PROCESS SENSORS CORPORATION

a KPM brand

Operation Manual

Pyrometer Models:

PSC-S44N / PSC-G44N / PSC-GE44N / PSC-S44N-VF / PSC-44N-VF / PSC-GE44N-VF / PSC-SR44N

Table of Contents

CHAPTER 1

General information

We are pleased that you have decided to purchase a high-quality Process Sensors IR pyrometer of series PSC-S44N / PSC-G44N / PSC-GE44N / PSC-S44NVF / PSC-G44NVF / PSC-GE44NVF / PSC-SR44N for non-contact temperature measurement.

Please read this manual carefully before beginning any operation with the pyrometer and keep it in a save place. It contains all the necessary information for set up and long-term operation of the pyrometer.

If you have any questions about the pyrometer, we ask you to read this manual first.

Should you still have any open questions, notice any errors in this manual or wish to pass on any tips and suggestions for improvement, please inform your supplier or contact us directly:

KPM Analytics North America
8 Technology Drive
Westborough, MA 01581
Cindy Merritt, Customer Service
774.399.0458
IRTemp@kpmanalytics.com

CHAPTER 2

General advice and safety regulations

In this chapter

Intended usage

This device is intended to be used only for non-contact temperature measurement. If you use the pyrometer contrary to the description in this user manual, it may cause loss of all warranty claims against the manufacturer.

Use and maintenance of the pyrometer

Use of the pyrometer is restricted to qualified personnel who have received instructions before initial operation and handling. Instructions should be given by a supervisor, or optionally, customer service.

The pyrometer must be operated only with an isolated safety extra-low voltage (SELV) that poses no danger to health and life of the user. Please refer to chapter Technical data and accessories, on page 12.

Modifications of the device

It is prohibited to do technical modifications on the device without permission of the manufacturer. Contraventions absolve the manufacturer from liability for any damages and will result in loss of all warranty claims against the manufacturer. Please note that the damage of the warranty seal on the back of the device also causes the loss of warranty claims.

Laser operation

The optional integrated laser aiming light meets the safety requirements of Class 2 and is identified accordingly:

Do not look directly into the beam when the laser is switched on!

Laser class 2:
A Class 2 laser is considered to be safe because the blink reflex (glare aversion response to bright lights) will limit the exposure to no more than 0.25 seconds.

CHAPTER 3

Maintenance and warranty

In this chapter

Maintenance

The device does not need any maintenance.
ATTENTION: Do not clean the lens with acidic or solvent-based fluids. Debris on the lens can be cleaned by using dry and oil free compressed air. For heavy pollution, please use a soft and dry tissue.

Packing and storage

If the original packaging is not available, please use a shock-proof package for shipment of the pyrometer. For overseas shipment or long-term storage in rooms with high humidity, the pyrometer

should be heat sealed to protect it against humidity. Please also protect the optics with a protection cover (as delivered) or a plastic film.

Warranty

Process Sensors IR / KPM Analytics will replace or repair defective parts, which result from design errors or manufacturing faults, within a period of two years from the date of sale. Special terms can be arranged, in writing, at the time of purchase of the equipment. Devices, for which the return under warranty has been approved, should be sent to Process Sensors IR / KPM Analytics. Please refer chapter Returns, request for RMA number below.

The warranty is void if the device is opened, disassembled, modified, or otherwise destroyed, without obtaining prior written approval from Process Sensors IR. The warranty is also invalidated if the device is improperly used, or if it is operated or stored under conditions which do not correspond to those defined in the technical specification.

Process Sensors IR does not accept liability for any damage or losses which might occur, including financial losses and consequential damages, as a result, of the use of equipment, or of manufacturer's defects in the design or manufacture of the device.

The seller does not give any warranty or assurances, that the equipment can be utilized for any special applications which the customer might have.

Returns, request for RMA number

If you already are a customer and want to return a product to us for recalibration, reconstruction, upgrade, repair or other, please request an RMA number first: www.ProcessSensorsIR.com/support

CHAPTER 4

Introduction

In this chapter

Scope of delivery

- IR sensor PSC-S44N/ PSC-G44N/ PSC-GE44N/ PSC-SR44N
- two mounting screw nuts M40 × 1.5
- manual
- Sofware PSCspot
- inspection sheet

Please note: A connection cable is not included in the scope of delivery. The separate cables have already been made up in advance for the connection of the pyrometer in different lengths. In that way, a safety class IP67 can be guaranteed for the cables. Please order the necessary cables in the required lengths (please refer chapter Accessories, on page 21).

Application range

The compact and digital pyrometers are specifically designed for industrial purposes. This device is suitable for non-contact temperature measurement starting from 75°C on many different materials like metals, graphite, or ceramics.

The solid stainless-steel housing allows usage even under rough environmental conditions. Measuring target sizes from 1.2 mm for the can be easily realized. With a fast minimal response time of only 5ms (t_{95}) the devices are usable for fast measuring tasks.

The PSC-SR44N is a digital ratio pyrometer that realizes target sizes starting from 1.5 mm (diameter) with a response time of 5 ms (t_{95}). The device measures the infrared radiation in two adjacent wavelength ranges and determines the resultant temperature value. This technology has many advantages in contrast to single color pyrometers as follows:

- Emissivity compensation.
- The measurement object can be smaller than the target.
- Measurements through dirty viewport windows, pyrometer, and dusty environments.

The pyrometer PSC-SR44N can work in the "ratio / 2-color mode" as well as in a 1-color mode.

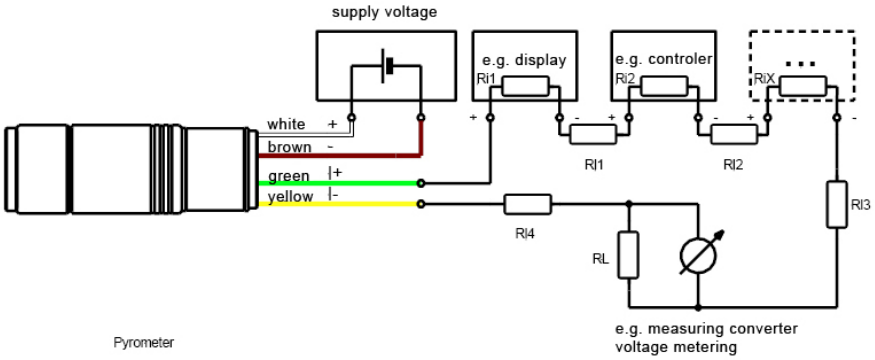
The pyrometer possesses a RS-485 interface. The devices are bus-compatible in this way and use the Modbus RTU protocol. Please read the document “Communication Description Modbus RTU” for detailed information about Modbus RTU.

