

Technical brochure

# Pressure and temperature controls, Type KPS



The KPS Series consists of a series of pressure- and temperature controlled switches. In this series, special attention has been given to meeting demands for a high level of enclosure, robust and compact construction, and resistance to shock and vibration.

For KPS pressure controls the position of the contacts depends on the pressure in the inlet connection and the set scale value. For KPS temperature controls the position of the contacts depends on the temperature of the sensor and the set scale value.

The series covers most outdoor as well as indoor application requirements and is suitable for use in monitoring alarm and regulation systems in factories, diesel plants, compressors, power stations and on board ships.

## Features

- A high level of enclosure
- Adjustable differential
- Robust and compact construction
- Resistance to shock and vibration
- Available with all major marine approvals

**Approvals**

EN 60 947-4-1  
EN 60 947-5-1

Underwriters Laboratories Inc., US-UL  
China Compulsory Certificate, CCC

**Ship approvals**

American Bureau of Shipping, ABS  
Det Norske Veritas, DNV  
Germanischer Lloyd, GL  
Registro Italiano Navale, RINA  
Maritime Register of Shipping, RMRS  
Nippon Kaiji Kyokai, NKK  
China Classification Society, CCS

Bureau Veritas, BV - Includes thermostats with fixed sensor and pressure controls with amoured capillary tube  
Korean Register of Shipping, KR (KPS 35, KPS 37, KPS 39, KPS 43, KPS 45, KPS 47)  
Lloyds Register of Shipping, LR

**Survey**

*1. Standard pressure controls*

-1 0 10 20 30 40 50 60 bar									Range P <sub>e</sub> bar	Type	Further information page
									0 - 2.5	KPS 31	3
									0 - 3.5	KPS 33	3
									0 - 8	KPS 35	3
									6 - 18	KPS 37	3
									10 - 35	KPS 39	3

*2. Type KPS pressure controls for high pressure and strongly pulsating media*

-1 0 10 20 30 40 50 60 bar									Range P <sub>e</sub> bar	Type	Further information page
									1 - 10	KPS 43	3
									4 - 40	KPS 45	3
									6 - 60	KPS 47	3

*3. Type KPS temperature controls*

-50 0 50 100 150 200 200 °C								Range P <sub>e</sub> bar	Type	Further informa- tion page
								-10 - 30	KPS 76	8
								20 - 60	KPS 77	8
								50 - 100	KPS 79	8
								70 - 120	KPS 80	8
								60 - 150	KPS 81	8
								100 - 200	KPS 83	8

**ISO 9001 quality approval**



Danfoss A/S is certificated by BSI in accordance with international standard ISO 9001. This means that Danfoss fulfils the international standard in respect of product development, design, production and sale. BSI exercises continuous inspection to ensure that Danfoss observes the requirements of the standard and that Danfoss' own quality assurance system is maintained at the required level.

**Installation**

*Installation*

KPS pressure switches are fitted with a 3 mm steel mounting plate. The units should not be allowed to hang from the pressure connection.

*Pressure connection*

When fitting or removing pressure lines, the spanner flats on the pressure connection should be used to apply counter-torque.

*Steam plant*

To protect the pressure element from excessive heat, the insertion of a water-filled loop is recommended. The loop can, for example, be made of 10 mm copper tube as shown in fig. 5.

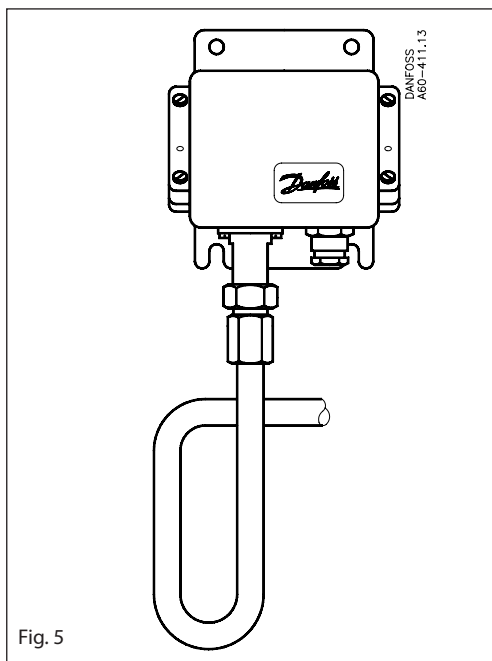


Fig. 5

*Water systems*

Water in the pressure element is not harmful, but if frost is likely to occur a water-filled pressure element may burst. To prevent this happening, the pressure control can be allowed to operate on an air cushion.

