PROCESS SENSORS
CORPORATION
a KPM brand

Operation Manual

Models: PSC-SF11N

PSC-G11N

PSC-GEF11N

PSC-SRF11N

Table of contents

General information

We are pleased that you decided for a high quality Process Sensors pyrometer series; PSC-SF11N, PSC-GF11N, PSC-GEF11N & PSC-SRF11N for non-contact temperature measurement.

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

If 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:

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Franlin Lakes,NJ 07417

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www: http://www.processsensorsIR.com

This way, you help us to provide you with the best possible product and correct documentation.

CHAPTER 1

General advice and safety regulations

In this chapter

Intended usage

This device has to be used only for non-contact temperature measurement. If you use the pyrometer not compliant 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 which has got instructions before initial operation and handling. Instructions should be given by a supervisor or optionally by Process Sensors 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 10.

Modifications of the device

It is strongly prohibited to do technical modifications of the device without permission of the manufacturer. Contraventions absolve the manufacturer from liability for any damages. It automatically causes 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 loss of warranty.

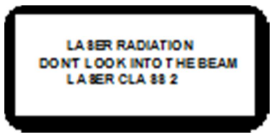
Environmental protection

The lens or its coating may contain harmful materials, which are without danger following the intended usage. The unit may not be disposed of with normal waste, for disposal send the device back to KPM Analytics, 8 Technology Drive, Westborough, MA 01581

Disposal (in accordance with RL2002/96/EC)

Laser operation

Fully mounted units including integrated laser-aiming light or optional laser aiming light adaptor meet the safety requirements of Class 2 and are identified accordingly:



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

Laser class 2:
Safe to the human eye on short exposition due to the eyelid closing reflex (looking into the beam for up to 0.25 s).

CHAPTER 2

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. A slight pollution of 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 Corporation will replace or repair defective parts, which result from design errors or manufacturing faults, within a period of one year 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:

KPM Analytics(KPM) 8 Technology Drive, westborough, MA 01581

The warranty is void if the device is opened, disassembled, modified, or otherwise destroyed, without obtaining prior written approval from PSC. The warranty is also void 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 specifications.

PSC does not accept liability for any damage or losses which might occur, including financial losses and consequential damages, as a result of use of the equipment, or which occurs as a result of 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.

Declaration

Changes in the interests of technical progress or changes that go back to amended statutory provisions stay reserved during delivery time if the delivery item is not substantially changed and therefrom the serviceability is not touched, the value is preserved or increased and the changes are reasonable for the purchaser.

CHAPTER 3

Introduction

In this chapter

Scope of delivery

- PSC-SF11N, PSC-GF11N, PSC-GEF11N, or PSC-SRF11N
- manual
- software PSC Spot
- inspection sheet

Please note: A connection cable, a fiber cable and the optics are not included in the scope of delivery. Please order the necessary parts in the required version separately (please refer chapter Accessories, on page 16).

Application range

The digital PSC 11series pyrometers are especially designed for industrial purposes. These devices are suitable for non-contact temperature measurement starting at 150 °C on many different surfaces such as metals, ceramics, graphite etc.

The rugged housing and fiber optic cable allows for usage even under rough environmental conditions. Measurement of very small objects is possible with small spot sizes from 0.7 mm. The digital PSC-11 series pyrometers have fast response times starting at 2 ms (t_{95}).

The infrared radiation of the measured object will be displayed on a detector and transferred in an electrical signal. This signal will be digitally processed and transferred in the standard temperature linear signal of 0/4 to 20 mA. This allows integration in measuring and controlling systems very easily.

The integrated red laser light is used for aiming the pyrometer (please refer to chapter-5, on page 19). The aiming light pinpoints the center of the measurement field. The blinking of the aiming light validates the operation. The active aiming light has no influence on the measurement result.

The PSC-SF11N/GF11N/GEF11N/SRF11N has an 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. Connect the pyrometer to a computer to adjust emissivity/ratio correction, sub temperature range, data storage settings and response time to the application.

The PSC-SRF11N are digital ratio pyrometers. The pyrometer measures in the ratio methods (2-color method) in which two adjacent wavelengths are used for the temperature determination.

This technique offers the following advantages compared to standard 1-color pyrometers:

- The temperature measurement is independent of the object's emissivity in wide ranges and is unaffected by dust and other contaminants in the field of view.
- The measuring object can be smaller than the spot size.
- Measurements through dirty viewing windows are possible up to a certain contamination.
- Additionally, the pyrometer can be switched to 1-color mode and be used like a conventional pyrometer

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 which 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/. Because the emissivity of a real body is generally dependent on the wavelength too, the spectral range of the used pyrometer has to be regarded as well when using the emissivity charts 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 4

Technical data and accessories

In this chapter

Device data PSC-SF11N, PSC-GF11N & PSC-GEF11N

Device type	PSC-SF11N	PSC-GF11N	PSC-GEF11N
Temperature ranges	600 °C to 1800 °C 800 °C to 2500 °C 900 °C to 3000 °C	250 °C to 1500 °C 350 °C to 2000 °C 250 °C to 2000 °C 400 °C to 2500 °C	150 °C to 1200 °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	20 µm to 2.6 µm
Distance ratio	please refer optics table		
Internal measurement value processing	digital		
Optics (refer table)	FOH I, FOH II, FOH F		
Emissivity ε	0.050 to 1.000		
Response time t95	2 ms (min.), adjustable up to 100 s		
Data storage	minimum/maximum value storage		
Measurement uncertainty [1)]	0.5 % of measured value in °C		0.5 % of measured value in °C + 2 K
Reproducibility [1)]	0.1 % of measured value in °C		0.1 % of measured value in °C + 1 K
Transmittance	50 % to 100 %		
Ambient radiation	adjustable within temperature range		
NETD[1,2)]	0.1 K[1)]		0.5 K
Output	0/4 mA to 20 mA, temperature linear, maximum burden: 500 Ω (galvanically isolated)		
Interface	RS-485 (galvanically isolated), half duplex, max. 115 kBd, Modbus RTU		
Aiming	laser aiming light, 630 to 680 nm, class II, < 1 mW		