Use the integrated LED or laser aiming light for aiming the pyrometer (please refer chapter Alignment of the pyrometer, on page 24). Please note that the LED aiming supports only the aiming. The size of the light spot can differ from the infrared measuring field. The LED aiming light is only available for the PSC-S44N and PSC-G44N.

Functional principle

The PSC-S44N / G44N/ GE44N / SR44N work in 4-wire technology. Beside the wires for the power supply, there are two additional wires for the temperature measuring output signal transmission. The infrared radiation of the measured object will be displayed on a detector and transferred via an electrical signal. This signal will be digitally processed and transferred in the standard temperature linear signal of 0/4 ... 20 mA.

The power transmission of the measuring signal is specifically suitable for bridging great distances. In current operation the influence of electromagnetic interferences on the measuring signal is minimized (low resistance receiver input). Accessory devices like a digital display or a controller, that convert the output signal of 0/4 mA to 20 mA, can be integrated in the current loop. Please note that the maximum burden R_{Burden} is 700 Ω.



Block diagram current loop

$$R_{Burden} = Ri1 + +Ri2 \ + RiX + Rl1 + Rl2 + Rl3 + Rl4 + RL$$

R_i	internal resistance of connected devices
R_l	lead resistance $R_l = \frac{\rho * l}{A}$
RL	load resistance
ρ	resistivityCu 0.0178 Ω $* \frac{mm^2}{m}$
l	pipeline length ($cable\ length * 2$)
A	conductor cross section

Example: Rl at 100 m cable length and $A = 0.25\ mm^2$ approx. 15 Ω

Basics

Find detailed information concerning basics of non-contact temperature measurement technology in references /1/-/3/.

Every real body emits, according to its surface temperature, infrared radiation which intensity is mostly less than that of an ideal radiating black radiator of the same temperature. The ratio of the radiations is characterized by emissivity ε. Emissivity charts can be found in citation /4/.

/1/ Lieneweg, F.: Handbuch der technischen Temperaturmessung. Verlag Vieweg, Braunschweig, 1976

/2/ Walther, L.; Gerber, D.: Infrarotmesstechnik. Verlag Technik, Berlin 1981

/3/ Stahl, K.; Miosga, G.: Infrarottechnik. Hüthig Verlag Heidelberg, 1986

/4/ Touloukian, Y.S..: Thermophysical Properties of Matter: The TPRC Data Series, Purdue University, Thermophysical Properties Research Center Staff, R. Browker, 1975, 1991:
Vol. 7. Thermal Radiative Properties: Metallic Elements & Alloys.
Vol. 8. Thermal Radiative Properties: Nonmetallic Solids.
Vol. 9. Thermal Radiative Properties: Coatings.

CHAPTER 5

Technical data and accessories

In this chapter

Device data PSC-S44N, PSC-G44N and Variable Focus (-VF versions)

Device type	PSC-S44N / PSC-S44N-VF		PSC-G44N / PSC-G44N-VF	
Temperature range	600 °C to 1800 °C	800 °C to 2500 °C	250 °C to 1300 °C 250 °C to 2000 °C	350 °C to 1800 °C
Sub temperature range	Adjustable within temperature range, minimum span 50 °C			
Spectral range	0.8 µm to 1.1 µm		1.5 µm to 1.8 µm	
Distance ratio	approx. 100:1	approx. 200:1	approx. 100:1	approx. 200:1
Optics (please refer table)	Fixed optics (type 210, 290, 650 and 4000) with quartz glass protection window, or **Variable Focus Optics (PSC-S44NVF / PSC-G44NVF)**			
Emissivity ε	0.05 to 1.00, adjustable via RS-485 interface			
Response time t95	5 ms (min.), adjustable up to 100 s via RS-485 interface			
Data storage	Minimum/maximum value storage, adjustable via RS-485 interface			
Measurement uncertainty[1)]	0.5 % of measured value in °C + 1 K			
Reproducibility[1)]	0.1 % of measured value in °C + 0.5 K			
NETD [2)]	0.1 K [1)]			
Ambient temperature dependence, static[3)]	< 0.1 K/K($T_{ambient}$)			
Output	0/4 mA to 20 mA temperature linear, burden max. 500 Ω, switchable via Software			
Interface	RS-485 (galvanically isolated), half duplex, max. 115 kB, Modbus RTU			
Aiming light	LED aiming light or laser aiming light			

Device type	PSC-S44N / PSC-S44N-VF	PSC-G44N / PSC-G44N-VF
Parameters	Adjustable via interface and software: Emissivity, response time, data storage settings, sub temperature range	
Power supply	24 V DC ± 25 %, residual ripple 500 mV	
Power consumption	max. 1.5 W	
Operating temperature	0 °C to 70 °C	
Storage temperature	–20 °C to 70 °C	
Weight	approx. 450 g	
Dimensions	Thread M40 × 1.5; length approx. 125 mm	
Protection class	IP 65 according to DIN EN 60529 and DIN 40050	
Test regulations	EN 55 011: 1998, limit class A	
CE symbol	According to EU regulations	
Scope of delivery	DS 44N / DG 44N with optics, two mounting screw nuts M40 ×1.5, manual, inspection sheet, software PSCSpot, **without** connection cable	
Factory settings	ε = 1, response time min. (5ms), sub temperature range = temperature range, clear time off, address 01, 19,2 kBd, output 4 to 20 mA (other parameter settings on request)	

1) Specifications for black body radiator, $T_{ambient}$ = 23 °C, t95 = 1s.

2) Noise equivalent temperature difference.

3) Deviation from$T_{ambient}$= 23 °C, T_{Object} = 1000 °C

Device data PSC-GE44N

Device type	PSC-GE44N / PSC-GE44N-VF		
Temperature range	75 °C to 650 °C	100 °C to 800 °C	150 °C to 1200 °C
Sub temperature range	Adjustable within temperature range, minimum span 50 °C		
Spectral range	2.0 µm to 2.6 µm		
Distance ratio	approx. 85:1	approx. 130:1	approx. 200:1
Optics (refer table)	Fixed optics (type 290, 650 and 1500) with quartz glass protection window, variable Focus optics		
Emissivityε	0.05 to 1.00, adjustable via RS-485 interface		
Response time t95	5 ms (min.), adjustable up to 100 s via RS-485 interface		
Data storage	Minimum/maximum value storage, adjustable via RS-485 interface		
Measurement uncertainty[1)]	0.5 % of measured value in °C + 2 K		
Reproducibility[1)]	0.3 % of measured value in °C + 1 K		
NETD [2)]	0.5 K [1)]		
Ambient temperature dependence, static[3)]	< 0.1 K/K($T_{ambient}$)		
Output	0/4 mA to 20 mA temperature linear, burden max. 500 Ω, switchable viasoftware		
Interface	RS-485 (galvanically isolated), half duplex, burden max. 115 kB, Modbus RTU		
Aiming	Integrated laser aiming light		
Parameters	Adjustable via interface and software: emissivity, response time, data storage settings, sub temperature range		
Power supply	24 V DC ± 25 %, residual ripple 500 mV		
Power consumption	max. 1.5 W		
Operating temperature	0 °C to 70 °C[4)]		
Storage temperature	–20 °C to 70 °C		
Weight	approx. 450 g		
Dimensions	Thread M40 × 1.5; length approx. 125 mm		
Protection class	IP 65 according to DIN EN 60529 and DIN 40050		
Test regulations	EN 55 011: 1998, limit class A		
CE symbol	According to EU regulations		
Scope of delivery	PSC-GE44N with optics, two mounting screw nuts M40 ×1,5, manual, inspection sheet, software PSCspot, **without** connection cable		

