

SYSTEM 3000

UV/VIS-RADIATION PYROMETER SPM U16W

OPERATING INSTRUCTIONS

EDITION: TB SPM U16W EN REV 4

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UV/VIS-Radiation Pyrometer SPM U16W

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1. Application

An essential component for controlling a waste incineration is the combustion control system. It handles inter alia, Process parameters such as steam flow, and the flue gas parameters temperature, oxygen content and concentration of pollutants. Fully automatic process control systems take over, inter alia, regulating the amount of primary air in the main combustion zone. Optimized burn-out control the production of CO and NO_x is considerably reduced. The furnace emissions are equalized and so busy the downstream flue gas cleaning facilities optimally.

In the control concept as well as events occurring after the Annual General combustion must be included. So often occur secondary effects such as emaciations to the finned walls immediately above the stampings on. They are the result of incomplete combustion that attack by corrosive gases (radicals) from lack of oxygen pipelines. You will be deprived of bound oxygen, which can embrittle the steel or lead to large-scale erosion.

To avoid this availability restrictive and costly corrosion, post-combustion air must be supplied specifically. This should be such that these effects are currently being prevented, without affecting the overall balance of the air guide disadvantageous. Used for this purpose, the UV radiation pyrometer SPM. It takes the primarily emitted by radicals flame radiation, which causes emaciations on, and brings them to the display. Thereafter, the secondary air can now be controlled, which ensures complete combustion. Corrosion of system components will be efficiently reduced.

2. Function

The UV/VIS radiation pyrometer **SPM** utilizes the integrating UV radiation analysis. The collected from its optical radiation is applied to the ultraviolet-sensitive photo-element, which is sensitive only to the desired band radiation by spectral filtering. Here, the range of 350-550 nm of the chemiluminescent radiation of the intermediate products of combustion is judged. It corresponds to the quantitative emission of radicals such as CH, CN, C₂ and CO. These substances are chemically active and therefore responsible for corrosion. The radiation power is converted by the radiation pyrometer SPM into an electrical signal. By the choice of the spectral sensitivity in the UV radiation band the background radiation of linings and the grate itself is hardly included because at these wavelengths the proportion of the inevitable black-body radiation is still low. The targeted burn-out control by secondary air control can be done efficiently. In this new process the total air is less needed because it can be used for targeted total combustion. The residence time of the flue gases in the radiation pass increases, the exhaust gas loss decreases. The average combustion chamber temperature increases, thus leading to the reduction of emissions by avoiding temperature peaks. The flame strike-through in the radiation pass is controllable, improves the maximum heat release and raises a total plant efficiency.

Because the radiation of the flame is rising with an exponent of 2 to 4 of the temperature, the **SPM** processes the signal with a logarithmical characteristic field. This guarantees a very wide dynamic scanner range. For this reason, the **SPM** can be used in each zone and intensity of the incineration process. SPM processes the input signal according to a logarithmic characteristic. This produces a dynamic range of the sensor is achieved, which allows the observation of a very large intensity range of the chemiluminescent radiation. Simplified the SPM can be compared with a spectral pyrometer that works rather than in the visible or infrared radiation in the UV band. But there is not the usual correction of the emissivity of the measured object and linearization of the T⁴ behavior. When SPM is deliberately avoided to a temperature calibration and linearization, since the measured band radiation is not a measure of the temperature but the intensity of the radicals. Instead, the user can define the lower range limit (background radiation = offset) and span (difference = radiation gain) even locally. Thus, the zero point and the scale value to local conditions (installation, firing system) can be set. The signal processing time (setting time) can be selected to be adapted to the given control systems.

3. Operation mode

The **SPM** provides the output signal as mA-signal and a frequency signal.

- **Operation mode frequency output**
The version with frequency output is only possible in conjunction with the flame detector 3001 MS.

NOTICE

The analogue output of the SPM can't be used if the Back Panel 3001 is used!

- **Operation mode analogue output**
The version with analogue output needs no additional devices. The signal can be sent directly to the PCS.

4. Mounting

Mounting is via a viewing tube of sufficient diameter so that the unobstructed view of the sensor is given fully in the firebox. Depending on the required sight tube length, the sight pipe diameter should be selected according to the opening angle of the SPM used. The radiation pyrometer SPM U16W is equipped with an optical system that provides a viewing angle of 16 degrees. Accordingly, the following table applies to the interpretation of the sight pipe diameter.