*Media-resistance*

See table of materials in contact with the medium, page 4. If seawater is involved, types KPS 43, 45, 47 are recommended.

*Pulsations*

If the pressure medium is superimposed with severe pulsations, which occur in automatic sprinkler systems (fire protection), fuel systems for diesel motors (priming lines), and hydraulic systems (e.g. propeller systems), etc., types KPS 43,45,47 are recommended. The maximum permissible pulsation level for these types is 120 bar.

*Setting*

When the pressure switch cover is removed, and the locking screw (5) is loosened, the range can be set with the spindle (1) while at the same time the scale (2) is being read. In units having an adjustable differential, the spindle (3) must be used to make the adjustment. The differential obtained can be read direct on the scale (4) or, with types KPS 43, 45, 47, can be determined by reading the scale value and using the nomograms in figs. 1, 2, 3 (page 3). The working line for determining the differential must not intersect the shaded areas in the nomograms.

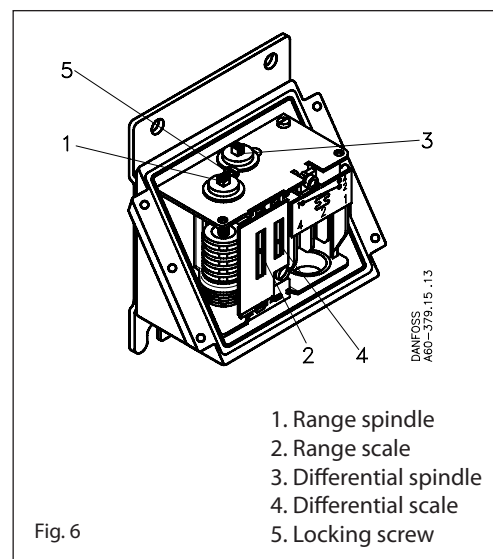


Fig. 6

- 1. Range spindle
- 2. Range scale
- 3. Differential spindle
- 4. Differential scale
- 5. Locking screw

*Selection of differential*

To ensure that the plant functions properly, a suitable differential pressure is necessary. Too small a differential will give rise to short running periods with a risk of hunting. Too high a differential will result in large pressure oscillations.

*Electrical connection*

KPS pressure switches are fitted with a Pg 13.5 screwed cable entry that is suitable for cable diameters from 5 to 14 mm. Contact function is shown in fig. 7.