Device type	PSC-GE44N / PSC-GE44N-VF
Factory settings	ε = 1, response time min. (5ms), sub temperature range= temperature range, clear time off, address 01, 19.2 kBd, output 4 to 20 mA (other parameter settings on request)

1) Specifications for black body radiator, $T_{ambient}$ = 23 °C, t95 = 1 s.

2) Noise equivalent temperature difference.

3) Deviation from$T_{ambient}$= 23 °C, T_{Object} = 600 °C

4) The measurement temperature should be at least 30 K (75 °C to 650 °C) / 60 K (100 °C to 800 °C) higher than the operating temperature.

Device data PSC-SR44N (2-color)

Device type	PSC-SR44N		
Temperature range	600 °C to 1400 °C	700 °C to 1800 °C	800 °C to 2500 °C
Sub temperature range	Adjustable within temperature range, minimum span 50 °C		
Spectral range	0.7 µm to 1.1 µm		
Distance ratio	approx. 50 : 1	approx. 100 : 1	approx. 200 : 1
Optics (refer table)	Fixed optics (type 290, 650 and 1500) with quartz glass protection window		
Emissivity ε	0.05 to 1.00, adjustable via RS-485 interface (1-channel mode)		
Ratio correction K	0.800 to 1.200 (ratio mode)		
Response time t95	5 ms (min.), adjustable up to 100 s via RS-485 interface		
Data storage	Minimum/maximum value storage, adjustable via RS-485 interface		
Measurement uncertainty[1)]	0.5 % of measured value in °C + 1 K		
Reproducibility[1)]	0.2 % of measured value in °C + 0.5 K		
NETD [2)]	0.1 K [1)]		
Ambient temperature dependence, static [3)]	< 0.2 K/K($T_{ambient}$)		
Output	0/4 mA to 20 mA temperature linear, burden max. 500 Ω, switchable via software		
Interface	RS-485 (galvanically isolated), half duplex, burden max. 115 kB, Modbus RTU		
Aiming	Integrated laser aiming light		
Parameters	Adjustable via interface and software: ratio correction, emissivity, response time, data storage settings, sub temperature range		
Power supply	24 V DC ± 25 %, residual ripple 500 mV		
Power consumption	max. 1.5 W		
Operating temperature	0 °C to 70 °C		
Storage temperature	–20 °C to 70 °C		
Weight	approx. 450 g		
Dimensions	Thread M40 × 1.5; length approx. 125 mm		
Protection class	IP 65 according to DIN EN 60529 and DIN 40050		
Test regulations	EN 55 011: 1998, limit class A		
CE symbol	According to EU regulations		

Device type	PSC-SR44N
Scope of delivery	PSC-SR44N with optics, two mounting screw nuts M40 ×1,5, manual, inspection sheet, software PSCspot **without** connection cable
Factory settings	ε = 1, response time min. (5ms), sub temperature range = temperature range, clear time off, address 01, 19.2 kBd, output 4 to 20 mA (other parameter settings on request)

1) Specifications for black body radiator, $T_{ambient}$ = 23 °C, t95 = 1 s.

2) Noise equivalent temperature difference.

3) Deviation from $T_{ambient}$= 23 °C, T_{Object} = 1000 °C

Fixed Focus Optics

Depending on customer requirements, the device is equipped with a fixed optics which has to be selected when ordering.

Optical data (Focal Point in Bold)		**OPTICS 210**											
Measurement distance a [mm]		0	100	**210**	300	400	500	600	800	1000	1500	2000	4000
Target size ∅M*) [mm] PSC-S44N	600 ... 1800 °C	12.5	7.5	**2.0**	8.2	15.1	22.0	28.9	42.7	56.5	91	126	264
	800 ... 2500 °C	12.5	7.1	**1.2**	7.1	13.6	20.1	26.6	39.7	52.7	85	118	248
Target size∅M*) [mm] DG 44N	250 ... 1300 °C	12.5	7.5	**2.0**	8.2	15.1	22.0	28.9	42.7	56.5	91	126	264
	350 ... 1800 °C	12.5	7.1	**1.2**	7.1	13.6	20.1	26.6	39.7	52.7	85	118	248
	250 … 2000 °C	12.5	7.5	**2.0**	8.2	15.1	22.0	28.9	42.7	56.5	91	126	264
Aperture Ø D [mm]		12.5											

Optical data (Focal Point in Bold)		**OPTICS 290**											
Measurement distancea [mm]		0	100	200	**290**	400	500	600	800	1000	1500	2000	4000
Target size∅M*) [mm] PSC-S44N	600 ... 1800 °C	11.8	8.8	5.7	**3.0**	8.6	13.7	18.8	29.0	39.2	65	90	192
	800 ... 2500 °C	11.8	8.2	4.7	**1.5**	6.5	11.1	15.7	24.9	34.1	57	80	172
Target size∅M*) [mm] PSC-G44N	250 ... 1300 °C	11.8	8.8	5.7	**3.0**	8.6	13.7	18.8	29.0	39.2	65	90	192
	350 ... 1800 °C	11.8	8.2	4.7	**1.5**	6.5	11.1	15.7	24.9	34.1	57	80	172
	250 … 2000 °C	11.8	8.8	5.7	**3.0**	8.6	13.7	18.8	29.0	39.2	65	90	192
Target size∅M*) [mm] PSC-GE44N	75 … 650 °C	11.8	9.0	6.1	**3.6**	9.4	14.7	20.0	30.7	41	68	95	200
	100 … 800 °C	11.8	8.6	5.3	**2.4**	7.7	12.6	17.4	27.4	37	62	86	185
	150 … 1200 °C	11.8	8.2	4.7	**1.5**	6.5	11.1	15.7	24.9	34.1	57	80	172
Target size ∅M*) [mm] PSC-SR44N	600 … 1400 °C	11.8	9.8	7.8	**6.0**	13	19	25	37	50	80	111	234
	700 … 1800 °C	11.8	8.8	5.7	**3.0**	8.6	13.7	18.8	29	39	65	90	192
	800 … 2500 °C	11.8	8.2	4.7	**1.5**	6.5	11.1	15.7	24.9	34.1	57	80	172
ApertureØD [mm]		11.8											