Device type	PSC-SF11N	PSC-GF11N	PSC-GEF11N
Switching output/ Switching threshold	1 opto relay, R_{load} min. 48 Ω/ adjustable within temperature range		
Parameters	Adjustable via interface and software or at the device: emissivity, transmittance, ambient radiation, response time, temperature unit °C or °F, data storage settings, sub range of measurement output, switching threshold of the switching output		
Power supply	24 V DC ± 25 %, residual ripple 500 mV		
Power consumption	max. 1.5 W (without load at the switching output)		
Operating temperature	0 °C to 45 °C (electronics), 0 °C to 250 °C (optics), 0 °C to 250 °C (fiber cable), 0 °C to 150 °C (fiber cable with 90° curve)		
Storage temperature	–20 °C to 70 °C		
Weight	approx. 600 g (without fiber cable and optics)		
Housing	aluminum housing with plug connection, display and keys, dimensions approx. 110 mm × 80 mm × 40 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-SF 11N/ PSC-GF 11N/ PSC-GEF11N, manual, inspection sheet, software PSC Spot, **without** connection cable, fiber optic cable or lens assembly		
Factory settings	ε = 1, response time min. (2 ms), transmittance 100 %, sub temperature range = temperature range, delete time off, address 01, 19.2 kBd, output 4 to 20 mA, switching threshold 1000/1010 °C. (other settings on demand)		

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

2) Noise equivalent temperature difference.

Device data PSC-SRF11N

Device type	PSC-SRF11N
Temperature range	700 °C to 1800 °C 800 °C to 2500 °C 900 °C to 3000 °C
Sub temperature range	adjustable within temperature range, minimum span 50 °C
Spectral range	0.7 µm to 1.1 µm
Distance ratio	please refer optics tables
Internal measurement value processing	digital
Optics (refer table)	ROH I and ROH II
Ratio correction K	0.800 to 1.200
Emissivity ε	0.050 to 1.000
Response time t95	5 ms (min.), adjustable up to 100 s
Data storage	minimum/maximum value storage
Measurement uncertainty [1)]	0.5 % of measured value in °C
Reproducibility [1)]	0.1 % of measured value in °C
Transmission of measured distance	50 % to 100 %
NETD[1,2)]	0.1 K[1)]
Output	0/4 mA to 20 mA temperature linear, max. burden: 500 Ω (galvanically isolated)
Interface	RS-485 (galvanically isolated), half duplex, max. 115 kBd, Modbus RTU
Aiming	laser aiming light, 630 to 680 nm, class II, < 1 mW
Switching output/ Switching threshold	1 opto relay, R_{Load} min. 48 Ω/ adjustable within temperature range
Parameters	adjustable via interface and software or at the device: ratio correction, emissivity, transmittivity, response time, temperature unit °C or °F, data storage settings, sub range of measurement output, switching thresholds of switching output
Power supply	24 V DC ± 25 %, residual ripple 500 mV
Power consumption	max. 1.5 W (without load at switching output)
Operating temperature	0 °C to 45 °C (electronics), 0 °C to 250 °C (optics), 0 °C to 250 °C (fiber cables), 0 °C to 150 °C (fiber cable with 90° curve)
Storage temperature	–20 °C to 70 °C
Weight	approx. 600 g (without fiber cable and optics)

Device type	PSC-SRF11N
Housing	aluminum housing with plug connection, display and keys, dimensions approx. 110 mm × 80 mm × 40 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-SRF 11N, manual, inspection sheet, software PYROSOFT Spot, **without** connection cable, fiber cable and optics
Factory setting	ε = 1, K = 1, response time min. (2 ms), transmissivity 100 %, sub temperature range = temperature range, delete time off, address 01, 19.2 kBd, output 4 bis 20 mA, switching threshold 1000/1010 °C. (other settings on demand)

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

2) Noise equivalent temperature difference.

Optics

The device is equipped with a fiber optic cable and an optical lens assembly. The respective optical data is dependent on the core diameter of the fiber cable.

Fiber Optic Cables

Depending on the temperature range a fiber optic cable with a diameter of 200 µm or 400 µm is used (please refer table).

Fiber cables have to be calibrated together with the respective device. They are marked with the same serial number as the device.

Fiber optic cables		
Temperature range		Fiber cable ∅[µm]
PSC-SF11N	600 °C to 1800 °C	200
	800 °C to 2500 °C	200
	900 °C to 3000 °C	200
PSC-GF11N	250 °C to 1300 °C	200
	250 °C to 2000 °C	200
	350 °C to 1800 °C	200
	400 °C to 2500 °C	200
PSC-GEF11N	150 °C to 1200 °C	400
PSC-SRF11N	700 °C to 1800 °C	200
	800 °C to 2500 °C	200
	900 °C to 3000 °C	200

The ambient temperature for fiber optic cable and optical lens assembly must not exceed 250°C (optical head side, FSMA-plug). For fiber optic cables with 90° bend, the ambient temperature must not exceed 150 °C.

Minimum allowable bending radii:

Short-term, local:	50 mm (200 µm fiber)	75 mm (400 µm fiber)
Continuous:	120 mm (max. 50 °C)	> 200 mm (above 50°C)

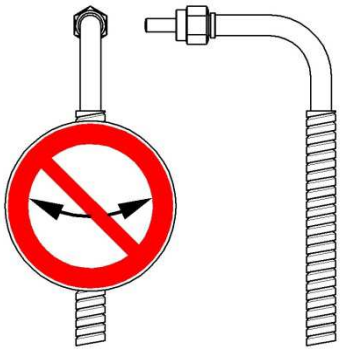
Avoid permanent movements!

(possible bending radius >> 200 mm and free from tension forces)

No tension forces! No knots or tight loops! Do not twist! Do not bend!

Do not lead around sharp corners! Use separate cable ducts and guides to maintain maximum bending radii.

Protect the fiber cable plug always with dust protection caps!



No transverse forces near (< 250 mm) the plugs!

Fiber cables with 90° curve: Tighten the plug on the side of the optical head not before the fiber cable has been protected from transverse forces!

Max. tightening torque of the plugs: 0.2 … 0.5 Nm

Arrest the fiber cable before it is connected to the device or at the optical head.

Arrest freely suspended fiber cables, especially when mounted vertically, every 500 mm!

