

Technical Data Combination Probe KS1D-Ex (Type ZPF2)

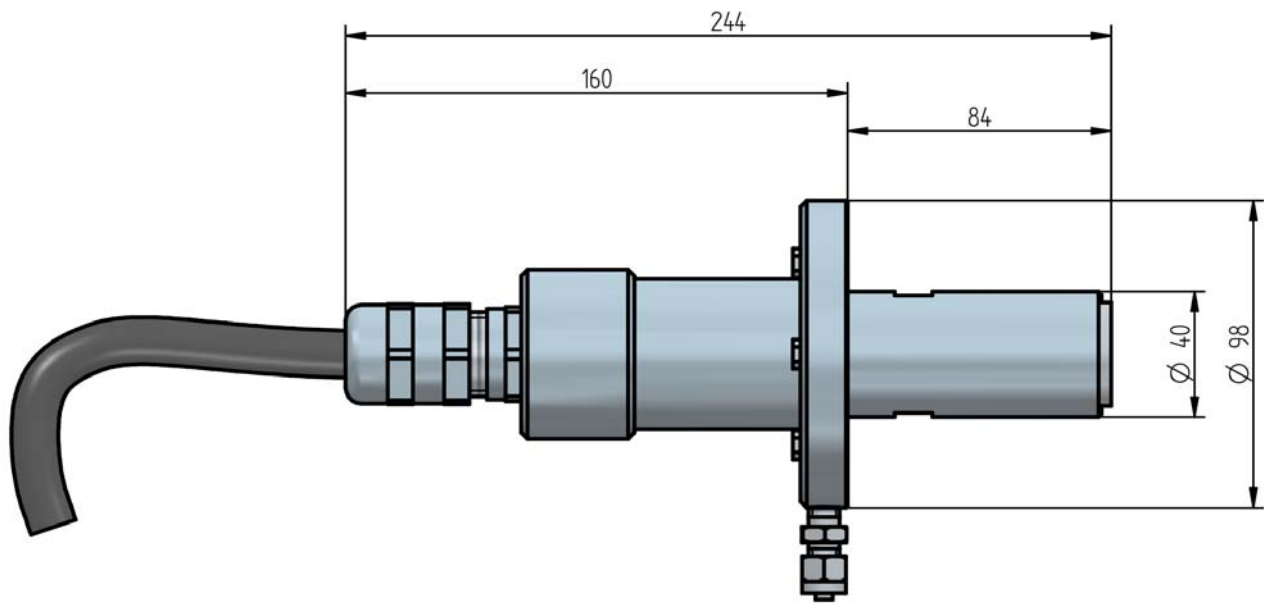


Fig. 1 Combination Probe KS1D-Ex (type ZPF2)

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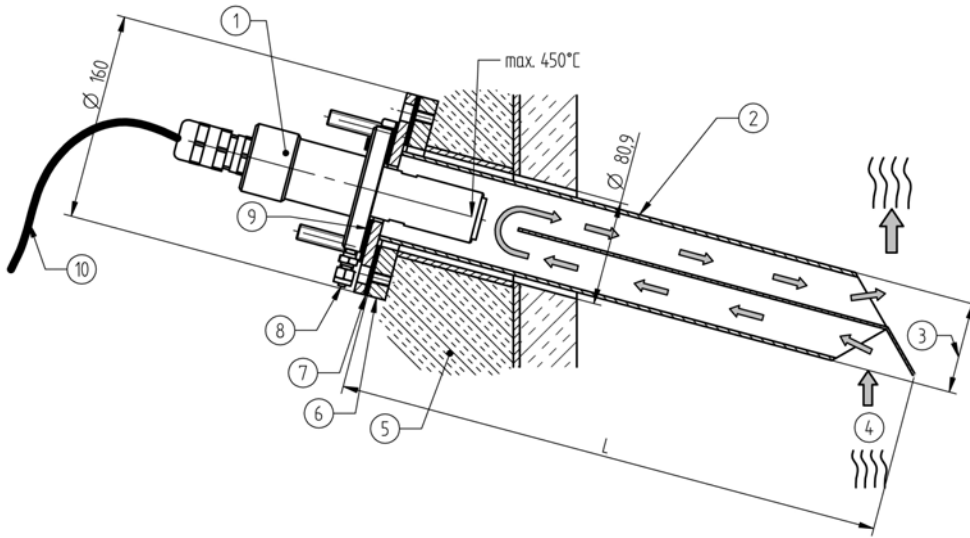


