EngineSens Motorsensor GmbH

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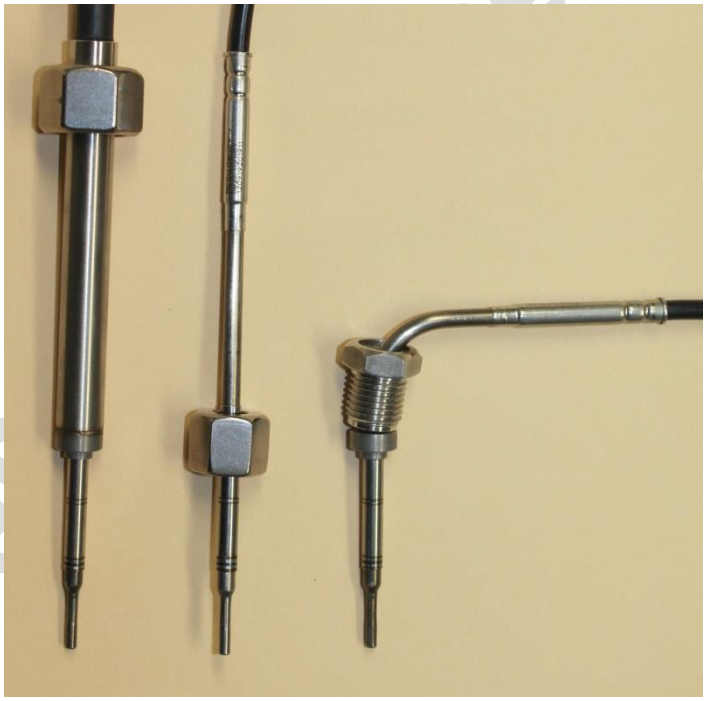
Installation instructions for High temperature probes HTS and HTS-EXT Part.-No. 20100, 20105, 20155



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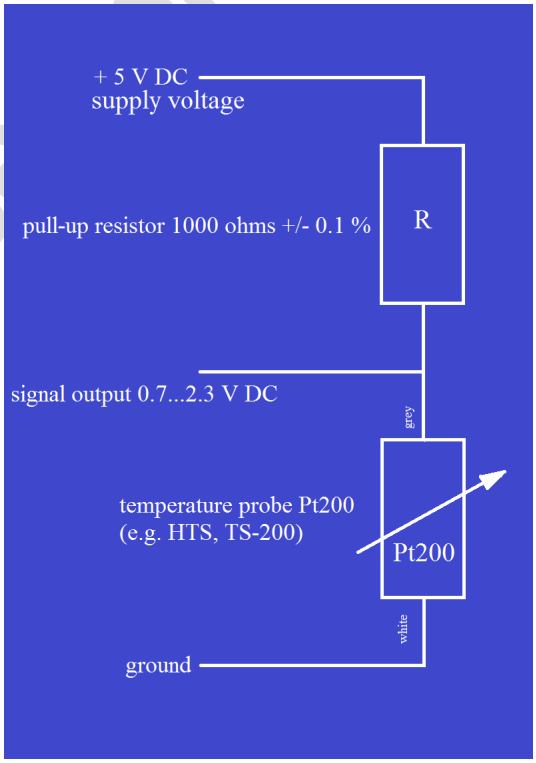
1. Mechanical installation

The temperature probe HTS (Ref. 20100) and HTS-EXT (EXT=70mm Ref. 20150, EXT=135mm Ref. 20155) are exhaust gas temperature sensors in a closed design with a Pt200 sensing resistor (PRTD). In contrary to "open housing designs" no installation restrictions have to be fulfilled. A position with the sensor tip facing upwards is applicable. The recommended tightening torque with the nut 17 mm is 45 Nm. A welding socket is offered as mechanical accessory under SO-200 (part-no. 40100). Every 50,000 km a visual inspection for proper fit of the exhaust gas temperature probe and damages of the cable should be done. Under ideal conditions the area of the reduced sensor tip is in the hottest flow of the gas stream. The sensing element is than hit directly and shows the shortest response time.
The steel of steel pipe between nut and cable outlet might be bent if required. Since there remains a risk of damage, this should be left to the expert. EngineSens Motorsensor offers a 90 ° bent version (Ref. 20105) and also variations of the intrusion depth.