If the fiber cable is changed, a recalibration is recommended.

Optical heads

Variable Focus Optics FOH and ROH

Variable Focus Optics; FOH II-65, ROH II-65 (**PSC-SRF11N** only)								
Measurement distance a in mm	0	65	85	110	150	200	240	300
Optics pullout b in mm	--	14	11	7	4	2	1	0
Optics length c in mm	--	70	67	63	60	58	57	56
Measuring field diameter M*) in mm								
Fiber optic cable with ∅ 200 µm	9	0.7	0.9	1.1	1.4	1.8	2.1	2.5
Fiber optic cable with ∅ 400 µm	9	1.3	1.7	2.1	2.8	3.6	4.2	5.0

Variable Focus Optics: FOH II-250, ROH II-250 (**PSC-SRF 11N** only)										
Measurement distance a (in mm)	0	250	300	400	600	800	1000	1500	2000	2500
Optics pullout b in mm	--	13.1	12.5	11.0	9.5	8.9	8.5	7.5	7.2	7.0
Optics length c in mm	--	69.5	68.0	66.5	65.0	64.4	64.0	63.5	63.2	63.0
Measuring field diameter M*) in mm										
Fiber optic cable with ∅ 200 µm	9	1.7	2.1	2.7	4.4	5.5	6.8	10	13	17
Fiber optic cable with ∅ 400 µm	9	3.0	3.7	5.0	7.2	9.2	12	18	24	31

Variable Focus Optics ; FOH I-100, ROH I-100 (**PSC-SRF11N** only)									
Measurement distance a in mm	0	100	130	165	225	300	500	700	1000
Optics pullout b in mm	--	5.8	4.0	3.0	2.0	1.3	0.6	0.3	0
Optics length c in mm	--	37.3	35.5	34.5	33.5	32.8	32.1	31.8	31.5
Measuring field diameter M*) in mm									
Fiber optic cable with ∅ 200 µm	6	0.9	1.1	1.4	2.0	2.7	4.5	6.5	9.0
Fiber optic cable with ∅ 400 µm	6	1.8	2.2	2.8	4.0	5.5	9.0	13	18

*) The measuring field diameter M defines a generally circular flat surface of a measuring object of which the radiation sensor receives 90 % 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.

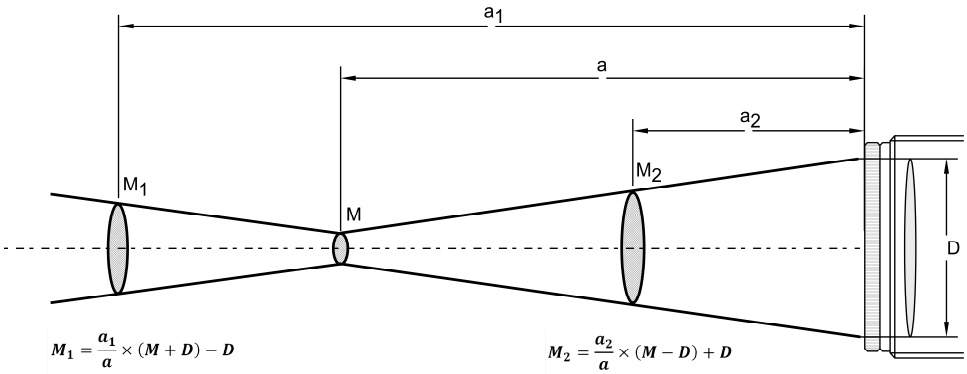
Fixed optics FOH F

Fixed optics type FOH	F-65	F-100	F-200	F-300	F-400	F-600	F-800	F-1000	F-2500
Measuring distance a [mm]	65	100	200	300	400	600	800	1000	2500
	Measuring field diameter M[mm]								
Fiber optic cable with ∅ 200 µm	0.7	1.0	1.8	2.1	2.7	4.4	5.5	6.8	10.0
Fiber optic cable with ∅ 400 µm	1.3	2.0	3.6	3.7	5.0	7.2	9.2	12.0	18.0

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 find 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 have the opportunity to calculate the values with the optional software PSC Spot Pro.

Accessories

Depending on the application in different areas and industrial facilities Process Sensors Corp. offers a wide range of accessories. Accessories can be ordered at any time and installed on site, e.g.

Mounting angle, fixed, for FOH I	PN#: PSC-3310A21510
Angle bracket, adjustable, for FOH II	PN#: PSC- 3310A21520
Mounting angle, fixed, for FOH II	PN#: PSC-3310A21522
Mounting angle, adjustable, for FOH II	PN#: PSC-3310A21523
Ball and socket mounting, for FOH II	PN#: PSC-3310A21521
Air purge adaptor for FOH I	PN#: PSC-3310A22510
Air purge adaptor for FOH II	PN#: PSC-3310A22520
Sighting tube 100 mm for air purge adaptor FOH II	PN#: PSC-3310A22530
Sighting tube 300 mm for air purge adaptor FOH II	PN#: PSC-3310A22535
Mirror 90° for FOH I	PN#: PSC-3310A31020
Screw nut for FOH II with protection window quartz glass	PN#: PSC-3310A34012

Screw nut for FOH II with protection window sapphire glass	PN#: PSC-3310A34013

Connection cable 2 m, straight, 12 pin	PN#: PSC-3310A11111
Connection cable 5 m, straight, 12 pin	PN#: PSC-3310A11112
Connection cable 10 m, straight, 12 pin	PN#: PSC-3310A11113
Connection cable 15 m, straight, 12 pin	PN#: PSC-3310A11114
Connection cable 20 m, straight, 12 pin	PN#: PSC-3310A11115
Connection cable 25 m, straight, 12 pin	PN#: PSC- 3310A11116
Connection cable 30 m, straight, 12 pin	PN#: PSC-3310A11117

Connection cables are also available with:

- angulated plug

Fiber cables for PSC-GEF11N:

Fiber cable 400 µm, stainless steel, 1.5 m	PN#: PSC-3310A44001
Fiber cable 400 µm, stainless steel, 2.0 m	PN#: PSC-3310A44002
Fiber cable 400 µm, stainless steel, 2.5 m	PN#: PSC-3310A44003
Fiber cable 400 µm, stainless steel, 5.0 m	PN#: PSC-3310A44004
Fiber cable 400 µm, stainless steel, 7.5 m	PN#: PSC-3310A44005
Fiber cable 400 µm, stainless steel, 10 m	PN#: PSC-3310A44006
Fiber cable 400 µm, stainless steel, 15 m	PN#: PSC-3310A44007

Fiber cable 400 µm, stainless steel, 90°, 1.5 m	PN#: PSC-3310A44011
Fiber cable 400 µm, stainless steel, 90°, 2.0 m	PN#: PSC-3310A44012
Fiber cable 400 µm, stainless steel, 90°, 2.5 m	PN#: PSC-3310A44013
Fiber cable 400 µm, stainless steel, 90°, 5.0 m	PN#: PSC-3310A44014
Fiber cable 400 µm, stainless steel, 90°, 7.5 m	PN#: PSC-3310A44015
Fiber cable 400 µm, stainless steel, 90°, 10 m	PN#:PSC-3310A44016
Fiber cable 400 µm, stainless steel, 90°, 15 m	PN#: PSC-3310A44017

Fiber cable for PSC-SF11N, PSC-GF11N & PSC-SRF11N:

Fiber cable 200 µm, stainless steel, 1.5 m	PN#: PSC-3310A42001
Fiber cable 200 µm, stainless steel, 2.0 m	PN#: PSC-3310A42002
Fiber cable 200 µm, stainless steel, 2.5 m	PN#: PSC-3310A42003
Fiber cable 200 µm, stainless steel, 5.0 m	PN#: PSC-3310A42004
Fiber cable 200 µm, stainless steel, 7.5 m	PN#: PSC-3310A42005
Fiber cable 200 µm, stainless steel, 10 m	PN#: PSC-3310A42006
Fiber cable 200 µm, stainless steel, 15 m	PN#: PSC-3310A42007

Fiber cable 200 µm, stainless steel, 90°, 1.5 m	PN#: PSC-3310A42011
Fiber cable 200 µm, stainless steel, 90°, 2.0 m	PN#: PSC-3310A42012
Fiber cable 200 µm, stainless steel, 90°, 2.5 m	PN#: PSC-3310A42013
Fiber cable 200 µm, stainless steel, 90°, 5.0 m	PN#: PSC-3310A42014
Fiber cable 200 µm, stainless steel, 90°, 7.5 m	PN#: PSC-3310A42015
Fiber cable 200 µm, stainless steel, 90°, 10 m	PN#: PSC-3310A42016
Fiber cable 200 µm, stainless steel, 90°, 15 m	PN#: PSC-3310A42017

Fiber optic cables with vacuum feed through are available on request.

CHAPTER 5

Installation and initial operation

In this chapter

Preparation

The pyrometer position and the respectively adjustable parameters are determined by the application. Please factor in ambient temperature, environmental conditions and potential occurrence of electromagnetic interferences when placing the pyrometer.

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 16). A water connection (water pressure max. 10 bar) is needed for the cooling jacket.

Environmental 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 be the result. An air purge unit (see chapter Accessories, on page 16) 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 beyond 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 16.
- Make sure that the Pyrometer is grounded properly.
- To avoid ground loops please connect only the cable shield or the ground of the pyrometer.

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 16.

Technical personal requirements

Qualified technical personnel should perform the installation. Please follow the instruction in this manual when installing the pyrometer.

Advice: We only recommend qualified personnel to operate the pyrometer. Process Sensors Corp. will not cover damages caused by improper installation of non-qualified technical personnel.

Mechanical installation

The housing of the pyrometer can be mounted with two screws (M4). Mounting angles for the optical head are available (please refer chapter Accessories on page 16).

Connecting cable

Please only use our connecting cables which have been made up in advance. The cables are available in different lengths (please refer chapter Accessories, on page 16). This ensures that the standards concerning EC Declaration of Conformity and safety class guidelines are followed.

Connection of optical lens assy. & fiber optic cables

Please remove the protection caps of the fiber optic cable, Lens assembly and pyrometer first. Then connect the marked end of the fiber optic cable (DIN plug with distortion lock) onto the pyrometer. The other end of the fiber optic cable (FSMA plug) has to be screwed onto the optical Lens assembly. You can mount the Lens assembly with the help of an optional mounting accessory.

Note: When laying the fiber optic cable please insure that the minimum bending radius does not get exceeded (please refer chapter Fiber Optic Cables on page 14).

Alignment of the Pyrometer

The device is equipped with an integrated laser aiming light for the exact alignment on the measurement object (laser: 630 to 680 nm, class II, < 1 mW).

The laser aiming light is focused when the laser is at a sharp point. It represents the center point of the measuring field. The blinking of the aiming light indicates that the sensor is operable. The active aiming light has no influence on the measurement result.

The laser aiming lights automatically turns off after 120 seconds to avoid overheating and damage.

Adjustment of the optical head

1. Plug in and tighten the fiber optic cable
2. Start up the pyrometer, laser light is on
3. Align the optics to the measurement object
4. Loosen rear ring nut on lens assembly
5. Hold screw connection of the fiber optic cable
6. Adjust housing pullout/length until the desired length is reached or the aiming light represents the desired measuring field (please refer chapter Optics on page 14)
7. Tighten ring nut

Turning on the Laser Light

There are three different possibilities to turn on the laser light:

via  button
via external pin (pin H bridged with pin K +24 V)
via software PSC Spot

The status of the laser light is displayed as follows:

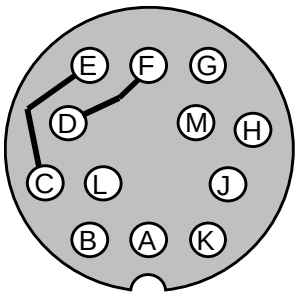
not active: 

and active: 

(blinking)

Connections

Pin		Description	Wire color
12 pin connector	K	+24 V DC	white
	A	0 V DC	brown
	L	+ analog output 0 or 4 to 20 mA	green
	B	─ analog output 0 or 4 to 20 mA	yellow
	H	pyrometer option: external pilot light switch	gray
	J	pyrometer option: external clearing of maximum value storage, switching output	pink
	F	D+ RS-485	black
	C	D─ RS-485 (twisted pair)	violet
	D	D+ RS-485 internally bridged with F	gray/pink
straight connector: P/N 99-5630-15-12 angled connector: P/N 99-5630-75-12	E	D─ RS-485 internally bridged with C (twisted pair)	rot/blau red/blue
	G	GND RS-485	red
	M	screen (only for cable extension)	green/yellow



12-Pin Connection Cable

Please note: Please install the driver so the pyrometer can be detected correctly. Please refer chapter 6, on page 34.