Fig. 2 Dimensional drawing KS1D-Ex with flue gas bypass tube

- 1 Combination Probe KS1D-Ex type 656R2021
- 2 Flue gas bypass tube
L= Length 500 ... 2,000 mm (19.685 ... 78.74 "in)
- 3 Diameter/diagonal maximum 70 mm (2.756 "in)
- 4 Permissible gas velocity:
1 ... 16 m/s (3.28 ... 52.5 ft/s)*
From 16 m/s (52.5 ft/s)* on with increasing accuracy!
- 5 Insulation counter flange
- 6 Counter flange with tube socket KTL coated type 655R0179 or
Counter flange with tube socket stainless steel 1.4571 type 655R0180
- 7 Flange seal graphite type 655P4211
- 8 Test gas unit
- 9 Flange seal Novaphit type 656P0263
- 10 Connecting cable, length 2 m (78.74 "in)

* Measured at measuring gas temperature 25 °C (77 °F). In case of smaller measuring gas temperatures it might be necessary to protect the probe from the incident flow.

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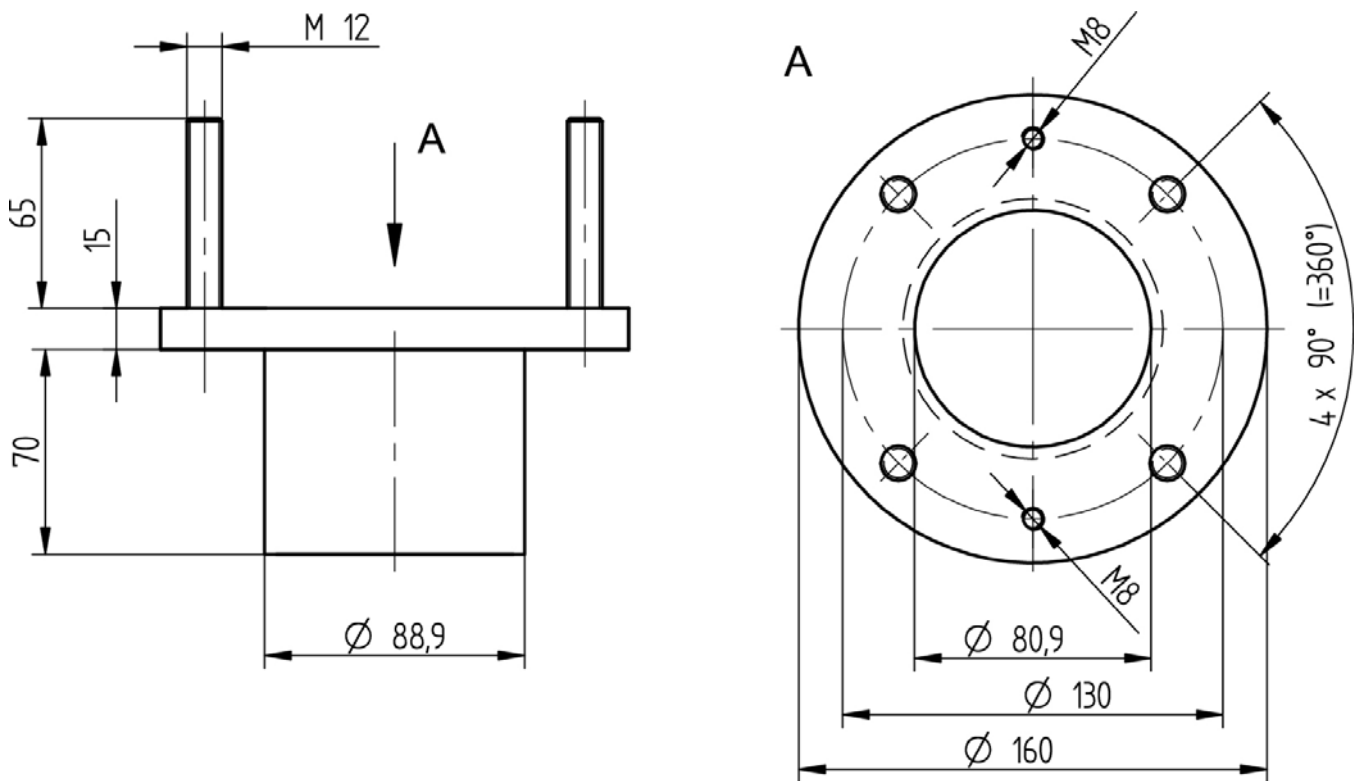