Diameter in Zoll / mm	Length in cm
1 / 25,4	15
1,5 / 38,1	20
2 / 50,8	25
3 / 76,2,	30
4 / 101,6	40

The radiation pyrometer is supplied with a quick release, which has a 1" pipe mount according to DIN ISO 228. It may thus be screwed directly onto the sight pipe. To compensate for pipe fitting error or set the optimal viewing direction during commissioning, a swivel mount is recommended. Is there a danger that conceded operating temperature of the SPM (60 ° C) by the heat conduction of the pipe cannot be met, the installation of a heat insulator is made for cooling and flushing (keeping the optics in use in dust-laden atmosphere) of the SPM, the quick release has also a 1/2" connection for a flushing medium. Here should be 10-15 m³ / h to be abandoned.

⚠ DANGER

In the event that penetration of hot or poisoned gas may be possible due to a removal of the SPM from the fast coupling device, the 1/2" coupling has to be closed and a valve should be integrated into the viewing pipe. A 3-way valve is recommended to continue the maintenance of the purging air and to ensure the cooling of the whole device.

The mentioned devices can be supplied by **BFI Automation**.

5. Installation

The radiation pyrometer is equipped with a robust standard industrial connector. To exclude the effects of interference on the signal transmission between the **SPM** and the flame detector, the use of the **BFI special cable KW 5** is recommended. The cable is halogen-free, thermally stable and resistant, and to acids, alkalis and oils largely resistant. It is performed in a double RF shield with 6 individual wires of which two are implemented as separately shielded data lines.

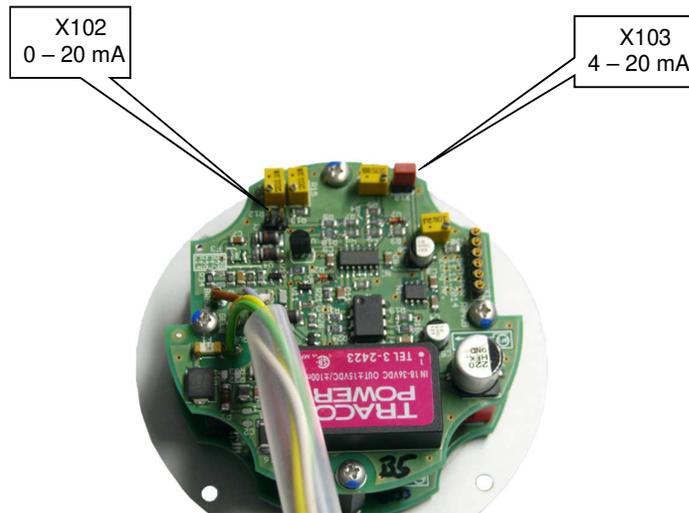
Important installation notes:

- The connecting cable is spatially separate entity of high-energy ignition and power lines over longer distances and not parallel to it.
- The RF cable shield must be low impedance, can be connected via the housing of the plug connector, the radiation pyrometer.
- The laying of the connection cable has to be done to the device connection plan in accordance with the VDE regulations.
- With the BFI special cables, distances between radiation pyrometer and signal acquisition of up to 500 meters without line driver can be realized.
- The radiation pyrometer is by following a hedged direct voltage of 24 V for immediate use. A preheating is not necessary.
- Set the measuring range is carried out in **SPM**. For this purpose, the device may need to be open when de-energized.
- The entire structure of the radiation pyrometer is fully electronic. Wear parts are not available. Maintenance of the equipment is not required.
- Further characteristics are given in the technical data.