Initial operation of the pyrometer

Connecting the pyrometer

For pyrometers operation of: PSC-SF11N/PSC-GF11N/PSC-GEF11N/PSC-SRF 11N a D.C. voltage of 24 V DC ± 25 % is required.

Please note: The operation of the pyrometer is only allowed in the defined voltage limits.

Please put the connecting cable in the 12-pin connector at the back side of the pyrometer and connect the other end of the cable to a 24 V DC power supply.

Please note: The device does not need a heating up time or start-up time. It is ready for operation immediately.

To meet the requirements of the electromagnetic compatibility all connecting cables should be shielded.

The shield of a 12 wire connecting cable is connected at pyrometer side only. At cable extensions the shield has to be extended too.

Functional principle

The PSC-SF11N, PSC-GF11N, PSC-GEF11N & PSC-SRF11N operate as a 4-wire sensor system. Besides the wires for the power supply, there are two more wires for transmitting the measuring signal. The infrared radiation of the measured object will be displayed on a detector and transferred in an electrical signal. This signal will be digitally processed and transferred in the standard temperature linear signal of 0/4 to 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 500 Ω.

Additional equipment like a digital display or a controller that processes the output signal 0/4 to 20 mA have to be connected in series between pin L (I+, green lead of the optional connection cable) and pin B (I–, yellow lead) of the pyrometer.

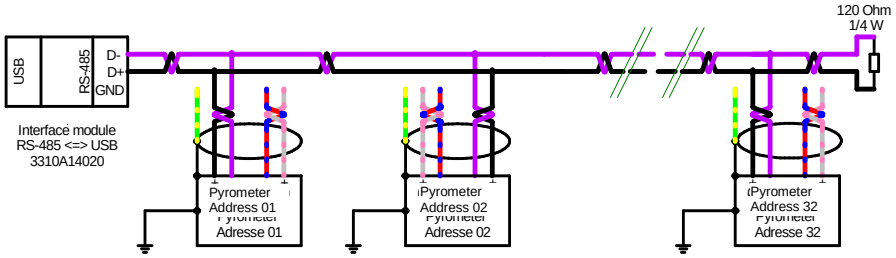
Connection of the pyrometer to RS-485

Please note that the pyrometer have to be addressed separately before connection. This is done with the help of the display and the buttons on the device. Every pyrometer must have a different address. The address 00 is forbidden 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. T**his 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. The applying of 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!

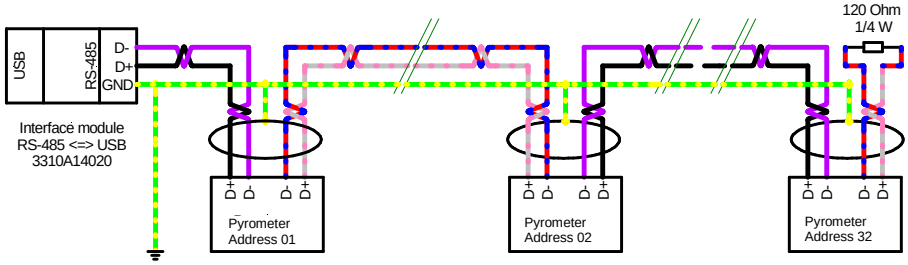
All stations in one segment should be ideally connected in series in a linear BUS. So the cable is looped through from station to station. Branch lines (T-pieces, branch connections) should be avoided but are possible for short distances (see figure).



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

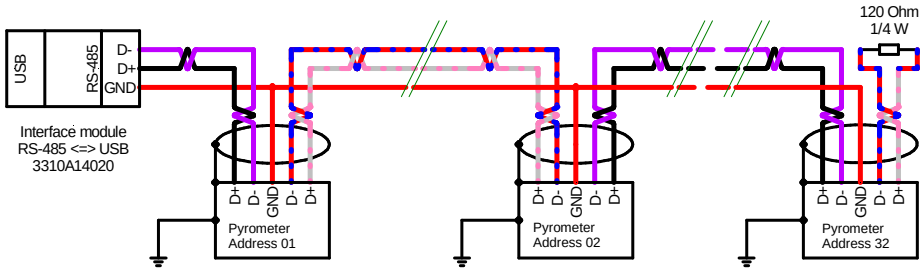
Please note the **maximum length of 3 m** for branch lines.

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.



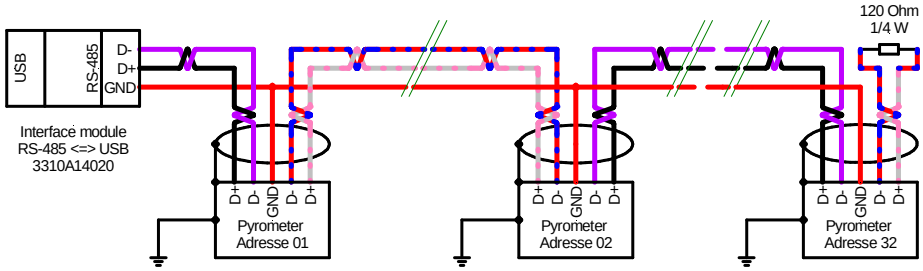
Schematic of a linear RS-485 bus with several pyrometers

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



Schematic 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.



Schematic of a linear RS-485 bus with several pyrometers

Pyrometer Address 01 Pyrometer Address 02 Pyrometer Address 32

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 or display and keys:

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. Emissivity charts can be found in literature /4/. Because the emissivity of a real body is generally dependent on the wavelength too, the spectral range of the used pyrometer has to be regarded as well when using the emissivity charts in citation.