Fig. 3 Dimensions of counter flange with tube socket

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Technical data*	
Measuring range	O ₂ : 0 ... 21 % O ₂
	CO _e : 0 ... 1.000 ppm (0 ... 10.000 ppm upon request)
Measuring precision	O ₂ : ± 5 % of measured value - not better than ± 0.3 Vol. %
	CO _e : ± 25 % of measured value- not better than ± 20 ppm after prior calibration under operating conditions with a CO reference measurement
	In measuring range ≤ 100 ppm: ± 10 ppm
Sensor signal	O ₂ : -30 ... +150 mV
	CO _e : -30 ... +800 mV
Response time	O ₂ : t ₆₀ : < 50 s t ₉₀ : < 130 s
	CO _e : t ₆₀ : < 60 s t ₉₀ : < 140 s
Response time with flue gas bypass tube (AUR)**	t _{60AUR} = Δt _{AUR} + t ₆₀ (see Fig. 4 Delay time as function of the velocity in the exhaust air channel depending on the varying lengths of the flue gas bypass tube (AUR) (flue gas extraction tube (GET))
Offset to environment	O ₂ < 0.3 Vol. %
	CO _e < 2 ppm
Hysteresis	O ₂ < 1 % from measured value
	CO _e < 1.5 % from measured value
Linearity	O ₂ < 1 % from measured value
	CO _e < 9 % from measured value
Repeating precision	O ₂ < 0.1 % deviation from measured value
	CO _e < 0.7 % deviation from measured value
Ambient pressure dependency	O ₂ < 0.1 % from measured value (of normal pressure at sea level in comparison with pressure at altitude of 2000 m, i.e., Δ = -200 mbar)
	CO _e < 16 % from measured value (of normal pressure at sea level in comparison with pressure at altitude of 2000 m, i.e., Δ = -200 mbar)
Differential pressure dependency	O ₂ < -1.8 mV U _{O2} per 100 mbar overpressure in the measuring chamber in comparison with environment
	CO _e < -0.17 mV U _{COe} per 100 mbar overpressure in the measuring chamber in comparison with environment
Drift	O ₂ < 1.7 % from measured value (after 1000 h of operation in EL light fuel oil and 1004 switching cycles on/off)
	CO _e < 18.4 % from measured value (after 1000 h of operation in EL light fuel oil and 1004 switching cycles on/off)
Cross sensitivity**	O ₂ : to CO ₂ (15 Vol. %) < 0.1 Vol. %
	O ₂ : to CO (874 ppm) < 0.1 Vol. %
	O ₂ : to CH ₄ (76 ppm) < 0.1 Vol. %
	O ₂ : to SO ₂ (76 ppm) < 0.1 Vol. %
	O ₂ : to NO (245 ppm) < 0.1 Vol. %
	CO _e : to CO ₂ (15 Vol %) < 26 ppm
CO _e : to O ₂ (1 Vol. %) < 38 ppm	

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Technical data*	
Moisture	O ₂ : < 2.3 % from measured value CO _e : < 9.1 % from measured value
Influence of the installation position	None if KS1D-Ex is installed according to the information in the operating instructions.
Influence of the mains voltage	None if KS1D-Ex is installed according to the information in the operating instructions.
Influence of leakage	None if KS1D-Ex is installed according to the information in the operating instructions.
Internal resistance of probe	15 ... 25 Ω (ZrO ₂ -measuring cell in the air in case of 17 W heating output)
Heating consumption	10 ... 25 W (typically in air approx. 18 W, according to design, measuring gas temperature, and measuring speed)
Supply voltage for heating	AC/DC At P _H 18 VA ® 18 VA
Heating current at P _H 20 VA	Approx. 1,6 A Approx. 5 A short term during heating PTC-characteristic
Insulation resistance	< 30 MΩ (between heating and probe connection)
Lifetime	> 3 years (in case of natural gas)
Weight	3.500 g / 2.886 lb
Material of probe housing	1.4401 (SS316L)
Material of connection line	Nickel-plated copper strand insulation polyester, reinforced and shielded 2 m
Operating temperature of the measuring cell (sensor)	typically 850 K ± 30 K
Measuring principle	Zirconium dioxide cell (ZrO ₂), potentiometric (voltage probe)
Heating time	approx. 30 min until operating temperature is reached

* Information according to EN 16340:2014 D

** O₂: Information assumes an operating gas composition of 5 Vol. % O₂, rest is N₂

CO_e: Information assumes an operating gas composition of 5 Vol. % O₂, 333 ppm CO_e, rest is N₂
(333 ppm CO_e = 166.5 ppm H₂ + 166.5 ppm CO)