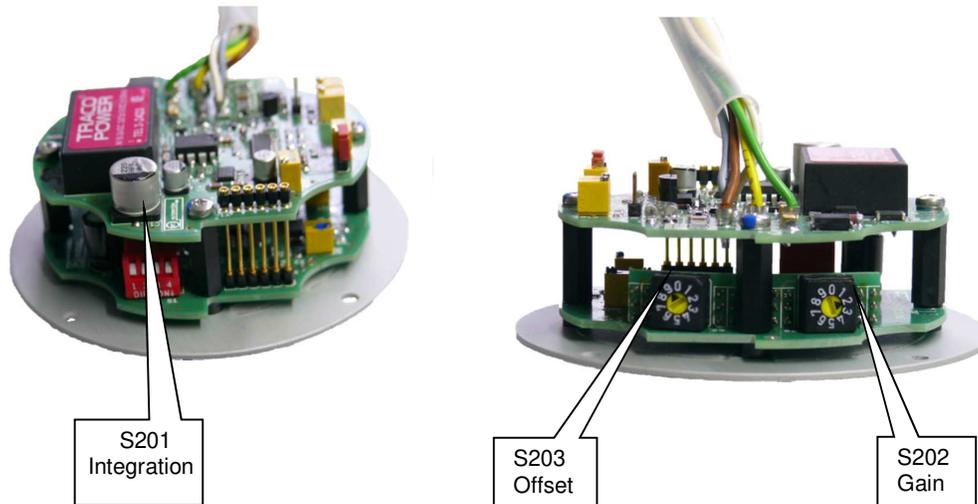
6. Setting of the device

To change the settings of the device, it is necessary for the device to open it. First disconnect the **SPM** of the cable and then disconnect the device from the purge air flange. Insert the radiation pyrometer on a flat situation and loosen the 4 screws of the lens sheet. The entire device chassis can now drag from the protective housing. It consists of a multi-disk assembly, in which the rearmost board carries the adjusters. With the help of a switch setting in the desired direction is to be performed (see output characteristics of field). The chassis is to use back in the housing, taking care to correctly position in the guides. If the electronics secured by the screws in the lens plate, the radiation pyrometer can be re-installed and connected.

The analog output can be adjusted to 0 -20 mA or 4 – 20 mA via jumper. Use only jumper X102 **or** X103.



7. SPM-Chassis and control board



Offset

to mask unwanted background radiation or a continuous signal at high gain selected.
The adjustment is made at the switch S203:

Position 0 = maximum back ground compensation (+ 0 dB)
Position 3 = middle back ground compensation (- 40 dB)
Position 9 = no back ground compensation (- 120 dB)

Factory setting = 9

Gain

for adapting the radiation power which is built over signal level.
The adjustment is made at the switch S202:

Position 1 = small signal steepness for big radiation changes (120 dB)
Position 4 = middle signal steepness for middle radiation changes (40 dB)
Position 9 = big signal steepness for small radiation changes (15 dB)

Factory setting = 2

Integration

for damping the output signal to optimize triggering of the control

Switch 1 = 10 seconds (setting time for 0 to 90 % output)
Switch 4 = 0.5 seconds (setting time for 0 to 90 % output)

Factory setting = 110 seconds (see also table on page 8)

8. Basic adjustment

After correct installation and electric connection, the radiation pyrometer is ready for operation immediately. For the adaptation to the resp. task, three parameters can be adjusted at the device independently from each other.

- the Gain (S202)
- the Offset (S203)
- the Integration time (S201)

The radiation pyrometer is factory set to a mean gain (2) at zero position min (9). When settling the maximum time constant, DIP switch 1-4 are selected to "ON". If this basic setting does not lead to the desired results, an appropriate parameterization of the SPM must be done. First, do not change the response time (S1), because the reading of the output intensity is easier by the large factory time constant. Adjust the zero position (offset) to the background signal that you want to hide. For this purpose a switch with 10 positions is available. If the desired setting was found under the help of the output characteristic, the gain is selected in the same way. Finally, shortening the response time to match existing control loops is possible (see table below).

9. Setting adjustment

The functioning of the gain and offset can be taken from the output characteristics. Each offset chosen for the fade out of the background signal, results into 10 fan-out curves for the gain. In case of strong amplification (gain = 9) the radiation energy is already achieved through a slight change to the maximum output signal of the **SPM**.