You can adjust the emissivity of the pyrometer models PSC-SF11N, PSC-GF11N, PSC-GEF11N & PSC-SRF11N in the range from 0.050 to 1.000. Please note that an incorrectly set emissivity can lead to incorrect measuring results. The result of the adjustment is directly indicated on the temperature display.

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

Transmissivity

If you measure through a window, e.g. a vacuum flange, the signal attenuation can be balanced with this parameter. The transmission value of the window material is specified in percent %. The effect of the adjustment can be directly traced in the display of the temperature display.

Ambient radiation (not for PSC-SRF11N)

All measuring objects with an emissivity of < 1 reflect external radiation from their ambience. In this way the measuring signal gets falsified. The ambient compensation prevents this influence.

In doing so the ambient temperature of the measuring object is specified (within the temperature range). The result of the adjustment is directly indicated on the temperature display.

Response time t_{95}

The pyrometers response time characterizes the time span in which the measured temperature during erratic variation has to 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 10 ms and is set by the value "min". Different response times can be adjusted up to 100 seconds.

Sub range

You can set a sub-range temperature range for the pyrometer. The sub-range temperature reduces the span of the overall temperature range and is limited to a minimum temperature span setting of 50 °C. This range limits only the scaling of the current output. The lower value refers to 0/4 mA and the upper value to 20 mA.

As described in chapter "Maximum and minimum value storage" below, the changing of the sub range cab be used as well for parameterization of the maximum value storage in mode **auto**.

Maximum and minimum value storage

Adjustment at pyrometer: **"Memory type = OFF"**

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

Adjustment at pyrometer: **"Memory type = Valley memory"**

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: **“Memory type = Peak memory”**

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.

If the operating mode valley/peak memory is chosen, you can adjust the following parameters in menu “**Clear time**”:

Adjustment at pyrometer: 5 ms ... 100 s

The extreme value is detected in a double storage that gets cleared alternately after the adjusted time. So the not-cleared data storage keeps its value for one more cycle time. Measurement value drops at clear time are avoided in this way.

Adjustment at pyrometer: **ext. contact**

Select external deletion

The deletion of the data storage is done with an external contact 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 20.

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

Adjustment at pyrometer: **auto clear**

Select auto deletion – 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.

Analog 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	$MBU = MBE - MBA$

Ratio correction K (PSC-SRF11N only)

Ratio/ 2-color pyrometers measure the radiation signal in two different wavelengths. These wavelengths are short and very close to one another. The ratio of the radiation of both signals determines 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 adjustment has a large influence on the measurement result, so changes should be made in small steps. The temperature result is shown on the temperature display.

Switching threshold of the switching output

The device has a switching output. The response time of the switches accords to the response time t_{95} of the device. Via an opto relay the power supply (+24 V) is switched on between pin J of the circular plug connector. The appliance that has to be switched has to be connected between pin J and pin A (0 V). The maximum allowable current caused by the appliance must be 500 mA. This accords to the minimum lead resistance of 48 Ω at a power supply of 24 V.

You can adjust a switch-on and a switch-off threshold for the switching output.

The following switching conditions are possible:

$T_{on} > T_{off}$: Switch **closes when exceeding** the switch-on threshold

and **opens when below** the switch-off threshold

$T_{on} < T_{off}$: Switch **closes when below** the switch-on threshold

and **opens when exceeding** the switch-off threshold

The deviation between switch-on and switch-off temperature equates to the hysteresis.

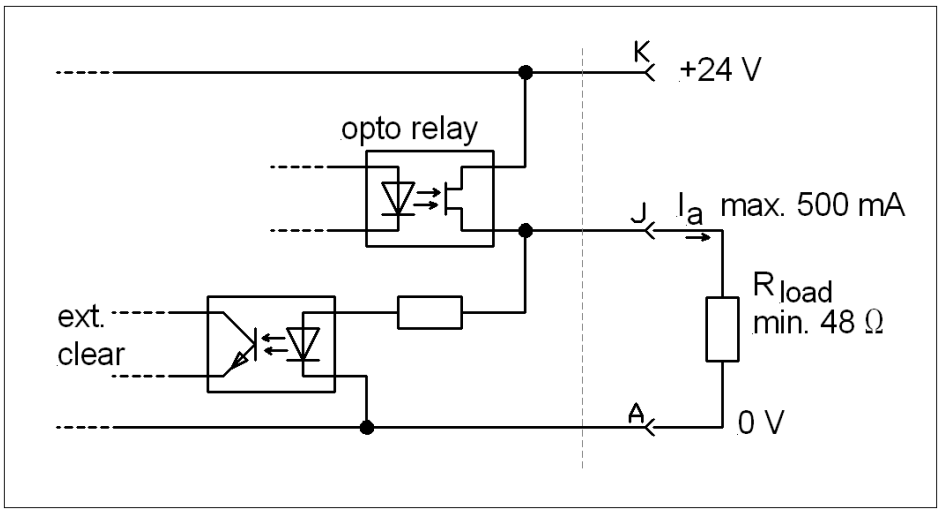
The current status of the switching output is displayed as follows:

 status OFF, no voltage on pin J

 status ON, +24V on Pin J

ATTENTION!

> Though pin J also serves as external deletion input of the maximum/minimum value storage, this function of the switching output is not activated in operation mode "ext. contact".
>
> This status is displayed with the symbol  .


K
+24 V
opto relay
J
Ia
max. 500 mA
Rload
min. 48 Ω
ext.
clear
A
0 V

Operation, display and menu

Informational displays

Some information about the device can be viewed by using special assignment of keys.

In the large display, keep the ENTER button and the PAR button pressed for approximately 2 seconds.

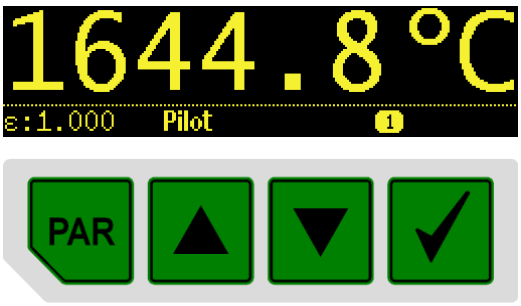
Additional menu 1:
Current device temperature
Maximum registered device temperature
Operating hours counter

In the large display, keep the ENTER button and the UP button pressed for approximately 2 seconds.