Conditions for Use	
Mounting / measuring gas extraction device	Directly in exhaust gas channel / in situ
Seal tightness	q _L ≤ 100 cm ³ /h**
Mounting position	Installation angle opposite horizontal 5 ... 90°
Permissible fuels	Residue-free, gaseous hydrocarbons, light fuel oil, heavy fuel oil (HFO), lignite and coal, biomass (according to design)
Permissible exhaust gas temperature on probe head	< 450 °C / 842 °F
Permissible continuous flue gas temperature	up to max. 1200 °C / 2192 °F in connection with flue gas bypass tube up to max. 1350 °C / 2462 °F in connection with flue gas extraction tube (GET)


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Conditions for Use	
Permissible measuring gas speed	< 16 m/s / 52.5 ft ^{**} From 16 m/s / 52.5 ft ^{**} on with increasing accuracy! Attention: With flue gas bypass tube (AUR)/flue gas extraction tube (GET) length > 1 m, a high current speed (> 30m/s / 98.42 ft/s)) can lead to flutter and vibration of flue gas bypass tube/ flue gas extraction tube.
Required test gas	for Offset: 21 Vol. % O ₂ in N ₂ or instrument air according to ISO 8573-1:2010 class (7:4:4) for O ₂ : 3 Vol. % O ₂ in N ₂ for CO _e : 3 Vol. % O ₂ , 200 ppm CO, 100 ppm H ₂ , in N ₂ , a portable calibration unit is available as an accessory
Test gas consumption	Approx. 3 ... 5 litres per test gas/per calibration at a flow rate of 60 ... 90 nl/h
Test gas connection	6 mm / 0.24 "in cutting ring fitting
Outlet port reference air	Inlet via sintered metal filter

* According to DIN V 18160-1:2006-01, seal tightness towards environment through housing and fastening.

** Measured at measuring gas temperature 25 °C / 77 °F. In case of smaller measuring gas temperatures it might be necessary to protect the probe from the incident flow.

Environmental Conditions

Transport	permissible temperature range	-20 ... +70 °C / -4 °F ... 158 °F
Storage	permissible temperature range	-20 ... +70 °C / -4 °F ... 158 °F
Degree of protection	according to DIN 40050	IP65
Type of protection	 II2G Ex d IIB+H2 T3 Gb (-20 °C ≤ Ta +60 °C) LCIE 13 ATEX 3045X IECEx LCIE 13.0027X	

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Delay time due to the flue gas bypass tube (AUR)/gas extraction tube (GET)
as a function of the flow velocity in the flue gas duct

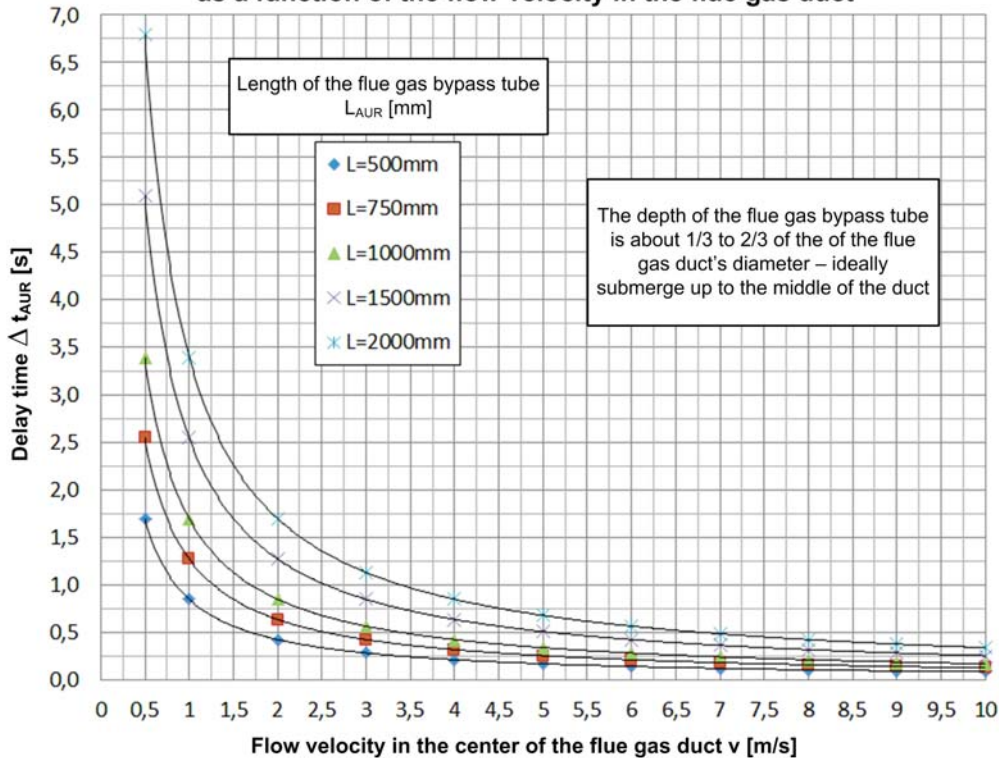


Fig. 4 Delay time as function of the velocity in the exhaust air channel depending on the varying lengths of the flue gas bypass tube (AUR) (flue gas extraction tube (GET)

The figure shows the delay time Δt [s] resulting from the length of the flue gas bypass tube (AUR)/flue gas extraction tube (GET) L [mm] as a function of a flow velocity in the middle of the flue air channel v [m/s].