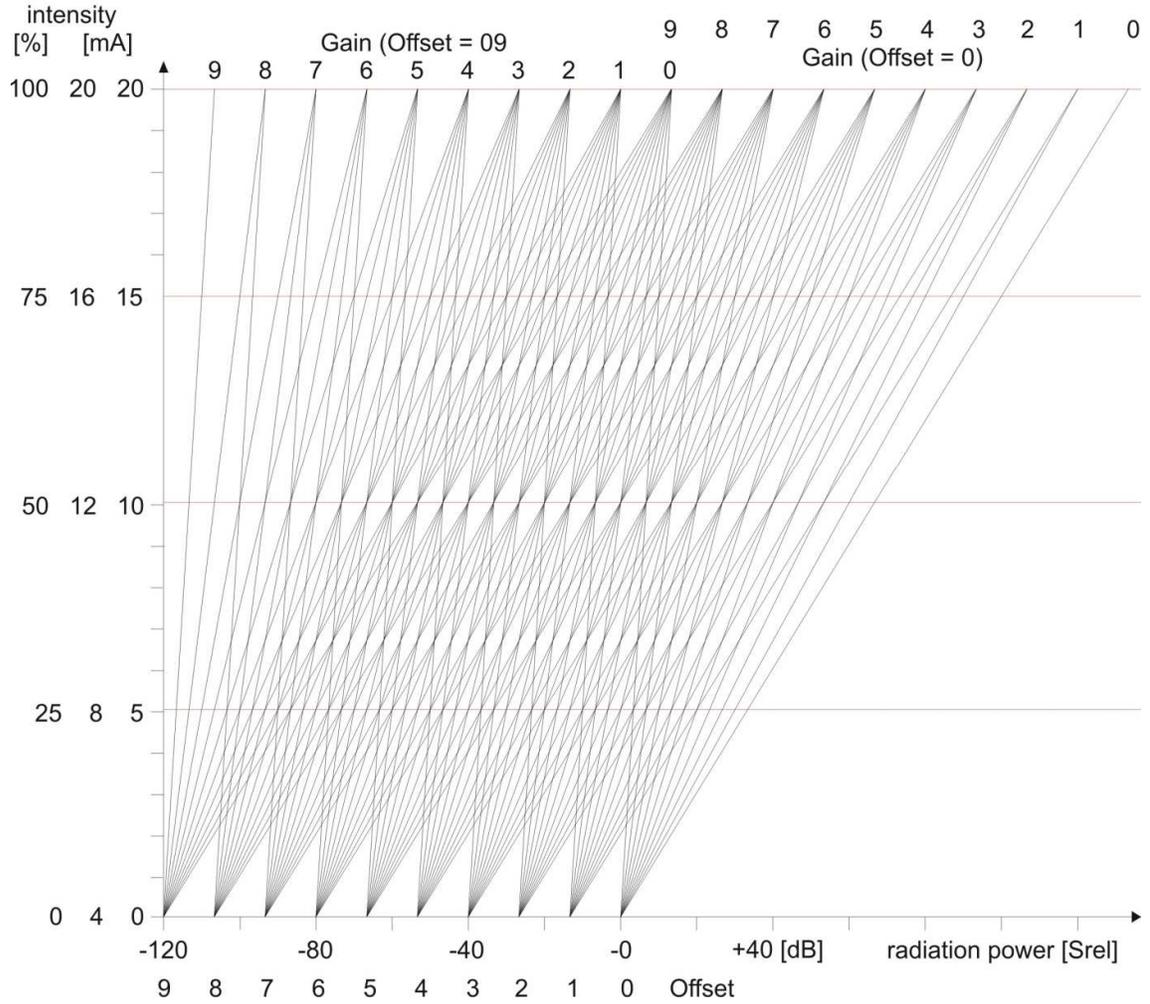
In case of considerable differences in the radiation energy resulting from the chosen lay-out of the **SPM**, it is recommended to chose a slight amplification only, thus achieving a slighter increase. The radiation energy can then be displayed over more than 6 decades (120 dB = 100.000)

By using the time information of the **SPM** output signal the adaptation to the available control system and the dynamic potentiometer is easily achieved. In case that immediate **SPM** reaction to a speedy change of radiation should become necessary, a shorter adjustment time should be chosen. For potentiometers with a longer time delay it would be advisable to use a slow-changing output signal achieved by a longer **SPM** integration time

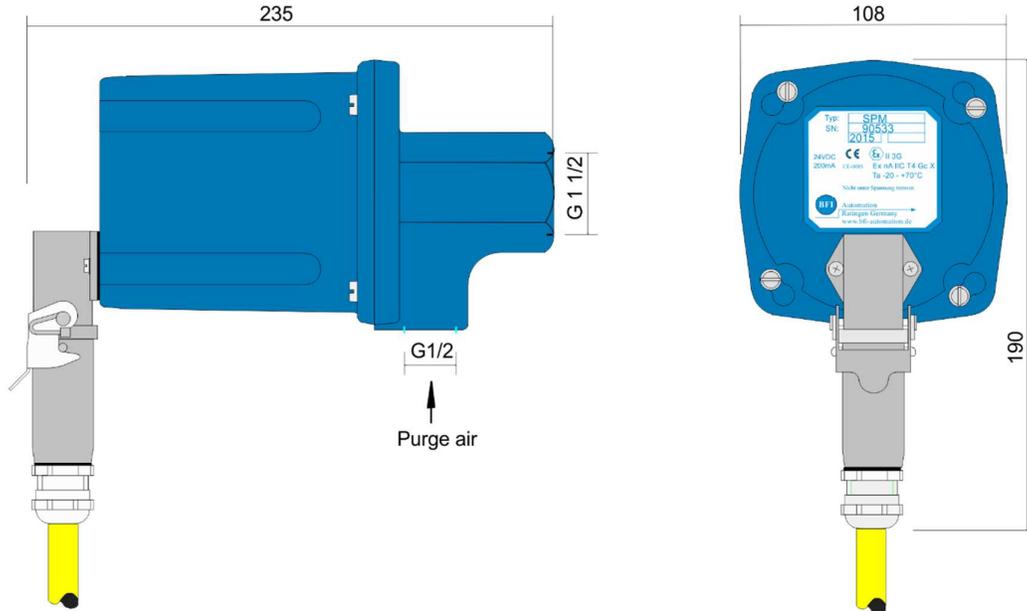
The available time factors can be taken from the stated below diagram:

DIP-Switch S201				Time [s]	Time [s]
1	2	3	4	0 - 90 %	0 - 99 %
				110	220
■				10	20
	■			4,9	9,8
		■		1,1	2,1
			■	0,54	1,1
■	■	■	■	0,33	0,65

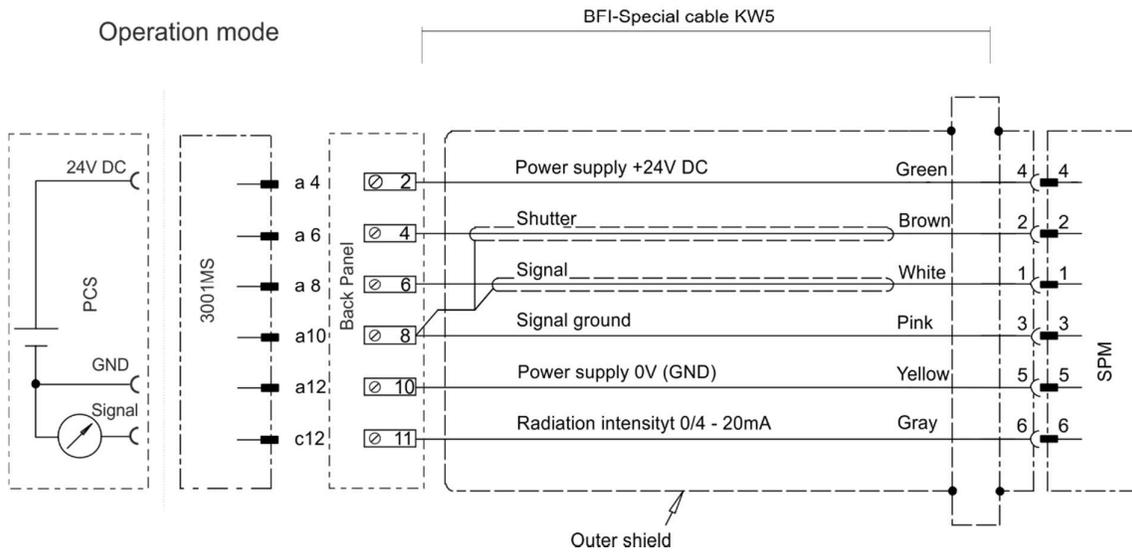
10. Characteristic field



11. Dimensions



12. Connection plan



Terminal	Function	Wire colour
1	Signal	Wh
2	Shutter	Br
3	Signal ground	Pk
4	Power supply +24VDC	Gn
5	Power supply GND	Ye
6	0/4-20mA output signal	Gr

13. Technical data

Settings	offset and gain adjustable in 10 steps and integration time in 6 steps
Spectral sensitivity	350 to 550 nm
Object of detection	CN, CH, C ₂ , CO, CO ⁺
Viewing angle	16 °
Lens type	Borosilicate
Operating voltage	24 VDC
Current consumption	max. 200mA
Ambient temperature	-20 to +70 °C
Electric connection	dust-proof plug connector
Protection	IP 65
Ex zone	II 3 G Ex nA IIC T4 Gc X (zone 2)
Length of cable	max. 500m (KW 5)
Sight tube connection	1" internal thread ISO 228
Purging air connection	1/2" internal thread ISO 228
Purging air quantity	10 - 15 m ³ /h at standard conditions
or	
Purging air pressure	0.02 bar over combustion chamber inner pressure
Weight	approx. 1.5 kg
Voltage insulation	1.5 kV between housing and electronic
measuring at 350 – 550 nm	CO = 449nm; C ₂ = 470nm, 520nm; CN = 388nm; CH = 431nm; CO ⁺ = 490nm
Part-No.	
SPM U16W	6010-0105-00