Additional menu 2:
Device name
Item number and serial number

The menu returns to the large display after approximately 4 seconds.

Large display PSC-SF11N, PSC-GF11N & PSC-GEF11N

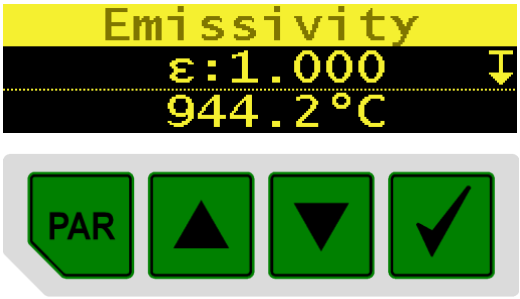


Possible actions:

- Switch aiming light– activated aiming light is blinking in the display:
  

  (aiming light switches off automatically after 120 seconds)
- Change to parameter display

Parameter display PSC-SF11N, PSC-GF 11N & PSC-GEF11N



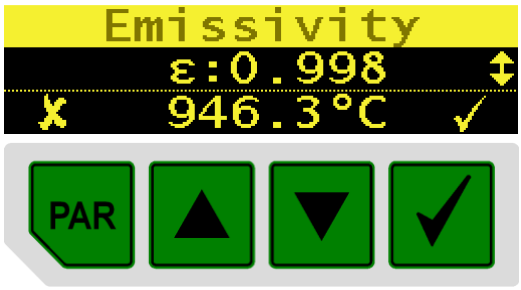
Possible actions:

- Change to next parameter.
  If the current parameter is changed, the change gets dropped.
- Changes parameter within allowable range.
  Parameter changes are marked with and in the display and demand to drop or to save the change.
  Changes of emissivity, transmissivity and ambient radiation are included in the temperature display immediately but are not saved yet.
  The following symbols next to the parameter mark the possibilities of changing the value:

  Parameter has maximum value and can be decreased only

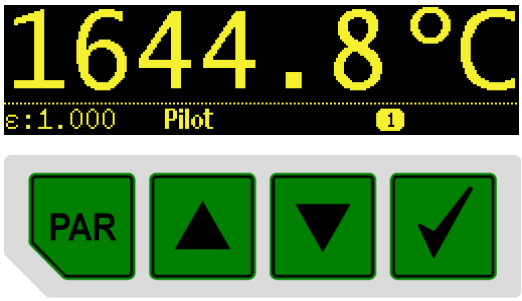
  Value can be decreased and increased

  Parameter has minimum value and can be increased only



-  If the current parameter has not been changed, the menu changes to the large display.
  If the current parameter has been changed, the change is saved and the menu changes to the next parameter.

Menu plan PSC-SF11N, PSC-GF11N & PSC-GEF11N



Emissivity

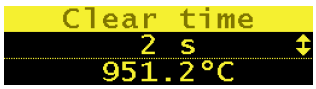
Transmissivity

Ambient radiation

Response time

Memory type

(only for clear time, peak/valley memory)



Analog output

Sub range start

Sub range end

Switch-on threshold *)

Switch-off threshold *)

RS-485 address

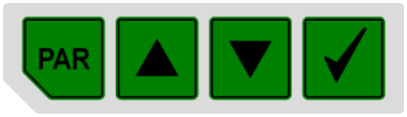
RS-485 baud rate

Display unit

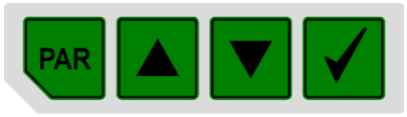
*) Menu is not displayed when maximum/minimum value storage in operation mode "ext. contact" is chosen

Large display PSC-SRF11N

(Single mode)



(Ratio mode)



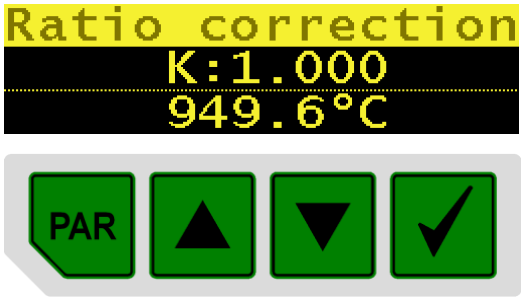
Possible actions:

-  Switch aiming light – activated aiming light is blinking in the display:

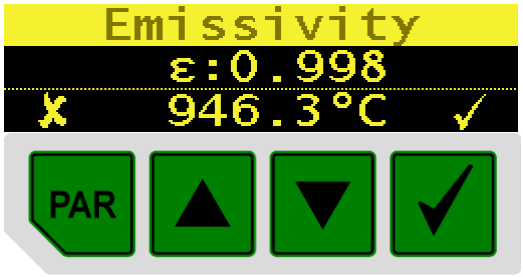
  (aiming light switches off automatically after 120 seconds)
-  Change to parameter display

Parameter display PSC-SRF11N



Possible actions:

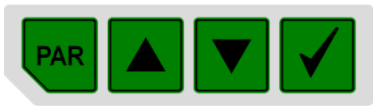
- PAR Change to next parameter.
  If the current parameter has been changed, the change gets dropped.
- Changes parameter within allowable range.
  Parameter changes are marked with ✗ and ✓ in the display and demand to drop or to save the change.
  Changes of ratio correction, emissivity, transmissivity and ambient radiation are included in the temperature display immediately but are not saved yet.
- The following symbols next to the parameter mark the possibilities of changing the value:
- Parameter has maximum value and can be decreased only
- Value can be decreased and increased
- Parameter has minimum value and can be increased only



- ✓ If the current parameter has not been changed, the menu changes to the large display.
  If the current parameter has been changed, the change is saved and the menu changes to the next parameter.

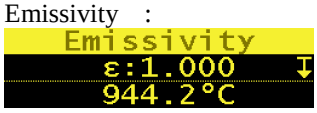
Menu plan PSC-SRF11N

(Single mode)



(Ratio mode)

Emissivity :



Ratio correction

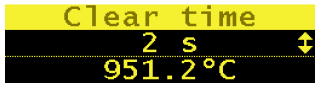
(dependent on measurement mode)

Transmissivity

Response time

Memory type

(only available for clear time, peak/valley memory)



Analog output

Sub range start

Sub range end

Switch-on threshold *)

Switch-off threshold *)

RS-485 address

RS-485 baud rate

Display unit

Measure mode

*) Menu is not displayed when maximum/minimum value storage in operation mode "ext. contact" is chosen

CHAPTER 6

Software PSC Spot

The software PSC Spot 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 PSC Spot Pro is available optionally.