Optical data (Focal Point in Bold)	**OPTICS 650**											
Measurement distancea [mm]	0	100	200	300	400	500	**650**	800	1000	1500	2000	4000

Target size∅M*) [mm] PSC-S44N	600 ... 1800 °C	10.8	10.1	9.5	8.8	8.2	7.5	**6.5**	10.5	15.8	29.1	42	96
	800 ... 2500 °C	10.8	9.7	8.6	7.4	6.3	5.2	**3.5**	6.8	11.2	22.2	33	77
Target size∅M*) [mm] PSC-G44N	250 ... 1300 °C	10.8	10.1	9.5	8.8	8.2	7.5	**6.5**	10.5	15.8	29.1	42	96
	350 ... 1800 °C	10.8	9.7	8.6	7.4	6.3	5.2	**3.5**	6.8	11.2	22.2	33	77
	250 … 2000 °C	10.8	10.1	9.5	8.8	8.2	7.5	**6.5**	10.5	15.8	29.1	42	96
Target size∅M*) [mm] PSC-GE44N	75 … 650 °C	10.8	10.3	9.9	9.4	8.9	8.4	**7.7**	11.9	17.6	32	46	103
	100 … 800 °C	10.8	10.0	9.2	8.3	7.5	6.6	**5.4**	9.2	14.1	26.6	39	89
	150 … 1200 °C	10.8	9.7	8.6	7.4	6.3	5.2	**3.5**	6.8	11.2	22.2	33	77
Target size ∅M*) [mm] PSC-SR44N	600 … 1400 °C	10.8	11.1	11.5	11.8	12.1	12.5	**13**	18.5	25.8	44	62	136
	700 … 1800 °C	10.8	10.1	9.5	8.8	8.2	7.5	**6.5**	10.5	15.8	29.1	42	96
	800 … 2500 °C	10.8	9.7	8.6	7.4	6.3	5.2	**3.5**	6.8	11.2	22.2	33	77
ApertureØD [mm]		10.8											

Optical data (Focal Point in Bold)		**OPTICS 1500**											
Measurement distancea [mm]		0	250	500	750	1000	1250	**1500**	1750	2000	2250	2500	2750
Target size∅M*) [mm] PSC-GE44N	75 … 650 °C	10.4	11.6	12.9	14.1	15.3	16.5	**17.7**	22.4	27.0	32	36	41
	100 … 800 °C	10.4	10.6	10.8	11.0	11.2	11.4	**11.6**	15.3	18.9	22	26	30
	150 … 1200 °C	10.4	9.9	9.4	8.9	8.5	8.0	**7.5**	10.5	13.5	16.5	19.4	22.4
Target size ∅M*) [mm] PSC-SR44N	600 … 1400 °	10.4	13.7	17	20.2	23.5	26.7	**30**	36.7	43.5	50.2	57	63.7
	700 … 1800 °C	10.4	11.2	11.9	12.7	13.5	14.2	**15**	19.2	23.5	27.7	31.9	36.2
	800 … 2500 °C	10.4	9.9	9.4	8.9	8.5	7.9	**7.5**	10.5	13.5	16.5	19.4	22.4
Aperture ∅D [mm]		10.4											

Optical data (Focal Point in Bold)		**OPTICS 4000**										
Measurement distancea [mm]		0	100	200	300	400	500	650	800	1000	1500	2000	**4000**
Target size∅M*) [mm] PSC-S44N	600 ... 1800 °C	10.4	11.1	11.9	12.6	13.4	14.1	15.2	16.3	17.8	21.5	25.2	**40**
	800 ... 2500 °C	10.4	10.6	10.9	11.1	11.4	11.6	12.0	12.3	12.8	14.0	15.2	**20**
Target size∅M*) [mm]	250 ... 1300 °C	10.4	11.1	11.9	12.6	13.4	14.1	15.2	16.3	17.8	21.5	25.2	**40**
	350 ... 1800 °C	10.4	10.6	10.9	11.1	11.4	11.6	12.0	12.3	12.8	14.0	15.2	**20**

PSC-G44N	250 … 2000 °C	10.4	11.1	11.9	12.6	13.4	14.1	15.2	16.3	17.8	21.5	25.2	**40**
Aperture∅D [mm]		10.4											

*) The measuring field diameter M defines a generally circular flat surface of a measuring object of which the radiation sensor receives90 % of the blackbody irradiance of the measuring object. The increase of the measuring signal caused by dihedral angle is characterized by the environmental factor SSE (size of source effect). It specifies how much the received blackbody irradiance increases when the measuring field diameter is doubled. The value is typical 3 % for above-named devices.

Variable Focus optics(-VF)

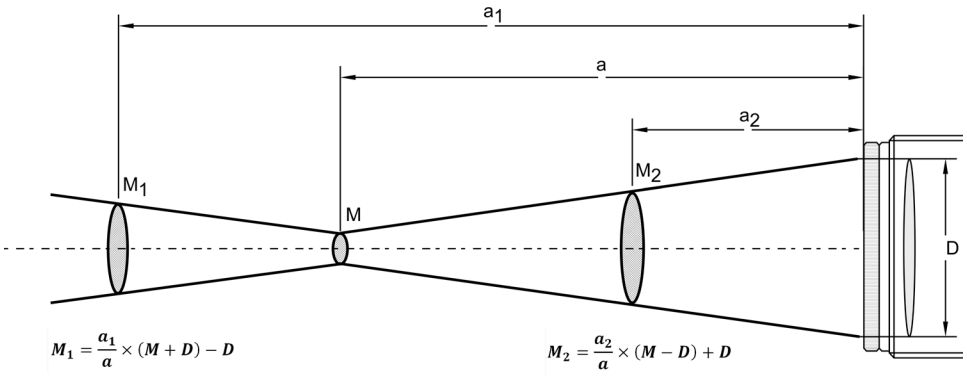
Optical data		**Variable Focus optics**		
Temperature range		Measurement distance a	Measurement target size M*)	Aperture D
PSC-S44N-VF	600 ... 1800 °C	300 … 800 mm	3.0 … 8.6 mm	10
	800 ... 2500 °C	300 … 800 mm	1.5 … 5.5 mm	10
PSC-G44N-VF	250 ... 1300 °C	300 … 800 mm	3.0 … 8.6 mm	10
	350 ... 1800 °C	300 … 800 mm	1.5 … 5.5 mm	10
	250 … 2000 °C	300 … 800 mm	3.0 … 8.6 mm	10
PSC-GE44N-VF	75 ... 650 °C	300 … 800 mm	3.6 … 10.3 mm	10
	100 ... 800 °C	300 … 800 mm	2.4 … 85.5 mm	10
	150 … 1200 °C	300 … 800 mm	1.5 … 5.5 mm	10

The focusable optics can be adjusted by turning the front focusing knurled ring.

