R_L can be switched as desired

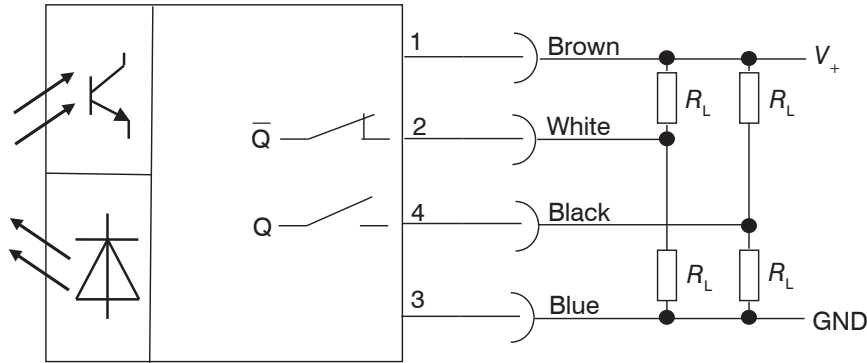


Fig. 43 Circuit = PP (Push/Pull) V_+ and GND switching

Setting:

Switching behavior = PNP V_+ switching

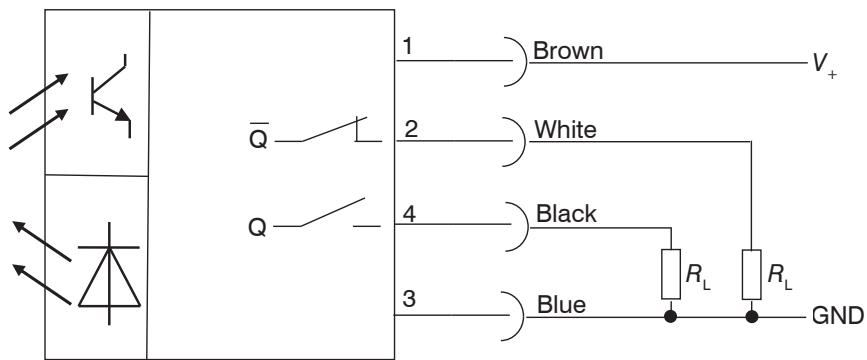


Fig. 44 Circuit = PNP V_+ switching

Setting:

Switching behavior = NPN GND switching

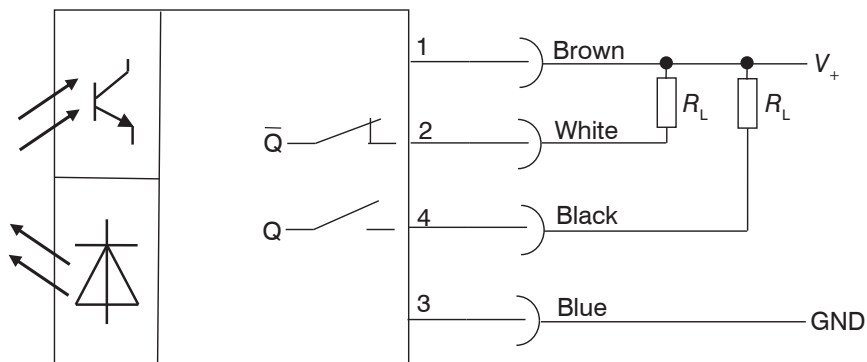


Fig. 45 Circuit = NPN GND switching

A 3.2 CLS1000-OK

Setting:

Switching behavior = PNP $V_{+ External}$ switching

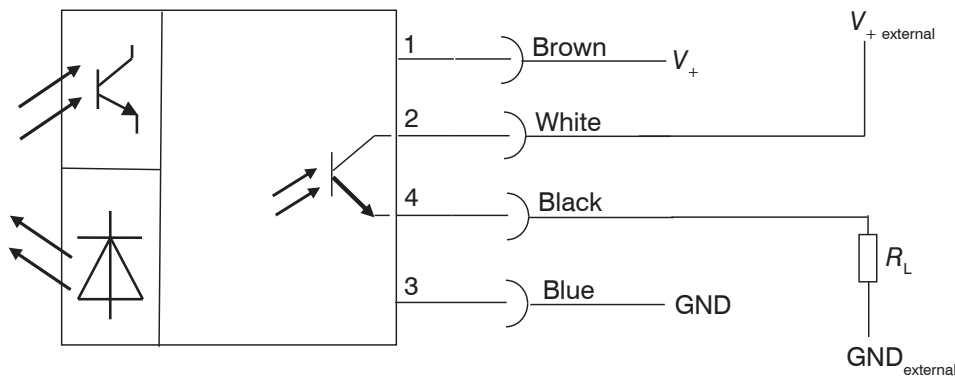


Fig. 46 Circuit = PNP $V_{+ External}$ switching

Setting:

Switching behavior = NPN $GND_{External}$ switching

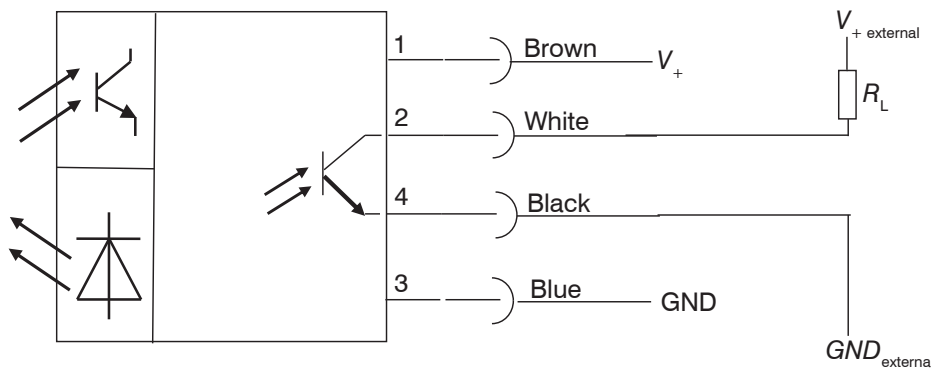


Fig. 47 Circuit = NPN $GND_{External}$ switching

A 3.3 CLS1000-AU

Setting:

Switching behavior Q = PNP V_{+} switching

Circuit for switching behavior PP, NPN as for CLS1000-QN and CLS1000-2Q

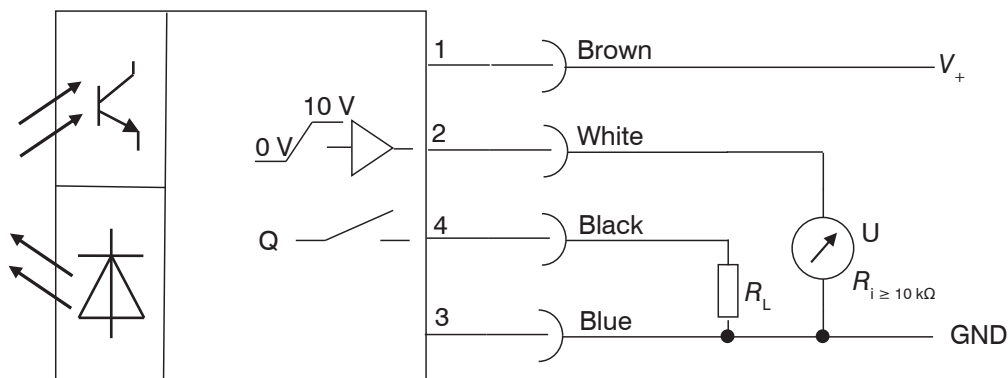


Fig. 48 Circuit Q = PNP V_{+} switching

A 3.4 CLS1000-AI

Setting:

Switching behavior Q = PNP V_+ switching

Circuit for switching behavior PP, NPN as for CLS1000-QN and CLS1000-2Q

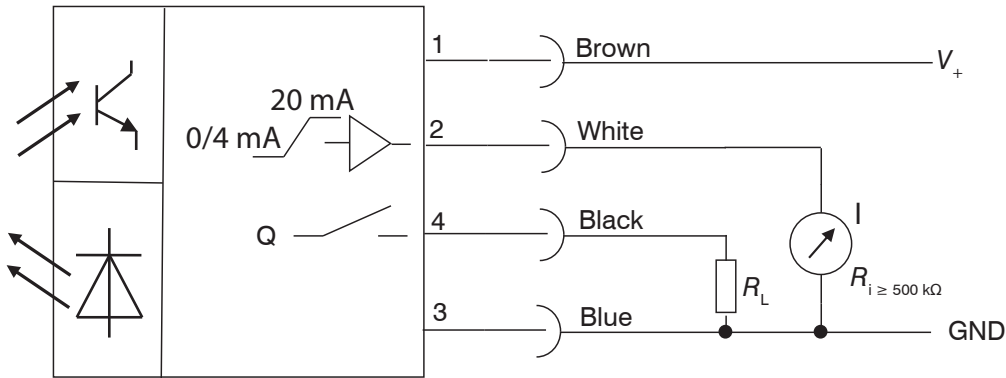


Fig. 49 Circuit Q = PNP V_+ switching

A 3.5 Trigger input CLS1000-xxT

With regard to wiring a circuit for the trigger input with a PP (push/pull) or PNP output, no special measures are required for any mode (High, Low, Pos., Neg.).

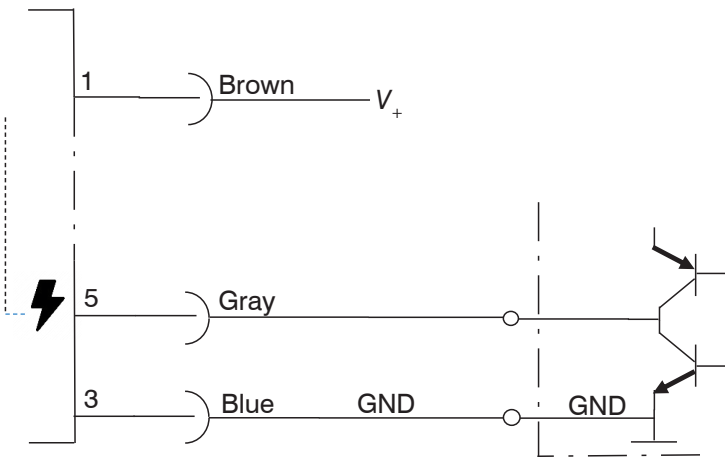


Fig. 50 Circuit for trigger input CLS1000-xx-T - PP or PNP

NOTICE

When wiring the trigger input with an NPN output, an external resistance $\geq 4.7 \text{ k}\Omega \leq 10 \text{ k}\Omega$ is necessary.

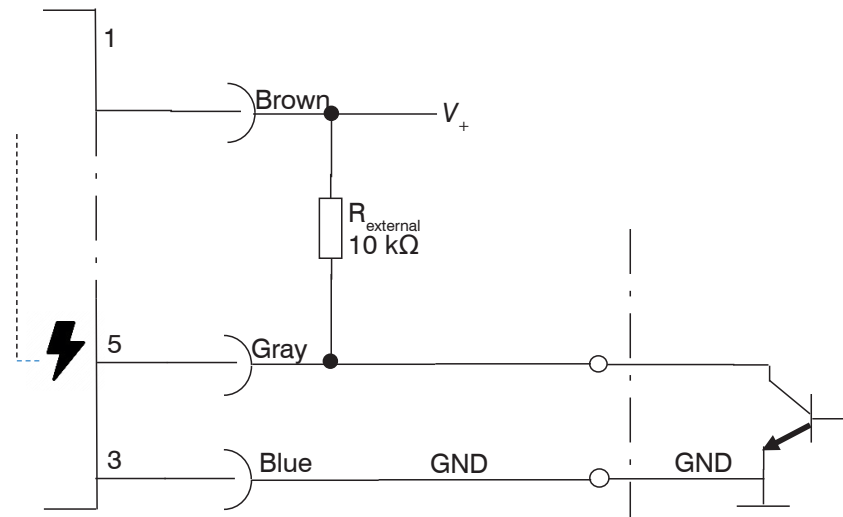


Fig. 51 Circuit for trigger input CLS1000-xxT - NPN



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