In this chapter

Installation of software

Before connecting the pyrometer, install in first step the software and drivers, 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:

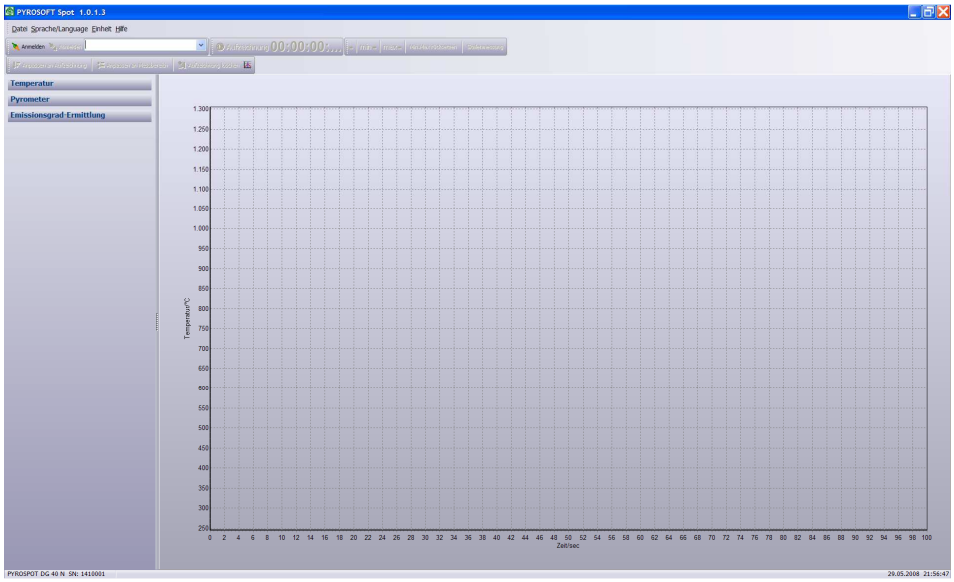
Found new hardware

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 Software



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 7

EG Declaration of conformity

For the product identified as follows:

PSC-SF11N, PSC-G11N, PSC-GEF11N, PSC-SRF11N

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:

2004/108/EC (electromagnetic compatibility)

and

2006/95/EC (electrical equipment designed for use within certain voltage limits)

For the assessment of the product following standards have been considered:

EN 61326-1

EN 61010-1

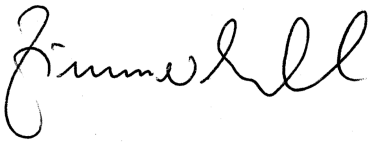
The manufacturer or importer is responsible for this declaration

Process Sensors Corporation
787 Susquehanna Ave
Franklin Lakes, NJ 07417

Date: 09/15/2010

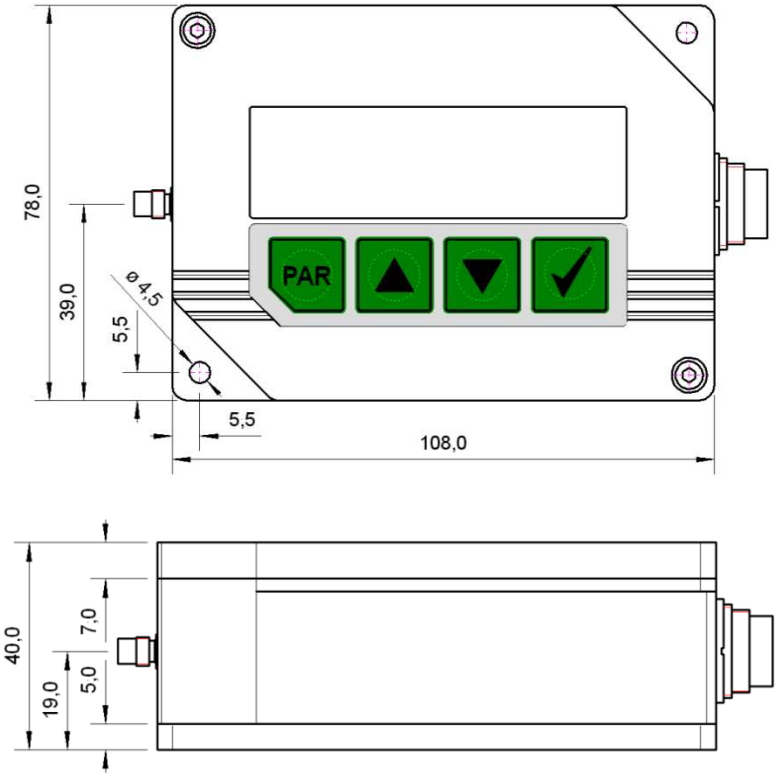
Issued by:

Dr. Zimmerhackl, Manfred
Quality Manager

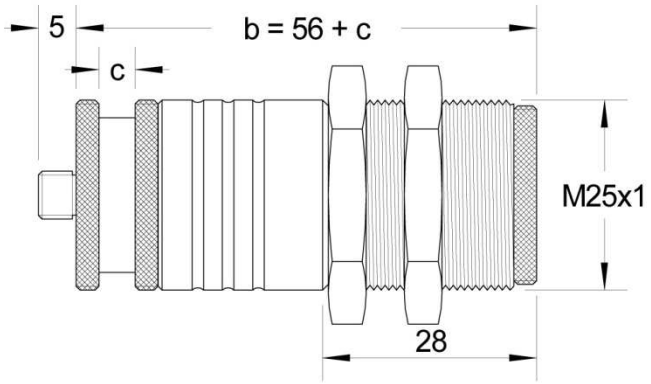


CHAPTER 8

Dimensional drawing (in mm)



Optical Lens Assembly FOH II and ROH II



Optical Lens Assembly FOH I and ROH I