Special note

Please note: The measuring object must be at least as large as the measuring field at current measurement distance.

The measuring field diameter M changes according to the measuring distance a. The respective values are to be found in the charts above (minimum measuring field diameter and respective measuring distance are marked bold).
Interim values can be calculated approximately with the following formulas:



Calculation of measuring field diameter M

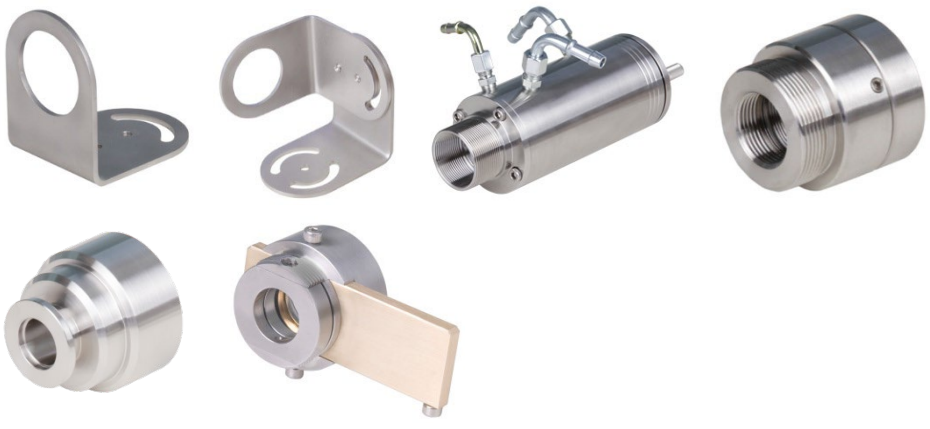
In addition, you can calculate the values with the PSCspot software.

Accessories

Process Sensors IR offers a wide range protective hardware for Cooling, Air purging, Mounting Brackets, and Protective Windows etc. for pyrometer installations in harsh and demanding areas.

Accessories can be ordered at any time and installed on site, e.g.

Mounting angle fixed	P/N: PSC-3310A21010
Mounting angle adjustable	P/N: PSC-3310A21011
Cooling jacket with air purge unit	P/N: PSC- 3310A23010
Air purge	P/N: PSC- 3310A22010
Vacuum flange KF16 with zinc selenide window	P/N: PSC-3310A34041
Window slide (without protection window)	P/N: PSC-3310A21210



Connecting cable 2 m, straight plug, 12 pin	P/N: PSC-3310A11111
Connecting cable 5 m, straight plug, 12 pin	P/N: PSC-3310A11112
Connecting cable 10 m, straight plug, 12 pin	P/N: PSC-3310A11113
Connecting cable 15 m, straight plug, 12 pin	P/N: PSC-3310A11114
Connecting cable 20 m, straight plug, 12 pin	P/N: PSC-3310A11115
Connecting cable 25 m, straight plug, 12 pin	P/N: PSC-3310A11116
Connecting cable 30 m, straight plug, 12 pin	P/N: PSC-3310A11117

Other connection cables variants are available:

- with right angle connector
- with right angle connector with laser button
- for high temperature (75 °C to 2500 °C)

Digital Meter

24 VDC Power supply P/N 950-004

CHAPTER 6

Installation and initial operation

In this chapter

Preparation

The pyrometer position and the respectively adjustable parameters are determined from the application. Concerning the pyrometer position, please take account of ambient temperature, atmospheric conditions, and potential occurrence of electromagnetic interferences. Furthermore, factor the cable conduit for the used connecting cables of the pyrometer into your planning.

Ambient temperature

The ambient temperatures must not exceed the allowed operation temperature for the pyrometer: 0°C to 70°C. Otherwise wrong measuring results may occur or even a damage the pyrometer. If the ambient temperature is too high the pyrometer must be used in combination with appropriate accessories (e.g., cooling jacket, please refer chapter Accessories, on page 21). A water connection (water pressure max. 10 bar) is needed for the cooling jacket.

Atmospheric conditions

Smoke, dust, steam or other air contamination, as well as contaminated optics, are a problem for non-contact temperature measurement. As the Pyrometer cannot receive the full infrared energy for an exact measurement, measuring errors will result. An air purge unit (see chapter Accessories, on page 21) can be helpful to avoid contamination of the lens. An air purge unit requires a respective air supply (air pressure < 0.5 bar, oil free).

Electromagnetic interferences

Any interferences may affect proper functionality of the pyrometer!

To protect the device from electromagnetic interferences the following methods are recommended:

- The device should be mounted as far as possible from potential sources of interferences, e.g., machine parts with electrical motors, which may produce interference peaks.
- Use shielded cables for all connections. Please select a cable from our accessories list, chapter Accessories, on page 21.
- Make sure that the Pyrometer is grounded properly.
- To avoid ground loops please connect only the cable shield or the ground of the pyrometer.

(Please refer chapter Installation of the pyrometer below.)

Installation of the pyrometer

Location requirements

It is recommended to use the available fixed or adjustable mounting angles for mounting of the device. Please refer chapter Accessories, on page 21.

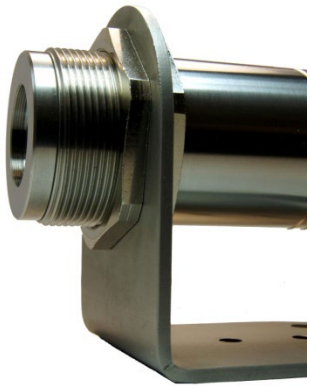
Operating personal requirements

Qualified operating personnel should do the installation. Please follow the instruction in this manual when installing the pyrometer.

Advice: We recommend only qualified personnel to operate the pyrometer. Process Sensors IR / KPM Analytics North America will not cover damages caused by improper installation of non-qualified operating personnel.

Mechanical installation

Please install the optional mounting angle at the required position first. Then install the device with the delivered threads M40 × 1.5 at the mounting angle.



Pyrometer with mounting bracket (optional)

For installing the pyrometer, please do the following steps:

1. Unscrew front mounting screw
2. Place back mounting nuts at the required position
3. Insert pyrometer into mounting bracket
4. Tighten mounting nuts

Connecting cable

Please use only our connecting cables which have been made up in advance. The cables are available in different lengths (please refer chapter Accessories, on page 21). This ensures that the standards concerning EC Declaration of Conformity and safety class are adhered.

Alignment of the pyrometer

A correct alignment of the pyrometer is simple by using the built-in targeting light.

LED targeting light
The LED light spot has approximately the measuring target size of the pyrometer but not absolutely exactly the same size. The LED targeting light is designed for continuous operation, it does not influence the measurement. Only for the PSC- S44N the light can cause measurement errors at the beginning of the basic temperature range. The pyrometer must be fixed in the correct measuring distance to avoid measuring errors caused by a too big target size.