2. Electrical Connection: voltage divider circuit

For most individual electrical solutions the plug of the connection cable is not useful. In that case cut away this connector.
A supply voltage of 5 V DC stabilized is required. Most engine ECUs are providing that. The white cable is to be connected with ground, while the gray wire is to be connected to the voltage divider circuit. This is now a standard in automotive wiring. Unlike other exhaust temperature sensors the polarity of the HTS does not matter. If only a 12 V electrical system is available, this voltage has to be transformed to 5 volts and has to be stabilized. A fitting voltage regulator with a cooling element is recommended. The voltage divider circuit should be set-up as shown on the sketch.



The pull-up resistor should be 1000 ohms. To minimize signal tolerances this resistor has to be in the class +/-0.1 % or even better. This resistor ensures that the measuring current is limited. The maximum admit table measuring current is 4mA.

3. Characteristic curve of temperature probes HTS and HTS-EXT

The temperature probe changes its electric resistance in dependence of the ambient temperature at the sensor tip. The probe can withstand 850°C permanently and up to 950°C for short periods. At 0°C a resistance value of 201 Ω can be measured at the connector. This increases to 774 Ω at 850°C. The characteristic curve above 0°C can be described by the following mathematic formula:

$$R(T) = 0{,}5\ \Omega + 200\Omega\ (1 + \alpha * T + \beta * T^2)$$

Whereas T represents the ambient temperature at the sensor tip

$\alpha = 3{,}86825*10^{-3}C^{-1}$
$\beta = -5{,}826*10^{-7}C^{-2}$

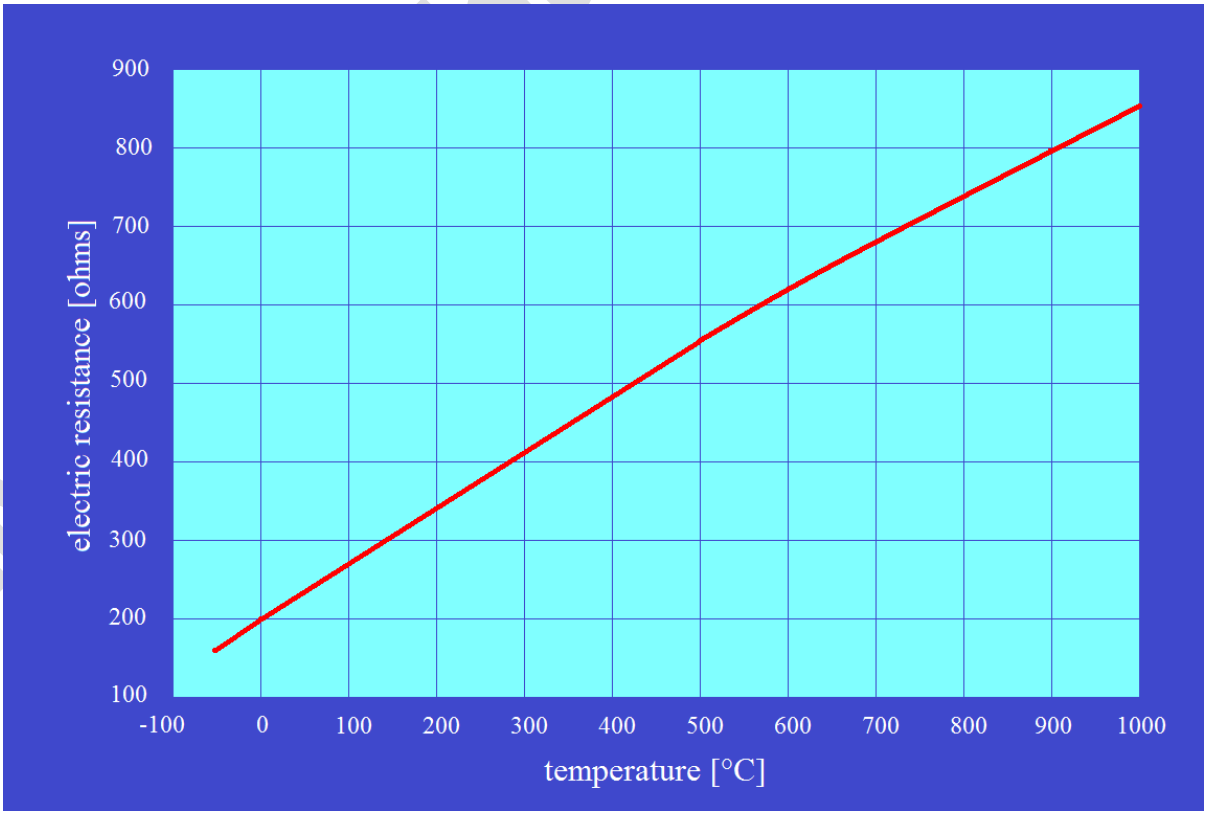
This results in the following table:

T [°C]	R [Ω]
-40	169,9
-20	185,5
0	201,0
25	220,3
50	239,4
75	258,4
100	277,2
125	295,0
150	314,4
175	332,8
200	351,1
225	369,2
250	387,1
275	404,9
300	422,6
325	440,1
350	457,5

T [°C]	R [Ω]
375	474,7
400	491,8
425	508,8
450	525,5
475	542,2
500	558,7
525	575,1
550	591,3
575	607,3
600	623,2
625	639,0
650	654,6
675	670,1
700	685,5
725	700,7
750	715,7
775	730,6

T [°C]	R [Ω]
800	745,3
825	760,0
850	774,4
875	788,7
900	802,9
925	816,9
950	830,8

This R-T-dependence can be shown in a graphics:



4. Output voltage at the voltage divider

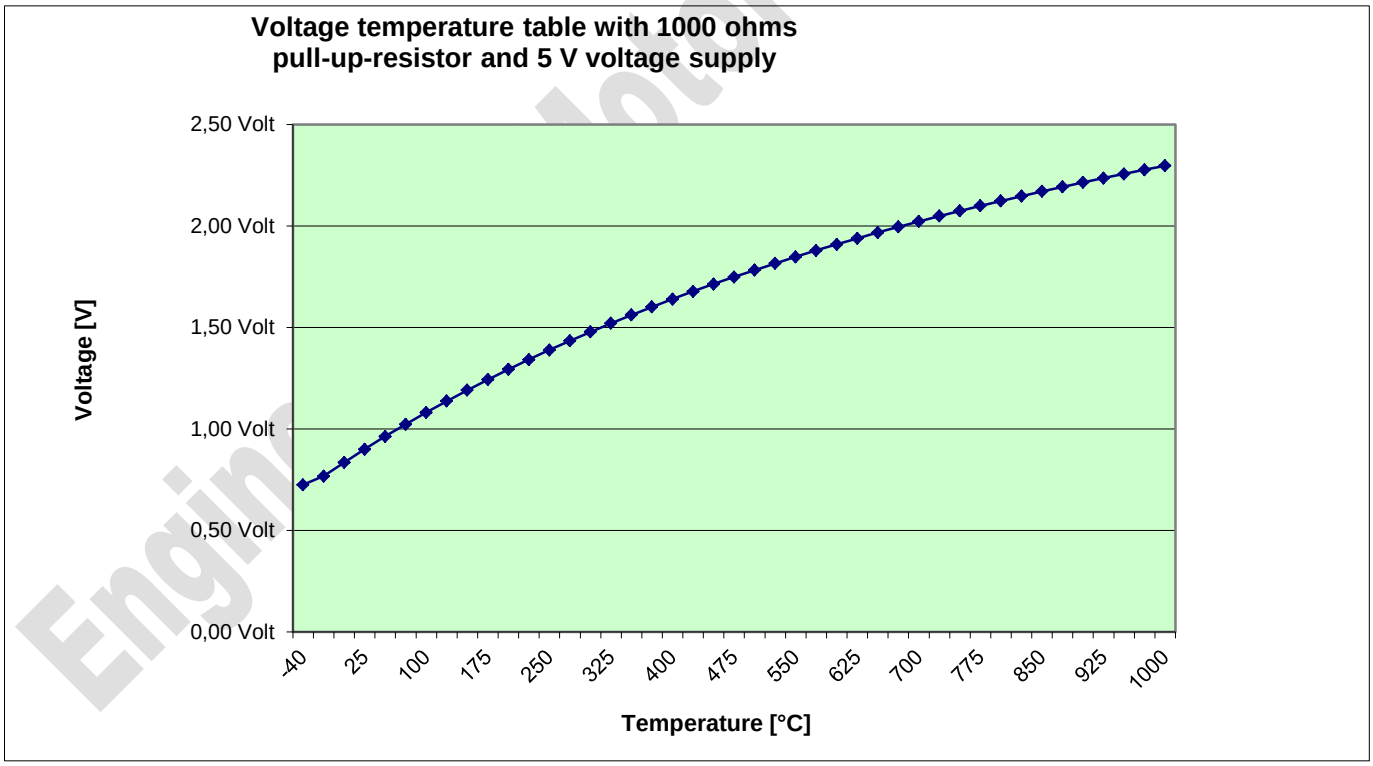
In a circuit according to 1.1 the following U_{SP} values depending on the sensor temperature can be measured:

T [°C]	U_{SP}
-40	0,73 Volt
-25	0,77 Volt
0	0,84 Volt
25	0,90 Volt
50	0,96 Volt
75	1,02 Volt
100	1,08 Volt
125	1,14 Volt
150	1,19 Volt
175	1,24 Volt
200	1,29 Volt
225	1,34 Volt
250	1,39 Volt
275	1,43 Volt
300	1,48 Volt

T [°C]	U_{SP}
325	1,52 Volt
350	1,56 Volt
375	1,60 Volt
400	1,64 Volt
425	1,68 Volt
450	1,71 Volt
475	1,75 Volt
500	1,78 Volt
525	1,82 Volt
550	1,85 Volt
575	1,88 Volt
600	1,91 Volt
625	1,94 Volt
650	1,97 Volt
675	2,00 Volt

T [°C]	U_{SP}
700	2,02 Volt
725	2,05 Volt
750	2,07 Volt
775	2,10 Volt
800	2,12 Volt
825	2,15 Volt
850	2,17 Volt
875	2,19 Volt
900	2,21 Volt
925	2,24 Volt
950	2,26 Volt
975	2,28 Volt
1000	2,30 Volt
1025	2,32 Volt
1050	2,33 Volt

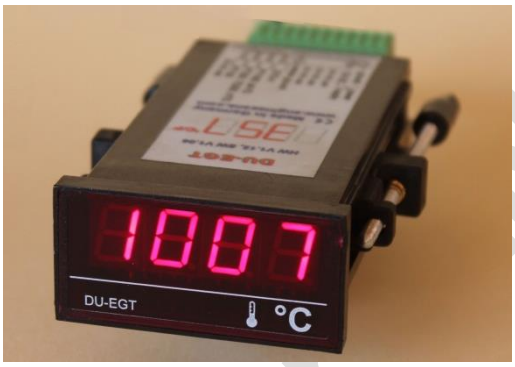
The same in a graphics:



5. Electrical accessories for the HTS sensor family

If required EngineSens offers an already assembled voltage divider circuit working with usual 12V supply (battery voltage) for easy mounting. The product “VD-200” gives voltage values according to above mentioned graphics. Also a display unit for Pt200 probes is available as DU-EGT.

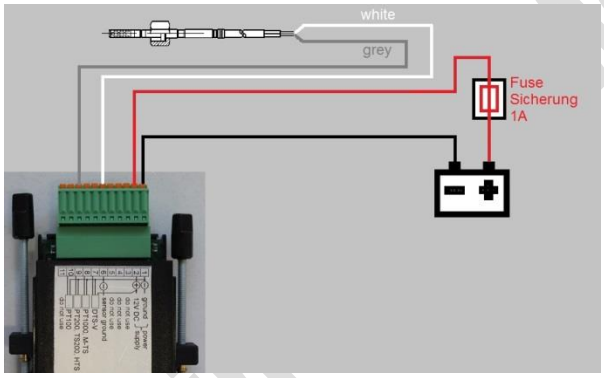
Voltage divider VD-200
Ref. 90050



Display unit DU-EGT
Ref. 70210

Display unit DU-EGT is included by EGT-Set Ref. 20500. The screw connectors are as follows:

Screw connector 1	ground
Screw connector 2	+12V DC
Screw connector 6	white cable of TS-200 or HTS
Screw connector 9	grey cable of TS-200 or HTS



Always good success!

Your Team

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