NOTICE

The limits of the technical data must be strictly adhered to.

NOTICE

LT3-Ex Lambda Transmitter, in combination with the Combination Probe cannot be used for LAMTEC CO/O₂ control.

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Order Information

Combination Probe KS1D-Ex for simultaneous measurement of oxygen (O₂) and unburnt residue (CO/H₂) in combination with bypass tube for flue gas temperatures up to 1200 °C / 192 °F

Description / Type	Type
Combination Probe KS1D-Ex (ZPF2), cable length 2 m / 6.6 "ft, IP65	656R2021

Flue gas bypass tube Ø 70 mm / 2.755" in, material: stainless steel 1.4571, for measuring gas temperatures up to 750 °C / 1,382 °F

Type	656R1014	656R1015	656R1016	656R1080	656R1081
Length	500 mm / 19.69" in	750 mm / 29.53" in	1,000 mm / 39.37" in	1,500 mm / 59.06" in	2,000 mm / 78.74" in

Flue gas bypass tube Ø 60 mm / 2.36 in, material Inconel 600 for measuring gas temperatures up to 950 °C /1742 °F

Type	656R1017	656R1018	656R1019	656R1085	656R1086
Length	500 mm / 19.69" in	750 mm / 29.53" in	1,000 mm / 39.37" in	1,500 mm / 59.06" in	2,000 mm / 78.74" in

Flue gas bypass tube Ø 60 mm / 2.36 "in, material Kanthal for measuring gas temperatures up to 1.200 °C (2,192 °F)

Type	656R1021	656R1022	656R1023	656R1088	656R1089
Length	500 mm / 19.69" in	750 mm / 29.53" in	1,000 mm / 39.37" in	1,500 mm / 59.06" in	2,000 mm / 78.74" in

Counter flanges

Description / Type	Type
Counter flange, inside tube diameter 80 mm / 3.15 "in, tube length 70 mm / 2.756 "in, Material: steel, EPD black, int. hole diameter in acc. to DN65 PN6	655R0179
Counter flange, inside tube diameter 80 mm, special length up to 500 mm / 19.69 "in, material: steel galv., int. hole diameter in acc. to DN65 PN6	655R0179/S
Counter flange, inside tube diameter 80 mm / 3.15 "in, tube length 70 mm / 2.756" in, Material: stainless steel 1.4571, int. hole diameter in acc. to DN65 PN6	655R0180
Counter flange, inside tube diameter 80 mm / 3.15 "in, special length up to 500 mm / 19.69 "in, material: stainless steel 1.4571, int. hole diameter in acc. to DN65 PN6	655R0180/S
Sealing for counter flange DN65 PN6, 3 mm / 0.118 "in, material: graphite	655P4211

Accessories

Description / Type	Type
ATEX connection cable Combination Probe KS1D-Ex / Lambda Probe LS2-Ex	656R2025
Probe connection box for Combination Probe KS1D-Ex / Lambda Probe LS2-Ex Housing for hazardous area 1 in acc. to ATEX/IECEX type of protection: IP66 Max. distance to LT3-Ex: 40 m / 131.23 "ft Material: aluminum die-casting 165 x 165 x 85 mm / 6.5" in x 6.5" in x 3.35" in	650R4028
Probe connection box for Combination Probe KS1D-Ex / Lambda Probe LS2-Ex Housing for hazardous area 1 in acc. to ATEX/IECEX type of protection: IP66 Max. distance to LT3-Ex: 40 m / 131.23 "ft Material: stainless steel 1.4301 150 x 210 x 81 mm / 5.91 " in x 8.27 "in x 3.19 "in	650R4029
Portable Calibration Unit with 2 test gases for O ₂ and CO _e	699R0062
Portable Calibration Unit with 2 test gases for O ₂ and CO _e , as well as synthetic air	699R0063

Spare parts

Description / Type	Type
Maintenance-Set (dust protection filter, graphite gasket) for probe KS1D-Ex / LS2-Ex	656R2027
Gasket for connecting head, Novaphit SSTC	656P0263

The information in this publication is subject to technical changes.



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