LASER targeting light
The LASER light spot does not have the same size as the measuring target size of the pyrometer. It marks the middle of the measuring field. The LASER targeting light is designed for non-continuous operation, it does not influence the measurement. Only for the PSC-S44N the light can cause measurement errors at the beginning of the basic temperature range. The pyrometer must be fixed in the correct measuring distance to avoid measuring errors caused by a too large of a target size.

The LASER will switch off automatically after 2 minutes. To avoid overheating the LASER flashes with about 0.5 Hz if the device temperature reaches more than 50 °C.

Advice: Before starting any measuring operation first thing is to aim the pyrometer towards the object you are going to measure.

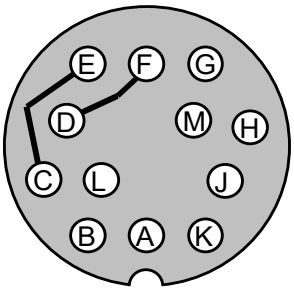
Connections

The 12 pin connections are located at the back side of the device as shown in figures. The plug-in construction of the connections allows a fast and safe connection and change of the devices.

1) 12 pin connections

Please refer to chapter Connecting the pyrometer, on page 26

Please note: Please install the driver so the pyrometer can be detected correctly. Please refer to chapter 7, PSC Spot Software on page 30.

Pin		Description	Wirecolor
12 pin connector  straight connector: P/N 99-5630-15-12 angled connector: P/N 99-5630-75-12 Franz Binder GmbH www.binder-connector.de	K	+24 VDC	white
	A	0 VDC	brown
	L	+ analog output 0 or 4 to 20 mA	green
	B	– analog output 0 or 4 to 20 mA	yellow
	H	pyrometer option: externalpilot light switch	grey
	J	pyrometer option: external clearing of maximum valuestorage	pink
	F	D+ RS-485 (twisted pair)	black
	C	D– RS-485 (twisted pair)	violet
	D	D+ RS-485 internally bridged with F (twisted pair)	grey/pink
	E	D– RS-485 internally bridged with C (twisted pair)	red/blue
	G	GND RS-485	red
	M	screen (only for cable extension)	green/yellow

12-Pin Connection Cable

Initial operation of the pyrometer

Connecting the pyrometer

The pyrometer requires a power supply of 24 V DC ±25 %.

Connect the IR pyrometer 12 pin cable at the back side of the pyrometer and connect the other end of the cable to a 24 V DC power supply.

Advice: The pyrometer is equipped with inverse-polarity protection.

Polarity is important when connecting the pyrometer with power supply (see Figure).

To meet the requirements of the electromagnetic compatibility all connecting cables should be shielded. The shield of the 12-wire connecting cable is connected at the pyrometer side only. If cable extensions are used, the shield has to be extended as well.

Switch on aiming light

You can switch on/off the aiming light as follows:

- via external pin (pin H bridged with pin K + 24 V)
- via IR sensor connection cable with laser push button
- via software PSCspot or optional PSCspot Pro

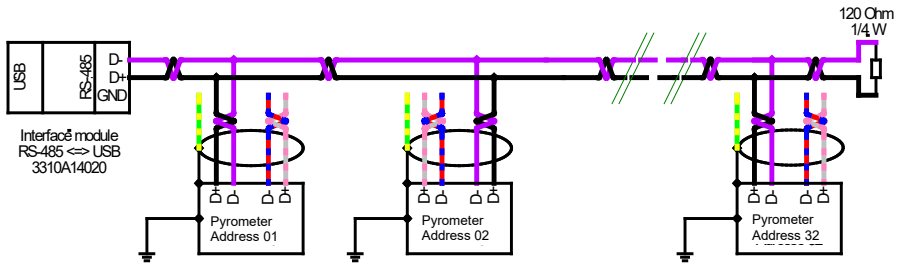
Connection of the pyrometer to RS-485

Please note that the pyrometer has to be addressed separately before connection. This is ideally done with the handheld programming device PSC-DHP 1040 that is available as an additional accessory. Every pyrometer must have a different address. The address 00 is not allowed so it is banned (factory set). The RS-485 connection enables BUS communication with up to 32 users.

It is important that both conductors D+ and D– do not get interchanged in the same segment. **This is the most common installation error!** The shielding must be applied to **only one end** of the cable at "PE" (potential earth). Either the pyrometer housing gets grounded from system side or via shield connector green/yellow. Connecting both ends to PE causes the generation of a ground loop. Its impedance (resistance > 0 Ω) leads to an unintentional fall of potential and thereby a disturbance of the wanted signal.

Lacking earth connections are the second most common cause of defect for RS-485 installations!

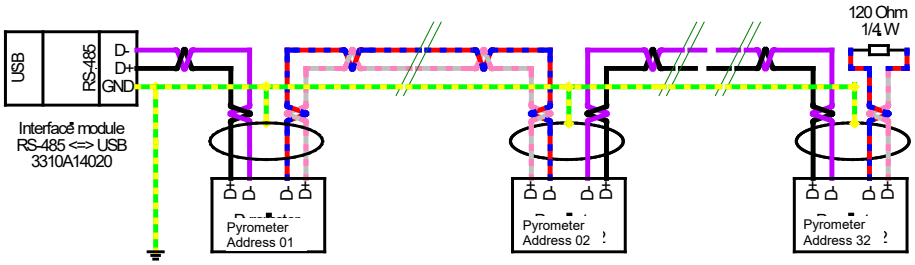
All stations in one segment should be ideally connected in series in a linear BUS. Therefore, the cable is looped through from station to station. Branch lines (T-pieces, branch connections) should be avoided but are possible for short distances (see figure).



Topology of a RS-485 bus with several pyrometers on branch lines

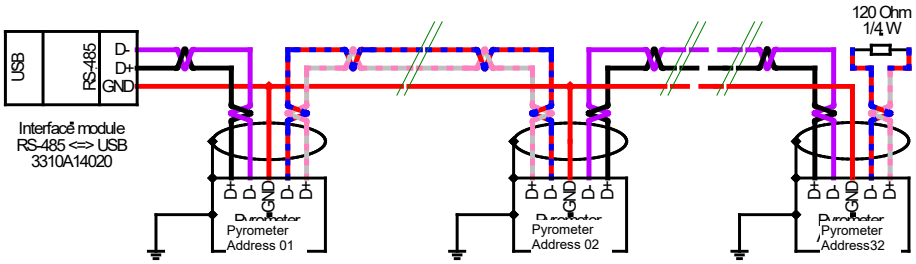
Please note the **maximum length of 3 m** for branch lines.