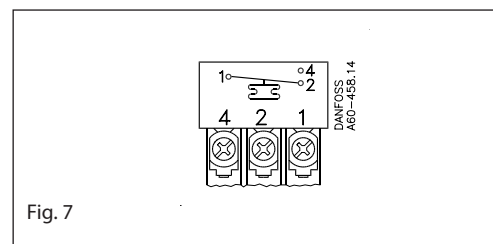


Fig. 7

## Temperature controls

### Technical data and ordering



KPS with rigid sensor



KPS with remote sensor



KPS with remote sensor and armoured capillary tube

When ordering, please state type and code number

Setting range °C	Mech. diff. adjustable/ fixed °C	Max. sensor temp. °C	Suitable sensor length see also "Accessories" mm				Cap. tube length m	Code no.			Type
			65	75	110	160					
-10 - 30	3 - 10	80	65	75	110	160	2		<b>060L311266</b>	<b>060L311366</b>	KPS 76
20 - 60	3 - 14	130	-	75	-	-	-	<b>060L311866</b>			KPS 77
20 - 60	3 - 14	130	-	-	110	-	-	<b>060L310066</b>			KPS 77
20 - 60	3 - 14	130	-	-	-	160	-	<b>060L313666</b>			KPS 77
20 - 60	3 - 14	130	65	75	110	160	2		<b>060L310166</b>	<b>060L310266</b>	KPS 77
20 - 60	3 - 14	130	-	-	110	160	5		<b>060L311966</b>	<b>060L312066</b>	KPS 77
50 - 100	4 - 16	200	-	75	-	-	-	<b>060L312166</b>			KPS 79
50 - 100	4 - 16	200	-	-	110	-	-	<b>060L310366</b>			KPS 79
50 - 100	4 - 16	200	-	-	-	160	-	<b>060L313766</b>			KPS 79
50 - 100	4 - 16	200	65	75	110	160	2		<b>060L310466</b>	<b>060L310566</b>	KPS 79
50 - 100	4 - 16	200	-	-	110	160	5		<b>060L312266</b>	<b>060L312366</b>	KPS 79
50 - 100	4 - 16	200	-	-	110	160	8		<b>060L312466</b>	<b>060L312566</b>	KPS 79
50 - 100	4 - 16	200	65	75	110	160	3		<b>060L314366</b>		KPS 79
50 - 100	9	200	-	75	-	-	-	<b>060L314166<sup>1)</sup></b>			KPS 79
70 - 120	4.5 - 18	220	-	75	-	-	-	<b>060L312666</b>			KPS 80
70 - 120	4.5 - 18	220	-	-	110	-	-	<b>060L312766</b>			KPS 80
70 - 120	4.5 - 18	220	-	-	-	160	-	<b>060L313866</b>			KPS 80
70 - 120	4.5 - 18	220	-	-	-	200	-	<b>060L315766</b>			KPS 80
70 - 120	4.5 - 18	220	65	75	110	160	2		<b>060L312866</b>	<b>060L312966</b>	KPS 80
70 - 120	4.5 - 18	220	65	75	110	160	3		<b>060L315666</b>		KPS 80
70 - 120	4.5 - 18	220	-	-	110	160	5		<b>060L313066</b>	<b>060L313166</b>	KPS 80
70 - 120	4.5 - 18	220	-	-	110	160	8		<b>060L313266</b>	<b>060L313366</b>	KPS 80
60 - 150	5 - 25	250	65	75	110	160	2		<b>060L310666</b>	<b>060L310766</b>	KPS 81
60 - 150	5 - 25	250	-	-	110	160	5		<b>060L313466</b>	<b>060L313566</b>	KPS 81
60 - 150	5 - 25	250	-	-	110	160	8		<b>060L311166</b>		KPS 81
60 - 150	5 - 25	250	-	-	200	-	-	<b>060L311066</b>			KPS 81
100 - 200	6.5 - 30	300	65	75	110	160	2		<b>060L310866</b>	<b>060L310966</b>	KPS 83
100 - 200	18	300	65	75	110	160	2		<b>060L313966<sup>1)</sup></b>		KPS 83

<sup>1)</sup>Thermostat with max. reset

### Electrical connection

KPS thermostats are fitted with a Pg 13.5 screwed cable entry suitable for cables from 5 to 14 mm. Contact function is shown in Fig. 5

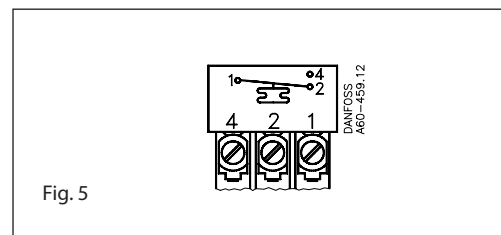
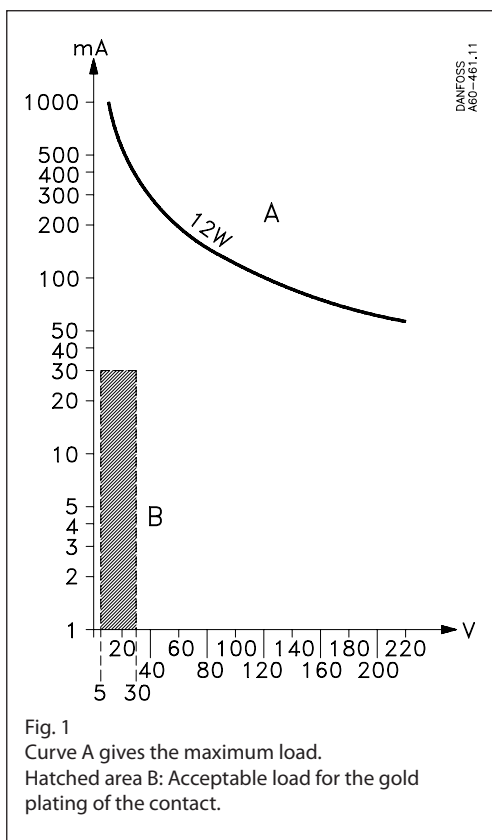


Fig. 5

Technical data



Contact load (Alternating current):

(when Au surface is burned away)  
Ohmic: 10 A, 440 V, AC-1  
Inductive: 6 A, 440 V, AC-3  
4 A, 440 V, AC-15

Starting current max. 50 A (locked rotor)

Ambient temperature -40 to +70 °C

Vibration resistance

Vibration-stable in the range 2-30 Hz, amplitude 1.1 mm og 30-300 Hz, 4 G.