If the pyrometer is grounded from system side (pyrometer housing has a direct connection to PE), the shield connector green/yellow serves only as an extension and must not be connected with PE. Otherwise, a ground loop can occur that leads to disturbances in the communication or to a flow of compensating current. The pyrometer can get damaged in this way.



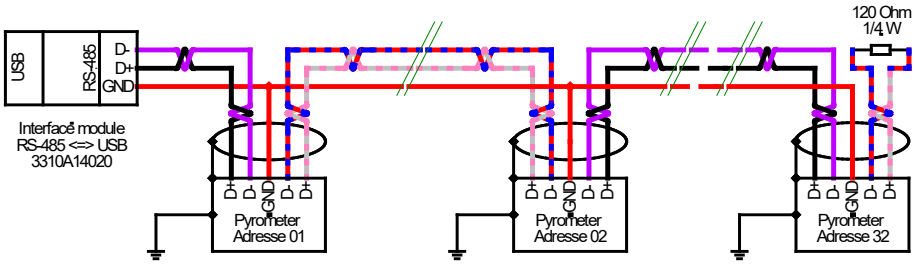
Topology of a linear RS-485 bus with several pyrometers

This configuration is used when great distances must be bypassed. Pipeline lengths up to 1200 m can be realized.



Topology for a linear RS-485 bus with several pyrometers

If the electrical grounding of the pyrometer housing cannot be done directly, all shield connectors are connected in one point with PE. This is ideally the electrical grounding of the connected computer.



Topology of a linear RS-485 bus with several pyrometers

Another possibility to avoid disturbances in the bus is the red marked connection of all GND lines in the figure above. Please note that ground loops can occur if the shield connector green/yellow is applied additionally.

Parameters

You can adjust the following parameters via RS-485 interface:

Emissivity ε

The emissivity of a measuring object specifies how much radiation it emits compared to an ideal heat radiator, a blackbody radiator, at the same temperature. According to Kirchhoff's Radiation Law, absorption and emission capacity are equal. The black body radiator has an emissivity of 1. In contrast, real measuring objects always have an emissivity of < 1. This value should be known and should be adjusted at the pyrometer.

You can adjust the emissivity of the pyrometers in the range from 0.05 to 1.00. Please note that an incorrectly set emissivity can lead to false measuring results.

Please note: If you specify a "true" temperature, the pyrometer calculates the emissivity independently. The software PSC Spot can also be used for the determination of the emissivity.

Ratio correction K

(For PSC-SR44N Pyrometer series only – Set in Ratio mode)

Ratio pyrometers measure the radiation signal in two different, but close to each other, spectral ranges and use the ratio of the radiation signal for the determination of the temperature. If the measurement object has the same emissivity in both spectral ranges, this value gets eliminated by ratio formation and a ratio correction is not necessary. Especially for metals, the ratio is $\frac{\varepsilon_1}{\varepsilon_2} \neq 1$ so a ratio correction is necessary.

Please note: This parameter has big influence on the measurement result so changes should be made in small steps. The effect can be traced directly in the display of the temperature display.

Response time t95

The pyrometers response time characterizes the time span in which the measured temperature during erratic variation must coincide with the measuring field, so the pyrometer is able to reach 95 % of the initial value of the measured temperature. The minimal response time within this series of devices is 10ms and is set by the value "min". Different timings can be adjusted up to 100 seconds.

Sub temperature range

You can set a sub temperature range for the pyrometer. The sub temperature range can only limit the temperature range and must has a minimum span of 50° C between lower and upper limit. This range limits only the scaling of the current output. The lower value refers to 4 mA and the upper value to 20 mA.

The change of the sub temperature range can be used for parameterization of the maximum value storage (please refer to text below).

Maximum and minimum value storage

Adjustment at pyrometer: **off**

The storage is switched off and the instantaneous value is measured.

Adjustment at pyrometer: **Delete time**

You can adjust this value between 100 ms and 100 seconds. Minimum and maximum value get detected in two data storages. The storages get deleted alternately after the adjusted time. The not-deleted storage keeps its value for one more cycle time. Breaking downs of the measuring value are avoided in this way.

Adjustment at pyrometer: **min**

Option minimum storage value

The lowest measured value is stored, so the digital display and the current output get frozen at the last measured minimum value. The minimum value storage is not available in operating mode “auto”. To detect the minimum, the delete time must be at least a triple of the response time.

Adjustment at pyrometer: **max**

Option maximum value storage

The highest measured value is stored, so the digital display and the current output get frozen at the last measured maximum value. To detect the maximum, the delete time must be at least a triple of the response time.

Adjustment at pyrometer: **auto**

Mode for discontinuous measurement problems.

Hereby e.g., moving parts are measured just in the moment of their passing of the pyrometers measuring field. The maximum temperature of the part is registered and saved. The minimum level of the sub temperature range is set as the temperature bar. With every culmination of this threshold the former value is deleted. The minimum level of the sub temperature range has to be exceeded by at least 1% or 2°C for the deletion to be carried out. For the sub temperature range being equivalent to the temperature range, the memory is erased if the minimal level of the temperature range is exceeded.

Adjustment at pyrometer: **external**

If the maximum value storage at the pyrometer is set to external, it can be deleted via the external pin or via software. Pin J serves as input for the external deletion. To delete the maximum value storage, pin J must be connected shortly to the power supply (pin K, +24 V DC). Please refer chapter Connecting the pyrometer, on page 26.

To delete the maximum value storage via PSC Spot or PSC Spot Pro software (optional), use the DELETE button in the register PARAMETER.

Analogue output

The scale of the current output can be switched from 0 ... 20 mA to 4 ... 20 mA with this parameter. Please consider the signal input of your evaluation device.

Formula for calculation of the temperature out of the current value

$$T_{Object} = \left(\frac{Iist - Imin}{Imax - Imin} * MBU\right) + MBA$$

$Iist$	read current value in mA
$Imin$	lower current value 0 or 4 mA
$Imax$	upper current value 20 mA
MBA	start of (sub) temperature range in °C
MBE	end of (sub) temperature range in °C
MBU	(sub)temperature range in °C $\quad MBU = MBE - MBA$

Example: DT 44L –40 °C to 1000 °C, read value Iist= 8 mA, Imin = 4 mA

$$T_{Object} = \left(\frac{8\ mA - 4\ mA}{20\ mA - 4\ mA} * 1050\ °C\right) + (250\ °C) = 512{,}5\ °C$$

Address/Baud rate

The address of the device can be changed with this parameter. This is important for bus systems with multiple users. Furthermore, there is the possibility to change the baud rate. Please consider that all bus users must use the same baud rate but different addresses. Please refer to chapter Switch on aiming light, on page 26, for further information.

CHAPTER 7

PSC Spot Software

The software PSCspot offers possibilities to parameterize the devices and to evaluate measuring data. The software is included in the scope of delivery. For extended function the software PSCspot is available optionally.