Enclosure

IP 67 to IEC 529 and DIN 40050.  
The thermostat housing is enamelled pressure die cast aluminium (GID-AISI 12). The cover is fastened by four screws which are anchored to prevent loss.  
The enclosure can be sealed with fuse wire.

Cable entry

Pg 13.5 for cable diameters from 5 to 14 mm.

Identification

The type designation and code no. of the unit is stamped in the side of the housing.

Scale accuracy

KPS 76: ±3 °C	KPS 80: ±3 °C
KPS 77: ±3 °C	KPS 81: ±6 °C
KPS 79: ±3 °C	KPS 83: ±6 °C

Switch

Single-pole changeover switch (SPDT).  
Contact material: Gold-plated silver contact.  
Direct current: 12 W, 220 V, DC-13 – See fig. 1

Snap point variation after 400 000 operations.  
KPS 76-83: max. drift 2 °C.

Function

Selection of differential

To ensure that the plant functions properly, a suitable differential is necessary. Too small a differential will give rise to short running periods with a risk of hunting. Too high a differential will result in large temperature variations

Differentials

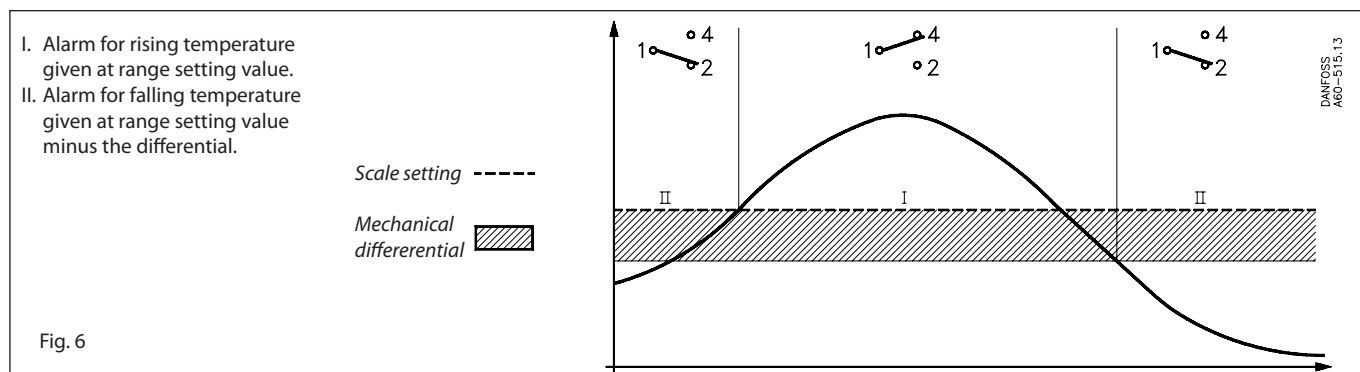
The mechanical differential is the differential that is set by the differential spindle in the thermostat. The thermal differential (operating differential) is the differential the system operates on.

The thermal differential is always greater than the mechanical differential and depends on three factors:

- 1) the flow velocity of the medium,
- 2) the temperature change rate of the medium, and
- 3) the heat transmission to the sensor

Thermostat function

Contacts 1-4 make while contacts 1-2 break when the temperature rises above the scale setting. The contacts changeover to their initial position when the temperature falls to the scale setting minus the differential. See fig. 6.





**Installation**

*Installation*

Location of unit: KPS thermostats are designed to withstand the shocks that occur, e.g. in ships, on compressors and in large machine installations. KPS thermostats with remote sensor are fitted with a base of 3 mm steel plate for fixing to bulkheads, etc. KPS thermostats with bulb sensor are self-supporting from the sensor pocket.

*Resistance to media*

Material specifications for sensor pockets:

*Sensor pocket, brass*

The tube is made of Ms 72 to DIN 17660, the threaded portion of So Ms 58Pb to DIN 17661.

*Sensor pocket, stainless steel 18/8*

Material designation 1.4305 to DIN 17440.

*Sensor position*

As far as possible the sensor should be positioned so that its longitudinal axis is at right angles to the direction of flow. The active part of the sensor is Ø13 mm x 50 mm long on thermostats with rigid sensors and 2 m capillary tube. The active length on the other thermostats is 70 mm (5 m and 8 m capillary tubes).

*The medium*

The fastest reaction is obtained from a medium having high specific heat and high thermal conductivity. It is therefore advantageous to use a medium that fulfills these conditions (provided there is a choice).

Flow velocity of the medium is also of significance. (The optimum flow velocity for liquids is about 0.3 m/s).

For permissible media pressure see fig. 2.

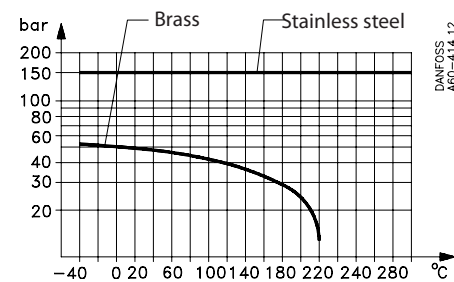


Fig. 2. Permissible media pressure on the sensor pocket as a function of temperature

*Setting*

When the thermostat cover is removed, and the locking screw (5, fig. 3) is loosened, the range can be set with the spindle (1) while at the same time the scale (2) is being read.

In units having an adjustable differential, the spindle (3) can be used while the scale (4) is being read.

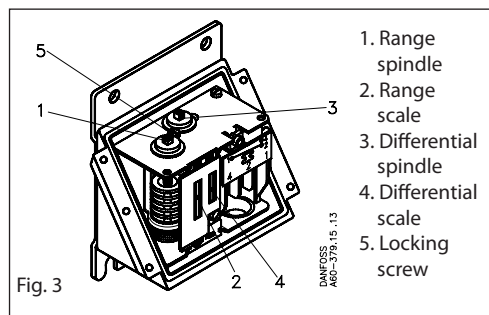


Fig. 3

*Scale correction*

The sensor on KPS thermostats contains an adsorption charge. Therefore function is not affected whether the sensor is placed warmer or colder than the remaining part of the thermostatic element (bellows and capillary tube). However, such a charge is to some extent sensitive to changes in the temperature and bellows and capillary tube. Under normal conditions this is of no importance, but if the thermostat is to be used in extreme ambient temperatures there will be a scale deviation. The deviation can be compensated for as follows:

Scale correction =  $Z \times a$

Z can be found from fig. 4, while **a** is the correction factor from the table below.

Type	Regulation range °C	Correction factor <b>a</b> for thermostats		
		with rigid sensor	with 2 and 5 m cap. tube	with 8 m cap. tube
KPS 76	-10 - +30		1.1	
KPS 77	20 - 60	1.0	1.4	
KPS 79	50 - 100	1.5	2.2	2.9
KPS 80	70 - 120	1.7	2.4	3.1
KPS 81	60 - 150		3.7	
KPS 83	100 - 200		6.2	

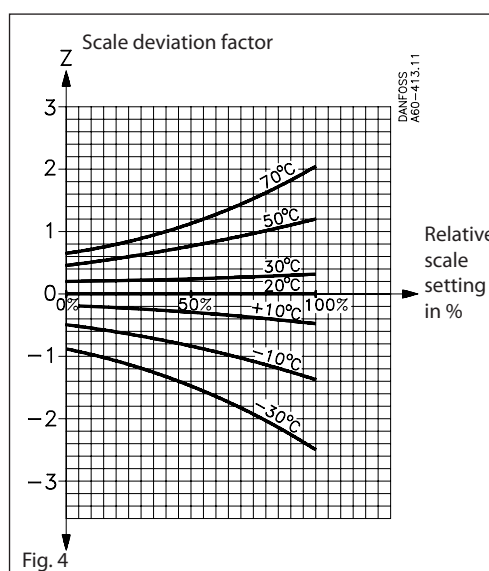


Fig. 4

**Examples**

*Example 1*

A diesel engine with cooling water temperature of 85 °C (normal). An alarm must be triggered if the cooling water temperature exceeds 95 °C. Choose a KPS 80 thermostat (range 70 to 120 °C). Main spindle setting: 95 °C. Differential spindle setting: 5 °C. The required alarm function is obtained by connecting to thermostat terminals 1-4. After the system has been in operation, assess the operating differential and make a correction if necessary.

*Example 2*

Find the necessary scale correction for a KPS 80 set at 95 °C in 50 °C ambient temperature.

The relative scale setting **Z** can be calculated from the following formula:

$$\frac{\text{Setting value} - \text{min. scale value}}{\text{max. scale value} - \text{min. scale value}} \times 100 = \%$$

$$\text{Relative scale setting: } \frac{95 - 70}{120 - 70} \times 100 = 50\%$$

Factor for scale deviation Z (fig. 4 page 11), Z ≅ 0.7

Correction factor a (table under fig. 4 page 11) = 2.4

Scale correction = Z × a = 0.7 × 2.4 = 1.7 °C  
The KPS must be set at 95 + 1.7 = 96.7 °C