Please note:

A DLL interface is included for the integration of user owned software solutions. This interface allows the access to all parameters via API functions. In this way the pyrometers can be integrated into different environments (e.g. MATLAB and LabView).

In this chapter

Installation of software

Before connecting the pyrometer, install the software and drivers first, otherwise it can cause some errors.

You will find the “setup.exe” on the CD ROM.

Run the setup and the installation of the software.

Following messages appear:

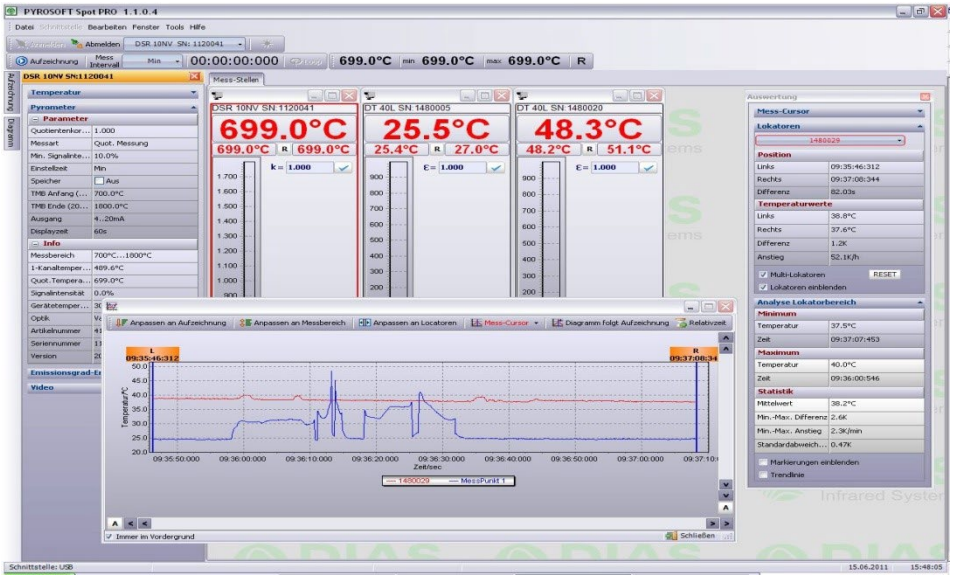
Found new hardware

USB Serial Port

Found new hardware

The new hardware was installed and is ready for use now.

After successful installation you can start the software by clicking the appropriate desktop icon.



PSC-Spot Pro Software interface – More features and functionality (optional)

Using the software

For a detailed description of all software function please refer to software manual on CD-ROM or use the online help function by pressing F1 key, Chapter 8.

EG Declaration of conformity

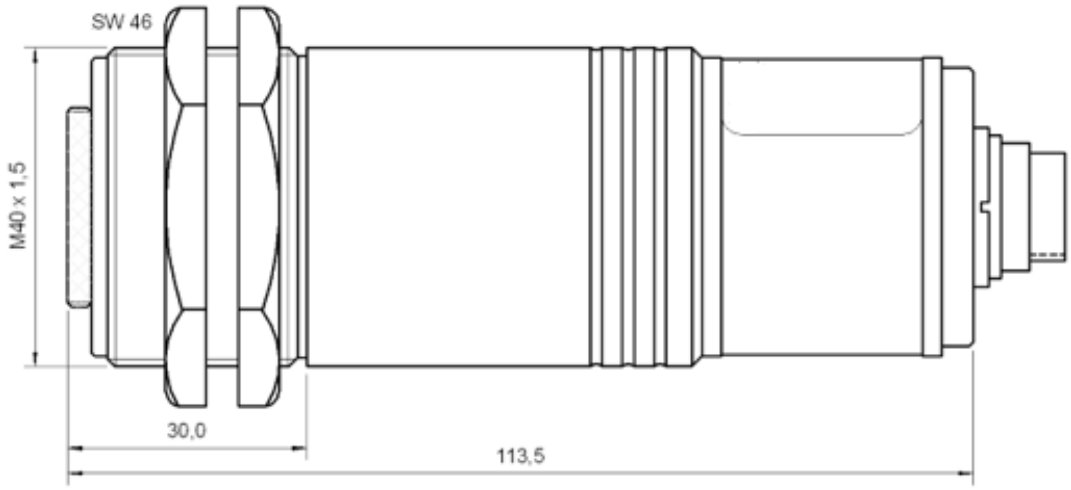
For the product identified as follows:
Infrared Pyrometer

It is hereby confirmed that this product meets the basic protection requirements, as defined in the Guidelines of the Committee for Harmonization of Legal Specifications of the Member States:
1: 2014/30/EU (electromagnetic compatibility, EMC)
and
2: 2014/35/EU (low voltage directive, NVD)

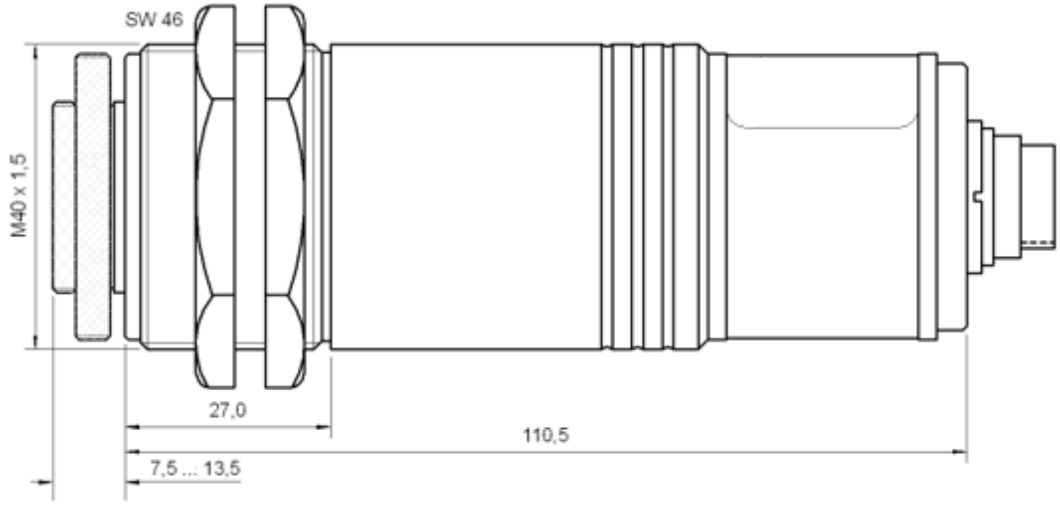
For the assessment of the product following standards have been considered:
1: EMC: EN 61326-1
2: NVD: EN 61010-1

CHAPTER 8

Dimensional drawing



PSC-S44N / PSC-G44N /PSC-GE44N with fixed focus optics



PSC-S44N / PSC-G44N /PSC-GE44N with variable focus optics